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United States
Coast Guard

ET1 UNIT 1: ADMINISTRATION

Coast GUARD
Training Center Petaluma

U. S. Coast Guard
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ET1 UNIT 1: ADMINISTRATION

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QUESTIONS ABOUT THIS TEXT SHOULD BE
ADDRESSED TO THE SUBJECT MATTER SPECIALIST
FOR THE ET RATING

Record of Changes			
Change Number	Date of Change	Date Entered	By Whom Entered

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Acknowledgments and References

Acknowledgments

Material is included in this pamphlet through courtesy of the designated source. The Coast Guard appreciates permission of the source to use this material, which contributes greatly to the effectiveness of this course. No copies or reproductions of the material shall not be authorized without permission of the appropriate source.

The Coast Guard wishes to thank the following individuals for their expertise and support in the development of this document:

ETC Chris Meyer

ETC Dave Baker

ET1 Starling

List of References

This pamphlet contains original material developed at the U. S. Coast Guard Training Center, Petaluma, California, and excerpts from the following technical publications:

- Electronics Manual, COMDTINST M10550.25 (series)
- Supply Policy and Procedures Manual (SPPM), COMDTINST M4400.19
- CMPlus Users Guide
- SFLC Support Gram
- Equipment Tag-Out Procedures, COMDTINST 9077.1 (series)
- Navy Installation and Maintenance Book, EMI Reduction NAVSEA SE000-00-EIM-150
- Ship's Maintenance and Material Management Manual (3M), OPNAVINST 4790.4 (series)
- Ordnance Manual, COMDTINST 8000.2 (series)
- Standard Practices for Shipboard Bonding, Grounding and Other Techniques for Electro-Magnetic Compatibility and Safety, MIL-STD-1310G

Notice to Students

Purpose

This pamphlet serves as a training aid to provide you with a general knowledge of Administration tasks required of an ET1.

Important Note

This text has been complied for TRAINING ONLY. It should NOT be used in place of official directives or publications. The test information is current according to the references listed. You should, however, remember that it is YOUR responsibility to keep up with the latest professional information available for your rating. Current information is available from the Enlisted Performance Qualifications revision 03-2009.

Course Content

This course content is based on the requirements stated in the Enlisted Performance Qualifications revision 03-2009.

Record of Changes

From time to time courses, after they are printed, have minor editorial changes made to them by the Subject Matter Specialist that do not require a new course. The student is responsible for any changes made to the course after printing and receipt from the Coast Guard Institute. The Coast Guard Institute will post on their web site a listing of current changes based on the course code and edition that should be downloaded in a **.pdf** format and entered in the current course material. The Coast Guard Institute will send an errata sheet out with each ordered course that list the required changes.

Pamphlet Content

This pamphlet contains six lessons:

Lesson 1: How to Develop a unit PMS schedule for electronic equipment

Lesson 2: How to Audit Safety Lock-Out/Tag-Out Log

Lesson 3: How to Audit spare parts and modules inventory

Lesson 4: How to Return Depot Level Repairable (DLR) carcasses

Lesson 5: How to Inspect electronic systems for Electro-Magnetic Interference (EMI) hazards

Lesson 6: How to Implement the installation of an electronics system

Lesson 7: How to Verify the installation of a field change/ORDALT

Notice to Students

Learning Objectives

Read the learning objectives before you begin reading the text. The objectives will guide you through the text and help you answer the questions in the self quiz at the end of each lesson.

Quizzes

Each lesson has a self-quiz and each pamphlet has a pamphlet review quiz. You will find the answers to each quiz on the pages following the quiz. Included are the reference pages for the answers.

These self-quizzes are meant to check your comprehension of the material you covered. If you are having problems understanding a section, go through it again or ask someone for help. The pamphlet review quiz questions are samples of the type of questions you will find on the end-of-course-test (EOCT).

SWE Study Suggestion

Servicewide exam questions for your rate and pay grade are based on the Professional and Military Requirements sections of the Enlisted Performance Qualifications revision 03-2009.

If you use the references from this text and consult the Enlisted Performance Qualifications, you should have good information for review when you prepare for your servicewide exam (SWE).

Lesson 1

HOW TO DEVELOP A UNIT PMS SCHEDULE

Overview

Introduction

This lesson contains information on how to develop a unit PMS schedule and covers the following topics:

- How to locate CGPMS
- How to develop a PMS schedule using the Asset Logistics Management Information System (ALMIS)
- How to develop Locally Planned Maintenance System (LPMS)

Objectives

Given a job aid, and CGPMS user's guide, **DEVELOP** a unit PMS schedule for electronic equipment in accordance with:

- Navy PMS procedures
- Local PMS procedures
- ALMIS

References

The following references were used for this lesson:

- Electronics Manual, COMDTINST M10550.25 (series)
- Ordnance Manual, COMDTINST 8000.2 (series)
- Ship's Maintenance and Material Management Manual (3M), OPNAVINST 4790.4 (series)
- CGPMS users guide

CGPMS Policies, Roles and Responsibilities

Introduction

This topic contains information on the Coast Guard Planned Maintenance System (CGPMS), including:

- CGPMS policy
- CGPMS objectives
- Unit responsibilities
- Other CGPMS roles and responsibilities

CGPMS Policies

Significant reductions in corrective maintenance have been obtained at units using the CGPMS policies listed below:

- CGPMS procedures and materials are mandatory at all Coast Guard units
- All other forms of planned maintenance systems (PMS) are not authorized when CGPMS is available
- When CGPMS is not available, Navy Planned Maintenance Systems (NPMS) are performed, if applicable
- Units will develop and use Locally Planned Maintenance Systems (LPMS) only if CGPMS and NPMS are not available
- Local recording of CGPMS actions is required, either by entering the information in ALMIS (when installed) or by using the CGPMS forms when ALMIS is not available

***Reference**: For more information about the requirements of using CGPMS materials, refer to the CGPMS User Guide, which is available through the SFLC Web site.*

Continued on next page

CGPMS Policies, Roles and Responsibilities (Continued)

Objectives

The objectives of using CGPMS are listed below:

- Provide a standardized planned maintenance program for electronic equipment within the Coast Guard
- Provide the necessary and required tools to plan, schedule, and perform effective planned/preventive maintenance
- Serve as a training tool for inexperienced technicians to familiarize them with new equipment
- Provide maintenance hours data that may be used to model staffing standards for Coast Guard units

Unit Respon-sibilities

The responsibilities of unit personnel for implementing the CGPMS are described in the table below:

Responsibility	Description
Unit CO or OinC	• Integrates CGPMS procedures into the unit's work schedule and ensures compliance • Requests required waivers of compliance from proper authority • Provides qualified personnel to perform CGPMS and submits Feedback Reports (FBRs) • Ensures appropriate support facility maintains unit PMS if an ET is not assigned

Continued on next page

CGPMS Policies, Roles and Responsibilities (Continued)

Responsibilities (Cont'd)

Responsibility	Description
Senior Technician (the senior technical supervisor, military or civilian, at the electronics facility)	• Schedules and performs planned maintenance • Incorporates CGPMS into the unit's training schedule • Initiates requests for CGPMS revisions using FBRs • Maintains a current CGPMS Library • Ensures Equipment History Forms are complete and current • If the unit does not have Electronics Material Officer (EMO), assumes the appropriate duties of the EMO
Electronics Maintenance Officer (EMO)	Ensures compliance with the CGPMS requirements in the division by: • Maintaining the CGPMS Work Schedule Books (WSBs) • Reviewing and inspecting CGPMS work schedules to ensure they are current and complete • Reviewing FBRs • Ensuring CGPMS is in the unit's training schedule ***Note:*** *EMO also briefs the CO or OinC on the status of unit's CGPMS.*

CGPMS Documents and Forms

WSB

The unit's Work Schedule Books (WSB) contains all the CGPMS documents. Each document is described in the table below:

Document	Description
CGPMS user's guide	A detailed explanation of the various components of CGPMS, and how they are used. ***Note:*** The User Guide is updated on an as needed basis and can be ordered from the SFLC by Feedback Report (FBR), or memo.
Maintenance Procedure Card (MPC)	Step-by-step maintenance actions to be performed on an electronic equipment or system.
Index of Maintenance Procedures (IMP)	An index of all applicable MPCs for a given piece of equipment or system.
List of Effective IMPs	• A list of all CGPMS materials for electronic equipment installed at or supported by the unit • Total annual maintenance hours for all the listed equipment
Master Index	This index contains the following information: • All available CGPMS procedures • Navy Maintenance Index of Procedures (MIP) for Navy equipment used by the Coast Guard See 7.2.3 in the Electronics Manual for more detail on ordering NPMS materials.

Navy Planned Maintenance System (NPMS)

Introduction

This topic contains information on the Navy Planned Maintenance System (NPMS), including:

- When to use the NPMS
- How to order NPMS
- How to request inclusion on to the NPMS distribution list

When to use NPMS

The Navy develops and provides Planned Maintenance System (PMS) procedures for Navy electronic equipment. Coast Guard units are expected to use the Navy Planned Maintenance System (NPMS) for Navy-owned or Navy-type equipment, for which CGPMS procedures do not exist.

Tracking and Reporting

Units shall be responsible for tracking, updating, and maintaining planned maintenance in ALMIS.

Inclusion to NPMS

For inclusion into NPMS, a letter or OPNAV 4790 C/K should be sent Commanding Officer, NAVSEA, Code 914.

For more information on inclusion to NPMS refer to the Electronics Manual, COMDTINST M10550.25 (series) section 7.2.3.3.

Locally Planned Maintenance System (LPMS)

Introduction

This topic contains information on Locally Planned Maintenance Systems (LPMS), including:

- When to use LPMS
- Guidelines for creating LPMS materials
- How to report LPMS to the Coast Guard Planned Maintenance System (CGPMS) Manager

When to use LPMS

A unit may develop and use a Locally Planned Maintenance System (LPMS) whenever the Coast Guard Planned Maintenance Systems (CGPMS) or Navy Planned Maintenance Systems (NPMS) are not available for an equipment or system they support.

The equipment's System Maintenance and Engineering Facility (SMEF) has the authority to approve a LPMS.

Guidelines

The SMEF must use the guidelines below to create LPMS documentation when needed:

- Format an LPMS as a CGPMS using a standard CGPMS Maintenance Procedure Card (MPC)
- Use the following forms for LPMS documentation:
  - Monthly and Annual Schedules, CG-5452/CG-5453
  - Equipment History Forms, CG-5454

LPMS Tracking and Reporting

The unit PMS manager, or designee, must send a notification letter with all LPMS documentation to the CGPMS Manager for review and possible inclusion into CGPMS. Planned maintenance must be tracked, updated and maintained using ALMIS.

Generate MDL

Introduction

This section contains information on the Asset Logistics Management Information System (ALMIS), including:

- The purpose of ALMIS
- How to generate an Asset Due Maintenance List in ALMIS
- How and when to complete an Asset Computerized Maintenance System (ACMS) MPC cover sheet
- How to us the text card
- How to use a remove and install card and complete an REM/INST cover sheet
- When to submit an Aeronautical Publication Change Recommendation Form

Purpose

The ALMIS program is designed to support modernized assets under the Coast Guard's new business model b y providing the following:

- Maintenance Management
- Total Asset Status Visibility
- Supply
- Technical Information Management
- Configuration Management

Continued on next page

Generate MDL (Continued)

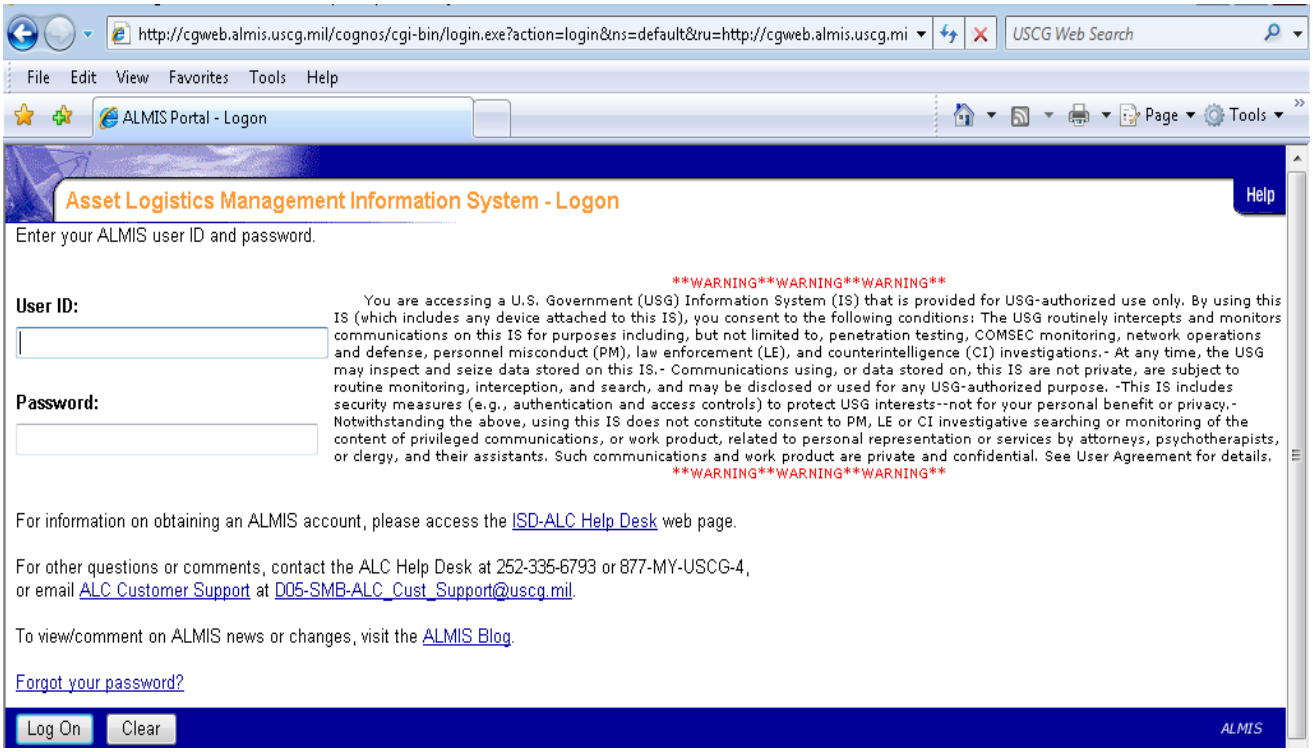
MDL Procedures

Once enrolled into ALMIS, an asset's preventive maintenance is automatically scheduled by the software. This schedule is known as an Asset Maintenance Due List Calendar or MDL. The following steps will demonstrate the procedure for generating an asset's MDL from within ALMIS:

Step 1: Log-in to ALMIS at the following link:

http://cgweb.almis.uscg.mil

Note: *You must have an ALMIS account established in order to log-in.*



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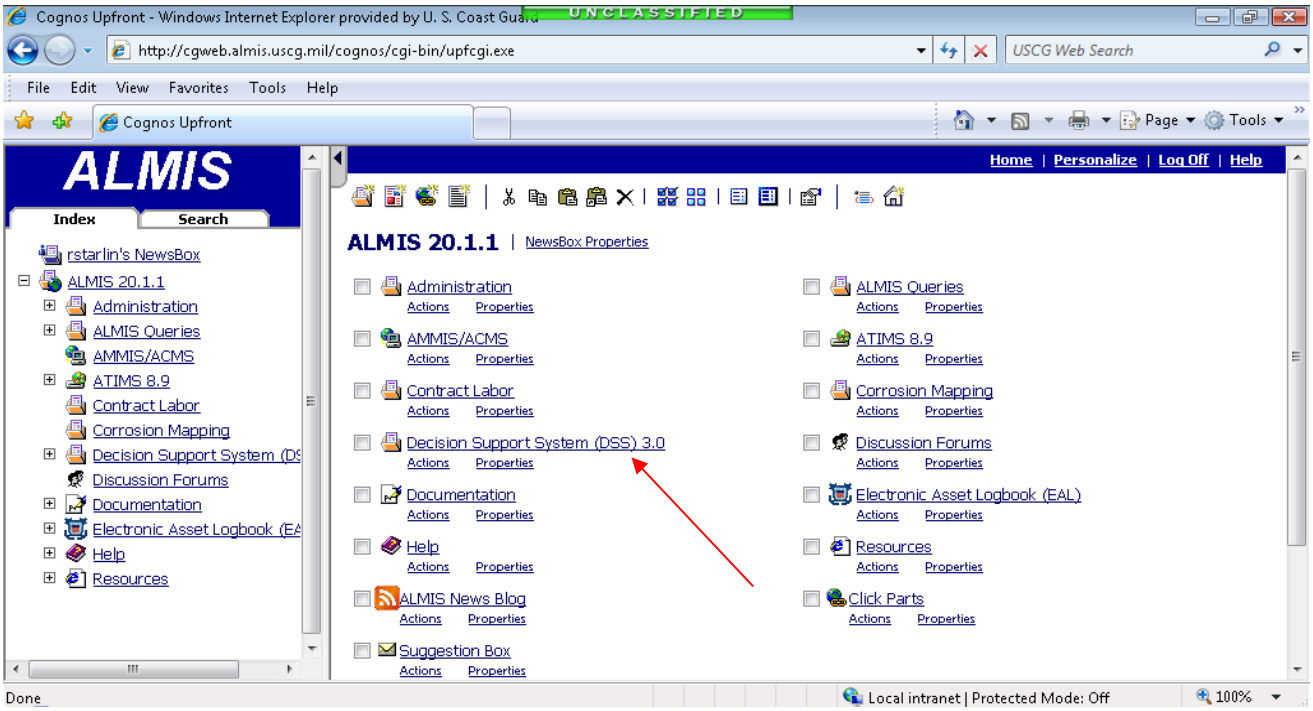
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 2: Click **"Decision Support System"**



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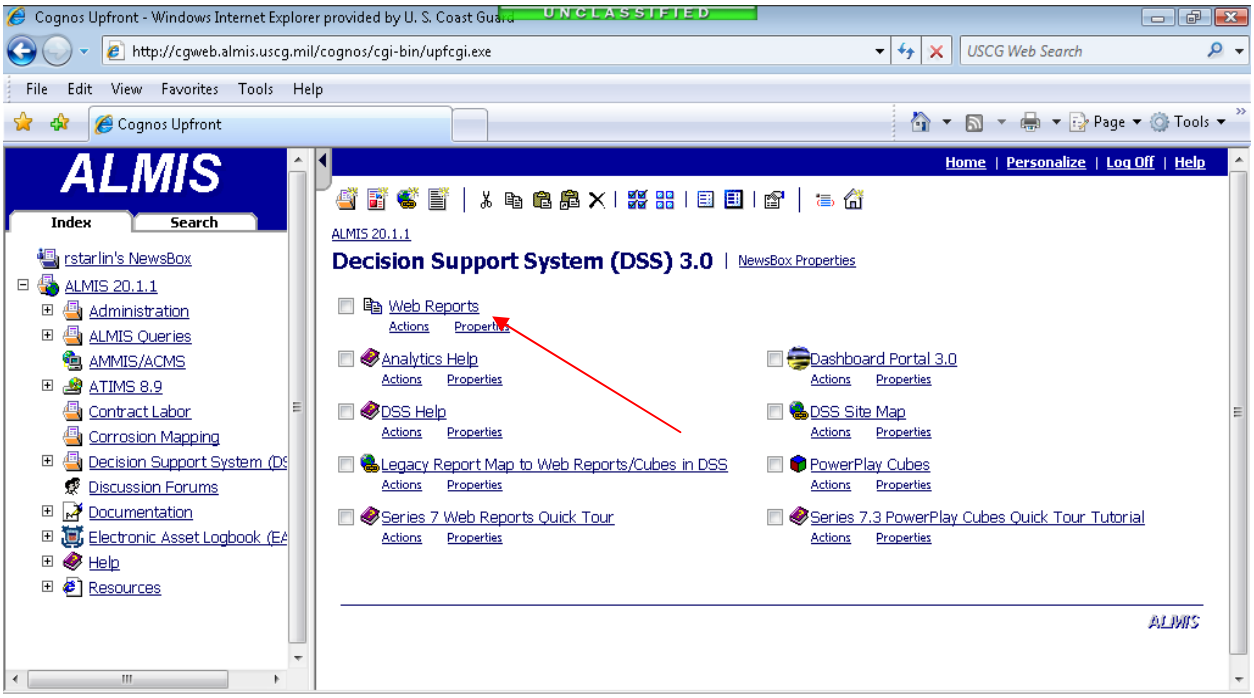
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 3: Click **"Web Reports"**



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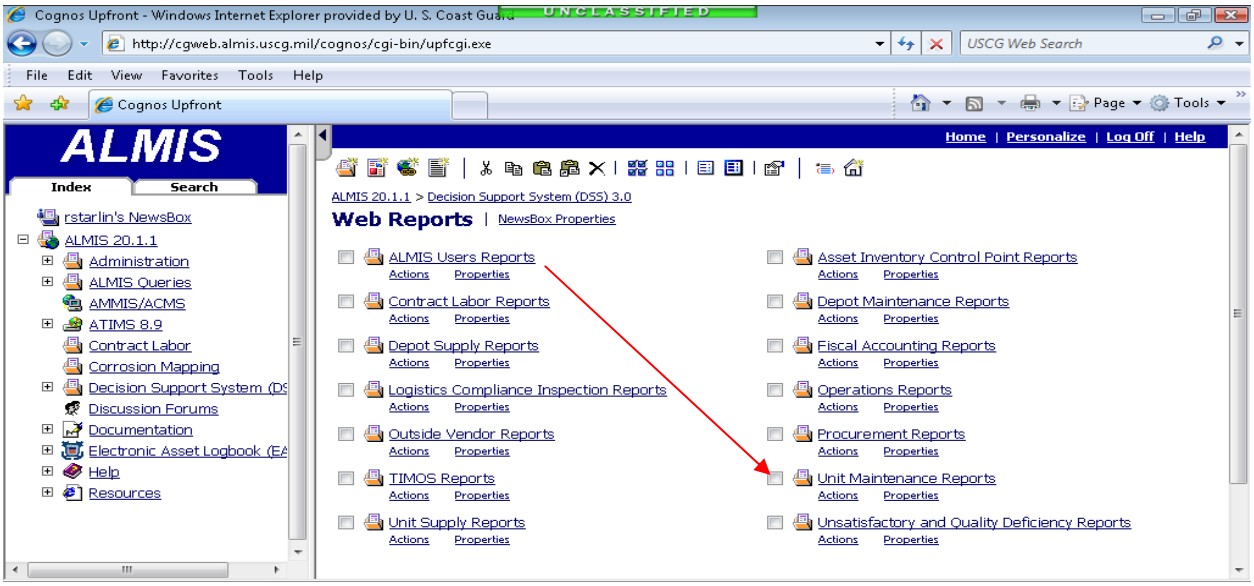
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 4: Click **"Unit Maintenance Reports"**



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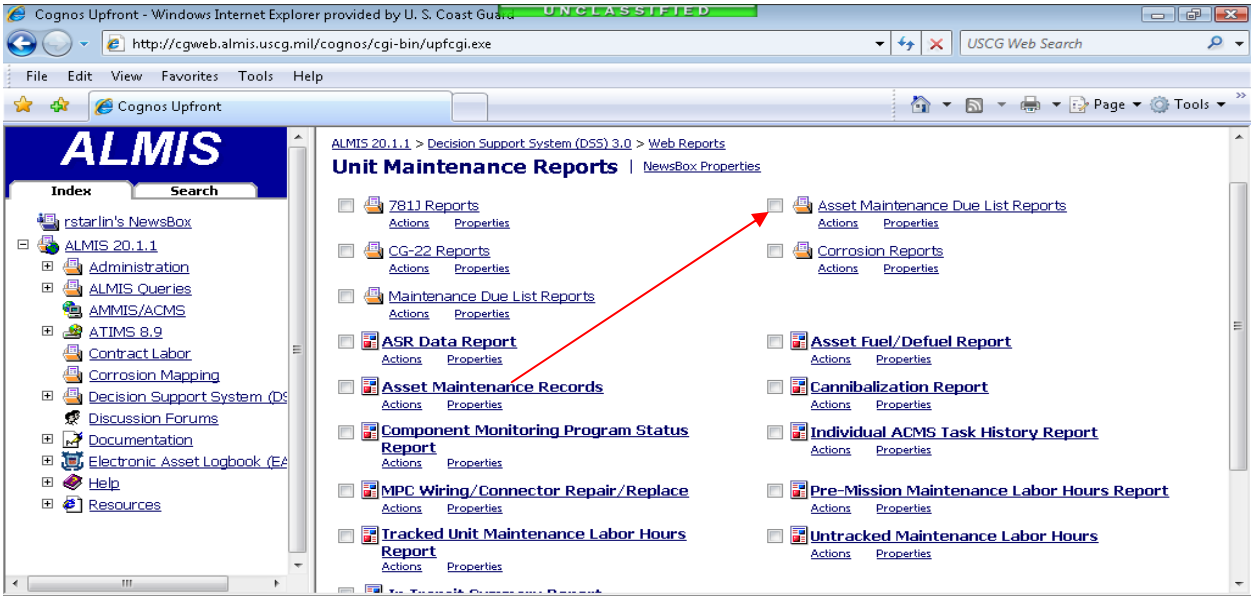
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 5: Click **"Asset Maintenance Due List Reports"**



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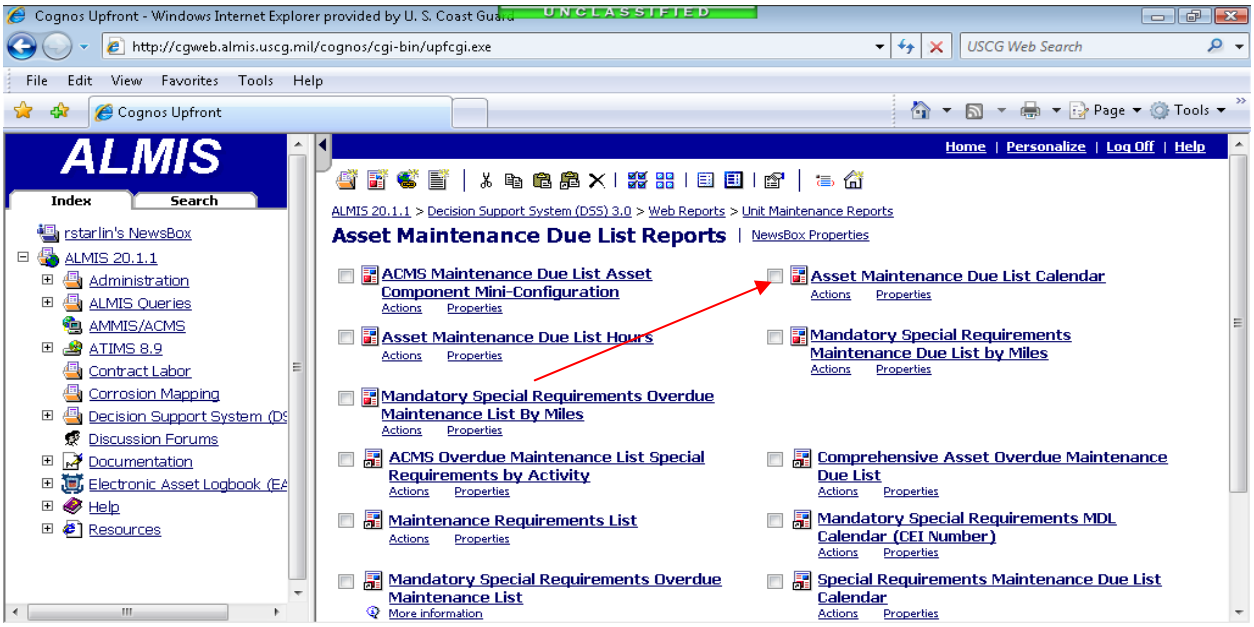
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 6: Click **"Asset Maintenance Due List Calendar"**



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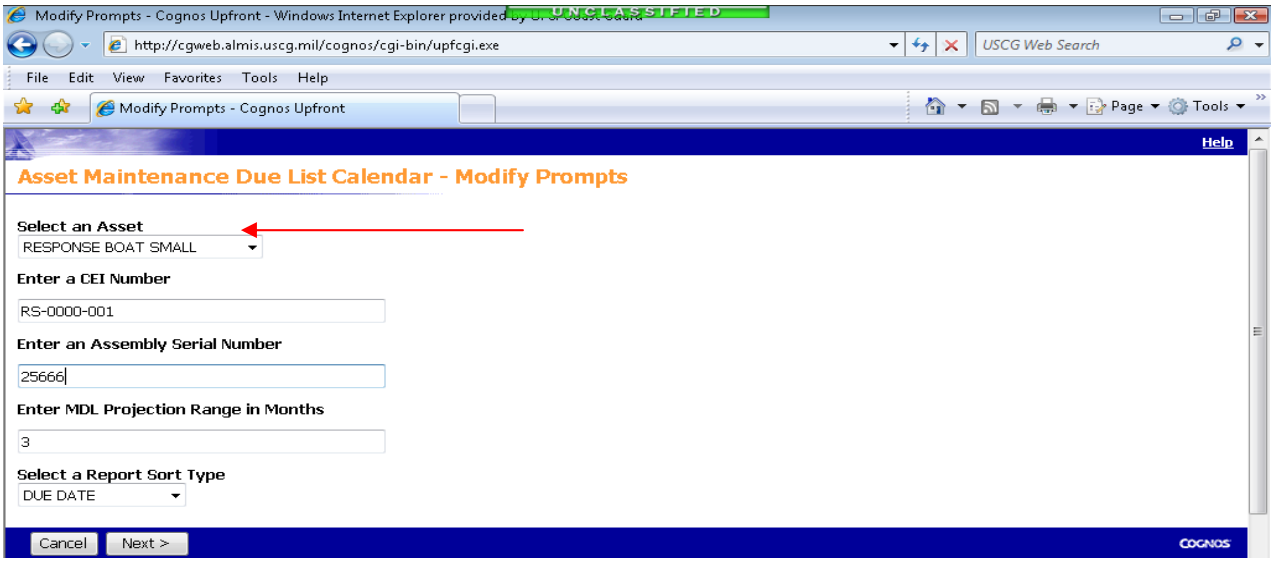
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 7: **Select an Asset Type** from the Drop Down List



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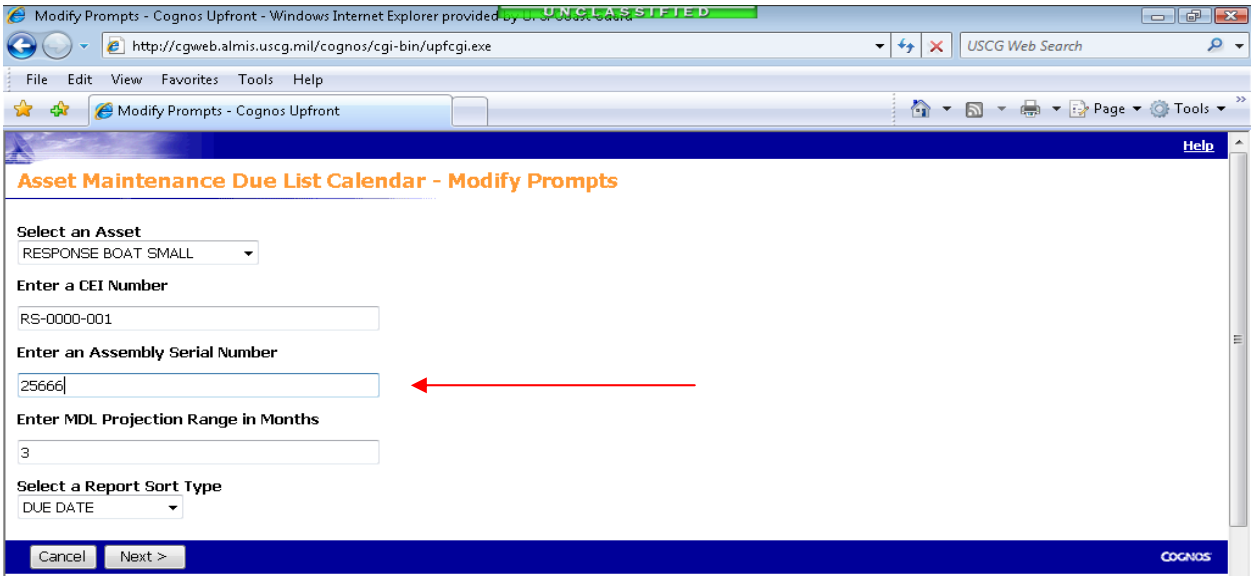
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 8: Enter the **Hull Number** of the specified Asset:



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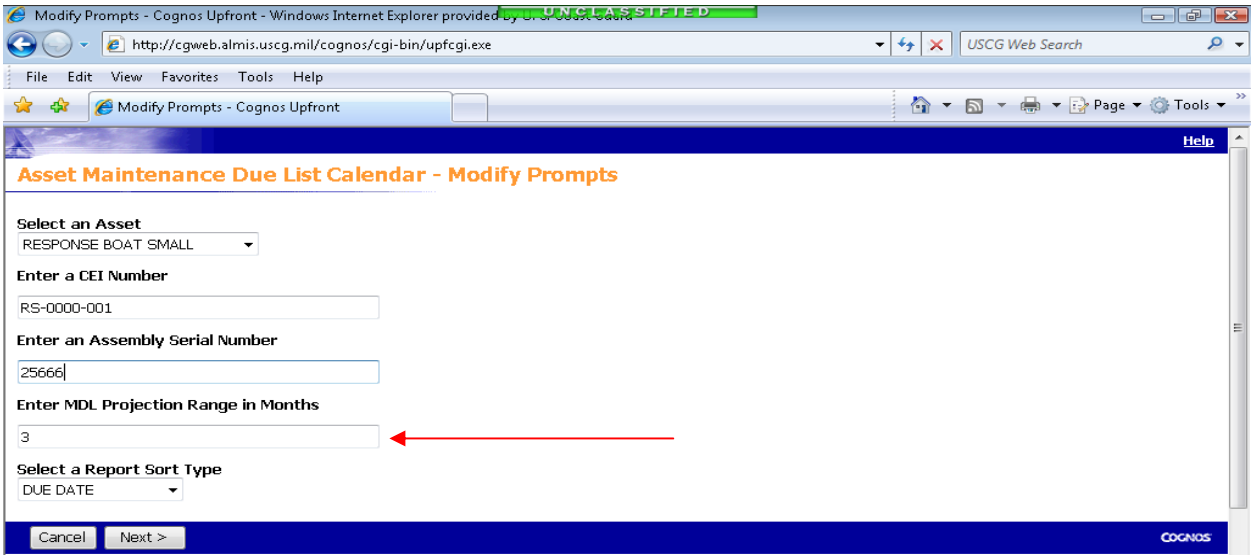
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 9: Enter the **Projection Range** for the MDL (Normally 3 months)



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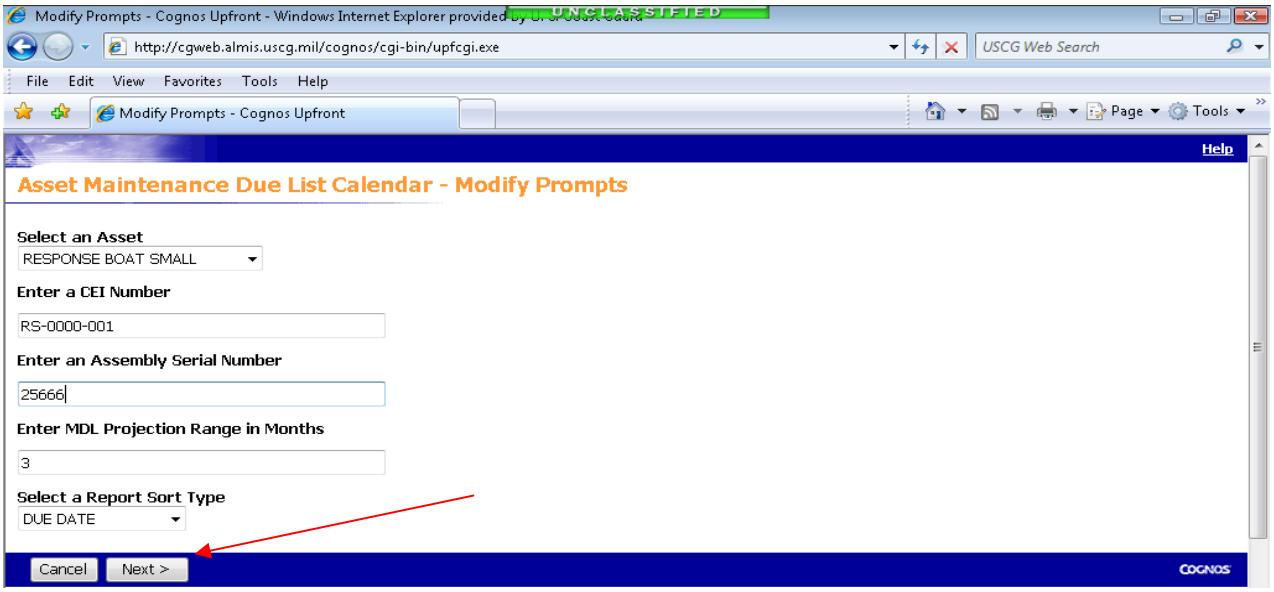
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 10: Click **"Next"**



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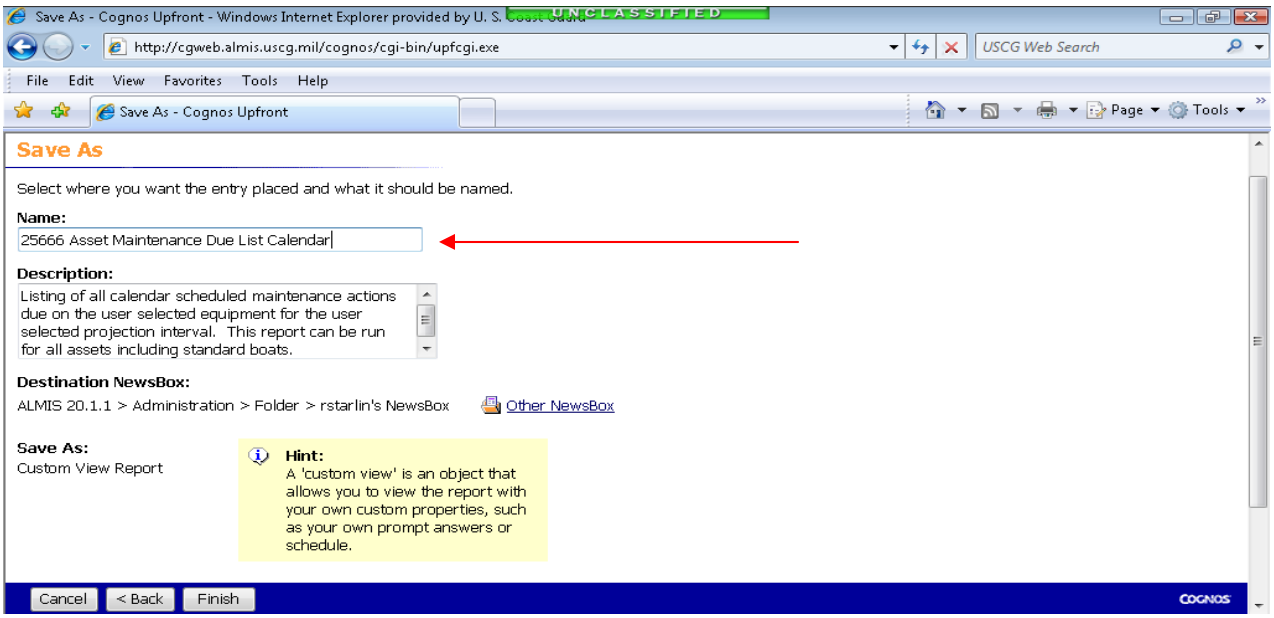
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 11: **Enter a name** for the MDL



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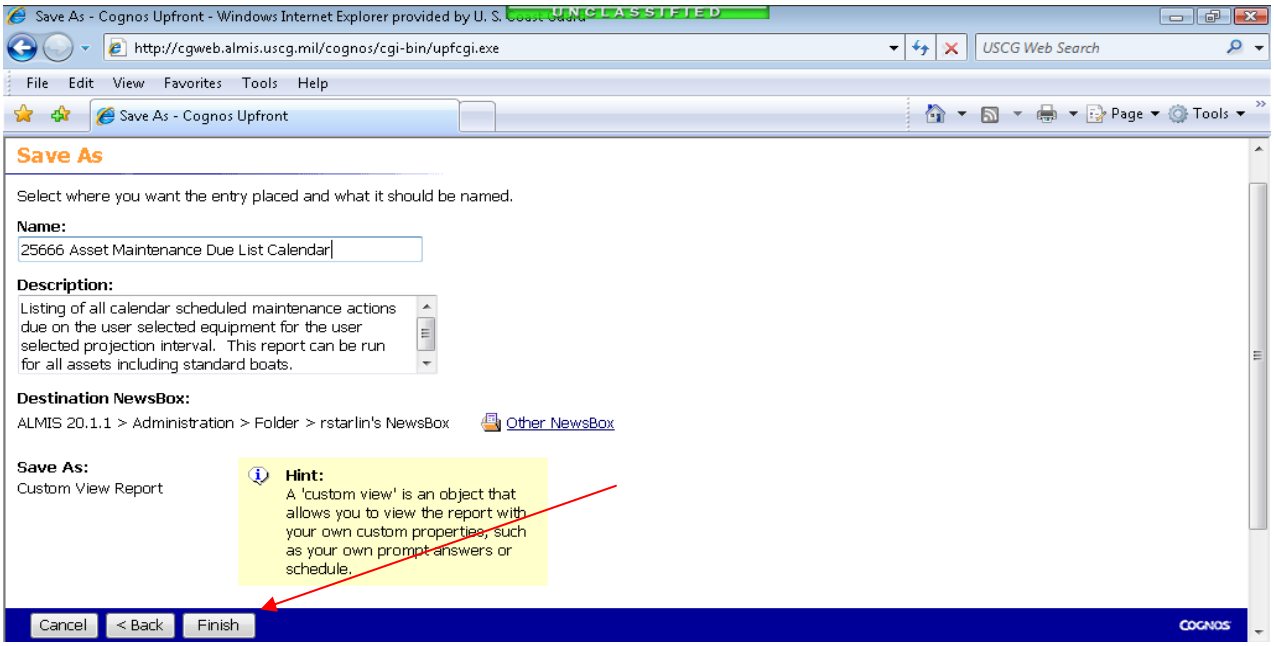
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 12: Click **"Finish"**



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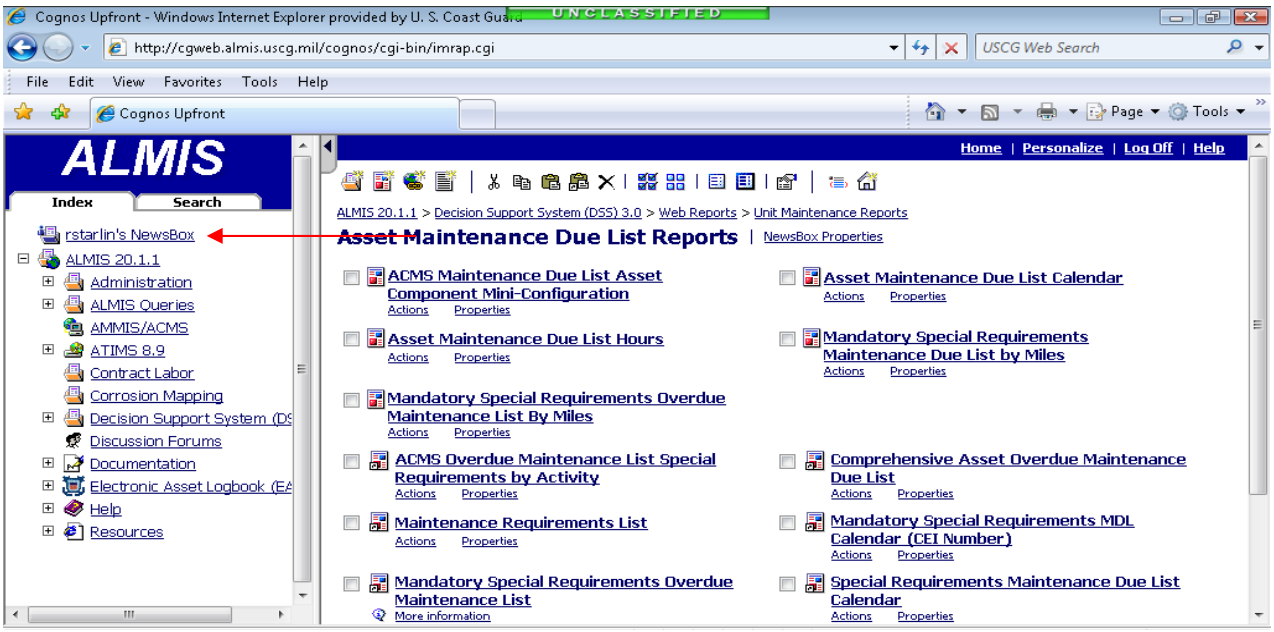
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 13: You will be returned to the **"Asset Maintenance Due List Reports"** screen. Click your **"NewsBox"**



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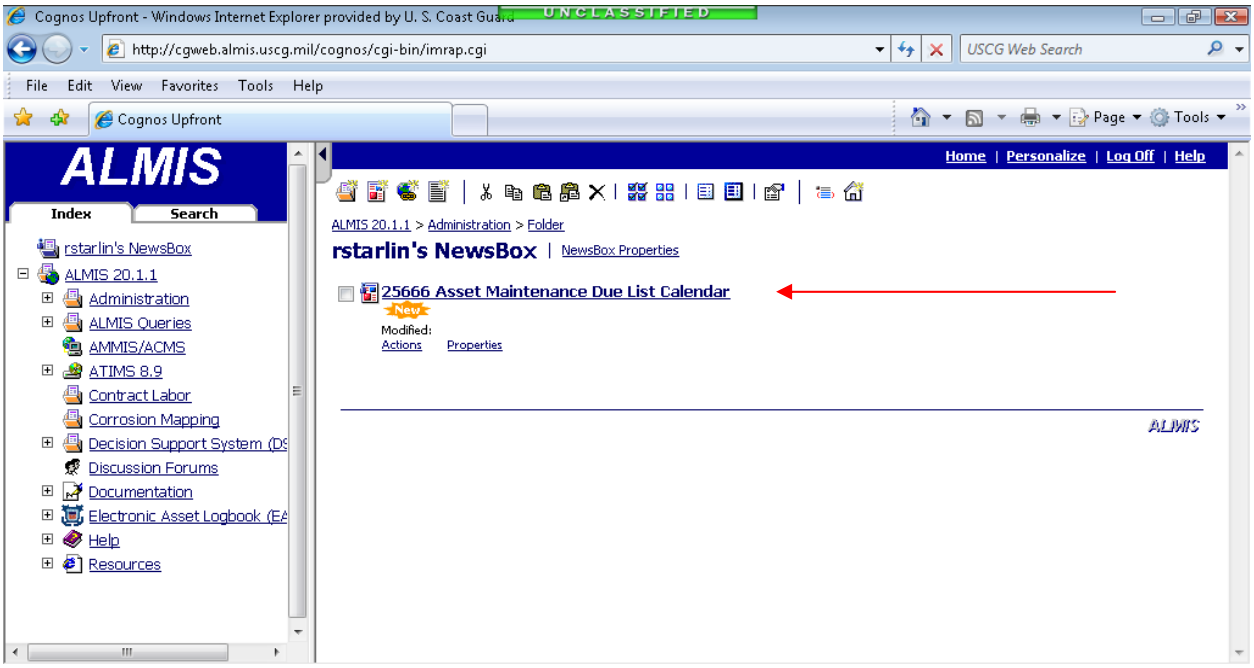
Generate MDL (Continued)

MDL Procedures (Cont'd)

Step 14: Click on the **MDL** you named in Step 11



Note: *Your MDL will be displayed in PDF Format. At this point, you can print the MDL and/or save it to the location of your choice.*

Generate MDL (Continued)

MDL Example Examples of an MDL are depicted on the next two pages:

ASSET MAINTENANCE DUE LIST CALENDAR

CEI Number: RS-0000-001
Months Projected: 3
Sort Prompt: DUE DATE

Description	Assembly Serial No.	Operating Activity	Last Unsuspened	Project Thru
RESPONSE BOAT SMALL	25666	STA OAK ISLAND		2010-04-04

Date/Time of Report: 01/04/2010 06:45 PM

CMSCODE	MPCNO	ACTION CODE	DESCRIPTION	SERIAL NUMBER	BAR CODE	POS	MECH TYPE	EST MHR	REQ'D MOS	INT EXT	EVERY HRS	LAST MAINT DATE	NEXT DUE DATE	DO NOT EXCEED	DUE HOURS
TQ0001	TQ0000.1	REPLACE	CREW SEATS	25666			MK	8.5	0	48	0	2009-07-29	2009-08-05	2013-08-04	0
TB5001	TB5000.1	MODIFY	ANCHOR LIGHT MAST	25666			MK	12.0	0	48	0	2009-07-30	2009-08-06	2013-08-05	0
TF2000	TF2000.0	MODIFY	AUTOMATIC IDENTIFICATION	25666			ET	1.0	0	48	0	2009-10-27	2009-11-03	2013-11-02	0
TB1020	TB1020.0	MODIFY	SAMPSON POST	25666			MK	6.5	0	6	0	2009-10-28	2009-11-04	2010-05-05	0
F12004	F12004.0	CHECK	MAGNETIC COMPASS DEVIATIO	25666			BM	1.0	12	1	0	2008-11-13	2009-11-13	2009-12-13	0
TF2000	TF2000.0	MODIFY	TCTO TF2000; AIS-MKD(0614	000488794	081138		ET	0.5	0	12	0	2009-11-10	2009-11-17	2010-11-17	0
B11001	B11001.0	INSPECT	TOW REEL BITTS TAFF RAIL	25666			BM	1.0	1	0	0	2009-11-02	2009-12-02	2009-12-09	0
H00001	H00001.0	INSPECT	STEERING SYSTEM	25666			MK	1.0	1	0	0	2009-11-19	2009-12-19	2010-01-03	0
J31002	J31002.0	INSPECT	HEATER	25666			FN	1.0	1	0	0	2009-11-19	2009-12-19	2009-12-26	0
Q00001	Q00001.0	INSPECT	CABIN SEAT	25666			MK	1.0	1	0	0	2009-11-19	2009-12-19	2009-12-26	0
052000	S0MRPT.0	REPORT	MONTHLY OPERATING STATUS	25666			MK	0.5	1	0	0	2009-11-30	2009-12-30	2010-01-06	0
B11011	B11011.0	SERVICE	RADAR POD AND LOCK DOORS	25666			MK	0.5	1	0	0	2009-11-30	2009-12-30	2010-01-06	0
P00030	P00030.0	CHECK	CDYZ-ACR/RLB-35 EPIRB 406	25666			SN	1.0	1	0	0	2009-12-02	2010-01-01	2010-01-04	0
M27500	M27500.0	INSP/CLN	CABIN DE-WATERING PUMP	25666			MK	1.0	6	1	0	2009-07-05	2010-01-03	2010-02-02	0
KB0021	KB0020.0	INSP/CHK	RING BUOY,THROWBAG,MARKER	25666			BM	2.0	5	1	0	2009-08-06	2010-01-05	2010-02-04	0
B40080	B40080.0	INSP/CLN	DOORS AND WINDOWS	25666			BM	2.0	1	0	0	2009-12-07	2010-01-06	2010-01-13	0
H00001	H00001.0	INSPECT	STEERING SYSTEM	25666			MK	1.0	1	0	0	2009-11-19	2010-01-18	2010-02-02	0
J31002	J31002.0	INSPECT	HEATER	25666			FN	1.0	1	0	0	2009-11-19	2010-01-18	2010-01-25	0
N00005	N00005.0	INSPECT	EMERGENCY EGRESS LIGHTING	25666			BM	0.5	3	1	0	2009-10-19	2010-01-18	2010-02-17	0
Q00001	Q00001.0	INSPECT	CABIN SEAT	25666			MK	1.0	1	0	0	2009-11-19	2010-01-18	2010-01-25	0
B11011	B11011.0	SERVICE	RADAR POD AND LOCK DOORS	25666			MK	0.5	1	0	0	2009-11-30	2010-01-29	2010-02-05	0
P00030	P00030.0	CHECK	CDYZ-ACR/RLB-35 EPIRB 406	25666			SN	1.0	1	0	0	2009-12-02	2010-01-31	2010-02-03	0
052000	S0MRPT.0	REPORT	MONTHLY OPERATING STATUS	25666			MK	0.5	1	0	0	2009-11-30	2010-02-01	2010-02-08	0
B11001	B11001.0	INSPECT	TOW REEL BITTS TAFF RAIL	25666			BM	1.0	1	0	0	2009-11-02	2010-02-01	2010-02-08	0
KA0001	KA0001.0	INSPECT	2.5 POUND FIRE EXTINGUISH	25666			MK	1.0	3	0	0	2009-11-02	2010-02-01	2010-02-10	0
KA0002	KA0001.0	INSPECT	2.5 POUND FIRE EXTINGUISH	25666			MK	1.0	3	0	0	2009-11-02	2010-02-01	2010-02-10	0
B40080	B40080.0	INSP/CLN	DOORS AND WINDOWS	25666			BM	2.0	1	0	0	2009-12-07	2010-02-05	2010-02-12	0
B10001	B10001.0	INSPECT	HULL VOIDS	25666			MK	1.0	3	1	0	2009-11-19	2010-02-18	2010-03-20	0
H00001	H00001.0	INSPECT	STEERING SYSTEM	25666			MK	1.0	1	0	0	2009-11-19	2010-02-18	2010-03-05	0
J31002	J31002.0	INSPECT	HEATER	25666			FN	1.0	1	0	0	2009-11-19	2010-02-18	2010-02-25	0

Indicates a component with a questionable part number. The part number of this component should be verified at the next scheduled maintenance of this part. Contact the ACMS contractor to update the component's part number.

Page 1 of 2

Continued on next page

Generate MDL (Continued)

MDL Example (Cont'd)

Now that the MDL has been generated, you can access an individual Maintenance Procedure by clicking on the MPCNO:

ASSET MAINTENANCE DUE LIST
CALENDAR

CEI Number: RS-0000-001
Months Projected: 3
Sort Prompt: DUE DATE
Assembly Serial Number: 25666

Date/Time of Report: 01/04/2010 06:45 PM

CMSCODE	MPCNO	ACTION CODE	DESCRIPTION	SERIAL NUMBER	BAR CODE	POS	MECH TYPE	EST MHR	REQ'D MOS	INT EXT	EVERY HRS	LAST MAINT DATE	NEXT DUE DATE	DO NOT EXCEED	DUE HOURS
Q00001	Q00001.0	INSPECT	CABIN SEAT	25666			MK	1.0	1	0	0	2009-11-19	2010-02-18	2010-02-25	0
052000	SOMR PT.0	REPORT	MONTHLY OPERATING STATUS	25666			MK	0.5	1	0	0	2009-11-30	2010-03-01	2010-03-08	0
B11011	B11011.0	SERVICE	RADAR POD AND LOCK DOORS	25666			MK	0.5	1	0	0	2009-11-30	2010-03-01	2010-03-08	0
B11001	B11001.0	INSPECT	TOW REEL BITTS TAFF RAIL	25666			BM	1.0	1	0	0	2009-11-02	2010-03-03	2010-03-10	0
P00030	P00030.0	CHECK	CDYZ-ACR/RLB-35 EPIRB 406	25666			SN	1.0	1	0	0	2009-12-02	2010-03-03	2010-03-06	0
B40080	B40080.0	INSP/CLN	DOORS AND WINDOWS	25666			BM	2.0	1	0	0	2009-12-07	2010-03-08	2010-03-15	0
E21003	E21001.1	TEST	CEMT-396-1, ANTENNA	25666			ET	1.0	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
E21005	E21000.0	INSPECT	BA-1012-2(71628) ANTENNA	25666			ET	1.0	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
E21030	E21000.0	TEST	BA-1012-2(71628) ANTENNA	25666			ET	0.5	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
E21032	E21032.0	INSPECT	MORAD-VHF-159 HD ANTENNA	25666			ET	0.5	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
E21033	E21032.0	TEST	MORAD-VHF-159 HD ANTENNA	25666			ET	0.5	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
E25001	E25000.0	TEST	CGG-T04KH9PW9AN XCVR	25666			ET	1.0	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
E25006	E25001.0	TEST	CRP-RAY-215 TRANSCEIVER V	25666			ET	0.8	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
F15001	F15000.0	INSPECT	235DT-PSE (1EE70) TRANSDU	25666			ET	0.8	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
F21002	F21002.0	INSPECT	GPA019 (1EE70) GPS/DGPS A	25666			ET	1.5	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
F21008	F21006.1	INSPECT	AIS GPS ANTENNA	25666			ET	0.5	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
F23005	F23001.0	INSPECT	RD-30 (1EE70) MULTI-DISPL	25666			ET	0.5	3	1	0	2009-12-07	2010-03-08	2010-04-07	0
H00001	H00001.0	INSPECT	STEERING SYSTEM	25666			MK	1.0	1	0	0	2009-11-19	2010-03-20	2010-04-04	0
J31002	J31002.0	INSPECT	HEATER	25666			FN	1.0	1	0	0	2009-11-19	2010-03-20	2010-03-27	0
Q00001	Q00001.0	INSPECT	CABIN SEAT	25666			MK	1.0	1	0	0	2009-11-19	2010-03-20	2010-03-27	0
B11011	B11011.0	SERVICE	RADAR POD AND LOCK DOORS	25666			MK	0.5	1	0	0	2009-11-30	2010-03-31	2010-04-07	0
052000	SOMR PT.0	REPORT	MONTHLY OPERATING STATUS	25666			MK	0.5	1	0	0	2009-11-30	2010-04-01	2010-04-08	0
P00030	P00030.0	CHECK	CDYZ-ACR/RLB-35 EPIRB 406	25666			SN	1.0	1	0	0	2009-12-02	2010-04-02	2010-04-05	0
B11001	B11001.0	INSPECT	TOW REEL BITTS TAFF RAIL	25666			BM	1.0	1	0	0	2009-11-02	2010-04-03	2010-04-10	0

Number of CMSCODEs: 54 MHR Grand Total: 74.50

Indicates a component with a questionable part number. The part number of this component should be verified at the next scheduled maintenance of this part. Contact the ACMS contractor to update the component's part number.

Page 2 of 2

Asset Computerized Maintenance System (ACMS)

ACMS

The Asset Computerized Maintenance System (ACMS) is a module in ALMIS used to track maintenance.

Mandatory Information for ACMS

The table below provides a description of each block, along with the information required to complete the ACMS MPC cover sheet:

Block	Information
Asset Number	Hull Number of the platform the technician is performing maintenance on.
Operating Activity	Name of the unit the asset belongs to. Example: Station Oak Island.
Maintenance Accomplished	Date the maintenance is completed.
Asset Hours	Total asset hours. Can be found in the Electronic Asset Logbook portion of ALMIS: • MUST BE TOTAL ASSET HOURS.
Maintenance Due	Actual date the maintenance was due.
Zulu Date	ZULU date on which the maintenance was completed.
Zulu Time	Exact ZULU time that the maintenance was completed.
Scheduled	Check this box if the maintenance was scheduled.
Unscheduled	Check this box if the maintenance was unscheduled.
Discrepancies Found	List any discrepancies found during the performance of maintenance.
Man Hours	Technician records time spent performing this procedure. Hours should be rounded to the nearest tenth.

ACMS (Asset Computerized Maintenance System (ACMS) (Cont'd)

Mandatory Info for AMCS (Cont'd)

The table below is a continuation of the table on the previous page:

Block	Information
Remarks	Any discrepancies should be noted here.
Technician's Signature	Technician should sign and print last name.
Technician's ID	Technician should record last 4 digits of SSN.
QA Blocks	If any Quality Assurance checks are required, the technician performing the QA will initial here.
Reviewed By	The Maintenance Supervisor signs here after reviewing the coversheet for accuracy.

Maintenance Procedure Cards (MPCs)

AMCS MPC Card

Below is an example of an MPC card that you will see in AMCS:

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.0
REV'D 02/20/09

ASSET NUMBER	OPERATING ACTIVITY	MAINTENANCE ACCOMPLISHED DATE MO	DAY	YEAR	ASSET HOURS	MAINTENANCE DUE DATE MO	DAY	YEAR	ASSET HOURS
		ZULU DATE MO	DAY	YEAR	ZULU TIME				

ITEM 1 ☐DUE	CMS CODE	ACTION	DESCRIPTION	CEINUM
	E25001	TEST	CGG-T04KKH9PW9AN, XCVR	RS-B000-001

☐ SCHEDULED ☐ UNSCHEDULED

DISCREPANCIES FOUND: NO____ YES____

MAN HOURS: MK___.___ DC___.___ EM___.___ **ET**___.___ IT___.___ GM___.___ BM___.___ FN___.___ SN___.___ OTHER___.___

REMARKS: _____

TECHNICIAN'S SIGNATURE_____ TECHNICIAN'S ID_____

* ASTERISK INDICATES QA REQUIRED	QA									

REFERENCES:
NONE

REVIEWED BY	LOG YN	DATA ENTRY COMPLETED

Page 1 of 8

Text Cards

Text Card Example

While working with the MPC, the technician may be referred to a **TEXT CARD** during the performance of the maintenance. A text card does not require the completion of a cover sheet. A text card provides the necessary steps to perform required procedures such as aligning a transceiver or loading a code plug. An example of a text card can be found on the following pages:

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.5
REV'D 05/23/08

THIS CARD IS MAINTAINED TO PROVIDE PROCEDURAL TEXT ONLY AND IS NOT REPORTED TO ACMS

CEINUM RS-B000-001

1 CGG-T04KKH9PW9AN TRANSCEIVER ALIGN

REFERENCES:
MPC E25000.2

TOOLS/TEST EQUIPMENT:
Cable, Test, RG58/U, BNC-BNC, P/N: BNCB60, CAGE: 05276, NIIN: 009335782
Communications Analyzer, SCAT: 4345
Computer Interface Cable, RIB, 9 pin serial, P/N: 30-80369B72, CAGE: 78205, NIIN: 013356595
Computer Interface Cable, RIB, 25 pin serial, P/N: 30-80369B71, CAGE: 78205, NIIN: 012708964
Computer Interface Cable, SRIB, 9 pin serial, P/N: 30-80390B48, CAGE: 78205, NIIN: 014497927
Computer Interface Cable, SRIB, 25 pin serial, P/N: 30-80390B49, CAGE: 78205, NIIN: 014850359
Computer, Laptop, PC Compatible with serial port
N (P) to BNC (J) Adaptor, P/N: UG146U, CAGE: 80058, NIIN: 005055142
Programming Cable, P/N: 30-80369B73, CAGE: 78205, NIIN: 013755247
Radio Interface Box (RIB), P/N: RLN-4008B, CAGE: 50012, NIIN: 012708980
Radio System Software, P/N: CVN6085 or RVN-4100
Smart Radio Interface Box (SRIB), P/N: RLN-1015A, CAGE: 50012

EXPENDABLES:
NONE

CONSUMABLES:
NONE

A PRELIMINARY STEPS

WARNING

OBSERVE SAFETY PRECAUTIONS WHEN WORKING WITH ELECTRICAL AND ELECTRONIC EQUIPMENT. FAILURE TO ADHERE TO THIS WARNING EXPOSES PERSONNEL TO THE DANGER OF ELECTRICAL SHOCK AND PERSONAL INJURY.

1. Place the following in the "ON" position:
   a. "ELECTRONIC BATTERY PANEL SWITCH" on the battery power panel.
   b. "VHF 2" circuit breaker on the 12VDC distribution panel.
2. Locate transceiver for Defender Class A craft:
   a. Loosen (6) retaining snaps on the rear control console canvas cover located at the rear starboard side of forward cabin.
   b. Remove rear control console canvas cover.
3. Locate transceiver for Defender Class B craft:
   a. Loosen (2) retaining screws on battery panel door.
   b. Open battery panel door.

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Continued on next page

Text Cards (Continued)

Text Card Example (Cont'd)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.5
REV'D 05/23/08

NOTE: Use of RIB or SRIB and size of computer serial port will determine which test cables are required. Ensure proper cables are used.

4. Connect transceiver to the Radio Interface Box (RIB) or Smart Radio Interface Box (SRIB), communications analyzer and laptop, using appropriate cables and connectors, (Refer to Figure 1).
5. Energize the transceiver, communications analyzer, RIB and laptop.

B PROGRAM

1. Double-click "ASTRO Spectra CPS" icon on laptop Windows Desktop.
2. Open "CODE PLUG" file, (Refer to Figure 2).
   a. Select "FILE" for drop down menu.
   b. Select "OPEN".
   c. Browse to location of current TISCOM approved code plug file and select.
      (1) Code plug window will be displayed.
3. Open "CLONE RADIO" file, (Refer to Figure 3).
   a. Select "TOOLS" for drop down menu.
   b. Select "CLONING".
   c. Select "CLONE RADIO".
      (1) "CLONE RADIO" window will be displayed.
4. Select "READ SERIAL NUMBER", (Refer to Figure 4).
   a. Ensure correct serial number is displayed.
      (1) Replace transceiver if serial number does not update, (Comply with MPC E25000.2).
5. Select "PROGRAM RADIO".
   a. Allow approximately 30 seconds for writing to complete.
      (1) Proceed to next test if writing is complete.
      (2) Confirm setup and repeat Step 1 B 5. if write fails.
         (a) Replace transceiver if failure continues, (Comply with MPC E25000.2).
      (3) Confirm correct code plug if error message is displayed stating that feature does not match.
         (a) Replace transceiver if error continues, (Comply with MPC E25000.2).
6. Select "CLOSE" when finished.

C ALIGNMENT

NOTE: TISCOM provides Radio System Software. Contact TISCOM to ensure you have the latest, approved version.

1. Double-click "ASTRO Radio Tuner" icon on laptop Windows Desktop.
2. Select "FILE" menu on laptop.
3. Select "READ DEVICE".
4. Verify port is set to appropriate port for computer.
   a. Click "OK".
5. Expand "ASTRO Tuner – Transmitter Alignments" tree, (Refer to Figure 5).

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Continued on next page

Text Cards (Continued)

Text Card Example (Cont'd)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.5
REV'D 05/23/08

NOTE: Perform only the Reference Oscillator and Power adjustments. All other adjustments provided in this software are to be performed at Depot Level only.

6. Open Reference Oscillator window.
7. Click in the "New Softpot Value" box.
8. Set up Communications Analyzer as follows:
   a. Set Frequency to frequency specified in software.
   b. Generate/Monitor to Monitor.
9. Select "Toggle PPT" or press "F6" to key transmitter.
10. Press "UP/DOWN" arrow keys to adjust the Reference Oscillator to achieve +/- 70 Hz frequency error, zero being the best possible result.
11. Select "Program" key or press "F8" to un-key radio and program new setting.
    a. Replace transceiver if indication is incorrect, (Comply with MPC E25000.2).
12. Close Reference Oscillator window.
13. Expand "ASTRO Tuner – Transmitter Alignments" tree, (Refer to Figure 6).
14. Select "TX High Power".

NOTE: The software comes preloaded with set frequencies for testing. Perform the following steps for each frequency provided.

15. Select "New Softpot Value" using TAB button.
16. Select "Toggle PPT" or press "F6" to key transmitter.

NOTE: High Power Output level is 25W +/- 2W; Low Power Output level is 1W +/- 0.4W.

17. Press "UP/DOWN" arrow keys to adjust output power as close as possible.
18. Select "Program" key or press "F8" to un-key radio and program new setting.
19. Repeat steps 1 C 15. thru 1 C 18. for each frequency listed.
    a. Replace transceiver if indication is incorrect, (Comply with MPC E25000.2).
20. Repeat Steps 1 C 15. thru 1 C 19. for Low Power.
    a. Replace transceiver if indication is incorrect, (Comply with MPC E25000.2).
21. Select "Close" when finished.

D FINAL STEPS

1. De-energize the transceiver, communications analyzer, RIB and laptop.
2. Disconnect test cables and connectors from transceiver, laptop and communications analyzer.
3. Connect antenna cable to transceiver.
4. Secure transceiver access for Defender Class A craft:
   a. Secure rear control console canvas cover.

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Continued on next page

Text Cards (Continued)

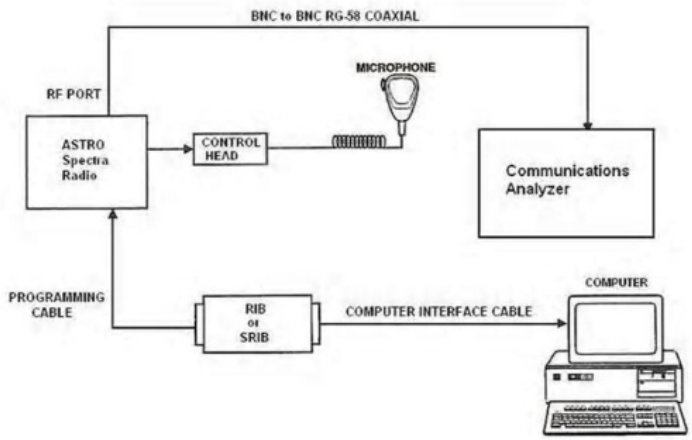
Text Card Example (Cont'd)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.5
REV'D 05/23/08

NOTE: There is no torque value required, do not over tighten.

5. Secure transceiver access for Defender Class B craft:
   a. Secure battery panel door.
6. Place the following in the normal operating position:
   a. "VHF 2" circuit breaker on the 12VDC distribution panel.
   b. "ELECTRONIC BATTERY PANEL SWITCH" on the battery power panel.
7. Document any discrepancies.



LAPTOP TEST SETUP
Figure 1

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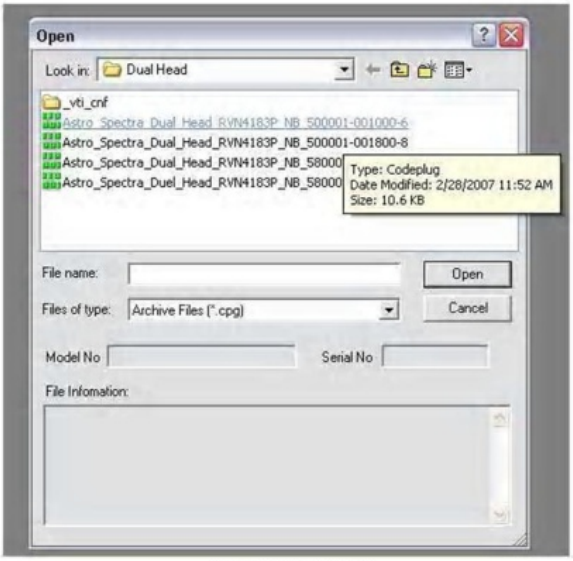
Continued on next page

Text Cards (Continued)

Text Card Example (Continued)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.5
REV'D 05/23/08



CODE PLUG FILE
Figure 2

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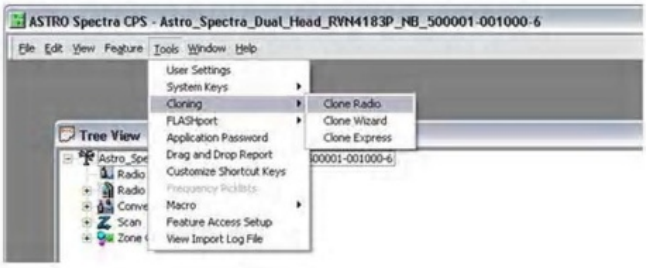
Continued on next page

Text Cards (Continued)

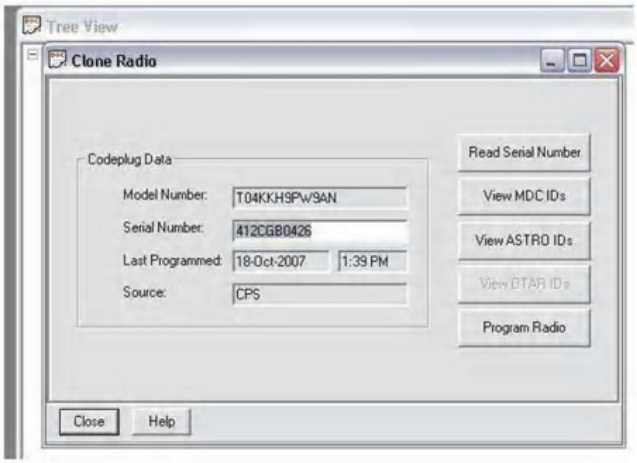
Text Card Example (Continued)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.5
REV'D 05/23/08



CLONE RADIO PROCEDURE
Figure 3



READ SERIAL NUMBER
Figure 4

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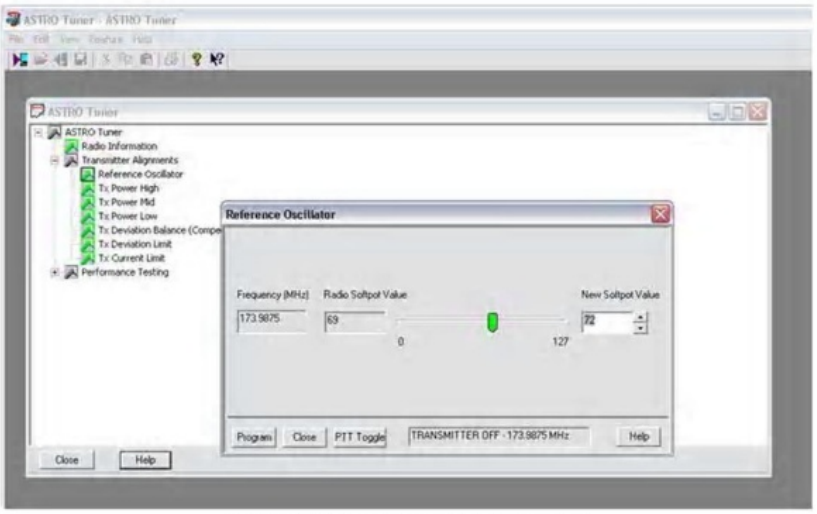
Continued on next page

Text Cards (Continued)

Text Card Example (Continued)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.5
REV'D 05/23/08



REFERENCE OSCILLATOR PROCEDURE
Figure 5

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Continued on next page

Text Cards (Continued)

Text Card Example (Continued)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.5
REV'D 05/23/08

POWER ALIGNMENT PROCEDURE
Figure 6

Page 8 of 8

REMOVE and INSTALL Card

REM / INST Cards

If a technician encounters a discrepancy that cannot be corrected by a text card, they may be directed to replace the unit. In this circumstance, the technician may be directed to complete a REM / INST Card. An example of an REM / INST card can be found on the following pages:

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.2
REV'D 08/31/09

ASSET NUMBER	OPERATING ACTIVITY	ASSET HOURS	MAINTENANCE ACCOMPLISHED MO	DAY	YEAR

ZULU DATE MO	DAY	YEAR	ZULU TIME

ITEM 1 ☐DUE	CMS CODE	CMS CODE ACTION	COMPONENT NAME	CEINUM
	E25005	REM/INST	CGG-T04KKH9PW9AN, XCVR	AV-E250-002

PART OFF

BARCODE	SERIAL NUMBER

REASON REMOVED: TIME___ TROUBLE___ CANNIBALIZATION___ OTHER___ COMPONENT STATUS: RFI__ NON RFI__

MAN HOURS: MK___.___ DC___.___ EM___.___ **ET**___.___ IT___.___ GM___.___ BM___.___ FN___.___ SN___.___ OTHER___.___

TECHNICIAN'S SIGNATURE	TECHNICIAN'S ID	QUALITY ASSURANCE SIGNATURE

PART ON

BARCODE	SERIAL NUMBER

MAN HOURS: MK___.___ DC___.___ EM___.___ **ET**___.___ IT___.___ GM___.___ BM___.___ FN___.___ SN___.___ OTHER___.___

TECHNICIAN'S SIGNATURE	TECHNICIAN'S ID	QUALITY ASSURANCE SIGNATURE

* ASTERISK INDICATES QA REQUIRED	QA								

REMARKS INDICATING THE REASON FOR REMOVAL ARE REQUIRED

REFERENCES:
NONE

REVIEWED BY	LOG YN	DATA ENTRY COMPLETED

Page 1 of 4

Continued on next page

REMOVE and INSTALL Card (Continued)

REM / INST Card (Continued)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.2
REV'D 08/31/09

1 CGG-T04KKH9PW9AN TRANSCEIVER, REMOVE AND INSTALL

REFERENCES:
MPC E25000.5
MPC E25004.0

TOOLS/TEST EQUIPMENT:
NONE

EXPENDABLES:
Transceiver, P/N: T04KKH9PW9AN, CAGE: 0W6G3, NIIN: 014598465

CONSUMABLES:
Cable Tie, P/N: AS33671, CAGE: 81343, NIIN: 008994606

A REMOVE (Refer to Figure 1)

1. Ensure the following is in the "OFF" position:
   a. "VHF 2" circuit breaker on the 12 VDC distribution panel.

   NOTE: Skip to Step 1 A 3. for Defender Class B.

2. Locate transceiver inside the starboard side control console for Defender Class A:
   a. Loosen six (6) retaining snaps on the rear control console canvas cover located at the rear starboard side of forward cabin.
   b. Remove rear control console canvas cover.
   c. Skip to Step 1 A 4.
3. Locate transceiver inside the port side Navigator console for Defender Class B:
   a. Loosen two (2) retaining hex head screws on battery panel door.
   b. Open battery panel door.
4. Remove cable ties from cable run, as necessary.
5. Disconnect the following:
   a. Antenna cable.
   b. Power cable.
   c. Data cable.
6. Remove the four side-mounted thumb screws.
7. Remove the transceiver from mounting bracket.
8. Remove control cable from transceiver.

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Continued on next page

REMOVE and INSTALL Card (Continued)

REM / INST Card (Continued)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.2
REV'D 08/31/09

B INSTALL (Refer to Figure 1)

1. Connect control cable to transceiver, P/N: T04KKH9PW9AN.
2. Position transceiver in mounting bracket.
3. Install four side-mounted thumbscrews.
4. Connect the following:
   a. Antenna cable.
   b. Power cable.
   c. Data cable.
5. Reinstall any cable ties that where removed in Step 1 A 4., using cable ties, P/N: AS33671.
6. Program radio set for area of operation, (Comply with MPC E25000.5)

   NOTE: Skip to Step 1 B 8. for Defender Class B.
7. Secure transceiver access for Defender Class A:
   a. Secure six (6) retaining snaps on the rear control console canvas cover.
   b. Skip to Step 1 B 9.
8. Secure transceiver access for Defender Class B:
   a. Close battery panel door.

      NOTE: There is no torque value, do not over tighten.
   b. Tighten two (2) retaining hex head screws on battery panel door.
9. Program radio set for area of operation, (Comply with MPC E25000.5).
10. Perform operational check, (Comply with MPC E25004.0).
11. Record maintenance action by completing appropriate sign-off, adding pertinent remarks.

Page 3 of 4

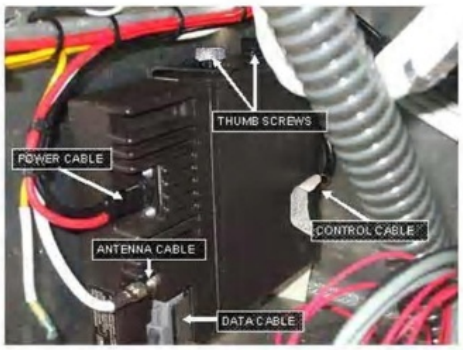
Continued on next page

REMOVE and INSTALL Card (Continued)

REM / INST Card (Continued)

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

RB-S-25
E25000.2
REV'D 08/31/09



CABLE AND SECURE POINT LOCATIONS
Figure 1

Page 4 of 4

Continued on next page

Completing an ACMS REM / INST Cover Sheet

Cover Sheet Information

Much like an ACMS MPC, a REM/INST cover sheet requires that information must be recorded.

Below is a description of each block and the data that should be recorded on an ACMS REM/INST cover sheet:

Block	Information
Asset Number	Hull Number of the platform the technician is performing maintenance on.
Operating Activity	Name of the unit the asset belongs to. Example: Station Oak Island.
Asset Hours	Total asset hours. This can be found in the Electronic Asset Logbook portion of ALMIS: • MUST BE TOTAL ASSET HOURS.
Maintenance Accomplished	Date the maintenance was completed.
Zulu Date	ZULU date on which maintenance was completed.
Zulu Time	Exact ZULU time maintenance was completed.
Part Off Barcode`	Barcode number of the part removed.
Part Off Serial Number	Serial number of part removed.
Reason Removed	Reason why the part was removed.
Component Status	Indicate if the part is RFI or NRFI.
Man Hours	Indicate how long it took the technician to remove the part and which rate performed the maintenance. ***Note:*** *Hours should be rounded to the nearest tenth.*

Continued on next page

Completing an ACMS REM / INST Cover Sheet (Continued)

Cover Sheet Information (Cont'd)

Block	Information
Technician's Signature	Technician should sign and print last name.
Technician's ID	Technician should record last 4 digits of SSN.
QA Signature	This only needs to be signed if a Quality Assurance check is required.
Part on Barcode	Barcode number of the part to be installed.
Part on Serial Number	Serial number of part to be installed.
Man Hours	Indicate how long it took the technician to remove the part, and which rate performed the maintenance. ***Note:*** *Hours should be rounded to the nearest tenth.*
Technician's Signature	Technician should sign and print last name.
Technician's ID	Technician should record last 4 digits of SSN.
Quality Assurance Signature	This only needs to be signed if a Quality Assurance check is required.
QA Blocks	If any Quality Assurance checks are required, the technician performing the QA will initial here.
Remarks	Remarks are mandatory on this cover sheet. Explain the discrepancy.
Reviewed By	The Maintenance Supervisor signs after reviewing the cover sheet for accuracy.

Aeronautical Publication Change Recommendation Form CG-22

Form CG-22

If any deficiencies are discovered within a publication utilized for a modernized asset, an AERONAUTICAL PUBLICATION CHANGE RECOMMENDATION FORM CG-22 should be completed by the maintenance technician and submitted to the maintenance supervisor for review. Once the maintenance supervisor has completed reviewing the form, it should be forwarded to the appropriate Electronic Support Unit for action.

Below is an example of a **CG-22:**

AERONAUTICAL PUBLICATION CHANGE RECOMMENDATION

1. OPFAC	2. UNIT	3. DATE INITIATED	4. CONTROL NUMBER / OFF LINE
5. CHANGE TITLE	6. ORIGINATOR (First, MI, Last, Rank)		7. ORIGINATOR PHONE
8. CG-22 TYPE Pub ☐ MPC ☐ Comb ☐	9. AIRCRAFT TYPE	10. PROCEDURAL (Y/N) YES ☐ NO ☐	11. TCTO (Y/N) YES ☐ NO ☐
12. PUBLICATION NUMBER		13. REV DATE	14. PAGE
15. ATA CHAPTER	16. PARAGRAPH	17. FIGURE	18. COMDT CHANGE (Y/N) YES ☐ NO ☐
19. MPC NUMBER	20. DATE	21. PAGE	22. INTERVAL CHANGE (Y/N) YES ☐ NO ☐

23. PUBLICATION DEFICIENCY:

RECOMMENDATION:

24. MPC DEFICIENCY:

RECOMMENDATION:

25. LOCAL QA (Signature)	26. ENGINEERING OFFICER OR DESIGNATED REPRESENTATIVE (Signature)

27. PRIME UNIT REMARKS:

	28. DATE IN:		29. DATE OUT:
30. ACTION CODE (A/P/D/X) APP ☐ PAR ☐ DISAPP ☐ CANCEL ☐	31. PRIORITY U ☐ N ☐ R ☐	32. TOPS (Y/N) YES ☐ NO ☐	33. SIGNATURE

34. TECHNICAL SERVICES REMARKS:

	35. DATE IN:		36. DATE OUT:
37. ACTION CODE (A/P/D/X) APP ☐ PAR ☐ DISAPP ☐ CANCEL ☐	38. PRIORITY U ☐ N ☐ R ☐	39. TOPS (Y/N) YES ☐ NO ☐	40. SIGNATURE

41. RCM SIGNATURE: (Interval Changes Only)	42. DATE OUT:	43. CODE: A ☐ P ☐ D ☐ X ☐	44. PRIORITY: U ☐ N ☐ R ☐
45. CG-41 SIGNATURE: (COMDTINST Changes Only)	46. DATE OUT:	47. CODE: A ☐ P ☐ D ☐ X ☐	48. PRIORITY: U ☐ N ☐ R ☐
49. TPS MANAGER: Signature Date:	**50. TPS FINAL:** Signature Date:		
51. MPC COTR: Signature Date:	**52. MPC FINAL:** Signature Date:		
Remarks:	Remarks:		

CG FORM 22 ALL PREVIOUS EDITIONS OBSOLETE 01 MAY 2007

Review Quiz

Questions

1. When CGPMS is not available, which of the following maintenance management systems should you use?

   A. NPMS
   B. LPMS
   C. CGPMS
   D. Nothing

2. When are you authorized to use LPMS?

   A. When NPMS isn't available
   B. When CGPMS isn't available
   C. When NPMS and CGPMS aren't available
   D. Never

3. Who is responsible for reviewing FBRs?

   A. CO
   B. EMO
   C. EO
   D. OPS

4. Which of the following personnel can approve LPMS for equipment?

   A. CO
   B. O5 or higher
   C. SMEF
   D. ELC

5. What does the acronym ACMS stand for?

   A. Alternative Computerized Management System
   B. Alternative Command Management System
   C. Asset Command Management System
   D. Asset Computerized Management System

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Review Quiz Answers

Answers

Question	Answer	Reference
1.	A	1-2
2.	C	1-2
3.	B	1-4
4.	C	1-7
5.	D	1-27

Lesson 2

HOW TO AUDIT SAFETY/TAGOUT LOG

Overview

Introduction

Standardized tag-out procedures for Coast Guard cutters and boats, further customized by each unit, are used to ensure the safety of personnel and to prevent improper operation of systems or equipment when the system or equipment is isolated or in an abnormal condition because of preventive maintenance or a casualty. Locking out is the preferred method of safeguarding against inadvertent operation of the switch.

Tag-out procedures for cutters and boats are governed by Equipment Tag-Out Procedures, COMDTINST 9077.1 (series), and lock-out procedures at shore units are governed by OSHA regulations.

Objectives

Given the local unit's safety lock-out and/or tag-out logs, **AUDIT** the logs IAW established Coast Guard and OSHA regulations.

References

The following references were used for this lesson:

- Electronics Manual, COMDTINST M10550.25 (series)
- Equipment Tag-Out Procedures, COMDTINST 9077.1 (series)

Tag-Out Procedures

Requirements

The department head shall be responsible for ensuring that checks and audits of all tag-outs are performed once every two weeks.

It is recommended that abbreviated audits also be conducted as part of routine watch relief.

Tag-Out Procedures

Review and refer to Equipment Tag-Out Procedure COMDTINST 9077.1 (series) as necessary during the audit process outlined below:

Step	Action
1.	Gather and review all applicable tag-out logs and record sheets at your unit.
2.	Check all active tags/labels listed in the tag-out logs for correct installation by visually comparing the information on the Tag-Out Record sheets, Tag-Out Index, and the Instrument Log with the tag/label on the item for which the tag is posted.
3.	Replace a missing or damaged tag by annotating the DANGER/CAUTION Tag-Out Record sheet that the tag is missing or damaged: • Make the annotation in the "Clearance/Position Condition" column, on the line corresponding number • Following tag-out procedures, issue a new tag using the next sequential number on the DANGER/CAUTION Tag-Out Record Sheet
4.	Note any audit discrepancies on the DANGER/CAUTION Tag-Out Record sheet; sign and date below the last entry.
5.	After all DANGER/CAUTION Tag-Out Record sheets have been audited, ensure that the individual responsible for the Tag-Out Log signs and dates the DANGER/CAUTION Tag-Out Index and Record of Audits and notes the number of active tags.

Note: *Completed inactive Record sheets shall be retained for 6 months and the tag numbering shall start on 1 OCT of each year at number (E/O) – 001.*

Record Sheets

Tag-Out Index and Record of Audit Sheet

Below is an example of the DANGER/CAUTION Tag-Out Index and Record of Audits sheet:

DANGER/CAUTION TAG-OUT INDEX AND RECORD OF AUDITS

LOG SERIAL	DATE ISSUED	TYPE (DANGER/CAUTION)	DESCRIPTION (SYSTEM, COMPONENT, WORK PERMIT OR TEST DOCUMENT REFERENCE)	DATE CLEARED

DEPT. OF TRANSP., USCG, CG-5603 (11-95) LOCAL REPRODUCTION AUTHORIZED

Continued on next page

Record Sheets (Continued)

Tag-Out Record sheet

Below is an example of the DANGER/CAUTION Tag-Out Record Sheet:

DANGER/CAUTION TAG-OUT RECORD SHEET

CONTINUED AS ADDTL SHEE CHECK BOX IF APPLICABLE C

DATE/TIME (tags issued)

SYSTEM OR COMPONENT

LOG SERIAL NO.

REASON FOR TAG-OUT:

PERSONNEL/EQUIPMENT HAZARDS INVOLVED (MANDATORY FOR DANGER TAGS):

AMPLIFYING INSTRUCTION (MANDATORY FOR CAUTION TAGS):

WORK NECESSARY TO CLEAR TAG(S) (INCLUDING TESTS):

TAG AUTHORIZATION (Signature)	NO. of Tags issued	POSTED BY	CHECKED BY	CLEARANCE AUTHORIZATION (Signature)	
REPAIR ACTIVITY REPRESENTATIVE				REPAIR ACTIVITY REPRESENTATIVE	
AUTHORIZING OFFICER (Required)				AUTHORIZING OFFICER (Required)	
TAG NO. LOCATION	TAGGED/POSITION	CONDITION		CLEARANCE/POSITION CONDITION	DATE/TIME CLEARED CLEARED BY
ADDITIONAL TAG AUTHORIZATION (Signature)	NO. of (Additional Tags)	POSTED BY	CHECKED BY	DATE/TIME (Additional Tags issued)	
REPAIR ACTIVITY REPRESENTATIVE					
AUTHORIZING OFFICER (Required)					

DEPT. OF TRANSP., USCG, CG-5604 (11-95) LOCAL REPRODUCTION AUTHORIZED

Continued on next page

Record Sheets (Continued)

Planned Maintenance

Below is an example of an Instrument Log sheet:

NAVSHIPS 9990/10 (REV.7-67)

(Formerly NAVSHIPS 5011-N/S-0105-642-0100)

INSTRUMENT L[8]

LABEL CONDITION CODE AND NO.	DATE/TIME LABELED.	INSTRUMENT NAME OR NUMBER	CONDITION AND/OR CORRECTION FACTOR	AUTHORIZED BY (SIGNATURE)	ATTACHED BY INITIALS	WORK NECESSARY TO CLEAR	DATE/TIME CLEARED	CLEARANCE AUTHORIZED BY (SIGNATURE)	LABEL REMOVED BY (INITIALS)

LINE OUT COMPLETE ENTRIES

LABEL CONDITION CODE OCC - OUT OF COMMISSION
CAL - OUT OF CALIBRATION

Lock-Out Audit Procedures

Introduction

As noted earlier in this lesson, safety lock-out procedures at shore units are governed by OSHA regulations. Refer to the OSHA website below for detailed guidance:

www.osha.gov/SLTC/electrical/index.html

Note: *By clicking on the alphabetized menu at the top of the webpage, you can find the regulations on any number of topics such as protective gear, hazardous materials, etc.*

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Review Quiz

Questions

1. How often should the tag-out log be audited?

   A. Every week
   B. Every 2 weeks
   C. Every 3 weeks
   D. Monthly

2. How long should completed inactive record sheets shall be retained?

   A. 1 month
   B. 4 months
   C. 6 months
   D. 12 months

3. Tag numbering shall start over on _____ of each year?

   A. 01 Sep
   B. 30 Sep
   C. 01 Oct
   D. 31 Oct

Review Quiz Answers

Answers

Question	Answer	Reference
1.	B	2-2
2.	C	2-2
3.	C	2-2

Lesson 3

HOW TO AUDIT SPARE PARTS AND MODULES INVENTORY

Overview

Introduction

Sound financial and inventory management requires proper inventory accountability. This means that detailed records of all acquired material shall be maintained IAW applicable Coast Guard policy and Federal mandates. All aspects of inventory management are critical to controlling cost, operation, efficiency, and mission readiness. This lesson provides the information you will need to inventory parts using CMPlus.

Objectives

Given access to CMPlus, and an inventory sample, **AUDIT** the spare parts and modules authorized by FLS.

References

The following references were used in the creation of this lesson:

- CMPlus User's Guide
- Supply Policies and Procedures Manual (SPPM), COMDTINST M4400.19 (series)

Configuration and Management Plus (CMPlus)

Introduction

The following step pages will take you through the proper way to inventory parts using CMPlus. For the purpose of this lesson, you will need to use a part out of your supply as a sample.

Step 1

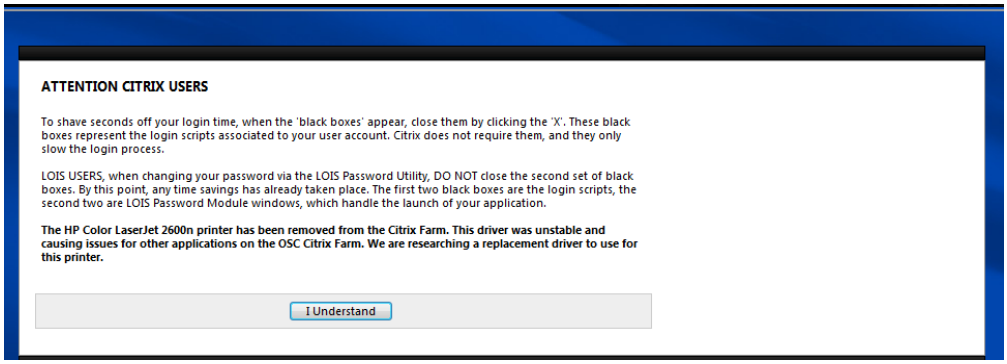
Begin by contacting OSC at 304.264.2500 and request to be added to the CMPlus user database. You will need your OPFAC to do this. Then go to OSCs website using the link below:

https://osctrxweb.uscg.mil/Citrix/XenApp/auth/silentDetection.aspx

Note: *The CMPlus administrator at your unit will assign you a username, a password and set permissions.*

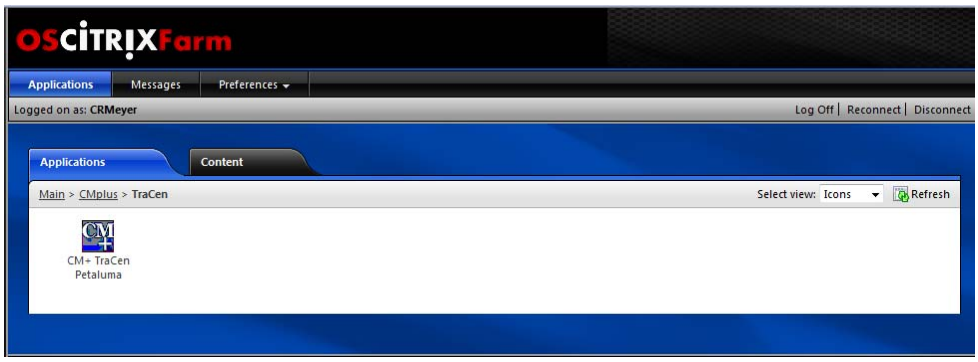
Step 2

Once at OSCs website you will see the page below. Read the disclosure then click "I understand":



Step 3

You will then be directed to the screen below. For the purposes of this lesson we will be using Tracen Petaluma. You should click "your unit":



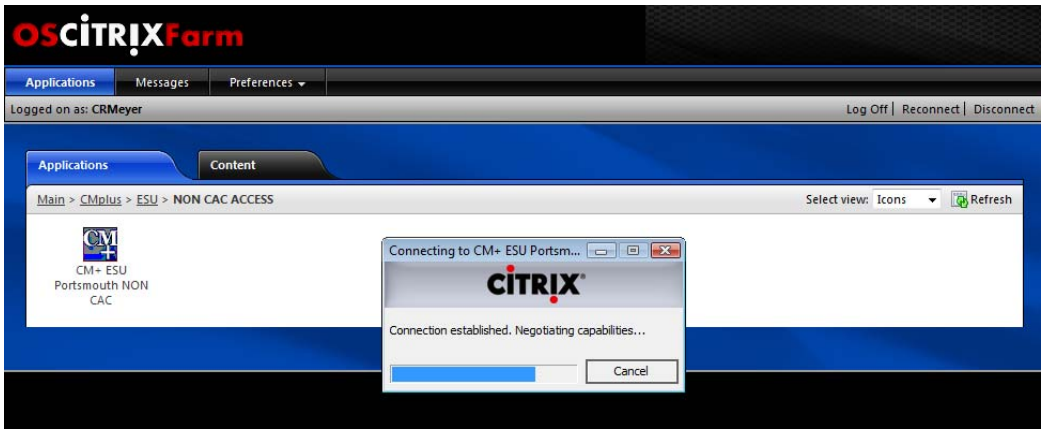
Continued on next page

Configuration and Management Plus (CMPlus) (Continued)

Step 4

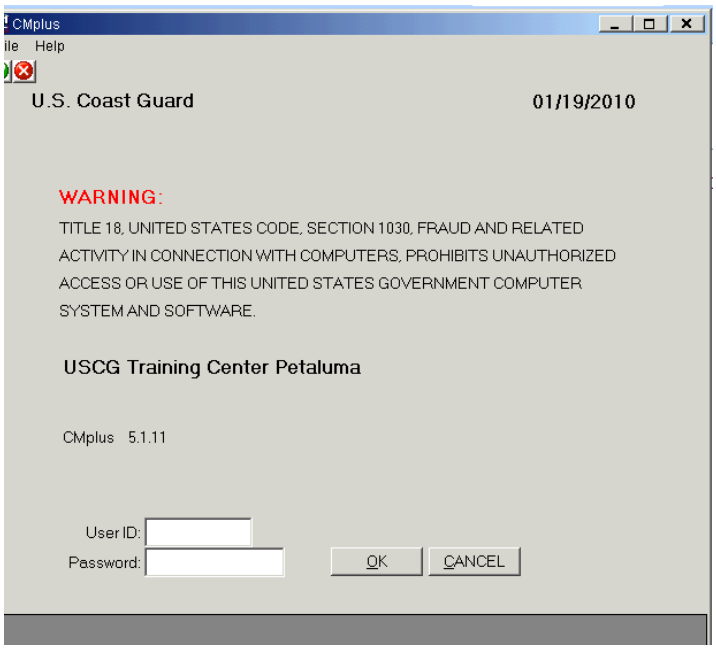
Once you've selected your unit icon you will be taken through a multi-step process to check your credentials. This is very similar to logging on your computer.

Note: *The logon process for CMPlus takes approximately 3 minutes.*



Step 5

Once your credentials have been verified, you will be directed to the CMPlus logon screen depicted below:

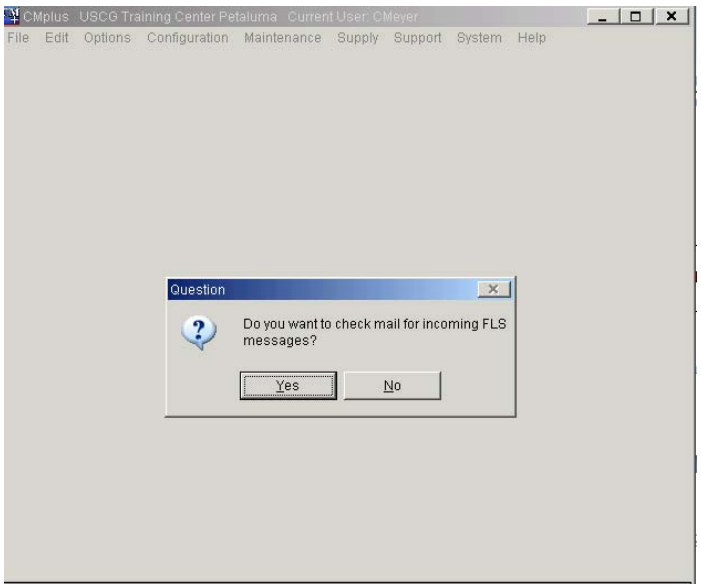


Continued on next page

Configuration and Management Plus (CMPlus) (Continued)

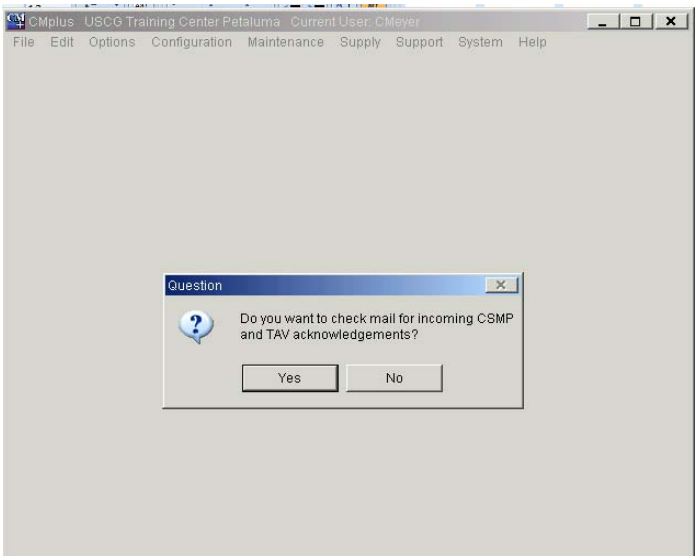
Step 6

Once you have entered your username and password you will be asked to view any incoming FLS messages, click “No”:



Step 7

Next you will be asked to view any incoming CSMP and TAV acknowledgements, again click “No”:



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Configuration and Management Plus (CMPlus) (Continued)

Step 8 You will be directed to the following page:

Click "Supply", then "Inventory", then "Items", then "Review Edit", then "All":

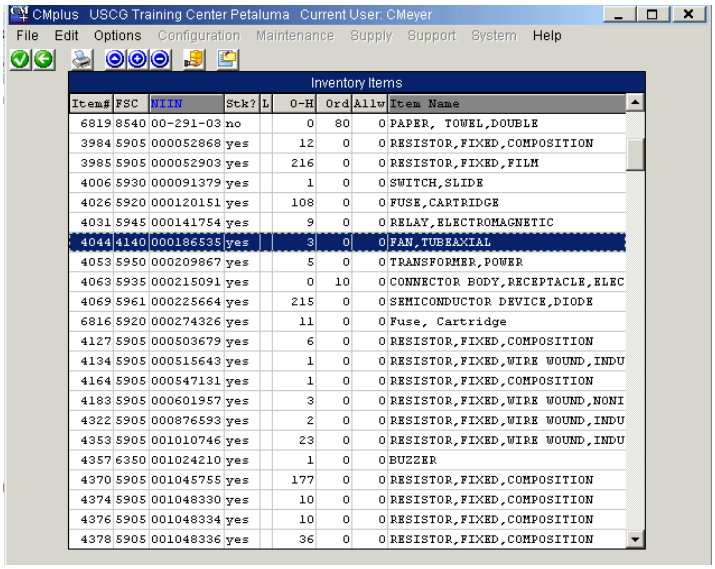
Note: *After "Review Edit" you can search a part using any amplifying information. For the purposes of this lesson we're going to use "All".*

Continued on next page

Configuration and Management Plus (CMPlus) (Continued)

Step 9

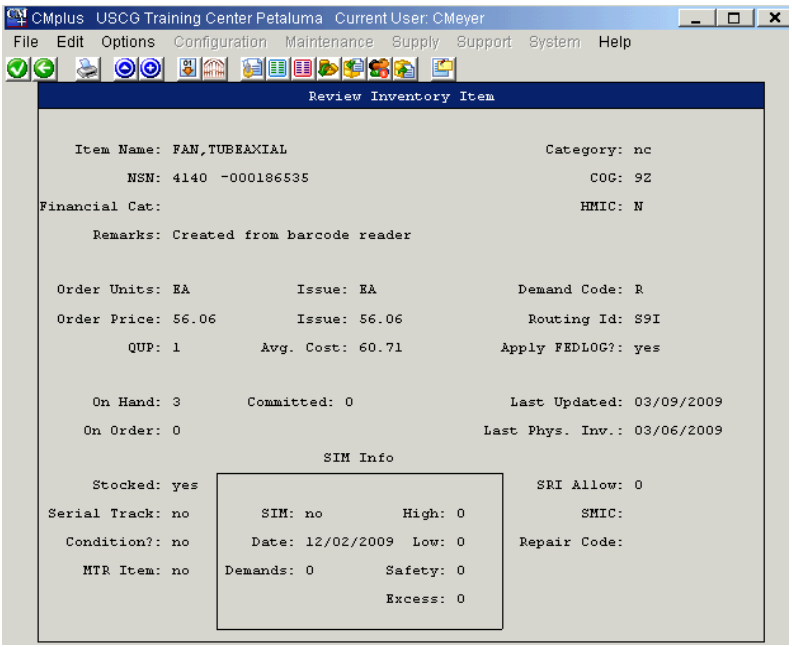
You will then be directed to a page that will look similar to the one below:



Item#	FSC	NIIN	Stk?	L	O-H	Ord	Allw	Item Name
6819	8540	00-291-03	no		0	80	0	PAPER, TOWEL,DOUBLE
3984	5905	000052868	yes		12	0	0	RESISTOR,FIXED,COMPOSITION
3985	5905	000052903	yes		216	0	0	RESISTOR,FIXED,FILM
4006	5930	000091379	yes		1	0	0	SWITCH,SLIDE
4026	5920	000120151	yes		108	0	0	FUSE,CARTRIDGE
4031	5945	000141754	yes		9	0	0	RELAY,ELECTROMAGNETIC
4044	4140	000186535	yes		3	0	0	FAN,TUBEAXIAL
4053	5950	000209867	yes		5	0	0	TRANSFORMER,POWER
4063	5935	000215091	yes		0	10	0	CONNECTOR BODY,RECEPTACLE,ELEC
4069	5961	000225664	yes		215	0	0	SEMICONDUCTOR DEVICE,DIODE
6816	5920	000274326	yes		11	0	0	Fuse, Cartridge
4127	5905	000503679	yes		6	0	0	RESISTOR,FIXED,COMPOSITION
4134	5905	000515643	yes		1	0	0	RESISTOR,FIXED,WIRE WOUND,INDU
4164	5905	000547131	yes		1	0	0	RESISTOR,FIXED,COMPOSITION
4183	5905	000601957	yes		3	0	0	RESISTOR,FIXED,WIRE WOUND,NONI
4322	5905	000876593	yes		2	0	0	RESISTOR,FIXED,WIRE WOUND,INDU
4353	5905	001010746	yes		23	0	0	RESISTOR,FIXED,WIRE WOUND,INDU
4357	6350	001024210	yes		1	0	0	BUZZER
4370	5905	001045755	yes		177	0	0	RESISTOR,FIXED,COMPOSITION
4374	5905	001048330	yes		10	0	0	RESISTOR,FIXED,COMPOSITION
4376	5905	001048334	yes		10	0	0	RESISTOR,FIXED,COMPOSITION
4378	5905	001048336	yes		36	0	0	RESISTOR,FIXED,COMPOSITION

Step 10

Double click the part you are looking to inventory and you will see a page that looks similar to the one below:



Note: *This page will tell you everything you need to know about the part such as number "On hand" or number "On order".*

Review Quiz

Questions

1. Who is responsible for assigning you a CMPlus username and password?

   A. OSC
   B. PSC Topeka
   C. Unit SPO
   D. CMPlus administrator at your unit

2. The CMPlus database is managed by _____.

   A. NAVSEA
   B. ELC
   C. OSC
   D. MLC

3. The first step in performing inventory in CMPlus is to contact _____;

   A. OSC
   B. ELC
   C. NAVSEA
   D. MLC

Review Quiz Answers

Answers

Question	Answer	Reference
1.	D	3-2
2.	C	3-2
3.	A	3-2

Lesson 4

HOW TO RETURN DEPOT LEVEL REPARABLE (DLR) ITEMS

Overview

Introduction

Significant cost savings can be realized within a federal organization when an effective Depot Level Reparable (DLR) Program has been implemented. DLR items are equipment or parts that have been identified as high cost items which can be repaired at a centralized designated repair facility and returned to the supply stock system for anticipated redistribution.

DLR item management pertains to DoD owned materiel and Mandatory Turn-In Reparables (MTR) pertains to Coast Guard owned materiel.

Note: *MTR is used for both DLR and MTR items in CMPlus.*

Objectives

Given the proper documentation and equipment, **RETURN** a DLR reparable item IAW the Supply Policies and Procedures Manual (SPPM), COMDTINST M4400.19 (series).

- Upon receipt of replacement part, understand time frame to return NRFI part
- Understand the documentation required to accompany an NRFI part
- Understand how to package and ship a part back to a repair facility

References

The following references were used to create this lesson:

- SFLC Support Gram
- Supply Policies and Procedures Manual (SPPM), COMDTINST M4400.19 (series)

Types of DLR Items

Introduction

The two types of DLR items are listed below:

- DoD owned and managed items. These items can be identified by their "7" series cognizant symbol
- CG owned and managed reparables

Requirements

The following requirements pertain to the management of all DLR items:

- Coast Guard customers shall also provide funded requisitions to the DoD for all DLR items
- Coast Guard users shall comply with DoD's reparable tracking system to ensure unserviceable carcasses are turned in for repair before the final billing takes place
- Coast Guard users shall use the proper Military Standard Requisitioning and Issue Procedures (MILSTRIP) Advice Code ("5_" series) to requisition DLR items. Requisitioners shall respond within five workdays to DLR follow-ups using proper response codes for DoD, and respond to MTR report message to the ELC
- Coast Guard units shall document and package unserviceable DLR items within 48 hours of receipt of replacement item
- Coast Guard units shall ship DLR items via traceable means
- Coast Guard units shall track unserviceable DLR via CMPlus. If CMPlus is unavailable, documents shall be manually – coded and shipped, and include method of shipment, tracking number, and receipt confirmation

Continued on next page

DLR Process

DLR Codes

The following codes are required when processing DLR transactions in the Federal Supply System (FSS):

- **Reparability Code** - The applicable reparability code for each National Stock Number (NSN) is listed in FEDLOG. Reparability codes denote whether an item is reparable and the lowest maintenance level at which repair or condemnation is normally accomplished
- **Cognizant Codes** - Identifies and designates the inventory control point, office or agency which exercises supply management
- **Activity Codes** - Identifies an activity for cataloging and management purposes within the Federal Catalog System
- **MILSMateriel Control Codes** - Segregates items into more manageable groupings (fast, medium, or slow movers) or notifies field activities of special reporting requirements

Note: *Coast Guard materiel control codes can be found in enclosure D or the Supply Policies and Procedures Manual (SPPM), COMDTINST M4400.19 (series).*

DLR Tracking Process

The DLR tracking system allows the Coast Guard supply systems to monitor the return of a NRFI carcass when a replacement reparable item is ordered. The tracking system maintains surveillance over DLR unserviceable carcasses to ensure recovery and reimbursement of the unserviceable carcass. If an NRFI carcass is not returned, the unit will pay the full price for a serviceable replacement requisition in the FSS. The tracking system ensures that the supply system maintains a rotatable pool of these high-dollar, reusable parts. The tracking system monitors carcasses through the use of MILSTRIP advice codes and DAAS.

Note: *Unit funds will be lost if the required timeframes and follow-up messages are not adhere to. Coast Guard units will be charged the standard price if a NRFI carcass is not returned to the appropriate repair or transshipment facility.*

DLR Process (Continued)

DLR Pricing

Listed below are the types of fees that are assessed to a reparable unit if it is **NOT** returned:

- **Standard Price** – A fee assessed when a Not Ready For Issue (NRFI) unit or unserviceable carcass is not turned in for repair to the appropriate facility. Coast Guard units will be assessed a fee for all parts that are not turned in. Cannibalized subassemblies or "beyond – repair" condition items will also result in a standard price charge

- **Net Price** – A fee assessed when a NRFI carcass is not turned into the response repair or transshipment center

DLR Requisition Types

The requisitioning department (e.g., the supply department) has the following options for ordering a DLR from the source of supply:

- CMplus MILSTRIP Format (excluding Casualty Report (CASREPs)

- CASREP Message in the MILSTRIP Format

- Fleet Logistic Support (FLS)

Packaging and Shipping a DLR Item

Packaging a DLR Item

Unserviceable DLR materiel should be packaged in the original container of the replacement item, to include reusing cushioning and bracing material. If the original packaging is not available for use, substitute packaging containers and accessories can be used to ensure the material is properly secured and protected. Any container and cushioning material that provides a comparable level of protection to that of the replacement item's packaging can be used. The unit must not delay returning the unserviceable carcass to the appropriate repair facility for credit.

Note: *If the unit anticipates or encounters a delay in returning the unserviceable asset the appropriate repair facility should be notified immediately by message or by email.*

Labeling a DLR Item for Shipping

The three types of labels required for DLR turn-in items are listed below:

- Caution labels
- Unserviceable Item Tags
- Unserviceable Item Labels

Shipping a DLR Item

NRFI DLR items shall be shipped within 48 hours to one of the following sources:

- Advance Traceability and Control (ATAC) Hub or Node Advance Traceability and Control Verification Center
- Source of Supply (SoS) or repairing Depot identified in FEDLOG
- Appropriate Coast Guard Inventory Control Point, for Coast Guard managed unserviceable DLR items

Note: *Although an ATAC Hub is an option, it is rarely used and should not be used with CG-managed items.*

Packaging and Shipping a DLR Item (Continued)

Shipping Methods

The methods for shipping a DLR item are listed below:

- FEDEX, UPS, or Freight Carrier Services
- Delivery - Used if the Coast Guard unit is in the immediate vicinity of the Designated Overhaul Point (DOP) or the ATAC transshipment point
- Mail - Used if the unit is not in the immediate vicinity of the DOP or transshipment point.

Note: *Priority 03 and 06 items will be shipped via traceable means (i.e., FEDEX, AWB, etc.). Priority 13 items will be shipped by certified mail. In all cases, traceable means shall be used.*

ELC DLR Process

The ELC DLR process is described in the table below:

The unit shall…..	• Identify the unserviceable asset and the need for a replacement part • Submit a requisition and "FTA" electronically through DAAS or forward a message off-line to the appropriate Primary Inventory Control Activity (PICA) for processing
The PICA shall….	• Establish stock record accounting for the item • Issue a serviceable item to replace the unserviceable carcass and establish a due date using the requisition number • Direct the unit to return the unserviceable carcass within 10 days. (Exceptions may be granted on a case-by-case basis)
After receipt of the replacement part, the unit shall…..	• Ship the unserviceable carcass to the appropriate depot to be repaired within 30 days with the BC1 (return document)

Note: *The ELC will send the unit a message at the 45th day stating that item is overdue and due back in 30 days to avoid billing. Units are billed at the 75th day and notification shall be sent to units via message.*

Review Quiz

Questions

1. What symbol should be used to identify DoD items?

   A. D
   B. 7
   C. M
   D. 3

2. Coast Guard units shall document and package unserviceable DLR items within _____ hours of receiving the replacement part.

   A. Twenty-four
   B. Forty-eight
   C. Sixty
   D. Seventy-two

3. How many days does ELC give the unit to return the NRFI carcass before it sends out a message?

   A. 10
   B. 15
   C. 30
   D. 45

Review Quiz Answers

Answers

Question	Answer	Reference
1.	B	4-2
2.	B	4-2
3.	D	4-6

Lesson 5

HOW TO INSPECT ELECTRONIC SYSTEMS FOR EMI HAZARDS

Overview

Introduction

This lesson provides you with the information necessary to achieve electromagnetic compatibility among electronic systems. Electromagnetic interference (EMI) can make successful operation of electrical and electronic equipment difficult. In extreme cases, EMI can render entire systems inoperative, leaving vessels unable to navigate, communicate, susceptible to collision, and virtually helpless.

Throughout this pamphlet, reference is made to shipboard installations; however, all discussions apply to shore units and floating units alike.

Objectives

Given electronic systems exhibiting symptoms of, or suspected of causing, Electromagnetic Interference (EMI), **INSPECT** the systems for EMI hazards in accordance with standard references.

References

The following references were used for this lesson:

- Standard Practices for Shipboard Bonding, Grounding and Other Techniques for Electro-Magnetic Compatibility and Safety, MIL-STD-1310G
- Navy Electronics Installation and Maintenance Book, EMI Reduction, NAVSEA SE000-00-EIM-150

Electro-Magnetic Interference (EMI)

Introduction

There are three types of EMI. They are:

- Man-made
- Natural
- Inherent

EMI can be classified as either narrowband or broadband.

Man-made Interference

Man-made interference impedes the reliable and efficient use of electrical and electronic equipment. To control interference it is necessary to recognize the many possible sources and methods by which it is propagated, and its effects on susceptible equipment. The task becomes difficult when several different types of interference occur simultaneously. Some of the more typical sources of interference are listed in the following table:

BROADBAND			NARROWBAND	
Transient	**Intermittent**	**Continuous**	**Intermittent**	**Continuous**
Function Switches	Electronic Computers	Commutation Noise	Doppler Shift Radar	Power line Hum
Motor Starters	Motor Speed Controls	Electronic Typewriters	Radio Transmitters: • Comms • Radar • ECM • IFF	Receiver Local Oscillators
Thermostats	Poor or Loose Ground Connections	Ignition Systems		
Timer Units		Arc and Vapor Lamps		
	Welding Equipment	Pulse Generators	Electronic Computers	
		Radar Modulators		
		Sliding Contacts		

Electro-Magnetic Interference (EMI) (Continued)

Narrow Band Interference

Narrowband interference consists of a single frequency or a narrow band of frequencies that occupies little space in the total receiver passband. Because they are narrow with respect to the receiver bandwidth, narrowband signals are unaffected by the bandwidth of the receiving device. Tuning the susceptible receiver away from an interfering narrowband signal can sometimes prevent an undesired response. However, even out-of-band signals may interfere if they are strong enough to force their way past the attenuation of the pre-selector or RF stages.

Broadband Interference

Broadband interference occupies a relatively large part of the radio frequency spectrum. Usually, it is not possible to tune away from broadband interference, since it is much wider than either the assigned frequency channel or the receiver bandwidth.

Transmitter Interference

In theory, communications, navigation, radar, or other type of transmitters are required to radiate energy only over the band of frequencies necessary to convey the intelligence that it is processing. In practice, however, a transmitter may emit energy at many frequencies and thus create a potential interference problem. Communications transmitters can produce spurious emissions from:

- Overdriven amplifiers
- Frequency multiplier stages
- Sideband splatter caused by overmodulation, excessive modulator bandwidths, or modulator nonlinearity
- Modulator noise
- Transmitter intermodulation and cross modulation caused by interaction between two or more transmitters

Radar transmitters can produce spurious emissions from:

- Arcing in PA stage, waveguide rotary joint, or antenna

Electro-Magnetic Interference (EMI) (Continued)

Electrical Controllers

The controller equipment associated with electrical installations directs the voltage and/or current applied to (or from) an electrical system. The control system may be a refined device with continuous and precise settings, or it may be a simple ON-OFF switch. Since continuous control results in slow variations of current waveform, there is relatively little interference. Make-brake contactors, such as switches and relays, cause sharp changes in the current waveform which may produce severe interference over a wide frequency band.

Motors and Generators

Electrical motors and generators are the most common sources of electromagnetic interference. Rotating electrical machinery interference is generated by the following:

- Arcing from brushes to commutator segments in DC motors or generators, or from brushes to slip rings in AC motors or generators
- Induction of interference into nearby electronic equipment from the high energy magnetic fields associated with rotating machinery
- Ripple, which is present to some degree, in the output of all DC generators
- Slot harmonics appearing as harmonic frequencies in the output of generators. These harmonics are the result of a lack of uniformity in the magnetic field caused by the effect of the armature slots on the distribution of the magnetic flux

Engines and Igniters

Ignition systems of gasoline engines can be sources of interference. Igniters for jet engines that use high voltage and high current can cause severe interference.

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Electro-Magnetic Interference (EMI) (Continued)

Lamps

The steep waveforms associated with the operation of fluorescent, mercury, sodium, and vapor lamps can cause broadband interference. This source of man-made interference is caused by electromagnetic coupling between wires or the degraded condition of conductors, insulators, and associated hardware.

Natural Interference

Natural interference, such as that caused by electrical storms, snowstorms, rain particles, or interstellar radiation, is referred to as atmospheric noise or static. This interference is characterized by the following types of noise in a receiver output:

- Impulses of high intensity, occurring intermittently, caused by local thunderstorms
- A steady rattling or crackling produced by distant thunderstorms
- Precipitation static (a continuous noise caused by the impact of charged particles against an antenna)
- A steady hiss type of static observed at high frequencies, apparently having an interstellar origin

Inherent Interference

A certain amount of interference inherent in receiving equipment is caused by thermal agitation of electrons in the circuit resistance.

Random motion of free electrons develops voltages in the conductors and components, and these voltages contribute to receiver background noise.

Methods of Coupling EMI

Introduction

Interference is transferred from an interfering source to the affected equipment by two general methods:

- Conduction
- Radiation

Conducted EMI

Conducted EMI involves the transfer of undesired energy through conductors between a source of interference and a susceptible device. The complete circuit can be made up entirely of metallic conductors, or the return path may be through earth ground.

The most common and most important paths for conduction currents are:

- Power supply cables
- Control and accessory cables
- Grounding systems
- Transmission lines

Factors Affecting EMI

The type of circuit, frequencies involved, power level, and amount of capacitive and inductive coupling between parts of the circuit, all have a bearing on the generation of interference that can be conducted from one piece of equipment to another. Different types of circuits are prone to generation of interference in different ways and to different degrees.

The care taken with lead dress, filtering, and shielding affects the amount of interference conducted from a piece of equipment and the degree of susceptibility of your equipment to this interference. In addition to the equipment features that may be responsible for conducted interference, energy radiated from high-power transmitters can be coupled into interconnecting cables and conducted into equipment.

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Methods of Coupling EMI (Continued)

Radiated EMI

Radiated EMI is any interfering signal transferred through space by an electromagnetic field. The radiated field represents energy that escapes from a source and spreads out in free space according to the laws of wave propagation.

An electromagnetic field is generated whenever current flows in a conductor and some energy in this field is radiated. Several factors determine the strength of the radiated signal. They are:

- Amount of current flow in the conductor from which the field radiates
- Efficiency of the conductor as an antenna (for example, physical configuration and orientation) and amount of shielding offered by nearby metal items
- Frequency of the current waveform causing the field. Very little energy is propagated at frequencies below 15 khz. Progressively stronger fields are radiated as the frequency of the current causing the field increases

Suppression methods for radiated EMI include confinement of the interference to the source to prevent its being radiated. Metal shielding is used around the EMI source to reduce the strength of any stray radiation and prevent it from reaching susceptible equipment. It is usually less expensive and less difficult to suppress interference at the source than to eliminate it once it has been radiated.

Interference from Electrical Devices

Introduction

Electrical machinery constitutes a serious source of broadband and narrowband interference. Broadband noise is generated during the commutation process by the brushes and the armature, arcing in bearings, friction between moving parts, internal arcing, and control windings. Narrowband interference arises from poor machine symmetry causing the generation of harmonic frequencies.

Rotating Machinery

Rotating machinery includes motors and mechanically-driven generators. The following are included in the category of rotating machinery:

- Rotary inverter (a DC-to-AC converter)
- Dynamotor (a DC motor and generator, operated from a single magnetic field, that functions either to step up or to step down DC voltages)
- Alternator (an AC generator)

These machines operate on the principle of converting mechanical energy to electrical energy, or electrical energy to mechanical energy. Because of the nature of their operation, these machines create various forms of radio interference caused by the following:

- Arcing
- Induction
- Ripple
- Slot Harmonics

Arcing

Arcing occurs when brushes sweep over commutator segments in DC motors and generators. Although microscopic arcing results from brush action on the slip rings of an AC motor or generator, the arcing is much less intense than that which occurs in the DC motor and is normally not a problem.

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Interference from Electrical Devices (Continued)

Induction

Interference voltages may be induced in communication equipment by action of the magnetic fields associated with rotating electrical machines.

Ripple

If the characteristic ripple found in the output of all DC generators is not adequately filtered, it can result in interference in communication equipment.

Harmonics

Harmonics in the output of the ship's service generators are usually caused by a changing field brought about mainly by the effects of the armature slots on the distribution of the magnetic flux. This effect causes harmonics to appear in the output. Harmonics are also produced by nonlinearities existing in the electrical system. Therefore, loads as well as generators can be the source of harmonic frequencies. The amplitude of these harmonics is dependent upon the extent of flux variations produced by the armature slot.

Interference from Transmitters

Introduction

Transmitters are not usually susceptible to interference, but they may cause considerable interference to other equipment. The equipment designer provides for adequate interference suppression in the manufacture of the equipment. However, the most well designed transmitter can cause serious interference if it is not properly maintained.

Spurious Emissions

Any emission from the generation source other than the one meant to transmit intelligence is a spurious emission that can cause interference. Spurious emissions are usually categorized as:

- Broadband emissions caused by arcing
- Spurious sidebands (splatter)
- Harmonic radiation
- Spurious outputs caused by parasitic oscillations
- Spurious outputs from the oscillator, frequency multipliers, and frequency synthesizer stages
- Transmitter noise
- Cross modulation and intermodulation

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Interference from Transmitters (Continued)

Broadband Emissions

Broadband emissions are recognized by their distribution across a wide portion of the tuning range of the affected receiver. They have a characteristic irregular, ragged, hash sound in the receiver output and are usually caused by arcing either in the transmission line, tuner/coupler, transmitter, or in the rigging and deck equipment of the ship.

High-power shipboard transmitters induce very high RF currents and voltages in surrounding structures. When discontinuities are present in these structures, there is a strong tendency toward arcing, which generates broadband interference. Cable armor can arc to a ship's hull even if the armor is grounded at regular intervals. Arcing or corona can often be seen at night when the transmitters are radiating.

One solution to this problem is to eliminate discontinuities such as corroded junctions, stray metal objects, long length of guy wires, unused cables and antennas. The goal is to make the entire topside area of the ship a single conducting structure by welding, brazing, bonding, and other methods. Interference from arcing is especially misleading. It is sometimes misinterpreted as a high ambient noise level and corrective action is not taken.

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Interference from Transmitters (Continued)

Spurious Sidebands (Splatter)

When a carrier is frequency or amplitude modulated by an intelligence bearing signal, a group of new frequencies is generated around the carrier frequency. These frequencies are caused by, and are a function of, the modulating or intelligence signal. The usable and important range of frequencies necessary to transmit intelligence determines the bandwidth of a signal. Sidebands occurring outside this necessary bandwidth are undesirable and should be eliminated. Spurious sidebands may arise from improperly tuned circuits, over modulation, or faulty equipment.

In addition to creating wasteful and undesirable sidebands, splatter caused by over-modulation distorts the desired transmission. The received signal has a characteristic “mush” sound instead of the crispness associated with properly operated transmitters.

Another reason for over-modulation is the different speech characteristics of individual operators. One operator may speak softly into a microphone located several inches away. Another operator may practically shout into the microphone located almost at his lips. This leads to widely varying speech levels throughout the transmitter and, consequently, varying average power output levels. If the transmitter is properly adjusted for the softer speaking operator, then over-modulation will result when a louder speaking operator uses the transmitter. Voice compression circuits and transmitter gain control circuits are standard accessories on most transmitters, and operators should take full advantage of them. Usually, these circuits are automatic in operation once they are switched into the system, but they must be properly adjusted and maintained.

Harmonic Radiation

Harmonic radiation is present to some degree in the output of all transmitters because of nonlinearity of the power output stage. Harmonics are integral multiples of the fundamental frequency. They are undesirable because they waste power and are a source of interference. Power transmitted in harmonics contributes nothing to desired communications.

Good design and correct tuning and loading usually ensure sufficient harmonic attenuation. Military specifications require that the second harmonic level be at least 60 db below the fundamental. Third and higher order harmonics must be at least 80 db below the fundamental. The use of multicouplers further attenuates transmitter-generated harmonics, thereby reducing their significance as sources of interference.

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Interference from Transmitters (Continued)

Parasitic Oscillations

Parasitic oscillations cause emissions at radio frequencies which are neither harmonics of the fundamental nor inter-modulation product frequencies. Parasitic emissions occur when a circuit is self-excited and goes into oscillation at a frequency other than the desired one. These emissions include shock excitation due to internal transients and unintentional excitation of circuit components by the carrier signal.

In a well-designed circuit, the usual cause of parasitic oscillation is improper lead dress following component replacement. The technician should ensure that component placement and wire positions are not haphazardly disturbed during troubleshooting or alignment. Parasitic oscillations may also occur in the output stage of a transmitter when improper neutralization follows tube replacement in that stage.

Spurious Outputs

In some transmitter systems, a mixer is used to produce the system fundamental output frequency or a sub-multiple of it. When this is the case, spurious signals are generated because of non-linearity of the mixer. Tuned circuits are required following the mixer stage to attenuate these undesired frequencies. Usually four or five tuned circuits must be provided.

A second type of signal generation, using frequency multiplier stages and a single master oscillator, is used in many transmitting systems. Since frequency multipliers are nonlinear, harmonics of the master oscillator frequency are generated. Extremely high Q circuits must be used in the multiplier stages of the transmitter to prevent high levels of harmonics of the master oscillator from being emitted along with the fundamental frequency of the transmitter.

Transmitter Noise

Transmitter noise is generated in the various RF stages, together with noise from the audio system and power supply. It is inherent in the radiation process and is evenly distributed in the spectrum near the carrier frequency. The effect of transmitter noise is similar to atmospheric noise.

In general, transmitter noise does not degrade the desired transmitter signal appreciably because the depth of modulation, or deviation, is small compared to the desired signal modulation. It is usually ignored as a cause of interference because adjacent receivers are not tuned near enough to the transmitter frequency for its effect to be noticed.

Interference from Transmitters (Continued)

Cross and Inter-modulation

Although cross modulation and intermodulation occur in both receivers and transmitters, only transmitters are considered in the following discussion. In both types of modulation, the mechanism responsible involves two or more signals present simultaneously in a nonlinear element. Both intermodulation and cross modulation can occur at the same time.

Cross modulation is the transfer of modulation from one carrier to another.

Intermodulation is the generation of numerous new frequencies from two or more original signals.

When transmitting antennas are closely spaced, a large degree of coupling exists between them. Powerful off-frequency signals from one transmitter can feed back into the final stage of a second via the closely coupled antenna systems. The output-tuned coupling network of the second transmitter may not offer sufficient attenuation to the offending signal to prevent it from reaching the nonlinear final stage and interfering with the desired signal.

One solution is to physically separate the transmitting antennas to decrease the transfer of RF energy between them. This approach is limited aboard ship since space is at a premium and other factors must be considered in antenna placement.

The most common solution at present is to use tunable filters (multicouplers) between transmitters and antennas. The additional attenuation offered by such filters to off-frequency signals is usually adequate to prevent them from coupling into a susceptible output stage. Another major benefit of using multicouplers is that several transmitters at different frequencies can be coupled to one broadband antenna, thereby reducing antenna requirements aboard ship.

Receiver Susceptibility

Introduction

No interference will occur in a receiver if the receiver responds only to the desired signal. However, all receivers are less than ideal, and all receivers are susceptible in varying degrees to undesired signals.

There are three ways that undesired signals intrude on a selected or desired signal:

- Linear intrusion via normal input terminals
- Nonlinear intrusion via normal input terminals
- Intrusion through ports not intended as signal inputs

Linear Intrusion

Linear intrusion is possible because the receiver acts as a normal bandpass filter which accepts any input containing frequency components in the receiver passband. Unwanted inputs with a spectrum centered at, or near, the tuned frequency of the RF filter are the usual interference sources. These inputs come from a variety of sources:

- Broadband noise arising from natural or man-made sources. The spectrum of such noise is essentially flat over the bandpass of a typical receiver
- Signals from communication sources assigned to a frequency at, or near, the receiver's center frequency. When these signals are separated from the receiver's center frequency by an amount less than the receiver's bandwidth, co-channel interference results
- Signals from communication sources whose frequencies are separated from the receiver's center frequency by more than the receiver's bandwidth (adjacent channel interference)
- Signals from communication sources assigned to frequencies within one of the internal pass frequencies (IF interference)
- Discrete (narrowband) signals generated in nonlinear elements in the shipboard electromagnetic environment. These signals are both intermodulation products and harmonics

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Receiver Susceptibility (Continued)

Linear Intrusion (Cont'd)

Typical natural broadband noise sources are:

- Thermal noise
- Shot noise
- Galactic noise
- Solar noise
- Atmospheric noise

Typical man-made noise sources include:

- Discharges on high voltage lines and devices
- Noise from automobile ignition systems
- Commutator noise
- Noise in complex switching systems
- Noise generated by fluorescent lamps
- Arcing across structural discontinuities located in high-energy radar beams
- Arcing of the waveguide in a radar system

Remedies for Broadband Noise

Remedies for broadband noise that overlaps the receiver bandpass must take advantage of differences between signal and noise characteristics. The most common methods of dealing with noise of a discrete impulse nature are limiting and blanking. Both are done before the broadband pulses have been filtered in the IF amplifier. This type of noise has short duration and large peak value. It can be limited to the level of the desired signal or totally blanked out for its brief duration. In either case, the signal is eliminated for the duration of the impulse with no significant loss of information.

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Receiver Susceptibility (Continued)

Remedies for Broadband Noise (Cont'd)

A filter preceding the limiter or blanker widens the interference pulse and makes these elements less effective as noise reducers.

For example, a typical impulse type of noise burst, which may be only 1 or 2 microseconds wide at the receiver input, can be lengthened to 100 microseconds or more by the selectivity of the receiver's IF amplifier. This wider pulse is more difficult to remove than the narrow pulse. A gap of 100 microseconds in the detector output signal is much more noticeable than a gap of 1 or 2 microseconds.

Blanking systems require information concerning the interfering impulses. Systems for eliminating the periodic uses of a nearby transmitter may use direct synchronization from the transmitter. When there is no access to the source, the receiver itself must sense the pulse in one branch to eliminate it in a second branch.

Broadband interference, such as white noise, that extends throughout the tuning range of a receiver can be suppressed by methods similar to those used against impulse noise, but the emphasis is on enhancing the desired signal. Advantage can be taken of known signal characteristics to design modulator and demodulator processes that increase the signal-to-noise ratio. An example of this is the matched filter detector which uses information about the shape of the signal pulses to discriminate between the signal and noise. The operator can increase the signal-to-noise ratio by selecting the minimum receiver bandwidth necessary for satisfactory signal reception.

Blanking Devices

One method used to reduce the effects of interference is cutting off or blanking the susceptible equipment during the time of the interference. This is very effective for pulse interference but not applicable for CW or continuous interference sources.

The interfering pulse can be used to generate a blanking pulse, or if the interference is periodic, as in radar pulses, a pretrigger can be taken from the interfering equipment and used to develop a blanking pulse. An example of pulse blanking is the method used to disable shipboard electronic countermeasures (ECM) equipment when the ship's radars are pulsed. A pretrigger from both radars is fed into a central pulse blanking device. This device generates blanking pulses which are used to turn off the ECM display. These "holes" in the display caused by blanking are not nearly as objectionable as the interference would be. If the blanking time is short, no significant detail is lost due to blanking.

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Receiver Susceptibility (Continued)

Co-channel Interference

Co-channel interference takes place in communication systems that are assigned the same, or nearly the same, carrier frequencies. Co-channel interference occurs when the center frequency, or carrier of an undesired signal, falls in any portion of the passband of another receiver.

The interfering signal may be a normal authorized frequency. However, since its carrier frequency and some sidebands are within the bandpass of the victim receiver, they will follow a normal signal path and appear as interference.

The susceptibility of a receiver to co-channel interference is greater than other types of interference since a co-channel signal is received, amplified, heterodyned, and detected in the same manner as a desired signal.

Adjacent Channel Interference

Adjacent channel interference occurs when some sidebands (not the center frequency or carrier of an undesired signal) are within the receiver bandpass. Adjacent channel interference occurs between communication systems that have been assigned neighboring channels.

Image Frequency Interference

In a heterodyne receiver, there are two signal frequencies that can combine (heterodyne) with the local oscillator signal to produce the receiver intermediate frequency (IF). One of these signals is the desired or tuned signal, and the other is called the image frequency.

The image frequency is separated from the desired signal by twice the IF, and is located on the side of the local oscillator signal opposite the desired frequency.

To keep an undesired signal at the image frequency from interfering, the undesired signal must be prevented from reaching the mixer stage where the unwanted combining takes place. Some receivers employ one or more resonant circuits, amplifier stages, or frequency selective filters between the antenna and the mixer stage. These resonant circuits or filters pass the desired signal and reject or attenuate the image frequency.

Little can be done to a receiver with poor inherent image rejection, but the technician can ensure that the receiver is carefully aligned, especially the front end. When additional image rejection is needed, an external preselector can be used with the receiver.

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Receiver Susceptibility (Continued)

Intermediate Frequency Interference

One final type of linear intrusion is the penetration of unwanted signals that are centered at any pass frequency within the receiver.

For instance, a large amplitude signal centered at one of the IF amplifier frequencies may manage to get by the input selective circuits to the IF amplifier. Once there, the unwanted signal proceeds through the rest of the receiver in a normal manner. To correct this problem, the input circuit selectivity and/or stray paths to the sensitive circuits must be controlled. As a rule, the first IF amplifier frequency is the most vulnerable, but consideration should be given to any other internal passbands used.

A practical method of reducing this type of interference is to insert a series, or parallel-resonant circuit, tuned to the susceptible frequency in the RF stage. This will attenuate or reject any undesired signal at the intermediate frequency.

Non-linear Intrusion

Nonlinear intrusion occurs when a strong unwanted signal penetrates the input filter circuits and encounters a nonlinear element such as the mixer of an overloaded RF amplifier stage. The unwanted signal mixes with the desired signal to produce many new signals. If any of these new frequencies fall within the IF passband, they will be processed along with, and interfere with, the desired signal. The unwanted mixing can also take place in nonlinear elements external to the receiver. This is referred to as hull-generated interference. Any in-channel new signals radiated from the nonlinearity can cause interference once they are processed in the receiver.

Because a strong signal is required to cause interference by nonlinear intrusion, nearby transmitters are usually the only significant sources. Sources which are not designated to radiate, spurious outputs of transmitters, and broadband noise sources are rarely found to be major contributors to nonlinear intrusion.

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Receiver Susceptibility (Continued)

Inter Modulation and Cross Modulation

Intermodulation and cross modulation, as previously discussed, are important in receivers as well as transmitters. The means of interference are essentially the same. Intermodulation or cross modulation in receivers, however, occurs when two or more signals are present simultaneously at the input. Intermodulation results in the generation of many new frequencies; cross modulation involves the transfer of information from an undesired carrier to a desired carrier. Both are caused by nonlinearity in a circuit near the receiver input.

Intermodulation is the most important. It becomes especially important when a range of frequencies is subdivided into separate communication channels, and when a number of these closely spaced channels are used simultaneously. When these signals meet in a nonlinear element, the new signals generated are sometimes spaced close in frequency to the original signals and fall within the tuned passband of the receiver.

Hull Generated Interference

Introduction

Hull-generated interference has become a major problem aboard ship because of:

- The increase in number and power level of transmitters
- The increase in sensitivity and number of receivers
- The requirement for increased use of the spectrum
- The increase in number of antennas
- The same, or in some cases, less mounting space for antennas

Interference signals caused by hull nonlinearities are directly related to the number and power level of transmitters and antennas being used at the same time. The more transmitters you have on the air, the more interference you are likely to have. The more power these transmitters put out, the more serious the interference problem is likely to be.

Rusty Bolt Affect

A ship has all the elements necessary to produce a harmonic generating and radiating system. The elements are present in the complex ship structures, equipment, and other objects in the high intensity RF fields. RF energy from shipboard transmitters induces current flow in these structures. If a corroded joint or oxidized fastening is in the path of current flow, rectification occurs. The distorted waveforms resulting from this process contain new signals. These signals, created by nonlinear junctions in the ship structures, are commonly called the “rusty-bolt” effect.

There are thousands of nonlinear elements present in the topside areas of steel ships including steel hulls with aluminum superstructures. Steel is inherently nonlinear even when free from oxidation. The nonlinearities that cause the majority of intermodulation problems, however, are metallic junctions exposed to weather.

Hull Generated Interference (Continued)

Nonlinearity Due to Corrosion

Two pieces of clean metal held tightly together have near zero impedance at the junction, which has little restriction to current flow. Deterioration to the metal occurs once it is exposed to the weather. This deterioration is due to corrosion. Since the oxides formed are a semiconductor, they destroy the metal-to-metal contact and the low impedance of the joint. The impedance varies under the influence of induced RF current from shipboard transmitters; that is, the junction becomes nonlinear. Corrosion is the culprit.

If moisture is present when metal objects are jointed, the junction will corrode. Corrosion is a complex process. Corrosive action may be either galvanic or electrolytic, or both, depending on the nature of the metals in contact and on whether the metal-to-metal contact is part of a direct current circuit. But, both types of corrosion take place only when moisture is in contact with the mating surfaces. The following is a partial list of the major causes of corrosion:

- Galvanic
- Fatigue
- Crevice
- Stress
- Welding

Galvanic Corrosion

When dissimilar metals are joined by the same corroding medium, electrochemical corrosion will occur. In order for galvanic action to occur, current must flow. In some cases, the current uses the metals as the prime conductor; in others, such as structures in a high RF field, the metals will intercept RF energy and become unexpected conductors. Reduction of galvanic corrosion requires a knowledgeable choice of construction materials and good construction techniques.

Fatigue Corrosion

The dangers inherent from fatigue corrosion are those from breakdown of a protective film on the metals caused by bending or vibration.

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Hull Generated Interference (Continued)

Crevice Corrosion

Corrosion is likely to form in crevices since they have a tendency to retain corrosive solutions. Elimination of this problem can be accomplished by smoothing surfaces and filling crevices. Crevices can be minimized by using welds instead of mechanical fasteners. Regardless of the torque applied to a bolt, it is practically impossible to eliminate crevices into which fluids can penetrate and cause corrosion.

Stress Corrosion

Stress corrosion occurs when internally or externally stressed metals are exposed to a corrosive environment. The loss of good bonds or structural integrity will depend upon:

- The amount of stress
- Corrosion medium present
- The structural configuration of the base metal

Stress corrosion is one of the most important and common types, but it is virtually impossible to predict since the same conditions that cause cracking in one metal will not influence another in the same general category. In general, high strength aluminum alloys are susceptible to cracking and should be avoided if possible.

Welding Corrosion

Corrosion can occur in areas where variations in grain size are produced by the heat from welding. Corrosion rates vary according to the heat input of the welding method and the geometry of the joint. The grain structure is changed by high temperatures caused by the inability of the heat to dissipate. The possibility of corrosion in these areas can be avoided by increasing the surface area so that heat is dissipated more rapidly.

New Signal Generation

Heterodyning

Mixing two signals in a nonlinear element to produce a new frequency is familiar to persons acquainted with the operation of a simple heterodyne receiver. A locally generated signal is applied along with the broadcast signal to a mixer or first detector stage. This stage is operated intentionally so as to distort and produce harmonics of the two input signals.

The output of this nonlinear stage consists of:

- Original two frequencies
- The sums of the two original frequencies
- The differences of the two original frequencies
- All of their harmonics

In a typical mixer stage, the difference frequency of the two original signals is selected for further processing. In some frequency translation schemes, however, any number of frequencies can be selected by inserting appropriately tuned circuits.

The point to keep in mind is that when a s ingle frequency sine wave is distorted in any manner, harmonics of that frequency are generated. When two or more single frequency sine waves are mixed in a distortion-producing (nonlinear) element, then many new frequencies are generated.

The process is called heterodyning. Little additional study is required to understand how a similar process occurs when corroded metallic objects are subjected to high intensity RF fields.

Sources of Hull Generated Interference

Typical hull-generated interference sources are:

- Loose metallic items in topside area
- Corroded stanchions and metallic lifelines
- Rusty anchor chains, metallic cables and mast items
- Rusty chains for accommodation ladders
- Metallic safety nets, chains, cables

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New Signal Generation (Continued)

Levels of Hull Generated Interference

The level of hull-generated interference signals is determined by:

- Output power of the transmitters
- Efficiency of the nonlinear element as a rectifier - that is, the degree of nonlinearity
- Coupling and amount of shielding between the transmitter and the nonlinear element
- The physical size, configuration and orientation of the metallic objects comprising the junction - that is, the larger the objects are with respect to a given wavelength, the more energy they will intercept and reradiate
- Physical properties - that is, gain of the transmit antennas

Additional Non-linear Sources

Studies show that steel is inherently nonlinear and produces intermodulation products. However, the level of these products is well below those levels produced by corroded junctions and becomes significant only after all other nonlinear sources have been eliminated.

Intermodulation also occurs in receiver front ends when two or more strong signals penetrate the pre-selector attenuation, overdrive the RF amplifier stage, and cause the RF amplifier stage to become nonlinear. The same mixing occurs if the signals are strong enough to penetrate to the mixer stage which is normally operated nonlinearly. The cure here is to insert additional attenuation to off-frequency signals ahead of the receiver. A tunable bandpass filter that offers attenuation to off-frequency signals is usually sufficient.

Another nonlinear element across which two or more signals may intermodulate is the final, or output stage, of a shipboard transmitter. Signals from one transmitter may couple, via closely spaced antenna systems, into the output stage of another transmitter. Intermodulation products from the mixing process are then transmitted and become interference sources.

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New Signal Generation (Continued)

Suppression Techniques

To prevent harmful EMI caused by nonlinear or intermittent metal- to-metal contact junctions in the topside electromagnetic environment, the ship's topside areas shall be, as nearly as possible, a single conducting surface free of all pinned, snap-linked, chain-linked, or other metallic discontinuities that might act as sources of intermodulation interference and broadband noise.

The following are examples of hull-generated EMI control requirements:

- Metal-to-metal contact junctions in the topside electromagnetic environment should be avoided by use of nonmetallic substitutes when available
- Metal-to-metal contact junctions, where movability or removability is not a requirement, should be class A bonded
- Metal-to-metal contact junctions, where movability or removability is a requirement, should be class B or class C bonded to provide a low impedance current path around the junction
- The joining of dissimilar metals by bolting or riveting should be minimized in topside areas
- Except for anchor and anchor holding, metal chain shall not be installed in topside areas
- Loose metallic items, such as pipes, cables, and portable rigging should not be stowed, stacked, or lashed down in topside areas

Radar Systems Interference

Introduction

Radar systems can create interference in the following ways:

- RF leakage from waveguides
- Arcing in waveguides
- Arcing in rotary joints
- Arcing in mast cables

RF Leakage from Waveguides

Leakage of RF power can occur at any waveguide or coaxial cable joint. Leakage from waveguide joints creates a narrowband interference source and also causes a decrease in transmission efficiency. To minimize leakage:

- The waveguide should be firmly connected with an RF shielding gasket between sections
- The bolts holding the waveguide joints together should be outside the high intensity RF area
- The gasket should be located between the bolt holes and the RF area

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Radar Systems Interface (Continued)

Arcing in Waveguides

Arcing can occur inside of waveguide causing a high voltage standing-wave ratio (VSWR) due to:

- Foreign objects (including moisture) in the waveguide
- Corroded or flaked-off coating
- A sharp bend in the waveguide run

Any arcing in wave guide will usually reduce the radar's range due to high VSWR. The radar's video will also be degraded. To detect any arcing inside of wave guide:

- Look for discoloration in the wave guide caused by heat
- Feel the waveguide for hot spots
- Check forward and reflected power using a radar transmission test set

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Radar Systems Interference (Continued)

Arcing in Rotary Joints

Arcing may result when a radar rotary joint is:

- Dirty
- Worn
- Misaligned

This is a cumulative process since arcing causes further deterioration of the joint which results in more arcing. Sustained arcing normally causes a complete breakdown of the rotary joint.

Arcing in Mast Cables

Arcing can result when high energy radar beams strike mast discontinuities, such as; corroded cables, cable hanger straps, service platform safety lines (of chains), and the like. This kind of arcing, which can normally be seen and heard, can be best detected at night when the radars are operating.

Good housekeeping practices, such as replacing corroded cables, cleaning and tightening loose strap brackets, and replacing all metal safety lines with nonmetallic rope, will eliminate interference from this source. Cables should be run inside the mast or on the opposite side of any radar antenna. Cables which are located in the main beam of radars should have RF shielding installed over them.

Continued on next page

Radar Systems Interference (Continued)

PRF Overload

Receivers that are close to a radar antenna, experience interference due to "brute force" penetration of the RF pulse energy. The receiver does not have to be tuned to the frequency of the radar for this action to occur. Intense RF energy simply forces its way past the front-end selectivity and enters the active amplifier stage. The amplifier is driven alternately between cutoff and saturation by the interfering pulse, which gives the characteristic radar PRF buzz at the receiver output. Usually, the interference is heard only when the receiving antenna is illuminated by the radar beam.

The most effective method for preventing this kind of interference is to locate all receiving antennas out of the main beam of nearby high power radars. In some cases, it is necessary to install additional shielding of RF transmission cables that pass through the main radar beam.

It is also possible to run antenna cables inside the mast or on the side of the mast opposite the one in the path of the radar beam. The mast then serves as a shield to reduce the energy pickup on the antenna cables.

Running Rabbits

Interference between radars usually appears as a series of moving dots, "running rabbits," on the CRT. It occurs when several ships with the same type of radars are operating within a few miles of each other. It can also occur between radars of different types aboard one ship. Since the offending radar is not at exactly the same PRF, the dots are moving radially along the indicator sweep creating spiral interference patterns. A trained operator can usually read through this interference. However, high pulses can obscure desired targets.

EMI Reduction

Introduction

The goal of personnel who design ships and equipment is to design, manufacture, and install the equipment so that all potential interference situations are eliminated. However, the goal of eliminating potential interference situations has not been achieved. Therefore, field EMI reduction techniques are necessary.

Bonding

Bonding is the process of providing a low impedance union between two metallic conductors. Grounding implies an extension of this definition to include the establishment of a common reference point with regard to electric potential. Bonding can be accomplished by a variety of means. The objective is to obtain minimum resistance between two surfaces. The preferred method to use for reduction of electromagnetic interference is one in which the joint becomes a homogeneous mass of the joined metals.

The best methods for accomplishing this are welding and brazing. Of lesser value than welding or brazing are methods that make extremely good physical contact, such as; pressure connections obtained by bolting or riveting, and the installation of a low impedance RF bonding strap that acts as a low linear impedance shunt around a deteriorated junction.

Equipotential Ground Planes

The importance of equipotential ground planes for proper equipment operation, EMI suppression, and personnel safety cannot be over emphasized. An equipotential ground plane is a large conducting area which offers little impedance to current flow. It may consist of a single large conducting element or of many elements bonded together.

A single connection that offers significant impedance to current flow can place an entire grounding system at a high potential with respect to ground. Shielding connected to the system will then be completely ineffective. When such a high impedance connection is subjected to large amounts of current, the potentials which result can be extremely hazardous to personnel and equipment.

Oxides may form at mating surfaces of conductors which will greatly increase the impedance of the bond and form nonlinear junctions capable of generating and radiating various harmonic signals. Effective bonding techniques must be used to prevent the degenerative and hazardous effects of high impedance bonds. Testing procedures and their limitations must be clearly understood to ensure that adequate bonding techniques are implemented properly.

Continued on next page

EMI Reduction (Continued)

General Bonding Techniques

There are two general techniques for bonding: direct and indirect. Direct bonding is achieved by direct metal-to-metal contact between two metal items through the process of welding or brazing. Indirect bonding is achieved by the use of a bonding jumper or bolts between two metal items.

Direct Bonding

Direct bonding is always the preferred method since the microscopic path length involved in direct bonding has lower RF impedance than that of any practical indirect bonding method.

Indirect Bonding

Indirect bonding is at best only a substitute where physical constraints make it impractical to use direct bonding. When bonding by the indirect method, the length of the bond path should be as short as possible. In addition, when using bond straps, the welded-at-both-ends bond strap is preferred over the removable-end strap.

Shielding

Introduction

The two main purposes of shielding are to confine EMI within a specific region, and to prevent EMI from entering a specific region. Ideally, only a transmitter radiates energy and only a receiver receives energy. This seldom happens since electronic equipment is constantly producing energy that may interfere with adjacent equipment. Shielding is a means of de-coupling and reducing interaction between equipment.

Shielding Methods

The following are some examples of methods used to shield equipment:

- Metal Seams - No Gasket. It is necessary to have clean metal-to metal mating surfaces. To make sure that good pressure contact is achieved between the metal surfaces, you should use set screws or rivets. If the metal seams become corroded or anodized, a serious interference source may develop

- Metal Seams - Metallic Gasket. Metal seams can be improved by using metallic gaskets placed between the surfaces. These gaskets, often made of knitted wire mesh, are resilient and are good conductors. The metal-to-metal contacts must be maintained by a pressure of approximately 20 psi

- Holes and Screening. Holes or openings in a shielding enclosure cause a decrease in shielding effectiveness. However, holes or openings usually cannot be avoided. Large holes, particularly in high-frequency applications, are bad offenders. So, holes should be as small as possible. If large holes are present, they must be covered with copper mesh screening

Filtering

Introduction

Filters are combinations of circuit components designed to pass currents at certain frequencies or to attenuate currents at other frequencies. They use the resonance characteristics of series and parallel combinations of inductance and capacitance. The reactance reduces interference by introducing high impedance in series with the interference currents and/or shunting them to ground through low impedance.

Filtering Selections

The following characteristics are common to all filter installations, and should be carefully considered in filter selection:

- Voltage rating of the circuit in which the filter is to be inserted and the maximum current that will pass through the filter. Unless otherwise specified, voltage and current ratings required of a filter are the maximum allowable for continuous operation. Any filter will perform satisfactorily when it is operated below its nameplate rating. The breakdown voltage of capacitors used in filters should also be considered. A safety factor of approximately 100% should be used. For a given application, the working voltage of a standard filter capacitor should be twice the voltage of the circuit in which it is used. In general, filter test voltage should be twice the filter's nameplate rating

- Operating frequency of the circuit and the frequencies to be filtered. Power-frequency specifications are primarily applicable to low-pass line filters. Filters should not be operated at power frequencies above those specified by the manufacturer. They will operate satisfactorily at frequencies below those marked on the nameplates

- Voltage drop that can be tolerated at the operating frequency. All filters using series inductors cause some voltage drop. The amount of this drop is determined by the series resistance of the filter. It may be expressed, for example, as maximum voltage drop at rated current 0.1 volt. In some cases, only the series resistance is given. When this occurs, the voltage drop for AC filters (when cutoff frequency is far removed from the operating frequency) or DC filters can be calculated by applying Ohm's law

- Maximum ambient temperature at which the filter must operate. If the ambient temperature varies from the range specified for the filter, failure or shortened service life may result

Continued on next page

Filtering (Continued)

Filtering Selection (Cont'd)

- Attenuation required of the filter for adequate interference reduction
- Minimum filter life is the number of hours a unit will operate satisfactorily under rated conditions and at maximum ambient temperature
- Circuit requirements such as minimum (or maximum) capacitance or insulation resistance. The capacitance to ground of a filter often determines the application of the filter. Some circuits may limit the maximum capacitance to ground to prevent long time-constant currents from charging the capacitors through a resistor. Another instance in which capacitive limitations are important is when capacitors might cause danger to personnel because of charging currents

Filter Applications

The object of a filter is to discriminate against some frequencies while not affecting others. Typical applications include the following:

- Power-line filtering prevents HF signals from being conveyed by the power line to vulnerable equipment
- Bypassing allows the passage of low frequencies or DC while providing a low impedance path to "ground" for high frequencies
- Feed-through allows LF signals to be passed through a panel or bulkhead while bypassing or blocking HF interference
- Wave trapping uses high Q resonant or anti-resonant circuits to reject certain frequencies
- Harmonic suppression prevents harmonics from reaching the antenna or radiating in any other way
- Duct and shaft filtering prevents unwanted signals from leaving an equipment via air ducts or control shafts

Cable Segregation

Introduction

One way to reduce or eliminate electromagnetic interference onboard ship is to segregate cables and equipment. By using separation structures, such as false decks, bulkheads, doors, and masts, energy in high level circuits may be prevented from coupling to low - level circuits. High - energy circuits may interfere with medium and low - level circuits either by direct coupling or inductive coupling. Whenever practicable, interference reduction segregation measures should be considered before equipment is installed, and should prove to be more effective than shielding and grounding at a later date.

Types of Cables

All cables are grouped into three major types:

- Active (high level) - Includes; Radar Modulator pulse, MF and HF Transmitter cables
- Passive (medium level) - Power and lighting cables, control cables, intercommunication and fire control cables, and cables other than those which are active or susceptible
- Susceptible (low level) - Radio receiving antennas and transceiver cables

Separation Requirements

The following table gives the minimum separation requirements between categories of cables:

Type	Active	Passive	Susceptible
Active`	18”	18”	18”
Passive	18”	None	2”
Susceptible	18”	2”	None

At times it may be physically impossible for you to meet the separation standards between cables. In those situations you should provide additional shielding between cables to prevent possible interference.

The shortest cable run between equipments is not necessarily the best run if the cable is active and passes through a susceptible area compartment. Running the active cable around the susceptible compartment may prevent many problems at a later date.

Continued on next page

Cable Segregation (Continued)

AC Power Cables

Cables carrying varying current or voltage should be routed separately from cables carrying DC. Where it is necessary to run separate phase conductors for alternating current cables, the individual conductors should be as close as practicable throughout their entire length.

Audio Frequency Cables

Cables carrying audio frequency should be routed separately from each other. In installations where adequate separation is not practicable, audio frequency lines should be twisted pairs with an outer shield.

Interconnecting Cables

Cables interconnecting the units of individual equipments, particularly radar equipment, should be grouped and routed separately from all other cables.

Coaxial and Unshielded Cables

Coaxial antenna cables should be routed separately from all other cables, such as control cables.

Unshielded antenna transmission lines should be routed in the shortest, most direct route practicable and as far from other antenna cabling as possible throughout their length.

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Review Quiz

Questions

1. Which of the following choices is not a type of EMI?

   A. Man-made
   B. Inherent
   C. Unnatural
   D. Natural

2. Radar transmitters can produce spurious emissions from what?

   A. Arcing
   B. Intermodulation
   C. Sparking
   D. Bonding

3. What is the transfer of modulation from on carrier to another called?

   A. Intermodulation
   B. Cross modulation
   C. Intramodulation
   D. Countermodulation

4. What is the generation of numerous new frequencies from two or more signals called?

   A. Intermodulation
   B. Cross modulation
   C. Intramodulation
   D. Countermodulation

5. Which of the following is not a type of cable?

   A. Passive
   B. Susceptible
   C. Active
   D. Inactive

Review Quiz Answers

Answers

Question	Answer	Reference
1.	C	5-2
2.	A	5-3
3.	B	5-14
4.	A	5-14
5.	D	5-36

Lesson 6

HOW TO IMPLEMENT THE INSTALLATION OF AN ELECTRONICS EQUIPMENT AND/OR SYSTEM

Overview

Introduction

The Surface Forces Technical Compliance Technical Order (TCTO) Process Guide is an adaptation of the Aviation TCTO Process Guide modified for application to Surface Forces. This Process Guide is intended to serve as a "training resource" for the users of the new TCTO, who generally speaking, may not be familiar with the new CG Logistics Model. Furthermore, this Process Guide is intended to be a "living document" with changes made as the Surface Forces Logistics Center (SFLC) and C4IT Service Center mature, and users become more familiar with the processes outlined within the Guide.

The Surfaces Forces TCTO Process Guide supercedes the Engineering Change and configuration management processes outlined in Chapter 041 of the Naval Engineering Manual, and Chapter 5 of the Electronics Manual. One goal of Logistics Modernization is to standardize configuration management policy and processes, to the greatest extent possible, throughout the Coast Guard. A component of this effort is the adaptation of TCTOs by Surface Forces, in place of Engineering Changes.

Objectives

Given the proper equipment and job aids, **IMPLEMENT** the installation of an electronics equipment and/or system IAW the Technical Compliance Technical Order (TCTO).

References

The following references were used for this lesson:

- Electronics Manual, COMDTINST M10550.25 (series)
- Surface Forces Technical Compliance Technical Order (TCTO) Process Guide

TCTO Applications

Introduction

This Surface Forces TCTO Process Guide applies to assets throughout the entire life-cycle. An asset is defined as any USCG Cutter, Barge or Boat. During acquisition, any changes executed to an asset class after one or more such assets have already been delivered, must be retrofitted, or a new asset sub-type must be created and concurrently authorized by CG-45, CG-731/751, CG-64, CG-113, and CG-9 (the Tri-Partite).

Note: *As of this writing the TCTO process for shore facilities is still in its infancy due to modernization. All shore facilities shall also use the guidelines directed by Surface Forces TCTOs until further direction becomes available.*

Modernization

Surface Forces TCTOs apply to assets and units that have undergone Logistics Modernization (Modernized Units), and those that are operating under a traditional Naval Engineering and Electronics support infrastructure (Non-Modernized Units). Where differences exist in processes for Modernized and Non-Modernized Units, these differences are indicated in the Surface Forces TCTO Process Guide.

PPE and Life-Saving Gear

The Surface Forces TCTO Process Guide also applies to personnel protective equipment and lifesaving gear intended specifically for use aboard assets when one or more such assets are assigned to units that have undergone Logistics Modernization, and if this equipment is enrolled in ALMIS.

TCTO Purpose

Introduction

TCTOs are required for the following configuration change proposals:

- Changes to an asset's mission characteristics or capability
- Changes in weight that significantly affect intact or damaged stability
- Non-Self-Righting Small Boats (less than 65 feet in length): Changes that create more than a 0.002 ft change in the center of gravity in any direction (vertical, longitudinal, or transverse) or net weight changes of more than 1/5 of 1% of the full load displacement
- Changes to hull structure, space allocation, watertight integrity, or compartment
- Change to any system that affects spare parts allowances
- Changes to an approved fluid, or paint system
- Changes requiring prototype evaluation
- Changes that require Electromagnetic Compatibility (EMC) or TEMPEST inspections
- Form, fit or function changes. A change to form is any change that affects the weight, balance, or movement of inertia of a component. A change to fit is any change that affects an interface with other components. A change to function is any change that affects operational characteristics
- All required software modifications affecting equipment installed on CG surface assets that have been evaluated by the appropriate Product Line Manager

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TCTO Purpose (Continued)

Introduction (Cont'd)

TCTOs are also required for the following configuration change proposals:

- Any change that modifies the Damage Control classification of a fitting
- Any change that modifies equipment, components, or materials used in a system. **EXAMPLE**: the replacement of an old fan motor (no longer manufactured) with a new fan motor that is a direct replacement with the same wiring connections, weight, and performance characteristics. Even though this example does not constitute a "form, fit, or function change," it still requires a TCTO to document the modification in asset configuration
- Fleet-wide time-sensitive inspections or changes
- Revisions to previously approved TCTOs
- Phase 1 and Phase 2 Configuration Control Board changes
- Any proposed change that is intended to modify an asset's mission characteristics or capability must be accompanied by a modification to the asset's Operational Requirements Document (ORD). The ORD is a top-level decision document which establishes the minimum acceptable standards of performance and optimum performance goals for an asset. Details regarding ORD development and requirements are contained in reference (e) of the Surface Forces TCTO Process Guide

Note: *Minor capability changes that come about as a result of replacing an obsolete component or software system with the equivalent currently available component or system (termed "Technology Refreshment") do not require an ORD. An example includes the replacement of an obsolete RADAR (no longer produced or supported by the OEM) with the same model RADAR built 10 years later, that now has automated target tracking, collision avoidance warnings, and Automated Information System integration software. Although these capabilities did not exist in the previous version, the intent of the Radar replacement was to address the obsolete system, not to increase capability. The increased capability was simply an incidental outcome of the replacement, and not the primary intent of the configuration change.*

TCTO Process

Steps

The steps for completing the TCTO process are furnished in the table below:

1. The TCTO process starts with an idea. This idea may start with suggestions from the field, MISHAPs, Original Equipment Manufacturer (OEM) Service Bulletins, or changes to operational requirements through Operational Requirements Documents (ORDs). They may also be initiated from within a Product Line, based on an Unsatisfactory Report (UR) for an affected part, an asset MISHAP, or from parts reliability data.

Note: *Anyone in the Coast Guard can raise an issue that starts the TCTO process, however, TCTOs must undergo initial screening by the Chain of Command, Prime Unit, Product Line, and C4IT Service Center (when applicable).*

2. TCTOs shall be initiated by submitting Form CG-22 with an attached draft TCTO, to the respective Product Line through the Chain of Command. TCTOs shall be endorsed by one of the authorities listed below, commenting specifically on the feasibility of the change based on the criteria established in reference (d) of the Surface Forces TCTO Process Guide. If the change is an operational improvement, the endorsing authority must comment specifically on the operational scope of the improvement, and specific impact on mission execution:

    - Cutter Commanding Officer (O-5 and above)
    - Group Commander
    - Sector Commander
    - Training Center Commanding Officer
    - District Chief of Response or Prevention
    - Asset Project Office Commanding Officer
    - Product Line Manager
    - Engineering Services Division (GS-14/O-5 and above)
    - C4IT Service Center of Excellence Commanding Officer
    - Electronics Support Unit Commanding Office

Continued on next page

TCTO Process (Continued)

Steps (Cont'd)

3. Any draft TCTO that proposes an improvement in asset operational capability must be accompanied by an Operational Requirements Document (ORD)

4. Draft TCTOs shall include as much of the following information as available to the originator:

a. **Application:** Must include all applicable assets.

b. **Purpose:** List the intended purpose of the change.

c. **TCTO Coordinator:** Leave blank.

d. **When to be accomplished:** Write down the recommended time frame for the change. Typically, unless the change is safety-related, the default time is four years (one availability cycle).

e. **By Whom to be Accomplished:** Indicate the optimal installation activity (unit, depot, contractor, etc.).

f. **What is required:** Include a cost estimate, list of parts, stock numbers, references, special tools, and personnel required to perform the installation. Also include any changes in spare parts inventories. Furthermore, estimate the personnel required to perform the work, including estimated labor hours.

g. **How Work is accomplished:** Provide a description of how the work shall be performed, with sufficient detail to allow the Product Line and Prime Unit to begin development of a TCTO.

h. **Supplemental Information:** Include estimated weight and moment information, including the estimated weight removed or added, and the location of the net weight change in reference to the Longitudinal Center of Gravity (LCG), Vertical Center of Gravity (VCG), and Transverse Center of Gravity (TCG). Also indicate any changes that may impact training requirements.

i. **Records:** Include all affected drawings, technical publications, and Maintenance Procedure Cards (MPCs), and if equipped, impacts to Operational Sequencing Systems.

Continued on next page

TCTO Process (Continued)

Steps (Cont'd)

5. When the Product Line receives a properly endorsed CG-22 and draft TCTO, they shall forward copies to the Prime Unit for initial validation, and begin taking action to process and track the draft TCTO. If the draft TCTO pertains to C4IT equipment, a copy shall also be forwarded to the C4IT Service Center. The Product Line shall hold routine audio conferences with the Prime Unit and C4IT Service Center to discuss status of pending draft TCTOs, and to coordinate the TCTO development process.

6. The Product Line Engineering Section shall enter a scanned copy of the CG-22 and draft TCTO into the SFLC (Surface Forces Logistics Center) Central Projects database for tracking purposes. This database shall be used to track all pending TCTOs. TCTOs that have been received by the Product Line, but have not yet been vetted by the Prime Unit are considered to be in "Concept" status.

   Once the Prime Unit and Product Line have started an initial validation of the draft TCTO, the Product Line Engineering Section shall update the status of the TCTO in SFLC Central Project's database by changing the status from "Concept" to "Validation". The respective C4IT Service Center CT shall team with the Prime Unit and Product Line to validate C4IT changes, commenting on impact to fleet readiness, and suitability for Phase I Surface Forces Configuration Control Board (SFCCB) review.

Note: *Several more steps are involved in the TCTO approval process, but due to the complexity of the process, this lesson will conclude at this step. It is important to understand that a TCTO that has been entered into this database isn't automatically approved.*

TCTO Example

Example

Below is an example of a TCTO:

U.S. COAST GUARD
ASSET COMPUTERIZED MAINTENANCE SYSTEM

MLB - 47
TH1000.0
REV'D: 02/25/09

ASSET NUMBER	OPERATING ACTIVITY	MAINTENANCE ACCOMPLISHED				MAINTENANCE DUE			
		DATE			ASSET HOURS	DATE			ASSET HOURS
		MO	DAY	YEAR		MO	DAY	YEAR	
		ZULU DATE			ZULU TIME				
		MO	DAY	YEAR					

ITEM NO.	CMS CODE	ACTION	DESCRIPTION	CEINUM
[X] DUE	TH1000	REPLACE	AUTOPILOT	ML-B000-001

☐ SCHEDULED ☐ UNSCHEDULED

MAN HOURS: MK___ DC___ EM___ ET___ GM___ BM___ FN___ SN___ OTHER___

REMARKS: _____

TECHNICIAN'S SIGNATURE | TECHNICIAN'S ID

*ASTERISK INDICATES QA REQUIRED | QA

IMMEDIATE ATTENTION REQUIRED

TIME COMPLIANCE TECHNICAL ORDER

TCTO MLB-47 TH1000

THIS TECHENICAL ORDER IS APPLICABLE TO ALL 47 FOOT MLB STANDARD BOAT HULLS.

THIS TECHNICAL ORDER DIRECTS AND AUTHORIZES THE REPLACEMENT OF THE CURRENT RAYTHEON AUTOPILOT SYSTEM WITH THE FURUNO NAVPILOT 500 AUTOPILOT SYSTEM.

REVIEWED BY | LOG YN | DATA ENTRY COMPLETED

Page 1 of X

Note: *In the body of this document you should put as much of the information contained in Step 4 of the TCTO process as feasible. This information is located on page 6 of this lesson.*

Review Quiz

Questions

1. Which of the following choices describes a "change to form"?

   A. Any change that affects an interface with other components
   B. Any change that affects operational characteristics
   C. Any change that affects the mission of an asset or component
   D. Any change that affects the weight, balance, or movement of inertia of a component

2. What is an Operational Requirements Document (ORD)?

   A. A top-level document that establishes the approval of a TCTO request
   B. A top-level decision document which establishes the minimum acceptable standards of performance and optimum performance goals for an asset
   C. A document submitted with the TCTO request
   D. A document submitted by the Product Line Manager to enter a TCTO into the TCTO database

3. Which form must be submitted with a draft TCTO?

   A. CG-22
   B. CG-25
   C. CG-20
   D. CG-29

4. Any draft TCTO that proposes an improvement to an asset's operational capability must be accompanied by a _____.

   A. DD-1149
   B. CG-22
   C. CG-29
   D. ORD (Operational Requirement Document)

5. Which section of the TCTO draft document contains the amplifying information?

   A. Header
   B. Footer
   C. Body
   D. Note

Review Quiz Answers

Answers

Question	Answer	Reference
1.	D	6-3
2.	B	6-4
3.	A	6-5
4.	D	6-6
5.	C	6-8

Lesson 7

HOW TO VERIFY THE INSTALLATION OF A FIELD CHANGE/ORDALT TO AN ELECTRONICS EQUIPMENT AND/OR SYSTEM

Overview

Introduction

This lesson contains information on Coast Guard-initiated field changes, including:

- A description of what qualifies as a field change
- The processes for approving, distributing, and installing field changes
- Field change requirements and exceptions
- Emergency and urgent alterations to electronic equipment
- Maintenance hints
- The difference between a field change and a
  - maintenance hint, or
  - depot change
- A description of the field change package
- Types of field changes
- Field change parts kit
- Distributing field change packages through the Engineering Logistics Center (ELC)
- Guidelines for field change trial installations
- An example of a Field Change Bulletin with enclosures

Continued on next page

Overview (Continued)

Objectives

Given the required parts and documentation, **VERIFY** the installation of a field change/ORDALT.

- Identify associated equipment
- Perform full functional to verify operation

References

The following references were used in this lesson:

- Electronics Manual, COMDTINST M10550.25 (series)
- Ordnance Manual, COMDTINST 8000.2 (series)
- Navy Electronics Installation and Maintenance Book, NAVSEA SE000-00-EIM-160

Purpose of Field Changes/ORDALT

Purpose

The Systems Management and Engineering Facility (SMEF), NAVSEA, or Engineering Logistics Center (ELC) issues field changes to:

- Modify electronic equipment to meet a change in operational requirements
- Remove hazards
- Correct design deficiencies
- Improve reliability and maintainability
- Correct technical documentation

Field change modifications may include changes to:

- Components
- Physical alteration of cabinets or housing
- Operational tolerances or capabilities
- Technical manuals

Coast Guard Initiated Field Changes

Types of Field Changes

Field changes to modify electronic equipment are issued to:

- Meet a change in operational requirements
- Remove safety hazards
- Correct design deficiencies
- Improve reliability and maintainability
- Correct technical documentation

The types of field change modifications, issued in the Coast Guard field change bulletin, are described in the table below:

Type	Description
1.	Type 1 field change furnishes a field change parts kit (which is assigned an Activity Control number, and includes documentation, parts, and special tools) required to complete a change. It requires the installing unit to: • Complete alterations to equipment • Add corresponding changes to the technical documentation
2.	Type 2 field change furnishes documentation only. It requires the installing unit to: • Procure (and provide the funds for) required parts or special tools from an appropriate supply source • Complete alterations to the equipment • Add corresponding changes to the technical documentation

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Types (Cont'd)

Type	Description
3.	Type 3 field change furnishes documentation and some of the parts or special tools needed in a field change parts kit. It requires the installing unit to: • Procure the remainder of the required parts or special tools from a specified source • Complete alterations to the equipment • Add corresponding changes to the technical documentation
4.	• Type 4 field change implements changes to technical documentation only. It requires no alterations to the equipment

Field Change Installation and Reporting

Field change installation and reporting is described in the process below:

Stage	Description
1.	The SMEF or ELC: • Notifies the activity supervisor that a field change package is being delivered via message traffic or e-mail • Provides a shipping number for tracking purposes ***Note:*** *The notification includes the target installation date.*

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Installation and Reporting (Cont'd)

Stage	Description
2.	The personnel assigned to install the field change (as indicated on the Field Change Bulletin): • Verifies the applicability of Coast Guard field changes in the Coast Guard Planned Maintenance System (CGPMS) Work Schedule Book • Installs all applicable field changes • Affixes the Field Change Accomplishment Plate ***Note:*** *Depending on the field change installation requirements, installations may be completed by:* • The unit's Electronics Technician (ET) • A supporting unit • A SMEF • A contractor
3.	The individual operating the unit confirms that a field change has been installed, by physically checking the equipment using the identification paragraph of the Field Change Bulletin and the Field Change Accomplishment Plate. ***Note:*** *Applicability of Coast Guard field changes may be verified in the CGPMS Work Schedule Book.*
4.	The activity/unit that receives the installed field change submits the OPNAV 4790/CK Configuration Change form to the ELC to report that the field change has been installed.

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Field Change Requirements

When a field change is issued for a specific type of equipment, the modification must be installed in all equipment of that specific type, as identified in the Field Change Bulletin. Any exceptions are specified by equipment serial number, location, or use, in the Field Change Bulletin.

IMPORTANT: *Engineering changes to installed electronic Coast Guard equipment can only be made when directed by an authorized field change. Exceptions can be made under emergency or urgent situations.*

Emergency Alterations to Equipment

Operational requirements may necessitate emergency alteration of equipment to:

- Effect a change in operational characteristics, which if not accomplished may seriously compromise national security
- Correct an extremely hazardous condition, which may result in
  - Fatal or serious injury to personnel
  - Extensive damage or destruction of the equipment.

IMPORTANT: *Units are advised to obtain permission prior to making any emergency alternations. However, in emergency situations, the Commanding Officer has final approving authority for implementing such alterations.*

Using the most expeditious method available to the unit, immediately report any emergency alteration. Follow up with a formal report by completing OPNAV 4790 CK, Configuration Change Form, and submitting it to the Configuration Data Manager.

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Urgent Alterations to Equipment

In urgent situations, the equipment alteration may authorized by:

- Electronics Advisory (ALDIST)
- SMEF advisory
- Field Change Bulletin

An urgent priority is assigned to field changes for one or more of the reasons below:

- To effect a change in operational characteristics, which if not accomplished may seriously compromise the mission effectiveness of the deployed equipment or forces
- To correct a potentially hazardous condition, which may result in serious injury to personnel or damage to the equipment
- To conform to significant contractual requirements
- To effect value engineering or other cost reduction efforts, net life cycle savings to the government of more than $100,000, where expedited processing of the change will be a major factor in realizing lower costs

Hints vs. Field Changes

A maintenance hint is a procedure not formerly documented that is useful in servicing electronic equipment. A maintenance hint is not a field change, because it does not change the configuration of the electronic equipment.

Example: *A maintenance hint may be a revised method for disassembly and re-assembly of a complicated servomechanism that simplifies the procedure or decreases the time involved.*

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Depot Change vs. Field Change

A depot change is not a field change because a modification to modules, subassemblies, or equipment is designated as depot level repairable, therefore the change is performed at a designated depot level maintenance facility.

Example of a Depot Change: A modified module that is designated for depot repair and is electrically, physically, functionally, and pin-for-pin interchangeable with the unmodified module, is simply returned to the supply pipeline upon modification.

Example of a "Depot Changed" Field Change: When a "Depot Changed" module or equipment is not directly interchangeable and requires mainframe wiring or component changes, it may be provided as a "Depot Changed" part for a Type 1 or Type 3 field change parts kit.

SMEF Request Through ELC

A SMEF may request that field change parts be stored in the Headquarters Office/Headquarters Unit (HQO/HQU) Materiel Management Projects at the Engineering Logistics Center (Code 031):

- For a limited time to ensure that necessary units have received the parts kits and bulletin to install in the applicable equipment
- When field change part kits fabricated by the Coast Guard are not distributed by the Commandant or SMEF (Assigned SMEFs can request a stock number for a Field Change Bulletin)

Note: *Bulletins are available on the applicable SMEF's intranet Web site.*

Reference: *For more detail on establishing, maintaining and closing an HQO/HQU Materiel Management Project, refer to Headquarters Materiel Management Projects at the Engineering Logistics Center, COMDTINST M4000.13 (series).*

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Field Change Bulletin

The Field Change Bulletin provides authority for the installation of the field change. The parts of the Field Change Bulletin are described in the table below:

Part	Description
Field Change Number	The number that uniquely identifies the field change. For Coast Guard equipment, the field change number is assigned by the SMEF or designated EM. For Navy-type equipment, field changes are numbered consecutively. The starting number depends on which branch initiated the field change. Navy- type field changes initiated by the Navy: • Field Changes numbers consecutively start with 1 Navy -type field changes initiated by the Coast Guard: • Field Change numbers consecutively start with 91
Field Change Type	Explains the type of field change to be implemented.
Activity Control Number	A number issued by the ELC.
Stock Number	The Federal Stock System number assigned to an item. The bulletin identifies the stock number of the parts needed for the installation.

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Field Change Bulletin (Cont'd)

Part	Description
Required Sections	The field change bulletin is organized into the following sections: • Purpose • Description • Equipment affected • Identification of accomplishment • Materials required • Tools required • Test equipment required • Procedure • Routine instructions
Distribution Instructions	All Field Change Bulletins must contain distribution directions, especially in the case of the following servicing units: • Electronics Support Unit (ESU) • Electronic Support Detachment (ESD) • Aids to Navigation (ATON)
Enclosures	The following enclosures are included, as needed, to clearly outline the field change to equipment managers and support personnel involved in implementing a field change: • Corrections to technical documentation • Parts lists • Step-by-step installation procedures • OPNAV 4790/CK Configuration Change Form

Coast Guard Initiated Field Changes (Continued)

Field Change Parts Kit

A field change parts kit is included with Type 1 and Type 3 field changes. It includes the following items needed to implement the field change:

- Parts
- Special tools
- Related parts lists
- Installation procedures
- A copy of the field change bulletin

Errata Sheet

If relatively minor mistakes have been made in the Field Change Bulletin, an Errata Sheet is issued to correct these errors, and distributed to all units that received the field change.

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Field Change Bulletin Example

Examples of Pages 1 and 2 of the Field Change Bulletin are depicted on the following pages:

ELECTRONIC FIELD CHANGE BULLETIN

F. C. NO. 19 TYPE 1 TO AN/FPN-64A(V) LORAN-C TRANSMITTER SET

PURPOSE:

This field change reduces the off-air time when switching output/coupling networks in the AN/FPN-64(V) and AN/FPN-64A(V) LORAN-C Transmitter Sets.

DESCRIPTION:

This field change modifies the 2A1A2A1A7 RF Switch Control PCB to reduce the off-air time to 15 seconds when switching output/coupling networks. This field change also provides corrections to the technical manual to document the changes to the RF Switch Control PCB.

EQUIPMENT AFFECTED:

This field change is applicable to all AN/FPN-64(V), and AN/FPN-64A(V) LORAN-C Transmitter Sets.

IDENTIFICATION OF ACCOMPLISHMENT:

The presence of 510 k ohm resistors for R20 and R35 on the 2A1A2A1A7 RF Switch Control PCB identifies accomplishment of this field change.

MATERIALS REQUIRED:

RF Switch Control PCB, NSN XB 5998-01-068-5615, modified by Depot Change 03 (orange stripe on the edge of the circuit card).

TOOLS REQUIRED:

None.

PROCEDURE:

1. Follow the step-by-step installation instructions in enclosure (1).

2. Perform the technical manual corrections in enclosure (2).

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Field Change Bulletin Example

3. Complete and return the Field Change Installation Feedback Report provided as enclosure (3).

ROUTINE INSTRUCTIONS:

1. Record completion of this field change by making an entry on the Field Change Accomplishment Plate, NSN OI 0264-LP-456-6411, available from the Naval Publications and Forms Center, Philadelphia, PA.
2. Maintenance support facilities shall maintain a library copy of this and all other applicable field change bulletins. Additional and replacement copies can be obtained from Coast Guard Engineering Logistics Center, Baltimore, MD. Order directly at no cost using MILSTRIP procedures; NSN CG 7610-01-GE8-6673 applies.
3. Upon completion, a copy of this field change bulletin shall be inserted in front of all applicable technical manuals. Cognizant commands shall ensure that the field change has been accomplished and that applicable technical manual annotations and reports have been made.

C. A. SCHUE, III

Encl: (1) Installation Instructions for FC 22/19 to the AN/FPN-64(V)/64A(V)
(2) Technical Manual Corrections for FC 22/19 to the AN/FPN-64(V)/64A(V)
(3) Field Change Installation Feedback Report

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Page 1 of Installation Instructions

Examples of pages 1 and 2 (Installation Instructions) are depicted in the following pages:

Installation Instructions for FC 22/19 to the AN/FPN-64(V)/64A(V)

SAFETY NOTE

COMPLY WITH U.S. COAST GUARD SAFETY PRECAUTIONS AND THE ELECTRONICS MANUAL, COMDTINST M10550.25A

NOTE: Read all instructions before attempting to complete this field change.

1. Order three modified RF Switch Control PCBs, NSN XB 5998-01-068-5615 (one for the installed TOPCO, one for the spare TOPCO, and one for a MICA spare), and using normal APA requisitioning procedures. Once received, proceed to step 2.
2. Notify the control station that this field change is being installed and might cause a MOA when power is secured and reapplied to the TOPCO.
3. Place the MANUAL/AUTO switch on the PPU A11 Panel to MANUAL.
4. Secure power to the TOPCO by turning off CB1 (battery) and CB2 (AC) on the rear of the unit.
5. Open the TOPCO and locate the RF Switch Control PCB (green card extractor).
6. Remove the existing RF Switch Control PCB.
7. Insert the modified RF Switch Control PCB and close the TOPCO.
8. Return power to the TOPCO, by turning on CB2 (AC) and CB1 (battery) on the rear of the unit.
9. Place the MANUAL/AUTO switch on the PPU A11 Panel to AUTO.
10. Notify the control station that you will be switching output/coupling networks twice to test the new RF Switch Control PCB.
11. Switch output/coupling networks by pressing the COMMAND button on the TOPCO. Note how long the station is off air. It should be off air for approximately 15 seconds.

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Page 2 of Installation Instructions

12. Switch output/coupling networks again by pressing the COMMAND button on the TOPCO. Note how long the station is off air. It should be off air for approximately 15 seconds.

13. Notify the control station that the installation is complete.

14. Return all unmodified RF Switch Control PCBs to ELC using normal procedures for returning defective XB items. On the "Serviceable/Unserviceable Material Tag" for trouble indication write "Requires most recent depot change".

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Tech Manual Corrections

An example of a "Technical Manual Corrections" enclosure to a Field Change Bulletin is shown below:

Technical Manual Corrections for FC 22/19 to the AN/FPN-64(V)/64A(V)

1. Make the following pen and ink corrections to the AN/FPN-64(V)/64A(V) Technical Manuals. Write "FC 22/19 to the AN/FPN-64(V)/64A(V)" at the bottom of each corrected page.
   a. Page 2-19, Table 2-2, Item 38, line 6, in the Function column, change 20 seconds to 15 seconds.
   b. Page 3-125, Figure 3-45, change both 20-Sec One-Shot to 15-Sec One-Shot.
   c. Page 3-126, Paragraph 3-222, 5th and 9th lines, change 20-sec to 15-sec.
   d. Page 3-126, Paragraph 3-223, 1st and 5th lines, change 20-sec to 15-sec.
   e. Page 3-186, Paragraph 3-355, sub-paragraph 1, 2nd line, change 20 sec nominal to 15 sec nominal.
   f. Page 3-189, Paragraph 3-360, sub-paragraph 7, change 20-sec to 15-sec.
   g. Page 3-189, Paragraph 3-360, sub-paragraph 8, change 20-sec to 15-sec.

2. Make the following page change:

REMOVE	INSERT
Page 5-121 (Original)	Page 5-121 (FC 22/19)

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Page 1 of Errata Sheet

An example of page 1 of an Errata Sheet is shown below:

ERRATA SHEET NO. 1
TO
F. C. NO. 19 TYPE 1 TO AN/FPN-64A(V) LORAN-C TRANSMITTER SET

PURPOSE:

This errata is being released to ensure timely modifications to the RF Switch Control PCBs and increase the number of spares in the pipeline. This errata modifies the installation instructions and provides resistors to accomplish this field change. Normally field units would not work on XB modules; however, the LORSTAs and the ELC repair depot would benefit from this, enabling the LORSTAs to accomplish this field change quickly and ensuring that adequate spare PCBs remain in stock.

LORSTAs that have ordered, but have not received the RF Switch Control PCBs, should cancel their orders. If modified PCBs have been received, verify that they function properly and install them in accordance with the original installation instructions in Field Change 22/19 to the AN/FPN-64(V)/64A(V). If the modified boards do not function properly, return them to ELC for repair.

PROCEDURE:

A qualified Electronics Technician shall perform the following procedure on each RF Switch Control PCB, using the proper soldering tools and techniques:

1. Identify the resistors to be replaced; R20 and R35, on the MICA spare RF Switch Control PCB.
2. De-solder and remove R20 and R35. Be very careful not to damage the circuit runs or eyelets.
3. Insert the new 510k-ohm resistors (provided by LSU) in the now vacant R20 and R35 locations.
4. Solder the new resistors in place, again being careful not to damage the circuit runs or eyelets.
5. Locate the black and brown stripes on the edge of the CCA. Using the paint pen provided, paint an orange stripe immediately following and the same length as the black and brown stripes.
6. Repeat steps 2 through 5 on the RF Switch Control PCB from the spare TOPCO.

Continued on next page

Coast Guard Initiated Field Changes (Continued)

Page 2 of Errata Sheet

An example of page 2 of an Errata Sheet is shown below:

7. After installing the new 510k ohm resistors in both spare RF Switch Control PCBs (from the MICA and spare TOPCO), test them both by following steps 2 through 12 in the original installation instructions supplied in Field Change 22/19 to the AN/FPN-64(V)/64A(V).

8. Repeat steps 2 through 5 on the RF Switch Control PCB that was removed from the on-line TOPCO.

9. After installing the new 510k ohm resistors in the RF Switch Control PCB that was in the on-line TOPCO, test it by following steps 3 through 13 in the original installation instructions supplied in Field Change 22/19 to the AN/FPN-64(V)/64A(V).

10. After verifying that all the PCBs function properly, return one spare PCB into the spare TOPCO and the other one into the MICA for storage.

PARTS SUPPLIED WITH THIS ERRATA:

Item Name	NSN	Quantity
510k Ohm, ¼ Watt Resistors	5905-00-246-8690	6
Orange paint pen	None	1

ROUTINE INSTRUCTIONS:

1. Record completion of this errata by making an entry on the Field Change Accomplishment Plate, National Stock Number (NSN) OI 0264-LP-456-6411 (available from the Naval Publications and Forms Center, Philadelphia, PA).

2. Maintenance support facilities shall maintain a library copy of this and all other applicable field change bulletins. Additional and replacement copies can be obtained from Coast Guard Engineering Logistic Center, Baltimore, MD. Order directly using MILSTRIP procedures; no cost is involved. NSN CG 7610-01-GE8-6674 applies.

3. Upon completion, a copy of this errata shall be inserted in front of all applicable technical manuals. Cognizant commands shall ensure that this errata has been accomplished and that applicable technical manual annotations and reports have been made.

G. K. Weeks, Jr.

Field Changes Initiated by Other Sources

Introduction

This topic contains information on field changes initiated by other sources, including:

- Agency equipment field change authorization policy
- Navy field changes
- Commercial field changes

Note: *As a rule, field changes generated by other agencies are authorized for those agencies' equipment which is used by the Coast Guard.*

Navy Field Changes

Coast Guard units are authorized to install Navy field changes to the appropriate equipment upon receipt of the field change. The table below describes the process used to notify the Coast Guard of Navy field changes to maintain compatibility of all Navy Type equipment, whether Navy-owned, or Coast Guard-owned.

Note: *Questions concerning Navy Type field changes may be addressed to either the Engineering Logistics Center (ELC) (Code 016) or Commandant.*

Stage	Description
1.	Navy In-Service Engineering Agent (ISEA) sends field changes to registered users of the Ship Configuration and Logistics Support Information System (SCLSIS) database. ***Note:*** Navy ISEA has similar functionality to a Coast Guard SMEF.

Continued on next page

Field Changes Initiated by Other Sources (Continued)

Navy Field Changes (Cont'd)

Stage	Description
2.	Coast Guard units complete the Navy field change. ***Note:*** *If the field change is outside the ability of the servicing technicians, the field command is completed on the next scheduled visit by the appropriate Systems Command (SYSCOM) Groom Team:* • *Space and Naval Warfare Systems Command (SPAWAR)* • *Naval Air Systems Command (NAVAIR)* • *Naval Sea Systems Command (NAVSEA)*
3.	After installing the field change, the unit submits an OPNAV 4790/CK Configuration Change Form to ELC (Code 016).

Commercial Field Changes

Field changes issued directly by a commercial manufacturer are not permitted.

The process for verifying and incorporating commercial field changes into the Coast Guard field change process is described in the table below:

Stage	Description
1.	A manufacturer issues a change bulletin for commercial electronic equipment used by the Coast Guard. ***Note:*** *When any unit receives information concerning a change to commercial equipment, not previously published or authorized, the unit forwards the information to the appropriate SMEF via NAVSEA.*

Continued on next page

Field Changes Initiated by Other Sources (Continued)

Commercial Field Change (Cont'd)

Stage	Description
2.	The SMEF: • Screens the commercial change bulletin to ensure applicability • Creates a Coast Guard Field Change Bulletin • Issues the Coast Guard Field Change Bulletin to Coast Guard operating units that have equipment that is applicable to the field change
3.	The Coast Guard unit implements the Coast Guard field change and completes all documentation.

Documenting Completed Field Changes

Introduction

This topic contains information on documentation requirements for completed field changes, including:

- Field Change Accomplishment Plate
- OPNAV 4790/CK Configuration Change Form
- CMPlus entries required for field changes

Field Change Accomplishment Plate

After completing the field change, the installer completes and affixes the Field Change Accomplishment Plate, using the guidelines below:

- Record all field changes completed for the equipment on the Field Change Accomplishment Plate
- Affix the completed Field Change Accomplishment Plate to the electronic equipment, in a visible location

Note: *Field Change Accomplishment Plates are available from the Naval Publications and Forms Center (NPFC), Philadelphia under NSN 0264-LP-456-6411.*

OPNAV 4790 C/K

The OPNAV 4790/CK Configuration Change Form is used to report to the Configuration Data Manager any configuration change, including installation, de-installation, or modification (after completing an authorized field change). After a field change is installed:

- The installer completes the OPNAV 4790/CK Configuration Change Form
- The unit's Commanding Officer (or designee indicated on the OPNAV 4790/CK)
  - verifies the information, and
  - signs and submits the form

Note: *Units must enter completed field changes into the CMPlus unit configuration management database.*

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Review Quiz

Questions

1. Which type of field change furnishes documentation only?

   A. Type 1
   B. Type 2
   C. Type 3
   D. Type 4

2. Which type of field change furnishes documentation and some of the parts?

   A. Type 1
   B. Type 2
   C. Type 3
   D. Type 4

3. Which can be used to document minor errors in the Field Change Bulletin?

   A. Errata Sheet
   B. FBR
   C. CG-22
   D. DD-1149

4. A Coast Guard SMEF has similar functionality to a Navy _____.

   A. NESA
   B. NISA
   C. NSA
   D. ISEA

5. Field changes issued directly by a commercial manufacturer are _____.

   A. permitted
   B. not permitted
   C. equipment dependent
   D. sometimes authorized

Review Quiz Answers

Answers

Question	Answer	Reference
1.	B	7-4
2.	C	7-5
3.	A	7-12
4.	D	7-20
5.	B	7-21

Appendix A

Questions

1. When should units use Local PMS? Choose all that apply.

   A. When Navy PMS isn't available
   B. When CGPMS isn't available
   C. At any time
   D. Never

2. Who is responsible for integrating CGPMS procedures into the unit's work schedule, and ensures compliance?

   A. ETIC
   B. EMO
   C. CO
   D. Ops

3. Which of the following logistics management program combines several applications in order to provide the necessary functions?

   A. CMPlus
   B. CGMS
   C. ACMS
   D. ALMIS

4. Who is responsible for ensuring that checks and audits of all tag-outs are performed once every two weeks?

   A. CO
   B. Department Head
   C. EMO
   D. XO

5. When asked to view incoming FLS messages in CMPlus, you should select the "_____" button.

   A. Yes
   B. No
   C. Maybe
   D. Ask me again later

6. After shipping a DLR item to the appropriate facility, how should the unit track the equipment?

   A. ALMIS
   B. ACMS
   C. CGMS
   D. CMPlus

Appendix A (Continued)

Questions (Cont'd)

7. After the unit receives a message stating that a DLR or MTR part is overdue, how many days do they have to send the appropriate part in?

   A. 10
   B. 15
   C. 30
   D. 45

8. The following transfer of interference from an interfering source to the affected equipment is caused by _____ and _____.

   A. convection
   B. radiation
   C. conduction
   D. absorption

9. In order for galvanic corrosion to occur _____ must happen.

   A. current must flow
   B. the metals must be outside
   C. overvoltage condition must exist
   D. one of the metals must get wet

10. When dealing with USCG field changes, who has the authority to provide shipping numbers for tracking purposes? Choose all that apply.

   A. OSC
   B. NAVSEA
   C. SMEF
   D. ELC

Appendix B

Answers

Question	Answer	Reference
1.	A and B	1-2
2.	C	1-3
3.	D	1-8
4.	B	2-2
5.	B	3-4
6.	D	4-2
7.	C	4-6
8.	B and C	5-6
9.	A	5-22
10.	C and D	7-5

Request for Feedback – ET1 Administration

Suggestions and Corrections

Please note your suggestions, corrections, and comments below.

Page	Location on Page	What Correction is Needed

Your Comments

If you were writing this pamphlet, what improvements would you make? What was good about it? What did you not like about it? Please be specific in your comments/suggestions.

To Contact You

Please provide the following so that we can contact you if needed.

Name	Unit	Phone
		( )

Mail, Fax, or Call

Please mail, fax, or call your information to:

Commanding Officer (CED)
U.S. Coast Guard
Training Center Petaluma
599 Tomales Rd.

PHONE: (707) 765-7129
FAX: (707) 765-7033

ATTN: _ET _Subject Matter Specialist_

LIST OF MATERIALS FURNISHED

COURSE TITLE: **ET1** COURSE CODE: **0122** EDITION: **3**

1. The materials for the course you requested are listed below. If any item listed is not enclosed in this package, report that fact to your Educational Service Officer (ESO).

2. If you enrolled in this course for credit, you have **36 months** to complete the course. If you requested course materials only, you will not receive an End-of-Course Test (EOCT) and will not receive credit for the course.

COMPONENT	NUMBER	QTY
PQG Certification Pamphlet	P12201	01
Administration	P12202	01
Electronic Installation Standards	P12203	01
Electronic Systems Planned Maintenance	P12204	01