U.S. Department of
Homeland Security
United States
Coast Guard

U. S. COAST GUARD ADDENDUM

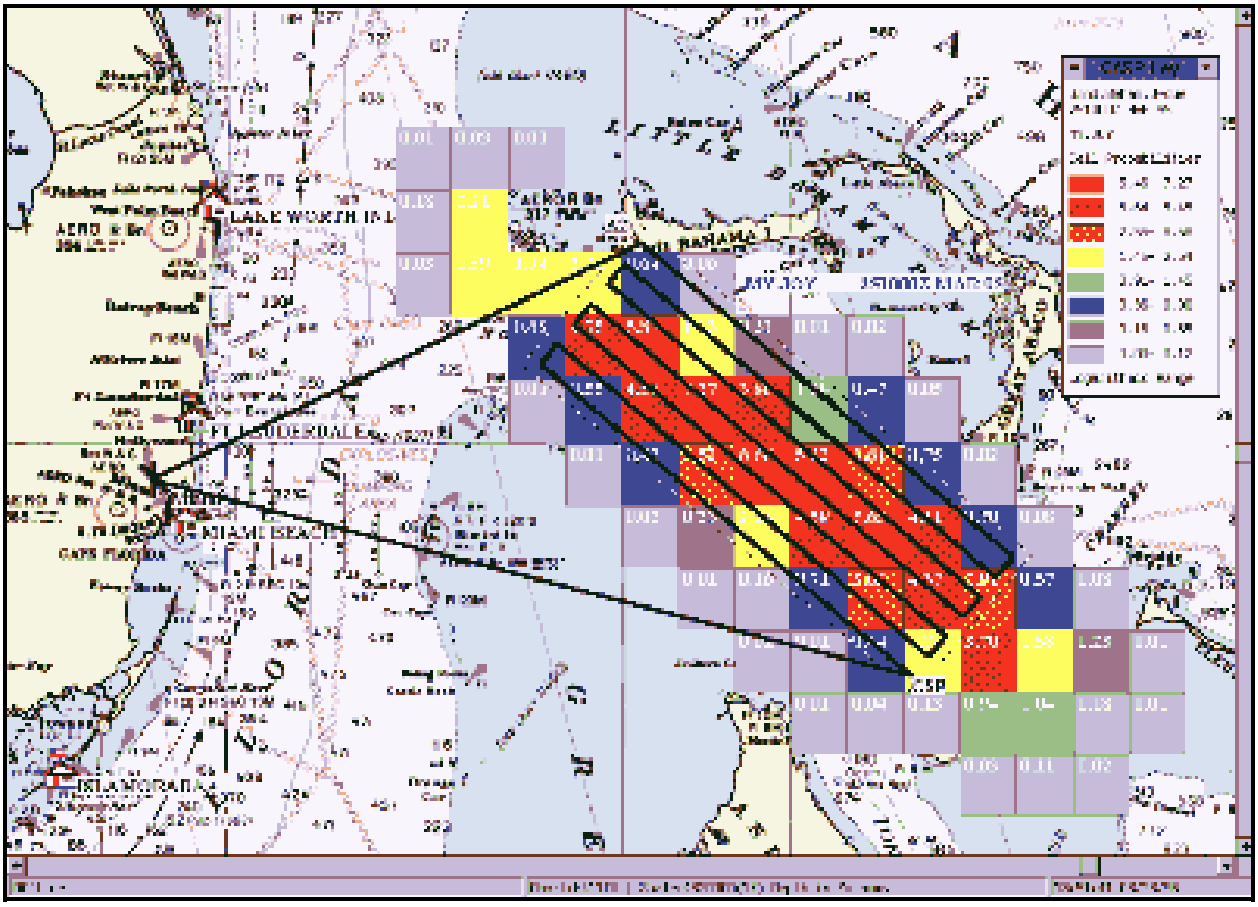
TO THE

UNITED STATES

NATIONAL SEARCH AND RESCUE SUPPLEMENT (NSS)

To The

International Aeronautical and Maritime Search and Rescue Manual (IAMSAR)



COMDTINST M16130.2D

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United States Coast Guard

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COMDTINST M16130.2D

29 APRIL 2004

COMMANDANT INSTRUCTION M16130.2D

Subj: U.S. COAST GUARD ADDENDUM TO THE UNITED STATES NATIONAL SEARCH AND RESCUE SUPPLEMENT (NSS) TO THE INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE MANUAL (IAMSAR)

1. PURPOSE. This Manual is the new Coast Guard Addendum (CGADD) to the United States National Search and Rescue Supplement (NSS), which is a supplement to the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR). This Addendum establishes policy, guidelines, procedures and general information for Coast Guard use in search and rescue (SAR) operations

2. ACTION. Area and District Commanders and Commanding Officers shall ensure that personnel performing SAR duties are familiar with the provisions of this new Addendum. Internet release authorized.

3. DIRECTIVES AFFECTED. U.S. Coast Guard Addendum to the National Search and Rescue (SAR) Manual, COMDTINST M16130.2C is cancelled.

4. DISCUSSION.

   a. The CGADD is a Coast Guard publication complementing the NSS and IAMSAR for Coast Guard SAR operations.

   b. The CGADD, NSS and IAMSAR are reference documents for SAR, which are published and revised to incorporate the latest techniques and recommendations for SAR.

   c. This new, completely reorganized and restructured Addendum includes procedures and information that may be useful to rescue agencies outside of the Coast Guard. As procedures presently incorporated in the CGADD are approved for joint use, they will be published in the NSS. As procedures are approved for international use, they will likewise be published in the IAMSAR. Although the CGADD is a Coast Guard policy publication, commands may share the information with other rescue organizations. In the event of apparent conflict between the provisions of this Addendum and other Coast Guard directives, the latest provision shall be applied and Commandant (G-OPR-1) shall be notified of the apparent conflict.

DISTRIBUTION – SDL No. 139

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NON-STANDARD DISTRIBUTION:

d. The policies and procedures in this Manual apply to Coast Guard facilities within the U.S., territories, and possessions, and to Coast Guard SAR operations worldwide. This directive promulgates internal Coast Guard planning guidance solely intended to promote efficiency and consistency in public service above and beyond the requirements of law and regulation. Any obligations discussed, flow only to the Coast Guard and Coast Guard personnel are expected to exercise broad discretion in performing the functions discussed. The Coast Guard retains the discretion to deviate from or change this guidance without notice. This document creates no duties, standard of care, or obligations to the public and should not be relied upon as a representation by the Coast Guard as to the manner of proper performance in any particular case.

5. POLICY.

a. Procedures, techniques, and terminology in this Addendum are adopted for use by the Coast Guard for SAR operations. Procedures, techniques, and terminology promulgated by the NSS and IAMSAR also apply to the Coast Guard. Where Coast Guard policies or procedures differ from NSS and IAMSAR manual, discussion and guidance will be provided within the Addendum.

b. The provisions of this Addendum are intended as a guide for consistent and uniform execution of the Coast Guard SAR program. This Addendum does not cover occurrences best handled through experience and sound judgement. The CGADD is not intended to place undue restrictions on use of sound judgement.

6. SUMMARY OF MAJOR CHANGES.

a. Preface and Program Overview:

(1) PPO-4, section VIII: Introduction of G-OPR as Program Manager for Command Centers.

b. Chapter 1:

(1) 1.3.2.2: SAR Controller interim qualification eliminated.

(2) 1.3.2.7: Restriction placed on assignment of collateral duties for SAR Controllers.

(3) 1.3.2.5: Clarification of watch frequency requirements for SAR Controllers.

(4) Table 1-4 (page 1-16): Training requirements table updated, including addition of ICS training requirements.

(5) 1.6.5.5.c.1: Information on updated SAR agreement with Mexico.

c. Chapter 2:

(1) 2.1: Update of GMDSS information to reflect CG capabilities and identification of GMDSS gear in use in the maritime arena.

(2) 2.1.5.7: Discussion of advent and proliferation of personal locator beacons.

(3) 2.6.1.3: Standardization of time conventions used in broadcasts.

(4) 2.5.4.1: Introduction of active listening (repeating back critical information) in SAR communications.

d. Chapter 3:

(1) 3.3.2.2: Codification of SLDMB policy previously promulgated by message.

(2) 3.4.11: Addition of Mass Rescue Operations (MRO) requirements for pre-event contingency planning.

(3) 3.4.13: Introduction of Automated Information System (AIS) as a SAR resource.

(4) 3.4.4.2.b: Discussion of 406 Mhz application in personal locator beacons.

e. Chapter 4:

(1) 4.2.6.1 (third note): Clarification of cellular phone use with respect to the Maritime SAR Assistance Policy (MSAP).

f. Appendix B: Update of MISLE data collection and replacement of SARMIS references with MISLE.

g. Appendix G: Introduction of new Mass Rescue QRC requiring pre-MRO SMC data input.

h. Appendix H: Search Planning Handbook – incorporates and updates all search planning information including applicable figures, tables and worksheets (except flares which are in Appendix I). Updates CGADD to better align it with the IAMSAR method.

i. Appendix I: Addition of geo-location services to identify the geographic position associated with a street address.

j. Appendix J: EPIRB registration options explained and discussed in light of new Personal Locator Beacons.

k. Appendix M: Updated COMSAT-C information.

l. Appendix N: Addition of SAR Controller PQS previously promulgated by message.

m. Throughout CGADD: The following changes were made throughout the manual.

(1) Change all references from Flag Plot to HQCC.

(2) Amended those items changed by the advent of Rescue 21.

(3) Changed all references to INS and Customs to the appropriate DHS Bureau title.

7. CHANGES. Recommendations for improvements to the Addendum and Coast Guard SAR operations are encouraged and should be submitted through the chain of command to Commandant (G-OPR-1).

J. J. HATHAWAY /s/
Director of Operations Policy

RECORD OF CHANGES

Change Number	Date of Change	Date Entered	Entered By:

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TABLE OF CONTENTS

REFERENCES

LIST OF FIGURES

LIST OF TABLES

PREFACE AND PROGRAM OVERVIEW

I Mission and Purpose
II Risk Management
III SAR Functions & Hierarchy
IV Statutory Authority & Responsibility
V SAR Publications
VI SAR Program Objectives, Goals, Standards and Requirements
VII SAR Program Focus
VIII SAR System Infrastructure
IX Terms Within the Addendum
X Applicability and Obligation

CHAPTER 1 SAR SYSTEM

1.1 Search and Rescue (SAR) Organization
1.2 SAR Coordination
1.3 Professional Requirements
1.4 Public Affairs & Next of Kin Interactions
1.5 Liaison and Contingency Exercises
1.6 Agreements

CHAPTER 2 SAR COMMUNICATIONS

2.0 Introduction to Communications
2.1 Global Maritime Distress and Safety System (GMDSS)
2.2 Digital Selective Calling (DSC)
2.3 SafetyNET Messaging
2.4 Maritime Mobile Service Identity (MMSI) Numbers
2.5 National Distress and Response System (NDRS) & Rescue 21
2.6 Urgent Marine Information Broadcasts (UMIBs)
2.7 Cellular Telephones and *CG
2.8 Electronic Mail
2.9 Lost Communications with a Coast Guard Asset
2.10 Recorded Radio Transmissions and Telephone Lines

CHAPTER 3 SEARCH PLANNING

3.1 SAR Planning and Operations Overview
3.2 Search Planning Methods and Tools
3.3 Search Planning Variables
3.4 Initial Response, Search Planning and Search Operations
3.5 Rescue Planning and Operations
3.6 Measures of Search Effectiveness
3.7 Aspects of Survival
3.8 Conclusion of SAR Operations
3.9 Case Documentation

CHAPTER 4 GENERAL SAR POLICIES

4.1 SAR Policies Overview
4.2 Maritime SAR Assistance Policy (MSAP)
4.3 General Salvage Policy (Other than Towing)
4.4 Firefighting Activities Policy
4.5 Direction and Navigational Assistance for Mariners
4.6 SAR Cost Recovery and Reimbursement
4.7 Emergency Medical Assistance
4.8 Justification for Non-Maritime EMS Response
4.9 Ice Rescues
4.10 Float Plans
4.11 Self-Locating Datum Marker Buoys
4.12 SAR and Security Concerns

CHAPTER 5 COAST GUARD SEARCH AND RESCUE UNITS (SRUs)

5.1 Operations Overview
5.2 Surface Craft Operations
5.3 Coast Guard Boats
5.4 Coast Guard Cutters
5.5 Aids to Navigation (ATON) Vessels
5.6 Aircraft
5.7 Crew Fatigue
5.8 Rescue Swimmers

CHAPTER 6 PROCEDURES FOR UNDERWATER INCIDENTS

6.1 Underwater Incidents Overview
6.2 Submersibles
6.3 Persons Trapped in Capsized Vessels
6.4 Underwater Acoustic Beacons (Pingers)
6.5 Action Required for Underwater SAR Preparation
6.6 Scuba Diving Incidents

Appendix A Command SAR Library

Appendix B MISLE

B.1 MISLE System
B.2 Reporting Criteria
B.3 Responsibility
B.4 Action
B.5 General Data Entry Guidelines
B.6 Data Retrieval

Appendix C Standard CG SAR Messages

C.1 Situation Report (SITREP)
C.2 Search Action Plan (SAP)
C.3 Sample DSC False Alert Message Format
C.4 SafetyNET Examples

Appendix D MEDEVAC Report (CG-5214)

Appendix E Emergency Medical Services Agreement

Appendix F SAR Contingency Exercises

F.1 Introduction
F.2 Identifying Maritime Contingency Response Communities
F.3 Developing Maritime Contingency Response Plans
F.4 Exercising Maritime Contingency Response Plans
F.5 Requesting Support for Maritime Contingency Response Plan Exercises

Appendix G SAR Checksheets

Initial SAR Checksheet
Supplemental SAR Checksheet
Overdue Checksheet
MEDICO / MEDEVAC Checksheet
Grounding Checksheet
Flare Sighting Checksheet
Aircraft Emergencies
Abandoned or Adrift
Beset by Weather
Capsized
Collision
Disabled
Disoriented
Uncorrelated MAYDAY, MAYDAY, probable hoax calls, automated S.O.S.
PIW
SARSAT
Taking on Water or Fire
SAR Case Suspension Checklist

Mass Rescue Operation Supplemental Checksheet

Appendix H Search Planning Handbook

H.1 Search Planning
H.2 Manual Solution Model
H.3 Datum Estimation
H.4 Search Area
H.5 Search Plan Variables
H.6 Search Area and SRU Assignment
H.7 Search Pattern Selection
H.8 Search Action Plans
H.9 Manual Solution Worksheets

Appendix I Flare Incidents

I.1 Flare Incidents
I.2 Definitions
I.3 Obtaining Sighting Data
I.4 Estimating Distances
I.5 Determining a Datum Area

Appendix J Emergency Position Indicating Radio Beacon (EPIRB) Registration Form

Appendix K Bibliography

Appendix L *CG Agreement

Appendix M COMSAT-C Web Interface

M.1 Launching the Web service interface
M.2 SafetyNET Message Procedures
M.3 Shore to Ship Distress Alerts
M.4 Search and Rescue Messages
M.5 Navigational Warning Messages
M.6 Compose Message
M.7 Delivery Status
M.8 Read Mail
M.9 Monitoring Messages
M.10 Canceling Messages
M.11 Sending a cancel notification
M.12 User Profile
M.13 Error Messages
M.14 Back-up System

Appendix N SAR Controller Personnel Qualification Standard (PQS)

INDEX

LIST OF EFFECTIVE PAGES

REFERENCES

(a) National Search and Rescue Supplement
(b) IAMSAR Manual
(c) Coast Guard Incident Management Handbook, COMDTPUB P3120.17 (series)
(d) U.S. Coast Guard Incident Command System Implementation Plan, COMDTINST 3120.15 (series)
(e) Boat Crew Seamanship Manual, COMDTINST M16114.5 (series)
(f) Team Coordination Training, COMDTINST 1541.1 (series)
(g) Operational Risk Management, COMDTINST 3500.3 (series)
(h) Public Affairs Manual, COMDTINST M5728.2 (series)
(i) The Coast Guard Freedom of Information and Privacy Acts Manual, COMDTINST M5260.3 (series)
(j) Federal/State Relations – Recreational Boating Safety, COMDTINST 16750.8 (series)
(k) Memoranda of Understanding /Agreements, COMDTINST 5216.18 (series)
(l) Maritime Law Enforcement Manual (MLEM), COMDTINST M16247.1 (series)
(m) U.S. Air Force Foreign Clearance Guide
(n) Management and Operation of the Amver System, COMDTINST 16122.2 (series)
(o) Radio Frequency Plan, COMDTINST M2400.1 (series)
(p) International SafetyNET Manual, IMO Publication
(q) Telecommunications Manual (TCM), COMDTINST M2000.3 (series)
(r) USMCC National Rescue Coordination Center and Search and Rescue Point of Contact Alert and Support Messages
(s) HQ USAF Operations Order 68-80; Busy Playmate – Search and Rescue; (HQ USAF msg 201330Z JAN 88)
(t) Situation Reports (SITREPS), COMDTINST 16125.1 (series)
(u) Emergency Medical Services Manual, COMDTINST 16135.4 (series)
(v) Marine Safety Manual, Vol. VI, Ports and Waterways Activities, COMDTINST M16000.11 (series)
(w) Federal Highway Safety Act of 1966
(x) (reserved)
(y) 30’ SRB Operator’s Handbook, COMDTINST M16114.15 (series)
(z) 47’ MLB Operator’s Handbook, COMDTINST M16114.25 (series)
(aa) 41’ UTB Operator’s Handbook, COMDTINST M16114.2 (series)
(bb) Rescue and Survival Systems Manual, COMDTINST M10470.10 (series)
(cc) Auxiliary Operations Policy Manual, COMDTINST M16798.3 (series)
(dd) Coast Guard Air Operations Manual, COMDTINST M3710.1 (series)
(ee) Coast Guard Helicopter Rescue Swimmer Manual, COMDTINST M3710.4 (series)
(ff) Cutter Surface Swimmer Program, COMDTINST 16134.2 (series)
(gg) Coast Guard Diving Policies & Procedures Manual, COMDTINST M3150.1 (series)
(hh) NAVSEA SUBMISS/SUBSUNK Bill for Submarines and Manned Noncombatant Submersibles, NAVSEAINST 4740.1 (series)
(ii) Exercise Planning Manual, COMDTINST M3010.21 (series)
(jj) IMO Radiocommunications and Search and Rescue Circular 31, Guidance for Mass Rescue Operations
(kk) Contingency Preparedness Planning Manual(CCPM), Volume I, Doctrine and Policy, COMDTINST M3010.11(series)

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LIST OF FIGURES

Figure 1-1 Determination of RCC to Respond
Figure 1-2 Operational Risk Management Process for Tactical Decision Making
Figure 1-3 GAR Risk Management Model
Figure 1-4 Risk Assessment Decision Matrix

Figure 2-1 Operational Overview of GMDSS

Figure 3-1 Vessel Adrift
Figure 3-2 Square Pattern: Single Unit
Figure 3-3 Sector Pattern: Single-Unit
Figure 3-4 Sector Pattern: Two-Unit
Figure 3-5 Center Point-Landmark
Figure 3-6 Landmark Boundaries Method
Figure 3-7 Search and Rescue Information Form for SOLAS Requirement

Figure 4-1 USCG SAR Mission Coordinator (SMC) Maritime Assistance Decision Flow Chart
Figure 4-2 Sample Float Plan
Figure 4-3 Deployed SLDMB (METOCEAN)

Figure 5-1 Example of Angle Below Horizon for Search Distance
Figure 5-2 Use of Plotter to Determine Proper Sight Angle

Figure F-1 A Response Community Model for Exercising
Figure F-2 Exercise Priorities According to Response Community Level
Figure F-3 Comparison of Exercise Organizations

Figure H-1 Track Line Drift
Figure H-2 Vector Plot of Basic Surface Drift Velocities
Figure H-3 Outline of the First Three Leeway Drift Taxonomy Levels
Figure H-4 Maritime Survival Craft
Figure H-5 Person-Powered Craft
Figure H-6 Full Keel One-design Sailboat
Figure H-7 Fin Keel One-design Sailboat
Figure H-8 Skiffs
Figure H-9 Personal Water Craft
Figure H-10 Sport Boats
Figure H-11 Sport Fishers
Figure H-12 Commercial Fishers
Figure H-13 Coastal Freighters
Figure H-14 River Currents
Figure H-15 Establishing a Starting Position and Position Error for Subsequent Drift
Figure H-16 Search Areas – Stationary Datum Point
Figure H-17 Search Areas – Moving Datum Point
Figure H-18 Search Area for Divergent Datums
Figure H-19 Search Areas – Datum Line
Figure H-20 Search Areas Expansion – Datum Line
Figure H-21 Track Spacing
Figure H-22 Sweep Width
Figure H-23 Estimated FLIR Sweep Width
Figure H-24 Coverage Factors
Figure H-25 Maritime Probability of Detection
Figure H-26 Probability of Containment (POC) for Single Point and Divergent Datums
Figure H-27 Manual Solution Probability Density
Figure H-28 Manual Solution POC is 64.76% for a Square Search Area Based on an Optimal Search Factor of 1.1

Figure H-29 CASP Probability Density Distribution
Figure H-30 Landmark Boundaries Method
Figure H-31 Center Point-Landmark
Figure H-32 Search Leg Orientation
Figure H-33 Typical Assignments for SRUs
Figure H-34 Trackline Single-Unit Non-Return (TSN)
Figure H-35 Trackline Single-Unit Return (TSR)
Figure H-36 Trackline Multi-Unit Return (TMR)
Figure H-37 Trackline Multi-Unit Non-Return (TMN)
Figure H-38 Parallel Track Single-Unit (PS)
Figure H-39 Parallel Track Multi-Unit (PM)
Figure H-40 Parallel Track Multi-Unit Return (PMR)
Figure H-41 Parallel Track Multi-Unit Non-Return (PMN)
Figure H-42 Parallel Track Single-Unit LORAN (PSL)
Figure H-43 Parallel Multi-Unit Circle (PMC)
Figure H-44 Parallel Single-Unit Spiral (PSS)
Figure H-45 Creeping Line Single-Unit (CS)
Figure H-46 Creeping Line Single-Unit Coordinated (CSC)
Figure H-47 Square Pattern: Single-Unit (SS)
Figure H-48 Sector Pattern: Single-Unit (VS)
Figure H-49 Sector Pattern: Two-Unit (VM)
Figure H-50 Flare Single-Unit (FS)
Figure H-51 Flare Multi-Unit (FM)
Figure H-52 Parallelogram Search Patterns
Figure H-53 Cross-Over Barrier Pattern (B)
Figure H-54 Expanded Area, Drift Oriented
Figure H-55 Expanded Area

Figure I-1a Luminous Range and Visibility, example with visibility of 27 nm
Figure I-1b Luminous Range and Visibility, example with visibility of 5 nm
Figure I-2 Geographic Range of a Flare by Height of Eye
Figure I-3a Example of angle when flare origin is beyond the horizon and unobserved
Figure I-3b Example of angle when flare origin is observed
Figure I-3c Example of angle measured form flare origin to top of trajectory
Figure I-4a Fist Method for measuring flare angles above the horizon
Figure I-4b Fist Method for measuring flare angles below the horizon
Figure I-5 Clock Method for determining bearing. Reporting source aligned with shore (left), bearing 1 o'clock; reporting source not aligned with shore (right), bearing 12 o'clock
Figure I-6 Observed angle below the horizon
Figure I-7 Relationship of Vertical Angles to Distances (Flat Earth)
Figure I-8 Example of relationships between meteorological visibility and luminous range (for a flare with 20 nm nominal luminous range)
Figure I-9 Step 1: Plotting reporting source position and position error
Figure I-10 Step 2: Plotting lines of bearing and bearing error
Figure I-11 Step 3: Bearing error including position error
Figure I-12 Step 5: Plotting maximum and minimum arcs
Figure I-13 Step 6: Enclosing the search area, including the safety factor
Figure I-14 Luminous Range Diagram
Figure I-15 Reporting Sources with different positions

LIST OF TABLES

Table 1-1 USCG SAR Coordinators, RCC's and Locations
Table 1-2 Standard SAR Mission Coordinator Assignment
Table 1-3 Relationship Between Various Decision Making Approaches
Table 1-4 SAR Knowledge Requirements

Table 1-5 SAR Course/Workshop
Table 1-6 Countries With Automatic Entry for SAR
Table 1-7 Other Countries Entry Procedures

Table 2-1 DSC Guard Frequencies, Associated Voice and SITOR Frequencies
Table 2-2 SafetyNET Message Types

Table 3-1 Initial Track Spacing
Table 3-2 Square Pattern Search Computations
Table 3-3 Sector Pattern Search Computations
Table 3-4 Beacon Alert and Corresponding Emergency Phase
Table 3-5 406 MHz and 121.5 MHz Beacons Comparison Table

Table 4-1 Ice Thickness Minimums to Support a Person or Vehicle
Table 4-2 Environmental Operating Parameters for SLDMBs

Table 5-1 Standard Boats
Table 5-2 Cutter-Based Response Boats
Table 5-3 Non-Standard Boats
Table 5-4 Coast Guard Boat Characteristics and Limitations
Table 5-5 Coast Guard Cutter Characteristics
Table 5-6 Coast Guard Aircraft Characteristics
Table 5-7 Angle Below Horizon by Altitude for Appropriate Distance

Table A-1 Joint International Publications (IMO and ICAO)
Table A-2 International Maritime Organization (IMO) Publications
Table A-3 Unpublished IMO Documents
Table A-4 Other International Documents
Table A-5 Regional Documents
Table A-6 National Documents

Table H-1 Names and Descriptions of Leeway Drift Taxonomy Levels
Table H-2 Conversion Factors
Table H-3 Leeway Speed and Direction Values for Drift Objects
Table H-3a Sub-Table for Maritime Life Rafts with Deep Ballast Systems and Canopies
Table H-4a Wind Current – North Latitudes
Table H-4b Wind Current – South Latitudes
Table H-5 Navigational Fix Errors
Table H-6 FCC DF Network Fix Errors
Table H-7 Dead Reckoning Errors
Table H-8 Recommended Visual Search Altitudes
Table H-9 Search Aircraft Speed Correction
Table H-10 Weather Correction Factor
Table H-11 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 300-500 Feet
Table H-12 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 750-1000 Feet
Table H-13 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 1500-2000 Feet
Table H-14 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 2500-3000 Feet
Table H-15 Uncorrected Visual Sweep Width – Helicopters for Altitudes 300-500 Feet

Table H-16 Uncorrected Visual Sweep Width – Helicopters for Altitudes 750-1000 Feet
Table H-17 Uncorrected Visual Sweep Width – Helicopters for Altitudes 1500-2000 Feet
Table H-18 Uncorrected Visual Sweep Width – Helicopters for Altitudes 2500-3000 Feet
Table H-19 Uncorrected Visual Sweep Width – Vessels and Boats
Table H-20 Visual Sweep Width Estimates for Daylight Detection Aids
Table H-21 Visual Sweep Width Estimates for Hand Held Orange Smoke
Table H-22 Visual Sweep Width Estimates for Night Detection Aids
Table H-23 Visual Sweep Width Estimates for Hand Held Red Flare (500 candlepower)
Table H-24 Visual Sweep Width Estimates for Life ring/Life jacket White Strobe (50,000 peak candlepower)
Table H-25 Sweep Widths and Recommended Settings for AN/SPS-73 Radar
Table H-26 Sweep Widths for Surface Vessel Radar (NM)
Table H-27 Sweep Widths for Forward-Looking Airborne Radar (AN/APS-137)
Table H-28 Sweep Widths for Forward-Looking Airborne Radar (AN/APS-133, AN/APN-215)
Table H-29 Sweep Widths for Forward-Looking Airborne Radar (AN/APS-127)
Table H-30 Sweep Widths for Side-Looking Airborne Radar (NM)
Table H-31 Sweep Widths and Recommended Settings for MARFLIR
Table H-32 Base Sweep Widths (BSW) for NVG – Helicopters
Table H-32a Environmental Situation Correction Factors for PIW
Table H-32b Environmental Situation Correction Factors for Boat/Raft
Table H-33 Sweep Width Estimates for Unlighted Targets from 210’ WMEC
Table H-34 Environmental Limitations and Multisensor Search
Table H-35 SLAR/Visual Weather Conditions
Table H-36 SLAR/Visual Sweep Widths (NM)
Table H-37 UTB SVR/Visual Sweep Width for Targets With Radar Reflectors
Table H-38 UTB SVR/Visual Sweep Width for Targets Without Radar Reflectors
Table H-39 WPB SVR/Visual Sweep Width for Targets With Radar Reflectors
Table H-40 WPB SVR/Visual Sweep Width for Targets Without Radar Reflectors
Table H-41 Height of Eye vs. Horizon Range
Table H-42 Square Pattern Search Computations
Table H-43 Sector Pattern Search Computations
Table H-44 Search Pattern Summary

Table I-1 Flare Characteristics
Table I-2a Angle of Observation Above the Horizon; Minimum Distance to the Flare (nm)
Table I-2b Angle of Observation Above the Horizon; Maximum Distance to the Flare (nm)
Table I-3a Angle of Observation Below the Horizon; Minimum Distance to the Flare (nm)
Table I-3b Angle of Observation Below the Horizon; Maximum Distance to the Flare (nm)
Table I-4 Angle of Observation from Flare Origin to Apex; Minimum and Maximum Distance (nm)
Table I-5 Maximum Distance for Meteor Flares, Angle of Observation Above the Horizon
Table I-6 Distances for Hand-held Flares (nm)

PREFACE & PROGRAM OVERVIEW

I Mission and Purpose
II Risk Management
III SAR Functions & Hierarchy
IV Statutory Authority & Responsibility
V SAR Publications
VI SAR Program Objectives, Goals, Standards and Requirements
VII SAR Program Focus
VIII SAR System Infrastructure
IX Terms Within the Addendum
X Applicability and Obligation

I Mission and Purpose

The mission and purpose of the Coast Guard's Search and Rescue (SAR) Program is to prevent death or injury to persons and loss or damage to property in the marine environment. The overall success of the Coast Guard's SAR program depends on many separate efforts, including SAR program management (doctrine, policy and procedures), facility management (platforms and units), support management (equipment, systems), training (proficiency), boating safety and marine inspection (prevention), and others. Ultimately, the success of our SAR program depends on the success of each and every SAR mission that we perform. The focus of this addendum is on the four key processes involved in performance of our SAR missions: (1) distress monitoring and communications; (2) search planning; (3) search coordination; (4) search and rescue operations. The addendum also addresses SAR records and administration, public affairs, SAR liaison and agreements, SAR exercises, and several other aspects of our SAR mission.

II Risk Management

We do dangerous work in a perilous environment. Our heritage is based in large part on the selfless acts of courageous men and women who use their tools and their judgment under the most demanding conditions to save the lives of others. This tradition continues as we perform duties that often place us in harm's way. With a renewed commitment to careful risk management, we seek to avoid jeopardizing the success of our missions by not unnecessarily endangering the lives of our own crews and the lives of those we go out to save. Successful missions begin with thoroughly understanding the environment in which we operate. Based on that understanding, we develop operational concepts, acquire appropriate equipment, and put our people through rigorous formal training. We build on that foundation by continuous operational training and drills, by improving our personal skills, and by maintaining our equipment at the highest state of readiness. In short, successful performance requires thorough preparation.

Preparation alone, however, is not enough. Success also requires that our people and equipment be used within the limits of their abilities. No small boat or aircraft, no matter how well maintained or skillfully piloted, can be expected to survive, much less perform a rescue, when wind and sea conditions are beyond the limitations of hull, airframe or the humans that operate them. Responsible commanders evaluate the capability of crew and equipment against the conditions likely to be encountered when deciding on the proper course of action. Conscious attention to time-tested and time-honored principles of risk management is a necessity.

Today's Coast Guard standard of response remains true to its legacy. We honor our heritage daily by casting off all lines or lifting off the runway in severe weather to save others' lives, while carefully weighing the risk of losing our own. We honor our heritage as well by attending to the principle that a proper and practiced understanding of duties, a thorough evaluation of the risks involved in an operation, and the exercise of good judgment in carrying out that operation is of paramount importance for success. With this in mind, Coast Guard units will carry out SAR missions only after the operational commander has ensured the unit is properly trained, equipped, maintained and ready for the mission and has assessed crew and equipment capabilities and limitations against the operational scenario and the known and predicted challenges the crew will face. Amplified discussion of SAR risk assessment is contained in Section 1.2.3 of this Manual.

III SAR Functions and Hierarchy

a. Search: An operation, normally coordinated by a rescue coordination center (RCC), rescue sub-center (RSC), or group/activities operations center, using available and appropriate personnel, facilities and resources to locate persons or property in distress.

b. Rescue: An operation with the primary purpose of retrieving persons in distress and delivering them to a place of safety. This may include providing for certain medical care or other critical needs. Rescue operations may also be performed for the purpose of preventing or mitigating property loss or damage. However, missions shall not normally be performed for the purpose of salvage or recovery of property when those actions are not essential to the saving of life. Beneficial secondary consequences of a rescue operation may be to prevent environmental damage or remove hazards to navigation, but these are not considered part of the rescue operation's objective.

c. The rescue of persons in distress is the highest priority SAR mission. Missions solely for saving property or for other purposes such as preventing environmental damage will always give way to saving a person's life.

IV Statutory Authority and Responsibility

The statutory authority for the U. S. Coast Guard to conduct SAR missions is contained in Title 14, Sections 2, 88, and 141 of the U.S. Code. The code states that the Coast Guard **shall** develop, establish, maintain and operate SAR facilities and **may** render aid to distressed persons and protect and save property on and under the high seas and waters subject to the jurisdiction of the United States. It also states that the Coast Guard **may** use its resources to assist other Federal and State entities. Thus, Coast Guard performance of SAR is essentially permissive in nature. Search and Rescue activity may be considered a mandated function, but no specific level of performance has been cited under the legislative authority. Nevertheless, judicial rulings have made it clear that once the Coast Guard undertakes a particular mission, we must conduct that mission with due diligence, we must not worsen a situation by our actions, and we must meet a reasonable standard of performance. Moreover, it is within our service's own code of ethics and our creed to carry out each mission to the best of our ability.

In accordance with the National Search and Rescue Plan, the Coast Guard is responsible for organizing available SAR facilities in Search and Rescue Regions (SRRs) as defined in the National SAR Supplement. These waters generally include all navigable waters subject to the jurisdiction of the United States, but also include international waters stretching far into the Atlantic and Pacific Oceans and the Gulf of Mexico.

V SAR Publications

a. Description. SAR doctrine, policy and procedures for the Coast Guard are provided in three primary publications. These publications provide material that applies to each of three levels within our SAR system. Each publication both complements and supplements the others.

- The **National Search and Rescue Plan** is a federal executive level inter-agency document that describes how the United States will meet its international legal and humanitarian obligations to provide SAR services. It establishes over-arching federal SAR policy, assigns SAR responsibilities to various federal agencies, and adopts the International Aeronautical Search and Rescue Manual and the National SAR Supplement for use by U. S. SAR agencies.
- The **International Aeronautical and Maritime Search and Rescue (IAMSAR) Manua**l, in three volumes, provides doctrine applicable on an international level. Volumes I and II of the manual describe the basic structure of the SAR system and address the fundamentals of the four basic processes listed in Section I of this preface: SAR communications, planning, coordination and operations. Volume III is designed for use by SAR facilities and by units or individuals in need of SAR services. Not all Coast Guard commands require the full three-volume set. In general, those commands, which serve as SAR Coordinator (SC), will require all three volumes, those commands which may serve as SAR Mission Coordinator (SMC) should have volumes II and III, and response units may need only volume III.
- The **United States National Search and Rescue Supplement (NSS) to the IAMSAR Manual** provides the inter-agency doctrine applicable at the federal level. This manual defines the national SAR system, expands on

topics covered by the IAMSAR Manual, and provides specific guidance for coordination and operations unique to the United States.

- The **Coast Guard Addendum (CGADD) to the NSS** provides policies, procedures, and standards applicable specifically to the U. S. Coast Guard. The CGADD serves as the standard reference for the entire Coast Guard to use in planning and conducting SAR missions. Further, it provides a common reference for discussion among Coast Guard SAR professionals and a timely mechanism for recommending and implementing improvements to the SAR system. Just as SAR is not the only mission conducted by our RCCs, Groups, air stations and boat stations, the SAR Program functions as part of the larger Coast Guard, and has developed our SAR doctrine as part of both the larger national and international maritime and aeronautical SAR networks. The CGADD addresses this organizational relationship and focuses on the particulars of search planning and response.
- There are several additional Coast Guard and other publications that provide policy, procedures and guidance that apply to SAR, and serve to enhance the overall professional knowledge of SAR personnel. A list of some of these publications is found in Appendix K.

b. Precedence. Each successive level of primary SAR publications, from the National SAR Plan to the CGADD, provides greater refinement of doctrine, policy and procedure. If conflicts arise between guidance or information in the various publications, Coast Guard SAR personnel shall follow the CG Addendum, unless otherwise directed by COMDT (G-OPR).

VI SAR Program Objectives, Goals, Standards and Requirements:

a. Program Objectives. Four general objectives provide direction for the SAR Program:

- Minimize loss of life, injury, and property loss and damage in the maritime environment;
- Minimize crew risk during SAR missions;
- Optimize use of resources in conducting SAR;
- Maintain a world leadership position in maritime SAR.

b. SAR Program Primary Goal. The ultimate **goal** of the Coast Guard's SAR program is to prevent loss of life in every situation where our actions and performance could possibly be brought to bear. Our success in meeting this goal is the result not only of how well the SAR system responds to maritime SAR incidents, but also the efforts of other maritime safety programs, including recreational boating safety and commercial vessel safety. Success reflects how these combined efforts provide mariners with seaworthy craft, proper equipment, necessary knowledge, training, and information to operate safely in the maritime environment, and to take the correct actions when faced with a distress situation.

c. SAR System Performance Benchmark. Although the ultimate goal is to save 100% of the lives endangered, based on calculations of historical performance and estimation of the attainable level of success, the current **benchmark** for performance of our collective maritime safety mission areas is **85%** lives saved of mariners in distress. As improvements are made in the SAR System we expect these improvements to be reflected in our performance. Periodic adjustments to the benchmark are planned as follows:

Goal	Fiscal Year					
	2004	2005	2006	2007	2008	2009
All mariners in distress, save	85%	86%	86%	87%	87%	88%

d. Specific SAR Response Benchmarks. Two specific benchmarks have been established to measure a subset of the overall Coast Guard Maritime Safety of Lives and Property goals - the response component of the service's maritime safety team. These indicate how well we are performing within the constraints of our current resources:

After Coast Guard notification, in waters over which the Coast Guard has SAR responsibility:

- Save at least **93%** of those people at risk of death. As improvements are made in the SAR System, we expect these improvements to be reflected in our response performance. Periodic adjustments to the benchmark are planned as follows:

Goal	Fiscal Year					
	2004	2005	2006	2007	2008	2009
All mariners in distress after CG has been notified, save	93%	93%	94%	94%	94%	95%

- Prevent the loss of at least **80%** of the property that is at risk of destruction.

NOTE: These benchmarks were established based on a macro analysis of expected survival times of people in the water and based on an excellent standard of response by existing rescue resources under the current SAR system. It is recognized that regional variances (cold water versus warm, resource-rich port area versus remote locations) will impact the success rate in specific regions.

e. General SAR Program Standards and Requirements. Certain standards and requirements have been developed for various components of the Coast Guard's SAR system.

- **SAR Readiness.** Each Coast Guard unit with a SAR readiness responsibility shall have a suitable SAR resource ready to proceed within 30 minutes of notification of a distress. This readiness requirement may be adjusted by District Commanders, and by unit commanders when this authority is delegated, based on resource constraints, crew fatigue limits, environmental considerations or other factors. This response standard is in no way intended to negate or supercede proper risk management. It is recognized that mechanical malfunction, unusual mission preparations or other factors may make it necessary to deviate from this standard. Such deviations shall be reported to the cognizant District Commander.

- **SAR Mission Response.** Based on assigned SAR areas of responsibility (AOR) for Coast Guard Groups and other Coast Guard units with specified SAR AORs, the siting, basing or staging of search and rescue units (SRU) should provide for no greater than a two-hour total response time for any one surface or air SRU within that Group or unit's AOR to arrive at any location within the AOR. This time is calculated from time of notification of the Coast Guard until the time of arrival on scene of an SRU, based on moderate environmental conditions which allow for operation of the SRUs at their top cruise speeds, and including 30 minutes of preparation time (i.e. a total of 90 minutes from underway to on-scene). This is a SAR system resource-planning standard; it does not create a requirement for SRUs to actually arrive on scene within this time in each and every case, as the particular circumstances of any given mission may make this impossible or contrary to proper risk assessment. It is recognized that this response standard may not be met in the AORs of all Coast Guard units with SAR responsibility, especially in those which include vast areas of open ocean and/or remote areas with little or no SAR demand.

- **SAR Watch Duty Length at CG Command Centers**. Military and civilian command center watchstanders will not stand more than 12 hours of continuous watch in any 24-hour period. Units unable to comply with the 12 hour standard shall request a waiver from the appropriate operational commander in their chain of command and notify G-OPR.

NOTE: Search and Rescue Regions (SRRs) associated with Rescue Coordination Centers (RCCs) are determined by international agreement, and are not strictly based on Coast Guard readiness and response standards. RCCs are nevertheless responsible for directing and coordinating response to SAR incidents, within their SRRs, by dispatching the most suitable assets in the timeliest manner possible. Likewise, the Coast Guard's SAR program is responsible for providing suitable assets in the proper locations to provide SAR capability throughout as much of our SRRs as possible.

- **National Distress and Response System (NDRS) Coverage.** NDRS is the primary distress alerting and SAR command, control and communications (C3) system for U.S. coastal waters (Sea Area A-1, which extends from the territorial baseline out to 20 nautical miles). The standard for the VHF-FM network is a minimum 90% continuous coverage for reception of a one-watt signal of a one-meter antenna, out to 20 nautical miles from

shore around the coastline of the continental U.S., the Great Lakes, main Hawaiian Islands, the Commonwealths of Guam, Puerto Rico, the U.S. Virgin Islands and portions of Alaska.

- **Basic SAR Training.** Successful completion of resident SAR planner training at the National SAR School is required for all Area, District, Section and Group/Activities Command Center (Rescue Coordination Center) watchstanders who perform SMC functions. Area/District (osr and Aosr) and other SAR staff personnel should also attend the resident course on a lower priority basis. An additional goal is to complete training in the Incident Command System (ICS) for all SAR planning personnel and SAR staffs.

- **SAR Command and Control Responsiveness.** SMCs shall process and evaluate information about a SAR incident, determine appropriate initial action, and initiate action within five minutes of notification of a distress incident. Units other than SMC receiving SAR incident information shall relay information to the SMC immediately.

- **Employment of Approved Search Planning Methodologies.** Use and documentation of an approved search-planning tool for all incidents that require search planning. Approved tools include manual solution work sheets with manual plotting, C2PC/JAWS, and CASP. (See Section 3.2)

- **Computer Assisted Search Planning (CASP) System.** CASP should be used for planning guidance for all cases involving incidents outside the 30 fathom mark when:

  – The duration of an incident has or could have exceeded 24 hours, and

  – There is uncertainty concerning the incident time, incident location, or type of search object(s) involved.

  NOTE: This does not preclude the use of CASP in other circumstances.

- **Amver System.** SMCs shall use Amver for identification of SAR facilities for all cases involving maritime and aeronautical incidents offshore when such facilities might be useful for mission accomplishment. SAR Coordinators (SC), SMCs, and others within the Coast Guard SAR System shall seek to increase ship participation in this voluntary ship reporting system for SAR and promote the use of Amver information for SAR purposes by other RCCs.

- **SAR Unit Training and Professionalism.** The SRU crew must be able to correctly operate all equipment provided on their vessels, aircraft or land vehicles to aid a person or property in distress. Specialized and recurrent training must be provided to personnel designated by the unit as Rescue Swimmers, Emergency Medical Technicians (EMTs), or First Responders. All personnel assigned these specialized rescue duties must demonstrate a high level of professionalism and competency as documented by completion of appropriate PQS, practical factors, and by their performance.

f. Coast Guard Unit SAR Readiness Requirements. Readiness requirements for individual units are assigned by the District Commander iaw the CG Organization Manual, COMDTINST M5400.7 (series), and CG Regulations, COMDTINST M5000.3 (series). The SAR unit response standard is geared toward quick response craft at boat and air stations. To meet the SAR response standard for most Coast Guard unit AORs, units will be required to maintain a B-0 (ready to proceed in 30 minutes) readiness. In certain areas and/or at certain times of the year, the presence of unit coverage overlap may allow a lower readiness than B-0 (greater than 30 minutes).

VII SAR Program Focus

The Coast Guard Headquarters Office of Search and Rescue (G-OPR) performs the functions of the SAR Program Manager. The SAR Program's overall purpose is to provide the resources and policy that facilitate Coast Guard field units in achieving optimal effectiveness in saving lives and property in distress or at risk of injury or damage. The program addresses known and latent deficiencies in the SAR system and strives for continuous improvement in Coast Guard SAR response capabilities through policy-making and budget actions. SAR Program efforts are focused in six key areas:

- SAR Doctrine and Procedures: adoption and development of IAMSAR Manual, National SAR Plan, National SAR Supplement, CG Addendum to the National SAR Supplement.

- SAR Professionalism: update of SAR School curriculum (including CBT courses); renewed emphasis on SAR planning skills for RCC and Activities/Group Command Center planners; development of SAR PQS, SAR Standardization (Command Center Stan Team).
- SAR Capabilities: development and acquisition of computer-assisted SAR planning and case management tools (SAROPS, CASP, MISLE (response module, SAR data entry, MMSI), C2PC/ JAWS,) and other operational equipment (self-locating datum marker buoys, Personal Locator Beacons (PLBs) for SAR crews, new SAR signaling and detection devices, etc.).
- SAR Communications: SAR related comms procedures; comms systems improvements (National Distress and Response System Modernization Project (NDRSMP) and Rescue 21), Global Maritime Distress and Safety System (GMDSS)).
- International SAR System: cooperation in doctrine, standards, organization, coordination, and R&D.

VIII SAR System Infrastructure:

The Coast Guard's SAR System infrastructure is composed of a network of Headquarters, Area, District and field commands:

- Headquarters offices with key SAR program, resource and support responsibilities include: Office of SAR Policy (G-OPR) (serves as program manager for all CG command centers), Office of Small Boat Forces (G-OCS), Office of Aviation Forces (G-OCA), Office of Boating Safety (G-OPB), Office of Auxiliary (G-OCX), Office of Command & Control Architecture (G-OCC); Marine Safety Office of Response (G-MOR), Office of Communications Systems (CG-62), Office of Force Management (G-SRF).
- Area and District staffs include senior officers and key staff assigned specifically to oversee operational and programmatic SAR matters ((Aosr), (Posr) and District (osr)). The functions of SAR Coordinator (SC) are carried out at this organizational level. Depending on the nature, complexity, duration, geography, and resource requirements of a particular SAR case, SMC functions are sometimes carried out at this level in the Area or District's multi-mission Command Center, which serves as the RCC.
- Groups and Activities. There are currently 42 of these multi-mission commands, including several that are combinations such as Group/Air Station or Group/MSO. SMC functions are typically carried out at the Group/Activity for most SAR cases.
- Air Stations and Boat Stations. These units perform specific assigned SAR missions as well as many other Coast Guard missions (LE, MEP, ATON, RBS, etc.). Over 1900 vessels (ships & boats) and over 200 aircraft (fixed wing and rotary wing) provide ready response around the nation.
- An extensive communications network for distress alerting and response coordination, consisting of the National Distress and Response System (NDRS) VHF-FM sites and MF/HF sites serving SAR communications needs. The sites are operated by a combination of Group communications centers and Communications Area Master Stations (CAMS), depending on the frequency band, location and other communications infrastructure considerations.

IX Terms within the Addendum. The following terms found in the Addendum have these intended meanings:

a. **"Shall"** is used to show an action, procedure or application that is mandatory.

b. **"Should"** is used to show an action, procedure or application that is recommended and expected as the normal course of action, although is not deemed mandatory.

c. **"May"** is used to show when an action, procedure or application is optional.

d. **"Will"** is used only to indicate futurity, never to indicate any degree of requirement for action, procedure or application.

X Applicability and Obligation

The policies and procedures in this manual apply to U. S. Coast Guard facilities within the U.S., territories, and possessions,

and to U. S. Coast Guard SAR operations worldwide. This directive promulgates internal Coast Guard planning guidance solely intended to promote efficiency and consistency in public service above and beyond the requirements of law and regulation. Any obligations discussed, flow only to the Coast Guard. Coast Guard personnel are expected to exercise broad discretion and to exercise sound judgment in performing the functions discussed. The Coast Guard retains the discretion to deviate from or change this guidance without notice. This document creates no duties, standard of care, or obligations to the public and should not be relied upon as a representation by the Coast Guard as to the manner of proper performance in any particular case.

This manual represents internal policy guidance to Coast Guard units and is not intended to create any right or cause of action on behalf of the public.

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CHAPTER 1
SEARCH AND RESCUE SYSTEM

1.1 Search and Rescue (SAR) Organization
1.1.1 Rescue Coordination Center
1.1.2 Rescue Sub-Center
1.1.3 Group/Activities Operations Center
1.1.4 Incident Command System and SAR

1.2 SAR Coordination
1.2.1 First RCC
1.2.2 SAR Mission Coordinator
1.2.3 Mission Briefings and Risk Management
1.2.4 Adverse Weather
1.2.5 Blood-Borne Pathogens

1.3 Professional Requirements
1.3.1 Training
1.3.2 Qualification/Currency
1.3.3 Certification
1.3.4 Professionalism/Standardization
1.3.5 SAR School Quota Assignment Prioritization

1.4 Public Affairs & Next of Kin Interactions
1.4.1 News Releases and Interviews
1.4.2 Training and Education
1.4.3 Next of Kin (NOK) Notification and Interaction

1.5 Liaison and Contingency Exercises
1.5.1 Contingency Response Community
1.5.2 SAR Facility List
1.5.3 Mass Rescue Operations Contingency Exercises
1.5.4 Information Sharing and Case Coordination
1.5.5 SAR Assessments
1.5.6 Sharing Computer SAR Applications

1.6 Agreements
1.6.1 Domestic and Local SAR Agreements
1.6.2 Department of Defense (DOD) SAR Agreements
1.6.3 Medical Advice
1.6.4 International SAR Agreements
1.6.5 SAR in Foreign Territories
1.6.6 Amver System

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Section 1.1
Search and Rescue (SAR) Organization

The National SAR Plan, Appendix A of reference (a), designates the Coast Guard as the aeronautical and maritime SAR Coordinator for the ocean areas for which the U. S. is responsible. Chapter 1 of reference (a) provides a chart showing the geographic areas of SAR responsibility and discussion on both international and domestic arrangements made to implement the United States SAR system.

1.1.1 Rescue Coordination Center

Rescue Coordination Center (RCC) is an internationally recognized designation of a facility with the responsibility to promote efficient organization of SAR services and to coordinate the conduct of SAR operations within a search and rescue region (SRR). For the Coast Guard, this is one of the primary functions performed at the Area and District level command centers and includes all aeronautical and maritime incidents within its maritime SRR. The Coast Guard in turn, for internal purposes and ease of administration, divides the SRR into areas of responsibility (AOR).

Table 1-1 USCG SAR Coordinators, RCC's and Locations

SAR Coordinator Command / RCC's	*Location*
Atlantic Area	Norfolk, Virginia
First District	Boston, Massachusetts
Fifth District	Norfolk, Virginia
Seventh District	Miami, Florida
Eighth District	New Orleans, Louisiana
Ninth District	Cleveland, Ohio
Pacific Area (NO SRR)	Alameda, California
Eleventh District	Alameda, California
Thirteenth District	Seattle, Washington
Fourteenth District	Honolulu, Hawaii
Seventeenth District	Juneau, Alaska

1.1.2 Rescue Sub-Center

Rescue Sub-Center (RSC) is an internationally recognized designation of a facility established where the RCC can not exercise direct and effective control over SAR facilities in remote areas, or where local facilities can be directed only through local authorities. There is only one RSC in the Coast Guard, Greater Antilles Section within CCGD7 (RSC San Juan under RCC Miami). Marianas Section within CCGD14 is not an RSC but does maintain SAR planning and coordination capabilities.

1.1.3 Group/Activities Command Center

The Command Center at the Group or Activities level is an internal Coast Guard designation. Command centers are subordinate to the RCCs. Group Command Centers, while performing many of the SAR duties, are not designated as RCCs or RSCs. The Group/Activities Command Center is responsible for SAR mission coordination and tactical control of search and rescue units (SRUs) in its AOR, which is within the SRR of the RCC.

1.1.4 Incident Command System and SAR

1.1.4.1 Background. SAR efforts primarily focus on finding and assisting persons in actual or apparent distress and are carried out within a well-defined SAR response system as per references (a) and (b) and this manual. These references have their basis in international law and have practical benefits that are intended to maximize the effectiveness of SAR operations, particularly when working with other military services, SAR authorities of other nations, and with ships or aircraft at sea. U.S. SAR service providers are obligated to follow these laws.

When an emergency warrants responses in addition to SAR, the National Interagency Incident Management System (NIIMS) Incident Command System (ICS) organizational structure should be used to manage the overall response. Examples of other activities that are not SAR, but are often closely associated with a large SAR incident, include:

- search and recovery,
- salvage,
- investigation,
- fire fighting,
- pollution response.

See reference (c) for a detailed description of the ICS organizational structure that will provide supervision and control of essential functions during a major SAR incident that includes, or will include, other non-SAR activities.

1.1.4.2 ICS and SAR System Interface. For large incidents that actually or potentially involve both SAR and non-SAR activities, the SAR Mission Coordinator (SMC), who is designated by the SAR response system, will initiate action and coordinate the overall SAR aspect of the response in accordance with references (a), (b), and this Addendum.

If a Coast Guard Incident Commander (IC) is designated, the SMC function will be placed under the umbrella of the ICS organizational structure, typically as the SAR Branch Director or SAR Group Supervisor in the Operations Section. Simply put, the SAR response system "plugs into" the ICS organizational structure, where the SMC (or someone designated by the SMC to carry out this function) serves as the "plug" or link. In essence, SAR personnel shall continue to use standard SAR terminology and procedures regardless of the scope of the SAR incident.

The SAR response may also include an On Scene Coordinator (OSC) and an Aircraft Coordinator (ACO). In some cases the person serving as IC or Operations Section Chief in the ICS structure may also be designated as the SMC, but the terms "Incident Commander" or "Operations Section Chief" are not interchangeable with titles associated with SAR response functions.

1.1.4.3 Closing/suspending a SAR case in an ICS structure. Only agencies designated as U.S. SAR Coordinators (i.e. the USCG for maritime regions) have the authority to suspend a SAR case. For example, the NTSB does not have the authority to suspend a maritime SAR case even though they may fill the IC role. As per reference (b), the IC may continue the SAR mission beyond the time when a SAR case would normally be suspended due to humanitarian considerations, large number of people involved, or forecast of greatly improved search conditions.

However, SRUs should not be placed at risked when potential for saving life is minimal, or when their use may preclude their availability for other missions. For the majority of incidents, the SAR response will be completed/suspended by the time the ICS structure is fully in place.

1.1.4.4 Transition from SAR to Other Missions. As the SAR mission winds down and other missions take precedence (i.e. search and discovery), the SMC may be designated to serve as a Branch Director or Group Supervisor in the operations section to manage on scene operations other than SAR. Likewise, Search Rescue Units (SRUs) may also be reassigned to other groups in the ICS structure once the SAR mission is concluded.

Coast Guard personnel with SAR responsibilities should receive sufficient ICS training to enable them carry out their respective duties. See Table 1-4 for minimum Coast Guard ICS training requirements.

Section 1.2
SAR Coordination

SAR coordination is discussed in the National Search and Rescue Plan contained in reference (a). Coordinating SAR response to any distress situation will be achieved through cooperation among SAR authorities willing and able to assist. To achieve this, the Coast Guard may enter into international, domestic and local SAR agreements as discussed in the section on Agreements within this Addendum.

As indicated in the IAMSAR Manual, any facility within a SAR organization should respond to distress situations whenever and wherever it is capable of doing so. SRRs are established to help ensure response to persons in distress will be coordinated, and should in no way be viewed as justification for an RCC not assisting persons in distress outside its own SRR. Cooperation among Coast Guard RCCs and with SAR authorities of other countries should be as close as practicable, and arrangements to request or grant a request for assistance should normally be handled at the RCC level as expeditiously as possible. The general principle that applies is that the facilities that are in the best position to respond should be tasked. On an operational level, SAR response includes:

- investigation,
- coordination,
- dissemination of information.

It is crucial that all levels of the SAR organization keep each other informed, both up and down the chain of command. The Case Documentation section within this Addendum discusses required documentation but the SAR planner needs to anticipate when additional awareness of an incident may be required (e.g., expansion of case complexity or public interest). Prior sharing of information in such situations will decrease the chance that superiors might be caught uninformed and that SRUs might be unable to respond.

1.2.1 First RCC.

Reference (a) outlines actions required by the "First RCC." The RCC affiliated with the unit which first acknowledges a distress alert is designated the First RCC and should assume responsibility for all subsequent coordination of SAR measures unless and until that responsibility is accepted by another RCC better suited to respond. Figure 1-1 summarizes the guidelines for the First RCC.

1.2.2 SAR Mission Coordinator (SMC).

An SMC is designated to manage each SAR mission and to coordinate resources.

1.2.2.1 SMC Designation. The SMC is designated by the SAR response system for each specific SAR mission and coordinates and manages the overall response to a SAR incident in accordance with references (a) and (b). There is always an SMC - which can be viewed to be either the RCC; a person within an RCC; or a person or unit outside of, or designated by, the RCC - given lead responsibility to coordinate the SAR response.

1.2.2.2 SMC Duties. The duties, responsibilities and relationships (to the rest of the SAR Response System) of the SMC are described in references (a) and (cc). If the situation gets beyond the capability of the current level of SMC, there should be no hesitation to shift the case up to the next level. When determining if a specific command is appropriate to act as SMC, consider the following:

(a) The nature and complexity of the case. Factors that contribute to complexity include:

(1) Number of participating SAR facilities and their parent organization (i.e. DOD, other nation, etc.),

(2) Planning tools required,

(3) Number and type of search objects,

(4) Number of possible persons to be assisted/saved,

(5) Media interest,

(6) Other coincidental missions involved (i.e. pollution, mass rescue, law enforcement, etc.).

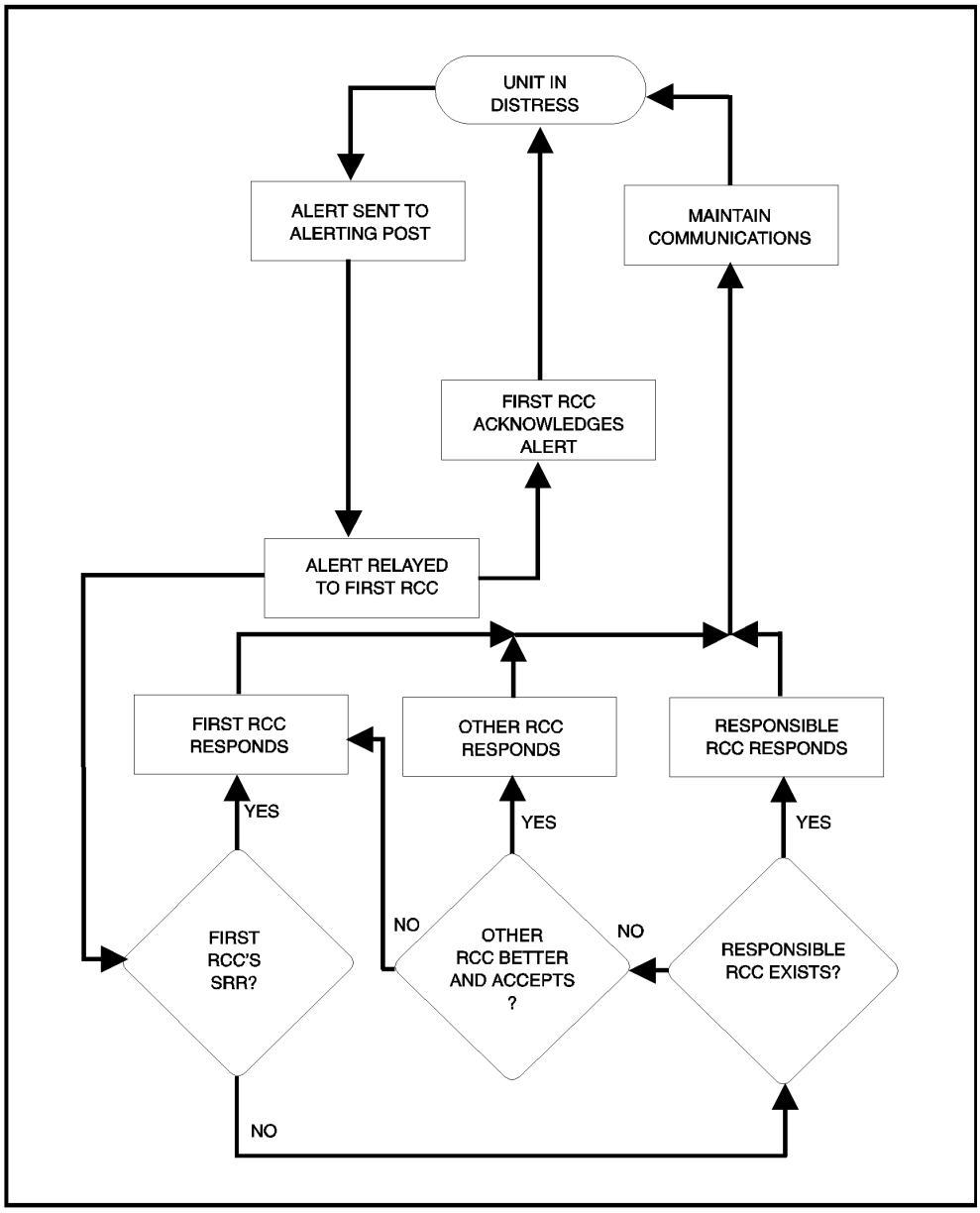


Figure 1-1 Determination of RCC to Respond

NOTE: First RCC retains responsibility until it is accepted by another RCC, and maintains communications with the unit in distress until the other RCC can do so.

(b) The nature and complexity of the case. Factors that contribute to complexity include:

(1) The adequacy of the unit's command, control, and communications capability in terms of equipment, personnel, training and experience,

(2) The unit's geographic proximity to the incident. Per reference (a), if a SAR mission crosses areas of responsibility (AORs) or SRRs, the RCC within whose region the last position report was received assumes overall responsibility. If the last report received was at the boundary of two regions, or if no position report was received, the RCC of the region the craft was entering usually assumes responsibility.

(c) CASP and Amver accessibility shall reside at the District/Area level and will not be delegated to the Group level. This does not preclude a District Command Center from running a CASP solution or an Amver SURPIC for a Group that retains SMC of a case. However, most cases involving the use of CASP and Amver take place offshore or are a result of an extended (multi-day) search. Typically, SMC of these types of cases resides at the District/Area level.

(d) The interaction Groups/Activities in their AOR have with governments and agencies of other countries.

1.2.2.3 SAR Mission Coordination. SAR missions are normally coordinated at the lowest practicable level within an SRR for both efficiency and practicality reasons, but SMC responsibilities shall not be delegated below the Group/Activities level.

However, some SMC tasks (i.e., SITREPs, MISLE data entries, initial response authority, etc.) may be delegated to Group units when they carry out single unit cases that do not require search-planning efforts. In these cases, the Group, as SMC, is still responsible for ensuring those functions are properly carried out. Once SAR response efforts exceed the initial response, the Group or other appropriate levels shall assume all SMC tasks.

1.2.2.4 Initiating Responsibility. Responsibility for initiating a response to distress incidents and requests for assistance rests with the coordinator of the region or sector in whose area the incident occurs. When boundary or location ambiguities exist, the unit receiving initial notification shall assume SMC and take immediate action to provide a response. SMC of a distress incident shall be retained until the incident is terminated or until proper relief is effected.

1.2.2.5 SMC Assumption. Coast Guard units should normally assume SMC according to Table 1-2, which is based on AORs. These SMC designations are the lowest levels normally assigned. SAR Coordinators may use discretion in SMC assignments where non-complex cases straddle group/activity (or district) boundaries and the mission may be effectively coordinated by one of the involved groups/activities (or involved districts). Incidents that require the SMC to be at the District RCC level or above are:

(a) Initial action for cases involving ELT and EPIRB, HF-DSC, and Inmarsat alerts; to ensure that cases are managed effectively throughout the Coast Guard. When the actual situation of the alerting vessel is determined, the SMC can be shifted down to the group/activities level to affect the response.

(b) Cases during which search planning by a Group/Activities extends beyond 36 hours **shall** be evaluated by the District to determine the unit's ability to continue search planning. If CASP is required, the District shall assume SMC. This does not preclude a Group from shifting SMC up prior to the 36-hour mark. Decisions to shift or not shift the SMC in all cases shall be documented in the case file.

(c) Cases involving mass rescue operations (see section 3.4.11).

(d) Cases outside the U.S. SRR's where a Coast Guard RCC is carrying out the duties of "first RCC", where assistance is requested by an international RCC outside the U.S., or where U.S. citizens appear to be in distress outside U.S. SRR and involvement of a U.S. RCC is appropriate.

Table 1-2 Standard SAR Mission Coordinator Assignment

Incident Location	*SAR Mission Coordinator*
Single Group/Activity AOR	Group/Activity (Command Center)
Multi-Group/Activity AOR's	District (RCC)
Section Search and Rescue Sub-Region (SRS)	Section (RSC)
Single District Search and Rescue Region (SRR) outside Group/Activity AOR	District (RCC)
Multi-District SRR's	Area (RCC)
Area SRR	Area (RCC)
Other Nation SRR's	Other Nation RCC or U.S. RCC by international agreement

These guidelines do not preclude Districts from establishing their own policies for subordinate units regarding additional factors that contribute to case complexity and when SMC will be shifted to the District.

1.2.2.6 **Delegating SMC.** RCCs will exercise great care in delegating SMC to subordinate Section, Activities or Group Command Center's whenever comprehensive SAR planning is involved or special coordination problems are anticipated, such as multi-service or multi-group operations.

1.2.2.7 **Reassuming SMC**. Having delegated SMC, RCCs shall always be ready to assume SMC responsibility from subordinate Command Center's when they request relief from cases that exceed their capabilities.

1.2.2.8 **Transferring SMC.** There will be occasions when it is appropriate to transfer SMC to another RCC either inside or outside the Coast Guard (national or international). A transfer may be appropriate when the other RCC is in a better position to handle the case.

1.2.3 Mission Briefings and Risk Assessment

Experience has taught us that doing everything right is no guarantee that a mission will not end in a mishap. But, we do know that not doing the right things right dramatically increases the risk of death or injury to the people we serve and ourselves. The following pages provide an overview for Operational Risk Management (ORM). There are various models and checklists that can be used, but all of them have these factors in common: defining the task, identifying the hazards, identifying options, evaluating risk versus gain, and executing the decision. Regardless of the model or checklist a unit uses to evaluate operational risk, that form shall be included in the case file.

1.2.3.1 **SMC Briefings.** SAR Mission Coordinators (SMCs) shall conduct briefings prior to launching or diverting resources for a particular SAR mission. SAR personnel shall be given all relevant details of the distress and all instructions for the SAR operation. This briefing shall, at a minimum, discuss the mission objective and all foreseeable hazards that might be encountered by the responding units. Known risks may include, but are not limited to:

- heavy weather,
- poor visibility,
- hazardous bar conditions,
- critical navigation segments of the transit,
- placing Coast Guard personnel on disabled vessels.

SMCs shall ensure that all assets tasked understand the mission and the known risks, and have an appropriate SAR action plan. SMCs shall continually assess the situation as the mission proceeds, and consciously and continually weigh the associated risks against the desired gain. SMCs shall be responsive to safety or capability concerns raised by cutter CO/OinCs, aircraft commanders, and coxswains, and modify the SAR action plan as appropriate. Included in this chapter are various models recommended for use to assist in determining risk. For cases

involving a large number of SAR assets, and/or when direct communication between the SMC and each unit is not feasible, the SAR Action Plan shall address foreseeable hazards and known risks associated with a particular mission.

Even when not SMC for a particular case, the operational staff at Stations and Groups retain their inherent responsibility for oversight of the SAR units (SRUs) assigned to them. Senior operational staff members at these units play a crucial role in risk assessment and risk management, even if not serving as SMC. Any tasking of SRUs that raises a safety or capability concern on the part of the parent Station or Group shall immediately be brought to the attention of the SMC.

1.2.3.2 Risk Management, General Guidelines For Boat Operations. See reference (e) for guidance in this area.

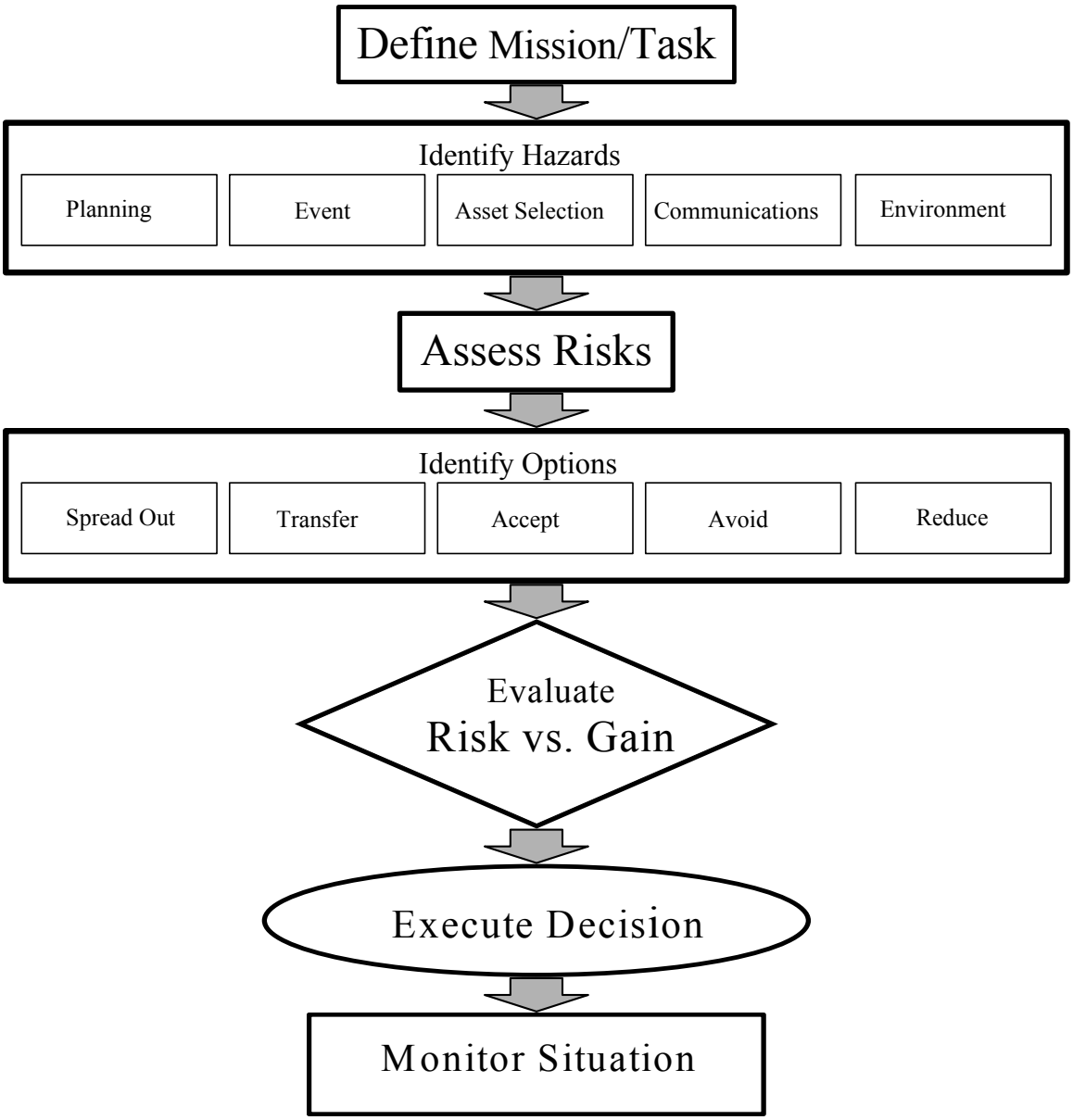


Figure 1-2 Operational Risk Management Process for Tactical Decision Making

Table 1-3 Relationship Between Various Decision Making Approaches

Generic Model Establish Goals	**Strategic Decision Making** Establish Goals/Objectives	**Tactical Decision Making** Define Mission/Task
Risk Assessment	Gather Stakeholders	Identify Hazards
	Establish Assumptions & Ground Rules	
	Check Baseline	
	Encode Expert Opinion	
	Develop Ranked List of Risks	Assess Risks
Risk Management	Determine Potential Countermeasures	Identify Options
	Develop Ranked List of Countermeasures	Evaluate Risk vs. Gain
	Select Countermeasures and Implement	Execute Decision
Effect Assessment	Assess Effect	Monitor Situation
	Continuous Improvement	

PEACE MODEL: USED TO IDENTIFY HAZARDS

- **Planning:** All resources & equipment used to properly plan & execute the mission (i.e. CG & non-CG resources, C2PC, AMS, CASP, etc.). Multiple resource operation - Air assets requiring air space deconfliction? Successive searches & relief assets planned ahead of time?
- **Event Complexity:** Personnel capable & properly trained to execute the mission.
- **Asset Selection:** Ensure the right asset is available for the mission. (Boat, cutter, aircraft and personnel.)
- **Communications:** Frequencies established & maintained with SMC, OSC & SRUs prior to arrival on scene. Comms maintained with the person(s) in need of assistance.
- **Environment Conditions:** How will conditions affect the mission or situation? How long will conditions remain the same?

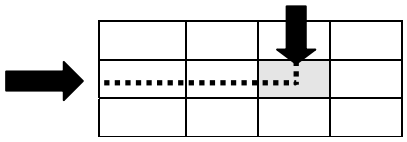
STAR MODEL: USED TO IDENTIFY OPTIONS

- **Spread Out:** Risk can be spread out by increasing either the SRUs responding to the distress or the time between exposures of the SRUs (refer to the Fatigue Standards).
- **Transfer:** Transferring risk does not change probability or severity but rather shifts possible losses or costs to another unit or entity (i.e. assuming SMC from a Group or transferring OSC responsibilities).
- **Avoid:** Canceling or delaying a mission until the risk is reduced (i.e. avoiding risks associated with a night search by planning for a first light search or waiting for poor weather to pass).
- **Accept:** Accept the risk when the benefits clearly outweigh the costs, but only as much as necessary to complete the mission.
- **Reduce:** To reduce risk: alleviate stress through increasing situational awareness & providing rest. Decrease the number of personnel involved; do you need to "launch the world" on this particular case?

GAR (GREEN, AMBER, RED) MODEL: FACTORS TO CONSIDER WHEN ASSESSING RISK

- **Supervision:** How closely do you need to supervise the SMC/OSC/SRU? The higher the risk the more a supervisor needs to focus on observing & checking.
- **Planning/preparation:** How much information is available, how clear is it, how much time is available to plan/execute the mission.
- **Crew Selection:** Consider the experience of the crews performing the mission. If individuals are replaced during the mission, assess their experience level & ensure proper turnover.
- **Crew Fitness:** Refer to published crew Fatigue Standards.
- **Environment:** Factors affecting personnel, unit readiness, and resource performance. Factors include the time of day, visibility, sea conditions, ceiling level, proximity to other external & geographic hazards & barriers.
- **Mission Complexity:** Consider both the time & resources required to conduct the mission. The longer the exposure to hazards for both the SRUs & the person(s) in need of assistance, the greater the risks involved. What is the precision level needed to successfully complete the mission?
- **Calculating the Risk:** To compute the total degree of risk for each hazard identified, assign a risk code of 0 for no risk through 10 for maximum risk to each of the six elements. Add the risk scores to come up with a total risk score.

How to use this Chart:



	High Gain	Medium Gain	Low Gain
Low Risk	**Accept the Mission. Continue to monitor Risk Factors, if conditions or mission changes.**	**Accept the Mission. Continue to monitor Risk Factors, if conditions or mission changes.**	**Accept the Mission. Re-evaluate Risk vs. Gain, should Risk Factors change.**
Medium Risk	**Accept the Mission. Continue to monitor Risk Factors and employ Control Options when available.**	**Accept the Mission. Continue to monitor Risk Factors and employ Control Options when available.**	**Accept the Mission. Continue to monitor Risk Factors and actively pursue Control Options to reduce Risk.**
High Risk	**Accept the Mission only with Command endorsement. Communicate Risk vs. Gain to Chain of Command. Actively pursue Control Options to reduce Risk.**	**Accept the Mission only with Command endorsement. Communicate Risk vs. Gain to Chain of Command. Actively pursue Control Options to reduce Risk.**	**Do not Accept the Mission. Communicate to Chain of Command. Wait until Risk Factors change or Control Options warrant.**

Figure 1-3 GAR Risk Management Model

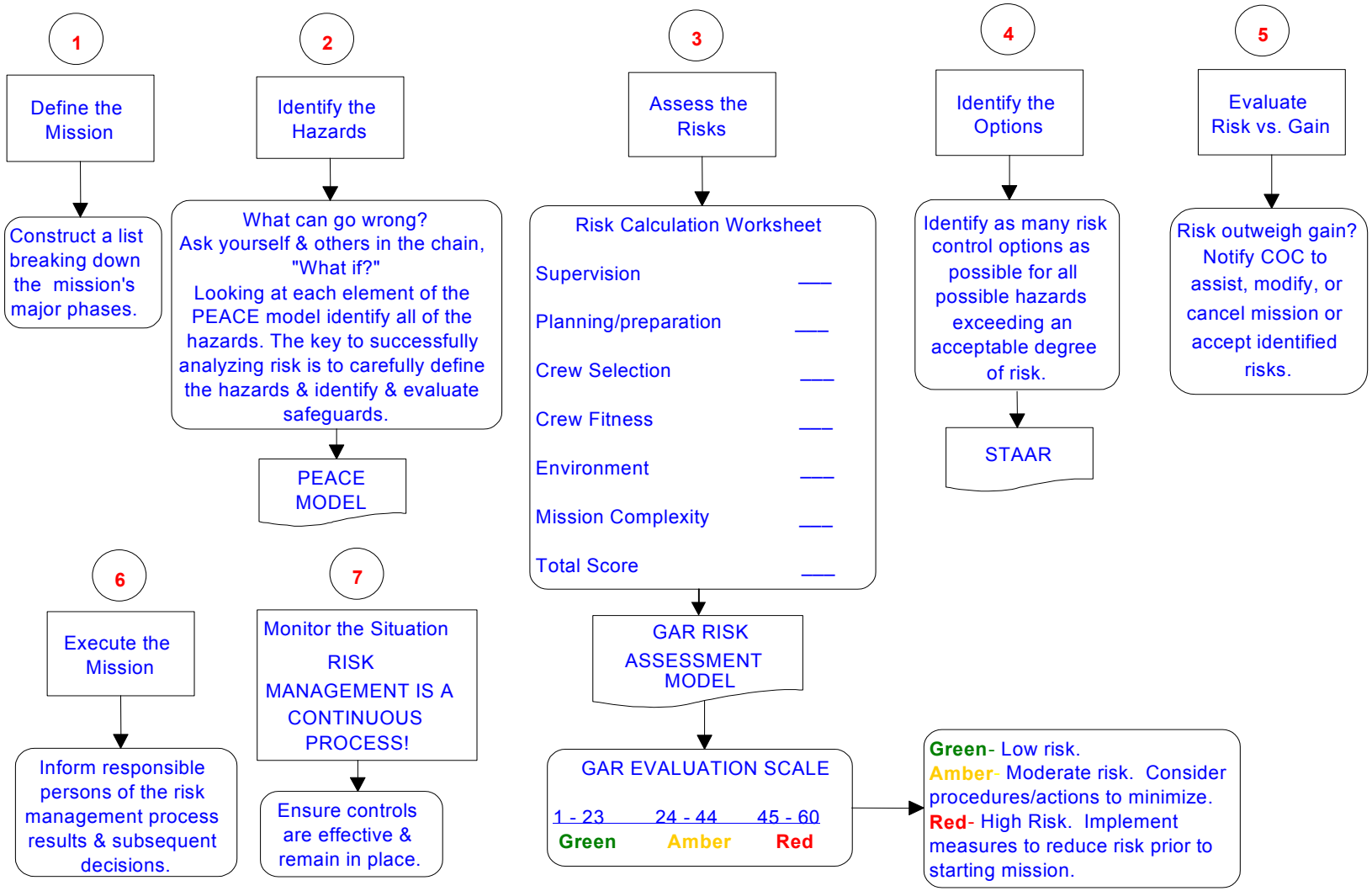


Figure 1-4 Risk Assessment Decision Matrix

1.2.3.3 **Crew Briefings.** A mission briefing shall be conducted among the crew of all SRUs prior to launching on a particular SAR case. Chapter 4 of the Boat Crew Seamanship Manual (reference (e)) outlines specific coxswain requirements for risk management, crew briefings and crew debriefs as part of standard boat operations. Aircraft commanders are responsible for all phases of flight, and are tasked with ensuring that all crewmembers and passengers are properly briefed on all aspects of the mission. Coast Guard Flight Manuals for rotary wing aircraft require crew briefings prior to hoisting operations, and mandate a discussion of, among other things, the assignment of crew duties, a discussion of rescue methods to be used, and specific emergency procedures to be followed.

1.2.3.4 **Training Sources.** Specific Team Coordination Training requirements for active duty, reserve, and auxiliary members are outlined in reference (f), Team Coordination Training. Chapter 4 of reference (e), and the course book "Team Coordination Training Student Guide" (available from the Coast Guard Institute), are two excellent sources for Coast Guard specific training on Risk Management and Team Coordination.

All units conducting SAR operations will review these two documents and incorporate them within the unit's training plan. Reference (g) and associated job aids (available from G-WKS-4, Afloat Safety Division website) should also be used to integrate Operational Risk Management (ORM) into daily SAR activities and processes.

1.2.4 Adverse Weather

1.2.4.1 As adverse weather is such an important, and relatively common, risk factor to be considered by the SMC and SRUs in the execution of a SAR case, the following definitions are extracted from the Boat Crew Seamanship Manual with the purpose of enhancing proper risk assessment:

1.2.4.2 Heavy Weather is defined as seas, swell, and wind conditions combining to exceed 8 feet and/or winds exceeding 30 knots. If heavy weather is forecasted, it should be considered when planning a mission. Reliable and up to the minute information is critical for planning. There are many sources of information available to the coxswains, heavy weather coxswains, surfmen, and commands of Stations. Ensuring that the information is found and used is the responsibility of every one involved in the mission. Note: This definition of heavy weather is not intended to define a heavy weather situation for a specific boat type. Heavy weather for each specific boat type may be determined at any time by the coxswain.

1.2.4.3 Rough bar/surf is determined to exist when:

- breaking seas exceed 8 feet;
- in the judgment of the Commanding Officer/Officer in Charge, rough bar/surf conditions exist; and/or
- in the judgment of the coxswain, there is doubt as to the present conditions.

When rough bar/surf conditions exist, a surfman shall be assigned as coxswain and all members of the boat crew shall wear all personal protective equipment unless waived by the Commanding Officer/Officer in Charge.

Rough bar – A rough bar is a river entrance or inlet where heavy seas or surf conditions exist. Also, in situations when the coxswain or the CO/OIC is unsure, a rough bar is assumed.

Surf – Surf is defined as the waves or swell of the sea breaking on the shore or a reef.

1.2.5 Blood-Borne Pathogens

Possible exposure to blood-borne pathogens exists during any SAR case. All SAR personnel should be cognizant of the possible presence of blood-borne pathogens and use sound situational awareness when planning and/or dispatching personnel to the scene of an incident.

Blood-borne pathogens are microorganisms that are passed via exposure to human blood or other infectious materials that could result in disease or death. Hepatitis B virus and Human Immunodeficiency Syndrome Virus (HIV) are most commonly associated with blood-borne pathogen diseases. Other infectious materials could include semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid visibly contaminated with blood and all body

fluids in situations where it is difficult or impossible to differentiate between body fluids, as well as any unfixed tissue or organs other than intact skin from a human (living or dead). Personnel shall take precautions whenever the potential of exposure to blood-borne pathogens exists. To reduce possible exposure, properly fitting latex or vinyl gloves shall be worn whenever the hands of personnel may come in to contact with blood or other potential infectious material. Eye protection, facemasks, or face shields shall be worn whenever splashes, spray, spatter or droplets of blood could contaminate the month, nose, or eyes. The use of pocket masks and resuscitation bags shall be used when emergency mouth-to-mouth resuscitation is performed.

Personnel should refer to Prevention of BloodBorne Pathogen Transmissions, COMDTINST M6220.8 (series) for further guidance to minimize the inadvertent exposure and disposal of contaminated materials due to blood-borne pathogens. This instruction provides detailed instructions on the use of protective equipment and proper disposal and clean up of contaminated materials.

Section 1.3
Professional Requirements

Training and experience are crucial to proper SAR response. Training combined with a demonstrated ability to perform the required tasks can lead to certification by the command that the individual is ready, willing, and able to assume SAR watchstanding duties.

Command leadership plays a significant role in shaping the watchstanders' attitudes towards SAR. It's expected that every Group/Activity/Station Commander, Commanding Officer and OinC will issue guidelines delineating his/her expectations regarding such things as notifications, specific interagency interactions and other matters specific to the command's AOR. These guidelines are not intended to replicate requirements published elsewhere, but rather to clarify the command's expectations in instances where that authority is allowed.

NOTE: A newly assigned Controller or Assistant Controller shall attend SAR School at the earliest practicable date. While awaiting assignment to SAR School, a prospective Controller or Assistant should be closely supervised in an on-the-job training status.

1.3.1 Training

Training consists of on-the-job training, structured unit training (to include appropriate written exercises), and formal training. All RCCs, RSCs, Groups and Activities will implement a formal program to qualify members of the command that are part of the SAR system. Table 1-4 shows the minimum level of SAR knowledge expected for various positions. Elements of the program will include:

- A written form of personal qualification standard (PQS). At a minimum, SAR Controllers will complete the performance elements found in Appendix N of this Addendum.
- A qualification board (Group/Activities level board members will consist of at a minimum: the Operations Officer, Command Center Supervisor and one other qualified watchstander).
- A letter of designation signed by d(osr) for RCC watchstanders, Section Commander for RSCs, or the Group/ Activities Commander for those assigned to Groups and Activities.

1.3.2 Qualification/Currency

1.3.2.1 Qualification Procedures. Upon completion of training, the prospective Controller and Assistant Controller must undergo qualification procedures, a process of demonstrating the capability to perform assigned tasks. SAR Controllers shall be fully qualified in SAR incident analysis, search planning, and mission management as described in reference (a).

1.3.2.2 Interim Qualification. Commands may not designate watchstanders with an Interim Qualification. Any person performing the function of Command Center SAR Controller will be fully qualified. Commands that are unable to meet this standard shall seek guidance from their chain of command on how to provide for continuity of operations.

1.3.2.3 Watch Frequency. Qualified watchstanders shall stand duty as discussed in 1.3.2.5.

1.3.2.4 Currency Training Program. To maintain currency, commands shall develop a comprehensive training program for all watchstanders (including Reservists and Auxiliarists) that covers all topics in Table 1-4 and includes a review of updated policy guidance (including information from Headquarters, SAR School, Areas and Districts). Attendance at this training shall be documented in members' training records and reviewed by the Operations Officer and Command Center Standardization Team (CCST).

Table 1-4 SAR Knowledge Requirements

Knowledge Area	Command Cadre	Operations Officer	Command Center SAR Controller [3/4]
Area Familiarization	M	M	M
C2PC and SAR tools application [5]		M	M
Case claiming/documentation		S	M
Chain of command notification/requirements	M	M	M
Datum and search area computations	M	M	M
Firefighting and General Salvage Policies	M	M	M
Hoaxes and Uncorrelated MAYDAY responses	M	M	M
Interagency cooperation/protocol/procedures	M	M	M
Major/Minor SAR responses	M	M	M
Maritime SAR Assistance Policy	M	M	M
Message preparation		M	M
Resource characteristics (traditional and nontraditional)	M	M	M
Risk Management	M	M	M
Search pattern criteria/selection	M	M	M
Suspension process	M	M	M
Use of QRCs/Job Aids/Checklists	S	M	M

Key: M =Mandatory Training S = Suggested Training 100/200/300 = Level of Training

Table 1-5 SAR Course/Workshop

Course/Workshop	Command Cadre	Operations Officer	Command Center SAR Controller
Maritime Search Planning Course		M	M
SAR Fundamentals Course			
SAR Supervisor Course	M		
Search Coordination and Execution (when available)	S	S	
Prospective Group Operations Officer Workshop		S	
Integrated Command Structure (ICS) [6]	300	300	100

Key: M =Mandatory Training S = Suggested Training 100/200/300 = Level of Training

Notes:

1. **Group Duty Officers** are not a defined or required position. However, if a unit chooses to have this intermediary review and reporting position between the Command Center Controller and Operations Officer (or Command Cadre), the member must meet the minimum qualifications noted for Command Center SAR Controllers.
2. The Command Center Supervisor, or Senior Controller, will meet all the qualifications required of Command Center SAR Controllers.
3. Command Center SAR Controllers must pass a qualification board.
4. The term "Command Center SAR Controller" for the purposes of qualifications includes all SAR controllers at the Area, District, Section, Group, Activities and level.
5. The various SAR Tools may not be required or apply at all levels and all commands. Tools include but are not limited to CASP, Amver, JAWS, C2PC, MISLE, MMSI database, sound manipulation software, and

hypothermia/survival software.

6. ICS level 300 training is required for the Group/Activities/Section Operations Officer and *either* the Commander or Deputy Commander. Senior Controllers (at all levels) must attend ICS 200.

1.3.2.5 Watch Frequency Requirements. All qualified SAR Controllers, including senior controllers and fill-in controllers are required to maintain watch proficiency through the use of currency watches. All qualified SAR Controllers will stand a minimum of two watches per month for the purpose of remaining current on watch policy and procedures. Additionally, military and civilian command center watchstanders will not stand more than 12 hours of continuous watch in any 24-hour period.

1.3.2.6 Demonstrating Proficiency. To maintain the integrity of the SAR system, ***all*** members involved in the SAR system must meet minimum knowledge requirements listed in the table above. Annually, all qualified controllers will demonstrate proficiency through completion of an on-line problem set provided by the National SAR School (when available). Controllers may fulfill this requirement either through tabletop exercises (JAWS/CASP problems) or written tests. Controllers must demonstrate proficiency in the following areas:

- Datum and search area computations (JAWS Coastal and Oceanic models as applicable to AOR),
- Firefighting and General Salvage Policies,
- Hoaxes and uncorrelated MAYDAY responses,
- Search pattern criteria/selection,
- Identifying available resources and their characteristics; familiarity with AOR SARFACs,
- Review of all QRCs.

1.3.2.7 Collateral Duty Assignment. Commands, in shaping the approach and attitude toward a unit's SAR program, should carefully consider the type and number of collateral duties assigned to SAR Controllers and the Command Center Supervisor/Senior Controller. SAR Controllers/Supervisors should not be assigned collateral duties that significantly degrade their ability to properly stand the watch, maintain currency, or inhibit the maintenance of a proper watch rotation. Further, Senior Controllers/Command Center Supervisors shall not be assigned collateral duties that would degrade their ability to exercise oversight, quality control, and leadership to a Command Center staff.

1.3.3 Certification

After completing qualification procedures, personnel must be certified in writing by their command prior to being assigned RCC, RSC, or Group Command Center watchstanding duties. This is where the individual's maturity and judgment are taken into account. Recertification procedures must also be documented and signed by the command.

1.3.4 Professionalism/Standardization

1.3.4.1 Return of Qualified Personnel to SAR Billets. The SAR Program encourages, and would like to see, initially certified SAR Controllers and Assistant Controllers return to Search Planning and Coordination and SAR program assignments throughout their careers.

1.3.4.2 Command Center Standardization Team. Because of the critical nature of Command Center decision-making, there is a need for service-wide standardization, followed up by periodic independent review and evaluation. The Command Center Standardization Team (CCST) provides Area, District, Section, Activities, and Group Command Centers periodic assessments of search planning and rescue coordination proficiency, training and certification, watch organization, documentation, command relationships, C2 capability, and knowledge of reference materials.

(a) The CCST will provide field units with technical information, guidance, and training that will assist them in complying with program responsibilities and execution. Additionally, the CCST will disseminate new standard procedures, techniques and solutions to common problems encountered relating to SAR planning

and coordination in operations centers. The CCST will also provide recommendations to the program manager regarding SAR policy and procedures as they relate to the International Aeronautical and Maritime SAR Manual, the National SAR Supplement and this Coast Guard Addendum.

(b) The CCST will facilitate Command Center training, standardization and evaluation in mission areas other than Search and Rescue as a secondary priority. Based on the needs of the operational commanders, non-SAR specialty assistance will be solicited, and provided based on the resources made available by other program managers.

(c) Results of CCST visits will be forwarded to the appropriate District OSR and G-OPR-1.

(d) The Stan Team can be reached by contacting The National Search and Rescue school or visiting their website on the CG Intranet.

1.3.4.3 District Professional Liaison. Districts shall assign a command center watchstander as a professional liaison to each Group/Activity within its AOR. The Liaison shall visit his or her assigned unit at least once a year to discuss relevant SAR issues and conduct requested training. Additional visits may include, when the subordinate unit is conducting a SAREX and when the CCST is conducting a visit.

1.3.5 SAR School Quota Assignment Prioritization

The curriculum of the National SAR School and changes to the numbers and types of SAR courses available, necessitate guidance for the assignment of quotas to prospective students of the National SAR School.

1.3.5.1 Maritime Search Planning Course (CG-060). Sufficient Maritime Search Planning quotas exist for Coast Guard personnel filling SAR Controller, Operations Officer and Assistant Operations Officer billets. Additional quotas are available to provide training to members included in unit "briefing chains", or personnel who have a responsibility to communicate the specifics of a SAR case up the chain of command or exercise oversight to the watch during the development of a SAR case. 25 quotas are available each year for Department of Defense personnel. In assigning students to MSP convenings, TQC should adhere to the following guidance:

(a) Coast Guard personnel shall be assigned quotas based on the following priority:

(1) G-OPR approved special requests,

(2) Command Center SAR Controllers (active duty),

(3) Group/Activities Operations Officers and Assistant Operations Officers,

(4) District assistant osr's,

(5) Command Center SAR Controllers (reserves/auxiliary),

(6) All others on a space available basis.

(b) International students. No more than 5 quotas per class convening of the regular MSP course; quotas to the regular MSP convenings will not exceed 40 per year (5 quotas X 8 convenings = 40). Additionally, one special convening has been set-aside exclusively for international students with a maximum of 18 students in this special convening.

(c) DOD Personnel. No more than 3 quotas per regular class convening; quotas will not exceed 25 per year (3 quotas X 8 convenings = 24. As such, one convening may have 4 DOD students). At least 30 days advance notice must be given to TQC in order for DOD to utilize these quotas for a given class convening. DOD quota requests shall be prioritized as follows:

(1) Air Force personnel are allowed a maximum of 2 seats per class.

(2) Other service branches on a space available basis.

The previous policy restricting attendance at the Maritime Search Planning course to those students who have not attended within the past 8 years is cancelled. TQC shall refer any request to re-attend the MSP course that falls within 3 years of the requester's previous MSP graduation date to G-OPR for approval.

1.3.5.2 SAR Supervisor Course (CG-070). In assigning students to this course, TQC should adhere to the following priority listing:

(a) Area/District/Section O/OSR/AOSRs

(b) Group/Activity CO

(c) Group/Activity XO

(d) Air Station CO/XO/OPS

(e) All others on a space available basis

1.3.5.3 Search Coordination and Execution (SC&E) Exportable Course (CG-062X). It is the responsibility of the visited District to provide funding and quota management for students to attend SC&E. Completion of this course fulfills the requirements for designation as Aircraft Commander as required by the Air Operations Manual. The National SAR School will provide student rosters to TQC as soon as possible after class graduation.

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Section 1.4
Public Affairs & Next of Kin Interactions

Public affairs for the Coast Guard is different from that for the other armed services and most other Federal agencies due to our unique missions which serve the citizens constantly and directly. Coast Guard search and rescue operations always have the potential to create considerable public interest. The image of the service is often "on-the-line" due to SAR and therefore, how a SAR incident is reported will affect the service either positively or negatively.

1.4.1 News Releases and Interviews

Reference (h) lists excellent instructions on news releases for SAR cases and is mandatory reading for all personnel at Coast Guard units that interact with the public as part of their duties. However, it is often found that Coast Guard personnel directly involved in a SAR case are interviewed with little or no advance notice. Boat coxswains, OODs, and crewmembers must be aware that they are all potential candidates for the camera or reporter's notepad. Dedicated public affairs personnel are very valuable for handling media requests and enabling search planners to remain focused on planning efforts.

1.4.2 Training and Education

Unit commands are encouraged to educate their personnel on public affairs. All watchstanders should be aware of information release criteria related to the privacy act, next-of-kin notification and ongoing investigation limitations (reference (i)). When in doubt, contact the public affairs office within your chain of command. Training is available for personnel with public affairs responsibilities through the Defense Information School (DINFOS), Commandant (G-IPA) or the nearest District Public Affairs Office.

1.4.3 Next of Kin (NOK) Notification and Interaction

1.4.3.1 General Discussion. The District Commander shall ensure the greatest possible sensitivity in interacting with family and friends of victims during the conduct of SAR cases where the Coast Guard is the lead agency. Group/Activity Commanders shall personally ensure that notifications are made and interaction established with the NOK at the earliest possible time.

1.4.3.2 Appropriate Coast Guard Point of Contact. It is recommended that Group/Activity Commanders personally handle this interaction. However, in the event that is not possible, this responsibility may be delegated to a mature member of the Command who may be physically proximate to the NOK (e.g., Station CO/OINC) that is thoroughly familiar with the case. When an Area or District assumes SMC from a subordinate command that has ongoing communication with the next-of-kin, it may be appropriate to continue contact with the next-of-kin at that lower level.

1.4.3.3 Prolonged Searches for Missing Persons. Notifications of missing persons are usually made by family members or friends. However, if it is not the NOK, then they should be contacted as soon as possible.

(a) The initial notification by the Group/Activity Commander, or his/her designated representative, should include a summary of the search efforts so far, future plans and a Coast Guard point of contact for future interactions. The possibility of not finding their family members should be included in the list of possible scenarios. This “plants the seed” in their minds that their loved ones may not be found at all, while still giving them hope that they will be found alive.

> **Note:** If possible, the command should highly encourage NOK to have one person act as point of contact and spokesperson for the family. These interactions should be as humanitarian as possible and there should only be one Coast Guard point of contact for the family.

(b) In accordance with Section 1.10.7 of Volume II of reference (b), the Group/Activity Commander, or his/her designated representative, should maintain daily contact with NOK providing them with the progress of ongoing search efforts and outlining future search plans. This helps reduce NOK’s stress associated with waiting and not knowing what happened to their loved ones and assists them in accepting the SMC’s decision

to suspend the search effort even if the missing persons are not located. Additionally, this provides for orderly interaction and, in turn, less distractions for SAR response personnel.

Note: The NOK should be provided information on mission progress and future actions before releasing it to the media.

(c) If requested, allow the family to visit the District Command Center or Group/Activity Operations Center, as applicable, to review details of the case. Seeing the search planning and coordination efforts may help them accept the situation. The Group/Activity Commander, or designated point of contact, should accompany the family when visiting the Command Center.

(d) Keep all briefings to NOK simple and avoid SAR acronyms and terms or any tables/tools that objectively measure survivability. General descriptions such as the type and number of SRUs, hours and square miles searched and general weather conditions should be used in briefing family members, as these factors are usually easy to understand. Also, take care to avoid creating a false sense of hope or making unrealistic promises to NOK. Under extreme emotions, it is easy to misinterpret "We're doing everything we can to find your husband" with "We will find your husband."

1.4.3.4 Suspending a Search. As the search progresses with no significant developments, it is helpful to remind NOK that the search cannot go on indefinitely. For prolonged searches, in accordance with Section 8.3.4 of Volume II of reference (b), NOK should be notified of the decision to suspend active searching if no significant developments occur at least one day prior to actual suspension. This prepares the family for the actual ceasing of operations while giving them at least one more day of hope.

While a Coast Guard spokesperson may have been designated as the command point of contact and provided the day-to-day briefs, the Group/Activity Commander shall be the one to inform the family that active searching has been suspended, as he/she is responsible for making the decision. When the Group/Activity Commander cannot make this call personally, the next senior officer should make the notification and pass along condolences on their behalf. Upon request, the family should be given a summary of the search effort and the opportunity to ask questions. The family should be reminded that although the active search has been suspended, Coast Guard units would continue to monitor the area for significant sightings and additional information. When the possibility exists that the case may involve a Marine Safety Office Investigation, the SMC should facilitate linkage of the families with an appropriate person at the investigating MSO for continued liaison and information sharing.

1.4.3.5 SAR Cases Involving Large Numbers of Victims. There are some SAR cases that typically involve large numbers of victims, particularly in a mass rescue operation (i.e. sinking cruise ship) or an incident that involves mass casualties.

Note: For airline crashes, airline companies are responsible for making NOK notifications.

In addition to the policy outlined above, the following procedures are extremely helpful when dealing with multiple NOKs (if the Incident Command System (ICS) is activated, then the Incident Commander (IC), not SMC, will be responsible for NOK interactions):

(a) Ensure that lodging is centrally located and/or easily accessible for those NOK who arrive in the area. This will facilitate daily briefings.

(b) Establish area where families of victims can receive daily mission briefings. This should be at the place where NOK are centrally lodged.

1.4.3.6 Loss of Life. In the event death occurs, the Group/Activity Commander shall personally ensure that notification is made as expeditiously as possible and with all due compassion. For those cases where the Coast Guard is not the lead agency or where interaction with NOK has not had the opportunity to develop, the command should endeavor whenever possible to use local, more qualified authorities for death notification. Local and state police departments are usually in the best position to make notification visits and are typically trained to perform this function. They are also networked with other agencies outside their jurisdictions and can make timely notifications in other counties or states. Group/Activity Commanders should partner with these agencies and establish agreements on how NOK notification should be made for local and out of state residents.

When local agencies are not available to make a NOK notification, the Group/Activity Commander may have to do it directly. This may also be the case if the family is already aware of the situation and has established a good interaction with the command (if this is the case Group/Activity Commanders can use their judgment as to whether notification should be made over the phone or through a personal visit). Regardless of how the contact is made, the following guidance is provided to assist in preparing to give notification:

(a) Obtain as much information as possible and have many of the facts committed to memory. Know the names of both the victim and NOK being notified and their relationship. Be prepared to answer questions and provide a point of contact at the facility where the body is located.

(b) Wear an appropriate uniform and ensure you have military identification. Whenever possible, travel in a government vehicle.

(c) Ideally, you want to make the notification to the primary NOK (i.e., spouse or parent). Make every attempt to inform the NOK in private. If you are at the residence, ask if you may enter. Speak quietly to the NOK until you gain approval for entering the house and closing the door. Do not enter without permission.

(d) Once inside, everyone should be seated. Be direct and to the point when informing the NOK. Do not sugarcoat your information. Using euphemisms or vague language may delay the NOK's acceptance of what has occurred. The words "dead" and "death" have a finality that has been found to be helpful for gaining NOK acceptance.

(e) As mentioned earlier, do not use technical SAR language. If appropriate, general descriptions such as the type and number of SRUs, hours and square miles searched and general weather conditions should be used in briefing NOK.

(f) Be prepared for a wide range of responses from denial to extreme physical or emotional responses such as fainting, anger, hysteria or even a heart attack. If necessary call local emergency medical services (have contact number and the NOK address readily available). Ask the NOK if other family, friends or clergy should be notified and offer to do it.

Family members are not encouraged, but are welcome to come to the Command or Operations Center to review details of the case.

1.4.3.7 Presumption of Death. There are times when NOK of missing persons who are presumed dead approach the Coast Guard and request a Letter of Presumed Death (LPD), usually to assist in insurance and probate court proceedings. If the case involved commercial mariners, the local MSO may have conducted an investigation and may be able to issue the letter.

The Coast Guard typically does not investigate recreational deaths or overdues and therefore is not authorized to issue an LPD in these cases. Often local or state authorities perform these functions. If the NOK are unable to get an LPD from a local agency, they may request some form of proof from the Coast Guard. If they do, the SMC for the case, after consulting the Servicing Legal Office, may provide a letter detailing the facts of the case, often in an affidavit or deposition to the court, describing the search parameters and results, probability of detection, and confidence factor. The affidavit provides only facts and opinions within the Coast Guard's competence, and makes no conclusion regarding death.

1.4.3.8 Counseling Aid to Families. In cases where death occurs, or unlocated persons exist at the time of case suspension; the families may need further assistance coping with the tragedy. Coast Guard SAR units will endeavor to use local agencies and nongovernmental organizations, whenever necessary to assist the families. These agencies are typically trained to perform functions such as grief counseling, trauma management, etc. If agreements/understandings are not in place, Group/Activity Commanders shall address this issue with local authorities to gain their cooperation.

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Section 1.5
Liaison and Contingency Exercises

SAR Coordinators will carry out active liaison efforts with organizations that can contribute to strengthening the readiness and capabilities of the international, national or local SAR systems. Such activities often help mitigate and control future emergency situations. Development and exercise of plans and improvement of communications are part of this work.

SAR Coordinators and RCC staff should routinely meet with counterparts in neighboring nations to work on improving working relationships, or to further implement international SAR agreements. However, any international SAR liaison efforts that may be sensitive, particularly significant, or otherwise non-routine must be coordinated in advance with the International Affairs Staff (G-CI) and SAR Program Manager (G-OPR) at Headquarters.

SAR liaison with states can be conducted under the Boating Safety Program (reference (j)). Liaison should also be carried out with local military commands, commercial SAR service providers, local SAR organizations, and any others who may contribute to improving SAR operations, or expanding available resources. Membership and involvement in the National Association of Search and Rescue is recommended.

1.5.1 Contingency Response Community

Maritime SAR Councils, usually organized by the Coast Guard, are committees of federal, state, local, or volunteer groups with SAR capabilities. These councils are governing bodies of the SAR community that are localized within the maritime SAR area. They enable SAR coordinators to coordinate efforts of local SAR organizations on a long-term basis. Such councils are usually identified with bodies of water such as lakes, bays, or sounds, or with adjacent metropolitan areas, and may include land areas within the maritime SAR area.

1.5.1.1 A SAR Council coordinates the activities of various groups, resolves SAR operational problems, develops contingency plans, and critiques exercises and major SAR incidents.

1.5.1.2 Councils should include scuba clubs, professional divers, firefighting services, emergency medical services, commercial assistance providers, similar groups with specialized SAR capabilities, and groups that normally respond to SAR incidents. In addition, the councils should be closely tied to other emergency management organizations such as the Federal Emergency Management Agency (FEMA), state and county emergency management agencies, and Coast Guard Captains of the Port.

1.5.2 SAR Facility List

All RCCs/Command Center's shall maintain a current Search And Rescue Facility (SARFAC) listing. The list shall be validated annually. At the Group/Activity level, the SARFAC list shall include all assets available within the AOR that can assist in responding to SAR, and at the District level, all assets available to the District. Operational Commanders shall ensure that they have up to date, 24-hour contact numbers for local authorities responsible for public safety and bridges, tunnels, pipelines and other facilities subject to waterways incidents within their AORs. Additionally, Operational Commanders shall ensure they have 24-hour contact numbers for DOD, state, county, municipal, volunteer, and commercial SAR resources in their AORs, including hospitals, ambulances, and coroners. Facility listings are particularly important for identifying capabilities not held by the Coast Guard.

1.5.2.1 Listings of dive rescue resources must include all available agencies and organizations with dive rescue capabilities. Specific information regarding transportation available or needed and pickup points for dive teams should be included. Dive rescues generally require an immediate response; all means for contacting dive teams 24 hours a day must be included.

1.5.2.2 When planning for a search using another agency's SRU, answers to the following questions should be known:

- What are the operating limitations of your resource? What is your response time? When can you be on scene?
- How will communications be conducted?

- Can your resource handle hoisting operations or MEDEVACs?
- How long can your resource stay on scene?

Information on another agency's SRU may be in the form of an Operational Asset SARFAC or it may be common knowledge for your watchstanders. Undoubtedly, you will not be able to maintain as much information on these resources as you have for Coast Guard boats or aircraft; however, all information is useful in planning. This knowledge may also prevent the loss of vital time.

1.5.3 Mass Rescue Operations Contingency Exercises

Due to the pace of normal operations, most Coast Guard units are well prepared to respond to routine SAR events. However, the Coast Guard could be called to respond to an incident involving large numbers of persons in the water, which could exceed the capabilities of local units. These have the potential to evolve into a Mass Rescue Operation (MRO) incident. These MRO scenarios could involve passenger vessels (foreign and domestic flagged), gaming vessels, passenger ferries, passenger aircraft and victims of floods, hurricanes and other natural disasters.

The rapid growth in the number and passenger capacity of cruise liners, casino/dinner cruise vessels, passenger ferries and transoceanic passenger aircraft increases the likelihood of SAR incidents with large numbers of persons in the water. Natural disasters, such as floods and hurricanes, cause similar concern. Such incidents can occur in waterways and harbors, along the coast, or out at sea. Initial response often includes both a Group and MSO and it may be appropriate to implement ICS. However, there are situations that are purely SAR, which may quickly evolve from a rescue to a recovery operation that is not SAR.

To maintain effective MRO capabilities response systems, notifications and response procedures should be exercised. While many procedures are employed daily in response to CG unit caseloads, many equally important procedures are employed far less frequently. These procedures, including response to hazardous substance incidents and intermodal (involving more than one mode of transportation) incidents such as commercial aircraft crashes and bridge allisions (vessels striking bridges), should be considered as possible scenarios. These scenarios are not all inclusive, but shown as examples. Contingency exercises of other MRO scenarios such as ones that could be unique to your AOR should also be considered for preparedness, readiness, and response planning.

1.5.3.1 Exercise Participation. Partners should include local Marine Safety Offices, Air Stations, other military commands as well as pertinent local, state, volunteer organizations and commercial assistance providers.

1.5.3.2 Emergency Points of Contact. Units will establish and validate 24-hour contact numbers for local authorities who are responsible for public safety, bridges, tunnels, pipelines, and other facilities subject to waterways incidents in the vicinity of the exercise. Key points of contact include those who operate these facilities and those who control traffic on, over, or through them.

1.5.3.3 Resource Augmentation. When planning and coordinating exercises, RCCs and Command Center's shall refer to their SARFAC listing and invite appropriate organizations.

1.5.3.4 Conducting MRO Contingency Exercises. RCCs and Groups should conduct a Table Top (TTX) or Command Post (CPX) exercise to establish and maintain positive working relationships with counterpart agencies; the exercise should focus on coordination, notification procedures, provisions as per established MOUs, and rescue operations. . In addition, TTXs and CPXs may be conducted as preliminary actions for Field Exercise (FTX) preparations.

1.5.3.5 Frequency of MRO Exercises. MRO FTXs shall be conducted in accordance with the Contingency Preparedness Planning Manual Volume I. Considering lessons learned from previous exercises, and the efficient use of the time and availability of exercise stockholders and participating members should be part of the exercise planning process. An actual major SAR case, e.g., cruise liner PRINSENDAM or TWA Flight 800, with lessons learned on SAR and MRO issues, can be counted as an MRO major exercise.

1.5.3.6 Exercise Planning Guidance and Sharing Lessons Learned. The Coast Guard's Exercise Planning Manual

provides guidance on how to plan and conduct an exercise, as well as reporting requirements for lessons learned. In addition, the Coast Guard Contingency Preparedness System (CPS) gives planning guidance. The purpose of CPS is to provide an efficient means of entering, integrating, managing, and monitoring Contingency Plans, Concept of Exercise reports, and capturing After Action Reports, Lessons Learned, and Best Practices from operations, contingency responses, and exercises. It can be found at http://llintra.comdt.uscg.mil/CPS/.

1.5.4 Information Sharing and Case Coordination

Coast Guard units will extend the maximum practicable cooperation to federal, state, local and private agencies in the prosecution of SAR missions.

1.5.4.1 Any Coast Guard unit receiving a request for SAR case information from a federal, state or local agency within their AOR will comply with that request unless there is a compelling reason to withhold it. Before the request is denied, concurrence will be obtained from the cognizant district commander.

1.5.4.2 Coast Guard commands, at all levels, shall establish sound working relationships with counterpart agencies within their AOR. Such relationships may take the form of formal agreements or MOU's. MOU's should be regularly reviewed for currency. This working relationship with other federal, state and local agencies must include timely and effective means of sharing SAR case information, as well as mission resources. This information is essential to these agencies to optimize their SAR case contribution, and for their investigative purposes, which ultimately benefit the Coast Guard.

1.5.5 SAR Assessments

A SAR assessment is intended to identify areas for improvement and to help assess needs of the SAR system.

1.5.5.1 The Coast Guard conducts two general types of assessment: internal and international. The internal (national) assessment is an evaluation of our national system as performed within the Coast Guard. Coast Guard personnel trained for this duty perform this type of assessment at a specific level (unit or RCC).

1.5.5.2 International SAR assessments are conducted by the U.S. Coast Guard at the request of a foreign government. Such requests from a foreign government may come directly to Coast Guard Headquarters SAR Program (G-OPR) or may come indirectly; e.g., through another U.S. agency, from IMO in accordance with an existing MOU, or to another part within the Coast Guard. An international SAR assessment is typically an evaluation of that country's overall SAR service. There are few people in the Coast Guard with experience in conducting this type of assessment.

1.5.5.3 All requests for an international SAR assessment shall be brought to the attention of Commandant (G-OPR). Such assessments shall be conducted under the guidance provided in reference (b), Volume I, Chapter 5, which provides broad guidance and Appendix H, *National Self-Assessment on Search and Rescue*, which is a general questionnaire on arrangements to develop and provide SAR services.

1.5.5.4 The U.S. SAR system has served as a model for many countries but should not be viewed as the exclusive way of providing SAR services. Any country requesting U.S. Coast Guard assistance in assessing their SAR system will be encouraged to complete the *National Self-Assessment on Search and Rescue* questionnaire contained in Volume I of the IAMSAR Manual before an on-site visit is conducted. The country will also be encouraged to provide an advance copy of the completed questionnaire since this document is very useful in preparing for the visit.

1.5.6 Sharing Computer SAR Applications

The authority to distribute SAR computer tools varies by application and agency and is different for domestic and foreign agencies as well as federal, state and local. These agencies desire to use the software for SAR coordination/planning and other emergency response operations. It is consistent with the SAR Program's goal to be a leader in SAR to promote using the best tools available for all SAR agencies (domestic and foreign).

1.5.6.1 **Use of C2PC/SARPC and CASP by Domestic and Foreign agencies.** The C2PC/SARPC, CASP and associated

SAR planning applications require a high level of competency to be effective. More importantly, the SAR Module and specifically the Joint Automated Worksheets (JAWS) functions within the SAR Module and rely on the SAR Controller to fully understand certain assumptions that are made in the processing. Without proper training an operator can easily develop incorrect search plans that can result in the loss of life. It is essential and critical that all users of the SAR Module participate in a SAR Training curriculum that will provide planners the knowledge required to effectively prosecute a case using these applications.

1.5.6.2 **Specific guidelines required for domestic state and local use of C2PC**: Consistent with the SAR leadership goal the SAR Program supports the distribution of the C2PC software to domestic agencies within the following specific guidelines.

(a) Domestic agencies requesting the software must have a sponsoring USCG command. The sponsoring command will provide assistance as needed to ensure the domestic agency has the necessary knowledge/skills to properly use C2PC and associated SAR planning software. Training via the National SAR School (either resident or exportable course) cannot be offered due to the overwhelming need within the USCG for these quotas. Any training would necessarily be provided locally by the sponsoring command. Sponsoring commands are limited to those that receive formal SAR School training (Groups, Activities, Sections, Districts).

(b) Domestic agencies having problems with software should first be required to contact their sponsoring command. If the sponsoring command cannot resolve the problem then the use of the Hotline should be authorized. This use should be carefully monitored to ensure any costs are adequately covered.

(c) C2PC/SAR Tools software may be provided free of charge to domestic agencies. Domestic agencies should receive their software via their sponsoring USCG command. When the software is transferred, the sponsoring command will ensure the agency information is properly documented for the C2CEN distribution list and software is receipted for by the agency.

1.5.6.3 **Specific guidelines required for other federal agencies use of C2PC**. C2PC and the SAR Module are Government off the Shelf (GOTS) application. Requests for C2PC may be made to the Office of Search and Rescue (G-OPR):

1.5.6.4 **Specific guidelines required for foreign use of SARPC**. To meet international SAR requirements the Coast Guard has merged C2PC and SAR module into a variant for international agencies called SARPC that can be purchased for nominal fee. Units shall refer all requests for SARPC to:

Commandant (G-CI)
U. S. Coast Guard
2100 Second Street, Southwest,
Washington D.C. 20593-0001.
Copy: G-OPR

1.5.6.5 **Specific guidelines for domestic and foreign use of CASP:** For legal and practical reasons, access to CASP software is not provided outside the United States Coast Guard.

1.5.6.6 **Specific guidelines for domestic and foreign use of other SAR applications:** Use of other SAR application will be on a case-by-case basis. These requests should be forwarded to the Office of Search and Rescue (G-OPR):

Commandant (G-OPR)
U. S. Coast Guard
2100 Second Street, Southwest,
Washington D.C. 20593-0001

Section 1.6
Agreements

"SAR agreements" are formal written agreements, memorandums of understanding, and comparable signed documents. They shall conform to requirements stipulated in the National SAR Plan, Appendix A in reference (a), other pertinent agreements, and the guidance of superiors in the chain of command.

1.6.1 Domestic and Local SAR Agreements

1.6.1.1 SAR Coordinators (District Commanders) are authorized to enter into domestic SAR agreements by the National SAR Plan. They need no specific approval from Commandant, but must comply with requirements prescribed by the Area SAR Coordinator (Area Commander) and reference (k).

1.6.1.2 SAR agreements should resolve local coordination problems. Local agreements should not include or repeat issues dealt with adequately in the National SAR Plan or agreements executed by senior commands. Local agreements are appropriate when certain local responsibilities need to be more clearly defined or contingency plans need elaboration. SAR agreements are not needed if SAR issues can be readily resolved by informal coordination.

1.6.1.3 Local operational commands are best able to recognize the need for SAR agreements. They should contact their District (osr) for guidance. Conversely, District Commanders should encourage commands to call attention to issues that may require stronger commitments than local informal coordination can provide.

1.6.1.4 When necessary and possible, SAR agreements with states should be included in Boating Safety Cooperative Agreements as authorized by 46 USC Chapter 131. More comprehensive maritime SAR agreements may be needed with territories whose land areas are also within the Coast Guard SAR Coordinator's area of responsibility such as Puerto Rico, the Virgin Islands, and Guam. Refer to reference (k) for instruction on instituting cooperative agreements.

1.6.1.5 One copy of SAR agreements shall be sent to Commandant (G-OPR). Area and District Commanders may prescribe additional requirements for distributing agreements made by subordinate commands.

1.6.1.6 Agreements should include provisions for canceling and amending. A typical provision for cancellation is six months' written notice by one party. Commands signatory to agreements shall review them annually to ensure that they are necessary and current. Unnecessary agreements should be promptly cancelled, and Commandant (G-OPR) advised.

1.6.2 Department of Defense (DOD) SAR Agreements

Reference (a) states that each U.S. Armed Force provides its own SAR for Service operations and that DOD facilities can be used under the National SAR Plan for civil SAR. When Coast Guard resources are assisting DOD facilities with SAR, the Coast Guard shall designate its own SMC to coordinate SAR operations. Coast Guard SMC case termination/suspension decisions will be independent of those of the DOD SMC (if assigned).

1.6.3 Medical Advice

SAR planners should anticipate requests for medical advice from ships at sea (via medico messages) or from boaters. Medico messages are discussed in Chapter 3 of reference (a). Replies to requests for medical advice should be done on a not-to-interfere basis with commercial providers. A qualified doctor must provide the Coast Guard the medical advice to be transmitted. Arrangements should be in place for consulting with local medical facilities or Coast Guard assigned Public Health Service medical doctors.

1.6.4 International SAR Agreements

The United States seeks to enter joint aeronautical and maritime SAR agreements where appropriate with other countries since, for practical purposes, a downed aircraft at sea is essentially a maritime incident. International SAR Agreements can only be negotiated by Commandant (G-OPR). While field commands are not authorized to develop formal SAR agreements with other countries, they should identify any needed agreements and notify Commandant (G-OPR) with the appropriate information. Local agreements with Canadian organizations must comply with the 1999 Trilateral SAR Memorandum of Understanding between the U.S., and Canadian and United Kingdom SAR authorities, appendix b of ref. a.

1.6.5 SAR in Foreign Territories

U.S. Coast Guard units are authorized to enter foreign territories to respond to information of persons missing or in distress; such assistance is to be provided without regard to the nationality of those in distress. It is important to understand that international law recognizes and provides for the duty and the right to save lives in danger or distress, even when they are within foreign territorial waters. However, these provisions must be balanced with international concerns for sovereignty of nations and national security. The following guidance and procedures are intended to help in establishing this balance. While provisions of international law on entry of foreign territory for SAR constitute only a small portion of those generally applicable to lifesaving and SAR, potential sensitivities and opposing views other nations may hold dictate that we exercise the entry right and duty knowledgeably and carefully. The following applies to the Coast Guard SAR organization and its facilities.

1.6.5.1 Discussion

(a) The United States is party to numerous international instruments (treaties, conventions and agreements) to promote cooperation with other countries in rendering assistance to persons in distress. Some federal agencies have similar plans, agreements, and procedures for coordinating SAR efforts.

(b) SAR response in foreign territory generally involves two principles which sometimes conflict the sovereign right of nations to control and regulate entry into, and operations within, their territory; and the humanitarian need to quickly and effectively assist persons or property in danger or distress without regard to nationality or circumstances. International instruments, and national policies of some countries, attempt to balance these concerns.

(c) Relations with foreign countries and the protection of U.S. citizens abroad are primarily the responsibility of the U.S. Department of State (DOS), which has no SAR facilities. When they need U.S. SAR facilities, Foreign Service posts (FSPs embassies and consultants) depend on facilities of the resident country, and assistance from the Coast Guard and other U.S. agencies. Guidance in Section 1.6.5.2 is intended to help coordinate Coast Guard procedures with those of FSPs.

(d) The obligation to rescue distressed mariners regardless of nationality is based on the principle and time-honored tradition that those at sea will, whenever they can without undue risk, assist fellow mariners in danger or distress.

(e) Coast Guard personnel should refer to operation of vessels or aircraft, including military craft, to enter or overfly the territorial sea of a foreign nation to render emergency assistance to persons, ships or aircraft in danger or distress from perils of the sea, as “assistance entry” (AE). Be aware that DOD commands use the term “right of assistance entry (RAE)” for such operations. International law and U.S. policy recognize the duty and right of such craft to carry out AE operations under certain conditions. Additionally, ships already engaged in innocent passage may stop to render assistance to persons in danger or distress.

(f) Perils of the sea are dangers commonly associated with operating on, over or under the oceans. They do not include law enforcement action taken by a coastal nation.

(g) AE of foreign territorial seas does not depend upon seeking or receiving permission of the coastal nation; however, some international agreements to which the U.S. is a party may limit such actions.

(h) Customary practice for aircraft entry is not as fully developed as for vessels, i.e. nations will recognize the right to carry out AE more readily for vessels than for aircraft. Also, entry by nonmilitary vessels is apt to cause less coastal nation concern than entry by military vessels. Therefore, safety of the rescue unit must be

considered in light of the views of the nation whose territorial sea or overlying airspace is being entered.

(i) The right to carry out AE extends only to bona-fide rescue operations, not to search operations. Coastal nation permission must be secured prior to flying over or landing in territory or territorial seas of a foreign nation for search operations unless other prior arrangements have been made. This can sometimes be arranged with an RCC of that nation.

(j) Ships and aircraft of other nations should be afforded comparable freedom to enter U.S. territorial seas. U.S. actions that unreasonably restrict entry will inevitably jeopardize the ability of U.S. vessels and aircraft to carry out AE.

1.6.5.2 Guidance for AE operations

(a) When the Coast Guard can render or arrange assistance to persons in danger or distress from perils of the sea within foreign territorial seas, it should do so in accord with the following guidance. Such actions must consider the safety of assisting personnel, and the safety of the persons in danger or distress. Such actions must also be taken with an appreciation of U. S. foreign relations with the coastal nation, and in accordance with any applicable international SAR agreement. Our goal is to balance concerns for saving lives and concerns about sovereignty and national security.

(b) A Coast Guard cutter or boat may carry out AE (unless a SAR agreement with the country requires a different procedure), when in the judgment of the unit or operational commander:

(1) There is reasonable certainty (based on the best available information regardless of source) that a person is in danger or distress from the perils of the sea,

(2) The distress location is reasonably well known, and

(3) The rescue unit is in position to render timely and effective assistance.

(c) Coast Guard aircraft may carry out AE as follows, unless a SAR agreement with the country provides differently. Accordingly:

(1) A Statement of No Objection (SNO) from Commandant (G-O) is required for Coast Guard aircraft to enter airspace over foreign territorial seas when, in the judgment of an aircraft commander or operational commander:

(i) A person is in danger or distress from perils of the sea, and delay in rendering assistance would not be life-threatening, and

(ii) Provisions in 1.6.5.2(b)(2) and 1.6.5.2(b)(3) are met.

(2) An SNO from Commandant (G-O) is not required for Coast Guard aircraft to immediately enter airspace over foreign territorial seas only when, in the judgment of an aircraft commander or operational commander:

(i) A person is in danger or distress from perils of the sea, and delay in rendering assistance is potentially life-threatening,

(ii) The provisions of in 1.6.5.2(b)(2) and 1.6.5.2(b)(3) are met, and

(iii) The aircraft is the only available resource capable of rendering safe, effective, and timely assistance.

(d) In all cases, Commandant (G-OPF) shall be promptly notified of an AE action in progress or contemplated by Coast Guard rescue units.

(e) Normally, the Coast Guard should refrain from AE when other rescue units, capable of rendering timely and suitable assistance, are known to be on scene or en route, unless there is good reason to believe that the other rescue units cannot or will not respond in an adequate or timely manner.

(f) When exercising the right to conduct AE operations as described in 1.6.5.2(b) and 1.6.5.2(c) above,

permission of the coastal nation should not be requested, unless otherwise directed by Commandant. However, the coastal nation should be notified of the entry at the earliest opportunity, both as a matter of courtesy and so its rescue units may be activated if necessary. Communications must avoid implying that permission is being requested; however, in recognizing the sovereignty of nations within their own territorial seas and the airspace over their territorial seas, communications should be carefully worded to foster cooperation in rescue efforts. If a coastal nation registers a protest against the entry of a rescue unit before that unit actually enters the nation's territorial seas, Coast Guard units shall not enter the territorial seas unless directed to do so by the operational chain of command.

(g) Reasonable doubt as to the immediacy or severity of a situation should usually be resolved by assuming the person(s) is in danger or distress, or that a life-threatening situation exists.

(h) AE should not be carried out to conduct searches. Entry for searching is permitted only with coastal nation consent, which may be arranged in advance by treaty, agreement, or informal arrangement, or on a case-by-case basis.

(i) Cutters conducting AE operations shall not deploy aircraft to, or use aircraft at, the distress scene unless an SNO from the Commandant has been obtained, or a determination has been made that the situation is potentially life-threatening under paragraph 1.6.5.2(b).

(j) If, while a Coast Guard unit is engaged in or intending to carry out AE, the coastal nation objects to the presence of the unit, or if its military or police units attempt to interfere with or otherwise disrupt efforts of the Coast Guard unit, attempts should be made to arrange alternative assistance to those in danger or distress, resolve disagreements amicably on scene, convince the coastal nation and its units of the humanitarian nature of the situation, and advise them of Coast Guard intentions. If such opposition, interference or disruption:

(1) Ceases, the rescue unit may proceed with its mission.

(2) Continues, and the distress is unlikely to be life-threatening, surface units and land based aircraft should depart and cutter-based aircraft should return to the cutter.

(3) Continues, and the distress appears life-threatening, Coast Guard units should, when possible, await direction via the operational chain of command, but may proceed to render immediate assistance.

(k) When deciding what actions to take under paragraph 1.6.5.2(j) above, the operational or unit commander must weigh the risk to the person(s) in distress including potential for other assistance, the apparent seriousness of the foreign government's communicated opposition, and its potential enforcement capability.

(l) The right of self-defense applies when conducting operations in or over foreign territorial seas. For the Coast Guard unit assisting on scene, the right of self-defense extends to and includes persons, vessels or aircraft being assisted and/or escorted; however, the right of self-defense does not include protecting the assisted persons (unless aboard the Coast Guard unit), vessels, or aircraft from legitimate law enforcement efforts conducted by a coastal nation (see paragraph 1.6.5.1(f) above). Chapter 4 of reference (l) and applicable Rules of Engagement provide more detailed information and procedures.

(m) In addition to other notifications discussed earlier, it may be useful for the SAR unit commander to make SECURITE broadcasts when entering into or over foreign territorial seas to conduct SAR operations. Furthermore, a coastal state should be notified of actual or potential marine pollution associated with a SAR incident.

1.6.5.3 Procedures

(a) Commandant (G-O) has established appropriate procedures, including prompt notification of or consultation with DOS as appropriate, to apply during the following situations:

(1) A Coast Guard unit is contemplating or undertaking AE (paragraphs 1.6.5.2(b) and 1.6.5.2(b));

(2) Entry of a Coast Guard unit is being objected to by a coastal nation, or being interfered with or otherwise disrupted by the nation's military or police, while carrying out AE; or

(3) A Coast Guard unit is exercising the right of self-defense in or over foreign territorial seas.

(b) Area and District Commanders shall:

(1) Ensure operational commanders, RCC controllers, watchstanders and SAR units understand what is expected of them when faced with situations involving entry of foreign territorial seas to perform either search or rescue operations.

(2) Establish procedures for timely notifications and requests via Commandant (G-OPF) as appropriate.

(3) Upon becoming aware of a SAR incident in foreign territory, assist or attempt to arrange appropriate assistance, including assistance from the coastal nation, consistent with the immediacy and severity of the situation. Follow standard SAR practices, subject to applicable entry constraints. Alert the coastal nation of potential marine pollution associated with the SAR incident. For SAR incidents involving ships carrying oil or hazardous chemicals off the coast of Canada or Mexico, ensure that notification given to that coastal nation includes alerting the nation's pollution incident On Scene Coordinator (OSC) under the appropriate Joint Contingency Plan. Such notification should be coordinated with the cognizant U. S. pre-designated On-scene Coordinator (Captain of the Port).

(4) Ensure adherence with these procedures for any SAR operation in or over a foreign territorial sea and:

(i) Continue to advise the coastal nation and DOS of the situation, Coast Guard action taken and intended, and the description, speed and location of Coast Guard units;

(ii) Direct units to:

- Proceed to the scene, render appropriate assistance, and then depart as soon as possible,
- Advise the coastal nation of the situation and intentions, or broadcast in the blind if communications cannot be established,
- Keep any involved RCC informed, and
- Monitor the situation.

(5) Follow the guidance of:

(i) Section 1.6.5.3 when information is received that a U.S. craft or a craft with U.S. citizens aboard is missing, or in danger or distress, while in a foreign nation, or its territorial sea or overlying airspace;

(ii) Section 1.6.5.4 (or enter to assist and notify Commandant (G-OPF), as appropriate) when situations call for AE.

(6) If neither this Addendum nor the U.S. Air Force Foreign Clearance Guide (reference (m)) covers the situation, request permission to enter territorial seas or overlying airspace directly from an RCC or RSC of the foreign nation or through the U.S. FSP.

(7) Document communications with any FSP. Include the Commandant and DOS as information addressees on all messages sent to a FSP. Send messages or telegrams to confirm telephone communications. Include the resident American Embassy, if there is one, as an information addressee when a message or telegram is sent to a FSP not located at an Embassy.

(8) Develop and issue appropriate subordinate directives to ensure implementation of this Addendum. The directives should include guidance on:

(i) Carrying out AE or performing SAR missions in foreign territory and territorial seas.

(ii) Establishing procedures to provide ships and aircraft of other nations comparable entry (for SAR purposes) into the U.S. territory or territorial seas.

(iii) Notifying, and when appropriate, requesting an SNO from Commandant (G-O). Communications should be by the most rapid means, followed by an immediate precedence action message carrying

out or intending to carry out AI to help persons in distress. After initial interagency coordination, subsequent action SITREPs should be addressed to the appropriate operational commander, with information to Commandant (G-O).

(iv) Advising Commandant (G-OPF) if:

- A coastal nation objects to AE by Coast Guard units, interferes with or otherwise disrupts such entry; or
- A coastal nation ceases to object to such entry, or ceases to interfere with or otherwise disrupt Coast Guard SAR operations.

  Such communications should be carried out by the most rapid means, and should be followed by an immediate precedence action message with Joint Chiefs of Staff, other Area and District Commanders, DOS, the American Embassy in the coastal nation, and the National Military Command Center (NMCC) included as immediate precedence information addressees.

(v) Advising, and when appropriate requesting a SNO when:

- Military or police units of a coastal nation attempt to interfere with or otherwise disrupt a Coast Guard unit carrying out AE;
- A Coast Guard unit is exercising, or is likely to exercise, the right of self-defense in or over a foreign territorial sea; or
- A Coast Guard unit is continuing a rescue mission for a life-threatening distress in a foreign territorial sea after the coastal nation has objected to entry.

  Such communications should be by the most rapid means, followed by a flash precedence message, with JCS, other Area and District Commanders, DOS, the American Embassy in the coastal nation, and the NMCC included as flash precedence information addressees.

(c) Coast Guard unit commanders, upon becoming aware of a SAR incident in foreign territory, should:

(1) Advise their operational commander via the most expeditious means consistent with the immediacy and severity of the situation, their position, on scene endurance and intentions based on the guidance of this Addendum.

(2) Assist or attempt to arrange assistance, and/or stand by for authorization to proceed, as appropriate; and attempt to:

- Establish and maintain communications with those in danger or distress, and with the coastal nation as directed by the operational chain of command;
- Determine the position, vessel description, nature of problem, persons on board, survival gear, on scene conditions, potential for marine pollution, etc.; and
- Relay this information to the appropriate RCC.

1.6.5.4 Guidance for Incidents Concerning U.S. Craft or Citizen Missing, in Danger, or in Distress in Foreign Territory or Territorial Seas.

(a) When information is received that a U. S. air or surface craft, or a craft with U.S. citizens aboard, is in danger or distress or missing while in or over territory or territorial seas of other adjacent countries:

(1) Determine via SAR communications channels (including commercial and Air Traffic Service facilities) the action taken and planned by responsible foreign SAR authorities to respond within their territory. If Coast Guard resources are carrying out AE, advise the foreign authorities.

(2) If the source of information is other than the cognizant U.S. FSP, and if prearranged SAR procedures do

not cover the case:

- Contact the appropriate U.S. FSP(s) by the most direct means;
- Pass them all pertinent information;
- Request that they immediately implement their procedures for such cases; and
- Recommend appropriate additional measures, particularly in cases of overdue surface craft. Area and District Commanders or their SAR Mission Coordinator (SMC), as appropriate, have authority to communicate with U.S. FSPs concerning the prosecution of SAR incidents, but must keep Commandant and DOS informed.

(3) If the original source of information is a U.S. FSP, help the Post evaluate the incident and recommend appropriate SAR action.

(4) Dispatch SAR forces and/or an SMC Team, as appropriate, when one of the following applies:

- Foreign SAR authorities request, or grant permission for, U.S. SAR assistance. In such cases, notify the appropriate FSP(s) (no further clearance is needed).
- The Area or District Commander or their SMC, as appropriate, decides that U.S. assistance should be provided. If the case involves assistance, notify the foreign government. For SAR operations not involving exercising the right to carry out AE, obtain consent from the foreign government if such consent has not been prearranged. Go through the appropriate FSP or, where applicable, adhere to provisions of a SAR agreement, treaty, or other international arrangement or practice adopted by the country involved. Section1.6.5.4 may help. Keep the FSP(s) advised.
- A U.S. FSP requests, or the Commandant directs, the dispatch of Coast Guard units, and advises that clearance has been obtained.

(5) Retain operational control of U.S. efforts unless it is operationally advantageous to pass control to another SMC, or it is in accordance with an applicable SAR agreement or standard international practice to do differently.

(6) Throughout the incident, keep the Commandant advised in case additional diplomatic efforts become necessary. Telephone initial reports to the Commandant (G-OPF) Duty Officer. Follow with appropriate SITREPS. Include DOS as an information addressee on all SITREPs. Notification of the U.S. FSP is not a substitute for notification to, or consultation with, DOS.

(7) Keep the original information source advised.

(b) DOS (ARA/CCA (Cuban Desk)), rather than USINT Havana, will be considered an FSP for Cuba for purposes of this section.

1.6.5.5 Supplemental guidance for Coast Guard RCCs

(a) General

(1) Generally, U.S. SAR operations within the jurisdiction of a foreign nation should be in accordance with that country's requirements and applicable SAR agreements. Exceptions may arise when exercising the right to carry out AE operations. Within certain limitations, each nation has the sovereign right to control access to its territory, territorial seas and the airspace over these areas.

(2) This section is based upon international agreements and policies of the countries or territories discussed. It complements the U.S. Air Force Foreign Clearance Guide (reference (m)), which is usually the first publication to reflect changes in policies of foreign countries, which might affect SAR entry. For situations not addressed by the Guide or this section, it may be appropriate to request permission to enter directly from an RCC or RSC of the country or through the U.S. FSP.

(b) **SAR Cases Involving Canada**. A 1999 trilateral SAR agreement among the U.S., Canada, and the United Kingdom provides for the full range of aeronautical and maritime SAR cooperation. Most situations requiring entry of U.S. SAR units into Canada are also governed by the Wrecking and Salvage Treaty of 1908 or the Air Search and Rescue Agreement of 1949 (see Appendix B of reference (a)). When conducting SAR operations in Canadian territorial seas, the provisions of these instruments should be followed, including submittal of post operational reports required by the 1908 Treaty. Keep the appropriate Canadian RCC informed of the situation.

(c) **SAR Cases Involving Mexico**

(1) The 1989 SAR agreement between the U.S. and Mexico provides the framework for cooperation in maritime SAR. The Mexican Navy is the maritime SAR agency in Mexico. In practice, the Mexican Navy Headquarters in Mexico City serves as the SAR coordinator and the SMC for all maritime SAR. Requests for SAR assistance from Mexico should be coordinated with the U.S. Defense Attaché Office (USDAO). However, the 1989 SAR agreement has resulted in direct coordination between U.S. Coast Guard RCCs and the Mexican Navy. Time permitting; the Mexican Navy should normally be afforded the opportunity to respond to cases within Mexican territorial waters. In all messages sent to USDAO Mexico City, include American Embassy, Mexico City as an information addressee. Be prepared to assist when U.S. citizens are involved, and/or when Mexican facilities may not be able to respond, particularly on the high seas. If the Mexican government cannot assist satisfactorily, consult with DOS via the Coast Guard National Command Center.

(2) Requests for extended communications or airport checks should be addressed to the American Embassy, Mexico City and/or U.S. Consulates in locations of likely assistance.

(3) A 1935 SAR Treaty between the U.S. and Mexico provides for entry of U.S. SRUs into the following areas to facilitate assistance to and salvage of U.S. vessels and aircraft in danger or shipwrecked on the coast or within the territorial seas:

(i) Within a radius of 720 nautical miles of the intersection of the international boundary line and the coast of the Pacific Ocean.

(ii) Within a radius of 200 nautical miles of the intersection of the international boundary line and the coast of the Gulf of Mexico.

(4) Entry for SAR in areas covered by the Assistance and Salvage Treaty of 1935 is permitted to assist persons aboard U.S. vessels or aircraft, which may be disabled or distressed. In addition to the port authority notifications required in the Treaty, notify the USDAO, Mexico City, of entry and departure of SAR units by the most rapid means followed by immediate precedence messages. These messages will be relayed to appropriate officials of the Mexican government. Similar procedures apply to Mexican vessels and rescue apparatus assisting Mexican vessels or aircraft in danger or shipwrecked on the coast or within the territorial seas of the U.S. as specified in the Treaty.

(5) For cases not falling under the Treaty and not involving AE, including cases over land, maritime cases requiring flights over Mexican land (even for refueling, etc.), and maritime cases outside the treaty limits, obtain entry clearances from the Mexican government.

(i) Personnel requesting aircraft clearances must have a working knowledge of the U.S. Air Force Foreign Clearance Guide. The following is recommended practice:

- Request emergency clearances for SAR missions by telephone at any time, and confirm by priority message. They will be handled as rapidly as possible by the USDAO staff. It is unnecessary and undesirable to use immediate precedence to confirm telephone clearance requests.
- Include intended flight paths in all clearance requests.
- When the need for clearance can be foreseen (such as on a continuing search mission) make

requests to the U.S. air attaché up to five days in advance and during working hours. Listing alternate aircraft and pilots gains some flexibility for changes in plans. If a search requiring aircraft clearances may continue over a weekend, request clearances for Saturday, Sunday, and Monday not later than the working hours on Friday; and include alternate pilots for each day. If the clearances later are not needed, they can be canceled easily.

(ii) Requests for vessel clearances to enter non-treaty waters for SAR purposes are handled in the same manner as for aircraft clearances into non-treaty airspace. Ordinarily they are originated by the SMC to the U.S. Naval Attaché.

(6) Mexican Naval Zones and Sectors:

(7) U.S. Consulates (C) and Consulates General (CG) in Mexico:

Ciudad Juarez (CG)	Matamoros (C)	Nogales (C)	Guadalajara (CG)	Merida (C)
Nuevo Laredo (C)	Hermosillo (C)	Monterrey (CG)	Tijuana (CG)	

Table 1-6 Countries with Automatic Entry for SAR

COUNTRY	NOTIFICATION CHANNEL
Anguilla	Rescue Sub-Center, Antigua
Antigua	Rescue Sub-Center, Antigua
Bahamas	American Embassy, Nassau and Air Traffic Control (ATC), Nassau International Airport
Barbados	American Embassy, Bridgetown
Belize	Airport Manager, Stanley Airport, Belize City and American Consulate General, Belize City
British Virgin Islands	Rescue Sub-Center, Antigua
Cayman Islands	Rescue Sub-Center, Antigua
Colombia	USDAO, American Embassy, Bogota
Costa Rica	USDAO, American Embassy, San Jose
Dominica	Rescue Sub-Center, Antigua
El Salvador	USDAO, American Embassy, San Salvador
French Guiana	Rescue Sub-Center, Cayenne. When the RCC acknowledges receipt, entry is authorized unless the RCC states otherwise. Ground parties require specific authorization. Aircraft in flight must file a flight plan and position report to nearest French ATC and then proceed.
Grenada	Rescue Sub-Center, Antigua
Guadeloupe	SAR Coordination Center, Raizet Airport. When the RCC acknowledges receipt, entry is authorized unless the RCC states otherwise. Ground parties require specific authorization. Aircraft in flight must file a flight plan and position report to nearest French ATC and then proceed. Note: SAR Center at Raizet Airport is under the jurisdiction of the RSC at Lamantin Airport in Martinique.
Guatemala	For U.S. Government craft on a SAR mission: USDAO, American Embassy, Guatemala City. For other than U.S. Government aircraft on a SAR mission: Director General of Civil Aviation La Aurora Aerodrome, Guatemala City.
Guyana	Rescue Coordination Center, Timehri International Airport and American Embassy, Georgetown.
Honduras	Director General of Civil Aviation Tegucigalpa and USDAO, American Embassy Tegucigalpa.
Jamaica	ATC, Palisadoes International Airport, Kingston and USDAO, American Embassy, Kingston.
Martinique	Rescue Sub-Center, Lamentin Airport and American Consul, Fort-de-France. When the RSC acknowledges receipt, entry is authorized unless the RSC states otherwise. Ground parties require specific authorization. Aircraft in flight must file a flight plan and position report to nearest French ATC and then proceed.
Montserrat	Rescue Sub-Center, Antigua
Netherlands Antilles	Rescue Coordination Center, Curacao and American Consulate General, Curacao
Nicaragua	Director of Civil Aviation, Ministry of Defense, Managua and USDAO, American Embassy, Managua. Aircraft must contact Managua Radio Before Entering Nicaraguan Territory [Note: Consult with Flag

COUNTRY	NOTIFICATION CHANNEL
	Plot, Commandant (G-OPF) before entry]
St. Kitts - Nevis	Rescue Sub-Center, Antigua
St. Lucia	Rescue Sub-Center, Antigua
St. Vincent	Rescue Sub-Center, Antigua
Surinam	Rescue Coordination Center, Zanderij and American Embassy, Paramaribo
Trinidad and Tobago	Director of Civil Aviation, Trinidad and American Embassy, Port of Spain
Turks and Caicos Islands	Rescue Sub-Center, Antigua
Venezuela	Rescue Coordination Center, Maiquetia and USDAO, American Embassy, Caracas

(d) If a protracted search is anticipated, as in **Countries with Automatic SAR Entry Policies**.

(1) Certain countries and territories may be entered by SRUs under Coast Guard control to respond to a known distress, or to transit through or land in the territory while on a SAR mission. Notify these countries of intended operations as soon as possible by an immediate precedence message through the channels indicated below as soon as practicable.

(2) The case of an overdue craft, request the country's permission to conduct operations in the notification message. Such extended operations should not be conducted without consent which occurs when the government concerned has:

- Requested U.S. assistance in the operations;
- Accepted assistance offered by the U.S.; or
- Granted a request of the U.S. to conduct the operation.

(3) The countries and territories listed in Table 1-7 have adopted the principle of automatic entry for units on a SAR mission. File messages to the foreign authorities listed below on the Aeronautical Fixed Telecommunications Network (AFTN) or Aeronautical Telecommunications Network (ATN) using SS priority indicator and International Civil Aviation Organization (ICAO) format, unless a more rapid means of communications is available. Communicate with appropriate U.S. authorities by the most rapid and direct means. The notification message should include full details of the projected mission and its necessity.

(e) **Other Countries:**

Table 1.7 Other Countries Entry Procedures

COUNTRY	PROCEDURES
Cuba	No agreed plan for entry is in effect. Cuba authorizes entry on a case-by-case basis. Before surface or air units conduct search operations in Cuban territorial waters or overlying airspace, DOS authorization to contact Cuban authorities must be obtained. Communications with Cuban authorities may be made over AFTN or telex to RCC Havana (for maritime cases include request to pass the message to the Directorate General of Border Guard Troops). If the attempts to communicate fail, the Coast Guard may contact USINT Havana in accordance with Department of State instructions and request that they contact the Cuban authorities on the Coast Guard's behalf. Service-to-service communication is preferable as it is usually more timely. Include full details of the projected mission and its necessity in messages requesting clearance. Confirm telephone conversations by message. A copy of any direct message to Cuban authorities should be sent to Commandant, DOS (ARA/CCA), and USINT Havana. If Cuban authorities initiate contact regarding SAR assistance, Coast Guard operational commanders can assume authorization to cooperate, but the Commandant and DOS should be immediately notified.
Dominican Republic	The May 2003 SAR agreement between the U.S. and the Dominican Republic provides for cooperation in aeronautical and maritime SAR. Established points of contact, RSC San Juan for the U.S. and the Dominican Navy Operations Center, would develop local operational

COUNTRY	PROCEDURES
	procedures.
Haiti	Obtain confirmed clearance from USDAO, American Embassy, Port Au Prince. Armed aircraft are not permitted to land under any circumstances.
Indonesia	IAW bilateral SAR agreement signed 1988
Japan	IAW bilateral SAR agreement signed 1986 (and amended in 1998)
Marshall Islands, Republic of the	IAW bilateral SAR agreement signed 1985
Micronesia, Federated States of	IAW bilateral SAR agreement signed 1988
New Zealand	IAW bilateral SAR agreement signed 2003
Palau	IAW bilateral SAR agreement signed 2002
People's Republic of China	IAW bilateral SAR agreement signed 1987
Russia	IAW bilateral SAR agreement signed 1988, in force even though signed under USSR

1.6.6 Amver System

Amver is a worldwide voluntary ship reporting system for SAR sponsored by the U.S. Coast Guard. Amver's primary function is to quickly provide SAR authorities with accurate information on the positions and characteristics of ships near a reported maritime or aviation distress that may be able to provide assistance. Vessels of all nations on a coastal or oceanic voyage anywhere on the globe are encouraged to participate by reporting their position. Amver-participating vessels are typically merchant vessels but can include megayachts, commercial fishing vessels or any other vessel that is capable of providing assistance. Vessels participate by sending movement reports (sailing plan, periodic position updates, and final report) to the Amver Center at the OSC via assigned coast or international radio stations or satellite service providers. Information from these reports is entered into a database that computes dead reckoning positions for vessels anywhere in the world while they are participating in the system. Vessel characteristics valuable for determining SAR capability from other available sources of information will be accessed through the Amver application.

Appropriate information about predicted locations and SAR characteristics of vessels within the area of interest is made available to recognized SAR authorities of any nation for use during an emergency. Because vessel movement information provided to Amver is considered proprietary commercial or financial information, it should be carefully guarded from external release and handled in accordance with the specific guidelines in reference (n) and the FOIA/Privacy Act Manual, reference (i). Predicted locations or Amver information are disclosed only for safety purposes, it is not provided to Coast Guard personnel in other mission areas (e.g., law enforcement or maritime investigations) nor other types of agencies. Search planning policy and procedures using Amver are discussed in Chapter 3 of this Addendum. Other guidance material includes:

- **Amver User's Manual (Ship Reporting System for Search and Rescue)**: Detailed guidance for the vessel and company on how to participate and general educational information. Published by G-OPR.
- **Management and Operation of the Amver System, COMDTINST 16122.2 (series)**: Coast Guard directive providing specific policy for the management and operation of the Amver system.
- Amver web site at: www.amver.com.

1.6.6.1 Deciding when to divert an Amver-participating vessel in response to a SAR operation is the responsibility of the SMC based on careful consideration of all available information. Commercial vessels that participate voluntarily in our SAR system are usually on tight logistical schedules, and diversions for SAR are costly for shipping companies.

1.6.6.2 Amver-participating vessels should be called upon to assist whenever necessary to respond to a life threatening situation. They may be used along their track to help verify distress information and to keep a lookout. Use of Amver-participating vessels to assist in extended searches should be weighed against use of other available resources. Divert as many vessels as are needed, but release them as soon as possible, consistent with the situation and their apparent importance to the SAR operation. SOLAS ships may be asked to serve as the OSC or to perform other functions in accordance with Volume III, *Mobile Facilities,* of the IAMSAR Manual, which they

should carry on board. While ships are valuable rescue facilities, they should be used sparingly for extended searches due to their relatively low speeds, small sweep widths, and high costs involved. Aircraft are preferred search facilities when available, but ships may be asked to search as warranted in the judgment of the SMC. (Regulation V/33 of the SOLAS Convention, in part, states "The master of a ship at sea which is in a position to be able to provide assistance, on receiving a signal from any source that persons are in distress at sea, is bound to proceed with all speed to their assistance…" – use of Amver allows the SMC to select the best facility(s) and allow the other vessels to proceed without diverting.)

NOTE: Merchant vessels are valuable rescue facilities, but should be used sparingly for extended searches.

1.6.6.3 Reporting usage of the Amver system by the RCC will ensure continued Coast Guard provision of Amver services and also encourage participation by commercial vessels. SAR SITREPs and District/Area Operations Summaries are to be sent to Amver Maritime Relations (message PLAD "COGARD AMR NEW YORK NY" or by e-mail) whenever an Amver-participating vessel makes a rescue (including number of persons rescued) or diverts to assist (with or without positive results), or a foreign RCC requests a SURPIC. This information will be compiled by AMR and reported in annual statistics for Coast Guard and public use. As feasible, the Coast Guard RCC should follow-up on foreign RCC requests for Amver information and report the outcomes as appropriate. The RCC should have procedures in place to quickly recognize any Amver-participating vessel that diverts or makes a rescue. Such recognition can be in the form of a thank you letter to the company/owner or a public service award for the vessel in an actual rescue.

CHAPTER 2
SAR COMMUNICATIONS

2.0 Introduction to Communications

2.1 Global Maritime Distress and Safety System (GMDSS)
2.1.1 Introduction
2.1.2 GMDSS Functions
2.1.3 GMDSS Coverage Areas
2.1.4 GMDSS Sub-Systems
2.1.5 Description of GMDSS Sub-Systems

2.2 Digital Selective Calling (DSC)
2.2.1 DSC Guard Requirements
2.2.2 HF/MF DSC Response Policy: Coast Guard Shore Units
2.2.3 MF DSC Response Policy: Coast Guard Afloat Resources
2.2.4 VHF-FM DSC Response Policy: Coast Guard Afloat Resources
2.2.5 VHF-FM DSC Response Policy: Coast Guard Shore Units

2.3 SafetyNET Messaging
2.3.1 General
2.3.2 SafetyNET Message Procedure
2.3.3 Drafting a SafetyNET Message
2.3.4 Monitoring SafetyNET broadcasts
2.3.5 Message Types

2.4 Maritime Mobile Service Identity (MMSI) Numbers
2.4.1 Introduction
2.4.2 MMSI Assignment and Registration
2.4.3 MMSI SAR Vessel Identification System

2.5 National Distress and Response System (NDRS) & Rescue 21
2.5.1 General
2.5.2 NDRS Coverage
2.5.3 NDRS Hardware
2.5.4 Channel 16
2.5.5 Other Uses of NDRS
2.5.6 Channel 16 Monitoring Requirements
2.5.7 New Capabilities Provided by the Rescue 21 System

2.6 Urgent Marine Information Broadcasts (UMIBs)
2.6.1 General
2.6.2 UMIB vs. Callouts
2.6.3 UMIB vs. MAYDAY Relay

2.7 Cellular Telephones and *CG
2.7.1 Cellular Telephones
2.7.2 *CG Agreements/Routing of *CG Calls
2.7.3 911

2.8 Electronic Mail
2.8.1 E-mail Policy

2.9 Lost Communications with a Coast Guard Asset
2.9.1 Lost Communications Procedures

2.10 Recorded Radio Transmissions and Telephone Lines
2.10.1 Guidance
2.10.2 Recording Manipulation Software/Devices

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Section 2.0
Introduction to Communications

Communications are essential to both distress alerting and the conduct of operations. This chapter discusses the primary communications systems used in the SAR system.

The Coast Guard communications system is undergoing a change and Rescue 21 with GMDSS is leading that effort. The following sections discuss the changes that have already been incorporated into Coast Guard operations. Some of these changes are extensive.

For example, Rescue 21 will:

- Eliminate the need for low-level sites.
- Provide nearly full coverage out to 20NM for a 1-watt transmission at 2 meters high.
- Provide the capability to each Group/Activities Command Center to communicate and coordinate with all CG assets in that region.
- Eliminate the need for a communications watch at small boat stations.
- Provide real time automated asset tracking of Rescue 21 equipped vessels, displayed on a geographic display at the Group Communications Center (GCC).
- Provide automation of repetitive broadcasts and text messages, such as UMIB's, safety messages, etc.

These are just a few examples of the changes that are occurring in the communications area and are further defined in the following sections.

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Section 2.1
Global Maritime Distress and Safety System (GMDSS)

2.1.1 Introduction

The Global Maritime Distress and Safety System (GMDSS) is an internationally established distress and safety system. GMDSS was established by the International Maritime Organization (IMO) in 1988, and GMDSS equipment carriage requirements are now mandatory for vessels subject to the Safety of Life at Sea (SOLAS) Convention. GMDSS also can benefit all maritime interests. GMDSS relies upon the establishment of specific "sea areas" of communications and multiple distress alerting and communications networks and methods. This improvement in ship-to-shore distress alerting requires particular equipment on board vessels and at Coast Guard RCCs, Groups, and CAMS in order to send and receive alerts. The primary purpose of GMDSS was to change from a ship-to-ship method of distress alerting to a ship-to-shore method. It provides for the automatic identification of the caller and the location of a vessel in distress. GMDSS became fully effective for the signatory nations of the SOLAS convention on February 1, 1999.

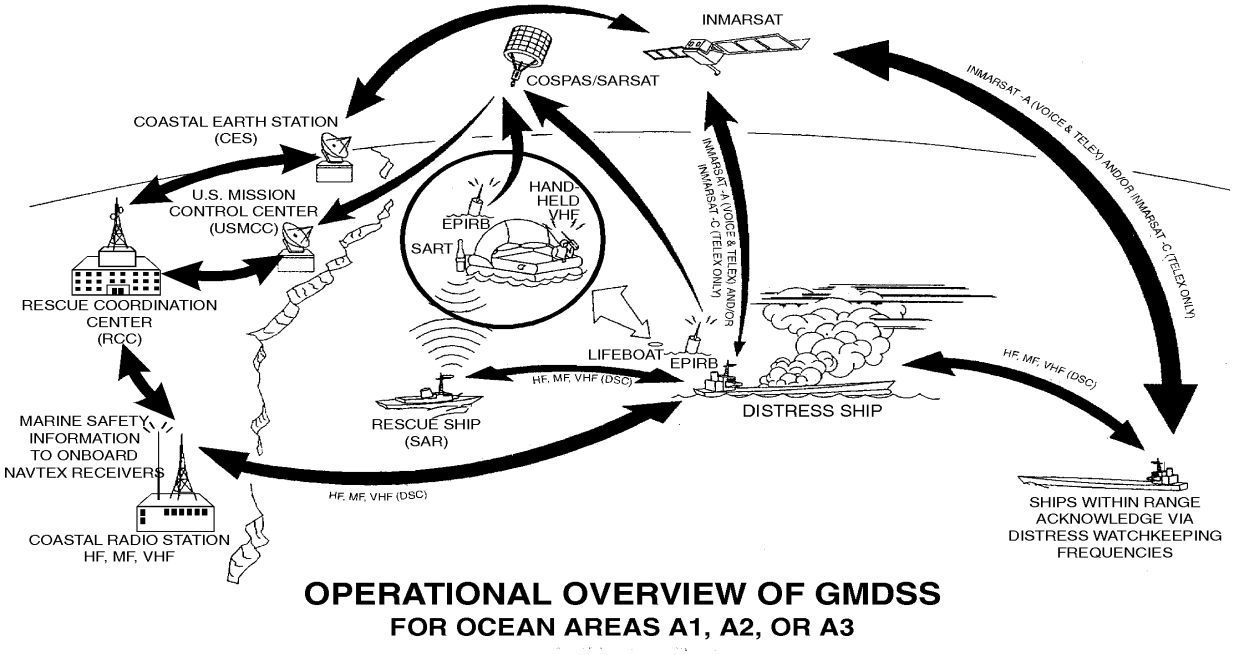

Figure 2-1 Operational Overview of GMDSS

GMDSS is the umbrella of internationally approved distress telecommunications systems. INMARSAT and 406 MHz EPIRBs are the internationally recognized methods of satellite distress alerting under GMDSS. Digital Selective Calling (DSC) is the internationally recognized method of sending a terrestrial digital distress alert. For mariners not equipped with INMARSAT, EPIRBs, or DSC, use of traditional HF/MF/VHF-FM distress voice channels is the preferred method of distress alerting.

2.1.2 GMDSS Functions

GMDSS has 9 specific functions which SOLAS ships must be capable of performing:

- Transmitting ship-to-shore distress alerts by at least two independent and separate means.

- Transmitting and receiving ship-to-ship distress alerts.
- Receiving shore-to-ship distress.
- Transmitting and receiving search and rescue (SAR) coordination communications.
- Transmitting and receiving on-scene communications.
- Transmitting and receiving locating signals (EPIRBS/ELTs).
- Transmitting and receiving maritime safety information (MSI).
- Transmitting and receiving general radio communications (ship/ship and ship/shore).
- Transmitting and receiving bridge-to-bridge communications.

2.1.3 GMDSS Coverage Areas

GMDSS divides the world's oceans into four "sea areas." SOLAS ships have distinct equipment carriage requirements for each area through which they transit.

2.1.3.1 SEA AREA A1: VHF-FM range - Coastal area within the radiotelephone coverage of at least one VHF coast station with continuous DSC alerting capabilities (approximately 20 miles offshore). Sea Area A1 must be declared effective by a signatory nation. The United States will declare Sea Area A1 when the Rescue 21 system is fully deployed.

2.1.3.2 SEA AREA A2: MF range - The area beyond VHF-FM coverage, within the radiotelephone coverage of at least one MF station with continuous DSC alerting capabilities (approximately 200 nautical miles offshore). Sea Area A2 must be declared effective by a signatory nation. The United States will declare A2 for the continental United States and selected OUTCONUS areas as soon as practicable.

2.1.3.3 SEA AREA A3: HF range Inmarsat - Generally defined as the area between 70N and 70S. Sea Area A3 includes Sea Areas A1 and A2 if those areas are not declared effective by the signatory nation.

2.1.3.4 SEA AREA A4: Beyond areas A1, A2, and A3. Generally defined as the polar region north of 70N and south of 70S.

2.1.4 GMDSS Sub-Systems

GMDSS consists of numerous telecommunications sub-systems, including:

2.1.4.1 Digital Selective Calling (DSC): for distress, urgency, safety, routine, ship's business, and test calling via HF/MF/VHF-FM.

2.1.4.2 NAVTEX: narrow-band direct-printing telegraphy for transmission of navigational and meteorological warnings and urgent information to ships on MF.

2.1.4.3 SITOR: Simplex Teletypewriter Over Radio for ship-to-shore communications and transmissions of Maritime Safety Information (MSI).

2.1.4.4 Inmarsat A (analog) and B (digital): for ship-to-ship and shore-to-ship voice, telex and fax communications utilizing satellite. It can be interconnected to public switched telephone and data networks.

2.1.4.5 Inmarsat C: for distress alerting via telex only, data communications and reception of MSI.

2.1.4.6 Radio-Telephone: for transmission via HF/MF/VHF-FM.

2.1.4.7 Satellite EPIRB: Satellite Emergency Position-Indicating Radio Beacon for distress alerting and locating survivors of distress incidents (406 MHz and Inmarsat E, 1645 MHz).

2.1.4.8 **SART:** Search and Rescue Transponder, for locating survival craft.

2.1.5 Description of GMDSS Sub-Systems

2.1.5.1 **Digital Selective Calling (DSC) --** DSC is a new IMO-specified technology intended to **initiate communications** over maritime radio and provide distress alert information to RCCs. DSC is similar to an electronic paging system: users of DSC may call a specific station or group of stations to establish communications. DSC calls are made using the applicable Maritime Mobile Service Identity (MMSI) number and appropriate DSC guard or calling frequencies, depending upon whether it is a distress alert or another type of call. The MMSI is the equivalent of the international radio call sign for establishing DSC communications. Federal Communication Commission (FCC) regulations require that all marine radio types accepted after June 17, 1999, have DSC capability. SOLAS convention regulated ships were required to outfit with DSC equipment as of February 1, 1999. Although DSC was intended to replace voice for initiating radio calls, the requirement for SOLAS class vessels to maintain a 24-hour continuous radio watch over VHF-FM channel 16 will remain in effect until at least February 1, 2005. The requirement of SOLAS ships to guard 2182 KHz was abolished on February 1, 1999.

(a) DSC distress calls may also be electronically relayed to the Coast Guard by any vessel that has a DSC compatible radio, or by other DSC equipped RCCs. All DSC distress calls, and DSC distress relays, shall be acted upon according to the guidance provided in this chapter.

(b) Detailed policy guidance for Coast Guard units equipped with DSC is provided in section 2.2.4. In general, shore units receiving DSC distress alerts should first acknowledge receipt of the call via DSC and then attempt to establish voice communications on an appropriate channel. Afloat units must wait 5 minutes to allow the shore units to respond. If there is no response then respond to the call and relay the alert as soon as possible to the nearest Coast Guard shore unit. RCC personnel should attempt to identify the vessel, either through database sources or by contacting the appropriate foreign RCC based on the country code (first three digits) of the caller's MMSI. There are no restrictions on RCC personnel contacting foreign RCCs for the purposes of SAR case execution.

(c) DSC calls fall into the following categories: Distress, Urgency, Safety, Routine, and Ship's Business. The most important information to be gleaned from an incoming DSC call is the category of call, the MMSI number, and (for distress calls) the position and nature of distress.

2.1.5.2 **NAVTEX** is a service specifically designed for the promulgation of Maritime Safety Information as a part of the GMDSS. All SOLAS-regulated ships were required to carry NAVTEX receivers on February 1, 1993. NAVTEX broadcasts are made by CG CAMS, GANTSEC and MARSEC.

(a) Coast Guard RCCs will use this broadcast method to alert ships in those coastal areas covered by NAVTEX to SAR and SAR-related information. The International Ice Patrol will use this system as a means of disseminating ice bulletins and warning messages. Districts, Sections and the CG NAVCEN will use this system as a means of disseminating notices to mariners.

(b) NAVTEX message drafters should be aware of specific formatting required to ensure messages reach the targeted area. NAVTEX messages are prepared in accordance with the Chapter 13 of the CG Aids to Navigation Manual - Administrative. Charts of NAVTEX service areas are available on the CG NAVCEN Internet site: http://www.navcen.uscg.gov.

2.1.5.3 **INMARSAT A, B and C distress alerts** are received via phone and fax at LANTAREA and PACAREA command centers from the Santa Paula, CA coast earth station, or by relay from other RCCs. Faxes from TELENOR arrive on a standard form.

2.1.5.4 **INMARSAT C telex replies** to ships sending distress alert messages are sent using distress priority. Command Centers have access to a web page established and maintained by INMARSAT C provider, TELENOR. This web page allows the RCCs to send distress priority messages to the vessel, or vessels in the vicinity of the distressed vessel. If web or Internet access is not available, RCCs can fax the desired message TELENOR for broadcast. RCCs shall call the TELENOR operator to verify receipt of fax. INMARSAT C telex messages are prepared in accordance with guidance provided in Section 2.3 and Appendix C, Section 4.

2.1.5.5 INMARSAT SafetyNET -- SafetyNET is a service of Inmarsat's Enhanced Group Call (EGC) system and was specifically designed for promulgation of Maritime Safety Information (MSI) as a part of GMDSS. The EGC system (technically a part of the INMARSAT-C system) provides an automatic, global method of broadcasting messages to all GMDSS-equipped vessels in both fixed and variable geographical areas or to predetermined groups of ships.

(a) Coast Guard RCCs shall disseminate and monitor search and rescue (SAR) distress related information using the INMARSAT SafetyNET system when the SAR case location is deemed to be outside the coverage of NAVTEX. In general, NAVTEX coverage extends to 200 NM off the coast. For specific coverage, charts of NAVTEX service areas are available on the CG NAVCEN Internet site: http://www.navcen.uscg.gov. The International Ice Patrol will disseminate ice warnings and International Ice Patrol bulletins to the appropriate NAVAREA using the SafetyNET system. Meteorological information is disseminated via SafetyNET by the National Weather Service and navigational information is disseminated by the National Imagery and Mapping Agency NIMA). **Coast Guard RCCs shall not disseminate routine meteorological and navigational information via SafetyNET**. Meteorological and navigational information should be forwarded to the appropriate agency for dissemination.

(b) SafetyNET service is provided through TELENOR's web interface, and via voice operator in case of Internet failure, as described in Section 2.1.1.4d. SafetyNET message drafters should be aware of specific formatting required to ensure messages reach the targeted area. SafetyNET Messages are prepared in accordance with guidance provided in Section 2.3 and Appendix C, Section 4. Charts of INMARSAT service areas are available on the CG NAVCEN Internet site: http://www.navcen.uscg.gov

2.1.5.6 HF/MF/VHF-FM Radio Telephone -- HF, MF, and VHF-FM Radiotelephone are also components of GMDSS.

2.1.5.7 406 MHz EPIRBs/ELTs/PLBs-- a component of GMDSS-- are integrated into the COSPAS-SARSAT system, which is an international joint venture in satellite-aided search and rescue. The concept involves the use of multiple satellites in low, near-polar orbits (LEOs) and geo-stationary satellites (GEOs) "listening" for distress transmissions from emergency beacons. The signals received by the satellites are relayed to a network of COSPAS-SARSAT ground stations where the location of the emergency is determined by measuring the doppler shift induced by the satellite motion relative to the distress signal. The fact that an alert has been detected, along with its position, is then relayed by way of a national Mission Control Center (MCC) to an appropriate national RCC or to another international MCC for initiation of the SAR activities. While EPIRBs are the primary equipment providing SARSAT emergency notification in the maritime environment, both Emergency Locator Transmitters (ELTs) used aboard aircraft and Personal Locator Beacons (PLBs) function identically within the SARSAT system. PLBs became legal for use in the United States in 2003. Due to their relatively low commercial price, it is expected that recreational boaters will increasingly use them as a method of emergency signaling. Policy for Coast Guard response to a PLB beacon is identical to that for an EPIRB or ELT.

2.1.5.8 INMARSAT-E EPIRBs -- (a.k.a. L-band EPIRBs) were developed by the German company, DORNIER. These EPIRBs are not authorized for sale in the U.S. but they do meet the International Maritime Organization (IMO)'s carriage requirements for satellite EPIRBs. INMARSAT-E EPIRBs do not have homing signals. They make use of the Inmarsat satellites and not the COSPAS-SARSAT satellites that 406 MHz EPIRBs use. Note: Most INMARSAT EPIRB reports will also supply position information as a result of these EPIRBs being typically outfitted with an integrated GPS receiver.

2.1.5.9 Search and Rescue Transponder (SART) -- The SAR Transponder (SART) is used for locating survival craft in the 9 GHz frequency band. Unique signals (swept frequency) are generated for interpretation only after being triggered by ship or aircraft radar. Range of air is 40 nautical miles; surface is 10 nautical miles. An audible alarm or light is activated on the SART when a rescue ship or aircraft is within close range. Battery capacity should be at least 96 hours. The SART signal appears as a distinctive line of 12 equally spaced blips on a radar screen extending outward from the SART position along its line of bearing.

Section 2.2
Digital Selective Calling (DSC)

2.2.1 DSC Guard Requirements

2.2.1.1 Coast Guard Shore Unit DSC Guard Requirements. Coast Guard CAMS will guard 6 DSC frequencies: 2187.5kHz, 4207.5kHz, 6312.0kHz, 8414.5kHz, 12577.0kHz, and 16804.5kHz. Coast Guard Groups equipped with MF DSC will guard 2187.5kHz. When equipped, Groups will also guard 156.525mHz (channel 70). DSC guard frequencies, and their equivalent voice and SITOR frequencies are listed in Table 2.1.

Table 2-1 DSC Guard Frequencies, Associated Voice and SITOR Frequencies

DSC Guard Frequency	Voice Frequency	SITOR Frequency
156.525MHZ	156.8MHZ	N/A
2187.5 KHZ	2182 KHZ	2174.5KHZ
4207.5 KHZ	4125 KHZ	4177.5KHZ
6312.0 KHZ	6215 KHZ	6268KHZ
8414.5 KHZ	8291 KHZ	8376.5KHZ
12577.0 KHZ	12290 KHZ	12520KHZ
16804.5 KHZ	16420 KHZ	16695 KHZ

2.2.1.2 Coast Guard Cutter/Boat DSC Guard Requirements

(a) Coast Guard vessels underway or at anchor equipped with VHF-FM DSC radios shall guard DSC frequency 156.525 MHz (channel 70).

(b) Coast Guard vessels underway or at anchor equipped with HF/MF DSC radios shall guard DSC frequency 2187.5 kHz.

2.2.1.3 Canceling Alerts. The proper method for stations or ships to cancel a false distress alert they initiated is outlined below:

(a) Stop the transmission immediately (i.e. turn the transceiver “off” then “on” again),

(b) Send a “Distress Cancellation” message from the DSC radio (HF only),

(c) Switch to the associated voice frequency,

(d) Make an “all stations” broadcast on the corresponding voice frequency.

The broadcast should indicate the name, call-sign, MMSI number, and that the station is canceling the false alert sent (quote distress text) with the local date and time.

Note: Other communications specific DSC policy and procedures can be found in Chapter 12 of ref (ii).

2.2.2 HF/MF DSC Distress Alert Response Policy: Coast Guard Shore Units

2.2.2.1 Purpose. To provide operational shore units with policy guidance for responding to HF and MF DSC distress alerts.

2.2.2.2 Coordination. DSC is unique, in that distress communications are initiated by digital data bursts that are widely distributed, but all follow-up communications after initial acknowledgement are typically handled by voice. International Telecommunications Union (ITU) regulations require each unit that receives a DSC distress alert or distress relay to send an acknowledgment, even if other units are already known to have done so. As such, it is probable that multiple groups, along with the appropriate communications area master station (CAMS), will receive and acknowledge the same MF DSC distress alert. It is also possible that the same distress alert may be

received on both HF and MF bands. For these reasons, it is important that Coast Guard units communicate with one another and with the default SAR Mission Coordinator (SMC) to ensure role clarity during DSC case execution.

2.2.2.3 Initial Action. All shore-based units that receive a DSC distress call or distress relay shall complete the following actions:

(a) Acknowledge the distress alert or distress relay.

(1) Distress Alerts - Shore units shall acknowledge all DSC distress alerts by means of the DSC acknowledgement function (sent to "All Ships") before taking any further action. Acknowledgements shall be made via DSC on the same frequency on which the distress alert was received, and shall take place after one minute to allow for units with automated MF/HF DSC to make calls on all MF/HF frequencies, and in all cases within 2.75 minutes of receipt, in accordance with ITU regulations. Acknowledgement does not imply assumption of SMC by the acknowledging unit. Acknowledgement simply means that a shore unit has received the DSC call and the U. S. Coast Guard is responding to it.

(2) Distress Relays – Shore units shall acknowledge all DSC distress relays as they are received. The first DSC Distress Relay for a given case shall be acknowledged via DSC. Subsequent Distress Relays that are received that relate to the same case may be acknowledged in one of two ways: a Distress Relay Acknowledgement sent to the "Individual" relaying vessel, or a voice acknowledgement. All acknowledgements shall take place within 2.75 minutes of receipt.

(b) Monitor the corresponding voice frequency. After acknowledging a DSC distress alert, each receiving unit shall monitor the corresponding voice frequency for at least 10-minutes, or until follow-up communications between the distressed vessel and the Coast Guard is established.

(c) Notify SMC. Each receiving unit shall notify the appropriate default SMC as outlined in section 2.2.2.6 ("SMC Determination"). Such notification will take place concurrent with the 10-minute monitoring period mentioned above.

(d) Simplex Teletype Over Radio (SITOR) response. In the small percentage of cases where a group receives a request to respond via SITOR instead of voice, they shall immediately inform their respective District Command Center, who will in turn pass the SITOR request to the appropriate CAMS.

2.2.2.4 2182 KHz AM and 2182 KHz USB Incompatibility. If the distress alert or distress relay originates on 2182 kHz voice instead of 2187.5 kHz DSC, the ACKNOWLEDGEMENT will be by voice on 2182 kHz USB. If the station does not answer, then the shore unit must change the mode of transmission to H3E (AM) and ACKNOWLEDGE using this mode. Older marine radios may not be able to "understand" USB transmissions – even if the shore unit can hear the transmission.

The older MF/HF radios carried by recreational boaters are unable to copy 2182 kHz USB. The reason for this is that these older radios automatically revert to AM when the "2182" red DISTRESS button is depressed. In the event that a boater sends an AM DISTRESS, the USB radios used by the USCG will be able to copy the transmission. When the USCG responds using USB, the boater will be unable to copy the transmission. In the event the USCG receives a distress on 2182 kHz, and after responding using USB, if the USCG is unable to establish contact**, then change to AM mode and repeat the call**.

2.2.2.5 Primary Voice Responder

(a) For all HF DSC distress calls, the primary voice responder shall be the appropriate CAMS. For MF DSC calls where a position is known, the primary voice responder shall be the group within whose AOR the distressed vessel is located. These units shall have the primary responsibility to initiate a voice response if the distressed vessel does not promptly come up on the corresponding voice frequency. The primary responder shall make a single callout to the vessel in distress on the appropriate voice frequency, using any available information included in the DSC alert to identify the vessel. This information may include the vessel's position, nature of distress, or MMSI number. If communications are established, the primary voice

responder shall verify that a distress situation exists, verify the vessel's position if possible, and notify the appropriate default SMC as outlined in section 2.2.2.6 ("SMC Determination").

(b) If the primary voice responder is unable to establish communications with the distressed vessel after making the voice callout and monitoring the voice frequency for five minutes, the primary responder shall send a single point DSC call to the distressed vessel's MMSI number, distress priority.

(c) Failure to establish communications. If communications with the distressed vessel cannot be established by the primary voice responder after following the steps outlined above, notification of such will be made to the default SMC. Only the SMC can make the determination that a DSC distress alert is a probable false alert.

(d) MF DSC distress calls with no position or invalid position. For MF DSC distress calls where no position information is known, and for calls where the position of the distressed vessel falls outside the AOR of any group with DSC capability, the 10-minute monitoring period for all receiving units remains in effect. If no communications are heard from the distressed vessel, the SMC may direct a specific unit that received the alert to assume the primary voice responder function.

2.2.2.6 SMC Determination

(a) Area Command Centers shall be the default SMC for all HF DSC distress calls. CAMS shall notify (by telephone, with follow-up via fax or message) the Area Command Center upon the receipt of all HF (and MF) DSC distress calls.

(b) District command centers shall be the default SMC for all MF DSC distress calls. Groups shall notify (by telephone, with follow-up via fax or message) their parent District Command Center upon receipt of all MF DSC distress calls.

(c) As this policy intends District Command Centers to be the default SMC for MF DSC distress cases, Area Command Centers should ensure that the appropriate district is notified whenever the area is informed of the receipt of an MF DSC distress call from its CAMS.

(d) In the small percentage of cases where groups receive MF DSC distress calls requesting a SITOR response, they shall indicate this in their initial notification to their respective District Command Center. In this situation, the area and district command centers shall jointly determine SMC on a case-by-case basis, and the applicable CAMS shall handle communications. The CAMS may be better suited to coordinate a response by selecting the most effective transmitter.

(e) In the small percentage of cases where it is determined by the CAMS that the same DSC distress alert has been received on both the HF and MF bands, they shall indicate this in their initial notification to their respective Area Command Center. In this situation, the Area and District Command Centers shall jointly determine SMC on a case-by-case basis.

2.2.2.7 Delegation of SMC

(a) Area Command Centers may delegate SMC for HF DSC distress cases to no lower than the District level. Delegation should normally occur in those cases where the position of the distressed vessel is known.

(b) Area Command Centers should also ensure that the appropriate District is informed of the receipt of MF DSC calls reported by the CAMS.

(c) Districts may delegate MF DSC distress cases to no lower than the Group level. Delegation should normally occur in those cases where the position of the distressed vessel is known. For cases where voice communications have not been established, Districts should attempt to identify the vessel via the MMSI Database and other known database sources on behalf of the Group.

2.2.2.8 SMC Responsibilities. DSC is an internationally recognized distress alerting system, and, as such, DSC initiated distress calls shall be immediately placed in the "distress" emergency phase. The first priorities of the default SMC are to determine if communications have been established with the distressed vessel, and to plot the distressed vessel's position, if known. For DSC distress cases outside of the U.S. area of SAR responsibility, the default SMC shall transfer SMC to the appropriate foreign RCC. If communications are established, and the

distressed vessel is in the SMC's AOR, the case shall be prosecuted according to existing SAR policies and procedures. For districts coordinating MF DSC cases, the district should determine which group will handle voice communications with the distressed vessel, as multiple groups may have received and acknowledged the initial MF DSC distress alert. Usually, the group in whose AOR the distressed vessel is located should be tasked to coordinate follow-up communications. If communications cannot be established, the default SMC should use the vessel's MMSI to query OSC Martinsburg "MMSI Database," and/or the "Maritime Mobile Access and Retrieval System (MARS)" database located on the ITU's website. The MMSI number can be used with either database to help determine the vessel's identity and any other possible means of contacting the vessel (such as an Inmarsat number). Where no communications are possible, but a position is provided via DSC that is inside the SMC AOR, assets should be dispatched to investigate as soon as possible.

2.2.2.9 Case Claiming. Units shall claim cases for DSC initiated distress calls according to the existing guidelines for cases in this Addendum. Generally, a case shall be claimed and MISLE data entered by all units that dispatch resources, and by units that expend at least 30 minutes of effort in coordination/communications.

2.2.2.10 Case Suspension. DSC alerts shall be treated as all other alerts. See Chapter 3, section 3.4.9 for uncorrelated distress broadcast & alert procedures.

Normal SAR case suspension procedures apply for those DSC initiated distress cases where:

(1) no communications with the distressed vessel can be established,

(2) no further information or means of contacting the vessel can be obtained from either database sources or other sources, and

(3) no position information is known.

2.2.2.11 Procedures for Non-Distress DSC Calls. Non-distress category DSC calls (Urgency, Safety, Routine, Ship's Business) should be acknowledged if requested by the originator. "Test" DSC calls should always be acknowledged. The originator of the DSC call will normally dictate the method of acknowledgment (i.e., DSC, voice, or SITOR) and the working frequency in the initial DSC data transmission. If a specific method of response (i.e., SITOR) is not available to the called station, it shall advise the nearest equipped Coast Guard station to respond to the originator on its behalf.

2.2.2.12 Reporting Requirements. The collection of DSC statistics is an important tool as we attempt to measure both the effectiveness of DSC as a distress alerting mechanism, and the volume of calls being generated by this new system. MISLE incorporates DSC as a method of notification, and detailed MISLE entries by SMCs are crucial to this statistical gathering process. Although MISLE will allow us to measure case specific DSC data, a separate reporting mechanism is needed in the short term to collect other crucial data, including the total number of DSC calls (distress and non-distress) received by units equipped with DSC.

Units equipped with the SWII HF/MF DSC system and software patch (CAMS and Groups) should maintain a log of the following data, broken down by month:

(a) Total number of DSC calls

(b) Total DSC distress calls

(c) Total DSC distress relays

(d) Total DSC urgency calls

(e) Total DSC safety calls

(f) Total DSC routine calls

(g) Total DSC other calls

Areas and Districts may establish their own procedures for the consolidation of this statistical data, but all input shall be forwarded by e-mail to cgcomms@comdt.uscg.mil no later than the tenth day of the month following the month being reported.

2.2.3 MF DSC Response Policy: Coast Guard Afloat Resources

2.2.3.1 **Purpose.** To provide Coast Guard afloat assets equipped with HF/MF DSC equipment with procedures for responding to MF DSC initiated distress alerts.

2.2.3.2 **General.** DSC radios maintain a continuous radio guard on MF frequency 2187.5 kHz, regardless of the channel that is tuned on the front panel. As such, cutters equipped with the DSC radios could receive a DSC distress alert on 2187.5 kHz. When a DSC distress alert is received, the radio will emit a loud audio alarm. This alarm shall be considered the equivalent of a "mayday" call, and requires the same level of response.

2.2.3.3 **Action.** Coast Guard cutters equipped with HF/MF DSC transceivers shall guard 2187.5 kHz continuously while underway and at anchor. Cutters that receive a DSC distress alert shall take the following steps:

(a) In areas where reliable MF DSC communications with one or more shore stations are feasible, CO/OinC's should defer acknowledgement so that a shore station can acknowledge receipt of the call. Any cutter receiving a call that is not acknowledged by a shore station within 5 minutes should acknowledge the call using procedures in sub-paragraph (c) below.

(b) In areas where reliable MF DSC communications with a shore station are known not to exist, cutters that receive an MF DSC distress call should wait at least one minute before acknowledging receipt of the distress alert.

(c) Cutters acknowledging receipt of a DSC distress alert in accordance with sub-paragraphs (a) or (b) should:

(1) Acknowledge receipt of the alert on the MF voice distress channel (2182 MHz) and attempt to establish communications with the distressed vessel.

(2) If unable to establish voice communications with the distress ship, cutters should acknowledge receipt of the distress alert using the DSC acknowledgment function. This action will send a DSC acknowledgement message to the distressed vessel, and terminate the DSC distress call.

(3) Cutters that acknowledge receipt of DSC distress alerts are responsible for notifying the applicable RCC (and Operational Control/Tactical Control, if different) by the most expedient means. Relevant information that could be available includes the distress vessel's MMSI number, position, and nature of distress. This information is normally included in the DSC alert and can be retrieved via the DSC radio display.

2.2.4 VHF-FM DSC Response Policy: Coast Guard Afloat Resources

2.2.4.1 **Purpose.** To provide Coast Guard afloat resources equipped with VHF-FM DSC with procedures for responding to DSC initiated distress alerts.

2.2.4.2 **General.** Some Coast Guard vessels have already received VHF-FM DSC radios. The United States will not be declaring Sea Area A-1 operational until the Rescue 21 system is fully operational. Deployment of VHF-FM DSC radios is progressing in order to meet the needs of radio replacement and new vessel construction projects. Upon installation, TISCOM personnel will provide familiarization training on the VHF-FM DSC radios to select cutter crewmembers.

These radios maintain a continuous radio guard on VHF-FM channel 70, despite the channel that may be tuned manually on the front panel. As such, vessels equipped with DSC radios could receive a distress alert on channel 70. When a DSC distress alert is received, the radio will emit a loud audio alarm. This alarm shall be considered the equivalent of a "mayday" call, and requires the same level of response.

2.2.4.3 **Action.** Coast Guard boats and cutters receiving a VHF-FM DSC distress alert shall:

For Coast Guard Boats:

(a) As soon as possible, inform the SMC of the contents of the distress alert.

(b) In areas where reliable VHF-FM DSC communications with one or more shore stations are feasible, coxswains should defer acknowledgement so that the SMC or a shore station can acknowledge receipt of the call. Any boat receiving a call that is not acknowledged by the SMC or a shore station within 5 minutes should acknowledge the call using procedures in sub-paragraph (d) below.

(c) In areas where reliable VHF-FM DSC communications with one or more shore stations are known not to exist, boats that receive a VHF-FM DSC distress alert from a vessel should, as soon as possible, notify the SMC and acknowledge receipt of the distress alert when instructed.

(d) Boats acknowledging receipt of a distress alert in accordance with subparagraphs (b) or (c) should:

(1) Acknowledge receipt of the alert on the VHF-FM voice distress channel 16 and attempt to establish communications with the distressed vessel.

(2) If unable to establish voice communications with the distressed vessel, boats shall acknowledge receipt of the distress alert using the DSC acknowledgment function. This action will send a DSC acknowledgement message to the distressed vessel, and terminate the DSC distress call.

(3) Boats that acknowledge receipt of distress alerts are responsible for informing the applicable Group or RCC (and OPCON/TACON, if different) by the most expedient means, of relevant information, to include but not limited to, the distressed vessel's position, nature of distress and MMSI number. This information is normally included in the DSC alert and can be retrieved via the radio display.

For Coast Guard Cutters:

(a) As soon as possible, inform the CO/OinC of the contents of the distress alert.

(b) In areas where reliable VHF-FM DSC communications with one or more shore stations are feasible, CO/OinC's should defer acknowledgement so that a shore station can acknowledge the receipt of the call. Any cutter receiving a call that is not acknowledged by a shore station within 5 minutes should acknowledge the call using procedures in sub-paragraph (d) below.

(c) In areas where reliable VHF-FM DSC communications with a shore station are known not to exist, cutters that receive a VHF-FM DSC distress from a ship should, as soon as possible, acknowledge receipt of the distress alert.

(d) Cutters acknowledging receipt of a distress alert in accordance with subparagraphs (b) or (c) should:

(1) Acknowledge receipt of the alert on the VHF-FM voice distress channel 16 and attempt to establish communications with the distressed vessel.

(2) If unable to establish voice communications with the distress ship, cutters shall acknowledge receipt of the distress alert using the DSC acknowledgment function. This action will send a DSC acknowledgement message to the distressed vessel, and terminate the DSC distress call.

(3) Cutters that acknowledge receipt of distress alerts are responsible for informing the applicable Group or RCC (and OPCON/TACON, if different) by the most expedient means. Relevant information that could be available includes the distress vessel's MMSI number, position, and nature of distress. This information is normally included in the DSC alert and can be retrieved via the radio display.

2.2.5 VHF-FM DSC Response Policy: Coast Guard Shore Units

2.2.5.1 Purpose. To provide operational shore units with policy guidance for responding to VHF-FM DSC distress alerts.

2.2.5.2 **Discussion.** Rescue 21 will provide Coast Guard Group operational shore commands with VHF-FM DSC capability. Until the Coast Guard is fully equipped with this capability, notification of receipt of a VHF-FM DSC distress call may be received by groups via Coast Guard vessels and other mariners equipped with VHF-FM DSC.

2.2.5.3 **Public Education.** Because Coast Guard shore units will not be equipped with VHF-FM DSC equipment until the completion of Rescue 21, the maritime public should be advised not to use VHF-FM DSC for distress alerting purposes until the Coast Guard is equipped with DSC and the United States declares GMDSS Sea Area A1 operational. Coast Guard vessels which receive a distress call or shore units which receive a distress relay should not immediately acknowledge the call, but forward it to the respective District Command Center for evaluation and to coordinate a response because numerous relays could be received from multiple sources over a vast region.

2.2.5.4 **System Operation.** VHF-FM radios equipped with DSC maintain a continuous radio guard on VHF-FM channel 70, despite the channel the owner may tune manually on the front panel. As such, vessels equipped with these DSC radios can receive a DSC distress alert on channel 70. When a DSC distress alert is received, most of these radios will emit a loud audio alarm and automatically shift to VHF-FM Channel 16. The distressed vessel can then begin a voice transmission on this frequency. VHF-FM DSC distress alerts shall be considered the equivalent of a "mayday" call, and require the same level of response. Current shore-side VHF-FM DSC alert reception infrastructure is limited in the United States. The majority of VHF-FM DSC alerts received today by Coast Guard shore stations are relayed from non-Coast Guard vessels equipped with DSC radios. After Rescue 21 is installed in a region, VHF-FM DSC alerts will automatically be received via the Coast Guard's National Distress and Response System.

2.2.5.5 **Action.** All VHF-FM DSC distress alerts shall be assumed to be distress incidents and will be classified in the distress emergency phase. Coast Guard shore units that receive notification of a VHF-FM DSC distress alert shall:

(a) Obtain relevant information from the reporting source, to include the distressed vessel's position, nature of distress, voice frequency and MMSI number. This information is normally included in the DSC alert and can be retrieved by the reporting source via the radio display. DSC equipped radios are also capable of transmitting messages other than distress. Although the Coast Guard will only respond to alerts that are of a DISTRESS nature, it is prudent for units to monitor ALL SHIPS and SAFETY alerts in the event that a situation could further develop into a DISTRESS incident.

(b) Attempt to establish VHF-FM communications with the distressed vessel on channel 16. If unable to establish voice communications with the distressed vessel, the SMC shall issue an Urgent Marine Information Broadcast (UMIB). This is the minimum response requirement for VHF-FM DSC distress alerts. The UMIB shall include text, requesting mariners and shore stations that received the VHF-FM DSC distress alert to contact the Coast Guard with their position. The UMIB shall be broadcast for at least one hour at 15-minute intervals. Radio call-outs are not sufficient--a UMIB is required.

(c) The SMC shall launch appropriate resources when there is sufficient information to establish a reasonable search area. In the absence of such information, search planners must engage in aggressive detective work, using every available means to narrow down a search area, including queries to ascertain if other boats or shore-based radios received the digital alert.

(d) It is also possible that the same distress alert may be received by multiple hi-sites. For these reasons, it is important that Coast Guard units communicate with one another to ensure role clarity (i.e. which unit is SMC) during VHF-FM DSC case prosecution. The Rescue 21 system will be able to break down the data stream to identify the Remote Fixed Facility (RFF(s)) the call was received on and indicate the quality and strength of the signal received on each RFF.

2.2.5.6 **SMC Responsibilities.** For groups that receive notification from third party vessels within their AOR equipped with VHF-FM DSC, they shall handle the case according to established procedures for "mayday" calls. The reporting source should be queried for the following information specific to the DSC call:

(a) Category of call (verify distress),

(b) Nature of distress,

(c) Position (if the distressed position is unavailable, request the position of the vessel, agency or radio tower that received the DSC alert and, if R21 equipped, refer to the information provided to you in the data stream for the necessary information),

(d) MMSI number.

For DSC calls that cannot be correlated, a UMIB should be made, utilizing the distressed vessel's MMSI. If communications cannot be established, SMC should use the vessel's MMSI to query the MMSI Database maintained by OSC Martinsburg, the MARS database located on the ITU's website, or other sources in an effort to identify the distressed caller. Where no communications are possible, but a position is provided, assets should be dispatched to investigate as soon as possible. If no communications are possible and the MMSI is not registered then treat the distress call as an uncorrelated mayday (ref. 3.4.9).

For RCCs that receive notification from Coast Guard vessels within their AOR equipped with VHF-FM DSC, they shall collect the same information as above. SMC for VHF-FM DSC calls with a position that falls within a group AOR may be delegated to the group.

2.2.5.7 Case Claiming and Case Suspension. Units shall claim cases for VHF-FM DSC initiated distress calls according to the existing guidelines in this Addendum. Generally, a case shall be claimed and a MISLE report made by all units that dispatch resources, and by units that expend at least 30 minutes of effort in coordination/communications. Normal SAR case suspension procedures apply for those DSC initiated distress cases where:

(a) No communications with the distressed vessel can be established,

(b) No further information or means of contacting the vessel can be obtained from either database sources or other sources, and

(c) No position information is known.

2.2.5.8 Statistics. Each Group/Activities will send a monthly report indicating the total number of VHF-FM DSC distress calls received and the number of actual VHF-FM DSC calls that were correlated to vessel in distress. Districts and Areas may establish their own procedures for the consolidation of data, but all input shall be forwarded by e-mail to cgcomms@comdt.uscg.mil no later than the tenth day of the month following the month being reported.

2.2.5.9 Process Improvement. All field units with DSC are encouraged to provide input to G-OPR and G-SCT via their operational commander on any procedural problems encountered or any suggestions for improving DSC response policy.

2.2.5.10 False Alert Violation Reporting

(a) Unless a false alert is handled as a hoax case, a radio violation report should be submitted for every vessel, including foreign vessel in U.S. SAR areas of responsibility, for:

- Those who inadvertently transmit a false distress alert without proper cancellation, or who fail to respond to a distress alert due to misuse or negligence;
- Those who repeatedly transmit false alerts; or
- Those who deliberately transmit false alerts.

(b) Local Federal Communications Commission Field offices should be contacted to determine whether they will handle radio violations from foreign ships. If they will, violation reports should be submitted to them. If not, violation reports should be submitted to CG headquarters.

(c) Procedures for submitting violation reports are included in USCG Radio Frequency Plan, reference (o).

2.2.5.11 False Alert Feedback Solicitations

(a) When a false alert is received a message should be sent to the offending vessel to ascertain the details associated with the alert. For recreational or other small craft that may not have record messaging capability, a mailing address should be found if possible and a letter sent in lieu of a message. The message/letter should indicate we are requesting the information to assist in sorting actual distress calls from false alerts and to help improve DSC system performance. Receipt of the message/letter by the offending vessel will help to educate the mariner on the proper use of the DSC Alert and implications of false alerts. Information received should be used by RCC's to identify system weaknesses. This information should be forwarded to the Office of Search and Rescue (G-OPR).

(b) A sample message format is provided in Appendix C. The same text should form the basis of a false alert feedback letter.

2.2.6 VHF-FM DSC Response Policy: Coast Guard Aircraft.

To be developed.

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Section 2.3
SafetyNET Messaging

2.3.1 General

SafetyNET messages are a tool used by Coast Guard SAR Mission Coordinators to alert the maritime public to a distress or potential distress situation. Example text is outlined in Appendix C, Section C.4. Organizational responsibilities and guidance on procedures was taken from reference (p), the International SafetyNET Manual, 1994 Edition.

2.3.1.1 When To Issue a SafetyNET Message. SafetyNET messages should be issued whenever the SMC determines that important maritime information needs to reach beyond the coverage of NAVTEX UMIBs. In cases near the outer ranges of NAVTEX coverage, both a NAVTEX UMIB and a SafetyNET message should be broadcast. SafetyNET messages shall be broadcasted when UMIBs would normally be required for Sea Area A3.

2.3.1.2 Who Should Issue SafetyNET messages. The International Maritime organization registers and authorizes Rescue Coordination Centers (RCCs) to broadcast, via SafetyNET, shore to ship distress priority alerts and other urgent information. SafetyNET messages are drafted using an INMARSAT-C supported web interface. Controllers at the nine Coast Guard District RCCs, plus Guam and Puerto Rico, have user names and passwords to access the secure web site.

2.3.2 SafetyNET Message Procedure

The following steps shall be followed for each situation requiring an INMARSAT-C SafetyNET broadcast. Instructions on how to complete each step using the TELENOR web interface are detailed in the INMARSAT-C Web Interface Users Instruction posted on the G-OPR website http://cgweb.comdt.uscg.mil/G-OPR/G-OPR.htm**.** Step by step procedures for using the TELENOR web site are provided in Appendix M. The INMARSAT-C web site also offers an extensive Help Guide for understanding the fields and buttons on each web form. This help section should be referenced for additional information.

(a) Determine the type of message to send and whether the message should be distress, urgent, or safety priority. In general, messages sent during the uncertainty phase of SAR should be sent at a safety priority, messages sent at the alert phase should be sent with urgent priority, and messages sent during the distress phase will have distress priority. A cost will be incurred for using priorities other than Distress or Urgent (see 2.3.6). Select the message form on the web interface based on the type and priority of message to be sent.

(b) Draft message in accordance with Section 2.3.3. and Appendix C. Request a receipt for every message.

(c) Print the screen. (see 2.3.4).

(d) Send the message.

(e) Record the Message Reference Number (MRN). The MRN will be displayed across the top of the form after pressing send.

(f) Check status and save a copy of the message. The status of the message, with a link to a copy of the message, will be displayed on the Delivery Status section of the web site.

(g) Save a copy of the receipt. The message receipt is sent to the inbox after all repeats of the message have been broadcast.

(h) Compare the original message to a copy of the message received over an EGC receiver. If the message is not the same, cancel the message and send a new message. If the message is broadcast longer than needed, proceed to step (i).

(i) Cancel the message. Messages are auto cancelled on the web page. If a case ends sooner than expected, cancel the message ahead of the scheduled auto canceling time. Messages that are not appropriately cancelled after the distress situation has been resolved tie-up communications channels and will incur expensive fees until finally cancelled.

2.3.3 Drafting a SafetyNET Message

Each SafetyNET message has addressing, subject, body (text of message), repeat count, repeat interval, and repeat echo options. Guidance on using these options is provided below.

2.3.3.1 Addressing a message for broadcast. Messages must be addressed to each satellite that covers the desired region of broadcast. Since the Atlantic is covered by both the AOR –E and AOR-W satellite regions; most messages addressed to a region in the Atlantic should be addressed to both satellites. Specific guidance on filling in the Latitude/Longitude/Radius of broadcast is provided in the User Interface instructions available from G-OPR's website and in the HELP section of the INMARSAT-C web site https://sby1.telenor-usa.net/ttlink/ops/login.jsp.

2.3.3.2 Addressing a message to a vessel. Messages to an INMARSAT-C mobile number must also be sent to a particular satellite. The recommended satellite selection for this type of message is "Best". The Best option sends the message to the satellite the terminal was last logged onto. If a message is sent to a satellite that the terminal is not logged into, the message will result in a fault of "absent" and will not be transmitted. The SMC should re-address the message to next applicable satellite until a successful transmission is made.

2.3.3.3 Subject. The subject of the message typed into the web form does not become part of the broadcast message. The subject will only appear under the subject heading on the delivery status table on the web site.

2.3.3.4 Text of SafetyNET Messages. The text of a SafetyNET message should contain as much information about the situation as is reasonable. For vessels, a description and last know position should be given when known. Both a latitude/longitude position and geographic description should be given if available. For sample messages, see Section C.4. of Appendix C.

2.3.3.5 RCC Name in Text. The name of the RCC sending the broadcast must be included in the text of the message. The name will be the keyword used for sending a "monitored" copy of the message back to the RCC. See Section 2.3.5. for more information on monitoring broadcasts.

2.3.3.6 Repeat Options.

(a) Echo. The repeat Echo option will broadcast the message after the first broadcast. Since a terminal cannot receive while it is sending messages, the Echo option allows a terminal that was sending a message during the original broadcast to still receive the broadcast. (Sending a message usually takes less than 6 minutes). The EGC receivers are manufactured to tilter out any messages already received. Terminals that have already received the broadcast will not receive a repeat copy. In almost all cases, the Repeat Echo option should be selected (Drop down box is "yes").

(b) Repeat Count. The Repeat Count option is the number of times the message will be sent.

(c) Repeat Interval. The Repeat Interval option is the time period between each broadcast. This option is coupled with the Repeat count for how long the broadcast will be made, up to a maximum of 28 days, i.e., if a repeat count of 12 is selected, with a repeat interval of 4 hours, the message will be broadcast every 4 hours, up to 12 times for a total of 2 days of broadcasting. (24 hours in one day – 6 broadcasts a day).

2.3.3.7 Printing and Saving Drafted Messages. It is recommended that RCCs print the screen version of the message before sending. The screen version provides information about repeat count and interval that is not available from the version posted under the MRN number on Delivery Status. The version that is saved under the MRN should be saved electronically for records. Directions on printing the screen and saving messages is available from the Web Interface Users Instruction posted on the G-OPR website http://cgweb.comdt.uscg.mil/G-OPR/G-OPR.htm.

2.3.4 Monitoring SafetyNET Broadcasts

The International Maritime Organization (IMO) requires all Marine Safety Information (MSI) providers to monitor the broadcasts that they originate. Monitoring must be completed by viewing the actual message that is received over an EGC receiver (from Section 5.7 of ref (p). Messages sent directly to a vessel cannot be monitored. RCCs shall confirm receipt of messages sent directly to vessels via INMARSAT-C's web interface. Status can be checked under delivery status and receipt can be requested. The message receipt indicates that message has been received by the vessel. It ***does not*** indicate that the message has been opened and read by the vessel.

2.3.4.1 Elements of Monitoring

(a) Check that the message has been broadcast.

(b) Confirm that the message is received correctly.

(c) Ensure that cancellation of the messages are properly executed.

(d) Observe any unexplained delay in the message being broadcast.

2.3.4.2 Receiving broadcast messages. The Coast Guard owns modified EGC receivers that receive all broadcasts to a satellite region and all copies of broadcast messages. The receivers to monitor AOR-E and AOR-W are located at CAMSLANT. The receiver to monitor Pacific Ocean Region (POR) is located at CAMSPAC. The Indian Ocean Region (IOR) cannot be monitored by the Coast Guard. The received messages are filtered by Coast Guard proprietary software and forwarded via CGMS record message to the originating RCC. Forwarding is based on the RCC name contained in the text of the message. Added to the header of each message is the "Rep #". Rep #'s start at zero. For example – if the message Rep # is 5, that copy is the 6th broadcast of the message. Echo messages will show the same Rep #.

2.3.4.3 Non-receipt of Broadcast Message. If a monitored copy of the message is not received the following steps shall be taken:

(a) The RCC shall contact the appropriate CAMS. CAMS units should be contacted based on the satellite region of the broadcast. CAMSLANT for AOR-E and AOR-W and CAMSPAC for POR.

(b) The appropriate CAMS will troubleshoot the receiver system and CGMS backside. CAMS personnel will manually push through any messages that are not automatically forwarded. CAMS personnel will notify the RCC if the message was not received.

(c) If a message is not received, or was apparently not broadcast, the RCC will cancel the broadcast and draft a new message for broadcast.

(d) If the second broadcast is not received, the RCC will contact TELENOR customer care to troubleshoot problems with the web service. Area Command Centers and G-OPR should be notified of any major problems with the web service.

2.3.4.4 Canceling Messages. The web service is set up to cancel messages after the Repeat count expires. It is the responsibility of the RCC to ensure the message was actually cancelled. Cancellation of messages should be verified under Delivery Status on the web page and by monitoring the messages broadcast over the satellite. The Rep # should not exceed the Repeat Count in the original message. If a message does not auto cancel correctly, or if a case ends prior to the all repeats being broadcast, the message shall be cancelled using the cancel option on the delivery status screen. <u>In addition, a cancellation message shall be broadcast to insure that the mariner is aware that a SAR situation no longer exists, requires their assistance, or a case has been suspended pending further developments. This message shall be sent with the same priority as the initial SafetyNET message. The MSG # that appears on the monitored copy of the SafetyNet message should be used to reference the message being canceled.. *Do not use the MRN # assigned by the web page.* For sample messages, see Section C.4 of Appendix C. Sending a cancellation message will not auto select the cancel option. Ensure the message is not longer being broadcast using the cancel option before broadcasting a cancellation message.</u>

2.3.4.5 Back-up Monitoring. If the Coast Guard monitoring system for SafetyNET is not operational, the National Imagery and Mapping Agency (NIMA) will provide forwarding services via fax. Fax numbers are provided to NIMA by G-OPR. Any changes in fax numbers should be forward to G-OPR for forwarding to NIMA.

2.3.5 Message Types

The Coast Guard is authorized to send messages with SafetyNET service codes of Distress, Search and Rescue coordination, and Nav-Warning per Annex 4, Section C of reference (p). The Distress service message can be sent with Distress Priority to a circular region. The SAR Coordination message can be sent with Distress, Urgent, and Safety Priorities to a circular or rectangular region. The Navigational-Warning service message can be sent with Urgent, Safety, and routine Priorities to a NAVAREA region. To send these types of messages using the web interface the Shore to Ship Distress Alert, Search and Rescue, and Navigational Warning EGC message forms are used. The table below describes, in general, what messages are most applicable during each of the SAR emergency phases, whether an Alarm sounds on a vessel for each message, the addressing format for that message, and a typical header that is displayed on the received message. (Headers are dependent on the manufacturer of each receiver.)

Table 2-2 SafetyNET Message Types

Emergency Phase	Web form(s)	Priority	Alarm	Addressing	Header of bcst msg
Uncertainty	Search and Rescue	Safety	No	Circular	SAR <priority> Call to Area: (specific Circular or Rectangular region)
	Navigational Warning	Safety	No	NAVAREA	MetWarn/Fore <priority> Call to Area: (# of Navarea)
Alert	Search and Rescue	Urgent	Yes	Circular	Search and rescue: (specific Circular or Rectangular region)
	Navigational Warning	Urgent	Yes	NAVAREA	NavWarn/Fore Safety Call to Area(# of Navarea)
Distress	Shore to Ship Distress Alert	Distress	Yes	Circular	Distress <priority> Call to Area: (specific Circular region)
	Search and Rescue	Distress	Yes	Rectangular	Search and Rescue (specific Circular or Rectangular region)

Note: Area and District command centers will incur a fee for any SAR messages sent with a priority of Safety. For exact cost contact TELENOR directly.

Section 2.4
Maritime Mobile Service Identity (MMSI) Numbers

2.4.1 Introduction

The IMO has adopted the International Telecommunication Union's (ITU) Maritime Mobile Service Identity (MMSI) as an internationally recognized method for identifying distress alerts from automated radio equipment (i.e. DSC alerts). In addition, foreign 406 MHz EPIRBs are also being encoded with MMSI data.

MMSIs are nine digits and, like a call sign, uniquely identify a specific vessel. The first three digits of the MMSI indicate the country to which the vessel is registered. The final six digits serve as the Ship Station Identifier.

Vessels using MMSIs can be identified by consulting the MMSI database maintained by OSC Martinsburg (discussed below), or by contacting the following sources:

- For U.S. MMSIs (366, 367, 368 or 303): FCC Watch Officer (202) 632-6975;
- For Bahamian MMSIs (308): Bahamian Telephone Co. (their FCC): (809) 325-0747. Bahamian POC in UK: 44-71-493-5515 (daytime) 44-327-86-0075 (nights);
- For all other countries: ITU Publication "List of Ship Stations"; MARS Database on ITU website; or via POCs listed in the International RCC Directory.

2.4.2 MMSI Assignment and Registration

2.4.2.1 SOLAS Class Vessels. The FCC assigns and will continue to assign marine radio licenses (and MMSI numbers) to U. S. SOLAS class vessels, which were required to have a DSC capable radio by February 1, 1999. The FCC sends the information contained on the vessel licenses to OSC Martinsburg, for inclusion in OSC's MMSI Database.

2.4.2.2 De-licensing of Recreational Boat Radio Stations. An FCC regulation requires that all marine radio type accepted after June 1, 1999 have DSC capability. This only refers to new radio designs existing designs can continue to be manufactured as presently configured (without DSC) for as long as the manufacturer desires. Despite the fact that all newly type accepted VHF-FM marine radio types contain DSC, the de-licensing of recreational boat radio stations that occurred as a result of 1996 Congressional action also removed the most effective means of assigning MMSIs to this constituency.

2.4.2.3 MMSI Assignment for non-SOLAS Class Vessels. In order to avoid having recreational boaters apply for an otherwise unnecessary license from the FCC in order to receive a valid MMSI, and pay the corresponding licensing fee, a new process for assigning MMSI numbers has been developed. The FCC issued a Public Notice in March 1997, soliciting for alternative management of the MMSI issuing process for non-SOLAS class vessels. Boat U.S. and MariTEL have both signed a Memorandum of Understanding (MOU) with the FCC and the Coast Guard in which they are authorized to issue MMSI numbers for non-SOLAS class vessels. Boat U.S. and MariTEL have also agreed to collect registration data from boaters and to download this information to the Coast Guard for search and rescue purposes. Other organizations may also apply to the FCC to provide this service. MMSIs may be applied for online at http://www.boatus.com/mmsi.

2.4.2.4 MMSI Assignment for U. S. Coast Guard Vessels and Shore Units. Information concerning the process of determining or acquiring MMSIs for Coast Guard specific vessels and shore units can be found on the Office of Communication Systems (CG-62) web page: http://cgweb.uscg.mil/CG-6/CG-62/mmsi.shtml. This site also provides general information on the MMSI numbering system.

2.4.3 MMSI SAR Vessel Identification System

In response to the SAR Program's requirement for accurate registration information on the owners of DSC radios, OSC Martinsburg has replaced the SAR ID Database with the web-based Maritime Mobile Service Identity (MMSI) Search and Rescue (SAR) Vessel Identification System ("MMSI Database"). This new database is a

visual web-based application that provides the SAR Planner with a rapid, reliable means of obtaining vessel information when planning a SAR case. The application allows the user to search for vessel information by Vessel Name, Vessel Call Sign, Official or State Registration Number, MMSI Number, IMARSAT Number, EPIRB Registration Number, or Soundex Search (vessel name only).

Queries will return all communications and contact information available for the vessel from the MMSI Database, as well as from the Lloyd's database. The MMSI Database includes available information from TELENOR, Federal Communications Commission, Australian Maritime Safety Agency, International Telecommunications Union, International Registries – Liberia, International Registries – Marshall Islands, and also recreational boater information collected by Boat U.S. and MariTEL. SAR watchstanders that work cases with vessels not registered in the MMSI database should add new records to the database with as much information as possible.

The MMSI Database is a web-based application that can be accessed via the Coast Guard Data Network by directly typing in the following URL: http://cgweb.uscg.mil/smalldb/mmsi.

This application is available to qualified personnel at the following units: RCCs, Sections, Groups, Activities, and Communication Stations. Users at units granted access to MISLE &/or the Amver SURPIC application (RCCs) will automatically be given access to the MMSI Database. New users at these units should contact their SAR Account Officer to obtain authorization. Coast Guard Groups, Activities, and Communications Stations that desire access should establish a SAR Account Officer and submit a request for user access via e-mail to OSC-SAR Admin.

Section 2.5
National Distress and Response System (NDRS) & Rescue 21

2.5.1 General

The Coast Guard is authorized by federal law (14 USC 2) to develop, operate and maintain "...rescue facilities for the promotion of safety on and over the high seas and waters subject to the jurisdiction of the United States...". This allows the Coast Guard to provide distress and safety communications for the boating public, both commercial and recreational. The system established and maintained by the Coast Guard to provide this service is the VHF-FM National Distress and Response System (NDRS). The primary function of the NDRS is to receive distress alerts, coordinate SAR operations, and communicate with all maritime interests in waters (including inland waters) in which the Coast Guard has SAR responsibilities. A secondary function is to provide short-range command and control communications for all Coast Guard missions.

Since 1948, the Coast Guard has been dedicated to the concept of a terrestrial based VHF-FM System as the primary national system for short-range safety and distress communications. A VHF-FM project was established in 1970 to implement nationwide VHF-FM coverage; survey existing facilities, requirements, and needs; and forecast future Coast Guard mission requirements. The system was designed to provide short-range (20 NM from the coastline) distress, safety, and command and control communications in all areas of maritime activity where the Coast Guard had jurisdiction. The title “National VHF-FM Radiotelephone Safety and Distress System” was shortened to the “VHF-FM National Distress and Response System (NDRS)”.

Currently the National Distress and Response System Modernization Project (NDRSMP) is replacing the NDRS short-range communication system outdated legacy equipment with an integrated communication equipment suite called Rescue 21. By the end of 2006, the new NDRS should be operational at all Coast Guard units. To clarify, the NDRS is the name for the short-range communications function, while Rescue 21 is the name of the equipment suite used to implement the NDRS function. Rescue 21 is an upgrade that is occurring not only to the remote communication sites and connecting infrastructure, but also at the Groups, Stations, MSOs, and vessels.

2.5.2 NDRS Coverage

The VHF-FM National Distress and Response System (NDRS) provides distress, safety, and command and control VHF-FM communications coverage in all areas of maritime activity in which the Coast Guard has SAR responsibilities. Coverage is required for:

(a) Coastal areas to at least 20 nautical miles offshore and in adjacent tidal waters. In areas where heavy concentrations of boating activity exist greater than 20 nautical miles offshore, coverage will also be provided to the extent practicable.

(b) All large bodies of inland waters such as Puget Sound, Long Island Sound, Chesapeake Bay and the U.S. waters of the Great Lakes.

(c) Navigable waterways where commercial or recreational traffic exists and the Coast Guard has SAR responsibility.

2.5.3 NDRS Hardware

The current NDRS is a collection of independently controlled VHF-FM base stations with multi-channel transceivers located at more than 300 sites in the continental U.S. (CONUS), Puerto Rico and the Caribbean, Alaska, Hawaii, and Guam. Each site has a transceiver, an antenna, and remote control hardware. In most cases, primary power is provided commercially, although backup power is available at a few selected locations. Locations were selected and distributed to provide the widest coverage possible; consequently, NDRS hardware is frequently co-located with other non-Coast Guard communications equipment. Since antenna height significantly affects the coverage area, the Coast Guard attempts to locate these sites to provide the greatest possible antenna height. As a result, NDRS transceiver sites are frequently referred to as "High Sites". Group/Activity units control base stations locally or remotely through the best available means. Particular attention was paid to

optimizing the receiving capability. The system was designed to achieve a high state of operational readiness using leased equipment and maintenance contracts.

2.5.4 Channel 16

Channel 16, 156.8 MHz, is designated as the maritime international distress and calling frequency and is monitored by Groups on a 24-hour-a-day basis via the NDRS. When a non-distress call is received on this frequency, the caller is usually asked to move to a working channel, if possible, to keep the distress channel available. Great care must be used to ensure communications are not lost with the person(s) calling the Coast Guard, in distress or not.

2.5.4.1 Active Listening. Two-way radio communications are often less effective due to weak reception/transmission, atmospherics, language dialects, or a heightened emotional state due to an emergent situation. When the information received is not absolutely clear to comprehend, it is *strongly recommended* that an effort be made to repeat the most critical information back to the sender to affirm the specific details. Inaccurate or incomplete information can result in search planners and operational units coordinating a response in a different manner based on the information provided. Time spent on ensuring that the information received is valid and accurate is worthwhile so that responding units can maximize their efficiency. An additional benefit of this practice is that other mariners operating in the general vicinity of a distress situation are better informed regarding the case particulars and may be more inclined to render assistance in a more timely manner than a unit that has to deploy from shore or divert from another mission to respond.

{Example: "Roger Sir, I understand that you are disabled ¼ nautical mile southwest of the sea buoy and are in need of assistance."}

2.5.5 Other Uses of NDRS

In addition to distress traffic, the NDRS is the primary tactical, short-range command and control communications system used by Coast Guard Groups, stations, and equivalent units. Typical uses include communications between Groups/stations and their underway vessels; MSOs and COTPs; and Vessel Traffic Service controllers and vessels. In addition to these uses, the Coast Guard must transmit marine safety information broadcasts over the NDRS at specified intervals. Note: that the receiver monitoring Channel 16 is inactive at any site that is transmitting safety broadcast or other VHF communications on the current NDRS system but once Rescue 21 is operational within a region, calls on Channel 16 can be received while transmitting.

2.5.6 Channel 16 Monitoring Requirements

All ships required to carry a VHF radio by SOLAS, Federal Communications Commission or Coast Guard regulations are additionally required to maintain a continuous watch on Channel 16. Ships are exempted from this watch only when participating in a vessel traffic service, or when communicating on another VHF channel.

2.5.7 New Capabilities Provided by the Rescue 21 System:

(a) Additional available channels

Every high level site will have 6 channels. One is dedicated to channel 16, one is dedicated to channel 70 for data only and one for UHF. The remaining 3 channels can be distributed to the regional station units for use at the GCCs discretion. For example, each high level site has 3 channels for general use, and if a GCC has 5 high-level sites within their AOR, then that totals 15 channels from which to choose. The GCC maintains full control of every high-level site at all times.

(b) Digital Selective Calling

The basic functionality of DSC is described in Section 2.2. In addition to the basic functionality, Rescue 21 also provides the ability to plot the DSC call on a geographic display and to rapidly interrogate the MMSI database to obtain any available information associated with the originating MMSI.

(c) Asset Tracking

This upgrade will provide a continuous common operating picture of Coast Guard assets within a GCCs

AOR. Coast Guard positions are recorded and transferred automatically to a chart on the terminal for real time visual display. Note: Assets not equipped with the Rescue 21 package will not transmit an asset-tracking signal. Assets will be automatically tracked even if they transit into adjacent AOR's. Once the assets pass into another AOR their signal will be automatically picked up by the GCC in charge of that region.

(d) Communications Coverage

The Rescue 21 communications coverage has been upgraded to receive a transmission of a 1-watt radio 2 meters high out to 20NM. The majority of maritime radios are 5 to 25-watts and are higher off the water, increasing reception range.

In regions where the Remote Fixed Facilities or RFF's, formerly referred to as high-level sites, are shared (when one RFF covers a portion of 2 AORs), the GCC region in which the RFF resides will have primary control. If the shared RFF is needed to perform Coast Guard missions in the secondary region then the secondary user must request control of the RFF. The primary user will relinquish control of shared towers for higher priority missions, such as, SAR, MEDEVAC, etc.

(e) Conferencing

Conferencing is a function that allows CG radio operators to communicate with State or local agencies. For example, if a Coast Guard boat needs to communicate with an ambulance waiting on shore, the Group communications specialist is able to call the ambulance company and patch the ambulance and Coast Guard boat directly with a few keystrokes in a console-to-console connection. Once the two units are connected all transmissions will be heard over both of the frequencies being used by each asset. It is advisable that the Coast Guard use working channels when connecting into such a phone conference.

(f) Protected Communications (KMF)

To Be Developed with CG62.

(g) Data Communications

To Be Developed with CG-62.

(h) Automated Broadcasts

The automated broadcast feature can be used for single or repetitive radio broadcasts. The broadcast can either be recorded in the operator's voice or broadcast with a voice synthesizer. Once the broadcast has been composed, recorded and is ready for release, a prompt will confirm the request for release so that broadcasts are not released prematurely. Additionally, the prompt will reappear each time the broadcast is to air. This will allow the operator to cancel the broadcast if it is no longer needed or change the broadcast as necessary.

(i) Recording and Playback

To Be Developed with CG-62.

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Section 2.6
Urgent Marine Information Broadcasts (UMIBs)

2.6.1 General

Urgent Marine Information Broadcasts (UMIBs) are a tool used by Coast Guard SAR Mission Coordinators to alert the maritime public to a distress or potential distress situation. Specific communications procedures and formatting to be used for UMIBs are outlined in Chapter 12 of reference (q), the Coast Guard Telecommunications Manual.

2.6.1.1 When To Issue a UMIB. UMIBs should be issued whenever the SMC determines that important maritime information needs to reach the widest possible audience. UMIBs shall be used upon the receipt of:

(a) all uncorrelated MAYDAY channel 16 calls,

(b) uncorrelated VHF-FM DSC distress calls,

(c) flare sightings,

(d) overdue vessel reports,

(e) other situations as deemed necessary by the SMC.

UMIBs should be issued on a schedule as outlined in Table 12-1 of reference (q). In general, this means a UMIB is issued upon receipt, and every fifteen minutes thereafter for the first hour. After that time, UMIBs are issued along with scheduled broadcasts until cancelled, or as directed by the originator on a case-by-case basis.

2.6.1.2 Who Should Issue a UMIB. Qualified communications personnel at COMMSTAs and Group/Activity Communication Centers, when directed by appropriate authority, will issue UMIBs. All UMIBs shall comply with the requirements and provisions reference (q).

2.6.1.3 Text of UMIBs. The text of a UMIB should contain as much information about the situation as is reasonable. For vessels, a description and last known position should be given when known. Both a latitude/longitude position and geographic description should be given if available. UMIBs that are to be broadcasted on VHF-FM shall include the time of the incident in both local time and Greenwich Mean Time (GMT).

The Rescue 21 system will provide the format for the draft automatically, however, watchstanders must assure that all the pertinent information is provided. It will also allow automatic scheduling and broadcast of the UMIB on the time interval determined by the Duty Officer.

2.6.2 UMIB vs. Callouts

Callouts differ from UMIBs in that they are a radio broadcast directed toward a specific vessel, rather than directed at a broad audience, as is the UMIB. Callouts also do not imply or require a state of “urgency” whereas the UMIB by definition conveys urgency. Usually callouts are appropriate at the earlier stages of an overdue vessel case in an attempt to establish communications with a specific vessel. When callouts fail, a UMIB will be issued. The use of callouts should not unduly delay the use of a UMIB.

2.6.3 UMIB vs. MAYDAY Relay

Mayday Relays are intended to alert the maritime public of an incident involving imminent danger to life. They are appropriate under three circumstances:

- when a unit not in distress seeks assistance for a unit that is in distress;
- when a responding unit realizes that additional assistance beyond their own capability is required; and
- when a distress message is heard by a unit not in a position to assist and that message is unacknowledged.

The majority of Coast Guard originated "Mayday Relay" messages would fall under (a) above. It is a value judgment made by the controller based an evaluation of all relevant circumstances, i.e. weather, previous

indication of distress, or debris sighting.

Section 2.7
Cellular Telephones and *CG

2.7.1 Cellular Telephones

Maritime cellular telephone usage is growing rapidly, and an increasing number of boaters are relying on cellular telephones in conjunction with, or sometimes instead of, VHF-FM radio to communicate with the Coast Guard. Cellular telephones can be a reliable supplemental means of communication for boaters in distress to contact the U.S. Coast Guard for help. However, they are NOT a replacement for VHF-FM radio, which remains the most effective and preferred method of voice communications, particularly in an emergency. While a cellular telephone is not the recommended or preferred method of distress communications, when properly used it does meet the requirements of reliable communications as outlined in the Maritime SAR Assistance Policy.

NOTE: Cellular telephones are NOT a replacement for VHF-FM radio.

2.7.1.1 The Coast Guard continues to encourage the use of VHF-FM radio as the primary method of distress notification. Cellular telephones are not an "alternative" to VHF-FM, which affords additional functionalities that are valuable in SAR, in contrast to the serious limitations of using a cellular telephone, particularly in an emergency.

- VHF-FM allows broadcast capability while cellular limits communications to point-to-point communications. Cellular telephone conversations cannot be heard by other boaters in the area who may be in a position to render immediate aid to someone in distress.
- VHF-FM allows easy direction finding on the generating station. Determining the general area (generally a 10-15 mile radius) of a cellular call requires close coordination with cellular service providers to identify the cellular "cell" from which it was placed, which is a time consuming endeavor.
- VHF-FM allows mariners to easily receive Broadcast Notice to Mariners, Urgent Marine Information Broadcasts, Urgent Weather Advisories, and Marine Assistance Request Broadcasts while cellular telephones will not receive this critical information.

2.7.1.2 Due to the limitations of cellular telephones, as outlined in paragraph 2.7.1.1, SAR checklists should include the following additional items for cases involving their use:

- caller's complete cellular telephone number including area code,
- user's cellular service provider or carrier (i.e., "Bell South Atlantic"),
- whether or not a roam number is needed to recall the user and what the complete roam number is,
- whether or not other means of communications are available (establish other communications with the caller before terminating the cellular call),
- wattage of the cellular telephone, antenna height from the waterline, and approximate battery strength,
- establish a communications schedule or require the caller to call back at a scheduled time if possible; ensure user understands the cellular telephone, if there is sufficient battery strength, must not be turned off in order to receive further communications,
- ask if the user has an alternate power source available, such as a charged back-up battery or the ability to plug into the boat's power system,
- if a Maritime Assistance Request Broadcast will be made, notify the caller that their cellular telephone number will be broadcast when the Commercial Assistance Provider or Good Samaritan contacts the Coast Guard on the alternate working frequency,
- obtain a shore-side point of contact.

2.7.1.3 Most cellular service providers offer some of the following services to assist in locating the origin of cellular calls from disoriented boaters.

- **Call Trace:** As long as there is a connection, the carrier's technician can determine which cell is receiving the call and, if power and antenna height are available, an approximate arc of distance from the cell tower.
- **Call Trace Modified:** After the call is initiated and the technician is notified, the caller can be instructed to call back at a specified time and the technician can determine through the use of signal strength at several cell sites, a more accurate probable position of the caller.
- **Cell Traffic Recording:** A carrier can determine the cell location of the last call placed by the subscriber given the cellular telephone number.
- **Tap:** This function provides notification when a call is made from the user's phone; beneficial in overdue cases.
- **Caller ID:** Indicates the number of the calling party, provided CG emergency line does not go through most private branch exchanges (PBX). Requires subscription from local carrier. If number is not displayed, Caller ID indicates whether carrier limitation or privacy blocking is the cause.

2.7.2 *CG Agreements/Routing of *CG Calls

In many areas of the country, cellular service providers have implemented a "*CG" access code that routes calls from boaters directly to the applicable Coast Guard operations centers, free of charge to both the boater and the Coast Guard. Other cellular service providers may also wish to implement "*CG." While *CG Agreements should not be initiated by Coast Guard commands, units that are approached by companies that desire to implement this service should actively partner with them to facilitate an agreement. Additionally, Coast Guard commands should also continue partnering with those companies that already provide *CG service to ensure that provisions of the agreement are being met. *CG agreements between cellular telephone companies and the Coast Guard should generally be coordinated at the District level. Within these agreements, the routing of *CG calls should be done to the most appropriate District RCC or Group Operations Center. Appendix L is an approved template that should be used for all *CG Agreements.

2.7.2.1 *CG Agreement Provisions. Coast Guard agreements with cellular service providers to provide *CG service shall include the following:

- *CG service shall be provided at no cost to the government or the boating customers.
- All publicity regarding *CG will accurately portray Coast Guard policy regarding use of cellular telephones for distress notifications.
- The Coast Guard will provide appropriate telephone numbers for call routing.
- *CG calls will automatically be routed to the appropriate and responsible Coast Guard resource.
- Cell location and coverage charts/maps detailing geographic location and identification of cell sites will be provided by the cellular service provider.
- Cellular service providers will furnish a 24-hour point of contact for "tracing" *CG calls and providing cell origination information.

2.7.2.2 All agreements with cellular service providers shall be made at no lower than the Group command level. Copies of all agreements within a District's SRR shall be held at the District.

2.7.2.3 Limitations of *CG. *CG service is a reliable supplemental means (to VHF-FM radio) of contacting the Coast Guard for help. *CG has the same limitations noted in paragraph 2.7.1.1. Additionally, a distress notification may be delayed if a boater normally operates in an area that has *CG and then tries to call the Coast Guard using *CG in an area where the service is not provided.

2.7.3 911

The *CG network does not replace the 911 telephone system; thus the Coast Guard must still be proactive in ensuring that maritime distress calls to 911 are promptly routed to the proper Group operations center (in some areas it may be to the SAR unit).

Section 2.8
Electronic Mail

2.8.1 E-mail Policy

Some communications providers offer satellite electronic mail capability. Electronic mail was not designed for distress communications, and the Coast Guard does not endorse the use of electronic mail for distress alerting purposes. The Coast Guard will not provide e-mail addresses to the public for the purposes of facilitating e-mail distress alerts, and no RCC or Command Center shall be required to monitor electronic mail for distress alerts.

2.8.1.1 **Although the Coast Guard does not endorse the use of e-mail for distress alerting, all discernable distress alerts--regardless of format--shall be acted upon expeditiously by Coast Guard personnel.** Coast Guard units that receive an e-mail distress alert shall notify the appropriate Coast Guard RCC by telephone. E-mail distress alerts should not be forwarded by e-mail, except as a follow-up to telephone notification to an RCC.

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Section 2.9
Lost Communications with a Coast Guard Asset

2.9.1 Lost Communications Procedures.

Chapters 14 and 15 of reference (q) discuss communications requirements for Coast Guard vessels and aircraft. Communications schedules (comm. skeds) for operational cutters, boats, and aircraft are established by the cognizant Operational Commander (OPCON). The decision to initiate a Search and Rescue case following lost communications with a Coast Guard asset is also the responsibility of that unit's OPCON. This decision is a judgment call, but units should not wait to alert the SMC once a comm sked is missed and subsequent attempts to contact the asset fail. For units equipped with the Rescue 21 system upgrade see section 2.9.1.3 – To Be Developed.

2.9.1.1 The following is taken from Chapter 15 of reference (q) regarding Lost Communications with a Coast Guard Aircraft: "If the Aircraft Commander fails to check in on the primary or secondary frequency within five minutes of their communications schedule, the guarding station shall initiate an alert. The aircraft's parent command shall be notified first, followed by the cognizant District Command Center…."

2.9.1.2 As with all search and rescue incidents, time is the enemy of a successful outcome. Lost Communication cases are essentially "overdues," but unlike most cases of overdue private vessels, the stringent communications schedule requirements of Coast Guard assets allow the SMC to proceed more rapidly through the Uncertainty to Alert to Distress emergency phases.

2.9.1.3 To Be Developed. The Rescue 21 procedures for lost communications will be developed and refined during the system Operational Testing and Evaluation process. A decision process and procedure for determining the cause of the loss of communication will be developed and incorporated.

Lost Communications vs. Out-of-Range – To Be Developed.

Use of Asset Tracking – To Be Developed.

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Section 2.10
Recorded Radio Transmissions and Telephone Lines

2.10.1 Guidance

2.10.1.1 The following guidance is taken from pages 1-5, 1-6, and 1-7 of reference (q):

Use of Recording or Monitoring Equipment

Coast Guard personnel, in the conduct of their official duties, may not engage in clandestine, surreptitious, or other covert use of telephone recording, listening, or monitoring equipment or aid or acquiesce in the use of such equipment.

Recording equipment is authorized for use at Coast Guard Command Centers, VTS, and COMMCEN units to record telephone or radio conversations since they primarily concern air safety, maritime safety, or SAR. The Coast Guard will not require beep tones or prior consent for the recording of calls.

Equipment installed on telephone lines only to provide a recorded announcement, voice mail service, or invite the caller to leave a message are considered office labor saving devices rather than communications equipment, and do not require approval.

Authorization to install and use monitoring equipment for situations not listed above must be obtained from the servicing legal office.

Inviolability of Information. The Coast Guard adheres to a policy of "inviolability" regarding the handling of wire or radio communication information. "Inviolability" means that no communicated information (including organizational messages, e-mail, and voice) will be released or divulged beyond the expectation intended by the originator of the information. Refer to Chapter 9 of this [Telecommunications] manual for additional information on internal routing and readdressals.

The Coast Guard frequently intercepts communications from masters to owners reporting their vessel disabled, aground, or in a condition that indicates the possible need for assistance. The Coast Guard, in the performance of its duty to protect life and property at sea and along the coast, may properly act on this information and offer the services of the Coast Guard to the vessel in need of assistance. THIS INFORMATION THUS OBTAINED SHALL NOT BE RELEASED FOR PUBLICATION.

Broadcast messages without designation of address are addressed to all concerned and there is no restriction on their release.

2.10.1.2 Public requests for the release of recorded radio or telephone transcripts shall be referred to the applicable Servicing Legal Office.

2.10.2 Recording Manipulation Software/Devices

In some instances the use of recording manipulation software/devices may be required to help determine the validity of distress, uncorrelated mayday, or hoax calls. The use of any recording manipulation software/devices is intended as a tool to help the SMC to make a logical determination for escalation and/or suspension of a SAR case where the caller's intent is uncertain. SAR case packages shall include a copy of the original unedited recording, and a copy of the final edited version used to help make any escalation or suspension decisions.

R21 Specific Procedures To Be Developed.

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CHAPTER 3
SEARCH PLANNING

3.1 SAR Planning and Operations Overview
3.1.1 SAR Incidents Profile
3.1.2 Search Planning
3.1.3 Uncertainty & Probability
3.1.4 The Goal of Search Planning
3.1.5 SAR Incident Data Collection; The Watchstander's Art
3.1.6 Standard Checksheet Formats

3.2 Search Planning Methods and Tools
3.2.1 Historical Background
3.2.2 Planning Searches Manually and with JAWS
3.2.3 Planning Searches with CASP
3.2.4 Amver System
3.2.5 Commence Search Point and Pattern Orientation Guidance
3.2.6 Search Area Designation

3.3 Search Planning Variables
3.3.1 Initial Conditions
3.3.2 Drift Theory

3.4 Initial Response, Search Planning and Search Operations
3.4.1 Offshore Incidents
3.4.2 Coastal Incidents
3.4.3 Flare Incidents
3.4.4 Distress Beacon Incidents
3.4.5 Night and Reduced Visibility Searches
3.4.6 Electronic Sensors and Sensor Searches3.4.7 Searches for Bodies
3.4.8 Aircraft Incidents
3.4.9 Uncorrelated Distress Broadcasts and Alerts
3.4.10 False Alarms, Hoaxes and Suspected Hoaxes
3.4.11 Mass Rescue Operations
3.4.12 Search Action Plans
3.4.13 Automatic Identification System (AIS)

3.5 Rescue Planning and Operations
3.5.1 Overview
3.5.2 Rescue Planning
3.5.3 Rescue and the MSAP
3.5.4 Disposition of Lifesaving Devices

3.6 Measures of Search Effectiveness
3.6.1 Probability of Success (POS)
3.6.2 The Value of Using POS
3.6.3 Determining POS

3.7 Aspects of Survival
3.7.1 Use of Hypothermia Software and Tables
3.7.2 Will to Live

3.8 Conclusion of SAR Operations
3.8.1 Case Closed
3.8.2 Case Pends
3.8.3 Active Search Suspended (ACTSUS) Pending Further Developments
3.8.4 Suspension by Other SAR Authorities when Coast Guard Units are Assisting

3.9 Case Documentation
3.9.1 SAR Case Claiming
3.9.2 SAR Case Situation Reports (SITREPs)
3.9.3 Medical Evacuation (MEDEVAC) Report
3.9.4 Marine Information for Safety and Law Enforcement (MISLE) Reports
3.9.5 SAR Case Studies

Section 3.1
SAR Planning and Operations Overview

3.1.1 SAR Incidents Profile

More than 95 percent of all Coast Guard SAR cases occur within 20 nautical miles of shore. Coast Guard helicopters and boats, our primary quick response assets, handle the majority of incidents to which the Coast Guard dispatches its own resources. Approximately 90 percent of all cases involve assist or rescue only -- no searching. Of all cases, 8 percent involve minor searches (less than 24 hours) and 2 percent of all cases involve major searches lasting more than 24 hours.

While a total of only 10 percent of Coast Guard cases involve searches, the Coast Guard spends more than $50 million annually on these searches in operating costs. Additionally, the condition of those in distress degrades the longer assistance is delayed. Therefore, it is advantageous to reduce the time spent searching whenever possible. Reliable and timely distress alerting, accurate position indicating, and efficient locating will reduce search time for those in distress before the rescue. Search planning tools, such as Computer Assisted Search Planning (CASP) and Joint Automated Work Sheets (JAWS), coupled with accurate environmental data, are essential for proper search planning.

3.1.2 Search Planning

There are basically only two methods for planning searches—manual and computer simulation. The manual search planning method is found in the *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual, Volume II*. Although there are several computerized versions of the manual method (sometimes with slight variations from *IAMSAR*) in use in various parts of the world, they are not fundamentally different from the manual method itself. JAWS is one of these. In some cases these computer programs have access to more detailed environmental data than is normally associated with paper-and-pencil methods, but otherwise the computer is simply being used as a tool to perform the same computations and display the same results the paper-and-pencil manual method would produce. The only software that uses the simulation approach is CASP. A new search-planning tool is currently under development to replace both JAWS and CASP. Search and Rescue Optimal Planning System (SAROPS) will use a simulation approach. The main advantage of simulation is that it allows a more realistic representation of real-world complexity than the grossly over-simplified manual method.

3.1.3 Uncertainty and Probability

Searching necessarily involves uncertainty. If the search object's location were known or could be accurately predicted, no searching would be necessary. Therefore, the first uncertainty the search planner must deal with is the object's location. This often involves uncertainties about the time and location of the distress incident, the types of objects (disabled craft, PIW, raft, etc) that may be adrift, etc. Even when these are known within close limits, if a significant amount of time will pass between the time of a distress and the arrival of resources on scene, uncertainty about the object's location will grow due to uncertainties in the available data about the environmental factors that cause drift, and uncertainties in knowledge about how the search object will respond to those factors. In addition, detection of the object once resources arrive on scene and begin searching is by no means certain. These uncertainties require the search planner to think in terms of probabilities. The three probabilities of primary concern are:

(1) The probability that the search object will be in some bounded area (probability of containment or POC).

(2) The probability that the search object will be detected; assuming it will be in an area at the time the area is searched (probability of detection or POD).

(3) The probability of finding the search object (probability of success or POS) based on both the POCs for the areas searched and the PODs from searching those areas.

For any given search area,

$$POS = POC \times POD .$$

For non-overlapping search areas that are covered more or less simultaneously, the total POS is simply the total sum of all the POS values for the individual search areas. The cumulative POS (POS_{CUM}) is the probability that all searching done to date would have located the search object.

3.1.4 The Goal of Search Planning

The ultimate goal of search planning is to find the survivors of a distress incident as quickly as possible. The way to achieve this goal is to increase the cumulative probability of success (POS_{CUM}) as quickly as possible using available and assigned resources. "Optimal effort allocation" is the process of finding the combination of search area, coverage, and resource assignments that produce the most efficient search plan. Unfortunately, this is a mathematically complex process that requires a sophisticated computer program. CASP performs this function but the resulting search plans are not always operationally feasible, requiring some adjustment by the search planner. JAWS and the *IAMSAR Manual* methods also produce "near-optimal" search plans based on a number of simplifying assumptions and corresponding "optimal search factors". SAROPS is being designed to produce search plans that are the most nearly optimal, operationally feasible, plans.

3.1.5 SAR Incident Data Collection: The Watchstander's "Art."

The collection of accurate, detailed incident data upon notification of a potential distress is a crucial element of the "Awareness" stage of a SAR incident. For example, communications with people in distress may be terminated abruptly, and the initial information collected may be the only means to affect a search and rescue effort. Despite this, the time taken to collect all of the information on the SAR incident checksheet could delay the Coast Guard's initial response and could unnecessarily put those in distress at greater risk. When responding to calls for assistance, watchstanders should focus on initially collecting only the most critical and relevant information necessary to determine the severity of the situation and an appropriate response. Usually, this information consists of the following items on the Initial SAR Incident Checksheet:

- vessel's position,
- vessel's description,
- nature of distress,
- number of persons on board.

For most cases, this will be sufficient information to determine an appropriate initial response and dispatch resources to assist. Those in distress should then be notified as soon as Coast Guard or other resources are dispatched, so that they know that help is on the way. Once these steps are completed, watchstanders can then continue the process of completing the Initial SAR Incident Checksheet, and any supplemental checksheets as necessary.

3.1.5.1 The ability to effectively communicate with persons in distress requires both skill and experience. Mariners whose stress level is high may speak quickly or incoherently; resulting in crucial information being passed that is not easily understood. Coast Guard radio watchstanders must be acute listeners and clear speakers. Watchstanders who speak in a clear, calm voice can often reduce the stress level of those with whom they are communicating. This in turn can help ensure that crucial information passed by the boater is more easily understood.

3.1.6 Standard Checksheet Formats

The use of SAR incident checksheets for the collection of SAR case data is required. The standard formats for Coast Guard SAR Incident Checksheets are provided in Appendix G. These sheets detail the minimum information to be gathered for each situation. However, the primary goal of gathering information is to reduce uncertainties about the survivors' location, status, and intentions as much as possible. Therefore, obtaining any and all available additional information related to these topics is strongly encouraged.

3.1.6.1 Use of these standard formats is strongly recommended. Modifications in format, or the creation of additional data fields, are authorized as deemed necessary by the operational commander to accommodate local practices. Modifications shall not eliminate information to be collected.

3.1.6.2 The "Initial SAR Incident Checksheet" should be completed for all incidents. The "Supplemental SAR Checksheet" contains other information that should be collected as circumstances warrant. Standard checksheets are also provided for specific incident types.

3.1.6.3 SAR Controllers shall not hesitate to launch resources prior to completing the checksheets. If the situation dictates, launch first then make all attempts to complete the checksheets as time permits.

3.1.6.4 While completing the checksheets, SAR Controllers should ascertain if personal flotation devices are being worn by persons on board at the specific points indicated on the sheets and advise the reporting source of the Coast Guard's intended actions.

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Section 3.2
Search Planning Methods and Tools

When developing a search plan, search planners must be detectives and information distillers. They must aggressively pursue leads and obtain all information available. They must continually think "outside the box."

Coast Guard search planners shall plan searches in one of three ways, subject to the guidance provided in this chapter: Manually in accordance with the *IAMSAR Manual* and Appendix H to this document, with JAWS or with CASP. Each of these methods is discussed in more detail below, along with their capabilities and limitations. Further guidance on usage is also provided.

3.2.1 Historical Background

Search theory is the scientific study of mathematical methods and algorithms for developing optimal search plans. This branch of the applied science, known as *operations research,* was developed by the U. S. Navy during World War II to aide in searching for enemy submarines and finding downed Allied fliers adrift on the ocean. In both areas, operationally practical methods were developed from the scientific theory and used to good effect. Today's manual search planning method is a direct descendent of these early methods. The digital computer has provided the tools to greatly enhance the effectiveness of these methods.

3.2.2 Planning Searches Manually and with JAWS

The *IAMSAR Manual, Volume II,* provides the basic guidance and worksheets for planning searches manually. This method, with the modifications described in Appendix H, is the approved standard for manual search planning in the U. S. Coast Guard. JAWS implements the *IAMSAR Manual* method with the Appendix H modifications and is therefore an approved standard for use in place of manual search planning. Both methods require and depend only on resources and data that are either locally available or can be obtained and entered by the search planner.

The manual method and JAWS may be used for planning searches when

- The distress incident time is known within plus or minus one hour.
- The region of possible distress locations is best described by a position and the probable error about that position.
- The commence search time is less than 24 hours after the distress incident.

These methods may be used for more complex situations and longer drift periods if CASP is unavailable. CASP may be used any time but shall be used whenever the above conditions are not met. For simple situations, all three methods should produce similar results. Further information, guidance and cautions are provided in Appendix H.

3.2.3 Planning Searches with CASP

CASP is hosted at the USCG Operations Systems Center in Kearneysville, WV, and is accessed via CGDN+, the Coast Guard's private data network. In addition to the CASP software itself, OSC also maintains global and regional gridded wind and sea current databases, some of which are updated twice daily with near-real-time outputs from circulation models run by the U. S. Navy at the Fleet Numerical Meteorology and Oceanography Center (FNMOC) in Monterey, CA. These databases are maintained for and used by CASP. The data they contain may also be viewed by using the "CURRENTS" selection from the OPCEN menu.

CASP is the only system in the world that uses a Monte Carlo simulation approach to support the search planning function. The manual method and JAWS compute only one or two drift trajectories ending at one or two "datums" and then assume the possible search object positions are distributed around those datums according to one particular type of statistical distribution. CASP, on the other hand, generates thousands of simulated search objects according to "situations" described by the search planner. It then draws independent random samples from the wind, current, and leeway data for each object, computes corresponding independent drift trajectories and then "maps" the resulting positions. Instead of using average values over the entire drift interval as the manual method and JAWS do, CASP moves each simulated search object on a one-hour time step, obtaining wind

and current data from its databases at every step based on the object's simulated position and time. CASP also recognizes land features down to a 6-minute resolution in latitude and longitude. (JAWS does not recognize land at all.) This provides more general, and more realistic, distributions of possible search object positions than those assumed by the manual method and JAWS. CASP can represent distributions of initial distress positions and times around a position, within an area represented by corner points of a polygon, or along an intended track. The manual method and JAWS are designed to handle only the first of these well, and then only when the uncertainties are relatively small. CASP also accounts for the effects, on each of the thousands of simulated search objects, of prior searching when estimating values for probability maps. CASP takes these effects into account when making optimal search plan recommendations for subsequent searches. Neither the manual method nor JAWS can do this, although they do use other techniques based on extensive simplifications to develop search area recommendations.

CASP shall be used to plan searches whenever the criteria for the manual method and JAWS are not met. Further information, guidance and cautions are provided in Appendix H.

3.2.4 Amver System.

Although it is not a search planning system, Amver is a computerized system for maintaining the dead reckoning position of participating vessels worldwide and is therefore a valuable resource for finding search and rescue facilities near a distress incident, especially one that occurs in a remote offshore location. Merchant vessels, including some commercial fishing vessels and megayachts, of all nations making coastal and oceanic voyages are encouraged to send movement reports (sailing plan, periodic position updates, and final report) to the Amver Center at the OSC via assigned coast or international radio stations or satellite service providers. Norway, Poland, and the U.S. (for certain vessels) require their merchant vessels to participate; other vessels participate voluntarily. The information is stored in the database at the Amver Center and used for SAR efforts. Recognized RCCs worldwide handling an oceanic SAR operation can request Amver information from any U.S. Coast Guard RCC. Like CASP, Amver is accessed via CGDN+. Amver information is available to RCC/RSC SAR planners in three categories:

(a) **SURPIC:** SURface PICture is a program that identifies and plots Amver vessels worldwide. This is especially useful in the event of a maritime emergency. RCC input includes the distressed vessel's position, type and time of SURPIC. Output is a text list of the closest vessels within a defined area and a selected subset of available vessel information. A graphic display of the information is available for U.S. Coast Guard RCCs. SURPIC information can be faxed or e-mailed (press the *Ctrl-Alt-Print Scrn* buttons on the standard workstation and paste the text or graphic into the e-mail) to a foreign RCC requesting help. SURPICs can be generated for the current time, a point up to 30 days in the past, or a point up to 14 days in the future. The four types of SURPICs are:

(1) **Radius SURPIC:** A surface picture defined by a distress position, a distance from the distress position (radius), and a Date Time Group (DTG) for the SURPIC.

(2) **Rectangle SURPIC:** A surface picture of a specific area defined by a northwest corner and a southeast corner, and a DTG for the SURPIC.

(3) **Snapshot Trackline:** A surface picture defined by the starting and ending position of a trackline, a distance from the trackline, and a DTG for the SURPIC. This SURPIC is useful in determining which vessels will be in a given area at a certain time (e.g., a space shuttle launch, an aircraft that may have to ditch, or an overdue vessel on a known course).

(4) **Moving Point:** The Moving Point SURPIC provides the user the capability to obtain a surface picture around a vessel's trackline with time variant. This SURPIC is defined by the starting and ending position of the vessel's trackline, and the estimated departure of the vessel. This SURPIC is useful when a vessel is overdue at its destination. If the vessel's trackline and departure can be estimated, a SURPIC can be generated the along trackline for each increment of time. Thus, the RCC can obtain a list of vessels that may have sighted the missing vessel.

(b) **Lloyd's Vessel Data:** The Lloyd's Vessel Data displays static information from the Lloyd's Registry describing the vessel such as: vessel name, international radio call sign, the Inmarsat number, Lloyd's number, hull ID (official number of registry), length, width, the year and month in which the vessel was built,

and the true and registered nationality and address of the owner company. Data on tens of thousands of vessels are obtained from Lloyd's and updated monthly.

(c) **Voyage Information:** Includes information on the current voyage; the vessel's current predicted position; a record of the most recent Amver reports received; and Amver and Lloyd's vessel data.

3.2.5 Commence Search Point and Pattern Orientation Guidance

All factors, including safety, endurance, projected survival times, navigation, environmental conditions and available resources, should be carefully considered when determining the orientation of search patterns and placement of commence search points.

A sample of factors to consider includes:

(a) When expected survival time is short, the decision may be made to place the commence search point at the datum position so as to put the SRU as close to the expected position of survivors as early as possible. Another alternative is to ensure the first search leg of the pattern passes through or over the datum position, placing the CSP accordingly.

(b) The resource's (includes aircraft, small boat and other available assets) proximity to the search area. Refer to the Asset Tracking System. The decision may be made to place the CSP at the point closest to the SRU's departure point in order to facilitate the start of searching as quickly as possible.

(c) The decision may be made to place the CSP at a point farthest away from the departure point, so as to have the SRU finish its search as close to its recovery point as possible. This addresses other considerations, such as: having the SRU pass through datum prior to searching; inserting a SLDMB at datum prior to searching; and having the SRU finish its search as close as possible to a base intended as a staging point for subsequent searches.

(d) For missions with multiple air SRUs, all CSPs and search pattern orientations should be coordinated so that all aircraft on scene during the same periods of time are creeping in the same direction so as to assure horizontal separation. Vertical separation of at least 500 feet must also be assured by assigning different search altitudes to aircraft that are in adjacent search areas at the same time. Strict adherence to these rules is paramount to risk assessment and safety of flight issues. It may also be appropriate to consider horizontal separation for surface assets in situations where visibility is reduced (fog, night, and heavy precipitation).

(e) Whenever possible, search legs should be parallel to the expected direction of search object drift during the search. This will minimize the distortion of the search pattern relative to the drifting search object. A poor choice of pattern orientation can significantly reduce search effectiveness. For example, a PS pattern where the direction and rate of creep match the direction and rate of the search object's drift during the search is almost completely ineffective and has little chance of success.

(f) Other orientation considerations include the direction of the sun, especially early and late in the day and the direction and size of the swells. Looking into the sun makes detection very difficult and small objects such as PIWs and rafts can sometimes be obscured from view while in the trough between large swells.

3.2.5.1 There are many, sometimes conflicting, factors to consider prior to making a final decision about where to place the CSP. Each SRU should carefully evaluate the search action plan to ensure commence search points and pattern orientations for the assigned sub-area and those for adjacent assignments meet safety requirements and provide the best opportunity for detecting the search object. The SMC must be notified immediately upon discovery of any safety issues and should be notified of all other apparent deficiencies as early as practicable. Although communications between the OSC and SMC should always be immediately available, OSCs are usually authorized in the search action plan to make necessary changes as long as the SMC is informed.

3.2.6 Search Area Designation

Search areas shall be designated using a letter (A, B, C…) sequentially for the overall search area. A new letter shall be assigned each time the search planner establishes a datum or drifts a datum. In the course of a search if a new independent datum is established due to new information or other circumstances, that datum shall continue with the next search letter designation for that case. Sub-areas to be searched by specific search units (or

combination of units) shall be numbered sequentially and associated with the overall search area by preceding the number with the letter designation of the overall search (A-1, A-2, etc.).

Section 3.3
Search Planning Variables

Search planning is based on a myriad of variables including environmental factors, the nature of the distress incident, and the available search platforms and their capabilities. Search planners can improve the likelihood of locating the search objects by doing the following:

- Obtaining, correlating and analyzing all information that may be related to the distress incident to establish its time and position as accurately as possible.
- Accurately estimating the search object's drift within the general search area.
- Determining the availability and capabilities of search and rescue units (SRUs) by referring to the Asset Tracking application.
- Ascertaining any LOB's from radio transmissions that are relative to the time frame of the distress call.

3.3.1 Initial Conditions

The initial data, estimates and assumptions on which a search plan is based often determine whether a search will be successful. Therefore it is necessary to establish the time and position of the distress incident as accurately as possible. Sometimes this is quite easy, as when a craft accurately reports its position at the time of the distress. At other times, such as when a craft is unreported or overdue, a substantial investigative effort must be initiated and maintained throughout the case until the survivors are found or active search is suspended pending further developments. In addition, the pre-distress movements of the craft must be considered in order to properly match possible distress positions with possible distress times. Simulation-based software like CASP can be very helpful in this regard.

3.3.1.1 Very often there is insufficient information to establish exactly where and when a distress occurred, even when a craft reports itself in danger. In cases of overdue or unreported craft, there is often conflicting information, especially in the early stages. In such situations, the search planner must develop *scenarios* that describe what may have happened. Such scenarios must be consistent with a substantial subset of the available information. Assumptions must be made to fill gaps in the available information and complete each scenario. Scenario development and analysis requires careful thought and sound judgment, taking care to avoid jumping to unwarranted conclusions or becoming fixated on only one of several possible scenarios.

3.3.1.2 Uncertainty estimates associated with the distress incident have a large impact on the size of the area that must be searched. The search planner must always bear in mind that the uncertainty associated with any piece of data is a reflection of how much confidence may be placed in it. For example, if the *Mary Jane* reports itself in distress and taking on water "50 miles southeast of Cape Fear" based on a GPS fix, that does not mean the quality of the information as reported is as good as the average quality of GPS positions. It would be more prudent to assume the range and bearing given were only approximate, possibly an estimate made by eye from a nautical chart while the reporting source was under stress. The resulting uncertainty about the distress position would then be much larger than the uncertainty associated with GPS navigation in general.

3.3.2 Drift Theory

On average, the Coast Guard conducts more than 5,000 searches annually, at a cost of about $50M. A fifth of the searches continue longer than 12 hours. These longer searches, which usually involve multiple resources, are much more expensive than short searches. In the longer searches, knowledge of the drift of the search object becomes very important to the search planner. If the search object is not in the region covered by the search, there is no chance of finding it. Thus, the better the drift of an object is known, the more likely it will be found. Shortening the search increases the probability that the person(s) in distress will survive. Survivors and their craft are small solid objects suspended at the often-turbulent interface between two huge fluid masses - the ocean and the atmosphere. The forces of these two entities exerted on the search object cause drift. When there is no wind,

objects will move with the current. When wind is present, it has two effects. First, friction with the water surface creates waves and alters the surface current. Second, the wind acting on the exposed surfaces of the object creates leeway. Drift is estimated as the vector sum of the total water current (including any contributions from wind stress on the water's surface) and the leeway as described in section H.3.4.

3.3.2.1 Datum Marker Buoy (DMB). Datum Marker Buoys (DMBs), both radio and self-locating, are tools for determining total water current in a search area. When using DMBs, search planners should use their best judgment to estimate the sphere of influence for which the DMB information is valid. The sphere of influence is smaller in the vicinity of high currents; i.e., the Gulf Stream, Florida Straits, or known variable current areas such as Georges Banks off of New England. Time is also a consideration. Marine science experts, such as those at the International Ice Patrol (IIP) are available to assist in estimates. As a rule, the sphere of influence should be no larger than that for water current information already available, such as system environmental information provided to CASP. Since on-scene ocean currents are so poorly known and hard to predict, the Coast Guard uses DMBs to provide a measure of the currents in search areas. Some DMBs now in use are located by radio direction finding (RDF) from the search unit, which must relocate the RDF/DMB for each ocean current estimate. These are being phased out in favor of self-locating datum marker buoys.

3.3.2.2 Self-locating Datum Marker Buoys (SLDMB) utilize satellite-based technology to determine buoy position. SLDMBs provide frequent, high-resolution position information independent of the search unit (search unit does not have to relocate the DMB). The SLDMBs drift with the water mass, providing high quality current information. The use of satellite technology greatly reduces the cost of a position determination in comparison to the cost associated with the RDF/DMB. Section 4.11 provides information and employment guidance for SLDMBs.

(a) SLDMBs improve the efficiency and effectiveness of Coast Guard SAR operations. The goal of the search is to find people so they can be rescued. The use of SLDMBs offers the opportunity of doing the job better, while also saving money.

(b) Search planners should use SLDMBs whenever possible. Planners should specifically direct units to deploy SLDMBs.

Section 3.4
Initial Response, Search Planning, and Search Operations

Effective, efficient prosecution of a SAR incident requires well thought out procedures. Not every incident will develop into a full-blown SAR case, but every case has the potential to greatly expand. Guidance within this section will aid the SAR Controller in developing the thought process for a rapid and thorough reaction upon receiving notification of a potential or actual distress.

3.4.1 Offshore Incidents

As defined in reference (a), the Commandant has divided the Maritime SAR area into two sections, Atlantic Area and Pacific Area Commands, responsible for efficient coordination between all SAR regions and sectors within their sections. The Area and District RCCs generally have responsibility for offshore incidents. Search planning is done with either JAWS or CASP in accordance with the guidance provided above.

3.4.2 Coastal Incidents

3.4.2.1 **Initial Response Search Area.** The Group Command Center generally has the responsibility for coastal incidents. When an SRU is dispatched, it should be sent to the datum position where the search object is expected to be when the SRU arrives on scene. This includes estimating the object's drift between the time of the incident and the ETA of the SRU on scene if the search object was not reported to be anchored or aground. Often it will be sufficient to mentally estimate the drift based on local knowledge and/or on scene conditions due to the short time spans with initial responses near the coast. When the search object is not located upon arrival on scene, the default initial response is to conduct a search with an average coverage of 1.0. For an expanding square search (SS), this means the track spacing should equal the sweep width. For a sector search by a surface craft, this means the search radius should be about twice the sweep width. For aircraft SRUs, the minimum radius should be the distance the aircraft can cover in one minute at search speed, or twice the sweep width, whichever is larger. Since aircraft can often cover the area several times in a short period, they should cover the area repeatedly until coverage of at least 1.0 is reached. For example, if the search speed were 90 knots and the sweep width was 0.1 NM, then a single six-sector pattern with a radius of 1.5 NM (distance covered in one minute at 90 knots) would achieve a coverage of about 0.19 in about 9 minutes. Covering the area six times would produce a total average coverage of about 6 x 0.19 = 1.1 in about an hour. Orient the search area and the first leg in the direction of drift, that is, in the same direction as the total drift vector. If the reported position of the distressed craft is in shallow water, it could be at anchor, and a search down the drift line may also be appropriate.

3.4.2.2 The SRU shall also keep the SMC constantly updated on conditions, findings, and when nearing completion of the initial response search. This direction should not preclude a SRU from using an alternate search pattern or area when it is clearly indicated (e.g., narrow waterway or other physical barrier).

3.4.2.3 First SRU on scene procedures. Pre-established operations and search procedures for the first SRU on scene are to immediately report the on-scene conditions and findings to the SMC. If the object of the SAR incident is not initially located, begin the appropriate search pattern. **Important note:** The objective is to perform an accurate search pattern *relative to the search object*. If the search object is adrift and likely to have a high drift rate (strong winds and/or currents), it is often better for surface SRUs to use more traditional DR navigation techniques without correcting for set and drift than to use modern high-precision navigation systems like GPS to trace a nearly perfect pattern over the bottom. The DR technique automatically compensates for the water current component of the search object's drift, which is especially important when searching for PIWs. For aircraft SRUs, the same effect may be obtained by deploying a smoke float at datum and flying the search pattern relative to that object. Surface SRUs may also find smoke floats to be helpful aids.

(a) For surface SRUs -- usually an expanding square search (SS) is performed. If the search area is confined or there is reason to have a high degree of confidence for the selected datum (i.e., debris found), the surface SRU may use a sector search (VS). For an initial search, use the appropriate track spacing from Table 3-1.

(b) For helicopter SRUs. Helicopters are a suitable platform to perform SS and VS pattern searches. Depending on the proximity to the coast and environmental conditions, an area with a larger radius covered multiple times may be appropriate for a helicopter during the initial search due to a higher search speed. For an initial search, use the appropriate track spacing from Table 3-1.

Table 3-1 Initial Track Spacing

Initial Track Spacing (NM)		
	Good Conditions	Poor Conditions
Search Object	wind < 15 kts seas < 3 ft	Wind ≥ 15 kts seas ≥ 3 ft
PIW	0.1*	0.1*
< 15 ft	0.5	0.2
≥ 15 ft	1.0	0.5
* or > 0.1 depending on SRU's minimum navigational accuracy and maneuvering capability		

3.4.2.4 SMC Action. In coastal SAR, the initial response datum shall be quickly established. In the interest of saving time and effort when doing drift computations manually, the datum for the initial response may be determined by calculating drift using the object's last known position and the effects of water current and wind without considering leeway divergence (Figure 3-1). Time of datum must take the underway and transit times for the SRU into consideration. When using JAWS or CASP, there is no time or effort penalty for including leeway divergence so it shall be included when those tools are used, which is the default mode.

If the initial response SRU reports arriving on scene without finding the search object, the SMC shall develop a more comprehensive search plan and shall notify appropriate additional resources that they may be needed and may deploy some of them immediately if conditions warrant. Examples of such conditions include, but are not limited to, the survival prospects of the distressed person(s), remaining daylight hours, remaining endurance of the initial response SRU, etc. In any case, no more than two hours should be allowed to elapse after the initial resource arrives on scene before a more comprehensive search plan is put into effect, which may require deployment of additional resources.

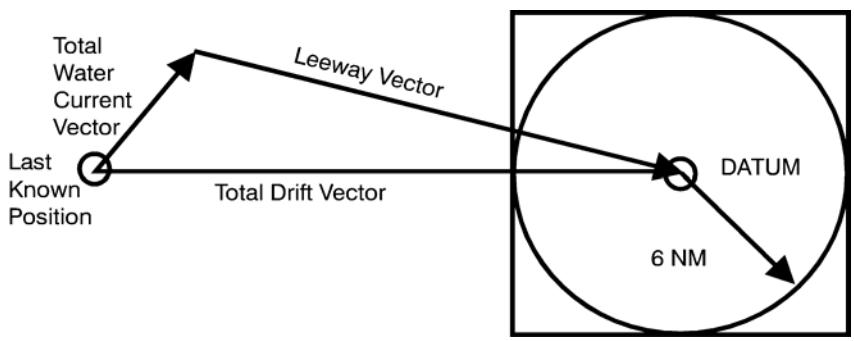

Figure 3-1 Vessel Adrift (Quick Manual Calculation for Initial Response)

(a) Factors to be considered for establishing this initial datum in coastal conditions are primarily tidal, river, coastal, longshore and wind driven currents. SMCs shall maintain data on water currents applicable to their local SAR environment. The annotated bibliography contained within Appendix K has excellent sources of such information.

(b) Local sources such as marinas, Coast Guard Auxiliarists, harbor masters, sailing and yacht clubs, pilot stations, oceanographic research institutions, state fish and game or park services, local sheriff and marine police, fishermen, marine operations and salvage companies may all contribute to develop a local data base of knowledge.

(c) Other references and sources of information regarding water current are outlined in the National SAR Supplement. Stations and search planners are reminded that one way to determine total water current for estimating drift is by using a DMB.

(d) An extremely important source of local, real-time on-scene environmental data is fishermen and other boaters. Timely, on scene environmental data from any source should not be overlooked.

3.4.2.5 **Search Area.** In the coastal environment, search areas that result from the guidance given above are usually large enough to include most objects if 6 or less hours have elapsed since the distress incident. If more than 6 hours have elapsed, or other conditions indicate (i.e. distress location is best described by a line or area datum, object type is unknown), the methods for determining search areas as described in the *IAMSAR Manual* should be used.

3.4.2.6 **Search Patterns.** The search patterns, listed in Chapter 5 of the, *IAMSAR Manual* can be used by any search unit. The National SAR Supplement expands upon the computations and techniques for performing coordinated vessel- and- aircraft search patterns. The complexity of some patterns may preclude their use by SRUs with limited navigational capability. The Square Pattern (sometimes called Expanding Square) and Sector Pattern are often the patterns used for initial search efforts. The information in the following paragraphs is provided as an aid to using these two patterns. A Course and Leg Identifier tool for these patterns is available and should be carried in SRUs for easy calculation of courses and times for each search pattern leg. This tool may be obtained through the federal supply system under DEPT. of TRANSP., USCG-PLOTTER (6-79) SN 7530-01-GF2-9010.

(a) **Square Single Unit -- Sierra Sierra (SS).**

(1) Use this pattern when confident the datum is within close limits. The first leg is normally in the direction of the search object's drift. All course changes are 90 degrees to the right. If possible, mark the datum position with a suitable floating marker that will be visible from several track spaces away, such as a smoke float. Try to keep the floating marker in the center of the pattern. Usually traditional DR navigation methods may be used to accomplish this.

(2) The pattern shown in Figure 3-2 has 1 NM track spacing. The length of each leg is indicated. For different track spacing, multiply the distances shown in the pattern by the desired track spacing to find the length of each search leg.

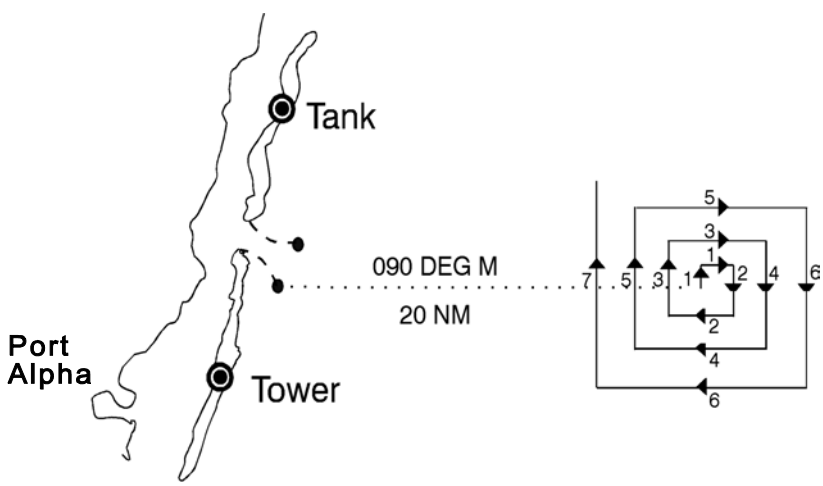

Figure 3-2 Square Pattern: Single Unit

To determine the time required to transit each leg, use Table 3-2, Square Pattern Computations. Enter the Table with the track spacing and SRU speed. Multiply the number from the Table by the length of the search leg shown in Figure 3-2 to get the time required to complete that leg at the given search speed.

Example: Track spacing = 3 NM, speed = 10 kts:

- Find the length of the second southerly leg. Solution: Multiply the length of the second southerly leg of Figure 3-2 (4) by the 3 NM track spacing to get 12 NM.
- Find the time required to complete this search leg. Example: Enter Table 3-2 with a track spacing of 3 NM and a search speed of 10 knots and read the value "18:00" (18 minutes and zero seconds). Multiply this value by 4 (leg factor in Figure 3-2). The result is 72 minutes to complete the leg.
- Coverage is computed as the ratio of sweep width to track spacing (C = W/S) in the usual fashion.
- POD is obtained from the appropriate POD vs. Coverage curve in Figure N-10 of the *IAMSAR Manual, Volume II*.

Table 3-2 Square Pattern Search Computations

Track Spacing	Speed (kts)								
	3	5	8	10	15	20	60	80	90
0.5	10:00	6:00	3:45	3:00	2:00	1:30	0:30	0.225	0:20
1.0	20:00	12:00	7:30	6:00	4:00	3:00	1:00	0:45	0:40
1.5	35:00	18:00	11:15	9:00	6:00	4:30	1:30	1:075	1:00
2.0	40:00	24:00	15:00	12:00	8:00	6:00	2:00	1:30	1:20
2.5	50:00	30:00	18:45	15:00	10:00	7:30	2:30	1:555	1:40
3.0	60:00	36:00	22:30	18:00	12:00	9:00	3:00	2:18	2:00
3.5		42:00	26:15	21:00	14:00	10:30	3:30	2:405	2:20
4.0		48:00	30:00	24:00	16:00	12:00	4:00	3:03	2:40
4.5		54:00	33:45	27:00	18:00	13:30	4:30	3:255	3:00
5.0		60:00	37:30	30:00	20:00	15:00	5:00	3:48	3:20
6.0			45:00	36:00	24:00	18:00	6:00	4:33	4:00
7.0			52:30	42:00	28:00	21:00	7:00	5:18	4:40
8.0			60:00	48:00	32:00	24:00	8:00	6:03	5:20

Note: All times in minutes and seconds
Note: Interpolation may be used in this table

(b) **Sector Search Patterns.** These patterns are best used when the datum is established within close limits, a very high coverage immediately around the datum is desired, and the area to be searched is not extensive. The patterns resemble the spokes of a wheel and cover circular search areas. Datum is located at the center of the wheel and should be marked with a suitable floating marker. By marking datum, the SRU has a navigation check each time the SRU passes through the center of the search area. Note that this means the search area is "drifting" with the floating marker, which is usually desirable. While there are many types of sector search patterns, a six-sector pattern is usually used. It consists of three equilateral triangles with one corner of each triangle at datum. See Figures 3-3 and 3-4. The search radius is also the length of the crossleg. The track spacing ranges from zero at datum to a maximum equal to the search radius at the end of each search leg. This search pattern can be used in both single and multi- unit searches. Sector searches have a very high Probability of Detection (POD) near datum as a result of the very high coverage there.

(1) **Sector Search Pattern: Single Unit -- Victor Sierra (VS)**, Figure 3-3. When practical, the first leg of the search is normally in the direction of search object drift. All turns in this pattern are 120 degrees to the right. All legs of the search pattern are equal to the chosen radius. Upon completion of the pattern, a second pattern is started with the heading of the new first leg 30 degrees to the right of the final course of the first pattern.

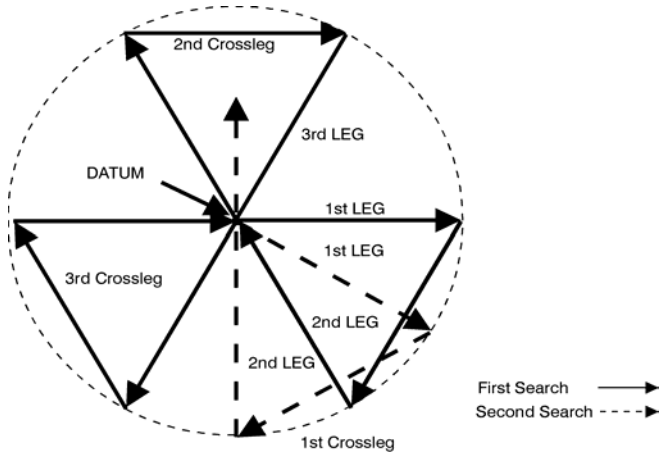

Figure 3-3 Sector Pattern: Single-Unit

(2) **Sector Search Pattern: Two-Units -- Victor Mike (VM).** The VM pattern may be used when two surface SRUs are available, Figure 3-4. As the first SRU begins a Victor Sierra search, the second begins its pattern at datum in a direction of 90 degrees to the left of the first leg of the first SRU. If the SRUs arrive on scene to begin the search at the same time, the second starts at a lower speed than the first. When the first SRU is about one leg ahead of the second, the second accelerates to search speed. The slow start of the second SRU prevents the SRUs from arriving at datum at the same time. When both have completed one VM pattern, the coverage is the same as if a single SRU had completed two VS patterns.

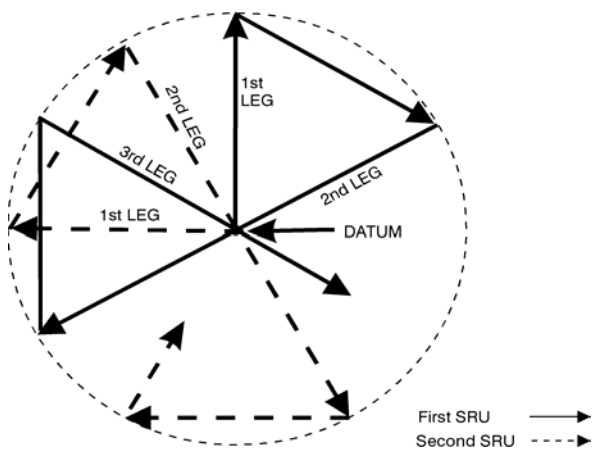

Figure 3-4 Sector Pattern: Two-Unit

(3) The sector search pattern becomes too complicated for more than two SRUs. When more than two SRUs are available, consider using a multi-unit parallel track (PM) search pattern, or dividing the search area into smaller areas and conducting single unit searches. Sector search distance and time calculations are as follows:

- To determine the distance traveled by each SRU completing a sector search, multiply the radius (R) by nine. (Trackline = 9 x R NM)
- To determine the Total Time (T) for a search, multiply the time (t) for one leg from Table 3-3 by nine. (T = 9 x t)
- To determine Total Area (A) covered in a search, square the radius (multiply the radius (R) by

itself), and then multiply the resultant by pi (3.14). (A = R x R x 3.14)

- To determine coverage (C), multiply the total distance SRUs traveled while searching by the sweep width (W) and divide the result by the area (A) covered. (C = (Trackline miles x W)/A)
- To estimate the average POD over the area covered, use the "Poor search conditions" POD curve from Figure N-10 of the *IAMSAR Manual, Volume II*. (A requirement for "Ideal search conditions" is parallel search legs, which the VS and VM patterns clearly do not have.)

Table 3-3 Sector Pattern Search Computations

Radius	Speed (kts)								
	3	5	8	10	15	20	60	80	90
0.5	10:00	6:00	3:45	3:00	2:00	1:30	0:30	0.225	0:20
1.0	20:00	12:00	7:30	6:00	4:00	3:00	1:00	0:45	0:40
1.5	30:00	18:00	11:15	9:00	6:00	4:30	1:30	1:075	1:00
2.0	40:00	24:00	15:00	12:00	8:00	6:00	2:00	1:30	1:20
2.5	50:00	30:00	18:45	15:00	10:00	7:30	2:30	1:555	1:40
3.0	60:00	36:00	22:30	18:00	12:00	9:00	3:00	2:18	2:00
3.5		42:00	26:15	21:00	14:00	10:30	3:30	2:405	2:20
4.0		48:00	30:00	24:00	16:00	12:00	4:00	3:03	2:40
4.5		54:00	33:45	27:00	18:00	13:30	4:30	3:255	3:00
5.0		60:00	37:30	30:00	20:00	15:00	5:00	3:48	3:20
6.0			45:00	36:00	24:00	18:00	6:00	4:33	4:00
7.0			52:30	42:00	28:00	21:00	7:00	5:18	4:40
8.0			60:00	48:00	32:00	24:00	8:00	6:03	5:20

Note: Time to complete one leg (t) in minutes and seconds
Note: Interpolation may be used with this table

3.4.2.7 Describing Search Areas. Search areas are described through various methods falling within the general categories of Corner Point, Trackline, Center Point, and Grid. Chapter 5 of the *IAMSAR Manual, Volume II*, provides a description of each of these methods. In addition, the specific methods below may be useful.

(a) Center Point-Landmark. The center point, or datum, may be designated by a bearing and distance from a geographic landmark. For example: Datum bears 060 degrees M, 10 NM from "Port Alpha" South Jetty light, major axis 000 degrees M, 6 NM by 6 NM (Figure 3-5).

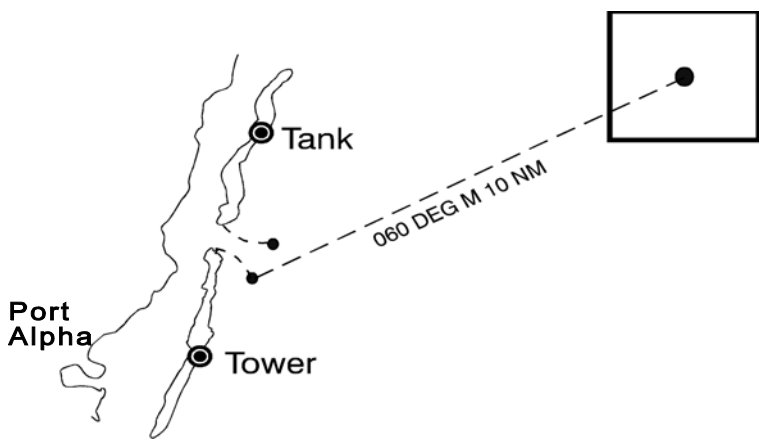

Figure 3-5 Center Point-Landmark

(b) Landmark Boundaries Method. Two or more landmarks are given as boundaries of the search area along a shoreline. For example: Search area from "Port Alpha" South Jetty, south to the Tower to 10 NM offshore (Figure 3-6).

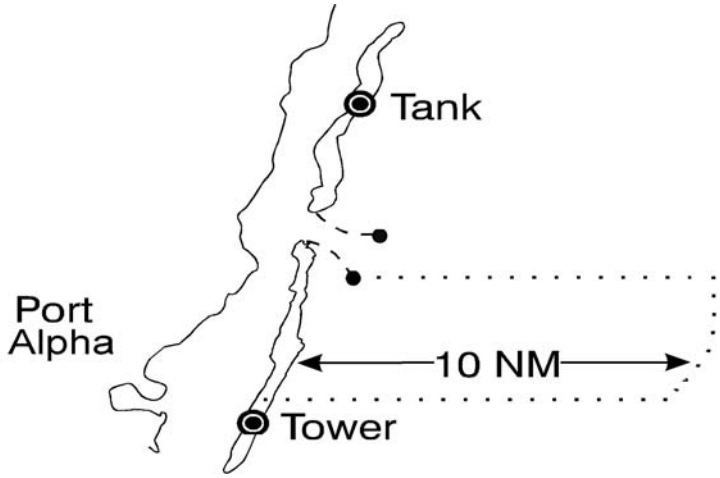

Figure 3-6 Landmark Boundaries Method

3.4.2.8 Track Spacing. Track spacing (S) is the distance between adjacent parallel search legs. The desired track spacing is a function of corrected sweep width, which is a measure of detection capability and will vary with search object type and environmental conditions, and the desired coverage. For a given desired coverage, the more difficult an object is to detect, the closer together the search legs must be.

NOTE: In darkness or extremely low visibility, surface search craft should periodically stop their engines and conduct an auditory search. If it is known or if there is a high probability that the PIW has night detection aids, a search may be conducted with track spacing compatible with the sweep width for the type of detection aid.

(a) Track Spacing by search object type, size and search unit. Detection capability also varies by search unit. The Tables and Graphs in Appendix H show the uncorrected visual sweep widths for search platforms for certain objects and correction factors for weather, fatigue and altitude in the case of aircraft. The most frequent search platforms used by Coast Guard resources for coastal SAR cases are small cutters (WPB), boats (MLB/UTB/UTM), and helicopters (HH-65/HH-60J). It is recommended that Coast Guard units copy and laminate the appropriate tables from Appendix H for each SRU and include them in the SRU pilot or coxswain kit as a quick on scene reference for initial searching while more thorough search planning is being conducted.

(b) Persons in the Water (PIWs). In most cases, a track spacing of 0.1 NM is the lower practical limit for accurate surface navigation, and is recommended for coastal surface PIW searches. Search legs for helicopter SRUs should allow at least one minute of level flight. Once on scene, helicopters should search the assigned area repeatedly using patterns of different orientations to achieve a coverage equivalent to a 0.1 NM track spacing when searching for PIWs.

3.4.3 Flare Incidents

Now that Federal law requires flares on all vessels, assistance cases are routinely affected as a result of response to flare sightings. The nature of flare distress signaling makes planning and execution of searches difficult due to:

- The wide variation of flare types;
- Range of possible maximum altitudes;
- The skill level and position of the reporting source/observer;
- The weather; and several other factors.

For that reason, the accuracy of the initial information received from a reporting source and/or observer is most critical. As with all SAR cases, a prompt, thorough and proper response yields the greatest chance of affecting a

rescue. Otherwise, the search planner may have no choice but to dispatch SRUs to search a large area to account for long range sighting possibilities. For example, a hand-held flare in a recreational boat seen on the horizon by a beach observer will be approximately 4 NM away while a parachute flare rising to 1200 feet and seen on the horizon by the same beach observer could be more than 30 NM away. Specific policies regarding response to flare incidents follow. Guidance on evaluating and planning for distress flare incidents is provided in Appendix I.

3.4.3.1 **Red and orange flares and pyrotechnics** are recognized as marine and aviation emergency signals and shall be treated as a distress and responded to unless available information indicates otherwise. Unresolved (insufficient information to either close or suspend) red or orange flares require first-light searches.

3.4.3.2 **Other flares and pyrotechnics**: Searches and follow-up searches for the sources of flares or other pyrotechnics other than red or orange flares will depend on the specifics of the case. These sightings should be carefully investigated to determine the appropriate level of response.

3.4.3.3 **Initial Search Object.** When a flare is observed at night, the initial search object should be the distress-signaling device unless other information indicates a specific object, such as the reporting source observing the point of origin (vessel, PIW, etc.).

(a) If search object drift is required, the same provisions for drift for first light searches should be followed.

(b) The provisions of section 3.4.5, which covers night and reduced visibility searches, should guide subsequent night searches.

(c) When a flare is observed in daylight, the guidance provided for first light search objects should be followed.

3.4.3.4 **First Light Search Object.** When planning a first light search following a flare sighting, in the absence of local information on probable search objects, the planner should use the factors for drift associated with the object listed in Table H-3 as: power vessel/sport boats/cuddy cabin /modified v-hull. A similar object for sweep width should be chosen (power boat 20 foot) unless local information would justify another object.

3.4.4 Distress Beacon Incidents

Distress beacons are one of the most important tools available to SAR authorities. The various distress beacon systems are covered in Chapter 3 of reference (a) and Section 2.1.4 of this Addendum.

3.4.4.1 **Risk Management Regarding Alert Positions.** In some instances, the indicated position for an alert is so significantly distant from available SAR resources that it is impractical to immediately dispatch resources to assist. Similarly, there are situations in which distress alert information is sketchy and the immediate dispatch of SAR resources would jeopardize the safety of others or leave a relatively large area of responsibility (AOR) without SAR coverage. In these situations, RCCs should spend a reasonable amount of time investigating and evaluating the situation prior to dispatching resources. Additionally, RCCs may attempt to alert alternative resources (e.g., Good Samaritans, Amver participants, other agencies, etc.) that may be in a position to assist.

3.4.4.2 **Response Policy.** In response to beacon alerts, RCCs should consider all available information such as position information, registration information, and the presence of corroborating information. RCCs should evaluate reports and attempt to correlate them with other indications of distress. Concurrently, they should attempt to obtain additional information on those involved. RCCs should expand their investigations as necessary to aggressively pursue the cause of alert signals and dispatch resources to assist, as circumstances require. Types of beacon alerts and response policy guidance are presented in Table 3-4 below.

Table 3-4 Beacon Alert and Corresponding Emergency Phase

BEACON ALERT	EMERGENCY PHASE
• 121.5/243 MHz Second Composite alert • 406 MHz GEO registered alert, unlocated alert • 406 MHz GEO unregistered, unlocated alert with digital encoded GPS position • 406 MHz LEO "A" solution alert • 406 MHz LEO registered, unlocated alert • 406 MHz LEO unregistered, unlocated alert with digital encoded GPS position	Initially evaluate as Distress
• 121.5/243 MHz First report of audible alert • 121.5/243 MHz First Composite alert • *406 MHz LEO "B" solution alert with probabilities >20%	Initially evaluate as Alert. Investigate, reevaluate and respond as facts and circumstances warrant.
• 121.5/243 MHz first alert • *406 MHz LEO "B" solution alert with probabilities <20%	Initially evaluate as Uncertainty. Investigate, reevaluate and respond as facts and circumstances warrant.
*All "B" solutions should be coordinated with the "A" solution cognizant RCC in evaluating and/or responding to alert/distress candidate "B" solutions. Always check vessel type/description and homeport/registration POC data against alert position. This practice can help flag correct "B" solutions.	

(a) Audible beacon alerts don't always indicate distress. Historically, many of these alerts have been false alarms resulting from hard aircraft landings or caused by crew error during vessel maintenance. Reports of audible beacon alerts indicate a beacon has been activated. SAR response to an audible beacon signal should be similar to the type of response provided for flare sightings. In cases where Coast Guard resources hear the beacon, they normally respond immediately and determine the signal source. Most other audible signal reports come from commercial aircraft and will help determine general beacon location.

(b) **406 MHz Beacon COSPAS-SARSAT Alerts.** Since 1990, beacon technology has been moving to a solely dedicated frequency for satellite distress beacons, 406 MHz. Use of this frequency will minimize interference problems. In addition, satellite software recognizes and relays only coded 406 MHz beacon signals, minimizing false alerts. The Coast Guard endorses the 406 MHz EPIRB as the preferred beacon type for maritime use. Accordingly, response to 406 MHz beacon alerts is immediate, keeping in mind the precepts of risk management. The use of the 406 MHz emergency frequency is not limited to strictly EPIRBs. Both Emergency Locator Transmitters (ELTs) and Personal Locator Beacons (PLBs) use the same frequency. The use of PLBs in the marine environment will become more common as they represent a more cost effective distress tool for recreational boaters. Beacon manufacturers are actively marketing PLBs to the recreational boating public. As an emergency signaling device, an ELT or a PLB functions similarly to a 406 MHz EPIRB; response policy to these beacons is identical.

(1) First alerts and composite solutions for 406 MHz beacons indicate a beacon has been activated. SAR response to a 406 MHz beacon alert should approximate response to a MAYDAY. The 406 MHz COSPAS-SARSAT system and equipment yield high confidence alerts and positions. However, factors such as satellite pass geometry, atmospheric anomalies, and beacon oscillator stability may degrade the beacon signal and position data. Any alert degradation is usually reflected in the split between A and B solution probabilities on first alert messages.

(2) **Registered but Unlocated 406 MHz Alerts.** Treat registered, but unlocated 406 MHz alerts as distress, exploit all reasonable means to ascertain distress position and assist the party in distress, including issuing a UMIB.

- Registered, but unlocated 406 MHz alerts signal distress, but contain no position information. In order to render assistance we must exploit all reasonable means to ascertain at least a general

distress position. Armed with a general position or usual operating area and suitable homing capable response assets, we are able to render timely, effective assistance.

- EPIRB registration points of contact are usually the most promising leads for information, particularly for position, situation and further points of contact. In addition, UMIBs should be used as a means to determine distress position and to maximize resource of opportunity response, unless there are compelling reasons to the contrary. When only general position information is available, suitable aircraft should be launched to exploit the 406 MHz beacon's 121.5 homing signal.
- For incidents where no position information other than homeport is available, issuing a UMIB in the vessel's homeport area is appropriate.

(3) **Unregistered/Unlocated GPS Protocol Beacons.** The latest 406 MHz beacon technology are known as Location Protocol Beacons or GPS Protocol Beacons. These beacons contain a GPS chip that can accurately calculate the position of the beacon and transmit that position as part of the beacon registration information received by the satellite. Since the SARSAT system requires multiple passes from low earth orbiting satellites to calculate the beacons position by Doppler shift, this technology provides a more timely method of notifying SAR responders of a beacons position.

- For alerts that contain an encoded GPS position, responders shall evaluate it as a distress incident regardless of whether the beacon is registered or if a location has been determined by the SARSAT system.
- When a composite position is obtained by SARSAT satellite passes, SAR planners should compare the encoded GPS position to the composite solution to verify the location of response.

(4) **50/50 Split Solutions.** 50/50 splits are no different then other A/B solutions and merely indicate the relative probability is for either solution to be the actual location of the beacon.

(c) **121.5/243 MHz Beacon COSPAS-SARSAT Alerts.** 121.5/243 MHz first alerts and even composite solutions don't always indicate a beacon has been activated. On average only 1% of first alerts are actual distresses. Spurious signal detections, due mainly to non-beacon emissions, cause numerous false alerts. Spurious signal sources include voice transmissions on 121.5/243 MHz, garage door openers, microwave transmissions, pachinko machines, satellite TV systems, computers and other systems.

(1) Because of their high false alert and false alarm rates, 121.5/243 MHz First Alerts, in and of themselves, initiate the Uncertainty Emergency Phase. RCCs should aggressively attempt to corroborate 121.5/243 MHz first alerts with any other potential distress information. RCCs should normally dispatch resources when they obtain amplifying information such as highflier audible reports and overdue or other distress reports. Following a first alert, RCCs will normally receive a composite solution, provided the beacon continues to transmit, within 48 minutes (average range from 30 - 90 minutes).

(2) The first Composite solution from a 121.5/243 MHz beacon alert corresponds, at a minimum, to the Alert Emergency Phase. RCCs should track the geographic position of composite solutions and respond accordingly. While composite solutions located at or near local airports are often non-distress, some have been caused by unreported aircraft crashes. A Second composite solution from a 121.5/243 MHz beacon alert corresponds, at a minimum, to the Distress Emergency Phase.

(3) Though response to 121.5/243 MHz beacon alerts and composite solutions represents a significant resource commitment with a limited likelihood of actual distress, once a second composite solution has been received, RCCs should make every effort to locate and determine the source of the signal. While it is common to determine that a signal source is emanating from an area where distress is unlikely (such as a marina, anchorage or airfield), due to SARSAT system limitations, allowing a 121.5/243 MHz signal to continue to transmit indefinitely will result in the masking of other possible 121.5/243 MHz distress signals within a 20 km radius of the existing transmission.

(d) **Alert Query Reports.** In pursuing amplifying distress information, RCCs may query the USMCC database to see whether or not a particular 406 MHz beacon has been activated, or to check for all beacon activations over a specific time period or in a specific area. RCCs may do so by requesting an Alert Query Report from

the USMCC. The USMCC user's manual, reference (r), has more information on this process and guidelines for interpreting these reports.

(e) **Limitations of the System.** As with any tool, search planners must be aware of system limitations. False alarms (inadvertent activations or hoaxes), non-beacon alerts, and unresolved beacon alerts reduce the efficiency of the C-S system. Operator misuse, equipment malfunctions, improper testing, and hoaxes may downgrade beacon effectiveness. Unresolved alerts are predominantly associated with 121.5/243 MHz, which is a congested aviation distress frequency. In addition, many false alerts are caused by non-beacon emissions, harmonics emanating from transmissions on those frequencies, and numerous other signal sources in this frequency band. While 121.5/243 MHz beacon alerts provide two equally possible beacon positions, requiring the RCC to wait for another satellite pass prior to dispatching resources, the A solution on a 406 MHz first alert will be the correct position 95% of the time. SAR resources can reasonably be dispatched immediately upon receipt of a 406 MHz first alert. A composite solution will be received, provided the beacon continues to transmit, usually within 60 minutes (average range from 45 - 90 minutes). Table 3-5 compares 121.5/243 MHz and 406 MHz beacons.

3.4.4.3 Policy on Follow-up to False Alarms. Results of beacon activation investigations are essential to improve the system. Units should ensure personnel aggressively pursue and document the cause of all accidental and inadvertent beacon alerts.

(a) Historically, problem areas include bracket failures, improper switch setting and marking, operator error, and water intrusion. False alarm information obtained by the Coast Guard should be passed to beacon manufacturers to improve beacon/bracket design or to improve national and international standards.

(b) In all cases, investigating personnel should educate beacon users on proper registration procedures and beacon usage. Coast Guard personnel should follow guidance in reference (o) and other appropriate directives in reporting all incidents to the FCC, advising them of the incident and of the actions taken. In the case of first-time offenders, the District Commander in which the vessel is registered should send an administrative letter to the owner expressing concern from a SAR and safety perspective. This letter should remind them of the importance of up-to-date beacon registration (for 406 MHz and other "registered" beacons), and user training and knowledge of EPIRB and ELT systems. In the case of repeat offenders, close coordination with the beacon owner and the manufacturer can help identify beacon problems and operator errors.

3.4.4.4 Registration/Follow-up Policy. All Coast Guard and Coast Guard Auxiliary units should make every effort to encourage beacon users to register their beacon. The easiest method for registration is online at www.beaconregistration.noaa.gov. Units should also have spare 406 MHz EPIRB registration cards for users to fill out and mail to the USMCC. A sample registration card is in Appendix J. **It is mandatory for the owner to register the 406 MHz beacon.** In addition, units should relay registration information to the USMCC. Other beacon types are registered in various ways. Units should strongly encourage beacon owners to "register" as soon as possible.

3.4.4.5 Improper Use of EPIRBS as DMBs. EPIRBs are **distress beacons**. As such, search planners shall not normally use them as DMBs. While it may seem convenient at times to leave an EPIRB drifting to mark datum during a SAR case, that beacon's signal may prevent another distress beacon from being properly tracked or heard.

(a) SLDMBs are the appropriate tools for marking datum in extended search cases. When located, EPIRBs shall be recovered and, whenever necessary and possible, SLDMBs deployed in the same position to mark datum. Standard radio DMBs work fairly well when no SLDMBs are available.

(b) In situations where the EPIRB is the only means of marking datum, close coordination between the SMC and the USMCC will be required.

Table 3-5 406 MHz and 121.5 MHz Beacons Comparison Table

406 MHz Beacons	121.5 MHz Beacons
Coverage: Global.	**Coverage:** Ground station dependent; ground stations have an effective radius of about 1800NM. Current coverage: about one-third of the world.
Reliability -- False Alerts/False Alarms: All alerts come from beacons. Satellite beacon transmissions are digital, coded signals. Satellites process only coded data; other signals are rejected. About 1 in 10 alerts are actual distresses. Individual beacon-unique coding and registration allow rapid incident corroboration. About 70% of 406 MHz beacons are registered. More than 80% of 406 MHz false alarms are resolved by a phone call.	**Reliability -- False Alerts/False Alarms:** Only about 1 in 4 alerts come from beacons. Satellites cannot discern beacon sources from many non-beacon 121.5 MHz sources. Fewer than 1 in 100 alerts are actual distress. 121.5 MHz beacons transmit anonymously. The only way to ascertain the situation is to dispatch resources to investigate -- a costly disadvantage.
Alerting: First alert confidence is sufficient to warrant launch of SAR assets. Earlier launches put assets on scene earlier-average 2 hrs saved in maritime, 6 hrs in inland. These savings are survival significant. Estimates put 406 MHz ELT lives saved potential at more than 100 per year in the U.S. alone. Average initial detection/alerting by orbiting satellites is about 45 minutes -- worst case about 60 minutes. Average time between subsequent satellite passes is about 60 minutes. Vessel/aircraft ID, point of contact information provided with alerts allows rapid corroboration or stand-down. Allows false alarm follow-up to continuously improve system integrity/reliability. Near instantaneous detection by geostationary satellites.	**Alerting:** High false alarm rate makes first-alert launch infeasible. Absent independent distress corroboration RCCs must wait for additional alert information. 121.5 MHz beacon launch decisions take six hours longer than for 406 MHz beacons on average (based on inland region data). Almost half of aviation accident survivors perish in the first six hours after the incident. Same as 406 MHz. Same as 406 MHz. Alerts are anonymous. 121.5 MHz technology not capable of transmitting data. No capability. No capability.
Position Information: 2-5 km accuracy on average. Position calculated by Doppler shift analysis. Capable of processing beacon transmitted position information from independent source, e.g.: GPS.	**Position Information:** 10-20 km accuracy on average. Position calculated by Doppler shift analysis. No capability.
Locating the Object: Superior alert position accuracy limits initial position uncertainty to about 40 sq. km. 121.5 MHz homing signal facilitates object location by radio detection finder equipped search units.	**Locating the Object:** Initial position uncertainty is about 700 sq. km. on average. Same as 406 MHz.

3.4.5 Night and Reduced Visibility Searches

Reduced visibility, either due to night or weather, significantly reduces the effectiveness of a search, particularly for objects that are not readily located using radar or other electronic sensors. For planning and conducting searches during night or under otherwise reduced visibility conditions, the following guidance is provided.

3.4.5.1 Timeliness. In addition to SAR incidents occurring at night, it is common for incidents to occur towards the end of the day when mariners are returning (or due to return) from a day on the water. A rapid response with a full search using the remaining daylight may obviate the need for a night search. For searches with reduced visibility in daylight hours, getting search units into the area rapidly will provide some search coverage and facilitate a rapid resumption of full search capability should conditions improve.

3.4.5.2 Search units. The choice of search units, air or surface, depends greatly on safety of operations under the given conditions, the search object, and the sensors available on the various search units.

(a) With reduced visibility it is imperative to employ those search units with the best sensors for the conditions.

(b) The expected duration of reduced visibility conditions will also dictate, to some degree, the choice of search units. If reduced visibility is expected for only a short period, surface units may proceed into the search area immediately while air units, which can arrive more rapidly, may be timed to arrive when conditions are improved. For reduced visibility of longer duration, the decision to use surface and air search units will be more dependent on search object, the sensors available on each search unit, and the effectiveness of those sensors for existing weather conditions.

(c) There may be times when conditions do not permit units to conduct a search such as severe storms. Although not able to effectively search, deploying a surface unit in the search area ready to respond rapidly to a signal or chance sighting should be considered. When this occurs, risk management mitigation strategies must be employed.

(d) Keeping a search unit in the area during reduced visibility is also important for survivor confidence. Sighting a search unit in the area lets survivors know the search is still on and will bolster their will to live.

3.4.5.3 Search object. The ability to detect an object is based on the sensors available on assigned search units. Depending on the incident and sensors available, the primary search object may be something other then the overall object of the search.

(a) Unaided visual searches at night will not readily detect unlit objects. Even large vessels may be hard to detect if not illuminated and smaller objects such as rafts and persons in the water are nearly impossible to see. Under such conditions the primary search object should be a night signaling device (flare, strobe, light).

(b) Enhanced visual searches using night vision goggles under favorable conditions will permit searchers to keep a PIW or small craft as the primary search object. The night vision goggles can take advantage of less bright light sources and reflective surfaces or materials.

(c) Night searches following a flare should have a primary search object of additional signaling devices. Sensors for other then visual search should also be utilized so that objects of interest within the search area may be investigated.

3.4.5.4 Search tactics. Searchers should utilize all possible means of detecting search objects, visual, electronic, and aural. These tactics are dependent on accurate search planning and coordination. The following should be considered in the planning and conduct of a reduced visibility search:

(a) The SMC should be fully aware of on scene conditions, as searches begin and any changes that occur during the search. Search units should pass to the SMC (or OSC if one is assigned), conditions upon arrival on scene and any changes. This information is critical to assigning appropriate track spacing to achieve the desired search results.

(b) At night all unnecessary lighting on search units should be secured, electronics lighting should be shifted to low light mode to minimize glare on the inside of windows and to preserve night vision.

(c) If the distressed craft or survivors are known to have distress signals, it is important for search units to make their presence known in hopes of getting the survivors to signal. Often the navigation lights alone may not be enough and additional lighting (blue light, search light) may be necessary to get a response. This tactic may be most appropriate for early on searches. The need to limit excess light for night vision considerations may be more appropriate for later searches where there has been ample opportunity for survivors to discharge or use any signaling devices.

(d) If a debris field is discovered, it may be appropriate for search crews to use lights or flares to illuminate the area to enable a better visual search of the concentrated area. This may mean sacrificing night vision for the crew in hopes of spotting PIWs or reflective material that the lights may illuminate.

(e) Ambient light sources should be exploited in a search.

(1) With bright shoreline lights, light colored objects or objects with reflective material in particular may be illuminated enough for the unaided eye to detect, while detection using NVGs will be greatly improved.

(2) A full or near full moon can also provide enough light for the unaided eye to detect an object and greatly improves NVG effectiveness. The reflection of the moon on the water also can be used to search for objects as it "moves" across the surface with the search unit's motion. This is particularly effective in calm conditions with the moon low in the sky.

(3) Large backlit objects may also provide a detectible profile when searching along a well-lit shoreline.

(f) Electronic sensors should be set according to search object as discussed in 3.4.6 below.

(g) On surface search units the engines should be secured (brought to idle if securing not possible) and all other noise minimized in order to call out to and hear calls from survivors. This is a particularly good practice when encountering a debris field or at regular intervals even though no debris is present.

(h) Search units should check buoys and fixed aids in the vicinity. PIWs may swim to something that floats or provides them some form of stability.

3.4.6 Electronic Sensors and Sensor Searches

3.4.6.1 Surface Vessel Radar. Appendix H contains recommended sweep width tables for surface vessel radar. In addition, the following information should be considered when planning searches utilizing surface vessel radars:

(a) The effective search range of radars varies greatly.

(b) Radar range sweep widths for small objects should only be applied in low sea states.

(c) Radar reflective devices significantly improved object detection probability.

(d) The decision of whether or not to utilize the surface vessel radar in a search, especially if it requires dedicating a crewperson who could be used for visual search, should be based on a comparison of the radar sweep width to those for other available sensors. Surface radar searches will generally be preferred when visibility is poor, sea state is low to moderate, and the object is equipped with a radar reflector. Radar sweep widths deteriorate rapidly with the onset of precipitation and/or seas of greater than 4 feet.

(e) Visual scanners should concentrate on the area in the immediate vicinity of the search unit during low visibility radar searches to avoid missing objects that pass through the area of heavy sea return.

3.4.6.2 Forward-Looking Airborne Radars (FLAR). The Coast Guard Research and Development Center has conducted research on Coast Guard fixed wing aircraft to determine detection capabilities of FLARs for SAR operations. From detection data collected under realistic search scenarios estimates of sweep width have been calculated. Appendix H includes the recommended sweep widths for the AN/APS-137, AN/APN-215, AN/APS-127, and RDR-1300.

(a) The AN/APS-137 radar, installed on the Coast Guard's HC-130 fleet, was evaluated for SAR object detection during three field tests conducted by the Coast Guard R&D Center and were reported on in Coast Guard

R&D Reports CG-D-14-93, CG-D-07-94, and CG-D-18-94. The AN/APS-137 FLAR is an X-band, air-to-surface Inverse Synthetic Aperture Radar (ISAR) that provides high resolution, small-object detection, weather avoidance, sea surveillance, and Doppler display. The AN/APS-137 system has special selectable features that enhance system performance against weak radar returns. Sweep width recommendations for conducting and planning AN/APS-137 (aircraft) SAR searches are provided in Appendix H.

(b) The RDR-1300 model radar is found on the HH-65 and HH-60J aircraft. This radar is comparable to the APS-215 and the sweep width tables corresponding to the APS-215 are applicable for searches conducted using the RDR-1300 radar.

3.4.6.3 Side-Looking Airborne Radar (SLAR). Side-looking airborne radar is installed on some Coast Guard fixed wing aircraft. The AN/APS-135 model is currently installed on two C-130s at CGAS, Elizabeth City and the AN/APS-131 model is found on the HU-25Bs at CGAS, Cape Cod. The main difference between the models is the length of the antenna.

(a) The AN/APS-131 model SLAR on the HU-25B aircraft is part of the AIREYE system. The AIREYE system was developed primarily as an oil pollution surveillance resource. The system includes infrared/ultraviolet (IR/UV) line scanning device and a KS-87B Aerial Mapping camera. The IR/UV and camera have very limited applicability to SAR. When doing electronic searches the HU-25B aircraft should rely on the AN/APS-131 in combination with its FLAR, the AN/APS-127, and not the IR/UV or mapping camera.

(b) Recommended sweep widths for SLAR on Coast Guard aircraft are shown in Appendix H. Specific findings of the research that are of interest to SAR planners are:

(1) SLAR models tested are capable of detecting 180-foot ships nearly 100% of the time in seas up to at least 6 feet and ranges up to 30 NM.

(2) Objects as small as 16-foot boats with metal equipment (engine, gas tanks, frames, etc.) can be detected better than 90% of the time in seas less than 3 feet and 30% - 50% of the time in seas of 3-6 feet. These objects can be detected in low sea states out to the 30 NM swath width limit.

(3) Four to ten person life rafts can be detected 40% to 70% of the time in seas less than 3 feet, but can be detected less than 15% of the time in seas of 3 to 6 feet.

(c) Presently these SLAR equipped aircraft are the primary iceberg surveillance platforms for the International Ice Patrol.

(d) SLAR has limited use during a search. SLAR is essentially an aerial surveying system. To adequately survey an area, the aircraft must fly level and straight. The SLAR aircraft or other SRUs can then identify the resultant SLAR film's objects.

3.4.6.4 Forward-Looking Infrared System (FLIR). FLIR data was collected in experiments conducted by the Coast Guard Research and Development Center. These studies tested the Northrop Corporation SeaHawk FLIR system, which is not being carried on any Coast Guard aircraft. Chapter 4 of this Addendum lists which Coast Guard aircraft carry FLIR capability.

(a) Extensive testing of FLIR as a SAR search resource with various objects has not been conducted. FLIR has a very narrow field of view. Most units operate with a 7-15 degree field of view. Recommended sweep widths and altitudes for use of FLIR are contained in Appendix H. Sweep widths should not exceed the effective azimuthal coverage of the system in use. Appendix H also contains illustrations of how to estimate a sweep width for a FLIR unit.

3.4.6.5 Night Vision Goggles (NVG). Many SAR incidents occur or become known to the Coast Guard during the afternoon or night. The greatest benefit of NVG is that this sensor enables searchers to conduct effective searches at night, thus search planners will not have to wait until first light the following day to begin effective visual searches. This will increase the probability of survival for those persons in distress. Research showed NVG searches from UTBs are not recommended because the lookouts are prone to seasickness when using NVG, but they are effective from aircraft. Sweep Width Tables for NVG Searches are provided in Appendix H.

3.4.6.6 Photo Reconnaissance Support. Photoreconnaissance is one resource that may have limited benefit in locating those in distress in a large maritime search area. Aircraft equipped for highflying photography include the Coast Guard HU-25B with a KS-87B camera and U.S. Air Force aircraft.

(a) High flying reconnaissance aircraft have the capability of covering large areas, up to 20,000 square nautical miles for example, with photographs that are developed and interpreted by technicians. If the sky is cloud free, the cameras cover the area thoroughly; however, specially trained technicians have to search the photographs, not unlike a crewmember on a search aircraft.

(b) The technicians thoroughly review the photographs looking for the search object; difficult and time-consuming work. Interpreting technicians have little experience with photographs of open ocean, since they usually look for ground sites using various reference points such as roads, forests, communities, etc. There are no such reference points at sea and this makes the "photograph search" more difficult. Also, they are often unfamiliar with what search objects look like from the air for identification purposes. The successful outcome of a search by these reconnaissance aircraft is solely dependent on the interpreting technician finding the object.

(c) In past SAR cases, the Coast Guard has requested Air Force aircraft use colored film. These requests were made under the assumption that the search objects will be more easily found due to the color contrast with the surface of the water than by the contrast on black and white film. Some limited testing by the Air Force was done with color film and high altitude aircraft during 1987. These tests were conducted under ideal weather conditions with minimal cloud cover and known objects in fixed positions. It was determined that small, brightly colored objects, such as a one-man yellow life raft could be detected, but dark objects were more difficult to find, and a one-man black life raft failed to be detected at all. Black and white film has not been tested for maritime searches, though it might be most suitable for large craft such as a fishing vessel. Coast Guard HU-25B aircraft equipped with a KS-87B camera will take black and white pictures only.

(d) Planners can assume that it will take at least one day to get the approval and establish the operations plan for the aircraft. After completion of the flight it may be another day for black and white film to be processed and interpreted. If color film is used the process may take longer because of the special processing that has to be done by one of the limited number of resources. Black and white film is normally processed and interpreted at the home base of the Air Force aircraft.

(e) Due to limited testing and low historical success rate, the Air Force, by agreement with the Coast Guard, will provide aircraft for photoreconnaissance support of SAR, only if requested by proper authority and under certain conditions. USAF policy regarding use of these aircraft for SAR support was promulgated by reference (s). The guidelines established by this directive are as follows:

(1) Use of highflying reconnaissance aircraft for all SAR efforts will be on a strict noninterference minimum cost basis. Scheduled operational requirements and priority training will normally not be rescheduled.

(2) U.S. Air Force Strategic Air Command (SAC/DORS) shall determine the availability of aircraft support based on area coverage, range, weather, type of film requested, mission and training impacts, etc.

(3) Unless directed by higher authority, only black and white film products shall be used. If color film is specifically required, the requester must coordinate handling procedures and possible cost reimbursement for film processing and exploitation.

(4) SAC/DORS will advise Air Force Headquarters of the SAR request and intended plan of action.

(5) "Special interest" situations involving Headquarters USAF or USCG, or Congressional directed SAR support shall be approved on a case-by-case basis at the air staff level. Air Force Headquarters will coordinate such cases with appropriate major commands, Headquarters ACC and Headquarters USCG, as required.

(f) The following procedures apply to Coast Guard commands:

(1) All Coast Guard requests for photoreconnaissance support of SAR are to be made through the operational chain of command to the appropriate Area Command Center. If the Area determines that this type of support is appropriate for the case, the Area shall initiate a request to USAF Headquarters Strategic Air Command (SAC)/DORS via AFRCC, Langley AFB, VA. If highflying assets are made available, the SMC will then be authorized direct liaison for passing SAR planning/execution information. The Area is to be kept informed of the status of the mission.

(2) Initial communications should be made by telephone, followed by formal request message. This will give the Area and SAC a heads up to an incoming request so time will not be lost waiting for record traffic. Commandant (G-OPR) shall be information addressee on all message communications involving a request for photoreconnaissance support.

(g) The above guidance is meant to be restrictive due to the expense of using these resources and their limited application to maritime SAR. However, when it is determined that a particular case may benefit by utilizing these resources, search planners should begin the request process as early as possible. These resources take considerable time to arrange and receive the final result of interpretation. An example of a beneficial use may be when the forecast is for bad weather that will preclude normal searching. Photo imagery collected before weather sets in could be studied while other resources are grounded.

(h) Applicable USAF phone contact numbers (SAC/DORS) are:

- During working hours: Autovon 271-5417, Commercial (402) 294-5417
- After working hours: Autovon 271-5707, Commercial (402) 294-5707

(i) The USAF message address is:

- STRATRECONCEN OFFUTT AFB NE//DORS//

3.4.7 Searches for Bodies

Coast Guard units are often requested to search for bodies. However, Coast Guard units are not provided the specific gear (e.g., dragging equipment, etc.) or training to conduct such searches. As per Chapter 4 of the USCG Regulations, "when it has become definitely established, either by time or circumstances, that persons are dead, the Coast Guard is not required to conduct searches for bodies. If, however, requests are received from responsible agencies, such as local police, military commands, etc., Coast Guard units may participate in body searches provided that these searches do not interfere with the primary duties of the units." The participation normally is confined to a surface search or support platform for other agencies to use their equipment.

3.4.8 Aircraft Incidents

Aircraft incidents present a particular challenge to SAR planners. The speed of aircraft and the distance they can travel in a short period of time often makes determining datum difficult. Once determined, the datum is rarely a well-defined point and results in a large initial search area. Various systems associated with aviation safety and tracking can assist in narrowing initial datum and reduce the area to be searched.

3.4.8.1 Emergency Locator Transmitters (ELTs), if operating properly following an aircraft crash or ditching, may provide a position through Sarsat or direction finding by SAR assets. However, once in the water aircraft rarely stay afloat and submerged ELTs will cease to provide a signal.

3.4.8.2 Aviation tracking radar systems are present throughout the United States and along the coast for defense and tracking of civil aviation. Several radar-tracking systems are covered in Chapter 2 of reference (a).

(a) Hill AFB provides technical certification and service for a nationwide array of linked air defense radar's that may provide valuable "near real-time" information to search and rescue planners prosecuting maritime and/or inland aircraft incidents. The radar information is fully archived for a 90-day period and playback of the event can give a "near real-time" dynamic picture of the subject aircraft's activities leading up to, and at the time of, the incident. Some of this information may be available from the local Air Route Traffic Control

Center (ARTCC), which provides greater radar coverage, both in geographic areas and in lower altitudes. It archives "RAW" or "SKIN PAINT" aircraft radar contact information, while the information that is available to ARTCC systems is generally filtered to show only radar information from aircraft that are using a transponder. RCC requests for this information should be made directly to one of the three points of contact given below. If the incident did not occur within that particular Air Defense Sector's (ADS) AOR, they will refer the RCC to the appropriate ADS for the incident.

CONTACTS

SAR requests (24 hours): Air Defense Sector (ADS)
Mission Crew Commander (MCC)

Western ADS	(253) 984-4311/4312
Southeast ADS	(850) 283-5205/5206
Northeast ADS	(315) 334-6802
84 RADES:	
Director of Operations	(801) 777-2047
Fax	(801) 777-3268
Hill AFB Command Post 24 hr pager to 84 RADES	(801) 777-3007

(b) Shortly after contact, the ADS should be able to furnish a last known position of the incident aircraft. Give ADS as much information as possible, as the radar system archives ALL air contacts received, and the incident aircraft must be selected from the data available. Within a period of up to a few hours, they will be able to call in an analyst who will review the radar system's archived information, review the available data and update the information. ADS will provide an electronic copy of the aircraft incident to the RCC, and assist in its interpretation. This playback will generally fit on a single floppy diskette and/or may be sent electronically. No special hardware or software is required to perform the playback; it will perform well on CGSWIII. The playback may be advanced rapidly, slowed, and paused as required. Each data point of the incident may be "clicked" to show that data point's related information, such as altitude, etc. Copies of the given screen pictures are also easily made using the existing "ALT-PRINT SCREEN" buttons on the PC and copying that information into the program of choice. NO special training is required.

3.4.9 Uncorrelated Distress Broadcasts & Alerts

This section provides the standard Coast Guard procedures to be used in prosecuting uncorrelated distress broadcasts. An uncorrelated distress broadcast is a distress broadcast that does not include position and/or identification information sufficient to generate a reasonable search area. A distress broadcast may use the internationally recognized distress word "MAYDAY" or any number of words that would indicate a need for assistance including, but not limited to, help, emergency, trouble, sinking, etc. An uncorrelated distress broadcast could also originate from a radio equipped with DSC where the radio was not interfaced with a GPS and the MMSI was not registered.

3.4.9.1 Thousands of distress broadcasts are received on VHF-FM channel 16 by Coast Guard units each year. Some are made by mariners who may not be able to transmit more than a single broadcast before the condition of their vessel, communication gear or a person renders them unable to transmit additional information. In these cases, we do not have the opportunity to establish direct communications with the caller, and may not be able to ascertain a location or identification. These situations severely hamper the Coast Guard's search planning and rescue coordination efforts. Regrettably, we also receive distress calls from calling parties with the clear intention to mislead or deceive our watchstanders. Despite this fact, all distress broadcasts shall be treated as legitimate distress calls unless determined otherwise.

DSC is a relatively new radio capability that allows the maritime public to transmit a distress by holding down a button located on the radio for 3 seconds. When properly installed and registered in the MMSI database the distress and GPS location would be transmitted via channel 70 to the closest receiving station. The imbedded information contains the owner/operator's information. However, if the radio was improperly installed, not integrated with GPS, and was not registered in the MMSI database, this would be considered an uncorrelated distress broadcast. The watchstander's only response option would be to issue a UMIB. A disadvantage to making a distress call via the DSC radio is that the transmitted distress is a data stream that does not allow the

system to home in on the signal and create a line of bearing.

3.4.9.2 **Watchstanders shall initially treat all distress broadcasts as distress incidents.** All distress broadcast incidents shall be aggressively prosecuted and carefully documented.

(a) The SAR mission coordinator (SMC) shall issue an urgent marine information broadcast (UMIB) for all distress situations, unless clearly not warranted. This is the minimum response requirement for uncorrelated distress broadcasts – callouts are not sufficient. The UMIB shall include text-requesting mariners and shore stations that heard the distress broadcast to contact the Coast Guard with their position. The UMIB shall be broadcast for at least one hour at 15-minute intervals.

(1) Based on information provided as feedback or lack of feedback, the UMIB should be modified to take advantage of this information.

(b) When sufficient information exists to establish a reasonable search area, the SMC shall launch appropriate resources to respond to a distress broadcast. In the absence of such information, search planners shall engage in aggressive detective work, using all means at their disposal to narrow down a search area, including:

(1) Analysis of high-level site reception. When an uncorrelated distress broadcast is received on two intersecting high-level sites, a reasonable search area may be developed from the overlapping area (depending on the size of overlapping area) and/or from the direction finding capability that provides a line of bearing from each high-level site to within +/- 2 degrees of the transmission. In some cases reception on a single high-level site may result in a searchable area due to the form of the geographic area in relation to high-level site location. Not receiving the distress broadcast on adjacent high-level sites may also allow elimination of overlap areas in initial search efforts. Additionally, the single line of bearing provided by the direction finding would help narrow the search.

(2) Queries to ascertain if other boats or shore based radios heard the call over low-level antennas. This should be accomplished via the UMIB. Additional queries may be made to refine this information. Knowledge of low-level antenna reception may yield additional reception area arcs, further narrowing the probable location of the distressed caller.

(3) Replay the transmission. For all uncorrelated distress broadcast cases, the SMC should immediately review recorded transmissions. The SMC should also immediately review all channel 16 transmissions addressed to the Coast Guard that cannot be readily identified as non-emergent. If possible, several different individuals should listen to the transmission to aid in verifying information. The SMC should be prepared to send an email with the distress transmission attached for the District command center upon request.

3.4.9.3 **Auto-Distress Communications.** In recent years, the Coast Guard has experienced an increase in the number of S-O-S transmissions and electronically synthesized MAYDAY calls on VHF-FM, as well as 2182 kHz distress alarms on MF/HF radio. Experience shows that these types of auto-distress transmissions are often triggered accidentally, creating potentially dangerous safety of life issues for the public and Coast Guard. For uncorrelated auto-distress notifications and alarms, the SMC does not need to launch unless there is a reasonable search area AND there are additional factors that would lead a controller to conclude that a mariner may be in distress. The reasoning is that a voice MAYDAY is an intentional act on the part of the mariner, whereas automatic broadcasts and alarms can be, and often are, triggered inadvertently.

(a) **Auto-Distress Broadcasts.** All Morse Code S-O-S transmissions and automated/synthesized voice MAYDAY broadcasts on Channel 16 VHF-FM are transmitted without position or vessel identification and shall be treated as uncorrelated MAYDAYs. Upon receipt of an S-O-S transmission or automated/synthesized voice MAYDAY broadcast, the SMC shall thoroughly investigate the incident and broadcast a UMIB as a minimum response in accordance with the policy and discussion noted in paragraph 3.4.9.2. Assets need not be immediately launched based solely on a single S-O-S or synthesized MAYDAY broadcast. Launching an asset would be appropriate if a reasonable search area can be determined *and* there are additional factors that may indicate an actual distress situation, i.e. voice MAYDAY, overdue vessels, flare sightings, local conditions or circumstances, etc. Note that this is a slight departure from the policy in

3.4.9.2(b) that requires assets to be launched based on establishing a reasonable search area alone. However, this policy does not preclude Districts from establishing the level of apprehension that will require a launch within their AOR; in fact they are encouraged to do so.

(b) **Auto-Distress Alarms.** Distress calls on 2182 kHz are often preceded by a radiotelephone alarm signal (a tone alternating between 1300 and 2200 Hz four times each second lasting for 30-60 seconds) that alerts listeners to the forthcoming distress message, and are no different from voice radio transmissions of "MAYDAY" or "Coast Guard, Coast Guard come in". In cases where 2182 kHz alarms are sent with no accompanying distress message (regardless of how long the alarm is sounded), they shall be treated in the same manner as uncorrelated Auto-Distress Broadcasts above.

3.4.9.4 The principles of aggressive prosecution and full use of available investigative tools applied for VHF-FM, MF and HF uncorrelated distress broadcasts shall be applied to the receipt of all forms of distress signals (e.g., SARSAT, cell phone, flares, etc.). The review process for case suspension or evaluation as a probable hoax should be equally rigorous.

3.4.9.5 **Reasonable Search Area.** In responding to uncorrelated distress broadcasts the SAR planner is faced with the decision to search or not search under the given circumstances. Search planners should keep in mind that the distress broadcast may be the only opportunity the mariner has to indicate a distress situation. A search for the source of the broadcast, if at all possible, should be the foremost objective. Coast Guard policy is to search if a reasonable search area can be determined. There are however, situations where a reasonable search area cannot be established. The following guidance is provided to assist in determining if an area is reasonable or not. As guidance, it does not relieve SMC's from making a decision, based on all the facts available, for each individual case. What may be a reasonable amount of time to devote to a search in one set of circumstances may not be true under another set of circumstances.

(a) **Search Resource:** SMC should select the resource most appropriate for searching in the general area of the uncorrelated distress signal (i.e. boat in bays/inlets, bounded or near coastal waters may be appropriate while a fixed-wing aircraft may be appropriate for open ocean area.).

(b) **Search Object:** First choice is the search object as included in the distress alert. If the distress alert does not mention a specific object, the second choice is an object selection based on local knowledge of craft, which typically operate in the general area of the alert. If no specific object can be selected based on local knowledge, the final choice is to use a 20-foot powerboat as the initial search object.

(c) **Search Area:** The SMC should determine from the transmission method of distress alert and any information contained in the alert, the probable area. Methods to do this are included in para. 3.4.9.2(b).

(d) **Search Time:** Calculate the time that would be required to complete a search with the chosen search resource, object and area.

(e) **Reasonable Decision:** If the search can be completed with 2 hours of on scene search time by a surface vessel or one hour by aircraft, it is reasonable to conduct the search. This equates to approximately a full sortie of search for an HH-65 being reasonable. Clearly the area that can be searched by other resources will not equal that of an HH-65, the same amount of time should be applied, and based on choice of appropriate search resource will determine the area that will be covered in a reasonable search. The 2 hours should not be considered a hard cutoff for when to conduct a search or not, rather an indicator considered with all the other facts of the case in making the decision.

3.4.10 False Alerts, Hoaxes and Suspected Hoaxes.

False alerts and hoaxes waste valuable operational resource dollars, frustrate SAR response personnel, and may adversely affect the Coast Guard's ability to respond to real distress calls. The situation is complicated by the fact that it is often very difficult to determine if an incident is a false alert, hoax, or real distress due to sketchy and/or contradictory information.

3.4.10.1 The following definitions apply:

(a) **False Alert:** A case where the subject reported to be in distress is confirmed not to be in distress and not to be in need of assistance. In a false alert case, the reporting source either misjudged a situation or inadvertently activated a distress signal or beacon resulting in an erroneous request for help, but did not deliberately act to deceive.

(b) **Hoax:** A case where information is conveyed with the intent to deceive.

NOTE: Until determined otherwise, Coast Guard units shall appropriately respond without delay to any notification of distress, even if suspected to be a false alert or hoax.

3.4.10.2 Distress broadcasts suspected to be hoaxes shall be thoroughly evaluated. The conclusion that a particular distress call is a probable hoax must be based on several articulable factors that would lead a reasonable person to conclude that the distress broadcast is false and there is no distress. **Until that determination is made, the distress broadcast shall be responded to as a distress**. At a minimum the following procedures shall be used in the evaluation to determine a probable hoax distress:

(a) Locate and replay the suspected hoax distress broadcast on the unit's voice logging recorder and utilize the direction finding capability, if available, to determine the direction of the call. If the line of bearing (LOB) is over land, identify any major waterways that are in the area of the LOB and eliminate the possibility that the distress is originating from that area. Use of sound manipulation software, if available, is encouraged to enhance or clarify the distress call. If used, the original and enhanced versions must be documented and saved as per Section 2.10.2.

(b) Analyze the call and consider all possible correlating SAR scenarios that could be associated with the event.

(c) If still deemed a probable hoax by the watchstander, replay the call to each level up the SAR chain of command. Each level should consider possible SAR scenarios. The final level of review is the District command center prior to final disposition by SMC.

(d) After all levels of review, if the consensus remains that the call is in fact a probable hoax, no other action will be required. If there is not consensus that the broadcast is a probable hoax, or if a recording was not made, the procedures for an uncorrelated distress broadcast will be followed.

3.4.10.3 Closing or Suspending a False Alert/Hoax Case. When the source of a hoax or false alert has been confirmed, SMC or the SC should close the case. However, when the source of a suspected false alert or hoax remains unknown, the case cannot be closed, but only suspended. Either the SC or SMC (with concurrence from the SC) may do this. In the event Coast Guard resources responded to a suspected hoax at the request of another agency, Coast Guard active involvement should only be withdrawn or reduced when the SC so directs.

3.4.10.4 Investigation/Follow-up. False alerts and hoaxes significantly drain our limited resources. All Coast Guard personnel are encouraged to find innovative ways to reduce the occurrence of these incidents. In the case of hoaxes, aggressive efforts to identify and prosecute offenders are important. To that end, all pertinent information relating to a suspected hoax shall be reported as soon as possible to the SC's RCC. The RCC shall evaluate the reports as they are received and determine the need for additional investigation. Early contact with their servicing legal office and coordination with CGIS will greatly enhance the likelihood of a successful criminal prosecution.

(a) **Federal Communications Commission (FCC) or other agency involvement.** The FCC can be an invaluable resource in efforts to identify a hoax caller. All RCCs should maintain a close relationship with the nearest FCC office and be familiar with its capabilities to assist in locating the source of a hoax call. The original recordings of a suspected hoax call shall be retained for use as part of the distress case evaluation and/or evidence for legal action. Legal action can result in penalties as discussed in Chapter 1 of this Addendum.

(b) **Coast Guard Investigative Services (CGIS).** CGIS is also a good source to relay information regarding hoax or suspected hoax cases. Often, they can follow-up with FCC and possibly assist in the investigation.

NOTE: 14 U.S.C. §88 (c) makes it a federal felony, punishable by significant imprisonment and/or a monetary fine, for anyone to knowingly and willfully communicate a false distress message to the Coast Guard or cause the Coast Guard to attempt to save lives and property when no help is needed. The statute also provides for a civil penalty of not more than $5,000 and holds the individual liable for all costs the Coast Guard incurs as a result of the individual's actions.

3.4.10.5 This policy does not attempt to define what is or is not an appropriate response in any given case. Operational commanders on a case-by-case basis must make that determination. This policy should not be interpreted by the public as creating any duty or obligation of the Coast Guard to respond to false alarm or hoax cases, and is intended only for internal agency administration, and is subject to change without notice. If public inquiry is received, the public may be informed of the policy. If informed, the public should be cautioned that it is solely for internal Coast Guard use, and that public reliance on the policy is not intended.

3.4.11 Mass Rescue Operations

Mass Rescue Operations (MROs) are civil SAR services characterized by the need to provide immediate assistance to large numbers of persons in distress, and doing so would exceed the capabilities normally available to SAR authorities. MRO planning, preparations and exercises are challenging and relatively complex. Effective arrangements for use of national and often international resources beyond those normally used for SAR are essential. MRO preparations require substantial commitments and partnerships among SAR authorities, regulatory authorities, transportation companies, military, commercial assistance and others.

MROs often need to be carried out and coordinated within a broader emergency response context that may involve hazards mitigation, damage control and salvage operations, pollution control, complex traffic management, large-scale logistics, medical and coroner functions, accident-incident investigation, and intense public and political attention, etc. Efforts often start immediately at an intense level and may need to be sustained for days or weeks.

The Coast Guard, as appropriate, should coordinate MRO plans with companies that operate aircraft and ships designed to carry large numbers of persons. Companies such as cruise ship or ferry operators should share in preparations to minimize the chances that MROs will be needed, and to ensure success if they are.

Planning for a contingency response to a MRO incident must be done before the fact in order to identify and engage resources and activities not normally used or called upon during normal Coast Guard operations. This may often include resources located hundreds of miles from the unit's area of responsibility to include inland and out-of-state assets. **Therefore, each SMC shall complete the forms provided in annexes two through seven in Appendix G (or locally reproduced versions; and updated yearly) in anticipation of a mass rescue event to document potential suppliers of air and surface assets, to document potential staging areas for resources and survivors, and to identify areas of risk where point of contact information is essential to a successful response.**

What the media reports may matter more than what SAR services do for shaping of public opinion about MROs. There should be no unwarranted delays in providing information to the media. Information must be readily available, and freely exchanged among emergency service providers, shipping, airline or other primary companies involved. Since opportunities to handle actual incidents involving mass rescues are rare and challenging, exercising MRO plans is particularly important.

Scenarios that could lead to an MRO include:

- hurricanes,
- heavy flooding,
- tornados,
- earthquakes,
- avalanches,
- weapons of mass destruction incident,
- hazardous material incidents,
- passenger ship or large airliner disasters.

3.4.11.1 An MRO focuses on the lifesaving aspects (rescue phase) of an incident response.

(a) The National SAR Plan (NSP) and the Federal Response Plan (FRP) provide basic guidance for immediate multi-agency MRO response. However, response to an MRO under the FRP is in addition to the SAR response, not in lieu of it. More detailed information and interagency guidance on this topic will be developed in the U.S. National Search and Rescue Supplement (NSS). The International Maritime Organization approved MRO input to the IAMSAR Manual on 6 February 2003. See Radiocommunications and Search and Rescue Circular 31, Guidance for Mass Rescue Operations.

(b) Whenever a situation may lead to an MRO and require a surge in response resources, the District or Area RCC, as determined by consultation, should normally handle SAR mission coordination. The SMC function may be shifted to or from another RCC (e.g., the Area or Air Force Rescue Coordination Center (AFRCC)) as appropriate, based on either geographic responsibilities or who is in the best position to coordinate the response.

(c) When a Coast Guard RCC is the organization responsible for response, it should immediately notify applicable federal, state or local resources in the area for assistance. DOD Directive 3025.1, *Military Support to Civil Authorities,* provides guidance to local military commanders for DOD response authority and procedures. The Coast Guard RCC shall also immediately contact the USCG Command Center (G-OPF) and, if the RCC is at the District level, the Area command, with the available information on the incident. Faxing the initial SAR check sheet, Mass Rescue Operation Supplemental check sheet, and other relevant documentation should follow up the initial call. Timely initial notification is critical; the report should not be delayed simply to gather additional information. The Command Center Duty Officer will initiate a conference call between USCG (G-OPR), DOD's Director of Military Support (DOMS), U.S. Joint Forces Command, the Federal Emergency Management Agency (FEMA), the National Guard Bureau and the AFRCC. The purpose of this telephone call is to synchronize available response capabilities and, if appropriate, expedite a federal disaster declaration.

(d) For overall coordination of lifesaving and other missions, an incident involving an MRO will often warrant designating an Incident Commander (IC) within or outside of the Coast Guard. In this case, until the rescue efforts are terminated or suspended, the RCC-designated SMC working under the organizational structure of the ICS should normally coordinate the MRO portion of the response.

(e) Coordination of SAR functions with other functions is usually achieved by assigning a representative of the SAR agency or of the SMC to the Operations Section of the ICS organization. This allows SAR services to be plugged into ICS and overall operations while still being able to function with relative independence in accordance with normal SAR procedures. ICS has an overall incident focus, while SAR services must remain focused on lifesaving. Except when functions other than SAR are relatively insignificant to the incident response, the IC should normally be someone other than the SMC. The priority mission will always be lifesaving, and the SMC should normally remain unencumbered by additional non-SAR duties. In some cases involving MROs, it may be better to locate the SMC near the incident site rather than at the RCC.

3.4.11.2 SAR Plan onboard Passenger Vessels

(a) The International Convention for the Safety of Life At Sea (SOLAS) requires certain passenger ships to have onboard a plan for cooperation with the SAR services in event of an emergency. The plan is sometimes referred to as a "SAR Plan" and is developed in cooperation between the ship, its company and the SAR service (U.S. Coast Guard for the U.S.). Also, the plan must include provisions for periodic exercises to test its effectiveness. Passenger ships falling under this SOLAS requirement are typically passenger ships and ferries on international voyages.

(b) To meet this SOLAS requirement, G-OPR, in conjunction with cruise industry input, developed the "*Search and Rescue Information Form*" (Figure 3-7) based on guidelines developed by IMO. The intent was to have the essential information needed to make an initial SAR response while maximizing access to the more detailed information available elsewhere (e.g., ship engineering plans). The "Search and Rescue Information Form" serves as the SAR Plan for a cruise ship and will be incorporated into the G-M inspection process for carriage of the plan by cruise ships and ferries under SOLAS. The form serves as a template but additional information may be included at the company's discretion. Other countries may require more extensive information as provided for in the IMO guidelines. Cruise ship companies will provide the completed form, and updated versions as needed, to G-OPR for forwarding to all the RCCs. The RCC will distribute within its district, as deemed necessary. In turn, G-OPR will provide any changes to the general Coast Guard information to a central point in the cruise industry for further distribution.

(c) SAR exercises will include passenger vessels. RCC and port-level contingency preparedness planning will incorporate the need for a passenger vessel SAR Plan into their exercise planning and their efforts with other emergency responders for SAR exercises.

3.4.12 Search Action Plans.

A standard SAP allows the reader to quickly find critical information by knowing that it will always be in a certain place and to identify vital information that is missing. Equally as important, the drafter of the SAP only needs to learn the format once, since it is standardized throughout the Coast Guard. The standard SAP format is provided in Appendix C. Benefits of this standardized format include:

- time saved in preparing the message;
- fewer calls looking for missing information;
- time saved finding information critical to executing the mission.

SEARCH AND RESCUE INFORMATION FORM

Ship's Name:
Company's Name/Address:
Ship Information:
- Basic Details of Ship:
  - MMSI:
  - Call Sign:
  - Country of Registry:
  - Type of Ship:
  - Classification Society:
  - Gross Tonnage:
  - Length Overall (in meters):
  - Maximum Draft (in meters):
  - Service Speed:
  - Maximum Number of Persons allowed onboard:
  - Number of Crew normally carried:
- Communications:
  - EPIRBs:
  - HF/MF Capabilities:
  - Inmarsat Capabilities:
    - SATCOM Numbers:
  - VHF capabilities:
  - Non-GMDSS communications capabilities:
- Lifesaving Equipment and capacities of each:
  - Lifeboats:
  - Rescue Boats:
  - Tenders:
  - Life rafts:
- Contact List:
  - 24-hour emergency contacts in order of precedence:
    Name position phone number (As detailed as necessary, but should be multiple contacts)
  - Further Company Points of Contact: (Company public relations officer is recommended.)

Figure 3-7 Search and Rescue Information Form for SOLAS Requirement

3.4.13 Automatic Identification System (AIS)

Automatic Identification System (AIS) is a mobile digital radio broadcast by a ship of its safety of navigation information. Though not designed specifically as a SAR tool, AIS can be useful in that role. AIS is mandated for carriage on a variety of ships on international voyages as well as certain U.S. domestic vessels. Some ships now carry AIS with many more expected to carry it as the requirement is phased-in through 2008. Currently, there is no international requirement to install equipment on shore but the U.S. intends to establish a national AIS as an element of maritime domain awareness (MDA) to identify vessels approaching or near the coastline, within U.S. ports and inland regions. Present capability for shoreside AIS is very limited but it is expected to grow quickly in the ports and then to a certain extent for the coastal waters. More specific information on the shoreside infrastructure will be provided as it becomes available.

AIS is a line-of-sight VHF-FM radio data transmission designed to:

- provide automatically to appropriately equipped shore stations, other ships and aircraft, information including the ship's identity, type, position, course, speed, navigational status and other safety-related information;
- receive automatically such information from similarly fitted ships;
- monitor and track ships; and,

- exchange data with shore-based facilities.

Merchant vessels and on-scene coordinators may have one opinion of how to use AIS for SAR response while shoreside SAR authorities or the SMC may have a different opinion. Benefits for SAR from this technology include:

- locate and identify the distressed vessel;
- identify vessels near the distress location or other vessels around the SAR facility;
- vector potential assisting vessels to the scene;
- serve as a means to crosscheck other reported information (radar, visual sighting, etc.);
- if carried on board the SAR response craft, serve as a means to track and monitor its safety;
- depending on the shoreside data network, provide local or regional electronic display of ongoing SAR operations.

Section 3.5
Rescue Planning and Operations

3.5.1 Overview

The majority of Search and Rescue incidents reported to the Coast Guard do not involve a search. Most often the location of the vessel or person involved in the incident is known and the action required is a rescue or assistance.

3.5.2 Rescue Planning

Chapter 6 of reference (a) and Chapter 2 of Volume II of reference (b), provide most of the information required for rescue planning. As with a search effort, rescues should be carefully planned and action directed through a Rescue Action Plan. The format for a Rescue Action Plan is provided in reference (a). Operations Risk Management (ORM) should be integrated into all SAR plans. (Refer to Section 1.2.3)

3.5.3 Rescue and the MSAP

Rescues encompass the full range of needs from distress to non-emergency incidents and should be evaluated and responded to in accordance with the provisions of the Maritime SAR Assistance Policy (MSAP).

3.5.4 Disposition of Lifesaving Devices

3.5.4.1 Emergency Position-Indicating Radio Beacons (EPIRBs) should be recovered and/or the signal secured whenever possible at the time of a rescue.

(a) EPIRBs should not be left afloat as a DMB. If additional persons remain missing or there is a need to mark the position of a vessel or floating debris a DMB should be used. (See 2.6.4.5)

(b) EPIRBs left adrift at the conclusion of a SAR incident, continue to transmit. The signal produced may prevent another distress beacon from being properly tracked or heard.

(c) EPIRBs used in SAR incidents that operated improperly or failed should be recovered for analysis.

3.5.4.2 Lifesaving vessels (life rafts, lifeboats and lifesaving float devices). A number of SAR cases involve recovering persons from life rafts, lifeboats or a variety of lifesaving float devices. These lifesaving vessels are made of wood, metal, fiberglass, rubber, and other materials, which, if left adrift, pose a hazard to navigation, contribute to environmental pollution and create the possibility of future false alarms. Additionally, the lifesaving vessel may be carrying petroleum products (if motorized) or other materials hazardous to the environment.

(a) The preferred action is to recover and deliver lifesaving vessels ashore. This may be accomplished by the on scene rescue units, a Good Samaritan vessel, the owner, or if arranged by the owner, via commercial salvage.

(b) If conditions and circumstances do not permit a safe recovery by on scene rescue units, rescue personnel should make every effort to mark the lifesaving vessel. The marking shall clearly indicate that the Coast Guard has investigated the lifesaving vessel. Markings should be made to be visible and recognizable from the air and sea at a distance of 300 feet. A broadcast notice to mariners should be made appropriate to location, type of hazard and future disposition.

(c) For lifesaving vessels left adrift which pose a hazard to navigation, the owner shall be advised of the responsibility for marking and recovering the vessel including appropriate lighting for night.

(d) For lifesaving vessels left adrift that are pollution hazards, the owner and/or responsible party shall be advised of responsibilities under the appropriate laws/regulations. Notify the cognizant Coast Guard Marine Safety Office.

(e) Destroying lifesaving vessels should only be carried out when there is no other reasonable option. Generally, destruction should only be done if the lifesaving vessel cannot be recovered or marked due to on scene circumstances; its condition or it poses a particular hazard if left afloat.

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Section 3.6
Measures of Search Effectiveness

Despite past reliance upon POD as a measure of search effectiveness, POS is a far more effective measure and the method of choice in the *IAMSAR Manual* and the *National SAR Supplement*.

3.6.1 Probability of Success (POS)

Although POD has been in the search planning vocabulary and used with the manual search planning method for many years, POS provides a much greater measure of search quality. POS is a statistically generated measure of search effectiveness and is the probability that a given search will succeed in locating the search object. POS depends on two factors: (1) the probability that the object is in the area searched (POC) and (2) the probability of detecting that object (POD) if it were there. Probability of Success is the product of the Probability of Containment and the Probability of Detection: POS = POC x POD. For a particular search, POS answers the question, "If the scenarios, POC, and POD values are an accurate reflection of the available information and data, what is/was the probability of finding the search object?" Cumulative POS is a measure of search effectiveness to date and answers the question, "If the scenarios, POC, and POD values are an accurate reflection of the available information and data, what is the probability that the search object would have been found by now?" Achieving a high cumulative POS value without locating the search object is an indication that either the object cannot be detected (e.g., because it is on the bottom in deep water) or that the scenarios, POC values, and/or POD values are suspect and a thorough of review of all the available information is in order to determine whether it has been interpreted, computed, and used correctly.

3.6.1.1 **POD (Probability of Detection)** is the statistical measure of detection performance. It is a function of sweep width, level of effort and size of the area searched POD is a "conditional probability." The "condition" is an assumption that the search object is definitely in the area searched. POD answers the question, "If the search object was in the searched area at the time of the search, what was the probability of detecting it?"

3.6.1.2 **POC (Probability of Containment)** is described as the probability that the search object(s) are contained in a particular area. Using computer simulation (CASP) we can develop containment probabilities (POC) based upon drift and scenario assumptions.

NOTE:
- POS measures search effectiveness.
- POD measures search sensor detection performance.
- POC measures search planning effectiveness.

3.6.2 The Value of Using POS

POS calculates search effectiveness by incorporating POC (the CASP weighted replication file) with the POD. POD only measures detection effectiveness; that is, it is used to estimate how well a search area was searched, but it does not incorporate the likelihood that the object will actually be in the particular area searched. POS does. The following examples will clarify this discussion:

- Searching an area that has no chance of containing the search object (POC = 0) will not be successful no matter how high the POD. Even if POD was 100% (which is not realistic) the POS is still zero (0 x 1 = 0).
- To give a more realistic example, if there is a 50% chance of the search object being in an area, then searching that area with a coverage factor of 1.0 (POD of 78%) produces a POS of 39% (.5 x .78 = .39). Even if POD was 100% (again unrealistic), the POS for this search rises to only 50% (.5 x 1 = .5) and no further because there is still a 50% chance that the search object was not in the search area.

3.6.2.1 POS balances options of looking very carefully in a small area for the object against looking less thoroughly over a larger area for the same object. As an analogy, think of looking for a misplaced set of keys. One could meticulously look for the keys in the sofa; moving pillows, pulling apart cushions, putting one's hands under the

sofa and in the joints of the furniture (high POD but low POC). Or, the same time could be used searching for the keys by scanning the tops of the sofa, mantel, bookcase and the rest of the family room and kitchen, concentrating on the most likely spots (lower POD but high POC). If it were known that the keys were lost in the sofa, option one would yield a higher POS. If there was uncertainty about where the keys were last seen or lost, then option two would probably yield a higher POS.

3.6.3 Determining POS

In Appendix H, a full comparison of determining POS within the Manual Solution with the CASP Solution is provided, as well as a discussion and associated graphics to make the "math" involved easier to understand.

3.6.3.1 Manual Solution. The manual solution can incorporate POC and POS. However, it does so in a way that is hidden from the search planner. Search planners, prior to the advent of CASP and the *IAMSAR Manual*, did not use POC and POS because there was no practical way to compute them manually. Unfortunately, this left an incorrect impression that POD is the statistic of interest in terms of measuring search effectiveness. It is not. As previously stated, POS is the measure of overall search quality/effectiveness.

3.6.3.2 CASP Solution. CASP is designed to provide a search plan that optimizes POS. However, caution must be used when using CASP to develop a search plan. It may optimize POS without regard to safety by overlapping search areas to get redundant coverage over high probability cells. This is equivalent to putting two search units in the same area at the same time. This not only is an inefficient use of SRUs and it may contribute to an accident. In these cases, the controller must establish separate areas and assign search resources to ensure safety.

Section 3.7
Aspects of Survival

3.7.1 Use of Hypothermia Software and Tables

The human body can experience symptoms of hypothermia at any temperature. Environmental factors such as wind and precipitation may severely limit the available search time. A survivor's life expectancy varies with the type of clothing worn, the clothing's wetness, survivor's activity, initial body temperature, physical condition, psychological condition and strength of "Will to Live." Further discussions about hypothermia can be found in the reference (b).

Computerized hypothermia tools exist that provide a good foundation to determine the effects of hypothermia for an average person and are recommended for SAR planning purposes. All calculations done using computerized tool should be "cross-checked" using the hypothermia table found in Appendix N of reference (b) and shall be included in case packages used to make any suspension decisions. These tools are guidelines, not absolute factors, for search planning and suspension.

3.7.2 Will to Live

The will to live is defined as the desire to live despite seemly insurmountable mental and/or physical obstacles and varies from one individual to another. The attributes that have the greatest effect on a person's will to live are their attitude and physical condition at the time of the incident. The will to live is one of the greatest intangibles for SAR controllers to consider when planning or suspending a search. Survival times are calculated minimums based on an average person, and the data does not take into consideration the will to live, which will differ, for every person depending on their situation. The will to live is extremely hard to define under any circumstances, but it is a part of the "Art of Search and Rescue versus science" and should be considered throughout the case.

3.7.2.1 Controllers should do their detective work by talking with family members, friends and/or co-workers. Questions should be posed tactfully about any significant emotional events (i.e. death in family, divorce, birth of child, newly wed) that may have occurred recently. This can provide a gauge of the victim's mental and physical state when he or she was last seen.

3.7.2.2 Case suspensions should not be solely based on data or tables. Times of possible case suspensions should be an optimistic guess that a person has a strong 'will to live'. Conversations with family members, friends, and/or co-workers will provide the best indication of this. Again, every case is different and every person's will to live is different and should be an educated guess weighing all internal and external factors.

3.7.2.3 With the proper attitude, people can exhibit exceptional physical and mental strength not normally thought possible.

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Section 3.8
Conclusion Of SAR Operations

There are three terms used to indicate the status of search and rescue cases; *Case Closed*, *Case Pends*, and *Active Search Suspended Pending Further Developments*. Each status has particular criterion associated with its use. The definitions and criterion for each status are described in the following sections.

3.8.1 Case Closed.

When the search object(s) is located, assistance to the object is completed, and no other SAR issues arise, the search and rescue case is considered closed. No further SAR related action by the Coast Guard is necessary or contemplated.

3.8.1.1 Persons who are the object of a search must all be accounted for in order for a case to be closed. When persons remain missing at the conclusion of SAR efforts, the case cannot be closed.

3.8.1.2 Personnel in MEDEVAC cases must either be transferred to other medical authorities or no longer require medical assistance once delivered ashore for the case to be closed.

3.8.1.3 When the object of a SAR case is property, the case may be closed when the object no longer requires SAR assistance. For vessels aground, sunk or in other condition requiring what is determined to be purely salvage assistance, the case may be closed.

3.8.2 Case Pends.

This term refers to an open case in which the search object has not yet been located and not all search efforts have been completed, or the search object is located, but rescue or assistance efforts have not yet been undertaken or concluded. Further action by the Coast Guard is necessary and planned. (Action may include coordination of other agency assets.)

3.8.3 Active Search Suspended (ACTSUS) Pending Further Developments.

When a SAR case cannot be closed and further search efforts appear futile, the search may be discontinued. The SAR case will remain open until the object of the search is located. If new information is received indicating the object of the search may not have been in the areas searched, or pertinent details of the search object were other than those previously reported, the search may be resumed.

3.8.3.1 The decision to grant ACTSUS is a judgment call that must be based on a careful analysis of the factors of an individual case. ACTSUS authority normally rests with the applicable SAR Coordinator, but may be delegated in writing. The authority to grant ACTSUS carries with it the responsibility for final review of the SAR efforts, requiring knowledge of search planning and a clear understanding of the measures of search effectiveness (see section 3.6.). In general the level for suspension lays one level in the SAR chain of command above the SMC. For some cases where the Group/Activity is the SMC, the Group/Activity Commander may also have suspension authority. This is acceptable in these cases because of the relative lower risk of the case type and consideration that the planning functions are actually being performed by persons other then the Group/Activity Commander personally. Prior to ACTSUS for cases involving persons known to be missing, the District (osr) at a minimum shall be briefed.

3.8.3.2 A sample SAR Case Suspension Checklist is included in Appendix G. This checklist or a locally produced checklist is recommended as an integral part of the suspension decision process.

3.8.4 Suspension by Other SAR Authorities when Coast Guard Units are Assisting

When another agency is the SMC for a search and Coast Guard units are participating in the effort, the Coast Guard will normally cease all efforts when the SMC suspends the case.

3.8.4.1 Actions in response to questionable suspension by other SAR authorities. There may arise cases, of which the Coast Guard is involved, when the other SAR authority, according to Coast Guard standards, makes a questionable suspension decision. Under these circumstances the following actions should be taken:

(a) The involved unit(s) should first convey their concern to the other agency SMC.

(b) If the nature of the concerns is not adequately addressed by the other agency SMC, the unit should brief up their SAR chain of command to the Coast Guard SAR Coordinator (RCC).

(c) The SAR Coordinator (or representative RCC) should contact the other agency to discuss the concerns.

(d) If the concerns are not answered at this level, the SC shall make a decision to either proceed independently to conduct further searches or accept the decision of the other agency.

Section 3.9
Case Documentation

Case documentation occurs both during and after an incident. During an incident, it serves to keep other involved parties informed and also to assist planning of subsequent operational effort. The SAR case file provides invaluable documentation for record purposes, determination of potential lessons learned and data for MISLE, which is an important management tool.

3.9.1 SAR Case Claiming

Coast Guard units shall claim credit for actions taken in response to an activation of the SAR system. Generally, activation of the SAR system will be those situations in which resources coordinate or render assistance, regardless of position or location of the incident. The intent is to ensure Coast Guard resource activity is properly documented to support analysis of SAR operating needs, management and budgetary decisions. Accordingly, this policy should be interpreted using common sense and reasonableness. Case claiming is documented by means of the Marine Information for Safety and Law Enforcement (MISLE) discussed later in this section and more extensively in Appendix B.

3.9.1.1 Requirements for Claiming a Case. Units may claim a case whenever a response is made no matter the time or effort expended. However, units are required to claim a case and submit MISLE data when a Search Rescue Unit (SRU) is launched or when more than 30 minutes of effort are expended. This applies to cases initiated by ELT/EPIRB, DSC and INMARSAT distress alerts. There is no need to claim every ELT/EPIRB case that expends less than 30 minutes of effort, as the RCCs are already required to submit an Incident History Feedback Sheet to the NOAA MCC, who enters the data into their database. For further DSC reporting requirements, see Section 2.B.2.j.

3.9.2 SAR Case Situation Reports (SITREPs)

General reporting requirements for operational incidents, including SAR, are described in reference (t). Passing key operational information in a timely manner, both up and down the SAR organization, is critically important to effective SAR case prosecution.

3.9.2.1 Standard Coast Guard SAR SITREP format. The standard format shall be used, other formats are not allowed except as detailed in paragraph 3.9.2.4; operational commanders may require additional information. The standard SAR SITREP format for Coast Guard use has been developed based on references (a), (b) & (t), and the United States Message Text Format (USMTF), with consideration of field unit requirements and desires. The Coast Guard standard SAR SITREP format and an example are provided in Appendix C.

3.9.2.2 Transmission methods. Timely dissemination of information can be more critical than the method of its transmission. Voice communications, followed later with written record traffic, may be substituted for initial SITREPs between the On Scene Commander (OSC) and SMC. Facsimile and e-mail are also acceptable substitutes in all cases at the discretion of the SMC. Information required does not change with transmission method and should be provided to the fullest extent possible.

3.9.2.3 Frequency of reports. Frequency of SITREPs for individual SAR cases shall be set by the SMC and subject to the following conditions:

(a) The period covered will normally coincide with each search effort (efforts of each individual search plan).

(b) The minimum frequency shall be daily.

(c) Initial SITREPs should be submitted as soon as significant information is available but should not be delayed unnecessarily for confirmation of all details. Amplifying information can be provided in subsequent reports.

These are the minimum requirements. SAR Coordinators may establish a higher frequency for operations within their search and rescue region.

3.9.2.4 SITREPs for DOD operations. The USMTF format shall be used for SITREPs when the SAR operation is DOD

directed or if otherwise instructed.

3.9.3 Medical Evacuation (MEDEVAC) Report

As directed by reference (u), MEDEVAC Report Form (CG-5214) shall be used for all SAR cases involving injured or ill persons. The form provides patient clinical information for the receiving medical facility, serves as a treatment guide for administering medical care, and allows data collection and evaluation. A sample MEDEVAC Report Form is in Appendix D.

3.9.4 Marine Information for Safety and Law Enforcement (MISLE) Reports

3.9.4.1 MISLE is the primary means of collecting and storing information relative to all Coast Guard SAR operations. This information is essential in order to have a true picture of the effort expended by the Coast Guard in support of SAR operations and a clear understanding of SAR incident trends. Additionally, the MISLE database is a measurement tool for determining the Coast Guard's effectiveness in the SAR aspect of its Maritime Safety Mission. MISLE information can also be used to:

- measure unit workload and effectiveness,
- determine resource utilization and needs,
- justify budget requests to meet projected requirements,
- analyze system operations for potential improvement and savings, and
- justify policies and procedures to manage the overall SAR Program more effectively.

3.9.4.2 MISLE data is entered at the unit level directly into a web-based database. Use, access and training information is provided on-line at the Operations System Center MISLE intranet site. Appendix B specifies the data collection and reporting procedures for Coast Guard units.

3.9.4.3 Units shall enter SAR data for every case they claim.

3.9.5 SAR Case Studies

To improve performance at all levels of the SAR system, it is critical to thoroughly analyze significant cases and share lessons learned. Volume II of the International Aeronautical and Maritime Search and Rescue Manual provides an overview of when, why and how to conduct a SAR Case Study.

3.9.5.1 Coast Guard SMC's shall conduct a case study when:

(a) Survivors are found inside the search area, after a search has been suspended;

(b) Survivors are found by someone not involved in the search, outside the search area;

(c) Directed by COMDT G-OPR, the Area or District Commander.

3.9.5.2 A SAR case study should be conducted whenever a SAR coordinator believes there may be benefit to the SAR System to share lessons learned and best practices. If recommendations have Coast Guard wide, national or international SAR system implications, the original study shall be routed via the chain of command to COMDT G-OPR for action. If recommendations impact local (unit, Group, District) policies or procedures, the original study shall be routed to the level that has authority over those policies or procedures for action. Copies of all SAR case studies shall be forwarded to COMDT G-OPR and the National SAR School. The program manager will be responsible for working with the National SAR School to extract lessons learned and best practices and disseminate that information.

3.9.5.3 SAR Case Studies are not Administrative Investigations; they are to be used primarily as a means of improving the SAR system. SAR Case Studies are also valuable teaching tools that benefit current and future SAR and

communications watchstanders. Case studies consider actions that could or should have been taken, as well as those actions not typically expected but show a benefit to the SAR system. Our goal is forward-focused and straightforward: to foster the continuous improvement, which is the hallmark of Coast Guard Search and Rescue.

3.9.5.4 A SAR case study deals only with significant factors, and should include the following:

(a) Subject line identifying the case with descriptive wording and SAR case number.

(b) A consolidated case narrative.

(c) Assumptions used in planning each search effort, including distress positions and times, search object types, and leeway parameters.

(d) Environmental data used, including water current, wind, and visibility.

(e) Actual distress positions and times, and actual search object type.

(f) For each day of the operation, search area coordinated, type of craft assigned, search patterns used, planned and actual sweep widths and track spacing, and computed datum points.

(g) Debriefing information from survivors, giving actual drift reconstruction, observed environmental conditions, and any sightings of search craft. See section 3.9.5.7 for information regarding survivor debriefing.

(h) Analyses of the effectiveness of Computer Assisted Search Planning (CASP) or other computerized search planning system used, and, when appropriate, the reasons why CASP was not used. The Coast Guard Operations System Center (OSC) and the NOAA Mission Control Center (MCC) shall be notified immediately of any pending case studies involving COSPAS-SARSAT, Amver, or CASP so historical data, voyage files, environmental data, system status, etc., as appropriate, can be captured on magnetic tape and retained for later analysis. SAR Case Studies sent to Commandant (G-OPR-1) should also include copies of computer SAR inputs and outputs and mailed separately if too bulky.

(i) Comments on use or lack of detection aids, performance of equipment, adequacy of communications and SRUs, and suspected reasons for failing to detect the object.

(j) Information on objects and persons located, including reference to their location within the CASP generated probability map (when CASP is used).

(k) Controller debrief and RCC/Command Center equipment data. Whenever practicable, interview or obtain statements from all controllers and watchstanders who participated in case prosecution. Include reference to the performance and adequacy of RCC/Command Center equipment.

(l) Computer floppy disks or appropriate electronic media containing all C2PC calculations and output including drift planning, icons, chart reference, etc.

(m) Copies of all Search Action Plans, SITREPS and other Message Traffic.

(n) All completed Checklists and Quick Response Cards.

(o) Chronologs.

3.9.5.5 More than one person should conduct a SAR case study. Participation should be extended to the HQ program manager, (G-OPR), SAR School, other RCCs, and Group Command Center's, as appropriate.

3.9.5.6 SAR Case studies may be limited to addressing only certain aspects of a case that are of particular interest. For example, problems with communications, use of computer search assets (CASP/Amver etc.) or international coordination or assistance might be singled out for examination. The Operations Systems Center shall be notified by most direct/rapid means of any problems encountered when using or attempting to use Amver or CASP. The MCC shall be notified by most direct/rapid means of any problems encountered when using or attempting to use the COSPAS/SARSAT system. Problems shall be documented via SITREP.

3.9.5.7 **Survivor debriefing and equipment data.** SAR case studies provide opportunities to analyze survivor experience and also lifesaving equipment performance. Survival in hostile environments is affected by many

variables including the physical condition of the survivors, action of the survivors, reinforcement given by rescue resources prior to rescue, and safety or survival equipment.

(a) Immediate survivor debriefing is necessary in cases where other persons remain missing. In addition, information given by survivors soon after their ordeal will be beneficial in determining how their experience affected their survival and how rescue personnel prosecuted the case from their perspective. This information is important for the Coast Guard to use in critiquing its rescue operations and in making improvements in SAR operations. The particulars of a survivor debriefing will vary case by case. Interviewers are to ascertain what information is pertinent for a case. Some examples of the type of information are:

(1) Cause of accident or distress;

(2) Age, physical condition, experience of survivors and fatalities;

(3) In cases where unsuccessful searches were conducted prior to location or case closing, determine whether search resources were seen or heard, whether any other vessels or aircraft were seen or heard, and what means survivors used to attempt to communicate or signal;

(4) Times of significant events during the distress, and times of sightings of resources.

(b) If survivors had onboard, used, or had problems with safety and survival equipment, or have recommendations for improvements, Coast Guard personnel debriefing survivors should obtain the following information and include it in the SAR case study or narrative:

(1) General condition of equipment, including defects and inherent capabilities;

(2) Coast Guard approval number (if approved);

(3) Name of manufacturer (if not approved);

(4) Size, capacity, or model number (if not approved);

(5) Date of manufacture; and

(6) Survivor statements on their experience with the equipment, including use and effectiveness.

3.9.5.8 Freedom of Information Act (FOIA) considerations. FOIA governs releasing case studies to the public. Certain portions of case studies may be exempt from release under the Freedom of Information Act or if the incident is under litigation, some records could fall within the public disclosure exemptions. Refer to reference (i) and consult with the servicing Legal Office for specific instructions on release of information prior to releasing case studies.

CHAPTER 4
GENERAL SAR POLICIES

4.1 SAR Policies Overview

4.2 Maritime SAR Assistance Policy (MSAP)
4.2.1 Preamble
4.2.2 Definitions
4.2.3 Background
4.2.4 Discussion
4.2.5 Policy
4.2.6 Procedures
4.2.7 SAR Coordinator and SMC Responsibilities
4.2.8 Marine Assistance Request Broadcast Format for Radiotelephone Transmission

4.3 General Salvage Policy (Other than Towing)
4.3.1 General
4.3.2 Small Craft
4.3.3 Operator Insistence

4.4 Firefighting Activities Policy
4.4.1 Overview
4.4.2 Operations

4.5 Direction and Navigational Assistance for Mariners
4.5.1 General
4.5.2 Lost/Disoriented Mariner
4.5.3 Hazardous Bars and Inlets
4.5.4 Weather Information

4.6 SAR Cost Recovery and Reimbursement
4.6.1 SAR Cost Recovery
4.6.2 SAR Cost Reimbursement
4.6.3 MEDEVAC at Sea
4.6.4 MEDEVAC vs. AIREVAC from Land

4.7 Emergency Medical Assistance
4.7.1 MEDICO
4.7.2 MEDEVAC
4.7.3 District Procedures
4.7.4 Medical Resources
4.7.5 Procedures
4.7.6 Transport of Next of Kin (NOK) with MEDEVAC Patients

4.8 Justification for Non-Maritime EMS Response
4.8.1 Statutory Background
4.8.2 EMS Agreements
4.8.3 Air Transportation Between Medical Facilities (Medical Transport)
4.8.4 Transport of Medical Supplies, Equipment, Blood, and Human Organs for Transplant
4.8.5 Escort of MEDEVAC Aircraft by Emergency Fire Equipment

4.9 Ice Rescues
4.9.1 Ice Rescue Operations
4.9.2 Ice Development and Characteristics
4.9.3 Ice Rescue Planning

4.9.4 Risks to Crews
4.9.5 Ice Rescue Resources and Utilization
4.9.6 Example of an Ice Rescue Instruction/Bill/Standing Order

4.10 Float Plans
4.10.1 General
4.10.2 Receiving a Float Plan
4.10.3 Action Taken After Receiving a Float Plan
4.10.4 Float Plan Form
4.10.5 Float Plan Services

4.11 Self-Locating Datum Marker Buoys
4.11.1 The SLDMB System
4.11.2 SAR Mission Coordinator Actions
4.11.3 Failed SLDMBs
4.11.4 Requests for SLDMB deployments by other agencies or nations
4.11.5 SLDMBs and use of Standard RDF/DMBs
4.11.6 SLDMB Deployment by Search and Rescue Units
4.11.7 Using SLDMBs to Mark Abandoned Vessels and Other Objects
4.11.8 Operating Parameters
4.11.9 Disposition of Recovered SLDMBs
4.11.10 Data Available Outside the Coast Guard
4.11.11 Logistics

4.12 SAR and Security Concerns
4.12.1 Non-Immigrant Security Concerns

Section 4.1
General SAR Policies Overview

The United States Coast Guard is the world's largest search and rescue organization. Saving lives and property at sea is a core mission that has defined the service for almost a century. This chapter discusses various policies with which SAR personnel must be familiar.

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Section 4.2
Maritime SAR Assistance Policy (MSAP)

This section sets forth policy and procedures for handling requests for any type of Search and Rescue (SAR) assistance from the Coast Guard and defines Coast Guard relationships with other possible sources of assistance. It establishes internal Coast Guard policy guidance only and is not intended to confer any right or benefit nor create any obligation or duty to the general public.

4.2.1 Preamble

The MSAP is the result of an effort enacted by Congress in 1982. It directed the Commandant to "review Coast Guard policies and procedures for towing and salvage of disabled vessels in order to further minimize the possibility of Coast Guard competition or interference with...commercial enterprise." The review was directed because of congressional concern that Coast Guard resources were being used unnecessarily to provide non-emergency assistance to disabled vessels that could be adequately performed by the private sector.

The MSAP represents more than a decade of development of relationships among the Coast Guard, Congress, the commercial towing industry, and the Coast Guard Auxiliary. Each iteration of the MSAP has received close scrutiny. It has been a give-and-take process that has culminated in a policy that is equitable to all stakeholders.

Problems have often arisen when individuals or groups have interpreted the MSAP to fit their own particular situation or personal agenda. This contradicts the aim of the policy and creates unnecessary conflict among those for whom it was intended to serve. The key is to follow the policy as it is intended, to seek clarification where necessary, and to collectively ensure that the disabled and/or endangered mariner gets fair, reasonable and consistent service throughout the United States. However, in order to clarify some of the more often misinterpreted aspects of the MSAP, notes have been added.

4.2.2 Definitions

4.2.2.1 Coast Guard Resources: Includes regular active duty personnel; reserve personnel when serving under any form of active or inactive duty orders; auxiliary personnel when serving under orders; cutters; boats; aircraft; and equipment of regular, reserve, and auxiliary Coast Guard units.

4.2.2.2 Emergency Phase: Classification made by the SAR Mission Coordinator (SMC) upon receiving a request for assistance. The three emergency phases; i.e., UNCERTAINTY, ALERT, and DISTRESS, are described in reference (a). A shortened definition of each is:

(a) An UNCERTAINTY phase exists when there is knowledge of a situation that may need to be monitored, or to have more information gathered, but that does not require moving resources.

(b) An ALERT phase exists when a craft or person is experiencing some difficulty and may need assistance, but is not in immediate danger or in need of immediate response. Apprehension is usually associated with the ALERT phase.

(c) The DISTRESS phase exists when grave or imminent danger requiring immediate response to the distress scene threatens a craft or person.

4.2.2.3 On Scene: When the assisting resource has completed any necessary transit to the vessel requiring assistance.

4.2.2.4 Safe Haven: A Safe Haven is considered a place that can accommodate and will accept the safe mooring of the vessel, and has available a means of communication, normally a telephone.

4.2.3 Background

4.2.3.1 Coast Guard Mission. The Coast Guard promotes safety on, over, and under the high seas and waters subject to the jurisdiction of the United States. The Coast Guard is authorized by law to develop, establish, maintain, and operate search and rescue facilities. The Coast Guard is authorized to perform any and all acts necessary to rescue

and aid persons; and to protect and save property at any time and at any place where its facilities and personnel are available and can be effectively used. However, there is no legal obligation for the Coast Guard to undertake any particular rescue mission.

4.2.3.2 **Coast Guard Auxiliary Mission.** The Coast Guard Auxiliary is a volunteer, non-military organization of civilians under the direction and administration of the Coast Guard. The functions of the Auxiliary include promoting safety and effecting rescues on the high seas and U.S. navigable waters. Auxiliary operational facilities are excellent resources that can, within their capabilities, enhance the Coast Guard's ability to respond to maritime emergencies. The Auxiliary has a proud tradition of support to the Coast Guard and helping mariners needing assistance on the water.

4.2.3.3 **Other Assistance Available.** The Coast Guard has often been the only source of readily available assistance to recreational boaters. However, commercial and additional volunteer sources of assistance exist and are capable and willing to provide various services to mariners. Additionally, other federal agencies and many state, county, and local governments have resources which may be capable and willing to assist the Coast Guard or otherwise provide assistance to mariners.

4.2.3.4 **Commercial Operator's License Required.** 46 U.S.C. § requires the operator of any vessel that tows a disabled vessel for compensation to have a valid license to operate that type of vessel in that particular geographic area.

4.2.4 Discussion

4.2.4.1 **Prevention.** The Coast Guard emphasizes that the best deterrent to needing assistance is a prepared and knowledgeable mariner. Before departing, the prepared operator ensures that all safety equipment, sufficient fuel for the voyage, and necessary charts are onboard; the vessel is in good operating condition; the radio is operating properly; and that someone knows the sailing plan of the operator and will notify the Coast Guard if the vessel fails to return when expected.

4.2.4.2 **Primary Concern.** The Coast Guard's primary concern in a search and rescue situation is that timely and effective assistance be provided.

4.2.4.3 **Responsibility for Action.** In search and rescue, the Operational Commander/SMC is usually in the best position to assess the circumstances of a particular case, and to take whatever steps are necessary to promote the safety of life and property.

4.2.4.4 **Safety Concerns When Disabled.** There is an inherent danger associated with being disabled on the water. Although a specific situation may not be classified as being in the DISTRESS emergency phase by the SMC, there may still be a real concern for safety either in the mind of the SMC or the mariner; i.e., the incident is in the ALERT emergency phase. The SMC must be sensitive to the level of apprehension caused in the mind of the mariner when having a problem in a small recreational vessel, particularly when concern is specifically expressed. The policy herein permits more expeditious response in those cases where the mariner expresses apprehension for the near-term safety of the occupants.

4.2.5 Policy

4.2.5.1 **Distress.** Immediate response will be initiated, if feasible, to any known situation in which the mariner is in imminent danger. This response may be provided by regular Coast Guard; Coast Guard Auxiliary; or other federal, private, state, local, or commercial entity resources. The SMC may use all sources of assistance in a distress situation without concern for conflict with private enterprise.

4.2.5.2 **No Conflict Concern--Any Situation.** Private organizations (non-commercial), state and local organizations, and Good Samaritans are acceptable sources of SAR assistance. When volunteered or available, their help can be used without any concern for conflict with commercial providers. However, if their expertise is unknown, the SMC shall more closely monitor the assistance provided. This is especially true in the case of Good Samaritans.

4.2.5.3 Guiding Principles in Non-Distress Cases. When specifically requested assistance, such as a commercial firm, marina, or friend, is not available, a request for assistance will be broadcasted. If a commercial provider is available and can be on scene within a reasonable time (usually one hour or less) or an offer to assist is made by a responder listed in the previous paragraph, no further action by the Coast Guard, beyond monitoring the incident, will be taken. Otherwise, a Coast Guard Auxiliary facility, if available, or a Coast Guard resource may be used.

NOTE: "Monitoring" of a non-distress incident need not necessarily constitute a radio communications schedule.

Three principles that guide assistance to vessels not in distress are:

(a) The first responder on scene with the vessel requesting assistance normally will provide assistance,

(b) If a Coast Guard resource or Auxiliary facility takes a disabled vessel in tow, the tow will normally terminate at the nearest safe haven, and

(c) Once undertaken, there is no requirement to break the tow except as described below in paragraph 4.2.6.6, "Relief of Tow".

NOTE: General procedures and instructions for towing are contained in the Boat Crew Seamanship Manual, COMDTINST M16114.5(series) (ref. (e)).

4.2.5.4 Non-Distress Use of Coast Guard. The Coast Guard both supports efforts of private enterprise and encourages volunteerism in assisting mariners. Coast Guard resources will not unnecessarily interfere with private enterprise. Coast Guard resources normally do not provide immediate assistance in non-distress cases **if alternative assistance is available.** A Coast Guard resource may assist in a non-distress situation when no higher priority missions exist and no other capable resource is reasonably available.

NOTE: "Reasonably available" means that the resources should be able to respond before the situation deteriorates.

4.2.5.5 Acceptable Auxiliary Employment. When on routine safety patrol under orders, Auxiliary operational facilities may be deployed to minimize response time to requests for assistance. Every effort shall be made to provide maximum SAR coverage in the assigned area of responsibility by using all available resources effectively. Auxiliary facilities may also be available for callout when not on routine patrol. Auxiliary facilities will be used to the extent of their capabilities and availability.

4.2.5.6 Inspection of Alternate Resources Not Required. There is no requirement for the operational commander to inspect, certify, or otherwise categorize the capabilities of commercial providers or any organization that responds to requests for assistance by mariners. Accepting or rejecting an offer of assistance is a function of the vessel operator. However, the operational commander should be familiar with the availability, capabilities, and operating practices of these alternate assistance providers, as they may form a significant element in the overall assistance network.

4.2.5.7 Conflict of Interest for Coast Guard and Auxiliary Personnel. Because of the possibility of conflict of interest, active duty Coast Guard personnel, Reservists under active duty or inactive duty orders, and Auxiliarists under orders are prohibited from engaging in commercial assistance activity of any sort. Likewise, Reserve and Auxiliary personnel are not to be used in any capacity that might give rise to the perception of a conflict of interest. Vessels and aircraft used for commercial assistance activities shall not be accepted as an Auxiliary facility, and a designated Auxiliary operational facility shall not be used as part of commercial assistance activities **at any time.**

NOTE: An Auxiliary facility remains so designated even when not under orders as long as the person(s) is/are a member of the Auxiliary.

4.2.5.8 Assistance to Auxiliary Facilities. Coast Guard resources or Auxiliary facilities may be used to help Auxiliary facilities in need of assistance at any time.

4.2.5.9 Use of Government Frequencies. Government frequencies are reserved for authorized use by government agencies. Commercial enterprise must use designated commercial frequencies. Commercial enterprise is NOT permitted to interfere with the Coast Guard's gathering of information or communicating with a vessel requesting assistance. They may, upon hearing of a request for assistance on a government channel, hail the vessel desiring assistance on an authorized calling frequency and switch them to a commercial channel to conduct business when Coast Guard communications are completed. They may also proceed to the location of the vessel requesting assistance, based on information overheard on the government channels. As net control, the Coast Guard MAY permit nongovernmental entities to conduct short business transactions on a government channel on a not-to-interfere basis, but any unit so doing must continue to monitor the communications.

NOTE: There is no requirement that the commercial channel be a frequency normally monitored by the Coast Guard.

4.2.6 Procedures

4.2.6.1 Obtain Information and Classify Case. When the Coast Guard receives a call for assistance, the SMC shall evaluate the circumstances to determine the severity of the case using information obtained from the mariner. It is the **initial** determination that will govern how a case is to be initially treated. Later developments may cause the SMC to reclassify the case and modify the response. If there is any question as to the degree of danger to persons or property, the case should be classified as being in the DISTRESS phase. A SAR event is dynamic. Information must be obtained and evaluated as the case progresses. The SMC shall take action appropriate to the situation. In determining the appropriate emergency phase, the SMC may consider a variety of factors, such as, but not limited to, the following:

(a) Nature of the situation;

(b) Position or lack of known location;

(c) Type, size, reported condition of vessel, food, water, emergency signaling devices, and survival/life saving equipment onboard;

(d) Visibility, including daylight or darkness conditions;

NOTE: A lack of visibility, in-and-of-itself, does not necessarily constitute a distress situation. Other factors, such as equipment limitations, proximity to shipping lanes, etc., must be considered prior to case classification.

(e) Tide and current conditions, and the ability of the vessel to anchor;

(f) Present and forecasted weather including wind and sea conditions, air and sea temperature;

(g) Special considerations such as number of personnel onboard, age, health, and special medical problems;

NOTE: "Special medical problem" requires use of common sense, e.g. an otherwise healthy person, who simply has a limb in a cast, does not necessarily constitute a special medical problem.

(h) Ability of the vessel to maintain reliable communications with a source of assistance. CB radio communications should be considered only under ideal conditions. They are not authorized on Coast Guard vessels for communication and Coast Guard shore units have no requirement to have CB capability;

NOTE: Another on scene vessel can act as the communications platform for a disabled boater. Although the Coast Guard discourages boaters from using cellular telephones for emergency purposes, they ***may*** be considered a reliable form of communication. If the cellular telephone connection is good, and there is no danger of losing the connection, then, in the absence of any other factors listed that would raise SMC's level of apprehension, the case should be classified as non-distress and treated as such. In such cases, the Command Center should act as a communications intermediary and should closely monitor the case to ensure the disabled boater does, in fact, receive the assistance required. It is acceptable for the SMC to dispatch a resource while broadcasting a MARB, but it is the intent of the policy to allow commercial providers the opportunity to respond.

(i) Degree of concern of the mariner for the safety of the occupants of the vessel - ask the questions, "Do you have safety concerns?" and if so, "What are they?"; and

(j) The potential for the situation to deteriorate after evaluating the relevant factors,.

4.2.6.2 **Distress.** For cases determined to be in the DISTRESS emergency phase:

(a) **Respond Immediately If Able.** An immediate response may be provided either by Coast Guard or Coast Guard Auxiliary resources. The SMC might be aware that other resources, such as private, local/state-operated vessels, or commercial providers, might be responding. That fact, however, normally should not delay or preclude a Coast Guard response. If Coast Guard resources cannot or are not responding, the caller should be notified.

NOTE: As mentioned in 4.2.6.1, if a case is classified as distress, the Coast Guard will respond immediately if able, to include broadcasting a UMIB, and dispatching appropriate resources.

(b) **First On Scene Assists.** The first assisting resource on scene capable of stabilizing and handling the situation, whether Coast Guard or other resource, should render appropriate assistance and complete the case if they desire. If a Coast Guard resource arrives on scene and another responder has the situation under control, the SMC should determine whether or not they are able to fully execute the case. If it appears that they can, then the Coast Guard resource may be withdrawn.

NOTE: If a Coast Guard resource arrives on scene first in a distress situation, and through their actions they render the situation non-distress, they may elect to complete the case, i.e., they may tow the disabled boat to the nearest safe haven if there is no higher need for the resource.

(c) **Intervene If Required.** If, upon arrival, a Coast Guard resource finds another responder on scene whose assistance is not adequate, the Coast Guard resource should immediately attempt to stabilize the emergency. Once the situation is stabilized, the Coast Guard resource may be withdrawn if the first responder appears capable and is willing to conclude the case. The Coast Guard resource should not normally be withdrawn if continued stability of the situation is dependent on Coast Guard equipment or expertise.

NOTE: The Coast Guard may direct a responding resource to drop tow or cease operations if it is determined that the resource or equipment is not adequate to perform the job at hand, e.g., a 23' boat cannot be expected to adequately tow a 70 ton fishing vessel.

(d) **Treat As Non-Distress If Appropriate.** If the Coast Guard responds to a request for assistance and determines, once on scene, that there is no emergency, the case will be handled as a non-distress, following the procedures outlined below.

4.2.6.3 **Non-Distress.** For cases determined NOT to be in the DISTRESS emergency phase:

(a) **Advise and Seek Desires.** The requester should be advised that:

(1) It appears there is no imminent danger;

(2) It is Coast Guard policy to defer to an alternate responder; and

(3) The Coast Guard will assist in contacting any specifically requested alternate assistance, such as a commercial provider or friend.

NOTE: The issue of what constitutes a "specific request for alternate assistance" has led to confusion. Clearly, if a requester names a specific individual, company, or network, that is a specific request. In the case of generic requests for a specific network organization, contact general dispatch at the parent organization. However, if the mariner is unable to clearly articulate the name of the desired source of assistance, the SMC should ask for clarification. If unable to get clarification, a MARB should be issued.

(b) **Offer a Marine Assistance Request Broadcast (MARB).** When specific alternate assistance is not requested or available, the mariner will be informed that a broadcast can be made to determine if someone in the area can come to his or her assistance.

(1) If the mariner requesting assistance states that a MARB is not desired or specifically requests that a Coast Guard resource or an Auxiliary facility be dispatched, again outline the policy and notify the mariner that unless a specific request is made for alternate assistance, the mariner must either accept the alternative of letting the Coast Guard make a MARB or arrange for his own assistance.

(2) If a MARB is declined, the SMC may monitor the condition of the mariner, but need take no further action unless requested or the situation deteriorates.

NOTE: If a MARB is declined in a non-distress situation, the Coast Guard has no further obligation to monitor or respond unless the boater changes his/her mind or the situation deteriorates. The burden lies solely with the boater.

(3) When a MARB is requested, proceed as described below.

(c) **Make a MARB.** A MARB will be made to solicit the voluntary response of anyone who can assist the mariner, and the MARB will include a general location of the vessel. (See sample MARB at the end of this section). The MARB must be worded carefully in order not to create an obligation by the vessel operator to accept or pay for the services of any and all responders. It is used to invite persons, such as commercial providers or Good Samaritans, interested in responding to do so **if they desire.** If no intent to respond to the MARB is heard within a reasonable period of time, Coast Guard resources or Auxiliary vessels may be directed to respond. A guideline of 10 minutes is recommended for the SMC to await an answer to a MARB before the SMC directs Coast Guard or Auxiliary resources to respond. Once the MARB is answered, the SMC will determine what a reasonable period of time is for a response time on scene, based on his or her experience with responders in the area and the circumstances of the case. Coast Guard resources or Auxiliary vessels may also be directed to respond if no alternate responder can do so within a reasonable period of elapsed time. Factors governing the elapse of a reasonable period of time for assistance to arrive on scene are discussed below, but such a period should not normally exceed one hour from first awareness of the case.

(d) **Monitor Response.** As part of the MARB, any resource that is responding should be requested to notify the Coast Guard of the estimated time of arrival (ETA) on scene. This notifies the Coast Guard of the actions of a responder. It also notifies the vessel requesting assistance of the ETA of the assisting resource. Moreover, it notifies other potential responders of the need for further assistance or whether they should proceed with any expectation that they will arrive on scene first. The SMC may repeat the identity and ETA of potential responders so that the mariner requesting assistance and others will know who has responded.

NOTE: Although it is encouraged that the MARB include Coast Guard notification of ETAs, it is not mandated. Neither is it mandated that the SMC repeat the identity and ETA of responders. It is, however, advised.

(e) **Maintain Communications.** A communications schedule between the Coast Guard and the requestor should be established until direct communication is achieved between the requester and responder to ensure that the situation does not deteriorate and that assistance has arrived.

(f) **Reasonable Time Determination.** Following the initial MARB, the SMC may wait a reasonable period of time before taking further action, during which additional MARBs may be made if desired by the SMC. The

"reasonable period of time" decision must be made by the SMC based upon the information collected at the outset of the communication with the mariner requesting assistance (see listing in paragraph 4.B.6.a. above), as updated by subsequent communications checks. Loss of or lack of effective direct communications may increase the level of apprehension. The definition of the ALERT emergency phase is again referred to, with its key word "apprehension." It should be considered that the situation may be causing apprehension in the mind of the mariner, especially if they have so indicated, and any action to alleviate that stress may be instrumental in preventing the situation from deteriorating. The greater the level of apprehension, the shorter the "reasonable period of time."

(g) **Simultaneous Arrival.** To minimize conflict, if an Auxiliary facility under orders or a Coast Guard resource arrives on scene nearly simultaneously with a commercial provider, they shall report to the SMC, remain on scene until it is confirmed the provider is capable of providing the required assistance and safely completing the case, then clear the area, and take no further part in the incident.

(h) **Mariner May Decline Offered Assistance.** To a limited extent, the mariner requesting assistance has the option to refuse offered assistance. If the requester refuses offers of assistance from a Good Samaritan or an Auxiliarist, another MARB may be issued or the SMC may decide to intervene and dispatch a different Auxiliary facility or a Coast Guard resource. The mariner may also elect to contact a commercial provider on a commercial channel.

(i) **Commercial Assistance Declined.** A more difficult situation may arise if the mariner requesting assistance rejects the first arriving commercial assistance. Coast Guard Auxiliary or Coast Guard units should not assist in these cases so long as the situation remains classified below the DISTRESS phase. Nevertheless, the mariner may be assisted in finding alternatives. Upon notification that the mariner does not desire the assistance offered by the commercial provider, the Coast Guard may, upon the mariner's request, broadcast one additional MARB. The Coast Guard may also provide the telephone numbers of other commercial providers in the area so that the mariner can call them through the Marine Operator. If this is successful, it is the responsibility of the mariner, not the Coast Guard, to negotiate who provides the service. If unsuccessful, and so long as the original commercial provider is on scene, the SMC may maintain a listening watch for the vessel, but must make it clear that neither Coast Guard nor Auxiliary units will be dispatched. Should the commercial provider abandon the case, the SMC may dispatch a Coast Guard or Auxiliary unit or issue an additional MARB, as appropriate. The principle that governs further action by the SMC is that, once a responder has arrived on scene, the level of apprehension regarding the case is probably significantly reduced. Further dealings between the requester and the responder are not Coast Guard responsibility. Additional services provided to the mariner requesting assistance would be provided only on a not-to-interfere basis so long as the level of apprehension remains low.

(j) **If Situation Deteriorates.** The SMC should normally dispatch Coast Guard resources at any time the circumstances in a case threaten to deteriorate into a DISTRESS situation that exceeds the capability of the assisting resource.

4.2.6.4 Cases Discovered By Auxiliary Facility. When an Auxiliary vessel on routine safety patrol or otherwise on orders discovers a vessel requesting assistance, but not in radio contact with the Coast Guard, the Auxiliarist will relay the request for assistance to the Coast Guard operational commander and may undertake to provide assistance, if capable. If a tow is undertaken, the Auxiliary vessel is required to notify the operational commander of the identity of the vessel, the location of the vessel, and the destination to which the vessel is being towed. No Auxiliary vessel may undertake the tow of another vessel unless the Auxiliarist is reasonably assured of the safety of both vessels and the persons onboard. If the Auxiliary vessel cannot safely tow a disabled vessel that is standing into danger, it may endeavor to remove the persons from the threatened vessel and stand by until a more capable resource arrives on scene.

NOTE: Cases discovered by the Auxiliary are a particularly sensitive section of the policy. How the situation is dealt with is the end product of sustained negotiations and compromise effort on the part of all concerned parties. It intends that the Auxiliarist, not the SMC, will make the judgement as to whether the Auxiliarist can safely assist. When the Auxiliarist notifies SMC that they intend to assist the vessel, it's not "asking for permission". The Auxiliarist has already determined that he/she can safely provide assistance, and the notification to SMC is a courtesy. This policy does not reduce the operational commander's authority and responsibility to exercise command and control over all assigned forces, including Auxiliary vessels on ordered patrols. The operational commander may override the Auxiliarist's decision if warranted by an evaluation of the circumstances. However, unless there is a specific reason to do so, such as an indication of unusual risk or hazard, or an operational need to assign the Auxiliary vessel to a higher priority mission, the decision to assist should be left to the Auxiliarist.

4.2.6.5 Safe Haven Considerations. In cases involving towing by the Coast Guard or Coast Guard Auxiliary, the vessel being assisted will normally be taken to the **nearest** safe haven. Coast Guard or Auxiliary resources should not tow the vessel beyond the nearest safe haven when there are commercial resources that could perform this function. Exceptions to this policy may be made in specific cases if, in the judgement of the SMC, they are warranted by humanitarian or other concerns. When determining the suitability of a potential safe haven, the SMC should be sensitive to the reluctance of some private firms and yacht clubs to accept a disabled or damaged vessel and the attendant potential liability.

4.2.6.6 Relief of Tow. In cases involving towing by the Coast Guard or Coast Guard Auxiliary where no emergency exists, the assisted vessel **may** be released to another provider who appears capable provided that:

(a) The SMC and coxswain of the assisting vessel determine that a hand-off can be carried out safely; and either

(b) Alternative assistance is desired and arranged by the operator of the vessel being assisted; or

(c) The operational commander has a higher need for the Coast Guard resource or Auxiliary facility.

4.2.6.7 Alternative to MARB. When no response to a MARB is evident, such as late at night or during an off-peak period, the SMC may dispatch Coast Guard resources or Auxiliary vessels. As an alternative, the SMC may pursue by telephone or other communication means any other SAR resource that can provide expeditious response and ask if the resource desires to respond. Again, unless the responder is an Auxiliary facility that will be under orders, the offer should be made in terms of an invitation to provide assistance rather than in terms of "request you proceed and assist." An estimated time of arrival should be obtained and passed to the mariner requesting assistance. Continue to monitor the situation. Direct contact with the vessel requesting assistance as soon as possible should be encouraged.

4.2.6.8 Communications Interference. If someone interferes with government communications, issue the command "CEASE TRANSMISSION." If interference continues, document the incident and process as an FCC violation. For further details regarding how to initiate a violation, refer to title, Radio Frequency Plan, COMDTINST M2400.1 (series) (ref (o)).

4.2.7 SAR Coordinator and SMC Responsibilities

4.2.7.1 Responsibilities

(a) SAR Coordinators shall direct SMCs within their region to follow the policy and procedures established in this section of the Coast Guard Addendum to the National SAR Plan insofar as practicable. SAR Coordinators are authorized to vary procedures where local conditions require it in order to achieve the overall intent discussed. Variances should be documented.

(b) SMCs must remain familiar with all SAR assistance resources within the SMC's AOR, including those of the Auxiliary, and shall direct those resources that the SMC believes are needed to the scene of a vessel in distress.

(d) SMCs at the Group or Activity level shall conduct regional public meetings with commercial assistance providers in their AOR no less than semi-annually, preferably prior to and at the conclusion of the local recreational boating season. These units will also maintain regular liaison with all known commercial assistance providers in their AOR in order to discuss policies, build cooperation, and air any Coast Guard or industry concerns. It is highly recommended that commercial providers be invited to participate in training and exercises held with other (state, local, volunteer organization) SAR assistance providers.

4.2.7.2 Maritime Assistance Decision Flow Chart. The Maritime Assistance Decision Flow Chart, figure 4-1, is provided to assist the SMC on MSAP decision-making. The flow chart is a tool to implement the policy, not the policy itself.

4.2.8. Marine Assistance Request Broadcast Format for Radiotelephone Transmission

4.2.8.1 Format

(a) Channel 16 (156.8MHz)

(b) HELLO ALL STATIONS (3 times) THIS IS (unit identification) RELAYING A MARINE ASSISTANCE REQUEST BROADCAST FOR (type of vessel) (nature of problem) IN THE VICINITY OF (location). LISTEN CHANNEL 22A, OUT.

(c) Channel 22A (157.1MHz)

(d) HELLO ALL STATIONS (3 times) THIS IS (unit identification) RELAYING A MARINE ASSISTANCE REQUEST BROADCAST (text) OUT.

4.2.8.2 Example of Text

(a) Channel 16 (156.8MHz)

HELLO ALL STATIONS. HELLO ALL STATIONS. HELLO ALL STATIONS. THIS IS COAST GUARD GROUP HAMPTON ROADS RELAYING A MARINE ASSISTANCE REQUEST BROADCAST FOR A DISABLED PLEASURE CRAFT IN THE VICINITY OF THE FOURTH ISLAND OF THE CHESAPEAKE BAY BRIDGE TUNNEL, LISTEN CHANNEL 22A, OUT.

(b) Channel 22A (157.1MHz)

HELLO ALL STATIONS. HELLO ALL STATIONS. HELLO ALL STATIONS. THIS IS COAST GUARD GROUP HAMPTON ROADS RELAYING A MARINE ASSISTANCE REQUEST BROADCAST FOR PLEASURE CRAFT MOONSHINE WYT5138. PLEASURE CRAFT MOONSHINE IS A SEVENTEEN-FOOT FIBERGLASS OUTBOARD DISABLED DUE TO LACK OF FUEL IN VICINITY OF THE FOURTH ISLAND OF THE CHESAPEAKE BAY BRIDGE TUNNEL LATITUDE 37-03N LONGITUDE 76-04W. ANY VESSEL DESIRING TO ASSIST THE MOONSHINE IS INVITED TO PROCEED TO THAT LOCATION OR CONTACT HIM BY RADIO. PLEASURE CRAFT MOONSHINE IS STANDING BY CHANNEL (an appropriate intership frequency). IF YOU ARE OFFERING TO ASSIST THE MOONSHINE, PLEASE RESPOND AND PROVIDE AN ESTIMATED TIME OF ARRIVAL. OUT.

(c) Channel 22A (optional acknowledgment of replies)

VESSEL SEA DOG RESPONDING, ETA 15 MINUTES--ROGER, OUT. VESSEL HELPER RESPONDING, ETA 35 MINUTES--ROGER, OUT.

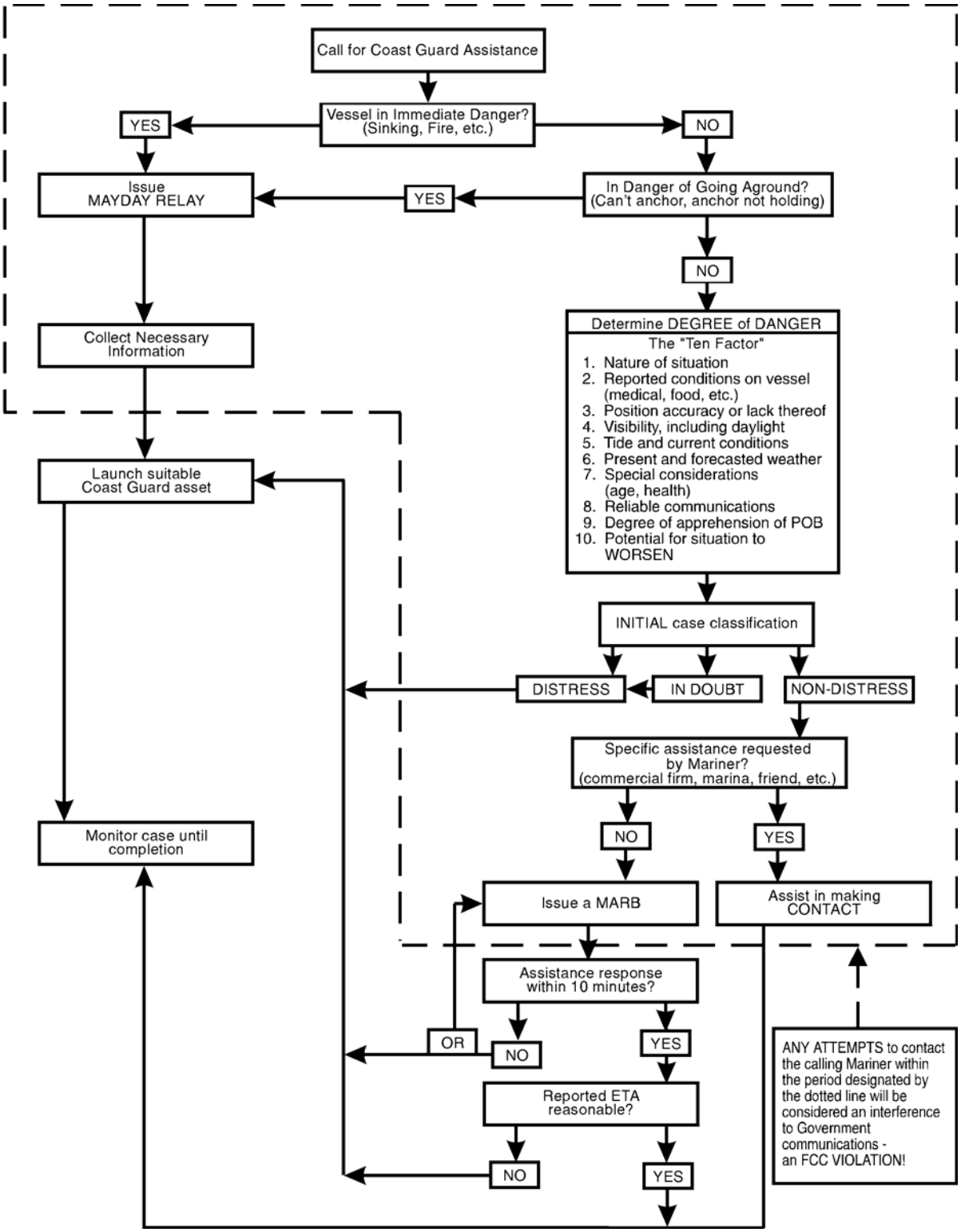

Figure 4-1 USCG SAR Mission Coordinator (SMC) Maritime Assistance Decision Flow Chart

Section 4.3
General Salvage Policy (Other than Towing)

The MSAP and General Salvage Policies were developed separately and remain distinct from one another.

4.3.1 General

When commercial salvors are on scene performing salvage, Coast Guard units may assist them within the unit's capabilities, if the salvor requests. When no commercial salvage facilities are on scene, Coast Guard units should only engage in salvage other than towing when limited salvage operations (e.g., ungrounding, pumping, damage control measures, etc.) can prevent a worsening situation or complete loss of the vessel. Any salvage operations shall be performed at the discretion of the unit CO/OINC.

NOTE: Coast Guard units and personnel shall not be unduly hazarded in performing salvage.

4.3.2 Small Craft

4.3.2.1 This policy applies to small craft that need salvage other than towing. However, when no commercial salvage companies are available within a reasonable time or distance, the District commander may modify the policy to provide for refloating a grounded boat which is not in peril of further damage or loss if:

(a) the Coast Guard units are capable of rendering the assistance,

(b) the owner requests the assistance and agrees to the specific effort to be made, and

(c) Coast Guard units and personnel are not unduly hazarded by the operation.

4.3.2.2 Prudent actions include:

(a) Allowing the next tide to refloat the vessel,

(b) Helping the mariner set anchors,

(c) Evacuating the passengers,

(d) Helping the mariner determine the vessel's seaworthiness.

4.3.3 Operator Insistence

Occasionally an operator will insist that the Coast Guard take action, such as pulling a vessel from a reef, which the Coast Guard personnel on scene consider unwise. The Coast Guard is under no obligation to agree to any such request or demand. If a decision to comply with such a request is made, it should be made clear to the operator that he is assuming the risk of the operation and the fact that the action is undertaken at his request against Coast Guard advice should be logged.

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Section 4.4
Firefighting Activities Policy

The Ports and Waterways Safety Act of 1972 (PWSA) (33 U.S.C. 1221 *et seq*.) acknowledges that increased supervision of port operations is necessary to prevent damage to structures in, on, or adjacent to the navigable waters of the United States, and to reduce the possibility of vessel or cargo loss, or damage to life, property and the marine environment. This statute, along with the traditional functions and powers of the Coast Guard to render aid and save property (14 U.S.C. 88(b)), is the basis for Coast Guard firefighting activities.

4.4.1 Overview

Traditionally, the Coast Guard has provided firefighting equipment and training to protect its vessels and property. Occasionally, The Coast Guard is called upon to provide assistance at major fires onboard other vessels and waterfront facilities. Although the Coast Guard clearly has an interest in fighting fires involving vessels or waterfront facilities, primary responsibility for maintaining necessary firefighting capabilities in U.S. ports and harbors lies with local authorities. The Coast Guard renders assistance as available, based on the level of personnel training and the adequacy of equipment. Coast Guard units do not normally have advanced firefighting capabilities. Firefighting requires technical expertise and a long-term training program to be done safely. Maritime firefighting is particularly hazardous on vessels due to closed compartments, HAZMAT, etc. The Commandant intends to maintain this traditional "assistance as available" posture without conveying the impression that the Coast Guard is prepared to relieve local fire departments of their responsibilities. Paramount in preparing for vessel or waterfront fires is the need to integrate the Coast Guard planning and training efforts with those of other responsible agencies, particularly local fire departments and port authorities.

4.4.2 Operations

4.4.2.1 Responsibilities and guidance. In accordance with reference (v), primary responsibility for coordinating firefighting activities involving commercial vessels or waterfront facilities within their AOR rests with COTPs. Reference (v) provides SRU crews with guidance on firefighting equipment, extinguishing agents and procedures.

NOTE: The SMC has coordination and planning responsibilities for fires involving recreational vessels.

Reference (v) provides detailed guidance on responsibilities for coordination, contingency planning, training, and how to do firefighting involving commercial vessels or waterfront facilities. In developing a Coast Guard unit's assistance posture, the following needs to be considered:

(a) level of the threat of fire,

(b) the jurisdictions involved,

(c) the capabilities of local fire departments,

(d) the availability of Coast Guard equipment,

(e) level of Coast Guard training.

4.4.2.2 Operations. Coast Guard personnel shall be prepared for and respond to fires onboard Coast Guard vessels. For all other marine firefighting situations, Commanding Officers of Coast Guard units shall adopt a conservative response posture, and shall focus their actions on those traditional Coast Guard activities not requiring unit personnel to enter into a hazardous environment.

(a) **Independent firefighting.** Coast Guard personnel shall not engage in independent firefighting operations, except to save a life or in the early stages of a fire to avert a significant threat without undue risk.

(b) **Commercial vessels and waterfront facilities.** Coast Guard personnel shall not actively engage in firefighting except in support of a regular firefighting agency under the supervision of a qualified fire officer.

NOTE: This term means a person who has been trained and certified, under National Fire Protection Association

(NFPA) guidelines to take command of firefighting operations.

The Commandant recognizes the significance of the cautious approach the Coast Guard has adopted for marine firefighting situations. The high training, equipment, and staffing thresholds will limit the response capability of many units, and in some areas, sources of support will not be readily available. Consequently, there will be occasions when a unit will be unable to mount a complete response to an incident. This circumstance is preferred to attempting a complex and potentially hazardous job without the necessary staffing, training and equipment.

4.4.2.3 **Firefighting in an ICS response structure.** If the Incident Command System (ICS) structure is used in responding to incidents involving fires on vessels or at waterfront facilities, a Firefighting Group should be established to coordinate local authorities responsible for fighting the fires. This should be coordinated prior to an incident.

Section 4.5
Direction and Navigation Assistance To Mariners

4.5.1 General

The responsibility for the safety and navigation of a vessel rests with the vessel's operator, not the Coast Guard. Units may pass any printed information, including navigational in nature, that comes from a recognized source. This includes any information from current/updated NOAA or NIMA nautical charts, Local Notice to Mariners, Light Lists Coast Pilot, etc. In all situations, the standard to follow is to make sure any information passed is prudent and based on fact, and never based on opinion or conjecture. **The Coast Guard will not provide courses to steer**. Additionally, any information passed to a mariner requesting assistance should be reflected in the appropriate communications log. Regardless, passing information should not interfere with more urgent operations**.** ***If there is any doubt for the safety of the individuals requesting assistance, this should be treated as a SAR case and an appropriate response developed***. Stated current standard navigational information that may be passed includes:

- Characteristics of lights,
- Magnetic or true bearings between charted objects,
- Charted range bearings,
- Charted traffic separation scheme bearings,
- Charted depth of water,
- Charted hazards,
- Radio beacon frequencies,
- Charted buoy positions,
- Lat/Long of charted objects.

If information is provided, the following language is recommended:

"Captain, based on your request, the following information from (chart #, light list #, NTM, etc.) is provided to assist you with your responsibility to safely navigate your vessel." Pass relevant information from the list above.

NOTE: The Coast Guard will not assume responsibility for navigating a vessel, but it may provide the master of a vessel certain navigation information if available as charted or published by a reputable source. In the field there is a perception that passing navigational information to mariners is discouraged because of the potential for liability. However, certain types of navigational information may be passed if it is accurate and reliable. Another consideration is that, while a mariner may only be requesting information and has not declared a distress, the vessel situation may dictate a more active involvement by the SMC as a precautionary measure.

4.5.2 Lost/Disoriented Mariner

Most requests for navigational information come from lost or disoriented mariners. When contacted by a lost or disoriented mariner, the watchstander should ask the mariner questions regarding:

- any nearby landmarks,
- aids to navigation,
- presence of commercial traffic (i.e., ferries, harbor tour boats, merchant vessels, etc.),
- depth and color of water,
- point of departure and destination,
- description of vessel's trackline from departure to present, etc.

If the Group Communications Center is equipped with direction finding (DF) equipment, it may also be used within its stated accuracy, +/- 2 degrees for R21, and if the DF fix or bearing is deemed reliable, to determine or verify the approximate position.

If the mariner's approximate position can be ascertained, the following response is appropriate:

"Based on the information you have provided (and/or the approximate position determined by our direction finding equipment), your vessel appears to be located in the vicinity of _____. Please be advised that this is an approximate position and should be used with other navigational information to assist you with your responsibility of safely navigating your vessel. We strongly recommend you study the chart for that area or consult with a passing vessel before proceeding further."

4.5.2.1 **Passing courses to Steer. Watchstanders shall not pass courses to steer**. However, in situations involving navigational safety, bearings between charted objects may be provided from a corrected chart in either degrees true or magnetic, provided you can determine the boater's position with reasonable certainty. Units should exercise caution because there are numerous geographical reference points with the same name and numerous buoys with the same numbers and characteristics (e.g., M1A). When passing a bearing between charted objects the watchstander should state whether the bearing is either true or magnetic and ensure that the mariner understands the difference. ***When a bearing using charted buoys is provided, the mariner shall be advised that this bearing was obtained from the buoy's charted position, which could differ from the actual location.*** It should also be pointed out to the mariner that this "bearing" is not a course to steer. Compass courses shall never be given because of the unique aspects of deviation, wind and current. If a compass course to steer is specifically requested, the following statement shall be passed to the mariner:

"Captain, we understand your request for steering directions, but because we do not know the affects of winds and seas on your vessel or any error you may have on your compass, we cannot calculate a safe course for you to steer to _____."

Note: If a Coast Guard unit is escorting a vessel, courses to steer may be provided by the escort unit if by not doing so, the escorted vessel would be put in imminent danger.

4.5.2.2 **Unable to Determine Position.** If the mariner's general position cannot be determined, particularly in reduced visibility, the best course of action may be to suggest that the lost/disoriented mariner anchor the vessel if it is not in or near a major shipping channel and the on scene conditions safely permit. If anchoring is not an option, the mariner should attempt to stay in the same position if deemed to be in safe water. If warranted, a communications schedule should be established with the vessel.

If the situation escalates from the uncertainty phase to the alert phase due to apprehension for the safety of the mariner, then dispatching a Coast Guard asset to locate and assist the lost/disoriented boat before a distress situation evolves may be the most prudent course of action. Important considerations include deteriorating weather, time of day, mariner's navigational competence, age and health of those on board, and size of vessel.

4.5.3 Hazardous Bars and Inlets

The Coast Guard may receive a request for advice on whether to enter an inlet or breaking bar during hazardous weather conditions. If a unit receives such a request, its first response shall be to advise the mariner to have all personnel aboard put on their PFDs. Generally, if the vessel is presently not in danger, it may be prudent to tell the vessel's operator that he or she stay out and do not attempt to enter (or leave) port until the weather moderates. "When in doubt, stay out" is good advice. If the mariner elects not to heed the advice and decides to put the vessel in a potentially hazardous situation, then consideration should be given to maintaining a communications schedule with the vessel until it is out of harm's way. Additionally, this may be treated as a potential distress case, and the SMC should evaluate the possibility of dispatching a Coast Guard resource to stand by or provide a precautionary vessel escort. The following text is recommended as a standard reply:

"Captain, we recommend each person on board put on a life jacket immediately. Because we do not know the capabilities of your vessel or the exact on-scene conditions, we cannot advise you to attempt crossing the bar/inlet. If you have doubt about your vessel's ability to safely cross the bar/inlet then you should not attempt the crossing."

4.5.4. Weather Information

If mariners request weather forecast information, they should be advised of the local VHF-FM frequency or channel where they can find continuous National Weather Service (NWS) broadcasts. If the mariner is unable to receive the NWS broadcasts, the latest NWS weather warnings for the local area may be read over the radio, operations and time permitting. If this is done, ensure that the entire text is read exactly as written, including the period and geographic area for which the forecast is valid. Actual observed conditions of wind direction/velocity, visibility, cloud cover and sea height may be also relayed. Observations made with a calibrated weather instrument may be reported as is while all other observations should be reported as "observed". Whenever weather conditions are reported, the date, time and location of the observation should also be included.

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Section 4.6
SAR Cost Recovery and Reimbursement

This section outlines the Coast Guard's position in regards to cost recovery and reimbursement in light of services provided, statutory direction, international obligations and the impact on SAR system effectiveness.

Issues of cost recovery and reimbursement may surface from both foreign and domestic entities assisting in SAR operations as well as the public in general. While we must be mindful to employ a cost-effective response to an incident, response to distress itself must not be delayed or limited by the misplaced concern of "who is to pay the bill".

NOTE: 14 U.S.C. § 88(c) makes it a federal felony for anyone to knowingly and willfully communicate a false distress message to the Coast Guard or cause the Coast Guard to attempt to save lives and property when no help is needed. Penalties include up to 6 years in prison, $250,000 fine, $5,000 civil penalty, and the possibility of repaying the Coast Guard for costs.

4.6.1 SAR Cost Recovery

The Coast Guard as a matter of both law and policy does not seek to recover the costs associated with SAR from the recipients of those services. There are currently two exceptions to this general rule where the Coast Guard does not seek to recover costs:

(a) 14.U.S.C. §654 authorizes the Coast Guard, under limited circumstances to sell fuel and supplies to furnish services to public and commercial vessels and other watercraft.

(b) 14 U.S.C. §88 (c) authorizes the Coast Guard to collect all costs the Coast Guard incurs as the result of an individual who knowingly and willfully communicates a false distress message to the Coast Guard, or causes the Coast Guard to attempt to save lives and property when no help is needed. See section 3.4.10.4.

4.6.2 SAR Cost Reimbursement

The Coast Guard **does not** reimburse other agencies or individuals for costs associated with SAR. Per the National SAR Plan, federal agencies may assist or request assistance in conducting SAR operations, and state and local agencies are encouraged, but not required to assist in SAR operations. Since there is no obligation for any agency to assist the Coast Guard, they do so on a not-to-interfere non-reimbursable basis.

4.6.3 MEDEVAC at Sea

A MEDEVAC at sea is considered SAR. The Coast Guard does not charge or accept charges for SAR.

4.6.4 MEDEVAC Versus AIREVAC from Land

A MEDEVAC from land is also SAR. An AIREVAC, air transportation between medical facilities, is essentially an air ambulance service and should be done only on a not-to-interfere basis with other missions or commercial providers.

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Section 4.7
Emergency Medical Assistance

The Coast Guard is routinely involved in requests for emergency medical assistance, both traditional maritime response and non-maritime emergency medical service incidents. Medical advice transmitted by Coast Guard facilities must come from qualified medical officers. Also, replies to requests for medical advice should be done on a not-to-interfere basis with commercial providers. Two policy sections address how emergency medical assistance will be provided and the criteria for action under various medical situations for maritime and non-maritime medical response.

The SMC is to have procedures in place for responding to a request for medical advice at sea (MEDICO) or for medical evacuation (MEDEVAC).

MEDICOs and MEDEVACs are part of the traditional Coast Guard SAR mission. Some shipping companies and vessel owners, however, have contractual arrangements with hospitals or commercial medical advisory companies to provide medical advice.

Often calls for emergency medical assistance cannot be immediately classified as a MEDICO or MEDEVAC. Knowledgeable operational medical advice is required to make this determination. The possibility of a MEDICO developing into a MEDEVAC is always present.

4.7.1 MEDICO

4.7.1.1 MEDICO, discussed in references (a) and (b), is an international term normally meaning the passing of medical information by radio. Medical advice is available through many sources that include Coast Guard and DOD medical providers, medical firms and hospitals contracted by shipping companies and international service organizations such as the International Radio-Medical Center (CIRM).

4.7.1.2 The Coast Guard shall cooperate to the extent possible to identify appropriate medical resources to relay medical assistance messages or assist in establishing communication between the vessel and their contracted services if commercial channels of communication are not available.

4.7.2 MEDEVAC

4.7.2.1 MEDEVAC can be extremely hazardous to both patient and crew because of severe environmental conditions frequently encountered at sea, and from dangers inherent in transferring a patient from vessel to vessel or from vessel to helicopter.

4.7.2.2 When deciding whether a case is sufficiently urgent to justify the risks involved with a MEDEVAC, the SMC should obtain advice from medical personnel, preferably Coast Guard or Department of Defense medical personnel, familiar with:

(a) SAR operations.

(b) Emergency medical capabilities of Coast Guard crews.

(c) Operating characteristics of Coast Guard SRUs.

4.7.2.3 In all MEDEVAC operations, the risks of the mission must be weighed against the risks to the patient and the responding resource. Factors to consider include:

(a) The patient's clinical status.

(b) The patient's probable clinical course if MEDEVAC is delayed or not performed. A delayed MEDEVAC which does not have a negative impact on the patient’s probable clinical course may:

(1) Provide for adequate planning,

(2) Allow the rescue unit to stay within its range limits,

(3) Enable a daylight evacuation,

(4) Allow the vessel to enter port, or

(5) Allow for the weather to moderate.

(c) Medical capabilities of responding Coast Guard personnel and equipment. Some Coast Guard operating units have Emergency Medical Technicians (EMTs); a few units have a Health Services Technician attached. Helicopter rescue swimmers are all EMT trained. All qualified boat crews have taken basic first aid training.

(d) Prevailing weather, sea, and other environmental conditions.

(e) Contractual arrangements between vessels and hospitals or commercial medical advisory services.

4.7.2.4 Guidance for filling out the required MEDEVAC Report is provided in Chapter 1 of this Addendum.

4.7.3 District Procedures

4.7.3.1 To help ensure timely response for MEDEVACs and prompt relay of MEDICO advice through Coast Guard channels of communication, each District should maintain a list of:

(a) Medical personnel available and qualified to recommend MEDEVACs and advise on MEDICOs. The medical personnel should be knowledgeable in Coast Guard helicopter and vessel SAR operations and in the capabilities of Coast Guard crews, helicopter rescue swimmers, Emergency Medical Technicians (EMTs), and Health Services Technicians (HSs).

(b) Primary sources of emergency medical advice include:

(1) Coast Guard or Department of Defense flight surgeons.

(2) Coast Guard or Department of Defense aviation medical officers.

(3) Coast Guard or Department of Defense general medical officers.

(4) Civilian physicians.

4.7.3.2 District Commanders should, if possible, indoctrinate personnel likely to make operational medical recommendations. The indoctrination may include aircraft familiarization, helicopter hoisting, and aircraft and boat operations.

4.7.4 Medical Resources

The primary sources of emergency medical advice should be contacted by telephone or the most rapid means available, as soon as possible after a call for emergency medical assistance is received. If none of these sources are immediately available within the District, similar resources in other Districts may be contacted. If contacting a qualified medical advisor is unavoidably delayed, the SMC may act independently, but should continue to seek medical recommendations.

4.7.5 Procedures

The United States has developed a recommended checklist for merchant vessels to use in medical emergency cases. Most of the information parallels that found on the MEDEVAC/MEDICO Checklist in Appendix G. The information requested to be on the merchant vessel checklist should be incorporated in procedures for MEDEVAC.

4.7.5.1 Recommended checklist content for use by vessels and the controllers is as follows:

"When requesting medical assistance for an ill or injured person, additional relative information as indicated below should be furnished. Other information may also be necessary in certain cases. Codes from Chapter 3 of the International Code of Signals may be used if necessary to help overcome language barriers. If medical evacuations are being considered, the benefits of such an evacuation must be weighed against the inherent dangers of such operations to both the person needing assistance and to rescue personnel.

(a) Patient's name, age, gender and nationality;

(b) Patient's respiration, pulse rate, temperature and blood pressure;

(c) Location of pain;

(d) Nature of illness or injury, including apparent cause and related history;

(e) Symptoms;

(f) Type, time and amounts of medications given;

(g) Time of last food consumption;

(h) Ability of patient to eat, drink, walk or be moved;

(i) Whether the vessel has a medical chest, and whether a physician or other medically trained person is aboard;

(j) Whether a suitable clear area is available for helicopter hoist operations or landing;

(k) Name, address and phone number of vessel's agent;

(l) Last port of call, next port of call, and ETA of next port of call; and

(m) Additional pertinent remarks."

4.7.5.2 Action upon receipt of a request for emergency medical assistance, either MEDICO or MEDEVAC, in general, is to:

(a) Contact qualified medical resources to obtain operational medical advice.

(b) Alert SAR forces when a MEDEVAC is likely.

(c) If an immediate MEDEVAC is not required, determine whether the vessel has a contractual arrangement with a commercial medical advisory service or hospital, and assist them as practicable.

SAR Coordinators may delegate this responsibility.

4.7.6 Transport of Next of Kin (NOK) with MEDEVAC Patients

Transporting NOK decisions are made by the SMC. The following paragraphs provide guidance for transport decisions for the possible situations that may arise. Final decisions to transport NOK for safety of operations are made by cutter commanding officers, boat coxswains and aircraft commander. Normally, in those situations where the decision is made to transport NOK with a patient, only one person would be permitted.

4.7.6.1 **Hoisting of NOK**. Due to the inherent dangers of hoisting, NOK will not normally be hoisted along with MEDEVAC patients except in cases where the patient is a minor child. For minor children one parent (or legal guardian) may accompany the child. Other situations, which may call for hoisting NOK, are:

(a) Patient being hoisted is the only parent present of a minor child (NOK),

(b) Hoisting of patient(s) from a vessel would leave the vessel and remaining person(s) in danger due to inability to safely operate the vessel in conjunction with current weather, location, delay in other help arriving, or

(c) There is severe emotional trauma to either the patient or NOK and on recommendation of the flight surgeon or other MEDEVAC advice source, it would be medically beneficial for the NOK to accompany the patient.

4.7.6.2 Transporting NOK by aircraft not involving hoisting. In MEDEVAC situations where a patient is to be transported by aircraft but hoisting is not involved, allowing NOK to accompany the patient may be allowed after evaluation of the risks and capabilities of the on scene resource.

4.7.6.3 Transporting NOK by surface craft. In MEDEVAC situations where a patient is to be taken off a vessel or other location by cutter or boat, the risks involved are generally lower then those with hoisting. Transporting the NOK by surface craft may be permitted after evaluation of risks and capabilities of the on scene resource. The SMC must consider the following in evaluating the risk involved when making a decision to transport NOK by surface craft:

(a) Dangers in transferring between vessels given relative sizes of vessels,

(b) Current on scene conditions (seas, winds, weather, daylight/dark), and

(c) Physical ability of the NOK to negotiate the move across to the Coast Guard vessel.

Section 4.8
Non-Maritime EMS Response

Coast Guard SAR resources may, and often do, become involved in the following types of non-maritime emergency medical service (EMS) incidents, MEDEVAC and Medical Transport missions, even though they are not required to do so:

- Emergency evacuation of injured from highways.
- Transfer of critically injured or ill persons from isolated locations to medical care facilities.
- Evacuation of non-critically injured or ill persons from remote or inaccessible areas where surface transportation is not practicable.
- Transfer of critically injured or ill persons from a medical care facility to another more capable of treating the case.
- Emergency deliveries of medical supplies, equipment, blood, and human organs for transplant.

What distinguishes medical transportation as a MEDEVAC, is the transportation takes the persons from a distress situation to a medical care facility.

4.8.1 Statutory Background

4.8.1.1 Reference (w) requires states to develop a highway safety program following Department of Transportation guidelines. Standard 11, "Emergency Medical Services (EMS)," of reference (w) is the basis for many state EMS systems. This standard is being supplanted by national voluntary standards developed by the American Society for Testing Materials (ASTM) F30 Committee on Emergency Medical Services. These standards provide for growth and quality assurance of future prehospital care.

4.8.1.2 Research has shown that helicopters are used effectively in civilian EMS systems. The Military Assistance to Safety and Traffic (MAST) program evolved as a cooperative effort of the Departments of Transportation, Defense, and Health and Human Services. The National Highway Traffic and Safety Administration of the Department of Transportation administers the program.

4.8.2 EMS Agreements

4.8.2.1 District Commanders are authorized and encouraged to enter into agreements for mutual cooperation and coordination of emergency medical services, with state, county, or local officials. General guidance on establishing agreements is provided in Chapter 1 of this Addendum. EMS agreements should include provisions such as the following:

(a) Coast Guard facilities should respond to requests only when operations permit. Their primary missions in the maritime areas take precedence.

(b) Agencies or officials should limit requests for Coast Guard assistance to serious cases in which response by non-Coast Guard resources would apparently be ineffective or not timely. Competition with private ambulance services, including air ambulances, shall be avoided. As required by reference (w), all inland cases shall be reported to, and coordinated with, the U.S. Air Force RCC (AFRCC).

(c) The pilot of an aircraft responding to an emergency medical request is the final judge of whether a mission can be accomplished safely, and may discontinue the mission.

(d) Agreements should be entitled "Emergency Medical Service Agreements" rather than "SAR Agreements."

4.8.2.2 Operational commanders may include other requirements in agreements, and must forward copies of all agreements to Commandant (G-OPR), (G-OCA), (G-WKH) and (G-CCS).

4.8.2.3 A sample EMS Agreement is contained within Appendix E.

4.8.3 Air Transportation Between Medical Facilities (Medical Transport)

Criteria listed below are to be used as a guide for Coast Guard aircraft making emergency transfers of critically ill or injured patients to/between hospitals or other medical facilities:

(a) Non-competition with available, suitable commercial air ambulance services.

(b) Suitability and availability of aircraft.

(c) Non-interference with Coast Guard primary missions and training.

(d) Case is designated as an emergency involving actual lifesaving or reduction of disability.

(e) Documented medical need for the movement.

(f) Trained health care personnel to be provided by the requesting medical personnel in accordance with needs and circumstances.

(g) Return transportation for attending medical personnel is NOT provided by, nor the responsibility of, the Coast Guard.

4.8.4 Transportation of Medical Supplies, Equipment, Blood, and Human Organs for Transplant

Emergency medical transportation requests may include the movement of medical supplies, equipment, blood, and human organs for transplant. The criteria for transportation of patients in 4.I.3 above shall be applied to non-patient medical cargo. Key in the decision is the medical necessity and urgency that cannot be met by other transportation.

4.8.5 Escort of MEDEVAC/Medical Transport Aircraft by Emergency Fire Equipment

MEDEVAC/Medical Transport aircraft should request an escort, when available, by emergency fire equipment during landing and taxi operations. This precaution allows for rapid evacuation of non-ambulatory patients from the aircraft in the event of a ground emergency.

Section 4.9
Ice Rescues

4.9.1 Ice Rescue Operations

Several domestic SAR Regions contain a variety of lakes, rivers, and tributaries that are extensively used by the public during the winter for recreational purposes. In some areas "ice bridges" are used to travel from mainland to islands and across frozen streams. Recreational and transit use of the ice, however, is hazardous and often results in the Coast Guard being called upon to perform search and rescue missions. This section discusses responsibilities, procedures, training, and equipment necessary to ensure the safety of Coast Guard personnel tasked with performing search and rescue operations on the ice. These operations, perhaps more than any other category of SAR, depend upon an interactive network of response agencies; each having specific capabilities and limitations. Maintaining close working relationships at the local level is essential to providing, safe, effective response to ice emergencies. Groups will incorporate this information into their MOUs as appropriate.

4.9.1.1 Group Responsibilities

(a) Designate those units that are required to maintain an ice rescue capability. This designation should be based on factors such as historical SAR data, and availability of non-Coast Guard ice rescue resources. Designations should be made in SOP or applicable instructions.

(b) Ensure that designated units are properly equipped and personnel trained.

4.9.1.2 Air Station Responsibilities. Air Stations should develop operational procedures specifically adapted for ice rescue situations, and identify training and equipment shortfalls to the applicable District (osr).

4.9.1.3 Cutter Responsibilities

(a) Cutters should identify potential ice emergency situations such as man overboard situations, whether from the cutter itself or vessels in the vicinity. Emergency bills should provide an adequate framework to respond to such situations. Ensure full use of risk assessment procedures for any response.

(b) Cutters should identify any training and equipment shortfalls and notify their applicable OPCON.

4.9.1.4 Station Responsibilities

(a) Stations designated to maintain an ice rescue capability shall follow the guidelines contained in this chapter. These guidelines are open to comment, and should be continuously evaluated and updated as necessary.

(b) ALL Stations shall maintain close working relationships with local agencies that conduct ice rescue operations. This will ensure that the Coast Guard is able to notify the appropriate resources under any circumstances.

(1) Since multi-agency resources are not uncommon, the conduct of joint training exercises and the development of local working agreements are encouraged as they are essential elements of pre-planning for an ice emergency.

(2) Mixed agency crews are permissible, but should be organized with care. Jurisdictional issues and conflicting policy guidance often limit the scope of operations for such "teams."

(c) Designated ice rescue stations shall develop and publish an ice rescue bill, instruction, or standing order. Each station's instruction will vary due to the presence of various rescue agencies or other local conditions.

(d) Ice Rescue Courses. There are various ice-rescue training courses available in the private sector. The curriculum of these courses varies, depending upon the type of ice rescue most prevalent in a particular region. Note: the Coast Guard does not endorse these courses.

4.9.2 Ice Development and Characteristics

Crews tasked with ice rescue responsibilities should have a thorough knowledge of ice characteristics, ice formation, and the hazards of hypothermia and frost bite. The more rescuers know about the risks involved with ice rescue, the better they are able to perform the mission, and, more importantly, be a survivor on the ice. Whenever possible, efforts should be made to include identification of different ice conditions during training exercises. Ice conditions are affected by a number of factors.

4.9.2.1 When water is cooled at the surface it begins to sink because it is heavier than the warm water that rises to replace it. This is called vertical circulation. This vertical circulation stops when the body of water becomes isothermic (all water at different depths is exactly 39.2 degrees). At this point water becoming colder stays at the surface and ice begins to form.

4.9.2.2 Ice near shore on a frozen lake may be unsafe due to pressures outward and upward which causes cracks to appear. Fluctuating water levels also cause inshore ice to be unsafe. Dropping water levels leave ice "high and dry" with no liquid beneath it to give it support.

4.9.2.3 Deep lakes usually remain open in the middle throughout the winter because of winds and currents.

4.9.2.4 New ice is stronger than old ice. Direct freezing of lake-water is stronger than ice formed from melting snow or refrozen ice. Clear new ice is stronger than ice clouded with air bubbles. Discolored or cloudy ice tends to indicate weaker ice.

4.9.2.5 Ice around stumps, pilings, or submerged objects is often weakened by convection heat given off by the object.

4.9.2.6 Underwater streams or springs with flowing water will cause weak spots by the circulating water. Any ice over or near moving water is too weak to be safe.

4.9.2.7 Strong sunshine shining through the ice and reflecting back off of the bottom will warm the ice from beneath and cause deterioration.

4.9.2.8 Table 4-1 lists ice thickness levels that are the minimums required to support a person or a vehicle:

Table 4-1 Ice Thickness Minimums to Support a Person or Vehicle
Provided for Internal Coast Guard Use Only

	Centimeters	Inches
Single person on skis/foot/snow shoes	5	2
Two people on skis, side by side shoes	10	4
½ ton vehicle	20	8
¾ ton vehicle	25	10
Over snow vehicle	30	12

Only with complete knowledge of ice formation and strength will the ice rescuer, be able to effectively judge how to complete the ice rescue.

4.9.3 Ice Rescue Planning

A critical part of a safe, effective ice rescue program is planning. Those stations designated as ice rescue units, should identify potential accident sites within their AOR, select the safest and most effective rescue approaches, and practice possible techniques using appropriate equipment at the site. The time spent planning and practicing is not fully appreciated until the time it becomes most valuable during a rescue. Ice rescue stations shall maintain quick-action cards or files that list the locations in their AOR where ice related accidents are most likely to occur and where ice rescue resources can be deployed. Some suggestions are:

(a) Survey all potential accident sites within the unit's AOR before winter freezes. Record the size of the area, water depth and any structures within the water at the site.

(b) Examine those sites to locate natural and man-made hazards, especially those with a history of accidents.

(c) Include the location of access sites and direct routes to them. Pay particular attention to areas that are relatively inaccessible or dangerous such as canyons, marshlands, etc.

(d) Survey all potential accident sites during periods of initial freeze, again recording characteristics of the location.

(e) Hold training exercises at potential accident sites when suitable ice forms. Staying within the limitations of the rescue team will help avoid unnecessary dangers.

(f) Organize and participate in multi-agency ice rescue drills to develop a greater understanding of capabilities, resources, and policies of various contributing agencies.

4.9.4 Risks to Crews

4.9.4.1 **Hypothermia** is primarily a function of temperature, body conditions, and weight, combined with exposure to the elements with inadequate protective clothing. COs/OinCs shall ensure personnel are in top physical condition, and are provided with proper cold weather gear, prior to being sent out on the ice.

4.9.4.2 **Frostbite** is the effect of excessive exposure to extreme cold. To minimize this risk, ice skiff crews shall be provided with adequate protective clothing, including foam padded ski masks, to minimize exposed skin. A wind-chill factor of –54 degrees Fahrenheit will cause frostbite in 10 minutes on exposed skin. At a wind-chill factor of –20 degrees Fahrenheit, frostbite will result on exposed skin in one hour.

4.9.5 Ice Rescue Resources and Utilization

4.9.5.1 **Helicopters.** Helicopters are the primary SAR resource for Ice Rescues. Group Command Center's shall determine when to request a helicopter, considering such factors as distance offshore, air temperature, ice conditions, urgency, and distance to the nearest air station. If any doubt exists, units should request a helicopter. The applicable Command Center is the approving authority for using helicopters.

4.9.5.2 Ice Skiffs

(a) Ice skiffs will normally be launched only in case of a known emergency with reliable position information, and will launch as close as possible to the actual emergency site. Ice skiffs should not be used to search for overdues, or investigate flare sightings.

(b) Untethered crewmembers should not normally go on to the ice without the skiff, or an equivalent platform to provide support in the event of breaking through the ice en route to the victim. In those rare instances where personnel must transit the ice without a skiff, they shall be tethered or closely observed.

(c) Ice skiffs should not be launched when visibility is less than ¼ of a mile, wave height is above two feet, or when a combination of air temperature and wind velocity exceeds a wind-chill factor of –54 degrees (F). The Group may waive these requirements on a case-by-case basis, but must notify the applicable Command Center.

(d) A minimum of four persons should be dispatched with the ice skiff and government vehicle when responding to a case. The coxswain and two crewmen should conduct the rescue while the fourth person should stay with the vehicle and maintain communications with the skiff and the Station.

(e) Handheld GPS receivers should be used on all deployments to provide reliable position information.

(f) Ice Skiff (and ATV) operations carry an inherent risk to personnel. The SMC shall be notified prior to deployment of personnel on an ice skiff.

4.9.5.3 Small Boat Use

(a) Except for bona fide emergencies involving immediate danger to life, boats should not be operated when wind and temperature conditions are such that accumulations of topside ice in excess of one inch may reasonably be expected.

(b) COs/OinCs needing to operate a boat in the ice shall ***carefully consider*** the situation, ice conditions, and alternative methods of achieving objectives. Coast Guard small boats are not designed to break ice. Group and District Command Center's shall also be kept advised.

(c) Observation of instability due to topside icing on any class of boat shall be immediately reported to the Command Center.

4.9.5.4 Other Equipment. New equipment that offers enhanced performance for our missions is constantly being developed. Units are encouraged to share information and experiences with such equipment with other units, other agencies, District (osr), and Commandant (G-OPR).

4.9.5.5 Ice Rescue Dive Teams. Many local agencies have ice rescue dive teams that can provide assistance to the CG if requested. Whenever the case involves a person slipping below the surface of the water/ice, diving operations must be considered. All stations shall maintain a file of those agencies in their AOR that have ice rescue dive teams.

4.9.5.6 Animal Rescues. Rescue attempts for animals stranded on the ice should only be conducted under ideal conditions after proper RISK ASSESSMENT. The chance of the animal being wild or rabid must be considered when evaluating the potential for injuries to crewmembers.

4.9.6 Example of an Ice Rescue Instruction/Bill/Standing Order

Subj: ICE RESCUE

Ref: (a) Coast Guard Addendum to the U. S. SAR Supplement, COMDTINST M16130.2D.

1. Purpose Provide guidance and policy for conducting ice rescues.

2. Discussion This station has the responsibility to provide assistance to persons in distress on the ice within our area of responsibility. Our equipment and personnel must be kept at a maximum state of readiness in order to accomplish this responsibility. During those months when ice or icing conditions exist, classroom training and actual ice rescue drills will be held. Ice skiff crewmembers will be required to read Chapter 4 of reference (a) and successfully complete the attached Certification Check-Off sheet. The procedures set forth in this instruction will be kept readily available for ice operations. Procedures outlined in reference (a) will be used in performing ice rescues.

3. Procedure

a) Upon receiving a call reporting an incident on the ice, all information pertaining to the case will be obtained and logged in the SAR Case Folder. The CO/Officer in Charge and Group Duty Officer will be notified immediately.

b) HELICOPTERS ARE CONSIDERED THE PRIMARY ICE SAR RESOURCE AND WILL BE REQUIRED FOR ALL CASES. This policy does not preclude the timely dispatch of our surface resources in an effort to prosecute the case in an expeditious and safe manner. GPS or a vehicle with emergency lights will also provide a reference point for the helicopter.

c) The minimum ice rescue crew will be three qualified members. A fourth person will be dispatched with the SAR vehicle to act as a spotter from shore and as a communication relay between the ice skiff and the Station. The crew of the ice skiff will wear dry suits/survival suits with ice cleats at all times on the ice.

Section 4.10
Float Plans

4.10.1 General

The Coast Guard has neither the responsibility nor the facilities to follow the voyages of vessels to their destinations and does not generally accept float plans. Mariners should be encouraged to pass information regarding proposed voyages to other responsible parties such as relatives, friends, yacht clubs, marinas or other facilities willing to perform that function.

4.10.2 Receiving a Float Plan

If a mariner insists on providing a Coast Guard unit with information regarding a proposed voyage, all pertinent information should be recorded on an Overdue Check Off Sheet, including estimated times of arrival and departure at way points. The following disclaimer should also be presented or read:

"The Coast Guard will keep this information on file and use it in the event your vessel is reported overdue. However, the Coast Guard does not have the responsibility or the facilities for following the voyages of vessels. The Coast Guard strongly recommends that you keep a responsible party informed of the movements of your vessel, keeping that party specifically advised of your expected and actual arrivals. You should instruct them that in the event your vessel does not arrive as planned, they should contact the nearest Coast Guard station."

4.10.3 Action Taken After Receiving a Float Plan

A copy of all float plans should be retained for a minimum of one month beyond the provided final expected arrival date. Retaining the float plan longer may be appropriate when the length of the voyage itself is of a long duration (e.g. trans-oceanic or around-the-world) and/or where the type of vessel lends uncertainty to duration of the voyage (e.g. sail vs. power vessels). On receipt of overdue vessel reports, Coast Guard units should check float plan files as a part of PRECOM checks.

4.10.4 Float Plan Form

When informed of the Coast Guard's policy many mariners will request a float plan form to fill out and provide to an alternative responsible party. Float Plan forms are available in some boating safety brochures produced by the Coast Guard and have in the past been printed individually. These may be provided directly to mariners. A sample Float Plan form that may be copied and used if other sources are not readily available is provided as Figure 4-2.

4.10.5 Float Plan Services

Some commercial and private organizations provide float plan services for members or subscribers. The methods of tracking voyages or reporting overdue vessels by these services vary. Some services offer SAR authorities access to all voyage and vessel data on the report of an overdue. Coast Guard units that perform SMC duties should maintain a listing and access instructions for all float plan services that serve their area of responsibility.

Complete this page, before going boating and leave it with a reliable person who can be depended upon to notify the Coast Guard or other rescue organization, should you not return as scheduled. **Do Not file this plan with the Coast Guard.**

Name of person filing: Phone Number:

Description of Vessel

Type: _____ Color: _____ Trim: _____
Registration No: _____ Document No: _____ Length: _____
Vessel Name: _____ Make: _____ Other info: _____
Engine Type: _____ Horsepower: _____
No. of Engines: _____ Fuel Capacity: _____

Survival Equipment

(check as appropriate)

☐ PFDs ☐ Flares / Type: _____ ☐ Mirror ☐ Smoke Signals
☐ Flashlight ☐ Food ☐ Paddles ☐ Water
☐ Anchor ☐ Raft ☐ Dinghy ☐ EPIRB/Type: _____
☐ Other

Communication / Navigation Equipment

☐ Radio (check as appropriate) ☐ VHF-FM ☐ MF ☐ HF ☐ Other: _____
☐ Cellular phone Number:
☐ LORAN C ☐ GPS ☐ RADAR

Automobile/Trailer

Auto license No./State: _____ Auto make/model: _____
Auto color: _____ Auto year: _____
Trailer type: _____ Trailer license No. _____
Where parked: _____

Persons On Board (# ____)

Name	Age	Address & Telephone No.

Do you or any of the persons on board have a medical problem? ☐ Yes ☐ No
If yes, what?

Trip Expectations

Leave at _____ From _____ Going to _____
Via _____ Via _____ Via _____
Expect to arrive/return by _____ (time) and not later than _____
Other pertinent info:

If not returned by _____ (time) call the COAST GUARD, or (local authority) _____
Telephone numbers:

Figure 4-2 Sample Float Plan

Section 4.11
Self-Locating Datum Marker Buoys

Self-Locating Datum Marker Buoys (SLDMB) utilize satellite-based technology to determine buoy position. SLDMBs provide frequent, high-resolution position information independent of the search unit (search unit does not have to relocate the DMB). The SLDMBs drift with the water mass, providing high quality current information. The use of satellite technology greatly reduces the cost of a position determination in comparison to the cost associated with the RDF/DMB.

Current information provided by SLDMBs may be used directly in search planning tools in conjunction with leeway data to estimate the direction and distance of drift for a search object.

Although fielded to support the SAR mission, SLDMBs may be used to support other missions as well. Possible applications exist for fisheries (high-seas drift nets tracking), law enforcement (floating contraband; bales of narcotics), maritime environmental response (oil spill tracking), and general maritime safety (marking of vessels or other objects adrift). Available stocks and funding will determine the resource commitment outside the SAR mission.

4.11.1 The SLDMB System

There are three major components to the SLDMB System: the buoys, the satellite system and the data system.

4.11.1.1 Self-Locating Datum Marker Buoy (SLDMB). A 7/10th Coastal Ocean Dynamics (CODE)/Davis-style oceanographic surface drifter with drogue vanes between 12 and 37 inches deep. The onboard electronics provide Global Positioning System (GPS) positioning and sensor data (buoy ID, position, and sea temperature).

(a) GPS positions are acquired at 15-minute intervals for the first two hours and at 30-minute intervals thereafter. Up to 13 half-hour data sets can be stored if necessary before transmission to a satellite.

(b) SLDMBs are air- or ship-deployable, and buoys are operational for 14 to 30 days after deployment.

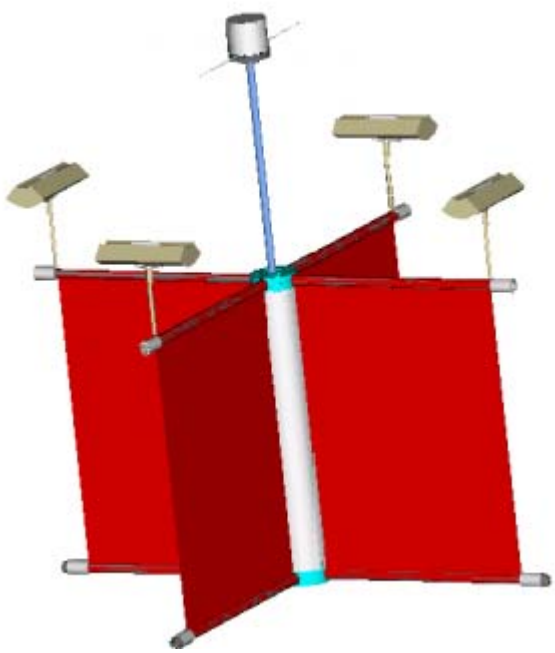

Figure 4-3 Deployed SLDMB (METOCEAN)

4.11.1.2 Service Advanced Research and Global Observation Satellite (ARGOS) Inc. ARGOS is the satellite data system that receives and forwards the information transmitted from the SLDMB to the Coast Guard using National Oceanographic and Atmospheric Administration (NOAA) polar-orbiting n-series satellites.

(a) SLDMB data will be transmitted within 30 – 90 minutes of deployment/activation. Depending on the deployment location, time of day, and position of the ARGOS satellites, there may be as much as a five-hour gap in satellite coverage (satellite footprint). SLDMBs retain up to 13 data reports, which will be uploaded to the Argos network when a satellite comes in view. Drift data requires a minimum of two positions (at least 30 minutes), but additional positions will ensure the electronics on board the SLDMB are operating properly. Waiting for the first hour's data (four 15-minute interval positions) is recommended.

(b) Sources for satellite pass data are available via the Internet. A recommended list is available via the SAR Program's Internet web site.

4.11.1.3 USCG SLDMB Web Site. The SLDMB web site is hosted at the Coast Guard's Operations Systems Center and is accessed via the intranet at the web address: http://sldmb.osc.uscg.mil/. The site provides operational data, logistics support, system documentation, and administrative functions.

(a) Operational SLDMB position (drift) data is made available via data requests and may be viewed or downloaded as a data table or exported to C2PC as an overlay for visual display.

(b) Logistics functions are used to track the ordering, shipping and deployment of SLDMBs. In addition, the system tracks the buoy shelf life, performance and failures. Reports on various logistics aspects can be generated for system management.

(c) System documentation provides a user's guide, tutorial, frequently asked questions, user forum, comments and new features listing. This on-line documentation provides the line-by-line user information needed to fully use the web site application. Brief descriptions are provided as needed in this Addendum.

(d) Administration functions include user accounts and contacts for the system.

4.11.2 SAR Mission Coordinator Actions

The SMC provides direction to SAR units for the deployment of SLDMBs, enters the deployed status in the SLDMB web site, and retrieves the data produced by the SLDMBs for use in SAR mission planning.

4.11.2.1 Deployment Considerations. The following guidance will help the SMC make decisions as to using SLDMBs as a tool in SAR efforts.

(a) **Type of case.** SLDMBs should be used in all cases where total water current data will be needed to effectively plan a search.

(b) **When to deploy.** One or more SLDMBs should be deployed as soon as it is apparent that the case will not be quickly resolved. It is far better to drop SLDMBs on a case that turns out to quickly resolve than to hold back dropping SLDMBs on a case that does absolutely require sea current information. **If you <u>think you might</u> need to deploy SLDMBs, then you <u>should</u> deploy SLDMBs**. SLDMBs should be dropped as early as possible, since the goal is to provide estimates of the drift of the SAR objects form the time of incident up until the end of the next search period. The earlier an SLDMB is dropped, the more useful the data will be to the case.

(c) **Number of SLDMBs to deploy.** The number of SLDMBs deployed should be sufficient to cover all possible scenarios for the case and the possible variation in the sea surface currents for the region of the case. At the start of a case most SRUs arriving on scene will not be carrying multiple SLDMBs unless directed by the SMC to do so before launch; a single SLDMB may all that is available initially.

(1) A single SLDMB may be all that is needed if the currents across the region are essentially the same or if the area of interest is fairly small.

(2) Multiple SLDMBs may be needed when the area of interest includes known or suspected varying currents such as near the boundary of the Gulf Stream or other major current feature, around or between

island chains, in the vicinity of major river outflows, or in the vicinity of inlets with significant tidal influence. The size of the region may also determine the number of SLDMBs needed. As the size of the region increases so will the number of SLDMBs required to accurately represent the current flow field.

(d) **Where to deploy.** Where a single SLDMB is to be used, it should be deployed at the last known position (LKP). Spacing between multiple SLDMBs is dependent upon the case, the expected variance in currents, and may require guidance from an oceanographer. When using multiple SLDMBs they should be deployed at last known position (LKP) or along the track line, and along the perimeter of an initial search area as needed to account for varying currents. Where leeway is a significant component of overall drift of the search object (most objects other then persons in the water), additional SLDMBs should be deployed in the downwind direction to cover the expected expanding search area. During the latter stages of a multi-day case, additional SLDMBs should be deployed to fill the gaps between the existing SLDMBs and to seed the area downwind.

(e) **Incidents in remote areas** present additional difficulties. Deployment of an SLDMB in an initial sortie is particularly critical due to the likely delay in additional sorties and the need to maximize searching during those sorties. Delaying until a later sortie to deploy an SLDMB can add hours to the delay in receiving critical sea current data. Dropping more then one in case of failure should also be considered for very remote area insertions.

(f) **Approaching nightfall or significant weather** may impact when an SLDMB should be deployed.

(g) **Time of year or climate.** In northern climes where water temperatures are colder, as in all response actions, deploying an SLDMB early may be prudent. Warmer climates make for longer survival of persons in the water, requiring longer searches, which will benefit more from the long-term availability of sea current information.

(h) **SLDMBs from previous cases** may still be in the area of a new incident, or have drifted into that area. A quick check of the data system may provide immediately available total water current information for the vicinity and time of the new incident.

4.11.2.2 **SMC Deployment Actions**. SMCs are the primary authority for directing the deployment of SLDMBs and will most times make the decision to deploy an SLDMB. However, SRUs arriving on scene often will not immediately find the search object. Prior direction to SRUs by the SMC can be given that would task the SRU to deploy SLDMBs in these situations giving consideration to time spent initially searching the area, nature of the incident, and remaining sortie time.

(a) **Direction to SRU's.** SMCs should provide SRUs with the location(s) for deploying SLDMBs. If multiple SLDMBs are needed, the SMC should direct the SRU to take additional SLDMBs on board. SRUs arriving on scene may not immediately find the search object. Prior direction should be given that would task the SRU to deploy SLDMBs with consideration to time spent initially searching the area, nature of the incident, and remaining sortie time. SRUs should be directed to pass location, time and Argos ID to the SMC immediately after deployment.

(b) **Marking SLDMBs as deployed.** SMCs will receive deployed location, time and Argos ID from SRUs. To mark the SLDMB as deployed within the data system, the SLDMB Web Site is accessed and SMC Console is selected. Here the buoy's Argos ID is entered in the "Enter Buoy Number" block, and deployment time, location, and SMC (command/initials) are entered in the "Enter Comment" block. Note: data for both blocks is required. After entering the data, the SMC clicks on the save button or hits the enter key on his keyboard to complete setting the status of the SLDMB to deployed. **ONLY** SMCs should be entering this data and marking SLDMBs as deployed. ***If the wrong Argos ID is used inadvertently, the SMC must immediately contact the OSC help desk (304-264-2500) to have the status reset on that Argos ID***.

(c) **Checking SLDMB Operation.** To ensure the SLDMB has deployed and begun operating, the SMC should check to see if data is being transmitted as soon as data would reasonably be available. Timing for this check is dependent on satellite pass (para. 4.11.1.2(b)).

4.11.2.3 **Data Retrieval and Output**. SMCs and other persons interested in the drift data provided by SLDMBs access that data via the SLDMB Web Site (http://sldmb.osc.uscg.mil) Data Request Page. Data selection is made within an entered time frame, geographical region and source of position data (GPS or AROGS/doppler). Data output is

available as either a Coast Guard C2PC overlay or as a screen display. Line by line direction is available in the on-line user's guide. *Note: The number of buoys, size of geographical region, and time frame requested all impact the size of the data record returned. It is recommended that a data record count of no more than 1500 be returned to avoid protracted delays when downloading data. A table of data parameters and number of records is available via the SAR Program's Internet web site.*

4.11.2.4 Data Use Guidance

(a) For all situations, an individual SLDMBs data used for the direction and speed of the current should correspond to the entire drift of the SLDMB that most closely matches the drift period of the search plan being developed. This may be obtained by using the distance and times related with the first and last positions that match the drift period. A quick estimate can be done on C2PC by using the quick bearing & distance tool run from start to end point of the drift track. SLDMB position data can be put in the C2PC/JAWS DMB data form and it will calculate the TWC. For CASP current data should be entered as case dependent environmental data (see (e) below).

(b) For a case using only a single SLDMB, the data obtained for current from that SLDMB may be entered directly to reflect the entire TWC in JAWS or within a reasonable sphere of influence in CASP case dependent environmentals.

(c) For multiple SLDMBs the SMC must decide how to properly apply the data. If the data from the various SLDMBs is similar this should pose little difficulty for the SMC; simply apply a representative SLDMBs data across the region. Where the data form the various SLDMBs is divergent, the SMC should consider running separate scenarios for JAWS. Within CASP the various SLDMB data may be put in as case dependent environmental data (see (e) below). Care must be taken in determining the area over which to apply the data. Consulting with an oceanographer may be needed.

(d) For multiple scenarios, the guidance provided in (b) and (c) should be applied. In general, scenarios are independent of environmental conditions, that is, environmental conditions are related to geography and do not change in regards to scenarios. By having multiple SLDMBs the SMC is essentially faced with the decision over which area to apply the information.

(e) **Using SLDMB data in CASP.** If SLDMB derived current data is to be used in CASP it should be entered as case dependent environmental data; current direction and current speed. Data from multiple SLDMBs may be entered. Additional guidance for CASP use may be found at the SAR Programs Internet web site.

(f) Where SLDMB data appears erratic, consultation with an oceanographer may be needed.

(g) SLDMB data retrieved either as a table or as an overlay for C2PC must be entered manually into SAR planning applications. Automated processes for data incorporation from SLDMBs and other sources are planned for the future.

4.11.3 Failed SLDMBs

Occasionally SLDMBs will fail to operate properly. The failure may be a result of a bad part within the buoy itself, damage in shipping and handling, or damage incurred during deployment. Failure indicators are most often receiving no data or corrupt data. Occasionally units deploying an SLDMB may observe a failure. If there is a suspected buoy failure after deployment, the OSC Customer Service line should be contacted at (304) 264-2500 to verify failure. The possibility exists that a buoy with a different ID than reported was actually deployed; in this instance, no buoy failure would have occurred; the unavailability of data would be due to human error. If a buoy is found to have failed or is damaged prior to deployment, the Engineering Logistics Center's (ELC) should be contacted at (410) 762-6236.

4.11.3.1 No data received (Confirmed buoy ID). When no GPS or ARGOS data is received from a buoy within ninety minutes, it is likely the buoy has failed, or the wrong buoy ID has been marked deployed. Once the SMC has confirmed the correct buoy ID has been deployed (and that no other buoy was erroneously marked deployed in its place), the SMC should determine whether a satellite pass for the SLDMB has occurred (see subparagraph 4.11.1.2(b)). If so, the buoy is considered inoperative. The SMC should then deploy another SLDMB as soon as possible and notify the OSC (a POC is listed on the SLDMB web site).

4.11.3.2 Corrupt data received. When the data being received appears erratic (widely spaced positions resulting in widely varying speeds/directions, initial position far from the deployed position, very sporadic data, etc.), it is likely the SLDMB has sustained damage or has a failure in the electronics package. The SMC should call the OSC help desk to verify the SLDMB web site and transmissions from Argos are not experiencing problems. If the SLDMB appears to be the source of the corrupt data, OSC help desk personnel should notify the Duty Analyst to terminate the SLDMB. The comments should include the reason for termination as corrupt data. The SMC should deploy another SLDMB as soon as possible.

4.11.4 Requests for SLDMBs deployments by other agencies or nations

The Coast Guard cooperates and lends support to a multitude of other agencies and nations in the conduct of SAR operations. SLDMBs, as with other SAR support, may be deployed on request of non-Coast Guard SMCs subject to the availability of resources. The same level of review should be applied as is for deploying search assets in support of non-CG search efforts.

4.11.5 SLDMBs and use of Standard RDF/DMBs

SLDMBs provide superior current information for the SAR planner's use in search planning. The standard RDF/DMB may still be useful in some roles, such as marking a debris field that searchers wish to relocate (homing function) over a short period of time, or in restricted waters to get a quick idea of drift for the first search effort. Standard DMBs may be used until no longer available.

4.11.6 SLDMB Deployment by Search and Rescue Units

4.11.6.1 Deployment from Aircraft. SLDMBs are deployable from Coast Guard HC-130, HU-25, HH-60 and HH-65 aircraft. Specific deployment procedures for individual aircraft types are provided in each aircraft flight manual. The General fixed and rotary-wing deployment guidance is available on the SAR Program Internet site. Coast Guard testing found for the HH-60 and HH-65 aircraft that 300 feet altitude and 70 knot airspeed was optimal. For situations using the drogue parachute, Coast Guard testing found the launch altitude should be in excess of 200 feet as it appeared to be the minimum altitude which allowed the parachute to open fully and be effective in directing the entry of the SLDMB into the water. For all deployments, the Drop Master must remove the tag that contains the SLDMB Argos ID 5-digit number. The Aircraft Commander should then report the time, location and ID for each drop to the SMC.

(a) **Fixed-wing aircraft deployment.** The SLDMB uses a 15-foot (4.6 m) static line to ensure that the parachute is correctly deployed from the buoy. The static line has loops at 10 feet and 15 feet for various aircraft. No tools are required for this deployment. The buoy must be removed from its protective wrapper, then the static line is hooked on and the buoy ejected from the aircraft.

(b) **Rotary-wing aircraft deployment.** For deployment from rotary-wing aircraft, the deployment method depends on the altitude of the aircraft at time of deployment.

(1) When the deployment height is less than 25 feet, (8 meters), and the aircraft is hovering, the buoy is removed from the it's protective wrapper, and both static line and parachute are removed. No tools are required for this. The buoy can then be launched directly from the aircraft.

(2) When the launch height is greater than 25 feet (8 meters) or if the aircraft has any significant forward speed (10 knots or more), the buoy is removed from it's protective wrapper, the static line and parachute cap then must be removed from the launch container. The parachute is then extracted from the top of the launch container, hand deployed from its parachute bag, <u>but not detached from the buoy</u>. The buoy is then launched from the aircraft. ***CAUTION: The shroud lines on the parachute present a tangle hazard to personnel deploying the SLDMB; care should be taken to avoid shrouds snagging on aircrew hands, arms, and/or flight gear before deployment.*** Note that no other parts need be removed and that the buoy will not deploy any other parts during launch or descent.

4.11.6.2 Deployment from Cutters and Boats. The design of the SLDMB with the removable parachute assembly makes it suitable for surface deployment from cutters and boats. Cutters and boats can be underway when deploying the SLDMB, with speed reduced to under 10knots to avoid causing damage during deployment. The SLDMB should be deployed with the bottom (end away from parachute shroud snap hook) of the launch container entering the

water first if possible. For all deployments, the deploying personnel must remove the tag that contains the SLDMB Argos ID 5-digit number. The Commanding Officer or Coxswain should then report the time, location and ID for each deployed SLDMB to the SMC. Procedures for preparing the SLDMB for surface deployment may be found at the SAR Program's Internet site.

4.11.6.3 SLDMB Self-deployment. SLDMBs are designed for fully automatic deployment after impact with the water. After impact with the water, the tape holding the launch container dissolves. This allows the launch container to be released and also frees the arms to deploy the drogue panels and removes the magnet, starting the electronics. A few minutes after the arms are deployed, the tape holding the antenna mast down dissolves. This frees the spring-loaded mast to extend, which also detaches the parachute. All parts are ballasted to sink or are biodegradable. At this point the buoy is fully deployed and operational. The self-deployment process takes between 4 and 11 minutes.

4.11.6.4 Deployment Cautions

(a) Proper deployment of the SLDMB is best achieved by leaving the SLDMB in the launch container, and allowing the SLDMB to self deploy. In opening the launch container, damage may inadvertently be done to the SLDMB.

(b) **Drogue Arm deployment.** All SLDMBs are packaged with folded arms. These arms are under tension with shock cord. Excessive stretching may break the shock cord and could cause injury.

(c) **Mast Extension.** The mast is spring-loaded and will extend about 16.5 inches. If the buoy is disassembled beyond simple removal of the parachute, care must be taken to retain the mast in its down position. Care must be taken if the mast is extended manually. Once extended, the mast cannot be retracted without major buoy repairs. ***CAUTION: SLDMBs should not be lifted by the antenna mast; lifting by the mast may damage the O-ring seal and permit water to enter the body of the SLDMB; rendering the SLDMB inoperable.***

4.11.7 Using SLDMBs to Mark Abandoned Vessels and Other Objects.

The self-locating functionality of the SLDMB makes it ideal to use when the Coast Guard has a need to track the location of an abandoned vessel or other floating object (debris, oil, contraband, etc.). When marking vessels or other objects, which will have any significant leeway component of drift, the SLDMB should be attached to the object if possible. This is particularly important when the vessel or object will be tracked for an extended period of time. Procedures for attaching SLDMBs to abandoned vessels and other objects are located on the SAR Program's Internet site.

4.11.8 Operating Parameters

4.11.8.1 Environment

(a) SLDMBs have been designed to operate under the conditions listed below.

Table 4-2 Environmental Operating Parameters for SLDMBs

Parameter	Conditions
Air Temperature	- 4 °F to + 95 °F (- 20 °C to + 35 °C)
Water Temperature	+ 28.4 °F to + 95 °F (- 2 °C to + 35 °C)
Water Type	Fresh and Salt Water
Significant Wave Height	0 to 26 feet (0 to 8 meters)
Wind speed at height of 10 meters	0 to 39 knots (0 to 20 meters per second)

(b) SLDMBs have also been designed to survive more extreme conditions during which they may not operate properly, but when conditions improve, they will resume correct operation. These conditions include: air temperatures down to – 22 °F (– 30 °C), significant wave heights to 39 feet (12 meters) and wind speeds up to 68 knots (35 meters per second).

4.11.8.2 Operating Life. SLDMBs are designed to operate for a minimum of 14 days from deployment. As built the

expected lifetime is 22 days after 18 months storage. Newer SLDMBs may last as long as 30 days when the buoys are designed to automatically shut down.

4.11.8.3 Water depth. SLDMBs will operate in any waters, which permit the free drift of the buoy with the surrounding water. For deployment, the water depth should be 10 feet or greater to prevent the buoy from hitting bottom when entering the water.

4.11.9 Disposition of recovered SLDMBs

On occasion the public will find SLDMBs that wash ashore or come upon them while boating. They may describe them as any number of things including buoys, mines, floats, etc. Coast Guard units should be familiar with the characteristics of SLDMBs to help to positively identify them.

4.11.9.1 Washed ashore SLDMBs. Coast Guard units when called should take custody of the SLDMB, record the time & location found, the Argos ID and condition. Forward the information to G-OPR. Current SLDMBs have been designed to be disposable, and in most instances the unit will be directed to dispose of the SLDMB.

4.11.9.2 Afloat SLDMBs. Afloat SLDMBs should be left floating whenever possible. On occasion it may be necessary to remove a floating SLDMB due to the specific location (hazard to navigation, etc.). If an afloat SLDMB may need to be removed, Coast Guard units should first ascertain that the SLDMB is not active by passing the Argos ID to their group/activities or district command center. The ID is on a plate near the base of the SLDMB's body; to see the number the SLDMB must be carefully removed from the water. ***CAUTION: SLDMBs should not be lifted by the antenna assembly; this may cause the O-ring to fail, allowing water into the body of the SLDMB, which will render it inoperable.*** If the command center does not know immediately the status of the SLDMB (in use for a ongoing case; or used in a recent case), the command center should enter the SLDMB web site and use the Argos ID to run a Buoy History. If the report shows the buoy status as deployed (active), a data request should be run entering a Time Frame of "Last 1 day" and Geographical Region – Select by Buoy Number entering the Argos ID. If no data is present, the SLDMB is no longer active awaiting automatic termination in the system. If data is still present, the SLDMB should be left in the water.

4.11.10 Data Availability Outside the Coast Guard

SLDMB drift data is useful to many other persons and agencies outside the Coast Guard, in particular it is valuable to the oceanographic community (government and academia). At present there is not a direct access capability for persons or agencies outside the Coast Guard to the data produced by Coast Guard deployed SLDMBs. There is no restriction on providing this data upon request. Requests for data should be forwarded to G-OPR.

4.11.11 Logistics

Logistics for the SLDMB are covered primarily within the Equipment Integrated Logistics Support Plan (EILSP) and the logistics section of the SLDMB web site with its associated user's guide. The EILSP along with additional information on distribution, ordering, tracking and stowage of SLDMBs is available via the SAR Program's cgweb site at: http://cgweb.comdt.uscg.mil/g-opr/g-opr.htm.

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Section 4.12
SAR and Security Concerns

4.12.1 Non-Immigrant Security Concerns

In carrying out our SAR mission we routinely MEDEVAC persons from vessels to the US for emergency medical treatment and bring other SAR incident survivors into the US. In such cases where the individual(s) are not believed to be US citizens or US permanent resident aliens, the SMC shall notify immigration enforcement officials (BICE) immediately to coordinate any law enforcement issues.

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CHAPTER 5
COAST GUARD SEARCH AND RESCUE UNITS (SRUs)

5.1 Operations Overview

5.2 Surface Craft Operations
5.2.1 Overview

5.3 Coast Guard Boats
5.3.1 Standard Boats
5.3.2 Nonstandard Boats
5.3.3 Coast Guard Auxiliary Vessels

5.4 Coast Guard Cutters
5.4.1 Patrol Boats (WPB)
5.4.2 Medium and High Endurance Cutters (WMEC and WHEC)
5.4.3 Icebreakers (WAGB)
5.4.4 Tugboats

5.5 Aids to Navigation (ATON) Vessels
5.5.1 49 Foot BUSLs
5.5.2 55 Foot ANB
5.5.3 WLR Vessels
5.5.4 WLI and WLIC Vessels
5.5.5 175 Foot WLMs
5.5.6 225 Foot WLBs

5.6 Aircraft
5.6.1 Helicopter Operations
5.6.2 Helicopter Capabilities
5.6.3 Fixed-Wing Aircraft Operations
5.6.4 Aerial Delivery
5.6.5 Judging Distances by Lookouts on Aircraft

5.7 Crew Fatigue
5.7.1 Overview
5.7.2 Boat Crew Fatigue Standards
5.7.3 Aircrew Fatigue Standards

5.8 Rescue Swimmers
5.8.1 Coast Guard Air Station Rescue Swimmers
5.8.2 Coast Guard Surface Swimmers

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Section 5.1
Operations Overview

All Coast Guard operational platforms (afloat and airborne) may be used to perform SAR. This Chapter assists SAR planners in selecting appropriate SRUs. Operating guidelines and procedures are contained in vessel type manuals or policies issued by SAR coordinators to meet local operating conditions.

Aircraft resources include Long-Range Search (LRS) fixed-wing aircraft (HC-130), Medium-Range Search (MRS) fixed-wing aircraft (HU-25), Medium-Range Recovery (MRR) helicopters (HH-60), and Short-Range Recovery (SRR) helicopters (HH-65). Decisions on using aircraft for the search or rescue phase of a SAR mission should be based on the availability of resources and a sound knowledge of their capabilities and limitations. Table 5-6 shows the capabilities and limitations of Coast Guard aircraft. Rescue planning should always include direct consultation with the aircraft parent activity.

Surface craft include High and Medium Endurance (WHEC and WMEC) cutters; 87’ and 110’ Patrol Boats (WPB/CPB), ATON vessels and tugboats, standard boats (MLB, SRB, and UTB), and a variety of rigid inflatable boats and nonstandard boats. While the majority of SAR responses among surface resources are by the standard and nonstandard boats, all surface craft are an important part of the Coast Guard SAR system. The various sections and tables in this chapter describe the capabilities and limitations of the many Coast Guard cutters and boats. SAR planners should have a thorough understanding of what these resources are capable of accomplishing.

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Section 5.2
Surface Craft Operations

5.2.1 Overview

Coast Guard surface craft have numerous capabilities and characteristics that make them excellent search and rescue platforms. SMCs must have knowledge of the capabilities of all Coast Guard vessels, including Coast Guard Auxiliary vessels and non-Coast Guard surface assets. Some of these non-Coast Guard assets include: state and local marine agency vessels, recreational vessels, commercial fishing vessels, and large merchant ships, such as those that participate in the Amver program.

Coast Guard patrol boats, High and Medium Endurance cutters, and Icebreakers have extensive communications suites that make them excellent command and control platforms. They also have the capability to stay on scene for longer periods of time than aircraft. Cutters are capable of rendering assistance in weather conditions than may preclude or limit the use of Coast Guard aircraft, and can generally recover a greater number of survivors than Coast Guard aircraft. Although larger cutters tend to operate primarily in Deepwater regions, all cutters (except WLIC's, WLI's, and WLR's) are capable of performing search and rescue operations in the coastal zone.

All cutters are equipped with boats that are capable of directly recovering survivors from the water. In conditions that do not allow for the launching of cutter boats, direct cutter recovery can be accomplished through the use of cargo nets deployed over the side. Many cutters also have a designated cutter swimmer who can be deployed (tethered) directly from the ship under certain conditions to recover survivors from the water.

Cutters equipped with flight decks may have deployed helicopters that can improve the range and effectiveness of the cutter in a sustained offshore search operation. Some cutters are also equipped with night vision goggles that are useful during night searches.

Coast Guard boats are the primary surface search and rescue platform. Their smaller size allows them to conduct searches in harbors, bays, and other remote areas that are inaccessible to larger patrol boats and cutters. The majority of Coast Guard search and rescue cases takes place within the range of station boats such as the 41' Utility Boat and 47' Motor Lifeboat. Both the 41' UTB and the 47' MLB are equipped with de-watering pumps to assist flooding vessels, and they can tow vessels up to 100 and 150 gross tons, respectively. All Coast Guard boats can be used to insert Datum Marker Buoys, execute search patterns, and recover and transport survivors.

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Section 5.3
Coast Guard Boats

Boats are multi-mission vessels that operate in coastal and inland waters and are not intended to operate independently for long periods of time. Boats are "single-watch" resources meaning they cannot be underway for an indefinite period of time. The information provided in this section will aid in selecting the appropriate boat resources for a given mission. Additional information can be found at the Coast Guard Boat Forces web page: http://cgweb.comdt.uscg.mil/G-OCS/ocshome.htm.

5.3.1 Standard Boats

The Coast Guard's multi-mission boats are designed to perform SAR missions in adverse weather and sea conditions. Some are designed for surf and bar operations and are self-righting and self-bailing.

Table 5-1 Standard Boats

Shore-Based Response	MLB	44' and 47' Motor Lifeboat
	SPC (HWX)	52' Heavy Weather Special Purpose Craft (previously the 5 2' MLB)
	UTB	41' Utility Boat, Big
	RB-M	45' Response Boat, Medium (Future State)
	RB-S/HS	25' Response Boat – Small/Homeland Security
ATON	ANB	55' AtoN Boat
	BUSL	49' Stern Loading Buoy Boat

5.3.1.1 47-Foot Motor Life Boat (MLB). This craft was designed to replace the 44-foot MLB. It is capable in adverse sea and weather conditions and can operate in surf and bar conditions. Operating limitations are published in reference (z) and include those listed in Table 5-1.

44-Foot Motor Life Boat (MLB). Only limited quantities still exist in service. This craft are slower and provide less crew protection than the 47' MLB.

5.3.1.2 52' Heavy Weather Special Purpose Craft (previously the 52' MLB, now the SPC (HWX)). There are four of these vessels that operate in D13. They have a greater range and towing capability than the 44' and 47' MLB and can operate in heavier wind, sea, and surf conditions.

5.3.1.3 41-Foot Utility Boat (UTB). Fast, powerful, maneuverable boats, UTBs are designed to operate in moderate weather and sea conditions. Their operation is not permitted in breaking surf or bar conditions. Operating limits are published in reference (aa) and include those listed in Table 5-1.

5.3.1.4 Response Boat -Medium (RB-M) (Future State). The RB-M will be the replacement platform for the 41 UTB.

5.3.1.5 Response Boat- Small (RB-S). These 25-foot aluminum boats have foam filled protective fendering. These highly maneuverable boats provide excellent crew protection with an enclosed cabin and a heater and are powered by twin outboard gas engines.

5.3.1.6 Response Boat - Homeland Security (RB-HS) - With a fleet size of 100, it is an almost identical craft to the RB-S. This craft is numbered with a 6-digit Coast Guard number vice the 5-digit number assigned to the RB-S fleet.

5.3.1.7 Aids to Navigation Boats (ATON) boats. The primary boat platform used at ANTs is the TANB.

5.3.1.8 Cutter-Based Response Boats. Cutters typically have some form of boat capable of operating independently from the cutter. Commanding Officers/Officers in Charge will determine response restrictions.

Table 5-2 Cutter-Based Response Boats

Ship Based Response	CB-L	19' – 22' Cutter boat-Large- assigned on board WLB, WHEC, WMEC, WIX, and WAGB
	CB-M	17' and 18' Cutter boat-Medium- assigned on board WLM, WPB and WTGB
	CB-S	14' and 15' Cutter boat- Small- assigned on board WLI, WLIC, WLR, 82' WPB and WYTL
	CB-OTH	24' Cutter boat -Over The Horizon (Zodiac 733 Interceptor)
	MSB	26' Motor Surf Boat

5.3.2 Nonstandard Boats (NSBs)

NSBs, the majority of which are UTLs, run the gamut of capability in sea keeping, communications, navigation ability, and crew protection. While some NSBs may be extremely capable 27'-30' vessels with complete navigation and communications systems, others may be much smaller 17'-21' minimally equipped open boats. The SMC must be fully aware of the various types of NSBs that may be used. The SMC must be constantly aware of the potential risks when using a NSB vice standard boat. A NSB's equipment outfit and operating limits are established by the applicable district commander, but are primarily restricted to within 10 NM of shore.

- SMCs must be sensitive to the effect of exposure and wet conditions on nonstandard boat crews. Boat crew mission effectiveness degrades significantly after the first sortie hour.
- SMCs must ensure NSB crews comply with the requirements of reference (bb).
- Towing with NSBs should be undertaken with caution, as they are not typically well equipped for towing, particularly in moderate to heavy sea states.

Table 5-3 Non-Standard Boats

ATON NSBs	ANB	63' and 64' AtoN Boat
	SPC (Cable)	Cable Servicing Special Purpose Craft
	TANB	Trailerable AtoN Boat
Non-ATON NSBs	SPC	General Special Purpose Craft – a boat that is unique in the performance of an authorized mission requiring specialized capability that cannot be met within the standardized shore-based response boat fleet.
	SPC (LE)	Law Enforcement Special Purpose Craft
	SPC (Surf)	30' Surf Special Purpose Craft (previously the 30' SRB)
	TPSB	22' Transportable Port Security Boat (Grey Boston Whaler)
	UTL	Utility Boat Light – a 17' - 28' 11" fiberglass or aluminum hulled boat that may have fendering, and have installed electronics and engines.
	SKF	Skiffs.

5.3.3 Coast Guard Auxiliary Vessels

These boats frequently conduct coastal SAR. They are privately owned and not specifically designed for SAR. They vary in size, type, design, power, endurance, and durability. SAR planners should be familiar with their operating characteristics, capabilities, and limitations, and use them only for missions within their capabilities as directed by reference (cc). Coast Guard Auxiliarists should keep the SAR planner (SMC) apprised of crew fatigue and vessel condition and capabilities during any SAR mission.

Table 5-4 Coast Guard Boat Characteristics and Limitations *

		USCG Boats					
		UTL (NSB)	**RB-S/RB-HS**	**RB-M**	**41' UTB**	**47' MLB**	**52' MLB**
Type		NSB-Ashore	Std – Shore		Std – Shore		
Length (ft)		17-30	25'		41'	47'	52'
Cruise Speed (KTS)		20-30	35		18	21	
Sprint Speed (KTS)		Avg 37	44		26	25+	11
Max Range (NM)		Varies	150/175		300	200	495
Max Offshore Distance (NM)		Avg 5-10	10		30	50	
Max Sea conditions (ft)		2-6	6		8	20	35
Max Surf/Bar Conditions		None	None		None	20	25
Max Wind (KTS)		Avg 20	30		30	50	
Max Draft (DIW)		Avg 2'	3' 3"		4' 1"	4' 6"	6' 11"
Operating Draft (u/w)		Avg 18"	2'				
Towing Capacity (tons)		Avg 3-5 tons	10		100 Tons	150 Tons	100 Tons
Max Persons O/B (incl. Crew)		Avg 6-8	10		23	9	45
Min. Operational Crew	**SAR**	2	2		3	4	5
	LE/HS	3	3		4	4	
SAR Equipment	Medical	Varies	Basic First Aid		Basic First Aid	Basic First Aid	
	Litter	No	Capable		Yes	Yes	Yes
	Dewatering Pump	Some have P-1	Capable for P-6		P-6	P-6	
	Illumination Flares	Varies			Varies	Varies	
Special Equipment Capability	Searchlight	Some have handheld	Yes		2 Installed 1 Handheld	3 Installed 1 Hand-held	
	Radar	Some	Yes		Yes	Yes	
	Deck Mounted Weps Capable	Typically no	2 X M60 or below		2 X M60 or below	No	
Comms	UHF	No	R21 only		R21 only	R21 only	
	VHF-AM	No	No		No	No	
	VHF-FM	Yes	Yes		Yes	Yes	
	HF Freq. Range	No	No		(HF/SSB) Transmit: 1.6-29.99 MHz Receive: 0.1-29.99 MHz		
	Asset Tracking	No	R21 only		R21 only	R21 only	
	DES	No	Yes		Yes	Yes	
	ANDVT	No	No		No	No	
	Loud Hailer	Some	Yes		Yes	Yes	
Navigation	ADF Channel/Freqs	No	No		VHF 16, 21, 83, 121.5 and 243 MHz		
	GPS/DGPS	Some	WAAS (HS) DGPS (S)		DGPS	DGPS	

* Summary only – See Operator's Manual for definitive and most current information.

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Section 5.4
Coast Guard Cutters

5.4.1 Patrol Boats (WPB)

Patrol Boats (WPBs) are multi-mission cutters that perform SAR in coastal and deepwater environments. Their sea-keeping ability, speed, crew size, and moderate endurance provide an offshore SAR capability. WPB characteristics are summarized in Table 5-5.

5.4.1.1 87-Foot "Marine Protector Class" CPB. The 87' WPB is an extremely capable short-range SAR vessel. They have a 3-day endurance with a range of over 800 nm. The 87' WPB is capable of speeds up to 25 kts, and can operate safely in 8-12 foot seas and conduct small boat operations in 5-8 foot seas. The 87' WPB carries sophisticated electronic navigation equipment capable of SAR planning.

5.4.1.2 110-Foot (34 Meter) "Island Class" WPB. The Island Class motion in heavy seas is greatly reduced through use of a stabilizing fin system. They carry a medium sized boat capable of being launched safely in 5-8 foot seas. Island Class Patrol Boats have a rated towing capacity of 500 tons but may be capable of towing larger vessels in ideal conditions. A and B class cutters which have not yet been retrofitted with slow speed drives have a minimum speed of 9.5 knots on one shaft or 11.5 knots on both shafts. This makes it complicated, although possible, for them to tow small vessels. All Island Class WPBs are capable of speeds in excess of 26 knots. Their range (full fuel load of 10,382 gallons) is 3,300 nautical miles at 12.8 Kts. Their maximum expected continuous underway period is 5 days without replenishment or 10 days with replenishment.

5.4.2 Medium and High Endurance Cutters (WMEC and WHEC)

Medium and High Endurance Cutters (WMEC and WHEC) are multi-mission vessels and will perform SAR in coastal and oceanic environments. These cutters serve as excellent platforms as OSCs due to extended operational periods, seaworthiness, range, speed, communications, and space for a large number of survivors and equipment. General characteristics of WMECs and WHECs, as provided by Commandant (G-OCU), are in Table 5-5.

5.4.3 Icebreakers (WAGB)

Icebreakers (WAGB) are multi-mission vessels and will perform SAR in coastal, oceanic, and high latitude (Arctic/Antarctic) environments. The MACKINAW operates exclusively in the Great Lakes. These cutters serve as excellent platforms as OSCs due to extended operational periods, seaworthiness, range, speed, communications, and space for a large number of survivors and equipment. General characteristics of WAGBs, as provided by Commandant (G-OCU), are in Table 5-5.

5.4.4 Tugs – WYTL and WTGB

Coast Guard tugs are often used for SAR, particularly for towing or firefighting. They also serve as primary assets for assistance to vessels in distress due to ice conditions. Because they are slow and have poor sea-keeping ability in adverse weather, they operate primarily in protected waters.

NOTE: Tugs serve as primary assets for assistance to vessels in distress due to ice conditions.

5.4.4.1 65-Foot Harbor Tugs (WYTL). Harbor tugs normally operate in protected waters with seas less than 6 feet. They can tow vessels up to 300 tons, break ice up to 12 inches, and have either a 3 or 4 meter RHI. Their endurance is 2 days without replenishment and maximum speed is 10 knots.

5.4.4.2 140-Foot Ice-Breaking Tugs (WTGB). These can be operated inshore and offshore in less than heavy weather conditions. Crew performance declines in 3-6 foot seas due to excessive deck wetness and rolling, but these vessels can proceed safely, although uncomfortably, in seas up to 15 feet. The WTGB is capable of breaking ice from 24 – 36 inches and has a draft of 12 feet. Endurance is 10 days. They are equipped with one RHI, but launching it in other than calm seas is hazardous.

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Section 5.5
Aids to Navigation (ATON) Vessels

The Coast Guard operates a variety of boats and cutters in coastal waters to maintain aids to navigation. Search and rescue operations centers should be familiar with the capabilities of those vessels operating in their area of responsibility in the event they are used for SAR. Although ATON vessels are designed and staffed for their mission of aids to navigation, they are excellent vessels of opportunity for distress SAR cases. A description of ATON vessels and their general capabilities is provided below.

5.5.1 49-Foot BUSLs

This vessel has fairly good sea-keeping ability, up to 5-foot seas, and can remain on scene overnight because of onboard accommodations. The top speed 10.5 knots limit a quick response. This boat is not capable of offshore operations.

5.5.2 55-Foot ANB

This is a fast platform with overnight accommodations and sea-keeping qualities equal to the 41-foot UTB. This boat has twin screws and a top speed of 22 knots and is capable of operating at low speeds for towing.

5.5.3 WLR Vessels

The 65-foot and 75-foot River Tenders (WLR), operate in calm river areas and can transit in seas less than 4 feet. Maximum speed is 10 knots and endurance is 10 days without replenishment. These have a small workboat onboard and can be used as a dive platform.

5.5.4 WLI and WLIC Vessels

The 65-foot and 100-foot Inland Buoy Tenders (WLI), and 75-foot, 100-foot and 160-foot Inland Construction Tenders (WLIC), operate in protected areas and can transit in seas of 3 to 6 feet. Maximum speed is 10 knots and endurance is 4 to 10 days without replenishment. These have a small workboat onboard and can be used as a dive platform.

5.5.5 175-Foot WLMs

The WLM is capable of limited offshore operations in 5-8 foot seas. They have a 3-day endurance, 2000 nm range, and a maximum speed of 12 kts. The WLM can transport fuel and water, and can carry a 40-ton deck load with a 10 ton lifting capacity. The WLM can operate in up to 9 inches of frozen ice or 3 feet of brash ice, and carries sophisticated electronic navigation and positioning equipment that includes SAR planning.

5.5.6 225-Foot WLBs

The WLB is a highly capable offshore platform with outstanding sea keeping capability in 12-20 foot seas. They have a 21-day endurance, 8000 nm range, and a maximum speed of 16 kts. The WLB can transport fuel and water, and carry an 80-ton deck load with a 20-ton lifting capacity. The WLB can operate in 14 inches of frozen ice and carries sophisticated electronic navigation and positioning equipment that includes SAR planning.

Table 5-5 Coast Guard Cutter Characteristics

		USCG Cutters					
		87' CPB	**110' WPB**	**140' WTGB**	**175' WLM**	**210' WMEC**	**225' WLB**
Deployment Duration		3 days	5 days/10 days w/replenishment	10 days	3 days	6 wks.	21 days
Max/Cruise Speed (KTS)		25/?	26+/12.8	14/12	12/10	18/13	16/12
Max Range (NM)		875	3,300	1800	2000	2,500/ 6,500	8000
Max Sea Conditions (ft)		8-12	8-12	15	5-8		12-20
Towing Capacity (tons)		200	500		800	10,000	2000
Draft (ft)		6	10	12	8	11	13
Ice Break (inches)				24 - 36	9		14
Lift Capacity (buoy boom)					10 tons		20 tons
SAR Equipment	First Aid	x	x	x	x	x	x
	Sickbay/ Corpsman					x	x
	Cutter swimmer	x	x	x	x	x	x
	Litter	x	x	x	x	x	x
	Portable Pump	x	x	x	x	x	x
	Flares	x	x	x	x	x	x
	Raft	x	x	x	x	x	x
	Portable VHF-FM Radio	x	x	x	x	x	x
Special Equipment Capability	Small boat Launch Restr.	RHI; Up to 8ft.	RHI; Up to 8ft.	RHI; Calm seas	RHI; Calm seas	26' MSB; CB-L up to Sea state 6	RHI; Up to 8 feet
	Flt. Deck Equipped	None	None	None	None	HH-65; In flight daylight fueling of HH-60	None
	NVG	x	x			x	x
	Searchlight	x	x	x	x	x	x
	VHF-AM DF		x			x	
	VHF-FM DF	x	x	x	x	x	x
	MF/HF DF	x	x		x	x	x
	X-band Radar	x	x	x	x	x	x
	S-band Radar	x					
	Air Search Radar						
Comms	UHF	x	x			x	x
	VHF-AM		x			x	
	VHF-FM	x	x	x	x	x	x
	VHF-FM DSC	x			x		x
	MF/HF	x	x	x	x	x	x
	MF/HF DSC						
	SATCOM		x			x	OCONUS Only
	MILSATCOM		x			x	

		USCG Cutters				
		270' WMEC	**290' WAGB**	**378' WHEC**	**399' WAGB**	**420' WAGB**
Deployment Duration		6 wks.	7 days	60-90 days	80 days	65 days
Max/Cruise Speed (KTS)		19.5/12	18.7/9	28/11	20/13	17/12.5
Max Range (NM)		3,850/10,250	41,000	2,400/14,000	25,000	Unknown
Max Sea Conditions					45'	
Towing Capacity (tons)		Unknown	Unknown	Unknown	Unknown	Unknown
Draft		14'	19'	15'	32'	29'
Ice Break (inches)			36"+		21"	54"
Lift Capacity (buoy boom)			N/A			
SAR Equipment	First Aid	x	x	x	x	x
	Sickbay/ Corpsman	x	x	x	x	x
	Cutter swimmer	x	x	x	x	x
	Litter	x	x	x	x	x
	Portable Pump	x	x	x	x	x
	Flares	x	x	x	x	x
	Raft	x	x	x	x	x
	Portable VHF Radios	x	x	x	x	x
Special Equipment Capability	Small Boat Launch Restrictions	26' MSB up to Sea state 6 CB-L up to Sea state 5	26' MSB; 21' CB & Ice Skiff	26' MSB CB-L up to Sea state 6	26' MSB; 2 CB-L up to Sea state 5; 36'LCVP, 36'ASB	26' MSB; 2 CB-L up to Sea state 5; 36'LCVP, 36' ASB
	Flight Deck	HH-65/60	No	HH-65/60	HH-65/60	HH-65/60
	NVG	x	x	x		
	Searchlight	x	x	x	x	x
	VHF-AM DF	x		x		
	VHF-FM DF	x	x	x		
	MF/HF DF		x	x		
	X-band Radar	x	x	x	x	x
	S-band Radar	x	x	x		
	Air Search Radar	MK92		MK92/SPS40		
Comms	UHF	x	x	x	x	x
	VHF-AM	x		x	x	x
	VHF-FM	x	x	x	x	x
	VHF-FM DSC	x	x	x		
	MF/HF	x	x	x	x	x
	MF/HF DSC					
	SATCOM	x		x	x	x
	MILSATCOM	x		x		

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Section 5.6
Coast Guard Aircraft

Aircraft SRUs can quickly search large areas, intercept and escort aircraft or other SRUs, and perform aerial delivery of supplies, equipment and personnel. While the pilot is the final judge of SRU capability during a mission, the SMC should be aware of the specifications of the aircraft within the Coast Guard inventory. This will allow the SMC to make more informed decisions when allocating resources. Table 5-6 provides the characteristics of Coast Guard aircraft.

Table 5-6 Coast Guard Aircraft Characteristics *

		USCG Aircraft				
		HH-65A	**HH-60J**	**HC-130H**	**HU-25**	**MH-68**
Inventory	Funded Allowances:	82	35	26	26	8
	Total:	94	42	30	41	8
MAX Weight (lbs.)		9200	21884	155000	32000	6613
Fuel Capacity (lbs.)		1900	6460	62900	10000	1055 [1]
MAX Endurance (hrs.)		3+30	6+00	14+00	5+45	2+15 [1]
Cruise Speed (KTAS)		125	125	290	410	137
Max Range (NM)		400	700	4500	1940	363
Radius of Action		150 [2]	300	1600	800	100
Normal Crew (pilots/aircrew)		2/1	2/2	2/5	2/3	2/1
SAR Equipment	Hoist	x	x			x
	Sling	x	x			x
	Basket	x	x			
	Litter	x [3]	x		x	
	Pump	x [3]	x	x	x	
	Homer	x	x	x	x	
	Flares	x	x	x	x	x
	DMB	x	x	x	x	x
	SLDMB	x[13]	x[13]	x[13]	x[13]	
	Raft	x		x	x	x
	Radios	x	x	x		
	Survival kits			x		
Special Equipment	NVG	x [4]	x [4]	x [4]	x [4]	x [4]
	Searchlight	x	x			
	SLAR			x		
	FLIR	x [6]	x [6]	see CASPER	x [7]	x
	APG-66 Radar				x [11]	
	APS-137			x		
	X-band Radar (Bendix 1300)	x	x			
	WX Radar (AN/PN-215)			x		
	AN/APS-127				x [5]	
	AN/APS-143				x [12]	
	Cargo Hook	x [8]	x [8]			

		USCG Aircraft				
		HH-65A	**HH-60J**	**HC-130H**	**HU-25**	**MH-68**
Special Equip (cont)	CASPER [8]			x [9]		
	HUD					x
	M240					x
	.50 Caliber Sniper Rifle					x
	UHF	x	x	x	x	x
Communications	VHF-AM	x	x	x	x	x
	VHF-FM	x	x	x	x	x
	HF	x	x	x	x	x
	Vinson	x	x	x	x	x
	DES	x	x [5]			
	ANDVT		x	x	x	x
	COTHEN				x [6]	
	Loud Hailer				x	
	SATCOM			x [6]	x [6]	
	MILSATCOM					x
	VOR	x	x			x
Navigation	VOR/DME			x	x	
	ADF	x [10]	x [10]	x [10]	x [10]	
	RNAV	x			x	x
	TACAN	x	x	x	x	x
	GPS	x	x	x	x	x
	INS		x	x	x	
	DOPPLER		x			

Notes:
[1] Auxiliary tank is available for an additional 180 lbs of fuel (20 min. additional endurance)
[2] HH-65A radius of action reduced to approximately 120nm with the addition of a rescue swimmer.
[3] Not routinely carried on aircraft. Use determined by circumstances of each mission.
[4] F/W: Scanner position (crewmen) only; R/W: Fully capable all positions (including pilots)
[5] HU-25A only
[6] Not all Aircraft
[7] HU-25C only
[8] HH-65A: 2K lbs; HH-60J: 6K lbs
[9] CASPER: FLIR/Electro-optical w/tactical workstation
[10] ADF: LF/UHF/VHF-FM/VHF-AM
[11] HU-25C and HU-25D only
[12] HU-25D only
[13] SLDMB: Capable/certified to deploy; not stored on board for all units, SMC should direct taking along when launching
* Summary Only – See Operator's Manual for definitive and most current information.

5.6.1 Helicopter Operations

Medium-Range Recovery (MRR) and Short-Range Recovery (SRR) aircraft are excellent resources for coastal searches. Maneuverability and outstanding visibility for search scanners make helicopters ideal for closely checking sightings and searching shorelines. They are generally excellent rescue platforms, capable of recovering personnel from a wide variety of distress situations on land and water.

5.6.2 Helicopter Capabilities

Coast Guard helicopters have the following capabilities:

- hover
- perform hoists
- deliver de-watering pump
- confined area landing
- direction finding
- night illumination
- search radar
- datum marker buoy deployment
- where available: deliver fire suppression kit; deploy rescue swimmer/emergency medical technician; night vision goggles; forward-looking infrared.

NOTE: Litter and de-watering pump are not normally on board the HH-65, and must be specified for the mission.

5.6.2.1 Procedures for helicopter hoisting are contained in the Flight Manual for each type of aircraft, and may vary depending on the on scene situation. Hoists from Coast Guard helicopters will normally be accomplished using a rescue basket, stokes litter, or rescue strop.

(a) The rescue basket is usually preferred, since it can be readily lowered to most surfaces and offers the greatest protection to the person being hoisted.

(b) The stokes litter is used to hoist non-ambulatory persons, or persons who have injuries that might be aggravated by sitting in a rescue basket. Only the Coast Guard air-hoistable stokes litter shall be used for helicopter hoisting. The stokes litter is not normally carried aboard SRR helicopters; the aircrew shall be briefed when the need for a litter is anticipated.

(c) The rescue strop is used only to hoist persons familiar with its proper use, for example, a military aviator. In all such cases, the rescue strop's safety straps must be fastened.

(d) Hoists may be performed by lowering the rescue device directly or by first lowering a polypropylene trail line with weight bag, which allows persons on the surface to assist in maneuvering the rescue device as it is lowered and retrieved.

5.6.2.2 **Helicopter Evacuation/Hoist Safety Briefing for Vessels.** The safety and efficiency of helicopter hoist operations is greatly enhanced if the crew of the vessel or the ground party at the rescue scene is briefed in advance on what is required. The following "canned" briefing for alerting vessels covers the essential points, and should be transmitted as far in advance of the helicopter arrival as practicable:

HELICOPTER EVACUATION SAFETY BRIEFING FOR VESSELS

I have a detailed briefing on the helicopter evacuation. Please let me know when you have everyone who will be involved in the operation assembled around the radio. If some members of the crew cannot be spared due to duties, do the best you can to assemble the remainder. Let me know when you are ready.

[*Pause until advised the crew is assembled*]

I will begin this detailed briefing, but I will pause periodically to answer your questions. If you have none after checking that everyone understands, simply say, "go ahead".

A Coast Guard helicopter is en route to your location. You need to make some simple preparations to maximize the safety of the hoisting operation for the patient, your vessel, and the helicopter. Lower or stow all masts and booms that can be lowered.

Provide a clear area for hoisting, preferably on the port side of the stern. Think about the clearance of rigging lines and antennas, as well as the chosen deck area. The helicopter pilot will make the final determination as to the location of the hoisting area upon arrival. Plan to keep all unnecessary personnel out of the way. All personnel on deck must wear PFDs. Do not take any flash photographs because they distract the helicopter crew during this demanding operation. During the entire hoist operation, gale force winds are generated by the rotor system of the helicopter and are strongest directly beneath it. Ensure that all loose gear is stowed or secured so as not to pose a personnel injury hazard due to being blown around on deck, or a hazard to the helicopter's rotor system or engines.

[*Pause*]

Ensure that the patient is wearing a PFD, unless their condition absolutely prevents it. The patient should be informed of any instructions of the rescue device. If a litter is used, the uppermost strap (chest strap) must be placed under the patient's arms and over the patient's chest. All other straps are to be placed over the patient's body. If a basket is used, the patient should sit in the bottom of the basket, with their back to one end and must keep their arms and legs inside the basket until the basket is brought inside the helicopter. The patient should have appropriate personal identification such as a driver's license, social security card, or passport and immunization record, a record of any medication(s) administered, and a modest supply of personal items, including any prescribed medications they may be taking regularly. Use of a small soft-type bag is recommended for packing these items. It should be tied to the litter between the patient's legs, or placed in the basket with the patient. Do not tie it to the hoist cable, hook, or steadying line. A person being hoisted should be free of any items of entanglement such as purses or luggage.

[*Pause*]

When the helicopter arrives in your area, change course to place the wind 30 degrees off your port bow and continue at standard speed. Once steadying up on the new heading, and after you are satisfied that you have no hazards on your radar, turn it to standby so that it does not radiate. You may turn it on again as soon as the helicopter departs the area with the patient. This new heading may be modified again at the request of the helicopter pilot upon arrival. Ensure that any heading the pilot asks for will not endanger your vessel. For smaller vessels, the rotor wash may make it difficult to steer the vessel. Advise the pilot immediately if any sea conditions or hazards exist which will limit your navigational capabilities.

[*Pause*]

The helicopter will provide all of the required equipment for the hoist operation and will brief you prior to commencing the hoist operation. The helicopter may first deliver an orange steadying line with weighted bags at the end. Until the hoist operation is completed, one of your crewmembers must tend this line at all times, keeping the line free from fouling. The rescue device should be guided to the selected location on deck by the vessel's crew using the steadying line. On each approach, allow the rescue device to touch your vessel, to discharge static electricity. If the rescue device has to be moved to the person being evacuated, unhook it from the hoist cable. Do not move the rescue device from the hoisting area with the hoist cable still attached. If the cable is unhooked, do not, I repeat, do not attach the hook or the cable to any part of your vessel. For everyone's safety, the helicopter may move off to the side while the patient is prepared for the hoist.

[*Pause*]

Upon signal from your vessel, the helicopter will move back over the vessel and lower the hook. Allow the hook to touch your vessel to discharge static electricity, and then fasten the hook to the rescue device using the large part of the hook. When everyone is ready for the hoist, have the deck crew give a thumb up signal to the helicopter. Ensure that the steadying line is tended to prevent the rescue device from swinging excessively, this is the primary reason it is being used. Once the rescue device is inside the helicopter, the helicopter crew will probably discard the steadying line. You may recover it or toss it overboard, but ensure you do not foul your screw either way.

[*Pause*]

When the helicopter, call sign "Coast Guard rescue _____", arrives, it will contact you on _____. The helicopter will look over your vessel, give final instructions, and begin the hoist. Do you have any questions?

[*Pause*]

The ETA of the helicopter is _____. I may be contacted on _____ if you have any further questions.

5.6.3 Fixed Wing Aircraft Operations

Long-Range Search (LRS) and Medium-Range Search (MRS) aircraft are excellent search platforms for most SAR missions. Fixed-wing aircraft generally are capable of covering large search areas and remaining on scene for several hours. Visual scanning by crewmembers, combined with electronic sensors such as radar, homing and night vision devices; and other specialized equipment, provide an extremely effective search capability. They are particularly effective when searching for larger targets and when searching large areas. Their higher speed makes them less effective when searching for a person in the water or when searching with track spacing less than one nautical mile. Fixed-wing aircraft may also be effective during the rescue phase of a SAR mission, especially in cases requiring: aerial delivery of equipment, communications, navigation assistance for rotary wing or surface craft, locating targets prior to arrival of rescue units, briefing vessel on helicopter hoisting procedures, providing on scene weather, providing SAR and communications coverage for the helicopter, or extended coverage.

The MRS is equipped with an onboard navigation system that can compute the heading, distance, time and location (rendezvous point) to reach a distressed aircraft or vessel. Data necessary for this computation includes last known position of the target (latitude/longitude), time of the location, target heading and target speed (true air speed for aircraft/speed of advance for vessels).

5.6.4 Aerial Delivery

The Coast Guard operates two types of fixed-wing aircraft that can deliver various SAR equipment in flight. Specific delivery procedures for each aircraft are in the aircraft flight manuals. However, the following information is useful to personnel planning SAR operations.

5.6.4.1 Aerial Delivery Procedures. Items may be dropped either free-fall (message block only) or with a parachute. A parachute with trail line attached is used for most SAR aerial deliveries. The parachute slows descent, reducing the possibility of damaging the item on impact, and of endangering the vessel if it is inadvertently hit. Ideally, the trail line falls over the target and the dropped object lands in the water close aboard. Except in special cases, equipment should not be dropped directly onto target vessels. Parachute weight limits are listed in reference (dd).

5.6.4.2 Air-Deployable Rescue Equipment. Reference (dd) restricts aerial delivery to the items listed in that publication. Authorization for delivering other items should be requested from Commandant (G-OAV) as soon as the need is anticipated. Analyzing the many safety factors of each nonstandard delivery takes time, and may preclude immediate approval.

5.6.5 Judging Distances by Lookouts on Aircraft

Lookouts in search aircraft must concentrate their visual scans within the distance conforming with the track spacing assigned to the SRU. Distance determination over open water can be very difficult and sight distance varies with the altitude of the aircraft. When there is an opportunity, an effective method is to locate a search object such as a vessel on the radar and maneuver the aircraft to place the vessel the same approximate distance from the aircraft as the lookout's required scan based upon the track spacing. Once the lookouts can see the actual distance, they can better orient their scan to the required track space. Without a visual reference, lookouts have a tendency to look much farther out than the distance desired, particularly when visibility is good.

NOTE: A lookout must be looking at least 10 degrees below the horizon to be searching within 1 NM of the SRU when the aircraft is at an altitude of 1000 feet. In particular, lookouts should avoid the natural tendency to look at the horizon, which is many miles farther away than the maximum detection range of most SAR search objects. The maximum scan range should fall between one and two sweep widths of the SRU.

5.6.5.1 Example. On a visual search with a 1 NM sweep width, the lookout should concentrate his search within about 1 NM of the SRU since the area beyond this distance will yield only a small chance of search object detection. Scanning distance from the SRU should not be adjusted on the basis of track spacing. It is important to understand that the POD vs. Coverage curves are based on the cumulative effects of scanning the areas between tracks from the adjacent tracks. However, for all practical purposes the maximum detection range usually falls between one and two sweep widths. This means that in a low-coverage search, the scan range may be less than the track spacing, while at moderate to high coverage the scan range should be equal to or greater than the track spacing. For all track spacings, the maximum scan range should fall between one and two ***sweep widths*** of the

SRU. A lookout must be looking at least 10 degrees below the horizon to be searching within 1 NM of the SRU when the aircraft is at an altitude of 1000 feet. It is surprising to find out how low below the horizon 10 degrees looks. See Figure 5-1. Lookouts must use a plotter or other measuring device to identify the desired angle. The following procedures are suggested for aircraft lookouts to use to determine the correct sight distance for searches:

(a) Using a clear plastic plotter:

(1) Hold the plotter with the straight edge up and sight down the straight edge to the horizon.

(2) Without moving anything but your eyeball, look down the desired degree line (for example, 10 degrees for 1 mile at 1000 feet). See Figure 5-1.

(3) The point where your gaze meets the water is the desired distance from the aircraft.

(4) To fix this sight picture, make a small mark on the window with a grease pencil or use a point on a fixed structural part of the aircraft such as wing pods, engine nacelles, sponsons, etc. Remember, this sight line is correct for the altitude of the aircraft and the lookout's seated or standing height.

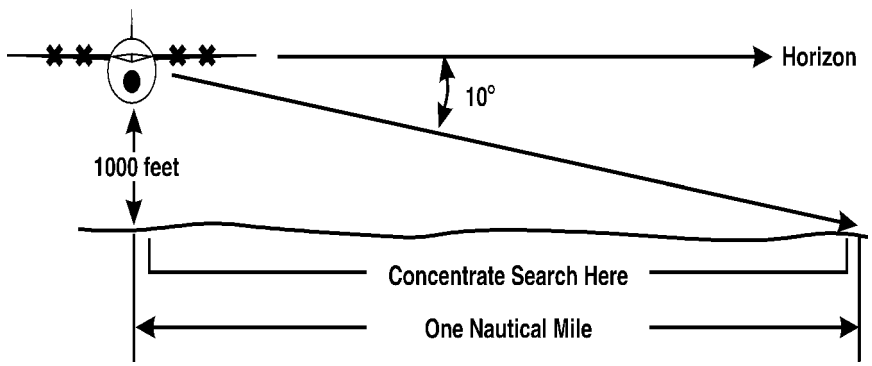

Figure 5-1 Example of Angle Below Horizon for Search Distance

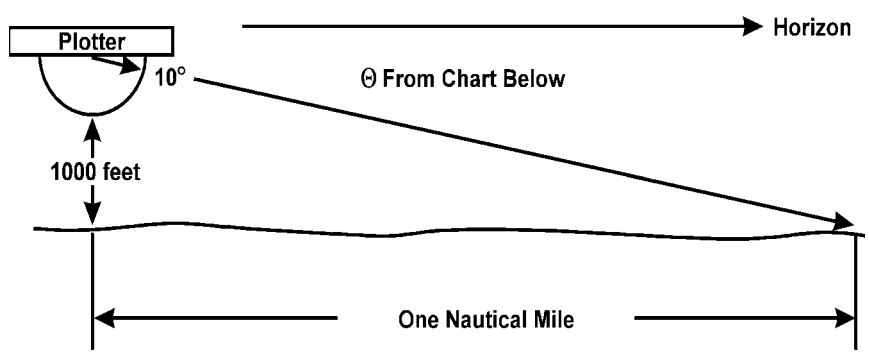

Figure 5-2 Use of Plotter to Determine Proper Sight Angle

(b) Use of points of reference on aircraft.

(1) Aircrews should determine various reference points on the aircraft for each lookout position that would correspond to distances for certain altitudes. Once established and lookouts are trained, then angles can be adjusted easily by the lookouts when the SRU changes altitude or track spacing assigned to the SRU is revised.

(2) The following table shows angles below the horizon by altitude for "rule of thumb" determination of distance.

Table 5-7 Angle Below Horizon by Altitude for Appropriate Distance

Altitude in Feet	Angle (in degrees) Between Horizon and Max Point of Search							
5000	59	40	29	23	12	8	6	5
4000	53	34	24	18	9	6	5	4
3000	45	27	18	14	7	5	4	3
2000	34	18	13	9	5	3	2	
1500	27	14	9	7	4	2		
1000	18	9	6	5	2			
500	9	5	3	2				
	0.5	1.0	1.5	2.0	4.0	6.0	8.0	10.0
	Distance In Nautical Miles							

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Section 5.7
Crew Fatigue

5.7.1 Overview

Crew fatigue can place greater limitations on the performance capabilities of SAR vessels and aircraft than the operating environment. Fatigue is a condition of impaired mental and physical performance brought about by extended periods of exertion and stress, which reduces the individual's capability to respond to external stimuli. Some factors contributing to fatigue are sleep loss, exposure to temperature extremes (hypothermia and heat stress), motion sickness, and changes in work and sleep cycles, physical exertion, workload, illness, hunger, and boredom.

5.7.2 Boat Crew Fatigue Standards

The standards for boat crew fatigue are provided in the U. S. Coast Guard Boat Operations and Training (BOAT) Manual Vol I, COMDTINST M16114.32 (series), and references (y - aa).

5.7.2.1 Background. Accidents in boat operations injure our personnel, reduce our operational capabilities, and cost money. Many of these mishaps have generally been attributed to crewmember error caused by insufficient training, and/or experience, compounded by prolonged operations and crew fatigue. Evidence exists to associate a high percentage of the mishaps with prolonged operations and crew fatigue. Since fatigue adversely affects operational capability and safety, it is necessary to establish reasonable boat crew utilization criteria. In doing so, mandatory boat crew mission hour limits have been established in ref (y-aa).

Fatigued personnel may not realize their physical state. A fatigued boat crew is physically and mentally unprepared for the rigors of a mission. They make judgment errors in boat handling and seamanship and exhibit decreased coordination, a narrowed attention span and a lower standard of performance. In addition, they show a decreased concern for safety and a willingness to "cut corners." Chronic fatigue must be reduced.

These guidelines are not a new concept. They are based on operational experience and subjective analysis of boat crew missions. The most immediate benefits to be derived from this program are the reduction of fatigue related mishaps involving boat crews and improved boat crew performance.

Fatigue standards generally provide maximum underway hours. These hours may be an accumulation of several missions (SAR, ELT, MEP, etc.) over a 24-hour period. However, there are occasions, especially during periods of severe weather, where operations will require a long amount of time to complete. In such cases, the prolonged hours and heavy weather will have an accelerating effect on the onset of fatigue as will the amount of time a crew member has been on duty or working prior to the mission. In establishing boat crew utilization criteria, consideration must be given to the cumulative effects of fatigue-inducing factors (heavy weather, temperature, boat mission, etc.), and human factors (motion sickness, survival clothing, changes in sleep and work cycles, work-duty time, etc.).

The guidelines presented are not intended to unduly restrict operational commanders when urgent operations are necessary. They are designed as the basis to modify the manner in which we pursue our missions to ensure safety, protect our personnel and to improve the overall quality of the services provided. No guidelines can cover every situation that will arise, however, the operational commander must consider the potential for urgent SAR (season, boating activity, weather, etc.) and risk. Common sense and sound judgment must be applied. The operational commander must determine the best course to follow in accomplishing certain urgent missions. It is not intended, except for emergencies, that additional crews be recalled when fatigue limits are reached. Other means of assistance such as other federal, state, local government resources, commercial, Coast Guard Auxiliary or adjacent units should be utilized in responding to non-urgent cases.

Units that cannot comply with operational and training requirements <u>and</u> the intent of the boat crew utilization guidelines without an increase in the unit's personnel allowance shall bring this information to the attention of the applicable program manager through the chain of command. This information provides operational justification for the billet needs. Subsequent request for additional billets, which would permit compliance, must be specific and fully justified.

The Crew Rest and Utilization guidelines, outlined in ref (y-aa), provide operational commanders maximum underway limits for boat crew personnel in order to improve their mental and physical readiness. Individual benefits derived depend upon the proper use of off-duty time to ensure good mental and physical condition. It is the responsibility of each boat crewmember to engage only in those off-duty activities that will not prevent reporting to duty fully rested.

The Commanding Officer/Officer-in-Charge of a station is responsible to determine when his or her boat crew is fatigued.

5.7.3 Aircrew Fatigue Standards

The standards for aircrew fatigue are provided in reference (dd).

5.7.3.1 Background. Uniform aircrew utilization standards are necessary to help reduce fatigue as a factor contributing to aircraft mishaps. **The standards are not intended to unduly restrict operational commanders when urgent operations are required; exceptions may be made by cognizant commanders as authorized per reference (dd). The standards cannot cover every situation that will arise. The command must determine the best course to follow in accomplishing certain urgent missions.** However, conformance with the "spirit" of these standards is necessary if chronic and acute fatigue is to be reduced. Commanding officers may establish more stringent comprehensive requirements after taking into account the variety of conditions that affect their units such as, but not limited to, mission, Bravo-Zero requirements, predominant weather, terrain, geographic location, individual pilot experience, use of sensors and mission time of day.

The spirit of these standards is to ensure that flight crews are well rested, alert, and capable of performing their duty safely. Although ground duties not related to a specific sortie are not counted as crew mission time, they must be considered in crew scheduling.

Section 5.8
Rescue Swimmers

Properly trained rescue swimmers should be used, when possible, to recover fatigued, unconscious, entangled or injured survivors from the water. Their use may reduce significantly some of the dangers inherent in maneuvering rescue vessels close to survivors.

NOTE: Rescue and surface swimmers shall not enter capsized or submerged objects – they may reach inside while maintaining a grasp on a reference point on the exterior of the object.

5.8.1 Coast Guard Air Station Rescue Swimmers

All Coast Guard air stations with helicopters have highly trained helicopter rescue swimmers who are EMT qualified. They are trained to deploy from the helicopter to recover an incapacitated victim from the water, day or night.

5.8.1.1 An SMC anticipating the need of a rescue swimmer shall specifically request one from the air station command; rescue swimmers are not a part of all flight crews. Their availability also depends on helicopter weight and space limitations and on scene conditions. Policies and procedures for use of helicopter rescue swimmers are delineated in reference (ee).

5.8.1.2 Reference (ee) states:

"The decision to deploy a rescue swimmer (RS) is initiated by the pilot-in-command, but the rescue swimmer has the authority to decline deployment if the RS assesses the situation to be beyond his/her capabilities . . . if deployed next to a capsized or submerged object, the RS is permitted to search visually and reach inside while maintaining a grasp on a reference point on the exterior of the object."

5.8.2 Coast Guard Surface Swimmers

Surface swimmers are collateral duty swimmers trained through the Personnel Qualification Standard (PQS). They are deployed from floating units, piers, or the shore.

5.8.2.1 Surface swimmers deployed from cutters assist people in the water. They are tethered to the cutter and are not meant to act on their own. While cutter swimmers are not required to be EMT qualified, they can assess an individual's physical condition and provide rescue breathing while the person is in the water. Cutter swimmers become qualified by completing the Cutter Swimmer Program PQS. Reference (ff) states:

"The Cutter Swimmer (CS) shall not enter capsized hulls or air frames, enter submerged vehicles, or conduct "diving" operations. If a CS determines that a person is trapped under or in an object, they may reach inside while maintaining a grasp on a reference point from the exterior of the object. . . The decision to deploy the swimmer rests with the CO/OinC. Cutter swimmers may decline to deploy if they believe the situation is beyond their personal capability."

5.8.2.2 Surface swimmers from station boats are normally deployed only to assist in man-overboard situations. They shall not enter capsized hulls. Reference (e) states: ". . . the coxswain will designate one of the crew as a swimmer . . .a swimmer should be used only when absolutely necessary because when a crewmember goes over the side to assist, it means an additional person has to be picked up from the water. Another crewmember must tend the line attached to the swimming harness at all times . . ."

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CHAPTER 6
PROCEDURES FOR UNDERWATER INCIDENTS

6.1 Underwater Incidents Overview

6.2 Submersibles
6.2.1 Coast Guard Resources
6.2.2 U.S. Navy Support
6.2.3 Use of Divers
6.2.4 Mutual Assistance Plans
6.2.5 Safety Requirements for Passenger-Carrying Submersibles
6.2.6 Voluntary Reporting System for Submersibles

6.3 Persons Trapped in Capsized Vessels
6.3.1 Swimmers
6.3.2 Divers
6.3.3 Rescue Procedures

6.4 Underwater Acoustic Beacons (Pingers)
6.4.1 Acoustic Beacons on Aircraft
6.4.2 Acoustic Beacons on Vessels
6.4.3 Acoustic Beacon Support

6.5 Action Required for Underwater SAR Preparation
6.5.1 Coast Guard Rescue Coordination Centers
6.5.2 Marine Safety Office (MSO)/Captain of the Port (COTP)

6.6 Scuba Diving Incidents
6.6.1 Dive Related Injuries and Symptoms
6.6.2 Emergency Treatment for Decompression Sickness and Air Embolism
6.6.3 SMC Procedures

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Section 6.1
Underwater Incidents Overview

Though not mandated to perform underwater rescues, the Coast Guard is responsible for developing, maintaining and operating facilities for the promotion of safety under--on and over--the high seas and waters subject to the jurisdiction of the United States. Traditionally, the Coast Guard has assisted distressed persons wherever and whenever possible. The responsibility extends to civilian submersibles operating on scientific, industrial or other missions; capsized or sunken vessels; or crashed aircraft in which persons may be trapped.

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Section 6.2
Submersibles

Most SAR cases involving submersibles have occurred on the surface. The Coast Guard or local resources handle these. Rescues of persons trapped in sunken vessels will normally require assistance from outside resources.

Submersibles have good safety records, but the few underwater accidents have demonstrated the difficulty of rescue and the potential for high public interest. The number of submersibles, especially for recreational and passenger-for-hire use, is increasing. This in turn increases the probability of rescue incidents.

6.2.1 Coast Guard Resources

The Coast Guard has no special equipment to assist submerged vessels or persons trapped in underwater habitats. Suitable outside equipment and assistance must be requested.

6.2.2 U.S. Navy Support

The U.S. Navy is the primary source of expertise and resources for complex underwater SAR incidents. The Navy's point of contact is the Navy Command Center Duty Captain at the Pentagon. This Navy command center can provide fleet resources, specialized experimental equipment and civilian undersea salvage specialists. When the Navy responds, it normally assumes SAR Mission Coordinator and the Coast Guard takes on a support role. Until then the Coast Guard must respond with its own or other available resources.

6.2.3 Use of Divers

Reference (gg) states that a Commanding Officer may use military divers, commercial divers or similarly highly trained diving resources, such as local police divers. If a Commanding Officer is faced with a life-threatening situation and none of the military, commercial, or other highly trained diving resources is reasonably available, he or she may consider using personnel with recreational diver qualifications who volunteer their services. Reference (gg) states clearly that this discretion should be exercised most carefully after seriously considering the training, qualification, medical, physical, and psychological condition of the volunteer, the condition of the diver's equipment, and the hazards of the dive.

6.2.4 Mutual Assistance Plans

Submersible operators have no mutual assistance plans at this time. However, plans are being developed which may consider creation of a mutual assistance program for research/construction deep submersible owners and operators. NOAA and members of the deep diving submersible community are facilitating this effort.

6.2.5 Safety Requirements for Passenger-Carrying Submersibles

6.2.5.1 The regulations governing passenger-carrying submersibles can be found at Title 46, Code of Federal Regulations, subchapter T (46 CFR parts 175-187). Under 46 CFR 175.110 (a)(4), the requirements of subchapter T are applicable when the submersible is carrying at least one passenger for hire. Since those regulations are primarily intended to cover surface vessels, many of the requirements cannot be applied to or may otherwise be inappropriate for submersibles. NAVIC 5-93 provides general guidance relative to the inspection and certification requirements for submersibles, and includes:

(a) Design and stability requirements,

(b) Lifesaving equipment,

(c) Fire protection equipment,

(d) Submersible operations, and

(e) Manning and licensing.

Additionally, submersibles may be subject to local operating restrictions imposed by the Captain of the Port (COTP) relative to navigation safety, port safety and security, and vessel traffic considerations.

6.2.6 Voluntary Reporting System for Submersibles

The Coast Guard operates a voluntary reporting system for civilian submersible operations for salvage, research, construction, etc. Submersible operators should be encouraged to provide the nearest Coast Guard District with details of their planned submersible operation.

Section 6.3
Persons Trapped in Capsized Vessels

Persons trapped under capsized vessels or in compartments (among others, this includes vessels, aircraft, and automobiles) pose extreme safety risks to both the victim and the SAR responders. Coast Guard resources for rescue in these cases are severely limited. Immediate Coast Guard SAR response resources may include SRUs that have rescue or surface swimmers. Rescue of persons trapped below the surface of the water must fully consider proper risk assessment and management. The situation could easily be of such extreme risk that it is imprudent to risk the lives of Coast Guard personnel even when the lives of others are in peril. The District Commander shall ensure guidance is in place so that experienced supervisors--not the SRU crew--decide how to proceed with rescue attempts.

6.3.1 Swimmers

Section 5.I provides a description and operating guidelines for the various Coast Guard rescue swimmers. References (e), (ee), and (ff) provide detailed operating guidance and limitations on what the rescue swimmer, cutter swimmer and surface swimmer are allowed to do. Essentially, a Coast Guard swimmer is NOT to go under the water and enter a capsized or submerged object.

6.3.2 Divers

Divers can be used to assist in rescuing persons trapped under a capsized vessel. Many state and local agencies have dive teams. The only Coast Guard units with divers assigned are located in Seattle (icebreakers), Honolulu and Guam (buoy tenders). Divers use specialized equipment including scuba gear and are normally trained in first aid and CPR. Professional divers are usually well versed in treating shock, near drowning, exposure and trauma. Reference (gg) states:

"[For dive operations in support of Coast Guard missions] unit commanding officers will normally use [certified] Coast Guard divers . . . However, situations may arise in which diving resources are required and a Coast Guard dive team is not available. In such situations, a unit commanding officer may request the assistance of other military divers, certified commercial divers or similarly highly trained diving resources, such as local police divers, through appropriate local channels . . ."

Furthermore,

"If faced with a life-threatening situation and none of the above-mentioned dive resources is reasonably available, a unit commanding officer may consider using any personnel with diving qualifications including recreational diving qualifications who volunteer services. Such personnel should be used only when, in the judgement of the unit commanding officer, the likelihood of saving a life and the hazard to the diver are both reasonable. The volunteer may be a Coast Guard person or a civilian . . ."

6.3.3 Rescue Procedures

Procedures recommended for rescuing personnel trapped in a capsized vessel are:

- Keep in contact with the person(s).
- Stabilize the hull.
- Estimate the volume of air remaining.
- Surface swimmers may attempt to direct trapped persons out but shall not dive under the vessel.
- Inject clean air if possible.
- Only if no rescue is possible, may you consider re-righting the vessel. Refer to reference (e).

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Section 6.4
Underwater Acoustic Beacons (Pingers)

The Underwater Acoustic Beacon, commonly called a "pinger," emits a sound that may be detected by surface craft or divers using an underwater acoustic locator. Some aircraft have pingers installed, and in limited circumstances SAR forces may be aided by attaching a pinger to the hull of a vessel.

6.4.1 Acoustic Beacons on Aircraft

Many aircraft downed in moderate or shallow waters have not been found, or excessive time and funds have been expended in determining crash locations. Some of these aircraft could have been located if they had an installed pinger. All Coast Guard aircraft have been equipped with pingers.

6.4.2 Acoustic Beacons on Vessels

Pingers may be attached to the hull of an overturned vessel that is in danger of sinking when personnel are known or suspected to be trapped inside the hull. This action is not routine, and is not taken in all SAR cases involving overturned hulls. When such action is needed, the OSC should request a pinger from the SMC.

6.4.3 Acoustic Beacon Support

Pingers are not readily available in all locations. They may be obtained from a Coast Guard or U.S. Navy air station or by calling the U.S. Navy Command Center Duty Captain desk at the Pentagon for supply by the Supervisor of Salvage. Personnel trained to locate pingers using locator receivers are available through the U.S. Navy Supervisor of Salvage office. For emergencies, requests for service are to be made with the U.S. Navy Duty Captain Desk in the Pentagon (703) 695-0231.

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Section 6.5
Action Required for Underwater SAR Preparation

Due to the limited capability of Coast Guard resources to respond to underwater incidents, the best response is to plan ahead, to know the limitations and to know whom to contact for additional assistance.

6.5.1 Coast Guard Rescue Coordination Centers

Coast Guard Rescue Coordination Centers shall:

(a) Monitor civilian submersible and underwater habitat activity within the District and advise the Commandant of developments that may affect procedures and policies of this directive.

(b) Encourage submersible manufacturers, owners and operators to participate in the voluntary reporting system for submersible operations.

(c) When informed of a civilian submersible operation, send a message to Chief of Naval Operations and issue a Notice to Mariners giving the location(s) and time(s) of the operation. Tourist submersibles are approved for specific sites and may have as many as 12 dives per day; therefore, notification for tourist submersibles should be as a permanent record.

(d) Maintain files of copies of the Certificate of Inspection (COI) and a copy of the submersible operations manual as approved by the COTP in the RCC for reference in the event of a rescue incident.

(e) Establish a resource file of local, state, commercial, military rescue and/or salvage divers and submersibles for use in underwater search and rescue.

(f) When assistance is required for a civilian underwater SAR incident:

(1) Notify the Navy Command Center Duty Captain at the Pentagon (on duty 24 hours: Commercial (703) 695-0231, Autovon 225-0231).

(2) If the incident involves a civilian submersible, request implementation of SUBMISS/ SUBSUNK per reference (hh). Send a follow-up message confirming the request.

(3) Respond with Coast Guard resources as appropriate (On Scene Commander, rescue platform such as buoy tender, traffic control, aircraft, communications and/or logistics.).

(4) Serve as SAR Mission Coordinator (SMC). If Navy resources are used, the Navy may assume SMC. If the Navy assumes SMC, continue to assist as requested.

(5) Inform the Area Commander and Commandant (G-OFP) and (G-OPR) of the progress of the rescue before and after the Navy assumes SMC.

(6) Prepare a SAR case study in addition to the normal assistance report.

(g) Maintain liaison with the Navy and other organizations to coordinate planning for civilian underwater SAR emergencies.

6.5.2 Marine Safety Office (MSO)/Captain of the Port (COTP)

MSOs/COTPs shall:

(a) Forward copies of the Certificate of Inspection (COI) and the approved operations manual of passenger carrying submersibles which they license to the appropriate RCC showing safety features and conditions, determined route, depth and any other applicable information necessary to prosecute a SAR case with the vessel.

(b) Submit to the appropriate RCC information on any requirements developed for recreational submersibles. Authorizations for recreational submersible operations should be copied to the RCC.

Section 6.6
Scuba Diving Incidents

Scuba divers occasionally suffer unique, compressed-gas injuries that few SAR response personnel understand or are prepared to handle. Coast Guard SRUs are not required to be experts in providing medical diagnosis or treatment for such injuries. However, it is expected that personnel will be able to recognize the general symptoms of dive related injuries so that their potential severity is recognized and that basic steps are taken to minimize worsening the medical condition.

6.6.1 Dive Related Injuries and Symptoms

Dive related injuries fall into three general categories, decompression sickness, air embolism and nitrogen narcosis. Decompression sickness and air embolism are the most serious threats to the diver and require immediate treatment with hyperbaric oxygen in a recompression chamber.

6.6.1.1 Decompression sickness, sometimes called the “bends”, is generally brought about by the diver absorbing gas into the blood from the compressed air breathed while diving. A diver must ascend slowly to avoid having these gases form into bubbles. Symptoms of bubble formation include pain at the joints, chest pain, headache/dizziness, confusion and numbness.

6.6.1.2 Air embolism is caused by excess gas pressure inside the lungs. It is most likely to develop during an improperly executed ascent. As the diver ascends, the air in the lungs expands, forcing gas bubbles directly into the bloodstream. This air (bubble) typically is transported to the brain where blockage of blood flow will occur depriving the brain of oxygen. Symptoms include blurred vision, paralysis, dizziness/nausea, weakness, confusion, headache, chest pain and unconsciousness.

6.6.1.3 Nitrogen narcosis or “rapture of the deep”, which is not a decompression illness, is caused by the narcotic effect of the nitrogen in the diver's breathing medium and disappears when the diver moves into shallower water or surfaces.

6.6.2 Emergency Treatment for Decompression Sickness and Air Embolism

Other divers with the victim will be excellent sources of information and an effort should be made to have one travel with the patient to the medical facility. Since it can be difficult to differentiate between decompression sickness and air embolism, it is best for field treatment of both. While many SRUs cannot provide extensive medical assistance, they do serve the essential role of transporting the victim and possibly stabilizing the situation.

6.6.2.1 Where the capability exists, the following steps are advised:

(a) Ensure airway, breathing, and circulation (ABC).

(b) Calm and reassure the victim.

(c) Attempt medical assessment and diving history.

(d) Administer fluids: If more than one hour from medical help, allow victim oral fluids at the rate of 4 fluid ounces every 15 minutes as tolerated. Oral Fluids should be withheld if transport time is less than one hour.

(e) Administer 100% oxygen.

(f) Place victim in a supine (flat on back) position; if the victim is nauseated, place the victim on his/her left side for airway management.

(g) Transport to nearest medical facility/recompression chamber.

Dive accident injuries are aggravated by reduced atmospheric pressure. Unpressurized aircraft conducting a diving accident MEDEVAC should fly at the lowest safe altitude; 500 - 1000 feet is best for the victim.

6.6.3 SMC Procedures

Any Coast Guard facility that would expect to perform as SMC for a diving accident case, typically RCCs and Command Center's, shall maintain a list of resources that can provide diving medical advice and a list of available recompression chambers. Divers Alert Network (DAN), located at Duke University Medical Center in North Carolina, is a nonprofit organization that provides emergency medical advice and assistance for underwater diving accidents. Diving emergency guidance can be obtained by telephone, **(919) 684-8111 for emergencies**, and (919) 684-2948 for routine matters.

Appendix A
Command SAR Library

Table A-1 Joint International Publications (IMO and ICAO)

Table A-2 International Maritime Organization (IMO) Publications

Table A-3 Unpublished IMO Documents

Table A-4 Other International Documents

Table A-5 Regional Documents

Table A-6 National Documents

Table A-1 Joint International Publications (IMO and ICAO)

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual								
Volume I, Organization and Management	✓							
Volume II, Mission Co-ordination	✓	✓		✓				
Volume III, Mobile Facilities	✓	✓	✓	✓	✓	✓	✓	

Table A-2 International Maritime Organization (IMO) Publications

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
International Convention for the Safety of Life at Sea (SOLAS) (Chapters IV Radiocommunications and V Safety of Navigation are of particular use.)	✓			✓		✓		
International Convention on Maritime Search and Rescue	✓			✓				
International SafetyNET Manual	✓							
International Code of Signals (INTERCO; NIMA Publication 102)	✓	✓		✓		✓		
NAVTEX Manual	✓							
International Maritime Dangerous Goods (IMDG) Code, as amended	✓			✓				
IMDG Code Supplement: Emergency Procedures (EMS); Medical First Aid Guide (MFAG); and Reporting Procedures	✓							

Table A-3 Unpublished IMO Documents

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
IMO Resolution A.706(17) World-Wide Navigational Warning Service	✓			✓				
IMO Resolution A.855(20) Standards for On-board Helicopter Facilities	✓			✓				
IMO Resolution A.887(21) Establishment, Updating and Retrieval of the Information Contained in the Registration Databases for the Global Maritime Distress and Safety System (GMDSS)	✓			✓				
IMO Resolution A.894(21) International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual	✓			✓				
Resolution MSC.70(69) Adoption of Amendments to the International Convention on Maritime	✓			✓				

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
Search and Rescue, 1979								
COM/Circ.129 Amendments to the International Code of Signals	✓	✓		✓		✓		
COMSAR 2/7/5 Inmarsat; Barring of SESs; Quick Unbarring of SESs by an RCC	✓							
COMSAR.3/INF.21 Inmarsat; SAR Co-ordination Communications; Distress Priority Communications from Shore-to-Ship	✓							
COMSAR/Circ.3 Relations Between NAVAREA Coordinators and Rescue Co-ordination Centers”	✓							
COMSAR/Circ.11 List of Coast Earth Station Operation Coordinators in Inmarsat System	✓							
COMSAR/Circ.11/Corr.1 Correction to COMSAR/Circ.11	✓							
COMSAR/Circ.12 Relays of Distress Alerts by Digital Selective Calling	✓							
COMSAR/Circ.13 Shore-to-Ship Communications During a Distress	✓							
COMSAR/Circ.15 Joint IMO/IHO/WMO Manual on Maritime Safety Information (MSI)	✓							
COMSAR/Circ.18 Guidance on Minimum Communication Needs of Maritime Rescue Co-ordination Centers (MRCCs)	✓							
COMSAR/Circ.19 Distress Priority Communications for RCC from Shore-to-Ship via Inmarsat	✓							
COMSAR/Circ.20 List of NAVAREA Coordinators	✓							
COMSAR/Circ.21 Procedure for Responding to DSC Distress Alerts by Ships	✓							
GMDSS/Circ.8 Master Plan of Shore-based Facilities for the GMDSS (GMDSS Master Plan)	✓							
GMDSS/Circ.8/Corr. Amendments to the GMDSS Master Plan	✓							
MSC/Circ.597/Rev.1 Piracy and Armed Robbery Against Ships	✓							
MSC/Circ.622/Rev.1 Recommendations to Governments for **Preventing and Suppressing Piracy and Armed Robbery Against Ships**	✓							

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
MSC/Circ.685 Amendment to Resolution A.706(17) World-Wide Navigational Warning Service	✓							
MSC/Circ.750 Amendments to Resolution A.706(17) World-Wide Navigational Warning Service	✓			✓				
MSC/Circ.794 IMO Standard Marine Communication Phrases	✓			✓				
MSC/Circ.805 Guidance for the Use of Radio Signals by Ships Under Attack or Threat of Attack from Pirates or Armed Robbers	✓			✓				
MSC/Circ.864 Guidelines for Preparing Plans Between Search and Rescue Services and Passenger Ships on Fixed Routes (in accordance with SOLAS regulation V/15(c))	✓			✓				
MSC/Circ.892 Alerting of Search and Rescue Authorities	✓			✓				
MSC/Circ.895 Recommendation on Helicopter Landing Areas on ro-ro Passenger Ships	✓			✓				
SAR.2/Circ.6 Area Search and Rescue Plans	✓			✓				
Note: This is consolidation of SAR.2/Circ.5 and SAR.3/Circ.5 and as of OCT 01 was not yet available.	✓							
AR.7/Circ.2	✓							
Documents and Publications in Addition to IMO's List (SAR.7/Circ.2)								
International Civil Aviation Organization (ICAO) Documents:								
ICAO Annex 10, Aeronautical Communications	✓			✓				
Volume I, Part II, Chapter 2 "Distress Frequencies"	✓			✓				
Volume II, Section 5.3 "Distress and urgency radiotelephony communications procedures"	✓			✓				
ICAO Annex 11, Air Traffic Services, Chapter 5 "Alerting Service"	✓			✓				
ICAO Annex 12, Search and Rescue	✓			✓				
ICAO Annex 14, Aerodromes, Chapter 9 "Emergency and Other Services"	✓			✓				
ICAO Regional Air Navigation Plans (RANPs) (applicable extracts of "Search and Rescue Services")	✓			✓				

Table A-4 Other International Documents

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
Radio-Medical Assistance, Volume I: Part I-Coded Medical Messages	✓			✓				
Radio-Medical Assistance, Volume II: Part I-The More Common Acute Illnesses	✓							
Radio-Medical Assistance, Volume II: Part II-Assistance and First Aid On Board	✓							
List of Radio determination and Special Service Stations (International Telecommunication Union (ITU))	✓							
Standard Marine Navigational Vocabulary	✓			✓				

Table A-5 Regional Documents

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace Operations Manual	✓			LANT UNITS				
North Atlantic International General Aviation Operations Manual	✓			LANT UNITS				

Table A-6 National Documents

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
National SAR Supplement (NSS)	✓	✓		✓	✓			
National SAR Plan (NSP) (contained within the NSS)	✓	✓		✓	✓			
Coast Guard Addendum to the NSS	✓	✓		✓	✓			
Flight Services, FAA 7110.10(series) (Federal Aviation Administration)	✓			✓				
Air Traffic Control, FAA 7110.65(series) (Federal Aviation Administration)	✓			✓				
Airport Emergency Plan, FAA's Advisory Circular AC No: 150/5200-31	✓			✓				
Water Rescue Plans, Facilities, and Equipment, FAA's Advisory Circular AC 150/5210-13	✓	✓		✓	✓			
Marine Radiotelephone Users Handbook	✓	✓		✓	✓			✓
Cospas-Sarsat Users Manual for U.S. RCCs	✓	✓		✓				
U.S. Air Force Foreign Clearance Guide	✓			✓				
NAVSEA SUBMISS/SUBSUNK Bill for Submarines and Manned	✓	✓		✓				

Noncombatant Submersibles								
Diving Accident Manual	✓	✓		✓	✓			
Incident Command System Manual/ Field Operational Guide	✓	✓		✓	✓			
Management and Operation of the Automated Mutual-assistance Vessel Rescue (Amver) System, COMDTINST 16122.2 (series)	✓	✓			✓			
Amver (Ship Reporting System) User's Manual	✓							
End User Manual for the Automated Mutual-assistance Vessel Rescue (Amver) System (Amver II Version 1.0, Phase IV) Vessel Arrivals Utility dated April 24, 1994 by Synetics	✓							
Global Maritime Distress and Safety System (GMDSS) SAR Vessel Identification User's Manual dated November 1, 1996 by Battelle	✓	✓						
CASP User's Manual.	✓	✓						
Admiralty List of Radio Signals, Volume 5, Global Maritime Distress and Safety System (GMDSS)	✓	✓		✓				
NIMA Publication 117 "Radio Navigational Aids"	✓	✓		✓				
"SAR Cooperation Plan for Passenger Ships" carried on board SOLAS-class passenger ships (cruise ships and passenger ferries on international voyages); copies provided from Coast Guard Headquarters	✓							
Coast Guard Air Operations Manual	✓	✓						
Coast Guard Rescue and Survival Systems Manual	✓	✓	✓	✓	✓	✓	✓	✓
Area/District Heavy Weather Plan	✓	✓		✓	✓			
Applicable Hurricane/Typhoon Operations Plan	✓	✓		✓	✓			
U.S. Army Corps of Engineers National Disaster Plan	✓	✓		✓	✓			
Local/subordinate Group SOPs	✓	✓		✓	✓		✓	
Coast Guard Auxiliary Flotilla Procedures	✓	✓	✓	✓	✓			
Civil Air Patrol guidance documents, where applicable	✓	✓		✓	✓			
Fleet Guides	✓	✓		✓	✓			
U.S. Navy Operating Areas and Warning Area instruction	✓	✓		✓	✓			
Bridges Over Navigable Waters of the U.S.	✓	✓			✓			
Bowditch ("The American Practical Navigator", NIMA Publication 9)	✓	✓			✓			
Light List (for own AOR)	✓	✓		✓	✓			
Tidal Current Tables	✓	✓		✓	✓			
Tide Tables	✓	✓		✓	✓			

U.S. Coast Pilot	✓	✓			✓			
Waterway Guide	✓	✓			✓			
U.S. Navy Marine Climatic Atlas of the World (applicable volume(s))	✓	✓		✓				
World Atlas	✓	✓		✓				
Fish Guides (for own AOR)	✓	✓		✓	✓			
Road maps	✓	✓		✓	✓			

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Appendix B
MISLE

B.1 MISLE System
B.1.1 Purpose
B.1.2 Discussion
B.1.3 Recommendations for System Improvements

B.2 Reporting Criteria
B.2.1 SAR Case
B.2.2 SAR Sortie
B.2.3 Case/Sortie Details
B.2.4 Reporting Efforts for Case Coordination and Communications
B.2.5 Co-located Units
B.2.6 Afloat Units
B.2.7 Headquarters Units
B.2.8 SAR Mission Coordinator (SMC)
B.2.9 Special Reporting Situations
B.2.10 Auxiliary Reporting

B.3 Responsibility
B.3.1 Mandatory Versus Optional Computer Fields

B.4 Action
B.4.1 Training
B.4.2 System Passwords
B.4.3 Use of On-line Guidance
B.4.4 Meeting Specific Reporting Criteria

B.5 General Data Entry Guidelines
B.5.1 Entry Time Zone
B.5.2 Case Numbers for Reopened Cases
B.5.3 Sortie Times
B.5.4 Entering Lives Data
B.5.5 Entering Property Data
B.5.6 Positions of Distress to be Entered for Uncorrelated Distress Broadcasts
B.5.7 Use of River Entries
B.5.8 Distance Entries

B.6 Data Retrieval
B.6.1 SAR Statistics
B.6.2 Pre-Formatted Reports
B.6.3 Ad Hoc Queries
B.6.4 Density Plots
B.6.5 SARSIM

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Section B.1
MISLE System

This appendix prescribes the administrative requirements and responsibilities for submitting and processing Search and Rescue (SAR) operations data.

B.1.1 Purpose

The Marine Information for Safety and Law Enforcement (MISLE) system provides a case management tool, ready access to a wide range of data useful in conducting SAR case response and information to:

- Measure unit workload and effectiveness;
- Determine resource utilization and needs;
- Justify budget requests to meet projected requirements;
- Analyze system operations for potential savings; and
- Promulgate policies and procedures to more effectively manage the overall SAR program.

B.1.2 Discussion

In FY 2003 the Marine Information for Safety and Law Enforcement (MISLE) systems response module was available for SAR data entry. The multi-mission data system replaced the SARMIS II, SAR mission only data system as the repository for SAR data. Having a single data system for entry of data relevant to a variety of missions is a significant benefit to those entering the data in addition to providing rapid access to a wealth of data for response operations, the system facilitates analysis of response across the full range of Coast Guard missions. MISLE is a web central database application maintained and operated by the Operations System Center (OSC). Users access the system using the Web Browser on their CG Standard Workstation.

B.1.2.1 MISLE is a case management system and permits the SMC to enter all SAR data for a case, including unit sortie information. Districts may elect to have all data entered by the SMC or have the SMC enter only the incident management data and individual units enter the sortie data. To best accomplish the latter, the SMC must first enter the minimum required data, and then retrieve the machine generated case number. This number is then provided to participating units for their use in entering sortie data. SMC assignment policy is detailed in Chapter 1. Units subordinate to the SMC may enter single unit cases.

B.1.2.2 Units should enter data in real time or near real time when possible. At a minimum in an effort to improve the timeliness and accuracy of SAR information within the Coast Guard, all units shall complete their SAR case data entry NLT five (05) days following the suspension or closing of a case.

B.1.2.3 MISLE generates sequential file numbers for each activity as well as an overall case number. For tracking purposes, the case number should be noted on SMC/Unit SAR case file folders.

B.1.2.4 MISLE has an online user guides to assist users in performing data entry. The user guides give detailed instructions for entering SAR incident data.

B.1.3 Recommendations for System Improvements

Comments or recommendations for improvements to the MISLE system for SAR should be sent to the OSC Hotline, where they will be consolidated and addressed by the MISLE Configuration Control Board.

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Section B.2
Reporting Criteria

B.2.1 SAR Case

A SAR case shall be officially opened for each instance the Coast Guard is specifically requested to render assistance. This requirement applies to those instances in which persons and/or property are subject to the risk of being injured, damaged, or lost and shall include assistance rendered to other Coast Guard resources regardless of the unit assigned. Incidents for which a SAR case must be opened include:

B.2.1.1 A SAR case is opened when a Coast Guard resource(s) is dispatched to render assistance.

B.2.1.2 **Coordination/communications.** A SAR case shall be opened when no hardware was launched, if Coast Guard personnel in coordination/communications expended at least thirty (30) minutes of effort.

B.2.2 SAR Sortie

A unit shall enter a SAR Sortie into MISLE each time one of its resources (hardware or personnel) is dispatched to respond to a SAR incident. The SAR Mission Controller (SMC) may enter all data for a case involving more than one unit, even if that unit launched no sortie.

B.2.3 Case/Sortie Details

For each incident the responding unit should complete a sortie and the SMC (same unit may fill in this portion even if not SMC in the event of a single unit case) shall enter the unique case details.

B.2.4 Reporting efforts for Case Coordination and Communications

An SMC should report all time spent coordinating a multi-unit response through appropriate entry in the Incident Management Activity. The Sortie Activity shall not be used to report coordination and communications efforts.

B.2.5 Co-located Units

Where a station and group are co-located, each should report the work done by its own resources under its own OPFAC. For groups who provide the communications watch and/or OOD for the station, coordination and communications efforts should be reported as the group.

B.2.6 Afloat Units

Afloat reporting units shall have their data entered by their Administrative Control (ADCON) Commander. If deployed the SMC for the case may also enter the data.

B.2.7 Headquarters units

Headquarters' unit's data shall be entered by the unit or by the SMC through prior arrangement with SMC unit.

B.2.8 SAR Mission Coordinator (SMC)

B.2.8.1 The SMC is responsible for ensuring completion of the entire set of SAR data for each case.

B.2.8.2 If the SMC is reassigned during a case, the unit designated SMC upon termination of the case shall fulfill these requirements.

B.2.8.3 The SMC is also responsible for completing the sortie data for non-Coast Guard resources participating in the case. For local/state resources, a subordinate unit that works directly with the local/state agency may do this more expediently.

B.2.9 Special Reporting Situations

B.2.9.1 Helicopters deployed aboard cutters for other than SAR purposes but which are utilized to prosecute a SAR incident shall be considered an extension of the cutter. This instance requires a Report utilizing the cutter's OPFAC.

B.2.9.2 Use of helicopter/shipboard operations for the specific purpose of prosecuting a SAR case constitutes a multi-unit case. This requires a separate Report from both the cutter and the helicopter's assigned Air Station.

B.2.9.3 Resources that are temporarily assigned duty (TAD) to another OPFAC shall report SAR cases under their own OPFAC.

B.2.9.4 Resources deployed to a facility that does not have a Coast Guard OPFAC number, and is not under the operational control (OPCON) of another Coast Guard OPFAC, shall report SAR incidents under their own OPFAC.

B.2.9.5 Bar conditions, frequently encountered in the Thirteenth District, are when the Coast Guard provides an escort service for vessels desiring assistance when crossing the bar. Usually, more than one vessel is escorted on a single trip. In such instances, multiple vessels should be entered. The assisting unit should file only ONE sortie for each trip across the bar regardless of the number of vessels being escorted.

B.2.9.6 Amver vessel participation sorties shall be entered by the SMC. All uses of Amver vessels shall be documented as part of a case. Vessels other then Amver participants should also be entered subject to level of participation.

B.2.10 Auxiliary Reporting

B.2.10.1 When the Auxiliary is the only resource employed, an entire report (notification, incident management, case and sortie sections) will be completed for that case by the Coast Guard unit exercising operational control over the Auxiliarists.

B.2.10.2 When the Auxiliary is just one of several resources employed, the sortie section needs to be completed by the OPCON unit.

Section B.3
Responsibility

SAR data is vital to effective program management and operational case analysis. Command cooperation and support are required to achieve a quality database. It is the responsibility of each reporting unit to ensure completeness, accuracy, and timely entry of their SAR response information. Area/District SAR offices shall perform quality checks of the data entered into MISLE by their units; ensuring submissions are complete, accurate, and timely. These checks shall be preformed using the Coast Guard Information System (CGINFO) at http://cginfo.osc.uscg.mil in conjunction with actually viewing case files on the MISLE system. G-OPR shall further conduct routine checks of the quality of the data submitted throughout the Coast Guard. Individual units are encouraged to view data via CGINFO; frequent checks will help maintain the quality of the data input and ensure data accurately credit the SAR efforts of that unit.

B.3.1 Mandatory Versus Optional Computer Fields

Units shall consider every field for which they have data as mandatory for entry purposes. The system was designed to allow the most rapid entry of data by not requiring the user to visit every screen. To ensure the minimum data common to all cases is collected, fields within the data entry system are designated as mandatory. Not completing these fields will result in an error and require entry before the record is complete. This mandatory designation is NOT indicative of the information that is needed by the Coast Guard for proper analysis and support of this vital mission.

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Section B.4
Action

Area/District Commanders, unit Commanding Officers and Officers-in-Charge shall:

B.4.1 Training

Ensure that personnel assigned with preparation and processing of SAR information have completed available training and familiarity with the MISLE system.

B.4.2 System Passwords

Contact OSC helpdesk to obtain MISLE passwords. OSC helpdesk may be reached by phone (304) 264-2500 or email oschelpdesk@osc.uscg.mil.

B.4.3 Use of Online Guidance

Use the online user guides when performing data entry functions in support of the MISLE.

B.4.4 Meeting Specific Reporting Criteria

Direct their unit's efforts toward meeting the specified reporting criteria set forth in Section B.2 above.

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Section B.5
General Data Entry Guidelines

B.5.1 Entry Time Zone

All times entered shall be entered in Zulu.

B.5.2 Case Numbers for Reopened Cases

A re-opened case shall be entered under its original case number and electronic file.

B.5.3 Sortie Times

B.5.3.1 A sortie is considered terminated if the resource (1) is an aircraft and shuts down its engines, or (2) is a vessel and becomes moored.

B.5.3.2 A resource which diverts from another mission to respond to a SAR incident, or diverts away from a SAR incident to another mission, shall only report the time spent on the SAR mission in the sortie.

B.5.3.3 Time on sortie should equal only the actual time spent underway and NOT include any time spent in refueling, picking up supplies, layover, etc.

B.5.4 Entering Lives data

Lives data shall include all persons involved in a case that are affected by the incident. For passenger vessels this should include both crew and passengers when appropriate. For MEDEVACs and MEDICOs only the person actually benefiting from the medical assistance shall be counted.

B.5.4.1 **Case level.** Lives at the case level reflect the actual number of persons assisted by the Coast Guard. The lives in all categories must equal the total number of persons involved. This data is used for reporting overall Coast Guard performance.

B.5.4.2 **Sortie level.** Lives at the sortie level reflect the efforts expended by each unit involved. The lives within a single sortie in all categories cannot exceed the total number of persons involved. Lives accounted across a series of sorties within a single case can exceed the total number of actual persons involved. Sortie lives accounting permits multiple units or sorties to assist a single individual and get credit for their contribution. When examining the resulting data, it should not be added across units to reflect the number of persons saved, lost, missing or assisted by the Coast Guard in a particular region. Added data may be used to show level of effort and contribution by a number of units.

B.5.4.3 **Lives saved** are those lives that would have been lost had the rescue action not been taken. This includes actually pulling a person from a position of distress or removing them from a situation that would likely resulted in their death had the action not been taken.

B.5.4.4 **Lives lost** are reported in several subcategories. To count a life as lost there must be a body recovered, otherwise it shall be entered within the Lives Unaccounted for category.

B.5.4.5 **Lives lost before notification** are those lives lost which to the best of the reporting unit's knowledge occurred before notification of the incident was made to the Coast Guard. This is not a legal declaration of death by a medical authority, but a judgment call to determine if response units could likely have affected the outcome.

B.5.4.6 **Lives lost after notification** are those lives lost which occurred after notification was made to the Coast Guard. When known the appropriate additional lives lost categories shall be used to more clearly refine at what point in the rescue process the life was lost. These include:

(a) **Lives lost after alongside** for lives lost after the assisting unit arrived on scene.

(b) **Lives lost after onboard assisting unit** for lives lost after the person was transferred to the assisting unit until the person was transferred to shoreside services (ambulance/medical personnel or hospital direct when delivered to hospital helo pad).

(c) **Lives lost after reaching shore facility** for lives lost after the assisting unit has transferred the person to shoreside services (ambulance/medical personnel or hospital direct when delivered to hospital helo pad).

B.5.4.7 **Lives unaccounted for** are those persons who at the end of a SAR response remain missing. This includes those persons presumed as lives lost but no body was recovered.

B.5.4.8 **Lives assisted** are those persons who are provided assistance that did not meet the criteria for lives saved but did receive some assistance. An entry for type of assistance provided is required for every life entered under this category. Persons merely onboard a vessel that is provided assistance directed at the vessel (repairs, fuel, etc.) are not necessarily assisted.

B.5.5 Entering Property Data

Property values to be entered include the value of the vessel, aircraft, structure or other property category as found in the SARMIS II entry property pull-down listing plus any cargo. For a fishing vessel, the value of catch on board shall be included in values entered as appropriate. Property values in a single case may fall into one or more categories. To accurately reflect the Coast Guard's efforts, it is important that all categories that apply are used. For example, a portion of the property is damaged or lost and the remainder is saved, values of each shall be entered in the appropriate category.

B.5.5.1 **Case level.** Property data at the case level reflects the actual value of property assisted by the Coast Guard. The property in all categories must equal the total value of property involved. This data is used for reporting overall Coast Guard performance.

B.5.5.2 **Sortie level.** Property data at the sortie level reflects the efforts expended by each unit involved. The property value within a single sortie in all categories cannot exceed the total value of property involved. Property values accounted across a series of sorties within a single case can exceed the total value of actual property involved. Sortie property accounting permits multiple units or sorties to assist the same property and get credit for their contribution. When examining the resulting data, it should not be added across units to reflect the amount of property saved, damaged, lost, missing or assisted by the Coast Guard in a particular region. Added data may be used to show level of effort and contribution by a number of units.

B.5.5.3 **Property saved** is the estimated value of property that would have been lost had the rescue action not been taken. This includes actually removing property from a position of distress or providing aid to property in a situation that would likely resulted in the property's loss had the action not been taken.

B.5.5.4 **Property damaged** is the estimated value of damage to property resulting from the incident.

B.5.5.5 **Property lost/totaled** is the estimated value of property that is either absolutely lost (not recovered) or is a constructive loss (beyond reasonable repair; no longer useful). Important to note that for property observed or know to have sunk, it shall be included as property lost.

B.5.5.6 **Property Unaccounted for** is the estimated value of property that at the end of a SAR response remains missing. This category is to be used only for those cases where the fate of the property is unknown and shall not include property observed or known to have sunk.

B.5.6 Position of distress to be entered for uncorrelated distress broadcasts

B.5.6.1 For VHF-FM uncorrelated MAYDAY or automated distress no specific position shall be entered. A generalized area within the call originated shall be entered.

B.5.6.2 For SARSAT unlocated do not enter a location. Enter the word “unlocated” in the text box.

B.5.6.3 For MF or HF unlocated do not enter a location. Enter the word “unlocated” in the text box.

B.5.6.4 For DSC without position follow scheme for VHF-FM, MF or HF as appropriate.

B.5.7 Distance Entries

B.5.7.1 Distance to scene shall be entered from the homeport if the resource is dispatched from there, or from the point diverted to the SAR sortie.

B.5.7.2 Distance off shore shall be entered as the distance from the closest point of land to the incident location.

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Section B.6
Data Retrieval

B.6.1 SAR Statistics

The Office of Search and Rescue compile summary data approximately one month after the end of each fiscal year. It is posted on the SAR Program Internet web site. (http://www.uscg.mil/hq/g-o/g-opr/sar.htm)

B.6.2 Pre-Formatted Reports

CGInfo via the intranet provides the ability to examine a wide range of data for both the case and sortie level data. Data for the various years is accessed different locations. All data prior to 2003 is accessed via the link for Search and Rescue. All data 2003 and later is accessed via the link for MISLE Response.

B.6.3 Ad Hoc Queries

To retrieve information that is not available from the CGInfo web site, the OSC MISLE staff should be contacted via the help desk.

B.6.4 Density Plots

The location of cases sorted for an individual request plotted on a digitized chart of any area of the globe. This capability is currently limited. Contact the OSC help desk to get a listing of data with associated position data. MISLE Geographic Information System (GIS) provides some ability to create density plots. The process is described in the on-line user guides for GIS and GIS Scatter Plots.

B.6.5 SARSIM

The Search and Rescue Simulation Model (SARSIM) is capable of analyzing a complex system of SAR resources. It is a technically oriented analytical tools which requires close teamwork between G-ORP and the recipient of the information.

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Appendix C
Standard CG SAR Messages

C.1. Situation Report (SITREP)
C.1.1 Overview
C.1.2 Standard Format

C.2 Search Action Plan (SAP)
C.2.1 Overview
C.2.2 Standard Format

C.3 Sample DSC False Alert Message Format

C.4 SafetyNET Examples
C.4.1 Example message text to vessel reporting a distress
C.4.2 Example marine broadcast text
C.4.3 Example cancellation text

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Section C.1
Situation Report (SITREP)

C.1.1 Overview

A standard SITREP ensures the information needed to properly conduct a search and rescue mission is available and the SAR chain of command is fully aware of the situation. The standard SITREP:

- Allows the reader to quickly find information by knowing where it is always located in the report,
- Facilitates review by drafters and reviewers to quickly recognize if information is missing, and
- Lets drafters of SITREP's learn the format once and no regardless of unit, produce the proper message with the required information.

C.1.2 Standard Format

The format is provided in the following paragraphs in a short form as a overview and rapid reminder for experienced SITREP drafters and in a longer form with section by section description of content. At the end a sample is provided to demonstrate how an actual SITREP would appear.

C.1.2.1 Standard SITREP format overview

P
FM
TO
INFO
BT
UNCLAS//N16130//
SUBJ: EMERGENCY PHASE; SITREP #; NAME/DESCRIPTION OF SUBJECT OF INCIDENT; ABBREVIATED NATURE OF DISTRESS; GENERAL GEOGRAPHIC LOCATION
PERIOD: (DTG) TO (DTG)
1. SITUATION:
A. CURRENT STATUS OF SAR CASE.
B. NOTIFICATION:
C. NARRATIVE:
D. DESC:
E. POB INFO:
F. ADDITIONAL POC:
G. WX:
2. ACTION TAKEN:
CHRONOLOGICAL RECORD OF WHAT WAS DONE, SRUs USED, SEARCH METHOD(S), SIGHTINGS OR FINDINGS, AREAS COMPLETED, POS.
3. FUTURE PLANS AND RECOMMENDATIONS:
4. AMPLIFYING INFO:
A. CASE INFORMATION.
B. RESULTS OF BOARDINGS.
C. STATUS OF AIDS TO NAVIGATION IN AREA OF INCIDENT.
D. POLLUTION.
E. MEDIA INTEREST.
5. CASE STATUS:
A. CASE CLOSED.
B. SORTIE DATA:
C. CASE NUMBER(S).
BT

C.1.2.2 Explanation by section

P
FM **(1)**
TO **(2)**
INFO **(3)**
BT
UNCLAS//N16130
SUBJ: **(4)** EMERGENCY PHASE **(5)**; SITREP **(6)**; NAME/DESCRIPTION OF SUBJECT OF INCIDENT **(7)**; ABBREVIATED NATURE OF DISTRESS **(8)**; GENERAL GEOGRAPHIC LOCATION **(9)**
PERIOD: (DTG) TO (DTG)

(1) SRU, OSC, SMC, SC (Area/Comdt SITREPs)

(2) OSC, SMC, SC, Area/Comdt

(3) Other interested/involved units/agencies. If OSC assigned, SRU send to OSC, DO NOT SEND to SMC. If not send directly to SMC.

- When incident involves pollution or threat of pollution message should go to MSO/COTP, EPA, and/or state pollution agency as appropriate.
- When incident involves commercial vessel message should go to MIO/MSO as appropriate.
- When incident involves deaths should go to MIO/MSO and/or state/local agency as appropriate.
- When incident involves civilian aircraft mishap message should go to FAA.
- When incident involves or results in obstruction to navigation message should go to COTP and/or Army Corps of Engineers as appropriate.

(4) UNCERTAINTY, ALERT or DISTRESS (Not in final SITREP.)

(5) SITREP ONE, TWO, THREE... when incident is being closed use SITREP # AND FINAL.

(6) Use NAME, REGISTRATION/DOCUMENT NUMBER, SIZE, and/or TYPE of craft (vessel, boat, aircraft, sailboard, etc.).

(7) Use SINKING, SUNK, AGROUND, TAKING ON WATER, ON FIRE, DISABLED, ADRIFT, COLLISION, ON BREAKWALL, DISORIENTED, LOST, OVERDUE, EXPLOSION, MEDEVAC, MEDICO, MAN OVERBOARD, PIW, EPIRB, ELT, CRASHED, etc., or combination as situation indicates.

(8) Use location from prominent landmark or point of land, location in body of water, or over prominent undersea feature (examples: NM SOUTH OF CITY PIER; 10 NM WEST OF SAN DIEGO; SOUTHERN CASCO BAY; EASTERN LAKE SUPERIOR; GRAND BANKS; FLORIDA STRAITS.

(9) Period of time covered by this report given as start date-time-group to end date-time-group.

1. SITUATION: **(10)**

A.	CURRENT STATUS OF SAR CASE	**(11)**
B.	NOTIFICATION	**(12)**
C.	NARRATIVE	**(13)**
D.	DESC	**(14)**
E.	POB INFO	**(15)**
F.	ADDITIONAL POC	**(16)**
G.	WX	**(17)**

(10) Use only the subparagraphs needed and renumber as appropriate. With the exception of subparagraph A, provide only information that is a change from previous SITREP or is new information. Subparagraph A is to be used on all SITREPS. When adding a new addressee it will be necessary to report all situation information.

(11) A short statement about status of object or subject condition such as: VESSEL STILL MISSING; PIW REMAINS UNLOCATED; SUBJECT LOCATED; F/V SUNK; etc. (Required for every SITREP).

(12) Provide:

- TIME of notification;
- by WHOM notified (name, phone number/other means of contact, relation to subject);
- HOW notified (radio, phone, cellular phone, in person, relay through other vessel/person, etc.)

(13) Provide description of incident:

- Amplification of what occurred, chain of events leading to situation;
- Most probable location (last know position/DATUM) of incident;

OR

- Route for overdue;
- Reason suspect overdue (missed appointment, float/flight plan, etc.)

(14) Describe the craft (vessel, aircraft, surfboard, etc.). Include TYPE, MAKE, MODEL, LENGTH, WIDTH, HEIGHT, ENGINE #/TYPE, MASTS, COLOR, SAILS #/COLOR, REGISTRATION/DOCUMENT NUMBER, DISTINCTIVE FEATURES. Also include:

- Communications gear (UHF, VHF, Cellular Phone & No., SATCOM, etc.)
- Electronics (LORAN, RADAR, depth finder, SATNAV, GPS, etc.)
- Survival gear (PFDs, survival/exposure suits, liferafts, lifeboats, parachutes, flares, signal/strobe lights, dye markers, mirrors, EPIRB/ELT, etc.)
- Other gear (Anchors, food, water, first aid kit, fuel supply, etc.)

(15) Provide information about people on board/involved:

- Number of persons on board as "# POB";
- Names, ages, addresses, phone #s, experience level (in general & in subject craft)/health

(16) List other people that have knowledge about subject or may provide additional information.

(17) Give on scene weather, winds, seas, swells, air temp, sea temp, clouds, ceiling, precipitation, visibility, tide, ice cover, etc.

2.	ACTION TAKEN	**(18)**
	CHRONOLOGICAL RECORD OF WHAT WAS DONE	**(19)**
	SRUs USED	**(20)**
	SEARCH METHOD (S)	**(21)**
	SIGHTINGS OR FINDINGS	**(22)**
	AREAS COMPLETED	**(23)**
	POS	**(24)**

(18) For SITREPS detailing actions taken in response to a search action plan, report search execution details ONLY if they DEVIATE from the search action plan.

(19) List actions by DTG, include: Notification by reporting source; SRU movements & actions; DMB insertions/relocations; other significant events.

(20) To describe SRUs, use type and hull/tail number. Hull/tail number is sufficient for subsequent entries in same message.

(21) Visual, electronic (radar, DF, IR, etc.), listening, etc.

(22) List all sightings/findings, including debris. If none, and you feel you must say so, use "NO SIGHTINGS"

(23) If part of search action plan give area designation (e.g. B-4). If only part of search action plan area searched give description of portion of area searched. If NOT part of search action plan give description of area searched, track spacing, pattern, search object.

(24) Give actual POS for completed areas (not PLANNED POD), or for partial areas if search discontinued mid-search.

3.	FUTURE PLANS AND RECOMMENDATIONS	**(25)**

(25) Describe actions planned for future execution. Include any recommendations and, if needed, a request for additional assistance/resources.

4.	AMPLIFYING INFO	**(26)**
	A. CASE INFORMATION	**(27)**
	B. RESULTS OF BOARDINGS	**(28)**
	C. STATUS OF AIDS TO NAVIGATION IN AREA OF INCIDENT	**(29)**
	D. POLLUTION	**(30)**
	E. MEDIA INTEREST	**(31)**

(26) Use only as needed.

(27) Any additional information relative to the case not covered in prior paragraphs: Use of Amver and/or CASP; results of SLDMB/DMB drift; debriefs; etc.

(28) Information about boardings where boardings may reveal information for further incident prosecution.

(29) Statement regarding aids to navigation in the vicinity of the incident when the incident include is one of following: grounding, collision, striking of aid. Statement should remark as to station and watch of aids to navigation.

(30) In cases of collision, grounding, fire, explosion, crash, sinking, capsizing, or others where pollution may result. Information about type and amount of possible pollutant onboard, signs of or potential for leakage, any action taken to prevent or stop leakage, any action taken to contain spill (if information not included in prior paragraphs).

(31) Indicate level of interest, negatives not required. If not included in FUTURE PLANS AND RECOMMENDATIONS, need for assistance with public affairs may be requested here.

5.	CASE STATUS	**(32)**
	A. CASE INFORMATION	**(33)**
	B. SORTIE DATA	**(34)**
	C. CASE NUMBER (S)	**(35)**

(32) CASE STATUS provides the status of the case at the time of the SITREP and data associated with the case.

(33) CASE CLOSED only if incident resolved. DO NOT USE "CASE PENDS". ACTIVE SEARCH SUSPENDED PENDING FURTHER DEVELOPMENTS when granted by SAR Coordinator (SMC use only). If none of these categories USE NOTHING!!

(34) List by unit for period of report. Data for sorties in progress during report are to be reported in SITREP covering period when sortie complete.

(35) List multi-unit and unit case numbers.

C.1.2.3 Example message:

E X A M P L E S I T R E P

P 121830Z DEC 00
FM STA SAULT STE MARIE MI
TO COMCOGARDGRU SAULT STE MARIE MI
INFO COGARD MSO SAULT STE MARIE MI
USCGC BISCAYNE BAY
BT
UNCLAS //N16230//
SUBJ DISTRESS SITREP ONE 30FT P/C ORION COLLISION WITH DRUMMOND ISLAND FERRY DETOUR PASS
PERIOD 121600Z - 121830Z DEC 00
1. SITUATION
A. P/C ORION SUNK, 1 PIW RECOVERED, 3 PIW REMAIN MISSING.
B. NOTIFICATION. AT 121600Z DEC 00 CAPT I.B. JINCSD, PILOT OF DRUMMOND ISLANDER VIA CH 16/22 VHF-FM.
C. NARRATIVE: CAPT JINCSD REPORTED WHILE ON OUTBOUND RUN TO ISLAND, P/C ORION CROSSED HIS BOW. AT 121535Z BOW OF FERRY CLIPPED PORT QUARTER OF P/C WHICH IMMEDIATELY BEGAN TO SINK. FERRY RETURNED TO SCENE AND PICKED UP 01 PERSON, O/O MR. SCHAEFER, WHO REPORTED 03 OTHER POBS. POB WERE WEARING PFDS. COLLISION OCCURRED 095 DEG T, 0.5 NM FROM MAINLAND FERRY DOCK IN DETOUR, MI. NO DAMAGE TO FERRY.
D. DESC: P/C ORION, 30 FT, BAYLINER, CABIN, OPEN BRIDGE, WHITE WITH BLUE STRIPE, WHITE SEAT CUSHIONS, SINGLE 300 HP I/O, FIBERGLASS CONSTRUCTION, MICHIGAN REG MC 1111 AD, GPS, VHF-FM 6 BLUE TYPE 3 PFDS, FLARE KIT (TYPE UNK), 20 LB DANFORTH ANCHOR, 150 FT ANCHOR LINE, 50 GALS GASOLINE; FERRY DRUMMOND ISLANDER, 84.5 FT, BEAM 30 FT, DRAFT 8 FT 2 IN, OIL FIRED, CAR FERRY (10 AUTOS), O/O BY EASTERN UPPER PENINSULA TRANSPORTATION AUTHORITY.
E. POB INFO: P/C ORION 4 POB; O/O RICH SCHAEFER, 45 YOA MALE, 007 SPY WAY, KINCHELOE MI, PH. 906-555-1991, 30 YRS BOATING, 1 YR WITH THIS VSL; REGINA MCNAMARA, 34 YOA FEMALE, FRIEND OF O/O, POOR SWIMMER; GREG PURVIS, 36 YOA MALE, FISHING BUDDY OF O/O, APT M1, SUNNYDALE FARM, TUCZON ARIZONA, NO PHONE, RECENT RECOVERY FROM HEART ATTACK, GOOD SWIMMER, NO EXPERIENCE ON BOATS; KATHRYN EBNER, 35 YOA FEMALE, CO-WORKER OF O/O, 501 BLUE JEANS AVE, RUDYARD MI, PH. 906-555-0000, 9 YRS BOATING/SAILING EXPERIENCE, EXCELLENT SWIMMER. FERRY DRUMMOND ISLANDER, CAPT I.B. JINCSD, 58 YOA MALE, BOX 20 RTE 3, DETOUR, MI, 906-555-1991, 38 YRS EXPERIENCE, 15 ON DRUMMOND ISLANDER.
F. ADDITIONAL POC: MR. FULL A. BALONEY, WATERFRONT STREET, DETOUR MI, 906-555-3474; OBSERVED COLLISION WHILE LOADING BOAT FOR FISHING TRIP.
G. WX: FOG, WINDS 350 DEG T/15 KTS, SEAS 180 DEG T/2 FT, VIS 0.5 NM, OVCST, A/T 28 DEG F, W/T 33 DEG F, SHORE ICE OUT 100 YDS.
2. ACTION TAKEN:
A. 121600Z DEC 00 GRU SAULT RCVD REPORT OF COLLISION.
B. 1605Z STA SAULT UTB CG41378 U/W.
C. 1620Z RCVD RPT THAT ONLY 1 POB RECOVERED, 3 PIW.
D. 1715Z CG41378 O/S COMMENCING SS SEARCH, 0.1 NM TRACK SPACING, SEARCH OBJECT PIW.

E. 1720Z A/S TRAVERSE CITY HH-65 O/S.
E. 1723Z CG41378 LOCATED/RECOVERED 2 YELLOW TYPE 3 PFDS.
F. 1820Z CG41378 DIRECTED BY SMC TO DISCONTINUE SS SEARCH TO CONDUCT CS SEARCH DOWN DRIFT LINE.
3. FUTURE PLANS AND RECOMMENDATIONS:
A. COMPLETE CS SEARCH.
B. RECOMMEND SHORELINE SEARCH.
C. RECOMMEND CGC BISCAYNE BAY CURRENTLY IN TRANSIT BE DIRECTED TO ASSIST IN SEARCH/ASSUME OSC.
4. AMPLIFYING INFO:
A. SEVERAL PASSENGERS ON FERRY REPORTED TWO PERSONS JUMPED INTO WATER OFF BOW OF P/C WITH PFDS. OTHER PERSON NOT SEEN.
B. RECOVERED PIW, MR. SCHAEFER TAKEN ASHORE BY FERRY AND MET BY AMBULANCE. ENROUTE TO STRAITS AREA HOSPITAL IN ST IGNACE. REPORTED BY FERRY CREW AS HYPOTHERMIC. CG REP SHOULD DEBRIEF MR. SCHAEFER.
C. ALL AIDS TO NAVIGATION IN AREA ON STATION AND WATCHING PROPERLY.
D. POLLUTION: LIGHT SHEEN IN VICINITY OF COLLISION/SINKING. DISSAPATING QUICKLY IN SEA ACTION. APPEARS TO BE GASOLINE.
E. MEDIA INTEREST: LOCAL REPORTER WAS ONBOARD FERRY AND TOOK PHOTOS IMMEDIATELY FOLLOWING COLLISION, INCLUDING SHOT OF P/C SINKING. SEVERAL PHONE CALLS RECEIVED FROM RADIO AND PRINT MEDIA. REFERRED CALLS TO GROUP PAO AS DIRECTED BY GROUP COMMAND CENTER.
5. CASE STATUS:
A. SORTIE DATA: STA SAULT 1 SORTIE/2.5 HRS
B. SARMIS CASE NUMBER 123456
BT

EXAMPLE SITREP

Section C.2
Search Action Plan (SAP)

C.2.1 Overview

A standard SAP allows the reader to quickly find critical information by knowing that it will always be in a certain place and to identify vital information that is missing. Equally as important, the DRAFTER of the SAP only needs to learn the format once, since it is now standardized throughout the Coast Guard. Benefits of this standardized format include:

- time saved in preparing the message
- fewer calls looking for missing information
- time saved finding information critical to executing the mission

C.2.2 Standard Format

The format is provided in the following paragraphs in a short form as a overview and rapid reminder for experienced SAP drafters and in a longer form with section by section description of content. At the end a sample is provided to demonstrate how an actual SAP would appear.

C.2.2.1 Standard SAP format overview

O
FM
TO
INFO
ACCT
BT
UNCLAS//N16130//
SUBJ: (PHASE) – NAME/DESCRIPTION OF SUBJECT OF INCIDENT – NATURE/LOCATION – DATE/TIME SAP INTENDED FOR (AM/PM)
1. SITUATION
A. CURRENT STATUS OF SAR CASE.
B. DESC:
C. POB:
D. SEARCH OBJECT: PRIMARY: SECONDARY:
E. FORECAST WX:
F. ADDITIONAL INFORMATION:
2. ACTION:
A. FOR (APPROPRIATE UNIT)
B. FOR (APPROPRIATE UNIT)
3. SEARCH AREA
AREA SIZE NW CNR NE CNR SE CNR SW CNR
4. EXECUTION:
AREA UNIT PARENT PATT CRP ALT MAJOR AXIS CSP TS
5. COORDINATION:
A. SMC IS
B. OSC IS
C.
D.
E.
F.
6. COMMUNICATIONS:
A.
B.

7. REPORTS:
A.
B.
C.
D.
E.
F.
BT
NNNN

C.2.2.2 Explanation by section

O	
FM	(1)
TO	(2)
INFO	(3)
ACCT	
BT	
UNCLAS//N16130//	
SUBJ: (PHASE) (4) – NAME/DESCRIPTION OF SUBJECT OF INCIDENT (5) – NATURE/LOCATION (6) – DATE/TIME SAP INTENDED FOR (7)	

(1) SMC

(2) OSC, SRUs

(3) Other interested/involved units/agencies.

- When incident includes the pollution or threat of pollution message should go to MSO/COTP, EPA, and/or state pollution agency as appropriate.
- When incident involves commercial vessel message should go to MIO/MSO as appropriate.
- When incident involves deaths should go to MIO/MSO and/or state/local agency as appropriate.
- When incident involves civilian aircraft mishap messages should go to the FAA.
- When incident involves or results in obstruction to navigation message should go to COTP and/or Army Corps of Engineers as appropriate.
- When incident involves COSPAS/SARSAT message should go to USMCC Suitland, MD
- When incident involves an Amver vessel as distressed craft or when acting as SRU message should go to Amver Maritime Relations Officer in New York, NY.

(4) UNCERTAINTY, ALERT or DISTRESS

(5) Use NAME, REGISTRATION/DOCUMENT NUMBER, SIZE, and/or TYPE of craft (vessel, boat, aircraft, sailboard, etc.).

(6) Use SINKING, SUNK, AGROUND, TAKING ON WATER, ON FIRE, DISABLED, ADRIFT, COLLISION, LOST, OVERDUE, EXPLOSION, MAN OVERBOARD, PIW, EPIRB, ELT, CRASHED, ETC., or combination as situation indicates.

(7) Use date and time or DTG, which corresponds to the DATE/TIME SAP intended for, commence search time.

1.	SITUATION	(8)
A.	CURRENT STATUS OF SAR CASE.	(9)
B.	DESC:	(10)
C.	POB:	(11)

D.	SEARCH OBJECT:	PRIMARY:	SECONDARY:	(12)
E.	FORECAST WX:			(13)
F.	ADDITIONAL INFORMATION:			(14)

(8) Use only the subparagraphs needed and renumber as appropriate. With the exception of subparagraph A, provide only information that is a change from previous SAP's and is new information. Subparagraph A is to be used on all SAPs. When adding a new address it will be necessary to report all situation information.

(9) A short statement about status of object or subject condition such as: VESSEL STILL MISSING; PIW REMAINS UNLOCATED; F/V SUNK; etc. (Required for every SAP).

(10) Describe the craft (vessel, aircraft, surfboard, etc.). Include TYPE, MAKE, MODEL, LENGTH, WIDTH, HEIGHT, ENGINE #/TYPE, MASTS, COLOR, SAIL #/COLOR, REGISTRATION/DOCUMENTATION NUMBER, DISTINCTIVE FEATURES. Also include:

- Communications gear (UHF, VHF, Cellular Phone & No., SATCOM, etc.);
- Survival gear (PFDs, survival/exposure suits, life rafts, lifeboats, parachutes, flares, signal/strobe lights, dye markers, mirrors, EPIRB/ELT, etc.);
- Other gear (Anchors, food, water, first aid kit, fuel supply, etc.).

(11) Provide information about people on board/involved:

- Number of persons on board "# POB";
- Names, ages, addresses, phone #s, experience level (in general & in subject craft)/health.

(12) The SMC's determination of what the SRUs should primarily and secondarily look for while on scene.

(13) Give on scene weather, winds, seas, swells, air temperature, sea temperature, clouds, ceiling, precipitation, visibility, tide, ice cover, etc.

(14) Any additional information not yet described.

2.	ACTION:	(15)
A.	FOR (APPROPRIATE UNIT)	(16)
B.	FOR (APPROPRIATE UNIT)	(17)

(15) Use only as needed.

(16) Describe individual SRU on scene times and other pertinent information or guiding instructions.

(17) Same as #16.

3.	SEARCH AREA					(18)
	AREA	SIZE	NW CNR	NE CNR	SE CNR SW CNR	(19)

(18) Use only as needed.

(19) From the AMS summary sheet or CASP/SAR TOOLS evaluate search patterns summary sheet, list all parameters with regards to length and width of search area and detail all corner points.

4.	EXECUTION:								(20)
AREA	UNIT	PARENT	PATT	CRP	ALT	MAJOR AXIS	CSP	TS	(21)

(20) Use only as needed.

(21) Detail all information as per example;

AREA	UNIT	PARENT	PATT	CRP	ALT	MAJOR AXIS	CSP	TS
A-1	HC-130	A.EC	PS	167	1000	07736-18N/075-40W		2

A-2	HH-60	A.EC	PS	167	500	07736-26N/075-07W	1.5
A-3	P3	NAVY	PS	167	1000	07736-24N/075-47W	2

5.COORDINATION:	(22)
A.	(23)
B.	(24)
C.	(25)
D.	(26)
E.	(27)
F.	(28)

(22) Use only as needed.

(23) Identify unit designated as SMC.

(24) Identify unit designated as OSC.

(25) Include the following statement verbatim or some variation; "OSC ADJUST TRACK SPACING (TS) AND ACFT UTILIZATION TO ATTEMPT COMPLETION OF ALL AREAS. OSC REVISE TS FOR TRAFFIC SEPARATION IF REQUIRED".

(26) Identify the time units are to be on scene, whether it be first light or some other specified time. Also include the statement; "ALL UNITS CONTACT OSC WHEN O/S AND PRIOR TO DEPARTING SCENE".

(27) State; "ALL ACFT PARENT COMMANDS OBTAIN CLEARANCES INTO WARNING AREAS. NOTIFY SMC OF ANY DIFFICULTY IN OBTAINING CLEARANCES".

(28) Identify any special instructions such as which units are to insert DMB in specific positions and how drift data should be passed to SMC prior to departing scene.

6.	COMMUNICATIONS:					(29)
A.						(30)
B.	ON SCENE FREQS:	HF	UHF	VHF(ACFT)	VHF(MARINE)	(31)

(29) Use only as needed.

(30) Identify specific air to ground controlling frequencies to be use as per regionally established communications plans.

(31) Identify specific on scene frequencies if units participating in search not from CG regional organization, e.g. DOD, other federal agencies, state/local agencies, other nationalities.

7.REPORTS:	(32)
A.	(33)
B.	(34)
C.	(35)
D.	(36)
E.	(37)
F.	(38)

(32) Use only as needed.

(33) Include the following statement; "OSC SUBMIT SITREP UPON ARRIVAL WITH WX. NOTIFY SMC TWO HOURS PRIOR TO DEPARTURE FM SEARCH AREA AND OF SIGNIFICANT DEVELOPMENTS".

(34) Include the following statement verbatim or some variation; "PARENT UNITS NOTIFY SMC WHEN AIRCRAFT LAUNCHES AND IF LAUNCH IS TO BE DELAYED BY MORE THEN 30 MINUTES".

(35) Include the following statement verbatim or some variation; "SRU'S REPORT NUMBER OF SORTIES, HRS SEARCHED, HRS FLOWN, TRACK SPACE, ALTITUDE, PCT OF SEARCH AREA COMPLETED OR NUMBER OF TRACK LEGS COMPLETED, AND ACTUAL O/S WEATHER ENCOUNTERED AT

CONCLUSION OF THE DAY'S SEARCH BY LANDLINE OR MOST RAPID MEANS".

(36) Include the following statement verbatim or some variation; "AIRCRAFT COMMANDERS VERBALLY DEBRIEF SMC WITHIN ONE HOUR OF COMPLETION OF DAYS SEARCH".

(37) Include the following statement verbatim or some variation; "OSC SUBMIT ONE SITREP DAILY AT THE CONCLUSION OF AIR SEARCHES. NOTIFY SMC OF ANY SIGNIFICANT EVENTS IMMEDIATELY VIA SATCOM NET".

(38) Include the following statement; "MAKE NOROPS REPORTS. REPORT ALL SIGHTINGS TO OSC/SMC AS APPROPRIATE".

C.2.2.3 Example message:

E X A M P L E S A P

O
FM CCGDFIVE PORTSMOUTH VA//CC//
TO COGARD AIRSTATION ELIZABETH CITY NC
COMPATWING FIVE BRUNSWICK ME
COGARD STA PORTSMOUTH VA
COGARD STA LITTLE CREEK VA
INFO COMCOGARDGRU HAMPTON ROADS VA
COMNAVAIRLANT NORFOLK VA
COMNAVSECFLT NORFOLK VA
ACCT
BT
UNCLAS//N16130//
SUBJ: DISTRESS – F/V MAE DORIS OVERDUE – 60NM SE OF CAPE HENRY VA – XX OCT XX – 0800(ZONE DESCRIPTION OBSERVED) ALPHA SEARCH
1. SITUATION
A. CURRENT STATUS OF SAR CASE: COMMSTA CHESAPEAKE RCVD CALL FM F/V STATING THEIR ENGINES WERE INOPERABLE AND WERE TAKING ON WATER FROM UNKNOWN SOURCE. MASTER STATED CREW MAKING PREPARATIONS TO ABANDON SHIP AS THEY CANNOT CONTROL FLOODING.
B. DESC: F/V MAE DORIS, 75FT WESTERN RIG TRAWLER, BLACK STEEL HULL, WHITE S/S, DOC#75902, H.P. NEW BEDFORD, MA, 4 MAN LIFERAFT, 406 EPRIB.
C. POB: (04) O/O: JOHN DALY: 431 CRAWFORD ST, PORTSMOUTH VA HM PHONE# (757)398-1234
CR: BILL MEESE: SAME ADDRESS AND PHONE.
CR: WES PULVER: SAME ADDRESS AND PHONE.
CR: SCOTT DECKER: SAME ADDRESS AND PHONE.
D. SEARCH OBJECT: PRIMARY: RAFT SECONDARY: PIW
E. FORECAST WX: VIS 5NM, CLOUD COVER 9/10, WIND 225T/35KTS, SEAS 225T/5-8FT, AIR TEMP 55F, WATER TEMP 56F, CEILING 1500FT, SUNRISE 1100Z, SUNSET 2200Z.
F. ADDITIONAL INFORMATION: MASTER AND CREW ALL ETREMELY EXPERIENCED FISHERMAN AND EXPERIENCE O/B MAE DORIS.
2. ACTION:
A. FOR A.EC HC-130 AS DISCUSSED WITH D5CC WATCH: CONDUCT SEARCH OF AREA A-1.
B. FOR A.EC HH-60 AS DISCUSSED WITH D5CC WATCH: CONDUCT SEARCH OF AREA A-2.
C. FOR P3: CONDUCT SEARCH OF AREA A-3 AS PER THIS PLAN.
3. SEARCH AREA

AREA	SIZE		
A-1	92X26	NW CORNER 36-18.N/075-39.9W	NE CORNER 36-14.2N/073-43.0W
		SE CORNER 35-53.5N/075-34.2W	SW CORNER 36-18.8N/075-41.4W
A-2	60X5	NW CORNER 36-44.1N/073-56.2W	NE CORNER 36-39.2N/073-54.8W
		SE CORNER 36-25.7N/075-07.6W	SW CORNER 36-30.6N/075-09.0W
A-3	92X26	NW CORNER 37-09.1N/074-03.6W	NE CORNER 36-43.8N/073-56.3W
		SE CORNER 36-23.1N/075-48.2W	SW CORNER 36-48.4N/075-55.5W

4. EXECUTION:

AREA	UNIT	PARENT	PATT	CRP	ALT	MAJOR AXIS	CSP	TS
A-1	HC-130	A.EC	PS	167	1000	077	36-18.1N/075-39.9W	2
A-2	HH-60	A.EC	PS	167	500	077	36-26.6N/075-06.9W	1.5
A-3	P3	AW FIVE	PS	167	1000	077	36-24.3N/075-47.3W	2

5. COORDINATION:
A. CCGD5 IS SAR MISSION COORDINATOR (SMC).
B. RESCUE 1500 IS ON SCENE COORDINATOR (OSC).
C. OSC ADJUST TRACK SPACING (TS) AND ACFT UTILIZATION TO ATTEMPT COMPLETION OF ALL AREAS. OSC REVISE TS FOR TRAFIC SEPARATION IF REQUIRED.
D. ALL SEARCH UNITS O/S BY XX1100Z. ALL UNITS CONTACT OSC WHEN O/S AND PRIOR TO DEPARTING SCENE.
E. ALL ACFT PARENT COMMANDS OBTAIN CLERANCES INTO WARNING AREAS. NOTIFY SMC OF ANY DIFFICULTY IN OBTAINING CLEREANCES.
F. RESCUE 1500 INSERT DMB IN POSITION 36-30.4N/074-53.7W AND PASS DRIFT DATA TO SMC PRIOR TO DEPARTURE FROM SCENE.
6. COMMUNICATIONS:
A. AIR/GROUND COMMS VIA COGARD CAMMSLANT PORTSMOUTH (PRIMARY 5696KHZ, SECONDARY 8983KHZ).

B. ON SCENE FREQS:	HF	UHF	VHF(ACFT)	VHF(MARINE)
PRIMARY	5680KHZ	282.8MHZ	123.1MHZ	157.075-CH81
SECONDARY	2181KHZ	243.0MHZ	121.5MHZ	156.8MHZ-CH16
TERTIARY	NOT IDENTIFIED			

7. REPORTS:
A. OSC SUBMIT SITREP UPON ARRIVAL WITH WX. NOTIFY SMC TWO HOURS PRIOR TO DEPARTURE FM SEARCH AREA AND OF SIGNIFICANT DEVELOPMENTS.
B. PARENT UNITS NOTIFY SMC WHEN AIRCRAFT LAUNCHES AND IF LAUNCH IS TO BE DELAYED BY MORE THEN 30 MINUTES".
C. SRUS REPORT NUMBER OF SORTIES, HRS SEARCHED, HRS FLOWN, TRACK SPACE, ALTITUDE, PCT OF SEARCH AREA COMPLETED OR NUMBER OF TRACK LEGS COMPLETED, AND ACTUAL O/S WEATHER ENCOUNTERED AT CONCLUSION OF THE DAYS SEARCH BY LANDLINE OR MOST RAPID MEANS.
D. AIRCRAFT COMMANDERS VERBALLY DEBRIEF SMC WITHIN ONE HOUR OF COMPLETION OF DAYS SEARCH.
E. OSC SUBMIT ON SITREP DAILY AT THE CONCLUSION OF AIR SEARCHES. NOTIFY SMC OF ANY SIGNIFICANT EVENTS IMMEDIATELY VIA SATCOM NET.
F. MAKE NOROPS REPORTS. REPORT ALL SIGHTINGS TO OSC/SMC AS APPROPRIATE.
BT
NNNN

EXAMPLE SAP

Section C.3
Sample DSC False Alert Message Format

O
FM **RCC NORFOLK//ACC//**
TO EASYLINK
NTF PRI
WUW 804 **(TELEX NUMBER)**
ZEN/M/V **(SHIP'S NAME)/(CALL SIGN)/(TELEX #)**
BT
UNCLAS//N16130//
((IMMEDIATE FM **RCC NORFOLK**))
SUBJ: FALSE DSC DISTRESS ALERT
AT **MMHH UTC DD MON** (DISTRESSED VESSEL'S DISTRESS TIME), A DISTRESS MESSAGE WAS SENT BY YOUR DSC EQUIPMENT AND RECEIVED AT **RCC NORFOLK**. **NORFOLK** HAS LEARNED THAT YOUR VESSEL WAS NOT IN DISTRESS. THE FOLLOWING INFORMATION WAS INCLUDED IN THE DSC DISTRESS ALERT:
DISTRESSED VESSELS'S MMSI: **XXXXXXXXX**
TIME OF DISTRESS: **HHMM UTC**
DISTRESSED VESSEL'S POSITION: **XX-XXX, XX-XXX**
NATURE OF DISTRESS: **XXXXXX (IF LISTED)**
IN AN EFFORT TO IMPROVE THE DSC ALERTING SYSTEM WORLDWIDE, RCC **NORFOLK** REQUESTS YOU PROVIDE THE FOLLOWING INFORMATION VIA TELEX:
A. ACTUAL POSITION OF YOUR VESSEL WHEN ALERT WAS SENT:
B. MAKE AND MODEL OF YOUR DSC EQUIPMENT:
C. REASON FOR DSC DISTRESS ALERT BEING SENT WHEN VESSEL WAS NOT IN DISTRESS (CHOOSE ONE FROM THE FOLLOWING LIST):
1. ACCIDENTAL/TEST – WHILE ATTEMPTING TO SEND TEST MESSAGE, ACCIDENTALLY SENT DSC DISTRESS MESSAGE.
2. ACCIDENTAL/NON-DISTRESS COMMUNICATIONS – WHILE USING EQUIPMENT FOR NON-DISTRESS COMMUNICATIONS, ACCIDENTALLY SENT DSC DISTRESS MESSAGE.
3. ACCIDENTAL/OPERATOR ERROR – WHILE ATTEMPTING TO CLEAR OLD MESSAGE QUEUE OR PERFORM OTHER ADMINISTRATIVE FUNCTION ON SYSTEM, ACCIDENTALLY SENT DSC DISTRESS MESSAGE.
4. EQUIPMENT MALFUNCTION – DSC DISTRESS ALERT SENT IN ERROR DUE TO KNOWN EQUIPMENT MALFUNCTION.
5. UNKNOWN REASON/KNOWN SENT – REASON FOR DSC DISTRESS ALERT SENT IS UNKNOWN, BUT OPERATOR AWARE MESSAGE WAS SENT.
6. UNKNOWN REASON/UNKNOWN SENT – REASON FOR DSC DISTRESS ALERT SENT IS UNKNOWN, AND OPERATOR UNAWARE MESSAGE WAS SENT.
7. OTHER – PLEASE PROVIDE ANY INFORMATION THAT CAN HELP DETERMINE THE CAUSE FOR THIS ALARM.
YOUR WILLINGNESS TO PROVIDE THIS INFORMATION WILL HELP THE INTERNATIONAL SAR COMMUNITY AS WE STRIVE TO SORT ACTUAL DISTRESS CALLS FROM FALSE ALERTS AND IMPROVE DISTRESS ALERTING.
REGARDS: **WESTERN ATLANTIC SAR COORDINATOR (RCC NORFOLK)**
TELEX: **127775**, PHONE **(757) 398-6231**.
BT
NNNN

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Section C.4
SafetyNET

C.4.1 Example message text to vessel reporting a distress

1. RCC NORFOLK HAS RECEIVED A DISTRESS ALERT REPORT FROM YOUR VESSEL WITH NO AMPLIFYING INFORMATION. REQUEST TO KNOW THE NATURE OF YOUR DISTRESS, IF ANY. IF YOUR VESSEL IS IN DISTRESS, REQUEST THE ADDITIONAL FOLLOWING INFORMATION:
   A. DESCRIPTION OF VESSEL
   B. EXACT NATURE OF DISTRESS
   C. CURRENT POSITION, COURSE, AND SPEED
   D. ON SCENE WEATHER: SEA DIRECTION AND HEIGHT, WIND DIRECTION AND SPEED, VISIBILITY AND BAROMETRIC PRESSURE, RISING OR FALLING.
   E. NUMBER OF PERSONS ON BOARD
   F. LIFE SAVING EQUIPMENT ON BOARD
   G. VESSELS INTENTIONS AND TYPE OF ASSISTANCE REQUIRED
   H. COMMUNICATIONS AND FREQUENCIES REQUIRED
2. REGARDS: WESTERN ATLANTIC SAR COORDINATOR (RCC NORFOLK) TELEX:127775, PHONE:(757) 398-6231, FAX:(757) 398-6392, INM-C (AOR-W): 430370680.

C.4.2 Example marine broadcast text

1. DISTRESS ALERT WAS TRANSMITTED IN POSITION XX-XXN, XXX-XXX. MARINERS TRANSITING THROUGH THIS AREA ARE REQUESTED TO KEEP A SHARP LOOKOUT AND MAKE FURTHER REPORTS TO RCC NORFOLK. RCC NORFOLK: PHONE 757-398-6231, FAX: 757-398-6392, INM-C 581 OR 584 430370670. TELEX 127775.//

C.4.3 Example cancellation text

1. THE M/V SUNFISH DISABLED AT POSITION XX-XXN, XXX-XX HAS BEEN ASSISTED AND NO LONGER REQUIRES ASSISTANCE. CANCEL RCC NORFOLK

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Appendix D
MEDEVAC Report (CG-5214)

Form CG-5214 is a 4-part form. Each page is identical and is distributed as follows:

- Part 1 to Patient
- Part 2 to Unit
- Part 3 to Triage Officer
- Part 4 to G-WKH-1

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EMERGENCY MEDICAL TREATMENT REPORT

VICTIM IDENTIFICATION

1. Name _____
2. Sex (check one) male ____ female ____
3. Estimated age yrs ____ mos ____

RESCUER INFORMATION

10. Name: _____ 11. Level:
12. Unit: _____
13. OPFAC #: _____
14. Rescue Vehicle: _____
15. Receiving Unit: _____
16. Time Patient Transferred: _____

DESCRIPTION OF INCIDENT

4. Date: _____
6. Time on scene: _____
7. Time of incident: _____
8. Location: _____

5. Type of incident:
a) marine ____
b) aviation ____
c) industrial ____
d) auto ____
e) domestic ____
f) other ____

NATURE OF EMERGENCY / MECHANISM OF INJURY

OBSERVATION OF VICTIM

FRONT BACK

TREATMENT (circle as needed)

1 - dressing
2 - tx splint
3 - splint
4 - c/collar
5 - back board
6 - tourniquet
7 - CPR
8 - airway
9 - oxygen
10 - MAST
11 - Miller B/B
O2 Liters ____

H - hemmorage
L - laceration
S - soft tissue injury
F - fracture
B - burns

MEDICATIONS:

ALLERGIES:

MEDICAL HISTORY / COMMENTS / ETC.
(include additional vitals, oxygen, fluids, etc.)

SKIN (Circle appropriate number or numbers)

1 - normal
2 - pale/ashen
3 - flushed
4 - cyanotic
5 - dry
6 - moist
7 - cold
8 - warm
9 - hot

	TIME / OBSERVED				
VITAL SIGNS					
LEVEL OF CONSCIOUS	Alert				
	Responds to Verbal				
	Responds to Pain				
	Uncon / Unresponsive				
PUPILS	Perl				
	Unequal				
	Nonreactive				
	Dilated				
	Pinpoint				
PULSE	Rate (Numeric)				
	Strong				
	Weak				
BREATHING	Rate (Numeric)				
	Regular				
	Shallow				
	Labored				
BLOOD PRESSURE	Blood Pressure				
TEMP	Temperature (circle) ORAL RECTAL				
MAST	**MAST BP**				
	COMPARTMENT		R	L	ABD

TIME	MEDICATIONS ADMINISTERED	DOSAGE

TRIAGE INFORMATION (CIRCLE ONE) **PRIORITY I** **PRIORITY II** **PRIORITY III**

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Previous Edition May be Used

PATIENT COPY

Reset

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Appendix E
Emergency Medical Services Agreement

EMERGENCY MEDICAL SERVICES AGREEMENT
between

The Governor (or County or Local Official) of the State (or County or Municipality) of _____ and
The Commander, _____ Coast Guard District.

1. Purpose

This Agreement provides a means of mutual coordination between the two signatories for using available facilities to aid persons in need of emergency medical services.

2. Scope

This Agreement is the basis for mutual cooperation for using communication and transportation facilities in support of emergency medical services under the National Highway Safety Act of 1966 within the State (or County or Municipality) of _____.

3. General

The National Highway Safety Act of 1966 requires states to implement comprehensive safety programs for the protection and preservation of life on public roadways within their respective jurisdictions. The program must be developed in accordance with uniform standards promulgated by the Secretary of Transportation or by National Voluntary Standards adopted by the American Society for Testing and Materials (ASTM) F30.0 Committee on Emergency Medical Services.

The U.S. Coast Guard provides rescue facilities for the promotion of safety on and over the high seas and waters under the jurisdiction of the United States. It is understood that the primary mission of these facilities is maritime search and rescue and that response to requests from state and local authorities shall be made on an operations-permitting basis only. It is further understood that this agreement is "interim" in nature, intended only to fill a void until adequate commercial or civil government helicopter ambulance service becomes available.

4. Organization

The Governor (or County or Local Official) of the State (or County or Municipality) of _____ of the County (or municipality) of _____, through his designated Highway Safety and Emergency Medical Service Representatives, shall coordinate with the Commander, _____ Coast Guard District, to implement the terms of this Agreement. Within the framework of this agreement, direct liaison between local Coast Guard commanders, local law enforcement agencies, and other emergency medical services coordinators is authorized.

5. Agreement

It is agreed that:

a. Law enforcement agencies or other designated emergency medical services coordinators within the State of _____ may request assistance from commanding officers of Coast Guard units for emergency medical transportation services within the scope of the Highway Safety Act of 1966. Such requests shall be limited to serious incidents in which Coast Guard facilities appear to be the most feasible means of providing the required assistance. Competition with private ambulance services, including air ambulance services, should be avoided.

b. Commanding officers of Coast Guard units may assist when the response will not interfere with the primary

mission of maritime search and rescue. They may assume the response is required, and will not unduly compete with private services.

c. The pilot of a Coast Guard aircraft dispatched pursuant to this Agreement shall be the final judge of the feasibility of the mission, and shall discontinue the mission if, in his or her opinion, it cannot be accomplished safely.

d. Before implementing this Agreement, Coast Guard commanders shall apprise agencies and officials designated to request EMS assistance, of the capabilities and limitations of Coast Guard helicopters and other facilities likely to assist.

_____	_____
Governor (County Commissioner or Mayor) State of _____ (County or Municipality)	Rear Admiral, U.S. Coast Guard Commander, _____ Coast Guard District

Appendix F
SAR Contingency Exercises

F.1 Introduction

F.2 Identifying Maritime Contingency Response Communities
F.2.1 Definition of a Response Community
F.2.2 Response Community Levels

F.3 Developing Maritime Contingency Response Plans
F.3.1 Contingency Definition
F.3.2 Contingency Response Planning

F.4 Exercising Maritime Contingency Response Plans
F.4.1 Guiding Principles
F.4.2 Implications of the Levels of Response Exercises
F.4.3 Initial Response Exercises
F.4.4 Response Community Exercises
F.4.5 Developing Response Capability Through a Balanced Mix of Exercise
F.4.6 Exercise Frequency

F.5 Requesting Support for Maritime Contingency Response Plan Exercises
F.5.1 Funding
F.5.2 Support Teams

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Section F.1
Introduction

This appendix provides guidance regarding maritime contingency response planning and exercises. District Commanders shall work with FEMA and other emergency response organizations to identify maritime contingency response communities and establish maritime SAR councils within their areas of responsibility. These councils should ensure that appropriate contingency response plans have been developed. In situations where no other agency has taken the lead on this issue, District Commanders are authorized to do so.

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Section F.2
Identifying Maritime Contingency Response Communities

While the Coast Guard traditionally has been the primary response organization for maritime incidents, the sheer numbers of people involved in potential maritime disasters involving passenger ferries, excursion vessels and passenger aircraft require significantly greater numbers of resources than the Coast Guard alone could provide. Other agencies such as the Department of Defense, the Federal Emergency Management Agency (FEMA) and State and Local Emergency Management Councils, as well as local maritime industry and other emergency support providers (hospitals, ambulance services, Red Cross, National Guard) are key players in response to potential maritime disasters. These organizations all come together to form a "maritime response community" - a group of organizations and individuals who would naturally come together to respond to a maritime incident.

F.2.1 Definition of a Response Community

A response community is:

A group of organizations and individuals who would naturally come together to respond to a maritime incident.

This definition is sufficiently broad to include any organization or group of individuals who would make a tangible contribution to the ultimate success of a maritime response.

F.2.1.1 **Possible organizations** include private companies like a vessel or facility owner or operator, or one or more companies providing specialized services, equipment or personnel related to a response operation. Other organizations include various government agencies with a mandated interest or involvement in emergency response and search and rescue.

F.2.1.2 **Possible individuals or groups** include citizens, emergency medical services providers, community groups, and groups linked by a common interest such as local fishing or towing associations. All of these groups can positively affect the outcome of maritime incident response activities through their efforts and resources.

F.2.1.3 **Maritime SAR Councils** are defined in this Addendum as committees of federal, state, local or volunteer groups with SAR capabilities localized within the maritime SAR response area. These committees serve as coordinating councils for maritime response communities.

F.2.2 Response Community Levels

Any organization that has prepared a contingency plan is actually part of several different response community levels, starting with itself at the core. This is illustrated in Figure F-1.

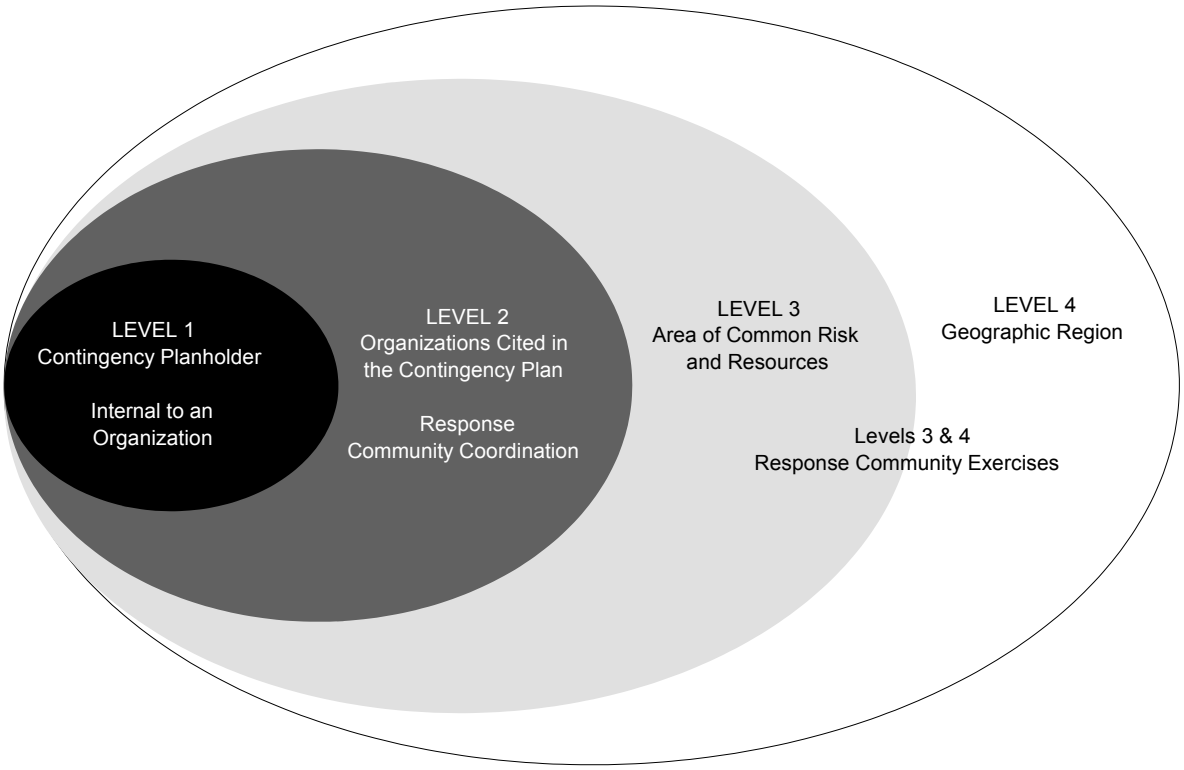

Figure F-1. A Response Community Model for Exercising

Level 1 — Contingency Plan Holder

This response community level consists of the response personnel, equipment and resources directly controlled by the contingency plan holder. For an excursion or gambling vessel owner, this includes the crew and operating staff organized into a response organization as well as response equipment maintained on board.

Level 2 — Organizations Cited in the Contingency Plan

This response community level consists of any external organizations that the plan holder would call for assistance in the event of a maritime incident. Such organizations are usually listed as key contacts in the contingency plan and might include vessel or equipment providers and contractors providing specialized services and trained personnel related to control, triage, or recovery operations, as well as government agencies.

Level 3 — Area of Common Risk and Resources

This response community level consists of the natural geographic area or zone in which a number of plan holders share a common incident risk such as navigational risk and common response resources. The best example is a port, harbor, or stretch of river where several vessel operators, facility operators, response organizations and different government jurisdictions co-exist and operate on an ongoing basis. It could also include a stretch of coastline or well-traveled navigational route.

Level 4 — Common Geographic Region

The regional response community level is simply a larger geographic region made up of a number of smaller areas of common risk (e.g., ports, harbors, or coastal traffic areas). A regional community usually has one or a few major centers of activity such as a large port. The administrative offices of larger community organizations are located there, serving as the management center for the various operations located in smaller Level 3 communities throughout the region.

Section F.3
Developing Maritime Contingency Response Plans

The Coast Guard is authorized to provide a nationwide system for maritime Search and Rescue response and to coordinate search and rescue efforts on navigable waters. Accordingly, the Coast Guard has established a network of response units throughout its jurisdiction to respond to mariners in distress. However, no single agency can provide for the level of response required in a maritime disaster situation. Similarly, the Federal Emergency Management Agency (FEMA) is authorized to coordinate emergency preparedness and response in the United States. FEMA has established a contingency organizational structure, which reaches to the local county level, but may or may not include local Coast Guard forces. To achieve efficient and effective contingency response, we need to join or establish maritime SAR councils and coordinate our efforts locally within response communities. We must work in concert with FEMA and with other Federal, State and local agencies, which have similar responsibilities for contingency response. Participation in Maritime SAR Councils will ensure individual participants and organizations know their specific roles within the response community. Only through focused, coordinated response efforts can the impact of a maritime disaster be minimized.

F.3.1 Contingency Definition

As defined in the Exercise Planning Manual, COMDTINST M3010.21 (series), a contingency is a significant natural or manmade event or emergency that threatens the safety of lives, property, or the environment; threatens a national security interest; or may negatively impact the nation's well being. A contingency involves a response situation that requires a level of activity that exceeds the unit's (or local organization's) scope of normal operations. Contingencies may vary in probability of occurrence, predictability, duration, and effect on the organization and the public.

F.3.2 Contingency Response Planning

Key lessons learned from past exercises provide general guidance for plan development and form the basic elements of an efficient contingency plan:

F.3.2.1 General Guidance:

- Plan for the worst case scenario;
- Keep the plan short and use simple language - no jargon;
- Use existing plans where possible;
- Use a Joint Command Center and one Incident Commander;
- Use a Joint Communications Center and employ existing communications plans.

F.3.2.2 Basic Contingency Plan Elements:

- Identify call out authorities.
  - Who can stand-up the community contingency response?
- Lay out specific notification procedures.
- Who are the key points of contact and how are they notified?
- Specify role definitions for coordination and operations.
  - Who will do what when?
- Specify the Joint Communications Plan.
- Address risk management within the response community organization.

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Section F.4
Exercising Maritime Contingency Response Plans

As contingency plans are developed within the response community, these plans must be exercised and refined. The Coast Guard Exercise Planning Manual, reference (ii), provides the framework through which exercise programs and activities of individual response community members can be organized, coordinated, and guided. The Manual describes procedures, standardizes terminology, and provides general guidance for planning, executing, and evaluating contingency preparedness exercises. Using the Manual, members of the maritime response community can achieve maximum benefit - individually and collectively - from maritime contingency response exercising. The following provides an executive summary of information on contingency exercise planning; the Coast Guard Exercise Planning Manual shall be the primary reference.

The exercise program is intended to involve the entire maritime response community across the country and focuses on the need for a response community approach to maritime response exercising. Such an approach recognizes that the response to an actual maritime incident will be a community effort, that is, it will involve personnel, resources and plans of several organizations and agencies in addition to the Coast Guard. The number of organizations will depend on the size, location, and circumstances of the incident.

An organization participates in the Exercise Program when it recognizes the Program's guidance in planning, conducting, and evaluating its maritime response exercise activities. Participation involves upholding program principles and fulfilling the responsibility of response community members.

The Exercise Program's success will be determined by the quality, consistency, coordination and frequency of maritime response exercises. It will also be determined by the tangible contributions made to the four goals of this program: planning, training, response techniques and exercising.

F.4.1 Guiding Principles

The following are guiding principles that provide the foundation of the Exercise Program.

F.4.1.1 Community approach to exercising. Maritime response exercising aims to incorporate the same cooperative management approach between response community members that would occur during response to a real emergency. The targeted levels of preparedness and exercising (e.g., type and frequency) are established jointly or by the community as a whole. Once determined, members work cooperatively to achieve them. Exercises are scheduled to maximize the frequency and degree of community involvement. Finally, exercise costs are shared fairly and equitably among the various community members.

F.4.1.2 Progressive development of response preparedness. The Response Community's preparedness is built progressively through simple, discrete exercises that are clearly focused on a limited number of measurable, achievable objectives. Starting with task-oriented operational exercises, then working on to functional and combined functional management exercises, the community develops its response capability and exercise experience levels in a gradual, logical fashion.

F.4.1.3 Identifying and sharing exercise lessons learned. All maritime response exercises are thoroughly evaluated and the lessons learned from them documented and appropriately acted on by participants. The Exercise Program holds that lessons learned from individual response community exercises should be reviewed and shared with other communities to improve overall response preparedness.

F.4.2 Implications of the Levels of Response Exercising

The response community levels shown in Figure 1 correspond directly to the "tiered" approach to the response of a real incident. As the incident size, severity and likely consequences of an incident increase, the personnel, resources and capabilities required to effectively deal with it escalate to higher levels of the response community. In the event of a maritime disaster, the resources of the entire national response community might be mobilized.

The response to every marine incident will involve some segment or level of the response community of which the contingency plan holder is a member. Therefore, it follows that an organization should exercise its contingency plan through each of the response community levels with which it might have to interact, depending on the size, complexity and risk of its operations or its designated scope of responsibility and accountability.

Generally, the complexity of exercising rises with each of the response community's levels. For instance, an internal exercise involving only the plan holder's personnel will be simpler to plan, conduct and evaluate than a community exercise involving all of the organizations operating in a particular port or coastal area.

Figure F-2 describes how the priorities of maritime incident response exercises might differ between each of the response community levels.

F.4.3 Initial Response Exercises

Level-1 exercises focus on individual facilities, vessels, and operating units. The emphasis in on developing and practicing on site personnel's initial response capabilities using regular task oriented operational exercises. Examples of such exercises include alerting key personnel, emergency termination of vessel on board activities, evacuation procedures, on site equipment deployment, and use of personal protective and lifesaving gear. Usually these exercises are limited to employees of a single organization or facility.

Management exercises at Level 1 are also internal undertakings. In other words, they are initiated, developed and led by a single organization to improve its own response preparedness level. External organizations are role-played to achieve the exercise objectives and to add an element of realism.

Level 4 – Common Geographic Area
- Several response management teams involved in all capacities (i.e., responders, controllers, and evaluators).
- Possible use of full scale exercise design.
- Catastrophic incident scenario threatening national interest and requiring inter-regional cooperation's and coordination's.
- Sponsored, initiated, and led by the government.
- Combined management exercise involving several functions and locations.
- Low frequency due to long planning horizons.

Level 3 – Area of Common Risk and Resources
- Incident scenario that reflects significant risk and scope within the area.
- Larger scale or more complex operational exercises especially vessel deployment and operation.
- Combined management exercises involving multiple primary response functions.
- Involves response management teams of more than one organization acting as responders.
- Planning, control, evaluation roles may be filled by different community members.
- Frequency might be annual or even less often but predetermined and jointly agreed to by the community as a whole.
- Might replace some Level 2 exercise activities by individual organizations.

Level 2 – Organizations Cited in the Contingency Plan
- Incident scenarios that will trigger a call for outside assistance and resources.
- First practical level of response community exercise application.
- Operational exercises aimed at initial response actions and vessel deployment.
- Adds limited-scale management exercises of one or few key primary response functions.
- Involves some or all response management team members and appropriate representatives of outside organizations in person.
- Highest frequency of management exercise.

Level 1 – Contingency Plan Holder
- Incident scenarios that are focused on smaller, higher probability, operational-type incidents.
- Operational exercises oriented around emergency operating procedures, initial response actions, and on site vessel readiness and deployment.
- Involves designated initial response personnel made up of on board operating and supervisory personnel.
- Internal to a single organization.
- Management exercise involves role-playing of outside agencies.
- Frequency should be regular, predetermined and highest of all response activities.

Figure F-2. Exercise Priorities According to Response Community Level

F.4.4 Response Community Exercises

Level-2 exercises are where the concept of a response community exercise becomes operative. At this level, the plan holder exercises with some or all of the external organizations listed in its contingency plan that it will rely

on for support, or that it will provide support during an incident response. At this level, management exercises involving the organization's response management team members are the focal point.

Exercises target a small number of primary response functions based on the organization's likely role and responsibilities during a real response (i.e., functional management exercises from Level 1). The functions might change from exercise to exercise as the organization works to develop its total management capability. This is the program's approach, rather than attempting to incorporate all relevant functions into a single complex exercise. At this level, large operational exercises might also take place, usually related to the deployment and operation of vessels and emergency services.

The Level-2 exercise is the most basic and traditional form of response community exercise. Although several organizations participate, the exercise is usually designed, controlled, and evaluated by the plan holder's organization. It retains a high level of management control over the exercise and pays all out of pocket costs associated with the exercise activities. External organizations cover their own direct costs.

Level-3 exercises represent a more advanced type of response community exercise. At this level, several organizations or plan holders come together as equals to cooperatively plan and execute a marine incident response exercise.

The objectives of the exercise are determined and agreed to collectively by the group instead of by a single sponsoring organization. An exercise planning committee may be set up for this purpose. Each organization contributes personnel, resources and money to the entire exercise development process from planning through to evaluation on a fair and equitable basis that has been established by the group.

Although one organization might agree to "initiate the disaster", the tasks of designing, controlling and evaluating the exercises are assigned to different personnel from the entire group. Additionally, some organizations are required to be part of the response management team in the capacities they would normally occupy following a real spill. Relatively more complex combined management exercises lend themselves well to this approach to exercising because the workload can be spread among more participants.

Figure F-3 compares the basic organization of a Level-3 response community exercise with the more traditional organization described in Level 2. In the Level-3 exercise organization, objectives are determined collectively and planning is done through a committee process and structure. In the Level-2 exercise organization, the sponsoring organization is in charge of the exercise development process and determines the exercise objectives. Other organizations follow its direction and leadership closely.

At Level-4, the common geographic region response community level, the advanced model of a community response exercise can be applied with excellent results. As presented in Figure 3, a potential exercise design is a fairly sophisticated management exercise that triggers several response functions and focuses on inter-organizational and interagency cooperation, coordination and communication during a major incident scenario. In an exercise of this scale, the planning, control and evaluation roles are assigned to different organizations or to teams made of individuals from the various organizations.

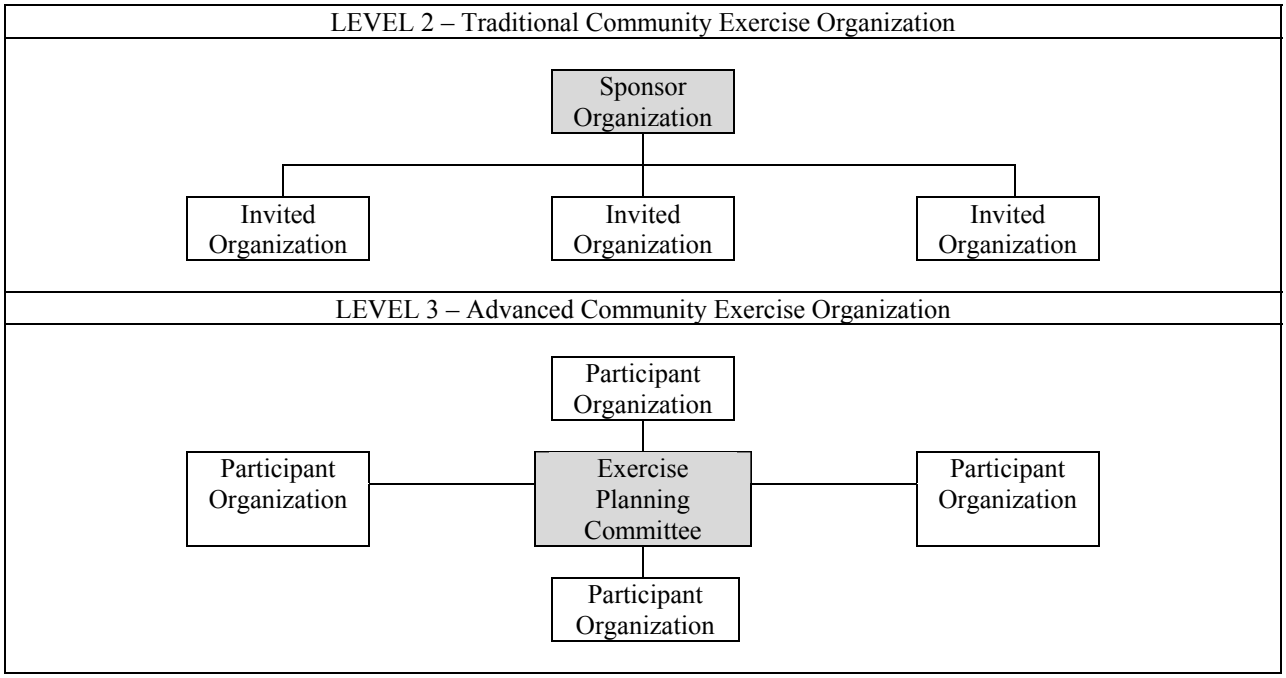

Figure F-3. Comparison of Exercise Organizations

The model also works well in an exercise involving more than one regional response community. For example, an exercise might be designed to assess several regions' ability to support the response to a catastrophic disaster scenario in another region. This type of exercise would likely be initiated and led by an organization with a clear interest or responsibility for emergency response across several regional response communities like the Coast Guard or FEMA.

F.4.5 Developing Response Capability Through a Balanced Mix of Exercise

Each member of the response community is responsible for improving its own response capabilities through exercising. Under the Exercise Program the challenge to each organization is to find the optimal balance between the different types, community levels and frequencies of exercises that best achieve the targeted improvements in preparedness within the budget allocated for this purpose.

The response community approach to exercising holds that the magnitude of the improvement can be significantly increased if the individual organizations are aware of and exercise cooperatively within the various community levels to which they belong as much as is realistically and economically practical. As already noted, this approach requires each member to be willing to:

- Coordinate its exercise plans and schedules with other members;
- Participate in and support community exercise initiatives in various possible capacities (i.e., responder, planner, controller, evaluator);
- Share costs, personnel and other resources; and
- Share exercise lessons learned among community members and other communities.

The collective improvement achieved through selective community exercising will be reinforced by each member's program of well-planned, cost effective, regular internal response exercises.

Each organization will continue to hold internal exercises aimed at its own specific needs and priorities and involving only its own or limited external personnel. The process begins with each response community member developing its own internal exercise program.

F.4.6 Exercise Frequency

The overall level of preparedness a community strives to achieve is determined by the capabilities of its individual members. The response community must collectively establish a standard level of exercising for its members for both operational and management exercises. Generally, the frequency of response exercises should be whatever is necessary to improve an organization's level of preparedness to where it can competently, effectively, and rapidly respond to a maritime incident. Once there, it must be able to maintain that level of capability.

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Section F.5
Requesting Support for Maritime Contingency Response Plan Exercises

F.5.1 Funding

Commands should budget for maritime contingency exercises based on the types of exercises planned and the anticipated costs. Specific guidance for determining exercise scope and estimating costs is located in the Exercise Planning Manual. Units that experience budgetary shortfalls should request exercise funding via their chain of command.

F.5.2 Support teams

Tiger teams are available to assist commands with contingency exercise planning. These teams are comprised of marine safety and readiness program personnel with experience in exercise planning. Upon request, the teams will deploy for up to one week to assist local commands with establishing a maritime contingency community response plan and exercise program. Interested commands should submit a letter request to G-M indicating the current status of local response community coordination and listing preferred and alternative dates for the support team visit.

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Appendix G
SAR Checksheets

The following checksheets are the standard for SAR checksheets and detail the minimum amount of information to be gathered for each situation. Units can modify the format of these checksheets to accommodate local practices, but will not eliminate any information. The specific information to be requested/passed to subjects in distress in regards to personal flotation devices and notifying of intended Coast Guard actions must remain in sequence as contained in the Initial SAR Checksheet.

Electronic forms of these checksheets and the information they contain may be used. Specifically, the processes used in the Response Log application and MISLE Response Activity fulfill this requirement.

Initial SAR Checksheet	G-3
Supplemental SAR Checksheet	G-4
Overdue Checksheet	G-5 thru G-6
MEDICO / MEDEVAC Checksheet	G-7
Grounding Checksheet	G-8
Flare Sighting Checksheet	G-9 thru G-12
Aircraft Emergencies	G-13
Abandoned or Adrift	G-14
Beset by Weather	G-14
Capsized	G-14
Collision	G-14
Disabled	G-15
Disoriented	G-15
Uncorrelated MAYDAY, MAYDAY, probable Hoax calls, automated S.O.S.	G-15
PIW	G-15
SARSAT	G-16
Taking on Water or Fire	G-16
SAR Case Suspension Checklist	G-17
Mass Rescue Operation Supplemental Check Sheet	G-18 thru G-28

Annex 1 GMDSS Operating Guidance for Masters of Ships in Distress Situations
Annex 2 Helicopter Resources
Annex 3 Fixed-Wing Resources
Annex 4 Inshore Resources
Annex 5 Offshore Resources
Annex 6 Potential Risk in Your AOR
Annex 7 Potential Survivor Sites

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Radio Call	Frequency:	High Site:	DF Bearing:
Type of Comms:		Original Relay	
Time:	Date:	UCN:	Initials:

-- Initial SAR Check Sheet --

1. Position How determined?		*Type of Position:*	[ ] Lat/Long [ ] Loran Lines [ ] Geographic Reference
2. Number of Persons On Board	Adults:	Children:	Total:
3. Nature of Distress (if PIW complete additional PIW box below)			
4. Description of Vessel	Name: Make:	Length: Color:	Type:
5. Have all persons on board the vessel put on Personal Flotation Devices / adequate number of PFD's available? Y / N			

***** ADVISE REPORTING SOURCE OF INTENDED ACTIONS AT THIS TIME *****

6. Determine Initial Severity / Emergency Phase	
[ ] Distress	**[ ] Uncertainty** **[ ] Alert**
[ ] Dispatch Resources / Activate SAR Alarm	*Additional information is needed*
[ ] ***Advise reporting source of Coast Guard's Actions***	*Complete one or more of the following:*
[ ] Issue Urgent Marine Information Broadcast (UMIB)	[ ] Supplemental Check-sheet
[ ] Brief Group / District	[ ] Overdue Check-sheet
[ ] Provide emergency instructions to vessel in distress	[ ] Flare Sighting Check-sheet
[ ] Complete additional check-sheets as situation dictates	[ ] MEDEVAC/MEDICO Check-sheet
	[ ] Grounding Check-sheet
	[ ] Mass Rescue Operation Supplemental Check sheet

Persons in the Water		
Number: Time: Confirmed? [ ]	Description:	[ ] PFD - type/color: [ ] Exposure Suit [ ] Light

***** Complete all of the above before shifting frequency; Complete below before hanging up phone *****

Reporting Source
Name:
Vessel Name:
Call back number (with area code): [ ] cell phone [ ] radio / call sign: / MMSI:
Address:

On Scene Weather			
Wind	Seas	Swells	Visibility
Weather Type			

SUPPLEMENTAL SAR CHECKSHEET

VESSEL			
	[ ] Document/Official Number [ ] State Registration		Communications Equipment [ ] VHF-FM [ ] HF [ ] DSC [ ] Other _____ [ ] Cellular: # Frequencies:
	Homeport	Flag	
	Usage	Hull Material	Navigation Equipment [ ] LORAN [ ] GPS [ ] OMEGA [ ] RADAR [ ] Fathometer [ ] Other:
	Prominent Features		Survival Equipment [ ] EPIRB Class/Type: _____ [ ] PFDs #s/Types: _____
	Cause of Incident		[ ] VDS/Flares [ ] Flashlight [ ] Raft/Lifeboat [ ] Dinghy/Skiff [ ] Food/Water [ ] Foul Wx Gear

PEOPLE						
	[ ] Owner [ ] Operator [ ] POB Name Address Phone			[ ] Owner [ ] Operator [ ] POB Name Address Phone		
	Age:	DOB:	Male/Female	Age:	DOB:	Male/Female
	[ ] Owner [ ] Operator [ ] POB Name Address Phone			[ ] Owner [ ] Operator [ ] POB Name Address Phone		
	Age:	DOB:	Male/Female	Age:	DOB:	Male/Female

Additional Comments

ACTION		
	Communications Schedule	
	Start Time	Frequency
	Time Interval [ ] 15 min [ ] 30 min [ ] 60 min [ ] Other	
	Remarks	

Set and Drift	[ ] Not a factor		
Set	[ ] T [ ] M	Drift	[ ] kts [ ] MPH
[ ] DMB	Type	Freq	
DMB	Inserted	Relocation	
Time			
Position	N	N	
	W	W	

OVERDUE CHECKSHEET

COMPLETE BOTH SIDES OF THIS CHECKSHEET,
EVALUATE INFORMATION AND TAKE INITIAL ACTION

One of the following might be reason to immediately launch an asset:
SIGNIFICANT HOURS OVERDUE, MEDICAL CONCERNS, COMMITMENTS, WEATHER HISTORY, AGE OF POB

Vessel LPOC: _____ Date/Time: _____
Did R/S confirm departure: **Y** **N**

Vessel NPOC: _____ Date/Time: _____
Did R/S confirm non-arrival: **Y** **N**

Intended route: _____

POB: Adults _____ Children _____ HRS OVERDUE: _____

Have they taken this trip before: **Y** **N** **UNK**
Do they usually stop over anywhere: **Y** **N** **UNK**
Do they have a habit of being late: **Y** **N** **UNK**

Last comms DTG: _____ Method: (VHF, L/L, etc.): _____

Intentions at last comms:

VESSEL DESCRIPTION:
Name:

Homeport:

Type VSL: PWR SPEED ROW SAIL

REG/DOC #:

Length: FT/M Type:

Make: Draft: FT/M

Hull Color: Hull Material:

S/S Color: Trim Color:

Sail Color: Fuel O/B:

Propulsion: I/B O/B I/O SINGLE TWIN

Prominent Features:

OWNER:
Name:

Address:

Phone: ( )

Is he/she on board: Y N

*** CONTACT OWNER IF NOT ON BOARD ***

ELECTRONIC EQUIPMENT:

RADAR FATH GPS LORAN SATNAV

EPIRB TYPE:

RADIOS: VHF HF SSB CB

Call Sign: FREQS:

Cellular Telephone:

Pager/Beeper:

ADDITIONAL INFORMATION:

SURVIVAL EQUIPMENT:

PFDs	**Y**	**N**	**UNK**
Flares:	**Y**	**N**	**UNK**
Flashlight:	**Y**	**N**	**UNK**
Dye:	**Y**	**N**	**UNK**
Mirror:	**Y**	**N**	**UNK**
Smoke Marker:	**Y**	**N**	**UNK**
Smoker:	**Y**	**N**	**UNK**
Spotlight:	**Y**	**N**	**UNK**
AUX electric power:	**Y**	**N**	**UNK**
Radar reflector:	**Y**	**N**	**UNK**
Drogue:	**Y**	**N**	**UNK**
Anchor:	**Y**	**N**	**UNK**
Anchor line:	**Y**	**N**	**UNK**
Food:	**Y**	**N**	**UNK**
Water:	**Y**	**N**	**UNK**
Raft:	**Y**	**N**	**UNK**
Description:			
Dinghy:	**Y**	**N**	**UNK**
Description:			

VEHICLE:

Make: Model:
License NR: Color:
Trailer Lic: Color:

SECOND VEHICLE:
Make: Model:
License NR: Color:
Trailer Lic: Color:

ADDITIONAL NOTES:

OPERATOR:

Address:

Phone: ( )
POC/NOK:
Phone: ( )
Experience with boat: **Y** **N** **UNK**
Experience in area: **Y** **N** **UNK**
Swimmer: **GOOD** **FAIR** **POOR** **NON**
Clothing:
Desc: HT: WT: Eyes:
Hair: Race: Age:
HEALTH: **GOOD** **FAIR** **POOR** **UNK**
COMMITMENTS:

PASSENGER:

Address:

Phone: ( )
POC/NOK:
Phone: ( )
Experience with boat: **Y** **N** **UNK**
Experience in area: **Y** **N** **UNK**
Swimmer: **GOOD** **FAIR** **POOR** **NON**
Clothing:
Desc: HT: WT: Eyes:
Hair: Race: Age:
HEALTH: **GOOD** **FAIR** **POOR** **UNK**
COMMITMENTS:

PASSENGER:

Address:

Phone: ( )
POC/NOK:
Phone: ( )
Experience with boat: **Y** **N** **UNK**
Experience in area: **Y** **N** **UNK**
Swimmer: **GOOD** **FAIR** **POOR** **NON**
Clothing:
Desc: HT: WT: Eyes:
Hair: Race: Age:
HEALTH: **GOOD** **FAIR** **POOR** **UNK**
COMMITMENTS:

ACTION TAKEN BY COAST GUARD

Confirm departure: **Y** **N** Confirm non-arrival: **Y** **N** UMIB: **Y** **N**

EVALUATE WEATHER HISTORY ALONG INTENDED TRACK:
WIND: _____ / _____ SEAS: _____ / _____ VIS: _____ SEA TEMP: _____ F/C

Initial EMERGENCY PHASE: **UNCERTAINTY** **ALERT** **DISTRESS**
Initial action taken:

MEDICO / MEDEVAC CHECKSHEET

PATIENT INFORMATION

Name: Age: Sex: **M** **F** Nationality:

Type of injury (symptoms and location):

When/how injury occurred:

Medications administered (type and amount):

Previous medical history (including medications):

PATIENT VITAL SIGNS

Temp: Airway: **OBSTRUCTED** **GURGLING** **OPEN**

B/P (Wrist/Neck): Resp: **SHALLOW** **NORMAL** **DEEP** **NONE***

Pulse: **NORMAL** **WEAK** **POUNDING** **NONE***

* IF NO PULSE/RESP, IS CPR BEING CONDUCTED? **Y** **N** How long?

Conscious: **Y** **N** Ambulatory: **Y** **N** Eyes: DILATED **Y** **N**

Convulsions: **Y** **N** Signs of Shock **Y** **N** REACTIVE **Y** **N**

Vomiting: **Y** **N** Bleeding: **Y** **N** EQUAL **Y** **N**

Tingling limbs: **Y** **N** Paralysis: **Y** **N**

Skin cond: **DRY** **NML** **CLAMMY** Skin color: **BLANCHED** **YLW** **NML** **BLUE** **RED**

First aid kit: **Y** **N** Treatment given:

Medical personnel: **DR** **RN** **EMT** **OTHER**

DIVING ACCIDENTS

Time of accident: _____

Total dives today: _____ Interval between dives: _____

Dive depth: _____ FT/M Dive duration: _____ Decompression: _____

Dives in last 24 HRS: **Y** **N** IF YES, when? _____

Dive depth: _____ FT/M Dive duration: _____ Decompression: _____

MISC INFORMATION

Vsl LPOC/Date: Vsl NPOC/ETA:

Communications: VHF-FM MF/HF CELLULAR FREQ/Number:

O/S Weather: Wind: _____ / _____ Seas: _____ / _____ VIS: _____ Sea temp: _____ F/C

FLT Surgeon BRFD: [ ] YES [ ] NO MEDEVAC: [ ] BOAT [ ] HELO

GROUNDING CHECKSHEET

PRIMARY INFORMATION

Are you taking on water? **Y N**

IF YES: What part of vessel? How fast? _____ GPM

Are there any injuries or people in the water? **Y N**

IF YES: TREAT AS A SAR CASE

Is there any pollution as a result of the grounding? **Y N**

IF YES: Type of material _____ Estimated quantity _____

Notify the MSO and gather additional information.

What type of bottom: MUD SAND ROCK OTHER

Type of Fuel O/B: Quantity of fuel:

Type of cargo O/B: Quantity of cargo:

OTHER INFORMATION

VSL DESCRIPTION

Name:

Homeport:

Type vsl: PWR SPEED SAIL MERCHANT

REG/DOC #:

Length: FT/M Type:

Make: Draft:

Hull Clr: Hull Mat:

S/S Clr: Trim Clr:

Propulsion: I/B O/B I/O SINGLE TWIN

Additional information:

OWNER

Address:

Telephone: ( )

Has Owner been NTFD: **Y N**

Shipping Agent (Commercial):

Rudder movement: **Y N**

Wheel movement: **Y N**

O/S Weather: Wind: _____ / _____ Seas: _____ / _____ Vis: _____ Sea Temp: _____ F/C

Weather forecast:

Next low tide:

Next high tide:

ACTION TAKEN BY CG

Conduct a visual ATON check with CG unit (ALWAYS REQUIRED): **Y N**

Issue broadcast: UMIB MARB BNTM

Notify: [ ] SMC [ ] MSO

Report taken by: _____ Date: _____

FLARE SIGHTING CHECKSHEET

OBTAIN INFORMATION ABOUT THE REPORTING SOURCE

Name First: _____ Last: _____

Position Latitude: _____ Longitude: _____

Bearing and range from prominent landmark: _____ Deg & dist

Street _____

address: _____

Note: A latitude and longitude can often be derived from a reporting source's street address through the use of geo-location services provided on the internet. G-OPR has funded such services. Information and links for the currently funded services can be found on the G-OPR website.

Position uncertainty: +/- _____ nm

Height of eye Height of reporting source, from sea level: _____ ft

If the reporting source is in a building, floor number: _____

Phone number Current location: _____

Home or work:

OBTAIN INFORMATION ABOUT THE FLARE CHARACTERISTICS

Color (Circle any that apply) RED AMBER WHITE GREEN OTHER: _____

Number of Flares Number observed: _____ Time of sighting: _____

Time and Duration Interval between flares: _____ Duration of burn: _____

Trajectory ___ Rise only ___ Fall only ___ Steady (no rise or fall)

___ Rapid rise and fall ___ Rapid rise and slow descent

Origin Observed: yes / no ___ Near horizon ___ Between source and horizon

Flare origin: ___ Surface ___ Air ___ Other: _____

Type (Based on above information)

PARACHUTE METEOR HANDHELD OTHER:

DETERMINE ANGLE OF OBSERVATION AND POSITION	
Angle of Observation	How determined: _____
	If determined by Fist Method: Fractions of a fist(s): _____
	Check one: ___ Angle below the horizon
	___ Angle above horizon
	___ Angle measured from flare origin to apex
	___ Steady, no angle of elevation observed
	Degrees: _____ Not more than: _____ deg Not less than: _____ deg
Bearing from Observer	How determined: _____
	If determined by clock method: Bearing at _____ o'clock
	Is the reporting source (or building that the reporting source is located in) perpendicular to the shoreline? yes / no
	If no, what is the orientation of the location to the shore line? _____ deg.
	Direction by: prominent landmark, street direction, moon, other
	_____
	Degrees: _____ Uncertainty: + / - _____ degrees
Obstruction	List any obstructions in the line of sight of the reporting source.
	_____
	Obstruction ___ in front of ___ behind flare ? Obstruction height: _____ ft
On-Scene weather	Wind: _____ / _____ Seas: _____ / _____ Visibility: _____ / _____
Vessels/ Aircraft	Were any vessels or aircraft observed in the area? yes / no
	If yes, description:

OBTAIN CLEAR MENTAL PICTURE OF WHAT THE REPORTING SOURCE OBSERVED

Draw sketch here.

	1 fist	----------
	¾	----------
Angle above Horizon	½	----------
	¼	----------
HORIZON		————————————
	¼	----------
Angle below Horizon	½	----------
	¾	----------
	1 fist	----------

AMPLIFYING INFORMATION

Reporting Source on a Vessel

Will the reporting source respond to the sighting? yes / no

If yes, expected time of arrival on scene: _____

Intended action by the reporting source: _____

Reporting Source on Land

Will the reporting source remain on scene or on the phone? yes / no

If no, how can the reporting source by re-contacted? _____

Intended action by the reporting source: _____

Additional information

_____

_____

OBTAIN INFORMATION FROM MILITARY AND CIVILIAN AUTHORITIES

Determine if the flare sighting corresponds to any of the following:

Other flare sightings:	yes / no	Known SAR cases:	yes / no
Known Exercises in progress:	yes / no	Known Overdues:	yes / no
Known fireworks display:	yes / no		

ACTION TAKEN BY COAST GUARD

Distance Distance from reporting source determined to be:

Minimum: _____ nm Maximum: _____ nm Uncertainty: + / - _____ nm

Bearing: _____ Uncertainty: + / - _____ deg

SAR Phase Evaluate emergency SAR phase: DISTRESS ALERT UNCERTAINTY

UMIB Issue UMIB: yes / no Time issued: _____ Time cancelled _____

Launch Sorties

UNIT	STATION	ETA	ACTION

Other Assistance _____

_____

_____

Intentions _____

_____

_____

First Light Search First light search planned: yes / no (Required for RED/ORANGE flares if there is insufficient information to either close or suspend).

Additional information: _____

_____

ACTSUS ACTSUS approved: yes / no

AIRCRAFT EMERGENCIES

NATURE OF DISTRESS: INFLIGHT EMERGENCY / DITCHED / OVERDUE

AIRCRAFT DATA

(AFRCC/FAA can provide cross-reference via tail number or name.)

Tail Number:_____ Nationality:_____ MILITARY / CIVILIAN

Type:_____ Description:_____
(Wing configuration, # engines, etc.)

Color:_____ No. of POB:_____

Flight Plan Filed: Y / N Type: VFR / IFR None Required: Y / N

Last Known Comms Frequencies:_____

Fuel Remaining:_____ Altitude_____

Survival Equipment: RAFT / LIFEJACKET(S) / EPIRB/ELT (Type:_____) / FLARES/ MIRROR / DYE /

SPOTLIGHT / FLASHLIGHT / OTHER:_____

Parachutes: Y / N

POSITION

Latitude/Longitude: _____N _____W

Bearing/Range: _____/_____T / M From:_____ (nav. aid)

Geographic Position: _____

Speed:_____ Course:_____T / M Altitude: _____ FT / M

O/S Weather: Winds:_____/_____ Seas:_____/_____ Vis:_____

ROUTE INFORMATION

Departure from:_____ ETD:_____

Via:_____ ETA:_____

Via:_____ ETA:_____

Via:_____ ETA:_____

Destination:_____ ETA:_____

Alternate Destination:_____

PILOT/OWNER/PASSENGER INFORMATION

Pilot Name:_____
Address:_____
Phone:_____

Owner's Name:_____
Address:_____
Phone:_____

Passenger Name:_____
Address:_____
Phone:_____

Passenger Name:_____
Address:_____
Phone:_____

ADDITIONAL INFORMATION SHEETS

ABANDONED OR ADRIFT

Did anyone see the vessel operating in the area? Y / N

Was it occupied? Y / N _____

How much and what type marine growth is on the hull? _____

_____

Is there a motor or means of propulsion? _____

Were the keys in the ignition? Y / N _____

Is there fishing or camping gear onboard which could have been carried or used on a recent trip? Y / N

_____

_____

Is there emergency equipment (PFDs, flares, radio, EPIRB) on board? Y / N

_____

Does the vessel have parted or cut lines attached? Y / N

_____

Are fenders rigged? Y / N _____

Is the anchor set or is there evidence that the anchor line was cut or parted? Y / N

_____

Is there debris in the area? Y / N _____

How far offshore is the boat? _____

Other damage? _____

Reports of overdue or unreported vessels in the same area? Y / N

BESET BY WEATHER

How long has the vessel been in the storm system?_____

What storm tactics are being used by the vessel, and what storm tactics are available?_____

_____

Is the vessel experiencing icing conditions?_____

CAPSIZED

Are there any People In the Water?_____

Any possibility that there are survivors trapped in the hull?_____

COLLISION

Are there any people missing (PIW case)?_____

Injuries?_____

Condition of the vessel involved:_____

_____

ADDITIONAL INFORMATION SHEETS

DISABLED

Are there any other vessels in the area?_____

Is the vessel experiencing any icing conditions?_____

DISORIENTED

Are there any other vessels in the area?_____

Is the vessel experiencing any Icing Conditions?_____

Landmarks and ATON the vessel can see:_____

_____

Depth of water at the vessel:_____ Trackline of the vessel since time of departure:_____

UNCORRELATED MAYDAY, MAYDAY, PROBABLE HOAX CALLS, AUTOMATED S.O.S.

PRIMARY INFORMATION

Exact wording of radio call:_____

_____

_____

_____

Possible correlating incidents:

DFs OBTAINED

SITE/LOCATION	BEARING (T / M)
_____	_____
_____	_____

HI SITES, LOCAL ANTENNA, AND OTHER UNITS RECEIVING THE TRANSMISSION

SITE/LOCATION	STRENGTH (strong, medium, weak)
_____	_____
_____	_____
_____	_____

PIW

What were the circumstances?_____

Is there any question that it was a person in the water? Describe what was sighted._____

_____

PIW name:_____ Age:_____Sex: M / F Weight:_____

PIW health:_____Nationality:_____

What was the PIW wearing (clothes)?_____

PIW swimming capabilities: excellent / medium / poor

Was the PIW seen going under? Yes / No

Did PIW resurface? Yes / No

Determine water temperature:_____

SARSAT DATA	
Site ID:	406 Hexidecimal Code:

Hi-Flyer Reports:

Posn:_____ Flight Level:_____ Positive / Negative

Posn:_____ Flight Level:_____ Positive / Negative

Posn:_____ Flight Level:_____ Positive / Negative

Posn:_____ Flight Level:_____ Positive / Negative

Posn:_____ Flight Level:_____ Positive / Negative

Posn:_____ Flight Level:_____ Positive / Negative

RESPONSE POLICY

Beacon Alert	Emergency Phase
• 121.5/243 MHz Second Composite alert • 406 MHz GEO registered alert • 406 MHz LEO "A" solution alert • 406 MHz LEO registered, unlocated alert	Initially evaluate as **DISTRESS**
• 121.5/243 MHz First report of audible alert • 121.5/243 MHz First Composite alert • 406 MHz LEO "B" solution alert with probabilities > 20%	Initially evaluate as **ALERT**. Investigate, reevaluate and respond as facts and circumstances warrant.
• 121.5/243 MHz first alert • 406 MHz LEO "B" solution alert with probabilities < 20%	Initially evaluate as **UNCERTAINTY**. Investigate, reevaluate and respond as facts and circumstances warrant.

TAKING ON WATER (TOW) OR FIRE

Are there any other vessels in the area?_____

Rate of flooding:_____ Are there any pumps onboard?_____

Can they keep up with the flooding?_____

Where/Why is the vessel flooding:_____

If a commercial vsl, type/amount of cargo:_____

Is the vessel experiencing any Icing Conditions?_____

SAR CASE SUSPENSION CHECKLIST

Safety

- ☐ If we decide to continue what is the risk to our SRU's?

Search Planning Tools

- ☐ Was C2PC/CASP used to determine search area and track spacing? If not, why not?
- ☐ What was the coverage factor obtained for the executed searches?
- ☐ What was the POD for the planned/completed searches?
- ☐ If CASP was used, what was the expected POS for the planned/completed searches?
- ☐ If CASP was NOT used, what was the level of confidence we were searching the correct area?

Case Review

- ☐ Are we aggressively using UMIBs?
- ☐ Proper Assumptions?
- ☐ Did we look in the correct places for the correct object?
- ☐ How certain were you of the initial position?
- ☐ How good was the search effort?
- ☐ Was a first light search conducted?
- ☐ Do/did we have enough assets on scene to adequately cover the area?
- ☐ What assets were used?
- ☐ Did we re-evaluate leads & clues?
- ☐ Did we review datum calculations?
- ☐ Were all the search areas searched?
- ☐ Were the search variables high enough? (track spacing, sweep width, navigation errors, environmentals, etc.)
- ☐ Did we have reasonable planning scenarios?
- ☐ What other agencies were involved?

Did you consider?

- ☐ Did they survive the incident?
- ☐ Could they survive after the incident?
- ☐ How much time has elapsed?
- ☐ On scene conditions?
- ☐ What will the weather be over the next 12 hours?
- ☐ The condition of potential survivors? (Pre-existing medical conditions or injuries)
- ☐ Their will to live?
- ☐ Survival equipment available?
- ☐ What do the survivability tables/program say? (CESM model)

Next of Kin Notification

- ☐ Has the NOK been kept informed?
- ☐ Has the Group Commander (or other appropriate level) been involved?
- ☐ Has the family been given advanced warning?

Media Interest

- ☐ Is there high or potentially adverse media interest?
- ☐ Is PAO/District (dpa) help needed?
- ☐ Press release/photos?

Mass Rescue Operation Supplemental Checksheet CASE#

Controller Date/Time

Nature of Distress *(Refer to Initial SAR Check Sheet)*	**Description of Craft** *(Refer to Initial SAR Check Sheet)*

1. Mission Objective Options

[ ] Rescue PIW _____

[ ] Rescue persons in life boats/life floats/ life craft

[ ] Evacuation

[ ] Vessel Inshore_____

[ ] Vessel Off Shore_____

[ ] Shore Side_____

[ ] Quarantine Options *(per Center for Disease Control & Public Health Service)*

[ ] Survivors remain w/ stricken craft _____

[ ] Consider Rescue & Assist Team _____

[ ] Consider place of refuge/safe haven_____

[ ] Proceed to scene, stand off & evaluate further due to potentially hazardous conditions _____

[ ] Other _____

2. Hazardous Condition Considerations

- Does the facility/craft/environment have any hazardous cargo/conditions that require special considerations? [ ] YES [ ] NO

  Type:_____Quantity:_____

- Has the safety of response personnel entering hazardous environment been evaluated? [ ] YES [ ]NO

- Is the proper PPE available for use? [ ] YES [ ] NO

3. Recommended SMC/ICS Actions (Use Operational Risk Management throughout)
[ ] Maintain comms links necessary for coordination
[ ] If large P/V involved determine intended action of master (see Annex 1)
[ ] Assume/Designate SMC
[ ] Dispatch/ recall high readiness & traditionally used resources as needed
[ ] Issue UMIB (VHF, MF, NAVTEX, SafetyNET)
[ ] Brief USCG National Command Center to initiate MRO/Security Forces conference call for outside CG assistance (202) 267-2100
[ ] Contact capable, available resources as needed to augment high readiness & traditionally used resources (see Annexes 2-5)
[ ] If Large Passenger Vessel involved refer to pertinent SAR Plan of Cooperation held by District RCC
[ ] Develop search/response plans
[ ] Establish safety/security zone
[ ] Establish flight restriction (land/air)
[ ] Designate OSC/ ACO(Land/Air) --- Deploy DMB
[ ] Contact company/ owner of Unit in distress/ obtain POB list(s) (If unknown see Annex 6 for Units at possible risk w/in AOR)
[ ] Make preparations to accept survivors (see Annex 7) &/or identify options for pick-up & cross decking of survivors
[ ] Implement ICS in accordance w/CG Incident Management Handbook, COMDTPUB P3120.17 (see Chapter 13, SAR)
[ ] Select triage/ place of safety sites (see Annex 7) [ ] Designate POC to conduct survivor/crew/responder accountability [ ] Deploy CG/ICS Liaison Officer to all sites [ ] Deploy medical personnel
[ ] Notify hospitals
[ ] Identify temporary shelter/messing for survivor/crew/responder [ ] Consider security/privacy issues
[ ] Engage Public Affairs Officer
[ ] Select staging area(s)
[ ] When emergency response in addition to SAR is needed use established Incident Command Post/Unified Command to coordinate overall response in accordance w/ USCG Incident Management Handbook

[ ] Account for activation of Federal Response Plan if presidential declaration of a major disaster/emergency is announced
[ ] Provide supplemental comms capability
[ ] Consider method(s) for keeping track of used/emptied survival craft
[ ] Deploy Decon Teams
[ ] Organize Critical Incident Stress Management (CISM) for survivors/families/crew/responders
[ ] Brief Decedent Affairs Officer
[ ] Brief Casualty Assistance Call Officer
[ ] Establish Next of Kin (NOK) notification [ ] Consider NOK muster location [ ] Consider security issues
[ ] Establish mortuary affairs
[ ] Deploy mobile comms equipment
[ ] Continue to brief appropriate District Staff and International, Federal, State, Local Agencies, and Private Industry Stakeholders, media
[ ] Document resources used in case of potential cost reimbursement under Stafford Act
[ ] After survivors are accounted for establish plan for recovery of evidence & debris [ ] Log the position/time of each piece of debris or human remains
[ ] Re- evaluate Search Plan
[ ] Continue to evaluate PERSTEMPO and OPTEMPO
[ ] Gather more indepth craft info i.e. plans, cargo layout, arrangements, MISLE
[ ] Consider use of interpreters for survivors, NOK
4. Sustained Operations (as needed)
[ ] Consider Case Suspension/Termination Plan
[ ] Consider lessons learned/CG SAILS

Safety & Survival Equipment

Communications Equipment

[ ] VHF-FM [ ] HF [ ] DSC [ ] Other _____

_____

[ ] Cellular: #_____

_____

[ ] Frequencies:_____

_____

Survival Equipment

[ ] EPIRB Class/Type: _____

_____

[ ] VDS/Flares_____

_____

[ ] Life floats _____

_____

[ ] Life boats_____

_____

[ ] Life raft_____

_____

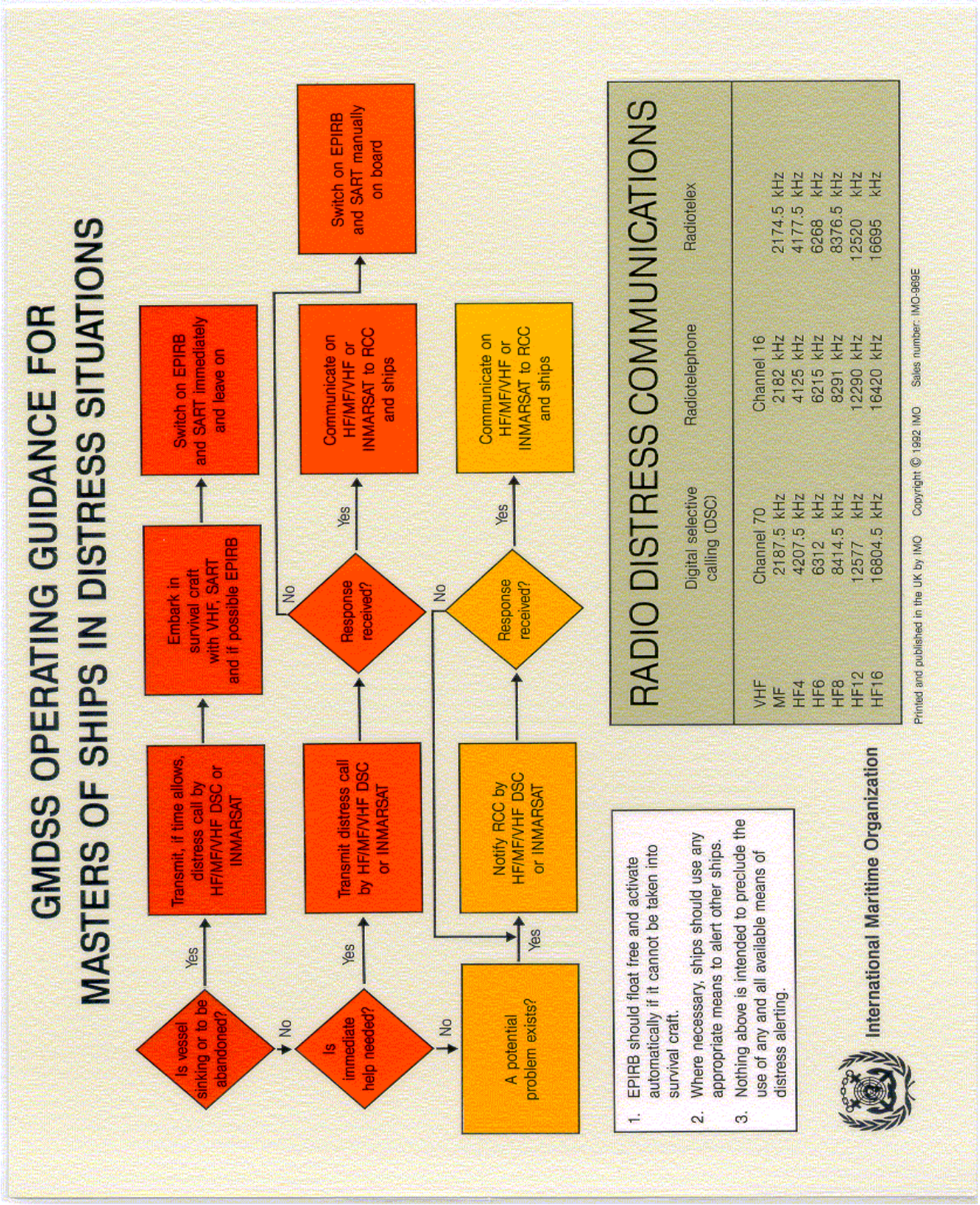
[ ] Dinghy/Skiff _____

_____

[ ] Other _____

_____

Comms			**Datum Marker**			
	Communications Schedule			Set and Drift [ ] Not a factor		
	Start Time	Frequency		Set [ ] T [ ] M	Drift [ ] kts [ ] MPH	
	Time Interval [ ] 15 min [ ] 30 min [ ] 60 min [ ] Other			[ ] DMB Type		Freq
				DMB	Inserted	Relocation
	Remarks			Time		
				Position	N	N
					W	W



ANNEX (1)

GMDSS Operating Guidance for Masters of Ships in Distress Situations

Mass Rescue Operation Supplemental Checksheet

HELO RESOURCES (Within range, as needed, up to 500 miles)
To augment high readiness and traditionally used resources

Static Data for planning (update/keep current)

FOR THE PORT/ AOR OF:								
OWNER & POC (24 hour Contact #)	NUMBER OF AVAILABLE HELO(s) BY TYPE	RESPONSE TIME	ENDURANCE (hrs)	HOISTING CAPABILITY (Y/N)	OFF-SHORE CAPABILITY (RANGE)	PASSENGER CAPACITY	DATE LAST UPDATED	COMMS FREQs/COMMENTS

ANNEX (2)
Helicopter Resources

Mass Rescue Operation Supplemental Checksheet

FIXED WING RESOURCES (Within range, as needed, up to 500 miles)
To augment high readiness and traditionally used resources

Static Data for planning (update/keep current)

FOR THE PORT/ AOR OF:								
OWNER & POC (24 hour Contact #)	**NUMBER OF AVAILABLE AIRCRAFT(s) BY TYPE**	**RESPONSE TIME**	**ENDURANCE (hrs)**	**CARGO CAPABILITY**	**OFF-SHORE CAPABILITY (RANGE)**	**PASSENGER CAPACITY**	**DATE LAST UPDATED**	**COMMS FREQs/COMMENTS**

ANNEX (3)
Fixed Wing Resources

Mass Rescue Operation Supplemental Checksheet

INSHORE RESOURCES
(i.e. HARBOR PILOT, TUGS, TOUR BOATS, FERRY, STATE, LOCAL, INDUSTRY, COMMERCIAL PROVIDERS)
To augment high readiness and traditionally used resources

Static Data for planning (update/keep current)

FOR THE PORT/ AOR OF:				
WHO & POC (24 hour Contact #)	**NUMBER OF RESOURCE(s) BY TYPE**	**RESPONSE TIME**	**DATE LAST UPDATED**	**COMMENTS/ SPECIAL CAPABILITIES**

ANNEX (4)
Inshore Resources

Mass Rescue Operation Supplemental Checksheet

OFF SHORE RESOURCES
(i.e. OFFSHORE PLATFORMS, FERRY, NAVY, NOAA, TUGS, COMMERCIAL PROVIDERS)
To augment high readiness and traditionally used resources

Static Data for planning (update/keep current)

FOR THE PORT/ AOR OF:				
WHO & POC (24 hour Contact #)	**NUMBER OF RESOURCE(s) BY TYPE**	**RESPONSE TIME**	**DATE LAST UPDATED**	**COMMENTS/ SPECIAL CAPABILITIES**

ANNEX (5)
OffShore Resources

Mass Rescue Operation Supplemental Checksheet

UNIT/FACILITIES AT POTENTIAL RISK IN YOUR AREA OF RESPONSIBILITY
(i.e. CRUISE LINE, FERRY, CASINO BOAT, DINNER CRUISE, AIRLINE, CHEMICAL/ NUCLEAR FACILITIES)

Static Data for planning (update/keep current)

FOR THE PORT/ AOR OF:					
COMPANY NAME/ ADDRESS/ CONTACT INFORMATION	**CRAFT NAME/ MEDICAL & EMERGENCY PERSONNEL CAPABILITY**	**EMERGENCY MANAGEMENT CENTER POC & CONTACT INFORMATION**	**HOURS OF OPERATION**	**DATE LAST UPDATED**	**COMMENTS**

ANNEX (6)
Potenial Rist in Your AOR

Mass Rescue Operation Supplemental Checksheet

POTENTIAL SURVIVOR TRIAGE/STAGING SITES
(Consider SRU turnaround time back to scene)

Static Data for planning (update/keep current)

FOR THE PORT/ AOR OF:				
DISEMBARK FROM	**LOCATION / POC (for further transfer)**	**LAT/LONG**	**DATE LAST UPDATED**	**COMMENTS**
Aircraft				
Small Vessel				
Large Deep Draft Vessel				

ANNEX (7)

Potenial Survivor Sites

Appendix H
Search Planning Handbook

H.1 Search Planning
H.1.1 Overview
H.1.2 Search Planning
H.1.3 Uncertainty and Probability
H.1.4 The Goal of Search Planning
H.1.5 Search Planning Methods and Tools

H.2 Manual Solution Model
H.2.1 Overview
H.2.2 Manual Search Planning Variables

H.3 Datum Estimation
H.3.1 Initial Position
H.3.2 Environmental Data
H.3.3 Aeronautical Drift
H.3.4 Maritime Drift
H.3.5 Enclosed and Coastal Waters
H.3.6 Dealing with Other Sources of Uncertainty
H.3.7 Computing Subsequent Datums

H.4 Search Area
H.4.1 Total Probable Error
H.4.2 Search Radius
H.4.3 Search Area Development
H.4.4 Repeated Expansion Concept

H.5 Search Plan Variables
H.5.1 Number of SRUs
H.5.2 Search Time Available
H.5.3 SRU Ground Speed
H.5.4 Track Spacing
H.5.5 Sweep Width
H.5.6 Coverage Factor
H.5.7 Measures of Search Effectiveness

H.6 Search Area and SRU Assignment
H.6.1 Allocating Effort
H.6.2 Partitioning the Search Area
H.6.3 Assigning SRUs to Search Areas

H.7 Search Pattern Selection
H.7.1 Factors in Selection
H.7.2 Search Pattern Nomenclature
H.7.3 Search Pattern Designation
H.7.4 Search Pattern Summary

H.8 Search Action Plans

H.9 Manual Solution Worksheets

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Section H.1
Search Planning

Search planning is necessary when the location of a distress is not known, or significant time has passed since the search object's position was last known. The SMC is responsible for developing and updating an effective search plan. The plan may involve a single SRU or many SRUs searching for several days.

H.1.1 Overview

Search planning consists of determining datum (the most probable location of the search object, corrected for drift) and search area, developing an attainable search plan, selecting search patterns, planning on scene coordination, transmitting the search plan to OSC/SRUs, and reviewing the search plan. Many factors influence the movement of the search object. The SMC judges the impact of these factors to determine the region to search and methods to use, evaluates the number and capabilities of available SRUs, and determines whether compromise between search area size and search effectiveness is necessary. The methods described in this chapter are based on historical information and mathematical theory, and represent generally accepted techniques for search planning. Though effective tools, they do not in themselves guarantee success; that depends on planner ability and judgment, and SRU effectiveness.

Search planning involves the following steps:

- Evaluate the situation, including any previous search results;
- Estimate the possible distress incident positions and how they are distributed (usually with respect to a datum position, line or area);
- Estimate the survivors' post-distress movements to produce an estimate of their possible locations at the time when search facilities can be on scene;
- Determine the best way to deploy the available search facilities so the chances of finding the survivors are maximized (optimal search effort allocation);
- Define search sub-areas and search patterns for assignment to specific search facilities;
- Provide a search action plan that includes a current description of the situation, search object description(s), specific search assignments for the search facilities, on-scene coordination instructions, and search facility reporting requirements;

These steps are repeated until either all survivors are found and rescued, or evaluation of the situation shows that continued searching is very unlikely to succeed in saving a life.

For land cases, search area is normally dependent on the environment. Natural boundaries, injuries, and other hard-to-quantify factors affecting movement are important in search area decisions. The experience and judgment of the SMC is a key factor. A more detailed discussion and planning guidance for land cases is provided in references (a) and (b).

H.1.2 Search Planning

There are basically only two methods for planning searches—manual and computer simulation. The manual search planning method is found in the *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual, Volume II*. Although there are several computerized versions of the manual method (sometimes with slight variations from *IAMSAR*) in use in various parts of the world, they are not fundamentally different from the manual method itself. JAWS is one of these. In some cases these computer programs have access to more detailed environmental data than one normally associates with paper-and-pencil methods, but otherwise the computer is simply being used as a tool to perform the same computations and display the same results the paper-and-pencil manual method would produce. The only software that uses the simulation approach is CASP. A new search-planning tool is currently under development that will replace both JAWS and CASP. It is called the Search and Rescue Optimal Planning System (SAROPS). SAROPS will use a simulation approach. The main advantage of simulation is that it allows a more realistic representation of real-world complexity than the grossly over-simplified manual method.

H.1.3 Uncertainty and Probability

Searching necessarily involves uncertainty. If the search object's location were known or could be accurately predicted, no searching would be necessary. Therefore, the first uncertainty the search planner must deal with is the uncertainty about the object's location. This in turn often involves uncertainties about the time and location of the distress incident, the types of objects (disabled craft, PIW, raft, etc) that may be adrift, etc. Even when these are known within close limits, if a significant amount of time will pass between the time of a distress and the arrival of resources on scene, the uncertainty about the object's location will grow due to uncertainties in the available data about the environmental factors that cause drift and uncertainties in our knowledge about how the search object will respond to those factors. In addition, detection of the object once resources arrive on scene and begin searching is by no means certain. These uncertainties require the search planner to think in terms of probabilities. The three probabilities of primary concern are the probability that the search object will be in some bounded area (probability of containment or POC), the probability that the search object will be detected, assuming it will be in an area at the time the area is searched (probability of detection or POD), and the probability of finding the search object (probability of success or POS) based on both the POCs for the areas searched and the PODs from searching those areas. For any given search area,

$$POS = POC \times POD \, .$$

For non-overlapping search areas that are covered more or less simultaneously, the total POS is simply the total sum of all the POS values for the individual search areas. The cumulative POS (POS_{CUM}) is the probability that all searching done to date would have located the search object.

H.1.4 The Goal of Search Planning

The ultimate goal of search planning is to find the survivors of a distress incident as quickly as possible, subject to resource availability. The way to achieve this goal is to increase the cumulative probability of success (POS_{CUM}) as quickly as possible with the available or assigned resources. A search plan that does this is the most efficient, or the optimal, plan. It is also the plan that will minimize the time required, on average, to locate the search object. "Optimal effort allocation" is the process of finding the combination of search area, coverage, and resource assignments that produces the most efficient search plan. Unfortunately, this is a mathematically complex process in the general case that requires a quite sophisticated computer program. CASP performs this function but the resulting search plans are not always operationally feasible, requiring some adjustment by the search planner. JAWS and the *IAMSAR Manual* method also produce "near-optimal" search plans based on a number of simplifying assumptions and corresponding "optimal search factors". SAROPS is being designed to produce the most nearly optimal, operationally feasible, search plans that are possible with the available assets.

H.1.5 Search Planning Methods and Tools

When developing a search plan, search planners must be detectives and information distillers. They must aggressively pursue leads and obtain all information available. They must continually think "outside the box."

Coast Guard Search planners shall plan searches in one of three ways, subject to the guidance provided in this chapter: Manually in accordance with the *IAMSAR Manual* and this Appendix, with JAWS or with CASP. Each of these methods is discussed in more detail below, along with their capabilities and limitations. Further guidance on usage is also provided in this Appendix.

Section H.2
Manual Solution Model

H.2.1 Overview

The Manual Solution and its automated version, JAWS, work on the principle of estimating an average (mean, expected) position and uncertainty about that position. The expected, or most likely, position is called ***datum*** and it is used as the reference position for planning a search. The level of uncertainty about the datum position is represented by the ***probable error*** of position. Probable error of position is defined as the radius of the circle centered on datum that contains 50% of the possible positions. For manual search planning, a particular type of probability density distribution is assumed. That type is called a circular bivariate normal distribution. This means that if datum were plotted on an ordinary piece of graph paper, then the distribution of x-coordinates for possible positions around datum would follow the familiar "bell curve," and likewise for the distribution of y-coordinates. The probability that any particular "square" or cell on the graph contains the actual position is the joint probability that the x-coordinate falls within the necessary range of values ***and*** that the y-coordinate falls within the necessary range of values for the point to fall within the cell in question. The joint probability is the product of the two individual (x and y) probabilities. The *IAMSAR Manual, Volume II, Appendix M* contains probability maps showing probability of containment (POC) values around a datum position for cells of various sizes in relation to the probable error. In theory, there is no maximum radius around datum that is guaranteed to contain all possible positions. However, a radius of three times the probable error has a POC value of over 99%.

Since objects in the marine environment tend to drift under the influence of wind and current, it is necessary to estimate the search object's location when planning a search. This is done by updating the datum position(s) to account for drift. Since uncertainty about the search object's position increases with the passage of time, it is also necessary to update this value. The size of the search area depends on the size of the ***total probable error of position (E)*** and on the amount of searching effort that is available. The size of the total probable error of position depends on the probable error of the initial distress position (X), the probable error due to uncertainty in the drift estimate (D_e), and the probable error of the search craft's position while searching (Y). The uncertainty of the drift estimate depends, in turn, on the uncertainties associated with the environmental factors affecting drift (wind and current) and the limitations in our knowledge of how drifting objects respond to these environmental factors.

Once a datum position and its total probable error have been established for a specific point in time, a search plan that maximizes the chances for finding the survivors can be developed based on the amount of searching effort available around that time. This is called "optimal effort allocation." It is the reason for having some estimate of how positional uncertainty around datum is distributed. If the nature of the distribution is known then it is possible to estimate the POC of a square centered on datum as a function of the square's inscribed radius. If POD as a function of coverage is also known, then it is possible to find the combination of search area size and coverage for a given level of effort that maximizes the probability of success (POS). Methods for doing this are described in the *IAMSAR Manual, Volume II*. These methods, with the modifications described in this Appendix, comprise the manual method approved for USCG use.

The modifications to the *IAMSAR Manual* methods described in this Appendix are:

- The *IAMSAR Manual* wind current graph and computations are replaced by the wind current computations given in paragraph H.3.4.4 and the wind current worksheet at the end of this Appendix.
- Additional worksheets are provided for computing reversing tidal and other currents.
- The table of probable errors of position associated with different means of navigation contains more means of navigation than the corresponding table in the *IAMSAR Manual*. However, the two tables agree when the method of navigation is the same. The same is true for other tables of probable position error associated with types of craft.
- The leeway divergence angles given in this Appendix are rounded up to the next highest whole degree and are therefore more accurate than those in the *IAMSAR Manual*, which are rounded up to the next highest multiple of five degrees. Ho wever, all leeway data for both this Appendix and the *IAMSAR Manual* are based on the same research and are therefore otherwise consistent.

- The sweep width tables given in this Appendix include more altitudes and therefore have more entries than those in the IAMSAR Manual. However, both sets of tables are based on the same research and are therefore consistent. The sweep width tables in the *IAMSAR Manual* are a proper subset of the tables contained in this Appendix.

Some additional information and graphs are also provided in this Appendix, but these are consistent with the material contained in the *IAMSAR Manual*.

In order to make manual search planning possible and avoid requiring an extensive background in search theory, mathematics and statistics, not to mention avoiding an impractical amount of computation, it was necessary to grossly oversimplify the approach to the search-planning problem and to make sweeping assumptions and generalizations. For these reasons, the manual method is truly adequate only for simple situations of relatively short duration (on the order of 24 hours adrift).

H.2.2 Manual Search Planning Variables

Search planning is based on myriad variables including environmental factors, the nature, time and location of the distress incident, the type(s) of search object(s) resulting from the distress, and the available search platforms and their capabilities, including the time at which they can be on scene. The variables whose values ultimately determine where to place the search area for a given time, as well as its size and orientation, are those variables needed to estimate a datum position and its uncertainty for a given time, plus the variables needed to estimate the available ***search effort (Z)*** around that time. Estimating a datum position and its uncertainty requires the following information:

- An estimate of the distress incident's date and time, and the distressed craft's position and positional uncertainty at that time.
- A list of search objects that may have been set adrift by the distress incident and the leeway coefficients for those objects along with the uncertainties about the objects' leeway.
- Wind and current data for the vicinity of the distress incident sufficient to cover any place the object(s) may have drifted since the distress incident, along with uncertainties about the wind and current values.
- The commence search or mid-search date and time.

Estimating the available search effort (Z) requires the following information:

- The numbers and types of search facilities available.
- The search endurance for each facility (depends on its overall endurance and the location of the search area in relation to the facility's departure and recovery locations).
- The search speed for each search facility.
- The effective sweep widths for the search object(s), environmental conditions, and search facilities as of the time of the search. (Note: For planning purposes, the average sweep width for the most likely type of search object may be used when estimating available search effort.)

Section H.3
Datum Estimation

The expected location of the search object at any given time is known as the ***datum*** for that time. Datum is a reference position, line or area that is used as a reference for describing the distribution of possible search object locations and for planning searches. Generally the region near the datum contains the most probable search object locations. As a practical matter, all datums are either single points or are formed by points that are then connected by line segments. Only points are updated for drift. For line and area datums, the points used to form them, plus the possible addition of other carefully chosen points are updated for drift and then a new datum line or area is inferred from the results. Determining datum begins with the reported position of the incident. Unless a distressed craft or individual is immobilized, as in a boat grounding or a debilitating physical injury on land, the actual position of the search object during the search may be substantially different from the initial position. Therefore, possible movement of the search object should be accounted for when calculating datum. Datum should be recomputed periodically as movement due to drift or other factors continues to affect the position of the search object. Recomputed datums are usually labeled sequentially (e.g., Datum1, Datum2, Datum3). The time for which the datum was computed should be noted.

The original manual method, developed during the Second World War, was designed to handle a single simple scenario with simple paper-and-pencil computations and plots. The simple scenario consisted of a single distress incident time with no appreciable uncertainty, and a single initial position that could have a significant amount of uncertainty due to the limitations of navigation at that time. Only a single type of search object was considered: a survivor adrift in a life raft like those carried by aviators. Drift updates assumed that the winds and currents over the entire area and period of concern could be adequately represented by their average values with no significant systematic variations present with respect to either time or space. This tended to rule out use in tidal areas or in areas with strong, persistent currents, such as the Gulf Stream with its high current gradients. In other words, the drift update method was generally adequate for open ocean use away from the influences of tides and strong currents.

It is possible, but not always practical, to extend the original method to include more variations and types of uncertainty than the original. It has been found, for example, that objects tend to have leeway off the down wind direction to the left or right and it is assumed that these port and starboard tacks are equally likely. This requires computing two datums instead of the original one. Other extensions are also possible, but as the number of distinct possibilities increases, so do the number of datums that must be computed. In fact, the number of computations tends to increase exponentially.

H.3.1 Initial Position

The location where the distress occurred is called the *initial position.* Initial positions, of course, depend on the craft's position at the time of the distress. Therefore, knowing where and when a distress could have occurred when definite information is not available (e.g., an overdue craft) depends on the craft's pre-distress behavior. To compute datum, the time and location of the craft's or survivors last reliable position are first considered. This will determine the type of datum to be computed. One of three situations usually exists, based on the initial information obtained:

H.3.1.1 Position Known (Point Datum). The incident is witnessed or reported by radar net, DF net, another craft, or the distressed craft itself, or position is computed from a previously reliable position. When a person on shore witnesses the incident, the incident position can often be derived from the street address of the reporting source's location through the use of geo-location services provided on the internet. G-OPR has funded such services. Information and links for the currently funded services can be found on the G-OPR website. When the position and time of the incident are known, drift is determined and an updated datum is computed.

H.3.1.2 Track Known (Line Datum). The intended track is known but the position along the track is unknown, or a single line of bearing, such as a DF bearing, is obtained. In other words, the distress is believed to have occurred somewhere along a line segment or a series of connected line segments. An updated datum line may be established as follows:

(a) The datum line is first plotted, and a series of estimated positions and times are computed for points along the line (e.g., estimated progress along the track). At a minimum, the estimated positions at each end of each line segment are used. If a line segment is long or it is known that significant variation in wind and/or current

values exist along the line segment, carefully chosen intermediate positions should be computed. Note that for a single line of bearing, all estimated positions will have the same time as when the line of bearing was observed, whereas for track lines, each estimated position will have its own associated time based on the craft's estimated departure time and speed(s) up to that point.

(b) A DR position and time is recommended for at least every 5° of latitude or longitude for aircraft tracks, at least each 24 hours on the track of a marine craft, and at least every 4 hours on the track of lost persons in inland areas. More frequent DR positions should be computed whenever necessary to represent varying environmental conditions along the intended track.

(c) Each position and time is considered as an initial position/time, and drift is computed for each position up to a common single (datum) time. Thus, a series of datum points is developed. All datum points are sequentially connected by straight lines to form a datum line. Figure H-1 demonstrates drifting a trackline.

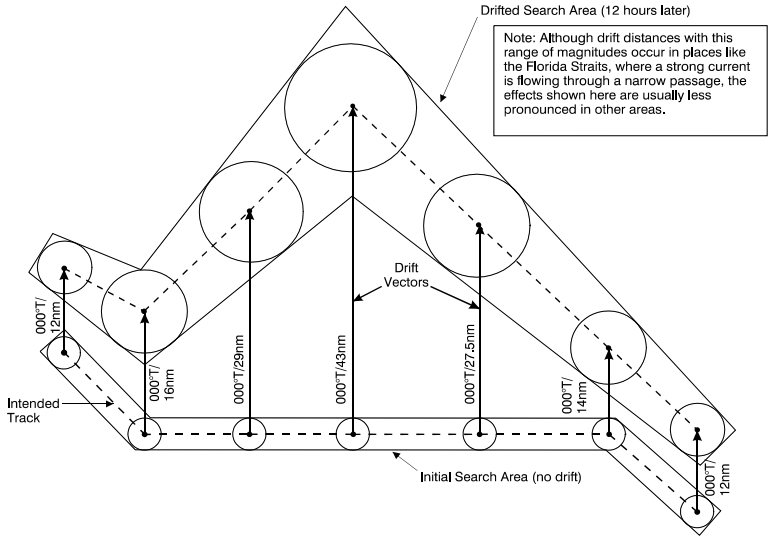


Figure H-1 Track Line Drift

H.3.1.3 General Area Known (Area Datum). Suppose neither the position nor the intended track is known, but the general area the craft was probably in, such as a lake, a military exercise area, or an offshore fishing ground, is known. In this case, a datum area is developed. Datum Areas are normally specified as polygons, using the coordinates of the corner points that define the polygon. Datum area computations depend on many factors, such as fuel endurance, natural boundaries, and known or suspected areas of occupancy. Datum area computations may be reasonably exact, or only a best guess.

(a) An aircraft glide area is a datum area, since the aircraft has an equal likelihood of being anywhere within that area. A maximum possibility area can be developed using hours of fuel on board, wind speed and direction, glide ratio, and time of departure. A vector representing wind speed and direction is added to the departure point. The SMC then determines the distance the aircraft could cruise from the time of departure to the end of fuel endurance, to which the possible glide distance is added. The SMC uses this as a radius for the datum area. A similar approach can be used for marine craft with fuel endurance in hours, maximum range at cruising speed, and water drift forces.

(b) Datum areas are usually large when the search object endurance is great or many unknown factors exist. Extensive detective work may be necessary to reduce this size to a reasonable initial region, or the SMC may have to outline the datum area based on other hypotheses. For instance, an aircraft may be reported missing while flying in a defined operating area or along a flight planned route, a fishing vessel may have gone to particular fishing grounds, a private aircraft or pleasure boat operating area may be known, or a yacht is on an extended coastal or ocean cruise without a specific route or destination. The datum area may be readily apparent. In other cases, the area can be narrowed by communications checks and deduction; if not, large

general areas may have to be searched.

(c) The larger the area, the more difficult it will be to update the datum area for drift. If the area is small to moderate in size and the environmental conditions (wind and current) are the same over the region containing the area and likely drift trajectories, a single corner point may be chosen and updated for drift, with the same drift applied to the other corner points. This will result in a new polygon identical to the original except for location. The initial probable position error for each corner point is always assumed to be zero, meaning that all possible distress positions are contained within the polygon. (For JAWS, manually enter a position error of 0.01 NM). After the first drift update, the probable position errors for the updated corner points are computed in the usual fashion. For large areas or more complex environmental conditions, more points should be selected as initial positions to ensure variations in environmental data and their effects on drift are adequately represented. At a minimum, each corner point shall be updated for drift individually. The time associated with all initial positions will be the search planner's best estimate for the time of the distress incident. The updated datum positions and their associated probable errors are plotted. Then, enclosing the resulting circles in a new polygon; plots the new datum area.

H.3.2 Environmental Data

H.3.2.1 Drift is movement of a search object caused by external forces present in the environment. Datum is calculated by determining which drift forces will affect the search object, selecting the most appropriate ones, and calculating a vector for each. The vectors are then added to determine a drift direction and speed. The length of time between the time of the incident and the desired datum time is then applied to obtain a drift direction and distance vector. This is added to the initial position to determine datum using standard navigational procedures. Drift distances should be calculated using the time between the last known position and a time selected by the SMC. This time of datum is normally chosen to coincide with the daily maximum search effort, using mid-search time or the first SRU arrival time.

H.3.2.2 The SMC should determine which environmental forces affected the search object during and after the incident:

(a) For marine incidents, currents and winds.

(b) For aircraft, primarily wind.

(c) For lost persons, terrain and meteorological conditions.

H.3.2.3 The SMC should attempt to quantify each force affecting drift, which is best done by vector, with bearing and length of the vector representing target direction and speed respectively. Since objects that float or fly are more affected by environmental forces, it is easier to quantify their possible movement. Lost persons, while affected by the environment, may choose to move or not, or may move unpredictably.

H.3.2.4 With the exception of certain databases maintained for use by JAWS and CASP, the Coast Guard does not maintain environmental databases that are readily available to search planners. Even those available to JAWS and CASP are sometimes either more coarse than desired or incomplete in some respect. None of the tools has winds aloft data available. CASP has access to global surface wind over water on a 1 x 1 degree x 12-hour grid but JAWS does not have direct access to any surface wind data. Both JAWS and CASP use long-term seasonal averages from climatology for sea current data on a 1 x 1 degree grid, although CASP has access to special regional files on a much finer grid. These include the Florida Straits on a 0.1 x 0.1 x monthly grid and a Gulf Stream (Western North Atlantic) regional product on a 0.2 x 0.2 x 12-hour grid from the U. S. Navy's Fleet Numerical Meteorology and Oceanography Center (FNMOC). CASP does not have access to tidal data and the tidal data available to JAWS is very limited.

H.3.2.5 Only the following sources of environmental data are approved for USCG use:

(a) National Oceanic and Atmospheric Administration (NOAA) Weather Service and Ocean Prediction Centers for analyses and forecasts.

(b) U.S. Navy Meteorology and Oceanography Centers (METOC) for analyses and forecasts.

(c) Wind and current databases maintained for use by CASP and JAWS for analyses and forecasts. (Wind and

current data available to CASP may be displayed by selecting "CURRENTS" from the OPCEN menu of the textual "teletype" interface to OSC-hosted SAR applications. C2PC/SAR Tools can also display the sea and tidal currents that it has available for JAWS.)

(d) On scene observations made by search facilities and inferred from DMB tracks.

(e) Other sources at or near the scene that the search planner has good reason to believe are reliable indicators of conditions on scene. Distant observations should not be used just because they are the nearest available.

Important notes: NOAA provides a number of products via the Internet, but includes a disclaimer that those products are not guaranteed to be the best or latest data. Direct observations from stations and weather buoys are also posted and recently the offshore buoy wind observations were formatted into synoptic 6-hour increments for ease of import into JAWS. ***However***, all observed data, regardless of source, must be used with extreme caution whenever the search object is not in the immediate vicinity of the observations.

An additional issue is that "surface wind" is defined as the wind at a mean height of 10 meters (about 33 feet) above the surface, and the leeway coefficients in Table H-3 are based on this definition. Direct observations may be from any height and should be "normalized" to a height of 10 meters according to a standard procedure used by meteorologists but not generally known to search planners. If in doubt about the most appropriate wind speed and direction to use, every effort should be made to contact the appropriate NOAA or USN METOC office for assistance. All Area, District, and Group command centers are strongly encouraged to establish and maintain periodic contact with personnel at NOAA and/or USN METOC offices with AORs overlapping the command center's AOR and arrange for their assistance when needed for SAR. Familiarization visits to each other's centers/offices are also strongly encouraged, as is the establishment of mutually acceptable standard operating procedures.

Datum Marker Buoys (DMBs), both radio and self-locating, are tools for determining total water current in a search area. When using DMBs, search planners should use their best judgment to estimate the radius of influence for which the DMB information is valid. The radius of influence is smaller in the vicinity of high currents; i.e., the Gulf Stream, Florida Straits, or known variable current areas such as Georges Banks off of New England. Time is also a consideration. Marine science experts, such as those at the International Ice Patrol (IIP) are available to assist in estimates. As a rule, the radius of influence should be no larger than that for water current information already available, such as system environmental information provided to CASP.

H.3.3 Aeronautical Drift

For situations where aircraft glide and parachute drift are needed, planners should refer to Appendix K to Volume II of the IAMSAR Manual (reference (b)).

H.3.4 Maritime Drift

On average, the Coast Guard conducts more than 5,000 searches annually, at a cost of about $50M. Most of the expense is in aircraft usage. A fifth of the searches continue longer than 12 hours. These longer searches, which usually involve multiple resources, are much more expensive than short searches. In the longer searches, knowledge of the drift of the search object becomes very important to the search planner. If the search object is not in the region covered by the search, there is no chance of finding the search object. Thus, the better the drift of an object is known, the more likely it will be found. Shortening the search saves SAR resources, but more importantly, a shorter search increases the probability that the person(s) in distress will survive.

H.3.4.1 Drift Theory. Search object drift in the marine environment is caused by the combined effects of currents and drag acting on the underwater surface of the object below the waterline and winds acting on the exposed sail area of the object above the waterline. It is assumed that objects tend to drift with the total water current, so the contribution that current makes to search object drift is the same as the total water current itself at that point in space and time. Leeway is motion relative to the water that is caused by the wind acting against the exposed sail area of the object. Most objects do not have perfectly circular symmetry. As a result, the balance of forces between the wind trying to move the object relative to the water and the drag the water exerts on the underwater surface of the object, the direction of the leeway tends to be to the left or right of the down wind direction rather than directly down wind. It is necessary to allow for each of these two possibilities since it is assumed that port and starboard tacks are equally probable. This in turn requires the computation of two drift velocity vectors and

two datums as shown in Figure H-2 below.

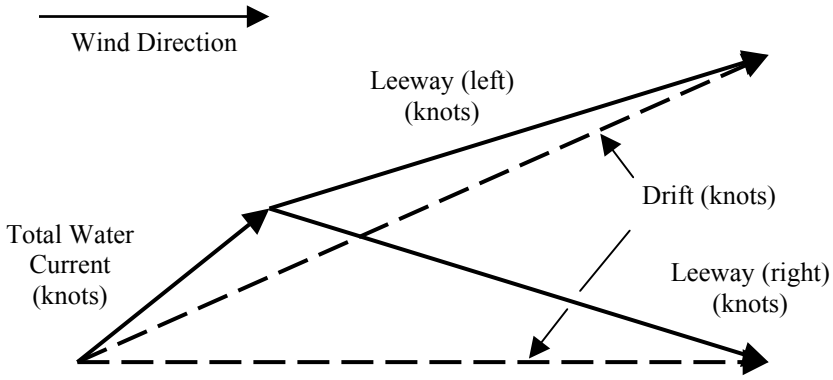


Figure H-2 Vector Plot of Basic Surface Drift Velocities

H.3.4.2 **Leeway (LW)** is the movement through water caused by winds blowing against the exposed surfaces of the search object. The pushing force of the wind is countered by water drag on the under-water surface of the object. Most marine craft have a portion of the hull and superstructure (sail area) exposed above the water. The more sail area the search object has, the greater the wind force on the object. Completely submerged objects are assumed to have no leeway. The SMC should get information on the physical characteristics of the search object to determine the amount of leeway.

(a) **Leeway Calculations.** Leeway is movement through the water caused by wind and waves acting on the search object. These forces are countered by water drag on the underwater portion of the drift object. This balance of forces results in a linear relationship between leeway speed and wind speed. Leeway speed is simply the magnitude of the velocity of the object relative to the water and can be estimated using the following equations.

Equation 1: Leeway speed (knots) = [Slope * Wind Speed (knots)] + Y_intercept (knots), for wind speeds greater than or equal to six knots.

Equation 2: Leeway speed (knots) = [Slope + Y_intercept/6] * Wind Speed (knots), for wind speeds less than six knots.

The second equation ensures that zero wind speed produces zero leeway and that the computed leeway for a six-knot wind is the same for both equations.

(b) **Leeway Taxonomy.** Allen and Plourde (1999) conducted a review of twenty-six leeway field studies. Presented in their report is a systematic approach (taxonomy) to classify leeway objects by primary and secondary characteristics that affect their leeway drift. This taxonomy's purpose is to provide a classification system that allows the search planner to identify an appropriate class for the drifting object of interest.

Given the enormous diversity of objects for which a search planner could be expected to predict drift, the taxonomy was developed with seven object classification levels progressing from general to more specific leeway-determining characteristics (Table H-1). These levels result in a "branching effect" for object classification that can be clearly seen in Figure H-3 where only the first three levels of the taxonomy are depicted.

Table H-1: Names and descriptions of Leeway Drift Taxonomy Levels

Taxonomy Level Number	Level Name	Level Descriptions
Level 1	Governmental Response Mechanism / Organizations	• Reflects governmental response mechanisms that are triggered • Reflects behavioral differences in response units • Identifies expected behavioral characteristics of the drift target • Reflects an expectation of the amount and types of datum information that may be available
Level 2	Primary Source of the Leeway Object	• Identifies the primary source of the drifting object • SAR targets originate from marine or aviation sources • Non-SAR targets originate from non-SAR sources
Level 3	Major Object Categories	• First level using specific drift object characteristics • Identifies broad categories of intended object use • Highest level that could possibly have leeway information
Level 4	Object Sub-Categories	• Identifies major divisions within drift object categories • First level for which the size or shape of the drift object determines its placement in the taxonomy • First level that considers the ratio of drift object surface area above and below the waterline • The majority of current target leeway drift information will be found at this level
Level 5	Primary Object Leeway Descriptor	• Identifies the drift object feature that exerts the greatest influence on the drift object leeway ratio (typically above or below the waterline) • Swamping or capsizing are dominant leeway characteristics
Level 6	Secondary Object Leeway Descriptor	• Identifies the drift object feature that exerts the second strongest influence on the drift object leeway ratio (typically the above or below the waterline features opposite the primary feature)
Level 7	External Modifiers	• Identifies those items that can affect an object's leeway drift that have not been addressed in earlier levels • These items are usually controlled by the occupants onboard leeway targets • These items effectively modify the primary and secondary influences identified in Levels 5 and 6.

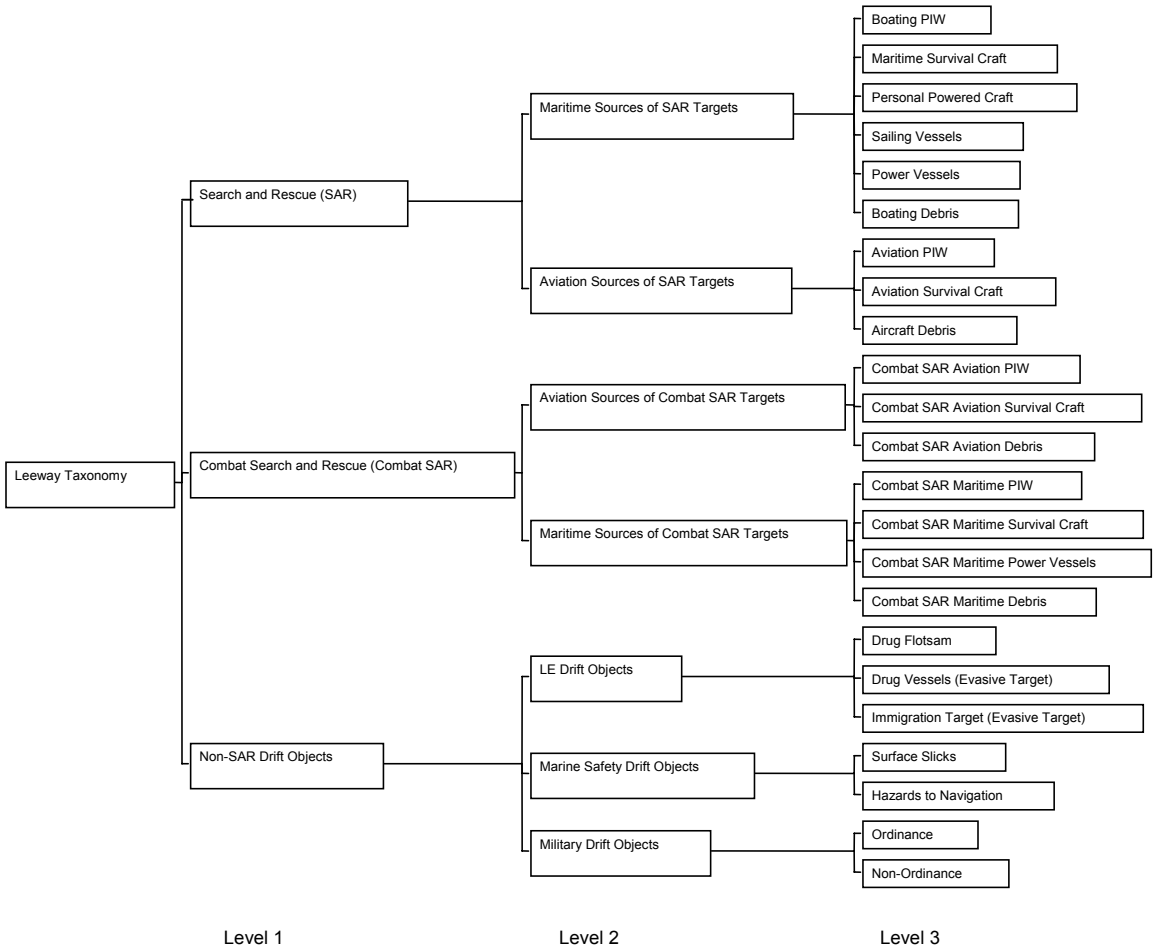


Figure H-3 Outline of the first three Leeway Drift Taxonomy levels.

(c) **Leeway Definitions and Calculations.** In conjunction with the development of the vessel taxonomy, the report by Allen and Plourde (1999) compiled the results from twenty-six leeway field tests, performed further analysis of other leeway studies, and presented results for general leeway categories. Their results provide valuable information to assist in correct application of the most accurate leeway values.

The first four columns of Table H-3 are the systematic organization of SAR objects by their leeway drift characteristics (a portion of the vessel taxonomy). The columns are organized from general to increasingly more specific following the taxonomy guidelines discussed above, however, the table actually begins with level three of the overall taxonomy. This is because our primary SAR interests lie within the taxonomy level two classification: "Maritime Sources of SAR Targets" (Figure H-3). The fifth and sixth columns of Table H-3 are coefficients to the leeway speed versus wind speed equation (Eq. 1). The Slope coefficient is dimensionless and the Y-intercept has units of nautical miles per hour [kts].

Leeway divergence angle is the divergence of the drift object from the downwind direction due to the lack of symmetry of a drift object. The seventh column in Table H-3 is the divergence leeway angle in degrees representing the average angle off the downwind direction. This value can be used to determine search area size based on uncertainty in the direction of leeway drift. Two examples to illustrate the use of Table H-3 are presented below:

Example 1

The search planner is looking for Persons-in-the-Water (PIWs) in winds of 15 KTS. Information is lacking on their condition (conscious or unconscious) and whether they are wearing lifejackets or survival suits. Thus the general category PIW is chosen. Equation (1) for general category of PIW for winds of 15 KTS is shown below.

Leeway Target Class				Leeway Speed		Divergence
Category	Sub Categories	Primary Leeway Descriptors	Secondary Leeway Descriptors	Slope	Y-intercept (KTS)	Angle (deg)
PIW				0.011	0.0680	30
	Vertical			0.005	0.0739	18
	Sitting			0.012	0.0004	18
	Horizontal	Survival Suit		0.014	0.1011	30
		Scuba Suit		0.007	0.0836	30
		Deceased		0.015	0.0778	30

Leeway speed (knots) = [0.011* 15 knots] + 0.0680 knots = 0.233 knots

Leeway Divergence Angle (degrees) = plus or minus 30 degrees.

Example 2

A fishing vessel has gone down, and four men were last seen entering their life raft in winds of 20 knots. After talking with the fishing vessel's home office, the manufacture and type of life raft on board is determined. An illustration from the manufacturer catalogue of the life raft is available at the manufacturer's web site. The search planner then enters Table H-3 at Survival Craft, moves through to the sub-category – Maritime Life Rafts, and then looking at the illustration from the manufacturer's web site determines that the 4-6 person life raft has deep ballast bags and a canopy. The search planner then goes to Sub-Table H-3A and finds the Capacity Modifier – 4-6 Person Capacity life rafts. The search planner does not know if the fishermen deployed their drogue (Drogue Modifier). Therefore, the search planner determines a search area, based upon a 4-6 person life raft. This scenario is shown below.

Leeway Target Class				Leeway Speed (kts)		Divergence Angle (deg)
Category	Sub Categories	Primary Leeway Descriptors	Secondary Leeway Descriptors	Slope	Y-intercept (kts)	
Survival Craft	Maritime Life Rafts	No Ballast Systems		0.042	0.0311	28
			no canopy, no drogue	0.057	0.2119	24
			no canopy, w/ drogue	0.044	-0.2002	28
			canopy, no drogue	0.037	0.1108	24
			canopy, w/ drogue	0.030	0.0	28
		Shallow Ballast Systems and Canopy		0.029	-0.0039	22
			no drogue	0.032	-0.0194	22
			with drogue	0.025	0.0136	22
			Capsized	0.017	-0.1011	8
		Deep Ballast Systems & Canopies	(See TableH-3A for Levels 4-6)	0.030	0.0156	13
	Other Maritime Survival Craft	life capsule		0.038	-0.0797	22
		USCG Sea Rescue Kit		0.025	-0.0408	7
	Aviation Life Rafts	no ballast, w/canopy	4-6 person, w/o drogue	0.037	0.1108	24
		Evac/ Slide	46-person	0.028	-0.0117	15

Leeway Target Class				Leeway Speed (kts)		Divergence Angle (deg)
Secondary Leeway Descriptors	Capacity Modifier	Drogue Modifier	Loading Modifier	Slope	Y-intercept (kts)	
Maritime Life Rafts with Deep Ballast Systems and Canopies	4-6 person capacity			0.029	0.0389	20
		without drogue		0.038	-0.0408	20
			light loading	0.038	-0.0408	20
			heavy loading	0.036	-0.0292	20
		with drogue		0.018	0.0272	16
			light loading	0.016	0.0525	32
			heavy loading	0.021	0.0	27
	15-25 person capacity			0.036	-0.0855	14
		w/o drogue	light loading	0.039	-0.0603	12
		with drogue	heavy loading	0.031	-0.0700	12
	Capsized			0.009	0.0	16
	Swamped			0.010	-0.0428	11

Leeway speed (knots)=[0.029* 20 knots] + 0.0389 knots = 0.619 knots

Leeway Divergence Angle (degrees) = plus or minus 20 degrees

(d) When utilizing these leeway values it should always be remembered that personnel onboard SAR targets are often able to change the target's leeway drift in ways that are not possible to predict or account for in the taxonomy. For instance a PIW may attempt to swim towards the nearest shore.

(e) If wind speed is measured in knots Table H-3 should be used and if wind speed is available in cm/s use Table H-2 to perform conversions as needed. The equation for Leeway Speed remains the same regardless of which values are used, but units must remain consistent.

Table H-2 Conversion Factors

To Covert From	*To*	*Multiply by:*
m/s	knots	1.94
cm/s	knots	0.02
knots	m/s	0.51
knots	cm/s	51.44

(f) Table H-3 was modified from the original report for operational use.

(1) Y-intercept (in knots) was rounded to nearest 0.01 knots (0.5 cm/s).

(2) Several vertical lines between leeway target modifiers where removed, where they were did not add further sub-division for that class.

(3) Several horizontal lines were thickened to separate leeway categories.

(4) Two classes were added back in: Sewage Floatables and Medical Waste.

(5) Under the Sub-Class: Commercial Fishing Vessels, Primary Leeway Descriptors – Junk was changed to Asian Coastal F/V.

(6) The Divergence Angles reported in Allen and Plourde (1999) "Review of Leeway: Field Experiments and Implementation" have been adjusted for Manual SAR planning tools. As recommended by the "Leeway Divergence" report, the original maximum values were divided by 1.35 and rounded up to the nearest degree to provide the average values appearing in this appendix.

(7) One additional column was added; the Standard Error of the Leeway data. These values are from Allen and Plourde (1999).

Standard Error (knots) = Syx (cm/s) x 0.019438462 knots/cm/s x 1.1774 St.Error / St.Dev

The original Standard Error data was rounded to the nearest 0.01 knot. The presented Standard Error column presents the Standard Error rounded up to the nearest 0.05 knots.

Rounding up the Standard Error is more inclusive of the error and presents the values to a reasonable degree of separation and simplicity.

Table H-3 Leeway Speed and Direction Values for Drift Objects

Leeway Target Class				Leeway Speed (kts)		Divergence Angle (deg)	St Err (kts)
Category	Sub Categories	Primary Leeway Descriptors	Secondary Leeway Descriptors	Slope	Y-intercept (kts)		
PIW				0.011	0.07	30	0.35
	Vertical			0.005	0.07	18	0.25
	Sitting			0.012	0.00	18	0.05
	Horizontal	Survival Suit		0.014	0.10	30	0.05
		Scuba Suit		0.007	0.08	30	0.15
		Deceased		0.015	0.08	30	0.25
Survival Craft	Maritime Life Rafts	No Ballast Systems		0.042	0.03	28	0.35
			no canopy, no drogue	0.057	0.21	24	0.25
			no canopy, w/ drogue	0.044	-0.20	28	0.10
			canopy, no drogue	0.037	0.11	24	0.05
			canopy, w/ drogue	0.030	0.00	28	0.35
		Shallow Ballast Systems and Canopy		0.029	0.00	22	0.35
			no drogue	0.032	-0.02	22	0.05
			with drogue	0.025	0.01	22	0.10
			Capsized	0.017	-0.10	8	0.05
		Deep Ballast Systems & Canopies	(See Table H-3A for Levels 4-6)	0.030	0.02	13	0.20
	Other Maritime Survival Craft	Life capsule		0.038	-0.08	22	0.05
		USCG Sea Rescue Kit		0.025	-0.04	7	0.10
	Aviation Life Rafts	No ballast, w/canopy	4-6 person, w/o drogue	0.037	0.11	24	0.05
		Evac/Slide	4-6 person	0.028	-0.01	15	0.10
Person-Powered Craft	Sea Kayak	w/ Person on aft deck		0.011	0.24	15	0.10
	Surf board	w/ person		0.020	0.00	15	0.25
	Windsurfer	w/ person and mast	& sail in water	0.023	0.10	12	0.10

Table H-3 (Continued) Leeway Speed and Direction Values for Drift Objects

Leeway Target Class				Leeway Speed (kts)		Divergence Angle (deg)	St Err (kts)
Category	Sub Categories	Primary Leeway Descriptors	Secondary Leeway Descriptors	Slope	Y-intercept (kts)		
Sailing Vessels	Mono-hull	Full Keel	Deep Draft	0.030	0.00	48	0.25
		Fin Keel	Shoal Draft	0.040	0.00	48	0.25
Power Vessels	Skiffs	Flat Bottom	Boston whaler	0.034	0.04	22	0.05
		V-hull	Std. Config.	0.030	0.08	15	0.10
			Swamped	0.017	0.00	15	0.10
	Sport Boats	Cuddy Cabin	Modified V-hull	0.069	-0.08	19	0.10
	Sport Fisher	Center Console	Open cockpit	0.060	-0.09	22	0.10
Power Vessels	Commercial Fishing Vessels			0.037	0.02	48	0.35
		Sampans	Hawaiian	0.040	0.00	48	0.25
		Side-stern Trawler	Japanese	0.042	0.00	48	0.25
		Longliners	Japanese	0.037	0.00	48	0.25
		Asian Coastal F/V	Korean	0.027	0.10	48	0.10
		Gill-netter	w/rear reel	0.040	0.01	33	0.10
	Coastal Freighter			0.028	0.00	48	0.25
Boating Debris	F/V debris			0.020	0.00	10	0.25
	Bait/wharf box holds a cubic meter of ice			0.013	0.27	31	0.15
		lightly loaded		0.026	0.18	15	0.10
		fully loaded		0.016	0.16	33	0.10
Misc. SAR Objects	Immigration Vessel	Cuban refugee raft	w/o sail	0.015	0.17	17	0.05
			w/ sail	0.079	-0.17	33	0.15
	Sewage Floatables	Tampon Applicators		0.018	0.00	5	0.35
	Medical Waste	Vials & Syringes		0.028	0.00	10	0.35

Sub–Table H-3A Sub-Table for Maritime Life Rafts with Deep Ballast Systems and Canopies

Leeway Target Class				Leeway Speed (kts)		Divergence Angle (deg)	St. Error (kts)
Secondary Leeway Descriptors	Capacity Modifier	Drogue Modifier	Loading Modifier	Slope	Y-intercept (kts)		
Maritime Life Rafts with Deep Ballast Systems and Canopies	4-6 person capacity			0.029	0.04	15	0.20
		w/o drogue		0.038	-0.04	15	0.15
			light loading	0.038	-0.04	15	0.15
			heavy loading	0.036	-0.03	15	0.10
		with drogue		0.018	0.03	12	0.10
			light loading	0.016	0.05	24	0.10
			heavy loading	0.021	0.00	20	0.10
	15-25 person capacity			0.036	-0.09	10	0.15
		w/o drogue	light loading	0.039	-0.06	9	0.10
		with drogue	heavy loading	0.031	-0.07	9	0.10
	Capsized			0.009	0.00	12	0.10
	Swamped			0.010	-0.04	8	0.05

(g) **Taxonomy class Definitions/Descriptions.** The following section provides information about each of the leeway drift objects in Table H-3. For each description, the target characteristics are summarized and pictures are provided where available. These target descriptions are in no way meant to be all-inclusive. They are intended to assist a search planner in target identification. Proper identification will make the application of more specific leeway values possible. Some categories in Table H-3 do not require further explanation and therefore descriptions/pictures are not included. The SAR planner should also be reminded that any classification system will have overlap between some categories. In these cases, a decision must be made about the most probable situation.

(1) **PIW.** Persons in the water including persons without any floatation, and those with a throwable cushion, with a PFD, in an anti-exposure suit and in survival/immersion suits.

(i) **Vertical.** Generally requires a conscious and active PIW to maintain this position. PIWs wearing a sport/work vest, anti-exposure suit, or float coat or having no flotation must actively maintain a vertical position in the water or become victims in the horizontal position.

(ii) **Sitting.** The classic fetal position with legs drawn up and arms huddled across the PFD. This is the preferred position a conscious or unconscious person assumes, especially in cold water, when wearing offshore lifejackets, horse-collar lifejackets, or inflatable vests. A conscious PIW hanging onto a throwable device will also assume the sitting position until he become unconscious at which time he become a victim.

(iii) **Horizontal.** Three separate configurations place the PIW in a horizontal position. A conscious or unconscious PIW wearing a survival suit will float flat on his back. A PIW in scuba gear, with an inflated buoyancy vest, will float in a semi-reclined position. The classic floating position of a victim is floating face down in the water.

(2) **Maritime Survival Craft.** Includes life rafts, lifeboats, and life capsules. It does not include dinghies or inflatable boats that may be carried for the same purpose. (Figure H-4)

(i) **Maritime Life Rafts.** If there is any question about what type of life raft a vessel may carry, a phone call to life raft repair and repackaging facilities close to the homeport of the distressed vessel may provide ballast, canopy, size, and drogue information.

- **Shallow Ballast.** Consists of a series of fabric pockets generally 4 inches in diameter and less than six inches in depth.
- **Deep Ballast.** Consist of large fabric bags, from 3-7 on the raft, that are at least 1’x 2’ x 2’.

(ii) **Other Maritime Survival Craft**

- **Life Capsule.** Fully enclosed crafts commonly used on large merchant and military vessels.

(iii) **Aviation Life Rafts.** Fall basically into two groups, life rafts and slide rafts. Aviation life rafts are similar to marine life rafts, but are usually made from lighter materials.

- **Evacuation/Slide.** Slide rafts are specifically designed devices intended to ease evacuation from an aircraft. They mount to doorframes or near wing emergency exits and are cut loose from the airframe once fully loaded.

(3) **Person- Powered Craft.** Includes all forms of rowed or paddled boats including rowboats, inflatable boats without motors, canoes, kayaks, surfboards and windsurfers. (Figure H-5)

(4) **Mono-hull Sailing Vessel.** It is assumed that all targets in this category are adrift; therefore sails are down or missing and the crew is unable to maneuver the vessel at all. For small centerboard sailing vessels typically used for racing and day sailing, assume the centerboard functions as a shoal-draft fin keel.

(i) **Full Keel.** Small to medium sized sailboats whose keel runs the full length or nearly the full length of the hull. While the forward portion of the keel is modified or eliminated on some full keel sailboats, the keel on all full keel sailboats extends aft to the rudder. This is an old hull

design and is not commonly used in new hull construction due to the relatively slow sailing speeds of this hull design. (Figure H-6)

(ii) **Fin Keel.** Small to medium sized sailboats with permanent keel skegs that do not extend aft to the rudder. (Figure H-7)

(5) **Skiffs.** Open boats less than 20 ft long that use an outboard motor as the primary source of propulsion. Some have characteristics identical to rowed boats with the exception that an outboard motor has been attached to the stern. This group includes, but is not limited to, tenders for larger vessels, bass boats, hunting boats, Jon boats, and a large category of utility boats. Skiffs are usually found on lakes and rivers, but are also common in the calm waters of many bays and rivers that provide access to the open ocean. Flat bottom skiffs include both those with truly flat bottoms and those like Boston whalers that have multiple shallow Vs to improve stability. (Figure H-8)

(6) **Personal Water Craft.** Include a number of different designs for one or more persons. Generally there are stand up models and ride on models. Some craft marketed as PWC closely resemble small sport boats. Most PWC's have water jet propulsion. No leeway drift experiments have yet been performed on PWC's and they do not appear within Table H-3. Leeway category choice should be based on number of passengers/loading, size of PWC (draft, length, freeboard) of PWC. These factors may be comparable (not exact) to several other leeway targets. (Figure H-9)

(7) **Sport Boats.** Includes pleasure craft from 15 to 28 feet long with beam widths from roughly 6 to 9 feet. They include metal, fiberglass, and wood vessels with a V, modified-V, or deep-V hull form. Sport boats can be outfitted with inboard, outboard, or I/O propulsion. This category includes side console (closed bow and bow riders) and cuddy cabin boats. (Figure H-10)

(8) **Sport Fisher.** Include pleasure and commercial craft form 17 to approximately 100 feet long with beam widths up to 24 feet. The majority are between 30 and 50 feet long, with beam widths between 10 and 15 feet. This class includes both semi-displacement and planning hull forms that can be outfitted with inboard, outboard, or I/O propulsion. This category includes boats with simple center console or walk-round cabin. Convertibles are sport fishers with a walk around cabin and flying bridge. Convertibles designed for offshore fishing may also have a spotting tower. Many convertibles provide extended cruising capabilities similar to sport cruisers, but their after deck design provides a larger open area to work fishing gear. Some of these vessels can also be found in the cruiser or motor yacht categories. (Figure H-11)

(9) **Commercial Fishing Vessels.** Include vessels from 45 to 100 feet long designed for fishing or shell fishing in coastal and ocean waters. They include side and stern trawling rigs, long liners, bottom dragging rigs, and purse seiners. Pole fishers are simply modified use of a sport fisher or sport cruiser and should be treated as such. Commercial fishers can be working alone, as paired vessels, or can be the mother ship to a group of smaller fishing skiffs. These vessels have different design features based on their purpose, but all have some form of deckhouse and an open area from which nets can lines are worked. A deck winch and boom system is commonly used to handle nets or lines. (Figure H-12)

(10) **Coastal Freighter.** Include a wide range of commercial shipping platforms up to 100 feet in length. These vessels transfer cargo from one port to another, and shipping agents can provide estimated voyage schedules. Coastal freighters include vessels with a deckhouse on the forecastle, a midships deckhouse (common to cargo vessels), and an aft deckhouse (common to tankers and container ships). Leeway of these vessels will of course not only vary with respect to deckhouse location; it will also be greatly affected by loading, amount, and type of cargo. (Figure H-13)

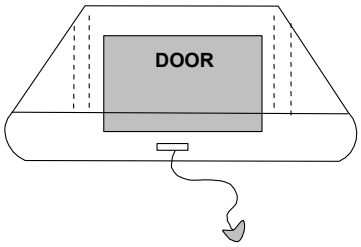
(11) **Boating Debris.** Includes any debris that can be expected from a boat that is sinking and/or breaking up. It may include paper or plastic containers, bedding or clothing, and a variety of fragmented boat sections.

(i) **Fishing debris.** Debris typical to a fishing vessel such as lifejacket, life ring, fishing float balls, fishing box lid, or wooden boards.

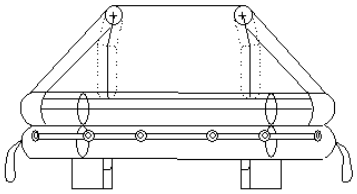
(ii) **Bait/wharf box.** Commercially available 1.1 X1.5 meter plastic box used by commercial fisherman for holding ice and/or fish. Although not it's intended use, it could also serve as a floatation/life raft by persons in distress.

- **lightly loaded.** Approximately 200 lbs (simulation of one person)
- **full loaded.** Approximately 800 lbs (simulation of four persons)

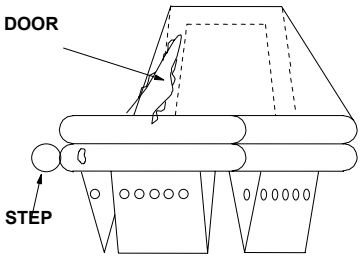
(12) **Immigration Vessel.** Refer to particular types of vessels typically employed in the business of illegally transporting alien persons to U.S. ports. This ranges from small coastal vessels to sailing vessels to homemade rafts and inner tubes. The districts along the southern U.S. coast and Caribbean territories are most likely to encounter these leeway targets.



No Ballast Life Raft



Shallow Pocket Ballast



Deep Pocket Ballast

Life Capsule

Figure H-4 Maritime Survival Craft

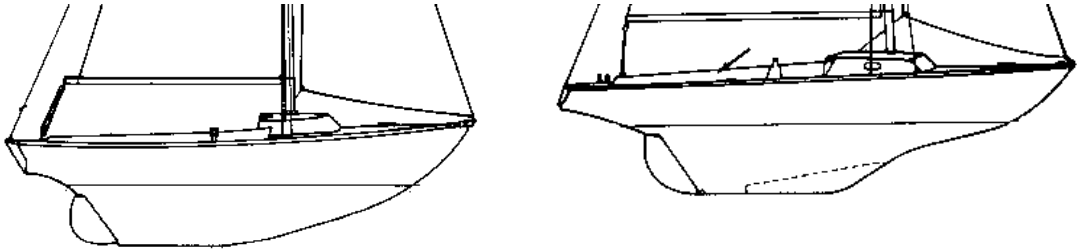
Row Boat

Sea Kayak

Canoe

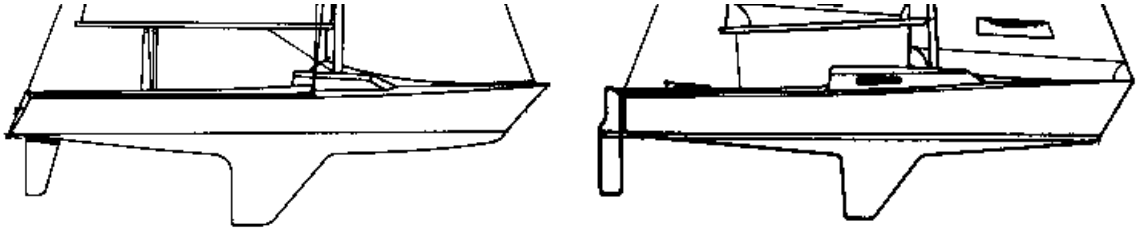
Surf Board

Figure H-5 Person-Powered Craft



Open Cockpit **Cabin**

Figure H-6 Full Keel One-design Sailboat



Open Cockpit **Cabin**

Figure H-7 Fin Keel One-design Sailboat

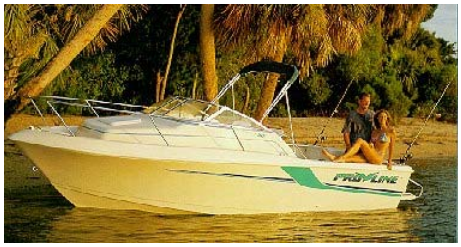
Flat Bottom Skiff

V-Hull Skiff

Figure H-8 Skiffs

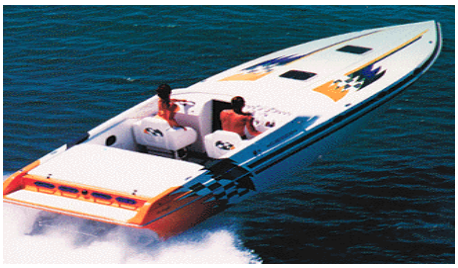
Figure H-9 Personal Water Craft

Bow Rider



Closed Bow

Cuddy Cabin



High Performance

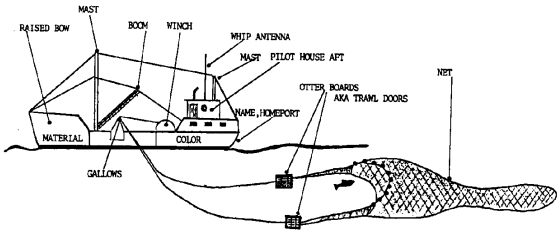
Figure H-10 Sport Boats

Center Console

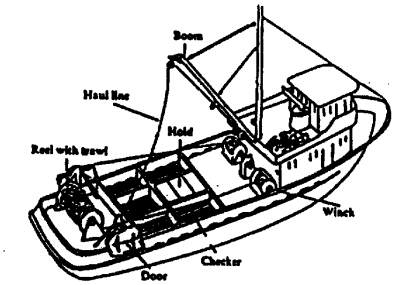
Walk Around Cuddy

Convertible

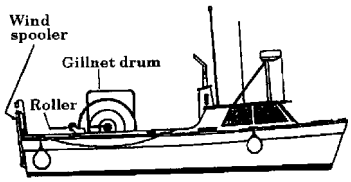
Figure H-11 Sport Fishers



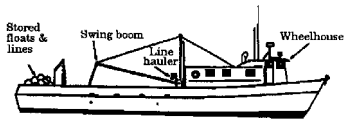
Side Trawler



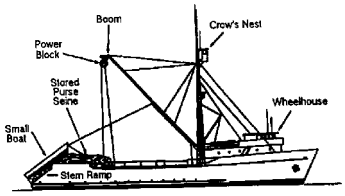
Stern Trawler



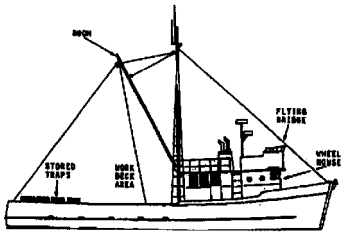
Gillnetter



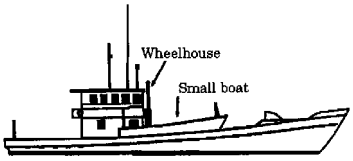
Longliner



Purse Seiner



Trap Boat

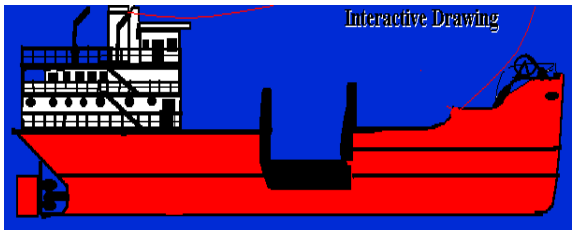


Sampan

Lobster Boat

Figure H-12 Commercial Fishers

Coastal Freighter with Mid Deckhouse



Coastal Freighter with Aft Deckhouse

Figure H-13 Coastal Freighters

H.3.4.3 **Sea Current (SC)** is the residual current when currents caused by tides and local winds are subtracted from local current. It is the main large-scale flow of ocean waters. Near shore or in shallow waters, sea current is usually less important than the tidal current or the local wind-driven current. The strongest sea currents exist near the edge of the continental shelf and are usually referred to as boundary currents. The strongest of these are generally on the western sides of ocean basins. Sea currents are driven by the energy of large-scale wind systems, the slight elevation of the ocean surface toward the center of ocean basins, and the interaction of ocean water masses of different densities.

(a) The preferred source of sea current information for most of the world's oceans is the Seasonal Mariano Global Surface Velocity files. Other sources include Naval Oceanographic Office Special Publication series 1400, Section 1 of the Oceanographic Atlas, the Atlas of Surface Currents, Pilot Charts, and the Defense Mapping Agency. These data sources are useful for estimating drift under "normal" or "average" conditions, but they may not accurately reflect the current on any particular day. In certain areas, such as the Florida Straits and the Western North Atlantic Ocean (a.k.a. Gulf Stream), special high-resolution regional sea current data products are available. Where available, such regional files are the preferred source for sea current data. The Florida Straits data is from climatology and requires the addition of local wind current to obtain total water current. The "Gulf Stream" data is based on a coupled atmospheric/oceanographic model that includes the wind driven component. Therefore, wind current should not be added to currents from this source. Both of these data sets are available from OSC through the "CURRENTS" display.

(b) Sea currents are not always steady. Their variability in both speed and direction can be great. Averages should be used with caution.

(c) Charts and atlases from which sea current data is obtained are derived from averaging past shipboard observations of drift. Observations are biased by a persistent wind current in regions dominated by trade winds (persistent winds from the same quadrant 75% of the time) as part of the observed sea current. Unless sea current for these regions is obtained from a better source, such as special current charts based on the average hydrography of the area, the resultant drift vector may not be accurate. For regions of persistent winds:

(1) If winds blow persistently within normal range of direction and speed, find the drift vector by omitting wind current effect from the vector diagram, and using only a sea current vector and leeway.

(2) If winds blow outside normal range of direction or speed for a period greater than 24 hours during the preceding 48 hours, use a correction vector to subtract the effect of persistent wind from sea current. The correction vector is found by computing the wind-driven current that the persistent wind would cause and reverse its direction. Considering the normal range of persistent wind, the best estimate of median direction and speed should be used. Once the "corrected" sea current vector is computed in this fashion, compute the wind current in the usual way and add it to the "corrected" sea current.

H.3.4.4 **Wind Current (WC)** or wind-driven current, is generated by the wind acting on the water surface over a period of time. As a wind blows over water, it causes horizontal water movement that grows with wind speed and duration. The method for computing wind current given below shall be used by USCG search planners. It replaces the method given in the *IAMSAR Manual, Volume II*.

(a) For areas that are more than 20 nautical miles from shore and have water depths greater than 100feet, wind current is computed using Table H-4 using recent wind history and forecasts. Wind currents also exist nearer shore along coasts and in lakes, rivers, harbors estuaries, etc. However, estimating wind current in these areas requires complex computer models tailored to the specific area. Therefore, wind current is not computed for manual search planning under these circumstances. Search planners should be alert for unusually strong winds that could affect the normal current flow in coastal or restricted waters and should seek assistance from the appropriate NOAA or USN METOC offices in these instances.

(b) In offshore areas, wind observations should be obtained beginning 48 hours before the assumed time the distressed craft began drifting. Accuracy of calculation is less with shorter wind histories. Forecasts should be used through the time period containing datum. On scene wind data should agree with the general circulation shown on area surface weather charts; if it does not, it should be either confirmed or disregarded. Generally, surface winds are directed 20° toward the low-pressure side of isobars on surface weather charts.

(1) Wind history is wind speed and direction near datum for the previous 48 hours, divided into 6-hour periods. Period 1 is the most recent 6 hours, period 2 the next most recent, and so on. Because wind observations are often available only at normal synoptic hours (0000Z, 0600Z, 1200Z, and 1800Z), it is best to select the wind interval that begins and ends midway between the synoptic hours bracketing the reported wind time. All other wind intervals also begin and end midway between normal synoptic hours.

(2) For each period, wind speed and direction are determined by using observed wind for the midpoint of the time period. When hourly winds are available, average wind speed over the time period is used. Wind speeds must be averaged vectorially.

(c) Wind current computation involves the following considerations:

(1) Wind current should be calculated in 48-hour periods made up of sub-periods of 6 hours or less. The first period should begin at the time of datum and move backward for eight 6-hour periods.

(2) The contribution that winds from each sub-period make should be determined and then added. The column in Table H-4a or H-4b with the latitude closest to the position where local wind current is calculated (do not interpolate) is selected.

(3) For each time period in Table H-4a, the lower number shows the relationship between wind speed and current speed, and the upper number shows the relationship between wind direction and current direction. The current speed of each period is found by *multiplying* wind speed by the lower number. The current direction for each period is determined by *adding* the upper number to the direction from which the wind blew. These contributions from each time period are added vectorially to obtain local wind current at the desired place and time.

Table H-4a Wind Current - North Latitudes

	NORTH LATITUDES													
Period	0°N	5°N	10°N	15°N	20°N	25°N	30°N	35°N	40°N	45°N	50°N	55°N	60°N	65°N
1	With sustained winds of 6 hours or more wind current speed will be 5% of wind speed with direction downwind.	185° 0.029	190° 0.028	196° 0.028	200° 0.027	205° 0.027	210° 0.026	214° 0.025	217° 0.024	221° 0.023	224° 0.022	226° 0.021	228° 0.020	230° 0.020
2		203° 0.012	226° 0.012	249° 0.012	271° 0.011	292° 0.011	312° 0.011	332° 0.011	350° 0.010	007° 0.010	022° 0.009	036° 0.009	049° 0.009	059° 0.008
3		219° 0.009	258° 0.009	296° 0.009	333° 0.009	009° 0.008	043° 0.008	076° 0.008	107° 0.008	136° 0.007	162° 0.007	186° 0.007	207° 0.007	224° 0.006
4		235° 0.008	289° 0.008	342° 0.008	035° 0.007	085° 0.007	134° 0.007	180° 0.007	223° 0.006	264° 0.006	301° 0.006	334° 0.006	003° 0.006	028° 0.005
5		250° 0.007	320° 0.007	029° 0.007	096° 0.006	162° 0.006	224° 0.006	283° 0.006	339° 0.006	031° 0.005	079° 0.005	121° 0.005	159° 0.005	192° 0.004
6		266° 0.006	352° 0.006	076° 0.006	158° 0.006	238° 0.006	314° 0.005	027° 0.005	095° 0.005	159° 0.004	217° 0.004	269° 0.004	315° 0.004	355° 0.004
7		282° 0.006	023° 0.006	123° 0.006	220° 0.005	314° 0.005	044° 0.005	130° 0.005	211° 0.004	286° 0.004	355° 0.004	056° 0.004	111° 0.003	158° 0.003
8		298° 0.005	054° 0.005	169° 0.005	281° 0.005	030° 0.005	134° 0.004	233° 0.004	327° 0.004	053° 0.004	132° 0.003	204° 0.003	267° 0.003	321° 0.003

Note: In each time period, the number shows the relationship between wind direction and current direction, and the lower number shows the relationship between wind speed and current speed.

Table H-4b Wind Current - South Latitudes

		SOUTH LATITUDES												
Period	0°S	5°S	10°S	15°S	20°S	25°S	30°S	35°S	40°S	45°S	50°S	55°S	60°S	65°S
1	With sustained winds of 6 hours or more wind current speed will be 5% of wind speed with direction downwind.	175° 0.029	170° 0.028	164° 0.028	160° 0.027	155° 0.027	150° 0.026	146° 0.025	143° 0.024	139° 0.023	136° 0.022	134° 0.021	132° 0.020	130° 0.020
2		157° 0.012	134° 0.012	111° 0.012	089° 0.011	068° 0.011	048° 0.011	028° 0.011	010° 0.010	353° 0.010	338° 0.009	324° 0.009	311° 0.009	301° 0.008
3		141° 0.009	102° 0.009	064° 0.009	027° 0.009	351° 0.008	317° 0.008	284° 0.008	253° 0.008	224° 0.007	198° 0.007	174° 0.007	153° 0.007	136° 0.006
4		125° 0.008	071° 0.008	018° 0.008	325° 0.007	275° 0.007	226° 0.007	180° 0.007	137° 0.006	396° 0.006	059° 0.006	026° 0.006	357° 0.006	332° 0.005
5		110° 0.007	040° 0.007	331° 0.007	264° 0.006	198° 0.006	136° 0.006	077° 0.006	021° 0.006	329° 0.005	281° 0.005	239° 0.005	201° 0.005	168° 0.004
6		094° 0.006	008° 0.006	284° 0.006	202° 0.006	122° 0.006	046° 0.005	333° 0.005	265° 0.005	201° 0.004	143° 0.004	091° 0.004	045° 0.004	005° 0.004
7		078° 0.006	337° 0.006	237° 0.006	140° 0.005	046° 0.005	316° 0.005	230° 0.005	149° 0.004	074° 0.004	005° 0.004	304° 0.004	249° 0.003	202° 0.003
8		062° 0.005	306° 0.005	191° 0.005	079° 0.005	330° 0.005	226° 0.004	127° 0.004	033° 0.004	307° 0.004	228° 0.003	156° 0.003	093° 0.003	039° 0.003

H.3.4.5 **Tidal Current (TC)** is found in coastal waters, and changes direction and velocity as the tide changes. The effect of the tide on currents in any area may be found by consulting current tables and charts, or by seeking local knowledge. Calculating wind and sea currents close to landmasses is normally not possible. Therefore, drift computations depend on tidal current and leeway. Procedures for determining tidal current vectors are provided with the worksheets in this Appendix, and the appropriate tidal current manual.

(a) With reversing currents that abruptly change direction approximately 180 degrees, the effect in one direction is normally greater than in the other, causing a net drift in one direction.

(b) With rotary tidal currents, an object will generally follow an elliptical path.

(c) The cumulative effect of tidal current and leeway may move the object into the influence of different tidal conditions or to where sea current takes effect. Consideration may shift from tidal to sea current in the later stages of a SAR case. Intermediate datums should be computed for small periods of time to account for different influences.

(d) Nearby landmasses may also affect tidal current. Inlets will channel and release a current, often in a different direction at the inlet mouth. When an object drifts near the mouth of a bay or inlet, manuals can be used to see whether tidal current data has changed.

H.3.4.6 **Other Water Currents** affecting search objects are usually difficult to calculate.

(a) *Lake Current (LC)* information usually comes from local knowledge, charts, tables, or computer models. A current in a large lake can vary with season, weather, or time of day.

(b) *River Current (RC)* information can usually be obtained from published data, local knowledge, or direct observation. Current data is published for most large rivers. The National Ocean Survey and the Army Corps of Engineers are the primary sources of information or river currents. In areas where a river discharges into the ocean, tidal current can affect river current upstream, and river current can affect tidal and sea currents. If offshore current is present, the SMC should not expect the river discharge to fan out symmetrically, but should expect displacement in the direction of the offshore current, as shown in Figure H-14. Local colleges or universities may be a source of specific knowledge regarding this interface.

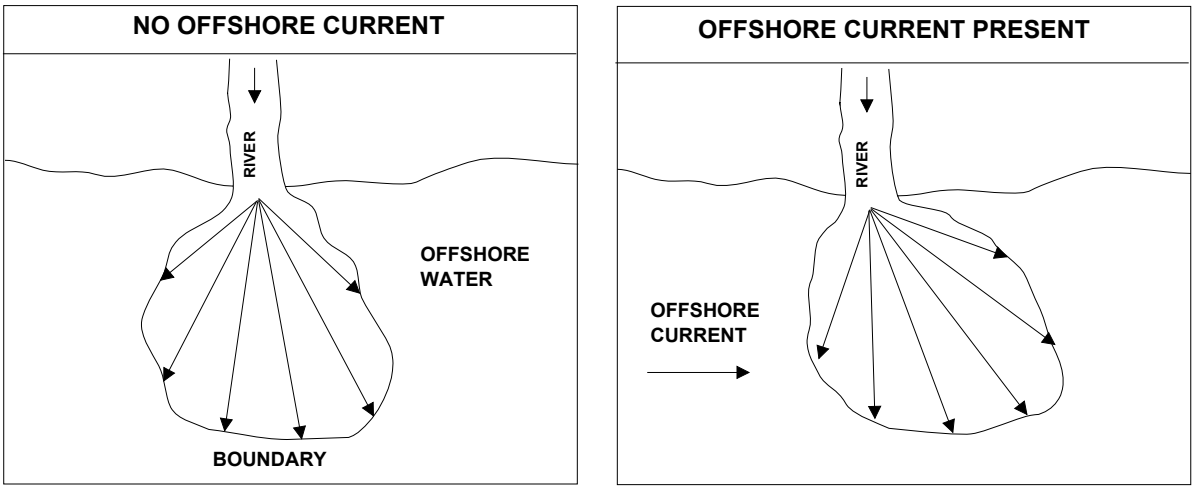


Figure H-14 River Currents

(c) *Bottom Current (BC)* should be considered in underwater incidents. Bottom current is usually not strong enough to move a sunken object, including a body. However, if current exceeds 4 to 5 knots, as in a rain-swollen river, the sunken target may tumble along the bottom. Bottom current information can be obtained from the Defense Mapping Agency Oceanographic Atlas for certain harbor, coastal, and ocean areas. Also, Defense Mapping Agency or Naval Fleet Weather Centers may be able to provide special analysis services for underwater and bottom currents. For bottom currents in harbor areas the Army Corps of Engineers should be consulted.

(d) *Swell/Wave Currents (SWC)* may, in the absence of winds, affect rafts and other small marine craft. Because SWC speed is slight, this drift force is usually disregarded. However, it may be useful for determining probable direction of target movement.

(e) *Surf Current (SUC)* is considered only for coastal surf areas and is more of a factor in rescue or salvage than in search planning. Surf current will move the object perpendicular to the line of breakers toward the shore. The object will also be displaced in the direction of any along-shore current.

H.3.4.7 **Total Water Current (TWC)** is the vector sum of currents affecting the search object. The best information on total water current is usually obtained from a Datum Marker Buoy (DMB).

(a) SLDMBs (Self-Locating Datum Marker Buoys), DMBs and sonobuoys are droppable floating beacons transmitting a signal on UHF frequencies or to a satellite tracking system (SLDMBs). The buoy drifts with surface currents, but shows no leeway. Of the three, SLDMBs provide the most accurate data on the water movement due to their specific design. Each standard DMB used on scene should operate on a different frequency to preclude confusion over DMB origin. SLDMB serial number must be noted to track that particular buoy's data.

(b) With minimal current, first-day standard DMB observations may be questionable because of SRU navigational error. The average over 2 to 3 days can reduce the effect of such error. DMBs should be inserted or relocated as accurately as navigational systems permit. SLDMB data can be used throughout a search.

(c) Information on currents obtained by a DMB should be used with caution. It provides information only while in the water and represents total water current (sea current and wind-driven current) valid only during the time of deployment and for the water area through which it traveled. Even so, it is probably a more accurate representation of current than that previously calculated from historical and statistical data. If there is a wide disparity between DMB and planning information, the SMC should consider adjusting search areas and/or datum.

(d) To preclude diversion from planned search patterns, SRUs should relocate radio beacon DMBs only at the beginning or end of search. SLDMBs do not require relocation by search units. SLDMBs are preferred for that reason and because each SLDMB has a GPS receiver that provides more much more frequent and more

accurate positioning than relocation by SRU could ever provide.

(e) Other on scene observations can improve the accuracy of drift estimates where information from normal sources (NOAA, U.S. Navy, SLDMB/DMB, SRUs on scene) is not available. Ships and stations near the incident can be asked for recent wind and local current observations, but these should also be used with caution. The quality of the observations is often unknown and affected by method and instrumentation used (calibration and location of instruments, etc.). These sources also do not provide predictions needed for planning purposes.

H.3.5 Enclosed and Coastal Waters

H.3.5.1 Drift in enclosed and coastal waters is derived by adding leeway and current vectors for the incident area in the same way as described above for the open ocean, except that wind current is not computed. Currents in enclosed and coastal waters tend to be more complex and variable than in the open ocean.

H.3.5.2 Leeway speed is calculated using the leeway speed values from Table H-3 and equations in paragraph H.3.4.2(a). Leeway direction is computed using the leeway divergence angles from Table H-3.

H.3.5.3 Two currents normally encountered in coastal environments are tidal and wind-driven currents. However, other currents should be included in calculations if their effect is significant.

(a) After leeway, tidal currents cause the greatest drift for most objects. Procedures for determining tidal current vectors are provided with the worksheets in this Appendix, and the appropriate tidal current manual.

(b) Wind current, normally present where the wind has a long enough fetch to generate sufficient stress on the water surface, is difficult to quantify. The tidal current manual for the East Coast of the United States has a wind current table based on historical data. Most other areas have no data. Whether to compute a wind current depends on SMC local knowledge and the environmental parameters. Wind current for enclosed and coastal areas, including water depths less than 100 feet and distances closer than 20 miles from shore, is not normally calculated because of variability and short fetch distances. On some larger or deeper lakes, such as the Great Lakes, wind current can be determined with reasonable accuracy.

H.3.6 Dealing with Other Sources of Uncertainty

H.3.6.1 The methods discussed so far have dealt only with situations where an initial position can be established or estimated for a specific point in time, there is only one type of search object, and the environmental conditions are more or less constant over the area containing the search object. Actual situations can be much more complex. In such cases it may be necessary to compute multiple drift updates resulting in multiple datums. A few examples of when this might be necessary are:

(a) The time and place of the distress incident are reasonably well known, but the type of search object is unknown (e.g., sailboat disabled and adrift, 4-person life raft adrift, and PIWs adrift are all possibilities).

(b) The craft's intended track is known but the time of the distress is unknown and the craft's pre-distress location cannot be accurately estimated for any given time after it was last known to be safe (e.g., departure time from port could have been any time between midnight and 0600, speed made good along the intended track could have been anything between 12 and 16 knots).

(c) The destination is uncertain (e.g., vessel was either going north to fishing area A or south to fishing area B).

(d) The destination is known but the route is not (e.g., there are two distinct routes that could have been taken).

H.3.6.2 The four examples given above illustrate two distinct kinds of situation for the search planner. In the first two, there is a single basic scenario from which a picture may be inferred about when and where a distress incident may have occurred and what its immediate outcome may have been. This is obvious in the first example. In the second example, the "where" is answered by the intended track and the "when" for any point along that track is may be inferred from the ranges of departure times and speeds.

For the last two examples above, there are distinctly different scenarios about the circumstances leading up to the

distress incident. In (c), the vessel could not be going to both fishing areas at once nor was there a continuous range of possible destinations between areas A and B. Two mutually exclusive scenarios have to be considered. The same is presumably true of (d). The two routes are certainly mutually exclusive (even if some legs are in common) since the craft could not follow both routes at once. If two specific routes suggest themselves from the available data and no others seem plausible, then there is no continuum of possible "intermediate" routes, either.

H.3.6.3 The SMC should consider the full range of possibilities when deciding how many datums to compute. For manual search planning, it is generally feasible to consider only the two or three most important of the unknown variables or the two or three most probable scenarios. "Importance" in this context means the variables that will have the most impact the outcome of the case. This could mean the most impact on search area size or it could be more related to expected survivor lifetime remaining. Even though PIWs may not be the most probable search object in a particular case, they could easily be the most important search object for the first search due to limited expected survival time.

H.3.6.4 The complexity of real-world SAR situations can quickly outstrip the capabilities of manual methods. When the search planner sees that it will take many datum updates to cover the range of possibilities, CASP must be used since it is the only tool presently capable of dealing with such complexity.

H.3.7 Computing Subsequent Datums

If the first search fails to locate the survivors, additional searches must be planned and carried out. Since virtually all objects exhibit leeway divergence, a drift update from a single initial position produces two datums. If additional searching is required, it is not immediately obvious how to proceed when two datums are available as starting points. Several possibilities suggest themselves:

(a) Compute the datums for the next search by starting with the original initial position.

(b) Compute new datums by using each of the two "first search" datums as "initial positions" for the next drift interval.

(c) Choose a position halfway between the two "first search" datums as the "initial position" for the next drift interval.

The first choice may require computing each of the two drift trajectories in steps in order to account for changes in the environmental factors over time and space. One advantage is that this method allows the search planner to account for updates in wind and current data since the previous datums were computed. Because the last portion of a drift update that is being used to plan a search must necessarily use forecast rather than actual observed data, this could be important, especially when forecasts prove to be inaccurate. The disadvantage, especially for manual methods, is that the longer the drift intervals from the initial position to the planned search time, the greater the amount of data and computations that are necessary. It is also possible for constantly veering or backing winds to eventually cause the datums to start converging rather than continue diverging.

The second choice has several disadvantages. First, it does not provide for re-computation when forecast data is replaced by observed or "analysis" data. Second, it produces a binary "explosion" of calculations: One initial position produces two datums, these then produce four datums, the next iteration produces eight datums, etc. An apparent "solution" to this problem is to assume that objects never change tack with respect to the wind, i.e., an object with leeway to the right of the down wind direction always has leeway to the right of the down wind direction. This brings it more in line with the first choice above, but the possibility of converging datums remains.

Although the third choice is also a compromise, it is still a viable solution when the forecast data used to plan the search proves to be accurate. When that is not the case, the two datums should be re-computed from more accurate environmental data before proceeding with the next drift update. The only remaining problem is how to establish the probable error (X_2) for the new "initial position." As long as the datums are not too far apart (either a small distance in nautical miles or less than four times the total probable error of position), a reasonable estimate of the probable error is the radius of a circle centered halfway between the two datums that just includes the individual probable error circles for each datum as shown in Figure H-15. This actually overestimates the probable error of position somewhat, but there is no easy way to obtain a more accurate estimate for the radius of a circle that contains just 50% of the possible search object positions. JAWS uses the point halfway between the

datums as the "initial position" for the next drift update, but it computes a more accurate and somewhat smaller estimate of the probable error around this position. An added advantage to this method is regularity. Each drift update always starts with a single initial position and produces two datums.

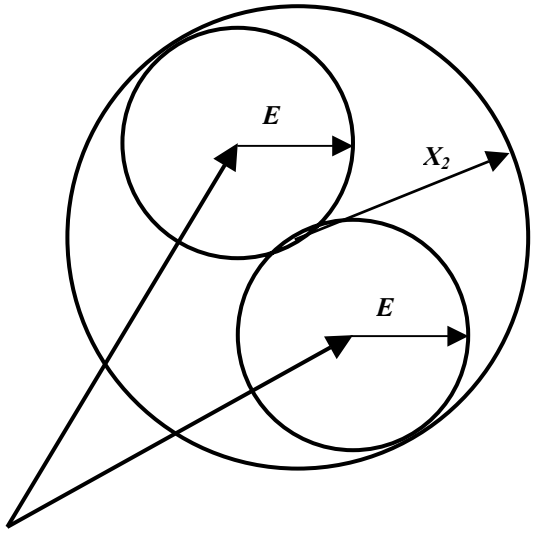


Figure H-15 Establishing a Starting Position and Position Error for Subsequent Drift

Section H.4
Search Area

The search area is the geographic area determined by the SMC as the best area to search for survivors. The amount of error inherent in the drift calculations, the uncertainty about the actual position of the distress, and the navigational capabilities of the SRU are used to calculate the total probable error of position (*E*). A search radius (*R*) is then computed from *E* and the amount of search effort (*Z*) available at the scene. The dilemma often faced by search planners is how to balance search area size (characterized by the search radius) and coverage for a finite amount of available effort. Increasing *R* causes more area to be covered, thus increasing POC, but it also causes the available effort to be spread more thinly, thus decreasing coverage and consequently decreasing POD. Decreasing *R* has the opposite effects. Since the goal of search planning is to maximize the product of POC and POD, i.e., to maximize POS (= POC x POD), the goal is to find the search radius where this occurs for the amount of search effort that is available. However, there are also other considerations.

(a) For areas such as large lakes, rivers, sounds, bays, or other coastal areas, the search area may depend on physical restrictions and time required to respond.

(1) When response times are short, the SMC may use a standard radius, adjusted for physical surroundings. In areas where a search can begin in less than 6 hours, a radius of 6 nautical miles is usually large enough to include most search objects.

(2) Expanding the area based on drift calculations may place a large part of the area ashore or move datum into the ocean. If the SMC determines the object probably has moved into open ocean, and the standard radius may not apply, additional planning may be needed.

(b) For open-ocean incidents, mathematical methods exist to determine *R* because drift estimation is more straightforward. The method described in the following paragraph is used primarily for air and watercraft, but could also be used for inland or coastal region planning.

H.4.1 Total Probable Error

H.4.1.1 Total Probable Error (*E*) is a mathematical tool in the process of determining the search area. It is based on the probable errors in estimation of drift (D_e), initial position of the incident (*X*), and navigational capability of the SRU (*Y*).

H.4.1.2 Total Drift Error (D_e) accounts for errors in estimating drift and is used when determining *E*.

(a) Drift velocity error depends on the probable errors in the wind, current, and leeway velocities used to compute drift. The *IAMSAR Manual* provides default values and the method for estimating the total probable drift velocity error from the probable errors associated with the individual velocities used to compute the drift. A useful rule of thumb for oceanic drift is that when the default velocity errors are used for wind, wind current, sea current and leeway, the computed total probable drift velocity error is 0.6 knots. If one of these components is omitted, say wind current because SLDMB data is available, then the default values result in a total probable drift velocity error of 0.52 knots. When the total probable drift velocity error is multiplied by the time adrift, this gives the total probable drift error, D_e.

(b) The default probable velocity errors are 0.3 knots for wind current, 0.3 knots for sea current, 0.3 knots for the uncertainty in drift velocity due to a 5-knot probable error in wind velocity, and 0.3 knots for leeway. However, Table H-3 includes probable leeway velocity error estimates and these should be used in lieu of the default value. If time is short, it is permissible to use the default total probable drift velocity errors given in (a) above, as appropriate, to reduce the computational burden. However, a more complete computation should be done when time permits.

Table H-5 Navigational Fix Errors

Means Of Navigation	*Fix Errors (NM)*
NAVSAT	0.5 NM
Radar	1 NM
Visual Fix (3 lines)*	1 NM
Celestial Fix (3 lines)*	2 NM
Marine Radio Beacon	4 NM (3 beacon fix)
LORAN C	1 NM
INS	0.5 NM per flight hour without position update
VOR	± 3 degree arc and 3% of distance or 0.5 NM radius, whichever is greater
TACAN	± 3 degree arc and 3% of distance or 0.5 NM radius, whichever is greater
GPS	0.1 NM**
DGPS	0.1 NM**

*Should be evaluated upward according to circumstances.
**Published accuracy of the system is much greater.

H.4.1.3 Initial Position Error (*X*) is the estimated probable error of the initial position based on the information available to the search planner. This may be the same as the probable navigational error of the distressed craft or the position fixing accuracy of the radio DF net, radar net, SOFAR net, etc., reporting the initial position. However, it may be a much larger value depending on how the position was reported. The search planner must always bear in mind that the uncertainty associated with any piece of data is a reflection of how much confidence may be placed in it. For example, if the *Mary Jane* reports itself in distress and taking on water "50 miles southeast of Cape Fear" based on a GPS fix, that does not mean the quality of the information as received is as good as the average quality of GPS positions. It would be more prudent to assume the range and bearing given were only approximate, possibly an estimate made by eye from a nautical chart while the reporting source was under stress. The resulting uncertainty about the distress position would then be much larger than the uncertainty associated with GPS navigation in general.

(a) If information on the means of navigation used by the distressed craft is available, the navigational fix errors (Fix_e) listed in Table H-5 are the minimum values that may be assumed for positions reported as navigation fixes ($X=Fix_e$). As discussed above, larger values may be appropriate depending on how the position information is represented. If the means of navigation on the distressed craft is unknown, the SMC should assign error on the following basis:

(1) 5 NM for ships, military submarines, and aircraft with more two engines.

(2) 10 NM for twin-engine aircraft.

(3) 15 NM for boats, submersibles, and single-engine aircraft.

(b) If the position is determined from an FCC direction-finding network, the fix error corresponds to the assigned classification of the fix as shown in Table H-6.

Table H-6 FCC DF Network Fix Errors

Class of Fix	*Fix Error*
A	20 NM
B	40 NM
C	60 NM

(c) When the initially reported position is based on dead reckoning (DR), an additional error is assumed for the distance traveled since the last fix. The initial position error is the sum of the fix error and DR error (DR_e). Table H-7 gives DR_e, which may be assumed for various types of craft.

Table H-7 Dead Reckoning Errors

Type of Craft	*DRe (% of the DR distance)*
Ship	5
Submarine (military)	5
Aircraft (more than 2 engines)	5
Aircraft (twin-engine)	10
Aircraft (single-engine)	15
Submersible	15
Boat	15

H.4.1.4 **SRU Error (*Y*)** based on errors in SRU navigation accuracy, should be considered by the SMC. Since SRUs maintain frequent fixes, usually only Fix_e is used. However, if an SRU uses DR navigation in the search area, the SMC should be advised. The SMC then uses both Fix_e and DR_e to determine SRU error ($Y = Fix_e + DR_e$).

H.4.1.5 **Total Probable Error (*E*)** is calculated as follows:

$$E = \sqrt{X^2 + D_e^2 + Y^2}$$

This is the standard method from statistics for computing the total probable error for the sum of independent distributions from the probable errors of the individual distributions. Due to the widespread use of very accurate electronic navigation devices, such as GPS receivers, the probable position errors for both the distress incident (*X*) and the SRUs (*Y*) may be, and often are, very small. This leaves total probable drift error as the major contributor to the total probable error of datum positions.

H.4.1.6 **Recalculation of *E*** is necessary when one of the following happens:

(a) The search object is adrift. An object in water continually drifts. The uncertainty about the object's position increases with the passage of time due to the total probable error in the drift velocity estimate. Each time a new datum is computed, the SMC must recompute D_e to account for this ever-increasing uncertainty. To illustrate, suppose a surface position is the initially reported position. Drift and drift error are zero because no time adrift has elapsed. However, suppose the total probable error in the drift velocity estimate is 0.6 knots. When datum is computed 4 hours later, $D_e = 4 \times 0.6 = 2.4$ nautical miles. Six hours later datum 2 is computed and D_e is now 6 x 0.6 = 3.6 nautical miles. After 24 hours, D_e is 24 x 0.6 = 14.4 NM. This process is continued throughout the mission.

(b) The SRUs change. The SMC recomputes *E* each time the SRU is changed if the $Fix_e(Y)$ changes.

(c) The initial position error changes. Once errors in the initial position are estimated, they usually are not changed unless later information shows initial assumptions to be in error.

H.4.2 **Search Radius**

The search radius (R) is the radius of a circle centered on each datum that is used to define a rectangular search area. The length of this radius is determined by finding the *optimal search factor,* f_s, as described in the *IAMSAR Manual, Volume II*. The value of f_s is a function of the relative search effort available, Z_r. For point datums, the relative effort is the ratio of the total available search effort, Z_{ta}, in square miles to the square of the total probable error of position (E^2), which also has units of square miles. The total probable error of position, *E*, is multiplied by f_s to get the optimal search radius R_o. The search area defined by this method is optimal or very nearly optimal, which means that it produces the maximum or very nearly the maximum POS that can be attained with the total available search effort. It is the best balance between search area size and coverage, given the total amount of search effort that is available at the scene. For subsequent searches, the optimal search radius is based on the cumulative relative effort and the additive principle of optimal searches. According to this principle, if the effort available on the first day of a search is Z_1 and the effort available on day two is Z_2, then, if the search on day one is optimal, the optimal search radius for day two is the same as the optimal radius for applying all the effort from both days ($Z_1 + Z_2$) to a single search. Therefore, even if the value of *E* did not increase with the passage of time, the optimal search radius tends to grow with each successive search as shown in Figure H-16 for a single

point datum and in Figure H-17 for a moving single point datum.

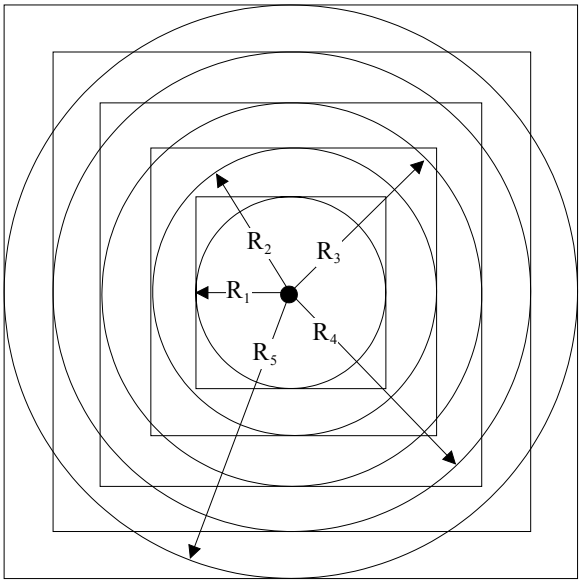


Figure H-16 Search Areas - Stationary Datum Point

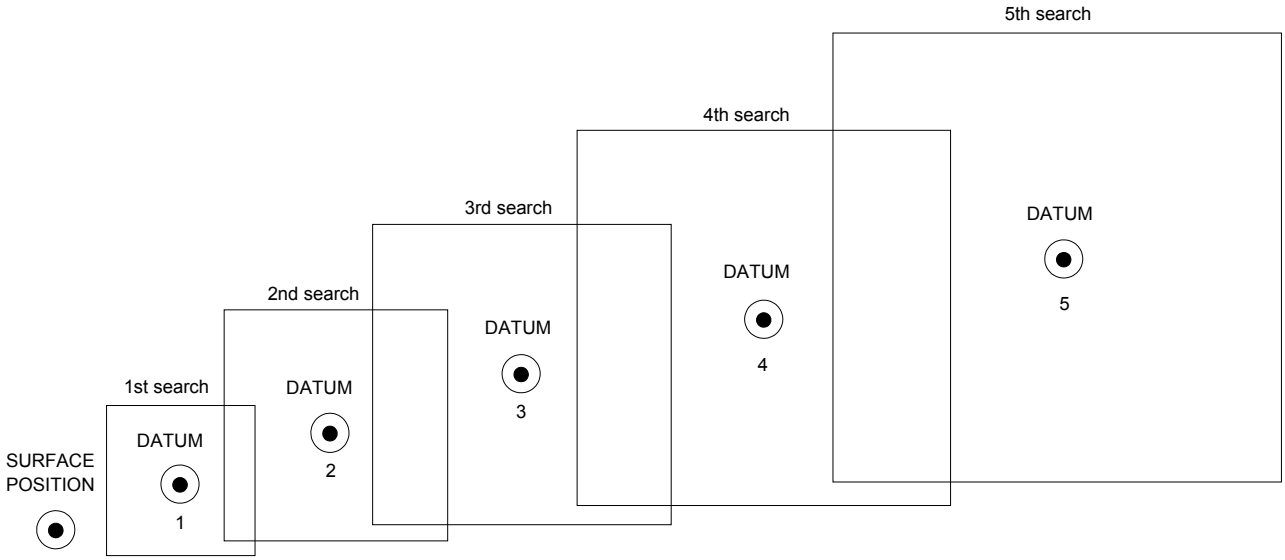


Figure H-17 Search Areas - Moving Datum Point

H.4.3 Search Area Development

H.4.3.1 Theoretically, the best search plan for a single point datum would be one that had its highest coverage at and near datum and then gradually and continuously decreased the coverage with increasing distance from datum in a way that matched up with the assumed distribution of possible search object positions until the available effort was exhausted. However, such search plans are impractical (not even the varying coverage of a VS pattern matches the assumed distribution of possible positions). Most of the time a square or rectangular search area is more practical. For divergent datums, a circle with the optimal search radius, R_o, is centered on each datum and a rectangle is circumscribed around the two circles as shown in Figure H-18.

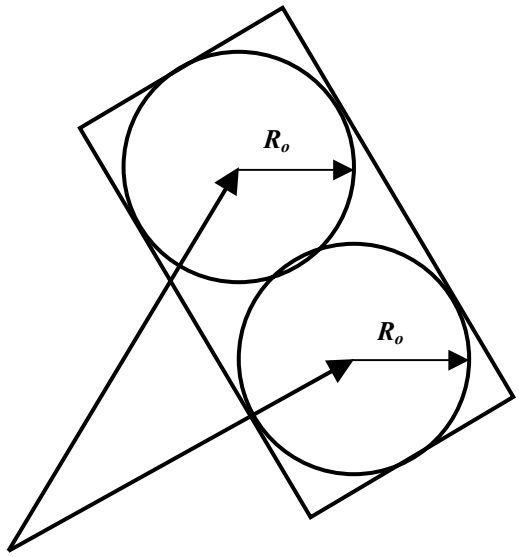
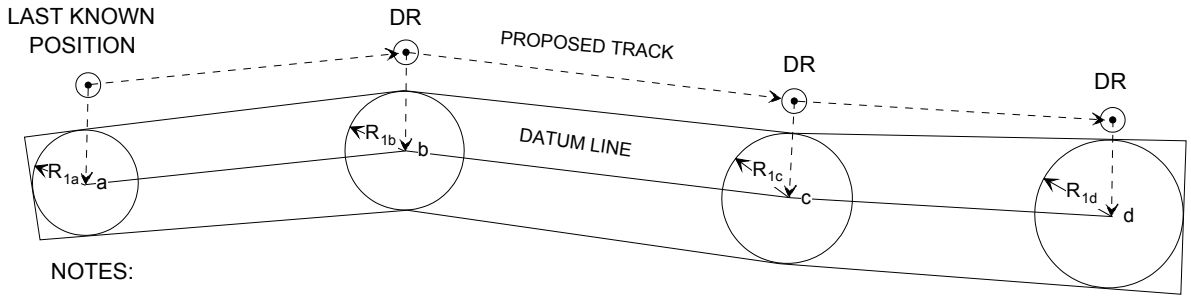


Figure H-18 Search Area for Divergent Datums

H.4.3.2 For a search with little or no drift, search area is constructed around a stationary datum. If the search object is not found, the area may be expanded for subsequent searches. Therefore, the area around datum, which continues to be the most probable location, is searched repeatedly.

H.4.3.3 For maritime incidents, datum will normally move during the search, as Figure H-17 illustrates. The enlargement of the search area for a moving datum is the same as for a stationary datum, but the area is centered on a new datum so that the water surface is re-searched where survivors are most likely to be.

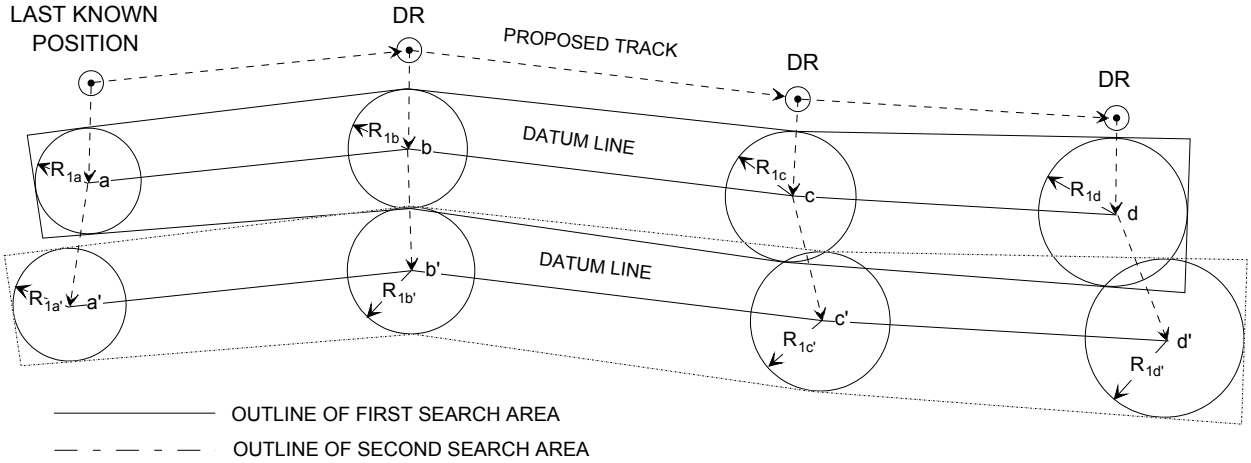
H.4.3.4 A search area along a datum line is set up by first developing a search radius for each datum along the trackline. Each datum is circled, using its search radius. Tangent lines are then drawn from circle to circle to establish search area boundaries.



NOTES:

1. DRIFT IS EXAGGERATED
2. POINTS a, b, c, d ARE DATUM POINTS FOR DR POSITIONS CORRECTED FOR DRIFT.

Figure H-19 Search Areas - Datum Line



NOTES:

1. DRIFT IS EXAGGERATED
2. POINTS a', b', c', d' ARE DATUM POINTS FOR DR POSITIONS CORRECTED FOR DRIFT.

Figure H-20 Search Areas Expansion - Datum Line

H.4.3.5 When only a datum area exists, search areas are developed differently:

(a) If the area is small, a search radius is computed as before and added to the radius of the datum area.

(b) If the datum area is a reasonable size for searching and probably contains the target, it can be used as the first search area. An example is a military aircraft disappearing in a prescribed operating area. When the datum area is based on reports of low flying or crashed aircraft, planners should avoid the tendency to excessively limit the size of the search area around the reported site. A radius of 15 miles from the observation point 30-50 miles in the aircraft direction of flight, and a 5-15 mile radius from the reported position of a crash, is usually preferred.

(c) If the original datum area is too large for search by available SRUs, the area should be reduced. Information obtained during the SAR effort may aid in determining what portion of the area to eliminate.

(d) As with point and line datums, drift may be considered in datum areas. For small or medium-size areas, drift

can be plotted using a single point, relocating the area for drift, and keeping the original orientation, size, and shape of the area. If the area is so large that positions have different drifts, it may be necessary to calculate drift for each section. Subsequent displaced areas will not keep their original shape.

H.4.3.6 After each search, a reevaluation should determine whether the next search should cover the same area, an expanded area, or a different area. Generally, at least one re-search is desirable.

H.4.4 Repeated Expansion Concept

The Repeated Expansion concept is a natural consequence of the additive principle of optimal search and, for moving objects, the ever-increasing uncertainty about the search object's location. However, search planners should bear in mind that there is usually no better opportunity to find survivors than on the first search. When the initial response fails to locate the search object quickly, it is generally better to apply enough resources to the first comprehensive search to assure a high POS while the search area is relatively small than to adopt a gradual escalation approach. The original version of the manual method was apparently aimed at a 50% POS on the first search. Whenever possible, search planners should try to improve on this figure by applying additional resources to the first search. However, sometimes even a 50% POS will not be possible because the uncertainty about the survivor's location is already too large to make this feasible. Situations involving overdue or unreported craft are often in this category. Situations involving very small search objects, such as PIWs may also fall into this category because small objects are difficult to detect, making it difficult to obtain sufficiently high PODs.

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Section H.5
Search Plan Variables

The goal of search planning is to cover as much of the search area as possible with a reasonable POD with the ultimate aim to maximize POS. Area coverage is a function of area size, corrected sweep width, and the number, speed, and endurance of SRUs used. POD and Coverage are measures of the thoroughness of a search. Coverage is a function of corrected sweep width and track spacing for search patterns with straight, parallel, equally spaced search legs. For other types of patterns, Coverage is a function of corrected sweep width, distance covered by the SRU while searching in the area, and the size of the area covered. POD is a function of Coverage. POS is a measure of search effectiveness. The planner should balance area size and coverage (POC and POD) so that POS is maximized.

H.5.1 Number of SRUs

H.5.1.1 An optimal search plan should always be developed as time permits. Every effort should be made to obtain sufficient and suitable SRUs to attain a reasonable POS, especially on the first search.

H.5.1.2 The first SRUs dispatched are usually alert SRUs, and are normally sent to datum or on a trackline search. Backup and standby SRUs are dispatched next. Supplementary SRUs may be requested from other activities.

H.5.1.3 When sufficient SRUs are not available, optimal use of those that are available becomes even more important. Developing an optimal search plan is more important when resources are scarce than when they are plentiful.

H.5.2 Search Time Available

H.5.2.1 The amount of search time available (*T*) is of paramount importance. Since survival rates normally decrease with time, the SMC is always working against the clock. Two major controlling factors for computing search time available are SRU endurance and amount of daylight available. Optimal search plans minimize the average time required to find survivors as well as maximize POS.

H.5.2.2 **Search Endurance** of the individual SRUs is normally more critical for aircraft. To calculate on scene endurance for an SRU, total mission endurance should be determined, contacting the parent agency if necessary. Time needed for transit to and from the assigned search area is deducted from total endurance, to obtain on scene endurance. Search endurance can be assumed to be 85 percent of on scene endurance, allowing 15 percent for identifying sighted objects.

(a) Generally, diversion to identify a target will have no appreciable effect on area coverage as long as the SRU "fixes" the location and time of departure from the search pattern and returns to the same point to resume search within a reasonable time.

(b) When SRUs operate far from home base, they can sometimes be deployed to an advance base so more time will be available for searching, and less time will be spent en route to and from the search area.

H.5.2.3 Sunset is the usual cut-off point for visual search with the unaided eye. Every time the SRU diverts, available daylight is reduced. Search object detectability changes after sunset. Searching after sunset is normally restricted to using NVGs, searching for visual detection aids (e.g., flares, strobe lights) or using electronic sensors (e.g., radar), dictating changes in track spacing to obtain desired coverage for the optimal search.

H.5.3 SRU Ground Speed

SRU ground speed (*V*) is important when calculating attainable area size. The faster the SRU, the larger the area covered. However, speed may adversely affect endurance and search effectiveness.

H.5.4 Track Spacing

H.5.4.1 **Track spacing (*S*)** is the distance between two adjacent parallel search legs. It directly influences coverage (*C*). Corrected sweep width (*W*) is a measure of detection capability and will vary with search object type, SRU/sensor

type, and environmental conditions. For search patterns that use straight, equally spaced parallel tracks, coverage is computed as the ratio of the corrected sweep width to the track spacing ($C = W/S$). The more difficult an object is to detect, the closer together the search legs must be to achieve a given coverage. See Figure H-21.

NOTE: In darkness or extremely low visibility, surface search craft should periodically stop their engines and conduct an auditory search. If it is known or if there is a high probability that the PIW has night detection aids, a search may be conducted with track spacing compatible with the sweep width for the type of detection aid

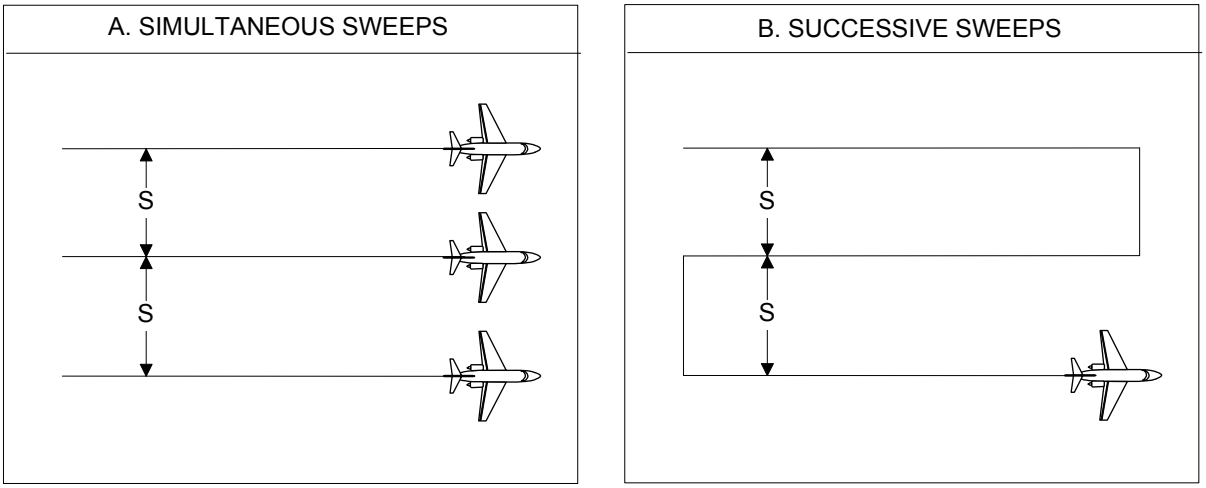


Figure H-21 Track Spacing

H.5.4.2 POD can be increased by decreasing track spacing (which increases coverage), but decreased track spacing means that either less area can be covered, that more time is needed to cover the same area with the same number of SRUs, or that more SRUs are needed to cover the same area in the same amount of time. If additional time and/or SRUs are not available, then only reducing the amount of area covered can increase POD. Conversely, increasing track spacing can expand the area covered, but this will decrease POD. The ideal "compromise" between area covered and POD is the one that produces the maximum POS.

H.5.4.3 The practical limits of SRU turning radii and navigational accuracy limit how much track spacing can be reduced. Optimum track spacing yields maximum POS during the time available, consistent with the economical use of available SRUs.

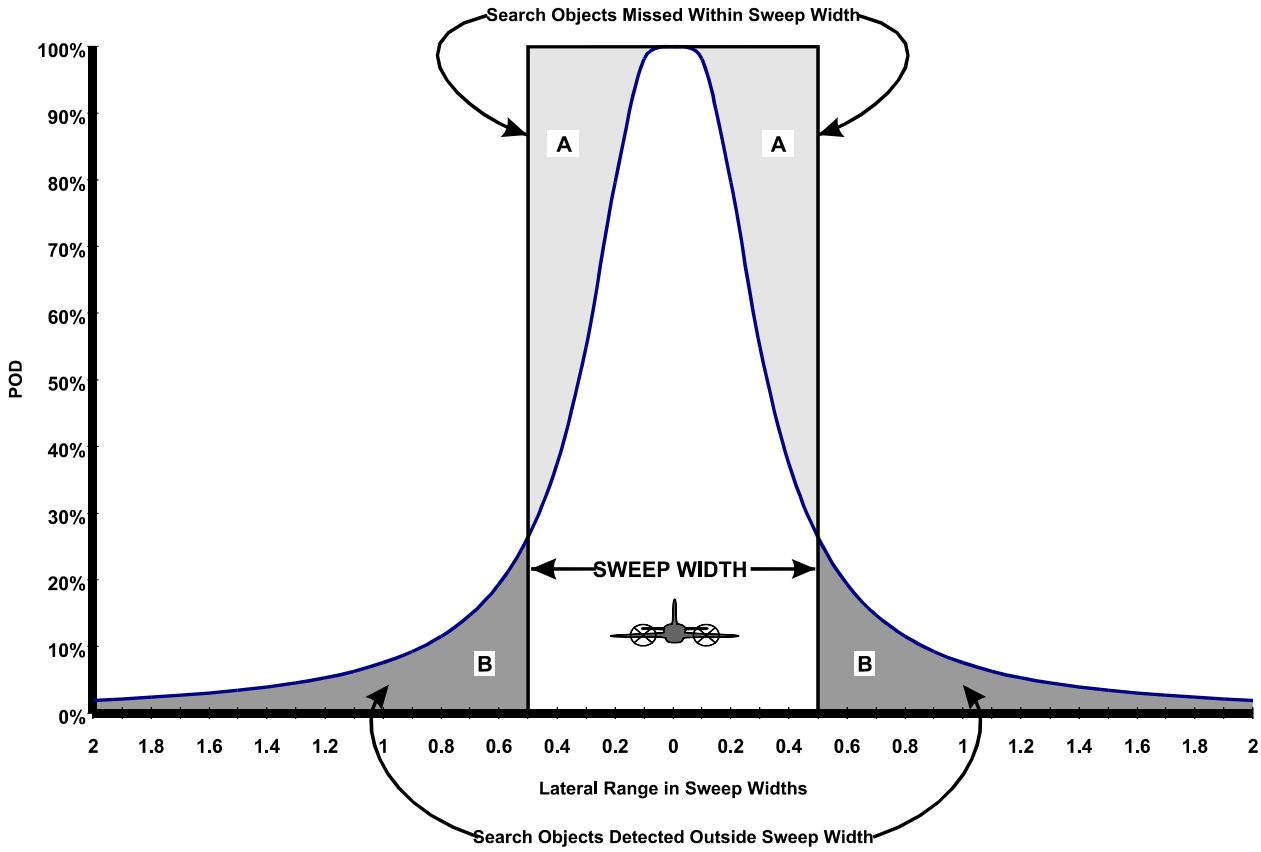
H.5.4.4 The most frequent search platforms used by Coast Guard resources for coastal SAR cases are small cutters (WPB), boats (MLB/UTB/UTM), and helicopters (HH-65/HH-60J). It is recommended that Coast Guard units copy and laminate the appropriate sweep width tables from appendix H for each SRU and include them in the SRU pilot or coxswain kit as a quick on scene reference for initial searching while more thorough search planning is being conducted.

H.5.4.5 Persons in the Water (PIWs). In most cases, a track spacing of 0.1 NM is the lower practical limit for accurate surface navigation, and is recommended for coastal surface PIW searches. For unassisted visual searches, helicopter SRUs should perform multiple searches of the assigned search area to achieve a coverage equivalent to that of a 0.1 NM track spacing since frequent tight turns are not conducive to effective scanning. Areas assigned to helicopters should provide for at least one minute of level flight at search speed for each search leg.

H.5.5 Sweep Width

H.5.5.1 **Sweep width (*W*)** is the width of a swath centered on the SRU's track where the probability of detecting the search object if it is outside of that swath is equal to the probability of missing the search object if it is inside that swath. It is a measure of detection capability based on search object and sensor characteristics, weather, and other

factors. Sweep width is less, often much less, than twice the maximum detection range, which is the farthest range at which the object can be detected. See Figure H-22. It is usually expressed in yards for underwater and ground searches, and in nautical miles for other types of searches. Use of the sweep width concept in any search allows solution of otherwise unworkable problems.



Note: Number of search objects missed in area "A" is equal to number of search objects sighted in area "B"

Figure H-22 Sweep Width

H.5.5.2 Sweep width varies with the type of search conducted. Visual searching is used most often. However, other sensor searches can be far more efficient than visual and should be considered when it is known, or even suspected, that the distressed craft or persons may be more readily detected by electronic or other non-visual means.

(a) Sensors include radio, radar, magnetic, voltage, radioactive, infrared, ultraviolet, electro-optical, and other electromagnetic signal sensing equipment. Most common in SAR applications are radio and radar, with infrared becoming increasingly available. Detection range information may be available from parent agencies, operating commands, manufacturers, or operators.

(b) Each SAR agency should test its specific equipment to develop accurate estimates of sensor sweep width. Output power, reflective capabilities, antennae heights, environmental ambient noise and clutter levels, and other factors that affect the quality of sensor receiving and transmitting may affect sweep width.

(c) Although some sensors may be more efficient at detecting objects than visual search, rarely are they able to recognize whether a detected object is the search object. Generally visual confirmation is required.

H.5.5.3 **Visual sweep widths** are determined by choosing an uncorrected sweep width based on type of search object and SRU altitude and correcting it for environmental conditions, speed, and fatigue. For maritime SAR, sweep width corrected (W) = sweep width uncorrected (W_u) x weather correction (f_w) x fatigue correction (f_f) x speed correction

(f_v-aircraft only). For land searches, see the *IAMSAR Manual*. Maritime sweep width tables are provided below. Factors affecting sweep width are:

(a) *Search Object characteristics.* The object's size, shape, color contrast and brightness contrast, and movement must be considered.

(b) *Meteorological Visibility.* The maximum range at which large unlighted objects such as landmasses can be seen constitutes meteorological visibility. Reduced visibility results in reduced detectability and sweep width.

(c) *Terrain/Sea Conditions.* Normally, the more level the terrain, the more effective a land search can be. Trees, rock outcroppings, and other surface irregularities decrease search effectiveness. Similarly, characteristics of the water surface such as sea state, whitecaps, wind streaks, foam streaks, breaking seas, swell systems, salt spray, and sun reflections decrease search effectiveness over water. Over water sweep width decreases as wind speed and significant wave height increase.

(d) *Cloud Cover.* Visual sweep widths may be reduced 10 to 20 percent by cloud cover above the SRU due to reduced surface illumination.

(e) *Search Altitude.* For many objects, the available sweep width tables indicate that sweep width increases slightly with increasing altitude up to 3,000 feet under ideal conditions. However, these figures should not be given undue regard as the smaller increases indicated are generally within the estimation error of the methods used to create the tables. For example, at 500 and 1,000 feet, the uncorrected sweep width for a four-person raft is given as 1.8 NM while at 1,500 and 2,000 feet the uncorrected sweep width is given as 1.9 NM. The decision on what altitude to assign should not be based on the difference in the uncorrected sweep widths. As a general rule, differences in sweep widths of less than 10% should be ignored when making altitude assignment decisions. Another general rule is that the search altitude should not be so high that it is an appreciable fraction of the corrected sweep width. As altitude decreases, the search object passes more rapidly through the scanner's field of vision. This effect is most pronounced at altitudes below 500 feet. Nevertheless, if a large number of objects are in the area, a low altitude is preferable to reduce diversions for identifying sightings. Also, low altitude favors object identification because scanners are more familiar with objects viewed from low angles. For maritime searches, the daylight lower limit is 200 feet for all search conditions, and altitude usually does not exceed 3000 feet even under ideal search conditions. For land searches, scanner efficiency decreases rapidly as altitude increases from 200 feet up to 2000 feet, and more slowly as it increases above 2000 feet. See Table H-8 for recommended search altitudes.

Table H-8 Recommended Visual Search Altitudes

Search Target	*Terrain*	*Recommended Altitudes (ft)*
Person, cars, light aircraft crashes	Moderate	200 to 500
Trucks, large aircraft	Moderate	400 to 1000
Persons, one-person rafts, surfboards light aircraft crashes	Water or flat	200 to 500
Small to medium- sized boats, liferafts, trucks, aircraft	Water or flat	1000 to 3000
Distress signals	Night-all	1500 to 2000

(f) *Search Speed.* At low altitudes, higher speed causes blurring of targets at close ranges and decreases exposure time to the scanner. At altitudes above 500 feet, search speed of traditional SRUs has no significant influence on over water sweep widths.

(g) *Maximizing Available Effort.* The available search effort on scene is the product of corrected sweep width (W), search speed (V) and *search* endurance (T) ($Z = W \times V \times T$). The combination of these that produces the largest value, subject to common sense and flight safety constraints, is generally the best combination because it maximizes the amount of searching the available SRUs can do. However, search planners are cautioned against spending excessive amounts of their valuable time trying to find the combination that provides the absolute maximum effort since gains are likely to be small. Search speeds should be within the range of values for which correction factors are given in Table H-9. For small objects, especially PIWs, search altitudes and speeds should be kept in the lower part of the range for which uncorrected sweep widths are given in Tables H-11 to H-19. Vertical separation must be maintained for aircraft in adjacent search areas, and speeds and altitudes are always subject to on scene conditions for reasons of flight safety.

H.5.5.4 Visual Sweep Width Corrections

(a) **Correcting for Search Aircraft Speed**. Enter the speed correction table (Table H-9) with aircraft type (fixed-wing or helicopter) and the speed flown. Read down the column to the search object. This value is the speed correction. Interpolate as required. There is no speed correction for surface SRUs.

Table H-9 Search Aircraft Speed Correction

Search Object	*Fixed Wing Speed (Knots)*			*Helicopter Speed (Knots)*			
	150 or less	*180*	*210*	*60 or less*	*90*	*120*	*140*
Person in Water	1.2	1.0	0.9	1.5	1.0	0.8	0.7
Raft - 1-4 Man	1.1	1.0	0.9	1.3	1.0	0.9	0.8
Raft - 6-25 Man	1.1	1.0	0.9	1.2	1.0	0.9	0.8
Power Boat - to 25 ft	1.1	1.0	0.9	1.2	1.0	0.9	0.8
Power Boat - 26-40 ft	1.1	1.0	0.9	1.1	1.0	0.9	0.9
Power Boat - 41-65 ft	1.1	1.0	1.0	1.1	1.0	0.9	0.9
Power Boat - 66-90 ft	1.1	1.0	1.0	1.1	1.0	1.0	0.9
Sail Boat - to 26 ft	1.1	1.0	0.9	1.2	1.0	0.9	0.9
Sail Boat - 30-52 ft	1.1	1.0	1.0	1.1	1.0	0.9	0.9
Sail Boat - 65-90 ft	1.1	1.0	1.0	1.1	1.0	1.0	0.9
Ship - over 90 ft	1.0	1.0	1.0	1.1	1.0	1.0	0.9

(b) **Position of the Sun.** The sun's position relative to SRU and target can significantly influence target appearance. Detectability, however, is not necessarily better or worse in any particular direction relative to the sun.

(c) **Correcting for Fatigue.** Degradation of detection performance during a search can be significant. The sweep widths given in the uncorrected visual sweep width tables, which follow, are adjusted for a normal amount of crew fatigue. If feedback from on scene SRUs indicates search crews were excessively fatigued, reduce sweep width values by 10 percent (multiply by 0.9).

(d) **Correcting for Weather.** Table H-10 can be used to determine the weather correction factor. *IAMSAR Manual Volume 2, Table N-7* provides corresponding information but under categories of "person in the water" and "life raft". It does not include "Other Targets".

Table H-10 Weather Correction Factor

	Search Object	
Weather: Winds (kts) or seas (ft)	Person in water, raft or boat < 30 ft	Other search objects
Winds 0 to15 kts or seas 0 to 3 ft	1.0	1.0
Winds >15 to 25 kts or seas >3 to 5 ft	0.5	0.9
Winds > 25 kts or seas >5 ft	0.25	0.9

H.5.5.5 Uncorrected Visual Sweep Width Tables

(a) Interpolation is to be used within these tables as needed.

(b) When vessel length is larger than the largest "power boat" or "sail boat", interpolate between the largest "power boat" or "sail boat" line and the smallest "ship" line.

(c) When searching for small targets, high search altitudes for aircraft SRUs yield little to no improvement in sweep width available while actually making it more difficult for aircraft scanners to visually detect the search object. For normal search operations, giving consideration to on scene weather and aircraft separation needs, search altitudes should be restricted to no higher than 1000 feet for small objects. For the purposes of using the following tables, entries for small objects are shaded in the tables for higher search altitudes for combinations of search object and altitude that should be avoided. Small objects include:

- PIWs

- Rafts ≤ 6 person
- Powerboats < 15 feet
- Sailboats < 15 feet

(d) For search altitudes up to 500 feet only, the values given for sweep width for a person in water may be increased by a factor of 4 if it is known that the person is wearing a personal flotation device.

(e) Visual searches are seldom conducted from altitudes above 3000 feet; however, for altitudes up to 5000 feet where visibility exceeds 3 NM and target size exceeds 25 feet, the sweep widths given for 3000 feet remain applicable.

Table H-11 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 300-500 Feet

Search Object	*Altitude 300 Feet Visibility (NM)*							*Altitude 500 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water*	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.3	0.7	0.9	1.2	1.3	1.3	1.3	0.3	0.7	0.9	1.2	1.4	1.4	1.4
Raft 4 person	0.4	0.9	1.3	1.7	2.0	2.2	2.2	0.4	1.0	1.3	1.8	2.0	2.2	2.2
Raft 6 person	0.1	1.1	1.5	2.1	2.5	2.7	2.7	0.4	1.1	1.5	2.2	2.5	2.8	2.8
Raft 8 person	0.4	1.2	1.6	2.3	2.6	2.9	2.9	0.4	1.2	1.6	2.3	2.7	2.9	2.9
Raft 10 person	0.4	1.2	1.7	2.4	2.9	3.2	3.2	0.4	1.2	1.7	2.5	2.9	3.2	3.2
Raft 15 person	0.5	1.3	1.9	2.7	3.2	3.5	4.0	0.5	1.3	1.9	2.7	3.3	3.6	4.0
Raft 20 person	0.5	1.4	2.1	3.1	3.7	4.2	4.8	0.5	1.5	2.1	3.2	3.8	4.2	4.8
Raft 25 person	0.5	1.5	2.2	3.4	4.1	4.6	5.2	0.5	1.6	2.3	3.4	4.1	4.6	5.3
Power Boat ≤ 15 ft	0.4	0.8	1.1	1.4	1.6	1.7	1.7	0.4	0.9	1.2	1.5	1.7	1.8	1.8
Power Boat 20 ft	0.5	1.6	2.4	3.5	4.3	4.8	4.8	0.5	1.7	2.4	3.6	4.3	4.8	4.8
Power Boat 33 ft	0.6	2.1	3.3	5.3	6.6	7.6	9.1	0.6	2.1	3.3	5.3	6.7	7.7	9.1
Power Boat 53 ft	0.6	2.6	4.5	8.1	10.9	13.1	16.4	0.6	2.7	4.5	8.1	10.9	13.1	16.5
Power Boat 78 ft	0.6	2.8	5.0	9.7	13.5	16.6	21.6	0.6	2.8	5.0	9.8	13.5	16.7	21.7
Sail Boat 15 ft	0.5	1.5	2.2	3.2	3.8	4.3	4.3	0.5	1.6	2.2	3.2	3.9	4.3	4.3
Sail Boat 20 ft	0.6	1.8	2.6	4.0	4.9	5.6	5.6	0.6	1.8	2.7	4.0	5.0	5.6	5.6
Sail Boat 25 ft	0.6	2.0	3.1	4.8	6.0	6.9	6.9	0.6	2.0	3.1	4.9	6.1	7.0	7.0
Sail Boat 30 ft	0.6	2.3	3.6	5.9	7.5	8.8	10.6	0.6	2.3	3.6	5.9	7.6	8.8	10.6
Sail Boat 40 ft	0.6	2.6	4.3	7.5	10.0	11.9	14.8	0.6	2.6	4.3	7.6	10.0	11.9	14.8
Sail Boat 50 ft	0.6	2.7	4.6	8.4	11.3	13.6	17.3	0.6	2.7	4.6	8.4	11.3	13.7	17.3
Sail Boat 70 ft	0.6	2.8	4.9	9.3	12.7	15.5	20.0	0.6	2.8	4.9	9.3	12.7	15.5	20.0
Sail Boat 83 ft	0.6	2.8	5.1	9.9	13.7	16.9	22.1	0.6	2.8	5.1	9.9	13.7	17.0	22.1
Ship 120 ft	0.6	2.9	5.4	11.1	15.9	20.0	26.9	0.6	2.9	5.4	11.1	15.9	20.1	26.9
Ship 225 ft	0.6	3.0	5.7	12.5	18.8	24.7	34.8	0.6	3.0	5.7	12.5	18.9	24.7	34.8
Ship ≥ 300 ft	0.7	3.0	5.8	13.2	20.6	27.9	41.4	0.7	3.0	5.8	13.2	20.6	27.9	41.4

* For search altitudes up to 500 feet only, the values given for sweep width for a person in water may be increased by a factor of 4 if it is known that the person is wearing a personal flotation device.

Table H-12 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 750-1000 Feet

Search Object	*Altitude 750 Feet Visibility (NM)*							*Altitude 1000 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.3	0.7	0.9	1.2	1.4	1.4	1.4	0.3	0.7	0.9	1.2	1.4	1.4	1.4
Raft 4 person	0.4	1.0	1.3	1.8	2.1	2.2	2.2	0.3	1.0	1.3	1.8	2.1	2.3	2.3
Raft 6 person	0.1	1.1	1.6	2.2	2.6	2.8	2.8	0.4	1.1	1.6	2.2	2.6	2.8	2.8
Raft 8 person	0.4	1.2	1.7	2.3	2.7	3.0	3.0	0.4	1.2	1.7	2.4	2.8	3.0	3.0
Raft 10 person	0.4	1.3	1.8	2.5	3.0	3.3	3.3	0.4	1.3	1.8	2.6	3.0	3.3	3.3
Raft 15 person	0.4	1.4	1.9	2.8	3.3	3.7	4.1	0.4	1.4	2.0	2.8	3.4	3.7	4.2
Raft 20 person	0.5	1.5	2.2	3.2	3.8	4.3	4.9	0.4	1.5	2.2	3.2	3.9	4.3	4.9
Raft 25 person	0.5	1.6	2.3	3.5	4.2	4.7	5.4	0.4	1.6	2.3	3.5	4.2	4.7	5.4
Power Boat ≤ 15 ft	0.4	0.9	1.2	1.6	1.8	1.9	1.9	0.4	1.0	1.3	1.7	1.8	2.0	2.0
Power Boat 20 ft	0.5	1.7	2.4	3.6	4.4	4.9	4.9	0.5	1.7	2.5	3.7	4.4	5.0	5.0
Power Boat 33 ft	0.6	2.1	3.3	5.3	6.7	7.7	9.2	0.5	2.2	3.4	5.4	6.8	7.8	9.3
Power Boat 53 ft	0.6	2.7	4.5	8.2	10.9	13.1	16.5	0.6	2.7	4.5	8.2	10.9	13.1	16.6
Power Boat 78 ft	0.6	2.8	5.0	9.8	13.5	16.7	21.7	0.6	2.8	5.1	9.8	13.6	16.7	21.7
Sail Boat 15 ft	0.5	1.6	2.3	3.3	3.9	4.4	4.4	0.5	1.6	2.3	3.3	4.0	4.4	4.4
Sail Boat 20 ft	0.5	1.8	2.7	4.1	5.0	5.7	5.7	0.5	1.8	2.7	4.2	5.1	5.7	5.7
Sail Boat 25 ft	0.6	2.1	3.1	5.0	6.2	7.0	7.0	0.5	2.1	3.2	5.0	6.2	7.1	7.1
Sail Boat 30 ft	0.6	2.3	3.6	6.0	7.5	8.9	10.7	0.6	2.3	3.6	6.0	7.6	8.9	10.7
Sail Boat 40 ft	0.6	2.6	4.3	7.6	10.0	11.9	14.9	0.6	2.6	4.3	7.6	10.9	12.0	14.9
Sail Boat 50 ft	0.6	2.7	4.6	8.5	11.4	13.7	17.4	0.6	2.7	4.6	8.5	11.4	13.7	17.4
Sail Boat 70 ft	0.6	2.8	4.9	9.3	12.7	15.6	20.0	0.6	2.8	4.9	9.3	12.8	15.6	20.1
Sail Boat 83 ft	0.6	2.8	5.1	9.9	13.8	17.0	22.2	0.6	2.8	5.1	9.9	13.8	17.0	22.2
Ship 120 ft	0.6	2.9	5.4	11.1	15.9	20.1	27.0	0.6	2.9	5.4	11.1	15.9	20.1	27.0
Ship 225 ft	0.6	3.0	5.7	12.5	18.9	24.7	34.9	0.6	3.0	5.7	12.5	18.9	24.7	34.9
Ship ≥ 300 ft	0.7	3.0	5.8	13.2	20.6	27.9	41.4	0.6	3.0	5.8	13.2	20.6	27.9	41.4

Table H-13 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 1500-2000 Feet

Search Object	*Altitude 1500 Feet Visibility (NM)*							*Altitude 2000 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Raft 1 person	0.2	0.7	0.9	1.3	1.4	1.4	1.4	0.1	0.6	0.9	1.2	1.4	1.4	1.4
Raft 4 person	0.3	1.0	1.3	1.9	2.1	2.3	2.3	0.2	0.9	1.3	1.9	2.2	2.3	2.3
Raft 6 person	0.3	1.1	1.6	2.3	2.6	2.9	2.9	0.2	1.1	1.6	2.3	2.7	2.9	2.9
Raft 8 person	0.3	1.2	1.7	2.4	2.8	3.1	3.1	0.2	1.2	1.7	2.5	2.9	3.2	3.2
Raft 10 person	0.3	1.3	1.8	2.6	3.1	3.4	3.4	0.2	1.2	1.8	2.7	3.1	3.5	3.5
Raft 15 person	0.3	1.4	2.0	2.9	3.4	3.8	4.3	0.2	1.4	2.0	3.0	3.5	3.9	4.4
Raft 20 person	0.4	1.5	2.2	3.3	4.0	4.4	5.1	0.4	1.5	2.2	3.4	4.0	4.5	5.1
Raft 25 person	0.4	1.6	2.4	3.6	4.3	4.8	5.6	0.3	1.6	2.4	3.6	4.4	4.9	5.7
Power Boat ≤ 15 ft	0.3	1.0	1.3	1.7	2.0	2.1	2.1	0.2	1.0	1.3	1.8	2.0	2.2	2.2
Power Boat 20 ft	0.4	1.7	2.5	3.7	4.5	5.1	5.1	0.3	1.7	2.5	3.8	4.6	5.1	5.1
Power Boat 33 ft	0.5	2.2	3.4	5.5	6.8	7.9	9.4	0.3	2.2	3.4	5.5	6.9	8.0	9.5
Power Boat 53 ft	0.5	2.6	4.5	8.2	11.0	13.2	16.6	0.4	2.6	4.5	8.3	11.0	13.3	16.7
Power Boat 78 ft	0.5	2.8	5.1	9.8	13.6	16.7	21.8	0.4	2.8	5.0	9.8	13.6	16.8	21.8
Sail Boat 15 ft	0.4	1.6	2.3	3.4	4.1	4.5	4.5	0.3	1.6	2.3	3.5	4.1	4.5	4.5
Sail Boat 20 ft	0.4	1.8	2.8	4.2	5.2	5.8	5.8	0.3	1.8	2.8	4.3	5.2	5.9	5.9
Sail Boat 25 ft	0.5	2.1	3.2	5.1	6.3	7.2	7.2	0.3	2.1	3.3	5.2	6.4	7.3	7.3
Sail Boat 30 ft	0.5	2.3	3.7	6.1	7.7	9.0	10.8	0.3	2.3	3.7	6.1	7.8	9.1	10.9
Sail Boat 40 ft	0.5	2.6	4.3	7.6	10.1	12.0	14.9	0.4	2.5	4.3	7.7	10.1	12.1	15.0
Sail Boat 50 ft	0.5	2.7	4.6	8.5	11.4	13.8	17.5	0.4	2.7	4.6	8.6	11.5	13.9	17.5
Sail Boat 70 ft	0.5	2.8	4.9	9.4	12.8	15.7	20.2	0.4	2.7	4.9	9.4	12.9	15.7	20.2
Sail Boat 83 ft	0.5	2.8	5.1	10.0	13.8	17.1	22.3	0.4	2.8	5.1	10.0	13.9	17.1	22.3
Ship 120 ft	0.5	2.9	5.4	11.1	16.0	20.1	27.0	0.4	2.9	5.4	11.1	16.0	20.1	27.1
Ship 225 ft	0.5	3.0	5.7	12.5	18.9	24.7	34.9	0.4	3.0	5.7	12.5	18.9	24.7	34.9
Ship ≥ 300 ft	0.6	3.0	5.8	13.2	20.7	27.9	41.4	0.5	3.0	5.8	13.2	20.7	27.9	41.5

Table H-14 Uncorrected Visual Sweep Width - Fixed Wing Aircraft for Altitudes 2500-3000 Feet

Search Object	*Altitude 2500 Feet Visibility (NM)*							*Altitude 3000 Feet* Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raft 1 person	0.1	0.5	0.8	1.2	1.4	1.4	1.4	0.1	0.5	0.8	1.1	1.3	1.3	1.3
Raft 4 person	0.1	0.8	1.3	1.8	2.2	2.4	2.4	0.1	0.7	1.2	1.8	2.1	2.3	2.3
Raft 6 person	0.1	1.0	1.5	2.3	2.7	2.9	2.9	0.1	0.9	1.5	2.2	2.7	2.9	2.9
Raft 8 person	0.1	1.1	1.7	2.5	2.9	3.2	3.2	0.1	1.0	1.6	2.5	2.9	3.2	3.2
Raft 10 person	0.2	1.2	1.8	2.7	3.2	3.5	3.5	0.1	1.1	1.8	2.7	3.2	3.5	3.5
Raft 15 person	0.2	1.3	2.0	3.0	3.6	4.0	4.5	0.1	1.2	2.0	3.0	3.6	4.0	4.5
Raft 20 person	0.2	1.4	2.2	3.4	4.1	4.6	5.2	0.1	1.4	2.2	3.4	4.1	4.6	5.3
Raft 25 person	0.2	1.5	2.4	3.7	4.5	5.0	5.7	0.1	1.5	2.4	3.7	4.5	5.1	5.8
Power Boat ≤ 15 ft	0.1	0.9	1.3	1.8	2.1	2.2	2.2	0.1	0.8	1.3	1.8	2.1	2.3	2.3
Power Boat 20 ft	0.2	1.6	2.5	3.8	4.6	5.2	5.2	0.1	1.6	2.5	3.9	4.7	5.3	5.3
Power Boat 33 ft	0.2	2.1	3.4	5.6	7.0	8.1	9.6	0.2	2.1	3.4	5.6	7.1	8.1	9.7
Power Boat 53 ft	0.3	2.6	4.5	8.3	11.3	13.3	16.7	0.2	2.5	4.5	8.3	11.1	13.4	16.8
Power Boat 78 ft	0.3	2.7	5.0	9.8	13.6	16.8	21.9	0.2	2.7	5.0	9.9	13.7	16.8	21.9
Sail Boat 15 ft	0.2	1.5	2.3	3.5	4.2	4.7	4.7	0.1	1.5	2.3	3.5	4.3	4.7	4.7
Sail Boat 20 ft	0.2	1.8	2.8	4.3	5.3	6.0	6.0	0.1	1.7	2.8	4.4	5.3	6.0	6.0
Sail Boat 25 ft	0.2	2.1	3.3	5.2	6.5	7.5	7.5	0.2	2.0	3.3	5.3	6.6	7.5	7.5
Sail Boat 30 ft	0.2	2.2	3.7	6.1	7.8	9.1	11.0	0.2	2.2	3.7	6.2	7.9	9.2	11.1
Sail Boat 40 ft	0.3	2.5	4.3	7.7	10.2	12.1	15.1	0.2	2.4	4.3	7.7	10.2	12.1	15.1
Sail Boat 50 ft	0.3	2.6	4.6	8.6	11.5	13.9	17.6	0.2	2.6	4.6	8.6	11.6	14.0	17.7
Sail Boat 70 ft	0.3	2.7	4.9	9.4	12.9	15.8	20.3	0.2	2.6	4.9	9.4	13.0	15.8	20.3
Sail Boat 83 ft	0.3	2.8	5.1	10.0	13.9	17.2	22.4	0.2	2.7	5.1	10.0	14.0	17.2	22.5
Ship 120 ft	0.3	2.8	5.4	11.1	16.0	20.2	27.1	0.2	2.8	5.3	11.1	16.0	20.2	27.1
Ship 225 ft	0.3	2.9	5.6	12.5	18.9	24.8	35.0	0.2	2.8	5.6	12.5	18.9	24.8	35.0
Ship ≥ 300 ft	0.3	2.9	5.7	13.2	20.7	27.9	41.5	0.2	2.9	5.7	13.2	20.7	27.9	41.5

* Visual searches are seldom conducted from altitudes above 3000 feet; however, for altitudes up to 5000 feet where visibility exceeds 3 NM and target size exceeds 25 feet, the sweep widths given for 3000 feet remain applicable.

Table H-15 Uncorrected Visual Sweep Width – Helicopters for Altitudes 300-500 Feet

Search Object	*Altitude 300 Feet Visibility (NM)*							*Altitude 500 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water*	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.4	0.9	1.2	1.5	1.7	1.7	1.7	0.4	0.9	1.2	1.6	1.8	1.8	1.8
Raft 4 person	0.5	1.2	1.6	2.2	2.5	2.7	2.7	0.5	1.2	1.6	2.2	2.6	2.8	2.8
Raft 6 person	0.5	1.4	1.9	2.7	3.1	3.4	3.4	0.5	1.4	1.9	2.7	3.2	3.5	3.5
Raft 8 person	0.6	1.4	2.0	2.8	3.3	3.6	3.6	0.6	1.5	2.0	2.8	3.3	3.7	3.7
Raft 10 person	0.6	1.5	2.1	3.0	3.6	3.9	3.9	0.6	1.6	2.2	3.1	3.6	4.0	4.0
Raft 15 person	0.6	1.6	2.3	3.3	3.9	4.3	4.9	0.6	1.7	2.3	3.3	4.0	4.4	5.0
Raft 20 person	0.6	1.8	2.6	3.8	4.5	5.1	5.8	0.6	1.8	2.6	3.8	4.6	5.1	5.9
Raft 25 person	0.6	1.9	2.7	4.1	4.9	5.5	6.3	0.6	1.9	2.7	4.1	5.0	5.6	6.4
Power Boat ≤ 15 ft	0.5	1.1	1.4	1.9	2.1	2.2	2.2	0.5	1.2	1.5	1.9	2.2	2.3	2.3
Power Boat 20 ft	0.7	2.0	2.9	4.3	5.2	5.8	5.8	0.7	2.0	2.9	4.3	5.2	5.8	5.8
Power Boat 33 ft	0.8	2.5	3.8	6.1	7.7	8.9	10.6	0.8	2.5	3.9	6.2	7.8	9.0	10.7
Power Boat 53 ft	0.8	3.1	5.1	9.2	12.2	14.7	18.5	0.8	3.1	5.1	9.2	12.3	14.7	18.5
Power Boat 78 ft	0.8	3.3	5.7	10.8	15.0	18.4	23.9	0.8	3.3	5.7	10.8	15.0	18.4	23.9
Sail Boat 15 ft	0.7	1.9	2.7	3.9	4.6	5.2	5.2	0.7	1.9	2.7	3.9	4.7	5.2	5.2
Sail Boat 20 ft	0.7	2.2	3.2	4.8	5.9	6.6	6.6	0.7	2.2	3.2	4.8	5.9	6.7	6.7
Sail Boat 25 ft	0.8	2.4	3.6	5.7	7.1	8.1	8.1	0.8	2.4	3.7	5.7	7.1	8.2	8.2
Sail Boat 30 ft	0.8	2.7	4.2	6.8	8.7	10.1	12.2	0.8	2.7	4.2	6.9	8.7	10.2	12.3
Sail Boat 40 ft	0.8	3.0	4.9	8.6	11.3	13.4	16.7	0.8	3.0	4.9	8.3	11.3	13.5	16.8
Sail Boat 50 ft	0.8	3.1	5.2	9.5	12.7	15.3	19.3	0.8	3.1	5.2	9.5	12.7	15.3	19.4
Sail Boat 70 ft	0.8	3.2	5.5	10.3	14.1	17.2	22.1	0.8	3.2	5.5	10.4	14.1	17.3	22.2
Sail Boat 83 ft	0.8	3.3	5.7	11.0	15.2	18.7	24.3	0.8	3.3	5.7	11.0	15.2	18.7	24.4
Ship 120 ft	0.8	3.4	6.0	12.2	17.4	21.9	29.3	0.8	3.4	6.0	12.2	17.4	21.9	29.3
Ship 225 ft	0.8	3.4	6.3	13.6	20.4	26.6	37.7	0.8	3.4	6.3	13.6	20.4	26.6	37.3
Ship ≥ 300 ft	0.8	3.5	6.4	14.3	22.1	29.8	43.8	0.8	3.5	6.4	14.3	22.1	29.8	43.8

* For search altitudes up to 500 feet only, the values given for sweep width for a person in water may be increased by a factor of 4 if it is known that the person is wearing a personal flotation device.

Table H-16 Uncorrected Visual Sweep Width – Helicopters for Altitudes 750-1000 Feet

Search Object	*Altitude 750 Feet Visibility (NM)*							*Altitude 1000 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water*	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.4	0.9	1.2	1.6	1.7	1.8	1.8	0.4	0.9	1.2	1.6	1.8	1.8	1.8
Raft 4 person	0.5	1.2	1.7	2.3	2.6	2.8	2.8	0.5	1.2	1.7	2.3	2.6	2.9	2.9
Raft 6 person	0.5	1.4	2.0	2.7	3.2	3.5	3.5	0.5	1.4	2.0	2.8	3.2	3.5	3.5
Raft 8 person	0.5	1.5	2.1	2.9	3.4	3.7	3.7	0.5	1.5	2.1	2.9	3.4	3.8	3.8
Raft 10 person	0.6	1.6	2.2	3.1	3.7	4.0	4.0	0.5	1.6	2.2	3.2	3.7	4.1	4.1
Raft 15 person	0.6	1.7	2.4	3.4	4.0	4.5	5.0	0.6	1.7	2.4	3.5	4.1	4.5	5.1
Raft 20 person	0.6	1.8	2.6	3.9	4.6	5.2	5.9	0.6	1.8	2.7	3.9	4.7	5.2	6.0
Raft 25 person	0.6	1.9	2.8	4.2	5.0	5.6	6.5	0.6	1.9	2.8	4.2	5.1	5.7	6.5
Power Boat ≤ 15 ft	0.5	1.2	1.6	2.0	2.3	2.4	2.4	0.5	1.2	1.6	2.1	2.3	2.5	2.5
Power Boat 20 ft	0.7	2.0	2.9	4.4	5.3	5.9	5.9	0.7	2.1	3.0	4.4	5.3	5.9	5.9
Power Boat 33 ft	0.7	2.5	3.9	6.2	7.8	9.0	10.7	0.7	2.6	3.9	6.3	7.9	9.1	10.8
Power Boat 53 ft	0.8	3.1	5.1	9.2	12.3	14.7	18.5	0.7	3.1	5.2	9.2	12.3	14.8	18.6
Power Boat 78 ft	0.8	3.3	5.7	10.9	15.0	18.4	23.9	0.8	3.3	5.7	10.9	15.0	18.5	23.9
Sail Boat 15 ft	0.7	1.9	2.7	4.0	4.8	5.3	5.3	0.6	1.9	2.8	4.0	4.8	5.4	5.4
Sail Boat 20 ft	0.7	2.2	3.2	4.9	6.0	6.7	6.7	0.7	2.2	3.2	4.9	6.0	6.8	6.8
Sail Boat 25 ft	0.7	2.5	3.7	5.8	7.2	8.3	8.3	0.7	2.5	3.7	5.8	7.3	8.3	8.3
Sail Boat 30 ft	0.8	2.7	4.2	6.9	8.8	10.2	12.3	0.7	2.7	4.2	6.9	8.8	10.3	12.4
Sail Boat 40 ft	0.8	3.0	4.9	8.6	11.3	13.5	16.8	0.7	3.0	4.9	8.6	11.4	13.5	16.8
Sail Boat 50 ft	0.8	3.1	5.3	9.5	12.7	15.4	19.4	0.7	3.1	5.3	9.5	12.8	15.4	19.5
Sail Boat 70 ft	0.8	3.2	5.5	10.4	14.2	17.3	22.2	0.8	3.2	5.6	10.4	14.2	17.3	22.2
Sail Boat 83 ft	0.8	3.3	5.7	11.0	15.2	18.8	24.4	0.8	3.3	5.7	11.0	15.3	18.8	24.4
Ship 120 ft	0.8	3.4	6.0	12.2	17.4	21.9	29.3	0.8	3.4	6.0	12.2	17.4	21.9	29.3
Ship 225 ft	0.8	3.4	6.3	13.6	20.4	26.6	37.3	0.8	3.4	6.3	13.6	20.4	26.6	37.3
Ship ≥ 300 ft	0.8	3.5	6.4	14.3	22.2	29.8	43.8	0.8	3.5	6.4	14.3	22.2	29.8	43.9

Table H-17 Uncorrected Visual Sweep Width – Helicopters for Altitudes 1500-2000 Feet

Search Object	*Altitude 1500 Feet Visibility (NM)*							*Altitude 2000 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water*	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Raft 1 person	0.3	0.9	1.2	1.6	1.8	1.8	1.8	0.2	0.8	1.2	1.6	1.8	1.8	1.8
Raft 4 person	0.4	1.2	1.7	2.3	2.7	2.9	2.9	0.3	1.2	1.7	2.3	2.7	3.0	3.0
Raft 6 person	0.4	1.4	2.0	2.8	3.3	3.6	3.6	0.3	1.4	2.0	2.8	3.3	3.6	3.6
Raft 8 person	0.4	1.5	2.1	3.0	3.5	3.9	3.9	0.3	1.5	2.1	3.0	3.6	3.9	3.9
Raft 10 person	0.4	1.6	2.2	3.2	3.8	4.2	4.2	0.3	1.6	2.3	3.3	3.9	4.2	4.2
Raft 15 person	0.5	1.7	2.4	3.5	4.2	4.6	5.2	0.3	1.7	2.5	3.6	4.3	4.7	5.3
Raft 20 person	0.5	1.9	2.7	4.0	4.8	5.3	6.1	0.4	1.8	2.7	4.0	4.9	5.4	6.2
Raft 25 person	0.5	2.0	2.9	4.3	5.2	5.8	6.7	0.4	1.9	2.9	4.3	5.3	5.9	6.8
Power Boat ≤ 15 ft	0.4	1.3	1.7	2.2	2.5	2.6	2.6	0.3	1.3	1.7	2.3	2.6	2.7	2.7
Power Boat 20 ft	0.6	2.1	3.0	4.5	5.4	6.1	6.1	0.4	2.1	3.0	4.5	5.5	6.1	6.1
Power Boat 33 ft	0.6	2.6	4.0	6.3	7.9	9.2	10.9	0.5	2.6	4.0	6.4	8.0	9.3	11.0
Power Boat 53 ft	0.7	3.1	5.2	9.3	12.4	14.8	18.6	0.5	3.0	5.2	9.3	12.4	14.9	18.7
Power Boat 78 ft	0.7	3.2	5.7	10.9	15.1	18.5	24.0	0.5	3.2	5.7	10.9	15.1	18.5	24.0
Sail Boat 15 ft	0.6	2.0	2.8	4.1	4.9	5.5	5.5	0.4	1.9	2.8	4.2	5.0	5.6	5.6
Sail Boat 20 ft	0.6	2.2	3.3	5.0	6.1	6.9	6.9	0.5	2.2	3.3	5.1	6.2	7.0	7.0
Sail Boat 25 ft	0.6	2.5	3.8	5.9	7.4	8.4	8.4	0.5	2.5	3.8	6.0	7.5	8.6	8.6
Sail Boat 30 ft	0.6	2.7	4.2	7.0	8.9	10.3	12.5	0.5	2.7	4.3	7.0	9.0	10.4	12.6
Sail Boat 40 ft	0.6	3.0	4.9	8.7	11.4	13.6	16.9	0.5	3.0	4.9	8.7	11.4	13.6	17.0
Sail Boat 50 ft	0.7	3.1	5.3	9.6	12.8	15.5	19.5	0.5	3.1	5.3	9.6	12.9	15.5	19.6
Sail Boat 70 ft	0.7	3.2	5.6	10.4	14.3	17.4	22.3	0.5	3.2	5.6	10.5	14.3	17.4	22.4
Sail Boat 83 ft	0.7	3.3	5.7	11.1	15.3	18.8	24.5	0.5	3.2	5.7	11.1	15.4	18.9	24.6
Ship 120 ft	0.7	3.3	6.0	12.2	17.5	22.0	29.4	0.5	3.3	6.0	12.2	17.5	22.0	29.4
Ship 225 ft	0.7	3.4	6.3	13.6	20.4	26.6	37.3	0.5	3.4	6.3	13.6	20.4	26.6	37.4
Ship ≥ 300 ft	0.7	3.4	6.4	14.3	22.2	29.8	43.9	0.6	3.4	6.4	14.3	22.2	29.8	43.9

Table H-18 Uncorrected Visual Sweep Width - Helicopters for Altitudes 2500-3000 Feet

Search Object	*Altitude 2500 Feet Visibility (NM)*							*Altitude 3000 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water*	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raft 1 person	0.1	0.8	1.1	1.6	1.8	1.8	1.8	0.1	0.7	1.0	1.5	1.8	1.8	1.8
Raft 4 person	0.2	1.1	1.6	2.3	2.7	3.0	3.0	0.1	1.0	1.6	2.3	2.7	3.0	3.0
Raft 6 person	0.2	1.3	1.9	2.8	3.3	3.7	3.7	0.1	1.2	1.9	2.8	3.3	3.7	3.7
Raft 8 person	0.2	1.4	2.1	3.1	3.6	4.0	4.0	0.1	1.3	2.1	3.1	3.6	4.0	4.0
Raft 10 person	0.2	1.5	2.2	3.3	3.9	4.3	4.3	0.1	1.4	2.2	3.3	3.9	4.3	4.3
Raft 15 person	0.2	1.7	2.5	3.6	4.3	4.8	5.4	0.2	1.6	2.4	3.7	4.4	4.9	5.5
Raft 20 person	0.3	1.8	2.7	4.1	4.9	5.5	6.3	0.2	1.7	2.7	4.1	5.0	5.6	6.3
Raft 25 person	0.3	1.9	2.9	4.4	5.3	6.0	6.9	0.2	1.9	2.9	4.4	5.4	6.0	6.9
Power Boat ≤ 15 ft	0.2	1.2	1.7	2.3	2.6	2.8	2.8	0.1	1.1	1.7	2.3	2.7	2.9	2.9
Power Boat 20 ft	0.3	2.0	3.0	4.6	5.5	6.2	6.2	0.2	2.0	3.0	4.6	5.6	6.3	6.3
Power Boat 33 ft	0.4	2.5	4.0	6.5	8.1	9.3	11.1	0.2	2.5	4.0	6.5	8.2	9.4	11.2
Power Boat 53 ft	0.4	3.0	5.2	9.3	12.4	14.9	18.8	0.3	3.0	5.2	9.3	12.5	15.0	18.8
Power Boat 78 ft	0.4	3.2	5.7	10.9	15.1	18.6	24.1	0.3	3.1	5.7	10.9	15.1	18.6	24.1
Sail Boat 15 ft	0.3	1.9	2.8	4.2	5.1	5.6	5.6	0.2	1.9	2.8	4.3	5.1	5.7	5.7
Sail Boat 20 ft	0.3	2.2	3.3	5.1	6.3	7.1	7.1	0.2	2.1	3.3	5.2	6.3	7.1	7.1
Sail Boat 25 ft	0.4	2.5	3.8	6.1	7.6	8.7	8.7	0.2	2.4	3.9	6.1	7.7	8.8	8.8
Sail Boat 30 ft	0.4	2.7	4.3	7.1	9.0	10.5	12.6	0.2	2.6	4.3	7.1	9.1	10.6	12.7
Sail Boat 40 ft	0.4	2.9	4.9	8.7	11.5	13.7	17.0	0.3	2.9	4.9	8.7	11.5	13.7	17.1
Sail Boat 50 ft	0.4	3.1	5.3	9.6	12.9	15.6	19.7	0.3	3.0	5.3	9.7	13.0	15.6	19.7
Sail Boat 70 ft	0.4	3.1	5.6	10.5	14.3	17.5	22.4	0.3	3.1	5.6	10.5	14.4	17.5	22.5
Sail Boat 83 ft	0.4	3.2	5.7	11.1	15.4	18.9	24.6	0.3	3.1	5.7	11.1	15.4	19.0	24.7
Ship 120 ft	0.4	3.3	6.0	12.2	17.5	22.0	29.4	0.3	3.2	6.0	12.2	17.5	22.0	29.5
Ship 225 ft	0.4	3.3	6.3	13.6	20.4	26.6	37.4	0.3	3.3	6.3	13.6	20.4	26.6	37.4
Ship ≥ 300 ft	0.5	3.4	6.4	14.3	22.2	29.8	43.9	0.3	3.3	6.4	14.3	22.2	29.8	43.9

* Visual searches are seldom conducted from altitudes above 3000 feet; however, for altitudes up to 5000 feet where visibility exceeds 3 NM and target size exceeds 25 feet, the sweep widths given for 3000 feet remain applicable.

Table H-19 Uncorrected Visual Sweep Width – Vessels and Boats

Search Object	*Vessel SRU Visibility (NM)*						*Small Boat SRU Visibility (NM)*					
	1	*3*	*5*	*10*	*15*	*20*	*1*	*3*	*5*	*10*	*15*	*20*
Person in Water*	0.3	0.4	0.5	0.5	0.5	0.5	0.2	0.2	0.3	0.3	0.3	0.3
Raft 1 person	0.9	1.8	2.3	3.1	3.4	3.7	0.7	1.3	1.7	2.3	2.6	2.7
Raft 4 person	1.0	2.2	3.0	4.0	4.6	5.0	0.7	1.7	2.2	3.1	3.5	3.9
Raft 6 person	1.1	2.5	3.4	4.7	5.5	6.0	0.8	1.9	2.6	3.6	4.3	4.7
Raft 8 person	1.1	2.5	3.5	4.8	5.7	6.2	0.8	2.0	2.7	3.8	4.4	4.9
Raft 10 person	1.1	2.6	3.6	5.1	6.1	6.7	0.8	2.0	2.8	4.0	4.8	5.3
Raft 15 person	1.1	2.8	3.8	5.5	6.5	7.2	0.9	2.2	3.0	4.3	5.1	5.7
Raft 20 person	1.2	3.0	4.1	6.1	7.3	8.1	0.9	2.3	3.3	4.9	5.8	6.5
Raft 25 person	1.2	3.1	4.3	6.4	7.8	8.7	0.9	2.4	3.5	5.2	6.3	7.0
Power Boat ≤ 15 ft	0.5	1.1	1.4	1.9	2.1	2.3	0.4	0.8	1.1	1.5	1.6	1.8
Power Boat 20 ft	1.0	2.0	2.9	4.3	5.2	5.8	0.8	1.5	2.2	3.3	4.0	4.5
Power Boat 33 ft	1.1	2.5	3.8	6.1	7.7	8.8	0.8	1.9	2.9	4.7	5.9	6.8
Power Boat 53 ft	1.2	3.1	5.1	9.1	12.1	14.4	0.9	2.4	3.9	7.0	9.3	11.1
Power Boat 78 ft	1.2	3.2	5.6	10.7	14.7	18.1	0.9	2.5	4.3	8.3	11.4	14.0
Sail Boat 15 ft	1.0	1.9	2.7	3.9	4.7	5.2	0.8	1.5	2.1	3.0	3.6	4.0
Sail Boat 20 ft	1.0	2.2	3.2	4.8	5.9	6.6	0.8	1.7	2.5	3.7	4.6	5.1
Sail Boat 25 ft	1.1	2.4	3.6	5.7	7.0	8.1	0.9	1.9	2.8	4.4	5.4	6.3
Sail Boat 30 ft	1.1	2.7	4.1	6.8	8.6	10.0	0.9	2.1	3.2	5.3	6.6	7.7
Sail Boat 40 ft	1.2	3.0	4.9	8.5	11.2	13.3	0.9	2.3	3.8	6.6	8.6	10.3
Sail Boat 50 ft	1.2	3.1	5.2	9.4	12.5	15.0	0.9	2.4	4.0	7.3	9.7	11.6
Sail Boat 70 ft	1.2	3.2	5.5	10.2	13.9	16.9	0.9	2.5	4.2	7.9	10.7	13.1
Sail Boat 83 ft	1.2	3.3	5.7	10.8	15.0	18.4	0.9	2.5	4.4	8.3	11.6	14.2
Ship 120 ft	1.8	3.3	6.0	12.0	17.1	21.5	1.4	2.5	4.6	9.3	13.2	16.6
Ship 225 ft	1.8	3.4	6.3	13.4	20.1	26.0	1.4	2.6	4.9	10.3	15.5	20.2
Ship ≥ 300 ft	1.8	3.4	6.4	14.1	21.8	29.2	1.4	2.6	4.9	10.9	16.8	22.5

H.5.5.6 Visual Distress Signaling Devices (VDSDs). When estimating sweep widths for VDSDs, such as pyrotechnics, dye markers, tracer bullets, or signal mirrors, use either twice the range at which survivors can be expected to detect the SRU, or the value given in Tables H-20, H-21, H-22, H-23 or H-24, whichever is smaller.

(a) *Daylight Detection Aids.* Effectiveness of daylight aids is marginal due to the difficulty in achieving target contrast in a sunlit environment. Estimated sweep widths for various daylight detection aids are given in Tables H-20 and H-21. Hand held orange smoke detectability varies by type of SRU, and also by time on task for surface SRUs. Estimated sweep widths for hand held orange smoke are given in Table H-21 for winds 10 knots or less. For winds over 10 knots the smoke tends to dissipate and sweep width degrades to less than 2 nautical miles.

Table H-20 Visual Sweep Width Estimate for Daylight Detection Aids

Device	*Estimated Sweep Width (NM)*	*SRU Type*
Red/orange balloon	0.5	Air or surface
Orange flight suit	0.5	Air
Red hand flare (500 candlepower)	0.5	Air or surface
Day/night flare	0.5	Air or surface
Red pen gun flare	0.75	Air or surface
Red reflective paulin	2.0	Air or surface
Tracer bullets	2.0	Air or surface
Green dye marker*	2.0	Air
Red/orange flag (waving) (3 ft x 3 ft)	2.5	Air or surface
Sun signal mirror	5.0	Air or surface
White parachute	5.0	Air or surface
Red meteor (star) or parachute flare (10,000 candlepower)*	6.0	Air or surface

*Greatly reduced in heavy seas

Table H-21 Visual Sweep Width Estimates for Hand Held Orange Smoke[1]

SRU Type	*Time on Task (hr)*	
	< 3	*≥ 3*
Small boat (CG 47' MLB or less)	4.6	2.8
Vessel (CG greater than 47')	6.9	5.0
Air*	7.7	

*Sweep width based on test results involving helicopters only.

(b) *Night Detection Aids.* If it is known, or suspected, that survivors can make a night signal, night visual searches should be conducted. Searches during the early stages potentially yield a high POD. Cloud cover, wind, and obscurations to visibility have less detrimental effects on night detection aids. Even a flashlight may be seen. On clear nights, pyrotechnics have been sighted in excess of 40 nautical miles. Sweep width should be based on the most likely VDSD to be used, and limited to slightly less than twice the estimated range at which survivors can detect the SRU. Estimated sweep widths for night detection aids are given in Table H-22, H-23 and H-24. Hand held red flare detectability varies by type of SRU, and also by time on task for surface SRUs. Estimated sweep widths for hand held red flares are given in Table H-23. Life ring and life jacket strobe light detectability varies by type of SRU and time on task, and also by wind speed for surface SRUs. Estimated sweep widths for life ring/life jacket white strobes (50,000 peak candlepower) are given in Table H-24.

Table H-22 Visual Sweep Width Estimates for Night Detection Aids

Device	*Estimated Sweep Width (NM)*	*SRU Type*
Strobe (2,000 candlepower peak)	0.5	Air or surface
Cyalume personnel marker light	1.0	Air or surface
Electric flashing SOS lantern or hand flashlight	3.0	Air or surface
Tracer bullets	4.0	Air or surface
Red Very signals	8.0	Air or surface
Aircraft marine markers	8.0	Air or surface
Red pen gun flare	8.0	Air or surface
Red meteor (star) or parachute flare (10,000 candlepower)	10.0 or twice limit of survivor/ SRU visibility	Air or surface

Table H-23 Visual Sweep Width Estimates for Hand Held Red Flare (500 candlepower)[1]

SRU Type	*Time on Task (hr)*	
	< 3	*≥ 3*
Small boat (41' UTB)	10.7	10.2
Vessel (90' WPB)	13.0	12.6
Air*	15.4	

*Sweep width based on test results involving helicopters only.

Table H-24 Visual Sweep Width Estimates for Life ring/Life jacket White Strobe (50,000 peak candlepower)[1]

Surface SRU	*Time on Task (hr)*	
Wind Speed (kts)	*< 3*	*> 3*
<10	3.9	2.1
10-15	2.6	1.1
*>15**	1.3	0.5

Air SRU**	*Time on Task (hr)*	
	< 1	*> 1*
	4.4	3.9

*Values for this category were extrapolated from test data.
**Based on test results with helicopters only.

H.5.5.7 EPIRB/ELT Sweep Widths

(a) The detection range data obtained from various sources may be tabulated as maximum, average, or minimum ranges:

(1) *Maximum detection range* - range at which a target is first detected which is the maximum of a series of such ranges taken on the target.

(2) *Minimum detection range* - range at which a target is first detected which is the minimum of a series of such ranges taken on the target.

(3) *Average detection range* - range that is the average of a series of ranges at which a target is first detected.

(b) The following guidelines, listed in order of preference, are recommended for developing an EPIRB/ELT sweep width:

(1) When minimum detection range is known: W = (1.7) x (minimum detection range).

(2) When average detection range is known: W = (1.5) x (average detection range).

(3) When maximum detection range is known: W = (1.0) x (maximum detection range).

(4) When no detection range is known: W = (0.5) x (horizon range), using horizon range table (Table H-39).

(c) If search aircraft VHF/UHF antennas are located on top of the aircraft or in the tail, the sweep widths determined by these rules should be reduced by 25 percent.

(d) Sweep width should be cut in half if searching in mountainous regions.

H.5.5.8 Radar Sweep Widths. Radar is primarily used for maritime search. Most aircraft radars available for SAR would be unlikely to detect typical search objects on land except for metal wreckage or vehicles in open desert or tundra. Sweep width depends on the type of radar, height of eye to the horizon, environmental clutter and noise, radar cross section of the search object, radar beam refraction due to atmospherics, and sensor operator ability.

This section provides sweep widths for a limited range of radar systems, search object types and sea conditions. For other radars, search objects and sea conditions, the manufacturer's detection performance estimates should be used when available. Manufacturers should have completed extensive testing of their products, and may be able to provide detection capabilities for particular objects and specified environmental conditions. If this information is not available, the SMC may ask radar operators for estimates of sweep width based on operational experience. An experienced radar operator familiar with the assigned radar should be able to offer fairly accurate estimates of effective (not maximum) detection range. Radar operators should be told that the effective detection range is the range at which they believe the search object will certainly be detected under prevailing conditions. Sweep width can be calculated as about twice this estimate of effective range. Sweep width estimates for small fiberglass or wooden craft that may be capsized are based on the assumption that the object has no engine or significant metal equipment exposed. Another way to estimate sweep width is to estimate the range beyond which the number of a given type of object that are detected will equal the number missed at closer ranges if it is assumed that such objects are uniformly distributed over the sea surface. Twice this range is the effective sweep width.

(a) **Significant Wave Height** is the height of seas that will typically be reported by an experienced mariner and was used in the development of the radar sweep width tables. Sweep widths for significant wave heights over 5 feet are not reported below because little data has been collected under these conditions, and most radars show excessive sea return (clutter) in these conditions.

(b) **Surface Vessel Radar.** The following information should be considered when planning searches utilizing surface vessel radars:

(1) The effective search range of radars varies greatly. (The AN/SPS-64 (V) was found to be more effective for small objects than the AN/SPS-66 model.)

(2) The AN/SPS-64 (V) and AN/SPS-66 radars both provided better search performance against small objects when the 3 NM range scale was used than when the 6 NM scale was used.

(3) The AN/SPS-73 radar was evaluated on the 6 NM range scale in low sea state only. While the AN/SPS-64 (V) and AN/SPS-66 radars were evaluated against small boats, the AN/SPS-73 was evaluated only against life rafts. A comparison of the low sea state sweep widths indicates that better search performance can be expected when using the AN/SPS-73.

(4) Surface vessel radar sweep widths for small search objects should only be applied in low sea states as tabulated below. For example, radar sweep width for 4-10 person life rafts without radar reflectors is nil when winds exceed 15 knots.

(5) Radar reflective devices significantly improved detection probability.

(6) The decision of whether or not to utilize the surface vessel radar in a search, especially if it requires dedicating a crewperson who could be used for visual search, should be based on a comparison of the radar sweep width to those for other available sensors. Surface radar searches will generally be preferred when visibility is poor, sea state is low to moderate, and the search object is equipped with a radar reflector. Radar sweep widths deteriorate rapidly with the onset of precipitation, higher winds and/or higher seas.

(7) Visual scanners should concentrate on the area in the immediate vicinity of the search unit during low visibility radar searches to avoid missing objects that pass close aboard through the area of heavy radar sea return.

(c) **For Surface Vessel Radar (SVR)**, the sweep widths in Tables H-25 and H-26 can be used, based upon limited at-sea testing with the AN/SPS-64(V) ,AN/SPS-66 and AN/SPS-73 radars. Because the AN/SPS-73 sweep widths achieved against life rafts are substantially higher than those achieved by the AN/SPS-64(V) against small boats, it is recommended that the life raft sweep width values also be used for small boats until more specific information is available for the AN/SPS-73.

(1) For intermediate-size objects in significant wave heights less than 5 feet, the information from Table H-28 must be interpolated. For significant wave heights greater than 5 feet, sweep width should be estimated by an experienced radar operator on the basis of sea state and search object characteristics.

(2) When windy conditions cause heavy sea clutter, SVR search patterns oriented with major search legs in the crosswind direction and crosslegs in the downwind direction provide the best radar coverage. However, sea conditions may inhibit searching in this manner.

(3) Although the AN/SPS-66 small boat radar is no longer in service, no sweep width data is yet available for the AN/SPS-69 or SINS radars that replaced it. In the absence of new information, the AN/SPS-66 sweep widths may be used as conservative estimates of small boat radar sweep widths.

Table H-25 Sweep Widths and Recommended Settings for AN/SPS-73 Radar (4-10 person life rafts with and without radar reflectors)

	SWEEP WIDTHS FOR AN/SPS-73 RADAR (Nautical Miles)				
WEATHER	OBJECT TYPE	On scene Surface Winds (kts)			
		<5	to 10	to 15	>15
No Rain or Drizzle	Raft w/ reflector	10.6	8.6	5.8	unknown
	Raft w/o reflector	5.1	2.5	0.9	nil
Moderate Rain	Raft w/ reflector	8.3	4.7	1.7	unknown
	Raft w/o reflector	4.3	1.5	0.3	nil
RECOMMENDED SETTINGS	Range Scale:	6 NM range scale			
	Pulse Width:	M1 pulse width (AUTO)			
	STC:	Zero			
	FTC: for rain	Less than 80% for no rain, at least 80%			
	Persistence:	No higher than 15			
	Interference Rejection:	ON at 100%			

Table H-26 Sweep Widths for Surface Vessel Radar (NM)

Object Type	*Significant Wave Height (ft)*	*Sweep Width (NM) Surface Vessel Radar System*	
		AN/SPS-64(V)	*AN/SPS-66*
Small (20 feet or less) fiberglass boats, without radar reflector or engine/metal equipment	0 to 1	1.4	0.8
	>1 to 5	1.1	0
Small (20 feet or less) fiberglass boats, with radar reflector or engine/metal equipment	0 to 1	5.0	2.0
	>1 to 5	1.6	0.4
Medium to large vessels (40 feet or over) with significant amounts of reflective material	0 to 3	13	9.5

(d) **Forward-Looking Airborne Radar (FLAR).** Research has been conducted on various fixed wing aircraft to determine the detection capabilities of FLARs for SAR operations. From detection data collected under realistic search scenarios estimates of sweep width have been calculated.

(1) The AN/APS-137 FLAR is an X-band, air-to-surface Inverse Synthetic Aperture Radar (ISAR) that provides high resolution, small-target detection, weather avoidance, sea surveillance, and Doppler display. The AN/APS-137 system has special selectable features that enhance system performance against weak targets. Sweep widths for conducting and planning AN/APS-137 (aircraft) SAR searches are summarized in table H-27 with consideration of the following general recommendations:

- Search altitude - 1500 feet or lower.
- Search speed - 180-220 knots IAS.
- Use only 16 NM range scale for life raft searches.
- Search full radar display, do not limit search by track spacing.
- Screen cursor may hide weak targets.
- Refresh radar screen when 1/4 of display in front of the aircraft is off-screen.

Table H-27 Sweep Widths for Forward-Looking Airborne Radar (AN/APS-137)

16 Nautical Mile Radar Range Scale (Sweep Width in Nautical Miles)										
	On-scene Surface Winds (kts)									
Object Type	*< 5*	*to 10*	*to 15*	*to 20*	*to 25*	*to 35*	*to 45*	*to 55*	*to 65*	*> 65*
4 to 10 person life raft	12.1	8.6	3.1	0	0	0	0	0	0	0
17 to 25 foot recreational boat	13.6	11.9	8.2	2.8	0	0	0	0	0	0
26 to 35 foot recreational boat	16.6	16.3	15.4	14.2	12.6	9.5	3.9	0	0	0
36 to 50 foot recreational boat	21.0	20.7	19.9	18.9	17.5	14.7	9.8	3.5	0	0

32 Nautical Mile Radar Range Scale (Sweep Width in Nautical Miles)										
	On-scene Surface Winds (kts)									
Object Type	*< 5*	*to 10*	*to 15*	*to 20*	*to 25*	*to 35*	*to 45*	*to 55*	*to 65*	*> 65*
17 to 25 foot recreational boat	17.4	15.7	12.0	6.6	0	0	0	0	0	0
26 to 35 foot recreational boat	22.1	21.7	20.9	19.7	18.1	14.9	9.3	2.1	0	0
36 to 50 foot recreational boat	29.0	28.7	27.9	26.9	25.5	22.7	17.8	11.5	3.8	0

(2) The RDR-1300 model radar is found on the HH-65 and HH-60J aircraft. This radar is comparable to the APN-215 and the sweep width tables corresponding to the APN-215, Table H-28, are applicable. For searches using the RDR-1300, APN-215, APS-133 and APS-127 FLAR (Tables H-28 and H-29) the following guidance is provided:

(i) Sweep widths for small objects in significant wave heights of 5 feet or greater decrease rapidly to zero.

(ii) Detection range is more often limited by either clutter or signal-to-noise ratio than by horizon distance.

(iii) AN/APS-127 searches should be conducted at lower altitudes whenever flight operations permit, particularly when seas are greater than two feet, because higher altitudes tend to enhance sea return.

(iv) The AN/APS-127 provides a useful detection capability for life rafts when the 10NM scale is used. The 20NM range scale may degrade detection capability at each range interval but the doubling of the range scale leads to a greater sweep width. Either the 10 or 20NM range scale is effective against 24 to 43 foot boats.

(3) The AN/APS-143 ISAR is carried in the HU-25D aircraft. No sweep width data are yet available for this system. In the absence of system-specific sweep width data for the AN/APS-143, sweep widths for the AN/APS-137 may be substituted but should be considered an upper bound. While both ISAR radars are designed for high performance air-to-surface maritime search, the HU-25D carries a smaller antenna and operator display than the HC-130.

(4) The AN/APG-66 multi-mode radar is carried on the HU-25C aircraft. No sweep width data is available yet for this system.

Table H-28 Sweep Widths for Forward-Looking Airborne Radar (AN/APS-133, AN/APN-215)

Object Type	*Significant Wave Height (ft)*	*Sweep Width (NM) Radar System*	
		AN/APS-133 MAP-1 and MAP-2 Modes	*AN/APN-215 SEARCH-1 and SEARCH-2 Modes*
Small (20 feet or less) fiberglass boats, without radar reflector or engine/ metal equipment	0 to 1	7	4
	>1 to 3	2	2
Small (20 feet or less) fiberglass boats, with radar reflector or engine/metal equipment	0 to 1	8	6
	>1 to 3	3	3
Medium to large (40 to 100 feet) targets with significant amounts of reflective material	0 to 1	40	40
	>1 to 5	4	4
Metal targets longer than 100 feet	0 to 1	>50	>50
	>1 to 5	16	16

Table H-29 Sweep Widths for Forward-Looking Airborne Radar (AN/APS-127)[2]

Object Type	*Range Scale(NM)*	*Search Altitudes(FT)*	*Significant Wave(FT)*	*Sweep Width(NM)*
6 to 10 person life rafts	10	500 to 4500	< 2	5.4
			2 to 5	1.8
			> 5	nil
24 to 43 foot boats	10	500 to 1000	< 2	12.8
			2 to 5	10.8
			6 to 10*	6.3
			> 10*	3.1
		1100 to 2400*	< 2	11.2
			2 to 5	9.2
			6 to 10	4.7
			> 10	2.3
		2500 to 5000	< 2	8.5
			2 to 5	7.2
			6 to 10*	3.5
			> 10*	1.5
6 to 10 person life rafts	20	500 to 4500	< 2	7.0
			2 to 5*	1.8
			> 6*	nil
24 to 30 foot boats	20	500 to 4000	< 2	14.1
			2 to 5*	7.0
			6 to 10*	4.9
			> 10*	2.4
31 to 43 foot boats	20	500 to 4000	< 2	24.9
			2 to 5*	15.3
			6 to 10*	7.0
			> 10*	3.5

*Values for this category were extrapolated from test data.

(e) **Side-Looking Airborne Radar (SLAR).** The MSS-5000 SLAR, which is a digital display/record upgrade to the AN/APS-135 SLAR, is currently available for use on up to two HC-130s at CGAS Elizabeth City. Unlike conventional search radars that constantly refresh the image of a large area, SLAR takes "snapshots" of the areas immediately to either side of a moving aircraft. The result is a moving surface map display that depicts a single "look" at any given location.

(1) The AN/APS-131 model SLAR, which was part of the HU-25B AIREYE oil spill reconnaissance system, has been decommissioned.

(2) Recommended sweep widths for SLAR on Coast Guard aircraft are shown in Table H-30. Specific findings of the research that are of interest to SAR planners are:

(i) SLAR models tested are capable of detecting 180-foot ships nearly 100% of the time in seas up to at least 6 feet and ranges up to 30 NM.

(ii) Objects as small as 16-foot boats with metal equipment (engine, gas tanks, frames, etc.) can be detected better than 90% of the time in seas less than 3 feet and 30% - 50% of the time in seas of 3-6 feet. These objects can be detected in low sea states out to the 30 NM swath width limit.

(iii) Four to ten person life rafts can be detected 40% to 70% of the time in seas less than 3 feet, but can be detected less than 15% of the time in seas of 3 to 6 feet.

(3) Presently these SLAR equipped aircraft are the primary iceberg surveillance platforms for the International Ice Patrol (IIP).

(4) SLAR has limited use during a search. SLAR is essentially an aerial surveying system. To adequately survey an area, the aircraft must fly level and straight. The SLAR aircraft or other SRUs must then identify any objects detected on the stored radar image.

(f) **Sweep widths for Side-Looking Airborne Radar (SLAR)**, based on tests of the AN/APS-94D SLAR systems, are given in Table H-32. Limited tests of the AN/APS-135 conducted with IIP indicate that the MSS-5000 should perform somewhat better than the sweep widths tabulated below.

(1) Sweep widths are based on altitudes of 2,500 to 4,000 feet for objects under 40 feet long, and 8,000 feet for objects over 40 feet long, with range scales no greater than 27 NM.

(2) SLAR is usually capable of searching large areas to either side of the aircraft and includes a digital record of the search that can be replayed for extended analysis.

(3) Search legs should be aligned upwind and downwind so that the radar signal is aimed crosswind at all times. This tactic allows the largest possible area to be searched without contending with heavy upwind sea clutter.

(4) When time and resources are sufficient to conduct multiple searches of an area, search tracks for the second search should be offset from the first search to compensate for the blind zone adjacent to aircraft ground track. The commence search point (CSP) for the second search is offset a distance at least equal to the blind zone width, which is approximately twice the search altitude.

Table H-30 Sweep Widths For Side-Looking Airborne Radar (NM)

Target Type	*Significant Wave Height (ft)*	
	0 to 1	*>1 to 5*
Fiberglass or wooden boats, 20 feet or less, without radar reflector or engine/ metal equipment	16	<6
Fiberglass or wooden boats, 20 feet or less, with radar reflector or engine/metal equipment	21	6
Life rafts, 4 to 10 persons without radar reflectors	12	<5
Objects, 40 to 100 feet, with significant metal equipment	47	24
Metal targets longer than100 feet	57	54

H.5.5.9 Other Sensor Sweep Widths

(a) **Forward-Looking Infrared (FLIR) Systems.** FLIR detects thermal (heat) energy and can be used day or night. It is adversely affected by rain and moderate to heavy fog because water readily absorbs thermal energy. Section 5.6 of this Addendum lists which Coast Guard aircraft carry FLIR capability. The MARFLIR system is carried by most WHECs and WMECs, and FLIR is becoming available on some CPBs and WPBs.

(b) **FLIR Sweep Widths.** Sweep widths and recommended system settings for MARFLIR, based on limited testing with life rafts, are given in Table H-31. Sweep widths should be approximated, using an experienced operator's best estimate of effective detection ranges for other FLIR systems, search object types and field of view/scan width limits. Operators should be told the effective detection range is the range at which they believe the object will certainly be detected under prevailing conditions. Sweep width should not exceed the effective azimuthal coverage of the FLIR system in use, regardless of object size. Figure H-23 illustrates a means of estimating FLIR sweep width using input from an experienced sensor operator.

(1) No sweep width data are yet available for Coast Guard airborne FLIRs.

(2) All FLIR systems have a limited field of view (FOV), and most offer multiple magnifications. Higher magnification means smaller FOV.

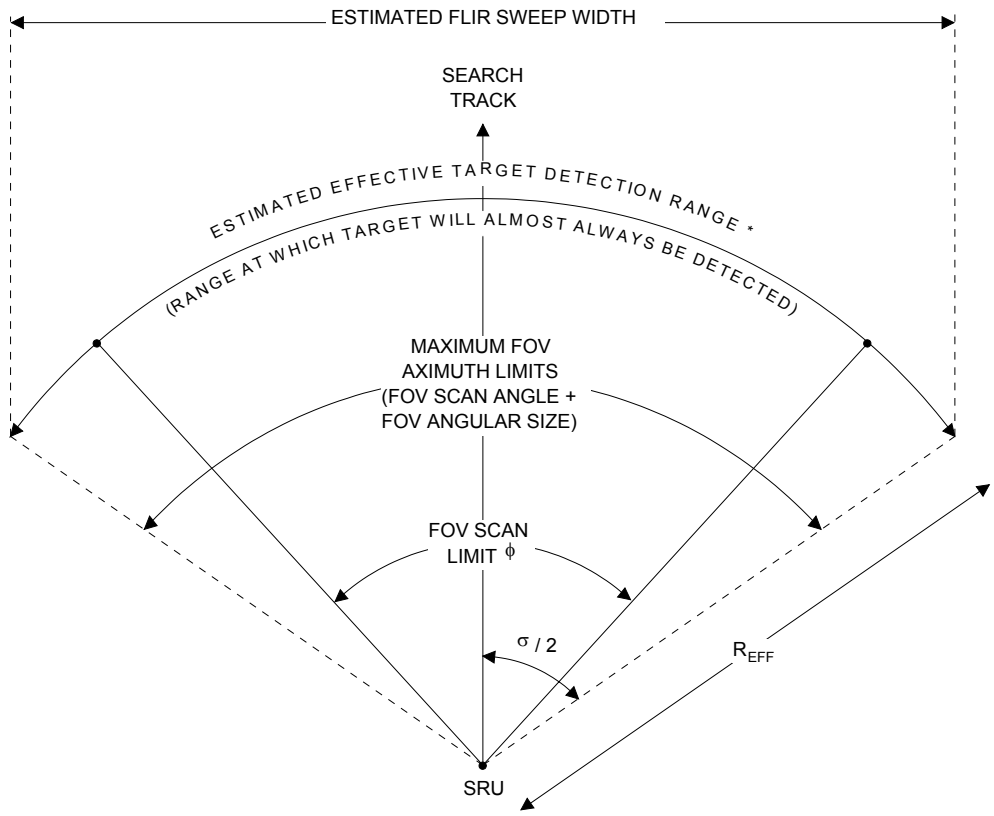
(3) Longer detection ranges achieved by using high magnification/small FOV must be balanced against the effective area coverage that can be achieved without leaving gaps.

(4) Many FLIRs have automated scan modes that can be set by the operator to help achieve more consistent area coverage. Options vary from system to system.

Table H-31 Sweep Widths and Recommended Settings for MARFLIR (4-10 person life rafts).

SWEEP WIDTHS FOR MARFLIR (4-10 person life rafts) (Nautical Miles)		
Daylight (nm)	**Sweep Width at Dusk/Night (nm)**	
5.0	**3.0**	
RECOMMENDED SETTINGS *	Sensor:	FLIR
	Polarity:	White Hot**
	Level Control:	Automatic**
	Zoom:	½ to ¾ of maximum zoom
	Extender:	Off
	Scan Rate:	30 to 45 degrees per minute***
	Scan Limit:	$000^{o}R \pm 90^{o}$

* **Search unit speed is assumed to be 10 knots.**
** Use of Black Hot polarity requires manual level control.
*** The 45-degrees/minute scan rate should only be used under favorable conditions, i.e., when high contrast is anticipated between the raft and background.



*FOR PREVAILING ENVIRONMENTAL CONDITIONS

NOTE: THE MAXIMUM FIELD OF VIEW (FOV) AZIMUTH LIMIT SHOULD BE USED ONLY IF COMPLETE AREA COVERAGE CAN BE ACHIEVED WITHIN THE EFFECTIVE TARGET DETECTION RANGE. OTHERWISE, A NARROWER FOV SCAN LIMIT SHOULD BE USED IN CALCULATING SWEEP WIDTH.

EXAMPLE CALCULATION

ϕ = FOV SCAN LIMIT (ANGLE THROUGH WHICH FLIR CAMERA SCANS) = 60 °
σ = MAXIMUM FOV AZIMUTH LIMITS (FOV SCAN ANGLE + FOV ANGULAR SIZE) = 90 °
R_{EFF} = ESTIMATED EFFECTIVE TARGET DETECTION RANGE = 3 nm
ESTIMATED SWEEP WIDTH = 2 SIN (σ / 2) x R_{EFF} = 2 SIN (45 °) x 3 nm = 4.2 nm

Figure H-23 Estimated FLIR Sweep Width

(c) **Night Vision Goggles (NVG).** Many SAR incidents occur or become known to the Coast Guard during the afternoon or night. The greatest benefit of NVG is that this sensor enables searchers to conduct effective searches at night, thus search planners will not have to wait until first light the following day to begin effective visual searches. This will increase the probability of survival for those persons in distress. Research showed NVG searches from UTBs are not recommended because the lookouts are prone to seasickness when using NVG, but they are effective from aircraft.

(1) **NVG Search Sweep Widths for Helicopters.** Select the base sweep width (BSW) for Boat, Raft or PIW search object from Table H-32. Illuminated search is a NVG search using one or two helicopter landing lights, or where available, an IR source of illumination, during the search. Select the appropriate environmental situation correction factors from Table H-32a for PIW or Table H-32b for boat/raft. Enter the base sweep width and environmental correction factors in the following equation to calculate the NVG sweep width:

$$BSW \times MVPHS \times CLDC \times VIS \times \left(\frac{Hs + WHCAPS}{2} \right) \times FATIGUE = SWEEPWIDTH$$

Correction factor for number of searchers: Base sweep widths always assume a 4-person NVG search. If only 3 persons are searching with NVGs, a correction factor must be applied. For Boat/Raft targets the correction factor is 0.8, and for PIWs the correction factor is 0.9. The correction factor should be applied to the sweep width calculated above.

(2) **NVG Search Sweep Widths for Vessels.** Table H-33 provides sweep width estimates for unlighted targets from a 210' WMEC. The values provided can be used as a guide for other unlit targets of similar size and for use of NVGs used from other surface craft.

(3) Other considerations for NVG use:

- During searches with NVGs for lighted targets, the sweep width should be a value equal to the lesser of the distance to the visual horizon or the estimated meteorological visibility.
- During searches for the green chemical Personal Marker Lights, NVGs should not be used because the filters used filter the green chemical light wavelength.
- The use of NVGs during searches from UTBs has found to be of limited value. Night searches should not be conducted from UTBs with NVGs used as the primary search sensor.

Table H-32 Base Sweep Widths (BSW) for NVG - Helicopters

Search Object		Search Type	
		Illuminated	Non-Illuminated
PIW [1]	w/o PFD or retro-reflective material	0.05	0.01
	w/ PFD	0.6	0.1
Rafts (canopies with retro-reflective material)	1 or 2-person	0.7	0.6
	4-person	0.9	0.8
	6-person [2]	1.0	0.9
	8-person	1.1	1.0
	10-person	1.2	1.1
	15-person	1.4	1.3
	20-person	1.6	1.4
	25-person	1.7	1.5
Boats (no lights or retro-reflective material)	8 to 12 ft	0.4	0.4
	13 to 19 ft [3]	0.8	0.8
	20 to 25 ft [4]	1.2	1.1
	26 to 35 ft	1.8	1.6
	36 to 45 ft	2.2	2.1
	46 to 55 ft	2.5	2.3

1 – values are estimates 2 – based on measured data 3 – based on 18-ft skiff data 4 – based on 21-ft skiff data

Table H-32a Environmental Situation Correction Factors for PIW

Environmental Condition		Search Type	
		Illuminated	Non-Illuminated
Moon Visible & Phase (MVPHS)	> 75%	1.1	1.4
	25 to 75%	1	1
	Moon not Visible or < 25%	0.9	0.7
Cloud Cover (CLDC)	< 25%	1.1	1.1
	25 to 75%	1	1
	> 75%	0.9	0.9
Visibility (VIS)	≥ 2 nm	1	1
	> 0.5 to < 2 nm	0.8	0.7
	≤ 0.5 nm	0.6	0.3
Significant Wave Height (Hs)	0 to < 3 ft	1.2	1.7
	3 ft	1	1
	> 3 to 6 ft	0.8	0.5
Whitecaps (WHCAPS)	None	1.1	1.3
	Few	1	1
	Many	0.9	0.8
Fatigue Factor (FATIGUE)	Rested (0 to 3 hr NVG search)	1	1
	Fatigued/Very Fatigued (> 3 to 6 hrs)	0.9	0.9

Table H-32b Environmental Situation Correction Factors for Boat/Raft

Environmental Condition		Search Type	
		Illuminated	Non-Illuminated
Moon Visible & Phase (MVPHS)	> 75%	1.15	1.32
	25 to 75%	1	1
	Moon not Visible or < 25%	0.88	0.76
Cloud Cover (CLDC)	< 25%	1.27	1.27
	25 to 75%	1	1
	> 75%	0.82	0.82
Visibility (VIS)	≥ 2 nm	1	1
	> 0.5 to < 2 nm	0.83	0.83
	≤ 0.5 nm	0.57	0.57
Significant Wave Height (Hs)	0 to < 3 ft	1.28	1.28
	3 ft	1	1
	> 3 to 6 ft	0.74	0.74
Whitecaps (WHCAPS)	None	1.13	1.13
	Few	1	1
	Many	0.87	0.87
Fatigue Factor (FATIGUE)	Rested (0 to 3 hr NVG search)	1	1
	Fatigued (> 3 to 4 hrs on NVGs)	0.9	0.9
	Very Fatigued (> 4 to 6 hrs)	0.8	0.8

Table H-33 Sweep Width Estimates for Unlighted Targets from 210' WMEC

Target	Seas at and Below 5 Feet	Seas Above 5 Feet
4 Person life raft	0.5	0.2
6 Person life raft	0.8	0.3
8 Person life raft	1.0	0.4
10 Person life raft	1.5	0.6
15 Person life raft	1.5	0.7

H.5.5.10 Multisensor Sweep Width Considerations

(a) Environmental parameters limit all types of search methods. Multisensor searching, both sensor and combinations of sensor and visual, can be used to mitigate environmental limitations. Table H-34 outlines various ways in which radar, infrared, and visual searches can be combined to complement each other and possibly overcome some environmental conditions.

(b) Sweep width values for various combinations of search sensors, based on the type of conditions, type of target, and sensors used, are presented in tables that follow.

(c) Combined sensor searches should be planned so that sensor capabilities complement each other. Search patterns and track spacing should be selected on the basis of the effectiveness of the different SRU sensors available. The most effective sensor should be favored and controllable parameters, such as speed and altitude, should be selected to maximize the performance of the most capable sensor.

(d) Multisensor searches are normally assigned only if they provide the maximum sweep width possible with the available personnel. Scanners should not be manning sensors ineffective for the search conditions if they might be used as visual scanners.

(e) Visual searching may supplement sensor coverage by filling in blind zones created by antenna configuration and physical or operational limitations of the electronic equipment.

Table H-34 Environmental Limitations and Multisensor Search

Environmental Limitation	*Visual*	*Radar*	*Infrared*
Darkness	Very limited detection capability	Short- and long-range target detection, but no identification	Short-range target detection/identification of long-range radar targets after closing
Poor visibility (daylight)	Detection and identification to limit of visibility	Short- and long-range target detection, but no identification	May extend limits of visibility when haze limits detection by naked eye
High sea state	Reduced effectiveness, but some ability to distinguish target from whitecaps	Detection of medium/ large targets only Many false targets	Short-range target detection/identification Better than visual search only at night or with high thermal contrast target

H.5.5.11 SLAR/Visual. The multi-sensor sweep width tables assume searching at 200 knots at 2000 feet altitude. Combined sweep widths for metal-hulled objects over 40 feet long are estimated to be the same as for SLAR search alone.

Table H-35 SLAR/Visual Weather Conditions

Parameter	*Good Conditions*	*Fair Conditions*
Wind Speed	8	15
Significant Wave Height (ft)	0.5	2
Visibility (NM)	10	5
Cloud Cover (%)	50	100
Time on Task (hr)	2	2
Search Speed (knots)	200	200
Search Altitude (ft)	2000	2000

Table H-36 SLAR/Visual Sweep Widths (NM)

Object Type	*Environmental Conditions*	
	Good	*Fair*
High-Contrast (e.g. white), 16- to 21-ft Fiberglass or Aluminum Boat with Engine and/or Other Metal Equipment	22.0	21.8
Medium-Contrast (e.g. Blue), 16-ft Fiberglass Boat Without Engine or Other Metal Equipment	17.1	16.8
Low-Contrast (e.g. Black), Life Raft without Metal Equipment or Canopy	13.7	13.3

* "Good" and "Fair" environmental conditions from Table 4-19.

H.5.5.12 SVR/Visual. Combined sweep widths for targets with a radar cross section of at least 50 square meters are estimated as twice the radar horizon range in conditions up to sea-state 3. For vessels with antenna heights above 30 feet, sweep widths in the tables should be considered as minimum values since the radar horizon will be longer for these SRUs.

Table H-37 UTB SVR/Visual Sweep Width for Targets With Radar Reflectors

Environmental Conditions	*High-Contrast 16-Ft Boat or Life Raft w/ Canopy*	*Medium-Contrast 16-Ft Boat or Life Raft w/o Canopy*	*Low-Contrast Life Raft w/o Canopy*
Good Weather; 0.5-ft Seas	3.6	3.2	3.0
Fair Weather; 3-ft Seas	1.1	0.8	0.7
Light Rain (1 mm/hr); 1-ft Seas	3.0	2.6	2.5
Moderate Rain (4 mm/hr); 1-ft Seas	2.2	1.8	1.6
Heavy Rain (16 mm/hr); 2-ft Seas	0.8	0.7	0.6
Moderately Heavy Snow (4 mm/hr of water); 2-ft Seas	0.7	0.6	0.6
Dense Fog (100-ft visibility); 0.5-ft Seas	1.9	1.9	1.9

Note: Sweep widths are rounded to nearest 0.1 nautical mile.

Table H-38 UTB SVR/Visual Sweep Width for Targets Without Radar Reflectors

Environmental Conditions	*High-Contrast 16-Ft Boat or Life Raft w/ Canopy*	*Medium-Contrast 16-Ft Boat or Life Raft w/o Canopy*	*Low-Contrast Life Raft w/o Canopy*
Good Weather; 0.5-ft Seas	3.5	3.0	2.9
Fair Weather; 3-ft Seas	*	*	*
Light Rain (1 mm/hr); 1-ft Seas	2.7	2.3	2.1
Moderate Rain (4 mm/hr); 1-ft Seas	2.1	1.6	1.4
Heavy Rain (16 mm/hr); 2-ft Seas	0.4	0.3	0.3
Moderately Heavy Snow (4 mm/hr of water); 2-ft Seas	0.2	0.2	0.1
Dense Fog (100-ft visibility); 0.5-ft Seas	0.4	0.4	0.4

Note: Sweep widths are rounded to nearest 0.1 nautical mile.
* The AN/SPS-66 radar was unable to detect targets without radar reflectors in these conditions. Visual sweep width alone applies.

Table H-39 WPB SVR/Visual Sweep Width for Targets With Radar Reflectors

Environmental Conditions	*High-Contrast 16-Ft Boat or Life Raft w/ Canopy*	*Medium-Contrast 16-Ft Boat or Life Raft w/o Canopy*	*Low-Contrast Life Raft w/o Canopy*
Good Weather; 0.5-ft Seas	5.5	5.1	5.1
Fair Weather; 3-ft Seas	1.7	1.6	1.6
Light Rain (1 mm/hr); 1-ft Seas	4.3	4.1	3.9
Moderate Rain (4 mm/hr); 1-ft Seas	2.5	2.2	2.2
Heavy Rain (16 mm/hr); 2-ft Seas	0.8	0.7	0.7
Moderately Heavy Snow 4 mm/hr of water); 2-ft Seas	1.7	1.7	1.7
Dense Fog (100-ft visibility); 0.5-ft Seas	3.6	3.6	3.6

Note: Sweep widths are rounded to nearest 0.1 nautical mile.

Table H-40 WPB SVR/Visual Sweep Width for Targets Without Radar Reflectors

Environmental Conditions	*High-Contrast 16-Ft Boat or Life Raft w/ Canopy*	*Medium-Contrast 16-Ft Boat or Life Raft w/o Canopy*	*Low-Contrast Life Raft w/o Canopy*
Good Weather; 0.5-ft Seas	4.9	4.3	4.1
Fair Weather; 3-ft Seas	1.3	1.2	1.2
Light Rain (1 mm/hr); 1-ft Seas	3.3	2.7	2.6
Moderate Rain (4 mm/hr); 1-ft Seas	2.1	1.6	1.4
Heavy Rain (16 mm/hr); 2-ft Seas	0.4	0.3	0.3
Moderately Heavy Snow (4 mm/hr of water); 2-ft Seas	0.3	0.2	0.2
Dense Fog (100-ft visibility); 0.5-ft Seas	0.8	0.8	0.8

Note: Sweep widths are rounded to nearest 0.1 nautical mile.

Table H-41 Height of Eye vs. Horizon Range

Height feet	*Nautical miles*	*Statute miles*	*Height feet*	*Nautical miles*	*Statute miles*	*Height feet*	*Nautical miles*	*Statute miles*
1	1.1	1.3	120	12.5	14.4	940	35.1	40.4
2	1.6	1.9	125	12.8	14.7	960	35.4	40.8
3	2.0	2.3	130	13.0	15.0	980	35.8	41.2
4	2.3	2.6	135	13.3	15.3	1,000	36.2	41.6
5	2.6	2.9	140	13.5	15.6	1,100	37.9	43.7
6	2.8	3.2	145	13.8	15.9	1,200	39.6	45.6
7	3.0	3.5	150	14.0	16.1	1,300	41.2	47.5
8	3.2	3.7	160	14.5	16.7	1,400	42.8	49.3
9	3.4	4.0	170	14.9	17.2	1,500	44.3	51.0
10	3.6	4.2	180	15.3	17.7	1,600	45.8	52.7
11	3.8	4.4	190	15.8	18.2	1,700	47.2	54.3
12	4.0	4.6	200	16.2	18.6	1,800	48.5	55.9
13	4.1	4.7	210	16.6	19.1	1,900	49.9	57.4
14	4.3	4.9	220	17.0	19.5	2,000	51.2	58.9
15	4.4	5.1	230	17.3	20.2	2,100	52.4	60.4
16	4.6	5.3	240	17.7	20.4	2,200	53.7	61.8
17	4.7	5.4	250	18.1	20.8	2,300	54.9	63.2
18	4.9	5.6	260	18.4	21.2	2,400	56.0	64.5
19	5.0	5.7	270	18.8	21.6	2,500	57.2	65.8
20	5.1	5.9	280	19.1	22.0	2,600	58.3	67.2
21	5.2	6.0	290	19.5	22.4	2,700	59.4	68.4
22	5.4	6.2	300	19.8	22.8	2,800	60.5	69.7
23	5.5	6.3	310	20.1	23.2	2,900	61.6	70.9
24	5.6	6.5	320	20.5	23.6	3,000	62.7	72.1
25	5.7	6.6	330	20.8	23.9	3,100	63.7	73.3
26	5.8	6.7	340	21.1	24.3	3,200	64.7	74.5
27	5.9	6.8	350	21.4	24.6	3,300	65.7	75.7
28	6.1	7.0	360	21.7	25.0	3,400	66.7	76.8
29	6.2	7.1	370	22.0	25.3	3,500	67.7	77.9
30	6.3	7.2	380	22.3	25.7	3,600	68.6	79.0
31	6.4	7.3	390	22.6	26.0	3,700	69.6	80.1
32	6.5	7.5	400	22.9	26.3	3,800	70.5	81.2
33	6.6	7.6	410	23.2	26.7	3,900	71.4	82.2
34	6.7	7.7	420	23.4	27.0	4,000	72.4	83.3
35	6.8	7.8	430	23.7	27.3	4,100	73.3	84.3
36	6.9	7.9	440	24.0	27.6	4,200	74.1	85.4
37	7.0	8.0	450	24.3	27.9	4,300	75.0	86.4
38	7.1	8.1	460	24.5	28.2	4,400	75.9	87.4
39	7.1	8.2	470	24.8	28.6	4,500	76.7	88.3
40	7.2	8.3	480	28.1	28.9	4,600	77.6	89.3
41	7.3	8.4	490	25.3	29.2	4,700	78.4	90.3
42	7.4	8.5	500	25.6	29.4	4,800	79.3	91.2
43	7.5	8.6	520	26.1	30.3	4,900	80.1	92.2
44	7.6	8.7	540	26.6	30.6	5,000	80.9	93.1
45	7.7	8.8	560	27.1	31.2	6,000	88.6	102.0
46	7.8	8.9	580	27.6	31.7	7,000	95.7	110.2
47	7.8	9.0	600	28.0	32.3	8,000	102.3	117.8
48	7.9	9.1	620	28.5	32.8	9,000	108.5	124.9
49	8.0	9.2	640	28.9	33.3	10,000	114.4	131.7
50	8.1	9.3	660	29.4	33.8	15,000	140.1	161.3
55	8.5	9.8	680	29.8	34.3	20,000	161.8	186.3
60	8.9	10.2	700	30.3	34.8	25,000	180.9	208.2
65	9.2	10.6	720	30.7	35.3	30,000	198.1	228.1
70	9.6	11.0	740	31.1	35.8	35,000	214.0	246.4
75	9.9	11.4	760	31.5	36.3	40,000	228.8	263.4
80	10.2	11.8	780	31.9	36.8	45,000	242.7	279.4
85	10.5	12.1	800	32.4	37.3	50,000	255.8	294.5
90	10.9	12.5	820	32.8	37.7	60,000	280.2	322.6
95	11.2	12.8	840	33.2	38.2	70,000	302.7	348.4
100	11.4	13.2	860	33.5	38.6	80,000	323.6	372.5
105	11.7	13.5	880	33.9	39.1	90,000	343.2	395.1
110	12.0	13.8	900	34.3	39.5	100,000	361.8	416.5
115	12.3	14.1	920	34.7	39.9	200,000	511.6	589.0

H.5.6 Coverage Factor (*C*)

Coverage Factor (*C*) is a measure of search thoroughness or how well an area was searched. It is used as an entering argument when calculating POD. In SAR action messages, *C* should normally be used rather than POD to indicate the coverage required. For patterns of straight equally spaced parallel tracks relative to the search object, the relationship of coverage to sweep width and track spacing is:

$$Coverage\ Factor\ (C) = \frac{Sweep\ Width\ (W)}{Track\ Spacing\ (S)}$$

Sweep width and track spacing are measured in the same units (nautical miles or yards), and *C* is dimensionless. The general relationship among coverage, sweep width (*W*), search speed (*V*), search endurance (*T*) and the amount of area (*A*) covered is:

$$Coverage\ Factor\ (C) = \frac{W \times V \times T}{A}$$

Again, the units of measure must be consistent, such as *W* in nautical miles, *V* in knots, *T* in hours and *A* in square nautical miles. This equation may be used to compute coverage regardless of the type of search pattern or lack of one, so long as the searching effort is spread over the area covered in a reasonably uniform fashion.

Higher coverage factors indicate more a more thorough search. Coverage factors of 0.5 and 1.0 are compared in Figure H-24. If coverage cannot be compromised, then additional SRUs should be found, the area decreased, the time increased, or SRU speed increased.

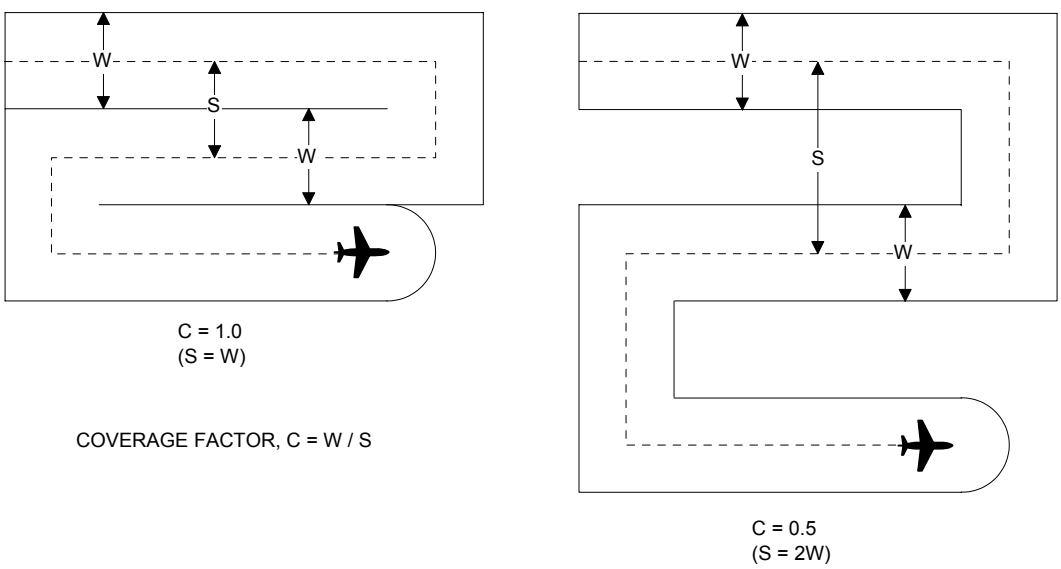


Figure H-24 Coverage Factors

H.5.7 Measures of Search Effectiveness

POS is used as the measure of search effectiveness, **NOT** POD.

H.5.7.1 Probability of Success (POS). Although POD has been in the search planning vocabulary and used with the manual search planning method for many years, it is a little known fact that POS has always been the true measure of search quality. POS depends on two factors: (1) the probability that the object is in the area searched (POC) and (2) the probability of detecting that object if it is present (POD). Probability of Success is the product

of the Probability of Containment and the Probability of Detection: POS = POC x POD. The "safety factors" given in earlier guidance were really optimal search factors that maximized the POS for the levels of effort required to search the recommended search area with a coverage of 1.0. Major shortcomings were that POS and the goal of maximizing its value were not explained, methods for computing its value were not provided because no method for estimating POC was provided, and no provision was made to accommodate levels of effort other than those required to cover the recommended search areas at a coverage of 1.0. This left POD as the only apparent measure of search results, but its limitations in this role were not explained.

POS estimation requires both POD and POC estimates. It is the probability that a given search will succeed in locating the search object. Cumulative POS is the probability that the search should have succeeded by now if all the facts and assumptions that went into developing the search plans and evaluating the search results were substantially correct. Attaining a high POS value without finding the search object is a clear indicator that all of the case data and assumptions need to be carefully reviewed to determine whether an error has been made, whether a plausible scenario was left out, whether some elements of the case data were given more or less credence than they deserved, etc.

H.5.7.2 **POD (Probability of Detection)** is the statistical measure of search sensor detection performance. It is a function of sweep width and track spacing. It is a conditional probability meaning that search planners assume the search object is in the search area.

(a) Probability of Detection is a function of coverage and the total number of searches in an area, and describes the thoroughness of a single search or the cumulative thoroughness of multiple searches of the same area relative to the search object. In maritime SAR, cumulative POD has relatively little meaning because search object motion has a significant random component due to the unpredictable vagaries of winds and currents. Cumulative POD is much more useful when looking for stationary objects using search areas that have fixed boundaries-a common situation in land search.

(b) For any search, the optimum search radius determines the size of the optimum search rectangle for the amount of search effort that is available on scene. This in turn determines the optimum coverage. There are two optimal search factor curves in the *IAMSAR Manual*-one for "ideal" search conditions and one for "poor" or more correctly "normal" search conditions. These optimal search factor curves are based on the two POD vs. Coverage curves shown in Figure H-25. Intermediate values may be used if conditions are between "ideal" and "normal". If in doubt, use the "normal" curves.

(1) Normal conditions include any situation significantly less than ideal. Anytime the corrected sweep width for a search object is less than the maximum uncorrected sweep width for that object, conditions are less than ideal and a value less than the ideal should be used. When the corrected sweep width for a search object is less than 90% of the maximum possible value for that object, the poor conditions curve should be used. Additional discussion on POD curves may be found in the *IAMSAR Manual*.

The "Ideal Search Conditions" curve in Figure H-25 is based on the assumptions that search patterns will be executed precisely, sweep width is accurately known and constant throughout the search, and the search object is in the search area. The "Normal Search Conditions" curve in Figure H-26 relaxes the first assumption but still requires that the searching effort be spread approximately uniformly over the area. The other two assumptions remain intact.

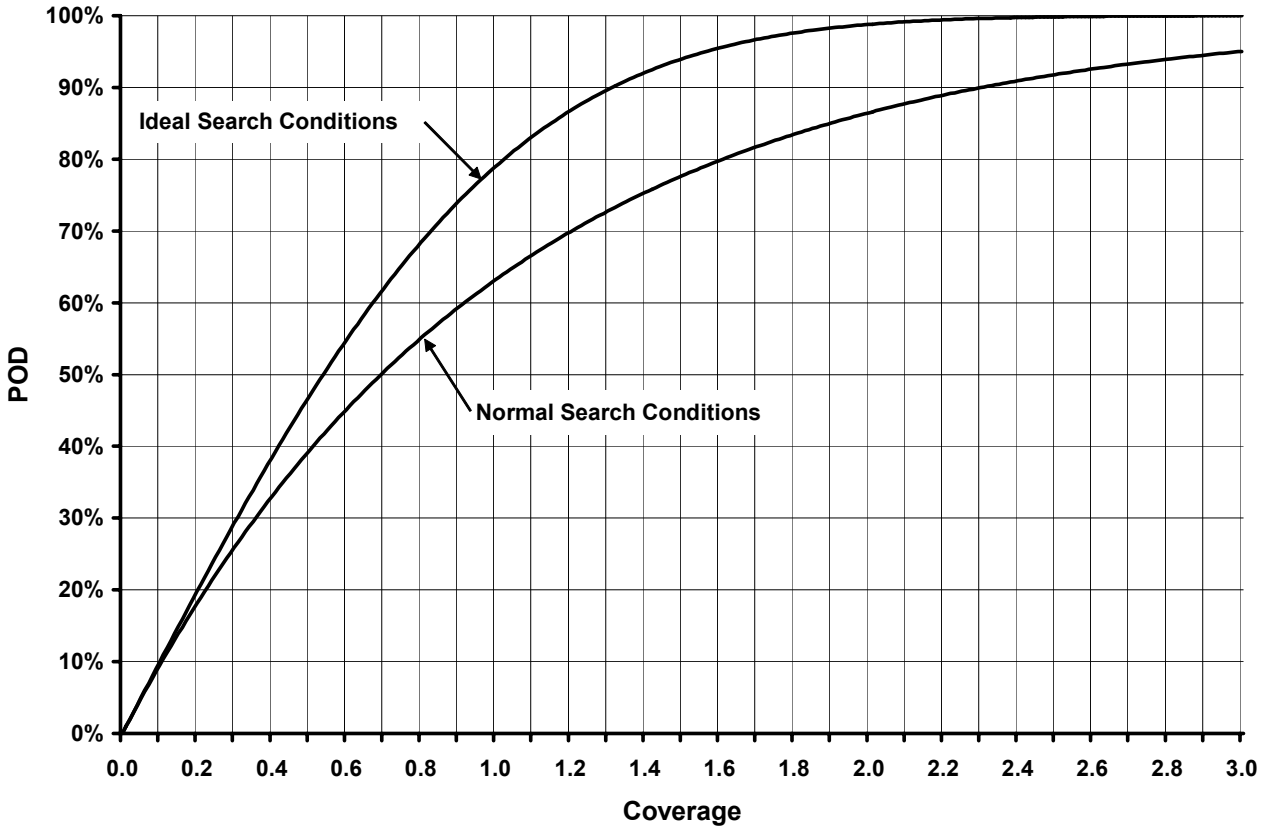


Figure H-25 Maritime Probability of Detection
(Average Probabilities of Detection Over an Area for Ideal: Visual Searches Using Perfect Parallel Sweeps Relative to the Object Under Ideal Conditions Normal: Any Other Object/Sensor/Conditions With A Known Corrected Sweep Width)

(c) Cumulative POD may be calculated from the following equation:

$$POD_{cum} = 1 - \left(\left(1 - POD_1\right) \times \left(1 - POD_2\right) \times \ldots \times \left(1 - POD_n\right)\right)$$

The subscripts 1, 2, …, n indicate that the POD values are for the first, second, …, n^{th} search of the same area relative to the search object. Although maritime search areas usually do not have fixed boundaries, even relative to the updated datum positions, it is reasonable to assume that the cumulative POD value applies in the near vicinity of the updated datum positions used to plan the searches.

An easier way to estimate cumulative POD is to use the "normal search conditions" POD curve as follows:

- If all POD values were obtained from the "normal search conditions" POD curve, then simply add the coverage factor values used to obtain those PODs and use this "cumulative coverage" like any individual coverage value to obtain the cumulative POD from the "normal search conditions" POD curve.
- If some POD values were obtained from the "ideal search conditions" POD curve, it is necessary to first find the corresponding coverage factors for the "normal search conditions" curve. This is done by entering the graph in Figure H-26 from the left with the POD value, moving right to the "normal search conditions POD curve then down to the horizontal axis to get the equivalent "normal search conditions" coverage. Once all coverage values have been referenced to the "normal search conditions" POD curve, they may be added to get an equivalent "cumulative coverage" and used like any other coverage to get the cumulative POD from the "normal search conditions" POD curve.
- If the "cumulative coverage" is greater than 3.0 and therefore off the graph in Figure H-26, the formula

for the "normal search conditions" POD curve is

$$POD_{Normal} = 1 - e^{-C}$$

where e is the base of the natural logarithms. Most scientific hand-held calculators have an "exponential function" or "EXP" key that computes the value of e^x where x is the value entered by the user. Simply enter the coverage or cumulative coverage as a negative number, press the "EXP" or "e^x" key and subtract the result from 1.0 to get the POD or cumulative POD.

A high Cumulative POD for successive searches of an area without locating the search object may indicate the object was not in or has moved out of the search area, has sunk, or has changed characteristics and requires a reevaluation of search area and coverage (e.g., primary target changes from a fishing vessel to a liferaft).

(d) For searches involving multiple resources, the total available effort and the optimal search factor, area, coverage factor and track spacing are computed using the procedures given in Chapter 4 and Appendix L of the *IAMSAR Manual*. This coverage factor may be used with the appropriate search curve of Figure H-26a to determine POD for the total area searched. If the search is unsuccessful, the search area should be expanded, using the procedures given in Chapter 4 and Appendix L of the IAMSAR Manual.. The POD for that particular search may be determined as before.

(e) Inland search POD is discussed in the *IAMSAR Manual* and the *National SAR Supplement*.

H.5.7.3 **POC (Probability of Containment)** is described as the probability that the search object(s) are contained in a particular area. POC values for rectangles centered on the datum position(s) may be inferred from the assumed distribution of possible search object positions around the datum(s). In order to estimate POS for a search it is necessary to have an estimate of the POC for the search area. Figure H-20 shows a graph of POS vs. Search Factor (f_s) for single point and divergent datums. The search radius R is the product of the search factor and the total probable error of position ($R = f_s$ x E).

The optimal search factor curves in the *IAMSAR Manual* were computed for single point datum (square) search areas but are used for both single and divergent datums for the sake of simplicity and because the loss of POS for divergent datums is generally small when compared to the "true" optimal value. It may be possible to improve the POS slightly in the case of divergent datums by modifying the search factor somewhat. A few trials using POC values from the appropriate divergent datums curve above and POD values from the appropriate curve in Figure H-25 should show whether this is worth pursuing. Such trials would involve the following steps:

(1) Using the search factor found from the *IAMSAR Manual* optimal search factor curves, obtain the POC from the most appropriate divergent datums curve above, multiply the search factor by E to get the search radius, compute the area of the resulting rectangle, compute the coverage attainable with the available resources, obtain the expected POD from the appropriate curve in Figure H-25 and compute the expected POS (POS = POC x POD).

(2) Choose a modified search factor and find the corresponding POC from the most appropriate divergent datums curve above, multiply the search factor by E to get a new search radius, compute the area of the resulting rectangle, compute the coverage attainable with the (same) available resources, obtain the expected POD from the appropriate curve in Figure H-25 and compute the new expected POS (POS = POC x POD).

(3) Compare the two POS values and choose the search radius that produces the higher POS.

(4) Repeat this process, if desired, until improvements in POS are no longer significant.

Using computer simulation (CASP) we can develop more general and more realistic containment probabilities (POC) mapped to a cellular grid based upon drift and scenario assumptions. CASP is also able to compute and show the effects of unsuccessful searching on such "probability maps" and use this information to help plan subsequent optimal searches. No other tool has this capability.

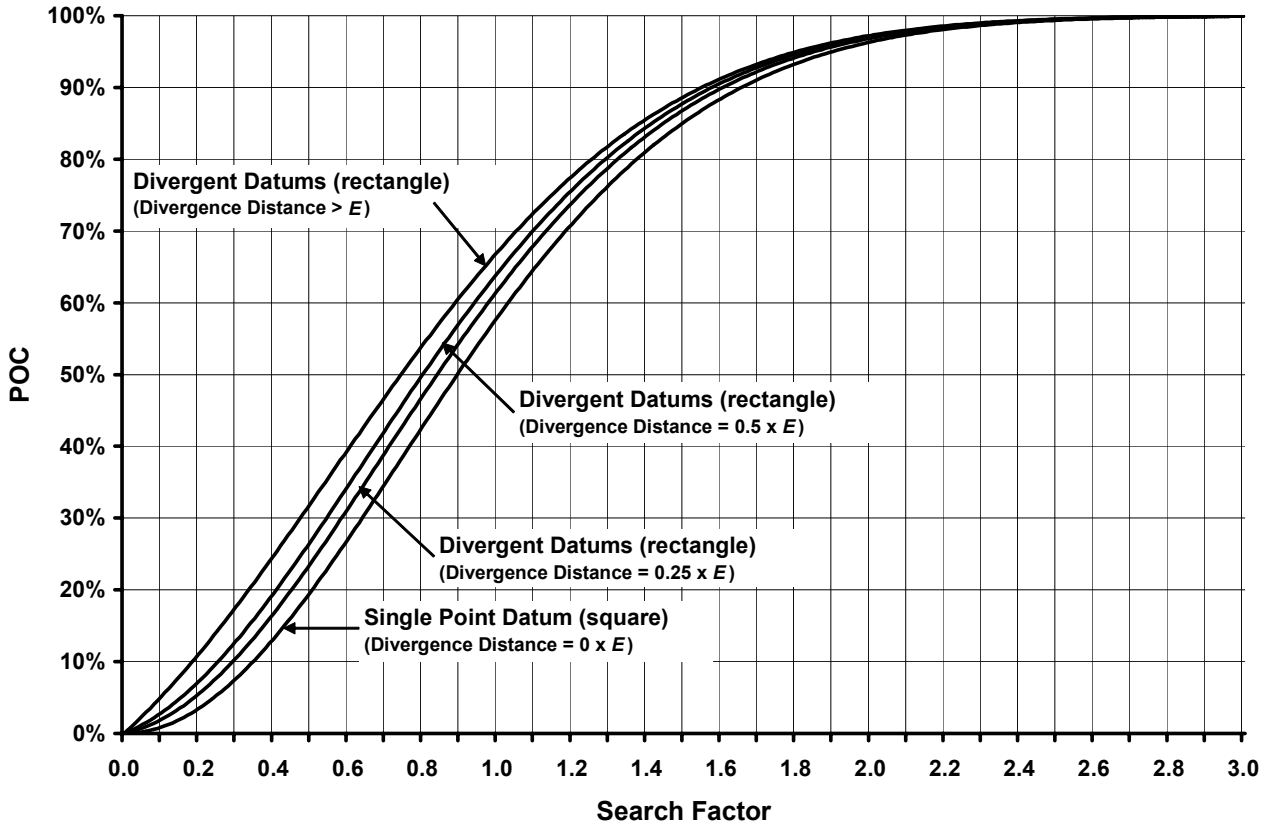


Figure H-26 Probability of Containment (POC)
For Single Point and Divergent Datums

NOTE:
- POS measures search effectiveness.
- POD measures detection performance.
- POC measures the likelihood of the search object to be in one region versus another.

H.5.7.4 The Value of Using POS. POS calculates search effectiveness by incorporating POC (e.g., the CASP weighted replication file) with the POD. POD only measures a sensor's effectiveness; that is, it is used to estimate how well one searched an area, but it does not incorporate the likelihood that the object will actually be in the particular area searched. POS does. The following examples will clarify this discussion:

- Searching an area that has no chance of containing the search object (POC = 0) will not be successful no matter how high the POD. Even if POD was 100% (which is not realistic) the POS is still zero (0 x 1 = 0).
- To give a more realistic example, if there is a 50% chance of the search object being in an area, then searching that area with a coverage factor of 1.0 (POD of 78%) produces a POS of 39% (.5 x .78 = .39). Even if POD was 100% (again unrealistic), the POS for this search rises to only 50% (.5 x 1 = .5) and no further because there is still a 50% chance that the search object was not in the search area.

POS balances options of looking very carefully in a small area for the object against looking less thoroughly over a larger area for the same object. As an analogy, think of looking for a misplaced set of keys. One could meticulously look for the keys in the sofa; moving pillows, pulling apart cushions, and putting one's hands under the sofa (high POD but low POC). Or, one could use the same time searching for the keys by scanning the tops of the sofa, mantel, bookcase and the rest of the family room and kitchen, concentrating on the most likely spots (lower POD but high POC). If it is known that the keys were lost in the sofa, option one would yield a higher

POS due to both a high POC and a high POD. If one were unsure where the keys were last seen or lost, then option two would probably yield a higher POS.

H.5.7.5 Determining POS. A comparison of the Manual Solution with the CASP Solution will make the "math" involved easier to understand.

(a) Manual Solution. The manual solution incorporates POC and POS, however; it has heretofore done so in a way that was hidden from the search planner. Search planners prior to the advent of CASP and later the *IAMSAR Manual* did not use POC and POS because there was no practical way to compute them manually. Only by searching the recommended Optimum Search Area generated by the Total Probable Error solution and safety factors at a coverage of 1.0 was one assured of having an optimal plan. Since the exact recommended area was rarely searched because effort levels were different from those required for exact compliance with these parameters, most searches were somewhat sub-optimal. POC and POS were not readily computable and were therefore ignored! This left the unfortunate, and incorrect, impression that POD is THE statistic in terms of measuring search effectiveness. It is not. As previously stated, POS is the measure of overall search quality/effectiveness. It combines the Probability of Containment (POC) factor and the POD factor (coverage) to give a true measure of the search's chances for success (POS).

(1) The manual solution assumes a "circular bivariate normal" search object location probability density distribution about each computed datum position prior to the first search. (For one datum, it looks similar to a 3-D "bell curve" shape - see Figure H-27.) The computed "total probable error of position" is radius of the 50% containment contour. That is, it is assumed there is a 50-50 chance of the object being located inside a circle whose center is at datum and whose radius equals the total probable error of position. For the first search effort, this radius is multiplied by the optimal search factor for the amount of search effort that is available.

(2) The search area computed by applying the optimal search factor produces the optimal or near-optimal search square or rectangle. Again, this is based on a circular bivariate normal distribution of possible search object positions around the datum(s). The POC for the resulting square or rectangle may be estimated from the curves in Figure H-26. As shown in Figure H-28, an optimal search factor of 1.1 produces a POC of 64.75%.

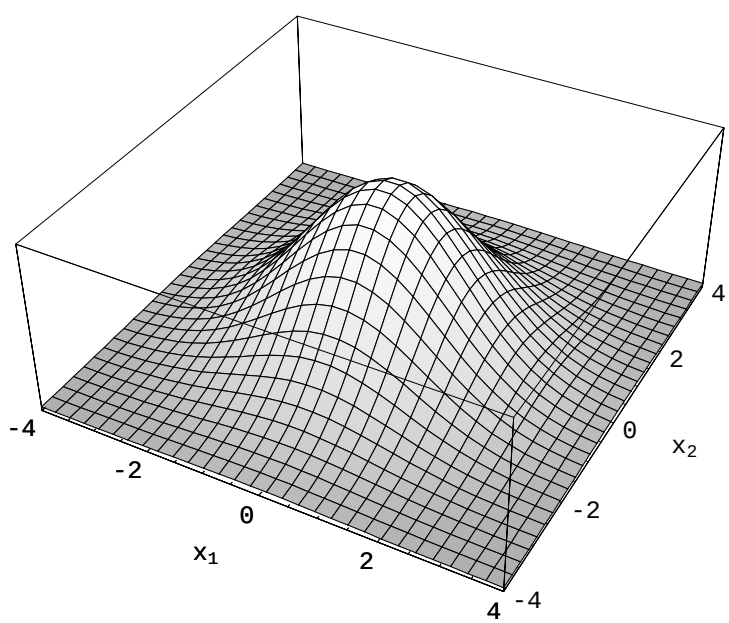


Figure H-27 Manual Solution Probability Density

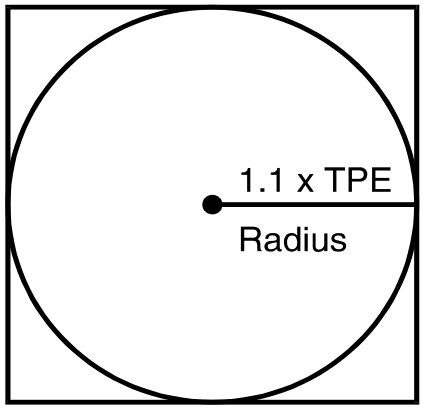


Figure H-28 Manual Solution POC is 64.76% for a Square Search Area Based on an Optimal Search Factor of 1.1

(b) CASP Solution. CASP is designed to provide a search plan that optimizes POS. However, caution must be used when using CASP to develop a search plan. It may optimize POS without due regard to safety by overlapping search areas. This is equivalent to putting two search units in the same area at the same time. This not only is often an inefficient use of SRUs, but it may contribute to an accident. In these cases, the controller must establish separate areas and assign search resources to ensure safety. SAROPS, in development, will correct the overlapping problem.

(1) CASP generates a replication file which computes the POC based upon drift assumptions. CASP produces probability density distributions that do not follow one of the standard distributions from statistics. Instead, CASP starts out with an "initial" distribution that is usually one of the standard types, but then computes tens of thousands of independent drift trajectories and "maps" the results. Based upon the probability distribution of replications in a drift-updated CASP file, different cells will have varying probabilities of containing the search object. In other words, each cell has its own unique likelihood (probability) of containing the object. An overall POC for a search area is determined by summing the probability of each individual gridded cell the area contains.

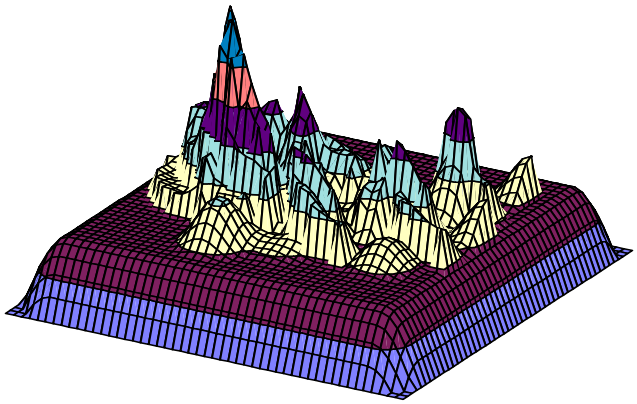


Figure H-29 CASP Probability Density Distribution

(2) POC is based upon the distribution of replications contained in the search area according to the CASP scenario. POS accounts for both POC and POD. That is why it is a better measure of search effectiveness than POD alone. The following example demonstrates the value of POS verses POD.

Example of POD vs. POS

	Area	POC	x	POD	=	POS
1	2571 SqNM	85%	x	40%	=	34%
2	1964 SqNM	70%	x	51%	=	36%
3	1080 SqNM	35%	x	78%	=	27%

(3) In this example, area 1 has an 85% chance of containing the object. If it can be searched with the available effort to attain a POD of 40%, it would yield a Probability of Success of 34%. Contrast this result with area 3, which if searched with the same effort produces a higher POD (78%) but has a much lower POC (35%) and yields a Probability of Success of only 27%. However, CASP demonstrates in this case that it is better to go with the third alternative and use the available effort to search a moderate area with a moderate POD, than to search a smaller area with a higher POD or a larger area with a lower POD. Exactly how much area should be searched and which area(s) should be searched at which coverage level(s) in order to maximize the POS in any given case will depend on the nature of the probability distribution and the amount of search effort available. Although it is necessary to be aware of the POD, POS is the better measure of search effectiveness.

(c) The following examples illustrate the usefulness of CASP and how POS information from the CASP output can guide search-planning decisions when developing a search area. If CASP is used as a search-planning tool, then the highest POS should guide the effort, not POD or POC.

(1) A look at a series of abbreviated CASP maps offers a comparison of search effectiveness for equal amounts of effort to search. A simple working definition of effort is Sweep Width times SRU trackline miles. In the example, the effort number represents the cumulative amount of area (in square miles) contained within the cell and all cells above it in the list, multiplied by the coverage factor. Coverage is a function of sweep width and track space; C = W/S. The smaller the track spacing, the higher the coverage factor and hence the greater the amount of effort needed to cover the same area. The sample CASP output table is provided for use with 3 examples that follow.

Sample CASP Outputs:

Cells In Order of Probability Density				Coverage 1.0 Cumulative		Coverage 1.5 Cumulative	
NR	PROB	SE Corner		Effort (SqNM)	POS	Effort (SqNM)	POS
1	17.67	41-00 N	68-00W	301.1	13.7	451.7	16.5
2	10.83	41-00N	68-20W	602.2	22.1	903.3	26.7
3	9.59	41-20N	68-00W	901.8	29.7	1352.7	35.6
4	8.60	41-20N	67-40W	1201.4	36.3	1802.1	43.9
5	8.09	41-20N	68-20W	1501.0	42.6	2251.4	51.2
6	6.25	41-00N	67-40W	1802.1	47.6	2703.1	57.4
7	4.19	41-00N	68-40W	2103.2	50.7	3154.8	60.9
8	2.43	41-20N	68-40W	2402.8	52.6	3604.2	63.2
9	2.17	41-20N	67-20W	2702.4	54.5	4053.5	65.2

Example 1: Compare Efforts of Approximately 900 SqNM

Coverage Factor of 1.0 (POD of 78%)	Coverage Factor of 1.5 (POD of 94%)
Top 3 cells 901.85 SqNM POC top 3 cells = 38.09 POS = POC x POD = 38.09 x .78 = 29.7	Top 2 cells 903.3 SqNM POC top 2 cells = 28.5 POS = POC x POD = 28.5 x .94 = 26.7

CASE F/V LUCKY STAR
DATUM TIME 311830Z OCT 91

	70 -20W	70 -0W	69 -40W	69 -40W	69 -0W	68 -40W	68 -20W	68 -0W	67 -40W
42-0N		6	2	2	20	140	193	165	165
41-40N	65	111	74	97	243	809	3 959	860	217
41-20N	202	194	139	192	419	2 1085	1 1767	625	206
41-0N	91	90	107	156	169	186	69	23	4
40-40N									

In this case, it would be better to search the area contained by the top three cells, POS of 29.7, with a lower POD (.78) than to search the area in the top two cells, POS of 26.7, with the higher POD (.94).

Example 2: Compare Efforts of Approximately 1800 SqNM

Coverage Factor of 1.0 (POD of 78%)	Coverage Factor of 1.5 (POD of 94%)
Top 6 cells 1802.1 SqNM POC top 6 cells = 61.03 POS = POC x POD = 61.03 x .78 = 47.6	Top 4 cells 1802.1 SqNM POC top 4 cells = 46.69 POS = POC x POD = 46.69 x .94 = 43.9

CASE F/V LUCKY STAR
DATUM TIME 311830Z OCT 91

	70 -20W	70 -0W	69 -40W	69 -40W	69 -0W	68 -40W	68 -20W	68 -0W	67 -40W
42-0N		6	2	2	20	140	193	165	165
41-40N	65	111	74	97	243	5 809	3 959	4 860	217
41-20N	202	194	139	192	419	2 1085	1 1767	6 625	206
41-0N	91	90	107	156	169	186	69	23	4
40-40N									

In this case, it would be better to search the area contained by the top six cells, POS of 47.6, with a lower POD (.78) than to search the area in the top four cells, POS of 43.9, with the higher POD (.94).

Example 3: Compare Efforts of Approximately 2700 SqNM.

Coverage Factor of 1.0 (POD of 78%)	Coverage Factor of 1.5 (POD of 94%)
Top 9 cells 2702.4 SqNM POC top 9 cells = 69.82 POS = POC x POD = 69.82 x .78 = 54.5	Top 6 cells 2703.1 SqNM POC top 6 cells = 61.03 POS = POC x POD = 61.03 x .94 = 57.4

CASE F/V LUCKY STAR
DATUM TIME 311830Z OCT 91

	70 -20W	70 -0W	69 -40W	69 -40W	69 -0W	68 -40W	68 -20W	68 -0W	67 -40W
42-0N		6	2	2	20	140	193	165	165
41-40N	65	111	74	97	8 243	5 809	3 959	4 860	9 217
41-20N	202	194	139	192	7 419	2 1085	1 1767	6 625	206
41-0N	91	90	107	156	169	186	69	23	4
40-40N									

In this case, it would be better to search the area contained by the top six cells, POS of 57.4, with a higher POD (.94) than to search the area in the top nine cells, POS of 54.5, with the lower POD (.78). This happens because the probability of finding the search object in cells 7,8 and 9 has decreased to the point where it is more productive to search the smaller area, cells 1-6, with a higher POD (closer track spacing).

Section H.6
Search Area and SRU Assignment

The SMC determines what constraints the search variables place on the optimal search area so the area that can actually be covered may be calculated. This obtainable search area may be subdivided into smaller regions for SRU assignment. If a search is unsuccessful, the SMC should reevaluate all information, modify the search plan, and search again, unless it is determined further effort is unlikely to be successful and search efforts should be suspended.

H.6.1 Allocating Effort

Varying the rate of search effort can control the assignment of SRUs to achieve maximum search effectiveness. Some situations call for an initial maximum search effort over wide areas. However, a maximum search effort cannot be mounted every time an overdue is first reported, nor can the SMC continue with a lesser effort when preliminary searches fail. The SMC carefully weighs the limitations of time, terrain, weather, navigational aids, search target detectability, suitability of available SRUs, search area size, distance between search area and SRU staging bases, and desired POD. Of all the factors involved, one or more may prove so important that the others become secondary. These controlling factors are considered first in preparing an attainable search plan.

H.6.1.1 When a distress is either known or strongly suspected, the time available for effective search will usually be limited, and a maximum effort search should be completed within this time. It is usually preferable to search an area with many SRUs from the onset when chances for success are highest. First search should be planned to locate survivors rapidly while they are still in a condition to use radio, visual, or other signaling aids, and battery transmission life of locator beacons is good. The following procedure is recommended:

(a) Plot a region large enough to reasonably ensure that the survivors are included (POC $\geq$ 80%) as a first approximation to the optimal search area.

(b) Use the area of the region as the total available effort, Z_{ta} (this amount of effort is sufficient to produce C = 1.0 for the first approximation).

(c) Using the *IAMSAR Manual* method for effort allocation, find the optimal search area for this level of effort. The resulting POS should be at least 62% for ideal search conditions and at least 50% for normal search conditions since those are the values obtained for coverage factor 1.0 and 80% POC.

(d) Fix the time by which the search should be completed.

(e) Calculate SRU hours required to search the area within the allocated time.

(f) Dispatch sufficient SRUs to search the area within the allocated time. If insufficient SRUs are available, re-compute the optimal search area and coverage based on the amount of effort that is available.

(g) If unsuccessful, obtain additional resources and optimally allocate the additional search effort they can provide. Review all available data to determine whether the datum position(s) should be revised.

(h) Do not reorient the search or change SRU search assignments, if avoidable, after the search plan has been transmitted to the SRUs. Once a large-scale search is ordered and SRUs dispatched, reorientation of the search area for that search may be difficult and wasteful. Planning should be thorough and adhered to.

(i) Resist the temptation to redeploy SRUs whenever new leads or doubtful sightings are reported. After assigned SRUs have been dispatched, additional SRUs should be dispatched to investigate new leads.

H.6.1.2 Overdues can produce very large initial estimates of the region(s) and time(s) where and when the distress incident may have occurred. An aggressive investigative effort should be undertaken to reduce the uncertainty about the time and place of possible distress incidents as much as possible. This is usually done by finding the last sighting or other indicator of when and where the missing craft was last known to be safe.

H.6.1.3 If a large-scale search is necessary, CASP is the search-planning tool of choice. After computing a drift update for the desired mid-search time, obtain an optimal search plan from CASP for the amount of effort that will be available on scene. Inspect the plan for operational feasibility and safety considerations, adjust as needed, and promulgate the plan to the SRUs. If CASP is not available, the IAMSAR Manual method or JAWS may be used.

H.6.2 Partitioning the Search Area

The computed search area is divided into subareas to be searched by SRUs, the number of subareas depending on the number of SRUs available. The size and orientation of the subareas depend on the capabilities of the SRUs and on environmental factors, such as the drift, sun or swell direction. Elongated search areas are better for navigation than small squares. Search legs, especially for elongated search areas, should be oriented in the same direction as the expected search object drift during the search to minimize the adverse effects of search pattern distortion relative to the drifting object.

H.6.2.1 Establishing Individual Search Area Sizes. This is done by means of:

$A_n = V \times S \times T$. To determine subarea dimensions:

(a) The estimated search subarea length (l') will be the smaller of:

(1) $\sqrt{A_t}$; or

(2) The distance that could be covered in 30 minutes for fixed-wing aircraft; or

(3) The distance that could be covered in 20 minutes for helicopters.

(b) The estimated width is $w' = \frac{A_n}{l'}$.

(c) The number of required track spacings is $n' = \frac{w'}{S}$.

This figure is rounded to the nearest even or odd whole number, n. If n is an even number the SRU completes its search pattern on the same side of the search area as it started, but if n is odd the SRU finishes on the opposite side. This factor should be considered if SRU endurance requires that the end search point be as near as possible to a refueling base.

(d) The subarea width is then w = n x S, and the length is $l = \frac{A_n}{w}$.

H.6.2.2 Search Area Designation (naming). Search areas shall be designated using a letter (A, B, C…) sequentially for the overall search area. A new letter shall be assigned each time the search planner establishes a datum or drifts a datum. In the course of a search if a new independent datum is established due to new information or other circumstances, that datum shall continue with the next search letter designation for that case. Sub-areas to be searched by specific search units (or combination of units) shall be numbered sequentially and associated with the overall search area by preceding the number with the letter designation of the overall search (A-1, A-2, etc.).

H.6.2.3 Describing Search Areas. SRUs must be able to plot the search area on the basis of information received from the SMC. Several standard methods are used to describe search areas:

(a) *Boundary Method.* Any square or rectangular area oriented east-west or north-south can be described by stating the two latitudes and two longitudes. Any inland search area that is bounded by prominent geographical features can be described by stating the boundaries in sequence. For example:

(1) D-7 Boundaries 26N to 27N, 64W to 65W.

(2) A-1 Boundaries Highway 15 to the south, Lake Merhaven to the west, Runslip River to the north, and Bravado mountain range to the east.

(3) Landmark Boundaries Method. Two or more landmarks are given as boundaries of the search area along a shoreline. For example: Search area from "Port Alpha" South Jetty, south to the Tower to 10 NM offshore (Figure H-30).

(b) *Corner Point Method.* This can be used for any area (except circular areas) that can be described by stating the latitude and longitude, or geographical features, of each corner, in sequence. For example:

(1) E-7 corners 23 15N 74 35W to 23 10N 73 25W to 22 20N 73 25W to 22 25N 74 25W to origin.

(2) A-6 corners Stony Tavern to Red River Bridge to Gunder Cave to origin.

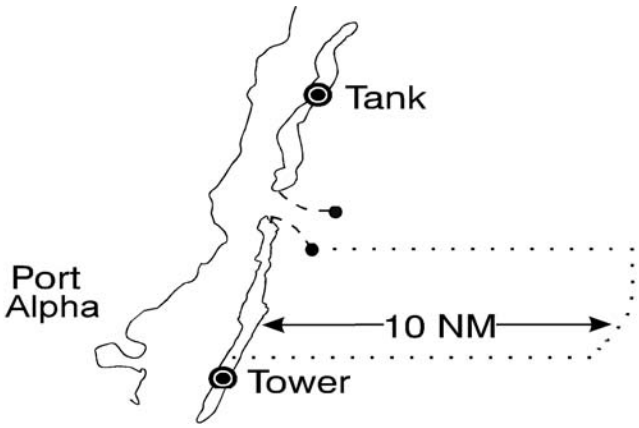


Figure H-30 Landmark Boundaries Method

(c) *Center Point Method.* Convenient for describing all but irregular search areas and quickly transmitted, this method gives latitude and longitude of the center point and the search radius, if circular, or the direction of the major axis and applicable dimensions, if rectangular. For example:

(1) 23 15N 74 35W, 12NM.

(2) 23 15N 74 35W, 060° true, 144 X 24 NM.

(3) Center Point-Landmark. The center point, or datum, may be designated by a bearing and distance from a geographic landmark. For example: Datum bears 060°M, 10 NM from "Port Alpha" South Jetty light, major axis 000°M, 6 NM by 6 NM (Figure H-31).

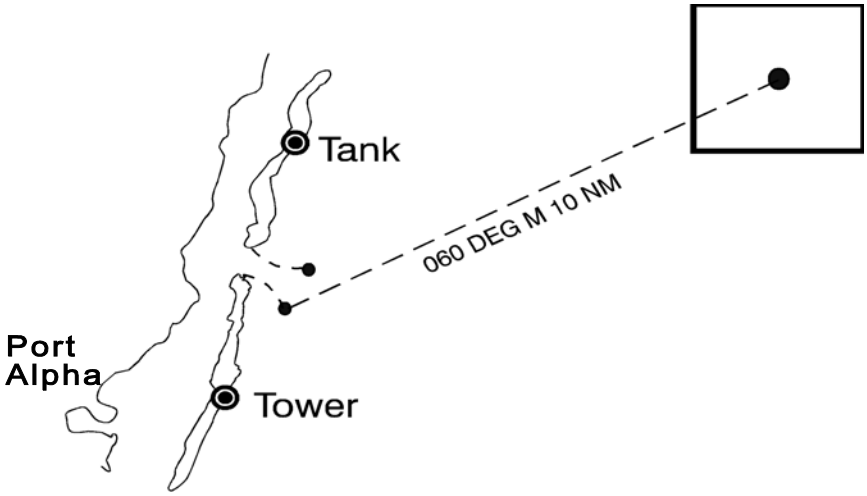


Figure H-31 Center Point-Landmark

The Boundary Method or Corner Point Method is preferred over the Center Point Method because the latter requires more plotting and makes detection of plotting errors more difficult. Also, if plotted on a chart of different projections from the SMC's (e.g., Lambert Conformal vs. Mercator), it results in plots of adjoining areas, which do not have the same boundaries or corner points.

(d) *Track Line Method.* Search areas may be described in this method by stating the track and the width of coverage. For example:

C-2 trackline 24 06N 78 55W to 24 50N 75 46W. Width 50 NM.

(e) *Grid Method.* Many areas are divided into grids on local grid maps. Use of these grids permits accurate positioning and small area referencing without transmitting lengthy geographical coordinates. However, all SRUs must have the same grid charts; SRUs could be endangered if there search areas overlap due to use of different grid systems. The grid method is most often used in inland SAR operations. See Chapter 5 and Appendix E of reference (a) concerning CAP grids.

(f) *Georef Method.* This method may be used to describe square or rectangular areas oriented N-S or E-W that coincide with Georef grids. The Georef method is not normally used. All SRUs involved in a Georef search should possess Georef grids to avoid endangering each other.

H.6.2.4 Orienting Search Areas. Search patterns should be oriented to maximize target exposure to SRUs. This is especially important in any combination of high sea state, low target freeboard, and low searcher height. Under these circumstances, search leg headings perpendicular to the seas or swells, whichever is dominant, prolong the time that objects are visible on the beam as the SRU passes. This search leg orientation is also best for minimizing roll motion of surface SRUs. This technique is illustrated in Figure H-32. However, search pattern distortion relative to the drifting search object is often the most important factor. Whenever the search object's expected drift rate (in knots) during the search exceeds 10% of the SRU's creep rate (net rate of motion perpendicular to the search legs-creep rate = track spacing/time from mid-point of one search leg to the mid-point of the next), search legs shall be oriented parallel to the direction of expected drift during the search whenever it is operational feasible to do so.

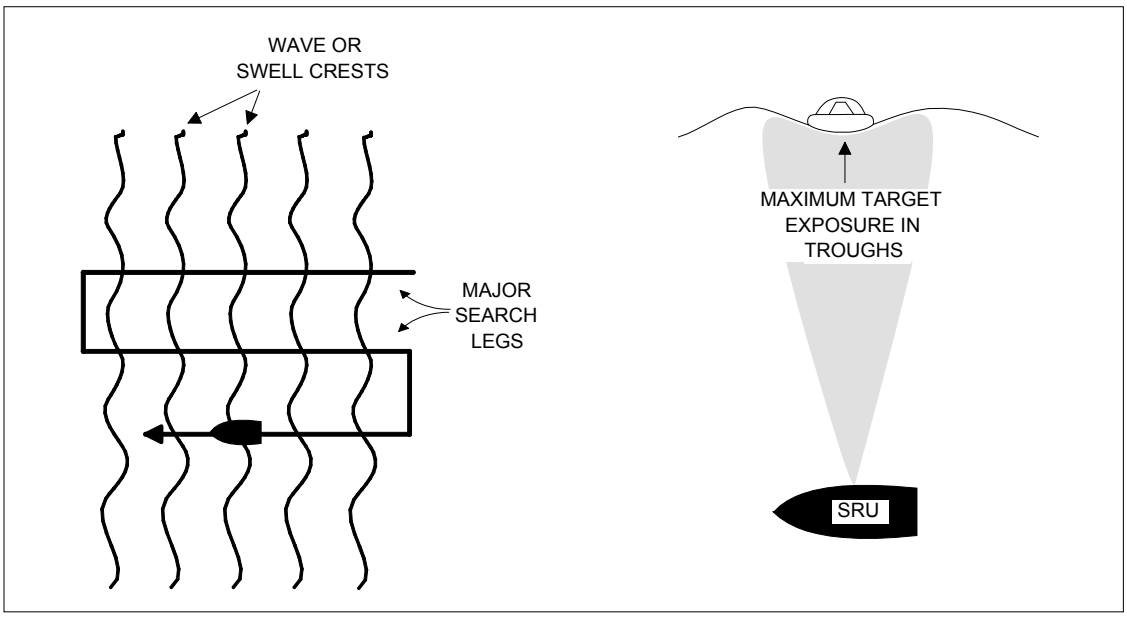


Figure H-32 Search Leg Orientation

H.6.3 Assigning SRUs to Search Areas

(a) After dividing overall search area into subareas, the SMC usually assigns an SRU to each subarea, designates search pattern execution and direction of pattern creep, and assigns search altitudes for aircraft. SRU safety is a most important consideration when search areas are being assigned.

(b) Occasionally, the SMC requires the OSC to make various search decisions, such as search pattern selection, track spacing, and individual SRU search area assignments. The SMC normally prescribes the overall search area and decides on subareas for SRUs.

(c) When allocating subareas, each SRU should be used only for searches for which it is operationally suitable. For example, if only aircraft are available, the following considerations are relevant:

(1) Short-range or medium-range aircraft should be used for areas close to a base.

(2) Fast, long-range aircraft should be used for more distant areas.

(3) Aircraft with poor navigation capability should be used in areas with prominent landmarks, or for searches requiring constant visual reference, as in shoreline searches.

(4) During good weather, search areas in coastal waters may be laid out so aircraft can fly search legs perpendicular to the coastline. This allows aircraft without modern navigation equipment to obtain a fix at the land end of each leg. However, terrain clearance must be considered.

H.6.3.1 Commence Search Point Guidance. All factors, including environmental conditions and available resources, should be carefully considered when determining where to place the commence search point (CSP) for particular search areas.

H.6.3.2 Other factors to consider include:

(a) The resource's (includes aircraft, small boat and other available assets)) proximity to the search area. The decision may be made to place the CSP at the point closest to the SRU's departure point in order to facilitate the start of searching as quickly as possible.

(b) The decision may be made to place the CSP at a point farthest away from the departure point, so as to have the SRU finish its search as close to its recovery point as possible. This addresses other considerations, such as: having the SRU pass through datum prior to searching; inserting a DMB at datum prior to searching and having the SRU finish its search as close as possible to a logistics base which would make them available for the next search or another mission.

(c) For missions with multiple air SRUs, all CSPs should be coordinated so that they are positioned at the same geographic corner for each individual search area (e.g. search areas A1-A5 will all have a CSP in the southeast corner). It is paramount to risk assessment and safety of flight issues that strict adherence to this rule is followed. The only caveat to the rule of adjacent CSPs would be if the SRUs for adjoining search areas were to commence their searches at significantly different times. It may be appropriate to consider separation for surface assets in situations where visibility is reduced (fog, night, and heavy precipitation).

Other considerations include orienting the search areas, patterns and particularly the CSP to account for environmental factors such as looking into or away from the sun while searching, or searching into or down swell vice in the trough. The type of search pattern, as well as the search object's drift (direction and speed) must also be considered when determining where to place the CSP.

There are many factors to consider prior to making a final decision about where to place the CSP. Each SMC must maintain communications with on scene units or the OSC to determine if the planned CSPs are in their proper places or if positions need to be modified.

(d) The SMC normally specifies the commence search point (CSP) which, along with pattern creep and search altitude, is used to maintain lateral and vertical separation. While SRUs should help themselves by using IFF/SIF interrogators, radar, air-to-air TACAN, and visual lookouts, the SMC and OSC also plan for safe separation between SRUs. An example of a separation plan (see Figure H-33) follows:

(1) The SMC first assigns all search patterns to creep north. This will help ensure that the aircraft in areas A-1 and A-2 maintain lateral separation of one search area width from the aircraft in areas A-3 and A-4 (assuming they begin their search at about the same time).

(2) Second, the SMC assigns the CSP as the southwest corner. This helps maintain separation between the two aircraft in A-1 and A-2, and between the two aircraft in A-3 and A-4, by a distance equal to the individual search area length (assuming A-1 and A-2 start search at about the same time, A-3 and A-4 start search at about the same time, and SRUs operate at the same speed).

(3) Third, the SMC assigns search altitudes of 500 feet for A-1 and A-4, and 1,000 feet for A-2 and A-3. This provides positive vertical separation between each aircraft and adjacent aircraft.

(4) Air-to-air TACAN channels are assigned to search areas for use by the SRUs. TACAN channel pairing must be 63 channels apart for air-to-air ranging operations. If SRU equipment allows the use of TACAN Y instead of TACAN X channels, interference with shore stations is reduced. The aircraft in A-1 and A-2 and in A-3 and A-4 would be concerned with approaching each other, even with an altitude separation of 500 feet. Therefore, the SMC could pair SRUs in A-1 and A-2 on TACAN channels 20 and 83, and A-3 and A-4 aircraft on channels 30 and 93. If the paired aircraft approach a common boundary simultaneously, they can monitor distance separation.

(5) Unless there is a large difference in the commence search times of the two diagonally opposite aircraft, the SMC assumes that adequate lateral and vertical separation will be maintained as long as each aircraft properly executes the assigned search pattern. No SRU should approach another SRU at a distance of less than one-track space. The SRU flies the legs nearest the search pattern perimeter at one-half track spacing inside its search area boundary.

(e) Outside the search area, lateral and vertical separation of aircraft is provided either by air traffic control (ATC) agencies under instrument flying rules, or by the aircraft themselves under visual flying rules. Since control of air traffic by ATC in the search area is usually not feasible because of low search altitudes, overall responsibility for maintaining safe separation within the search area rests with the OSC.

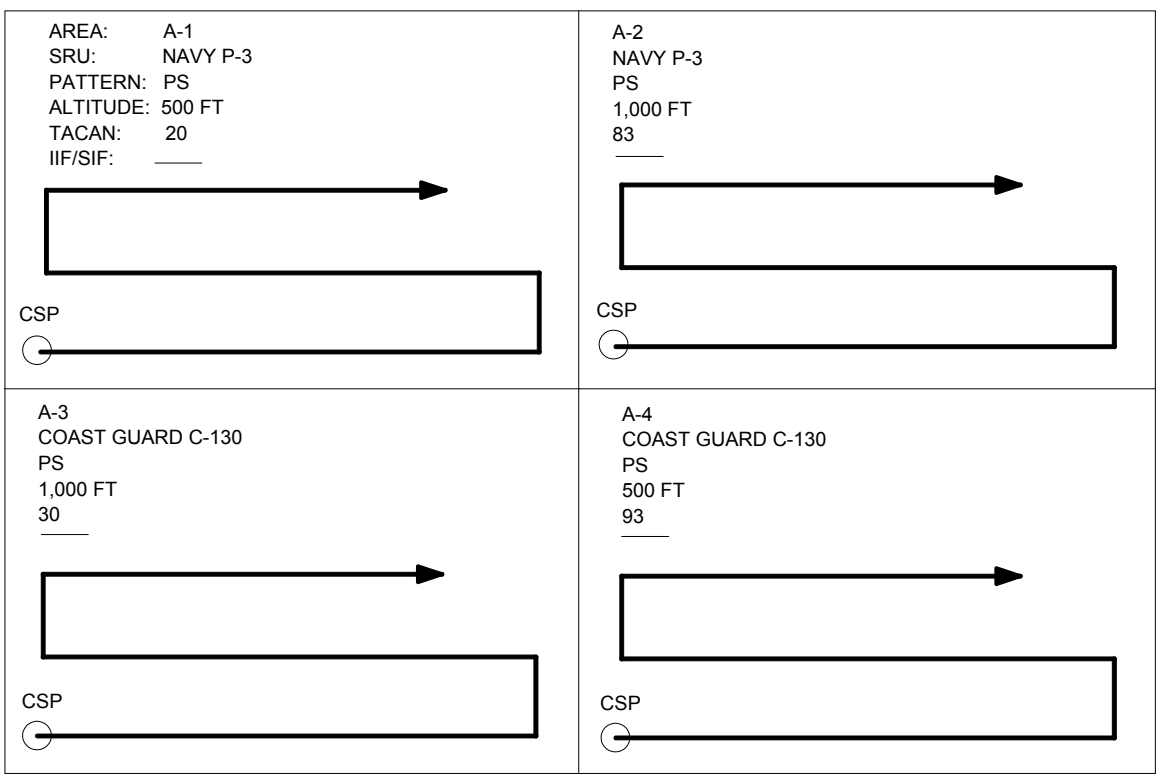


Figure H-33 Typical Assignments for SRUs

Section H.7
Search Pattern Selection

To ensure that the search area is uniformly searched, use of standard search patterns allows the SMC to calculate probable search effectiveness. This information is valuable for assigning SRUs, and for planning future searches. Any search unit can use the search patterns listed in this Appendix. The complexity of some may preclude their use by SRUs with limited navigational capability.

H.7.1 Factors in Selection

Search pattern selection depends on many factors, including accuracy of datum, search area size, number and capabilities of SRUs, environmental conditions, size of search target, and type of survivor detection aids. While the factors are interrelated, some may be more important than others. The SMC should satisfy the more important factors while meeting others as nearly as possible.

H.7.1.1 The type and number of available SRUs are controlling factors in selection of search patterns. SRU turning diameters, speeds, detection capability, and navigational accuracy have a significant impact on the uniformity of search area coverage and on POD. POD curves are valid only when SRUs follow search pattern tracks accurately.

(a) *Surface Craft.* Navigation accuracy of surface SRUs is generally not a significant problem as long as global positioning systems GPS & DGPS, LORAN C, inertial, SATNAV, or radar navigation aids are available. DR navigation can cause significant errors in search pattern execution, even in coastal areas with visual references. Sea states of three feet or more can also adversely affect the ability of small surface SRUs to execute search patterns accurately.

(b) *Aircraft.* High-speed aircraft are more likely to accumulate turn errors, especially with narrow track spacing, because of their larger turn diameters. Low-speed aircraft are more sensitive to wind because the crosswind component will be a higher percentage of search speed. The following should be considered when planning aircraft searches:

(1) Aircraft navigation accuracy has improved due to increased use of, and improvements in, navigation computers, area navigation (RNAV), global positioning systems GPS &DGPS, INS, and LORAN C. More sophisticated systems can be coupled to an autopilot, enabling execution of accurate search patterns.

(2) When accurate navigation systems are not available, the type of pattern that requires minimum turns and maximum search leg length is usually selected to reduce turning errors and to ease navigation. For high-speed aircraft, patterns and search area assignments that allow turns outside the search area should be considered to allow aircraft to establish themselves on each leg, improving uniformity of area coverage.

H.7.1.2 Once large-scale search efforts are under way, redeployment of SRUs or changing of assigned search patterns becomes difficult. Careful consideration should be given to selecting patterns and designating SRUs. Unique patterns based on search circumstances may be developed.

H.7.2 Search Pattern Nomenclature

H.7.2.1 Commence Search Point (CSP) is the location in the search pattern where the SRU begins searching. Specifying the CSP allows the SRU to efficiently plan the en route track, and ensures that SRUS are separated and that the SRU begins search at the desired point and time.

H.7.2.2 Search Leg is the long leg along the track of any pattern.

H.7.2.3 Crossleg is the connection between two search legs.

H.7.2.4 Creep is the general direction in which an SRU moves through a rectangular or square area, normally the same direction as the crosslegs.

H.7.3 Search Pattern Designation

A coded system of letters is used to designate search patterns. The first letter designates the major pattern characteristic. The second letter denotes SRU number ("S" is a single-unit search; "M" is a multiunit search). The third letter designates specialized SRU patterns or instructions.

H.7.3.1 Trackline Patterns (T) are used when the intended route of the search object is known. A route search is usually the first search action since it is assumed that the target is near track, and that either it will be easily seen or the survivors will signal. The trackline pattern is a rapid and reasonably thorough coverage of the missing craft's proposed track and area immediately adjacent, such as along a datum line.

(a) *Trackline Single-Unit Non-Return (TSN)* search is made along the track or datum line. The letter "N" in the third position indicates that the pattern makes one or more searches along the track, but the search terminates at the opposite end of track from where it began. See Figure H-34.

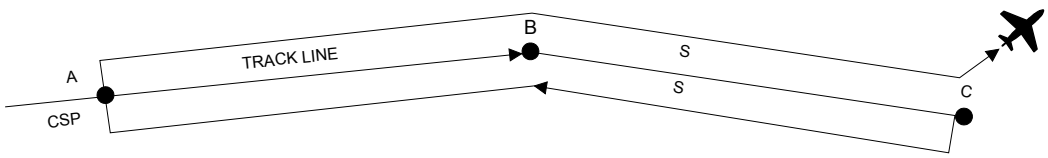


Figure H-34 Trackline Single-Unit Non-Return (TSN)

(b) *Trackline Single-Unit Return (TSR)* has the CSP offset 1/2 search track spacing from the trackline or datum. The SRU runs up one side and down the other, ending one track space from where it began. See Figure H-35.

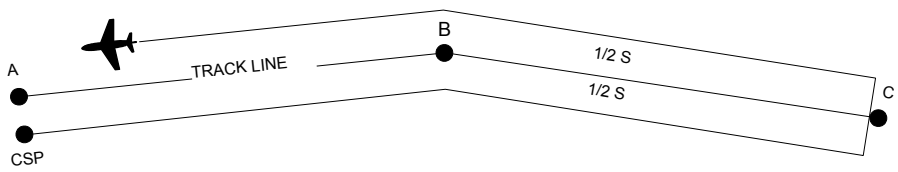


Figure H-35 Trackline Single-Unit Return (TSR)

(c) *Trackline Multi-Unit Return (TMR).* Two or more SRUs are used in an abeam formation to afford greater width coverage along track. See Figure H-36.

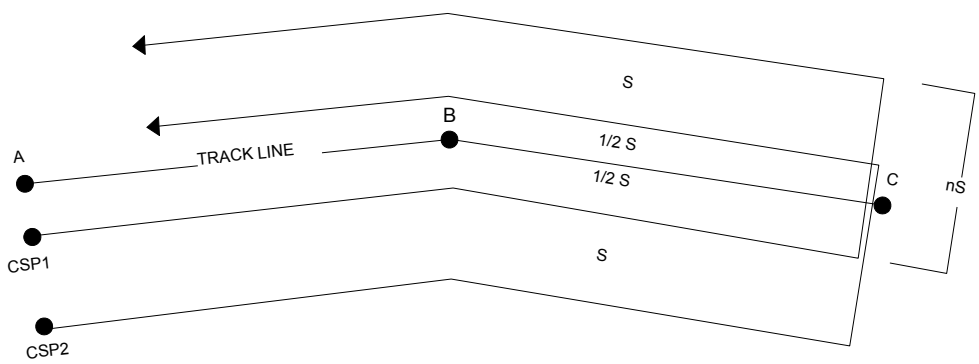


Figure H-36 Trackline Multi-Unit Return (TMR)

(d) *Trackline Multi-Unit Non-Return (TMN).* This pattern is the same as TMR except search terminates at the opposite end of track from where it began. See Figure H-37.

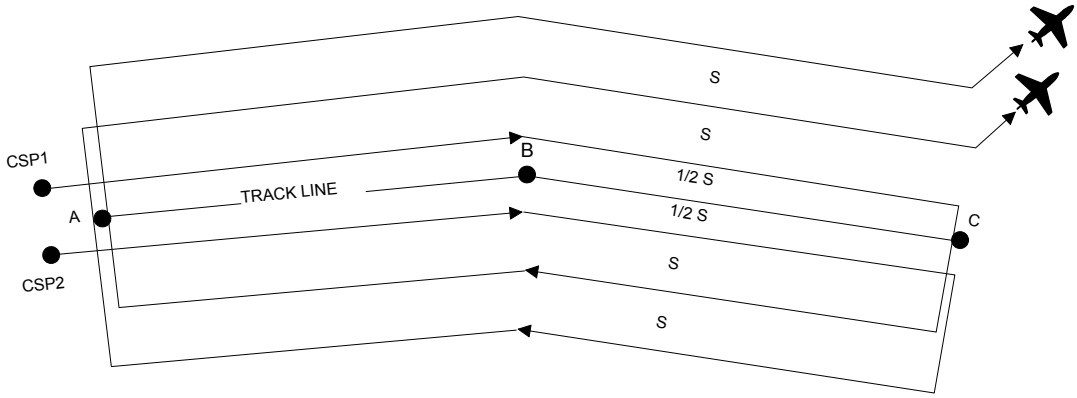


Figure H-37 Trackline Multi-Unit Non-Return (TMN)

H.7.3.2 **Parallel Patterns (P)** are best adapted to rectangular or square areas and have straight search legs that are usually aligned parallel to the major axis. Parallel patterns are normally used for large, fairly level search areas, where only approximate initial position is known, and when uniform cover-age is desired. Special parallel circle patterns are normally used for small underwater areas and have legs of adjacent concentric circles.

(a) *Parallel Track Single-Unit (PS)* is used by single SRUs for searching rectangular areas and is mostly used by fixed-wing aircraft. Search legs are oriented along the major axis, providing longer legs and fewer turns. See Figure H-38.

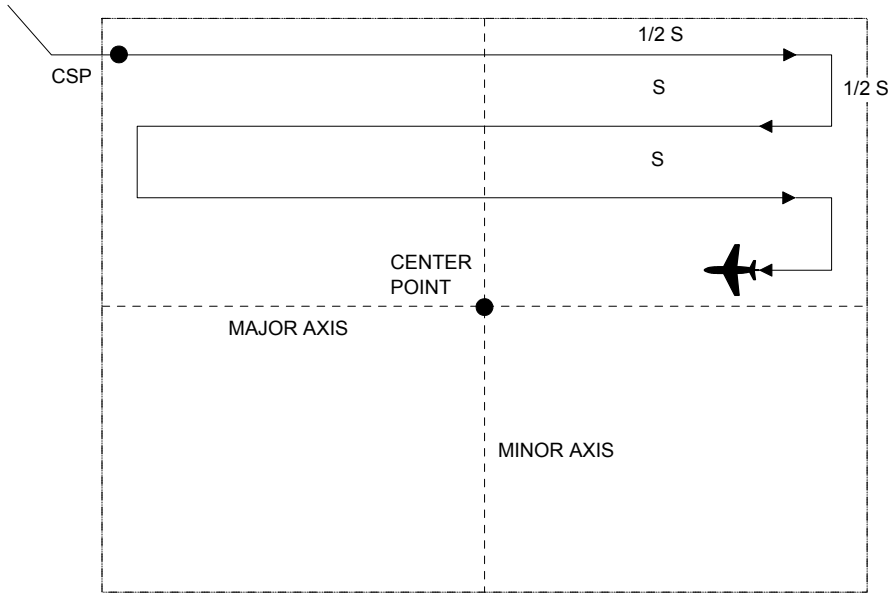


Figure H-38 Parallel Track Single-Unit (PS)

(b) *Parallel Track Multi-Unit (PM)* provides accurate track spacing and fast area coverage, and an increased safety factor for aircraft over water. One SRU is designated as guide and handles navigation, communications, and control. Turns at the end of legs should be executed by signal from the guide. Crosslegs are a distance equal to the track spacing multiplied by the number of SRUs in the team (n). See Figure H-39. Land SRUs use procedures are in reference (a).

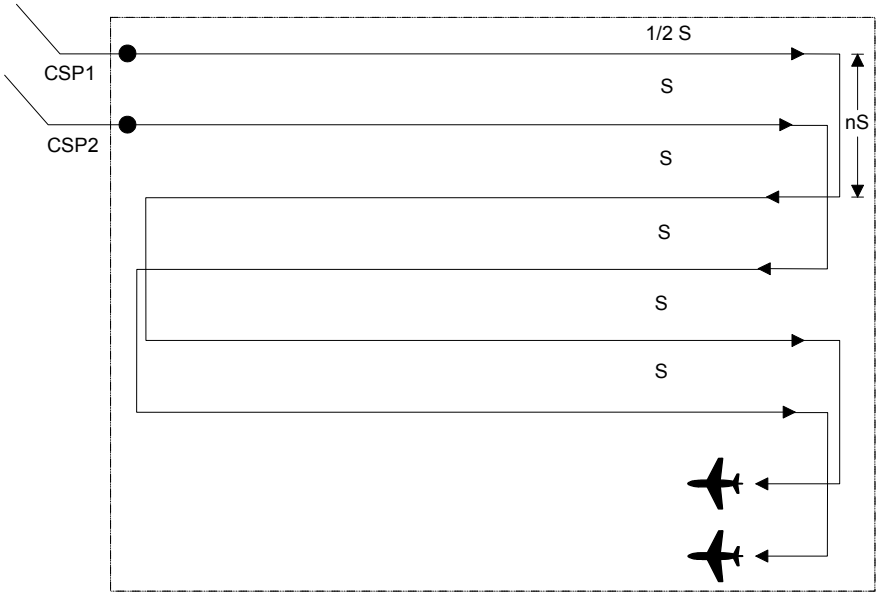


Figure H-39 Parallel Track Multi-Unit (PM)

(c) *Parallel Track Multi-Unit Return (PMR)* is used when simultaneous sweep of an area to maximum radius is desired. It provides concentrated coverage of large areas in a minimum time period, and allows the use of aircraft with different speeds in a parallel search pattern. See Figure H-40.

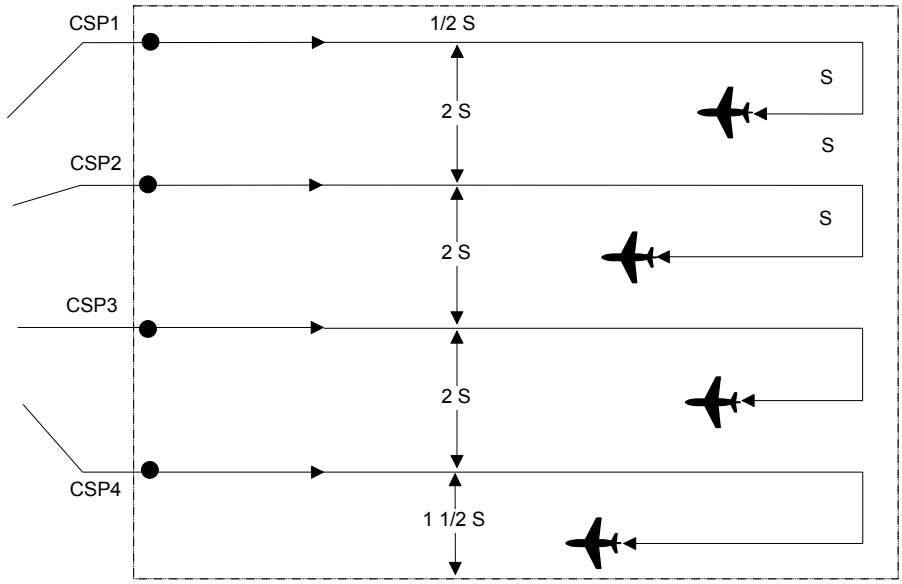


Figure H-40 Parallel Track Multi-Unit Return (PMR)

(d) *Parallel Track Multi-Unit Non-Return (PMN)* is similar to the PMR, except that SRUs continue to a

destination other than the departure point. It is normally used when en route vessels are available and will alter their tracks to provide uniform coverage of the search area. See Figure H-41.

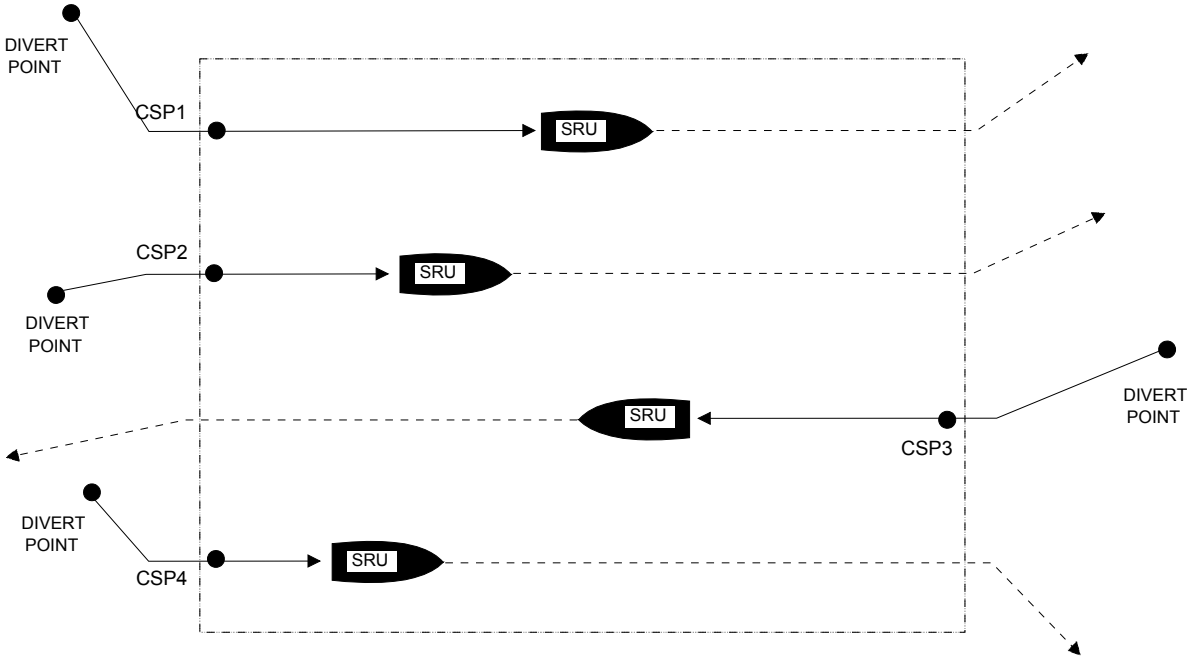


Figure H-41 Parallel Track Multi-Unit Non-Return (PMN)

(e) *Parallel Track Single-Unit LORAN (PSL)* is one of the most accurate search patterns for searching areas covered by LORAN, GPS, or similar navigational systems. The pattern must be oriented so legs flown by the SRU are parallel to a system of LORAN lines, or GPS point to point, and so on. LORAN lines are selected at the track spacing desired. As each leg is flown, the selected line reading is preset on the receiver indicator. The letter "L" in the third position is used to indicate. See Figure H-42.

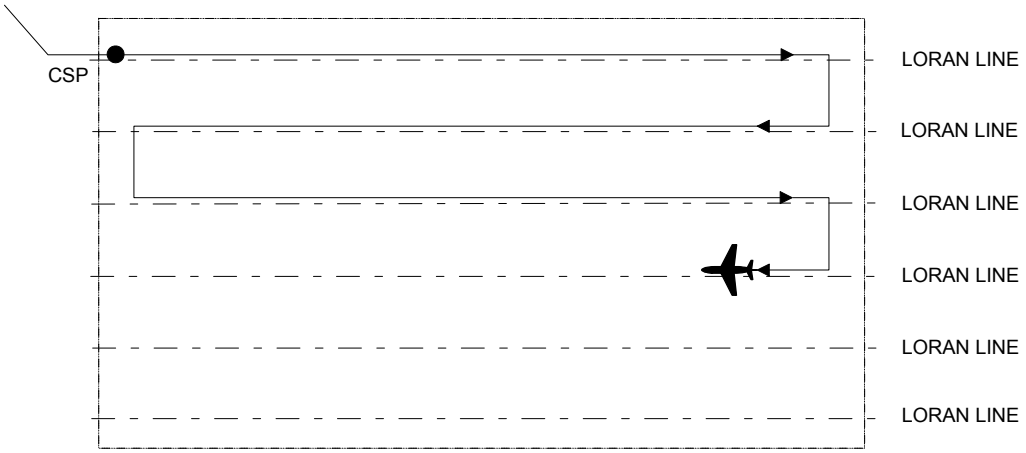


Figure H-42 Parallel Track Single-Unit LORAN (PSL)

(f) *Parallel Multi-Unit Circle (PMC)* is used by two or more swimmers for underwater search of small areas,

generally less than 25 yards in diameter. A line or rope is knotted along its length at distances equal to the track spacing. The line is anchored in the center of the area and swimmers use the knots to maintain uniform spacing, beginning with the innermost knots for one set of circles, then shifting outward to the next set of knots. See Figure H-43.

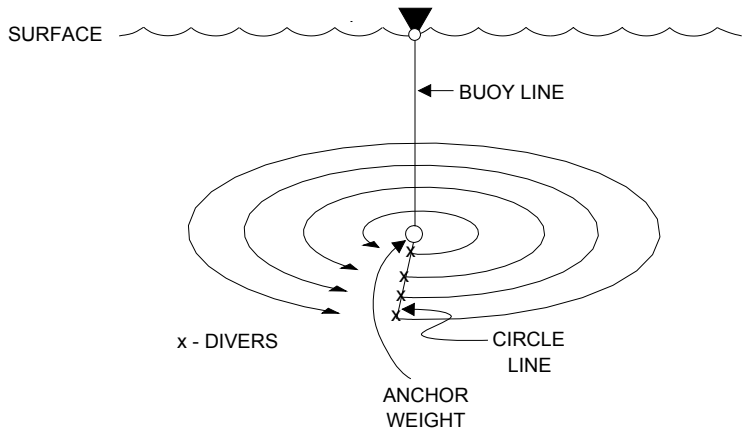


Figure H-43 Parallel Multi-Unit Circle (PMC)

(g) *Parallel Single-Unit Spiral (PSS)* is used by a single underwater swimmer for search of small areas, generally less than 25 yards in diameter. The swimmer uses a line coiled on a fixed drum in the center of the area, and swims in ever-increasing spirals, using the line to maintain proper track spacing by keeping it taut. See Figure H-44.

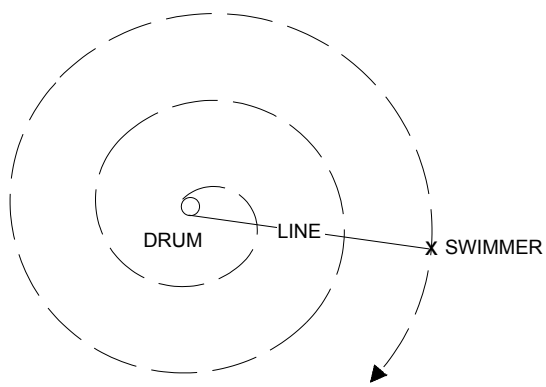


Figure H-44 Parallel Single-Unit Spiral (PSS)

H.7.3.3 **Creeping Line Patterns (C)** are a specialized type of parallel pattern where the direction of creep is along the major axis, unlike the usual parallel (P) pattern. They are used to cover one end of an area first, or to change direction of the search legs where sun glare or swell direction makes this necessary.

(a) *Creeping Line Single-Unit (CS).* The CSP is located 1/2 track spacing inside the corner of the search area. See Figure H-45.

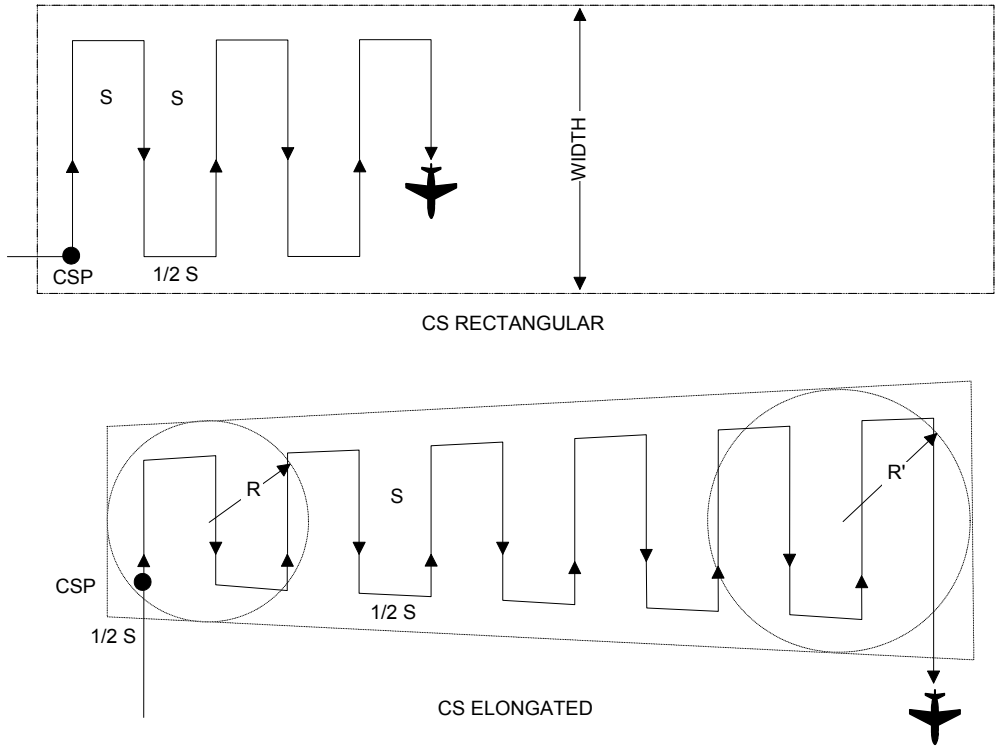


Figure H-45 Creeping Line Single-Unit (CS)

(b) *Creeping Line Single-Unit Coordinated (CSC)* is used when aircraft and either vessels or boats are available. The aircraft track is planned so that advance of successive legs of the search pattern equals that of the marine craft, and the aircraft passes over the vessel on each leg. This results in a more accurate search pattern, and enables quick rescue by marine craft once survivors are located. If the vessel is radar equipped, it should assist the aircraft in keeping on course and advise the aircraft when it is 5 miles from the end of each leg and at the time to turn onto a cross leg. Advisories of distance off course are based on an average of several fixes. Whenever the aircraft is within range, visual bearings should be taken and plotted with radar ranges. Coordinated patterns should be started before entering the search area so that full coverage of the area will be assured. See Figure H-46. See reference (a) for procedures for coordinated patterns.

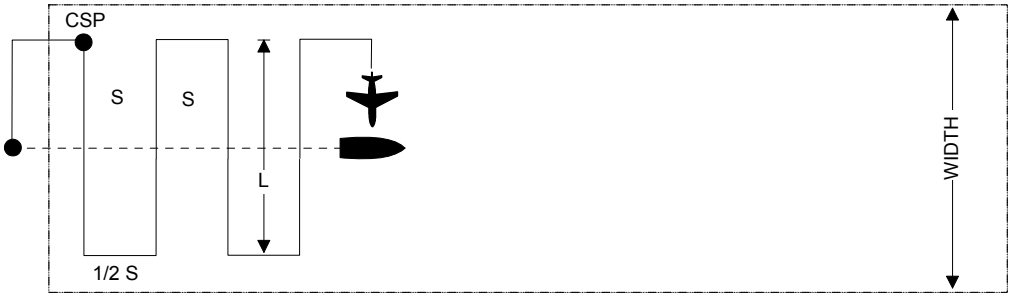


Figure H-46 Creeping Line Single-Unit Coordinated (CSC)

H.7.3.4 **Square Patterns (S)** are used to search a small area when some doubt exists about the distress position. They provide more uniform coverage than a sector search and may be expanded. Square searches are referred to as expanding square searches beginning at datum and expanding outward. If datum is a line instead of a point, the

pattern may be changed to an expanding rectangle. The first leg is usually directly into the wind or current to minimize navigation errors. A precise pattern, it requires the full attention of the navigator. If two aircraft (the maximum that should be used) are assigned to the same area, they must fly their individual patterns at different altitudes on tracks, which differ by 45°. See Figure H-47.

(a) **Square Single Unit -- Sierra Sierra (SS).**

(1) Use this pattern when confident the datum is within close limits. The first leg is normally in the direction of the search object's drift. All course changes are 90 degrees to the right.

(2) The pattern shown in Figure H-47 has 1 NM track spacing. The length of each leg is indicated. For different track spacing, multiply the distances shown in the pattern by the desired track spacing to find the length of each search leg.

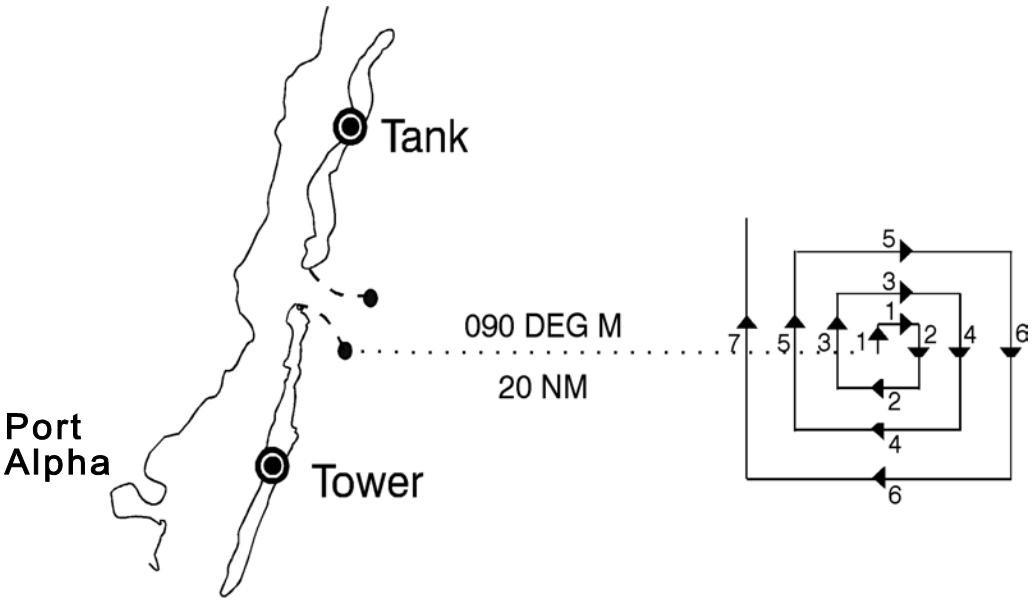


Figure H-47 Square Pattern Single-Unit (SS)

To determine the time required to transit each leg, use Table H-42, Square Pattern Computations. Enter the Table with the track spacing and SRU speed. Multiply the number from the Table by the length of the search leg shown in Figure H-47 to get the time required to complete that leg at the given search speed.

Example: Track spacing = 3 NM, speed = 10 kts:

- Find the length of the second southerly leg. Solution: Multiply the length of the second southerly leg of Figure H-51 (4) by the 3 NM track spacing to get 12 NM.
- Find the time required to complete this search leg. Example: Enter Table H-42 with a track spacing of 3 NM and a search speed of 10 knots and read the value "18:00" (18 minutes and zero seconds). Multiply this value by 4 (leg factor in Figure H-47). The result is 72 minutes to complete the leg.

Table H-42 Square Pattern Search Computations

Track Spacing	Speed (kts)								
	3	5	8	10	15	20	60	80	90
0.5	10:00	6:00	3:45	3:00	2:00	1:30	0:30	0.225	0:20
1.0	20:00	12:00	7:30	6:00	4:00	3:00	1:00	0:45	0:40
1.5	35:00	18:00	11:15	9:00	6:00	4:30	1:30	1:075	1:00
2.0	40:00	24:00	15:00	12:00	8:00	6:00	2:00	1:30	1:20
2.5	50:00	30:00	18:45	15:00	10:00	7:30	2:30	1:555	1:40
3.0	60:00	36:00	22:30	18:00	12:00	9:00	3:00	2:18	2:00
3.5		42:00	26:15	21:00	14:00	10:30	3:30	2:405	2:20
4.0		48:00	30:00	24:00	16:00	12:00	4:00	3:03	2:40
4.5		54:00	33:45	27:00	18:00	13:30	4:30	3:255	3:00
5.0		60:00	37:30	30:00	20:00	15:00	5:00	3:48	3:20
6.0			45:00	36:00	24:00	18:00	6:00	4:33	4:00
7.0			52:30	42:00	28:00	21:00	7:00	5:18	4:40
8.0			60:00	48:00	32:00	24:00	8:00	6:03	5:20

Note: All times in minutes and seconds
Note: Interpolation may be used in this table

H.7.3.5 **Sector Patterns (V)** These patterns may be used when datum is established within close limits, a very high coverage is desired in the immediate vicinity of datum, and the area to be searched is not extensive. The patterns resemble the spokes of a wheel and cover circular search areas. Datum is located at the center of the wheel and should be marked with a suitable floating marker. By marking datum, the SRU has a navigation check each time the SRU passes through the center of the search area. While there are many types of sector search patterns, a six-sector pattern is usually used. It consists of three equilateral triangles with one corner of each triangle at datum. See Figures H-48 and H-49. The search radius is also the length of the crossleg. The track spacing ranges from zero at datum to a maximum equal to the search radius at the end of each search leg. This search pattern can be used in both single and multi- unit searches. An average POD for sector patterns can be determined by using the mid-leg track spacing. Sector searches have high Probability of Success (POS) near datum assuming the object is in the search area. Generally, aircraft sector search areas do not have a radius greater than 20 to 30 miles, while marine craft use a maximum radius of 5 miles. Because only a small area is covered, datum should be recomputed on every search to allow for drift. If the search is oriented over a marker, adjustment for total water current (TWC) will occur automatically, and only leeway must be considered. For standardization, all turns should be made to the right.

(a) *In Sector Single-Unit (VS)* searches, four-sector and six-sector patterns are most commonly used. See Figure H-48.

(1) The six-sector pattern is easiest since it divides the circle into three equal triangles with one corner of each triangle at datum. All search legs, crosslegs, and the maximum track spacing are equal to the radius of the circle.

(2) The four-sector pattern has 90° between successive radii, and only two search legs (diameters) and one crossleg (equal to 1.4 times search radius) are required to complete the pattern. To obtain complete area coverage, the pattern is rotated 45° after completion of the first pattern, and then run again.

(b) *Sector Single-Unit Radar (VSR)* is used when a radar-equipped marine craft takes station at the center of the pattern and provides radar navigation assistance to one aircraft completing a sector search pattern.

(c) **Sector Search Patterns**.

(1) **Sector Search Pattern: Single Unit -- Victor Sierra (VS)**, Figure H-48. When practical, the first leg of the search is normally in the direction of search object drift. All turns in this pattern are 120° to the right. All legs of the search pattern are equal to the chosen radius. Upon completion of the pattern, a second pattern is started with the heading of the new first leg 30° to the right of the final course of the first pattern.

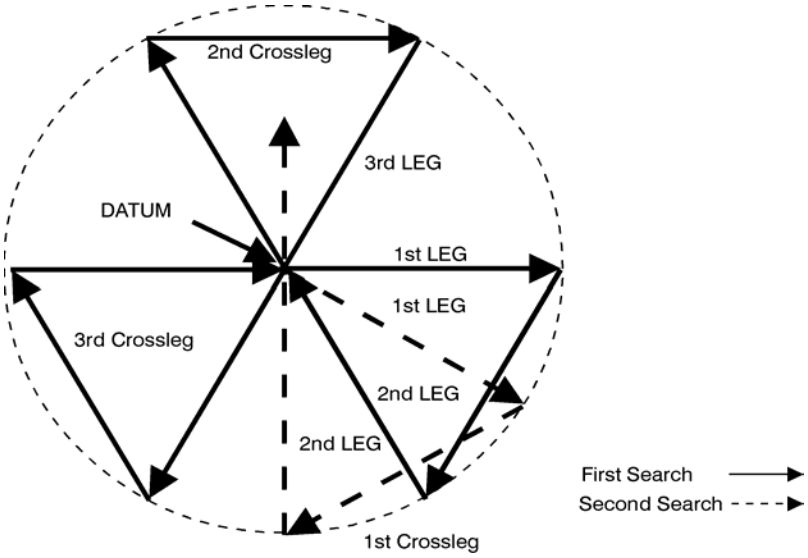


Figure H-48 Sector Pattern Single-Unit (VS)

(2) **Sector Search Pattern: Two-Units -- Victor Mike (VM).** The VM pattern is used when two SRUs are available, Figure H-49. As the first SRU begins a Victor Sierra search, the second begins its pattern at datum in a direction 90° to the left of the first leg of the first SRU. If the SRUs arrive at datum to begin the search at the same time, the second starts at a lower speed than the first. When the first SRU is about one leg ahead of the second, the second accelerates to search speed. The slow start of the second SRU prevents the SRUs from arriving at datum at the same time. When both have completed one VM pattern, the coverage is the same as if a single SRU had completed two VS patterns.

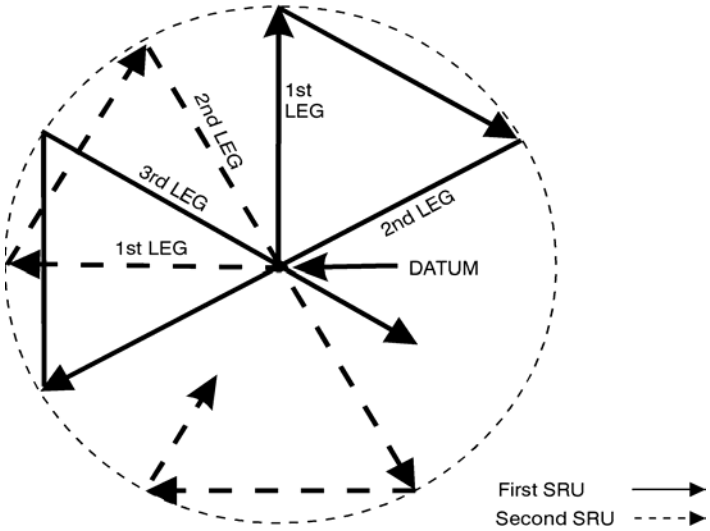


Figure H-49 Sector Pattern Two-Unit (VM)

(3) The sector search pattern becomes too complicated for more than two SRUs. When more than two SRUs are available, consider using a multi-unit parallel track (PM) search pattern, or dividing the search area into smaller areas and conducting single unit searches. Sector search distance and time calculations

are as follows:

- To determine the distance traveled by each SRU completing a sector search, multiply the radius (R) by nine. (Trackline = 9 x R NM)
- To determine the Total Time (T) for a search, multiply the time (t) for one leg from Table H-43 by nine. (T = 9 x t)
- To determine Total Area (A) covered in a search, square the radius (multiply the radius (R) by itself), and then multiply the resultant by pi (3.14).

  (A = R x R x 3.14)

Table H-43 Sector Pattern Search Computations

Radius	Speed (kts)								
	3	5	8	10	15	20	60	80	90
0.5	10:00	6:00	3:45	3:00	2:00	1:30	0:30	0.225	0:20
1.0	20:00	12:00	7:30	6:00	4:00	3:00	1:00	0:45	0:40
1.5	30:00	18:00	11:15	9:00	6:00	4:30	1:30	1:075	1:00
2.0	40:00	24:00	15:00	12:00	8:00	6:00	2:00	1:30	1:20
2.5	50:00	30:00	18:45	15:00	10:00	7:30	2:30	1:555	1:40
3.0	60:00	36:00	22:30	18:00	12:00	9:00	3:00	2:18	2:00
3.5		42:00	26:15	21:00	14:00	10:30	3:30	2:405	2:20
4.0		48:00	30:00	24:00	16:00	12:00	4:00	3:03	2:40
4.5		54:00	33:45	27:00	18:00	13:30	4:30	3:255	3:00
5.0		60:00	37:30	30:00	20:00	15:00	5:00	3:48	3:20
6.0			45:00	36:00	24:00	18:00	6:00	4:33	4:00
7.0			52:30	42:00	28:00	21:00	7:00	5:18	4:40
8.0			60:00	48:00	32:00	24:00	8:00	6:03	5:20

Note: Time to complete one leg (t) in minutes and seconds
Note: Interpolation may be used with this table

H.7.3.6 **Contour Patterns (O)** are used for search in mountainous and hilly terrain. They are adaptable to underwater SRUs for searching peaks on the ocean floor. Contour searches are covered in references (a) and (b).

H.7.3.7 **Flare Patterns (F)** are used only at night. Detection of survivors without visual aids is difficult at night. Parachute flares increase the chance of detection only slightly and are effective mostly for large objects in well-defined search areas on flat land or at sea. Parachute flares should be used for searches over land when the urgency is such that the risk of starting ground fires becomes acceptable. They are more useful in sea searches where searchers under parachute flare illumination are less likely to be confused by silhouettes or reflections from objects other than the target. The flares are normally dropped from a fixed- wing aircraft above and ahead of the SRU. The most effective SRUs for flare patterns are, in order, vessels, helicopters, and fixed-wing aircraft.

(a) *Flare Single-Unit (FS)* is conducted by a single vessel or helicopter with an aircraft dropping flares. See Figure H-50.

(1) For ships, the aircraft should drop the flares upwind of the vessel, off the starboard or port bow. Flare burnout should occur on the opposite quarter of the vessel. Illumination may be on one or both sides of the SRU.

(2) For helicopters, the search pattern should be flown into the wind or downwind at a minimum altitude of 500 feet. Favorable visual meteorological conditions should exist. The flares should be dropped at the 2 o'clock or 10 o'clock positions at a height, which permits flare burn out at or below helicopter altitude. Illumination should be continuous because alternating between light and darkness disorients helicopter pilots. With consideration for wind strength, the pattern should be planned so that the fixed-wing aircraft drops a new flare just before the old burns out. The helicopter pilot should be able to see the flare or flare-dropping aircraft when the flare is dropped.

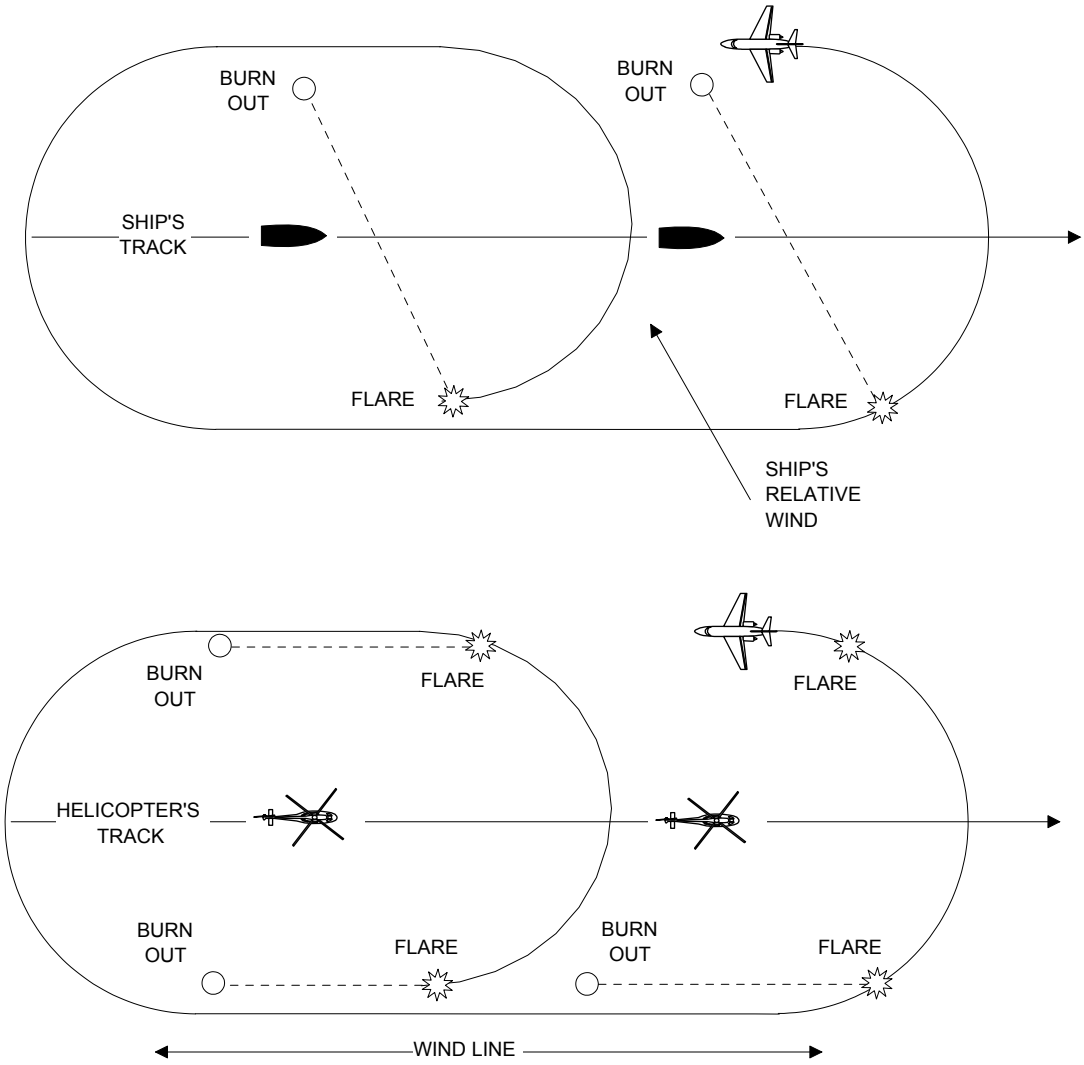


Figure H-50 Flare Single-Unit (FS)

(b) *Flare Multi-Unit (FM)* is similar to the Parallel Track Multiunit Non-Return pattern. The vessels form abeam with spacing between ships depending on size of target and local conditions. The search legs are oriented into the wind. The aircraft flies a racetrack pattern over the formation, and between vessels, dropping a set of flares upwind so that they are over the formation during the middle of the burning period. The aircraft drops a new set as the previous set burns out. See Figure H-51.

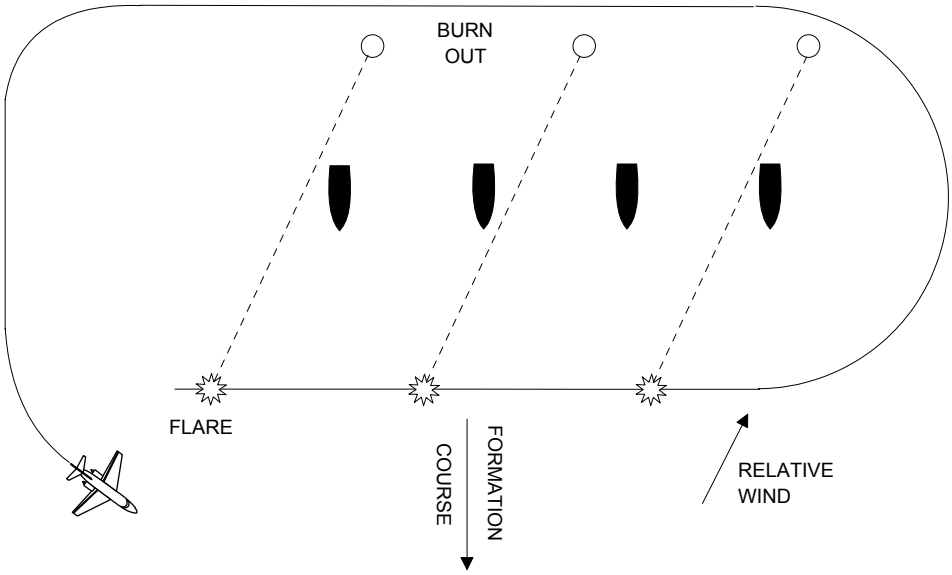


Figure H-51 Flare Multi-Unit (FM)

H.7.3.8 **Homing Patterns (H)** are used to locate emergency transmitters or other radio or electronic emissions from survivors or distressed craft when the detected signal is too weak for homing equipment to receive, or the SRU does not have homing equipment. Patterns for these searches are discussed in reference (b) (IAMSAR).

H.7.3.9 **Drift Compensation During a Search.** If the target and SRU are in motion, it may be necessary to consider the relative motion plot of the SRU with respect to the target, especially in high current areas. Failure to account for target motion may cause the target to drift out of the search area before the search is completed. Even if the target remains in the search area, the pattern relative to the target may be so distorted that POD is greatly reduced.

(a) While it is possible to compensate any search pattern for drift, in practice compensation is normally applied to parallel path (PS/CS) searches. To determine whether compensation is needed, planners ascertain expected velocity of target drift (v) during the next search, maximum dimensions (length (l) and width (w)) of the search area, and search speed (V) and track spacing (S) to be used.

(1) If the value of (v x l)/(V x S) is less than 0.1, compensation for drift is not necessary. Otherwise, orient the search area so that the major axis is parallel to target drift direction, and investigate the problem further.

(2) If the value of (v x w)/(V x S) is less than 0.1, no compensation is necessary. Otherwise, patterns for drift compensation should be considered.

(b) Patterns accounting for search target motion are:

(1) *Parallelogram Pattern (P_d).* In these patterns the search legs are parallel to target expected motion. The perimeter of the area relative to the earth can be found by moving the down creep side of the uncompensated area the distance the target is expected to drift during the search of that area. For multi-SRU searches, the total area should be divided into adjacent areas that join only along sides parallel to the search legs (see Figure H-52). All SRUs should creep in the same direction, with altitude separation provided for aircraft SRUs. Each area should be compensated to account for differences expected in drift rate between subareas.

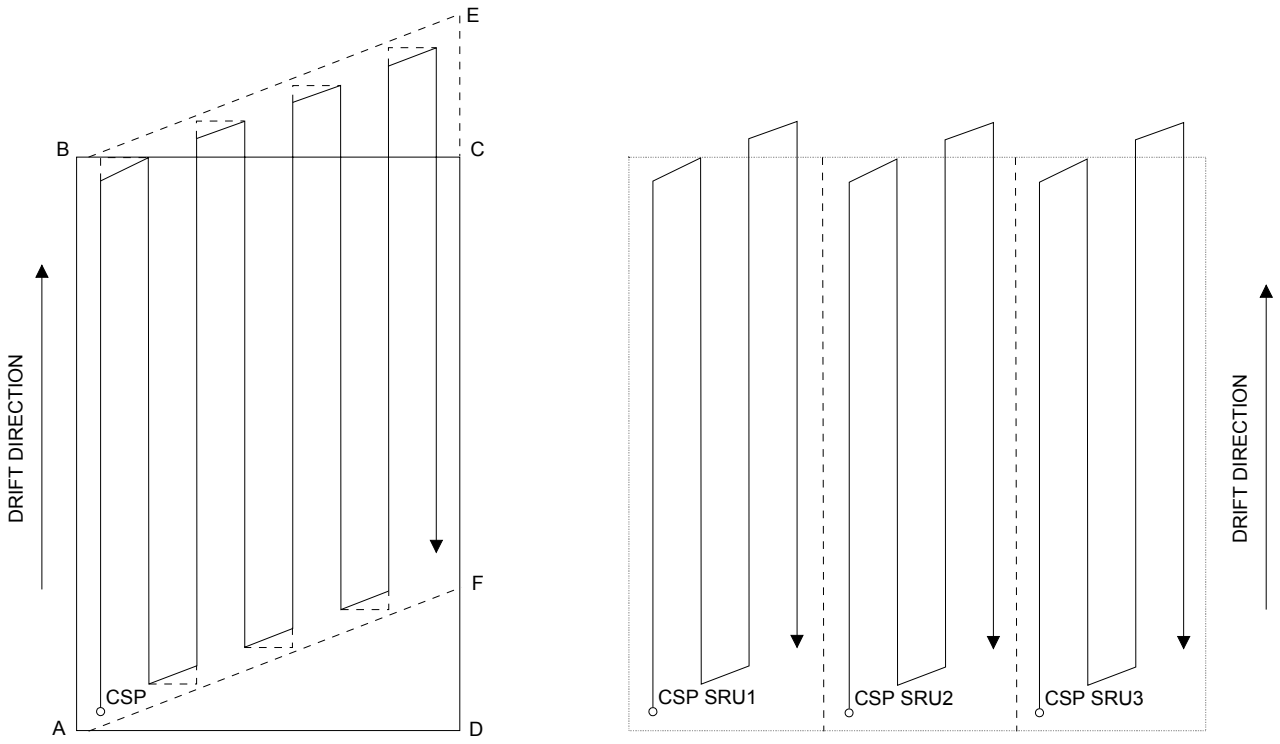


Figure H-52 Parallelogram Search Patterns

(2) *Cross-Over Barrier Pattern (B).* These patterns have search legs perpendicular to the expected relative movement of targets. The three types of barriers -- depending on relationships of search speed, search leg length, and target speed -- are advancing, stationary, and retreating barriers (see Figure H-53). Most barrier patterns executed by aircraft will be advancing. If multiple barrier patterns are used, search areas should be joined only along sides parallel to search legs. All SRUs should creep in the same direction, with aircraft given altitude separation. Barrier and parallelogram patterns should never be used in adjacent areas. A barrier pattern is more sensitive than a parallelogram pattern to differences between the computed rate of target drift and target rate of drift.

(3) *Expanded Area.* Circumstances may not permit use of parallelogram or barrier patterns for drift compensation. The search area size and number of SRUs may preclude establishing adjoining search areas. If so, the planner should expand the area and plan a search with non-compensated patterns. The amount and direction(s) of expansion should be consistent with expected target drift. Figure H-54 illustrates a case of drift direction reasonably well known, but a search area grouping requiring the expanded area technique. In this case, search areas are oriented in the direction of drift. Figure H-55 illustrates a similar case where the search area cannot be oriented with the drift direction. When the search is completed, the initial area, not the expanded area, is completely covered relative to the search target.

(c) When drift compensation is used, SRUs should arrive on scene at assigned times. Delays may occur, but target motion continues and its effect on area coverage relative to the target should be considered. In some cases the assigned area of a late arrival can be moved down drift without adversely affecting SRU separation. In other cases, the SMC will need to determine the uncovered area and search it later to ensure coverage. Search area prioritization also reduces the effects of delay or interruption. Areas can be ranked according to probability of containing the target. If this is done in advance, SRUs can be reassigned from areas of lower probability.

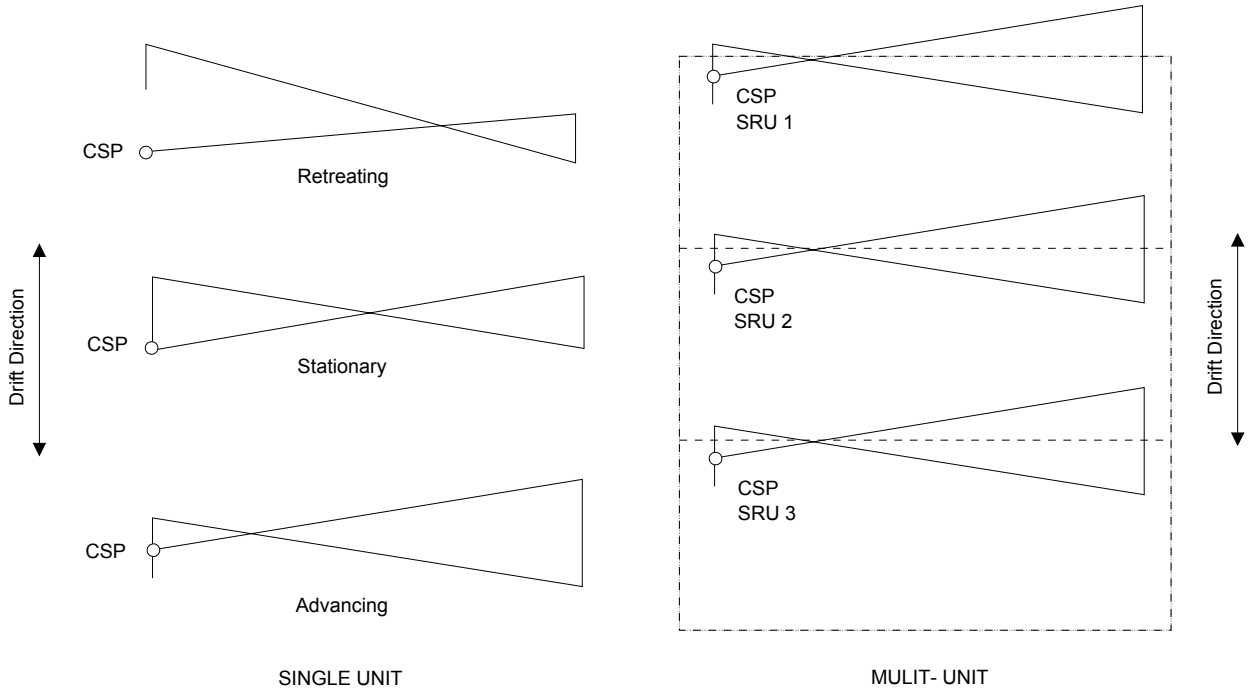


Figure H-53 Cross-Over Barrier Pattern (B)

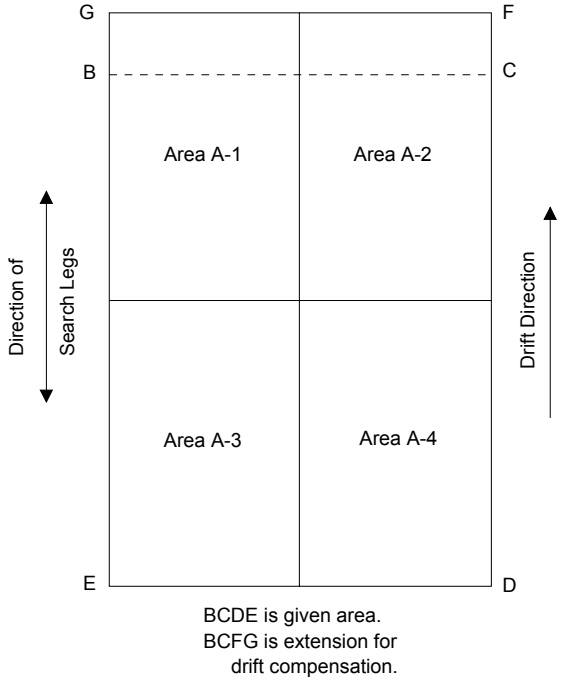


Figure H-54 Expanded Area, Drift Oriented

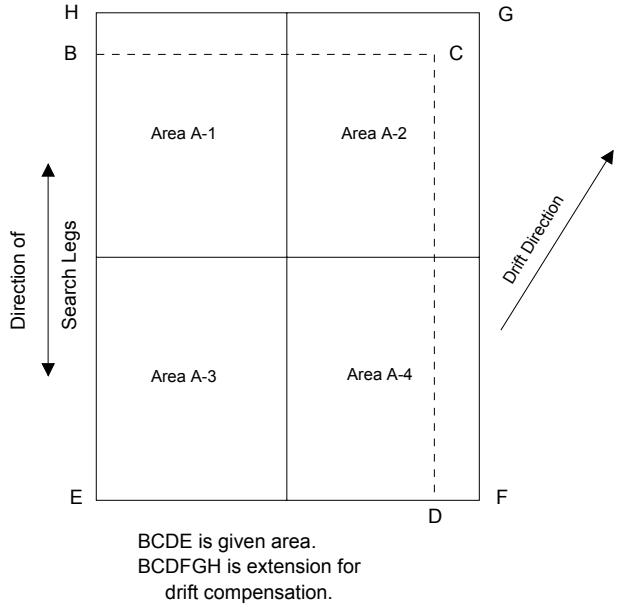


Figure H-55 Expanded Area

H.7.4 Search Pattern Summary

Characteristics of the various types of search patterns are summarized in Figure H-46.

Table H-44 Search Pattern Summary

Pattern	*Name*	*SRU required*	*Remarks*
TSR	Trackline single-unit return	1	For search of a trackline or line of position when unit must break off search at same end of track as search originated.
TMR	Trackline multiunit return	2 or more	Same AS TSR except that 2 or more SRUs a are used cruising abeam of each other.
TSN	Trackline single-unit	1	Same as TSR except that search terminates at non-return at opposite end of track from commence search point.
TMN	Trackline multiunit	2 or more	Same as TMR except that search terminates at nonreturn opposite end of track from commence search point.
PS	Parallel track single-unit	1	Search of a large area when position of distress is unknown.
PM	Parallel track multiunit	2 or more	Same as PS except two or more SRUs search abeam of each other a distance S apart.
PMR	Parallel track multiunit	2 or more	Used for search of long rectangular area where return only one track out and back is possible.
PMN	Parallel track multiunit	2 or more	Only en route SRUs or transient craft available nonreturn for one track through search area.
PSL	Parallel track single-unit	1	Same as PS except SRU uses Loran lines for Loran line greater navigational accuracy on tracks.
PMC	Parallel multiunit circle	2 or more	Underwater pattern only.
PSS	Parallel single-unit spiral	1	Underwater pattern only.
Pd	Parallel drift compensated	1 or more	Used when target motion requires drift Compensation
CS	Creeping line single-unit	1	Distress generally known to be between two points. Wider than trackline patterns.
CSC	Creeping line single-unit coordinated	1 acft + 1 ship	Same as PS except coordinated ship movement used to obtain greater navigational accuracy.
SS	Square single-unit	1	Distress Position known within close limits and search area not extensive.
SM	Square multiunit	2 acft	Same as SS except two SRUs fly at different altitudes on tracks which differ by 45°
VS	Sector single-unit	1	Distress position known within close limits and search area not extensive.
VSR	Sector single-unit radar	1 acft + 1 ship	Same as VS except ship controls aircraft by radar.
OS	Contour single-unit	1	Search of mountainous/hilly terrain.
OM	Contour multiunit	2 or more	Search of mountainous/hilly terrain by land search teams.
FS	Flare single-unit	1 acft + 1 ship or 2 acft.	Night visual search only.
FM	Flare multiunit	1 acft + ships	Night visual search only.
HSA	Homing single-unit aural	1	Electronic homing-in use.
HSM	Homing single-unit meter	1	Electronic homing-in use.
HMN	Homing multiunit nonreturn	2 or more	Electronic positioning use.
B	Cross-over Barrier	1 or more	Used when target motion requires drift compensation.

Section H.8
Search Action Plans

A standard SAP allows the reader to quickly find critical information by knowing that it will always be in a certain place and to identify vital information that is missing. Equally as important, the DRAFTER of the SAP only needs to learn the format once, since it is now standardized throughout the Coast Guard. Benefits of this standardized format include:

- time saved in preparing the message
- fewer calls looking for missing information
- time saved finding information critical to executing the mission

The standard SAP format is provided in Appendix C.

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Section H.9
Manual Solution Worksheets

The following worksheets are for the modified inputs to the manual solution contained in the IAMSAR Manual, which corresponds with the Joint Automated Worksheets (JAWS) available with C2PC and SARPC. A job aide follows each worksheet. The worksheets included are:

- Reversing Tides & Other Currents Worksheet
- Wind Current Worksheet

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REVERSING TIDES & OTHER CURRENTS WORKSHEET

Case Title: _____ Planner's Name: _____ Date: _____

A. Incident Summary

	MINIMUM	MAXIMUM
1. Latitude	_____N/S	_____ N/S
2. Longitude	_____ W/E	_____ W/E
3. Surface Position DTG	_____ Z _____	_____ Z _____
4. Datum DTG	_____ Z _____	
5. Drift Interval	_____ HRS	_____ HRS

B. Time Conversions: GMT + Zone Description (Rev) = Zone Time

1. Surface Position DTG (Zone Time) _____ _____
2. Datum DTG (Zone Time) _____

C. Reversing Tidal Currents (Minimum / Maximum / First Search) (circle one)

1. REFERENCE STATION: _____ PAGE: _____ DATE: _____
   SUBSTATION: _____ REFERENCE NUMBER: _____

2. TIME DIFFERENCES

MINIMUM BEFORE	MINIMUM BEFORE
Flood _____ HRS _____ MIN	Ebb _____ HRS _____ MIN
Max Flood _____ HRS _____ MIN	Max Ebb _____ HRS _____ MIN

3. VELOCITY INFORMATION
   FLOOD: SPEED RATIO _____ AVERAGE DIRECTION _____ °T
   EBB: SPEED RATIO _____ AVERAGE DIRECTION _____ °T

4. a) REFERENCE STATION					b) SUBSTATION				
TIME	SPEED	TIME	SPEED	(E/F?)	TIME	SPEED	TIME	SPEED	(E/F?)
_____	SLACK	_____	_____		_____	SLACK	_____	_____	
_____	SLACK	_____	_____		_____	SLACK	_____	_____	
_____	SLACK	_____	_____		_____	SLACK	_____	_____	
_____	SLACK	_____	_____		_____	SLACK	_____	_____	
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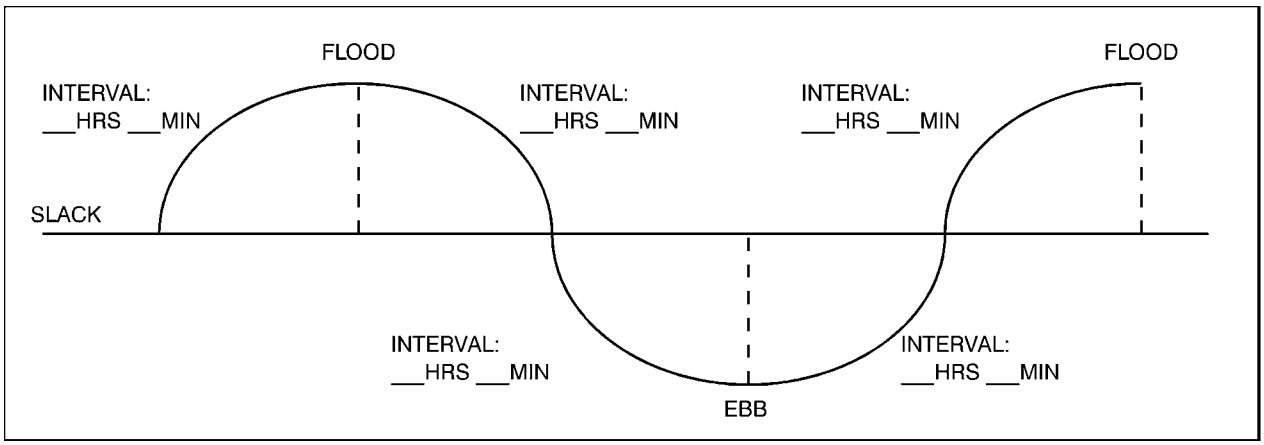

5. TIDAL CURRENT CHART
INCIDENT TIME: _____ DATUM TIME: _____

6. COMPUTING AVERAGE FACTOR OF CYCLE:
a) Time interval from slack water to incident: _____ HRS _____ MIN (Same Half-Cycle)
Time interval from slack water to DATUM: _____ HRS _____ MIN (Same Half-Cycle)

b) FACTORS FOR THE FLOOD/EBB CYCLE (1)	b) FACTORS FOR THE FLOOD/EBB CYCLE (2)
_____ _____ _____ _____ _____	_____ _____ _____ _____ _____
_____ _____ _____ _____ _____	_____ _____ _____ _____ _____
_____ _____ _____ _____ _____	_____ _____ _____ _____ _____
_____ _____ _____ _____ _____	_____ _____ _____ _____ _____
_____ _____ _____ _____ _____	_____ _____ _____ _____ _____
c) TOTAL VALUE OF FACTORS IN THIS CYCLE: _____	c) TOTAL VALUE OF FACTORS IN THIS CYCLE: _____
Divided by: Total Number of factors in Cycle: _____	Divided by: Total Number of factors in Cycle: _____
Equals: Average Factor for Cycle: _____	Equals: Average Factor for Cycle: _____

7. COMPUTING THE AVERAGE CURRENT SPEED FOR THE CYCLE:

Maximum Current Speed for the Cycle: _____ KTS	Maximum Current Speed for the Cycle: ____ KTS
Multiplied by the Average Factor EQUALS	Multiplied by the Average Factor EQUALS
The Average Speed for the Cycle: _____ KTS	The Average Speed for the Cycle: _____ KTS

8. COMPUTING TIDAL CURRENT VECTOR FOR THE CYCLE:

	(1) F / E	(2) F / E
Time Duration of Drift through the Flood/Ebb Cycle:	_____ HRS	_____ HRS
Multiplied by the Average Current Speed:	_____ KTS	_____ KTS
EQUALS: Magnitude of Current vector for the Cycle:	_____ NM	_____ NM

9. CALCULATING THE TOTAL TIDAL CURRENT VECTOR:
1st Current Vector: _____ °T _____ NM + 2nd Current Vector: _____°T _____ NM

EQUALS: Total Reversing Tidal Current Vector: _____ °T _____ NM

OTHER CURRENTS WORKSHEET

1. There are many other currents that may affect a search object. Some of these are: Lake, Longshore, River, Surf, Rotary, etc. The form is self-explanatory..

2. Type of Current: _____

3. Source of information: _____

	MINIMUM	MAXIMUM
4. Set	_____ °T	_____ °T
5. Drift	_____ KTS	_____ KTS
6. Vector Direction from above and	_____ °T	_____ °T
Drift x Drift Interval	_____ NM	_____ NM

REVERSING TIDAL CURRENT WORKSHEET
Job Aid

Introduction

This Job Aid provides step-by-step instructions to compute Reversing Tidal Current vectors as well as other currents. Tab 1 provides amplifying information on filling out section C.6.b)(Factors of each cycle).

A. Incident Summary

This section of the worksheet is a review of the incident data.

NOTE: Use two columns only if calculations are from previous D_{min} and D_{max}

1. Latitude — Enter data from Datum Worksheet line B.3.
2. Longitude — Enter data from Datum Worksheet line B.4.
3. Surface Position DTG — Enter data from Datum Worksheet line B.2.
4. Datum DTG — Enter data from Datum Worksheet line C.1.
5. Drift Interval — Enter data from Datum Worksheet line C.2.

B. Time Conversion

Tidal Current Tables use Standard Meridian Time (Zone Time) for predictions. To properly use these tables, SAR Planners must know the Zone Description based upon the Standard Time Meridian. By using the following methodology, the SAR Planner avoids confusion among Local Time, Daylight Saving Time, and Legislated Time. The formula is:

GMT + ZD (reversed) = ZT

Greenwich Mean Time (GMT) is equal to Zulu time. Zone Descriptions (ZD) can be found in various manuals, such as Bowditch. Article 1814 of Bowditch explains this conversion.

1. Surface Position DTG — Enter the result of A.3. + ZD (rev.)
2. Datum DTG — Enter the result of A.4. + ZD (rev.)

C. Reversing Tidal Currents

1. Reference Station — Record date of incident. In the Index of the appropriate Tidal Current Tables, locate and record Substation Name and Reference Number, Reference Station Name and Page Number.
2. Time Differences — In Table 2 of Tidal Current Tables, locate Substation and record Time Differences, if applicable.
3. Velocity Information — In Table 2 of Tidal Current Tables, locate Substation and record Speed Ratio and Average Direction for Maximum Flood and Maximum Ebb, if applicable.
4. Time of Each Cycle
   a) Reference Station — In Table 1 of Tidal Current Tables, locate Reference Station. Record the applicable Predicted Times of Slack Water, Max Flood/Ebb and Speed of Max Current. Annotate speed with F for Flood or E for Ebb.
   b) Substation — Add or subtract Time Differences (2. above) to Reference Station Predicted Times [4.a)] and record results. Multiply Speed Ratio (3.

	above) times Reference Station Predicted Speed and record results to **hundredths** (0.XX). Annotate resultant Speed with **F** or **E**.
5. Tidal Current Chart	Record Incident Time and Datum Time [form A.3. and A.4.]. Plot Incident and Datum Times on Tidal Current Chart. Label all affected times of Slack Water, Max Flood, and Max Ebb for the incident. Calculate the Interval of the 1st Half and 2nd Half of each Affected Cycle. Record results.
6. Computing Average Factor of Cycle	
a. Time interval	Calculate the interval from Slack Water, within same half-cycle, to Incident and record results. Calculate the time interval from Slack Water within the same half-cycle to Datum and record results.
b. Factors for the cycle	Using Table 3 of the Tidal Current Tables, determine which Table to use, A or B. Using Table 3, obtain necessary factors for each half of the Flood/Ebb Cycle. Record appropriately and circle F (Flood) or E (Ebb).

NOTE: If unsure of this instruction, refer to TAB 1 of this Appendix.

c. Average Factor	Add the factors [6.b)] for each cycle and record results. Count the number of factors [6.b)] and divide the Total Value of Factors by the number of factors. Record results to **thousandths** (0.XXX).
7. Average Speed	Record the Max Current Speed [4.b)]. Multiply it by the Average Factor and record result to **hundredths** (0.XX).
8. Vectors For Each Cycle	Calculate the Duration of Drift through each Cycle and record result to **hundredths** (0.XX). Record the Average Current Speed and multiply it by the Duration of Drift. Record result to **hundredths** (0.XX).
9. Tidal Current Vectors	Record the Average Direction of Drift for each appropriate Cycle [3. above]. Record the Magnitude of Current Vector for each appropriate Cycle [8. above]. Use a Maneuvering Board or Scientific Calculator to calculate the Total Reversing Tidal Current Vector. Record result to **tenths** (0.X).

TAB 1

General

Tab 1 provides a detailed explanation and step-by-step directions for filling out section 6.b, Factors of each cycle, of the Reversing Tidal Current Worksheet. You may find it helpful to use it in conjunction with the job aid located earlier in this appendix.

INSTRUCTION 6.b: REVERSING TIDAL CURRENT WORKSHEET

At the top of section 6.b, circle the direction of the cycle (Flood/Ebb). Now go to Table 3. Use Table A for all other places except those listed for Table B. From your Tidal Current chart, locate the starting point of your cycle. There are two places you can start at: incident position or slack water. Starting at incident, there are three possible situations:

INCIDENT TO DATUM, SAME HALF CYCLE:

Use Instruction 6.b(1)

INCIDENT TO MAX CURRENT, 1st HALF OF CYCLE:

Use Instruction 6.b(2)

INCIDENT TO SLACK WATER, 2nd HALF OF CYCLE:

Use Instruction 6.b(3)

INSTRUCTION 6.b(1): INCIDENT TO DATUM, SAME HALF OF CYCLE

Locate the interval from the Tidal Current chart (section 5) for that half of the cycle and locate the column in Table 3 for that interval. Do not interpolate on this Table. If you are halfway between the columns, go to the next higher column. Now on the left side of the Table enter the incident interval (time interval between slack water to datum). This is the factor for the incident; circle it. The next event is datum. On the left side of the Table enter the datum interval (time interval between slack water to datum). This is the factor for the datum; circle it. Now record the factors you circled and all in between. Check the number of factors for the cycle. For every 20 minutes of drift you should have one factor. (If you have one too many factors or are short one factor - ok. This is probably due to rounding off on Table 3.) You have all the factors for your cycle; go to the instructions for section 6.c.

INSTRUCTION 6.b(2): INCIDENT TO MAX CURRENT, 1st HALF CYCLE

Locate the interval from the Tidal Current chart (section 5) for that half of the cycle and locate the column in Table 3 for that interval. Do not interpolate on this Table. If you are halfway between the columns, go to the next higher column. Now on the left side of the Table enter the incident interval (time interval between slack water to incident). This is the factor for the incident; circle it. The next event is Max Current. The max current is represented by the last 1.0 listed in the column (bottom of column); circle it. Now record the factors you circled and all in between. These factors are only for the 1st half of your cycle; you are not finished yet. Move on to the next half cycle, there are two possible situations.

MAXIMUM CURRENT TO SLACK WATER, 2nd HALF OF CYCLE:

Use instruction 6.b(4)

MAXIMUM CURRENT TO DATUM, 2nd HALF OF CYCLE:

Use instruction 6.b(5)

INSTRUCTION 6.b(3): INCIDENT TO SLACK WATER, 2ND HALF OF CYCLE

Locate the interval from the Tidal Current chart (section 5) for that half of the cycle and locate the column in Table 3 for that interval. Do not interpolate on this Table. If you are halfway between the columns, go to the next higher column. Now on the left side of the Table enter the incident interval (time interval between slack water to incident). This is the factor for the

incident; circle it. The next event is slack water. The slack water is represented by the last factor listed at the top of the column; circle it. Now record the factors you circled and all in between.

Remember, you have not reached datum yet, you only calculated the factors for the first cycle. After you are finished with the 1st current vector you must continue with the next cycle starting at the slack water. There are two possible situations:

SLACK WATER TO MAX CURRENT, 1st HALF OF CYCLE:

Use instruction 6.b(6)

SLACK WATER TO DATUM, 1st HALF OF CYCLE:

Use instruction 6.b(7)

INSTRUCTION 6.b(4): MAX CURRENT TO SLACK WATER, 2ND HALF OF CYCLE

Locate the interval from the Tidal Current chart (section 5) for that half of the cycle and locate the column in Table 3 for that interval. Do not interpolate on this Table. If you are halfway between the columns, go to the next higher column. The first event in this half of the cycle is maximum current. Since we already have a factor for maximum current in this cycle (last factor in the 1st half of the cycle), we will circle the next factor after max current. The max current is represented by the last 1.0 listed in that column (bottom of column), cross it out. Circle the next factor just above it. This factor represents 20 minutes after maximum current. The next event is slack water. Slack water is represented by the last factor listed at the top of the column; circle it. Now record the factors you circled and all in between. You now have all the factors for your cycle, go to the instructions for section 6.c.

Remember, you have not reached datum yet, you only calculated the factors for the first cycle. After you are finished with the 1st current vector you must continue with the next cycle starting at the slack water. There are two possible situations:

SLACK WATER TO MAX CURRENT, 1st HALF OF CYCLE:

Use instruction 6.b(6)

SLACK WATER TO DATUM, 1st HALF CYCLE:

Use instruction 6.b(7)

INSTRUCTION 6.b(5): MAX CURRENT TO DATUM, 2ND HALF OF CYCLE

Locate the interval from the Tidal Current chart (section 5) for that half of the cycle and locate the column in Table 3 for that interval. Do not interpolate on this Table. If you are halfway between the columns, go to the next higher column. The first event in this half of the cycle is maximum current. Since we already have a factor for maximum current in this cycle (last factor in the 1st half of the cycle), we will circle the next factor after max current. The max current is represented by the last 1.0 listed in that column (bottom of column), cross it out. Circle the next factor just above it. This factor represents 20 minutes after maximum current. The next event is datum. On the left side of the Table enter the datum interval (time interval between slack water to datum). This is the factor for datum; circle it. Now record the factors you circled and all in between. Check the number of factors for the cycle. For every 20 minutes of drift you should have one factor. (If you have one too many factors or are short one factor - ok. This is probably due to rounding off on Table 3.) You have all the factors for your cycle; go to the instructions for section 6.c.

INSTRUCTION 6.b(6): SLACK WATER TO MAX CURRENT, 1st HALF OF CYCLE

Locate the interval from the Tidal Current chart (section 5) for that half of the cycle and locate the column in Table 3 for that interval. Do not interpolate on this Table. If you are halfway between the columns, go to the next higher column. The first event in this half of the cycle is slack water. Slack water is represented by the last factor listed at the top of the column; circle it. The next event is max current. The max current is represented by the last 1.0 listed in the column (bottom of column); circle it. Now record the factors you circled and all in between. These factors are only for the 1st half of your cycle; you are not finished yet. Move on to the next half cycle, there are two possible situations:

MAXIMUM CURRENT TO SLACK WATER, 2nd HALF OF CYCLE:

Use instruction 6.b(4)

MAXIMUM CURRENT TO DATUM, 2nd HALF OF CYCLE:

Use instruction 6.b(5)

INSTRUCTION 6.b(7): SLACK WATER TO DATUM, 1st HALF OF CYCLE

Locate the interval from the Tidal Current chart (section 5) for that half of the cycle and locate the column in Table 3 for that interval. Do not interpolate on this Table. If you are halfway between the columns, go to the next higher column. The first event in this half of the cycle is slack water. Slack water is represented by the last factor listed at the top of the column; circle it. The next event is datum. On the left side of the Table enter the datum interval (time interval between slack water to datum). This is the factor for the datum; circle it. Now record the factors you circled and all in between. Check the number of factors for the cycle. For every 20 minutes of drift you should have one factor. (If you have one too many factors or are short one factor - ok. This is probably due to rounding off on Table 3.) When you have all the factors for the cycle, go to the instructions for section 6.c).

WIND CURRENT WORKSHEET

Case Title: _____ Planner's Name: _____ Date: _____

A. Incident Summary

	MINIMUM	MAXIMUM
1. Latitude	_____ N/S	_____ N/S
2. Longitude	_____ W/E	_____ W/E
3. Surface Position DTG	_____ Z _____	_____ Z _____
4. Datum DTG	_____ Z _____	
5. Drift Interval	_____ HRS	_____ HRS

B. Wind Current Vector Computations Required

WC (#)	Reported Wind DTG	Wind Valid Period	Number of Hours
( )	0000Z	2100 - 0300	_____
( )	0600Z	0300 - 0900	_____
( )	1200Z	0900 - 1500	_____
( )	1800Z	1500 - 2100	_____
( )	0000Z	2100 - 0300	_____
( )	0600Z	0300 - 0900	_____
( )	1200Z	0900 - 1500	_____
( )	1800Z	1500 - 2100	_____
		Total hours (sum number of hours column)	_____

C. Wind Current Vector Computations

Interval	Reported Wind DTG	Wind (A)/(B)	Coefficients (C)/(D)	Contribution (A+C)/(BxD)
1		/	/	/
2		/	/	/
3		/	/	/
4		/	/	/
5		/	/	/
6		/	/	/
7		/	/	/
8		/	/	/

Resultant LWC (_____°T/ _____ KTS) times number of hours this period ( )
Equals WC ( ): _____ °T/ _____ NM

WIND CURRENT WORKSHEET

Interval	Reported Wind DTG	Wind (A)/(B)	Coefficients (C)/(D)	Contribution (A+C)/(BxD)
1		/	/	/
2		/	/	/
3		/	/	/
4		/	/	/
5		/	/	/
6		/	/	/
7		/	/	/
8		/	/	/

Resultant LWC (_____°T/ _____ KTS) times number of hours this period ( )
Equals WC ( ): _____ °T/ _____ NM

Interval	Reported Wind DTG	Wind (A)/(B)	Coefficients (C)/(D)	Contribution (A+C)/(BxD)
1		/	/	/
2		/	/	/
3		/	/	/
4		/	/	/
5		/	/	/
6		/	/	/
7		/	/	/
8		/	/	/

Resultant LWC (_____°T/ _____ KTS) times number of hours this period ( )
Equals WC ( ): _____ °T/ _____ NM

D. Total Resultant Wind Current Vector {WC} = WC(1) + WC(2) + WC(3) +. . .

[WC( ): ____ / ____, WC( ): ____ / ____, WC( ): ____ / ____]

Total Resultant Wind Current Vector (WC) = _____ °T / _____ NM

WIND CURRENT WORKSHEET
Job Aid

Introduction

The WIND CURRENT WORKSHEET is used to calculate current caused by the effect of persistent winds on the surface of the water. Wind current is calculated when the surface position is more than 20 NM from shore and the water depth is greater than 100 FT.

A. Incident Summary

This section of the worksheet is a review of the incident data.

NOTE: Use two columns only if calculations are from previous D_{min} and D_{max}.

1. Latitude — Enter data from Datum Worksheet line B.3.
2. Longitude — Enter data from Datum Worksheet line B.4.
3. Surface Position DTG — Enter data from Datum Worksheet line B.2.
4. Datum DTG — Enter data from Datum Worksheet line C.1.
5. Drift Interval — Enter data from Datum Worksheet line C.2.

B. Wind Current Vector Computations Required

Wind Current is calculated in 48-hour periods made up of sub periods of 6 hours or less. The first period begins at the time of datum and moves backward for eight 6-hour periods.

1. Wind Valid Period Column – Left Side — Scan the left hand column; insert the surface position time (A.3.) into the appropriate time slot.
2. Wind Valid Period Column – Right Side — Scan the right hand column; insert the datum time (A.4.) into the appropriate time slot.
3. WC(#) column — Consecutively, number the spaces in this column from surface position time to datum time.
4. Reported Wind DTG column — Starting with WC(1), append the appropriate date. Stop at the last numbered WC(#). 0000Z begins a new day.

EXAMPLE

WC (#)	Reported Wind DTG	Wind Value Period		Number of Hours
( )	0000Z	2100 - 0300		
(1)	040600Z	040730 ~~0300~~ - 0900		1.50
(2)	041200Z	0900 - 1500		6.00
(3)	041800Z	1500 - 2100		6.00
(4)	050000Z	2100 - ~~0300~~	050100	4.00
( )	0600Z	0300 - 0900		
( )	1200Z	0900 - 1500		
( )	1800Z	1500 - 2100		

5. Number of Hours column	Calculate the number of hours of drift for each WC period and enter result rounded off to **hundredths** (0.XX).
6. Total Hours	Sum the Number of Hours Column and enter the result. This figure should match the drift interval figure (A.5.).
C. Wind Current Vector Computations	This section calculates the local wind current (LWC) for each WC period. This method takes into account the effects of past or changing winds as well as Coriolis effect.
1. Reported Wind DTG column	On line 1, enter the Reported Wind DTG of the WC(#) from Section B above, corresponding with the wind current that this list will compute. The remaining lines will be the "Reported Wind DTG" for the wind history over the past 48 hours.
2. Wind (A)/(B) column	Obtain wind information from National Weather Service, Fleet Weather Service, or any other reliable source for the appropriate DTGs and enter wind direction (A) and speed (B).
3. Coefficients (C)/(D) columns	Obtain and enter the wind coefficients for the closest latitude from the wind current tables (Tables H-4a and H-4b). DO NOT INTERPOLATE between latitudes. If surface position is exactly between two columns (i.e., 07° 30' N), predict the direction of total drift, which should push the drifting object toward different latitude.
4. Contribution (A+C)/(BxD) column	Calculate Contribution: a. For each line, add the directions from columns A and C. If A+C is greater than 360 then subtract 360. b. For each line, multiply column B (wind speed) by column D (coefficient). Enter result rounded off to **thousandths** (0.XXX).
5. Resultant LWC times number of hours this period	Using a maneuvering board, or scientific calculator, vectorially add the vectors in the Contributions column. Enter result rounded off to **tenths** (0.X) of degrees and **hundredths** (0.XX) of KTS. Enter number of hours for this WC from Section B.
6. Equals WC(_): ____° T/___NM	Enter appropriate WC(#). Enter direction from Resultant LWC. Multiply LWC speed by the number of hours for this period and enter result (NM) rounded off to **hundredths** (0.XX).
7.	Complete steps 1 thru 6 for additional WC(#).
D. Total Resultant Wind Current Vector =	
1.	Enter all WC(#) vectors.
2. (WC) =	Using a maneuvering board, or scientific calculator, vectorially add the WC(#) vectors. Enter resultant direction and distance in **tenths** (0.X) of degrees and NM here and on Datum Worksheet, section E., line 1.

Appendix I
Flare Incidents

Recommended procedures and guidance for flare case planning are provided in this Appendix. Flare Sighting Check Sheets start on I-24. (These sheets may also be found in Appendix G.)

I.1 Flare Incidents
I.1.1 Response to Flares
I.1.2 Importance of Accurate Information
I.1.3 Importance of a Prompt Response
I.1.4 Skills Needed for Taking a Flare Sighting Report

I.2 Definitions
I.2.1 Meteorological Visibility
I.2.2 Nominal Range
I.2.3 Luminous Range
I.2.4 Geographic Range

I.3 Obtaining Sighting Data
I.3.1 Reporting Source
I.3.2 Flare Characteristics
I.3.3 Helpful Information to Obtain

I.4 Estimating Distances
I.4.1 Angle Above Horizon
I.4.2 Angle Below Horizon
I.4.3 Angle Measured From Origin to Apex
I.4.4 Limiting Factors

I.5 Determining a Datum Area
I.5.1 Single Reporting Source
I.5.2 Multiple Reporting Sources
I.5.3 Search Planning

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Section I.1
Flare Incidents

I.1.1 Response to Flares

Red and orange flares are recognized as marine and aviation emergency signals, and they must be treated as a distress and responded to unless available information indicates otherwise. Unresolved (insufficient information to either close or suspend) red or orange flares require first-light searches. Continued searches and searches in response to other than red or orange flares will depend on the specifics of the case.

I.1.2 Importance of Accurate Information

The nature of flare distress signaling makes planning and execution of searches difficult due to wide variations in flare types, possible altitudes, skill and position of the reporting source, and weather as well as many other factors. For that reason, the accuracy of the initial information received from a reporting source is most critical. For example, a hand-held flare in a recreational boat seen on the horizon by a reporting source standing on the beach will be approximately 7 nm away, while a parachute flare rising to 1200 feet and seen on the horizon by the same reporting source could be more than 18 nm away.

I.1.3 Importance of a Prompt Response

As with all SAR cases, a prompt, thorough and proper response yields the greatest chance of a rescue. Otherwise, the search planner may have no choice but to expand and/or extend the search, dispatching additional SRUs to search larger areas.

I.1.4 Skills Needed for Taking a Flare Sighting Report

Persons taking a flare report should have a good understanding of the applicable principles and procedures. The inquiry process requires patience and good interpersonal skills since reporting sources are rarely familiar with the terminology or procedures for prosecuting flare sightings. A flare reporting checklist must be used to ensure that a proper report is taken to get all the facts.

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Section I.2
Definitions

I.2.1 Meteorological Visibility

The greatest distance at which a black object of suitable dimensions can be seen and recognized by day against the horizon sky, or, in the case of night observations, could be seen and recognized if the general illumination were raised to the normal daylight level.

I.2.2 Nominal Range

The maximum distance at which a light can be seen in clear weather as defined by the International Visibility Code (meteorological visibility of 10 nautical miles).

I.2.3 Luminous Range

The maximum distance at which a light can be seen *under existing visibility conditions*. Luminous Range does not take into account the elevation of the light, the observer's height of eye, the curvature of the earth, or interference from background lighting.

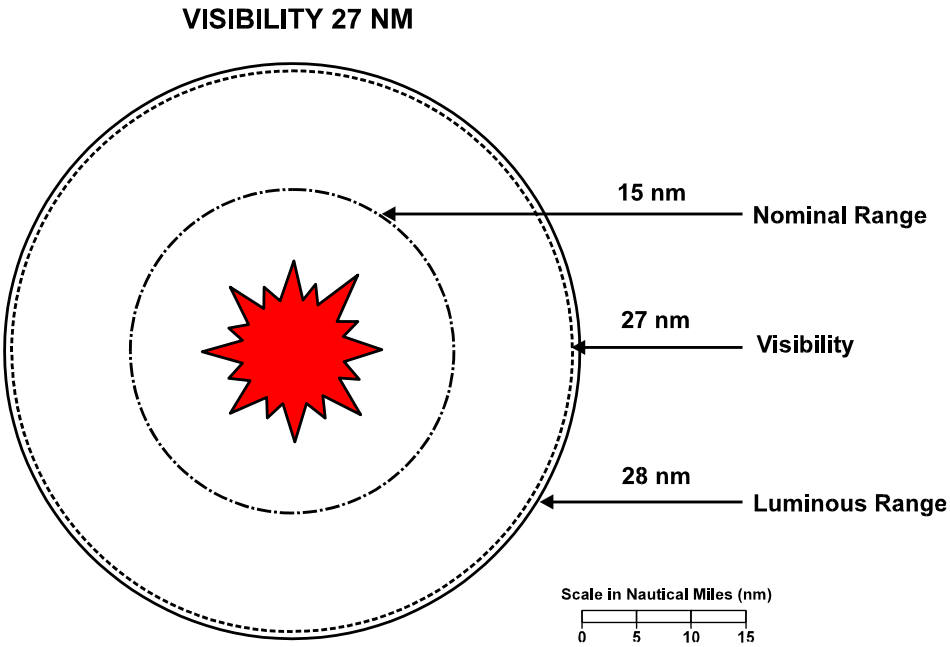

Figure I-1a Luminous Range and Visibility, example with visibility of 27nm

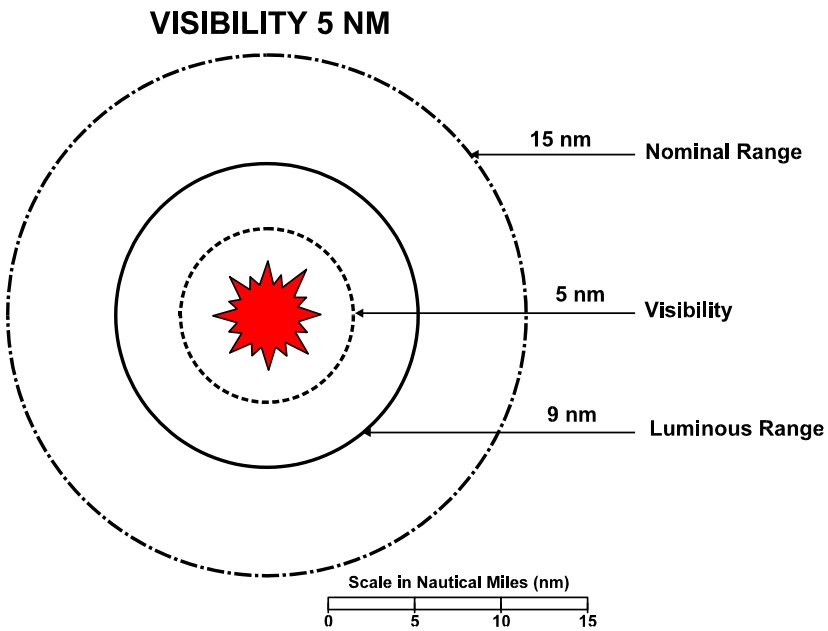

Figure I-1b Luminous Range and Visibility, example with visibility of 5 nm

I.2.4 Geographic Range

The maximum distance at which the curvature of the earth permits a light to be seen from a particular height of eye *without regard to the luminous intensity of the light*. Geographic range can be determined by adding the distance of the horizon from the observer and the distance of the horizon from the light.

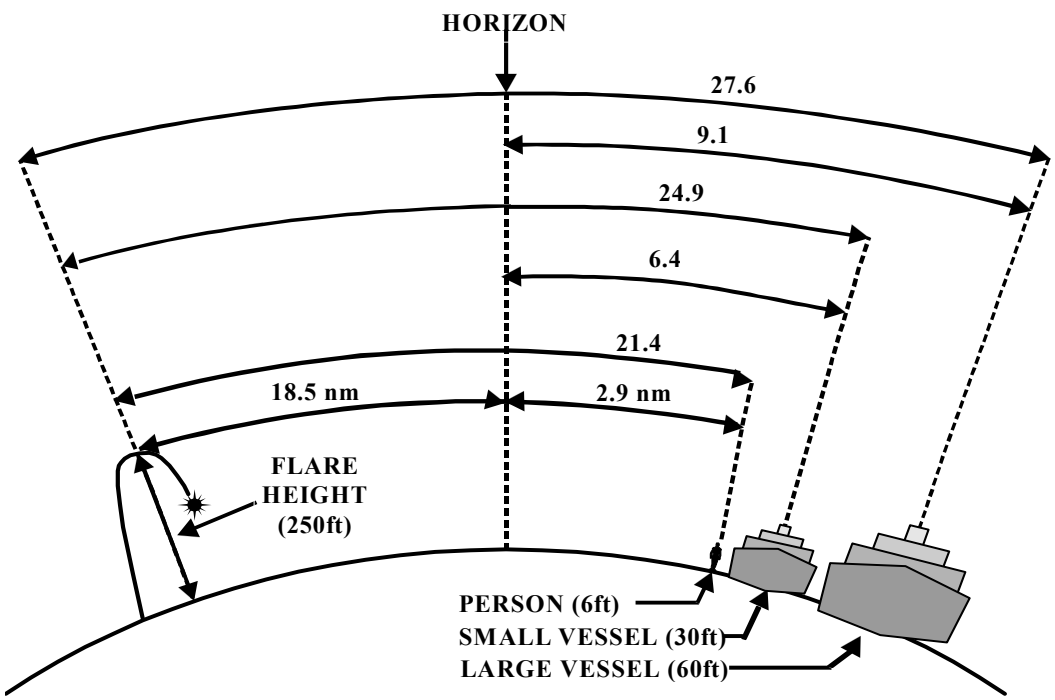

Figure I-2 Geographic Range of a flare by Height of Eye

Section I.3
Obtaining Sighting Data

I.3.1 Reporting Source

The following information about the reporting source should be obtained:

I.3.1.1 Position. Reporting source position is the point from which distance and direction are measured. Attempt to obtain: latitude/longitude; bearing and range from a prominent landmark; or street address.

Note: A latitude and longitude can often be derived from a reporting source's street address through the use of geo-location services provided on the Internet. G-OPR has funded such services. Information and links for the currently funded services can be found on the G-OPR website. In the event that no street address is available, consider dispatching an auxiliarist or a police officer with a hand held GPS to the reporting source location to obtain a GPS position. These practices will reduce the position error of the reporting source to virtually zero.

I.3.1.2 Height of eye. To most accurately estimate the range to the flare from the reporting source, the height of eye of the reporting source is important. If the reporting source is in a tall building, record the floor number and estimate 10 feet per floor above the height of eye at ground level.

I.3.1.3 Personal information of the source. Obtain the name of the reporting source and establish a means of further contact. Request that the reporting source remain on scene or return to the position of the sighting in order to assist in the search and rescue unit (SRU) placement. A reporting source who provides a way to be contacted or is willing to remain on the scene or return to the scene is more credible than one unwilling to do these things.

I.3.2 Flare Characteristics

Characteristics can aid in determining the distress location, and may correlate with other sightings, phenomena, or military exercises. Flares can be identified primarily by trajectory and duration of burn. As Table I-1 describes, meteor flares have a rapid rise and rapid fall. Parachute flares exhibit a rapid rise and slow descent. These characteristics can be observed by an astute reporting source. Judging the height of the flare is much more difficult, even for a trained eye. It is important to note that the height of a flare significantly affects the size of the search area. If the type of flare can be determined to be a meteor flare, rather than a parachute flare, the search area can be significantly reduced since meteor flares can achieve only about 1/3 the maximum height of parachute flares. Parachute flares are rare among recreational boaters. If a flare is determined to be a parachute flare, a major search effort may be needed to cover a large geographic area. Table I-1 lists characteristics by flare type, but additional information can also be helpful. As much of the following information as possible should be collected:

I.3.2.1 Color. It is critical in assessing urgency. Red and orange flares must be treated as distress cases until proven otherwise.

I.3.2.2 Number of flares, time(s) of sighting(s), and intervals between flares.

I.3.2.3 Apparent origin of the flare. Did the reporting source see where the flare came from? If so, was it near the horizon or definitely between the reporting source and the horizon? Did the flare illuminate any objects? If so, what were they?

I.3.2.4 Trajectory. The nature of the flare's trajectory is an extremely important clue. Every effort should be made to obtain accurate answers to the following questions: Did the reporting source see the flare both rise and fall? Rising only? Falling only? What were the rates of rising and falling (rapid rise and fall, rapid rise, slow fall, etc.)? Was the trajectory steep (mostly vertical) or flat (mostly horizontal)? Answers to these questions will help establish the type of flare and therefore the possible heights it could reach as well as provide some additional clues about its location. Table I-1 shows the characteristics of some common types of flares.

I.3.2.5 Time interval and duration of burn. This also aids in determining the type of flare.

Table I-1 Flare Characteristics

TYPE	TRAJECTORY	AVERAGE HEIGHT	CANDLEPOWER NOMINAL RANGE
METEOR*	RAPID RISE AND DESCENT	250 - 400 FT	10000 - 30000 15 - 17 NM
PARACHUTE**	RAPID RISE/SLOW DESCENT	1000 - 1200 FT`	20000 - 40000 14 - 20 NM
HAND-HELD***	STEADY	ASSUME 10 FT	500 - 15000 8 - 16 NM
*Meteor flares have no minimum altitude requirements. **Parachute flare requirements by SOLAS: 300 meters (990') height, 30K candlepower. ***Hand-held candlepower requirements: USCG-500; SOLAS-15000.			

I.3.2.6 Angle of observation. Often the reporting source will not be able to accurately estimate the angle of elevation without some assistance. The angle of elevation is the angle measured from the horizon to the top of the trajectory.

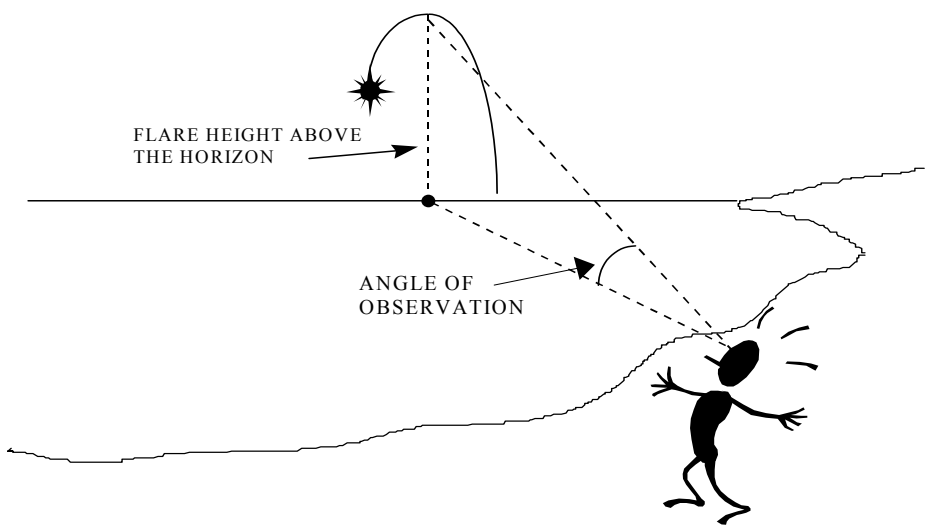

Figure I-3a Example of angle when flare origin is beyond the horizon and unobserved

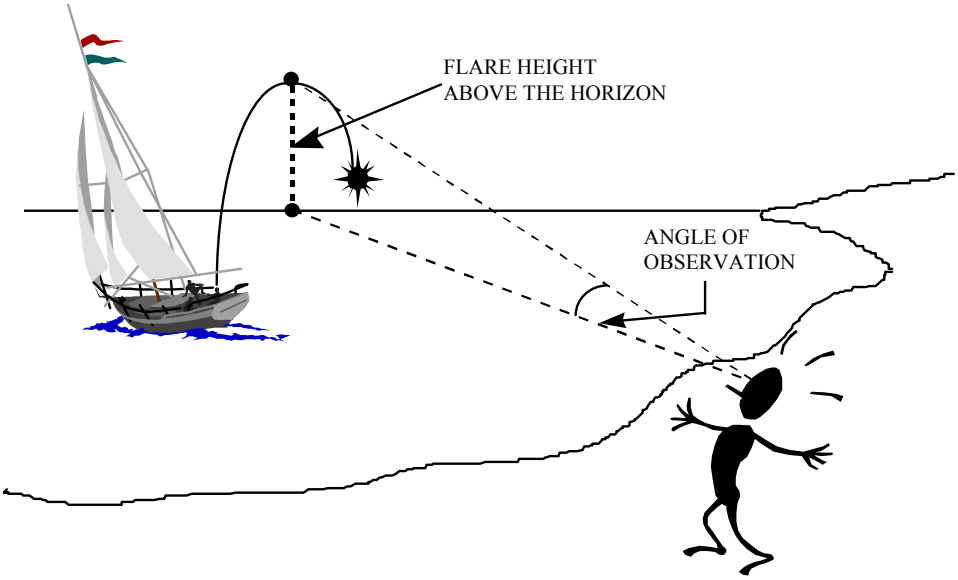

Figure I-3b Example of angle when flare origin is observed

If the origin of the flare is observed, the reporting source may measure the angle from the origin to the top of the trajectory. This method of determining the angle may be helpful when the horizon cannot be seen or used as a reference.

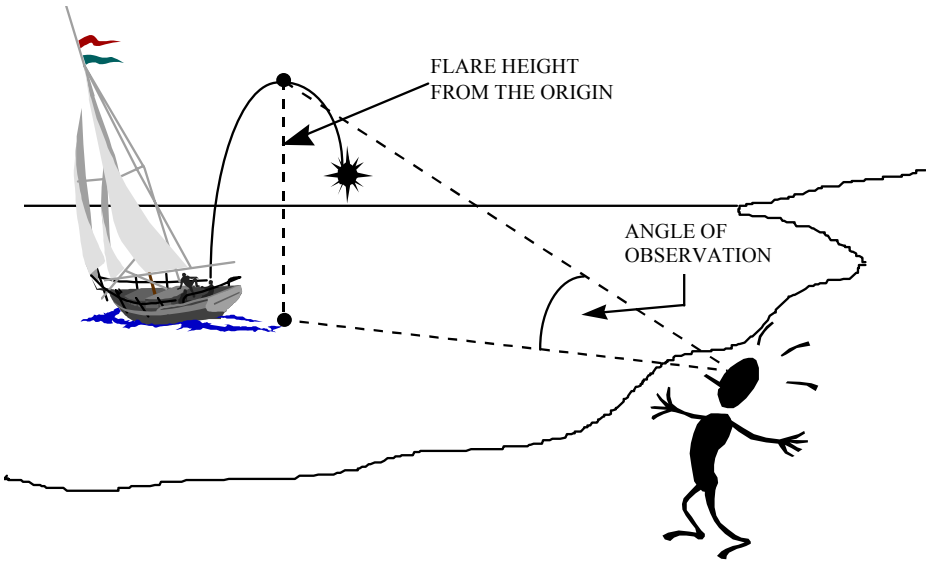

Figure I-3c Example of angle measured from flare origin to top of trajectory

The person taking the report should be sure to determine exactly what angle is measured. "Is the angle from the horizon to the top of the trajectory or from the point where you saw the flare take off to the top of the trajectory?" This distinction will become important in the planning stage.

(a) A major point to remember is that for any flare sighting with an angle of elevation of more than 8 degrees, the distance of the flare from the reporting source is less than 1.4 nm.

(b) Closed Fist Method. A closed fist held at arm's length with the thumb side up represents approximately 8 degrees of arc.

Unless the reporting source's height of eye is greater than the height of the flare at the top of its trajectory, the flare will normally appear to rise above the horizon. In this situation, when the bottom of the fist is aligned on the horizon relatively accurate estimates of small vertical angles can be made. Brief the reporting source on this reference system. "If you hold your fist at arm's length, with your thumb on top and the bottom of your fist on the horizon, was the top of the trajectory above or below the top of your fist?" If the flare was sighted below the top of the fist, have the reporting source attempt to more accurately estimate the angle with the horizon.

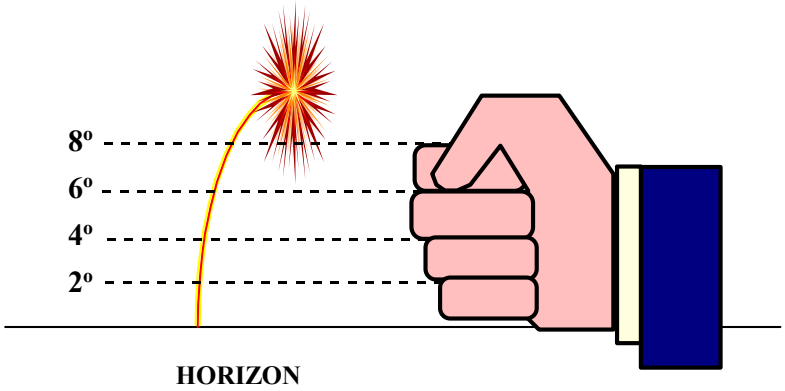

Figure I-4a Fist Method for measuring flare angles above horizon

An estimate of three fingers or half a hand can be extremely useful. Obtain the final estimate in terms such as "not less than ½ hand and not more than 1 ½ hands." Convert number of fingers or fractions of hands to degrees based on Figure I-4a above.

Estimates collected from untrained reporting sources are necessarily fraught with uncertainty. Search planners must carefully question reporting sources of flares to remove as much of the uncertainty as possible without encouraging the reporting source to report unjustifiably precise estimates. Search planners must then develop search plans that reflect the actual uncertainties. Failure to do so can result in searching either too small or too large an area and missing the target. An estimate of "definitely less than a fist, but definitely more than a quarter of a fist," translated to degrees as definitely less than 8 degrees but more than 2 degrees, can tremendously limit the datum area as compared with, "I can only say less than a fist." The objective is to "bracket" or estimate the bounds of the area containing the sighted flare without covering substantially too much or too little area.

With hand-held flares, and even meteor flares if the reporting source is high enough, the flare may not rise above the visible horizon if it originates between the reporting source and the horizon. In this case, the reporting source should be asked to align the top of the index finger with the horizon and estimate the apparent distance *below* the horizon using the fist method described above. See Figure I-4b.

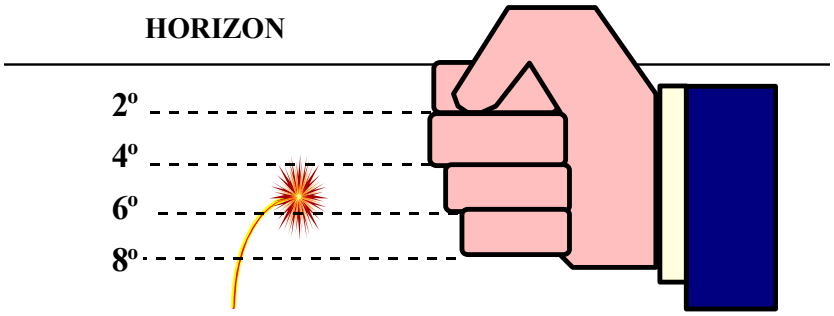

Figure I-4b Fist Method for measuring flare angles below the horizon

I.3.2.7 Bearing from the reporting source. There are several means by which a bearing may be estimated:

(a) clock method, (Figure I-5 shows how to determine the line of bearing by referring to the direction as points on a clock, with twelve o'clock being perpendicular to the reporting source in relation to the shore line or building where the reporting source is located. Most buildings along the shoreline will be aligned with the shore. If the "clock" is being referenced to a building's walls that are not aligned with the shoreline, then the search planner will need to determine the orientation of the building.)

(b) gyro/magnetic compass,

(c) reference object,

(d) seaman's eye, or

(e) a guess.

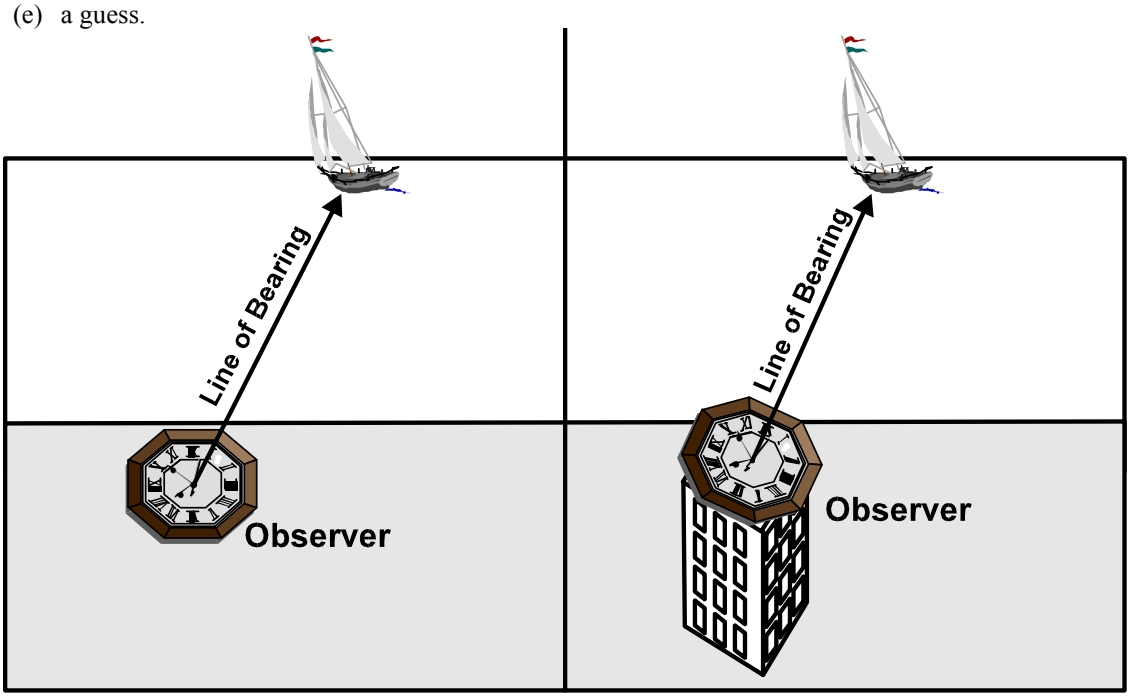

Figure I-5 Clock Method for determining bearing. Reporting source aligned with shore (left), bearing 1 o'clock; reporting source not aligned with shore (right), bearing 12 o'clock.

If the reporting source has difficulty in confidently estimating direction, amplifying information, such as the following, should be obtained:

(a) direction relative to the street direction,

(b) direction relative to a line passing through reporting source's position and another prominent landmark or reference point,

(c) identity of prominent landmarks on either side of the line of bearing from the reporting source to the flare,

(d) direction relative to the trend of the shoreline in that area, or

(e) direction relative to the line between the reporting source and the moon or a star or constellation the reporting source can confidently identify.

The search planner should estimate the degree of uncertainty in the form of bearing errors to the right and left of the reported bearing. These will establish rightmost and leftmost bearings from the reporting source. Datum

estimates must reflect real doubts. Failure to reflect realistic uncertainties can lead to false confidence in a search's chances for success.

I.3.2.8 Distance. Estimating distance directly from an observation, without recourse to vertical angles and tables, is difficult for even an accomplished seaman. Data developed in research conducted by the Coast Guard Research and Development Center (Robe, R.Q., et al., 1985) has shown that in most cases reporting sources tend to underestimate distance. Most estimates of distance should not be given significant consideration unless the reporting source is basing the estimate on the distance to a known object on or near the flare's line of bearing.

I.3.3 Helpful Information to Obtain

I.3.3.1 Aircraft/vessels seen in vicinity. If the reporting source can see the vessel being illuminated by the flare then the flare is inside the horizon. If an aircraft was seen, it may be possible to correlate this report with reports, if any, from the aircraft. It may also be possible to correlate the report with aircraft positions (from radar or radar playback) at the time of the sighting.

I.3.3.2 Obstructions. Information about obstructions can be of value in several ways.

(a) **Gauging distance.** For example, a flare seen to rise/descend in front of an island clearly indicates the maximum distance to the flare is the distance to the island. If seen behind an obstruction it clearly indicates the minimum distance is the obstruction distance.

(b) **Determining direction.** Flares seen over or between identifiable obstructions give the reporting source a reference for determining direction.

(c) **Estimating angle of elevation.** For example, a flare seen over the top of a nearby stand of 60 ft trees by a reporting source standing on the ground (assuming level terrain) means the flare could not have been fired from a distance very far beyond the tree line.

I.3.3.3 On scene weather and visibility. This can be useful in limiting the area to be searched. Ascertain how visibility was determined, such as from objects that are just visible at a known range. Keep in mind that horizontal visibility factors, such as ground fog, may not limit the visibility for a meteor or parachute flare as much as for a hand-held flare.

Section I.4
Estimating Distances

Estimating the distance of the flare from the reporting source is one of the more difficult problems in search planning. Flare sightings are generally made by untrained, inexperienced reporting sources. While any information they can provide is helpful, it also has a large associated uncertainty. However, the reporting source is not the only source of uncertainty. The actual height of the observed flare at the top of its trajectory is also subject to a large uncertainty. For reports of less than 4 degrees (1/2 fist), the range of distances increases very rapidly. Planners must use all means to obtain accurate information to establish a manageable search plan.

Before presenting the actual step-by-step procedures for using the distance tables for estimating minimum and maximum distances from the reporting source, an explanation of the rationale behind these procedures and tables is in order.

I.4.1 Angle Above the Horizon

If the flare is observed above the horizon at the apex of its trajectory, then its distance from the reporting source will depend on the reporting source's height of eye, the observed angle above the horizon and the height of the flare above the surface. Assuming that information about the first two factors can be obtained from the reporting source, this leaves the height of the flare as the only "unknown." For flares that are fired into the air, the maximum height is assumed to be 1200 feet for parachute flares and 500 feet for meteor flares. The minimum height for both types of flare is assumed to be 250 feet or 10 feet above that of the reporting source for heights of eye greater than 240 feet. A flare that rises only 250 feet must be much closer to a given observer (e.g. height of eye 20 feet) in order to produce a given observed angle above the horizon (e.g. 1 degree) than a flare rising to 1200 feet which produces the same angle from the same point of observation. The distance in the first case is 2.31 nm while the distance in the second case is 10.98 nm. Therefore, the minimum distance table (Table I-2a) is based on the assumed minimum flare heights and the maximum distance tables (Tables I-2b and I-5) are based on the assumed maximum flare heights. The procedures presented later in this appendix also show how to account for realistic limitations in the ability of reporting sources to estimate vertical angles and to identify different types of flares.

Example: If a reporting source with a sextant whose height of eye is 20 feet observes a flare rise to one degree above the horizon, it would be about 11 nm away if it rose to 1200 feet but only 2.3 nm away if it rose to only 250 feet. However, if the reporting source could only estimate the angle as between 0.5 and 2 degrees, then the minimum and maximum ranges would become 1.2 nm and 19.2 nm.

I.4.2 Angle Below the Horizon

If the reporting source is high enough, and the flare is low enough at the top of its trajectory, then it will not appear to rise above the horizon. If this happens, then the flare must be between the reporting source and the horizon. However, for large heights of eye, the distance to the horizon can be quite substantial. The datum area can be reduced significantly if angles *below* the horizon can be measured or estimated. In this case, for a given height of eye and angle below the horizon, the higher the flare rises above the surface, the closer it must be. This is exactly opposite to the situation described in the preceding paragraph. Since a flare that does any rising at all and fails to cross the horizon line must be quite close, the minimum distance was computed by assuming the maximum flare height was 10 feet below that of the reporting source for heights of eye up to 240 feet and 250 feet for greater heights of eye. A minimum flare height of zero was used to determine the maximum distance from the reporting source.

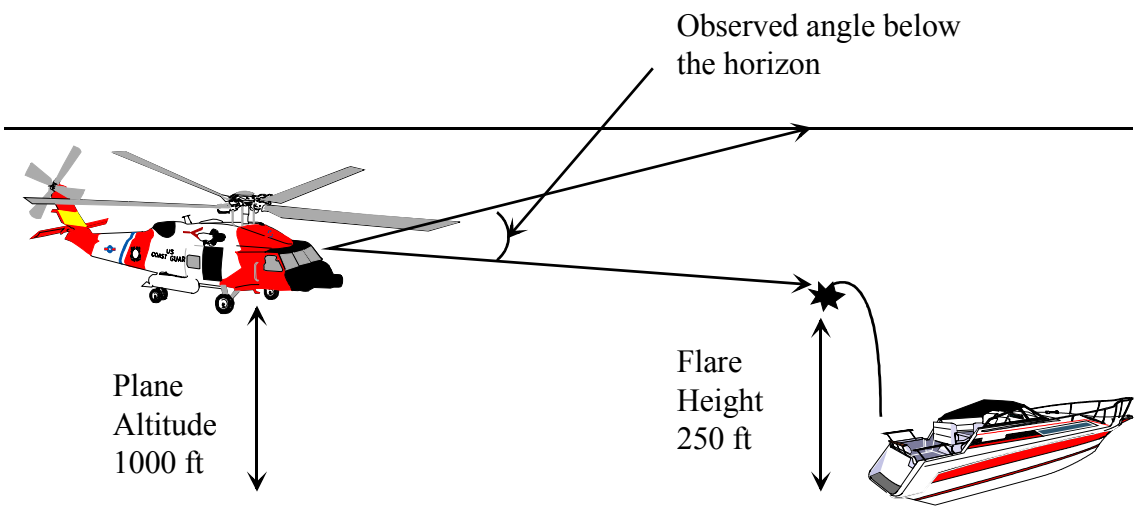

Figure I-6 Observed angle below the horizon

Example: A reporting source with a sextant and a height of eye of 300 feet observes a flare rise to within one degree of the horizon. If the flare's maximum height was 250 feet, it would be only 0.36 nm from the reporting source. If the maximum height was zero and it never actually left the surface, it would be about 2.2 nm away. However, if the reporting source could only estimate the angle as between 0.5 and 2 degrees below the horizon, then the minimum and maximum distances become 0.2 nm and 3.6 nm.

I.4.3 Angle Measured from Origin to Apex

The reporting source may not have a visible horizon to use as a reference for measuring angles, but may be able to estimate the angle between the origin and maximum height of the flare. Because the origin can be seen, the flare must be closer than the distance of the horizon, if the horizon could be seen. However, as stated before, for larger heights of eye the distance of horizon can be many miles away. To determine the maximum distance, and limit the datum area, a flare height of 1200 feet is assumed; and to determine the minimum distance, a flare height of 250 feet is assumed. The reporting source's height is not a factor in these calculations for several reasons. First, it is assumed that the earth is flat between the reporting source and the flare. Thus the horizon, which was used as a reference in the previous methods and whose distance from the reporting source varied with the reporting source's height of eye, is not a factor. Second, even though there are slight differences in the geometry and computed distances for different heights of eye, for the flat earth model and the heights and distances involved, these differences are insignificant. The solution found by using zero for the assumed height of eye and the simple trigonometry of right triangles produces sufficiently accurate results.

Example: If a reporting source with a sextant observes a flare rise to an observed angle of one degree from the flare origin to the apex, it would be about 11.3 nm away if it rose to 1200 feet but only 2.4 nm away if it rose to only 250 feet. However, if the reporting source could only estimate the angle as between 0.5 and 2 degrees, then the minimum and maximum distances become 1.2 nm and 22.6 nm. Figure I-7 illustrates this concept for several vertical angle observations.

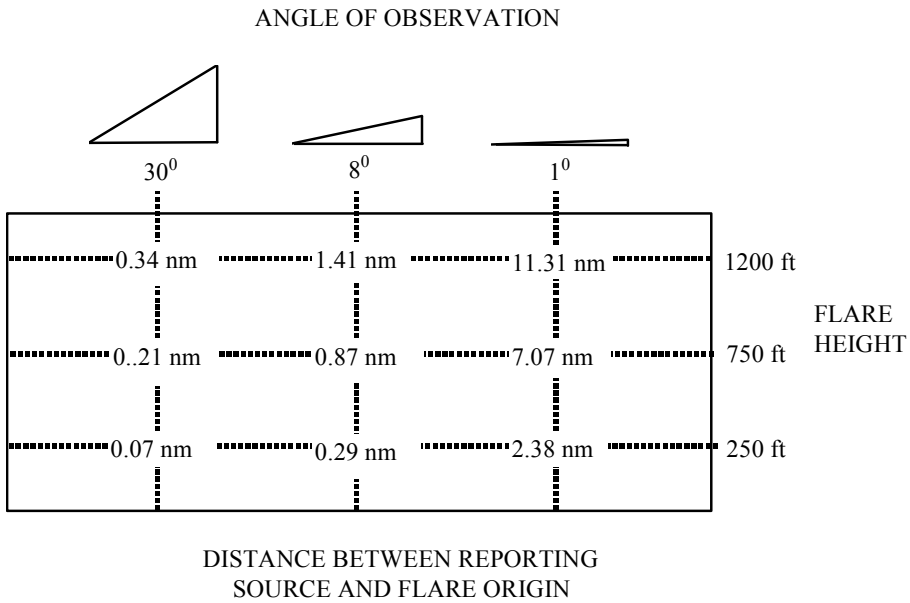

Figure I-7 Relationship of Vertical Angles to Distances (Flat Earth)

I.4.4 Limiting Factors

I.4.4.1 Geographic range. The geographic range is the absolute limiting factor for the maximum distance of all flares from the reporting source. Only rarely will flares be sighted at such an extreme range.

I.4.4.2 Luminous Range. The maximum distance may be limited by the luminous range of the flare at the time and place of the sighting. There is a complex relationship between luminous range and meteorological visibility. Because a flare is a bright source of light, it can be seen at distances greater than the meteorological visibility. As meteorological visibility decreases, so does a flare's luminous range. However, the relationship between the two changes dramatically. As shown in Figure I-8, a flare with a nominal luminous range of 20 nm may have actual luminous ranges from less than two to nearly five times the meteorological visibility. If on-scene visibility is known to be such than even the brightest flare could not be seen at a distance equal to the maximum distance estimated by other means, some portion of the far end of the datum line or area may be eliminated. For a flare having a nominal luminous range of 20 nm, the table below shows the actual luminous range under various visibility conditions. Figure I-14, discussed later, may be used to estimate luminous ranges in virtually all situations of practical interest.

On-scene Meteorological Visibility	Luminous Range
0.25 nm (500 yards)	1.2 nm
1 nm	3.5 nm
2 nm	6 nm
5 nm	12 nm
10 nm	20 nm
27 nm	40 nm

Figure I-8 Example of relationships between meteorological visibility and luminous range (for a flare with 20 nm nominal luminous range)

Visibility can be a significant limiting factor, but to be valid, it must be accurately determined for the immediate area of the reporting source at the time of the sighting. The average reporting source may misjudge distances to a visible object, and hence misjudge visibility, especially at night. Horizontal visibility may not have the same diminishing effect on meteor or parachute flares, as these flares may be seen above a ground fog or ground haze.

I.4.4.3 Obstructions. If a flare was definitely seen to rise/fall in front of an obstruction, its distance from the reporting source can be no greater than the distance to the obstruction. Similarly, if the flare is seen behind an obstruction, it can be no closer than the obstruction.

I.4.4.4 Position of origin or point last seen relative to horizon. If the reporting source saw the flare rise and fall between his position and the horizon, and can confidently estimate whether the flare rose from the surface or fell to the surface ¼, ½, ¾, of the distance to the horizon, or near or at the horizon, this information can reinforce other datum indicators or limit the maximum distance. Table H-41 (Table 12 of The American Practical Navigator (Bowditch, ed. 1995)) provides distance of the horizon for various heights of eye. When using this method, caution should be exercised when limiting maximum distance to a value significantly less than the distance of the horizon.

Section I.5
Determining a Datum Area

I.5.1 Single Reporting Source

I.5.1.1 Plot the reporting source's position on a chart and draw a circle of radius equal to the reporting source's probable position error around that point.

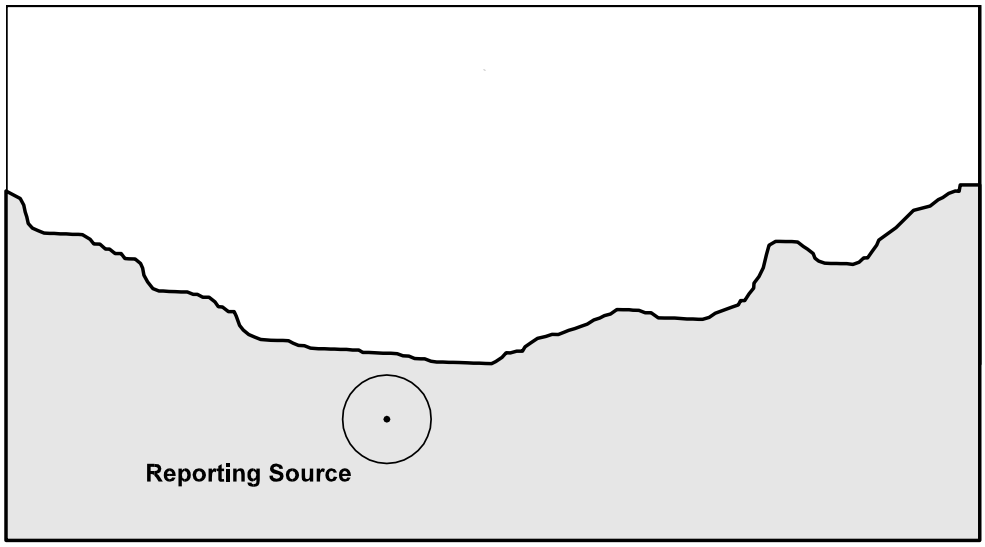

Figure I-9 Step 1: Plotting reporting source position and position error

I.5.1.2 Draw the line of bearing (LOB) along which the reporting source sighted the flare, with lines on either side showing the probable bearing error. The LOB should extend at least 20 nm toward the flare, and far enough behind the reporting source to intersect the position error circle on the side opposite the flare.

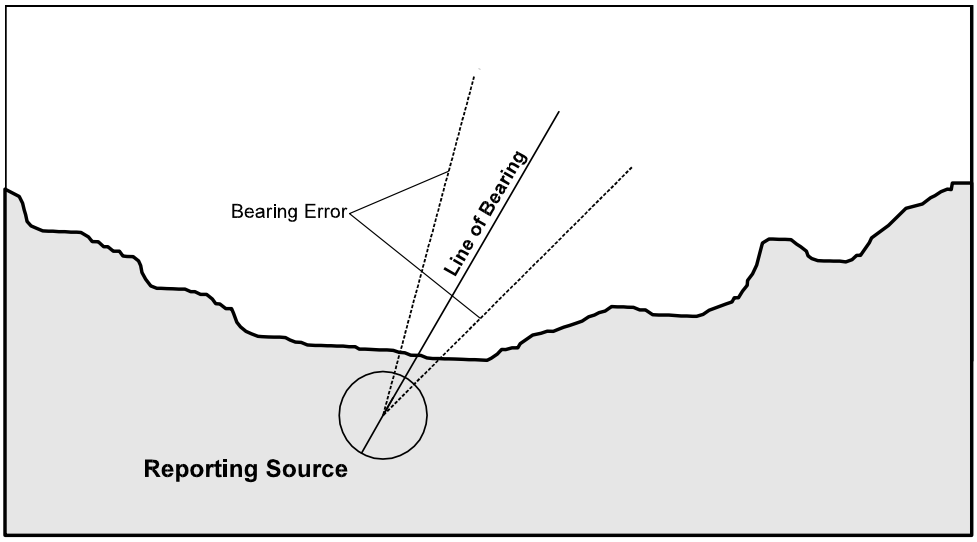

Figure I-10 Step 2: Plotting line of bearing and bearing error

I.5.1.3 Draw a line through the reporting source's position perpendicular to the flare's LOB. At each point where this line crosses the probable position error circle, draw a line parallel to the corresponding bearing error line.

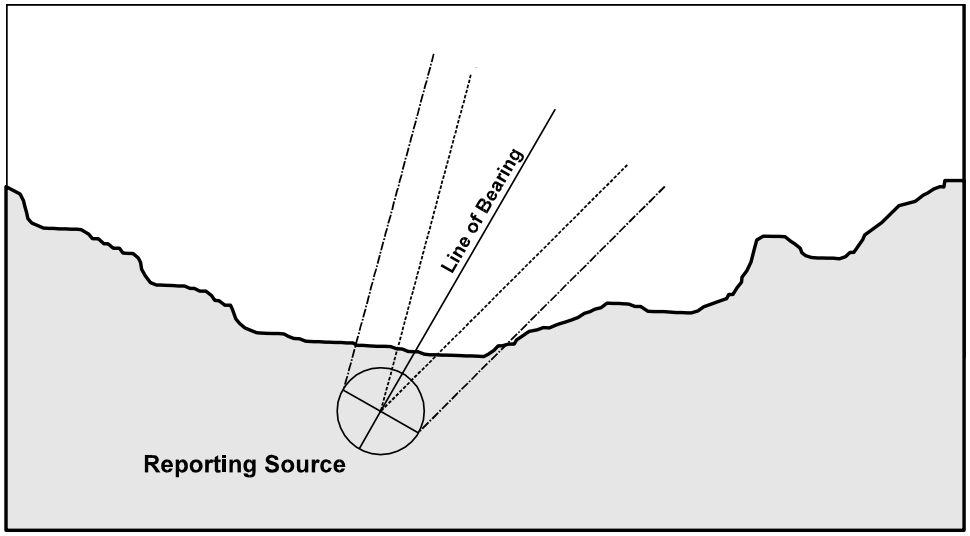

Figure I-11 Step 3: Bearing error including position error

I.5.1.4 Compute minimum and maximum distances by identifying which type of angle has been reported, convert fractions of a fist or numbers of fingers to degrees, and use these angles along with the reporting source's height to reference the appropriate set of minimum and maximum distance tables as described in (a) through (e) below. Determine if on-scene visibility can limit the maximum distance, as described in (f) below.

It is important to note that if a range has been given for the observed angle, the *maximum* angle should be used with the minimum distance table and the *minimum* angle should be used with the maximum distance table. For example, suppose the reporting source states that the flare was "definitely less than a fist, but definitely more than a quarter of a fist." This would be translated to a maximum angle of 8 degrees and a minimum angle of 2 degrees. Use 8 degrees to determine minimum distance, and 2 degrees to determine maximum distance.

(a) If the angle is reported to be **above the horizon**, use Tables I-2a and I-2b as follows:

- Table I-2a, *Minimum Distance to Flare, Angle of Observation Above the Horizon*, determines the closest distance to the flare from the reporting source. Determine the minimum distance by using the maximum observed angle above the horizon. Angles can be determined by converting fractions of a fist to degrees.

  Example: A flare seen ½ of a fist above the horizon, or at an angle of observation of 4 degrees, could be as close as 0.57 nm for a reporting source at 10ft.

- Table I-2b, *Maximum Distance to Flare, Angle of Observation Above the Horizon,* determines the maximum distance to the flare from the reporting source. Determine the maximum distance by using the minimum observed angle above the horizon, converted from fraction of a fist to degrees.

  Example: A flare seen ¼ of a fist above the horizon, or at an angle of observation of 2 degrees would have a maximum distance of 5.63 nm for a reporting source at 10ft.

Given this range of observed angles, the flare must be roughly between 0.6 nm and 5.6 nm from the reporting source - a separation of only 5 nm. A more conservative estimate, obtained by "rounding" the minimum distance down and the maximum distance up the next 0.5 nm increment, would be 0.5 to 6.0 nm from the reporting source.

(b) If the angle is reported to be **below the horizon**, use Tables I-3a and I-3b as follows:

- Table I-3a, *Minimum Distance to Flare, Angle of Observation Below the Horizon*, determines the closest distance to the flare from the reporting source. Determine the minimum distance by using the maximum observed angle below the horizon. Angles can be determined by converting fractions of a fist to degrees.

  Example: A flare seen ½ of a fist below the horizon, or at an angle of observation of 4 degrees, could be as close as 0.11nm for a reporting source at 300 ft.

- Table I-3b, *Maximum Distance to Flare, Angle of Observation Below the Horizon,* determines the maximum distance to the flare from the reporting source. Determine the maximum distance by using the minimum observed angle below the horizon, converted from fraction of a fist to degrees.

  Example: A flare seen ¼ of a fist below the horizon, or at an angle of observation of 2 degrees would have a maximum distance of 1.23 nm for a reporting source at 300 ft.

Given this range of observed angles, the flare must be roughly between 0.1 nm and 1.2 nm from the reporting source - a separation of only 1.1 nm. A more conservative estimate, obtained by "rounding" the minimum distance down and the maximum distance up the next 0.5-mile increment, would be 0.0 to 1.5 nm from the reporting source.

Caution: As angles below the horizon become small, distances increase very rapidly. For example, a flare at zero height above the water observed as 0.5 degrees below the horizon from a height of eye of 260 feet is only 3.23 nm away but such a flare on the horizon could be as far as 18.9 nm away. Only if the flare is observed to be a definite, measurable angle below the horizon should maximum distances based on Table I-3b be used. Otherwise, the distance of the horizon should be used.

(c) If the angle is reported to be **from the origin up to the flare apex**:

The methods used in the two situations above cannot be used if the angle of observation is determined to be from the flare origin to the flare apex. This angle requires a different set of computations. Table I-4, *Distance Range for Angle of Observation from Flare Origin to Apex*, should be used to calculate the distance range using the minimum and maximum angles converted from fractions of a fist.

Example: A flare seen to rise from its origin as much as one fist, or at an angle of observation of 8 degrees, could be as close as 0.29 nm for the reporting source. If the minimum angle observed was ½ of a fist, or an angle of 4 degrees, then the flare could be as much as 2.82 nm from the same reporting source. A more conservative estimate would be between 0.0 and 3.0 nm from the observer.

(d) If the flare is **determined to be a meteor flare**:

- To determine the minimum distance to the flare, Table I-2a, *Minimum Distance to Flare, Angle of Observation Above the Horizon* should be used as in a) above because the minimum height is still assumed to be 250 feet or 10 feet above that of the reporting source for heights of eye greater than 240 feet. It is only the maximum height that has changed.

  Example: A flare seen ½ of a fist above the horizon, or at an angle of observation of 4 degrees, could be as close as 0.57 nm for a reporting source at 10ft.

- If it can be determined from the description of the flare's trajectory that it is a meteor flare, Table I-5 *Maximum Distance for Meteor Flares, Angle of Observation Above the Horizon* should be used to determine the maximum distance. Using this table will significantly reduce the search area and should only be used in those cases where the flare's type is not in question. Determine the maximum distance by using the minimum observed angle above the horizon, converted from fraction of a fist to degrees.

  Example: A flare seen ¼ of a fist above the horizon, or at an angle of observation of 2 degrees would have a maximum distance of 2.35 nm for a reporting source at 10ft.

Given this range of observed angles, the flare must be roughly between 0.6 nm and 2.4 nm from the reporting source - a separation of only 1.8 nm. A more conservative estimate, obtained by "rounding" the minimum distance down and the maximum distance up the next 0.5 nm increment, would be 0.5 to 2.5 nm from the reporting source.

Note: Tables I-3a and I-3b, *Minimum and Maximum Distance to Flare,* (respectively) *Angle of Observation Below the Horizon,* should still be used if the reporting source can identify the type of flare as a meteor because these tables are not affected by flare maximum height. Maximum distances in Table I-3b were calculated using a minimum height of zero. For more information see section 4.B above.

(e) If the flare is **determined to be a hand-held flare**:

If it can be determined from the description of the flare's trajectory (or lack of one) that it is a hand-held flare, Table I-6 *Distances for Hand-held Flares* should be used to determine the distance using the angle below the horizon. A flare height of 10 feet is assumed.

Example: A flare seen as much as ¾ of a fist below the horizon, or at an angle of observation of 6 degrees, could be as close as 0.14 nm for a reporting source at 100 ft. If the minimum angle observed was ¼ of a fist below the horizon, or an angle of 2 degrees, then the flare could be as much as 0.39 nm from the same reporting source. A more conservative estimate would be between 0.0 and 0.5 nm from the observer, but even this is a very small separation.

Caution: As angles below the horizon become small, distances increase very rapidly. For example, a hand-held flare at a height of 10 feet above the water observed as 0.5 degrees below the horizon from a height of eye of 100 feet is only 1.27 nm away but such a flare on the horizon could be as far as 15.4 nm away (the geographic range found by adding the distances of the horizon from 100 feet and 10 feet). Only if the flare is observed to be a definite, measurable angle below the horizon should maximum distances based on Table I-5 be used. Otherwise, the geographic range should be used at this point.

f) Determine if on-scene visibility can limit the maximum distance by using the largest appropriate nominal range from Figure I-2 and the on-scene visibility with Figure I-14 to determine the luminous range of the flare. Enter the Luminous Range Diagram (Figure I-14) from the right or left vertical scale using the flare's nominal range. Follow the corresponding horizontal line across to the curve representing the meteorological visibility. Move vertically to read the luminous range from the top or bottom horizontal scale. For example, a flare with a nominal range of 15 nm has a luminous range of 28 nm when the meteorological visibility is 27 nm.

I.5.1.5 Show the minimum and maximum distances as arcs extending to the bearing error lines on either side of the LOB. The center point used to draw the maximum distance arc should be where the LOB intersects the position error circle on the side toward the flare. The center point used to draw the minimum distance arc should be where the LOB intersects the position error circle on the side away from the flare.

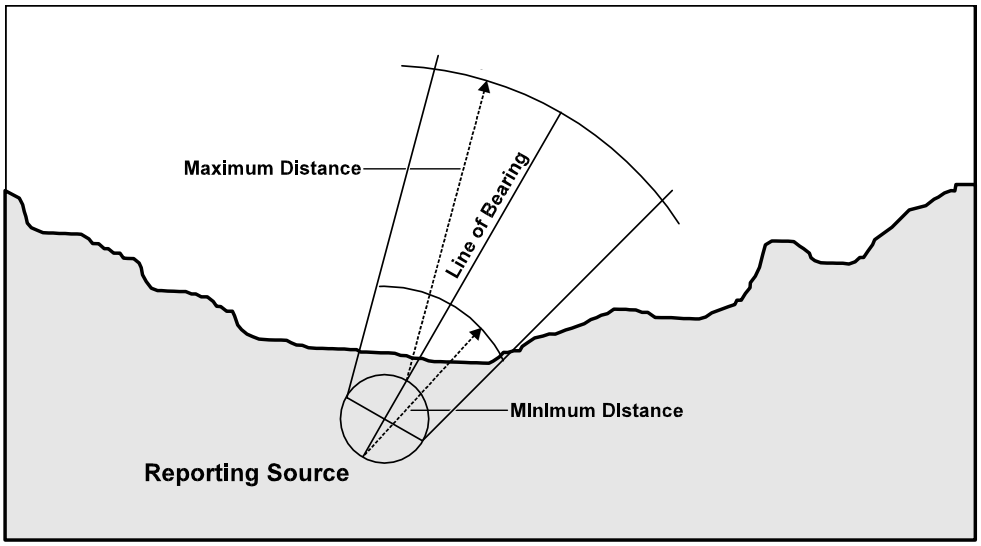

Figure I-12 Step 5: Plotting maximum and minimum arcs

I.5.1.6 Enclose the resulting area in a rectangle as shown in Figure I-13. Multiply the rectangle's length and width by the appropriate safety factor (1.1 for the first search) and draw a second, larger rectangle around the first. This will be the search area.

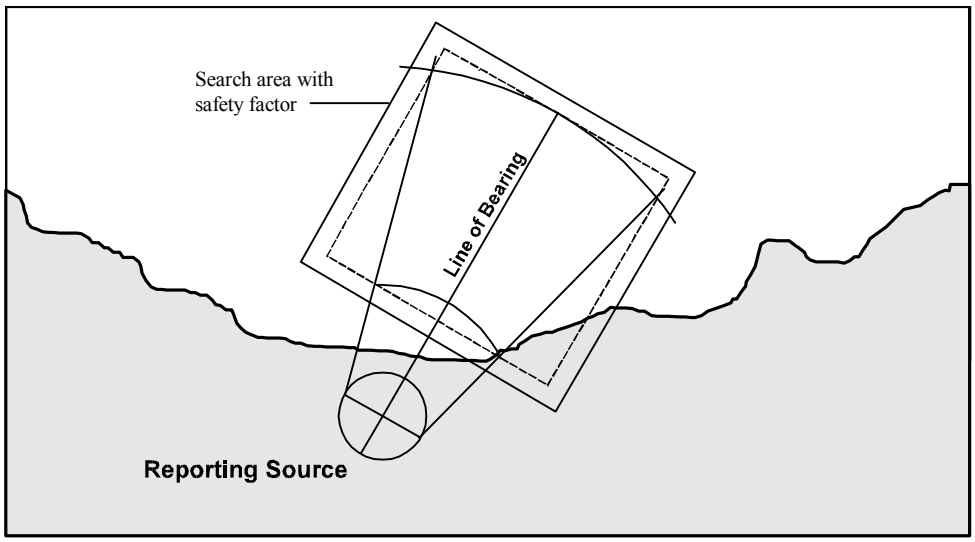

Figure I-13 Step 6: Enclosing the search area, including the safety factor

I.5.1.7 Check with local military and civilian authorities for the presence of operations, including possible fireworks displays. If the position of the sighting plots within a warning or restricted area, contact the controlling authority for possible correlation with activities in that area.

Caution: Although these procedures are designed to produce reasonably conservative results, search planners should not hesitate to expand the size of the search area if they feel it is too small or they have other reasons to believe the plotted area may have a less than 50% chance of containing the flare's origin.

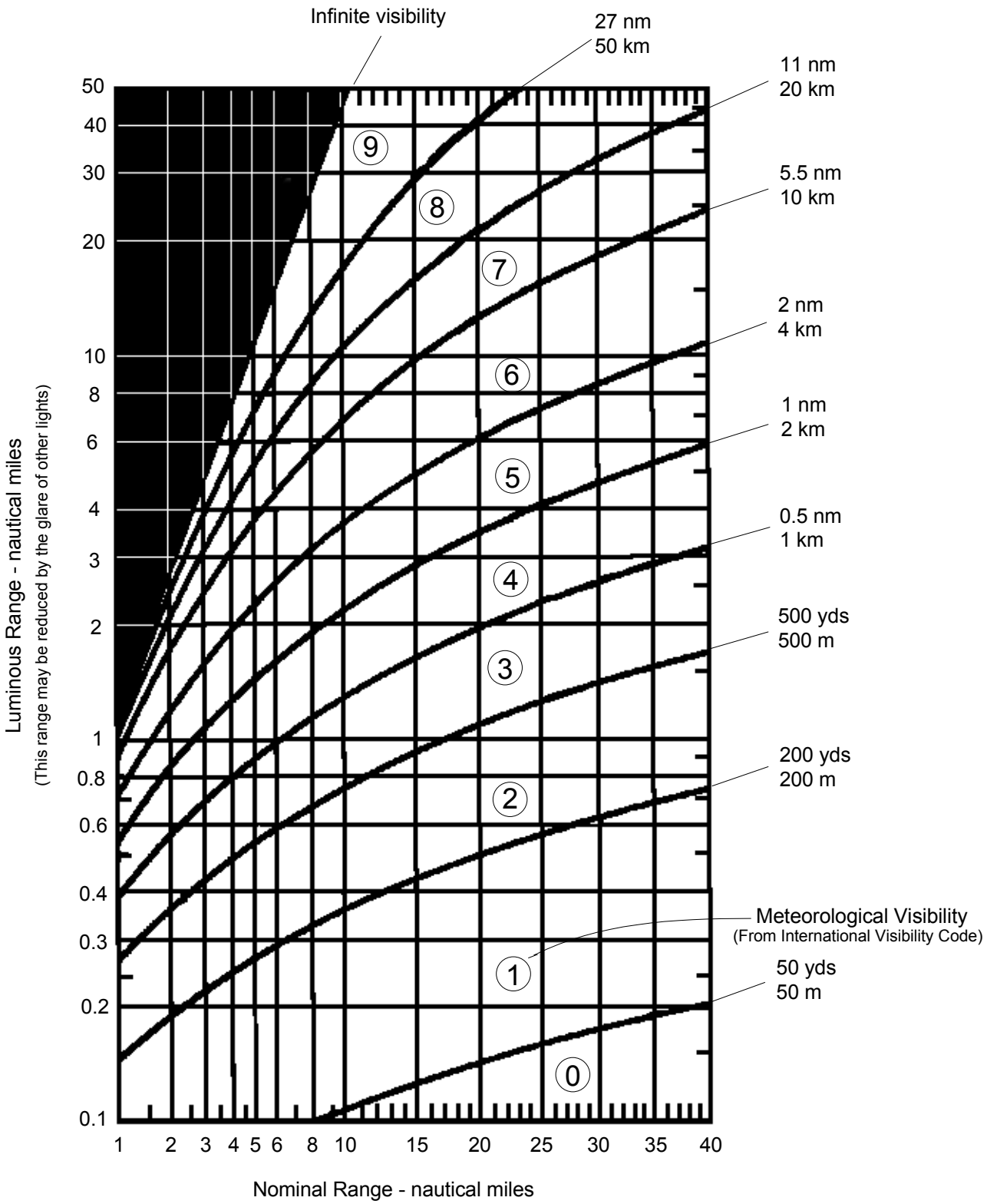

Figure I-14 Luminous Range Diagram (The American Practical Navigator, Bowditch, 1995)

I.5.2 Multiple Reporting Sources

When two or more reliable reporting sources provide good lines of bearing with good crossing angles, determining datum can be accomplished as in Figure I-15. For multiple report cases, determine which three reports are best and use these three reports to complete minimum and maximum calculations. Any time multiple reports are received, even from approximately the same location, the possibility of multiple flares must be considered.

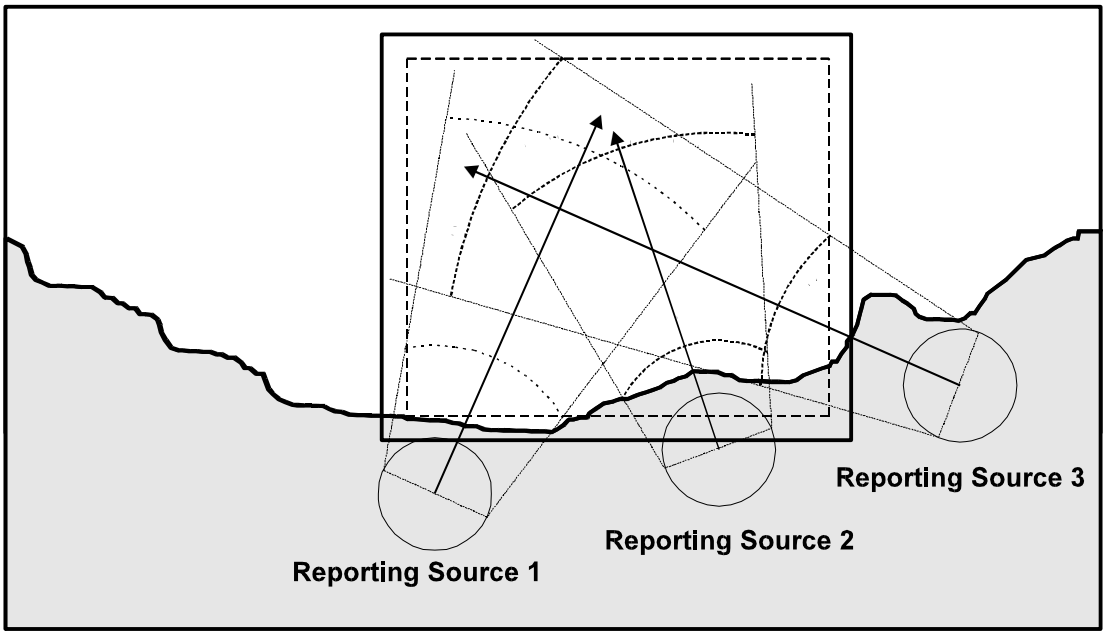

Figure I-15 Reporting sources with different positions

I.5.2.1 Reporting Sources have approximately the same position: Plot each individual reporting source's estimated range and bearing to the flare, properly accounting for the uncertainties in the reporting source's position, bearing estimate and vertical angle estimate. Once all reports are plotted, draw a rectangle that includes all of them, or at least all those that appear to be in reasonable agreement, and expand it by the appropriate safety factor.

I.5.2.2 Reporting Sources have significantly different positions: In this case if all reporting sources saw the same flare, there is a good chance of obtaining a reasonably accurate location for the flare by means of cross bearings. Again, plot each individual report as if it was a single report. Draw a rectangle that includes all of the points where bearing error lines cross and expand it by the appropriate safety factor. To be more conservative, include all the distance uncertainties as well, as shown in Figure I-15.

I.5.3 Search Planning

After establishing a datum area using the procedures outlined above, it will be necessary to plan a search based on this datum. If the difference between the time of the sighting and the SRU's time of arrival on-scene is short, and the search object's drift is likely to be slow, then the datum area may also be used as the search area. The search planner may then proceed with the remainder of the search planning and execution process. However, in areas of high drift rates or when there will be a significant delay in the SRU's arrival on-scene, the search planner may need to compute a new datum area for the SRU's projected arrival time which accounts for search object drift.

Report taken by: _____ Date: _____

FLARE SIGHTING CHECKSHEET
(page 1 of 4)

OBTAIN INFORMATION ABOUT THE REPORTING SOURCE	
Name	First: _____ Last: _____
Position	Latitude: _____ Longitude: _____
	Bearing and range from prominent landmark: _____ Deg & dist
	Street _____
	address: _____
	Position uncertainty: +/- _____ nm
Height of eye	Height of reporting source, from sea level: _____ ft
	If the reporting source is in a building, floor number: _____
Phone number	Current location: _____
	Home or work:
OBTAIN INFORMATION ABOUT THE FLARE CHARACTERISTICS	
Color	(Circle any that apply) RED AMBER WHITE GREEN OTHER: _____
Number of Flares	Number observed: _____ Time of sighting: _____
Time and Duration	Interval between flares: _____ Duration of burn: _____
Trajectory	___ Rise only ___ Fall only ___ Steady (no rise or fall)
	___ Rapid rise and fall ___ Rapid rise and slow descent
Origin	Observed: yes / no ___ Near horizon ___ Between source and horizon
	Flare origin: ___ Surface ___ Air ___ Other: _____
Type	(Based on above information)
	PARACHUTE METEOR HANDHELD OTHER:

FLARE SIGHTING CHECKSHEET
(page 2 of 4)

DETERMINE ANGLE OF OBSERVATION AND POSITION	
Angle of Observation	How determined: _____
	If determined by Fist Method: Fractions of a fist(s): _____
	Check one: ___ Angle below the horizon
	___ Angle above horizon
	___ Angle measured from flare origin to apex
	___ Steady, no angle of elevation observed
	Degrees: _____ Not more than: _____ deg Not less than: _____ deg
Bearing from Observer	How determined: _____
	If determined by clock method: Bearing at _____ o'clock
	Is the reporting source (or building that the reporting source is located in) perpendicular to the shoreline? yes / no
	If no, what is the orientation of the location to the shore line? _____ deg.
	Direction by: prominent landmark, street direction, moon, other
	_____
	Degrees: _____ Uncertainty: + / - _____ degrees
Obstruction	List any obstructions in the line of sight of the reporting source.
	_____
	Obstruction ___ in front of ___ behind flare ? Obstruction height: _____ ft
On-Scene weather	Wind: _____ / _____ Seas: _____ / _____ Visibility: _____ / _____
Vessels/ Aircraft	Were any vessels or aircraft observed in the area? yes / no
	If yes, description:

FLARE SIGHTING CHECKSHEET
(page 3 of 4)

OBTAIN CLEAR MENTAL PICTURE OF WHAT THE REPORTING SOURCE OBSERVED

Draw sketch here.

	1 fist	----------
	¾	----------
Angle above Horizon	½	----------
	¼	----------
HORIZON		
	¼	----------
Angle below Horizon	½	----------
	¾	----------
	1 fist	----------

AMPLIFYING INFORMATION

Reporting Source on a Vessel

Will the reporting source respond to the sighting? yes / no

If yes, expected time of arrival on scene: _____

Intended action by the reporting source: _____

Reporting Source on Land

Will the reporting source remain on scene or on the phone? yes / no

If no, how can the reporting source by re-contacted? _____

Intended action by the reporting source: _____

Additional information

_____

_____

OBTAIN INFORMATION FROM MILITARY AND CIVILIAN AUTHORITIES

Determine if the flare sighting corresponds to any of the following:

Other flare sightings:	yes / no	Known SAR cases:	yes / no
Known Exercises in progress:	yes / no	Known Overdues:	yes / no
Known fireworks display:	yes / no		

FLARE SIGHTING CHECKSHEET
(page 4 of 4)

ACTION TAKEN BY COAST GUARD

Distance Distance from reporting source determined to be:

Minimum: _____ nm Maximum: _____ nm Uncertainty: + / - _____ nm

Bearing: _____ Uncertainty: + / - _____ deg

SAR Phase Evaluate emergency SAR phase: DISTRESS ALERT UNCERTAINTY

UMIB Issue UMIB: yes / no Time issued: _____ Time cancelled _____

Launch Sorties

UNIT	STATION	ETA	ACTION

Other Assistance _____

Intentions _____

First Light Search First light search planned: yes / no (Required for RED/ORANGE flares if there is insufficient information to either close or suspend).

Additional information: _____

ACTSUS ACTSUS approved: yes / no

Table I-2a Angle of Observation Above the Horizon; Minimum Distance to the Flare (nm)

Reporting Source Height ft	0.50 ^{0}	1.00 ^{0}	1.50 ^{0}	2.00 ^{0}	2.50 ^{0}	3.00 ^{0}	3.50 ^{0}	4.00 ^{0}	5.00 ^{0}	6.00 ^{0}	7.00 ^{0}	8.00 ^{0}	10.00 ^{0}	12.00 ^{0}	14.00 ^{0}	16.00 ^{0}
10	4.68	2.35	1.55	1.16	0.92	0.77	0.65	0.57	0.46	0.38	0.32	0.28	0.23	0.19	0.16	0.14
20	4.71	2.31	1.51	1.12	0.89	0.74	0.63	0.55	0.44	0.36	0.31	0.27	0.22	0.18	0.15	0.13
30	4.69	2.25	1.46	1.08	0.86	0.71	0.61	0.53	0.42	0.35	0.30	0.26	0.21	0.17	0.15	0.13
40	4.64	2.18	1.41	1.04	0.83	0.68	0.58	0.51	0.40	0.33	0.29	0.25	0.20	0.16	0.14	0.12
50	4.57	2.11	1.36	1.00	0.79	0.65	0.56	0.49	0.39	0.32	0.27	0.24	0.19	0.16	0.13	0.12
60	4.47	2.03	1.30	0.96	0.76	0.62	0.53	0.46	0.37	0.30	0.26	0.23	0.18	0.15	0.13	0.11
70	4.37	1.95	1.24	0.91	0.72	0.59	0.50	0.44	0.35	0.29	0.25	0.21	0.17	0.14	0.12	0.10
80	4.25	1.87	1.19	0.87	0.68	0.56	0.48	0.42	0.33	0.27	0.23	0.20	0.16	0.13	0.11	0.10
90	4.12	1.78	1.12	0.82	0.64	0.53	0.45	0.39	0.31	0.26	0.22	0.19	0.15	0.13	0.11	0.09
100	3.97	1.69	1.06	0.77	0.61	0.50	0.42	0.37	0.29	0.24	0.21	0.18	0.14	0.12	0.10	0.09
110	3.81	1.59	1.00	0.72	0.57	0.47	0.40	0.35	0.27	0.23	0.19	0.17	0.13	0.11	0.09	0.08
120	3.64	1.50	0.93	0.68	0.53	0.44	0.37	0.32	0.25	0.21	0.18	0.16	0.12	0.10	0.09	0.08
130	3.46	1.40	0.87	0.63	0.49	0.40	0.34	0.30	0.24	0.19	0.17	0.14	0.11	0.09	0.08	0.07
140	3.26	1.29	0.80	0.58	0.45	0.37	0.31	0.27	0.22	0.18	0.15	0.13	0.10	0.09	0.07	0.06
150	3.05	1.19	0.73	0.53	0.41	0.34	0.29	0.25	0.20	0.16	0.14	0.12	0.10	0.08	0.07	0.06
160	2.83	1.08	0.66	0.48	0.37	0.30	0.26	0.22	0.18	0.15	0.12	0.11	0.09	0.07	0.06	0.05
170	2.59	0.97	0.59	0.43	0.33	0.27	0.23	0.20	0.16	0.13	0.11	0.10	0.08	0.06	0.05	0.05
180	2.34	0.86	0.52	0.37	0.29	0.24	0.20	0.18	0.14	0.11	0.10	0.08	0.07	0.06	0.05	0.04
190	2.07	0.74	0.45	0.32	0.25	0.20	0.17	0.15	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03
200	1.78	0.62	0.38	0.27	0.21	0.17	0.14	0.13	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03
220	1.15	0.38	0.23	0.16	0.13	0.10	0.09	0.08	0.06	0.05	0.04	0.04	0.03	0.02	0.02	0.02
240	0.41	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
260	0.43	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
280	0.45	0.13	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
300	0.48	0.14	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
320	0.50	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
340	0.53	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
360	0.56	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
380	0.59	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
400	0.62	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
420	0.66	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
440	0.70	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
460	0.75	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
480	0.80	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
500	0.85	0.16	0.09	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
520	0.91	0.16	0.09	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
540	0.98	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
560	1.05	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
580	1.14	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
600	1.24	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
620	1.35	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
640	1.47	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
660	1.62	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
680	1.78	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
700	1.98	0.18	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
720	2.20	0.18	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
740	2.45	0.18	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
760	2.74	0.18	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
780	3.07	0.19	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
800	3.44	0.19	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
820	3.84	0.19	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
840	4.27	0.19	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
860	4.74	0.20	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
880	5.24	0.20	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
900	5.76	0.20	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
920	6.29	0.20	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
940	6.85	0.21	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
960	7.41	0.21	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
980	7.98	0.21	0.10	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
1000	8.56	0.21	0.10	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01

Table I-2b Angle of Observation Above the Horizon; Maximum Distance to the Flare

Reporting Source Height ft	0.50 ^{0}	1.00 ^{0}	1.50 ^{0}	2.00 ^{0}	2.50 ^{0}	3.00 ^{0}	3.50 ^{0}	4.00 ^{0}	5.00 ^{0}	6.00 ^{0}	7.00 ^{0}	8.00 ^{0}	10.00 ^{0}	12.00 ^{0}	14.00 ^{0}	16.00 ^{0}
10	18.69	10.84	7.44	5.63	4.52	3.77	3.23	2.82	2.25	1.87	1.60	1.40	1.12	0.92	0.79	0.68
20	19.16	10.98	7.49	5.65	4.52	3.76	3.22	2.81	2.25	1.87	1.60	1.39	1.11	0.92	0.78	0.68
30	19.50	11.08	7.52	5.65	4.51	3.75	3.21	2.80	2.23	1.86	1.59	1.38	1.10	0.91	0.78	0.68
40	19.77	11.14	7.53	5.65	4.50	3.74	3.20	2.79	2.22	1.85	1.58	1.37	1.09	0.91	0.77	0.67
50	20.01	11.19	7.54	5.64	4.49	3.73	3.18	2.78	2.21	1.83	1.57	1.37	1.09	0.90	0.77	0.66
60	20.22	11.23	7.53	5.62	4.47	3.71	3.17	2.76	2.20	1.82	1.55	1.36	1.08	0.89	0.76	0.66
70	20.40	11.26	7.53	5.61	4.45	3.69	3.15	2.74	2.18	1.81	1.54	1.35	1.07	0.89	0.75	0.65
80	20.57	11.28	7.51	5.59	4.43	3.67	3.13	2.73	2.17	1.80	1.53	1.34	1.06	0.88	0.75	0.65
90	20.73	11.29	7.50	5.57	4.41	3.65	3.11	2.71	2.15	1.78	1.52	1.33	1.05	0.87	0.74	0.64
100	20.87	11.30	7.48	5.54	4.39	3.63	3.09	2.69	2.14	1.77	1.51	1.31	1.04	0.86	0.73	0.64
110	21.00	11.31	7.46	5.52	4.37	3.61	3.07	2.67	2.12	1.76	1.50	1.30	1.04	0.86	0.73	0.63
120	21.12	11.30	7.44	5.49	4.34	3.59	3.05	2.65	2.10	1.74	1.49	1.29	1.03	0.85	0.72	0.63
130	21.23	11.30	7.41	5.47	4.32	3.56	3.03	2.64	2.09	1.73	1.47	1.28	1.02	0.84	0.72	0.62
140	21.33	11.29	7.39	5.44	4.29	3.54	3.01	2.62	2.07	1.71	1.46	1.27	1.01	0.83	0.71	0.62
150	21.43	11.28	7.36	5.41	4.27	3.52	2.99	2.60	2.06	1.70	1.45	1.26	1.00	0.83	0.70	0.61
160	21.52	11.27	7.33	5.38	4.24	3.49	2.97	2.58	2.04	1.69	1.44	1.25	0.99	0.82	0.70	0.61
170	21.61	11.25	7.30	5.35	4.21	3.47	2.94	2.56	2.02	1.67	1.42	1.24	0.98	0.81	0.69	0.60
180	21.69	11.23	7.26	5.32	4.18	3.44	2.92	2.54	2.01	1.66	1.41	1.23	0.97	0.81	0.68	0.59
190	21.77	11.21	7.23	5.29	4.15	3.42	2.90	2.52	1.99	1.64	1.40	1.22	0.97	0.80	0.68	0.59
200	21.84	11.18	7.20	5.25	4.12	3.39	2.88	2.50	1.97	1.63	1.39	1.21	0.96	0.79	0.67	0.58
220	21.97	11.13	7.12	5.19	4.06	3.34	2.83	2.45	1.94	1.60	1.36	1.18	0.94	0.78	0.66	0.57
240	22.09	11.06	7.04	5.11	4.00	3.28	2.78	2.41	1.90	1.57	1.34	1.16	0.92	0.76	0.65	0.56
260	22.19	10.99	6.96	5.04	3.94	3.23	2.73	2.37	1.87	1.54	1.31	1.14	0.90	0.75	0.63	0.55
280	22.28	10.91	6.87	4.97	3.88	3.17	2.68	2.33	1.83	1.51	1.29	1.12	0.88	0.73	0.62	0.54
300	22.35	10.83	6.79	4.89	3.81	3.12	2.64	2.28	1.80	1.48	1.26	1.09	0.87	0.71	0.61	0.53
320	22.42	10.73	6.69	4.81	3.74	3.06	2.58	2.24	1.76	1.45	1.23	1.07	0.85	0.70	0.59	0.52
340	22.47	10.64	6.60	4.73	3.68	3.00	2.53	2.19	1.72	1.42	1.21	1.05	0.83	0.68	0.58	0.50
360	22.52	10.53	6.50	4.65	3.61	2.94	2.48	2.15	1.69	1.39	1.18	1.03	0.81	0.67	0.57	0.49
380	22.56	10.42	6.40	4.56	3.54	2.88	2.43	2.10	1.65	1.36	1.15	1.00	0.79	0.65	0.55	0.48
400	22.58	10.30	6.29	4.48	3.47	2.82	2.38	2.06	1.61	1.33	1.13	0.98	0.77	0.64	0.54	0.47
420	22.60	10.18	6.18	4.39	3.39	2.76	2.33	2.01	1.58	1.30	1.10	0.96	0.75	0.62	0.53	0.46
440	22.61	10.06	6.07	4.30	3.32	2.70	2.27	1.96	1.54	1.27	1.07	0.93	0.74	0.61	0.52	0.45
460	22.61	9.92	5.96	4.21	3.25	2.64	2.22	1.92	1.50	1.23	1.05	0.91	0.72	0.59	0.50	0.44
480	22.60	9.78	5.85	4.12	3.17	2.57	2.17	1.87	1.46	1.20	1.02	0.89	0.70	0.58	0.49	0.42
500	22.59	9.64	5.73	4.03	3.10	2.51	2.11	1.82	1.43	1.17	0.99	0.86	0.68	0.56	0.48	0.41
520	22.56	9.49	5.61	3.93	3.02	2.45	2.06	1.77	1.39	1.14	0.97	0.84	0.66	0.54	0.46	0.40
540	22.53	9.34	5.48	3.84	2.94	2.38	2.00	1.72	1.35	1.11	0.94	0.81	0.64	0.53	0.45	0.39
560	22.49	9.18	5.36	3.74	2.86	2.32	1.95	1.68	1.31	1.08	0.91	0.79	0.62	0.51	0.44	0.38
580	22.44	9.01	5.23	3.64	2.79	2.25	1.89	1.63	1.27	1.04	0.88	0.77	0.60	0.50	0.42	0.37
600	22.39	8.84	5.10	3.54	2.71	2.19	1.83	1.58	1.23	1.01	0.86	0.74	0.59	0.48	0.41	0.35
620	22.32	8.66	4.97	3.44	2.63	2.12	1.78	1.53	1.19	0.98	0.83	0.72	0.57	0.47	0.40	0.34
640	22.25	8.48	4.83	3.34	2.54	2.05	1.72	1.48	1.15	0.95	0.80	0.69	0.55	0.45	0.38	0.33
660	22.17	8.29	4.69	3.24	2.46	1.99	1.66	1.43	1.11	0.91	0.77	0.67	0.53	0.43	0.37	0.32
680	22.08	8.09	4.55	3.13	2.38	1.92	1.60	1.38	1.08	0.88	0.75	0.65	0.51	0.42	0.36	0.31
700	21.98	7.89	4.41	3.03	2.30	1.85	1.55	1.33	1.04	0.85	0.72	0.62	0.49	0.40	0.34	0.30
720	21.87	7.68	4.27	2.92	2.21	1.78	1.49	1.28	1.00	0.82	0.69	0.60	0.47	0.39	0.33	0.28
740	21.75	7.47	4.12	2.81	2.13	1.71	1.43	1.23	0.96	0.78	0.66	0.57	0.45	0.37	0.31	0.27
760	21.63	7.25	3.97	2.70	2.04	1.64	1.37	1.18	0.92	0.75	0.63	0.55	0.43	0.36	0.30	0.26
780	21.49	7.02	3.82	2.59	1.96	1.57	1.31	1.12	0.88	0.72	0.61	0.52	0.41	0.34	0.29	0.25
800	21.34	6.79	3.66	2.48	1.87	1.50	1.25	1.07	0.83	0.68	0.58	0.50	0.39	0.32	0.27	0.24
820	21.18	6.54	3.50	2.37	1.78	1.43	1.19	1.02	0.79	0.65	0.55	0.47	0.37	0.31	0.26	0.23
840	21.01	6.29	3.34	2.25	1.69	1.36	1.13	0.97	0.75	0.62	0.52	0.45	0.35	0.29	0.25	0.21
860	20.82	6.04	3.18	2.14	1.61	1.29	1.07	0.92	0.71	0.58	0.49	0.43	0.33	0.28	0.23	0.20
880	20.62	5.77	3.02	2.02	1.52	1.21	1.01	0.87	0.67	0.55	0.46	0.40	0.32	0.26	0.22	0.19
900	20.41	5.50	2.85	1.90	1.43	1.14	0.95	0.81	0.63	0.51	0.43	0.38	0.30	0.24	0.21	0.18
920	20.18	5.21	2.68	1.79	1.34	1.07	0.89	0.76	0.59	0.48	0.41	0.35	0.28	0.23	0.19	0.17
940	19.94	4.92	2.51	1.67	1.24	0.99	0.83	0.71	0.55	0.45	0.38	0.33	0.26	0.21	0.18	0.15
960	19.68	4.62	2.33	1.54	1.15	0.92	0.76	0.65	0.51	0.41	0.35	0.30	0.24	0.19	0.17	0.14
980	19.39	4.31	2.15	1.42	1.06	0.84	0.70	0.60	0.46	0.38	0.32	0.28	0.22	0.18	0.15	0.13
1000	19.09	3.99	1.97	1.30	0.97	0.77	0.64	0.55	0.42	0.35	0.29	0.25	0.20	0.16	0.14	0.12

Table I-3a Angle of Observation Below the Horizon; Minimum Distance to the Flare (nm)

Reporting Source Height ft	0.50 ^{0}	1.00 ^{0}	1.50 ^{0}	2.00 ^{0}	2.50 ^{0}	3.00 ^{0}	3.50 ^{0}	4.00 ^{0}	5.00 ^{0}	6.00 ^{0}	7.00 ^{0}	8.00 ^{0}	10.00 ^{0}	12.00 ^{0}	14.00 ^{0}	16.00 ^{0}
10	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
20	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
30	0.16	0.09	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
40	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
50	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
60	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
70	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
80	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
90	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
100	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
110	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
120	0.14	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
130	0.13	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
140	0.13	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
150	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
160	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
170	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
180	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
190	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
200	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
220	0.12	0.07	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
240	0.12	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
260	0.12	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
280	0.36	0.22	0.16	0.12	0.10	0.09	0.07	0.07	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02
300	0.59	0.36	0.26	0.20	0.17	0.14	0.12	0.11	0.09	0.07	0.06	0.06	0.05	0.04	0.03	0.03
320	0.81	0.50	0.36	0.28	0.23	0.20	0.17	0.15	0.12	0.10	0.09	0.08	0.06	0.05	0.05	0.04
340	1.04	0.64	0.47	0.36	0.30	0.25	0.22	0.20	0.16	0.13	0.12	0.10	0.08	0.07	0.06	0.05
360	1.26	0.78	0.57	0.44	0.37	0.31	0.27	0.24	0.19	0.16	0.14	0.12	0.10	0.08	0.07	0.06
380	1.47	0.92	0.67	0.52	0.43	0.37	0.32	0.28	0.23	0.19	0.17	0.15	0.12	0.10	0.08	0.07
400	1.68	1.05	0.76	0.60	0.50	0.42	0.37	0.32	0.26	0.22	0.19	0.17	0.14	0.11	0.10	0.08
420	1.89	1.18	0.86	0.68	0.56	0.48	0.41	0.37	0.30	0.25	0.22	0.19	0.15	0.13	0.11	0.10
440	2.10	1.32	0.96	0.76	0.62	0.53	0.46	0.41	0.33	0.28	0.24	0.21	0.17	0.14	0.12	0.11
460	2.30	1.45	1.06	0.83	0.69	0.59	0.51	0.45	0.37	0.31	0.27	0.23	0.19	0.16	0.13	0.12
480	2.50	1.58	1.15	0.91	0.75	0.64	0.56	0.49	0.40	0.34	0.29	0.26	0.21	0.17	0.15	0.13
500	2.70	1.70	1.25	0.99	0.81	0.69	0.60	0.54	0.44	0.37	0.32	0.28	0.22	0.19	0.16	0.14
520	2.89	1.83	1.34	1.06	0.88	0.75	0.65	0.58	0.47	0.40	0.34	0.30	0.24	0.20	0.17	0.15
540	3.08	1.96	1.44	1.14	0.94	0.80	0.70	0.62	0.50	0.42	0.37	0.32	0.26	0.22	0.19	0.16
560	3.27	2.08	1.53	1.21	1.00	0.86	0.75	0.66	0.54	0.45	0.39	0.34	0.28	0.23	0.20	0.17
580	3.46	2.21	1.62	1.29	1.06	0.91	0.79	0.70	0.57	0.48	0.42	0.37	0.30	0.25	0.21	0.18
600	3.65	2.33	1.72	1.36	1.13	0.96	0.84	0.74	0.61	0.51	0.44	0.39	0.31	0.26	0.22	0.20
620	3.83	2.45	1.81	1.43	1.19	1.01	0.88	0.78	0.64	0.54	0.47	0.41	0.33	0.28	0.24	0.21
640	4.02	2.58	1.90	1.51	1.25	1.07	0.93	0.83	0.67	0.57	0.49	0.43	0.35	0.29	0.25	0.22
660	4.20	2.70	1.99	1.58	1.31	1.12	0.98	0.87	0.71	0.60	0.52	0.45	0.37	0.31	0.26	0.23
680	4.38	2.82	2.08	1.65	1.37	1.17	1.02	0.91	0.74	0.62	0.54	0.48	0.38	0.32	0.27	0.24
700	4.55	2.94	2.17	1.73	1.43	1.22	1.07	0.95	0.77	0.65	0.56	0.50	0.40	0.33	0.29	0.25
720	4.73	3.05	2.26	1.80	1.49	1.28	1.11	0.99	0.81	0.68	0.59	0.52	0.42	0.35	0.30	0.26
740	4.91	3.17	2.35	1.87	1.55	1.33	1.16	1.03	0.84	0.71	0.61	0.54	0.44	0.36	0.31	0.27
760	5.08	3.29	2.44	1.94	1.61	1.38	1.21	1.07	0.87	0.74	0.64	0.56	0.45	0.38	0.32	0.28
780	5.25	3.40	2.53	2.01	1.67	1.43	1.25	1.11	0.91	0.77	0.66	0.58	0.47	0.39	0.34	0.29
800	5.42	3.52	2.62	2.09	1.73	1.48	1.30	1.15	0.94	0.79	0.69	0.61	0.49	0.41	0.35	0.31
820	5.59	3.64	2.70	2.16	1.79	1.54	1.34	1.19	0.97	0.82	0.71	0.63	0.51	0.42	0.36	0.32
840	5.76	3.75	2.79	2.23	1.85	1.59	1.39	1.23	1.01	0.85	0.74	0.65	0.52	0.44	0.37	0.33
860	5.92	3.86	2.88	2.30	1.91	1.64	1.43	1.27	1.04	0.88	0.76	0.67	0.54	0.45	0.39	0.34
880	6.09	3.98	2.97	2.37	1.97	1.69	1.48	1.31	1.07	0.91	0.78	0.69	0.56	0.47	0.40	0.35
900	6.25	4.09	3.05	2.44	2.03	1.74	1.52	1.35	1.11	0.93	0.81	0.71	0.58	0.48	0.41	0.36
920	6.42	4.20	3.14	2.51	2.09	1.79	1.57	1.39	1.14	0.96	0.83	0.73	0.59	0.50	0.43	0.37
940	6.58	4.31	3.22	2.58	2.15	1.84	1.61	1.43	1.17	0.99	0.86	0.76	0.61	0.51	0.44	0.38
960	6.74	4.42	3.31	2.65	2.21	1.89	1.66	1.47	1.20	1.02	0.88	0.78	0.63	0.52	0.45	0.39
980	6.90	4.53	3.39	2.71	2.26	1.94	1.70	1.51	1.24	1.05	0.91	0.80	0.64	0.54	0.46	0.40
1000	7.06	4.64	3.48	2.78	2.32	1.99	1.74	1.55	1.27	1.07	0.93	0.82	0.66	0.55	0.48	0.41

Table I-3b Angle of Observation Below Horizon; Maximum Distance to the Flare (nm)

Reporting Source Height ft	0.50 ^{0}	1.00 ^{0}	1.50 ^{0}	2.00 ^{0}	2.50 ^{0}	3.00 ^{0}	3.50 ^{0}	4.00 ^{0}	5.00 ^{0}	6.00 ^{0}	7.00 ^{0}	8.00 ^{0}	10.00 ^{0}	12.00 ^{0}	14.00 ^{0}	16.00 ^{0}
10	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
20	0.33	0.17	0.12	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
30	0.48	0.26	0.18	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02
40	0.62	0.34	0.23	0.18	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02
50	0.76	0.42	0.29	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03
60	0.90	0.50	0.35	0.26	0.21	0.18	0.16	0.14	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03
70	1.03	0.58	0.40	0.31	0.25	0.21	0.18	0.16	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04
80	1.16	0.65	0.46	0.35	0.28	0.24	0.21	0.18	0.15	0.12	0.10	0.09	0.07	0.06	0.05	0.05
90	1.29	0.73	0.51	0.39	0.32	0.27	0.23	0.20	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.05
100	1.42	0.80	0.56	0.43	0.35	0.30	0.26	0.23	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06
110	1.54	0.88	0.62	0.47	0.39	0.33	0.28	0.25	0.20	0.17	0.14	0.13	0.10	0.08	0.07	0.06
120	1.66	0.95	0.67	0.52	0.42	0.35	0.31	0.27	0.22	0.18	0.16	0.14	0.11	0.09	0.08	0.07
130	1.78	1.03	0.72	0.56	0.45	0.38	0.33	0.29	0.23	0.20	0.17	0.15	0.12	0.10	0.08	0.07
140	1.90	1.10	0.77	0.60	0.49	0.41	0.36	0.31	0.25	0.21	0.18	0.16	0.13	0.11	0.09	0.08
150	2.02	1.17	0.83	0.64	0.52	0.44	0.38	0.33	0.27	0.23	0.19	0.17	0.14	0.11	0.10	0.08
160	2.13	1.24	0.88	0.68	0.55	0.47	0.40	0.36	0.29	0.24	0.21	0.18	0.15	0.12	0.10	0.09
170	2.25	1.31	0.93	0.72	0.59	0.50	0.43	0.38	0.31	0.26	0.22	0.19	0.15	0.13	0.11	0.10
180	2.36	1.38	0.98	0.76	0.62	0.52	0.45	0.40	0.32	0.27	0.23	0.20	0.16	0.14	0.12	0.10
190	2.47	1.45	1.03	0.80	0.65	0.55	0.48	0.42	0.34	0.29	0.25	0.22	0.17	0.14	0.12	0.11
200	2.59	1.52	1.08	0.84	0.69	0.58	0.50	0.44	0.36	0.30	0.26	0.23	0.18	0.15	0.13	0.11
220	2.80	1.66	1.18	0.92	0.75	0.64	0.55	0.49	0.39	0.33	0.28	0.25	0.20	0.17	0.14	0.12
240	3.02	1.80	1.28	1.00	0.82	0.69	0.60	0.53	0.43	0.36	0.31	0.27	0.22	0.18	0.16	0.14
260	3.23	1.93	1.38	1.08	0.88	0.75	0.65	0.57	0.46	0.39	0.33	0.29	0.24	0.20	0.17	0.15
280	3.44	2.06	1.48	1.15	0.95	0.80	0.70	0.61	0.50	0.42	0.36	0.32	0.25	0.21	0.18	0.16
300	3.64	2.19	1.58	1.23	1.01	0.86	0.74	0.66	0.53	0.45	0.38	0.34	0.27	0.23	0.19	0.17
320	3.84	2.32	1.67	1.31	1.07	0.91	0.79	0.70	0.57	0.48	0.41	0.36	0.29	0.24	0.21	0.18
340	4.04	2.45	1.77	1.38	1.14	0.96	0.84	0.74	0.60	0.50	0.44	0.38	0.31	0.26	0.22	0.19
360	4.24	2.58	1.86	1.46	1.20	1.02	0.88	0.78	0.63	0.53	0.46	0.40	0.32	0.27	0.23	0.20
380	4.43	2.71	1.96	1.53	1.26	1.07	0.93	0.82	0.67	0.56	0.49	0.43	0.34	0.29	0.24	0.21
400	4.62	2.83	2.05	1.61	1.32	1.13	0.98	0.87	0.70	0.59	0.51	0.45	0.36	0.30	0.26	0.22
420	4.81	2.96	2.14	1.68	1.39	1.18	1.03	0.91	0.74	0.62	0.53	0.47	0.38	0.32	0.27	0.24
440	4.99	3.08	2.24	1.76	1.45	1.23	1.07	0.95	0.77	0.65	0.56	0.49	0.40	0.33	0.28	0.25
460	5.18	3.20	2.33	1.83	1.51	1.29	1.12	0.99	0.80	0.68	0.58	0.51	0.41	0.34	0.30	0.26
480	5.36	3.32	2.42	1.91	1.57	1.34	1.16	1.03	0.84	0.71	0.61	0.54	0.43	0.36	0.31	0.27
500	5.54	3.44	2.51	1.98	1.63	1.39	1.21	1.07	0.87	0.73	0.63	0.56	0.45	0.37	0.32	0.28
520	5.72	3.56	2.60	2.05	1.69	1.44	1.26	1.11	0.91	0.76	0.66	0.58	0.47	0.39	0.33	0.29
540	5.90	3.68	2.69	2.12	1.75	1.50	1.30	1.15	0.94	0.79	0.68	0.60	0.48	0.40	0.35	0.30
560	6.07	3.80	2.78	2.20	1.82	1.55	1.35	1.19	0.97	0.82	0.71	0.62	0.50	0.42	0.36	0.31
580	6.25	3.92	2.87	2.27	1.88	1.60	1.39	1.24	1.01	0.85	0.73	0.64	0.52	0.43	0.37	0.32
600	6.42	4.04	2.96	2.34	1.94	1.65	1.44	1.28	1.04	0.88	0.76	0.67	0.54	0.45	0.38	0.33
620	6.59	4.15	3.05	2.41	2.00	1.70	1.48	1.32	1.07	0.90	0.78	0.69	0.55	0.46	0.40	0.35
640	6.76	4.27	3.14	2.48	2.06	1.75	1.53	1.36	1.11	0.93	0.81	0.71	0.57	0.48	0.41	0.36
660	6.93	4.38	3.22	2.55	2.12	1.81	1.58	1.40	1.14	0.96	0.83	0.73	0.59	0.49	0.42	0.37
680	7.10	4.50	3.31	2.62	2.17	1.86	1.62	1.44	1.17	0.99	0.85	0.75	0.61	0.51	0.43	0.38
700	7.26	4.61	3.40	2.69	2.23	1.91	1.67	1.48	1.20	1.02	0.88	0.77	0.62	0.52	0.45	0.39
720	7.43	4.72	3.48	2.76	2.29	1.96	1.71	1.52	1.24	1.04	0.90	0.80	0.64	0.54	0.46	0.40
740	7.59	4.84	3.57	2.83	2.35	2.01	1.75	1.56	1.27	1.07	0.93	0.82	0.66	0.55	0.47	0.41
760	7.75	4.95	3.66	2.90	2.41	2.06	1.80	1.60	1.30	1.10	0.95	0.84	0.68	0.56	0.48	0.42
780	7.91	5.06	3.74	2.97	2.47	2.11	1.84	1.64	1.34	1.13	0.98	0.86	0.69	0.58	0.50	0.43
800	8.07	5.17	3.83	3.04	2.53	2.16	1.89	1.68	1.37	1.16	1.00	0.88	0.71	0.59	0.51	0.44
820	8.23	5.28	3.91	3.11	2.59	2.21	1.93	1.72	1.40	1.18	1.02	0.90	0.73	0.61	0.52	0.46
840	8.39	5.39	4.00	3.18	2.64	2.26	1.98	1.76	1.43	1.21	1.05	0.92	0.74	0.62	0.53	0.47
860	8.54	5.50	4.08	3.25	2.70	2.31	2.02	1.80	1.47	1.24	1.07	0.95	0.76	0.64	0.55	0.48
880	8.70	5.61	4.16	3.32	2.76	2.36	2.07	1.83	1.50	1.27	1.10	0.97	0.78	0.65	0.56	0.49
900	8.85	5.71	4.25	3.39	2.82	2.41	2.11	1.87	1.53	1.29	1.12	0.99	0.80	0.67	0.57	0.50
920	9.01	5.82	4.33	3.45	2.87	2.46	2.15	1.91	1.56	1.32	1.14	1.01	0.81	0.68	0.58	0.51
940	9.16	5.93	4.41	3.52	2.93	2.51	2.20	1.95	1.60	1.35	1.17	1.03	0.83	0.70	0.60	0.52
960	9.31	6.03	4.50	3.59	2.99	2.56	2.24	1.99	1.63	1.38	1.19	1.05	0.85	0.71	0.61	0.53
980	9.46	6.14	4.58	3.66	3.05	2.61	2.28	2.03	1.66	1.41	1.22	1.07	0.87	0.72	0.62	0.54
1000	9.61	6.25	4.66	3.72	3.10	2.66	2.33	2.07	1.69	1.43	1.24	1.09	0.88	0.74	0.63	0.55

Table I-4 Angle of Observation from Flare Origin to Apex; Minimum and Maximum Distance (nm)

Observed angle	Minimum Distance to flare	Maximum Distance to flare
0.50	4.71	22.63
1.00	2.36	11.31
1.50	1.57	7.54
2.00	1.18	5.66
2.50	0.94	4.52
3.00	0.79	3.77
3.50	0.67	3.23
4.00	0.59	2.82
5.00	0.47	2.26
6.00	0.39	1.88
7.00	0.34	1.61
8.00	0.29	1.41
10.00	0.23	1.12
12.00	0.19	0.93
14.00	0.17	0.79
16.00	0.14	0.69
20.00	0.11	0.54
24.00	0.09	0.44
28.00	0.08	0.37
32.00	0.07	0.32

Table I-5 Maximum Distance for Meteor Flares, Angle of Observation Above the Horizon

Reporting Source Height ft	0.50 ^{0}	1.00 ^{0}	1.50 ^{0}	2.00 ^{0}	2.50 ^{0}	3.00 ^{0}	3.50 ^{0}	4.00 ^{0}	5.00 ^{0}	6.00 ^{0}	8.00 ^{0}	10.00 ^{0}	12.00 ^{0}	14.00 ^{0}	16.00 ^{0}
10	8.91	4.70	3.14	2.35	1.88	1.56	1.33	1.17	0.93	0.77	0.58	0.46	0.38	0.32	0.28
20	9.11	4.71	3.13	2.33	1.86	1.54	1.32	1.15	0.92	0.76	0.57	0.45	0.37	0.32	0.28
30	9.23	4.70	3.10	2.30	1.83	1.52	1.30	1.13	0.90	0.75	0.56	0.44	0.37	0.31	0.27
40	9.31	4.68	3.07	2.27	1.80	1.49	1.27	1.11	0.88	0.73	0.55	0.43	0.36	0.31	0.27
50	9.36	4.64	3.03	2.24	1.77	1.47	1.25	1.09	0.87	0.72	0.53	0.43	0.35	0.30	0.26
60	9.40	4.60	2.99	2.20	1.74	1.44	1.23	1.07	0.85	0.70	0.52	0.42	0.34	0.29	0.25
70	9.42	4.55	2.94	2.17	1.71	1.41	1.20	1.05	0.83	0.69	0.51	0.41	0.34	0.29	0.25
80	9.42	4.50	2.90	2.13	1.68	1.39	1.18	1.03	0.81	0.67	0.50	0.40	0.33	0.28	0.24
90	9.41	4.45	2.85	2.09	1.65	1.36	1.15	1.00	0.80	0.66	0.49	0.39	0.32	0.27	0.24
100	9.40	4.39	2.80	2.05	1.61	1.33	1.13	0.98	0.78	0.64	0.48	0.38	0.31	0.27	0.23
110	9.37	4.32	2.75	2.01	1.58	1.30	1.10	0.96	0.76	0.63	0.47	0.37	0.31	0.26	0.23
120	9.33	4.26	2.70	1.96	1.54	1.27	1.08	0.94	0.74	0.61	0.46	0.36	0.30	0.25	0.22
130	9.29	4.19	2.64	1.92	1.51	1.24	1.05	0.91	0.72	0.60	0.44	0.35	0.29	0.25	0.22
140	9.23	4.11	2.59	1.88	1.47	1.21	1.03	0.89	0.71	0.58	0.43	0.34	0.28	0.24	0.21
150	9.17	4.04	2.53	1.83	1.44	1.18	1.00	0.87	0.69	0.57	0.42	0.33	0.28	0.23	0.20
160	9.11	3.96	2.47	1.79	1.40	1.15	0.97	0.85	0.67	0.55	0.41	0.32	0.27	0.23	0.20
170	9.03	3.88	2.41	1.74	1.36	1.12	0.95	0.82	0.65	0.54	0.40	0.32	0.26	0.22	0.19
180	8.95	3.80	2.35	1.70	1.33	1.09	0.92	0.80	0.63	0.52	0.39	0.31	0.25	0.21	0.19
190	8.86	3.71	2.29	1.65	1.29	1.06	0.89	0.78	0.61	0.51	0.37	0.30	0.24	0.21	0.18
200	8.77	3.63	2.23	1.60	1.25	1.02	0.87	0.75	0.59	0.49	0.36	0.29	0.24	0.20	0.17
220	8.55	3.44	2.10	1.51	1.17	0.96	0.81	0.70	0.56	0.46	0.34	0.27	0.22	0.19	0.16
240	8.31	3.26	1.97	1.41	1.10	0.90	0.76	0.66	0.52	0.43	0.32	0.25	0.21	0.18	0.15
260	8.04	3.06	1.84	1.31	1.02	0.83	0.70	0.61	0.48	0.39	0.29	0.23	0.19	0.16	0.14
280	7.74	2.85	1.70	1.21	0.94	0.76	0.65	0.56	0.44	0.36	0.27	0.21	0.17	0.15	0.13
300	7.40	2.64	1.56	1.11	0.86	0.70	0.59	0.51	0.40	0.33	0.24	0.19	0.16	0.13	0.12
320	7.02	2.41	1.42	1.00	0.77	0.63	0.53	0.46	0.36	0.30	0.22	0.17	0.14	0.12	0.11
340	6.60	2.18	1.27	0.90	0.69	0.56	0.47	0.41	0.32	0.26	0.20	0.15	0.13	0.11	0.09
360	6.14	1.94	1.12	0.79	0.61	0.49	0.42	0.36	0.28	0.23	0.17	0.14	0.11	0.09	0.08
380	5.61	1.69	0.97	0.68	0.52	0.43	0.36	0.31	0.24	0.20	0.15	0.12	0.10	0.08	0.07
400	5.03	1.43	0.82	0.57	0.44	0.36	0.30	0.26	0.20	0.17	0.12	0.10	0.08	0.07	0.06
420	4.35	1.17	0.66	0.46	0.35	0.29	0.24	0.21	0.16	0.13	0.10	0.08	0.06	0.05	0.05
440	3.58	0.89	0.50	0.35	0.27	0.21	0.18	0.16	0.12	0.10	0.07	0.06	0.05	0.04	0.04
460	2.65	0.60	0.34	0.23	0.18	0.14	0.12	0.10	0.08	0.07	0.05	0.04	0.03	0.03	0.02
480	1.51	0.31	0.17	0.12	0.09	0.07	0.06	0.05	0.04	0.03	0.02	0.02	0.02	0.01	0.01
500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table I-6 Distances for Hand-held Flares (nm)

Reporting Source Height ft	0.50 ^{0}	1.00 ^{0}	1.50 ^{0}	2.00 ^{0}	2.50 ^{0}	3.00 ^{0}	3.50 ^{0}	4.00 ^{0}	5.00 ^{0}	6.00 ^{0}	7.00 ^{0}	8.00 ^{0}	10.00 ^{0}	12.00 ^{0}	14.00 ^{0}	16.00 ^{0}
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
30	0.32	0.17	0.12	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
40	0.46	0.25	0.18	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02
50	0.61	0.34	0.23	0.18	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02
60	0.75	0.42	0.29	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03
70	0.88	0.49	0.34	0.26	0.21	0.18	0.15	0.14	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03
80	1.01	0.57	0.40	0.31	0.25	0.21	0.18	0.16	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04
90	1.14	0.65	0.45	0.35	0.28	0.24	0.21	0.18	0.15	0.12	0.10	0.09	0.07	0.06	0.05	0.05
100	1.27	0.72	0.51	0.39	0.32	0.27	0.23	0.20	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.05
110	1.40	0.80	0.56	0.43	0.35	0.30	0.26	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06
120	1.52	0.87	0.61	0.47	0.38	0.32	0.28	0.25	0.20	0.17	0.14	0.13	0.10	0.08	0.07	0.06
130	1.64	0.95	0.67	0.51	0.42	0.35	0.31	0.27	0.22	0.18	0.16	0.14	0.11	0.09	0.08	0.07
140	1.76	1.02	0.72	0.56	0.45	0.38	0.33	0.29	0.23	0.20	0.17	0.15	0.12	0.10	0.08	0.07
150	1.88	1.09	0.77	0.60	0.49	0.41	0.35	0.31	0.25	0.21	0.18	0.16	0.13	0.11	0.09	0.08
160	2.00	1.16	0.82	0.64	0.52	0.44	0.38	0.33	0.27	0.23	0.19	0.17	0.14	0.11	0.10	0.08
170	2.11	1.23	0.87	0.68	0.55	0.47	0.40	0.36	0.29	0.24	0.21	0.18	0.15	0.12	0.10	0.09
180	2.23	1.31	0.93	0.72	0.59	0.49	0.43	0.38	0.31	0.26	0.22	0.19	0.15	0.13	0.11	0.10
190	2.34	1.38	0.98	0.76	0.62	0.52	0.45	0.40	0.32	0.27	0.23	0.20	0.16	0.14	0.12	0.10
200	2.45	1.45	1.03	0.80	0.65	0.55	0.48	0.42	0.34	0.29	0.25	0.22	0.17	0.14	0.12	0.11
220	2.67	1.58	1.13	0.88	0.72	0.61	0.53	0.46	0.38	0.31	0.27	0.24	0.19	0.16	0.14	0.12
240	2.89	1.72	1.23	0.96	0.78	0.66	0.57	0.51	0.41	0.34	0.30	0.26	0.21	0.17	0.15	0.13
260	3.10	1.85	1.33	1.03	0.85	0.72	0.62	0.55	0.44	0.37	0.32	0.28	0.23	0.19	0.16	0.14
280	3.31	1.99	1.43	1.11	0.91	0.77	0.67	0.59	0.48	0.40	0.35	0.30	0.24	0.20	0.17	0.15
300	3.51	2.12	1.52	1.19	0.98	0.83	0.72	0.63	0.51	0.43	0.37	0.33	0.26	0.22	0.19	0.16
320	3.72	2.25	1.62	1.27	1.04	0.88	0.77	0.68	0.55	0.46	0.40	0.35	0.28	0.23	0.20	0.17
340	3.92	2.38	1.72	1.34	1.10	0.94	0.81	0.72	0.58	0.49	0.42	0.37	0.30	0.25	0.21	0.19
360	4.11	2.51	1.81	1.42	1.17	0.99	0.86	0.76	0.62	0.52	0.45	0.39	0.32	0.26	0.23	0.20
380	4.31	2.63	1.91	1.49	1.23	1.04	0.91	0.80	0.65	0.55	0.47	0.41	0.33	0.28	0.24	0.21
400	4.50	2.76	2.00	1.57	1.29	1.10	0.95	0.84	0.69	0.58	0.50	0.44	0.35	0.29	0.25	0.22
420	4.69	2.88	2.09	1.64	1.35	1.15	1.00	0.89	0.72	0.61	0.52	0.46	0.37	0.31	0.26	0.23
440	4.88	3.01	2.19	1.72	1.42	1.20	1.05	0.93	0.75	0.63	0.55	0.48	0.39	0.32	0.28	0.24
460	5.06	3.13	2.28	1.79	1.48	1.26	1.09	0.97	0.79	0.66	0.57	0.50	0.40	0.34	0.29	0.25
480	5.24	3.25	2.37	1.87	1.54	1.31	1.14	1.01	0.82	0.69	0.60	0.52	0.42	0.35	0.30	0.26
500	5.43	3.37	2.46	1.94	1.60	1.36	1.19	1.05	0.85	0.72	0.62	0.55	0.44	0.37	0.31	0.27
520	5.60	3.49	2.55	2.01	1.66	1.42	1.23	1.09	0.89	0.75	0.65	0.57	0.46	0.38	0.33	0.28
540	5.78	3.61	2.64	2.08	1.72	1.47	1.28	1.13	0.92	0.78	0.67	0.59	0.47	0.40	0.34	0.30
560	5.96	3.73	2.73	2.16	1.78	1.52	1.32	1.17	0.95	0.80	0.70	0.61	0.49	0.41	0.35	0.31
580	6.13	3.85	2.82	2.23	1.84	1.57	1.37	1.21	0.99	0.83	0.72	0.63	0.51	0.43	0.36	0.32
600	6.31	3.97	2.91	2.30	1.90	1.62	1.42	1.25	1.02	0.86	0.74	0.65	0.53	0.44	0.38	0.33
620	6.48	4.08	3.00	2.37	1.96	1.68	1.46	1.29	1.05	0.89	0.77	0.68	0.54	0.45	0.39	0.34
640	6.65	4.20	3.09	2.44	2.02	1.73	1.51	1.34	1.09	0.92	0.79	0.70	0.56	0.47	0.40	0.35
660	6.82	4.31	3.17	2.51	2.08	1.78	1.55	1.38	1.12	0.95	0.82	0.72	0.58	0.48	0.41	0.36
680	6.98	4.43	3.26	2.59	2.14	1.83	1.60	1.42	1.15	0.97	0.84	0.74	0.60	0.50	0.43	0.37
700	7.15	4.54	3.35	2.66	2.20	1.88	1.64	1.46	1.19	1.00	0.87	0.76	0.61	0.51	0.44	0.38
720	7.32	4.66	3.44	2.73	2.26	1.93	1.69	1.50	1.22	1.03	0.89	0.78	0.63	0.53	0.45	0.39
740	7.48	4.77	3.52	2.80	2.32	1.98	1.73	1.54	1.25	1.06	0.92	0.81	0.65	0.54	0.46	0.41
760	7.64	4.88	3.61	2.87	2.38	2.03	1.78	1.58	1.29	1.09	0.94	0.83	0.67	0.56	0.48	0.42
780	7.80	4.99	3.69	2.94	2.44	2.08	1.82	1.62	1.32	1.11	0.96	0.85	0.68	0.57	0.49	0.43
800	7.96	5.10	3.78	3.00	2.50	2.13	1.86	1.66	1.35	1.14	0.99	0.87	0.70	0.59	0.50	0.44
820	8.12	5.21	3.86	3.07	2.55	2.18	1.91	1.70	1.38	1.17	1.01	0.89	0.72	0.60	0.51	0.45
840	8.28	5.32	3.95	3.14	2.61	2.24	1.95	1.73	1.42	1.20	1.04	0.91	0.74	0.62	0.53	0.46
860	8.44	5.43	4.03	3.21	2.67	2.29	2.00	1.77	1.45	1.23	1.06	0.93	0.75	0.63	0.54	0.47
880	8.59	5.54	4.12	3.28	2.73	2.34	2.04	1.81	1.48	1.25	1.08	0.96	0.77	0.64	0.55	0.48
900	8.75	5.65	4.20	3.35	2.79	2.39	2.09	1.85	1.51	1.28	1.11	0.98	0.79	0.66	0.56	0.49
920	8.90	5.76	4.28	3.42	2.84	2.43	2.13	1.89	1.55	1.31	1.13	1.00	0.81	0.67	0.58	0.50
940	9.05	5.86	4.36	3.48	2.90	2.48	2.17	1.93	1.58	1.34	1.16	1.02	0.82	0.69	0.59	0.52
960	9.21	5.97	4.45	3.55	2.96	2.53	2.22	1.97	1.61	1.36	1.18	1.04	0.84	0.70	0.60	0.53
980	9.36	6.08	4.53	3.62	3.01	2.58	2.26	2.01	1.64	1.39	1.20	1.06	0.86	0.72	0.61	0.54
1000	9.51	6.12	4.61	3.69	3.07	2.63	2.30	2.05	1.68	1.42	1.23	1.08	0.87	0.73	0.63	0.55

Appendix J
Emergency Position Indicating Radio Beacon (EPIRB) Registration Form

Beacon Registration Options:

EPIRB/ELT/PLB owners may register their beacons using the following registration form. Beacon owners can also update their existing registration information including ownership information, emergency contacts and vessel information with the same form. Please note that online registration is now available from the NOAA website at www.beaconregistration.noaa.gov as an alternative method. When speaking with beacon owners after a SAR case, SAR planners should inform beacon owners of the online registration web site as a means of keeping beacon information up to date.

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Save Time! Register your beacon at www.beaconregistration.noaa.gov

406 MHz EPIRB Registration Form

Mail or fax to:

Fax # (301) 568-8649

NOAA/NESDIS
Direct Services Division, E/SP3
Federal Bldg 4, Room 0158
Washington, DC, 20233

Check the appropriate box:

❑ New EPIRB Registration
❑ Change of EPIRB Ownership
❑ Change of EPIRB Information

1. Unique Identifier Number (15 Digits)

2. EPIRB Category
❑ Category I (automatic activation)
❑ Category II (manual activation only)

3. Manufacturer:_____
4. Model No.:_____

Owner Information

5. Owners Name (Last, First Middle Initial):_____
6. Mailing Address:_____
_____ 7. Country:_____
8 Telephone:_____ _____
(Home) (Work)

Vessel Data

9. Type: **Sail** ❑ Sloop ❑ Yawl ❑ Schooner ❑ Other
Power ❑ Fishing ❑ Tug ❑ Cargo ❑ Tanker ❑ Cabin Cruiser ❑ Other
Color:_____
10. Radio Equipment: ❑ Inmarsat VHF HF MF Other:_____
11. Telephone Numbers: Inmarsat_____ Cellular:_____
12. Vessel Name:_____ 13. Call Sign:_____
14. Documentation or Registration Number:_____
15. Length Overall (ft):_____ 16. Capacity (crew and passengers):_____
17. Homeport (Marina/Dock City/State):_____
18. Additional Data:_____
_____

Emergency Contacts

19. Name of Primary 24-Hour Emergency Contact:_____
20. Telephone: (Home)_____ (Work)_____

21. Alternate 24-Hour Emergency Contact:_____
22. Telephone: (Home)_____ (Work)_____

Signature:_____ Date:_____

If you have any questions about this form or EPIRB registration in general please call toll-free 1-888-212-SAVE between the hours of 0830 - 1630 (EST) Mon - Fri.

OMB 0648-0295 exp. 10/98

PRIVACY ACT INFORMATION

Solicitation of this information is authorized by Parts 80 and 87, Title 47 CFR. The information you furnish may assist search and rescue teams in locating your vessel in the event of beacon activation. Failure to register this 406 MHz EPIRB with NOAA could result in monetary forfeiture being issued to the owner.

Public reporting burden for this collection is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to NOAA at:

NOAA/NESDIS
Direct Services Division E/SP3
Federal Building 4, Room 0158
Washington, DC, 20233

All registration forms will be entered into the 406 MHz Beacon Registration Database within 48 hours of receipt. A confirmation letter, a copy of the actual registration, and a proof-of-registration decal will be mailed to you within two weeks. When you receive these documents, please check the registration information carefully and affix the decal to your EPIRB. If you have a category I (Float-free) EPIRB, please affix the decal so that it can be easily seen without removing the EPIRB from its bracket. If for some reason you do not receive confirmation back from NOAA, please call toll-free 1-888-212-7283 for assistance.

Appendix K
Bibliography

ANNOTATED BIBLIOGRAPHY FOR RESCUE COORDINATION CENTERS

The Annotated Bibliography for Rescue Coordination Centers, was produced by the Improvements to Search and Rescue Capabilities (ISARC) project under project element 1012.6. Additional reference materials have since been added.

Senior Rescue Coordination Center Controllers (RCC) expressed a need for a list or bibliography of references that each Operations Center should have. Innumerable sources of oceanographic data exist including historical data and near real-time data as well as estimates from numerical models. The Annotated Bibliography presents the results of a search of available resources that could aid the RCC Controllers in their Search and Rescue operations and includes the following types of data:

- Sea surface temperature
- Wind climatology and resulting wind current
- Ocean wave prediction
- Sea state climatology
- Sea current (low frequency)
- Tides and tidal currents
- General oceanography texts
- Other types of relevant information

The references described herein consist of atlases, charts, computer software, tabulated data as well as texts and reports. The references selected present the data in formats that are best suited to providing answers understandable and suitable for non-oceanographers. The table below shows the different sources of information and what types of information each source contains. A list specific to the First District is included at the end. A list specific to each district will be published as completed.

The Command SAR Library requirements are contained in Appendix A.

Source	Sea Surface Temperature	Wind Climatology and Wind Currents	Ocean Wave Prediction	Sea State	Sea Current	Tides and Tidal Current	General Oceanography	Other Types of Information
Boating Almanac							T/D	T
Bowditch								T
Chapman Piloting								T
CG Addendum								T
CG Rescue & Survival Systems Manual								T
Coast Pilot	T/D							
Evaluation of Wind Current		T						
Glossary of Oceanography							T	T
Major Currents in the Atlantic					T			
Marine Climatic Atlas CD-ROM	C/D	C/D		C/D				
NDBC Observations		C/D		C/D				
NOAA Ocean Products Center	A							
National SAR Supplement		T				T		T
Pierson, Newman and James			T					
Satellite Imagery	A/D							
Summary Synoptic Met. Obs.	D	D		D				
Surface Currents					A			
Tidal Current Charts						A		
Tidal Current Diagrams						A		
Tidal Current Tables						D		
Tide. 1						C/D		
Tide Tables						D		
Tides ABC						C/D		
Navy Hindcast Ocean Wave Model		A	A	A/D				
Navy Marine Climatic Atlas	A/D	A/D		A/D				
Wave Forecasts & Navigation								T
Waterway Guide						T		T

A – Atlases, charts and graphical data
C – Computer software
D – Digital and tabular data
T – Texts and reports

Bibliography

The bibliography is divided into three sections: atlases, charts, and other graphical data; digital and tabular data; and books and reports. The majority of these references have been reviewed at the R & D Center. The few that have not been are noted as unexamined.

Atlases and Charts

NOAA Ocean Products Center,
World Weather Bldg., Room 100, 5200 Auth Road, Camp Springs, MD 20746. TEL: (301) 763-8030, FAX: (301) 702-3068.

Ocean Features Analysis (OFA) and Sea Surface Thermal Analysis (SSTA): Available for 3 months, 6 months, or 1 year via subscription land fax and subscription mail. The prices vary depending on the chart and duration. There is a small fee for receiving by fax, one time, 1-5 charts. For more precise information on the chart cost contact NOAA/NCDC, Federal Building, Asheville, NC 28801-2696, Attention: Subscriptions or call (704) 259-0619. For more information on or interpretation of the OFA contact: NOAA/NOS/OPC, 5200 Auth Road, Room 100, Camp Springs, MD 20746, (301) 763-8294 or (301) 763-8030.

The North Panel OFA is also available to ships at sea via radio-facsimile transmission from the National Weather Service Forecast Office in Boston, Massachusetts. The frequency is 7530 kHz and the chart is transmitted at 1730 UTC daily. For more information contact: National Weather Service Forecast Office, Massachusetts Technology Center, Suite 102N, Logan International Airport, Boston, MA 02128.

Gulf Stream Wall Bulletin: Available through several sources. One is the Coast Guard radio broadcast from Portsmouth (NMN), VA transmitted at 1600 UTC and 2200 UTC on single band frequencies 6501, 8764, and 13089 kHz.

Oceanographic Monthly Summary: Subscription orders should be placed with Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402.

The Ocean Products Center (OPC) has developed a series of ocean thermal products, both real time and synoptic, which are distributed by AFOS, one of NOAA's Family of Services. Among the OPC's responsibilities is the production of the Oceanographic Features Analysis (OFA) charts for the U.S. Atlantic coast and Sea Surface Thermal Analysis (SSTA) charts for the North Atlantic and North Pacific Oceans. These products are derived from polar orbiting thermal infrared satellite images and data. NOAA's polar orbiting satellite infrared imagery is the primary data source for generating the OFA and the digital data is used to generate the SSTA. Features depicted on the OFAs include the location of the Gulf Stream, Gulf of Mexico Loop Current, other ocean fronts, eddies, and sea surface temperatures. The North Panel OFA (80 W to 45 W, 32 N to 49 N) is produced on Monday, Wednesday, and Friday. The South Panel OFA is produced on Tuesday and Thursday. The resolution of image data used in the analysis varies from 1-8 km. The SSTAs are automated charts of area sea surface isotherms (lines of equal temperatures) with a resolution of 14 km. The areas covered by the SSTAs are: Cape Cod to Cape Hatteras, Cape Hatteras to 30 N, East Coast of Florida to 18 N, and the Gulf of Mexico. These charts are produced once a week and are mailed to National Climatic Data Center (NCDC) for FAX and mail distribution to users. The Gulf Stream Wall Bulletin is directly derived from the Ocean Feature Analyses. It is a series of latitude and longitude points that, when plotted and connected, describe the north wall position of the Gulf Stream. Monthly sea surface temperatures, means and anomalies for all ocean basins are summarized in the publication, "Oceanographic Monthly Summary" (OMS). End of month Gulf Stream position and eddy translations are indicated in the OMS. There is a section on West Coast ocean features as well as Alaskan sea ice analysis. During the ice-free months on the Great Lakes, a surface temperature analysis is produced.

Satellite Imagery
U.S. Coast Guard Research and Development Center, 1082 Shennecossett Road, Groton, CT 06430-6096. TEL: (203) 441-2741, FAX: (203) 441-2792.

The Coast Guard R & D Center now has the ability to generate remotely sensed images of sea surface temperature for the western Atlantic Ocean and Gulf of Mexico using its satellite receiving station. The satellite receiving station will enable the Coast Guard to estimate sea surface currents over a broad expanse of the ocean using Advanced Very High Resolution Radiometric (AVHRR) images. The technique, which the Improvements to Search and Rescue Capabilities (ISARC) project is currently developing, is based on the comparison of a time-series of remotely sensed images. The motion of thermal features will be determined from the images. Knowing the distance the features have traveled and the

time between images, the surface currents can be estimated. The current vectors obtained from this will provide a pattern of the sea surface circulation. The drift information from the datum marker buoys will be incorporated into the derived circulation pattern. The current magnitudes and directions obtained from the satellite imagery will be incorporated into the Computer Assisted Search Planning (CASP) program.

Surface Currents, West Central North Atlantic Ocean including East Coast of the United States,

Feb 1978, Naval Oceanographic Office, NSTL Station, MI 39522. Naval Oceanographic Office Special Publication 1400-NA 6, AD A102 094.

This atlas, and the series of which it is a part, is computer generated and automatically plotted. It made available the most recent surface current data collected at that time and is supposed to be updated whenever sufficient amounts of data are added to the data file. This and the other atlases are based on a vast quantity of data as compared to the previous manually compiled editions printed in the mid-thirties. The surface current speed and direction information is based mainly on ship drift.

U.S. Navy Hindcast Spectral Ocean Wave Model Climatic Atlas,

U.S. Naval Oceanography Command Detachment, Asheville, NC, 1983.

North Atlantic Ocean (1983) NAVAIR 50-1C-538. S/N 0850 LP 014 1000. AD-A141 810. Not available on paper from NOCD Asheville. For sale by the Supt. of the Docs.

North Pacific Ocean (1985) NAVAIR 50-1C-539. S/N 0850 LP 014 2000. AD-A165 871. Shipping list no.: 85-2012-P.

These atlases give wind speed and direction, significant wave height and direction and wave slope parameter, modal wave period and directionality. Applying the Spectral Ocean Wave Model in hindcast mode to historical wind and pressure fields produced data in the atlases.

U.S. Navy Marine Climatic Atlas of the World,

U.S. Naval Oceanography and Meteorology, Naval Weather Service Detachment, Naval Oceanography Command Detachment, Asheville, NC, Naval Oceanography Command.

This publication is in nine volumes, one for each ocean basin, and two for the world.

Vol I. North Atlantic Ocean, 1974, NAVAIR 50-1C-528, S/N 0850 LP 000 7010. AD-A021 933, (This may be revised as: Climatic Study of the United States Atlantic Coast and Associated Waters (1989) NAVAIR 50-1C-555. S/N 0850 LP 015 2000. AD 210 198.)

Vol II. North Pacific Ocean, 1977, NAVAIR 50-1C-529, S/N 0850 LP 000 7510. AD-A072-498, Produced for the Naval Oceanography and Meteorology at the National Climatic Center.

Vol III. Indian Ocean, 1976, NAVAIR 50-1C-530, S/N 0850 LP 000 8010. AD-A072-499, Produced for the Naval Oceanography and Meteorology at the National Climatic Center.

Vol IV. South Atlantic Ocean, 1978, NAVAIR 50-1C-531, S/N 0850 LP 000 8510. AD-A072-500, Prepared at the National Climatic Center, March 1978.

Vol V. South Pacific Ocean, 1979, NAVAIR, 50-1C-532, S/N 0850 LP 000 9010. AD-A089 035, Prepared at the National Climatic Center, October 1979.

Vol VI. Arctic Ocean, 1963, NAVWEPS 50-1C-533, S/N 0850 LP 000 9500. AD-A953-275.

Vol VII. Antarctic, 1965, NAVWEPS 50-1C-50, S/N 0850 LP 000 5500. AD-A953-276.

Vol IX. World-wide Means and Standards Deviations, 1981, NAVAIR 50-1C-65, AD-A108-222. Prepared by Naval Oceanography Command Detachment, Asheville, NC, May 1981. Includes bibliographies and indexes.

These publications were prepared by the National Climatic Data Center/NESDIS and published for the U.S. Navy, Naval Oceanographic Command. The publication presents maps of average weather and oceanic data such as wind speed and direction, significant wave height and direction, and visibility and cloudiness. The data is presented both as surface graphs and tables and the information is depicted as isopleths, graphs, and/or statistics. The data have a very coarse resolution.

Tidal Current Charts.

Available from NOAA/NOS — Distribution Branch, ACF Warehouse Room 210, 6501 Lafayette Ave., Riverdale, MD 20737-1199. Also available from Defense Mapping Agency (DMA).

Boston Harbor (1974)
Narragansett Bay (1971)
Narragansett Bay to Nantucket Sound (1973)
Long Island Sound and Block Island Sound (1977)
New York Harbor (1956)
Upper Chesapeake Bay (1973)
Charleston Harbor, South Carolina (1967)
Tampa Bay
San Francisco Bay
Puget Sound - Northern Part (1973)
Puget Sound - Southern Part (1973)

Tidal Current Charts graphically represent tidal currents in selected bays and harbors of the United States. Each publication of the Tidal Current Chart series consists of a set of 12 or 13 charts, with direction and velocity of the tidal current (shown graphically) for each hour of the tidal cycle for a major reference station. The charts, which may be used for any year, present a comprehensive view of the tidal current movement in the respective waterways as a whole and also supply a means of readily determining, for any time, the direction and speed of the current at various localities throughout the water areas covered. These charts depict the harmonic and rotary analysis results of current meter observations. A recent series of tidal current charts for Delaware River and Bay were produced using the results from a numerical estuarine circulation model. Model results were compared with observations to determine the skill of model predictions. The Narragansett Bay tidal current chart is to be used with the annual tide tables. The other charts require the annual tidal current tables.

Tidal Current Diagrams.

Available from NOAA/NOS — Distribution Branch, ACF Warehouse Room 210, 6501 Lafayette Ave., Riverdale, MD 20737-1199. Also available from DMA.

Tidal Current Diagrams are a series of 12 monthly diagrams to be used with the Tidal Current Charts to give the user a convenient method to determine the current flow on a particular day. Tidal Current Charts are available for Boston Harbor, Long Island Sound and Block Island Sound, and New York Harbor. The diagrams are published annually.

Tables

Marine Climatic Atlas Compact Disk-Read Only Memory (MCA CD-ROM)

Produced at the Federal Climate Complex Asheville by Naval Oceanography Command Detachment Asheville.

The primary database used for the Marine Climatic Atlas CD-ROM (MCA) was PILOT CHART - Sums of Global Atlas Marsden Squares. The primary source was the Marine Climatic Atlas of the World data file comprised of ship surface observations covering the period January 1850 through December 1970. This database contains 1-degree and 5-degree quadrangle summaries giving the observation count for eight-point wind roses, and means and standard deviations for: wind speed (knots), pressure (pressure-1000mb to 10th), air temperature (deg. C to 10ths), wet bulb temperature (deg. C to 10ths), dew point temperature (deg. C to 10ths), sea surface temperature (deg. C to 10ths), air-sea temperature difference (deg. C to 10ths), and wave height (meters). Also included are light (dry bulb) temperature equal to or less than -2 deg. C and wind speed equal to or greater than 13 knots and heavy (dry bulb temperature equal to or less than -9 deg. C and wind speed equal to or greater than 30 knots) superstructure icing potential, frequency of gales (equal to or greater than 34 knots), and eight-point surface current roses. The current roses were summarized by 1-degree squares utilizing ocean current data that were compiled from ship drift reports that were forwarded by various merchant marines and then digitized by Naval Oceanographic Office, Bay, St. Louis, MS. MCA is designed to run on a Zenith 248 desktop computer (or other IBM compatible) using MS-DOS. Data can be displayed in isopleths with overlay capability or point data and printed out. Unexamined.

National Data Buoy Center Observations

Buoy data are available from the following meteorological sources. For pricing information contact the individual firms.

Accu-Weather, Inc., 619 West College Avenue, State College, PA 16801 TEL: (814) 234-9601, FAX: (814) 238-1339.

Weather Network, 3760 Morrow Lane, Suite F, Chico, CA 95928-8865 TEL: (916) 893-0308, FAX: (916) 893-4517.

Weather Services International, 4 Federal Street , Billerica, MA 01821 TEL: (508) 670-5000, FAX: (508) 670-5100.

Weatherbank, Inc., 5 Triad Center, Suite 315, Salt Lake City, UT 84180 TEL: (801) 530-3131, FAX: (801) 530-3174.

Ocean Routes, Seimac Limited, 271 Brownlow Avenue, Dartmouth, Nova Scotia, Canada B3B 1W6, TEL: (902) 468-3007, FAX: (902) 468-3009.

The purpose of the Data Buoy Program is to provide automatic real-time collections of environmental data from critical marine data void areas: deep oceans, off-of-the-shelf coastal regions, and the Great Lakes. In support of this program automated moored data buoys, Coastal-Marine Automated Network (C-MAN) stations and Coast Guard large navigation buoys (LNBs) record hourly observations. The observations include wind direction and speed, air temperature, barometric pressure, SST (at 1 m), and non-directional wave spectra. The observations are relayed via GOES, and at some of the C-MAN stations, data can be collected by telephone. The best approach for an infrequent user who wants to receive all data collected from several stations in the last few days would be to dial into a meteorological consulting firm's computer. All that is needed is a PC and an asynchronous modem. Connect charges cost about $60/hour and it takes about 1 minute to acquire data for two days at 1200 baud. Long distance charges can be avoided by dialing into a local TYMNET phone number. Other marine observations and forecasts can also be obtained in this manner. Firms offering this service include Accu-Weather Inc., Weather Network, Weather Services International (WSI) and Weatherbank, Inc. These firms get their data from the NWS. Though data acquisition costs are low, this method has some disadvantages. Some companies decode the data and place them in tables where data resolution may be lost. In addition communication problems may garble data. Dave Gilhousen of the National Data Buoy Center (601) 668-2840, said that at present there is no direct user access to the buoy data. The drifting buoy data is limited to the mid-southern latitudes 30-50s. He suggested three methods for accessing the moored buoy data.

1) The National Weather Service will install new computers in about three years. Presently, there are a limited number of asynchronous ports. It may be possible to set up an external user capability.
2) Establish an account with a commercial weather service such as Accu-Weather, Ocean Routes or WSI. Gilhousen recommends Ocean Routes or WSI over Accu-Weather. Only 1-2 minute contact would be needed to obtain weather and buoy data. A decoder would need to be run to obtain the buoy data.
3) Monitor satellite, West Star 5, ourselves (GOES is very expensive). Can obtain the software. There would also be data delivery charges. Unexamined.

Summary Synoptic Meteorological Observations, (SSMO)

United States Naval Weather Service Detachment, United States Naval Oceanography Command, Asheville, NC. These publications were prepared and published by the National Climatic Data Center/NESDIS for the Naval Oceanography Command.

Available from NTIS.

North American Coastal Marine Areas - Revised Atlantic and Gulf Coasts, Vol. 1 (Around Newfoundland), Vol. 2 (St. Lawrence River to New York), Vol. 3 (Atlantic City to Miami, Vol. 4 (Guantanamo, and the Gulf of Mexico from the southern tip of Florida to the Texas-Mexico border).

Summary of synoptic meteorological observations (SSMO): selected South Pacific island marine areas, 1979.

Summary of synoptic meteorological observations for Great Lakes areas, 1975. Vol. 1: Lake Ontario and Lake Erie. Vol. 4: Lake Superior

Summary of synoptic meteorological observations Siberian coastal marine areas, 1975

Summary of synoptic meteorological observations: North American Coastal marine areas, 1975. Vol. 5: Pacific Coast areas 30-35, Vol, 6: Pacific Coast areas 36-41.

These publications, which utilized data from the years 1850 through 1979, provide statistical information on weather and ocean waves for most of the continental coastal marine areas (19) of the world. The publications consist chiefly of tables. The data contained in these tables were obtained from Marine Surface observations. The data are based upon observations made by ships in passage. Such ships tend to avoid bad weather when possible, thus biasing the data toward good weather samples. Tables include: percentage frequency of weather occurrence by wind direction and by hour, percentage frequency of weather occurrence by wind direction by speed and by hour, percentage frequency of weather occurrence by air temperature, means, extremes, and percentiles of air temperature by hour, percentage frequency of air temperature and the occurrence of fog versus air-sea temperature difference, percentage frequency of surface wind speed and direction versus sea height, percentage frequency of wave height versus wave period and other meteorological observations. Extreme temperatures are the one maximum and one minimum value appearing in the marine data file. The tables appear together for each month and in the annual summary.

Tidal Current Tables
Available from NOAA/NOS — Distribution Branch, ACF Warehouse Room 210, 6501 Lafayette Ave., Riverdale, MD 2037-1199.

Also available from DMA.

Atlantic Coast of North America
Pacific Coast of North America and Asia

Tidal Current Tables provide predicted times and directions of maximum flood and ebb current and of slack or minimum currents and times of flow reversal for each day of the year at 54 stations located around the Atlantic coast of North America and the Pacific coast of North America and Asia, as well as data for predicting currents at about 2,400 subordinate stations in these areas. The subordinate stations are identified by latitude, longitude, and the geographic name of the locality and are referenced to a station having daily predictions. Listed time differences or ratios must be applied to the values of the reference station to provide current predictions at these subordinate locations. The Tidal Current Tables include tables for calculating current velocity at any intermediate time and duration of slack water or weak current. The information provided is mainly for estuaries. The data is derived or computed. The predictions of the tidal currents are based on the harmonic analysis of current meter observations. The predictions are for the astronomic or tidal currents, only. The Tidal Current Tables include tables depicting the rotary tidal currents and current diagrams for specific locations. The Tidal Current Tables come in two volumes: Atlantic Coast of North America and Pacific Coast of North American and Asia.

Tide. 1: Rise & Fall,
Micronautics, P.O. Box 1071, Rockport, ME 04856, TEL: (800) 456-TIDE or (207) 236-0610.

Micronautics has created a PC-based program, entitled Tide.1: Rise & Fall, which plots a daily tide curve in character graphics on the screen or a useful and convenient printout. Tide.1: Rise & Fall predicts times and heights of high and low water at more than 3,200 coastal locations in North America. Tide.1 will also give the times of sunrise and sunset, and produce a daily tide plot. The tides can be predicted in feet or meters. The program includes help windows, and several printer and file formats. Requirements: Tide.1 runs on an IBM PC or compatible with 384 KB and DOS 2.0 or above. A hard disk or math co-processor is not necessary. With Calendar Creator Plus, tide calendars are also available. Regions available: New York and New England, Mid Atlantic Coast, Southeast and Gulf Coasts, West Coast and Hawaii, Central America and Caribbean, Alaska and British Columbia and East Coast Canada.

Tide Tables
Available from NOAA/NOS — Distribution Branch, ACF Warehouse, Room 210, 6510 Lafayette Ave., Riverdale, MD 20737-1199. Also available from DMA.

East Coast of North and South America, including Greenland
West Coast of North and South America, including Hawaiian Islands
Europe and West Coast of Africa, including Mediterranean Sea
Central and Western Pacific Ocean and Indian Ocean

Tide Tables include the predicted times and heights of high and low waters for each day of the year for about 200 of the most important harbors, which are designated as reference stations. Tables include full daily predictions for reference ports and differences and other constants for other stations. The tidal predictions are based on the harmonic analysis of water level data collect on land based stations and are of astronomic water levels, only. Tide Tables also contain tables

for obtaining the approximate height of the tide at any time, a table of local mean time of sunrise and sunset for every 5th day of the year for different locations, a table for the reduction of local mean time to standard time, a table of moonrise and moonset for several locations, a table of Greenwich mean time of the moon's phase, apogee, perigee, greatest north and south and zero declination, and the time of the solar equinoxes and solstices. Tide Tables are available for the following regions: the East Coast of North and South America including Greenland; the West Coast of North and South America, including the Hawaiian Islands; Europe and the west coast of Africa, including the Mediterranean Sea; and the Central and Western Pacific Ocean and the Indian Ocean. Corrections to this publication, after the date of printing may appear in the quarterly summaries numbered 13, 26, 39, and 52 of the Notice to Mariners. They may also appear in the Local Notice to Mariners.

Tides ABC
Available from TIDES ABC Distribution, N/OMal, Room 315, 6001 Executive Blvd., Rockville, MD 20852. Contact: Milton Rutstein (301) 443-8467 or Treen Windfield (301) 443-8807. Software is available.

This is a database, data dissemination system which supplies real-time and synoptic, oceanographic data of water levels. These real-time gauges are in estuaries along the East Coast from Charleston, SC to Boston Harbor; and Southern California, San Francisco Bay, Willapa Bay and Neah Bay, WA. Land-based stations equipped with telephone telemetry collect the data, which is observational. This software package allows the user to obtain real-time water level data and predictions for periods of 1 to 6 days of the astronomic water level for comparison. Presently, 20 locations can be accessed using this system. The data is digital and can be obtained using an IBM PC with a math coprocessor, 448 KB memory and Hayes mode. A limited number of printers are supported. Unexamined.

Books and Reports

Boating and Almanac
Boating Almanac Co., Inc., 203 McKinsey Road, Severna Park, MD 21146 (301) 647-0084.
Each volume is available from distributors or directly from Boating Almanac. This almanac is published annually in four volumes.

Vol. 1) Maine to Rhode Island
Vol. 2) Long Island Sound
Vol. 3) Delaware Bay, New Jersey, Hudson River Basin, Lake Champlain, and the Erie Canal
Vol. 4) Chesapeake Bay

Its primary purpose is to provide boaters with a list of available resources. It pinpoints marinas and marine facilities on reproduced nautical charts.

Boisvert, W.E., 1967, Major Currents in the North and South Atlantic Oceans Between 64N and 60S, 92 pp. AD 827 586. Naval Oceanographic Office TR # 193.

This report depicts the locations, directions of flow, speeds, and other characteristics of major currents in the North and South Atlantic. The approximate boundaries and the main body of each major current are shown based on ship drift observations and direct measurements. The ship drift observations on which many of the descriptions are based number in the hundreds of thousands and are retained at the National Oceanographic Data Center and U.S. Naval Oceanographic Office. Although the data used in this report are dated, the descriptions of the various currents are clear and concise and give a comprehensive summary of their principal characteristics. The information provided by this report may be useful in understanding the circulation patterns in the Atlantic.

Bowditch, N., 1981, American Practical Navigator: An Epitome of Navigation, Defense Mapping Agency Hydrographic Center, Pub. 9, DMA Stock No. NVPUB9V2, Vol. 1 and 2.

For sale by authorized Sales Agents of the Defense Mapping Agency, Office of Distribution Services.

These two volumes constitute a general reference on navigation. The first volume covers the fundamentals of navigation and then discusses piloting and dead reckoning, and celestial navigation. It also contains chapters on oceanography (oceans, tides and tidal currents, ocean currents, ocean waves, breakers, and surf, ice in the sea), weather (observations, elements and tropical cyclones, sea state) and electronics and navigation. Volume II contains useful tables, mathematics for navigation and navigational calculations.

Coast Guard Rescue and Survival Systems Manual, COMDTINST M10470.10 (series.)

This manual provides an up-to-date single source of guidance and technical information relevant to rescue equipment

and survival systems used by Coast Guard surface units. Aviation units shall comply with the provisions of the Coast Guard Aviation Life Support Systems Manual COMDTINST M13520.1 (series). This manual contains information on dewatering pump kits, emergency flotation bags, inflation life rafts, personal flotation devices, protective clothing and equipment, hypothermia protective clothing, survival kit and items, supplementary equipment and emergency medical technician's equipment.

Dick, J.E., 1991, *Evaluation of Search and Rescue (SAR) Method for Determining Local Wind Current*, U.S. Coast Guard, Research and Development Center, Report No. CG-D-07-02. Government Accession No. AD-A252635, 22 pp.

This report discusses a preliminary investigation of the National Search and Rescue (SAR) Manual method for calculating wind driven currents. The derivation of the model recommended by the SAR manual is reviewed and the local wind current predictions are compared with a complex one-dimensional model. Several aspects of the model are assessed for physical correctness. Recommendations for a manual and a numerical method are provided based on the comparison of the predictions. These recommendations should be regarded as provisional until the experimental investigation has been performed and the results analyzed.

Glossary of Oceanographic Terms, 1966, 240 pp. AD 640 463. Naval Oceanographic Office Special Publication # 35.

This glossary provides definitions of oceanographic and allied terms. It contains abbreviations, acronyms, titles, and locations of institutions, agencies, activities, etc., involved in oceanography-oriented projects.

James, R.W., 1957, *Application of Wave Forecasts to Marine Navigation*, Special Publication #1, U.S. Naval Oceanographic Office, (Reprinted 1959, 1975), 85 pp. AD 158 747.

The effects of currents, winds, and wave on ship propulsion are discussed. The most important term in the overall loss of ship speed is shown to be wave action. This action works two ways: directly through the actual resistance of the water to the movement of the ship, and indirectly through the voluntary reduction in speed necessitated by violent motions of pitch, heave, and roll. Methods are shown for the use of synoptic and prognostic wave charts in the selection of an approximate least-time track, and examples of tracks used by commercial steamship companies are given. Some secondary applications of wave charts are illustrated by examples. The appendix contains graphs showing the relationship between ship speed and head, beam, and following waves of varying heights.

Maloney, E.S., 1991, *Chapman Piloting, Seamanship and Small Boat Handling*, 60th ed. (illus.) 652 pp. ($32, ISBN 0-68810425-8 Hearst Marine Books), Morrow, William and Company, Incorporated.

This book includes general information on weather, tides and currents. It also contains a chapter on electronic equipment: communications, navigation and other uses.

National Search and Rescue Manual, U.S. Coast Guard, Department of the Army, Department of the Navy and Department of the Air Force, 1986, and the Coast Guard Addendum to the National Search and Rescue Manual, COMDTINST M16130 .2 (series).

Pierson, W.J., Jr., G. Newman and R.W. James, 1955*, Practical Methods for Observing and Forecasting Ocean Waves by Means of Wave Spectra and Statistics*, U.S. Navy Hydrographic Office. Reprinted 1960, 1971, 284 pp. AD 739 935.

The book is a compendium of facts and theories concerning ocean waves based on research in Britain and the United States. It describes basic concepts and techniques of the first major attempt to apply wave research to wave forecasting. The book contains a basic and understandable discussion on the properties of ocean waves. Chapters cover the generation and forecasting of waves and operational applications of forecasting methods, including examples. A section also covers weather map analysis with information on how to determine fetch, wind velocity and duration.

U.S. Coast Pilot
The Coast Pilots can be obtained from NOAA/NOS — Distribution Branch (N/CG33), ACF Warehouse, Room 210, 6510 Lafayette Ave., Riverdale, MD 20737-1199. Also available from DMA.

The Coast Pilot supplements the navigational information shown on the nautical charts. It gives sailing directions between ports, including recommend courses and distances. It describes channels with their controlling depths and all dangers and obstructions. The Coast Pilot lists harbors and anchorages. Also included are tables of climatological and meteorological data, currents and ice conditions, and mean sea surface temperature. It is published in nine volumes:

1) Eastport to Cape Cod
2) Cape Cod to Sandy Hook
3) Sandy Hook to Cape Henry

4) Cape Henry to Key West
5) Gulf of Mexico, Puerto Rico and Virgin Islands
6) Great Lakes and connecting waterways
7) California, Oregon, Washington and Hawaii
8) Dixon Entrance to Cape Spencer
9) Cape Spencer to Beaufort Sea

Waterway Guide
The guides are available from Communication Channels, Inc., Book Dept, 89, 6255 Barfield Road, Atlanta, GA 30328. The guide is published in four editions:

Southern Edition covering the coast from the Georgia/Florida border, Florida and the Gulf Coast of Mexico, including the Okeechobee Waterway. It also includes coverage of Tenn-Tom Waterway.

Northern Edition covering the C & D Canal and the Delaware Bay, along the New Jersey shore through New York Harbor, Long Island Sound, the South Shore of Long Island, Narragansett and Buzzards Bay, and the coasts of Massachusetts and Maine to the Canadian border.

Mid-Atlantic Edition covers the Chesapeake Bay, both Eastern and Western Shores, from the C & D Canal to Norfolk, including the great rivers, and the entire Intracoastal Waterway, through Virginia, the Carolinas, and Georgia, to the Florida border.

Great Lakes Edition covers all of the five Great Lakes, and their connecting waterways, the Canadian and U.S. canals, the Rideau Canal, the Trent-Severn Waterway, the St. Lawrence Seaway, the Hudson River, and the Erie Canal

These guides, which are updated annually, include navigational advice and local cruising information. They are written for boaters who know how to read a chart but who are entering an unfamiliar harbor. The guides include information on anchorages, new hazards, notes of new bridge regulations, bridges under construction or repair, changes in bridge clearances, the locations of sagging overhead cables, and inlet conditions, up-to-date information on shoals, scheduled dredging operations and controlling depths, a reference section with information on the Coast Guard and the Corps of Engineers, distance tables, a listing of publications, weather information, an explanation of the Coast Guard radio beacon system, a user's guide to VHF-FM radios with an accompanying list of Public Coast Marine Operators, important current tables for the year, current diagrams, tide tables, and information about refurbished marinas and other services and amenities useful to boaters. The guides include a long list of advertisers, with an index in the back. The main body of each book is divided into geographical areas covered by the sections, and each section is broken down into shorter chapters. Each of the major sections begins with a full-page chart of the area covered, an assessment of that area's cruising characteristics, and vital statistics. The subsections cover the actual route, described mile by mile, with significant harbors, ports, anchorages, hazards, and points of interest along the way. At the end of each section the facilities listing gives marine facilities by area, with a telephone number, an identifying number for the accompanying chart and a description of available services. This guide, because of the large area it covers, gives much more limited information about each harbor than other cruising guides reviewed.

Specific Localities

FIRST DISTRICT

Backus, R.H., ed., 1987 *Georges Bank*. (Illus.). 632 p, (ISBN 0-262-02223-0) MIT Press.

This text contains chapters on atmospheric variables and patterns, wave climate, tides, hydrographic structure and variability, seasonal mean circulation, low frequency current and bottom pressure variability and mixing processes.

Duncan, R.F. and J.P. Ware, 1990, *A Cruising Guide to the New England Coast including the Hudson River, Long Island Sound and the Coast of New Brunswick*, rev ed. 736 pp., (ISBN 0-399-15023-4, Putman) Putman Publishing Group.

This guide was first published in 1937 and is now in its 10th edition. It includes notes from history, tradition, and folklore in addition to supplementing the U.S. Coast Pilot, NOAA charts and tables of tides and currents with additional information of navigational importance. It also supplies information about shore services. Unlike the Cruising Guides to Maine by Johnson, this guide describes passages in words rather than in clear, easily followed and understood charts.

Eldridge Tide and Pilot Book, Pub. By Robert Eldridge White, 64 Commercial Wharf, Boston, MA 02110.
Available in marine stores and bookstores.

This book contains current charts of the Boston area. It also contains pilot information.

Embassy Complete Boating Guides

Embassy's Complete Boating Guide to Long Island Sound, 4th ed., (illus.), 450 pp., 1992, (ISBN 0-930527-21-6).

Embassy's Complete Boating Guide to Rhode Island and Massachusetts, 2nd ed., (illus.), 450 pp., 1992, (ISBN 0-930527-20-8).

Complete Boating Guide to the Connecticut River, 2nd ed., (illus.), 240 pp., 1990, (ISBN 0-9616371-1-0).

Embassy Marine Publishing and Foremost Books have produced several cruising guides of interest to the First District. These guides include navigational advice and cruising information. They also contain an extensive list of advertisers with information and marine facilities.

Johnson, D., *Cruising Guide to Maine: Kittery to Rockland, Vol I*., 216 pp., 1987, Paper (ISBN 0-918752-07-8) and *Cruising Guide to Maine: Rockland to Eastport, Vol II*., 164 pp., 1986, Paper (ISBN 0-918752-05-1), Wilensky, Julius M., editor, Wescott Cove Publishing Company.

This guide takes the reader up the Maine coast chart by chart. The description of each harbor is listed with its chart number. It makes no attempt to mention every cove or inlet, nor does it include harbors that can be entered with "local knowledge only." However, it appears to be a fairly complete guide for the cruising sailor. This guide includes many clear reprints of charts with boat yards, marinas, yacht clubs, guest moorings, and other points of interest located on the chart. Passages between ports are shown on NOAA charts and at much smaller scale for complicated or potentially dangerous routes. Alternative passages are described and shown, and discussion is given on the best circumstances for each route. Areas of complicated tidal currents are shown in easy to understand format. Discussion of local services, history, places of interest and things to do are also given. Many areas include photos of the harbors. A chapter is devoted to offshore and coastal currents in the Gulf of Maine, including permanent, periodic, and reversing currents, and a discussion of where the tidal current tables may be incorrect. The chapter also discusses the effects of constricted passages and topography on tidal currents and temporary currents such as wind-driven currents. This information is essential when dealing with the coast of Maine because the velocities at the strength of full ebb and flood tide are so great in some parts of the Gulf of Maine, and the range between high and low water so impressive that they completely dominate all other considerations in coastal navigation.

Regional Tide and Tidal Current Tables, New York Harbor to Chesapeake Bay, NOS, 1990, published biennially.
These tables can be obtained from NOAA/NOS — Distribution Branch, ACF Warehouse, Room 210, 6510 Lafayette Ave., Riverdale, MD 20737-1199. Also available from DMA.

These tables include predicted times and heights of the high and low water for every day of the year for specific coastal region reference stations and differences for obtaining similar predictions for numerous subordinate locations. It also contains daily predictions of the times of slack water and the times and speeds of strength of flood and ebb currents for specific coast region reference stations and time differences and speed ratios for numerous subordinate locations. Unexamined.

URI Dept of Ocean Engineering, 1979, Model-predicted tidal current charts, Long Island Sound to Buzzards Bay, Marine Bulletin Ser.: No. 30 28 p, (ISBN 0-938412-25-6, P771). URI, Sea Grant Publications unit.

These current charts show the hourly directions and velocity of tidal currents in Long Island Sound and Buzzards Bay. The charts are referenced to high water at Newport, Rhode Island. There is not one tidal current chart for each hour after high tide at Newport, giving a total of 13 charts covering one tidal cycle (about 12.4 hours). To determine which chart to use, simply subtract the time of the previous high tide at Newport from the present time. The directions of the current are indicated by arrows, while the velocities, are expressed by numbers alongside the arrows. The velocities, given in knots, are based on mean tidal conditions. However, it is suggested that if there are any questions on the accuracy of these charts, consult the NOAA National Ocean Survey Tidal Current Chart series for this area for a more definitive description of the tidal circulation features. So these may not be an improvement over the NOAA series charts.

Additional Reference Materials

Ketchen, H.G.; St. Martin, J.; Hoer, G.L.; Mazour, T.J.*; Evaluation of U.S. Coast Guard Forward-Looking Radars*. Report No. CG-D-17-84. USCG Research and Development Center and Analysis & Technology, Inc., March 1984.

Lewandowski, M.J.; Hover, G.L.*; Sweep Width Determination for HU-25B Airborne Radar: Life Raft and Recreational Boat Targets*. Report No. CG-D-01-90. USCG Research and Development Center and Analysis & Technology, Inc., September 1989.

Murphy, D.L.; Ezman, A.T.; Perdue, J.L.; *CASP's Use of Its World Historical Sea Currents*. Technical Report No. 91-01. USCG International Ice Patrol.

Osmer, S.R.; Nash, L; Hover, G.L.; Mazour, T.J.*; Coast Guard Surface Vessel Radar Detection Performance*. Report No. CG-D-18-82. USCG Research and Development Center and Analysis &Technology, Inc. April 1982.

Osmer, S.R.; Nash, L; Hover, G.L.; Mazour, T.J.; *Preliminary Assessment of U.S. Coast Guard Short Range Recovery (SRR) Forward Looking Infrared (FLIR) System Small Target Detection Performance*. Report No. CG-D-20-82. USCG Research and Development Center and Analysis & Technology, Inc., May 1982.

Reynolds, W.H.E.; Robe, R.Q.; Hover, G.L.; Plourde, J.V.*; Evaluation of Night Vision Goggles for Maritime Search and Rescue.* Final Report Pending. USCG Research and Development Center and Analysis & Technology, Inc., Preliminary Report March 1990.

Robe, R.Q.; Hover, G.L.; *A Static Evaluation of Selected Visual Distress Signaling Devices*. Report No. CG-D-15-85. USCG Research and Development Center and Analysis & Technology, Inc., January 1985.

Robe, R.Q.; Edwards, N.C.; Murphy, D.L.; Thayer, N.; Hover, G.L.; Kop, M.E.*; Evaluation of Surface Craft and Ice Target Detection Performance by the AN/APS-135 Side Looking Airborne Radar (SLAR).* Report No. CG-D-2-86. USCG Research and Development Center, International Ice Patrol, and Analysis & Technology, Inc., December 1985.

Robe, R.Q.; Hover, G.L.; *Visual Sweep Width Determination for Three Visual Distress Signaling Devices*. Report No. CG-D-30-86. USCG Research and Development Center and Analysis & Technology, Inc., September 1986.

Robe, R.Q.; Hover, G.L.; *Preliminary Sweep Width Determination for HU-25A Airborne Radars: Life Raft and Recreational Boat Targets*. Report No. CG-D-11-88. USCG Research and Development Center and Analysis & Technology, Inc. December 1987.

Robe, R.Q.; Raunig, D.L.; Marsee, R.L.; *AN/APS-137 Forward Looking Airborne Radar (FLAR) Evaluation Final Report*. Report No. CG-D-18-94. USCG Research and Development Center and Analysis & Technology, Inc., May 1994.

CG R&D Center Report CG-D-14-90, March 1990.

CG R&D Center Report CG-D-01-91, August 1990.

CG R&D Center Report CG-D-03-92, June 1991.

CG R&D Center Report CG-D-13-92, November 1991.

CG R&D Center Report in press, R&DC Report #03/93.

Appendix L
*CG Agreement

Memorandum of Understanding
Between
Commander, _____ Coast Guard District
And
[Cellular Provider]
For
Implementation of Star CG (*CG) Services

This Star CG (*CG) Memorandum of Understanding ("Agreement") is made and entered into this _____ day of [month, year], by and between the United States _____ Coast Guard District, [city], [state] ("___ District"), and [Cellular Provider], a limited liability company with its principal place of business located at [street address], [city], [state / zip code] ("Cellular Provider").

WITNESSETH:

WHEREAS, [Cellular Provider] operates Personal Communications Services ("PCS") telecommunications systems pursuant to licenses issued by the Federal Communications Commission (the "FCC");

WHEREAS, the Coast Guard supports efforts that facilitate safety of lives and property at sea;

WHEREAS, [Cellular Provider]'s PCS is capable of providing toll-free, abbreviated dialing direct access to the ____ District via the *CG keystrokes;

WHEREAS, the ____ District provides maritime emergency response within its Area of Responsibility; the ____ District finds that *CG is an accepted method of providing direct access to Coast Guard Search and Rescue ("SAR") Groups ("Groups"); and SAR Groups operating within the ____ District are capable of accepting *CG calls; and

WHEREAS, [Cellular Provider] wishes to offer its subscribers toll-free, abbreviated dialing to access the ____ District in conjunction with its PCS telecommunications systems in such regions as are herein described on the terms and subject to the conditions set forth in this Agreement.

NOW, THEREFORE, the Parties agree as follows:

1. Agreement Term and Termination of Agreement.

(a) The Agreement shall commence as of the date hereof and, unless terminated earlier by either [Cellular Provider] or ____ District in accordance with the provisions of this Section 1, shall continue for a period of three (3) years.

(b) A biannual review of this Agreement shall be conducted by each party to determine if any amendments or changes are needed to reflect current conditions and requirements. Either party may then propose changes to this Agreement upon written notice to the other, who shall respond in writing within thirty (30) days of receipt of the proposal. Any changes will go into effect only upon mutual consent of the parties.

(c) Notwithstanding the provisions of Section 1(b), either party may, at any time, propose changes to this Agreement upon written notice to the other, who shall respond in writing within thirty (30) days of receipt of the proposal. Any changes will go into effect only upon mutual consent.

(d) This agreement may be terminated by either party upon sixty (60) days written notice.

2. Obligations of _____ District.

(a) The geographic extent of the ____ District is described in 33 Code of Federal Regulations 3.05-1(_). ____ District agrees to provide [Cellular Provider] with the coordinates (latitude/ longitude, state borders or other standard means of location) that describe the boundaries of each search and rescue SAR Group within the ____

District. ____ District shall notify [Cellular Provider] within thirty (30) days after any changes to the boundaries that affect this Agreement. For each SAR Group, the ____ District shall provide the SAR Group's emergency telephone number and a point of contact (name and non-emergency telephone number) at the SAR Group. ____ District shall provide updates to [Cellular Provider] within five (5) days any time the SAR Group telephone number changes. ____ District shall update [Cellular Provider] within thirty (30) days if the telephone number for the SAR Group Telecommunication Specialist-In-Charge (the SAR Group point of contact) changes.

(b) ____ District shall coordinate testing with [Cellular Provider] to ensure *CG calls are routed to the appropriate SAR Group.

(c) ____ District shall provide [Cellular Provider] with texts and documents describing United States Coast Guard policy regarding use of wireless telephone service for distress notifications.

3. Obligations of [Cellular Provider]

(a) [Cellular Provider] shall program its mobile switch centers located within ____ District jurisdiction to automatically route *CG calls to the SAR Group designated to handle calls for a specified sector. At [Cellular Provider's] discretion, [Cellular Provider] may program a mobile switch center with the translation number from a neighboring SAR Group's number if [Cellular Provider] determines there is a high likelihood that one particular site will handle more marine calls than the other.

(b) Upon establishment of *CG within its network, [Cellular Provider] shall test the service by contacting individual SAR Groups to coordinate testing of proper call routing. Furthermore, [Cellular Provider] shall provide each SAR Group with the name and phone number of a [Cellular Provider] contact to call regarding network operations. Testing may be conducted biannually at the discretion of [Cellular Provider] in close coordination with each SAR Group's point of contact.

(c) [Cellular Provider] shall use the information provided by the ____ District as part of the ____ Districts obligation under this agreement to program each PCS tower site with the correct SAR Group number, dependent upon the location of the tower.

4. Publicity. Any publicity [Cellular Provider] may disseminate regarding *CG service shall accurately portray United States Coast Guard policy as per section 2.7.2 of U.S. Coast Guard Addendum to the National SAR Supplement, COMDTINST M16130.2D regarding the use of wireless telephone service as an additional way for boaters to contact the Coast Guard in times of emergency. [Cellular Provider] shall not, without authority, use the combination of letters "USCG" or the words "Coast Guard" for the purpose of training or advertisement to include the effect of leading the public to believe that [Cellular Provider] has any connections with the Coast Guard.

5. Representations and Warranties

(a) [Cellular Provider] represents and warrants that it has full authority to enter into this Agreement and to perform its obligations hereunder.

(b) ____ District represents and warrants that it has full authority to enter into this Agreement and to perform its obligations hereunder.

6. Survival. All provisions of this Agreement which may reasonably be interpreted or considered as surviving the completion, expiration, termination, or cancellation of this Agreement shall survive the completion, expiration, termination, or cancellation of this Agreement.

7. Regulations. This Agreement is made subject to all present and future valid orders and regulations of any regulatory body having controlling jurisdiction over the subject matter hereof and the parties. In the event any of the provisions this Agreement are contrary to, or in conflict with, any such order, regulation, or law, this Agreement shall be deemed modified to the extent necessary to comply with any such order, rule, regulation, or law, and shall be modified in such a way as the parties hereto mutually agree is consistent with the intent of the parties.

8. **Governing Law.** As an agency of the federal government, the Coast Guard, and its employees, are subject to the strictures of the Federal Tort Claims Act (Act), as amended (28 U.S.C. sections 2671-2680). The Act generally controls the manner and extent of liability for claims for damage or loss of property, personal injury or death caused by the acts or omissions of the Government, its officers, employees and agents in the use of property.

9. **Notices**. Unless otherwise provided, any notice required or permitted under this Agreement shall be given in writing and shall be deemed effective upon personal delivery to the party to be notified or on the fifth (5th) day following deposit with the United States Post Office, by registered or certified mail (return receipt requested), postage prepaid and addressed to the party to be notified at the address of such party set forth below, or at such other address as such party may designate by ten (10) days advance written notice to the other party.

   If to ____ District:

   Commander, ____ Coast Guard District (dt)
   U.S. Coast Guard
   [street address]
   [city, state, zip code]

   [contact phone #]
   [contact facsimile #] (facsimile)

   If to [Cellular Provider]:

   [Cellular Provider]
   Attn: Senior Director, Legal and Regulatory Affairs
   [street address]
   [city, state, zip code]

   [contact phone #]
   [contact facsimile #] (facsimile)

10. **Section Headings**. Section headings are for reference only, and shall not be construed as substantive parts of this Agreement. Each capitalized term used in this Agreement (including any schedule or exhibit attached hereto) shall have the meaning attributed to it in any part of this Agreement (including any such schedules or exhibits).

11. **Scope of Agreement**. This Agreement is the exclusive (as between [Cellular Provider] and the ____ District only) agreement, with respect to its subject matter and, as of its effective date, supersedes all prior and contemporaneous agreements, negotiations, representations and proposals, written or oral, related to its subject matter.

IN WITNESSETH WHEREOF, each of the parties has caused this Agreement to be duly executed in its name and on its behalf, all on the date first above written.

[Cellular Provider]

By: _____

Printed Name: _____

Title: _____

Date: _____

COMMANDER, ____ COAST GUARD DISTRICT

By: _____

Printed Name: _____

Title: _____

Date: _____

Appendix M
COMSAT-C Web Interface

M.1 Launching the Web service interface

M.2 SafetyNet Message Procedures

M.3 Shore to Ship Distress Alerts

M.4 Search and Rescue Messages

M.5 Navigational Warning Messages

M.6 Compose Message

M.7 Delivery Status

M.8 Read Mail

M.9 Monitoring Messages

M.10 Canceling Messages

M.11 Sending a cancel notification

M.12 User Profile

M.13 Error Messages

M.14 Back-up System

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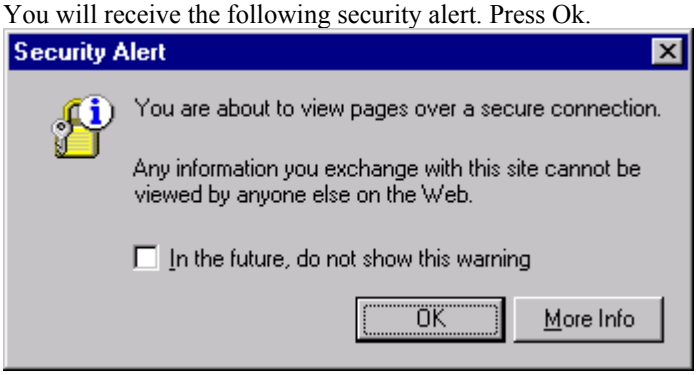
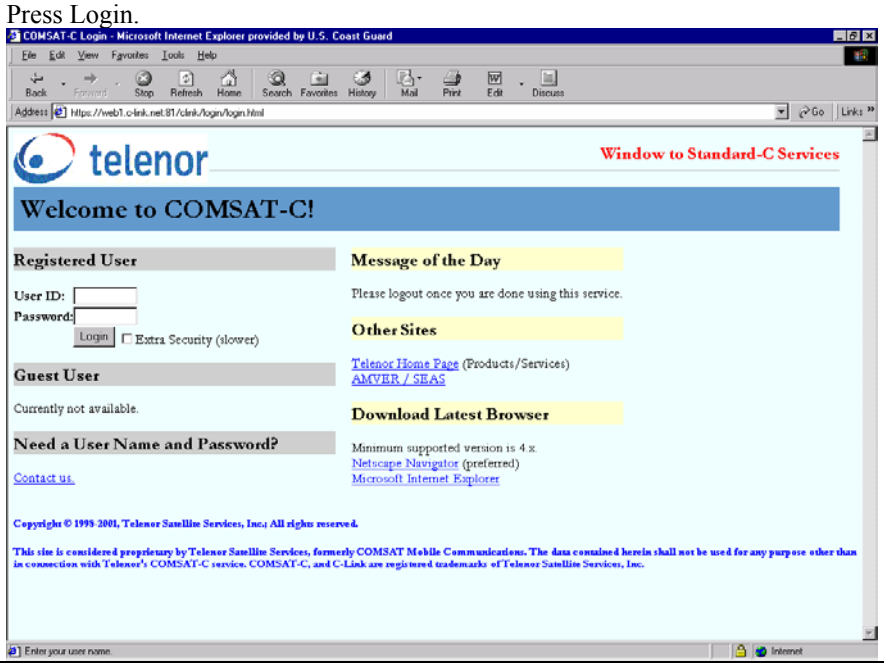
Section M.1
Launching the Web Service Interface

Follow the steps below to launch and login to the COMSAT INMARSAT-C Web Interface. These steps will bring you to the COMSAT-C Main Page.

Step	Action
1	Open Internet Explorer, type in www.c-link.com, press Enter or Go.
2	You will receive the following security alert. Press Ok. 
3	The following login screen will appear. Type in your User Name and Password. Select Extra Security. Press Login. 

4	The Main page will appear. Click on the menu items on the left to send broadcasts, read mail, check delivery status, change your user profile, ... Detailed steps for these options are in the following sections.

Section M.2
SafetyNET Message Procedure

The following steps should be followed for each situation requiring an INMARSAT-C SafetyNet broadcast, per Chapter 2 of the CG Addendum to the National SAR Manual. Details on completing each step are covered in separate sections.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Select the appropriate message type based on the emergency phase of the case and the addressing region. The table below is an excerpt from the table in section 2.3.6 of the CG Addendum to the National SAR Manual.
<table>
<tr><th>Emergency Phase</th><th>Web form(s)</th><th>Priority</th><th>Addressing</th></tr>
<tr><td>Uncertainty</td><td>Search and Rescue</td><td>Safety</td><td>Circular Rectangular</td></tr>
<tr><td></td><td>Navigational Warning</td><td>Safety</td><td>NAVAREA</td></tr>
<tr><td>Alert</td><td>Search and Rescue</td><td>Urgent</td><td>Circular</td></tr>
<tr><td></td><td>Navigational Warning</td><td>Urgent</td><td>NAVAREA</td></tr>
<tr><td>Distress</td><td>Shore to Ship Distress</td><td>Distress</td><td>Circular</td></tr>
<tr><td></td><td>Search and Rescue</td><td>Distress</td><td>Rectangular</td></tr>
</table></td></tr>
<tr><td>2</td><td>Draft and send the message.</td></tr>
<tr><td>3</td><td>Check the Delivery Status for status of your message. Save the Message to the case file.</td></tr>
<tr><td>4</td><td>Check your inbox for a receipt and save the receipt to the case file.

Note: Receipt of broadcasts confirms the LES has received your message and has forwarded it for broadcast over the satellites. Receipt of composed messages confirms an individual terminal has received the message.</td></tr>
<tr><td>5</td><td>Ensure monitored copy of message arrives. Compare monitored copy to original message.</td></tr>
</table>

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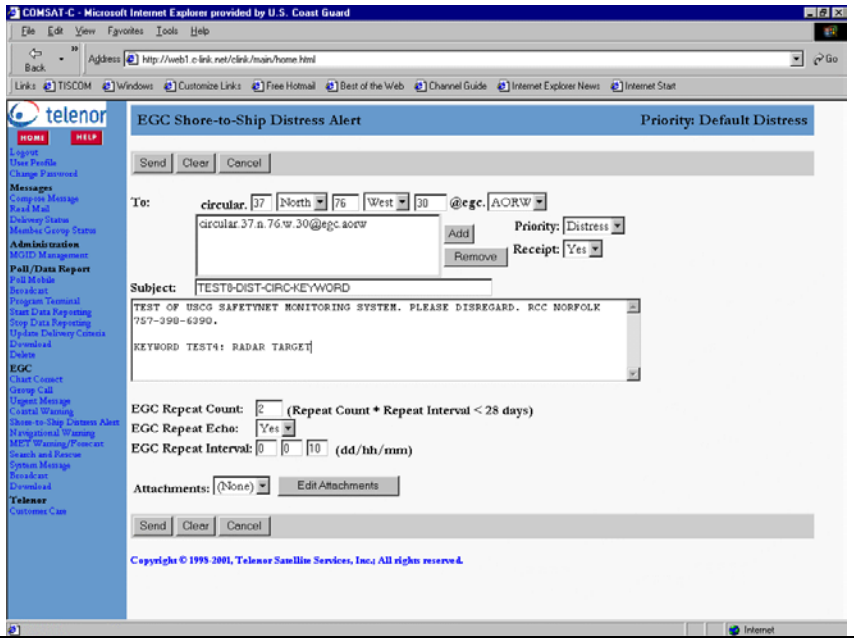
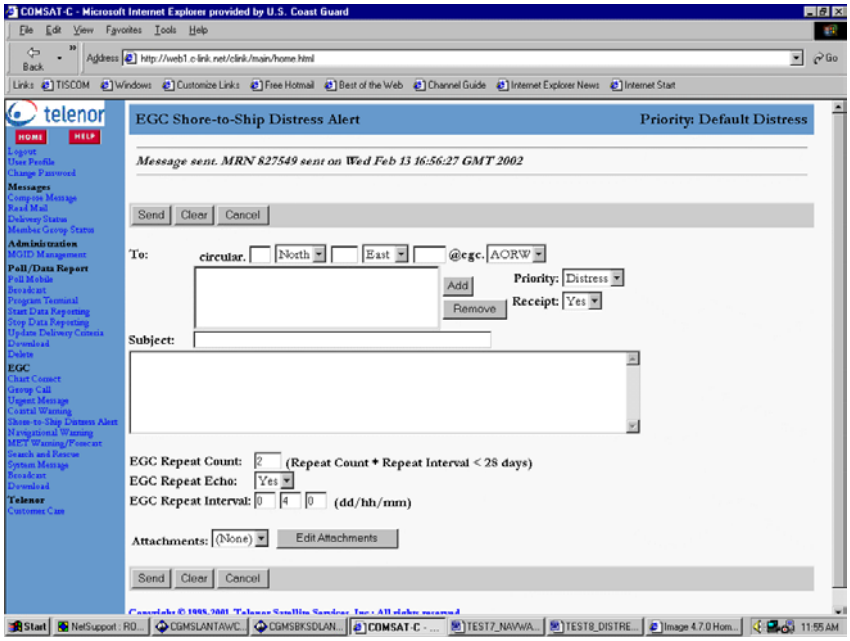
Section M.3
Shore to Ship Distress Alerts

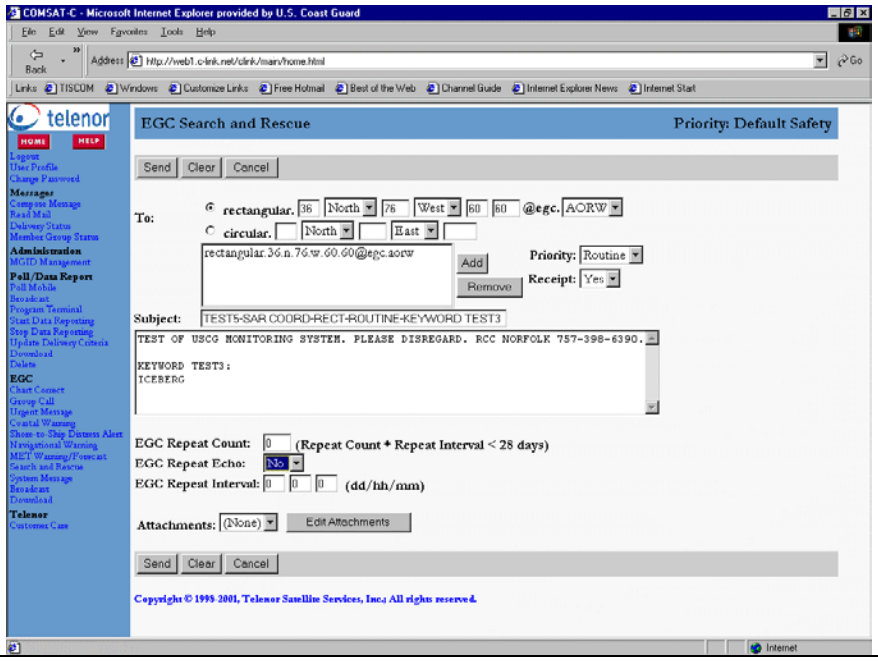
Follow the steps below to send a distress alert to a circular region.

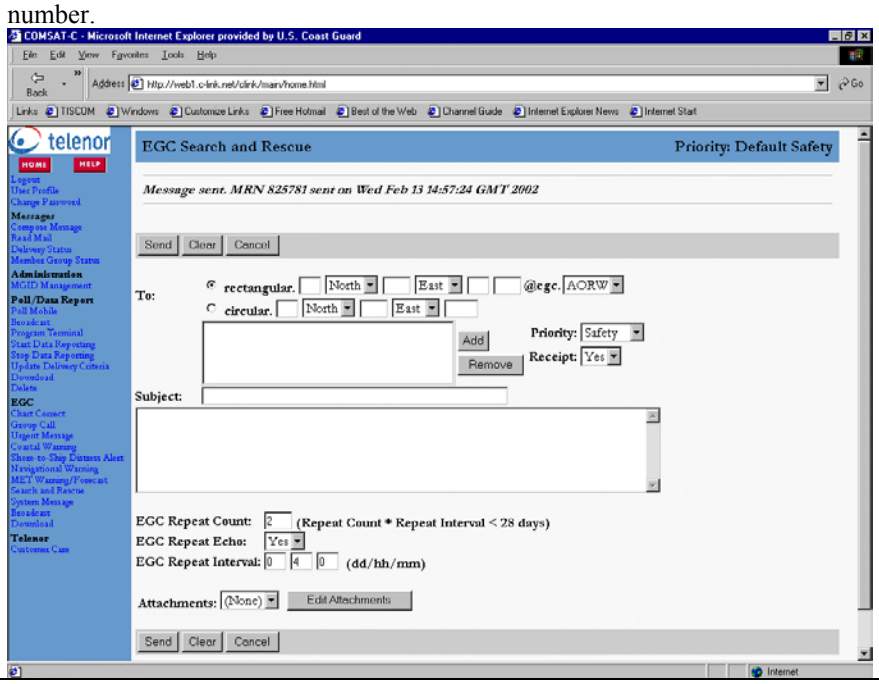
Step	Action
1	Click on "Shore to Ship Distress Alert" under the EGC Section to open the following Shore to Ship Distress Alert form: 
2	Address the message: Along the top line fill in the: Latitude, select North or South Longitude, select East or West Radius of broadcast around the given position (NM). Select which satellite the message will be broadcast over (AOR-W, AOR-E, POR, IOR) Click Add.
3	Repeat step 2 for each satellite footprint (ocean region) the message must be broadcast to. If a position is within two satellite regions the message must be addressed to both regions for broadcast. This most often occurs with positions in the AOR-E and AOR-W regions.
4	Ensure "Distress" is selected under the Priority drop down box. Always send the Distress Message type with Distress priority!
5	Ensure "Yes" is selected under the Receipt drop down box. If you do not select "Yes", you will not get a receipt in the inbox after the message has been broadcast. (No charges incurred for broadcast receipt.)
6	Type in a subject. This subject will not appear in the broadcast message but can be used to find messages in the delivery status table.
7	Type in the body of the message. Ensure your RCC name is included in the message body for forwarding of monitored copies of your messages.
8	Enter the Repeat Count – the total number of times the message is sent. (<u>not</u> including the echo.) Enter the Repeat Interval – the time interval between each of the repeat broadcasts. Repeat Count*Repeat Interval = the total time from first broadcast to last. I.e. If the count = 4 and interval = 6 hrs, the message is broadcast 4 times, every 6 hours, for a total time of 24 hours from first to last broadcast.

9	Ensure Repeat Echo is set to "Yes" – Repeat Echo indicates whether the system is to retransmit the EGC message six minutes after each scheduled broadcast. Since a vessel that is broadcasting a message cannot receive messages, and since most broadcasts are less than 6 minutes, the echo option ensures a message is received.
10	Ensure "None" is selected under the attachments drop down box.
11	Review for accuracy and press send. *This step very important since messages usually pass through the system within seconds. You may not have time to cancel a message prior to the initial broadcast being made.
12	After you press send, the form clears and the MRN is given along the top of screen. Record the MRN number. 

Section M.4
Search and Rescue Messages

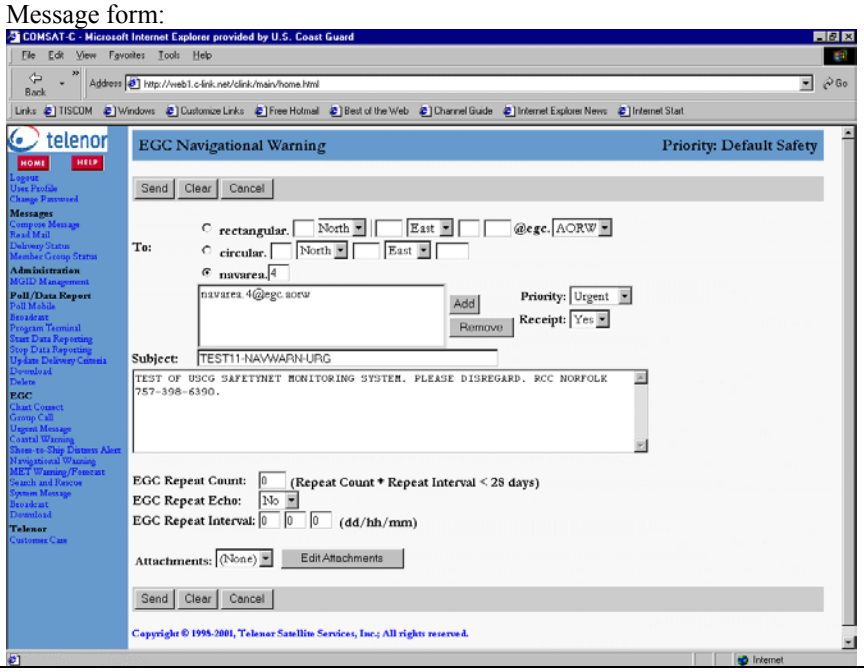
Follow the steps below to send a search and rescue message to a rectangular or circular region.

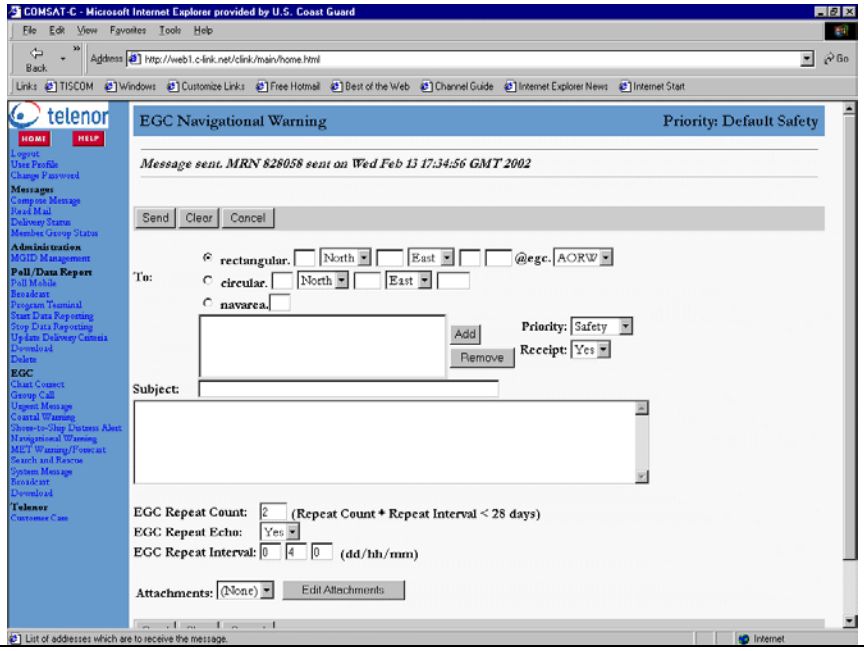
Step	Action
1	Click on "Search and Rescue" under the EGC Section to open the following Search and Rescue Message form: 
2	Address the message: For <u>Rectangular Areas</u> fill in the: Latitude, select North or South Longitude, select East or West Latitudinal Extension (degrees) Longitudinal Extension (degrees) Select which satellite the message will be broadcast over (AOR-W, AOR-E, POR, IOR) Click Add. *Note: The position entered is the southwest corner of the rectangular broadcast area. For <u>Circular broadcasts</u> fill in the: Latitude, select North or South Longitude, select East or West Radius of broadcast around the given position. (NM) Select which satellite the message will be broadcast over (AOR-W, AOR-E, POR, IOR) Click Add.
3	Repeat step 2 for each satellite footprint (ocean region) the message must be broadcast to. If a position is within two satellite regions the message must be addressed to both regions for broadcast. This most often occurs with positions in the AOR-E and AOR-W regions.
4	Select the Priority.
5	Ensure "Yes" is selected under the Receipt drop down box. If you do not select "Yes", you will not get a receipt in the inbox after the message has been broadcast. (No charges incurred for broadcast receipt.)
6	Type in a subject. This subject will not appear in the broadcast message but can be used to find messages in the delivery status table.

7	Type in the body of the message. Ensure your RCC name is included in the message body for forwarding of messages once they are received over a CG receiver at the CAMS.
8	Enter the Repeat Count – the total number of times the message is sent (not including the echo). Enter the Repeat Interval – the time interval between each of the repeat broadcasts. Repeat Count*Repeat Interval = the total time from first broadcast to last. I.e. If the count = 4 and interval = 6 hrs, the message is broadcast 4 times, every 6 hours, for a total time of 24 hours from first to last broadcast.
9	Ensure Repeat Echo is set to "Yes" – Repeat Echo indicates whether the system is to retransmit the EGC message six minutes after each scheduled broadcast. Since a vessel that is broadcasting a message cannot receive messages, and since most broadcasts are less than 6 minutes, the echo option ensures a message is received.
10	Ensure "None" is selected under the attachments drop down box.
11	Review for accuracy and press send. *This step very important since messages usually pass through the system within seconds. You may not have time to cancel a message prior to the initial broadcast being made.
12	After you press send, the form clears and the MRN is given along the top of screen. Record the MRN number. 

Section M.5
Navigational Warning Messages

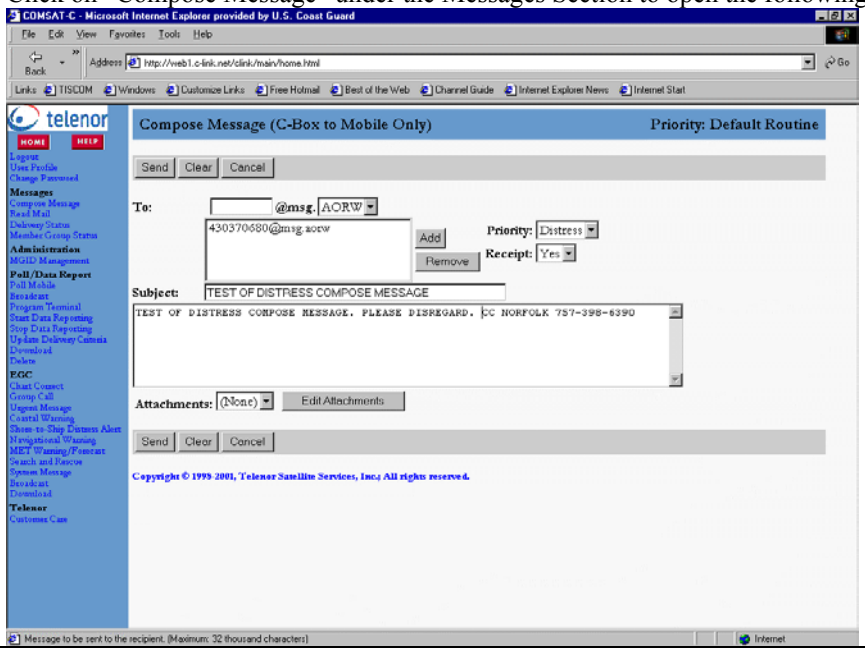
Follow the steps below to send a message to a NAVAREA.

Step	Action
1	Click on "Navigational Warning" under the EGC Section to open the following Navigational Warning Message form: 
2	Address the message: Select the circle next to 'navarea'. Enter the Navarea as a number. i.e. 4 for Northern Atlantic. Select which satellite the message will be broadcast over (AOR-W, AOR-E, POR, IOR) Click Add.
3	Repeat step 2 for each satellite footprint (ocean region) the message must be broadcast to. If a position is within two satellite regions the message must be addressed to both regions for broadcast. This most often occurs with positions in the AOR-E and AOR-W regions.
4	Select the Priority.
5	Ensure "Yes" is selected under the Receipt drop down box. If you do not select "Yes", you will not get a receipt in the inbox after the message has been broadcast. (No charges incurred for broadcast receipt.)
6	Type in a subject. This subject will not appear in the broadcast message but can be used to find messages in the delivery status table.
7	Type in the body of the message. Ensure your RCC name is included in the message body for forwarding of messages once they are received over a CG receiver at the CAMS.
8	Enter the Repeat Count – the total number of times the message is sent (<u>not</u> including the echo). Enter the Repeat Interval – the time interval between each of the repeat broadcasts. Repeat Count*Repeat Interval = the total time from first broadcast to last. I.e. If the count = 4 and interval = 6 hrs, the message is broadcast 4 times, every 6 hours, for a total time of 24 hours from first to last broadcast.

9	Ensure Repeat Echo is set to "Yes" – Repeat Echo indicates whether the system is to retransmit the EGC message six minutes after each scheduled broadcast. Since a vessel that is broadcasting a message cannot receive messages, and since most broadcasts are less than 6 minutes, the echo option ensures a message is received.
10	Ensure "None" is selected under the attachments drop down box.
11	Review for accuracy and press send. *This step very important since messages usually pass through the system within seconds. You may not have time to cancel a message prior to the initial broadcast being made.
12	After you press send, the form clears and the MRN is given along the top of screen. Record the MRN number. 

Section M.6
Compose Message

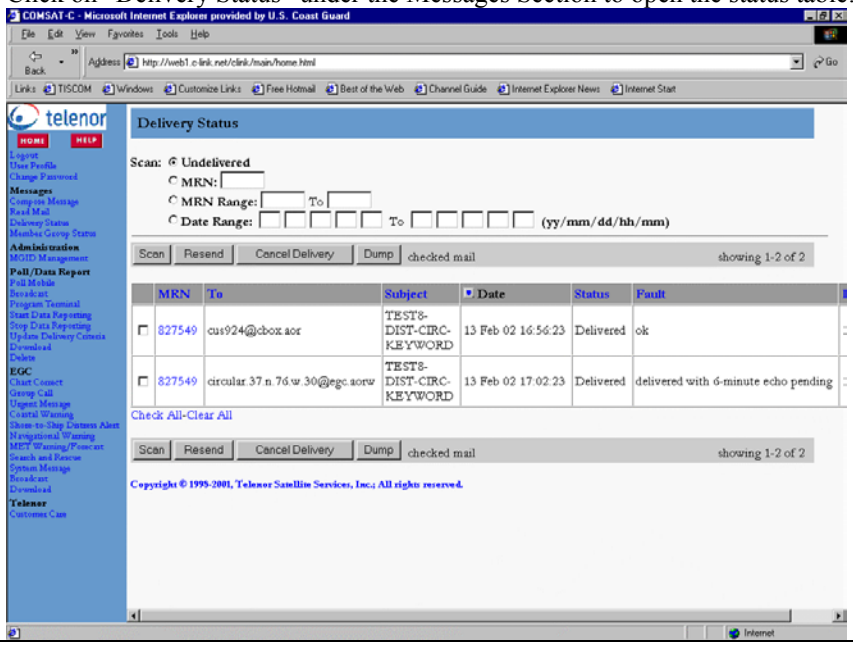
Follow the steps below to send a message directly to a vessel.

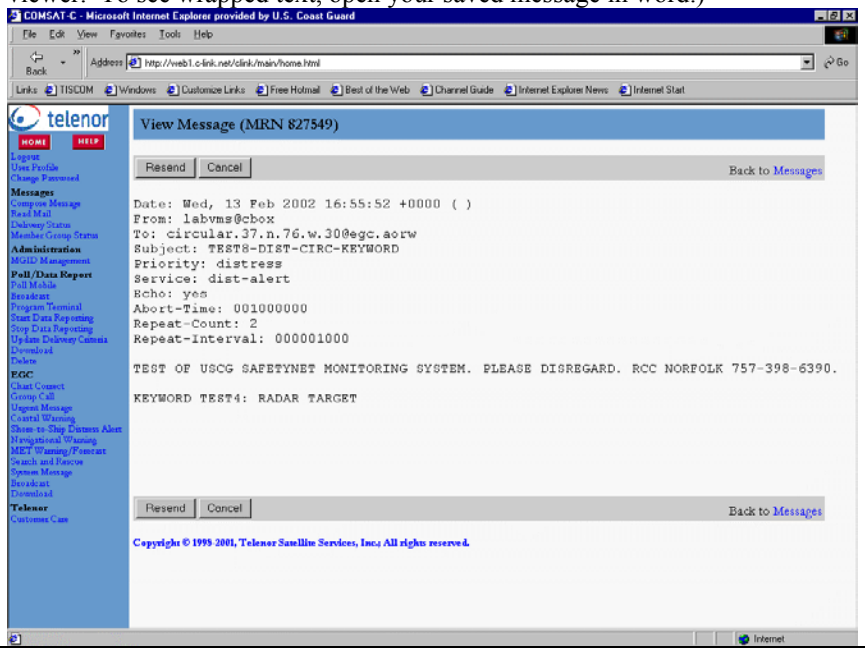
Step	Action
1	Click on "Compose Message" under the Messages Section to open the following Compose Message form: 
2	Address the message with the INM-C number to the ocean region Best. The "Best" ocean region option will send the message to the satellite the terminal was last logged onto. If you know the vessel to be in a certain region you can address the message to the know satellite for that region instead.
3	Select Priority.
4	Ensure "Yes" is selected under the Receipt drop down box. This receipt will confirm that the vessel actually received the message. If you do not select "Yes", you will not get a receipt in the inbox after the message has been broadcast. A minimal charge will be incurred for this receipt.
5	Type in a subject. This subject will not appear in the broadcast message but can be used to find messages in the delivery status table.
6	Type in the body of the message.
7	Ensure "None" is selected under the attachments drop down box.
8	Review for accuracy and press send.

9	After you press send, the form clears and the MRN is given along the top of screen. Record the MRN number.

Section M.7
Delivery Status

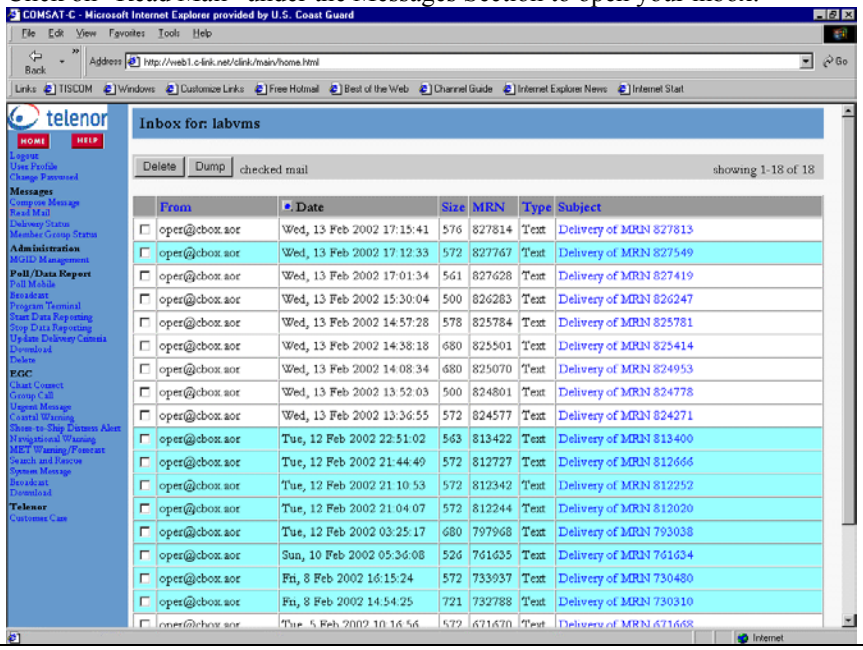
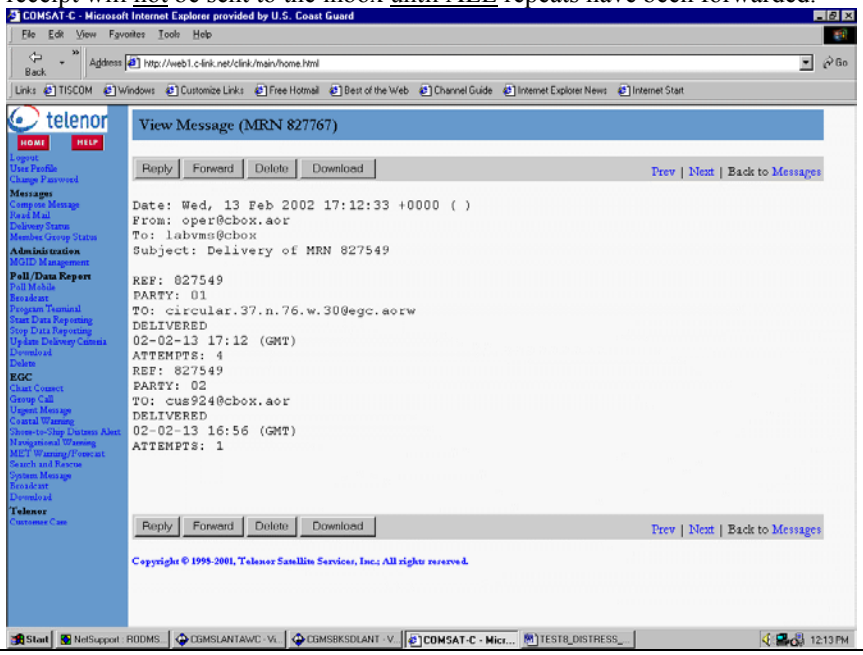
Follow the steps below to check the status, view, and save your message.

Step	Action
1	Click on "Delivery Status" under the Messages Section to open the status table: 
2	Check for your MRN number by typing the number into the box next to "MRN", select the circle next to MRN, and press SCAN. You can also type in date ranges or MRN ranges and press SCAN. The MRN(s) for those dates or MRN numbers will appear on the screen.

3	Verify status under Status Column (failed, delivered, cancelled, in progress). The following are potential status categories and what they mean. If status is 'failed', check Fault tables for cause of failure, fix the problem causing the failure, and resend. If delivered, proceed to step 4. **Status:** Delivered. **Fault:** ok. **Description:** All copies (including all repeats) have been forwarded for broadcast. **Status:** In progress. **Fault:** Delivered with repeat pending. **Description:** The message was broadcast the number of times indicated in the Retires column and repeat broadcast(s) are pending. **Status:** In progress. **Fault:** Absent. **Description:** Delivery attempted but the terminal was not logged into the satellite the message was addressed to. This Status will remain until 3 retries have been completed. **Status:** Failed. **Fault:** See fault tables. **Description:** See fault tables. **Status:** Cancelled. **Fault:** Message transfer cancelled. **Description:** The broadcast of the message was cancelled manually.
4	Open MRN message by clicking on the MRN number once. Verify message is the same as what you submitted. If the message matches what was sent, proceed to step 5. If the message has an error, cancel the message, draft a new message, and press Send. (The text does not wrap around in the Internet Explorer viewer. To see wrapped text, open your saved message in word.) 
5	Save the Message from the Delivery Status table (view table by clicking "Delivery Status" or the Back arrow button to get the previous screen.). Right click on the MRN number and select "Save As". Save to an electronic case file designated by your command center.

Section M.8
Read Mail

Follow the steps below to read mail. Mail consists of messages sent to your cbox from another cbox and receipts from messages sent.

Step	Action
1	Click on "Read Mail" under the Messages Section to open your inbox: 
2	Receipts are displayed with a subject: "Delivery of MRN". Open the receipt by clicking on the subject. Review the receipt to ensure your message was received by COMSAT and forwarded for broadcast. The receipt will not be sent to the inbox until ALL repeats have been forwarded. 

3	Save the Receipt from the Inbox window (view inbox by clicking "Read Mail" or the Back arrow button to get the previous screen). Right click on the subject and select Save As. Save the receipt to an electronic case file designated by your command center.

Section M.9
Monitoring Messages

Follow the steps below to monitor the broadcast message.

Step	Action
1	Wait for message to be forwarded via CGMS from the respective CAMS site. In general, messages should be received within 30 minutes of broadcast. If message arrives, proceed to step 2, if not, proceed to step 5.
2	Compare the information between the "QUOTE" and "UNQUOTE" on the monitored message, to the original message obtained from the delivery status window. The example message shown below is the monitored copy of the message drafted in the Search and Rescue Messages Section above. The parts of the message are explained below. R 131457Z FEB 02 ZUI ASN-ACC044000045 FM COGARD CAMSLANT CHESAPEAKE VA//EGC// TO COMINTICEPAT GROTON CT COMLANTAREA COGARD PORTSMOUTH VA//ACC// BT UNCLAS SUBJ: MSG 8 (Rep: 0) SAR COORDINATION QUOTE 13-14:57 044 6234 EGC LES 1 - MSG 8 - SAR Routine Call to Area: 36+60 N 76+60 W - Rep# 0 TEST OF USCG MONITORING SYSTEM. PLEASE DISREGARD. RCC NORFOLK 757-398-6390. KEYWORD TEST3: ICEBERG UNQUOTE BT NNNN

<table>
<tr><td>2
cont'd</td><td>
<u>R 131457Z FEB 02 ZUI ASN-ACC044000045</u>
CGMS Message precedence will be set based on priority of the SafetyNET Message:

Distress – Flash (Z)
Urgent – Immediate (O)
Safety – Priority (P)
Routine – Routine (R)

The CGMS Switch sets the time. It is not necessarily the same as the time the message was received on the receiver.

<u>FM COGARD CAMSLANT CHESAPEAKE VA//EGC//</u>
CGMS messages will always be from the backside circuits at CAMSLANT or CAMSPAC.

<u>TO COMINTICEPAT GROTON CT
COMLANTAREA COGARD PORTSMOUTH VA//ACC//</u>
CGMS messages will be addressed to units whose keywords appear in the text of the message.

<u>SUBJ: MSG 8 (Rep: 0) SAR COORDINATION</u>
The CGMS Message Subject includes the Message ID, Repetition number and Service Type.

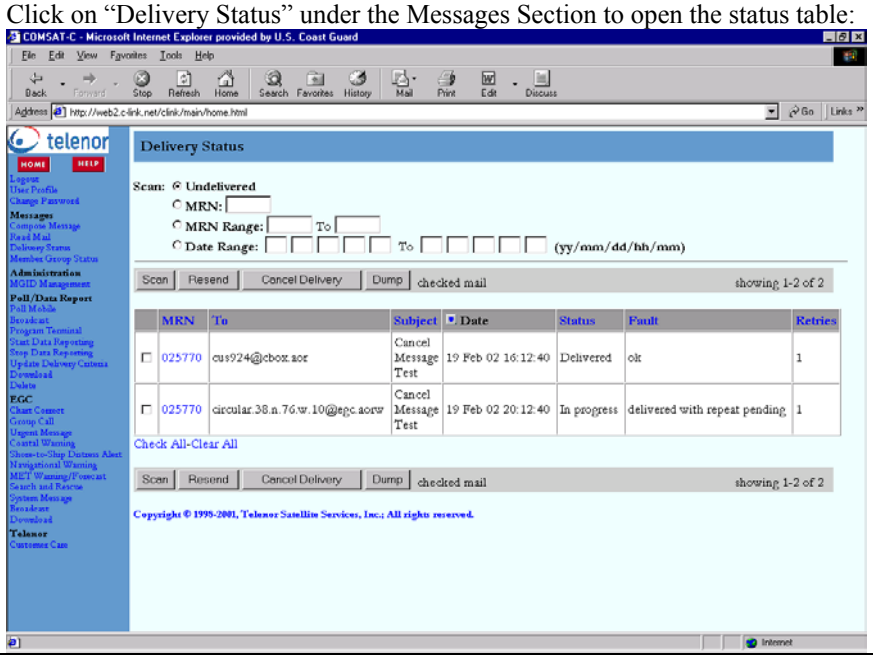
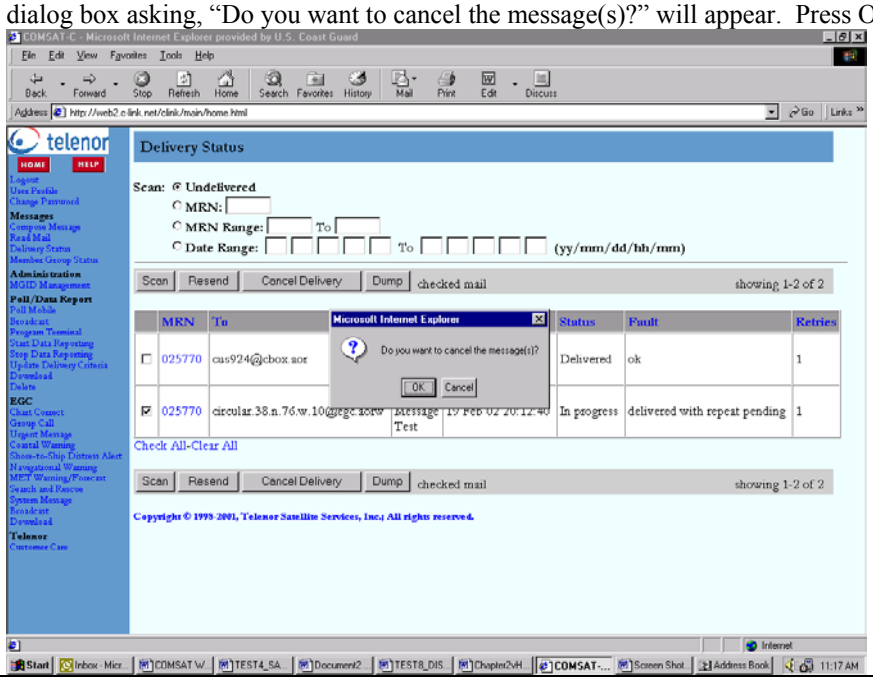
<u>QUOTE…UNQUOTE</u>
The message as received on the Thrane and Thrane manufactured is placed within "QUOTE" and "UNQUOTE" in the CGMS message. The receiver places a header on the message. The header is explained in the table below. The service type, priority, and position should be the same as those on the original message from the web site. The text displayed after the header should be identical to the text typed into the text box on the web site.

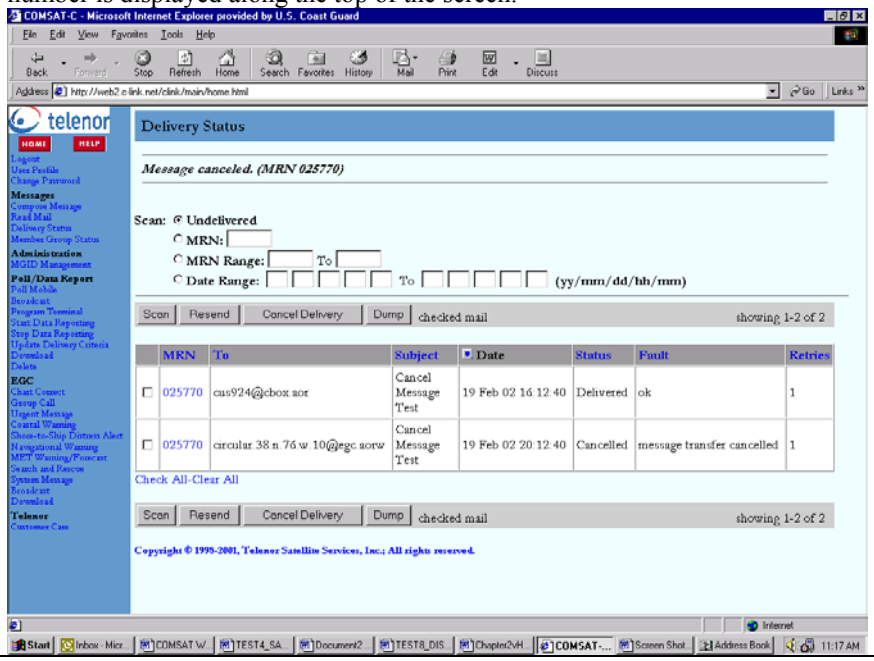
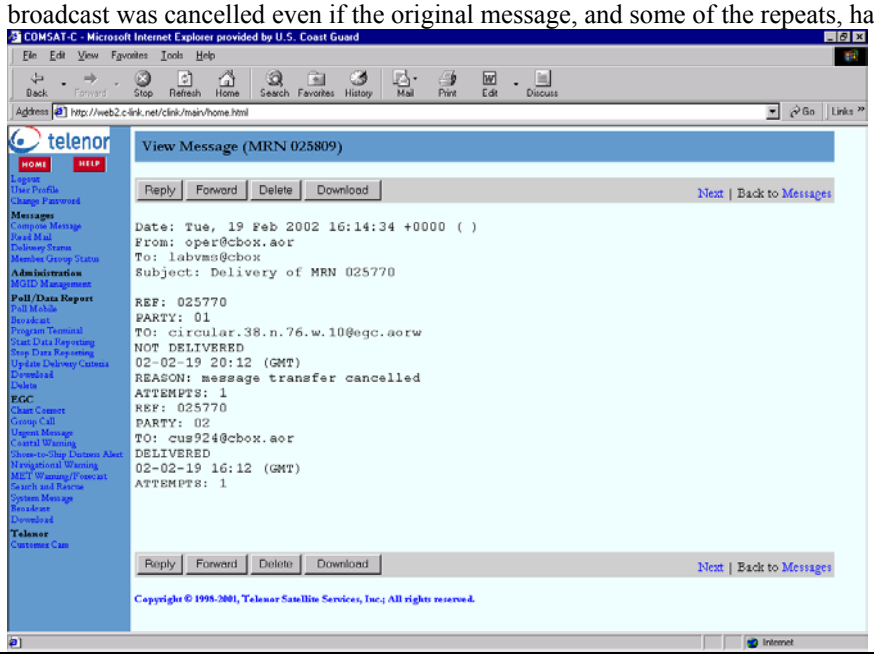
<u>Header explanation:</u>
<table>
<tr><td>13-14:57</td><td>Day – hour:minute</td></tr>
<tr><td>044 6234</td><td>LES ID number (ignore)</td></tr>
<tr><td>EGC LES 1</td><td>LED ID (ignore)</td></tr>
<tr><td>MSG 8</td><td>Message ID number. (Not the same as MRN from website).</td></tr>
<tr><td>SAR</td><td>Service Type</td></tr>
<tr><td>Routine Call to Area</td><td>Priority</td></tr>
<tr><td>36+60 N 76+60 W</td><td>Position</td></tr>
<tr><td>Rep# 0</td><td>Repetition number of broadcast.
I.e. This is first message broadcast or 0th 'repetition'.
Echo messages will show same Rep number.</td></tr>
</table>
</td></tr>
<tr><td>3</td><td>A monitored copy of the message should be received for every original broadcast, Echo, and repeat broadcast of the message.</td></tr>
<tr><td>4</td><td>If a message is broadcast more times than requested, cancel the message. If the message was not broadcast as long as needed, contact customer care and redraft the message if needed.</td></tr>
<tr><td>5</td><td>If a monitored copy of the message is not received within 30 minutes, contact the respective CAMS. Check if:
1. The monitor is up and running,
2. The message is in the CAMS CGMS log. (Provide keyword information to CAMS to perform search of archived files.)

If the monitoring system appears to be running correctly, contact Customer Care to verify that the web system is functional.</td></tr>
</table>

Section M.10
Canceling Messages

Follow the steps below to cancel a message. Messages can be cancelled while in progress for broadcast or while waiting for a repeat broadcast. Messages that have already been broadcast cannot be cancelled (recalled).

Step	Action
1	Click on "Delivery Status" under the Messages Section to open the status table: 
2	Check for your MRN number by typing the number into the box next to "MRN", select the circle next to MRN, and press SCAN. You can also type in date ranges or MRN ranges and press SCAN. The MRN(s) for those dates or MRN numbers will appear on the screen.
3	Click the box next to the MRN number of the message you want to cancel. Press "Cancel Delivery". A dialog box asking, "Do you want to cancel the message(s)?" will appear. Press Ok. 

4	After you press the cancel delivery button and ok in the dialog box, “Message cancelled” with the MRN number is displayed along the top of the screen. 
5	For pending broadcast messages, such as an urgent or distress, that have gone out once (or several times) and are queued for repeat broadcast, the delivery status screen will show “message transfer cancelled.” If the message was already broadcast and is not scheduled for rebroadcast (as with the message to cus924), the Status will still say “Status Delivered” and Fault “ok”. Since the message was already broadcast, it will not be cancelled. (Messages cannot be recalled.)
6	After the message is cancelled, the receipt is sent to the inbox. The receipt will indicate that the entire broadcast was cancelled even if the original message, and some of the repeats, has been broadcast. 

Section M.11
Sending a cancel notification

M.11.1 Canceling a message per the "Canceling Messages" steps does not notify mariners that a case has closed or that requested information is no longer needed (i.e. rescue in progress).

M.11.2 If an RCC chooses to broadcast a message, notifying mariners that a case has closed, the cancel notification should:

M.11.2.1 Be sent using the same message form and priority as the original broadcast.

M.11.2.2 Reference the MSG number shown on the monitored copy of the message. (The MRN received from the web is not broadcast to the mariners.)

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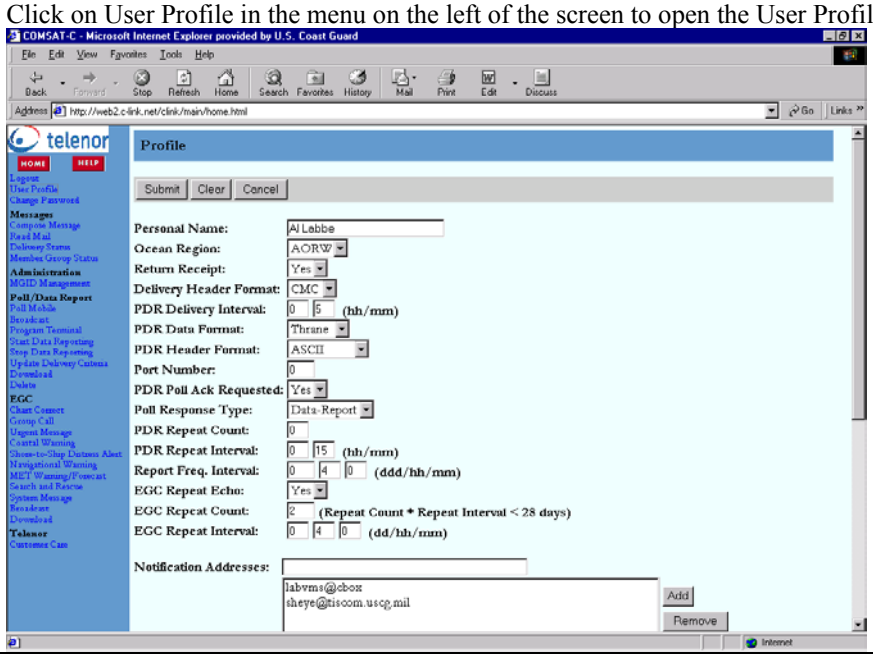
Section M.12
User Profile

Changes can be made to user defaults through the User profile. Follow the steps below to change User Profile settings.

Step	Action
1	Click on User Profile in the menu on the left of the screen to open the User Profile. 
2	Changes can be made using the drop down boxes or typing in the fields and clicking add as appropriate. See the Help section on the web for information on User Profile fields and options.
3	After all desired changes are made, click Submit. To go back to the last settings submitted, click Clear.
4	Click Cancel to exit the User Profile. Changes should now be in affect for any messages selected.

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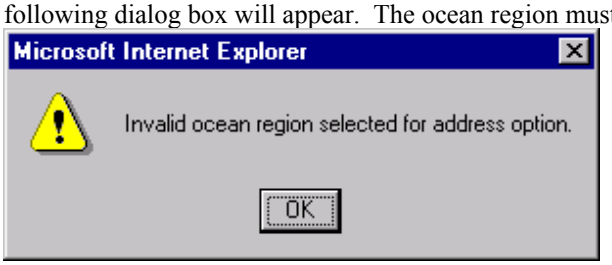
Section M.13
Error Messages

The following errors will be displayed if forms are not filled out correctly on the web site. Corrective action, as indicated below, must be taken to send the message.

Error	Description
Lat/Long incorrect	If an incorrect latitude or longitude is entered, the following dialog box will be displayed when the user presses "Send". The message cannot be sent until the lat/long is corrected.
Invalid Ocean Region	If an invalid ocean region is entered, such as BEST for an urgent message broadcast, the following dialog box will appear. The ocean region must be corrected to send the message. 
Lat/Long/Extensions fields blank	If a lat/long field or extensions/radius fields are left blank, the following dialog box will appear. Fields must be filled in to send the message.

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Section M.14
Back-Up system

Follow the steps below to broadcast a message if the Internet or Web Interface is not available. If the monitoring system requires back-up, contact G-OPR.

Step	Action
1	Draft SafetyNET Message using word or similar tool. Include all message properties including: Message Type (Search and Rescue, Distress, NAVAREA) Addressing: NAVAREA or Position with (rect, circ) extension Satellite(s) Priority Receipt Repeat Count Repeat Interval Repeat Echo Text (including Keyword)
2	Fax Message to LES: 203-262-6088
3	Call LES direct and request message to be broadcast over INMARSAT-C: 1-800-627-4728

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Appendix N
SAR Controller Personnel Qualification Standard (PQS)

The following pages comprise the standard minimum requirements for qualification of Search and Rescue Controllers at Coast Guard Command Centers. Commands may waive (NOT delete) those items that do not apply in their geographic region. Commands may also ADD requirements specific to their needs. This long overdue qualification tool is a result of significant work by the PQS working group and will eliminate the need for duplicative effort at each command.

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RECORD OF PERFORMANCE QUALIFICATIONS

COMMAND CENTER CONTROLLER (SAR)

INSTRUCTIONS

Record of Performance Qualifications shall be completed for all Command Center Controllers and watch standers whose duties involve planning SAR missions, assuming SMC, and briefing Command Staff of SAR missions. As proficiency in each performance qualification is demonstrated, a qualified Controller shall complete the DATE and INITIALS column. Personnel are required to demonstrate proficiency in each qualification level without assistance. This qualification covers required skills in the area of Search and Rescue Command Center watch standing and administration.

REFERENCES

a. International Aeronautical & Maritime SAR Manual (IAMSAR)	Doc 9731-AN/958
b. U.S. National SAR Supplement to the IAMSAR Manual (NSS)	May 2000
c. Coast Guard Addendum to the United States National SAR Supplement to the International Aeronautical & Maritime SAR Manual (CDADD)	COMDTINST M16130.2 (series)
d. Communications Watchstander Guide	COMDTINST M16120.7 (series)
e. U. S. Coast Guard Boat Operations and Training Manual Volumes I & II	COMDTINST M16114.32 & M16144.33
f. Communications Watchstander Qualification Guide	COMDTINST M16120.7 (series)
g. Incident Command System	COMDTINST M3120.14 (series)
h. USMCC National Rescue Coordination Center and Search and Rescue Point of Contact Alert and Support Messages	
i. CASP Users Handbook	
j. Staffing Standards Manual	COMDTINST M5312.11 (series)
k. Telecommunications Manual (TCM)	COMDTINST M2000.3 (series)
l. Operational Risk Management	COMDTINST 3500.3
m. Critical Incident Stress Management (CISM)	COMDTINST 1754.3
n. GMDSS Watchstanders' Handbook	
o. Software Verification Guide for C2PC version bundle 2.7.0	
p. CESM Hypothermia Software	
q. Digital Voice Logger User Handbook	

DATE COMPLETED ALL PERFORMANCE QUALIFICATIONS FOR EACH LEVEL

QUALIFICATION	**DATE**
Command Center Controller	
Name	**Phone Number**
Unit	

SIGNATURE OF SUPERVISOR				
DATE	**NAME/SIGNATURE**	**INITIALS**	**RATE**	**UNIT**

1.0 Prerequisites

Maritime Search Planning – required for all Command Center Controllers.

Setup user access for each program, i.e.: MMSI, CASP, MISLE.

2.0 Area Familiarization

Complete AOR familiarization at designated subordinate commands under your command's operational control.
Operational Control *(Area/District) (Group)*

Complete appropriate over flight(s) within your AOR (CGAux, CG Helo/Fixed wing)
State prominent maritime points of interest in your AOR.

a. Bays
b. Sounds
c. Towns
d. Boat ramps
e. Major AtoN
f. Rivers
g. Other

3.0 911 Operator Assistance

1. Conduct a familiarization visit to a 911 Operations Center.
2. Describe the information required by C.G. for relay from 911 personnel.
3. Describe the complications associated with receiving initial notifications of an incident via a 911 operator.
4. Describe the importance of call back information to operator or supervisors to obtain additional SAR data.

4.0 General Knowledge (Ref. C.)

1. List the two SAR Program Goals
2. List and briefly explain the seven primary SAR Program Standards
3. State and briefly explain the SAR Response Standard
4. Discuss the National SAR Plan, where it is found and the relevance it has with respect to SAR policy
5. Understand the Navigational Assistance Policy

5.0 PUBLIC AFFAIRS

1. State USCG policy on who may conduct interviews
2. State the list of information that can be released to the media
3. State the list of information that cannot be released to the media
4. State the Public Affairs resources available to your unit

6.0 SAR ASSETS

1. List all USCG SAR assets for your AOR and describe with the following:

a. Capabilities
b. Limitations

c. Launch authority 2. Be familiar with USCG Auxiliary assets in your AOR and describe with the following: a. General capabilities b. Limitations c. Launch Authority 3. List all other SAR assets in your AOR and describe with the following: a. Capabilities b. Limitations c. Launch authority 4. Describe any local or international SAR agreements that pertain to your AOR. **7.0 SMC RESPONSIBILITY** 1. State the criteria when a unit should assume SMC. 2. State the criteria when SMC should be passed to another SMC authority. **8.0 SAR CHECK SHEETS** 1. Demonstrate a familiarity with the required check sheets in the CG Addendum. 2. Demonstrate a familiarity with unit specific check sheets. 3. State CG policy on use and retention of SAR check sheets. **9.0 CASE SUSPENSION** 1. State the levels of authority for granting ACTSUS. 2. State the information that is to be included when requesting a suspension. 3. Conduct a simulated Case Suspension Brief including a suspension checklist. 4. State the policy for Next of Kin (NOK) notification. 5. Describe the process of keeping NOK informed. 6. Describe the following outside influences concerning Case Suspension; a. Political b. Media c. Next of Kin 7. Discuss circumstances under which a case may be terminated. **10.0 FLOAT PLANS** 1. State the Coast Guard's general policy regarding float plans. 2. Explain the options available to the boating public for filing a float plan. 3. Describe the policy regarding mariners insisting on filing a float plan with the Coast Guard. 4. Describe the actions required when receiving float plans. **11.0 MARITIME SAR ASSISTANCE POLICY** 1. Define the three emergency phase classifications. 2. State the factors used to determine between distress and non-distress. 3. State the appropriate response efforts for distress and non-distress cases in		

accordance with the CG Addendum.

4. State when the following resources can be used:
    a. Commercial
    b. USCG Auxiliary
    c. USCG Assists
    d. Other agencies
    e. Good Samaritans
    f. Foreign entities
5. Define and state the following:
    a. MARB
    b. MARB minimum required broadcast time
    c. Procedure if commercial assistance declined
    d. Procedure to determine if response vessel is capable of assistance
6. State the cases requiring Command, District, and Area level briefings.
7. Demonstrate proficiency at adequately briefing a SAR case.
8. State the purpose of conducting SMC, SRU, and Command level briefings (i.e. ensuring proper risk assessment is conducted at all levels).
9. Define safe haven and list the primary safe havens in your AOR.
10. State issues to be considered for relief of tow and when it is appropriate.

12.0 UNCORRELATED DISTRESS

1. Read and summarize USCG policies/messages pertaining to uncorrelated distress.
2. Define what constitutes an uncorrelated distress.
3. Define what constitutes a probable hoax.
4. Define what constitutes a hoax.
5. Define Reasonable Search Area (prevailing conditions, available information, available assets).
6. Explain the factors to consider when articulating a reasonable search area. (DF signal obtained, number of high sites, etc.)
7. Define alert types:
    a. Voice transmission
    b. Auto SOS
    c. Digital Selective Calling (DSC)
    d. HF Alert Tone
    e. “MAYDAY Mike”
    f. Other
8. Describe what emergency phase is associated with Uncorrelated Distress.
9. Locate all High Sites in AOR and how they interact with other high sites for determining reasonable search area.
10. Define Coast Guard assumed ranges for high level and low level reception (distance a signal can be heard).
11. Locate all low level sites in AOR with live watches.
12. Demonstrate the use of C2PC overlays for High Sites and DF sites.
13. Locate all DF sites within AOR.
14. Explain the capabilities and limitations of DF equipment.
15. Describe the minimum response to an Uncorrelated Distress.
16. Describe the briefing matrix relating to an uncorrelated Distress.
17. State the minimum requirements of a UMIB.
18. Demonstrate proficiency with available audio manipulation software.

19. Demonstrate proficiency with available data recording devices.
20. Describe how a Search Object is determined for Uncorrelated Distress.

13.0 FIRE FIGHTING ACTIVITIES POLICY

1. State the USCG policy on marine fire fighting.
2. Describe how USCG assets are to be used in the following fire fighting incidents:
    a. Incidents involving people
    b. Incidents involving Property/Salvage
    c. Incidents involving pollution
3. Describe the responsibilities of the following agencies in marine firefighting;
    a. MSO/MSD
    b. Local Fire Department
    c. Commercial operators
4. Demonstrate the use of the appropriate Quick Response Card (QRC).

14.0 SALVAGE OPERATIONS

1. State the USCG policy for conducting salvage operations.
2. State the USCG Auxiliary policy for conducting salvage operations.
3. List commercial salvage companies within your AOR and describe with the following:
    a. Capabilities
    b. Current Memorandum of Understanding (MOU)
4. Visit a commercial salvage company within your AOR.

15.0 ICE RESCUES

1. List the following ice rescue resources within your AOR and their capabilities:
    a. USCG/Federal
    b. State
    c. Local
2. State the ice breaking capabilities and ice operating restrictions of USCG assets in your AOR.
3. Define the following:
    a. Hypothermia
    b. Frost Bite
4. State the ice thickness minimums to support the following:
    a. Single person
    b. Two persons
    c. ½ ton truck
    d. ¾ ton truck
    e. Snowmobile
5. State resource prioritization policy when responding to an ice rescue.
6. State the policy for ice rescue of animals.
7. Identify ice-breaking routes within your AOR and broadcast notification procedures.

16.0 MESSAGE TRAFFIC

1. Draft the following message traffic as an exercise:
    a. SITREP
    b. Search Action Plan (SAP)
    c. UMIB
    d. MARB
    e. BNM
    f. SAFETYNET
    g. Other
    h. State the release authority for the above traffic for your command

17.0 VOICE MANIPULATION SOFTWARE

1. Locate the Voice Manipulation Software on the Command Center computer.
2. Locate the Default Save Directory and access files from it.
3. Open the Goldwave software program.
    a. Open a new file.
    b. Record a WAV file.
    c. Save a WAV file.
    d. Adjust time length recording.
    e. Demonstrate speeding and slowing audio files.
    f. Demonstrate use of the Low/High Pass Filter.
    g. Demonstrate use of the Noise Reduction Filter in background noise reduction.
    h. Demonstrate cut and paste of a WAV file.
    i. Demonstrate use of loop play.
    j. Demonstrate knowledge of device controls.
4. Convert a WAV file to Mpeg Layer 3 Format.
5. Diagram and explain wiring configuration of DVL to Goldwave Interface.
6. State policy on retention of original and enhanced DVL recordings and Goldwave recordings.
7. State policy and standards for naming case WAV files.

18.0 DIGITAL VOICE LOGGER

1. State the function of the DVL.
2. State all the circuits, radio channels, and other comms recorded by the DVL.
3. State the operating system of the DVL.
4. State the medium used by the DVL to record upon.
5. Demonstrate the following:
    a. Record and playback functions
    b. Select channels for playback
    c. Select proper time interval selection (T 10, T 20, T 30)
6. State the importance of time synchronization.

19.0 C2PC FUNCTIONS

1. Demonstrate the ability to display BSB charts.

2. Demonstrate the ability to display high sites and display descriptive information.
3. Demonstrate the ability display existing overlays.
4. Demonstrate the ability to display maps.
5. Demonstrate the ability to e-mail .srp files.
6. Demonstrate the ability to save .srp files to electronic folders.
7. Demonstrate the ability to print documents to other printers.

20.0 C2PC KNOWLEDGE

1. Demonstrate and describe the following functions:
    a. Coastal and Oceanic environment selection
    b. Sea Current page
    c. Tidal current page
    d. DMB/SLDMB Tool
    e. Search Pattern evaluation tool
    f. LORAN Calculator
2. Conduct a simulated exercise utilizing C2PC SAR Tools in:
    a. Coastal environment
    b. Oceanic environment

21.0 TIDES AND CURRENTS

1. Demonstrate the ability to manually enter tides and currents into C2PC
2. Demonstrate ability to determine appropriate tidal substation
3. Demonstrate ability to apply tidal current to drift solution
4. Discuss the application of the following tides and currents found in your AOR:
    d. Tidal current
    e. River current
    f. Long shore current
    g. Reversing tidal current
    h. Spring tide
    i. Sea current
    j. Rip current
    k. Lake current
    l. Wind current
    m. Rotary current
    n. Local knowledge
5. Identify two sources of obtaining WX data for applicable locations for last 48 hours.
6. Describe the importance and limitations of the DMB / SLDMB drift computations.
7. Identify all vectors of a drift solution produced by the SAR Tools AMS/JAWS program.

22.0 FLARE CONE (C2PC USE)

1. State the USCG policy on flares.
2. Conduct a simulated flare sighting case:
    a. Incorporate the “Fist Method”
    b. Utilize C2PC/SAR Tools flare tool
    c. Generate a flare cone

d. Generate a Flare Check Sheet

3. Conduct a simulated flare cone drift for first light search.
4. State the suspension criteria for flare cases.

23.0 SWEEP WIDTH

1. Define sweep width.
2. Describe the relationship between sweep width and track spacing.
3. Demonstrate how to use the sweep width calculator within SAR Tools.
4. Demonstrate the two different ways of opening sweep width tables within SAR Tools.
5. Know when to apply the daytime sweep width tables and the electronic sweep width tables.

24.0 SEARCH PATTERNS

1. List the eight major Search Pattern types.
2. State the following factors for the above pattern types:
   a. Selection criteria
   b. Major axis selection criteria
   c. Commence search point selection criteria
   d. Aircraft altitude selection criteria
3. State the basic information needed by an SRU to conduct a search pattern.

25.0 SUBSEQUENT SEARCH (SUBSEQUENT DRIFT)

1. Define a Subsequent Search.
2. Demonstrate the procedures for conducting a Subsequent Search in C2PC/SAR Tools.
3. State the information transferred from a first search to Subsequent Search.
4. State the factors to consider when conducting Subsequent Search.

26.0 SEARCH EFFECTIVENESS

1. Define the following:
   a. Probability of Detection (POD)
   b. Probability of Success (POS)
   c. Probability of Containment (POC)
   d. Coverage factor
2. Discuss the relationships and trade-offs of the above definitions in optimal solutions.
3. State the USCG policy for coverage factor goal.

27.0 AMVER

1. Describe the Amver program.
2. State the policy for release of Amver information.
3. Demonstrate the ability to run the following Amver SURPICS:
   a. Radius
   b. Rectangle

c. Snapshot
d. Moving point

4. Demonstrate the ability to access and interpret voyage info.
5. Demonstrate the ability to locate an Amver ship participants capabilities.
6. Demonstrate the ability to contact an Amver participant via Inmarsat.
7. Describe follow-up notifications required when using an Amver vessel.

28.0 DATABASE/INTERNET RESOURCES

1. Define, explain and obtain access to the uses of databases, i.e.:
   a. MISLE
   b. MARS
   c. State Registry
   d. Inmarsat
2. State commonly used appropriate Internet sites in conducting SAR.

29.0 COLD EXPOSURE SURVIVAL MODEL (CESM)

1. Demonstrate the use of the CESM online software.
2. Conduct a simulated use of the tool in a probability of survival case that may require ACTSUS.
3. Describe the limitations of the software.
4. Describe results of CESM data and state proper interpretation of it.

30.0 DIRECTION FINDER

1. State the DF capabilities within your AOR with the following descriptors:
   a. Location
   b. System type
   c. Recording method
2. Conduct a simulated exercise on C2PC highlighting the following:
   a. Plotting DF bearings
   b. Search object selection
   c. Search pattern selection
   d. Subsequent search (drifted)

31.0 GMDSS/ SARSAT/ EPIRB

1. DEFINE and provide info on the following terms:
   a. AOR-E
   b. AOR-W
   c. CAMSLANT
   d. CES
   e. Doppler Shift
   f. DSC
   g. EGC
   h. EPIRB
   i. PPIRB
   j. GPIRB
   k. ELT

l. PLB
m. Geostationary Satellite Orbit
n. IMO
o. Inmarsat
p. IOR
q. ITU
r. LUT
s. MSI
t. SRR
u. MMSI
v. NAVAREA Warning
w. NAVTEX
x. NBDP
y. NOAA
z. Polar Orbiting Satellite
aa. POR
bb. RCC
cc. SART
dd. SOLAS
ee. USMCC

3. State the Sea Areas for the following coverages:
   a. One coast station
   b. Radiotelephone of one coast station
   c. Inmarsat with continuous alerting
   d. Area outside of A-1, A-2, A-3
4. Name the two systems that have EPIRBs associated with GMDSS.
5. State the main type of EPIRB associated with each satellite system.
6. Demonstrate the use of a SARSAT Incident Feedback Report.

32.0 GLOBAL COMMAND AND CONTROL SYSTEM (If So Equipped)

1. State the purpose of the GCCS.
2. Demonstrate the ability to use the GCCS.
3. Demonstrate requesting technical support for GCCS:
   a. During normal work hours
   b. After working hours
4. State the procedure for a system casualty.

33.0 COMPUTER ASSISTED SEARCH PLANNING (CASP) PROGRAM

1. State the requirements to open a CASP case
2. State the limitations of CASP
3. Demonstrate the following:
   a. Interpret a CASP probability map
   b. Evaluate a search area using CASP SAR Tools
   c. Import search areas
   d. Obtain optimal search area
4. Define Case Independent Environmental Data

5. State the problems with using Case Independent Environmental Data **34.0 RISK MANAGEMENT** 1. Discuss the GAR risk management tool. 2. Discuss the SPE risk management tool. 3. State the roles of the following with reference to Operational Risk Management: a. Command Center Controller b. SRU c. OSC d. SMC		
NAME: (LAST, Middle Initial)		

INDEX

110 foot (34Meter), 3-19, 5-1, 5-3, 5-8, 5-11, 5-14, A-2, A-5, H-42, H-52, H-64
121.5/243 MHz Beacon, 3-22, 3-24
133 foot WLM, 5-8, 5-13~14
140 foot Ice-Breaking Tugs (WTGB), 5-8, 5-11, 5-14
156.8 MHz, 2-7, 2-14~15, 2-26, 2-29~31, *see also Channel 16*
157 foot WLM, 5-8, 5-13~14, 5-8, 5-13~14
180 foot WLB, 5-8, 5-13~14
225 Foot WLB, 5-1, 5-8, 5-13~14
30 foot Surf Rescue Boat (SRB), 5-3, 5-8
406 MHz Beacon, 2-5~6, 2-8, 2-23, 3-21~24, G-16, J-3~4
41foot Utility Boat (UTB), 3-19, 5-3, 5-5, 5-7, 5-9, 5-13, C-8, H-42, H-52, H-63~64
44 foot Motor Life Boat (MLB), 3-19, 5-3, 5-5, 5-7, 5-9, H-42, H-51
46 foot BUSL, 5-7
47 foot Motor Life Boat (MLB), 3-19, 5-3, 5-5, 5-7, 5-9, H-42, H-51
49 foot BUSL, 5-7
55 foot ANB, 5-1, 5-7~8, 5-13
82 foot (25 Meter), 3-19, 5-1, 5-3, 5-8, 5-11, 5-14, A-2, A-5, H-42, H-52, H-64
87 Foot, 3-19, 5-1, 5-3, 5-8, 5-11, 5-14, A-2, A-5, H-42, H-52, H-64
911, 2-1, 2-32, N-5

Active Search Suspended Pending Further Developments (ACTSUS), 3-2, 3-45, G-12, I-27, N-5
Aeronautical Fixed Telecommunications Network (AFTN), 1-38
Agencies, SAR, 4-29, G-20
Aids to Navigation (ATON) vessels, 5-3, 5-13
Air Defense Sector (ADS), 3-30
Air embolism, 6-13
Air Force Rescue Coordination Center (AFRCC), 3-29, 3-35, 4-29, G-13
Air Route Traffic control Centers (ARTCCs), 3-30
Air Search and Rescue Agreement of 1949, 1-36
Air station rescue swimmers, 4-29
Air Traffic Control, separation of aircraft, H-82
Air Traffic Control (ATC), 1-37, A-5, H-82
Air Traffic Service, 1-35, A-4
Air transportation between medical facilities, 4-1, 4-23
Aircraft, 1-4, 1-13, 1-19, 1-37~38, 1-40, 2-17, 2-35, 3-1, 3-28~29, 4-1, 4-30, 4-41, 5-1, 5-3, 5-17~18, 5-21, 6-1, 6-9, G-1, G-10, G-28, H-35, H-45~48, H-52, H-81, H-83, I-12, I-25, N-5
Aircraft Coordinator (ACO), 1-4, G-19
Aircraft incidents, 3-29
Aircraft SRUs, 5-17
AIREYE, 3-27, H-57
Alert, 1-33, 2-9, 2-16~17, 2-22, 2-35, 3-20~22, 3-33, 4-27, C-1, C-15, D-3, G-3, G-16, M-5, M-7, N-3, N-5
Alerting, 3-24, A-4
Alerts, 2-9~10, 3-1, 3-21~22, 3-24, 3-30, 3-33, A-3, M-1, M-7
Alternative assistance, 4-12
AN/APN-215, 3-26, H-56
AN/APS-127, 3-26~27, 5-17, H-55~56
AN/APS-131, 3-27, H-57
AN/APS-135, 3-27, H-57, K-12
AN/APS-137, 3-26~27, H-55, H-56, K-12
AN/SPS-64(V), H-54
AN/SPS-66, H-53~54, H-64
Analysis, 3-31, K-3, K-11~12
Area Control Center (ACC), 3-28, C-15, M-19~20
Areas of responsibility (AOR), PPO-4, 1-3, 1-7~8, 1-15, 1-17~18, 1-25~27, 2-10~12, 2-15~16, 2-20~21, 2-26~27, 3-20, 3-30, 3-32, 4-12~13, 4-17, 4-32~34, A-6~7, C-17, G-1, G-19, G-23~28, H-10, M-7, M-9, M-11, N-5
Assistance and Salvage Treaty of 1935, 1-36
Assistance entry (AE), 1-30~36
Assumptions, 1-10, 3-11, 3-49, G-17
Audible beacon, 3-21
Automated Manual Solution (AMS), 1-10, C-11, N-5
Automated Mutual-assistance Vessel Rescue System (Amver), PPO-5, 1-1, 1-7, 1-16, 1-39~40, 2-24, 3-1, 3-8~9, 3-20, 3-49, 5-5, A-6, B-6, C-6, C-10, N-5
Auxiliary facility, 4-7, 4-10~12
Auxiliary vessels, 4-10, 4-12
Aviation tracking radar systems, 3-29
Awareness stage, 1-5, 1-10, 1-13, 3-37, 4-10

Boating Safety Program, 1-25
Boats, 2-14, 3-37, 4-41, 5-1, 5-3, 5-7~9, 5-11, H-18, H-21, H-24, H-50, H-60
Boundary, H-78, H-80
Briefings, 1-1, 1-8, 1-13, 1-18, 1-22~23, 5-19, 5-21, N-3, N-5

Caller ID, 2-32
Canada, 1-33, 1-36, K-6~7
Captain of the Port (COTP), 1-33, 6-1, 6-6, 6-11, C-4, C-10
Case, SAR folders studies, 3-48~49, 3-50
Case claiming, 1-16, 3-47
Case Closed, 3-2, 3-45
Case documentation, PPO-5, 1-5, 1-16~17, 3-35, 3-47, 4-38, *see also Case File*
Case Pends, 3-2, 3-45
Case studies, 3-48~50
Cellular telephones (CELTEL), 2-31
Centro Internazionale Radio-Medico(CIRM), 4-25

Channel 16, 2-1, 2-15, 2-26, 3-31, 4-13, *see also 156.8 MHz*
Channels, K-10
Charts and overlays, 2-8, 2-32, 3-7, 4-6, 4-19, A-7, H-5, H-26, H-28, H-69, H-72~73, H-80, K-1~5, K-8, K-9~11, N-5
Checksheets, 3-4, G-1
Chill, wind and water, 1-17, 3-43, 4-32, 5-25, K-9
Coast Earth Station (CES), A-3, N-5
Coast Guard Auxiliary, 3-23, 4-5~7, 4-9, 4-11~12, 5-1, 5-5, 5-8, 5-25, A-6
Coast Guard mission, PPO-6, 2-25, 2-27, 6-7, B-3
Coast Guard SAR resources, 4-29
Coastal nation, 1-31
Coastal Patrol Boat (CPB), 5-3, 5-11, 5-14, *see also 87 foot WPB*
Cold water near-drowning, 1-17, 3-43, 4-32, 5-25, K-9, *see also Hypothermia*
Command Center, PPO-4~6, 1-3, 1-7~8, 1-15~18, 1-22, 1-25~26, 1-36, 2-3, 2-7, 2-10~11, 2-15, 2-21, 2-33, 2-35, 2-37, 3-13, 3-29, 3-35, 3-49, 4-9, 4-33~34, 6-5, 6-9, 6-11, 6-14, F-7, G-19, N-1, N-3, N-5, *see also Operations Center*
Commercial enterprise, 4-8
Communications, PPO-6, 1-10, 1-32, 1-34, 1-38, 2-1, 2-3~24, 2-27, 2-35, 3-31, 3-37, 4-10, 4-12, 4-20, 5-18, A-3~4, B-1, B-5, C-5, C-11, F-7, G-4, G-7, G-21, L-1, N-3
Communications, voice, 2-7, 2-11~15, 2-31
Communications schedule, 2-35
Composite solutions, 3-21~23
Computer Assisted Search Planning (CASP), PPO-5~6, 1-7, 1-10, 1-16~17, 1-28, 3-1, 3-3~4, 3-7~8, 3-11~14, 3-41~42, 3-49, 4-40, A-6, C-6, C-11, G-17, H-3~4, H-9~10, H-31, H-69~73, H-77, K-4, K-12, N-3, N-5
Contingency exercises, 1-26
Contour searches, H-93
Controllers, 1-15~18, 2-19, 3-5, 3-43, K-1, N-1, N-3, N-5, *see also RCC Controllers, SAR Mission Coordinator & Search Planners*
Cooperation, 1-5, A-6, G-19
Coordination, 1-1, 1-5, 1-7, 1-13, 1-16~17, 1-19, 1-27, 1-37, 2-9, 2-22, 3-35, B-1, B-5, N-3
Coordination, on scene, *see On Scene Coordinator*
Coordinator, SAR (SC), *see SAR Coordinator*
Coordinator, SAR chain of command, PPO-4, 1-5, 1-15, 1-18, 1-21, 1-29, 1-32, 1-34, 3-29, 3-33, 3-45, 3-46, 3-48, 5-25, C-3, F-15
Coordinator, SAR mission (SMC), *see SAR Mission Coordinator*
Cospas-Sarsat, 3-29, A-5
Cost recovery, 3-28, 4-23, G-20
Course and Leg Identifier, 3-15
Coverage Factor (C), H-1, H-66, H-74~76
Crew fatigue, 5-25
Cuba, 1-35, 1-38
Currents, sea and wind, H-26, H-28
Cutter swimmer, 5-14~15, 5-27
Cutters, 1-32, 2-13~14, 4-31, 4-41, 5-1, 5-5, 5-7, 5-11, 5-14~15

Data, 2-24, 2-27, 3-1, 3-4, 3-8, 4-2, 4-39~40, 4-43, 5-21, B-1, B-11~12, B-15, C-7, G-23~28, H-1, H-9, I-1, I-7, I-12, J-3, K-3~6, K-8, N-5
Database, 2-11~12, 2-16, 2-23~24, J-4
Datum, 1-16~17 3-12, 3-16, 3-18, 5-5, H-1, H-7~10, H-29, H-36, H-38, H-79, H-91, H-103, H-106~107, H-111, H-113~114, I-1, I-11, I-17
Datum Marker Buoy (DMB), 3-12, 3-15, 3-23, 3-39, 4-2, 4-37, 4-40~41, 5-5, 5-17, C-6, C-12, C-14, G-4, G-19, G-21, H-10, H-29~30, H-81, N-5, *see also Self-Locating Datum Marker Buoy*
Debriefing, 3-49
Debriefing, survivor, 3-49~50
Debriefing information, 3-49
Deceased persons, 1-22
Decompression sickness, 6-13
Defense Information School (DINFOS), 1-21
Delivery, 2-19~21, 5-1, 5-21, M-1, M-5, M-15~17, M-21
Delivery, aerial, 5-17, 5-21
Department of Defense (DOD), 1-1, 1-5, 1-18, 1-25, 1-29~30, 3-35, 3-48, 4-25~26, C-12, F-5
Department of State (DOS), 1-30, 1-32~36, 1-38, K-5, K-7
Detection, Probability of (POD), *see Probability of Detection*
Detection capability, 3-19
Digital Selective Calling (DSC), 1-7, 2-1, 2-5~7, 2-9~17, 2-23, 2-26, 2-29~30, 3-47, 5-14~15, A-3, B-13, C-1, C-15, G-4, G-21, N-5
Direction finding (DF), 4-20, 5-14~15, C-6, G-3, H-7, H-34, N-5, *see also Homing & Radio Direction Finding*
Distress, 1-34, 2-7, 2-9~10, 2-12, 2-19, 2-22, 2-25, 2-35, 3-1, 3-20~22, 3-30~33, 4-6~7, 4-9, A-3, A-4, B-1, G-1, G-3, G-18, G-22, H-44, H-51, H-98, K-12, M-1, M-5, M-7, M-20, M-29, N-5
Distress beacons, 3-20
Distress Emergency Phase, 3-22
Distress signals, H-44
Dive related injuries, 6-13
Divers, 6-1, 6-5, 6-7, 6-14
Divers Alert Network (DAN), 6-14
Documentation, 1-5, 3-2, 3-47, J-3
Dominican Republic, 1-39
Drift, 3-1, 3-11~12, 4-38, G-4, G-21, H-1, H-7~13, H-17~18, H-30, H-32~33, H-35, H-95, H-97, H-103~107, H-111, H-113
Drift, compensation for, H-95~96, H-98
Drift, parachute, H-10

Drift Error, H-33

Effectiveness, 3-1, 3-41, H-1, H-51, H-66, *see also Probability of Success*
Electronic sensors and sensor searches, 3-25, 5-21, H-41, H-43, H-62
Emergency, PPO-5, 1-26, 2-6, 2-8, 2-22, 3-21~22, 3-29, 3-39, 4-1, 4-5, 4-25~26, 4-29~31, 6-1, 6-13, A-2, A-4~5, E-1, F-5, G-3, G-16, J-1, J-3, M-5
Emergency Locator Transmitter (ELT), 1-7, 2-6, 2-8, 3-21, 3-23~24, 3-29, 3-47, 5-25, C-4~5, C-10~11, G-13, H-52, J-1, N-5, *see also Emergency Position Indicating Radio Beacon*
Emergency medical services (EMS), 4-1, 4-29~30, A-2, E- 2
Emergency Medical Technicians (EMTs), PPO-5, 4-26, 5-27, D-3, G-7
Emergency Position Indicating Radio Beacon (EPIRB), 1-7, 2-5~6, 2-8, 2-23~24, 3-21~23, 3-37, 3-39, 3-47, 4-36, C-4~5, C-10~11, G-4~5, G-13~14, G-21, H-52, J-1, J-3~4, N-5, *see also Emergency Locator Transmitter*
EMS Agreements, 4-1, 4-29
Entry for searching, 1-32
Environmental data, 3-49
Environmental factors, 3-43
EPIRB registration cards, 3-23
Equipment, 2-37, 3-37, 4-1, 4-30, 4-34, 4-36, 4-43, 5-9, 5-14~15, 5-17, 5-21, A-5, G-4, G-13, G-21, H-63, J-3
Error, probable, 3-7, H-5, H-9, H-31, H-33~35, H-69, H-71
Escort, 4-1, 4-30
Exercises, 1-1, 1-25~26, F-1, F-9~11, F-15, G-11, I-26

Facilities, 1-40, 2-27, 4-1, 4-8, 4-30, A-2~3, A-5
False alarms, 3-23
False alerts, 3-33
Family members, 1-23
Fatigue standards, 5-25
FCC violation, 4-12
Federal Aviation Administration (FAA), A-5, C-4, C-10, G-13
Federal Communications Commission (FCC), 2-7, 2-16, 2-23~24, 2-26, 3-23, 3-34, 4-12, H-34, L-1
Federal Emergency Management Agency (FEMA), 1-25, 3-35, F-3, F-5, F-7, F-12
Firefighting Activities Policy, 4-1, 4-17
First RCC, 1-1, 1-5~6
First search, H-77
Fixed wing, N-5
Flares, 4-36, 5-9, 5-14~15, 5-17, G-4, G-6, G-9, G-21, I-1, I-3, I-7, I-12, I-19~20, I-24, I-33~34
Foreign Service Posts (FSP), 1-33, 1-35~36
Forms, SAR message, 2-22
Forward-Looking Airborne Radar (FLAR), 3-26~27, H-55~56, K-12
Forward-Looking Infrared System (FLIR), 3-27, 5-17~18, H-58~59, K-12
Freedom of Information Act (FOIA), 1-39, 3-50
Frequency, 1-15, 1-17, 1-26, 2-9, 2-16, 3-47, F-1, F-10, F-13, G-3~4, G-21

General Salvage Policy, 4-1, 4-15
Global Maritime Distress and Safety System (GMDSS), PPO-6, 2-1, 2-3, 2-5~8, 2-15, 3-37, A-2~3, A-6, G-1, G-22, N-3, N-5
Global Positioning System (GPS), 2-8, 3-11, 3-13, 3-21~22, 3-24, 3-30~31, 4-33~34, 4-36~37, 4-40, 5-9, 5-18, C-5, C-7, G-4~5, H-29, H-34~35, H-83, H-87, I-7
Grid, 3-18, H-80
Ground speed, SRU, H-41

Haiti, 1-39
HC-130, 3-27, 4-41, 5-3, 5-17, C-12~14, H-56~57
Helicopter hoisting, 4-26~27, 5-19, 5-21
Helicopters, 3-14, 4-33, B-6, H-48~50, H-60
HF radio, 2-10, 3-31
HH-60J, 3-19, 3-27, 5-17~18, H-42, H-55
HH-65, 3-19, 3-27, 3-32, 4-41, 5-3, 5-14~15, 5-17~19, C-8, H-42, H-55
High Endurance Cutters (HEC), 5-1, 5-11
Hoax, 3-33, G-1
Homing, H-95, H-98, *see also Direction Finding & Radio Direction Finding*
HU-25, 3-27~28, 4-41, 5-3, 5-17~18, H-56~57, K-11~12
Hypothermia, 3-1, 3-43, 4-33, N-3, N-5, *see also Cold water near drowning*

Incident, PPO-5, 1-1, 1-3~4, 1-8, 1-22, 3-1, 3-4~5, 3-35, 3-47, 4-18, A-6, B-5, F-7, F-10, G-4, G-19~20, H-103, H-106~107, H-111, H-113, N-3, N-5
Incident Command System (ICS), PPO-5, 1-1, 1-3~4, 1-16~17, 1-22, 1-26, 3-35, 4-18, A-6, G-19, N-3
Incident type and severity, 3-5
Information, RCC, 6-11
Information sharing, 1-5
Information sources, 1-13, 1-39, 3-15, 6-13, H-28, K-1
Infrared, H-62, K-12
Initial action stage, PPO-5
Initial position, 3-24, H-7
Initial Position Error, H-34
Initial response, 1-26
Inmarsat, 1-7, 2-6, 2-8, 2-12, 3-8, 3-37, A-3, J-3, N-5
Inmarsat C, 2-6, 3-37
Inmarsat SafetyNET, 2-1, 2-8, 2-19~22, A-2, C-1, C-17, G-19, M-5, M-20, M-29
International Aeronautical and Maritime Search and Rescue Manual (IAMSAR), PPO-2, PPO-6, 1-5, 1-

27, 1-40, 3-3~4, 3-7, 3-15~16, 3-18, 3-35, 3-41~42, 3-48, A-2, H-3~6, H-10, H-26, H-33, H-35, H-44~45, H-67, H-69, H-71, H-77, H-95, H-101, N-3
International Civil Aviation Organization (ICAO), 1-38, A-1~2, A-4
International Code of Signals, 4-27, A-2
International Convention for the Safety of Life at Sea (SOLAS), 1-40, 2-5~7, 2-23, 2-26, 3-36~37, A-2, A-4, A-6, I-8, N-5
International Convention on Maritime Search and Rescue, A-2
International Ice Patrol (IIP), 2-7~8, 3-12, 3-27, H-10, H-57, K-12
International Maritime Organization (IMO), 1-27, 2-5, 2-7~8, 2-21, 2-23, 3-35~36, A-1~5
International Telecommunication Union (ITU), 2-9~10, 2-12, 2-16, 2-23, A-5, N-5
Inverse Synthetic Aperture Radar (ISAR), 3-27, H-55~56

Joint Chiefs of Staff (JCS), 1-34

Land Earth Station (LES), M-5, M-19~20, M-29
Land SRUs, H-86
Last known position (LKP), 4-39
Law enforcement agencies, E-1
Leeway (LW), H-10~19, H-21, H-30
Leeway divergence, H-14
Liaison, 1-1, 1-18, 1-25, G-19
Local knowledge, N-5
Local User Terminal (LUT), N-5
Locating, 3-24
Long-Range Search (LRS) fixed-wing aircraft, 5-3, 5-21
Lost person, H-9

Marine Assistance Request Broadcast (MARB), 2-31, 4-1, 4-9~13, G-8, N-5
Marine Information for Safety and Law Enforcement (MISLE), PPO-6, 1-7, 1-16, 2-12, 2-16, 2-24, 3-2, 3-47~48, B-1, B-3, B-5, B-7, B-9, B-15, G-1, G-20, N-5
Marine pollution, 1-4, 1-6, 1-32~34, 3-27, 3-34, 3-39, C-4, C-6, C-10, G-8, N-5
Maritime Mobile Service Identities (MMSI), PPO-6, 1-16, 2-1, 2-7, 2-9~16, 2-23~24, 2-26, 3-30~31, 3-37, C-15, G-3, N-5
Maritime SAR Assistance Policy (MSAP), 1-16, 2-31, 3-1, 3-39, 4-1, 4-5, 4-13, 4-15
Mass Rescue Operations, 1-1, 1-26, 3-1, 3-34~35, G-19
MAYDAY, 1-16~17, 2-1, 2-29, 3-21, 3-30~32, B-12, G-1, G-15, N-5
Measure of search effectiveness, 3-9, 3-41~42, 3-45, H-3, H-41, H-44, H-66, H-70~71, H-73, H-77, H-83, *see also Effectiveness & Probability of Success*
Media, 1-6, G-17, N-5
Medical advice, 4-1, 4-25~27, C-4, G-1, G-3, G-7
Medical evacuation (MEDEVAC), 2-27, 3-2, 3-45, 3-48, 4-1, 4-23, 4-25~30, 4-45, 6-13, C-4, D-1, G-1, G-3, G-7
MEDICO, *see Medical advice*
Medium Endurance Cutters (MEC), 5-1, 5-11
Medium-Range Recovery (MRR) helicopters, 5-3, 5-18
Medium-Range Search (MRS) fixed-wing aircraft, 5-3, 5-21
Merchant vessels, 1-40, 3-8, 3-38
Messages, 2-8, 2-19~21, A-5, C-1, M-1, M-9, M-11, M-13, M-15, M-17, M-19, M-21~23, M-27, N-3
Meteorological, 2-8, H-44, I-1, I-5, I-15, K-6
Mexico, PPO-2, 1-33, 1-36, 1-37, K-3, K-6, K-10
Military, PPO-4, 1-34, 3-35, 4-29
Military Assistance to Safety and Traffic (MAST), 4-29, D-3
MISLE, *see Marine Information for Safety and Law Enforcement*
Mission, PPO-1, PPO-4, 1-1, 1-7~8, 1-10~11, 2-8, 3-30, 3-48~49, 4-5~6, A-2, B-5, G-18
Mission Control Center (MCC), 1-34, 2-8, 3-30, 3-47, 3-49
Morse Code, 3-31
Motor Life Boat (MLB), 3-19, 5-3, 5-5, 5-7, 5-9, H-42, H-51
MRO, *see Mass rescue operations*

National Association of Search and Rescue (NASAR), 1-25
National Distress and Response System (NDRS), PPO-4, PPO-6, 2-1, 2-15, 2-25~26
National maritime SAR area, 1-25
National Military Command Center (NMCC), 1-34
National SAR Plan (NSP), PPO-3, PPO-6, 1-3, 1-29, 3-35, 4-12, 4-23, A-5, N-5
National SAR School, PPO-5, PPO-6, 1-1, 1-15, 1-17~19, 1-28, 3-48~49
National SAR Supplement (NSS), PPO-2~3, PPO-6, 1-18, 3-15, 3-35, 3-41, A-5, H-69, K-2, L-2, N-3
NAVTEX, 2-6~8, 2-19, A-2, G-19, N-5
Navy SAR resources, 6-11
News, 1-1, 1-21
Night and reduced visibility searches, 3-20, 3-25, H-60
Night vision goggles (NVG), 3-26~27, 5-14~15, 5-17, H-59~61
Non-distress, 2-12

Office of Search and Rescue (G-OPR), PPO~6, 1-18~19, 1-25, 1-27~30, 1-39, 2-16~17, 2-19~22, 3-29, 3-35~36, 3-48~49, 4-29, 4-34, 4-43, 6-11, B-7, B-15, H-7, I-7, M-29
On scene, G-17, H-10, H-26, H-54, I-12
On scene conditions, G-17
On Scene Coordinator (OSC), 1-4, 1-10~11, 1-33, 1-39~40, 2-12, 2-16, 2-23~24, 3-7~9, 3-25, 3-47, 3-49,

4-39~41, 6-9, B-3, B-9, B-15, C-4, C-8~10, C-12~14, G-19, H-3, H-10, H-26, H-81~82, N-5
Operations Center (OPCEN), 1-1, 1-22~23, 1-39, 2-32, 3-7, H-10, K-1, N-5, *see also Command Center*

Parachute, 5-21, H-93, I-7, I-8
Patrol boats (WPBs), 3-19, 5-1, 5-3, 5-8, 5-11, 5-14, A-2, A-5, H-42, H-52, H-58, H-64
Person overboard, 4-31
Personal Locator Beacon (PLB), PPO-6, 2-8, 3-21, J-1, N-5
Persons in the water (PIW), 3-3, 3-14, 3-19~20, 3-25, C-4, C-5, C-7~8, C-10~11, C-13, G-1, G-3, G-14, G-15, G-18, H-4, H-14, H-16~17, H-20, H-42, H-60~61
Persons trapped under capsized vessels, 6-7
Phases, emergency, *see Emergency phases*
Planning, PPO-5, 1-5, 1-10~11, 1-16~19, 1-26~27, 3-1, 3-3~4, 3-7, 3-11, 3-13, 3-34, 3-39, 4-2, 4-32, F-1, F-7, F-9~10, F-12, F-15, G-17, H-1, H-3~4, H-6, H-77, I-1, I-23, N-5
Plans, 1-27, 3-1, 3-36, 3-49, 4-2, 4-35, 6-1, 6-5, A-4, A-5, F-1, F-7, F-9, H-1, H-99
Plans, SAR, 3-39
Ports and Waterways Safety Act of 1972 (PWSA), 4-17
Precedence, PPO-3
Preliminary Communications Search (PRECOM), 4-35
Priority, 2-22, A-3, M-5, M-7, M-9, M-11, M-13, M-20, M-29
Probability of Containment (POC), 2-23, 3-3, 3-21, 3-41~42, 4-40, C-3~4, C-7, G-6, G-19, G-23~28, H-4~5, H-33, H-41, H-66~67, H-69~77, N-5
Probability of Detection (POD), 3-3, 3-16, 3-18, 3-41~42, 5-21, C-6, G-17, H-4~5, H-33, H-41~42, H-51, H-66~71, H-73~77, H-83, H-91, H-95, N-5
Probability of Success (POS), 3-1, 3-3~4, 3-41~42, C-3, C-5~6, G-17, H-4~5, H-33, H-35, H-39, H-41~42, H-66~67, H-69~77, H-91, N-5
Public affairs, 1-21, *see also Media & News*
Public Health Service (PHS), 1-29, G-18
Publications, PPO-1~2, A-1~2, A-4, K-11
Pyrotechnics, 3-19~20, 3-26, 3-32, C-5, C-11, G-9, G-12, G-14, H-41, H-51, H-93~94, I-3, I-7~8, I-10, I-13, I-15~16, I-23~24, I-27, N-5

Qualification, 1-1, 1-15, 5-27, N-1

Radar, 3-26, 5-9, 5-14~15, 5-17, G-6, H-34, H-53~56, H-62~64, H-91, K-11~12
Radar, Forward-Looking Airborne (FLAR), 3-26~27, H-55~56, K-12
Radar, Side-Looking Airborne (SLAR), 3-27, 5-17, H-57, H-62~63, K-12
Radar, IFF equipment, H-81
Radar range sweep widths, 3-26
Radar reflective devices, 3-26
Radar reflective devices, H-53
Radar sweep widths, 3-26, H-53
Radar transponder, 2-7~8, N-5
Radio direction finding (RDF), 3-12, 4-2, 4-37, 4-41, *see also Direction finding & Homing*
RCC controllers, 1-33, *see also Controllers, SAR Mission Coordinator & Search Planners*
RDR-1300, 3-26~27, H-55
Regional Air Navigation Plan (RANP), A-4
Reimbursement, 4-1, 4-23
Reliability, 3-24
Reports, 1-27, 3-2, 3-21~22, 3-27, 3-47~48, 4-38, B-1, B-15, G-14, G-16, K-8
Rescue, PPO-2, PPO-4~6, 1-1, 1-3~5, 1-25~27, 1-37~38, 2-1, 2-3, 2-6, 2-13, 2-15, 2-19, 2-22, 2-24~27, 2-29, 2-35, 3-1, 3-35~37, 3-39, 3-43, 3-47, 3-49, 4-1~2, 4-31~34, 5-1, 5-3, 5-21, 5-27, 6-1, 6-7, 6-11, A-3, A-5~6, D-3, G-1, G-3, G-18, G-22~28, H-15, H-17, K-1~2, K-8~9, M-9, N-1, N-3
Rescue, underwater, 6-3
Rescue Coordination Center (RCC), PPO-2, PPO-4~6, 1-1, 1-3, 1-5~8, 1-15, 1-17, 1-25, 1-27, 1-31, 1-33~34, 1-36~38, 1-40, 2-7~8, 2-12~14, 2-17, 2-19~21, 2-23, 2-32~33, 3-8, 3-21, 3-23, 3-30, 3-33, 3-35~36, 3-46, 3-49, 4-29, 6-1, 6-11, A-2~3, A-5, C-15, C-17, G-19, K-1, M-7, M-10~11, M-19, M-23, N-3, N-5
Rescue planning, 5-3
Rescue Sub-Center (RSC), PPO-2, 1-1, 1-3, 1-8, 1-17, 1-33, 1-36~39, 3-8
Rescue Unit (RU), 1-4, 3-47
Research and development (R&D), PPO-6, 3-27, K-12
Risk Management, PPO-1, 1-1, 1-8~9, 1-11, 1-13, 1-16, 3-20, 3-39, G-19, N-3, N-5

Safety, PPO-3, PPO-6, 1-13, 1-22, 1-26, 1-29, 2-5~8, 2-12, 2-21~22, 2-24~25, 3-36, 3-39, 3-48, 4-6, 4-29, 5-19, 6-1, 6-5, 6-11, A-2~3, E-1, G-17, G-21, M-5, M-20
Safety Of Life At Sea (SOLAS), *see International Convention for the Safety of Life at Sea*
SafetyNET, *see Inmarsat SafetyNET*
Salvage, 1-16~17, 4-15, 6-9, N-5
SAR, aeronautical, PPO-3
SAR, maritime, PPO-3, 1-3~4, 1-25, 1-29~30, 1-36, 1-39, 3-29, F-3, F-5, F-7, H-43, H-67
SAR agreements, 1-5, 1-25, 1-29~30, 1-35, N-5, 1-3, 1-5, 1-30, 1-35, 1-39, 3-20, 3-34, 3-38, 3-46, 4-35
SAR case file, 1-7~8, 3-47, B-3, B-7, M-5, M-16, M-18, *see also Case documentation*
SAR case study, 3-48~50, 6-11
SAR checksheets, G-1
SAR controllers, 1-16, 3-43
SAR coordination, 1-5, 1-27
SAR Coordinator (SC), PPO-2, PPO-5~6, 1-3~4, 1-7, 1-19, 1-25, 1-29, 1-33, 2-1, 2-5~7, 2-9, 3-33, 3-45~47, 4-1, 4-12, 4-27, C-4, C-7, H-26, K-8, N-5

SAR exercises, PPO-1, 3-36
SAR facilities, PPO-2, PPO-5, 1-3, 1-5, 1-30
SAR facility list (SARFAC), 1-25~26
SAR incident, PPO-4~5, 1-4~5, 1-15, 1-21, 1-25~26, 1-32~35, 3-4, 3-13, 3-25, 3-27, 3-39, 3-48, 4-45, 6-5, 6-11, B-3, B-5~6, B-11, H-59
SAR incident data, B-3
SAR Management Information System (SARMIS), B-3, B-12, C-8
SAR manual, K-9
SAR Mission Coordinator (SMC), PPO-2, PPO-5~6, 1-1, 1-4~5, 1-7~11, 1-13, 1-21~23, 1-29, 1-35~37, 1-39~40, 2-10~11, 2-14~16, 2-19~20, 2-29, 2-35, 2-37, 3-9, 3-13~14, 3-23, 3-25, 3-29, 3-31~35, 3-38, 3-45~48, 4-~2, 4-5~6, 4-8~14, 4-17, 4-19~20, 4-25~28, 4-33, 4-35, 4-38~42, 4-45, 5-8, 5-17~18, 5-27, 6-1, 6-5, 6-9, 6-11, 6-14, B-1, B-3, B-5~6, C-4, C-7~14, G-8, G-19, H-3, H-8~9, H-11, H-28~31, H-33~35, H-41, H-53, H-77~78, H-80~83, H-96, N-3, N-5
SAR plan, PPO-5~6, 1-3, 1-5, 1-8, 1-17, 1-28~29, 3-8, 3-22, 3-27, 3-29, 3-32, 3-39, 3-43, 4-40~41, 5-3, 5-8, 5-11, 5-13, H-16, H-20, H-57, J-1
SAR planner, PPO-5, 1-5, 1-29, 3-8, 3-22, 3-27, 3-29, 3-32, 4-41, 5-3, 5-8, H-20, H-57, J-1
SAR plans, 3-39
SAR Program, PPO-1, PPO-3~5, 1-17, 1-25, 1-27~28, 2-23, 3-48, 4-38, 4-40~43, B-15, N-5
SAR Program Goals, N-5
SAR Program Manager, PPO-5, 1-25, *see also Office of Search and Rescue*
SAR Program Objectives, PPO-1, PPO-3
SAR Program Standards, PPO-4, N-5
SAR Region (SRR), *see Search and Rescue Region*
SAR resources, 1-25, 3-20, 3-23, B-15, H-10
SAR response, PPO-5, 1-3, 1-4, 1-5, 1-7, 1-15, 1-16, 1-22, 1-30, 3-21, 3-33, 3-35, 3-36, 3-38, 5-3, 6-7, 6-13, B-7, B-12
SAR School, PPO-6, 1-1, 1-15, 1-18, 1-28, 3-48, 3-49
SAR sub-region (SRS), *see Search and Rescue Sub-Region*
SAR system, PPO-2~5, 1-3, 1-15, 1-17, 1-25, 1-27, 1-39, 2-3, 3-47~49, 4-13, 4-23, 5-3
SAR Transponder (SART), 2-7~8, N-5
SAR Unit (SRU), *see Search and Rescue Unit*
satellite, 1-39, 2-5~6, 2-8, 2-20~21, 2-33, 3-8, 3-12, 3-21~24, 4-37~40, H-29 K-3, K-6, M-7, M-9, M-11, M-13, M-16, N-5
Scanning, 5-21
Scenarios, 3-35
Scuba divers, 6-13
Sea current (SC), H-26, K-1, N-5
Search, PPO-1~2, PPO-4~5, 1-1, 1-3~5, 1-8, 1-16~19, 1-22, 1-25, 1-27, 1-39, 2-7~8, 2-22, 2-24, 2-35, 3-1~4, 3-7, 3-9, 3-11~20, 3-25~26, 3-32, 3-35~37, 3-39, 3-41~43, 3-45, 3-47, 3-49, 4-2, 4-5, 4-41, 5-13~15, 5-21~23, A-2, A-4, B-3, B-15, C-1, C-9 F-7, G-12, G-17, G-20, H-1, H-3~4, H-6, H-10, H-26, H-33, H-35~38, H-41, H-44~50, H-55~58, H-60~63, H-66~67, H-69, H-71~72, H-77~78, H-80~81, H-83~85, H-91~93, H-95~96, H-98~99, H-103, I-1, I-10, I-23, I-27, K-1, K-3, K-9, K-12, L-1, M-1, M-5, M-9, M-19, M-29, N-1, N-3, N-5, *see also Searches*
Search, datum, *see Datum*
Search, electronic, 3-27
Search and Rescue coordinator (SC), *see SAR Coordinator*
Search and Rescue Optimal Planning System (SAROPS), PPO-6, 3-3~4, H-3~4, H-72
Search and Rescue Radar Transponder (SART), *see SAR Transponder*
Search and Rescue Region (SRR), PPO-2, PPO-4, 1-3, 1-5, 1-7~8, 2-32, 5-3, 5-18~19, K-12, N-5
Search and Rescue Sub-Region (SRS), 1-8
Search and Rescue Unit, arrival on scene, PPO-4, 1-10, 3-13, 3-25, G-11, I-26
Search and Rescue Unit (SRU), PPO-4~5, 1-11, 1-25~26, 3-9, 3-13~14, 3-16~17, 3-19, 3-47, 4-2, 4-17, 4-39, 4-41, 5-17, 5-21, 5-23, 6-7, C-4, C-6, C-10~11, C-13, G-17, G-28, H-1, H-3, H-9, H-29~30, H-33, H-35, H-41~45, H-50~52, H-62, H-66, H-73, H-77~78, H-80~84, H-86~87, H-90~93, H-95~96, H-98, I-7, I-23, N-5
Search area, 3-9, 3-18, H-78, H-80, H-96
Search Effort, H-1, H-44, H-73, H-77
Search endurance, 1-34, 3-9, 3-14, 5-8, 5-11, 5-13, 5-18, H-6, H-8, H-41, H-44, H-66, H-78
Search object, 3-25, H-10, H-41, N-5
Search patterns, H-62, H-80
Search planners, 3-11~12, 3-32, 3-42, H-4, H-26, H-71, I-10, *see also Controllers, RCC Controllers & SAR Mission Coordinator*
Search planning, datum, *see Datum*
Search planning, 1-39, 3-3, 3-11, 3-13, H-3, H-6
Search speed, H-44, H-55
Searches, 1-21, 3-1, 3-7, 3-20, 3-25~26, 3-28~29, H-51, H-68, *see also Search*
Searches, aircraft, H-83
Searches, electronic, 3-27
Searches, extended, 1-40
Searches for bodies, 3-29
Sector Pattern, *see Sector Search*
Sector search, 3-15~18, H-91, H-92~93
SECURITE broadcasts, 1-32
Self-Locating Datum Marker Buoy (SLDMB), 3-9, 3-12, 4-2, 4-37~43, 5-17~18, C-6, H-29~30, H-33, N-5, *see also Datum Marker Buoy*
Sensors, 3-1, 3-25~26, H-43
Ship reporting system, PPO-5, 1-1, 1-7, 1-16, 1-39~40, 2-24, 3-1, 3-8~9, 3-20, 3-49, 5-5, A-6, B-6, C-6, C-10, N-5
Short-Range Recovery (SRR) Helicopters, 1-3, 1-5, 1-7~8, 2-32, 5-3, 5-18~19, K-12, N-5

Side-Looking Airborne Radar (SLAR), 3-27, 5-17, H-57, H-62~63, K-12
Sierra Sierra, *see Square Pattern*
Signals, 4-36, A-4, A-6
Signals, emergency, 3-20, I-3
Simultaneous Arrival, 4-11
Situation reports (SITREPs), 1-7, 1-34~35, 1-40, 3-2, 3-47~49, C-1, C-3~5, C-7, C-12~14, N-5
Sound Fixing and Ranging (SOFAR), H-34
Square Pattern, 3-15, 3-16, H-89~91
Square Pattern Computations, 3-16, H-90
Square Single Unit, 3-15, H-90
Staffing, N-3
Stage, planning, I-9
Standard Marine Navigational Vocabulary, A-5
Statement of No Objection (SNO), 1-31~32, 1-34
Submersibles, 6-1, 6-5~6, A-5
Surf and bar operations, 5-7
Surf Rescue Boat (SRB), 5-3, 5-8
Surface swimmers, 5-27, 6-7
Surface vessel radar, 3-26, H-53
SURPIC, 1-7, 1-40, 2-24, 3-8
Survival, 3-1, 3-43, 3-50, 4-36, 5-17, A-6, C-5, C-11, G-4, G-13, G-17, G-21, H-14~15, H-17, H-20, H-22, K-2, K-8, L-2
Survival equipment, G-17
Survivors, 3-11, 3-48, G-18
Survivors, debriefing, 3-50
Suspend, 3-2, 3-45, G-12, I-27, N-5
Sweep width, 3-27, H-42~43, H-51~53, H-55, H-57~58, H-62~64, H-66

Tap, 2-32
Terrain, H-44
Tidal Currents, H-103, H-106
Total Probable Error (E), H-1, H-33, H-35, H-71
Total Water Current, H-29
Track Spacing, 3-14, 3-16, 3-19, H-1, H-41~42, H-91
Trackline, 3-8, 3-17~18, G-15, H-84~85, H-93, H-98
Training, PPO-5, 1-1, 1-13, 1-15~16, 1-21, 1-28, 5-25, B-1, B-9
Tugboats, 5-1

U.S. Air Force, 1-18, 1-33, 1-36, 3-28, 3-35, 4-29, A-5, K-9
U.S. Air Force Foreign Clearance Guide, 1-33, 1-36, A-5
U.S. Air Force Strategic Air Command, 3-28
U.S. Navy, 1-36, 1-39, 3-7, 6-1, 6-5, 6-9, 6-11, A-6, A-7, H-9, H-30, K-2, K-4, K-9
Unbarring, A-3
Uncertainty Emergency Phase, 3-22
Underwater acoustic beacon, 6-9
United States Message Text Format (USMTF), 3-47~48
USDAO, 1-36~39
USMCC, 3-22~23, C-10, N-3, N-5
Utility Boat (UTB), 3-19, 5-3, 5-5, 5-7~9, 5-13, C-8, H-42, H-52, H-63~64
Utility Boat-medium (UTM), 3-19, H-42

VHF radio, 2-26
VHF-FM, PPO-4, PPO-6, 2-1, 2-5~9, 2-13, 2-14~17, 2-23, 2-25, 2-29, 2-31~32, 3-30~32, 3-37, 4-21, 4-36, 5-9, 5-14~15, 5-18, B-12~13, C-7, G-4, G-7, G-21, K-10
Victor Mike, *see VM*
Victor Sierra, *see VS*
Visual scanners, 3-26, H-54
Visual search, H-43, H-46, H-48, H-50, H-62
VM, 3-17~18, H-92, *see also Sector Search*
Voice communications, 3-47
VS, 3~14, 3-16~18, H-37, H-91~92, H-98, *see also Sector Search*

Water chill, 1-17, 3-43, 4-32, 5-25, K-9
Weather, 1-1, 1-13
Weather, adverse, 1-13
Weather, 2-8, 2-31, 4-1, 4-21
Weather, 5-7
Weather, adverse, 5-7, 5-11
Weather, A-6
Weather, G-1, G-3, G-7~8, G-13
Weather, H-9, H-29, H-45, H-63~64, H-114
Weather, K-3~4, K-6
World Health Organization (WHO), C-7
World Health Organization (WHO), G-25~26
World Meteorological Organization (WMO), A-3
Wrecking and Salvage Treaty of 1908, 1-36

X-band, 3-27
X-band, 5-14~15, 5-17
X-band, H-55

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List of Effective Pages

Subject Matter	Page Numbers	Effective Pages
Record of Changes	ROC-1 (reverse blank)	Original
Table of Contents	i thru iv	Original
References	v (reverse blank)	Original
List of Figures	vii thru viii	Original
List of Tables	ix thru x	Original
Preface & Program Overview	PPO-1 thru PPO-7 (reverse blank)	Original
Chapter 1 – contents	1-1 (reverse blank)	Original
Section 1.1	1-3 thru 1-4	Original
Section 1.2	1-5 thru 1-14	Original
Section 1.3	1-15 thru 1-19 (reverse blank)	Original
Section 1.4	1-21 thru 1-23 (reverse blank)	Original
Section 1.5	1-25 thru 1-28	Original
Section 1.6	1-29 thru 1-40	Original
Chapter 2 – contents	2-1 (reverse blank)	Original
Section 2.0	2-3 (reverse blank)	Original
Section 2.1	2-5 thru 2-8	Original
Section 2.2	2-9 thru 2-17 (reverse blank)	Original
Section 2.3	2-19 thru 2-22	Original
Section 2.4	2-23 thru 2-24	Original
Section 2.5	2-25 thru 2-27 (reverse blank)	Original
Section 2.6	2-29 (reverse blank)	Original
Section 2.7	2-31 thru 2-32	Original
Section 2.8	2-33 (reverse blank)	Original
Section 2.9	2-35 (reverse blank)	Original
Section 2.10	2-37 (reverse blank)	Original
Chapter 3 – contents	3-1 thru 3-2	Original
Section 3.1	3-3 thru 3-5 (reverse blank)	Original
Section 3.2	3-7 thru 3-10	Original
Section 3.3	3-11 thru 3-12	Original
Section 3.4	3-13 thru 3-38	Original
Section 3.5	3-39 (reverse blank)	Original
Section 3.6	3-41 thru 3-42	Original
Section 3.7	3-43 (reverse blank)	Original
Section 3.8	3-45 thru 3-46	Original
Section 3.9	3-47 thru 3-50	Original
Chapter 4 – contents	4-1 thru 4-2	Original
Section 4.1	4-3 (reverse blank)	Original
Section 4.2	4-5 thru 4-14	Original
Section 4.3	4-15 (reverse blank)	Original
Section 4.4	4-17 thru 4-18	Original
Section 4.5	4-19 thru 4-21 (reverse blank)	Original
Section 4.6	4-23 (reverse blank)	Original
Section 4.7	4-25 thru 4-28	Original
Section 4.8	4-29 thru 4-30	Original
Section 4.9	4-31 thru 4-34	Original
Section 4.10	4-35 thru 4-36	Original
Section 4.11	4-37 thru 4-43 (reverse blank)	Original
Section 4.12	4-45 (reverse blank)	
Chapter 5 – contents	5-1 (reverse blank)	Original
Section 5.1	5-3 (reverse blank)	Original
Section 5.2	5-5 (reverse blank)	Original
Section 5.3	5-7 thru 5-9 (reverse blank)	Original

Subject Matter	Page Numbers	Effective Pages
Section 5.4	5-11 (reverse blank)	Original
Section 5.5	5-13 thru 5-15(reverse blank)	Original
Section 5.6	5-17 thru 5-23 (reverse blank)	Original
Section 5.7	5-25 thru 5-26	Original
Section 5.8	5-27 (reverse blank)	Original
Chapter 6 – contents	6-1 (reverse blank)	Original
Section 6.1	6-3 (reverse blank)	Original
Section 6.2	6-5 thru 6-6	Original
Section 6.3	6-7 (reverse blank)	Original
Section 6.4	6-9 (reverse blank)	Original
Section 6.5	6-11 thru 6-12	Original
Section 6.6	6-13 thru 6-14	Original
Appendix A	A-1 thru A-7 (reverse blank)	Original
Appendix B – contents	B-1 (reverse blank)	Original
Section B.1	B-3 (reverse blank)	Original
Section B.2	B-5 thru B-6	Original
Section B.3	B-7 (reverse blank)	Original
Section B.4	B-9 (reverse blank)	Original
Section B.5	B-11 thru B-13 (reverse blank)	Original
Section B.6	B-15 (reverse blank)	Original
Appendix C – contents	C-1 (reverse blank)	Original
Section C.1	C-3 thru C-8	Original
Section C.2	C-9 thru C-14	Original
Section C.3	C-15 (reverse blank)	Original
Section C.4	C-17 (reverse blank)	Original
Appendix D – contents	D-1 (reverse blank)	Original
Emergency Medical Treatment Report CG-5214	D-3 (reverse blank)	Original
Appendix E	E-1 thru E-2	Original
Appendix F – contents	F-1 (reverse blank)	Original
Section F.1	F-3 (reverse blank)	Original
Section F.2	F-5 thru F-6	Original
Section F.3	F-7 (reverse blank)	Original
Section F.4	F-9 thru F-13 (reverse blank)	Original
Section F.5	F-15 (reverse blank)	Original
Appendix G – contents	G-1 (reverse blank)	Original
Checksheets	G-3 thru G-28	Original
Appendix H – contents	H-1 (reverse blank)	Original
Section H.1	H-3 thru H-4	Original
Section H.2	H-5 thru H-6	Original
Section H.3	H-7 thru H-32	Original
Section H.4	H-33 thru H-39 (reverse blank)	Original
Section H.5	H-41 thru H-76	Original
Section H.6	H-77 thru H-82	Original
Section H.7	H-83 thru H-98	Original
Section H.8	H-99 (reverse blank)	Original
Section H.9	H-101 (reverse blank)	Original
Manual Solution Worksheets	H-103 thru H-114	Original
Appendix I – contents	I-1 (reverse blank)	Original
Section I.1	I-3 (reverse blank)	Original
Section I.2	I-5 thru I-6	Original
Section I.3	I-7 thru I-12	Original
Section I.4	I-13 thru I-16	Original
Section I.5	I-17 thru I-34	Original
Appendix J – contents	J-1 (reverse blank)	Original
406 MHz Beacon Registration Form	J-3 thru J-4 [no numbers on pages]	Original

Subject Matter	Page Numbers	Effective Pages
Appendix K	K-1 thru K-12	Original
Appendix L	L-1 thru L-4	Original
Appendix M – contents	M-1 (reverse blank)	Original
Section M.1	M-3 thru M-4	Original
Section M.2	M-5 (reverse blank)	Original
Section M.3	M-7 thru M-8	Original
Section M.4	M-9 thru M-10	Original
Section M.5	M-11 thru M-12	Original
Section M.6	M-13 thru M-14	Original
Section M.7	M-15 thru M-16	Original
Section M.8	M-17 thru M-18	Original
Section M.9	M-19 thru M-20	Original
Section M.10	M-21 thru M-22	Original
Section M.11	M-23 (reverse blank)	Original
Section M.12	M-25 (reverse blank)	Original
Section M.13	M-27 (reverse blank)	Original
Section M.14	M-29 (reverse blank)	Original
Appendix N – introduction	N-1 (reverse blank)	Original
Command Center Controller PQS Sheets	N-3 thru N-14	Original
Index	INDEX-1 thru INDEX-7 (reverse blank)	Original
List of Effective Pages	LEP-1 thru LEP-3 (reverse blank)	Original

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