U.S. Department of
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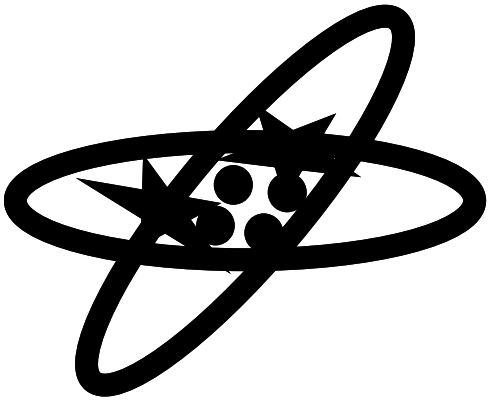
United States
Coast Guard

ET2 UNIT 6: ELECTRONIC SYSTEMS CORRECTIVE MAINTENANCE



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ET2 UNIT 6: ELECTRONIC SYSTEMS CORRECTIVE MAINTENANCE

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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 are 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:

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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)
- Equipment Tag-Out Procedures, COMDTINST 9077.1 (series)
- Navy Installation and Maintenance Book, Test Methods and Practices SE000-00-EIM-130
- Navy Installation and Maintenance Book, General Maintenance SE000-00-EIM-160
- Manufacturer’s Technical Manuals

Notice to Students

Purpose

This pamphlet serves as a training aid to provide you with a general knowledge of Electronic Systems Corrective Maintenance tasks required of an ET2.

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.

Course Content

This course content is based on the requirements stated in the Enlisted Performance Qualifications (EPQs) 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 three lessons:

Lesson 1: How to Perform corrective maintenance on a UHF transceiver

Lesson 2: How to Perform corrective maintenance on an Electronic Charting System

Lesson 3: How to Perform corrective maintenance on a Surface Serach Radar

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 Manual, COMDTINST M1414.8 (series).

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

Lesson 1

HOW TO PERFORM CORRECTIVE MAINTENANCE ON A UHF TRANSCIEVER

Overview

Introduction

The need for a rugged compact versatile radio, able to transmit and receive AM/FM in plain or secure voice, is met by the AN/WSC-3 (V). This transceiver is the focus of this lesson.

Objectives

Given a job aid, and technical manuals **PERFORM** corrective maintenance on the AN/WSC-3 UHF transceiver IAW local unit PMS procedures.

References

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

- Electronics Manual, COMDTINST M10550.25 (series)
- Equipment Tag-out Procedures, COMDTINST 9077.1 (series)
- Navy Electronics Installation and Maintenance Book, Test Methods and Practices SE000-00-EIM-130
- Navy Electronics Installation and Maintenance Book, General Maintenance SE000-00-EIM-160
- Manufacturer’s Technical Manual

AN/WSC- 3 (V)

Introduction

The primary function of a transceiver is to take the plain or secure voice intelligence from the terminal equipment and transform it into electrical RF energy, which is then routed to the antenna.

Technical Information

The following table contains the characteristics and specifications of the AN/WSC-3 UHF Radio Set:

Characteristic	Specification
Frequency Range	225.000 MHz to 399.975 MHz
Number of possible channels	7000
Channel Spacing	25 KHz
Preset Channels	20
Transmitter Output Power	FM-1 to 100 Watts adjustable AM – 30 Watts
Types of emissions	AM plain and secure voice FM plain and secure voice
Sensitivity	AM – 3.5 microvolts FM – 3.0 microvolts

AN/WSC-3 Transceiver

Of the four AN/WSC-3 versions available for the Coast Guard to choose from, only versions 6 and 7 are used for Line-of Sight (LOS) voice communications.

Continued on next page

AN/WSC- 3 (V) (Continued)

A25 Interface Module

There are three types of 1A1A25 Interface Modules. This module is the interface between the radio and terminal equipment for voice/audio signals going in, and out, of the transceiver:

Standard Interface – this module provides an interface between incoming and outgoing AM/FM signals by using switching, amplification, and mode selection methods. The module is used in both transmit and receive. Standard Interface provides unbalanced inputs/outputs in the AM and FM secure voice modes, and 600ohm balanced inputs/outputs in the AM and FM plain voice modes. This module requires internal level adjustments to balance the output.

SAS Interface: The SAS interface functions the same as the standard interface module, with the exception that separate input lines are not used for secure and plain audio signals.

Switchable Audio Interface: The switchable audio interface is functionally identical to either Standard Interface or the SAS Interface. This module contains a ten-position dual in-line package (DIP) switch. Proper positioning of this switch at the time of installation, provides a SAS Interface or a Standard Interface configuration.

System Functions

There are five major functions performed by the Radio set. These functions are:

- Transmit
- Receive
- Built-In-Test
- Control
- Power Distribution

Continued on next page

AN/WSC- 3 (V) (Continued)

Transmit

The transmit function coverts plain voice and secure voice signals into modulated radio frequencies (RF) and applies them to the antenna for transmission. This function also provides a side-tone signal which allows the audio information to be monitored through the receive function. You can hear yourself talk in the headset.

Receive

The receive function selects for reception of RF signals in the radio frequency range, and converts them for detection of plain and secure voice. Audio is provided for local or remote use. The receive function also provides blanking indication and signal values.

BITE

The BITE function enables selected signals, which turn on various components of the other modules. The results of each BITE select signal appear on the BITE meter as a visual means of determining proper operation. The BITE function also provides a malfunction lamp indicator and external alarm signal outputs.

Control

The control function contains all the front panel switches for operating the radio set locally, and the circuits for providing remote operation. The control function provides the output signals to determine which frequency is selected for transmit and receive operation, and which mode of modulation is selected. When the radio set is appropriately configured, the control function can select remote or local control.

Corrective Maintenance

WSC-3 Technical Manual

Due to the size of the corrective maintenance procedures for the WSC-3, troubleshooting and corrective maintenance tips can be found in Chapters 5 and 6 in the WSC-3 manual from SFLC's website:

http://10.38.68.50/xData/projects/CombatSys/Elex/spawar/wsc3/an-wsc-3_technical_manual.pdf

Procedural Checklist

Below is a procedural checklist to aid in troubleshooting:

Date:_____ **AN/WSC-3(V)7#**_____ **(Small / Large Cutter)**

Technician(s):_____

1. **SYMPTOM RECOGNITION** *(While doing a complete functional check of the system, Circle all Faulty Symptoms that apply)*

Front Panel Indicators:
- Primary Power
- Standby
- Fuse
- Malfunction

Malfunction Lamp:
- Stdby - Power Supply
- Bad Bite
- Opera - Frequency

Operate mode and Keyed:
- Carrier On
- RF Power Out
- (FM 20 dBw, AM 14.8 dBw
- TRACEN = 17/14.8 dBw)

Modulation (AM mode):
(meter movement with audio input)
- Local Handset
- Remote Handset
- Red Handset

Sidetone:
- Local Handset
- Remote Handset
- Red Handset

Squelch:
- Disabled - Noise returns
- ON - Quiet

Describe your symptoms:_____

_____**Instructors initials**_____

2. **LOCALIZATION** *(Probable faulty function / Module)*

BIT TEST (circle NOGO's):

- 1 - Power
- 2 - 5 MHz RF Oscillator
- 3 - 5 MHz Oven
- 4 - Synthesizer
- 5 - 44.5 MHz RF Oscillator
- 6 - 44.5 MHz Oven
- 8 - Translator Bypass
- 10 - Transmitter
- 11 - Keyline
- 12 - VSWR
- 13 - Blanker
- 14 - Main IF Amp
- 15 - Am Detector
- 16 - FM Detector
- 17 - Reciever Front End

Indentify Module designation(s) for possible faulty function *(ie, 1A1A2)*:

_____

_____**Instructors initials**_____

3. **FAULT ISOLATION** *(Isolate fault to module, cable, ect. Indicate test points readings)*:

_____

_____

_____**Instructors initials**_____

4. **CORRECTIVE ACTION** *(Replace Module or Align Module)*:

_____**Instructors initials**_____

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Review Quiz

Questions

1. List the 3 types of A25 interface modules?

_____

_____

2. Which of the WSC-3 transceiver functions provides a malfunction lamp indicator and external alarm signal outputs?

   A. Transmit
   B. BITE
   C. Receive
   D. Control

3. Where can you find the technical manual for the WSC-3 transceiver?

   A. NAVSEA
   B. MLC Pac
   C. MLC Atlantic
   D. SFLC's website

Review Quiz Answers

Answers

Question	Answer	Reference
1.	Standard Interface, SAS Interface, Switchable Audio Interface	1-3
2.	B	1-4
3.	D	1-5

Lesson 2

HOW TO PERFORM CORRECTIVE MAINTENANCE ON ELECTRONIC CHARTING SYSTEMS

Overview

Introduction

In this lesson you will learn about Electronic Charting Systems (ECS) and how to maintain them. The ECS was developed to provide tools for safe navigation and execution of CG missions.

Objectives

Given the authority and using a job aid, **PERFORM** corrective maintenance on one of the following Electronic Charting Systems:

- SCCS (Shipboard Command and Control System)
- COMDAC INS (COMmand Display And Control Integrated Navigation System)
- ECPINS (Electronic Chart Precise Integrated Navigation System)
- Transas

References

The following references were used for this lesson:

- Electronics Manual, COMDTINST M10550.25 (series)
- Equipment Tag-Out Procedures, COMDTINST 9077.1 (series)
- Manufacturer's Technical Manuals

SCCS System Overview

Introduction

The SCCS (Shipboard Command and Control System) is designed to automate tactical information management and enhance SCCS tactical decision making. It integrates sensors, displays, communications, and advanced computing technology into a contemporary Combat Systems Center architecture. SCCS provides for the rapid processing, fusion, and information dissemination of tactical data obtained from organic sensors and over the horizon data links.

SCCS operates on Sun Microsystems computers, running the Common Operating Environment (COE) and the Solaris operating system and incorporates Coast Guard specific sensor interfaces. These interfaces include:

- LOng RAnge Navigation (LORAN)
- Gyro compasses
- Speed log
- Officer in Tactical Command Information eXchange System (OTCIXS)
- Secure Internet Protocol Routing NETwork (SIPRNET)
- AN/SPS-73 radar
- Link 11.

The Coast Guard's requirements for an integrated navigation system resulted in the development of the COMmand Display And Control Integrated Navigation System (COMDAC). COMDAC INS is a fully integrated C2 navigation system, and is included as part of SCCS Version 2.

Associated Equipment

SCCS incorporates a number of different information and data systems to perform its missions. These systems are listed below:

- Server and Workstation Computers
- Network Attached Storage (NAS)
- Video
- Input/Output devices
- Tactical Equipment
- Sensor Equipment

System Equipment

Server and Workstation Equipment

One Concorde Server is located in Combat Information Center (CIC) on the SCCS-270' and 378' cutters. It is connected to the LANs and is accessed from the maintenance position console. It provides password management and administrative system control. It is also the Redundant Array of Inexpensive Disk (RAID) Failover Host.

The computer installed on 210' and 110' cutters the computer is a Gulfcoast Sparcstar/Sunfire V210 Workstation. This computer acts as the server in place of the Concorde on bigger cutters. It provides password management and administrative system control. It is also the RAID Failover Host.

Networked Attached Storage (NAS)

Every SCCS configuration uses one RAIDTEC SNAZ E6 Networked Attached Storage (NAS) device. The NAS uses three active hard drives and one hot spare. It contains data, such as chart and image information, that is required by all workstations.

Video

The SCCS video sources includes the following:

- Workstations and Server
- SPA-25G Radar Indicator
- CAP'N program
- Maritime Forward Looking Infrared (MARFLIR)
- Flight Deck Video System (FDVS)
- Optical Surveillance System (OSS)

Continued on next page

System Equipment (Continued)

Input/Output Devices

Each SCCS platform requires at least one 16 - port Terminal Server and Panel Interface. The Terminal Server receives inputs, via the Interface Panel, from the system's sensors and transmits the data to the LANs. It has 16 ports, each connected to a port on the Interface Panel via individual DB25 to RJ45 adapter cables. Serial Data passes through the TS-16 and is distributed to the LAN by way of an Ethernet connection to the LAN switch. Terminal Server supports the equipment listed below:

- NDIU
- DCU
- NMEA Expander
- Cisco Network Switches
- KVM Switches
- USB Peripheral Devices
- Printers
- Uninterruptible Power Supplies (UPS)

Tactical Equipment

LINK-11 is a subsystem that provides tactical data to the SCCS-378 configuration via a serial communication channel. The LINK-11 software resides on a standalone Tactical Advance Computer (TAC-3). The TAC-3 provides data processing and display functions necessary to view and manipulate track information. Track data can then be broadcast to the main SCCS system via the established communication channel.

Sensory Equipment

SCCS incorporates a number of different sensory equipment. This equipment is listed below:

- GPS/DGPS receivers
- LORAN (RAYNAV-750) receiver
- Radar (AN/SPS-73 and MK-92))
- Depth sounder (Echotrac or V850)
- Speed logs/Doppler (SRD 500, SRD-331, or DSN-450) platform dependent
- Analog Navigation Sensor Inputs (NDIU or DCU) platform dependent
- AIS

Corrective Maintenance

Corrective Maintenance

Corrective maintenance for all versions of SCCS shall be performed to the system level. If there is an inoperable system, you will see it during initial startup of the system. SCCS will either not start up at all or will be missing one or more of its sensory signals.

For troubleshooting procedures please see Chapter 5 of the following manual at C2CEN's website:

http://cgweb.lant.uscg.mil/c2cen/Files/SystemManual(SM)v2.3.3Rev02July08.pdf

COMDAC

Introduction

The Command Display And Control Integrated Navigation Segment, or COMDAC INS, is the Coast Guard's Electronic Charting and Integrated Navigation System (ECINS) software of choice. In short, it is a software application used for shipboard navigation and collision avoidance. It is designed to run on the Common Operating Environment (COE) developed by DISA.

COMDAC INS is built to meet Coast Guard requirements and International, NATO and U.S. Navy Standards. It can perform any function that can be done on a paper chart. However, COMDAC INS is not just a one-for-one substitute for conventional paper navigation. COMDAC INS uses a variety of sensor inputs to aid in safe navigation. Some of these sensors include:

- Differential Global Positioning System (DGPS) receivers
- LORAN receivers
- Radar lines of positioning (LOPs)
- Visual LOPs
- Speed logs
- Depth sounders
- Wind sensors
- Dynamic tide and current vectors
- Continuously updated turn points
- Radar overlay for both navigation and collision avoidance
- Fusion of Command and Control and Navigation information.

Large amounts of information are integrated into one real-time picture. Using this system, ship drivers know where they are right now, as opposed to where they were several minutes ago.

Continued on next page

COMDAC (Continued)

COMDAC Chart Formats

COMDAC INS uses a variety of different electronic chart formats, including:

- National Oceanographic and Atmospheric Agency (NOAA)
- Electronic Navigational Charts (ENC)
- Raster Nautical Charts (RNC)
- National Geospatial-Intelligence Agency's (NGA) Digital Nautical Charts (DNC®)

While available as a standalone system, ship's capabilities are enhanced when COMDAC INS is integrated with a Command and Control system such as the Coast Guard's SCCS and the U.S. Navy's NAVSS. This fusion allows bridge and Command Information Center (CIC) members to see and work from the same picture.

Availability

COMDAC INS is currently fielded on more than 50 USCG cutters, including WHECs, WMECs, and WPBs. COMDAC INS is also fielded on 117 USN vessels.

Corrective Maintenance

At the time of this writing the corrective maintenance tasks for this lesson have not been developed. Corrective maintenance will be to system level. Usually, performing a full functional operational test of the system and all peripherals will aid you in determining the inoperable system. Many times a simple reload of the software or charts will repair the system.

For further operating or troubleshooting procedures, see the following manual on C2CEN’s website:

http://cgweb.lant.uscg.mil/c2cen/manuals.htm#COMDAC

ECPINS System Overview

Introduction

The Electronic Chart Precise Integrated Navigation System (ECPINS) is the Electronic Charting System used on WLB and WLM buoy tenders. It is also the preferred system on 399' WAGB Polar Ice Breakers.

System Equipment

ECPINS incorporates a number of different equipment. This equipment is listed below:

- Operator Control Panel (OCP)
- 5200 NG Computer
- Keyboard, Video and Trackball Switch
- Video Interface
- Flat Panel Display Monitor

Operator Control Panel (OCP)

The OCP allows interaction between the operator and the ECPINS software. Each OCP has a flush - mounted, backlit, membrane keyboard and a flush - mounted rectangular trackball assembly, but is considered a desktop model. OCPs are located port, starboard, and in the center of MSCC on the WLBs.

5200 Personal Computer

The 5200 personal computer (PC) is the navigational computer used for ECPINS. One 5200 PC is located in a 19 inch rack mountable chassis. On the WLB, the 5200 PC is located on the starboard side, aft of the bridge. On the WLM, the 5200 PC is located in the radio rack in the chart room.

Continued on next page

ECPINS System Overview (Continued)

KVT Switch

The Keyboard, Video, and Trackball switch replaced the Video Trackball switch in the first upgrade. Two KVTs are installed on each WLB and WLM to provide functionality to the keyboard and trackballs at the Port Ship's Control System (SCS), Starboard SCS, and Main Ship's Control Control (MSCC). The KVT routes keyboard, video and trackball information to the different conning station displays, OCPs, and Remote Control Units (RCUs). The primary KVT routes the Route Monitoring information and video to all conning stations and the ECPINS station. If the primary route monitoring computer fails, a manual toggle switch on the primary KVT panel can be activated to enable the ECPINS back up computer. The secondary KVT routes the Route Planning information to all conning stations. The secondary KVT is not connected to the ECPINS. On the WLB, the KVTs are located within the Navigator Console. On the WLM the KVTs are located in the radio rack in the chart room.

Video Interface

The video interface routes the video of the ECPINS to the KVT switch. One video interface is installed as part of each ECPINS configuration. The video interface is a universal, analog computer-video interface.

Display Monitor

The monitor displays the information of the ECS and the interaction between the operator and the ECPINS software. One monitor is installed as part of each ECPINS configuration. The monitor is a desktop flat panel with a viewable 18.1" display.

Corrective Maintenance

Procedural Checklist

Below is a procedural checklist for troubleshooting ECPINS:

ECPINS Operation: Observe or perform the following at the Primary Operator Position while in the PRIMARY Mode of Operation:

a. TrackBall	Yes_____	No____
b. Keyboard	Yes_____	No____
c. ECPINS Video	Yes_____	No____
d. ATON Video	Yes_____	No____
e. Area Chart displayed	Yes_____	No____
f. Radar overlay displayed and aligned	Yes_____	No____
g. Positioning Sensor Data		
1. DGPS A	Yes_____	No____
2. DGPS B	Yes_____	No____
h. Heading sensors		
1. Gyro	Yes_____	No____
2. Fluxgate (if installed)	Yes_____	No____
i. ARPA contacts	Yes_____	No____
j. AIS contacts	Yes_____	No____
k. Anemometer Wind Speed and Direction	Yes_____	No____
l. Echo Sensors		
1. #1 Depthsounder	Yes_____	No____
2. #2 Depthsounder	Yes_____	No____
m. Audio Alarm	Yes_____	No____
o. Tides and Currents	Yes_____	No____
p. Search Patterns	Yes_____	No____

ECPINS Operation: Observe the following at the Port Bridge Wing Station while in the Primary Mode of Operation:

a. TrackBall	Yes_____	No____
b. ECPINS Video	Yes_____	No____
c. ATON Video	Yes_____	No____
d. Area Chart displayed	Yes_____	No____

ECPINS Operation: Observe the following at the Stbd Bridge Wing Station while in the Primary Mode of Operation:

a. TrackBall	Yes_____	No____
b. ECPINS Video	Yes_____	No____
c. ATON Video	Yes_____	No____
d. Area Chart displayed	Yes_____	No____

Continued on next page

Corrective Maintenance (Continued)

Procedural Checklist (Cont'd)

ECPINS Operation: Observe or perform the following at the Backup Operator Position while in the PRIMARY Mode of Operation:

a. TrackBall	Yes_____	No____
b. Keyboard	Yes_____	No____
c. ECPINS Video	Yes_____	No____
d. ATON Video	Yes_____	No____
e. Area Chart displayed	Yes_____	No____
f. Radar overlay displayed and aligned	Yes_____	No____
g. Positioning Sensor Data		
1. DGPS A	Yes_____	No____
2. DGPS B	Yes_____	No____
h. Heading sensors		
1. Gyro	Yes_____	No____
2. Fluxgate (if installed)	Yes_____	No____
i. ARPA contacts	Yes_____	No____
j. AIS contacts	Yes_____	No____
k. Anemometer Wind Speed and Direction	Yes_____	No____
l. Echo Sensors		
1. #1 Depthsounder	Yes_____	No____
2. #2 Depthsounder	Yes_____	No____
m. Audio Alarm	Yes_____	No____
o. Tides and Currents	Yes_____	No____
p. Search Patterns	Yes_____	No____

ECPINS Operation: Observe or perform the following at the Primary Operator Position while in the BACKUP Mode of Operation:

a. TrackBall	Yes_____	No____
b. Keyboard	Yes_____	No____
c. ECPINS Video	Yes_____	No____
d. ATON Video	Yes_____	No____
e. Area Chart displayed	Yes_____	No____
f. Radar overlay displayed and aligned	Yes_____	No____
g. Positioning Sensor Data		
1. DGPS A	Yes_____	No____
2. DGPS B	Yes_____	No____
h. Heading sensors		
1. Gyro	Yes_____	No____
2. Fluxgate (if installed)	Yes_____	No____
i. ARPA contacts	Yes_____	No____
j. AIS contacts	Yes_____	No____
k. Anemometer Wind Speed and Direction	Yes_____	No____
l. Echo Sensors		
1. #1 Depthsounder	Yes_____	No____
2. #2 Depthsounder	Yes_____	No____
m. Audio Alarm	Yes_____	No____
o. Tides and Currents	Yes_____	No____
p. Search Patterns	Yes_____	No____

Continued on next page

Corrective Maintenance (Continued)

Procedural Checklist (Cont'd)

ECPINS Operation: Observe or perform the following at the Port Bridge Wing Station while in the BACKUP Mode of Operation:

a. TrackBall	Yes_____	No____
b. Keyboard	Yes_____	No____
c. ECPINS Video	Yes_____	No____
d. ATON Video	Yes_____	No____
e. Area Chart displayed	Yes_____	No____

ECPINS Operation: Observe or perform the following at the Stbd Bridge Wing Station while in the BACKUP Mode of Operation:

a. TrackBall	Yes_____	No____
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c. ECPINS Video	Yes_____	No____
d. ATON Video	Yes_____	No____
e. Area Chart displayed	Yes_____	No____

ECPINS Operation: Observe or perform the following at the Stbd Bridge Wing Station while in the BACKUP Mode of Operation:

a. TrackBall	Yes_____	No____
b. Keyboard	Yes_____	No____
c. ECPINS Video	Yes_____	No____
d. ATON Video	Yes_____	No____
e. Area Chart displayed	Yes_____	No____
f. Radar overlay displayed and aligned	Yes_____	No____
g. Positioning Sensor Data		
1. DGPS A	Yes_____	No____
2. DGPS B	Yes_____	No____
h. Heading sensors		
1. Gyro	Yes_____	No____
2. Fluxgate (if installed)	Yes_____	No____
i. ARPA contacts	Yes_____	No____
j. AIS contacts	Yes_____	No____
k. Anemometer Wind Speed and Direction	Yes_____	No____
l. Echo Sensors		
1. #1 Depthsounder	Yes_____	No____
2. #2 Depthsounder	Yes_____	No____
m. Audio Alarm	Yes_____	No____
o. Tides and Currents	Yes_____	No____
p. Search Patterns	Yes_____	No____

Transas

Introduction

Transas is the preferred Electronic Charting and Integrated Navigation Systems (ECINS) used on 87’ and 110’ WPBs. The systems operate using commercial software produced by Transas called NaviSailor 3000 ECDIS-I (NS3000).

As installed on the 87’ patrol boat fleet, Transas NS3000 is a combination of hardware and software used for shipboard navigation and collision avoidance that meets international and Coast Guard standards to navigate without paper charts. The system interfaces with a variety of sensors to give the operator a real time understanding of the ship’s situational picture. These sensors include:

- Differential Global Positioning System (DGPS) receivers,
- Radar
- VHF radio
- Speed log
- Wind monitor
- Depth sounder
- Gyrocompass
- Automated Identification System (AIS)

PATFORSWA 110’ WPBs utilize Transas NS3000, in combination with GPS and AIS sensors, as a situational awareness and command and control tool.

System Information

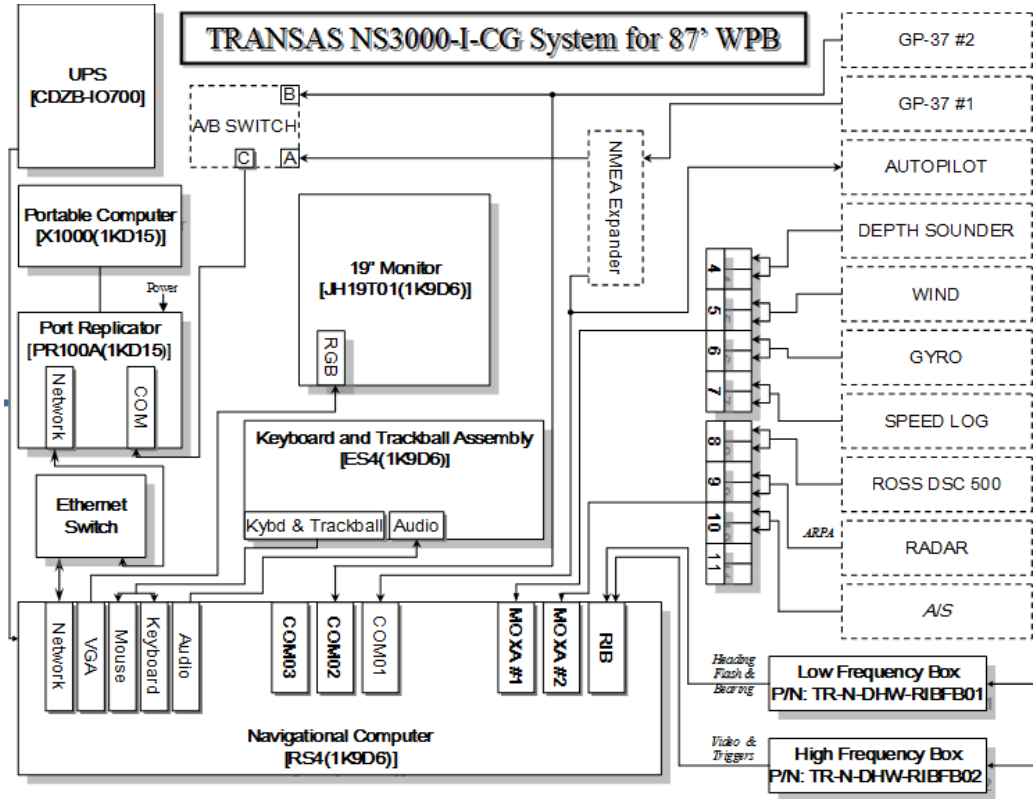
The Transas NS3000-I-CG System consists of the RS4 navigational computer, the JH19T01 19” flat panel display, the ES4 flush-mount keyboard and trackball assembly, the X1000 portable computer and an ethernet switch. Navigational sensors and external devices connect directly to the primary navigational computer, the RS4.

Continued on next page

Transas System Overview

Block Diagram

Below is a block diagram of the Transas system on an 87' WPB:



Corrective Maintenance

At the time of this writing the corrective maintenance tasks for this lesson have not been developed. Corrective maintenance will be to system level. As always performing a full functional operational test of the system and all peripherals will aid you in determining the inoperable system. Many times a simple reload of the software or charts will repair the system.

For further operation or troubleshooting issues please refer to the following manual at C2CEN's website:

http://cgweb.lant.uscg.mil/c2cen/Files/TranUSERMANUAL.pdf

Review Quiz

Questions

1. Which of the following information or data systems is **NOT** incorporated into SCCS?

   A. Tactical Equipment
   B. Video
   C. Server Computers
   D. VHF Comms

2. How many hard drives are used by the RAIDTEC SNAZ E6 Networked Attached Storage (NAS) device?

   A. One
   B. Two
   C. Three
   D. Four

3. Which tactical subsystem provides tactical data to the SCCS-378 configuration?

   A. OTCIXS
   B. Link 11
   C. Raynav 21
   D. Sun microsystems

4. Which type of Electronic Charting System is used on 87’ and 110’ WPBs?

   A. SCCS V(11)
   B. Transas
   C. Comdac
   D. ECPINS

Review Quiz Answers

Answers

Question	Answer	Reference
1.	D	2-2
2.	D	2-3
3.	B	2-4
4.	B	2-13

Lesson 3

HOW TO PERFORM CORRECTIVE MAINTENANCE ON SHIPS SURFACE RADAR

Overview

Introduction

The AN/SPS-73 radar replaces the AN/SPS-64 across the fleet and is the most widely used radar on large cutters. The Scaleable Integrated Navigation System (SINS) is the most common radar set to be used on most small boat applications. The Bridgemaster E series is most commonly used on WLB/WLM applications. In this lesson we will go over these system configurations and how to perform corrective maintenance on them.

Objectives

Upon completion of this lesson you will be able to:

- **Identify** an AN/SPS-73 SSR
- **Identify** a Scaleable Integrated Navigation System (SINS) SSR
- **Identify** a Bridgemaster E Series SSR
- **Perform** corrective maintenance on an AN/SPS-73 SSR set
- **Perform** corrective maintenance on an SINS SSR set
- **Perform** corrective maintenance on a Bridegmaster E Series SSR

References

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

- CGPMS
- Electronics Manual, COMDTINST 10550.25 (series)
- Equipment Tag-out procedures, COMDTINST 9077.1 (series)
- Manufacturer’s Tech manuals

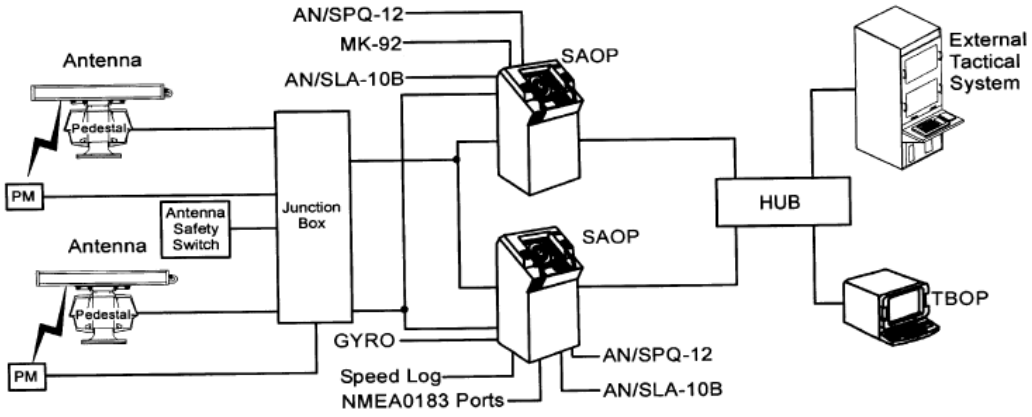
AN/SPS-73 SSR Set

Introduction

The AN/SPS-73(V) Surface Search Radar (SSR) is designed for both large and small cutter applications and has been used at sea since April 1997. The SSR provides operators with an advanced navigational and surveillance system that enhances situational awareness of the maritime environment. The AN/SPS-73(V) system is comprised of a Furuno radar and a Raytheon designed Stand-Alone Operator Position (SAOP). The radar portion of the SSR includes the antenna, pedestal, receiver/transmitter, and performance monitor and is available in 25kw X-Band and 30kw S-Band. The SAOP combines the use of processor cards, video monitor, trackball, and keyboard to provide complete control of the radar system. All WAGB, WHEC, WMEC and WIX cutters are configured for dual radars and SAOPS. All other SSR equipped cutters are configured for a single X-band radar and SAOP.

Configurations

In its simplest configuration, the AN/SPS-73 radar set would contain a radar set and a single display communicating over a 100Base-T LAN. A more typical configuration is depicted below:



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AN/SPS-73 SSR Set (Continued)

System Components

A typical AN/SPS-73 Radar set consists of a combination of the following basic components:

- Radar
- Operator Position (OP)
- Interconnect Equipment

Radar Portion

The radar portion of the SSR includes the following items:

- Antenna
- Pedestal
- Receiver/Transmitter
- Performance Monitor
- Antenna Safety Switch

Antenna

The antenna element is a Commercial Off-The-Shelf (COTS) unit manufactured by Furuno Electric Co. Ltd. The antenna unit consists of a horizontal polarized antenna mounted on top of a pedestal.

Pedestal

The pedestal contains a motor and bearing signal generator. Both X-band and S-band antenna pedestals are used in the SSR system.

Antenna Safety Switch

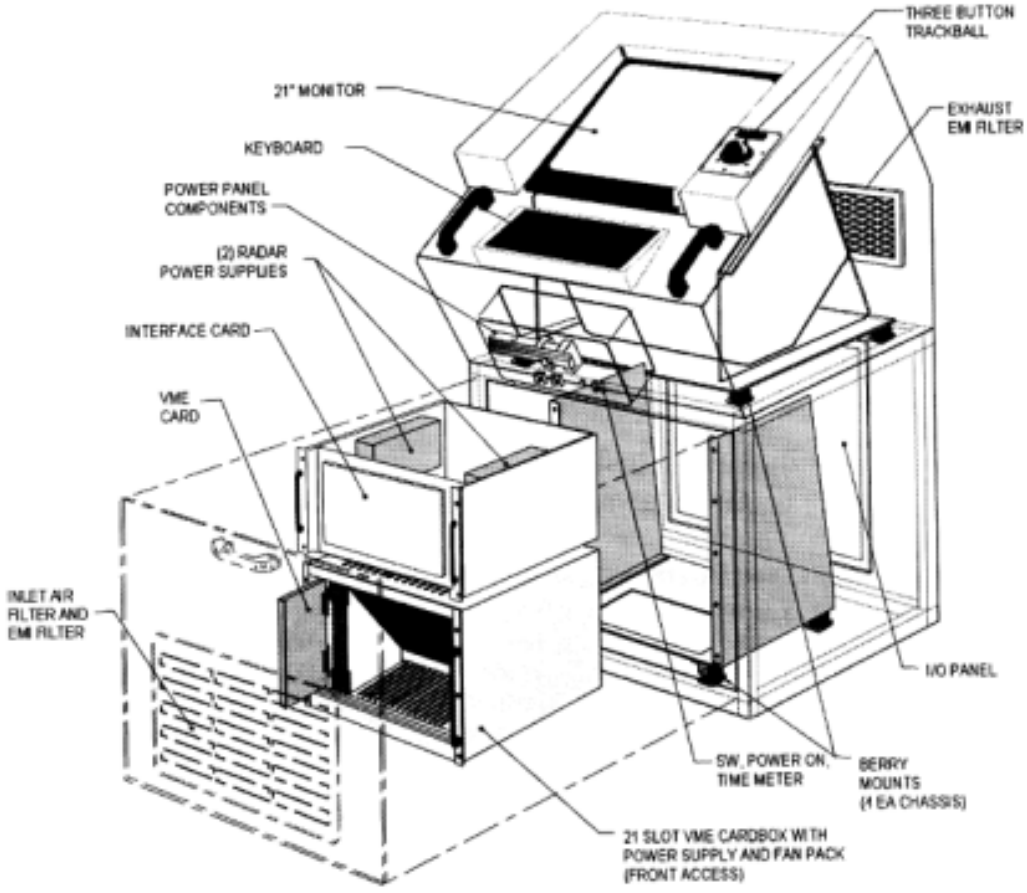
The antenna safety switch is manufactured by Raytheon and is used to keep the radar transmitter from being activated when personnel are working on or near the antenna. It disables the antenna rotation as well as the transmit trigger by keeping the R/T in a stand-by mode.

Continued on next page

AN/SPS-73 SSR Set (Continued)

Stand-Alone Operator Position (SAOP)

The SAOP is a Raytheon designed unit consisting of COTS assemblies. The SAOP combines the Radar Processor (RP) and OP functions to provide complete control of the radar. The RP and OP Circuit Card Assemblies (CCA) are housed in a 21-slot Versabus Module Eurocard (VME) chassis. The SAOP also includes a 21-inch color Cathode Ray Tube (CRT) monitor, keyboard, and trackball. The display window on the monitor is divided into a control panel and radar image area for improved system-user interface. Power supplies and power distribution panels supply the correct voltage and current levels required by the SAOP. The SAOP is connected to an R/T and may also support multiple TBOPs, additional SAOPs, or RRPs and external tactical equipment through the 100Base-T LAN. The SAOP is depicted below:

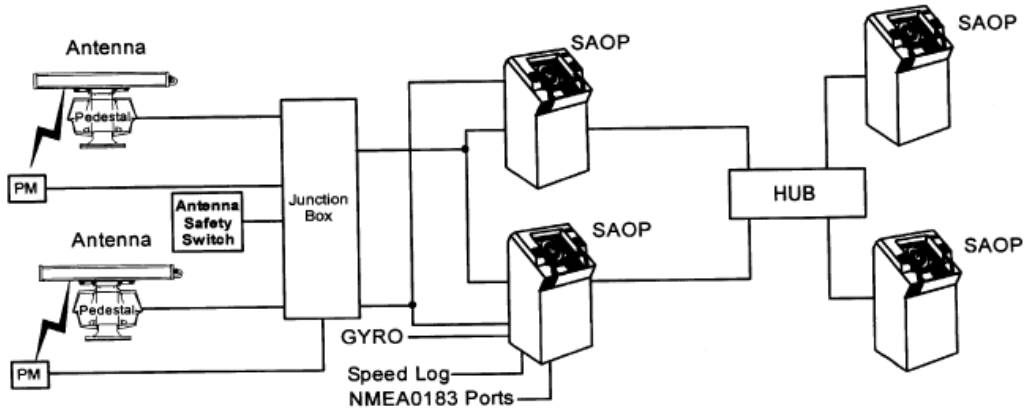


System Configurations

AN/SPS-73 SSR (V1)

The WAGB-400 Polar Ice Breaker configuration is made up of the following components:

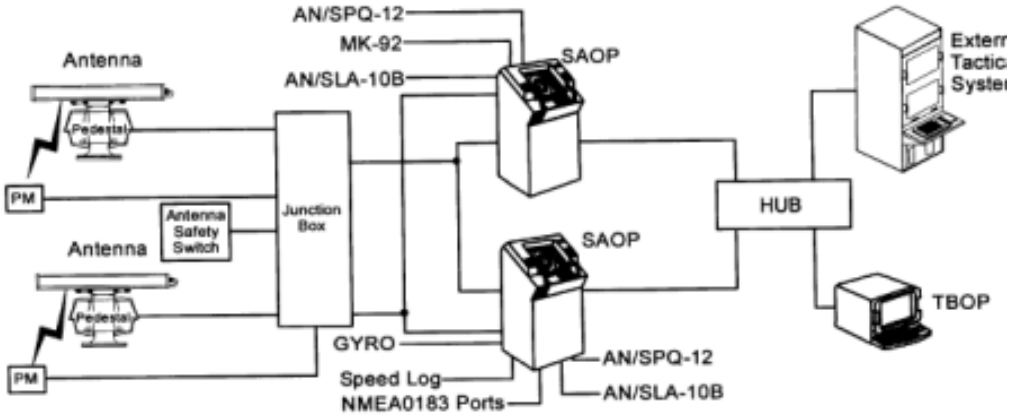
- Two SAOPs containing both RP and OP card sets
- Two SAOPs containing OP card set only
- Two 25kW X-up radar with R/T built into the pedestal



AN/SPS-73 SSR (V2)

The WHEC-378 High Endurance Cutters configuration is made up of the following components:

- Two SAOPs
- One TBOP
- One 25kW X-up radar with R/T built into the pedestal
- One 30kW S-up radar with R/T built into the pedestal



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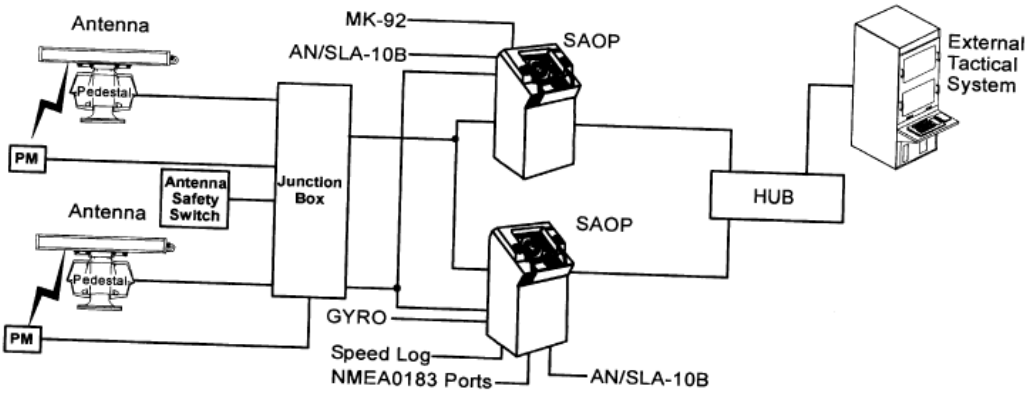
System Configurations (Continued)

AN/SPS-73 SSR (V4)

The WMEC-270 Medium Endurance Cutter configuration contains:

- Two SAOPs
- One 25kW X-up radar with R/T built into the pedestal
- One 30kW S-up radar with R/T built into the pedestal
- Junction Box

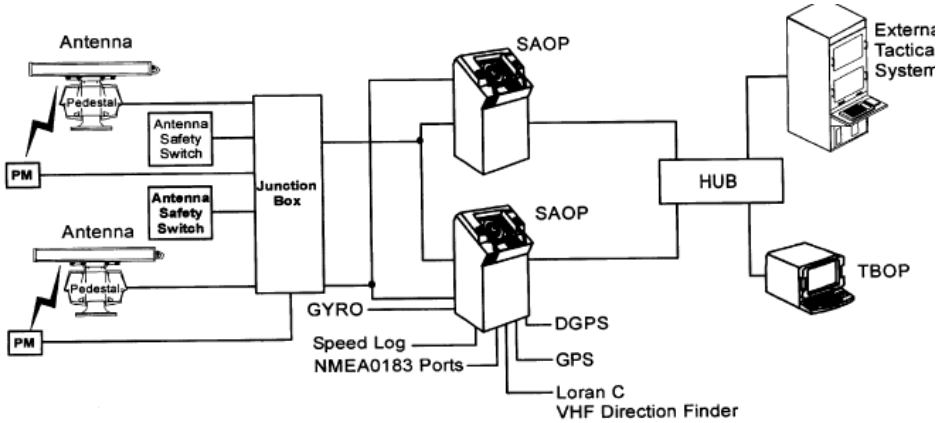


AN/SPS-73 SSR (V6)

The WMEC-210 Medium Endurance Cutter configuration contains:

- Two SAOPs
- Two 25kW-up radar with R/T built into the pedestal
- Junction Box

Note: The TBOP in this configuration was taken out in order to make room for the WMEC-210 SCCS installation on all applications.



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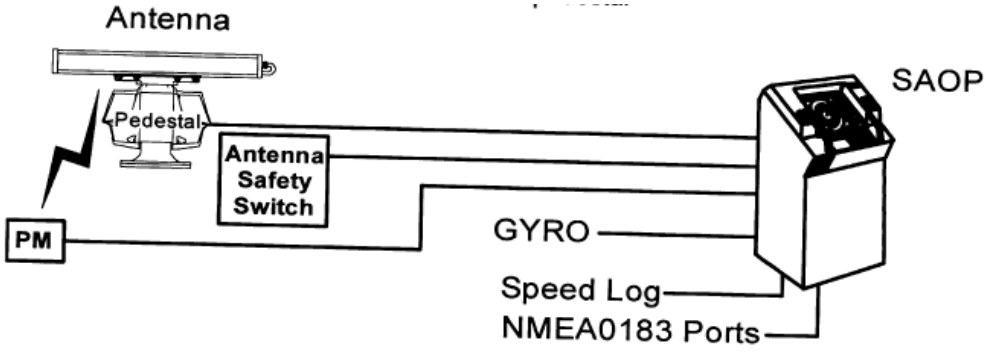
System Configurations (Continued)

AN/SPS-73 SSR (V11)

The WPB-110 and the WPB-87 Patrol Boat configuration contain:

- One SAOP
- One 25kW X-up radar with R/T built into the pedestal



Note: You can see that there are several versions of the AN/SPS-73 SSR set that aren't covered in this lesson. Due to modernization, those versions have either changed or the platform has been discontinued.

Corrective Maintenance

Introduction

Troubleshooting the SSR is based on the following:

- Symptoms observed when the system is powered up
- Operational program alerts that appear in the operational display system alerts window
- Indicators that result from equipment Built in Test (BIT)

Due to the enormous size of the troubleshooting section in the AN/SPS-73 radar maintenance manual, a link has been provided below to the manual. Please see Chapter 5 for troubleshooting procedures:

http://cgweb.lant.uscg.mil/c2cen/Files/SPS73_maintman.pdf

Scaleable Integrated Navigation System (SINS)

Introduction

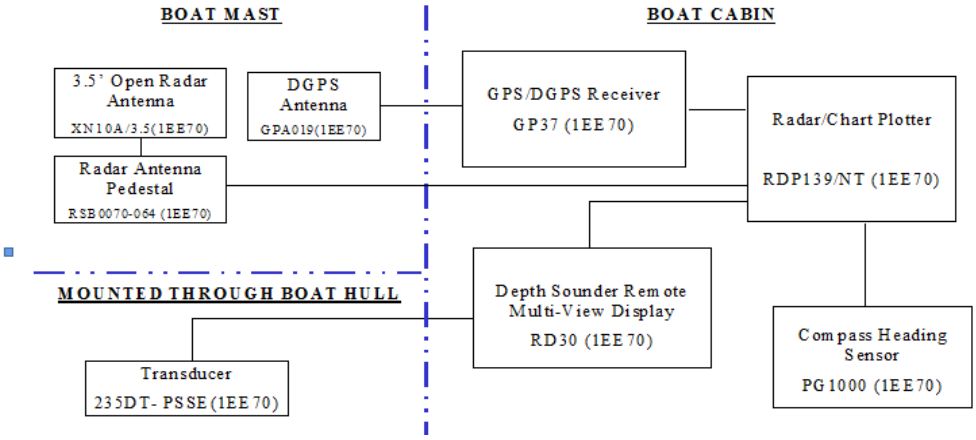
The Scaleable Integrated Navigation System (SINS) is the replacement for the AN/SPS-69(V) radar system, the CMX-MX-200 GPS/LORAN receiver, and the ST-50 Depth Sounder on the small boat fleet. The SINS is a commercial-off-the-shelf (COTS) integrated system intended to meet the requirements as set forth in Chapter Two of the Objective Architecture and Transition Plan (OATP). The SINS is designed to be installed on all standardized small boats in the fleet.

Planned Life Cycle

The SINS is a COTS System it is expected to have a service life of eight years, per current industry standards.

System Description

The basic SINS system V(1) is installed on 41' UTB's and consists of a radar (4KW power) with a combination radar display/chart plotter, a Differential Global Positioning System (DGPS) receiver, a depth sounder and a compass heading sensor. Different platforms will use the same base nomenclature for SINS, but will be designated as a separate version of SINS. A block diagram for a 41' UTB V(1) is shown below.



41' UTB SINS V(1) Block Diagram

Note: At the time of this writing the only EILSP on the SINS system is of the 41' UTB Version 1. The block diagrams of other versions will be similar to this. This lesson will be updated as new information becomes available.

Continued on next page

Scaleable Integrated Navigation System (SINS) (Continued)

Maintenance Support

The maintenance philosophy for SINS is that each piece of SINS equipment is a Lowest Reparable/Replaceable Unit (LRU) (i.e., the GPS/DGPS receiver, the compass heading sensor, etc.). The servicing ESD is considered the organizational level of maintenance for the unit. There is no Intermediate or Depot level support and C2CEN is the SMEF for the SINS.

Corrective Maintenance

At the time of this writing there are no corrective maintenance procedures available. This section will be updated as new information becomes available.

Bridgemaster E Series

Background

Each WLB/WLM Buoy Tender is equipped with two Bridgemaster radar systems. The primary radar system is located forward on the bridge and secondary radar system is located in the chart room. The Bridgemaster Radar has a low predicted failure rate and is easy to maintain.

The ships have two X-band scanner units (rather than normally configured X-Band and S-Band unit). A two X-Band system setup was installed because there wasn't sufficient room on the mast for an S-Band scanner antenna. Both of the X-Band scanner units are located on the mast of the ship.

Master Control

A display unit can only be connected to one scanner at a time, and only a master display has full control of the scanner. The controls, which are available at a master display but NOT at a slave display, are listed below:

- Switching the transceiver between standby and transmit mode
- Selection of transmission pulse-length
- Tuning the transceiver
- Selecting Manual or AFC mode for tuning
- Tuning the performance monitor

Maintenance

At the time of this writing no link has been provided to the Bridgemaster E series Ship's Manual. This lesson will be updated as more information becomes available. The following pages contain flowcharts to aid in troubleshooting.

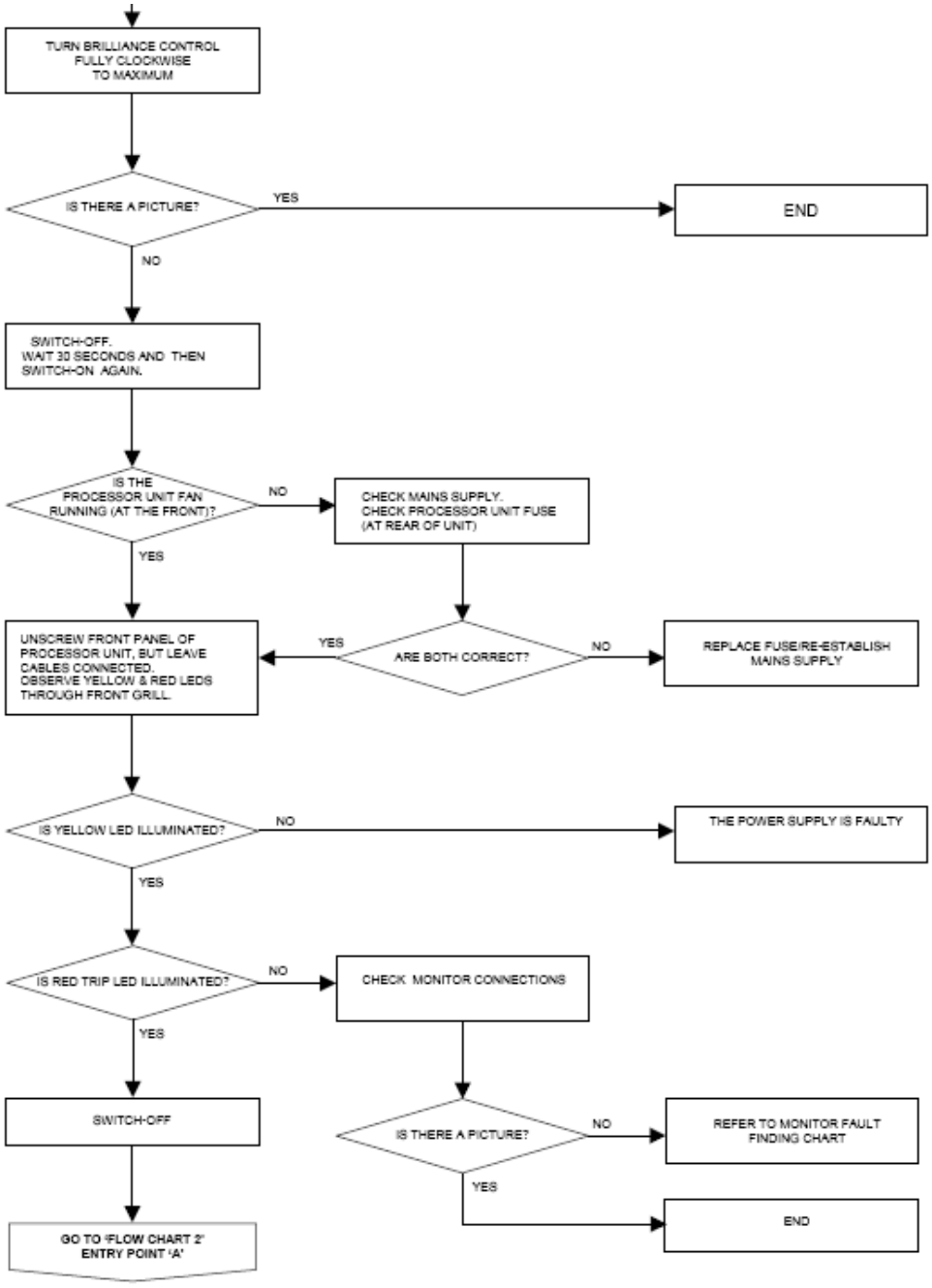
Corrective Maintenance

Introduction

Flowcharts for the isolation of display unit faults are provided on the following pages. Flowcharts 1 & 2 address problems in which there is no picture, while Flowcharts 3 & 4, address problems in which the picture is visible, but there are other faults.

Flowchart 1 (No Picture)

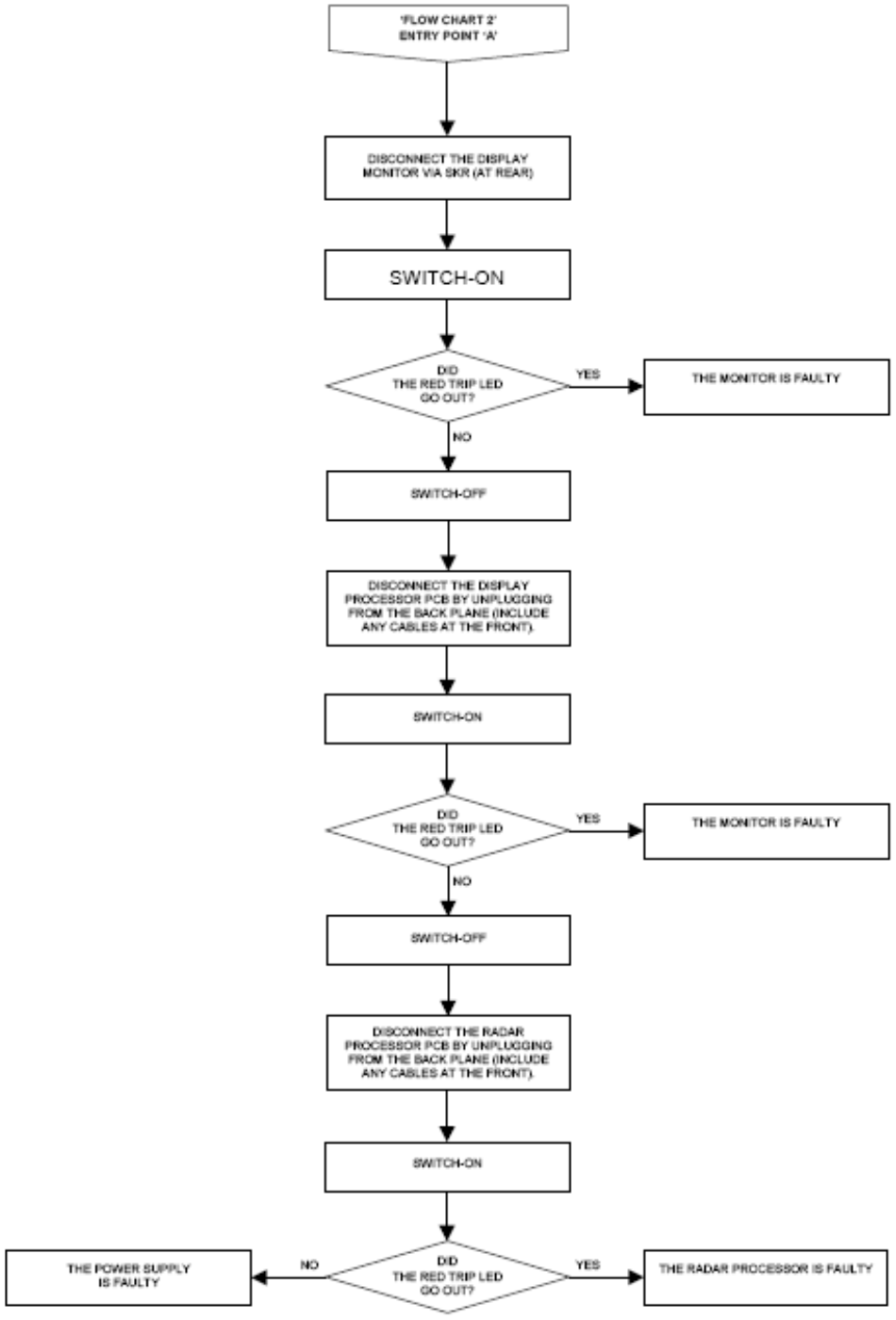
Monitor Unit faults (no picture):



Corrective Maintenance (Continued)

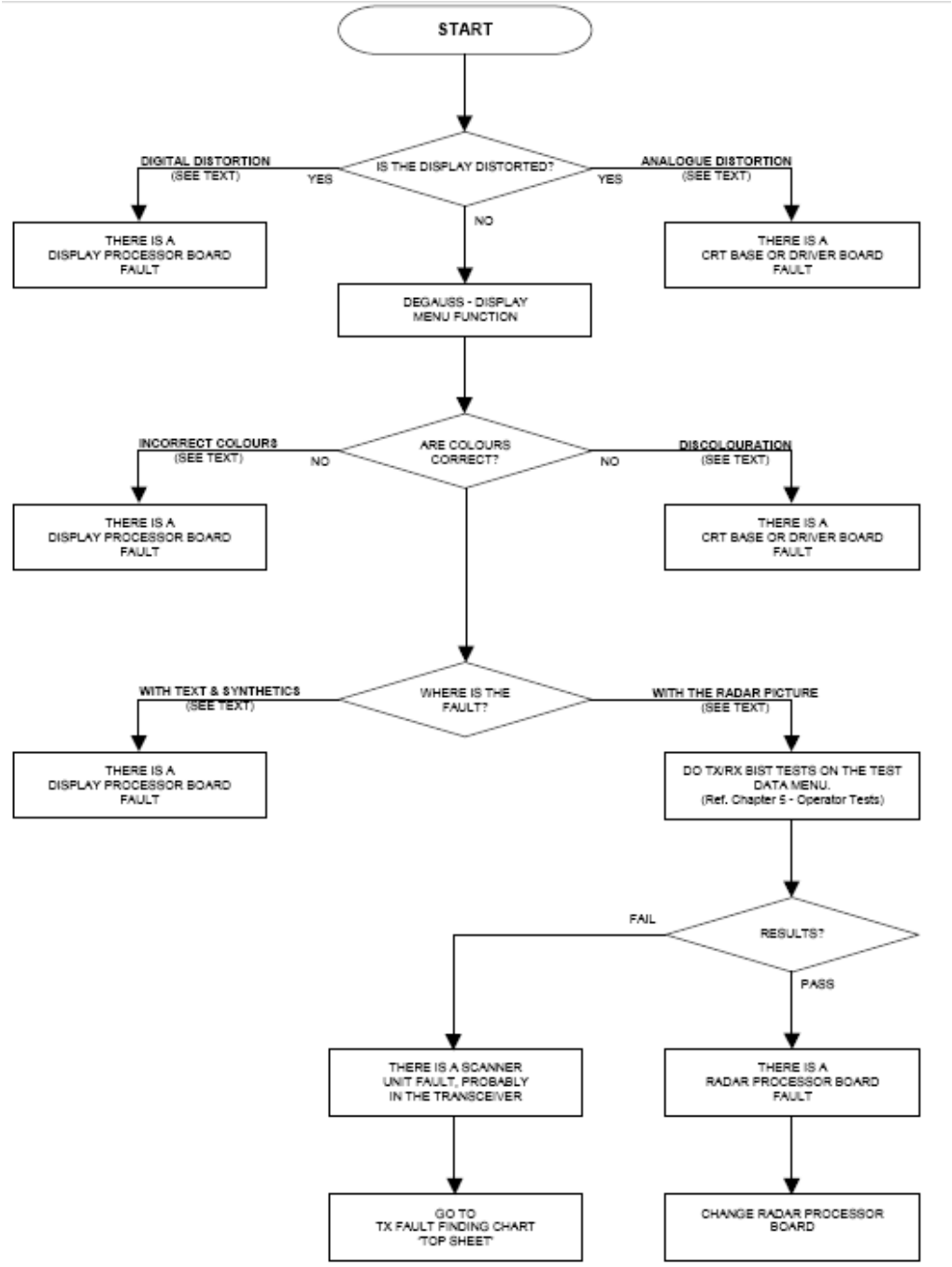
Flowchart 2

Monitor Unit Faults (No Picture):



Corrective Maintenance (Continued)

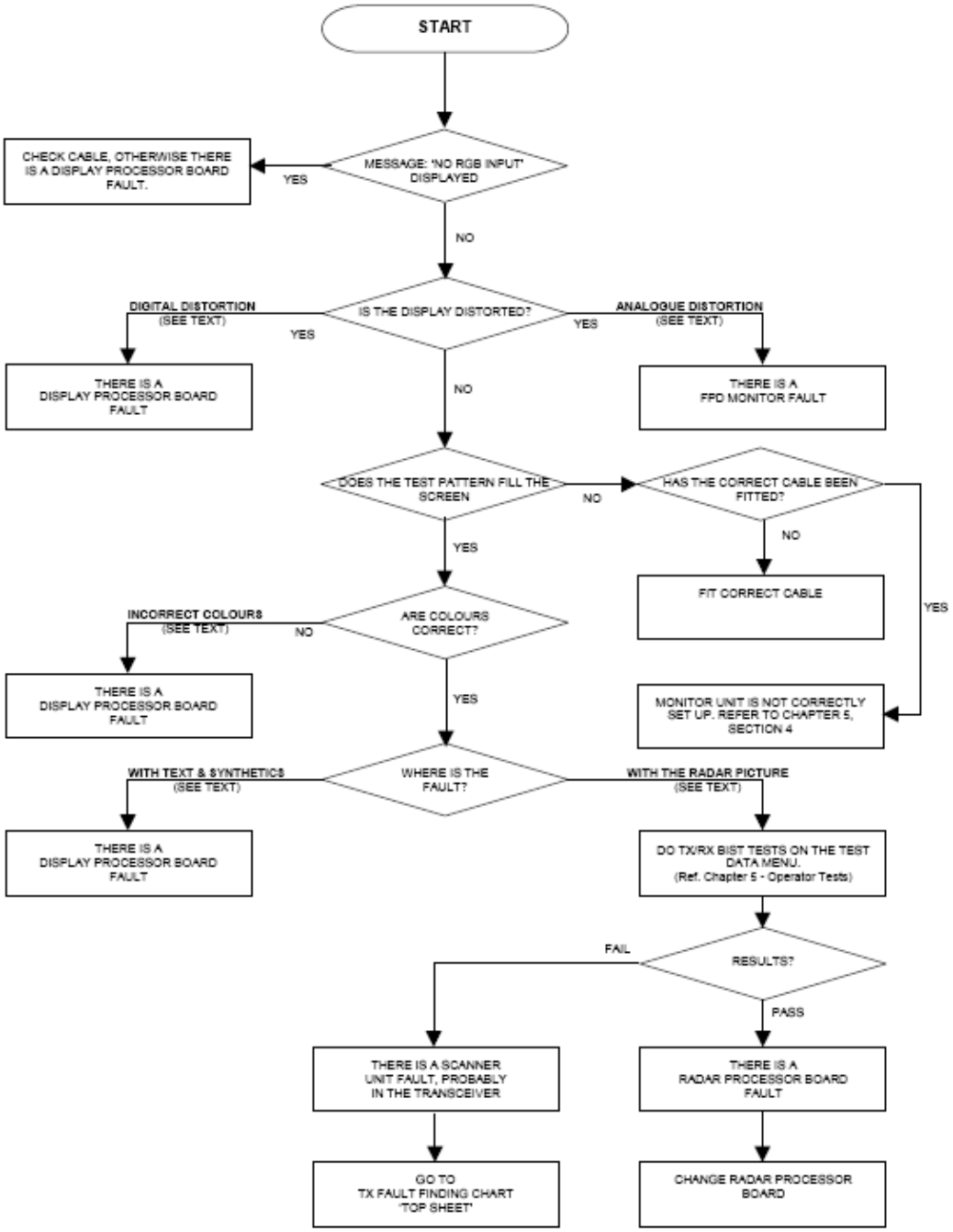
Flowchart 3 Monitor Unit (CRT) Faults (with picture):



Corrective Maintenance (Continued)

Flowchart 4

Monitor Unit (FPD) Faults (with picture):



Note: These flowcharts can be found in Chapter 6 of the Bridgemaster ship's manual. Due to the extensive number of flowcharts for troubleshooting the scanner unit, a hyperlink to the ship's manual will be available soon.

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Review Quiz

Questions

1. What type of LAN does the 73 radar communicate across?

   A. 5 Base-T
   B. 10 Base-T
   C. 100 Base-T
   D. Wireless router

2. The Antenna Safety Switch disables the antenna rotation and transmit trigger by keep the R/T in the _____mode.

   A. Stand-by
   B. On
   C. Off
   D. None of the above

3. Which type of antenna configuration does the 210' WMEC use on the 73 radar configuration?

   A. One X band and one S band
   B. Two X band
   C. Two S band
   D. One S band

4. Which type of antenna configuration is used on a Buoy Tender's Bridgemaster E series radar?

   A. Two X band
   B. Two S band
   C. One X band
   D. One S band

Review Quiz Answers

Answers

Question	Answer	Reference
1.	C	3-2
2.	A	3-3
3.	B	3-6
4.	A	3-11

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Appendix A

Questions

1. The sensitivity level for the AM frequency on the WSC-3 transceiver is set to _____ microvolts.

   A. 2.0
   B. 2.5
   C. 3.0
   D. 3.5

2. Which of the following 1A1A25 Interface modules provides an interface between incoming and outgoing AM/FM signals?

   A. Standard Interface
   B. SAS Interface
   C. Switchable Audio Interface
   D. None of the above

3. On which platform is the Concorde Server used for SCCS?

   A. 378’
   B. 210’
   C. 110’
   D. 87’

4. Which of the following systems is NOT used as an SCCS sensory equipment device?

   A. Depth Sounder (Echotrach or V850)
   B. Radar (AN/SPS-73 or MK-92)
   C. GPS Receiver
   D. WSC-3 Transceiver

5. Which of the following Electronic Charting Systems (ECS) uses NaviSailor as its software?

   A. SCCS
   B. ECPINS
   C. Transas
   D. COMDAC

6. Which of the following radar operator positions uses a 21 - slot Versabus Module Eurocard (VME) Chassis?

   A. AN/SPS-73
   B. Bridgemaster E Series
   C. SINS
   D. AN/SPS-64

Appendix B

Answers

Question	Answer	Reference
1.	D	1-2
2.	A	1-3
3.	A	2-3
4.	D	2-4
5.	C	2-13
6.	A	3-4

Request for Feedback – Electronics Technician 2nd Class

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.

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		( )

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ATTN: _ET _Subject Matter Specialist_

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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	P22201	01
Administration	P22202	01
Performance and Training	P22203	01
Special and Emergency Procedures	P22204	01
Electronic Installation Standards	P22205	01
Electronic Systems Planned Maintenance	P22206	01
Electronic Systems Corrective Maintenance	P22207	01