Loran Operations Manual

Table of Contents

Chapter 1 Preface

Preface 1-1
Purpose of this Manual 1-1
Objective of this Manual....................1-1
Applicability....................1-1
Authority 1-2
Discussion 1-3
Additional Instructions....................1-3
Manual Maintenance 1-3
Reference Publications....................1-4

Chapter 2 Command and Control

Section A Organizational Structures 2-1
Headquarters Organization 2-1
NAVCEN Organization 2-1
Organizational Flowchart....................2-2
Operational Control (OPCON)....................2-3
Administrative Control (ADCON)....................2-3
Loran Operation Control (OPCON) East Flowchart....................2-4
Loran Operation Control (OPCON) West Flowchart 2-4
Loran Administrative Control (ADCON) East Flowchart....................2-5
Loran Administrative Control (ADCON) West Flowchart....................2-5
Section B Support Organization....................2-6
Transmitting Station Electronic Support....................2-6
Monitor Receiver Site Electronic Support 2-8
Control Station Electronic Support 2-9
Transmitting Station Civil Engineering Support 2-9
Monitor Receiver Site Civil Engineering Support 2-10
Administrative Support 2-11
Personnel Augmentation....................2-11
Section C Duties and Responsibilities 2-12
Introduction....................2-12
NAVCEN Commanding Officer....................2-12
NAVCEN Operations Officer....................2-12
NAVCEN Chief, Systems Management Divison 2-13
NAVCEN Assistant Operations Officer 2-15
NAVCEN Systems Management Loran Branch Chief....................2-15
Chain Operations Control Officer (COCO)....................2-17
Control Station Supervisor....................2-19
Transmitting Station CO/OIC....................2-21
Control Station Duty Officer (CSDO) 2-22
Control Station Duty Technician 2-23
Control Station Watchstander....................2-24
Transmitting Station Duty Electronics Technician 2-25
Transmitting Station Watchstander....................2-26

Chapter 2 Command and Control, Continued

Section D Shared Roles and Responsibilities 2-27
Division of Control Station/Watch Responsibility 2-27
Control Station/Watch Assignments 2-27
Oscillator Control Responsibility 2-28
Oscillator Control Assignments 2-28
Monitor Receiver Site Assignments 2-29
Monitor Receiver Site A1 and A2 Assignments 2-29
Monitor Receiver Site A1 and A2 Assignments Continued 2-30

Chapter 3 Loran System Control

Section A Loran System 3-1
Overview 3-1
System 3-1
Chain 3-1
Chain Control 3-1
Integrity 3-1
Section B Loran System Control Parameters 3-2
Control Station 3-2
Overview 3-2
Time Difference (TD) 3-2
Envelope to Cycle Difference (ECD) 3-3
Controlling Standard ECD (CSECD) 3-4
Far Field Envelope-to-Cycle Difference (F/F ECD) 3-4
Signal Strength (Gain) 3-4
Transmitting Station 3-5
Envelope to Cycle Difference (ECD) 3-5
Calculated ECD 3-5
Nominal ECD 3-6
Digital Panel Meter ECD (DPM ECD) 3-6
Assigned ECD 3-6
Time Interval Number (Coarse TINO) 3-7
Synchronization Number (SYNC) 3-7
Local Envelope Number (LEN) 3-7
Cycle Compensation (C/C) 3-7
Radiated Signal Strength 3-8
Antenna Current 3-8
Nominal Antenna current 3-8
Maximum Antenna current 3-8
Low Power 3-8
Blink Antenna current 3-8

Chapter 3 Loran System Control, Continued

Section C Loran Operational Control 3-9
Modes of Control 3-9
Introduction 3-9
Control Receiver Modes 3-9
Remote/Local Modes 3-10
Casualty Recovery Responsibility Modes 3-10
Preferred Mode of Control 3-10
Precedence of Control 3-10
Mode of Control Examples 3-11
Mode of Control Examples Continued 3-12
Modes of Control and Responsibility 3-13
Timing Blink Tolerances 3-14
ECD Blink Tolerances 3-14

Chapter 4 Normal Operations

Section A Control Station Operations 4-1
Loran Consolidated Control System (LCCS) 4-1
Introduction 4-1
LCCS Configuration 4-1
Time Difference Controller (TDC) 4-1
TDC Operating Mode 4-2
Ki/Ks 4-2
Control Policy (CONPOL) 4-2
Communications 4-2
Power 4-2
Monitor Receiver Sites 4-3
Introduction 4-3
Configuration 4-3
Report Intervals 4-3
Alarm Tolerances 4-3
Monitor Receiver Sites, Continued 4-4
Nominal Values 4-4
Local Station Operating Set (LSOS) 4-5
Introduction 4-5
LSOS Software 4-5
LSOS Configuration 4-5
LSOS Data Alarm Windows 4-5
LSOS Data Interval 4-6
LSOS Station Alarm Assignments 4-6
LSOS Station Alarm Descriptions 4-7
Remote Automated Integrated Loran (RAIL) 4-8
Introduction 4-8
RAIL Software 4-8
RAIL Configuration 4-8
RAIL Data Alarm Windows 4-8
RAIL Data Interval 4-9

Chapter 4 Normal Operations, Continued

Control Station Daily Routine....4-10
Watchstander Daily Routine....4-10
Watch Relief....4-10
Control Station Daily Operations Record....4-11
Charts....4-11
TDC/Bias Plots....4-11
Local Phase Adjustment (LPA)....4-12
Maintenance Phase Adjustment (MPA)....4-12
Message Traffic....4-12
Loran Operations Information System (LOIS) NT....4-12
Transmitting Station (TS) Mode....4-12
Control Station (CS) Mode....4-13
Routine Equipment Switches....4-14
Transmitting Station Maintenance Mode....4-14
Parameters During Routine Equipment Switches....4-14
Routine Equipment Maintenance....4-15
Monitor Receiver Site Calibration....4-15
LCCS Daily Archive....4-15
System Sample....4-16
Introduction....4-16
Communication Test....4-16
Time of Transmission (TTM)....4-16
System Sample Times....4-17
Invalid System Sample Data....4-17
Control Station Watchstander Reference Material....4-18
Status Board....4-18
Watchstander Reference Book....4-18
Equipment Checks....4-19
LCCS....4-19
ABS....4-19
Section B Transmitting Station Operations....4-20
Loran Station Operating Set (LSOS)....4-20
Introduction....4-20
LSOS Configuration....4-20
LSOS Operating Mode....4-20
LSOS Software....4-20
LSOS Station Alarm Assignments....4-21
LSOS Station Alarm Descriptions....4-22
Remote Automated Integrated Loran (RAIL)....4-23
Introduction....4-23
RAIL Software....4-23
RAIL Configuration....4-23
RAIL Data Alarm Windows....4-23
RAIL Data Interval....4-24
RAIL Peak Reference....4-24

Chapter 4 Normal Operations, Continued

Other Equipment Configurations 4-25
- Timer(s) Configuration 4-25
- Automatic Blink System (ABS) 4-25
- TTX Feedback Operation 4-25
- TTX DESLOT Operation 4-25
- Timing Receiver 4-26
- Communications 4-26
- DC Backup Power 4-26
- Blanking 4-27
- Priority Rate Blanking 4-27
- Alternate Rate Blanking 4-27
- Priority Rate 4-27
- Blanking Scheme Assignments 4-28

Transmitting Station Duty Personnel 4-29
- OUTCONUS Duty Sections 4-29
- CONUS Duty Sections 4-29
- Primary Recall 4-29
- Secondary Recall 4-29
- Recall 4-29
- Fire/Intrusion Alarm Systems 4-30

Transmitting Station Daily Routine 4-31
- Watchstander Daily Routine 4-31
- Assuming TS Mode 4-31
- Watch Relief 4-31
- Transmitting Station Log 4-32
- Operator's Comments 4-32
- Message Traffic 4-32
- LOIS 4-32
- Prior to Assuming CS Mode 4-33

Routine Equipment Switches 4-34
- Coordinating Routine Equipment Switches 4-34
- TTX Switching Cycle 4-34
- SSX O/C Networks 4-34
- Timers 4-34
- PATCO 4-34

Routine Equipment Maintenance 4-35
- LSOS Station Maintenance 4-35
- Pulse Analysis 4-35

System Sample 4-36
- Introduction 4-36
- Communications Test 4-36
- System Sample TINO 4-36
- System Sample Times 4-37
- Invalid System Sample Data 4-37

Transmitting Station Status Board 4-38
- Status Board 4-38
- TTX Status Board Example 4-39
- SSX Status Board Example 4-40

Chapter 5 Abnormal Operations

Section A Control Changes.....5-1
Control Change Policy.....5-1
Introduction.....5-1
Notification.....5-1
Methods to Pass Control.....5-1
Correlated Numbers.....5-2
Correlated Numbers Calculation.....5-2
Non Alpha Control LPA Policy.....5-3
Section B Abnormal Conditions.....5-3
Pulse Building.....5-4
Introduction.....5-4
When to Pulse Build.....5-4
Pulse Build to Nominal ECD.....5-4
Control Station Actions.....5-5
Transmitting Station Actions.....5-6
Time Steps.....5-7
Introduction.....5-7
Control Station Actions.....5-7
Transmitting Station Actions.....5-8
ABS Degraded State.....5-9
Introduction.....5-9
Control Station Actions.....5-9
Transmitting Station Actions.....5-9
Time Difference Controller.....5-10
TDC Manual Mode Conditions.....5-10
TDC Reset.....5-10
LSOS Station Alarms.....5-11
Introduction.....5-11
Control Station Actions.....5-11
Transmitting Station Actions.....5-11
LSOS Failure.....5-12
Introduction.....5-12
Control Station Actions.....5-12
Transmitting Station Actions.....5-12
LCCS Failure.....5-13
Control Station Actions.....5-15
Transmitting Station Actions.....5-15
Control Station Primary Communications Failure.....5-16
Control Station Actions.....5-16
Transmitting Station Actions.....5-17
Transmitting Station Primary Communications Failure.....5-18
Control Station Actions.....5-18
Transmitting Station Actions.....5-18
Monitor Receiver Site Primary Communications Failure.....5-19
Control Station Actions.....5-19
Monitor Receiver Site Maintenance/Failure.....5-20
Control Station Actions.....5-20
Control Station Power Failure.....5-21
Introduction.....5-21
Control Station Actions.....5-21
Transmitting Station Actions.....5-22

Chapter 5 Abnormal Operations, Continued

Transmitting Station Power Failure 5-23
Introduction....................5-23
Control Station Actions....................5-23
Transmitting Station Actions....................5-23
Backup Power System Failure....................5-24
Control Station Actions....................5-24
Transmitting Station Actions....................5-24
TTX Transmitter....................5-25
Introduction....................5-25
Control Station Actions....................5-25
Transmitting Station Actions....................5-25
SSX Transmitter....................5-26
Introduction....................5-26
Control Station Actions....................5-26
Transmitting Station Actions....................5-26
Transmitting Station Receiver System Failure....................5-27
Introduction....................5-27
Control Station Actions....................5-27
Transmitting Station Actions....................5-27
Standby Timing Path Failure....................5-28
Introduction....................5-28
Control Station Actions....................5-28
Transmitting Station Actions....................5-28
Tower Lighting System Failure....................5-29
Introduction....................5-29
Control Station Actions....................5-29
Transmitting Station Actions....................5-29
Section C AUTM/EUTM....................5-30
Procedures....................5-30
Introduction....................5-30
Procedures Prior to AUTM/EUTM....................5-31
Control Station Actions....................5-31
Transmitting Station Actions....................5-31
Procedures During AUTM/EUTM....................5-32
Control Station Actions....................5-32
Transmitting Station Actions....................5-32
Procedures After AUTM/EUTM....................5-33
Control Station Actions....................5-33
Transmitting Station Actions....................5-33
Section D Test Transmissions....................5-34
LSU Test Transmissions....................5-34
Introduction....................5-34
Authorized Chains for Test Transmissions....................5-34
Authorized Rates for Test Transmissions....................5-34
Test Transmissions Specifications....................5-35
Tango Specifications....................5-35
Test Transmissions on Existing Operational Rates....................5-36
LSU Responsibilities....................5-36
COCO NEUS/GLKS Responsibilities....................5-36

Chapter 5 Abnormal Operations, Continued

Test Transmissions on Non-Operational Rates 5-37
Introduction 5-37
Authorized Rates for Test Transmissions 5-37
LSU Responsibilities 5-37
NAVCEN Responsibilities 5-37
Section E Heavy Weather/Natural Disasters 5-38
Overview 5-38
Introduction 5-38
Preparation 5-38
Personnel Safety 5-38
Control Station Heavy Weather/Natural Disaster 5-39
Control Station Actions 5-39
Transmitting Station Actions 5-39
Transmitting Station Heavy Weather/Natural Disaster 5-40
Control Station Actions 5-40
Transmitting Station Actions 5-40

Chapter 6 Propagation Anomalies

Section A Definitions and Procedures 6-1
Solar Event Descriptions 6-1
Sudden Ionospheric Disturbance (SID) 6-1
Polar Cap Absorption (PCA) 6-1
Geomagnetic Storms 6-1
Non Solar Event Descriptions 6-2
Atmospherics 6-2
Weather 6-2
Interference 6-2
Solar Event Procedures 6-3
Verification 6-3
Blink 6-3
Notification 6-3
Control Shifts 6-3
Solar Event LPA Policy 6-3
TDC 6-3
Non-Solar Event Procedures 6-4
Non-Solar Event Verification 6-4
Example 6-4

Chapter 7 Casualty Recovery

Section A Casualty Recovery Procedures 7-1
Control Station 7-1
Blink 7-1
Casualty Verification 7-1
Blink During Master Off-Air 7-2
CSDO Responsibility 7-2
Control Station Recovery Flowchart 7-3
Transmitting Station 7-4
Blink 7-4
Casualty Verification 7-4
Blink During Master Off-Air 7-4
Stopping Blink 7-5
Transmitter Emergency Stop 7-5
Returning to Alpha Control 7-5
Transmitting Station Recovery Flowchart 7-6

Chapter 8 Loran Chain Timing

Section A Chain Synchronization 8-1
Introduction 8-1
UTC Synchronization 8-1
Time of Transmission Monitor Equipment 8-1
Section B Oscillator Adjustments 8-2
Oscillator Timing/Frequency Adjustments 8-2
Introduction 8-2
Steering Adjustments 8-2
Chain Time Step 8-2
Section C Oscillator Control 8-3
Oscillator Timing/Frequency Control 8-3
Introduction 8-3
TTM Data 8-3
Master Station Timing Adjustment Criteria 8-4
Master Transmitting Station Operate Oscillator Adjustment Criteria 8-5
Secondary Transmitting Station Operate Oscillator Adjustment Criteria 8-6
Operate Oscillator Installation 8-7
LOIS Data Reset 8-7
Master MPAs 8-7

Chapter 8 Loran Chain Timing, Continued

Section D Oscillator Management Procedures 8-8
Transmitting Station Oscillator Management 8-8
Introduction 8-8
Environment 8-8
Rack Access 8-8
Temperature Monitoring 8-8
Magnetic Environment 8-9
Vibration 8-9
Adjustments 8-9
Oscillator Readings 8-9
Oscillator Tolerances 8-9
New Oscillator 8-10
Procedure For Oscillator Failure 8-10
Section E Cross- Baseline, Cross-Chain and 1PPS References 8-12
Procedures 8-12
Introduction 8-12
Cross- Baseline Procedures for Secondary Transmitting Stations 8-12
Cross-Chain Procedures for Dual Rated Transmitting Stations 8-12
Cesium 1PPS Procedures 8-13
Cross-Chain Timing for Transmitting Station Cape Race and Fox Harbor 8-14

Chapter 9 Administration

Section A Record Keeping 9-1
Overview 9-1
Introduction 9-1
Control Station Records 9-1
Control Station Log 9-2
Control Station Log Signature Requirements 9-2
Control Station Log Retention Requirements 9-3
LCCS Data 9-3
Control Station Minimum Chart Markings 9-4
Control Station TELCO Outage Log 9-4
Control Station General Records Retention 9-4
Record Retention Table 9-5
Control Station Historical Records Retention 9-5

Chapter 9 Administration, Continued

Transmitting Station Records........9-6
Transmitting Station Log........9-6
Transmitting Station Log Entries........9-7
RAIL Data........9-7
Transmitting Station Minimum Chart Markings.........9-8
Oscillator Records........9-8
Distribution Amplifier Log........9-9
Transmitter Maintenance Log........9-9
Transmitting Station General Records Retention........9-10
Record Retention Table........9-10
Transmitting Station Historical Records Retention........9-11
Section B Casualty Reporting Procedures........9-12
Casualty Reporting........9-12
Overview........9-12
Message Precedence and Release Time........9-12
Routing........9-12
CASREP Categories........9-12
Requesting Assistance........9-13
Canadian Coast Guard CASREP Instructions........9-13
Discrepancy Report (DISREP)........9-13
Section C Unusual Time (UUT) Notification and Analysis........9-14
UUT User Notification........9-14
Overview........9-14
User Notification Requirements........9-14
UUT Analysis........9-14
Overview........9-14
UUT Analysis Requirements........9-14
Types of UUT Analysis........9-15
Criteria for Simplified UUT Analysis........9-15
Simplified UUT Analysis........9-15
Simplified UUT Analysis Report Content........9-15
Simplified UUT Analysis Review Process........9-15
Detailed UUT Analysis Submission........9-16
Detailed UUT Analysis Criteria........9-16
Detailed UUT Analysis Report Format........9-17
Detailed UUT Analysis Review Process........9-17
Detailed UUT Analysis Report Enclosures........9-18

Chapter 9 Administration, Continued

Section D AUTM/EUTM 9-19
Authorized Unusable Time 9-19
Overview 9-19
Definitions...9-19
Requesting AUTM 9-20
Requesting EUTM 9-20
AUTM Proposal/User Objections...9-20
Approval of AUTM 9-21
Approval of EUTM..9-21
General Rules for AUTM Messages 9-21
NOTAMs……………………………………………………………………………………9-21
Post AUTM/EUTM Notification 9-22
Sample AUTM Message 9-22
Chain Specific Additional Notification...9-22
Section E Training and Qualification Programs 9-23
Overview 9-23
Introduction...9-23
Training Responsibilities 9-23
ADCON 9-23
Headquarters Program Manager 9-23
OPCON...9-23
COCO..9-23
Transmitting Station CO/OIC and Control Station Supervisor 9-24
CONUS Transmitting Station Personnel 9-24
OCONUS Transmitting Station Personnel 9-24
Transmitting and Control Station Personnel...9-24
Types of Training...9-25
Formal 9-25
Informal...9-25
Drills..9-25
Operational Training Requirements...9-26
Training Topics 9-26
Training Schedule 9-26
Periodic Evaluation 9-26
Training Records...9-27
Qualification Program...9-28
Overview 9-28
Check-off List 9-28
Certification Exam..9-28
Duty Personnel Qualification..9-28
COCO Evaluation 9-28
Revoking Duty Qualification 9-29
Re-Qualification Procedure..9-29
Section F Personnel...9-30
Overview 9-30
Introduction...9-30
CO/OIC Evaluations 9-30
Transmitting Station CO/OIC Personnel Evaluations 9-30
Off Duty Employment 9-31
Off Duty Employment Guidelines 9-31
Request for Approval for Off Duty Employment..9-31

Chapter 9 Administration, Continued

Section G Awards ... 9-32
Operational Performance Award ... 9-32
Transmitting Station Operational Performance Award ... 9-32
Award Submission ... 9-32
Award Criteria ... 9-32
Control Station Operational Performance Award ... 9-33
Award Submission ... 9-33
Award Criteria ... 9-33
Non-Operational Awards ... 9-34
Unit Awards ... 9-34
Multiple Awards ... 9-34
Section H Station Visits/User Inquiries ... 9-35
Station Visits ... 9-35
Public Affairs ... 9-35
User Inquiries ... 9-35
User Inquiries ... 9-35
Simple Data Request ... 9-35
Operational Data Request ... 9-35
Minimum Information for Requests ... 9-36
Request for Uninterrupted Operational Periods ... 9-36
Affidavit ... 9-36
Witnesses ... 9-36
Section I Operational Reports ... 9-37
Reports ... 9-37
Overview ... 9-37
Monthly Report ... 9-37
Monthly Report Format ... 9-37
Report of Interference to Loran ... 9-38
COCO Actions ... 9-38
Report of Interference from Loran ... 9-39
COCO Actions ... 9-39
Section J Operational Inspection Program ... 9-40
Station Inspection ... 9-40
Overview ... 9-40
Schedule ... 9-40
Inspection Check-off List ... 9-40
Pre-Inspections ... 9-40
Inspection Procedures ... 9-41
Outbrief ... 9-41
Inspection Weighting Factors ... 9-41
Inspection Ratings ... 9-41
Inspection Ratings Table ... 9-41
Inspection Report ... 9-42
Action Item Follow-up ... 9-42
Follow-up Visits ... 9-42
Inspection Report ... 9-43
Action Item Follow-up ... 9-43
Follow-up Visits ... 9-43
Section K Technical Archives ... 9-44
Library ... 9-44
Overview ... 9-44
Technical Archive ... 9-44
SMEF Advisories ... 9-44
Section L NAVCENINST M16562.1 (series) Changes ... *9-44*
Procedure ... 9-44

Chapter 10 Acronyms & Abbreviations

Chapter 11 Glossary

Appendix

Table of Contents

Appendixes

Appendix A – Operational Orders

- Operational Orders Placeholder

Appendix B – Chain Operations Control Officer Instructions

- COCO Instructions Placeholder

Appendix C – Job Aids

- TAB 1 -- Determining Assigned ECD
- TAB 2 -- Correlation
- TAB 3 – 5061A Oscillator/Microstepper Adjustment Worksheets/Examples
- TAB 4 – 5071 Oscillator Adjustment Worksheets
- TAB 5 -- Monitor Site Calibration Worksheet
- TAB 6 -- Control Station Casualty Flow Chart
- TAB 7 -- Transmitting Station Casualty Flow Chart

Appendixes, Continued

Appendix D – Logs, Reports, Messages and Affidavit

- TAB 1 -- Logs
  - Example of the Control Station
  - Example of the Transmitting Station
- TAB 2 -- Reports
  - COCO Monthly
  - Simplified UUT Analysis
  - Formal UUT Analysis
- TAB 3 -- Messages
  - AUTM
  - Sample AUTM Proposal message
  - AUTM Approval
  - Sample AUTM Approval message
  - EUTM
  - Sample EUTM message
- TAB 4 -- Affidavit

Appendixes, Continued

Appendix E – Training/PQS

- TAB 1 – Training and Qualifications
  - Control Station
  - Transmitting Station
- TAB 2 – Areas of Training
  - Control Station Watchstander
  - Control Station Duty Technician
  - Transmitting Station Watchstander
  - Transmitting Station Duty Technician
  - Safety Observer
- TAB 3 – Qualification Checklist
  - Safety Observer Qualification Checklist
  - Control Station Watchstander Qualification Checklist
  - Transmitting Station Watchstander Qualification Checklist
  - Engineering Watchstander Qualification Checklist
  - Control Station Duty Technician
  - Transmitting Station Duty Technician Qualification Checklist
  - Control Station Duty Officer Qualification Checklist

Appendixes, Continued

Appendix F – Station Supplement

- TAB 1 -- LSOS Initialization Data
- TAB 2 -- ABS Initialization Parameters
- TAB 3 -- RAIL Initialization Parameters
- TAB 4 -- Communications Contingency Plan
- TAB 5 -- Communications Diagrams
- TAB 6 -- Heavy Weather Bill
- TAB 7 -- Tower Icing
- TAB 8 -- Power Distribution Diagrams
- TAB 9 -- Fire/Security System Documentation
- TAB 10 -- Unit Training Lesson Plans

Appendix G – Equipment Configurations

- TAB 1 -- Transmit Station
- TAB 2 -- Control Station

Appendix H – Pulse Building

- Pulse Building Guide

Appendix I – SMEF Advisories

- SMEF Advisories Placeholder

Appendixes, Continued

Appendix J – Technical Notes

- TAB 1 -- Transmit Station Equipment and Procedures
  - Automatic Blink System
    - Maintenance Precautions
  - GCF-W-1002 LSOS
    - Maintenance Precautions
- TAB 2 -- Control Station Technical Notes
  - Synchronous or Near Synchronous Interference

Chapter 1

Preface

Overview

Chapter Introduction

This chapter describes the purpose, objective, authority, and maintenance of this Manual.

Table of Contents

This chapter contains the following topics.

Preface 1-1
Purpose of this Manual 1-1
Objective of this Manual 1-1
Applicability 1-1
Authority 1-2
Discussion 1-3
Additional Instructions 1-3
Manual Maintenance 1-3
Reference Publications 1-4

Preface

Purpose of this Manual

The purpose of this Manual is to establish polices and procedures necessary for operation of the Long Range Navigation (Loran) service.

Objective of this Manual

The objectives are to:

- Define the organization and responsibilities of the entities that operate and support the Loran system.
- Define the parameters and modes of operation of the Loran system.
- Establish procedures for operation of the Loran system.
- Define administrative requirements for the Loran system.
- Provide technical guidance when necessary.

Applicability

The policies and procedures in this Manual apply to Chain Operations Control Officer(s) (COCO), Loran transmitting stations, control stations and monitor receiver sites under the Operational Control (OPCON) of Commanding Officer, U.S. Coast Guard Navigation Center (NAVCEN).

Through international agreement, the policies and procedures in this Manual also apply to the Canadian East Coast, Canadian West Coast and the Russian-American chains.

The instructions contained herein are operational in nature and **do not** relieve the transmitting station Commanding Officer (CO)/Officer-in-Charge (OIC), or monitor receiver site maintenance facility of any duties or responsibilities directed by higher authority.

Preface, Continued

Authority

The legal authority for establishing, maintaining and operating the Loran radionavigation system is derived from the following:

- **U.S. Code, Title 14, Section 81 - Aids to Navigation Authorized:** In order to aid navigation and to prevent disasters, collisions, and wrecks of vessels and aircraft, the Coast Guard may establish, maintain and operate electronic aids to navigation systems:
  - required to serve the needs of the Armed Forces of the United States peculiar to warfare and primarily of a military concern as determined by the Secretary of Defense or any department within the Department of Defense; or
  - required to serve the needs of the maritime commerce of the United States; or
  - required to serve the needs of the air commerce of the United States as requested by the Administrator of the Federal Aviation Administration (FAA).
- **U.S. Code, Title 14, Section 82 - Cooperation with Administrator of the FAA:** The Coast Guard, in establishing, maintaining, or operating any aids to air navigation herein provided, shall solicit the cooperation of the Administrator of the FAA to the end that the personnel and facilities of the FAA will be utilized to the fullest possible advantage.
- **Code of Federal Regulations, Title 33, Part 62.1(c) - Navigation and Navigable Waters:** The Coast Guard maintains systems of marine aids to navigation consisting of visual, audible, and electronic signals which are designed to assist the prudent mariner in the process of navigation.
- **U.S. Public Law, 100-223, Section 310 - Radio Navigation Systems:** Loran Master transmitters located in the United States and all Loran Master transmitters subject to the jurisdiction of the United States shall be synchronized to within approximately 100 nanoseconds of universal time.

Preface, Continued

Discussion

Coast Guard Loran chains provide a hyperbolic system of radio navigation. Because of the inherent accuracy of the system, mariners and aviators use the Loran system in all weather conditions over land and sea to obtain high accuracy position information.

Performance goals are:

- **99.9%** signal availability for transmitting stations.
- **99.7%** availability for a Loran triad including authorized Off-Air times.

Additional Instructions

This manual **is not** intended to be the sole source of reference and guidance for Loran operations. Additional instructions applicable to Loran operations include, but are **not** limited to the following:

- **Chain Operating Order (OPORDER):** COCOs and transmitting stations shall maintain the current OPORDER for their chain(s).
- **Chain Instructions: These additional instructions such as letters,** memos, messages, Standard Operating Procedures (SOP), etc., originate at Commandant, NAVCEN, and COCOs. In each case, direction in these instructions **shall not** contravene policy established by higher authority.

Manual Maintenance

This manual will be reviewed for revision on an annual basis. Any comments concerning the content of this manual should be submitted in accordance with Chapter 9 Section L. If further assistance is needed contact:

Attn: Operations Officer

Commanding Officer
U.S. Coast Guard Navigation Center
7323 Telegraph Road
Alexandria, VA. 22315-3998

Phone: (703) 313-5800
Fax: (703) 313-5805

E-mail: NISWS@navcen.uscg.mil
With "Forward to Loran Ops"
For CG Global users: NavCen RNav LORAN

Preface, Continued

Reference Publications

The following publications are suggested references and contain information relative to Loran operations, history, and support.

- Aids to Navigation Manual, Radionavigation, COMDTINST M16500.13
- Electronics Manual, COMDTINST M10550.25 (series)
- Specification of the Transmitted Loran Signal, COMDTINST M16562.4 (series)
- Loran User Handbook, COMDTPUB P16562.6
- Federal Radionavigation Plan, current edition
- Tower Engineering Manual, COMDTINST M11000.4 ?
- Casualty Reporting Procedures, COMDTINST M3501.3 (series)
- Organizational Manual, COMDTINST M5400.7
- Coast Guard Regulations, COMDTINST M5000.3
- MLC LANT Standard Operating Procedures
- MLC PAC Standard Operating Procedures
- Title 14, United States Code (U.S.C.)
- Title 33, United States Code of Federal Regulations (C.F.R.)
- U.S. Public Law 100-223
- Applicable Equipment Technical Manuals

Chapter 2

Command and Control

Overview

Chapter Introduction This chapter describes the organizational relationship and responsibilities of the entities that operate and support the Loran system.

Table of Contents This chapter contains the following topics.

Section A Organizational Structures 2-1
Headquarters Organization 2-1
NAVCEN Organization 2-1
Organizational Flowchart....2-2
Operational Control (OPCON)....2-3
Administrative Control (ADCON)....2-3
Loran Operation Control (OPCON) East Flowchart....2-4
Loran Operation Control (OPCON) West Flowchart 2-4
Loran Administrative Control (ADCON) East Flowchart....2-5
Loran Administrative Control (ADCON) West Flowchart....2-5
Section B Support Organization....2-6
Transmitting Station Electronic Support....2-6
Monitor Receiver Site Electronic Support 2-8
Control Station Electronic Support 2-9
Transmitting Station Civil Engineering Support 2-9
Monitor Receiver Site Civil Engineering Support 2-10
Administrative Support 2-11
Personnel Augmentation....2-11
Section C Duties and Responsibilities 2-12
Introduction....2-12
NAVCEN Commanding Officer....2-12
NAVCEN Operations Officer....2-12
NAVCEN Chief, Systems Management Divison 2-13
NAVCEN Assistant Operations Officer 2-15
NAVCEN Systems Management Loran Branch Chief....2-15
Chain Operations Control Officer (COCO)....2-17
Control Station Supervisor....2-19
Transmitting Station CO/OIC....2-21
Control Station Duty Officer (CSDO) 2-22
Control Station Duty Technician 2-23
Control Station Watchstander....2-24
Transmitting Station Duty Electronics Technician 2-25
Transmitting Station Watchstander....2-26
Section D Shared Roles and Responsibilities 2-27
Division of Control Station/Watch Responsibility....2-27
Control Station/Watch Assignments....2-27
Oscillator Control Responsibility....2-28
Oscillator Control Assignments....2-28
Monitor Receiver Site Assignments 2-29
Monitor Receiver Site A1 and A2 Assignments....2-29
Monitor Receiver Site A1 and A2 Assignments Continued 2-30

Section A

Organizational Structures

Headquarters Organization

Commandant: The Commandant (G-C), assisted by headquarters staff, plans, directs, coordinates, and evaluates Coast Guard activities carried out by the areas and districts; and provides immediate direction to headquarters units.

Program Manager: The Chief, Office of Aids to Navigation (G-OPN), under the direction of the Assistant Commandant for Operations (G-O), is the Loran Program Manager. Acting under authority delegated by the Commandant (G-C), the Program Manager provides policy, guidance, and direction for management of the Loran system.

Support Manager: The Chief, Office of C2 and Navigation Systems (CG-64), under the direction of the Assistant Commandant for Command, Control, Communications, Computers and Information Technology (CG-6), is the Loran Support Manager. Acting under authority delegated by the Commandant (G-C), the Support Manager directs and coordinates electronics engineering support of the Loran system.

NAVCEN Organization

Commanding Officer: The Commanding Officer, U. S. Coast Guard Navigation Center (NAVCEN) under the direction of Chief, Office of Aids to Navigation (G-OPN) is responsible for supervision and management of Loran operations.

Operations Officer: The Operations Officer, under the direction of the Commanding Officer is responsible for supervision and management of LORAN operations.

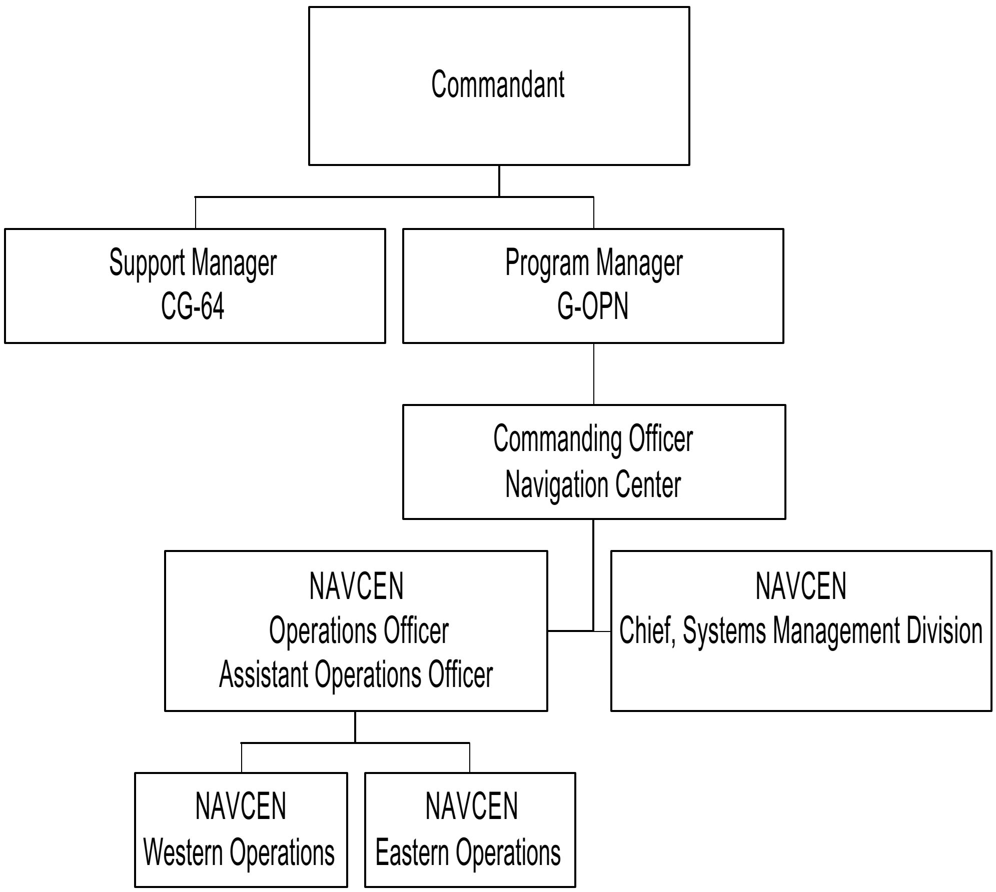
Assistant Operations Officer: The Assistant Operations Officer, under the direction of the Operations Officer is responsible for supervision and management of Loran operations.

Systems Management Division: The Chief, Systems Management Division, under the direction of the Commanding Officer is responsible for coordination and development of Loran operational directives.

Organizational Structures, Continued

Organizational Flowchart

The below flowchart shows the organizational structure from Commandant to NAVCEN Operations Divisions.



Organizational Structures, Continued

Operational Control (OPCON)

All U.S. Loran transmitting stations and monitor receiver sites are under the Operational Control (OPCON) of Commanding Officer, U. S. Coast Guard Navigation Center (NAVCEN).

OPCON is responsible for the accuracy, availability, reliability, and integrity of the Loran signal.

Note
Figures 2-2 and 2-3 show the system Operational Control Organization.

Administrative Control (ADCON)

All U.S. Loran transmitting stations are under the Administrative Control (ADCON) of their respective District Commander. For day-to-day execution, these functions may be assigned to a command, such as a Group, in the geographic area of the Loran station.

ADCON is responsible for the readiness of each Loran transmitting station within District boundaries.

Note
Figures 2-4 and 2-5 show the system Administrative Control Organization.

Organizational Structures, Continued

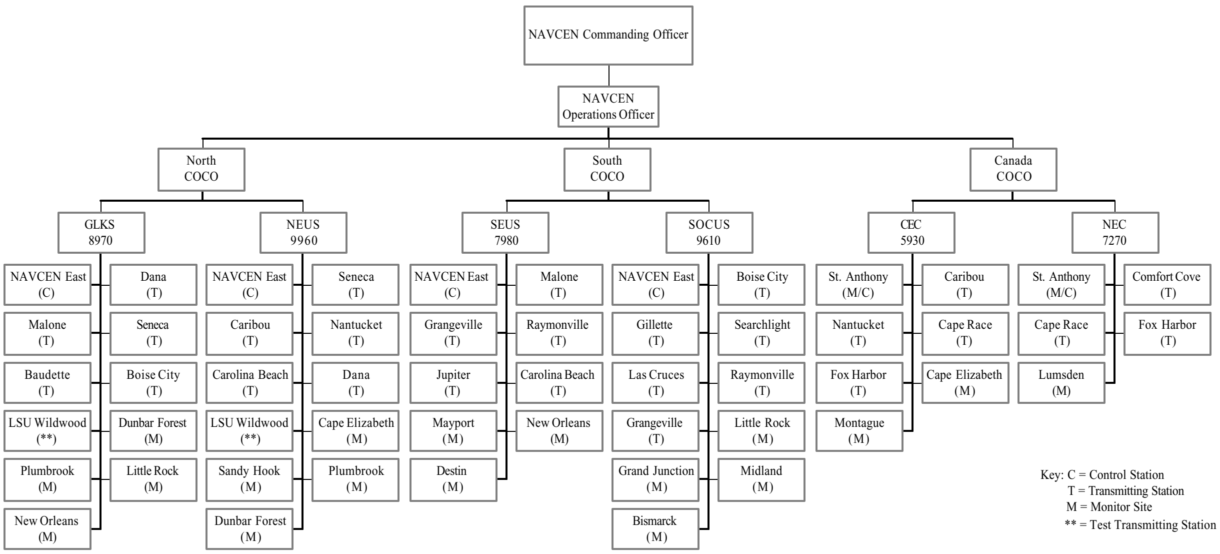


Figure 2-2
Loran Operational Control (OPCON) East

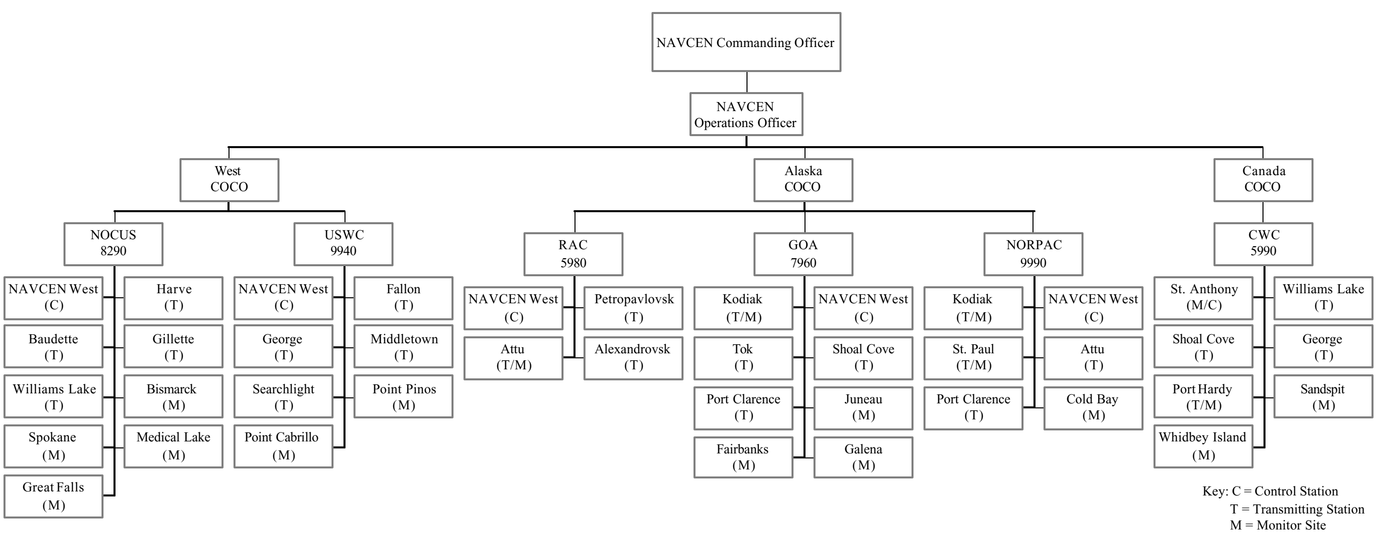


Figure 2-3
Loran Operational Control (OPCON) West

Organizational Structures, Continued

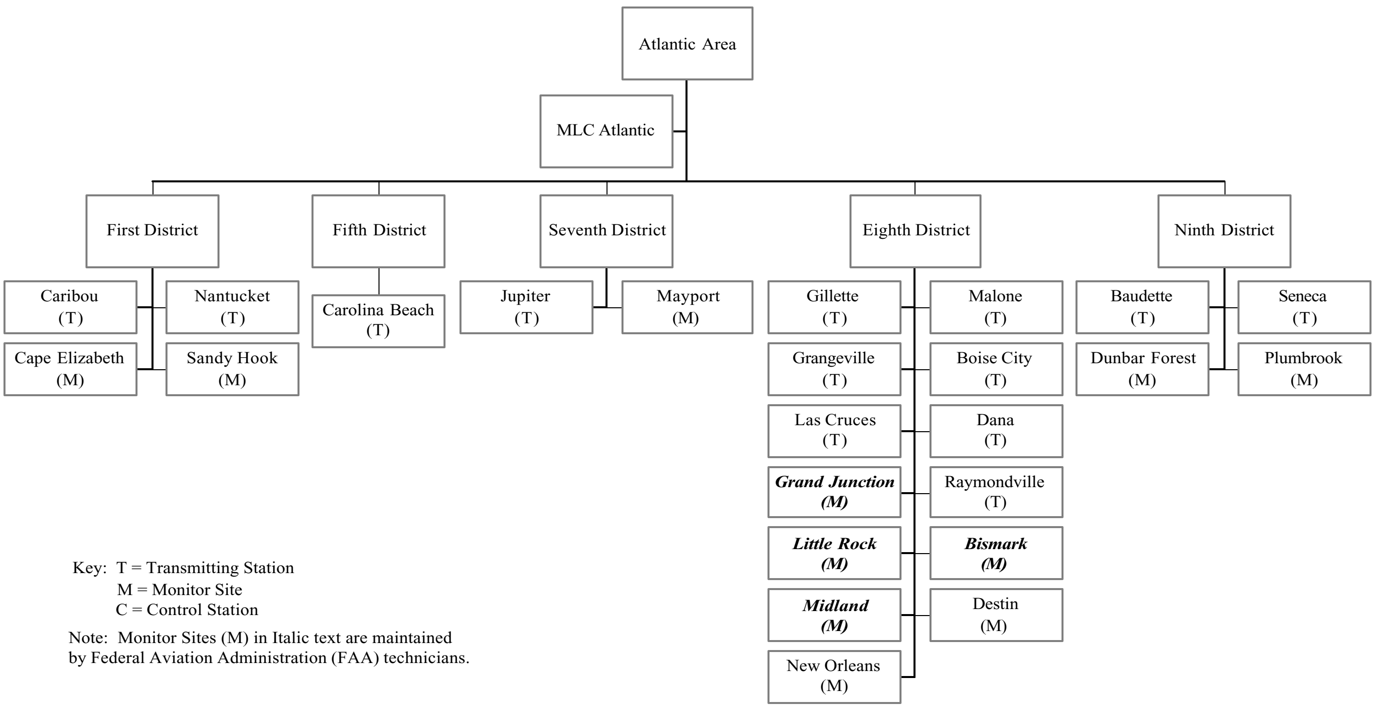


Figure 2-4
Administrative Control (ADCON) East

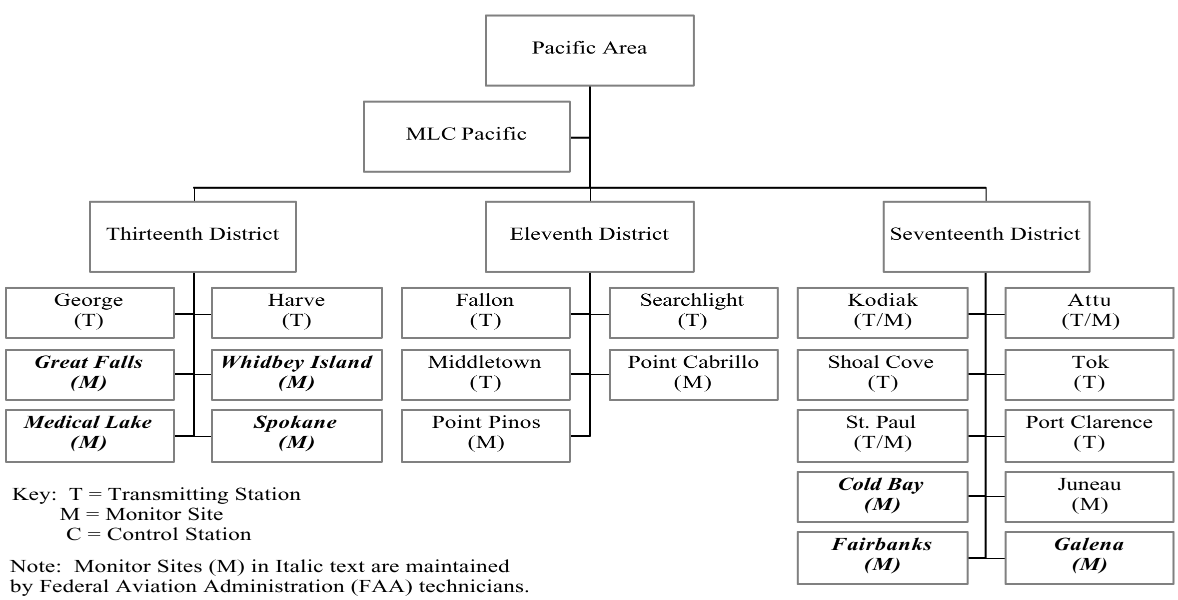


Figure 2-5
Administrative Control (ADCON) West

Section B

Support Organization

Transmitting Station Electronic Support

The organizational maintenance responsibility of transmitting station electronic equipment resides with personnel assigned to that station. Intermediate support responsibility resides with the Loran Support Unit (LSU). Electronic Systems Support Units (ESU) provide non-Loran equipment electronic support.

The table below provides non-Loran equipment electronic support responsibilities for each transmitting station.

Loran Station	Responsible ESU
Attu	ESU Kodiak
Baudette	ESU Cleveland
Boise City	ESU St. Louis
Caribou	ESU Boston
Carolina Beach	ESU Portsmouth
Dana	ESU St. Louis
Fallon	ESU Alameda
George	ESU Seattle
Gillette	ESU St. Louis
Grangeville	ESU New Orleans
Havre	ESU Seattle
Jupiter	ESU Miami
Kodiak	ESU Kodiak
Las Cruces	ESU New Orleans
Malone	ESU New Orleans
Middletown	ESU Alameda
Nantucket	ESU Boston
Port Clarence	ESU Kodiak
Raymondville	ESU New Orleans
Searchlight	ESU Alameda
Seneca	ESU Cleveland
Shoal Cove	ESU Kodiak
St. Paul	ESU Kodiak
Tok	ESU Kodiak

Note

LSU provides Systems Management Engineering Functions (SMEF) for all Loran equipment.

Support Organization, Continued

Monitor Receiver Site Electronic Support

The organizational maintenance responsibility of monitor receiver site electronic equipment resides with the respective ESU or Federal Aviation Administration (FAA) field office. The next level of support is the Loran Support Unit.

The table below provides electronic support responsibilities for each monitor receiver site.

Monitor Receiver Site	Responsible ESU or FAA
Attu	LORSTA Attu
Bismarck	FAA/ESU St. Louis
Cape Elizabeth	ESU Boston
Cold Bay	FAA/ESU Kodiak
Destin	ESU New Orleans
Dunbar Forest	ESU Cleveland
Fairbanks	FAA/ESU Kodiak
Galena	FAA/ESU Kodiak
Grand Junction	FAA/ESU St. Louis
Great Falls	FAA/ESU Seattle
Juneau	ESU Kodiak
Kodiak / Spruce Cape	ESU Kodiak
Little Rock	FAA/ESU St. Louis
Mayport	ESU Miami
Medical Lake	FAA/ESU Seattle
Midland	FAA/ESU New Orleans
New Orleans	ESU New Orleans
Plumbrook	ESU Cleveland
Point Cabrillo	ESU Alameda
Point Pinos	ESU Alameda
Sandy Hook	ESU New York
Spokane	FAA/ESU Seattle
St. Paul	LORSTA St. Paul
Whidbey Island	ESU Seattle

Note

LSU provides SMEF for all Loran equipment.

Support Organization, Continued

Control Station Electronic Support

The organizational maintenance responsibility of control station Loran Consolidated Control System (LCCS) equipment resides with NAVCEN. Intermediate support resides with, U.S. Coast Guard Loran Support Unit (LSU). LSU also provides (SMEF) for LCCS.

Transmitting Station Civil Engineering Support

Civil engineering support for transmitting station facilities, grounds and tall towers reside with the respective Civil Engineering Unit (CEU).

The table below provides civil engineering support responsibilities for each transmitting station.

Loran Station	Responsible CEU
Attu	CEU Juneau
Baudette	CEU Cleveland
Boise City	CEU Cleveland
Caribou	CEU Providence
Carolina Beach	CEU Cleveland
Dana	CEU Miami
Fallon	CEU Oakland
George	CEU Oakland
Gillette	CEU Miami
Grangeville	CEU Miami
Havre	CEU Oakland
Jupiter	CEU Miami
Kodiak	CEU Juneau
Las Cruces	CEU Miami
Malone	CEU Miami
Middletown	CEU Oakland
Nantucket	CEU Providence
Port Clarence	CEU Juneau
Raymondville	CEU Miami
Searchlight	CEU Oakland
Seneca	CEU Cleveland
Shoal Cove	CEU Juneau
St. Paul	CEU Juneau
Tok	CEU Juneau

Support Organization, Continued

Monitor Receiver Site Civil Engineering Support

Civil engineering support for monitor receiver site facilities resides with the respective Civil Engineering Unit (CEU).

The table below provides civil engineering support responsibilities for each monitor receiver site.

Monitor Receiver Site	Responsible CEU
Attu	CEU Juneau
Bismarck	CEU Cleveland
Cape Elizabeth	CEU Providence
Cold Bay	CEU Juneau
Destin	CEU Cleveland
Dunbar Forest	CEU Cleveland
Fairbanks	CEU Juneau
Galena	CEU Juneau
Grand Junction	CEU Cleveland
Great Falls	CEU Oakland
Juneau	CEU Juneau
Kodiak / Spruce Cape	CEU Juneau
Little Rock	CEU Cleveland
Mayport	CEU Miami
Medical Lake	CEU Oakland
Midland	CEU Miami
New Orleans	CEU Miami
Plumbrook	CEU Cleveland
Point Cabrillo	CEU Oakland
Point Pinos	CEU Oakland
Sandy Hook	CEU New York
Spokane	CEU Oakland
St. Paul	CEU Juneau
Whidbey Island	CEU Oakland

Support Organization, Continued

Administrative Support

A District Commander may obtain administrative support for a transmitting station from a subordinate unit or an Integrated Support Command (ISC).

Administrative support includes but is not limited to:

- Personnel record maintenance
- Contracting support
- Medical administration
- Housing administration
- Budget administration.

Personnel Augmentation

When the number of personnel available falls below the level necessary to maintain the transmitting station mission, personnel augmentation shall be considered.

The transmitting station Commanding Officer (CO)/Officer in Charge (OIC) will notify the respective ADCON and COCO(s) of the need for and expected duration of the augmentation.

COCO will assist ADCON in verifying the need for augmentation. ADCON is responsible for coordination and funding of the augmentation.

Section C

Duties and Responsibilities

Introduction

This section provides direction for management, supervision, and execution of Loran operations.

NAVCEN Commanding Officer

The Commanding Officer, U.S. Coast Guard Navigation Center (NAVCEN) is responsible as OPCON for supervision and management of all Loran operations.

Commanding Officer, NAVCEN responsibilities include:

- Plan and administer a program for U.S. Loran operations.
- Coordinate assigned international Loran operations.
- Initiate or review requests for new equipment, or modifications to existing installations, and furnish funding justification as required.
- Review plans for construction or modification of Loran transmitting stations and associated structures and equipment.
- Operationally certify new or major changes to Loran transmitting stations, monitor receiver sites, associated structures and equipment.
- Administer an operational performance awards program.
- Provide guidance and assistance to Headquarters and/or District program and support managers pertaining to operational or support objectives, planning, and budgetary administration.
- Administer a quality assurance program for Loran transmitting stations and monitor receiver sites to assess operational readiness.
- Authorize and coordinate transmitting station equipment and tower maintenance that require Authorized Unusable Time (AUTM) greater than two hours.

Duties and Responsibilities, Continued

NAVCEN Operations Officer

The Operations Officer, under the direction of the Commanding Officer is responsible for supervision and management of LORAN operations.

Operations Officer, NAVCEN responsibilities include:

- Administer Operational Control of all Loran Transmitting Stations and monitor receiver sites within the NAVCEN AOR.
- Operate the Russian-American Chain in cooperation with Russia.
- Liaison with ADCON for Loran Stations (Groups, MSO, District).
- Coordinate East and West Loran Operations.
- Present Weekly Operations Report to Commanding Officer.
- Implement Operations Policy.
- Administer Operations Award & recognition program.
- Approve Loran Station OIC candidates.
- Determine operational requirements.
- Resolve readiness issues with other CG units (personnel, parts, and hazards).
- Detachment Supervisor of the NAVCEN Western Operations Detachment.

Duties and Responsibilities, Continued

NAVCEN Chief, Systems Management Division

The Chief, Systems Management Division shall maintain the technical expertise to act as the Coast Guard's center of excellence for radionavigation systems. The Chief, Systems Management Division is responsible for analysis of existing systems, planning improvements, developing of national and international standards, and promoting the development of new applications. As the Coast Guard's technical experts for radionavigation, the Chief, Systems Management Division shall:

- Analyze the Loran system to ensure efficient and effective use of Coast Guard resources.
- Coordinate and oversee major system improvements;
- Develop doctrine and oversee conformance;
- Analyze operational measurements and trends of Loran services, related systems and information resources;
- Identify evolving user requirements and develop plans to meet them;
- Coordinate support of existing and planned systems with headquarters level staffs, commands, MLCs, and field units.

In cooperation with representatives of national, international, state and local governments, private industry, and universities, the Chief, Systems Management Division shall perform the following radionavigation system related functions:

- Investigate systems improvements;
- Lead in the development of national and international standards;
- Sponsor the development of applications;
- Promote global use and standardization;
- Continually upgrade these systems to improve performance and address the needs of federal, state, and local governments and the general public.

Duties and Responsibilities, Continued

NAVCEN Assistant Operations Officer

The Assistant Operations Officer assists the Operations Officer in the administration of operational control of all Loran transmitting stations and monitor receiver sites within the NAVCEN Area Of Responsibility (AOR). Western Operations is defined as operations in the Western United States, Alaska, and Canadian West Coast. Eastern Operations is defined as operations in the Eastern and Southeast United States, Gulf Coast, Great Lakes, and Canadian East Coast.

Assistant Operations Officer responsibilities include:

- Develop and administer a program for the operations of all Loran transmitting stations.
- Provide weekly operational reports to the NAVCEN Operations Officer.
- Review monthly Loran operation reports noting any abnormalities or signal degradation.
- Investigate any signal or system abnormalities.
- Interface with appropriate personnel at CEUs, ESUs, districts, or other entities concerning support issues.
- Act as Operations Officer in the temporary absence of the incumbent.

Duties and Responsibilities, Continued

NAVCEN Systems Management Loran Branch Chief

The Systems Management Loran Branch Chief is responsible for the management of the Loran program and oversight of the Loran Navigation Service including:

- All policy and programmatic concerns/requirements;
- Drafting and publishing all pertinent doctrine;
- Analyzing operational measurements and trends to optimize the Loran service;
- Establishing and maintaining liaison with Service users and other Service providers;
- Providing NAVCEN representation to appropriate industry standards groups and symposiums;
- Maintaining the Specification of the Transmitted Loran Signal, COMDTINST M16562.4A; including periodic reviews and drafting proposed changes as required;
- Establishing and maintaining technical liaison with relevant Coast Guard organizations: Commandant, CG Research and Development Center, USCG Academy, MLCLANT, MLCPAC, and Loran Support Unit;
- Providing liaison for LORAN Control Station SMEF;
- Manage the Loran Operations Information System (LOIS);
- Manage upgrades or changes to LORAN primary and backup communications.
- Fund backup communications.

Duties and Responsibilities, Continued

Chain Operations Control Officer (COCO)

COCO is responsible for supervision of the Loran chain(s) within their Area of Responsibility (AOR). COCO is the direct representative of NAVCEN and is responsible to the Operations Division Chief. COCO has broad authority over the operational functions performed by all elements of the Loran chain. When two COCOs share dual-rated Loran transmitting stations, one will be designated as the Primary COCO.

COCO responsibilities include:

- Develop and administer a program for the operation of all Loran transmitting stations within their respective AOR.
- Review and evaluate the performance of assigned Loran chain(s) and initiate action to correct or improve operations as necessary.
- Evaluate the operational readiness of each transmitting and control station using the NAVCEN quality assurance program as a guideline.
- Coordinate with the user community whenever a change in operations of a Loran chain(s) is expected to affect vessels, aircraft, or other Loran users in the area.
- Ensure the users are notified of Unusable Time (UUT) as required.
- Authorize Authorized Unusable Time (AUTM) of two hours or less.
- Investigate reports of interference or other abnormal events affecting the coverage area.
- Gather and analyze Loran Operations Information System (LOIS) data necessary to prepare a monthly report of Loran operations and forward this report to the respective Operations Division Chief.
- Review all LOIS data, Loran operations reports and message traffic for discrepancies or problems. Immediately report any serious technical or logistical problems to the respective Operations Division Chief.
- Resolve questions about **blink** periods, passing of control, or other operational procedures.
- Maintain UUT records and records of other abnormal events. Prepare investigative reports as required.
- Monitor transmitting station(s) oscillators and issues corrections as required.
- Establish the assigned ECD for each transmitting station.
- COCO's will provide additional guidance through COCO Instructions as appendices.

Chain Operations Control Officer Assistant (COCOA)

The COCO Assistant is responsible for supporting the COCO in administrating Loran operations.

COCO Assistant responsibilities include:

- Review and evaluate the performance of assigned Loran chain(s) and forward to COCO; develop action plans that correct or improve operations as necessary.
- Participate in the coordination of notifying the user community whenever a change in operation of a Loran chain(s) is expected to affect vessels, aircraft, or other Loran users in the area.
- Ensure the users are notified of Unusable Time (UUT) as required through message traffic by release of the COCO.
- Draft Authorized Unusable Time (AUTM) of two hours or less.
- Assist with the investigation of reports of interference or other abnormal events affecting the coverage area.
- Gather and analyze Loran Operations Information System (LOIS) data necessary to prepare a monthly report of Loran operations and forward this report to the respective COCO.
- Review all LOIS data, Loran operations reports and message traffic for discrepancies or problems. Immediately report any serious technical or logistical problems to the respective COCO.
- Maintain UUT records and records of other abnormal events. Prepare investigative reports as required.
- Monitor transmitting station(s) oscillators/TTM data and forward suggested corrections to COCO.
- Assist with establishing the assigned ECD for each transmitting station.
- Track Lorsta CASREP’s
- Maintain a log accuracy program and resolve conflicts in event logging.
- Assign COCO unusable time in LOIS.

Duties and Responsibilities, Continued

Control Station Supervisor

The Control Station Supervisor manages the monitor and control function performed at the control station.

Control Station Supervisor responsibilities include:

- Ensure Loran operations are conducted in accordance with this instruction, the Radionavigation Manual, COMDTINST M16500.13, Operation Orders, and COCO Instructions.
- Develop and administer a program to operate and maintain the Loran control station equipment.
- Review and evaluate the performance of Loran control station equipment and personnel.
- Initiate immediate action to correct equipment failures.
- Perform the duties of COCO during their absence.
- Submit Loran Operations Information System (LOIS) data to COCO on a routine basis for preparation of Loran reports.
- Report to COCO instances of interference or other abnormal events.
- Develop and administer a program to train and certify all control station technical and watchstanding personnel.
- Per Appendix E, LORAN training will be held for a minimum of 1 hour per week. In addition, weekly UUT will be reviewed.
- Review and verify the accuracy of all control station logs and reports required for Loran operations, maintenance, and engineering.
- Ensure all control station preventive maintenance is performed and documented.
- Supervise LCCS System Administration.

Assistant Control Station Supervisor

The Assistant Control Station Supervisor manages the monitor and control function performed at the control station and is the senior technician responsible for all electronics and communication systems performance.

Assistant Control Station Supervisor responsibilities include:

- Ensure Loran operations are conducted in accordance with this instruction, the Radionavigation Manual, COMDTINST M16500.13, Operation Orders, and COCO Instructions.
- Develop and administer a program to operate the Loran control station equipment.
- Review and evaluate the performance of Loran control station equipment and personnel.
- Initiate immediate action to correct equipment failures.
- Ensure that Loran Operations Information System (LOIS) data is submitted to COCO on a routine basis for preparation of Loran reports.
- Report to the Control Station Supervisor instances of interference or other abnormal events.
- Develop and administer a program to train and certify all control station technical and watchstanding personnel.
- Review of all control station logs and reports required for Loran operations, maintenance, and engineering.
- Ensure all control station preventive maintenance is performed and documented.
- Perform LCCS System Administrator duties.
- Develop and administer a Duty Technician program for the maintenance of all control station systems and equipments.
- Develop and maintain a log quality control program.

Duties and Responsibilities, Continued

Transmitting Station CO/OIC

The Commanding Officer (CO) / Officer-in-Charge (OIC) of a transmitting station is responsible for the operational readiness and operation of the station.

CO/OIC responsibilities include:

- Ensure Loran operations are conducted in accordance with this instruction, the Radionavigation Manual, COMDTINST M16500.13, Operation Orders, and COCO Instructions.
- Develop and administer a program to operate Loran equipment on the transmitting station.
- Maintain timing, transmitting and associated ancillary equipment to meet the mission requirements.
- Develop and administer a program to train and certify all transmitting station technical and watchstanding personnel in accordance with Appendix A. This includes ensuring that LORAN training and LORAN specific drills are each held for a minimum of 1 hour per week.
- Review and evaluate the performance of transmitting station equipment and systems.
- Coordinate with the control station and COCO whenever a change in operational status is expected.
- Initiate immediate action to correct equipment failures.
- Coordinate and schedule with COCO any equipment and tower maintenance that will require AUTM.
- Review for accuracy and submit LOIS data to COCO on a routine basis for preparation of Loran reports.
- Report to COCO instances of interference or other abnormal events.
- Review and ensure the quality of all transmitting station logs, charts and reports required for operations, maintenance, and engineering.
- Ensure all preventive maintenance is performed and documented.

Duties and Responsibilities, Continued

Control Station Duty Officer (CSDO)

The Control Station Duty Officer (CSDO) provides immediate operational guidance and direction to the control and transmitting station watchstanders.

CSDO responsibilities include:

- Possess a thorough working knowledge of the Loran Consolidated Control System (LCCS), backup power system, and communications equipment.
- Draft and release Casualty Reports (CASREP), Authorized Unusable Time (AUTM), and Unusable Time (UUT) messages.
- Notify COCO of any UUT meeting the user notification requirements with the exception of solar induced activity.
- Collect all documents required to complete a UUT analysis and forward to COCO for events meeting the criteria.
- Resolve conflicts concerning **blink**, passing of control, or other operational procedures.
- Assist control and transmitting station duty watchstander during casualties beyond their capabilities.
- Assist control station duty technician with corrective maintenance to the LCCS System and communication equipment to restore normal operations.
- Assist the transmitting station and monitor receiver site technicians in troubleshooting equipment as required
- Make the decision to utilize transmitting station Emergency Stop.

Duties and Responsibilities, Continued

Control Station Duty Technician

The Control Station Duty Electronics Technician (ET) is available to correct any control station equipment problem that is beyond the capability of the control station watchstander.

Control Station Duty Electronics Technician (ET) responsibilities include:

- Possess a thorough working knowledge of the LCCS, backup power system, and communications equipment.
- Perform LCCS and communications equipment corrective maintenance; observing the safety procedures contained in the Electronics Manual, COMDTINST M10550.25 series.
- Be a Control Station Watchstander and be prepared to assume the watch while on duty.
- Perform LCCS data backups in accordance with the most recent directives.
- Maintain the most recent LCCS code version, updates, and patches on the standby LCCS.
- Daily review of all control station logs and reports. Report discrepancies to the Control Station Supervisor
- Assist the transmitting station and monitor receiver site technicians in troubleshooting equipment as required.
- Assist the control station Supervisor in maintenance of the LCCS file system.
- Notification of the CSDO in the event that an equipment casualty can not be corrected.
- Perform LCCS data restorations.

Duties and Responsibilities, Continued

Transmitting Station Duty Electronics Technician

The Transmitting Station Duty Electronics Technician (ET) corrects any casualty situation that is beyond the capability of the control or transmitting station watchstander.

Transmitting Station Duty Electronics Technician (ET) responsibilities include:

- During casualty situations, coordinate with the control station as necessary to regain the assigned parameters utilizing casualty recovery procedures.
- Possess a thorough working knowledge of all transmitting station equipment.
- Perform Pulse Analysis as required.
- Perform corrective maintenance on electronics equipment to restore normal operations.
- Notify CO/OIC of any abnormal conditions as directed.

Duties and Responsibilities, Continued

Transmitting Station Watchstander

The Transmitting Station Watchstander monitors and maintains the basic operating parameters and corrects any discrepancy or deviation from normal operations when the transmitting station is in delta (local) control.

Transmitting Station Watchstander responsibilities include:

- In the event of an Out-of-Tolerance condition, ensure system integrity is maintained by starting secondary **blink**.
- While in TS mode, take immediate action to correct any equipment casualty that affects the transmitted signal.
- Perform System Sample.
- While in control, monitor all local parameters and make adjustments as necessary to maintain parameters within the assigned tolerances.
- Insert timing corrections as directed by the controlling station or COCO.
- Possess a thorough working knowledge of all transmitting station equipment.
- Ensure recall equipment is operating properly.
- Ensure the control station has correct recall information.
- Maintain the transmitting station log and charts.
- During watch relief, verify Remote Automated Integrated Loran (RAIL), ABS data and pending alarms. Also, provide the on-coming watchstander with complete operational status of all transmitting station equipment.
- Notify Duty Electronics Technician as directed.
- Master Transmitting Station Watchstanders will be qualified to assume Bravo Control of their chains as outlined in Chapters 3 and 5.

Duties and Responsibilities, Continued

Control Station Watchstander

The Control Station Watchstander monitors and maintains the basic parameters of operation, and corrects any discrepancy or deviation from normal operations.

Control Station Watchstander responsibilities include:

- Maintain system integrity by ensuring secondary **blink** is started in the event of an Out-of-Tolerance (OOT) condition.
- Perform System Sample.
- Monitor and control Loran Time Differences (TD) of all baselines.
- Monitor the Envelope to Cycle Difference (ECD) and signal strength of each transmitting station.
- Recover transmitting station parameters while in Control Station (CS) mode or notify the transmitting station while in Transmitting Station (TS) mode.
- Provide assistance to transmitting station personnel during a casualty.
- Ensure control information (i.e. CS/TS mode) is passed to the transmitting station in a timely manner via any communications method available.
- Verify Time Difference Controller (TDC) recommended Local Phase Adjustments (LPAs) are required and inserted to ensure the Time Difference (TD) remains within the assigned tolerances.
- Properly maintain control station logs and charts, noting any changes affecting transmitting station parameters, changes in equipment status and shifts of control.
- During watch relief:
  - verify proper operation of Loran Consolidated Control System (LCCS), Monitor receiver sites, Local Station Operating Set (LSOS), Automatic Blink System (ABS)
  - verify all data and pending alarms to all chains monitored.
  - provide the on-coming watchstander with complete operational status of all chains monitored.
- Notify/recall control station and transmitting station personnel as directed.
- Ensure any changes made to monitor receiver site nominals or LSOS parameters are entered into the LCCS initialization screens and recorded in the control station Log.
- Perform LCCS daily backups.
- Perform monitor site calibrations weekly and after monitor site maintenance.

Section D

Shared Roles and Responsibilities

Division of Control Station/Watch Responsibility

Several of the dual-rated transmitting stations are controlled by different control station/watches. The transmitter(s) and LSOS at a dual-rated transmitting station are shared by both rates. Actions taken during a casualty recovery on one rate can adversely affect recovery effort on the other rate. To avoid conflict between the two controlling stations/watches, a Primary control station/watch is designated for each of these transmitting stations.

The Primary Control Station /Watch is responsible for the following:

- Respond to all station alarms.
- Coordination of recovery from all dual-rate casualties.
- Transmitting station personnel recall.

Note

Designation of a Primary control station/watch for a dual-rated transmitting station **does not** relieve the Secondary control station/watch for that station of any monitoring or recovery responsibilities.

Control Station/Watch Assignments

The table below shows Control Station/Watch assignments for dual rated transmitting stations.

Dual Rated Loran Station	Primary Control Station/Watch	Secondary Control Station/Watch
Baudette	Eastern Operations	Western Operations
Boise City	Eastern Operations (SOCUS)	Eastern Operations (GLKS)
Carolina Beach	Eastern Operations (NEUS)	Eastern Operations (SEUS)
Caribou	St. Anthony	Eastern Operations
George	Western Operations	St. Anthony
Gillette	Eastern Operations	Western Operations
Malone	Eastern Operations (SEUS)	Eastern Operations (GLKS)
Nantucket	Eastern Operations	St. Anthony
Searchlight	Western Operations	Eastern Operations
Shoal Cove	Kodiak	St. Anthony
Williams Lake	St. Anthony	Western Operations

Shared Roles and Responsibilities, Continued

Oscillator Control Responsibility

COCOs have the responsibility for transmitting stations oscillator control. For dual-rated transmitting stations under the direction of two COCOs, the Primary COCO is responsible for the transmitting station's oscillators.

Oscillator Control Assignments

The below table shows Primary COCO oscillators assignments.

Loran Station	COCO
Attu	NORPAC
Baudette	GLKS
Boise City	SOCUS
Cape Race	CEC
Caribou	CEC
Carolina Beach	NEUS
Comfort Cove	NEC
Dana	GLKS
Fallon	USWC
Fox Harbor	CEC
George	USWC
Gillette	SOCUS
Grangeville	SEUS
Havre	NOCUS
Jupiter	SEUS
Kodiak	NORPAC
Las Cruces	SOCUS
Malone	SEUS
Middletown	USWC
Nantucket	NEUS
Port Clarence	NORPAC
Port Hardy	CWC
Raymondville	SOCUS
Searchlight	USWC
Seneca	NEUS
Shoal Cove	GOA
St. Paul	NORPAC
Tok	GOA
Williams Lake	CWC

Shared Roles and Responsibilities, Continued

Monitor Receiver Site Assignments

Operational management of the monitor receiver sites is delegated to COCO. When a monitor receiver site serves two chains, a single COCO will be designated as the operational manager for that site.

Monitor Receiver Site A1 and A2 Assignments

The table below provides monitor receiver sites and their Alpha 1 and Alpha 2 assignments, and the COCO assigned as operational manager.

Monitor Receiver Site	(A1)	(A2)	COCO
Attu	5980 – M/X		NORPAC
Bismarck	8290 – M/W/X	9610 – V	NOCUS
Cape Elizabeth	9960 – W	5930 – X 9960 – M/X/Y/T	NEUS
Cold Bay	9990 – X/Y		NORPAC
Destin		7980 – W/X/Y/Z	SEUS
Dunbar Forest	8970 – M/X/Y	9960 – Z	GLKS
Fairbanks	7960 – Z		GOA
Galena		7960 – Z	GOA
Grand Junction	9610 – M/V/W	9610 – X	SOCUS
Great Falls		8290 – M/W/X	NOCUS
Juneau	7960 – Y	7960 – M/X	GOA
Kodiak	9990 – M/Z 7960 – M/X	7960 – Y	NORPAC
Little Rock	8970 – W/Z 9610 – Z	9610 – M/Y	SOCUS
Lumsden		7270 – M/W/X	NEC
Mayport	7980 – Y/Z	7980 – M	SEUS
Medical Lake		8290 – Y	NOCUS
Midland	9610 – X/Y	9610 – W/Z	SOCUS

Continued on next page

Shared Roles and Responsibilities, Continued

Monitor Receiver Site A1 and A2 Assignments Continued

The table below provides monitor receiver sites and their Alpha 1 and Alpha 2 assignments, and the COCO assigned as operational manager.

Monitor Receiver Site	(A1)	(A2)	COCO
Montague	5930 – M/X/Y/Z		CEC
New Orleans	7980 – M/W/X	8970 – W/Z	SEUS
Plum Brook	9960 – Z 8970 – T	8970 – M/X/Y	GLKS
Point Cabrillo	9940 – W	9940 – M/X/Y	USWC
Point Pinos	9940 – M/X/Y	9940 – W	USWC
Port Hardy	5990 – M	5990 – X/Y/Z	CWC
St. Anthony	7270 – M/W/X	5930 – M/Y/Z	NEC
St. Paul		9990 – M/X/Y/Z	NORPAC
Sandspit	5990 – X		CWC
Sandy Hook	9960 – M/X/Y/T	9960 – W	NEUS
Spokane	8290 – Y		NOCUS
Whidbey Island	5990 – Y/Z	5990 – M	CWC

Chapter 3

Loran System Control

Overview

Chapter Introduction

This chapter provides instructions for Loran system control. Specific areas addressed are chain control methods and operating parameters.

Loran operations may be broadly defined by two functions:

- Generation of Loran signals by transmitting stations.
- Control of those signals by a control station.

Table of Contents

This chapter contains the following topics.

Section A Loran System....3-1
Overview....3-1
System....3-1
Chain....3-1
Chain Control....3-1
Integrity....3-1
Section B Loran System Control Parameters....3-2
Control Station....3-2
Overview....3-2
Time Difference (TD)....3-2
Envelope to Cycle Difference (ECD)....3-3
Controlling Standard ECD (CSECD)....3-4
Far Field Envelope-to-Cycle Difference (F/F ECD)....3-4
Signal Strength (Gain)....3-4
Transmitting Station....3-5
Envelope to Cycle Difference (ECD)....3-5
Calculated ECD....3-5
Nominal ECD....3-6
Digital Panel Meter ECD (DPM ECD)....3-6
Assigned ECD....3-6
Time Interval Number (Coarse TINO)....3-7
Synchronization Number (SYNC)....3-7
Local Envelope Number (LEN)....3-7
Cycle Compensation (C/C)....3-7
Radiated Signal Strength....3-8
Antenna Current....3-8
Nominal Antenna current....3-8
Maximum Antenna current....3-8
Low Power....3-8
Blink Antenna current....3-8

Table of Contents

This chapter contains the following topics.

Section C Loran Operational Control 3-9
Modes of Control 3-9
Introduction 3-9
Control Receiver Modes 3-9
Remote/Local Modes 3-10
Casualty Recovery Responsibility Modes 3-10
Preferred Mode of Control 3-10
Precedence of Control 3-10
Mode of Control Examples 3-11
Mode of Control Examples Continued 3-12
Modes of Control and Responsibility 3-13
Timing Blink Tolerances 3-14
ECD Blink Tolerances 3-14

Section A

Loran System

Overview

System

The Long Range Navigation (Loran) system provides a precise, all weather, 24 hour a day radionavigation service. Loran is a low frequency, hyperbolic radionavigation system that operates in the frequency band of 90 to 110 kHz with a carrier frequency of 100 kHz. The Loran User Handbook, COMDTPUB P16562.6, contains basic information concerning the Loran system.

Chain

The basic element of a Loran system is the chain. A chain consists of a Master transmitting station and at least two Secondary transmitting stations. A Master and a single Secondary transmitting station form a baseline. Each Loran chain provides signals suitable for accurate navigation over a designated advertised user area. Hyperbolic Lines of Position (LOP) are determined by measuring the Time Differences (TD) in reception of signals from the Master and Secondary transmitting stations.

Chain Control

The purpose of control is to ensure the accuracy and integrity of the transmitted signals within the advertised user area. Chain control parameters are established by OPCON and can be found in each Chain Operation Order's.

Integrity

Loran transmitting stations are constantly monitored to detect signal abnormalities that would render the system unusable for navigation purposes. Secondary transmitting stations will **"blink"** to notify users that a baseline is unusable.

Section B

Loran System Control Parameters

Control Station

Overview

The control station functions as a real-time monitor of each Loran signal. Monitor receiver sites, located in the user area, are used as the primary source of information regarding system performance. Time Differences are controlled to ensure stability of the LOPs in the user area. The pulse shape and strength of each signal are monitored to ensure advertised user area coverage.

Time Difference (TD)

TD is the time interval between receipt of the Master signal and receipt of a Secondary signal as measured by a monitor site receiver. The control station, using information from monitor receiver sites, continuously monitors each baseline TD. By making phase adjustments to the Secondary transmitting station's signal, the TD is maintained near a Controlling Standard Time-Difference (CSTD). The CSTD and tolerances for each baseline are assigned by NAVCEN and are listed in the Chain Operations Order.

Control Station, Continued

Envelope to Cycle Difference (ECD)

ECD is defined, in Specification of the Transmitted Loran Signal, as the time relationship between the phase of the RF Carrier and the time origin of the envelope waveform. In practice, ECD is used to monitor and control the relationship between the shape of the envelope and the Standard Zero Crossing (SZC) of the pulse.

A Loran receiver typically uses the envelope of the pulse to locate the SZC. The accuracy of the Loran system is dependent upon the ability of a user receiver to properly discriminate the SZC. Therefore, the relationship between envelope shape and the SZC of the pulse must be maintained to ensure user receivers properly acquire the Loran signal.

ECD is controlled at the transmitting station and monitored by the control station.

Types of ECD are:

- Controlling Standard
- Far Field
- Nominal
- Calculated
- Transmitted
- Assigned

Each ECD listed above is either an assigned value with a tolerance or the actual measurement. The ECD values for individual stations will differ based on equipment configurations and geographic relationship between the station and the user area.

Control Station, Continued

Controlling Standard ECD (CSECD)

This value is set in the Chain Operations Orders. The pulse shape is continuously monitored in the user area and compared to the CSECD value. The tolerance for ECD as measured by the monitor receiver is +/-1.5 microseconds from CSECD.

Far Field Envelope-to-Cycle Difference (F/F ECD)

F/F ECD is the time relationship between the phase of the RF carrier and the time origin of the envelope waveform as measured by the monitor receiver site. F/F ECD is continuously monitored and compared to the Controlling Standard ECD (CSECD). F/F ECD is the current value of the transmitting station's ECD as measured in the user area.

Signal Strength (Gain)

Monitor receiver site gain is used as an indicator to ensure each transmitting station is broadcasting the signal with enough power to properly cover the advertised user area. The strength of the transmitted signals at the monitor receiver site is constantly monitored.

Transmitting Station

Envelope to Cycle Difference (ECD)

ECD is defined, in Specification of the Transmitted Loran Signal, as the time relationship between the phase of the RF Carrier and the time origin of the envelope waveform. In practice, ECD is used to monitor and control the relationship between the shape of the envelope and the Standard Zero Crossing (SZC) of the pulse.

A Loran receiver typically uses the envelope of the pulse to locate the SZC. The accuracy of the Loran system is dependent upon the ability of a user receiver to properly discriminate the SZC. Therefore, the relationship between envelope shape and the SZC of the pulse must be maintained to ensure user receivers properly acquire the Loran signal.

ECD is controlled at the transmitting station and monitored by the control station.

Types of ECD are:

- Controlling Standard
- Far Field
- Nominal
- Calculated
- Transmitted
- Assigned

Each ECD listed above is either an assigned value with a tolerance or the actual measurement. The ECD values for individual stations will differ based on equipment configurations and geographic relationship between the station and the user area.

Calculated ECD

Calculated ECD is a measurement of the actual transmitted ECD. To measure the transmitted ECD, a pulse analysis will be performed by the transmitting station watchstander. The tolerance for Calculated ECD is +/-0.5 microseconds from the Nominal ECD.

Transmitting Station, Continued

Nominal ECD

Nominal ECD (NECD) should be the ECD of the transmitted pulse. Under ideal conditions, when a transmitting station's transmitted ECD is at nominal ECD, the calculated ECD should be at NECD and the Far Field ECD should be at CSECD. All transmitting stations will maintain their calculated ECD to within +/-0.5 microseconds of the nominal value.

Note

The Chain Operation Order establishes the nominal value for each transmitting station's transmitted ECD.

Transmitted ECD

Transmitted ECD is displayed on the RAIL monitor indicating the pulse shape of the transmitted signal. The ECD of the transmitted pulses are continuously monitored at the transmitting station. Transmitting stations are to maintain their transmitted ECD as read via RAIL, within +/- 0.5 microseconds of the assigned ECD.

Assigned ECD

The assigned ECD is the value displayed on RAIL when the pulse shape of the transmitted signal is at nominal ECD. The ECD of the transmitted pulses are continuously monitored at the transmitting station. Transmitting stations are to maintain their ECD as displayed by RAIL, within +/- 0.5 microseconds of the assigned ECD value.

Notes

1. COCO establishes the assigned ECD for each transmitting station.
2. Appendix C describes the process of determining assigned ECD.

Transmitting Station, Continued

Time Interval Number (TINO)	TINO is the time interval between arrival of the Remote Phase Code Interval (RPCI) signal generated by the receiver and the Local Phase Code Interval (LPCI) signal generated by the timer. TINO is continuously monitored at the transmitting station, but is normally used only in the event of a casualty or abnormal condition.
Synchronization Number (SYNC)	SYNC is the time interval between RPCI and the standard zero crossing of the first transmitted pulse (envelope strobe). SYNC is continuously monitored at the transmitting station but is normally used only in the event of a casualty or abnormal condition.
Local Envelope Number (LEN)	LEN is the time interval between LPCI and the envelope strobe. LEN is available at the transmitting station but is normally used only in the event of a casualty or abnormal condition.
Cycle Compensation (C/C)	The cycle compensation loop automatically compensates for variations in the path delay between the timer and the radiated signal, thus keeping LEN constant. C/C is continuously monitored at the transmitting station but is normally used only during a casualty or abnormal condition.

Transmitting Station, Continued

Radiated Signal Strength

The strength of the radiated signal from a transmitting station has direct impact on the range at which the signal will remain usable. For this reason, the output power level of each station is monitored and controlled to ensure proper system coverage.

Antenna Current

Antenna current, as measured by RAIL, is derived from the feedback of the transmitted signal. The antenna current reading is an indication of the output power level of the station. RAIL continuously monitors the antenna current of the transmitted signal.

Nominal Antenna Current

Nominal antenna current is the antenna current value assigned in the Chain Operations Orders that must be maintained during normal operations.

Maximum Antenna Current

Maximum antenna current is the highest value at which the transmitter can operate without signal distortion or damage to equipment. The maximum antenna current is established at 50 Amps above the nominal antenna current value.

Low Power

Low Power is 80% of nominal antenna current. This is the lowest value allowed before corrective action is taken.

Blink Antenna Current

The power level at which the signal is considered to be insufficient to meet system coverage requirements is 70.7% of nominal antenna current (half of rated power). User notification, **blink**, is required at this point.

Section C

Loran Operational Control

Modes of Control

Introduction

The mode of control is defined in three parts:

- Receiver used for Control
- Remote/Local
- Casualty Recovery Responsibility

Control Receiver Modes

The receiver used to control the baseline determines the control mode. A transmitting station may be capable of assuming either Bravo, Charlie, or Delta control. Control stations have the capability of assuming all modes of control using Loran Consolidated Control System (LCCS). Baseline control using the transmitting station receivers is intended for short-term control only. Control is always of the baseline, not of a single transmitting station.

There are four modes of baseline control:

- **Alpha (A)** – Baseline controlled using the far field monitor receiver site.
- **Bravo (B)** – Baseline controlled using Master transmitting station's local receiver locked onto the Secondary transmitting station.
- **Charlie (C)** – Baseline controlled using the Secondary transmitting station's local receiver locked onto another Secondary transmitting station.
- **Delta (D)** – Baseline controlled using the Secondary transmitting station's local receiver locked onto the Master transmitting station.

Modes of Control, Continued

Remote/Local Modes

There are two modes that refer to the status of the transmitting station equipment for the execution of timing adjustments and **blink** commands.

These modes are:

- **Remote (REM):** The control station, or Master transmitting station during Bravo control, **can** insert timing adjustments (LPAs or MPAs) and **blink** commands. The transmitting station equipment is capable of accepting and executing these commands.
- **Local (LOC):** The control station, or Master transmitting station during Bravo control, **cannot** insert timing adjustments (LPAs or MPAs) and **blink** commands. The transmitting station equipment is not capable of executing these commands remotely and the transmitting station must insert these commands locally.

Casualty Recovery Responsibility Modes

There are two modes that define who is responsible for recovering a transmitting station's parameters during a casualty. Since transmitting stations are not always manned, these methods of assigning responsibility clearly define which station will take action in the event of a casualty.

These modes are:

- **Control Station (CS)** – The control station is responsible for casualty recovery.
- **Transmitting Station (TS)** – The transmitting station is responsible for casualty recovery.

Preferred Mode of Control

The preferred mode of control will be Alpha control.

Precedence of Control

The precedence of control is Alpha, Bravo, Delta, and Charlie.

Note

COCO may authorize deviations from the normal control precedence.

Modes of Control, Continued

Mode of Control Examples

A-REM(CS) – The baseline is being controlled using either the A-1 or A-2 monitor receiver site. The control station, via LCCS, will insert LPAs, MPAs or **blink**. The control station is responsible for casualty recovery.

A-REM(TS) – The baseline is being controlled using either the A-1 or A-2 monitor receiver site. The control station, via LCCS, will insert LPAs, MPAs or **blink.** The transmitting station will assume control in case of a casualty and is responsible for casualty recovery.

A-LOC(TS) – The baseline is being controlled using either the A-1 or A-2 monitor receiver site. The control station will direct the transmitting station to insert LPAs, MPAs or **blink**. The transmitting station will assume control in case of a casualty and is responsible for casualty recovery.

B-REM(CS) – The baseline is being controlled from the control station, via LCCS, using the local receiver at the Master transmitting station. The control station via LCCS will insert LPAs, MPAs or **blink**. The control station is responsible for casualty recovery.

B-REM(TS) - The baseline is being controlled by the Master transmitting station watchstander using the local receiver at the Master transmitting station. The Master transmitting station via Teletype (TTY) will insert LPAs, MPAs or **blink**. The transmitting station experiencing the casualty is responsible for casualty recovery.

B-LOC(TS) - The baseline is being controlled by the Master transmitting station watchstander using the local receiver at the Master transmitting station. The Master transmitting station will direct the Secondary transmitting station to insert LPAs, MPAs or **blink**. The transmitting station experiencing the casualty is responsible for casualty recovery.

Continued on next page

Modes of Control, Continued

Mode of Control Examples Continued

C-REM(CS) – The baseline is being controlled by the control station, via LCCS, using a Secondary transmitting station local receiver locked onto another Secondary transmitting station. The control station via LCCS will insert LPAs, MPAs or **blink**. The control station is responsible for casualty recovery.

C-REM(TS) - The baseline is being controlled by a Secondary transmitting station watchstander using a receiver locked onto another Secondary transmitting station. The controlling Secondary transmitting station via Teletype (TTY) will insert LPAs, MPAs or **blink**. The transmitting station experiencing the casualty is responsible for casualty recovery.

C-LOC(TS) - The baseline is being controlled by a Secondary transmitting station watchstander using a receiver locked onto another Secondary transmitting station. The controlling Secondary transmitting station will direct the transmitting station experiencing the casualty to insert LPAs, MPAs or **blink**. The transmitting station experiencing the casualty is responsible for casualty recovery.

D-REM(CS) - The baseline is being controlled from the control station, via LCCS, using the local receiver at the Secondary transmitting station. The control station via LCCS will insert LPAs, MPAs, and **blink**. The control station is responsible for casualty recovery.

D-LOC(TS) - The baseline is being controlled using the local receiver at the Secondary transmitting station, LPAs, MPAs, and **blink** will be inserted locally by the Secondary transmitting station. The transmitting station experiencing the casualty is responsible for casualty recovery.

Modes of Control, Continued

Modes of Control and Responsibility

Below table shows different modes of control and responsibility for casualty detection, starting **blink** and casualty recovery.

	Responsibility To:		
Mode of Control	**Detect Casualty**	**Start Blink**	**Recover from Casualty**
A1-REM-CS	CS	CS	*CS
A1-REM-TS	CS	CS	TS
A1-LOC-TS	CS	TS	TS
A2-REM-CS	CS	CS	*CS
A2-REM-TS	CS	CS	TS
A2-LOC-TS	CS	TS	TS
B-REM-CS	CS	CS	*CS
B-REM-TS	Master	Master	TS
B-LOC-TS	Master	TS	TS
C-REM-CS	CS	CS	*CS
C-REM-TS	**TS	**TS	TS
C-LOC-TS	**TS	TS	TS
D-REM-CS	CS	CS	*CS
D-LOC-TS	TS	TS	TS

Note

1. * = The control station will initiate recovery action until transmitting station personnel arrives.

2. ** = A Secondary transmitting station is controlling a transmitting station experiencing a casualty.

Modes of Control, Continued

Timing Blink Tolerances

Below table shows timing **blink** tolerances for specific control modes.

Control Receiver	Parameters	Tolerances
Alpha 1	TD	+/- 100 nanoseconds from CSTD
Alpha 2	TD	+/- 100 nanoseconds from correlated CSTD
Bravo	TINO	+/- 100 nanoseconds from correlated CSTD
Charlie	TINO	+/- 100 nanoseconds from correlated CSTD
Delta	TINO	+/- 100 nanoseconds from correlated CSTD

ECD Blink Tolerances

Below table shows ECD **blink** tolerances for specific control modes.

Control Receiver	Parameters	Tolerances
Alpha 1	ECD	+/- 1.5 microseconds from CSECD
Alpha 2	ECD	+/- 1.5 microseconds from CSECD
Bravo	ECD	+/- 0.5 microseconds from assigned ECD
Charlie	ECD	+/- 0.5 microseconds from assigned ECD
Delta	ECD	+/- 0.5 microseconds from assigned ECD

Note

1. All transmitting stations will monitor their transmitted ECD while in Bravo, Charlie or Delta control and shall maintain the RAILECD, within +/- 0.5 microseconds of assigned ECD.

Chapter 4

Normal Operations

Overview

Chapter Introduction

Control Station: During normal operations, the control station has Alpha control of all baselines. The control station monitors the Time Difference (TD) between the Master and Secondary transmitting stations, F/F ECD, and signal strength using the monitor receiver sites, Remote Automated Integrated Loran (RAIL) system. The control station functions as a real-time monitor of each transmitting station's data, alarms, and physical condition.

Transmitting Station: During normal operations, each transmitting station transmits a precisely timed and shaped series of Loran pulses of sufficient power to provide advertised user area coverage. Local signal characteristics are continuously measured at each transmitting station. These measurements can be used by both transmitting and control stations for short-term control or restoration of normal operations following a casualty.

Table of Contents

This chapter contains the following topics.

Section A Control Station Operations....4-1
Loran Consolidated Control System (LCCS) 4-1
Introduction....4-1
LCCS Configuration 4-1
Time Difference Controller (TDC)....4-1
TDC Operating Mode....4-2
Ki/Ks....4-2
Control Policy (CONPOL)....4-2
Communications 4-2
Power 4-2
Monitor Receiver Sites....4-3
Introduction....4-3
Configuration 4-3
Report Intervals....4-3
Alarm Tolerances 4-3
Monitor Receiver Sites, Continued....4-4
Nominal Values....4-4
Local Station Operating Set (LSOS) 4-5
Introduction....4-5
LSOS Software 4-5
LSOS Configuration 4-5
LSOS Data Alarm Windows....4-5
LSOS Data Interval 4-6

Table of Contents

This chapter contains the following topics.

LSOS Station Alarm Assignments....4-6
LSOS Station Alarm Descriptions....4-7
RAIL....4-8
Introduction....4-8
RAIL Software....4-8
RAIL Configuration....4-8
RAIL Data Alarm Windows....4-8
RAIL Data Interval....4-9
Control Station Daily Routine....4-10
Watchstander Daily Routine....4-10
Watch Relief....4-10
Control Station Daily Operations Record....4-11
Charts....4-11
TDC/Bias Plots....4-11
Local Phase Adjustment (LPA)....4-12
Maintenance Phase Adjustment (MPA)....4-12
Message Traffic....4-12
Loran Operations Information System (LOIS) NT....4-12
Transmitting Station (TS) Mode....4-12
Control Station (CS) Mode....4-13
Routine Equipment Switches....4-14
Transmitting Station Maintenance Mode....4-14
Parameters During Routine Equipment Switches....4-14
Routine Equipment Maintenance....4-15
Monitor Receiver Site Calibration....4-15
LCCS Daily Archive....4-15
System Sample....4-16
Introduction....4-16
Communication Test....4-16
Time of Transmission (TTM)....4-16
System Sample Times....4-17
Invalid System Sample Data....4-17
Control Station Watchstander Reference Material....4-18
Status Board....4-18
Watchstander Reference Book....4-18
Equipment Checks....4-19
LCCS....4-19
ABS....4-19
Section B Transmitting Station Operations....4-20
Loran Station Operating Set (LSOS)....4-20
Introduction....4-20
LSOS Configuration....4-20
LSOS Operating Mode....4-20
LSOS Software....4-20
LSOS Station Alarm Assignments....4-21
LSOS Station Alarm Descriptions....4-22
Remote Automated Integrated Loran (RAIL)....4-23
Introduction....4-23
RAIL Software....4-23
RAIL Configuration....4-23
RAIL Data Alarm Windows....4-23
RAIL Data Interval....4-24
RAIL Peak Reference....4-24
Other Equipment Configurations....4-25
Timer(s) Configuration....4-25
Automatic Blink System (ABS)....4-25
TTX Feedback Operation....4-25
TTX DESLOT Operation....4-25

Timing Receiver....4-26
Communications....4-26
DC Backup Power....4-26
Blanking....4-27

Table of Contents continued

Priority Rate Blanking 4-27
Alternate Rate Blanking 4-27
Priority Rate 4-27
Blanking Scheme Assignments 4-28
Transmitting Station Duty Personnel 4-29
OUTCONUS Duty Sections 4-29
CONUS Duty Sections 4-29
Primary Recall 4-29
Secondary Recall 4-29
Recall 4-29
Fire/Intrusion Alarm Systems 4-30
Transmitting Station Daily Routine 4-31
Watchstander Daily Routine 4-31
Assuming TS Mode 4-31
Watch Relief 4-31
Transmitting Station Log 4-32
Operator's Comments 4-32
Message Traffic 4-32
LOIS 4-32
Prior to Assuming CS Mode 4-33
Routine Equipment Switches 4-34
Coordinating Routine Equipment Switches 4-34
TTX Switching Cycle 4-34
SSX O/C Networks 4-34
Timers 4-34
PATCO 4-34
Routine Equipment Maintenance 4-35
LSOS Station Maintenance 4-35
Pulse Analysis 4-35
System Sample 4-36
Introduction 4-36
Communications Test 4-36
System Sample TINO 4-36
System Sample Times 4-37
Invalid System Sample Data 4-37
Transmitting Station Status Board 4-38
Status Board 4-38
TTX Status Board Example 4-35
SSX Status Board Example 4-36

Section A

Control Station Operations

Loran Consolidated Control System (LCCS)

Introduction

The Loran Consolidated Control System (LCCS) receives data from monitor receiver sites and transmitting station equipment. LCCS uses this data to display transmitting station alarms, parameters, and plots data for the control station watchstander. The control station watchstander, using LCCS, can control all the baselines in the chain.

LCCS Configuration

The control station's monitoring equipment normally consists of the LCCS, two primary communications links, and backup communications modems. The initialization data for each LCCS will be based on the chains monitored. Each control station will have a list of all the LCCS initialization parameters. These parameters will change based on operations and seasonal variations. The control station watchstander will document all changes to the initialization data.

Note

COCO will authorize any changes to the initialization parameters.

Time Difference Controller (TDC)

The purpose of the TDC is to keep the baseline TD from being constantly positive or constantly negative from CSTD, thus keeping the Lines of Position stable in the user area. The TDC calculates and automatically inserts LPAs as required to maintain CSTD. The TDC also generates a plot showing the present Time Difference Error (TDE) from CSTD and the Cumulative Time Difference Error (CUM TDE). The CUM TDE is a computation based on the TDE values for the previous 90 minutes. The CUM TDE should sine wave positive and negative across zero. COCO determines the operating parameters for the Time Difference Controller (TDC). Changes to the TDC parameters shall be noted on the Monthly Report of Loran-C Operations.

Note

The TDC is described in detail in the LCCS Operators Guide.

Loran Consolidated Control System (LCCS), Continued

TDC Operating Mode

The TDC will normally be operated in the automatic mode for all baselines. In this mode, LPA decisions for a particular baseline made by the TDC will automatically be sent to that particular transmitting stations equipment.

Ki/Ks

There are two factors used to determine the amount of effect that the TD error (Ki) and the cumulative TD error (Ks) will have on LPA recommendations. COCO may change these factors to produce different TD control behavior. Ki and Ks can be set in the LCCS initialization screen for each baseline. The default value for each is 20.

Control Policy (CONPOL)

The CONPOL determines what periods during the day each Ki and Ks factors will be used. COCO may change these CONPOL periods to produce different TD control behavior. CONPOL can be set in the LCCS initialization screen for each baseline.

The two periods are:

- CONPOL 1 is normally used during the daylight hours.
- CONPOL 2 is normally used during the nighttime hours.

Communications

Each LCCS has a primary and secondary frame relay T1. Back up communications are provided via cellular or satellite modems.

Power

All LCCS equipment, with the exception of the printer and speakers, will be backed up by the Uninterruptible Power Supply (UPS). This includes the communications interfaces provided by the Telephone Company.

Monitor Receiver Sites

Introduction

Alpha monitor receiver sites are used for long term monitoring and control of transmitting station parameters. They are located in the user area in order to ensure integrity of the Loran system. This type of monitoring is referred to as System Area Monitoring (SAM).

Configuration

Two Alpha monitor receiver sites are installed in different locations within the user area to monitor each baseline. One receiver is the primary control receiver and is designated as Alpha One (A-1). The other receiver is designated as Alpha Two (A-2).

Report Intervals

The report interval for each monitor receiver site will normally be set to 30 minutes. It will not be set any greater than 30 minutes.

Alarm Tolerances

Alarm tolerances for each monitor receiver site will be set according to the table below.

Alarm	Alpha-1	Alpha-2
Time Difference Deviation (TDD)	.08	.10
Envelope Deviation (EDD)	.10	.15
Signal Strength Deviation (SSD)	6	6

Monitor Receiver Sites, Continued

Nominal Values Each monitor receiver site will have a different set of controlling nominal values based on regional conditions. COCO will assign the nominal values for each monitor receiver site in the chain with the exception of the A-1 CSTD and CSECD and the A-2 CSECD. The monitor receiver site operating values may change based on operations and seasonal variations. The control station watchstander will document all changes to the monitor receiver site nominal values and record them locally.

Note

A-1 CSTD and CSECD and the A-2 CSECD are established under the Chain OPORDER and can only be changed under the authority of a revised OPORDER. Seasonal variations are considered when establishing these parameters.

Local Station Operating Set (LSOS)

Introduction

The LSOS at each transmitting station monitors equipment, environmental alarms, and provides equipment control capabilities. This data is sent to LCCS via RAIL. The control station watchstander monitors the alarms from each transmitting station and is capable of issuing commands to transmitting station equipment to correct casualties.

LSOS Software

Unless otherwise directed by COCO, only the most current approved software version will be used. LSOS software is not to be modified without specific direction from COCO.

Note

No copies of superseded, inoperative, or other LSOS software will be retained onboard once COCO has approved an updated version.

LSOS Configuration

Each transmitting station in the chain will have a different set of assigned values. Each control station will maintain a current listing of all the assigned values and transmitting station alarms. The RAIL and LSOS data values and assigned deviations must match.

LSOS Data Alarm Windows

The LSOS Data Alarm tolerances will be set in the LCCS Initialization screen as follows:

Parameter	LCCS Alarm Tolerances
Antenna Current	50 Amps
ECD	0.5 uSec
RCV ECD	* 0.5 Volts
TINO	0.5 uSec
SYNC	0.5 uSec
M-L∅	100 nSec
C/C	50 nSec

Note

* = COCO may change this value based on transmitting station receiver performance.

Local Station Operating Set (LSOS), Continued

LSOS Data Interval

The LSOS Data Interval will be set to three-minute intervals under normal operations. LSOS will send local transmitting station data to LCCS every three minutes providing LSOS is not in the Station Maintenance Mode.

LSOS Station Alarm Assignments

Transmitting stations will conform to the standard LSOS station alarm configuration as listed below. COCO may authorize deviations from this listing based on local conditions and equipment configurations.

Alarm	TTX Station		SSX Station	
Number	Alarm	Color	Alarm	Color
1	Bldg Intrusion	Red	Bldg Intrusion	Red
2	Fire	Red	Fire	Red
3	Gen Set Failure	Red	Gen Set Failure	Red
4	Gen On Line	Yellow	Gen On Line	Yellow
5	Comm Power Fail	Yellow	Comm Power Fail	Yellow
6	Fire Sys Tbl	Red	Fire Sys Tbl	Red
7	Ops High Temp	Yellow	Ops High Temp	Yellow
8	Xmtr High Temp	Yellow	Xmtr High Temp	Yellow
9	Xmtr Sec Cool	Yellow	Spare	Green
10	Twr Lights Fail	Yellow	Twr Lights Fail	Yellow
11	DC I/F Trouble	Red	DC I/F Trouble	Red
12	Spare	Green	Spare	Green

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Local Station Operating Set (LSOS), Continued

LSOS Station Alarm Descriptions

Below table shows alarm tiles and descriptions.

Alarm #	Alarm Title	Description
1	**Building Intrusion**	Activates when the physical security of the building has been compromised.
2	**Fire**	Activates when any zone on the transmitting station fire system goes into an alarm condition
3	**Generator Set Failure**	Activates under any condition that would prevent the generator from automatically assuming the transmitting station load. This alarm will also activate upon any condition that has caused the generator to shut down.
4	**Generator On Line**	Activates when the generator is supplying power to transmitting station equipment.
5	**Commercial Power Failure**	Activates when commercial power is unavailable.
6	**Fire System Trouble**	Activates when the transmitting station fire panel goes into a trouble condition.
7	**Operations Room High Temperature**	Activates when the temperature in the Operations Room indicates the environmental system has failed or the temperature has exceeded 75°F. The monitoring equipment for this alarm will be installed in the GCF-RWL-1817B Frequency Standard Set.
8	**Transmitter Room High Temperature**	Activates when the temperature in the Transmitter Room indicates the environmental system has failed.
9 (TTX)	**Transmitter Secondary Cooling**	Activates when the TTX water cooling system has failed. This will be activated using water temperature monitoring equipment.
9 (SSX)	**Spare**	This alarm is not normally wired.
10	**Tower Lighting Failure**	Activates when tower lighting monitoring equipment has detected a tower lighting failure.
11	**DC Interface Trouble**	Activates upon a loss of AC input to DC supply and loss of an output from the DC supply.
12	**Spare:**	This alarm is not normally wired.

Remote Automated Integrated Loran (RAIL)

Introduction

The RAIL at each transmitting station samples local operating parameters, monitors equipment, and provides a communications interface. The information from RAIL is sent to LCCS via a communications link. The control station watchstander monitors the alarms and data from each transmitting station and is capable of issuing commands to transmitting station equipment to correct casualties.

RAIL Software

Unless otherwise directed by COCO, only the most current approved software version will be used. RAIL software is not to be modified without specific direction from COCO.

Note

No copies of superseded, inoperative, or other RAIL software will be retained onboard once COCO has approved an updated version.

RAIL Configuration

Each transmitting station in the chain will have a different set of assigned values. Each control station will maintain a current listing of all the assigned values and transmitting station alarms.

RAIL Data Alarm Windows

The RAIL Data Alarm tolerances will be set in the LCCS Initialization screen as follows:

Parameter	LCCS Alarm Tolerances
TINO	0.5 uSec
SYNC	0.5 uSec
C/C	50 nSec
M-LO	100 nSec
Antenna Current	50 amps
Xmt ECD	0.5 uSec
Rcv ECD	0.5 uSec

Remote Automated Integrated Loran (RAIL), Continued

RAIL Data Interval

The RAIL Data Interval will be set to 5 second intervals under normal operations. RAIL will send local transmitting station data to LCCS every 5 seconds providing RAIL is not in the Station Maintenance Mode.

Control Station Daily Routine

Watchstander Daily Routine

The primary responsibility of the control station watchstander is to monitor and control the timing and integrity of a Loran chain(s).

Watch Relief

Upon assuming the watch, the oncoming watchstander takes responsibility for the timing and integrity of the Loran chain(s).

The following are minimum requirements that will be completed prior to assuming the watch.

- Verify the operational mode in effect for each transmitting station.
- Verify monitor receiver site parameters and initialization data are correct.
- Verify transmitting station data values on the initialization screens are correct.
- Request and review pending alarms from each transmitting station.
- Request and review a data round from each transmitting station.
- Request and review a full status message from each ABS unit.
- Review all charts.
- Review the bias plots.
- Review the current recall data.
- Review message traffic for operational messages.
- Review outstanding CASREPs.
- Review the logs for completeness and accuracy.
- Update the Status board.
- Review the pass down log.
- Verify that back up comms are not in use unnecessarily.

Note

Any dispute between watchstanders during watch relief will immediately be reported to the CSDO.

Control Station Daily Routine, Continued

Control Station Daily Operations Record

The control station log is an account of the day's events. The control station watchstander is responsible for maintaining the station log. The log is considered a legal document and will be kept current and accurate. The log will be opened at 00:00Z and closed at 23:59:59Z.

At the end of the operational day, the following reports will be included with the log:

- LCCS Daily Control Monitor Report
- LCCS Bias Plots
- LOIS Daily Detailed Report

Note

Specific log entries are addressed in Chapter 9.

Charts

During normal operations, LCCS will mark the charts with the required entries as they occur. The watchstander should periodically review the charts to ensure that they are properly marked and make any additional entries as required.

TDC/Bias Plots

The control station watchstander will review the Bias Plots periodically to ensure LCCS is making the proper LPA corrections to compensate for the present and Cumulative TDE drift. If the watchstander suspects a problem with operation of the TDC, they will notify the CSDO immediately.

The following guidelines apply:

- If the present and cumulative TDE is positive, LCCS should recommend negative LPAs.
- If the present and cumulative TDE is negative, LCCS should recommend positive LPAs.
- LCCS should not recommend an LPA if the present TDE is positive and the cumulative is negative.
- LCCS should not recommend an LPA if the present TDE is negative and the cumulative is positive.
- LCCS should not insert more than two LPAs in an hour per baseline.
- The Cumulative total for LPAs should not exceed 100 nanoseconds for a baseline during a 24-hour period.
- Verify the bias plots are active.

Control Station Daily Routine, Continued

Local Phase Adjustment (LPA)

LPA's are inserted at Secondary transmitting stations due to normal oscillator drift and short-term changes in the propagation path. LPA's are not inserted to a Master transmitting station. **A LPA should not normally exceed 40 nanoseconds in value.**

Maintenance Phase Adjustment (MPA)

MPAs are inserted when timing corrections are required due to equipment switches, time steps, casualties, or maintenance.

Message Traffic

The control station watchstander shall be aware of all messages pertaining to operations within their respective Loran chain and enact notification as directed locally.

Loran Operations Information System (LOIS) NT

The control station watchstander will complete and send the LOIS daily operations report after the change of day. This report will include the previous day's events and data. Log entries for events that do not have a LOIS code assigned will be entered as comments. The watchstander will ensure the LOIS database is updated and resent following any corrections to a previously submitted LOIS report.

Transmitting Station (TS) Mode

During this mode, the transmitting station is responsible for casualty recovery. Transmitting station personnel can recover from a casualty more quickly and effectively than control station personnel; therefore, the transmitting station will assume TS mode when on board the station and within hearing distance of the alarms.

Control Station Daily Routine, Continued

Control Station (CS) Mode

During this mode, the control station is responsible for casualty recovery. It is critical that all transmitting station systems are functioning properly and the control station is able to issue commands remotely to the transmitting station equipment.

Prior to allowing transmitting station personnel to depart, the control station will:

- Ensure there are no alarms pending
- Ensure LSOS and RAIL are sampling data properly
- Obtain a full status report from the ABS unit and verify the following:
  - Time is correct
  - ABU Left is on-line
  - Mode is Armed
  - PTM Status is 00
  - PTM State is 88
  - OP RF Offset <40nSec
  - MPT Offset is 0
  - RF Gate Offset <40nSec
  - No Active Alarms
- Verify the recall personnel listed are correct. Update if necessary.
- Verify the transmitting station icon on the LCCS chain screen is GREEN.

Routine Equipment Switches

Transmitting Station Maintenance Mode

Transmitting station personnel will place LSOS in Station Maintenance mode prior to performing maintenance or when station equipment is placed in Local. This prevents excessive alarms caused during maintenance from distracting the control station watchstander.

Parameters During Routine Equipment Switches

Routine maintenance at the transmitting stations may require equipment switches. The control station watchstander will coordinate all equipment switches and monitor all transmitting station parameters during each switch. During an equipment switch, chart tracks may shift. A TD shift of 20 nanoseconds or greater requires the insertion of a Maintenance Phase Adjustment (MPA). Shifts exceeding those noted below must be reported to the transmitting station and the CSDO.

- **Timers:**
  - Cycle Comp shifts of 40 nanoseconds or more
  - Any shift in F/F ECD and local ECD
  - TD Shift of 40 nanoseconds or more
- **Pulse Amplitude Timing Controller (PATCO):**
  - Local and far field ECD shifts greater than 0.2 microseconds
  - TD shift of 40 nanoseconds or more
  - Cycle Comp shift of 100 nanoseconds or more
- **Solid State Transmitter (SSX) Output Coupling Network:**
  - Local and far field ECD shifts greater than 0.2 microseconds
  - TD shift of 40 nanoseconds or more
  - Cycle Comp shift of 100 nanoseconds or more
- **Tube Type Transmitter (TTX):**
  - Local and far field ECD shifts greater than 0.2 microseconds
  - TD shift of 40 nanoseconds or more
  - Cycle Comp shift of 300 nanoseconds or more

Routine Equipment Maintenance

Monitor Receiver Site Calibration

A calibration is performed to calculate the correct Envelope Correction Number (ECDCR) for that monitor receiver site. The change in the ECDCR value should not exceed +/-.12 from the previous value.

The monitor receiver sites shall be calibrated:

- weekly,
- after receiver maintenance, or
- as directed by the CSDO.

Note

1. Refer to the Operators Guide for the GCF-LN-02A-PCMS (V) Primary Chain Monitor Set Chapter 3 for calibration procedures.
2. A calibration worksheet is provided in Appendix J.

LCCS Daily Archive

After the change of day, the control station watchstander will perform a backup of the LCCS database using the daily archive function. Once the archive is completed, the watchstander will verify the archive has been completed successfully by checking the daily archive log for the date and the message indicating the archive is 100% complete. The control station watchstander will notify the duty technician if they are unable to successfully complete the daily archive.

System Sample

Introduction

System Sample (S/S) is a daily-standardized one-hour period representative of typical operations. This is the primary source of data for use in the Loran Operations Information System (LOIS). During this one-hour period, data is observed, recorded, and entered in the LOIS Daily Detailed Report. The data is collected for each transmitting station in the chain during system sample.

The following guidelines apply during System Sample:

- Transmitting station personnel shall be onboard and in TS mode during System Sample.
- Pulse Analysis shall be completed during the System Sample hour.
- Transmitting stations will **not** perform routine equipment switches or maintenance.
- Timing Control Number (TMCN) for the monitor receiver sites will be set to 60, unless otherwise authorized by the CSDO.

Communication Test

At the beginning of System Sample, a Watch Call (W/C) will be sent to each transmitting station in **TS Mode.** Reply via TTY to confirm receipt of the W/C.

Time of Transmission (TTM)

LCCS will automatically poll the TTM data daily at system sample. Data will be forwarded to COCO's office.

System Sample, Continued

System Sample Times

Below are times for System Sample:

Loran Rate	System Sample Time
5930	1600Z to 1700Z
5980	2000Z to 2100Z
5990	2000Z to 2100Z
7270	1600Z to 1700Z
7960	2000Z to 2100Z
7980	1600Z to 1700Z
8290	2000Z to 2100Z
8970	1600Z to 1700Z
9610	1600Z to 1700Z
9940	2000Z to 2100Z
9960	1600Z to 1700Z
9990	2000Z to 2100Z

Invalid System Sample Data

The following circumstances will invalidate the System Sample data:

- Equipment switches during System Sample.
- Casualties that affect the On-Air signal or monitor receiver sites.
- Propagation anomalies.
- More than two LPAs on any baseline during System Sample.

Control Station Watchstander Reference Material

Status Board

At a minimum, the following information will be posted on a status board located in the operations room:

- Transmitting station/monitor receiver site CASREPs
- The names of transmitting and control station recall personnel.
- Control mode for each transmitting station.
- Operate equipment for each transmitting station.
- Remarks section listing important information such as pending AUTMs, Time Steps, and any information regarding transmitting station equipment status (i.e. NON-DESLOT).

Watchstander Reference Book

The control station watchstander is responsible for ensuring that the Reference Book remains current. This book will be used during watch reliefs to verify transmitting station and monitor receiver site operating parameters.

The watchstander reference book contains:

- Assigned LSOS and RAIL data values for each transmitting station.
- Nominals for each monitor receiver site.
- Recall information for each transmitting station and monitor receiver site.
- The telephone company trouble log.

Watchstander Pass down Log

The control station watchstander is responsible for ensuring that the Pass down Log is updated and remains current. This book will be used during watch relief's to verify temporary changes in operating policies and procedures that conflict with current instructions which may be necessary to deal with unique situations or equipment status.

The watchstander reference book contains:

- Directions from the COCO/CSDO to the watch

Equipment Checks

LCCS

The control station watchstander will periodically check the Bias Lines to ensure the TDC is operating properly. Transmitting station data rounds will be periodically checked to ensure the data is being continuously updated.

ABS

Each ABS Unit in the chain will be checked at watch relief to verify proper operation. Each unit should be in the ARMED Mode. Pulse Time Measurement (PTM) State and Status codes should read 00 and 88. PTM offsets should be near zero. There should not be any active alarms on either Automatic Blink Unit (ABU).

Section B

Transmitting Station Operations

Loran Station Operating Set (LSOS)

Introduction

The LSOS at each transmitting station monitors equipment and environmental alarms. These alarms are sent to LCCS via RAIL.

LSOS Configuration

Each transmitting station in the chain will have a different set of LSOS initialization parameters. All transmitting stations will set the oscillator step size to 10 nanoseconds.

LSOS Operating Mode

During normal operations, LSOS will function in the Normal Operations mode using the primary communications channel. LSOS will be placed in the Station Maintenance mode prior to performing equipment maintenance. While in Station Maintenance mode, LSOS continues to report all alarms to LCCS; however, these alarms will not activate the LCCS audio alarm.

LSOS Software

Unless otherwise directed by COCO, only the most current approved software version will be used. Transmitting and control station personnel shall not modify LSOS software or system parameters unless specifically directed by COCO.

Note

No copies of superseded, inoperative, or other LSOS software will be retained onboard once COCO has approved an updated version.

Loran Station Operating Set (LSOS), Continued

LSOS Station Alarm Assignments

Transmitting stations will conform to the standard LSOS station alarm configuration as listed below. COCO may authorize deviations from this listing based on local conditions and equipment configurations.

Alarm	TTX Station		SSX Station	
Number	Alarm	Color	Alarm	Color
1	Bldg Intrusion	Red	Bldg Intrusion	Red
2	Fire	Red	Fire	Red
3	Gen Set Failure	Red	Gen Set Failure	Red
4	Gen On Line	Yellow	Gen On Line	Yellow
5	Comm Power Fail	Yellow	Comm Power Fail	Yellow
6	Fire Sys Tbl	Red	Fire Sys Tbl	Red
7	Ops High Temp	Yellow	Ops High Temp	Yellow
8	Xmtr High Temp	Yellow	Xmtr High Temp	Yellow
9	Xmtr Sec Cool	Yellow	Spare	Green
10	Twr Lights Fail	Yellow	Twr Lights Fail	Yellow
11	DC I/F Trouble	Red	DC I/F Trouble	Red
12	Spare	Green	Spare	Green

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Loran Station Operating Set (LSOS), Continued

LSOS Station Alarm Descriptions

Below table shows alarm tiles and descriptions.

Alarm #	Alarm Title	Description
1	**Building Intrusion**	Activates when the physical security of the building has been compromised.
2	**Fire**	Activates when any zone on the transmitting station fire system goes into an alarm condition
3	**Generator Set Failure**	Activates under any condition that would prevent the generator from automatically assuming the transmitting station load. This alarm will also activate upon any condition that has caused the generator to shut down.
4	**Generator On Line**	Activates when the generator is supplying power to transmitting station equipment.
5	**Commercial Power Failure**	Activates when commercial power is unavailable.
6	**Fire System Trouble**	Activates when the transmitting station fire panel goes into a trouble condition.
7	**Operations Room High Temperature**	Activates when the temperature in the Operations Room indicates the environmental system has failed or the temperature has exceeded 75°F. The monitoring equipment for this alarm will be installed in the GCF-RWL-1817B Frequency Standard Set.
8	**Transmitter Room High Temperature**	Activates when the temperature in the Transmitter Room indicates the environmental system has failed.
9 (TTX)	**Transmitter Secondary Cooling**	Activates when the TTX water cooling system has failed. This will be activated using water temperature monitoring equipment.
9 (SSX)	**Spare**	This alarm is not normally wired.
10	**Tower Lighting Failure**	Activates when tower lighting monitoring equipment has detected a tower lighting failure.
11	**DC Interface Trouble**	Activates upon a loss of AC input to DC supply and loss of an output from the DC supply.
12	**Spare:**	This alarm is not normally wired.

Remote Automated Integrated Loran (RAIL)

Introduction

The RAIL at each transmitting station samples local operating parameters, monitors equipment, and provides a communications interface. The information from RAIL is sent to LCCS via a communications link. The control station watchstander monitors the alarms and data from each transmitting station and is capable of issuing commands to transmitting station equipment to correct casualties.

RAIL Software

Unless otherwise directed by COCO, only the most current approved software version will be used. RAIL software is not to be modified without specific direction from COCO.

Note

No copies of superseded, inoperative, or other RAIL software will be retained onboard once COCO has approved an updated version.

RAIL Configuration

Each transmitting station in the chain will have a different set of assigned values. Each control station will maintain a current listing of all the assigned values and transmitting station alarms.

RAIL Data Alarm Windows

The RAIL Data Alarm tolerances will be set as follows:

Parameter	RAIL Alarm Tolerances
TINO	100 nSec
SYNC	100 nSec
C/C	200 nSec
Mas ECD	1.5 uSec
Antenna Current	50 amps
Xmt ECD	0.5 uSec

Remote Automated Integrated Loran (RAIL), Continued

RAIL Data Interval

The RAIL Data Interval will be set to 5 second intervals under normal operations. RAIL will send local transmitting station data to LCCS every 5 seconds providing RAIL is not in the Station Maintenance Mode.

RAIL Peak Reference

The RAIL peak reference must be set to the 13th half cycle in order for RAIL to display the proper antenna current. The reference peak volts must be calibrated when RAIL is initialized and during Pearson Transformer calibrations. Failure to do this properly could result in an improper reading of the transmit ECD and antenna current.

Other Equipment Configurations

Timer(s) Configuration

The uppermost Loran timer in the equipment cabinet is referred to as Timer No.1 and shall normally be the Operate (on-line) timer. The Loran timer below Timer No.1 is referred to as Timer No.2 and shall normally be the Standby Timer.

Automatic Blink System (ABS)

The ABS Unit consists of two Automatic Blink Units (ABUs). The left ABU in the equipment chassis is referred to as ABU Left and will normally be the Operate (on-line) ABU. The right ABU is referred to as ABU Right and will normally be the Standby ABU. NAVCEN authorization must be obtained before bypassing ABS.

TTX Feedback Operation

A Tube Type Transmitter (TTX) will normally operate using feedback.

Note

Operating in the open-loop mode must be authorized by CSDO and coordinated closely with the control station due to possible effects on the transmitted signal parameters.

TTX DESLOT Operation

A TTX will normally be operated in the De-energized Standby Loran Transmitter (DESLOT) mode. Weather conditions, equipment maintenance, or degraded equipment condition may require the TTXs to be operated in the Non-DESLOT mode.

Note

COCO must authorize operation in the Non-DESLOT mode.

Other Equipment Configurations, Continued

Timing Receiver

Each receiver will have a different configuration based on local conditions. COCO will establish the configuration for the receivers. The receiver configuration may change based on operations and seasonal variations. The transmitting station personnel will document all changes to the receiver configuration and record them locally.

Communications

All local equipment providing primary and secondary communications must be backed up by UPS Power.

DC Backup Power

Distribution of power from the PP-7839/G DC Supplies will be configured in accordance with the GCF-RWL-1817B Manual.

Ops Room UPS

The ops room UPS replaces the DC backup power. This UPS provides continuous power to all critical equipment in the ops room. The UPS should not be operated in the bypassed mode except for preventive maintenance or casualty recovery.

Other Equipment Configurations, Continued

Blanking

At dual rated transmitting stations, the two rates periodically overlap each other. A blanking scheme is used to avoid transmission of overlapped pulse groups.

The blanking schemes are:

- **Priority Rate Blanking**
- **Alternate Rate Blanking**

Priority Rate Blanking

In the **Priority Rate Blanking** scheme, the **Priority Rate** is never blanked. In the event of an Alternate Blanking Interface (ABI) failure, the ABI defaults to **Priority Rate Blanking**.

Alternate Rate Blanking

In the **Alternate Rate Blanking** scheme, each rate is alternately blanked.

Priority Rate

The **Priority Rate** is the rate that is never blanked in the **Priority Rate Blanking** scheme. The **Priority Rate** is determined by OPCON. It is implemented by attaching Local Interval from the Priority Rate Timer Set Control to J2 on the Alternate Blanking Interface.

Continued on next page

Other Equipment Configurations, Continued

Blanking Scheme Assignments

The blanking scheme for each dual rated transmitting station is defined in Specification of the Transmitted Loran Signal, M16562.4A. The table below contains Blanking Scheme and Priority Rate assignments.

Loran Station	Blanking Scheme	Priority Rate
Attu	Priority	NORPAC 9990
Baudette	Alternate	GLKS 8970
Boise City	Alternate	SOCUS 9610
Caribou	Alternate	NEUS 9960
Fox Harbor	Priority	NEC 7270
Cape Race	Priority	NEC 7270
Carolina Beach	Alternate	NEUS 9960
Dana	Alternate	NEUS 9960
Fallon	None	None
George	Alternate	USWC 9940
Gillette	Alternate	SOCUS 9610
Grangeville	Alternate	SOCUS 9610
Havre	None	None
Jupiter	None	None
Kodiak	Alternate	GOA 7960
Las Cruces	None	None
Malone	Alternate	GLKS 8970
Middletown	None	None
Nantucket	Alternate	NEUS 9960
Port Clarence	Alternate	GOA 7960
Raymondville	Alternate	SOCUS 9610
Searchlight	Alternate	USWC 9940
Seneca	Alternate	NEUS 9960
Shoal Cove	Alternate	GOA 7960
St. Paul	None	None
Williams Lake	Alternate	NOCUS 8290
Tok	None	None

Transmitting Station Duty Personnel

OUTCONUS Duty Sections

The duty section will be comprised of at least three personnel. The duty section will consist of a Watchstander/Safety Observer, a Duty Electronics Technician, and the Engineering Watchstander.

CONUS Duty Sections

The duty section will be comprised of at least two recall personnel. One person is designated as the Primary Recall and the other is designated at the Secondary Recall. Each duty section will include a Duty Electronics Technician as either the Primary or Secondary Recall. **At least one member of the duty section will also be a qualified Engineering Watchstander.**

Primary Recall

Outside normal working hours, the Primary Recall Watchstander is the first respondent to a casualty or abnormal condition. The Primary Recall Watchstander is responsible for System Sample, Pulse Analysis and checking in and out with the control station. The Primary Recall Watchstander is also responsible for any other daily routines as directed.

Secondary Recall

The Secondary Watchstander will be called by the Primary Recall Watchstander for assistance or to act as a safety observer when required. If the Control Station is unable to reach the Primary Recall Watchstander they will contact the Secondary Recall Watchstander.

Recall

When recalled by the control station, recall personnel shall make every effort to **safely** return to the station as quickly as possible. Recall personnel shall comply with all traffic laws and posted speed limits. Personnel shall not attempt to return to the station if conditions have deteriorated to the point that travel would be considered life threatening. Recall personnel will inform the control station of unsafe travel conditions. Refer to Appendix “B” for the recall times.

Transmitting Station Duty Personnel, Continued

Fire/Intrusion Alarm Systems

Fire and Intrusion alarm auto dialers (if installed) will be programmed to notify local authorities. Recall personnel shall not enter the station in response to these alarms unless they can take reasonable measures to ensure their safety. In some areas, local authorities may require a formal agreement allowing them to enter or take action on an U.S. Government Reservation. Stations will ensure these agreements are in place where required. Local authorities must not be burdened by false alarms. Station personnel are responsible to ensure these systems are in proper working order. Any failure of these alarms systems will require an onboard security watch.

Transmitting Station Daily Routine

Watchstander Daily Routine

Primary responsibilities of the transmitting station watchstander are to be prepared to restore signal timing and integrity, or to assume baseline control.

Assuming TS Mode

Upon arrival at the transmitting station, duty personnel will contact the control station watch and assume TS mode. While onboard, they will remain in TS mode provided they are within hearing distance of the SAU alarm.

Watch Relief

Upon assuming the watch, the oncoming watchstander assumes responsibility for transmitting station operations. Any dispute between watchstanders during watch relief will immediately be reported to the CO/OIC.

The following are minimum requirements that will be completed prior to assuming the watch.

- Verify status of transmitting station equipment.
- Verify status of communications.
- Verify the operational mode in effect for the transmitting station.
- Note all information concerning any pending actions (E.g. Time Steps, AUTM).
- Review the logs for completeness and accuracy.
- Review the charts.
- Review message traffic for operational messages.
- Review outstanding CASREPs.
- Update the Status board.

Transmitting Station Daily Routine, Continued

Transmitting Station Log

The transmitting station log is a running account of the day's events. The transmitting station watchstander is responsible for maintaining the station log. The log is considered a legal document and it will be kept current and accurate. Each day, the station log will be opened at 0000Z and closed at 23:59:59Z. The watchstander is required to log events while in TS Mode. The LOIS transmitting station daily report will be used as the station log.

Note

Specific log entries and requirements are addressed in Chapter 9.

Operator's Comments

While in TS Mode, transmitting station personnel are required to enter comments annotating maintenance or other deviations on the electronic charts.

Note

Specific charts marking requirement are addressed in Chapter 9.

Message Traffic

The transmitting station watchstander shall be aware of all messages pertaining to operations within their respective Loran chain and enact notification as directed locally.

LOIS

The LOIS daily operations report will be submitted on the next working day. This report will include the previous day's events and data.

Transmitting Station Daily Routine, Continued

Prior to Assuming CS Mode

Prior to assuming CS Mode, the transmitting station watchstander will pass the names of the recall personnel and physically check the following:

- **Generators/Automatic Transfer System (ATS):** The generators and ATS must be capable of supplying power to the transmitting station in case of a commercial power failure.
- **Air Conditioning:** The air conditioning system must be operating normally for proper cooling in the operations and transmitter spaces.
- **Security:** The transmitting station security system must be functioning properly. All doors and windows must be monitored to prevent unauthorized access.
- **Fire System:** The transmitting station fire system must be functioning properly. Any equipment shutdown functions or controls must be working.
- **Recall Equipment:** All pagers or cellular telephones must be working properly. These systems will be tested at least weekly to ensure proper operations.
- **LSOS:** LSOS will be in the Normal Operations mode with no alarms. Ensure the LSOS printer has enough paper to operate until the next working day.
- **ABS:** The ABS will be on-line with no alarms.
- **RAIL:** There should be no pending alarms.

Routine Equipment Switches

Coordinating Routine Equipment Switches

All routine equipment switches will be coordinated with the control station watchstander. Tube Type Transmitter (TTX) switches and Solid State Transmitter (SSX), Output/Coupling Network switches will cause a momentary loss of service to the users. These switches will be minimized to those necessary to accomplish required maintenance.

TTX Switching Cycle

TTX stations will switch transmitters at two-week intervals to balance the time each transmitter is on-line and to accomplish preventive maintenance.

Note

COCO will approve deviations from this schedule.

SSX O/C Networks

Solid State Transmitter (SSX) stations will switch O/C Networks at least quarterly to balance the time each O/C Network is on-line and to accomplish preventative maintenance.

Note

COCO will approve deviations from this schedule.

Timers

Timers will be switched to accomplish preventative maintenance.

PATCO

PATCOs will be switched at least monthly and to accomplish preventative maintenance.

Routine Equipment Maintenance

LSOS Station Maintenance

Transmitting station personnel will place LSOS in Station Maintenance mode prior to performing maintenance or when transmitting station equipment is placed in Local. This prevents excessive alarms caused during maintenance from distracting the control station watchstander.

Pulse Analysis

A Pulse analysis for each rate will be performed:

- During the specified rates System Sample hour.
- Daily at TTX stations
- On the first working day of the week at SSX stations
- Anytime a **different** PATCO, O/C Network or transmitter is on-air longer than 4 hours during a day.

System Sample

Introduction

System Sample (S/S) is a daily-standardized one-hour period representative of typical operations. This is the primary source of data for use in the Loran Operations Information System (LOIS) NT. During this one-hour period, data is observed, recorded and entered in the LOIS Daily Detailed Report. Transmitting stations will be onboard, in TS mode, and will not perform routine equipment switches or maintenance during this time.

Communications Test

At the beginning of System Sample, a Watch Call (W/C) will be sent to each transmitting station in TS Mode. Each transmitting station will reply via the TTY that they received the W/C. W/C will not be sent on weekends or holiday routine.

System Sample TINO

The average TINO from System Sample will be used to update the TINO number for each baseline on the transmitting station status board.

Note
Directions can be found in Appendix C.

System Sample, Continued

System Sample Times

Below are times for NAVCEN rate specific System Sample times.

Loran Rate	System Sample Time
5930	1600Z to 1700Z
5980	2000Z to 2100Z
5990	2000Z to 2100Z
7270	1600Z to 1700Z
7960	2000Z to 2100Z
7980	1600Z to 1700Z
8290	2000Z to 2100Z
8970	1600Z to 1700Z
9610	1600Z to 1700Z
9940	2000Z to 2100Z
9960	1600Z to 1700Z
9990	2000Z to 2100Z

Invalid System Sample Data

The following circumstances will invalidate the System Sample data:

- Equipment switches during System Sample.
- Casualties that affect the On-Air signal or monitor receiver sites.
- Propagation anomalies.
- More than two LPAs on any baseline during System Sample.

Transmitting Station Status Board

Status Board

At a minimum, the following information will be posted on a status board located in the operations room:

- Transmitting station operating parameters.
- Transmitting station CASREPs.
- Operate equipment and equipment configuration.
- Remarks Section listing important information such as:
  - Pending AUTMs
  - Time Steps,
  - Any information regarding transmitting station equipment status (i.e. NON-DESLOT).

Note

1. Figure 4-1 is an example of the TTX station status board

2. Figure 4-2 is an example of the SSX station status board.

FIGURE 4-1
TTX STATUS BOARD EXAMPLE

<table>
<tr><td>RATE:</td><td>TINO:</td><td colspan="2">Ant Curr:</td><td>ECD:</td></tr>
<tr><td></td><td>SYNC:</td><td colspan="2">LEN:</td><td></td></tr>
<tr><td>RATE</td><td>TINO:</td><td colspan="2">Ant Curr:</td><td>ECD:</td></tr>
<tr><td></td><td>SYNC:</td><td colspan="2">LEN:</td><td></td></tr>
<tr><td>Operate Transmitter</td><td colspan="4">XMTR #</td></tr>
<tr><td>Equipment Settings</td><td colspan="2">XMTR NR</td><td colspan="2">XMTR NR:</td></tr>
<tr><td>Low Rate:</td><td colspan="2">ETA DIAL</td><td colspan="2">ETA DIAL</td></tr>
<tr><td></td><td colspan="2">PSYN:</td><td colspan="2">PSYN:</td></tr>
<tr><td></td><td colspan="2">DROOP:</td><td colspan="2">DROOP:</td></tr>
<tr><td></td><td colspan="2">GAIN:</td><td colspan="2">GAIN:</td></tr>
<tr><td>High Rate:</td><td colspan="2">ETA DIAL:</td><td colspan="2">ETA DIAL:</td></tr>
<tr><td></td><td colspan="2">PSYN:</td><td colspan="2">PSYN:</td></tr>
<tr><td></td><td colspan="2">DROOP:</td><td colspan="2">DROOP:</td></tr>
<tr><td></td><td colspan="2">GAIN:</td><td colspan="2">GAIN:</td></tr>
<tr><td>REMARKS/CASREPs:</td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

FIGURE 4-2
SSX STATUS BOARD EXAMPLE

RATE:	TINO:	Ant Curr:	ECD:
	SYNC:	LEN:	
RATE	TINO:	Ant Curr:	ECD:
	SYNC:	LEN:	
Operate Equipment	PATCO	O/C Network	
Low Rate: Rate A	**PATCO 1**	**PATCO 2**	
	ECD Setting	ECD Setting	
	Power Level	Power Level	
	AT1 Setting	AT2 Setting	
High Rate: Rate B	**PATCO 1**	**PATCO 2**	
	ECD Setting	ECD Setting	
	Power Level	Power Level	
	AT1 Setting	AT2 Setting	
REMARKS/CASREPs:			

Chapter 5

Abnormal Operations

Overview

Chapter Introduction

The following chapter contains guidance and instructions for abnormal operations. Sections in this chapter, when necessary, are divided into control station procedures and transmitting station procedures for each abnormal condition.

Definition of Abnormal Conditions

Abnormal conditions are generally a degraded state of operational readiness that does not cause Unusable Time. Equipment failures or maintenance may cause these conditions. Authorized Unusable Time (AUTM) is normally related to maintenance and testing. Emergency Unusable Time (EUTM) is used for emergency maintenance or repairs. The procedures for AUTM/EUTM periods are covered in this chapter.

Detecting an Abnormal Condition

Any stations detecting an abnormal condition, regardless of control mode, will immediately contact the controlling station and all of the stations involved.

Note

If the discrepancy cannot be resolved or doubt exists as to whether the baseline is In-Tolerance, **start blink**, and notify the Control Station Duty Officer (CSDO) immediately.

Table of Contents

This chapter contains the following topics.

Section A Control Changes....5-1
Control Change Policy....5-1
Introduction....5-1
Notification....5-1
Methods to Pass Control....5-1
Correlated Numbers....5-2
Correlated Numbers Calculation....5-2
Non Alpha Control LPA Policy....5-3

Table of Contents

This chapter contains the following topics.

Section B Abnormal Conditions 5-3
- Pulse Building....................5-4
  - Introduction....................5-4
  - When to Pulse Build 5-4
  - Pulse Build to Nominal ECD 5-4
  - Control Station Actions....................5-5
  - Transmitting Station Actions 5-6
- Time Steps....................5-7
  - Introduction....................5-7
  - Control Station Actions....................5-7
  - Transmitting Station Actions 5-8
- ABS Degraded State 5-9
  - Introduction....................5-9
  - Control Station Actions....................5-9
  - Transmitting Station Actions 5-9
- Time Difference Controller 5-10
  - TDC Manual Mode Conditions....................5-10
  - TDC Reset....................5-10
- LSOS Station Alarms 5-11
  - Introduction....................5-11
  - Control Station Actions....................5-11
  - Transmitting Station Actions 5-11
- LSOS Failure 5-12
  - Introduction....................5-12
  - Control Station Actions....................5-12
  - Transmitting Station Actions 5-12
- LCCS Failure 5-13
  - Control Station Actions....................5-15
  - Transmitting Station Actions 5-15
- Control Station Primary Communications Failure 5-16
  - Control Station Actions....................5-16
  - Transmitting Station Actions 5-17
- Transmitting Station Primary Communications Failure 5-18
  - Control Station Actions....................5-18
  - Transmitting Station Actions 5-18
- Monitor Receiver Site Primary Communications Failure 5-19
  - Control Station Actions....................5-19
- Monitor Receiver Site Maintenance/Failure 5-20
  - Control Station Actions....................5-20
- Control Station Power Failure....................5-21
  - Introduction....................5-21
  - Control Station Actions....................5-21
  - Transmitting Station Actions 5-22
- Transmitting Station Power Failure 5-23
  - Introduction....................5-23
  - Control Station Actions....................5-23
  - Transmitting Station Actions 5-23
- Backup Power System Failure 5-24
  - Control Station Actions....................5-24
  - Transmitting Station Actions 5-24
- TTX Transmitter....................5-25
  - Introduction....................5-25
  - Control Station Actions....................5-25
  - Transmitting Station Actions 5-25

Table of Contents

This chapter contains the following topics.

SSX Transmitter 5-26
Introduction 5-26
Control Station Actions 5-26
Transmitting Station Actions 5-26
Transmitting Station Receiver System Failure 5-27
Introduction 5-27
Control Station Actions 5-27
Transmitting Station Actions 5-27
Standby Timing Path Failure 5-28
Introduction 5-28
Control Station Actions 5-28
Transmitting Station Actions 5-28
Tower Lighting System Failure 5-29
Introduction 5-29
Control Station Actions 5-29
Transmitting Station Actions 5-29
Section C AUTM/EUTM 5-30
Procedures 5-30
Introduction 5-30
Procedures Prior to AUTM/EUTM 5-31
Control Station Actions 5-31
Transmitting Station Actions 5-31
Procedures During AUTM/EUTM 5-32
Control Station Actions 5-32
Transmitting Station Actions 5-32
Procedures After AUTM/EUTM 5-33
Control Station Actions 5-33
Transmitting Station Actions 5-33
Section D Test Transmissions 5-34
LSU Test Transmissions 5-34
Introduction 5-34
Authorized Chains for Test Transmissions 5-34
Authorized Rates for Test Transmissions 5-34
Test Transmissions Specifications 5-35
Tango Specifications 5-35
Test Transmissions on Existing Operational Rates 5-36
LSU Responsibilities 5-36
COCO NEUS/GLKS Responsibilities 5-36
Test Transmissions on Non-Operational Rates 5-37
Introduction 5-37
Authorized Rates for Test Transmissions 5-37
LSU Responsibilities 5-37
NAVCEN Responsibilities 5-37

Table of Contents

This chapter contains the following topics.

Section E Heavy Weather/Natural Disasters 5-38
Overview 5-38
Introduction 5-38
Preparation 5-38
Personnel Safety 5-38
Control Station Heavy Weather/Natural Disaster 5-39
Control Station Actions 5-39
Transmitting Station Actions 5-39
Transmitting Station Heavy Weather/Natural Disaster 5-40
Control Station Actions 5-40
Transmitting Station Actions 5-40

Section A

Control Changes

Control Change Policy

Introduction

Not all abnormal conditions will require changes in control. Normally, the control station will be in Alpha control of the baseline. Control of the baseline will be passed in order of priority.

The precedence of control is Alpha, Bravo, Delta, and Charlie.

Changes in control result from:

- **Equipment failures**
- **Communications failures**
- **Equipment maintenance**

A transmitting station will assume control only when directed by a Control Monitor or during the total loss of communications.

Notification

The CSDO will be notified immediately if Alpha control cannot be maintained.

Methods to Pass Control

Baseline control shall be passed by any method possible using the following order of precedence:

Teletype:

- The station passing control will identify itself and provide the station assuming control the following:
  - Past Hours Deviation (Correlated Numbers)
  - Reason for passing control
  - Time
  - Watchstander's initials.
- The station assuming control will acknowledge with:
  - An affirmative statement
  - Time
  - Watchstander's initials.

Voice , Telephone or Cellular/Satellite Telephone): The station passing control will call the station assuming control giving the past hours deviation(s) and the reason for passing control. The station assuming control will acknowledge with an affirmative statement.

Passing of Control Policy, Continued

Correlated Numbers

When the control station determines that control must be passed, the past hours deviation(s) will be calculated and passed to the station assuming control. The deviation(s) passed to the station will be calculated by taking that past hour's average from CSTD using the 10-minute increments on the TD chart. This value will be rounded to the nearest tens of nanoseconds (e.g. 7.5 nanosecond average = Deviation of 10 nanoseconds). The transmitting station assuming control will use the past hour's RAIL TINO average and algebraically subtract the deviation. This is the Correlated Number or CSTD for the transmitting station. The RAIL TINO control number will be changed to reflect the Correlated Number. **Blink** tolerance lines will be established +/- 100 nanoseconds by RAIL from the Correlated CSTD.

Correlated Numbers Calculation

The table below is an example Correlated Numbers calculation that is to be used if the RAIL hourly TINO average is not valid:

Data	Numbers
Control Station Deviation	(-30)
Station Fine TINO Average	60
Subtracted Algebraically	-(-30)
Correlated Number (CSTD)	90
Tolerance	+/- 100
Blink Tolerance Lines (Goal Posts)	-10/+190

Note

1. If the past hours deviation(s) are unattainable from the station passing control, a deviation of zero will be utilized. **Blink** tolerance will be +/- 50 nSec from Correlated CSTD.

2. COCO must authorize any deviations from this policy.

3. See Appendix C for an example correlation.

Passing of Control Policy, Continued

Non Alpha Control LPA Policy

When the last hour's average, is greater than or equal to half tolerance (50nSec), insert an LPA with a maximum value of 40nSec. If more than one LPA is needed within a 60 minute period, contact CSDO. Also contact the CSDO if the cumulative value of LPAs exceeds 100nSec during any period of non alpha control, or the tracks exceed 80nSec from correlated CSTD

The CSDO will review the baseline cumulative LPA totals, the Bias Plots (time/magnitude of LPA insertions), and the predicted oscillator drift. The CSDO may determine that a shift of control is a preferable alternative to additional timing adjustments.

If tracks exceed tolerance, **start blink**.

Modes of Control

The station that accepts control of a Station/Baseline must determine the mode of control (i.e. B-REM-TS etc.) Refer to Chapter 3 for more information on modes control.

Section B

Abnormal Conditions

Pulse Building

Introduction

Pulse building allows minor corrections to the transmitted pulse because of normal tube degradation. Pulse building and Envelope Timing Adjustment (ETA) should not be used to compensate for problems in the transmitters. Transmitting stations are to verify their pulse shape by determining Calculated ECD using the LOIS program.

When to Pulse Build

TTX stations will pulse build when:

- Calculated ECD exceeds +/-0.3 uSec from Nominal ECD or
- RMS Error exceeds 0.70%.

Note

ECD differences between transmitters shall not exceed .2 uSec.

Contact COCO if difficulties are encountered during pulse building.

Pulse Build to Nominal ECD

TTX stations will pulse build to Nominal ECD rather than Far Field ECD. COCO will be notified when a transmitting station's Calculated ECD is within tolerance and the Far Field ECD varies more than +/- 1.0 microseconds from CSECD.

Note

A copy of the pulse building guide is attached as Appendix H.

Pulse Building, Continued

Control Station Actions

Transmitting station personnel will notify the control station watchstander when they are going to perform pulse building.

The control station watchstander will perform the following:

- Ensure operations with the other stations/rate will not interfere with their ability to monitor the charts and respond to requests.
- Place LCCS TDC into the Manual Mode for that baseline. If the Master transmitting station is pulse building, all Secondary transmitting stations will be placed in the Manual Mode.
- Ensure baseline is in Alpha Control.
- Pass A-LOC(TS)
- Pass the current F/F ECD and TD values to the transmitting station.
- Monitor the TD and ECD tracks closely. Notify transmitting station personnel if the ECD or TD tracks approach tolerance limits.
- When pulse building is complete, pass the transmitting station the F/F ECD and TD values.
- Enter any MPAs as required. All TD corrections caused by pulse building will be entered as MPAs.
- Return the LCCS TDC to the automatic mode after pulse building is complete.
- Once Pulse Building is complete the transmitting station may go into A-REM (TS).

Pulse Building, Continued

Transmitting Station Actions

Transmitting station personnel will perform the following:

- Check in with the control station prior to pulse building. Do not begin pulse building until the control station watchstander has given authorization.
- Update the status board. Ensure the current Pulse Generator (P-GEN) settings are listed.
- Obtain the F/F ECD and TD values from the control station.
- Assume A-LOC(TS)
- Begin pulse building. Do not exceed +/- 0.5 microseconds from Assigned ECD unless authorized by COCO.
- After completing each adjustment, perform a pulse analysis and obtain the current F/F ECD value and TD values.
- When pulse building is completed, run a final pulse analysis and enter values into LOIS.
- Update the status board with the final P-GEN Settings.
- Update LOIS P-GEN settings.
- Assume A-REM(TS).

Time Steps

Introduction

Time Steps will be accomplished by the control station using 40 nanosecond MPAs, with at least five minutes between each step. If needed, a 20 nanosecond MPA can be used to complete the desired Time Step value. COCO will notify USNO the next business day after any Time Step.

Control Station Actions

The transmitting station watchstander does not need to be on board during the Time Step, providing communications are functioning properly and MPAs can be entered remotely.

To complete the Time Step, the control station watchstander will perform the following:

- 30 minutes prior to the Time Step, verify all baseline TDs are near CSTD
- Place all baselines in the Manual Mode on the TDC.
- Verify ABS operations and synchronize both ABUs.
- Establish alternate communications with any transmitting stations that must enter MPAs locally.
- Verify the number, amount, and direction of MPAs.
- The control station will enter the Time Step via LCCS and, if necessary, direct the transmitting station entering MPAs locally to insert the MPA.
- The control station will enter MPAs in the following order; M, W, X, Y, Z, V.
- Monitor Alpha data for at least 5 minutes to insure tracks settle at the same value as they started.
- Repeat the above steps at a minimum of five-minute intervals until the Time Step is completed.
- After the completion of the Time Step the control station will perform the following:
  - return all baselines to Automatic Mode on the TDC.
  - Synchronize the ABS units and verify the offsets are near zero.
  - Notify the CSDO upon completion of the Time Step and of any problems noted.

Note

ABS will start blink if the amount of step exceeds 500nSec unless ABS is synchronized during the time step.

Time Steps, Continued

Transmitting Station Actions

Providing communications are working and the control watchstander can enter MPAs remotely, the transmitting station watchstander does not need to be on board during the Time Step.

The transmitting station watchstander will perform the following when required:

- If primary communications are down, establish alternate communications with the control station. Verify the number, amount and direction of MPAs.
- Synchronize the ABS Unit.
- Enter the MPAs locally as directed by the control station.
- Synchronize the ABS Unit.

ABS Degraded State

Introduction

The ABS Degraded State is used when transmitting station personnel are performing maintenance that would adversely affect the signals used by the ABS unit to monitor the transmitted signal. ABS is capable of operating with only one Pulse Time Measurement (PTM) module or one oscillator input with the RF Gate input from the receiver.

Note

Refer the ABS Operators Guide for further information.

Notify the CSDO when placing ABS in degraded state.

Control Station Actions

Prior to performing any maintenance that will affect the 5 MHz inputs to the ABS unit, transmitting station personnel must command ABS to enter the Degraded State via the TTY. Once the command has been sent and ABS executes it, ABS will enter the Degraded State Pending. Once ABS simultaneously loses two oscillator inputs or two operational PTMs, it will enter the Degraded State Locked. This state will remain active until ABS is commanded to release the Degraded State. If for any reason the ABS unit is in Degraded State Pending or Locked, transmitting station personnel will be on board.

Transmitting Station Actions

While performing maintenance that would affect the 5 MHz inputs to the ABS unit (i.e. Oscillator patching, LSOS UPS maintenance, Distribution Amplifier maintenance) transmitting stations will place the ABS unit into the Degraded State Locked. Once normal operations are restored, restore ABS operations to normal by releasing the Degraded State.

Note

Until the ABU enters the Degraded State locked, it will continue to use all available PTMs for offset data to detect events. Once ABS is in the Degraded State Locked, it will use the remaining operational PTM's offset measurements to detect **blink** events, even if all three PTMs and Oscillator inputs are available.

Time Difference Controller

TDC Manual Mode Conditions

The TDC will be placed in the Manual Mode during the following situations:

- Time Steps
- Timers in Local
- Pulse Building
- Control Station Emergency Evacuation.

TDC Abnormal Conditions

The TDC will be placed in the Abnormal Mode during the following situations:

- Casualties
- Solar activity
- Weather
- High noise (low SNR)

TDC Reset

When the TDC returned to the automatic mode, it may be necessary to reset the TDC. The control station watchstander will notify the CSDO if they suspect a problem with the performance of the TDC. The CSDO will review the performance of the TDC before authorizing a TDC reset.

LSOS Station Alarms

Introduction

LSOS transmitting station alarms are grouped as either Red or Yellow alarms. A Red alarm indicates a more threatening condition than a Yellow alarm.

Control Station Actions

Red Alarms: The control station watchstander will recall transmitting station personnel immediately.

Yellow Alarms: The control station watchstander will notify transmitting station personnel.

Transmitting Station Actions

Red Alarms: Transmitting station personnel are required to respond and remain onboard until the alarm is cleared. A failure of any of the RED contact-closure functions, which monitor security and environmental control conditions, will require a security/fire watch at the transmitting station.

Yellow Alarms: Transmitting station personnel are to be notified of the alarm condition. The transmitting station CO/OIC shall have standing orders regarding specific response requirements.

LSOS Failure

Introduction

LSOS provides the control station with the ability to control equipment remotely, view equipment status, and monitors equipment performance

Control Station Actions

If the control station loses the ability to send commands or obtain equipment status, the watchstander will perform the following:

- Recall transmitting station personnel as necessary.
- Once transmitting station personnel are on board pass A-LOC(TS) until LSOS operations are normal.
- Once normal LSOS operations are restored, the control station can assume CS Mode.

Transmitting Station Actions

Transmitting station personnel will be recalled if the control station is experiencing problems with LSOS. The transmitting station watchstander will perform the following:

- Assume A-LOC(TS) until LSOS operations are normal.
- Take the following necessary maintenance precautions:
  - Place the Timers in Local
  - Remove A8J17 from the rear of the Timer Set Control
  - Disconnect the transmitter emergency stop cable from the rear of the Remote Operating System (ROS) Interface.
  - TTX stations will place the coupler in local.
- Once normal LSOS operations are restored, the control station can assume CS Mode.

RAIL Alarms

Introduction

RAIL transmitting station alarms are grouped as either Red or Yellow alarms. A Red alarm indicates a more threatening condition than a Yellow alarm.

Control Station Actions

Red Alarms: The control station watchstander will recall transmitting station personnel immediately.

Yellow Alarms: The control station watchstander will notify transmitting station personnel.

Transmitting Station Actions

Red Alarms: Transmitting station personnel are required to respond and remain onboard until the alarm is cleared.

Yellow Alarms: Transmitting station personnel are to be notified of the alarm condition. The transmitting station CO/OIC shall have standing orders regarding specific response requirements.

RAIL Failure

Introduction

RAIL provides the control station with the ability to control equipment remotely and provides data rounds of all locally monitored parameters at regular intervals. A failure of the RAIL CPU will cause a loss of primary and backup communications. The control station will be unable to take any actions remotely.

Control Station Actions

If the control station loses the ability to send commands, obtain data, or if the data provided by RAIL exceeds tolerance or is erratic, the watchstander will perform the following:

- Recall transmitting station personnel.
- Once transmitting station personnel are on board pass A-LOC(TS) until RAIL operations are normal.
- Once normal RAIL operations are restored, the control station can assume CS Mode.
- Notify the CSDO

Transmitting Station Actions

Transmitting station personnel will be recalled if the control station is experiencing problems with RAIL. The transmitting station watchstander will perform the following:

- Assume A-LOC(TS) until RAIL operations are normal.
- Once normal RAIL operations are restored, the control station can assume CS Mode.

LCCS Failure

Control Station Actions

In the event of a LCCS failure, the control station watchstander will:

- Obtain the past hours deviations for all baselines and pass them via the TTY if available.
- Recall the Master transmitting station watchstander to assume control and verbally pass the deviation values.
- Notify Secondary transmitting station watchstanders and verbally pass the deviation values.
- Recall the control station Duty Technician.
- Notify CSDO.
- Communications checks between transmitting stations will be initiated by the controlling station every 60 minutes.

Transmitting Station Actions

The transmitting station watchstander will be recalled to the station in case of a LCCS failure.

The transmitting station watchstander will perform the following:

- Obtain the past hours deviations if they are available.
- Return to the transmitting station as directed.
- The Master transmitting station watchstander will assume Bravo Control of the chain and correlate the TINOs .
- If Bravo communications are functioning properly the Master transmitting station will assume B-REM(TS).
- If Bravo communications are not functioning properly, the Master transmitting station will contact all Secondary transmitting stations and have them assume B-LOC(TS).
- All Secondary transmitting station watchstanders will contact the Master transmitting station.
- If communications cannot be established or maintained, the transmitting station will assume the appropriate mode of control (Delta) and correlate the TINOs.
- Communications checks between transmitting stations will be initiated by the controlling station every 60 minutes.
- Contact the control station when operations are restored.

Control Station Primary Communications Failure

Control Station Actions

In the event of a primary communications link failure at the control station, with no alpha information available, the control station watchstander will attempt to re-establish communications using the following steps:

- Initiate the LCCS Communications Reset function.
- Notify the telephone company as necessary. Record the ticket number in the log.
- Attempt to ping the router

If these attempts fail, the watchstander will perform the following:

- Initiate the LCCS back-up communications link to the Master transmitting station. Assume B-REM(CS).
- Recall the Master transmitting station watchstander to assume control of the chain. Pass the past hours deviation values.
- Recall Secondary transmitting station watchstanders. Pass the past hours deviation values.
- Once the Master transmitting station has assumed control, secure the back-up communications link.

Notify the CSDO.

Maintain hourly contact with the telephone company and the Master transmitting station until repairs are complete.

- Attempt to re-establish communications every 30 minutes.

Control Station Primary Communications Failure, Continued

Transmitting Station Actions

In the event of a communications outage all transmitting station watchstanders will be recalled at the discretion of the CSDO.

The transmitting station watchstander will perform the following:

- Obtain the past hours deviation values from the control station.
- The Master transmitting station watchstander will assume Bravo Control of the chain and correlate the TINOs.
- If Bravo communications are functioning properly the Master transmitting station will assume B-REM(TS).
- If Bravo communications are not functioning properly, the Master transmitting station will contact all Secondary transmitting stations and have them assume B-LOC(TS).
- All Secondary transmitting station watchstanders will contact the Master transmitting station.
- If communications cannot be established or maintained, the transmitting station will assume the appropriate mode of control (Delta).
- Communications checks between transmitting stations will be initiated by the controlling station every 60 minutes.

Transmitting Station Primary Communications Failure

Control Station Actions

In the event of a primary communications link failure at a transmitting station, the control station watchstander will attempt to re-establish communications using the LCCS Communications Reset function.

If this attempt fails, the watchstander will perform the following:

- Initiate the LCCS back-up communications link to the transmitting station.
- Recall the transmitting station watchstander to assume A-LOC(TS) at the discretion of the CSDO.
- Pass the past hours deviation values.
- Once the watchstander is on board, secure the back-up communications link.
- Notify the Telephone Company of the outage. Note the ticket number in the log.
- Maintain hourly contact with the Telephone Company and the transmitting station until repairs are complete.
- Attempt to re-establish primary communications every 30 minutes.

Transmitting Station Actions

In the event of a communications outage at the transmitting station, the transmitting station watchstander will be recalled.

The transmitting station watchstander will perform the following:

- Obtain the past hours deviation values from the control station.
- Assume A-LOC(TS).
- If communications cannot be established or maintained, the transmitting station will assume the appropriate mode of control (Bravo/Delta).
- Perform a communications check every 60 minutes.

Note:

If the Alpha information and back up comms are available; and data rounds can be taken every 15 mins, then recall of the transmitting station is at the discretion of the CSDO.

Monitor Receiver Site Primary Communications Failure

Control Station Actions

In the event of a primary communications link failure at a monitor receiver site, the control station watchstander will attempt to re-establish communications using the LCCS Communications Reset function.

If this attempt fails, the watchstander will perform the following:

- Shift control as necessary.
- Determine the cause of the outage (Comms/Power).
- Notify the telephone or power company of the outage.
- Maintain hourly contact with the Telephone or Power Company until repairs are completed.
- Attempt to re-establish primary communications every 30 minutes.

Monitor Receiver Site Maintenance/Failure

Control Station Actions

During maintenance or when a monitor receiver site fails (equipment, power, communications), the control station will attempt to maintain baseline control using the remaining monitor receiver site. The actions required by the control station for monitor receiver site maintenance or failures are listed below:

Loss of A-1 Monitor only:

- Shift to A-2 control.
- Verify that LCCS has correlated the A-2 TD chart properly.
- Initiate the Converge function on the TDC.
- When the standard deviation error is less than +/- 10, initiate the Stop Converge command.
- Recall monitor receiver site maintenance personnel as appropriate.

Loss of the A-2 Monitor only:

- Make the appropriate log entry indicating that the monitor receiver site is down.
- Recall monitor receiver site maintenance personnel as appropriate.

Loss of A-1 and A-2:

- Control station watchstander will assume B-REM (CS) mode for the baseline(s) affected.
- If unable to assume B-REM (CS) mode, the control watchstander will assume D-REM (CS) mode for the baseline(s) affected.
- Recall monitor receiver site maintenance personnel as appropriate.
- Inform the CSDO that the control station is unable to maintain Alpha control.

Control Station Power Failure

Introduction

The control stations have battery backup for all critical LCCS equipment. These battery backups will provide power until the emergency generator comes on-line.

Control Station Actions

In the event of a commercial power failure and the generator does not assume the load, perform the following:

- Obtain the past hours deviation values for all baselines and pass them via the TTY.
- Begin recalling all transmitting station watchstanders and verbally pass the past hours deviation values.
- The Master transmitting station watchstander will assume Bravo Control of the chain. If Bravo communications are working, the Master transmitting station will assume B-REM(TS). If not, contact all Secondary transmitting stations and have them assume B-LOC(TS).
- All Secondary transmitting station watchstanders will contact the Master transmitting station to obtain the current control mode.
- If communications cannot be established or maintained, the transmitting station will assume the appropriate mode of control (Bravo/Delta).
- Communications checks between transmitting stations will be initiated by the controlling station every 60 minutes.
- Log off both chains on LCCS.
- Once LCCS logs out and the screens are displaying the sign-on screen, secure power to the LCCS computer and allow it to perform an emergency shutdown before losing power.
- Contact the CSDO immediately.
- Contact the Master transmitting station when power is restored.
- Once normal operations are restored, assume control.

Control Station Power Failure, Continued

Transmitting Station Actions

In case of a loss of power at the control station, transmitting station personnel will perform the following:

- Obtain the past hours deviation values from the control station.
- Return to the transmitting station as instructed.
- The Master transmitting station watchstander will assume Bravo Control of the chain and correlate the TINOs. If Bravo communications are working the Master transmitting station will assume B-REM(TS). If not, contact all Secondary transmitting stations and have them assume B-LOC(TS).
- All Secondary transmitting station watchstanders will contact the Master transmitting station.
- If communications cannot be established or maintained, the transmitting station will assume the appropriate mode of control (Delta) and correlate the TINOs.
- Communications checks between transmitting stations will be initiated by the controlling station every 60 minutes.
- Remain on board until control station operations have been restored and the control station has assumed control.

Transmitting Station Power Failure

Introduction

Transmitting stations are equipped with emergency power generators and battery back-up power supplies. A loss of commercial power will not normally result in a casualty condition.

Control Station Actions

In the event of a commercial power failure, the emergency generator should automatically provide power for transmitting station operations. If commercial power is lost, the control station watchstander will perform the following:

- Notify transmitting station personnel that the station is on generator power.
- Monitor the transmitting station alarms to ensure there are no generator problems.
- Recall transmitting station personnel, if there are any equipment alarms or station alarms not associated with the Gen-on-Line or Comm Power Fail alarms.

Transmitting Station Actions

Under normal conditions, a loss of power at the transmitting station will not cause a casualty condition. The CO/OIC of the transmitting station will establish guidelines and procedures for generator operations.

Backup Power System Failure

Control Station Actions

LCCS UPS: If the LCCS UPS fails or does not meet the Coast Guard Planned Maintenance System (CGPMS) requirements during maintenance, the UPS will be CASREPed. A replacement unit/battery pack will be ordered once technicians determine the cause of the failure.

Transmitting Station Actions

LSOS/RAIL UPS: If the LSOS or RAIL UPS fails or does not meet the CGPMS requirements during maintenance, the UPS will be CASREPed. A replacement unit/battery pack will be ordered once transmitting station technicians determine the cause of the failure and complete the following:

- The transmitting station shall assume TS mode until the UPS is fully operational.
- Timers will be placed in local.
- Remove the transmitter emergency stop cable.
- Remove the Timer Switch Control Cable from the rear of the Timer Set Control (A8J17).
- TTX will place the coupler in local.

PP-7839/G: If any of the PP-7839/G power supplies fail or do not meet the CGPMS requirements during maintenance, the power supply will be CASREPed. A replacement unit or batteries will be ordered once transmitting station technicians determine the cause of the failure and complete the following:

- Transmitting station shall assume TS mode until back-up power is reestablished in accordance with Appendix J.

OPS ROOM UPS: If the Operations Room UPS fails, the unit will be placed in bypass. Station personnel will remain on board in A-REM(CS) until the unit is repaired.

TTX Transmitter

Introduction

Abnormal TTX transmitter operations are:

- Transmitter power output less than nominal but greater than the low power threshold (80%).
- ECD is in-tolerance with shifts greater than 0.2 uSec.
- While in CS mode, three or more MOAs within a 24-hour period.
- Any standby transmitter, transmitter cooling, or transmitter room temperature alarms.
- Any P-GEN alarms.
- Automatic switch.

Control Station Actions

The control station watchstander will perform the following:

- Verify that the transmitting station is On-Air and In-Tolerance.
- Recall transmitting station personnel.
- Pass TS Mode when transmitting station personnel arrive.
- Notify the CSDO.

Transmitting Station Actions

Transmitting station personnel will perform the following:

- Return to the transmitting station as directed.
- Verify the transmitting station is On-Air and In-Tolerance.
- Assume TS Mode. Based on the failure, determine if REM/LOC mode is required.
- Place LSOS in the Station Maintenance mode until normal operations are restored.

SSX Transmitter

Introduction

Abnormal SSX transmitter operations are:

- Any HCG fault that will not reset.
- Transmitter Not Auto alarm.
- Transmitter Operational alarm.
- Transmitter System alarm.
- Transmitter room temperature alarms.
- ECD is In-Tolerance with shifts greater than 0.2 uSec.
- Output/Coupling Network Status changes.

Control Station Actions

The control station watchstander will perform the following:

- Verify that the transmitting station is On-Air and In-Tolerance
- Recall transmitting station personnel.
- Pass TS Mode when transmitting station personnel arrive.
- Notify the CSDO.

Transmitting Station Actions

Transmitting station personnel will perform the following:

- Return to the transmitting station as directed.
- Verify the transmitting station is On-Air and In-Tolerance.
- Assume TS Mode. Based on the failure, determine if REM/LOC mode is required.
- Place LSOS in the Station Maintenance mode until normal operations are restored.

Transmitting Station Receiver System Failure

Introduction

Failure of the receiver system prevents the control station from obtaining local timing parameters. It also significantly reduces the transmitting station's ability to recover from a timing casualty.

Control Station Actions

Control station watchstander will perform the following:

- Verify that the transmitting station is On-Air and In-Tolerance.
- Recall transmitting station personnel.
- Pass TS Mode when transmitting station personnel arrive.
- Notify the CSDO.

Transmitting Station Actions

Transmitting station personnel will perform the following:

- Return to the transmitting station as directed.
- Verify the transmitting station is On-Air and In-Tolerance.
- Assume TS Mode.
- Dual rated transmitting stations will display the Cross-Chain TD (CCTD).
- Master transmitting stations will display the 1 PPS TD
- Single rated transmitting stations will not have any remote or other local timing reference and will need to rely on data from the remote stations.
- Place LSOS in the Station Maintenance mode.

Note

See Appendix J that describes CCTD and 1 PPS TD.

Standby Timing Path Failure

Introduction

The Alpha monitors and transmitting station timing should not be affected by a standby timing path failure. This is the key to identifying this type of casualty.

Control Station Actions

The control station watchstander will perform the following:

- Verify that the transmitting station is On-Air and In-Tolerance
- Recall transmitting station personnel.
- Pass TS Mode when transmitting station personnel arrive.
- Notify the CSDO.

Transmitting Station Actions

Transmitting station personnel will perform the following:

- Return to the transmitting station as directed.
- Verify the transmitting station is On-Air and In-Tolerance.
- Assume TS Mode. Based on the failure, determine if REM/LOC mode is required.
- Place LSOS in the Station Maintenance mode until normal operations are restored.

Tower Lighting System Failure

Introduction

In the interest of aircraft safety, transmitting stations are required to maintain tower obstruction lightning systems and report their failure.

Control Station Actions

The control station watchstander will notify transmitting station personnel and the CSDO immediately of a tower lighting system alarm.

Transmitting Station Actions

Transmitting station personnel will perform the following:

- Report failures of tower lighting systems that cannot be repaired within thirty minutes to the nearest Flight Service Station (FSS) of the Federal Aviation Administration (FAA).
- Transmitting station personnel will have the telephone number for the nearest FSS office readily available.
- All reports shall include the name of the person making the report, his/her telephone number, and the name of the transmitting station affected and the estimated time of repair.
- Draft and send a CASREP as per local instructions.
- If it is later determined that the tower obstruction lighting system will be inoperative more than 15 days, the transmitting station will inform the FSS office of the new estimated time of repair.
- Notify the FSS once proper operations have been restored.

Section C

AUTM/EUTM

Procedures

Introduction

The following are procedures for conducting an Authorized Unusable Time (AUTM) or Emergency Unusable Time (EUTM) period. These periods are used for maintenance and testing at the transmitting stations. Normally the transmitting station will go Off-Air to perform any maintenance. Equipment testing may result in the transmitting station being Off-Air and/or Out-Of-Tolerance during this period. Close cooperation is necessary between the control station and the transmitting stations to prevent any Out-Of-Tolerance without **Blink** (OTBK).

Procedures Prior to AUTM/EUTM

Control Station Actions

Ten minutes prior to the start of the AUTM/EUTM period the control station will:

- Ensure the CSDO is present in the operations room.
- Obtain the past hours deviation and pass the value to the transmitting station.
- Print the past hours RAIL and Bravo data for the transmitting station.
- Place LCCS in the Manual Mode for the affected baseline(s).

Transmitting Station Actions

Ten minutes prior to the start of the AUTM/EUTM period the transmitting station will:

- Ensure senior personnel (CO/OIC, XPO) are present in the operations room.
- Obtain the past hours deviation from the control station and correlate the TINOs.

Procedures During AUTM/EUTM

Control Station Actions

During the AUTM/EUTM period the control station will:

- Pass control at the start of the AUTM/EUTM.
- Declare the baseline(s) abnormal on the TDC.
- Monitor all the other transmitting stations closely. LCCS will experience multiple alarms from the monitor receiver sites and remote stations for the transmitting station during the AUTM/EUTM. Watchstanders must pay close attention to the alarms during this period to ensure the integrity of the rest of the chain.
- Once the transmitting station returns on-air **blinking**, monitor the TD and ECD tracks to ensure the station returns in-tolerance.
- Await notification from the transmitting station that the signal and baseline are in tolerance.
- Assume control and use all available sources to verify baseline(s) and signal are in tolerance before stopping **blink**.

Transmitting Station Actions

During the AUTM/EUTM period the transmitting station will:

- Assume control at the start of the AUTM/EUTM.
- Complete the necessary maintenance/testing.
- Prior to returning on-air, the transmitting station will ensure **blink** has been started.
- TINO tracks may shift during the AUTM/EUTM period, adjustments will not be made to TINO until the transmitting station returns On-Air.
- The AUTM/EUTM will not extend beyond the scheduled time period.
- The transmitting station will make every effort to return On-Air **blinking** 10 minutes prior to the end of the AUTM/EUTM.
- Upon returning on-air the transmitting station will check/recover all parameters.
- When all parameters are correct, the transmitting station will notify the control station and pass control.
- The control station will verify baseline and signal parameters using all available sources before stopping **blink**.

Procedures After AUTM/EUTM

Control Station Actions

After the AUTM/EUTM period the control station will:

- Resume Alpha control once the monitor receiver tracks are steady.
- Enter MPAs as needed to return the baselines to their tracking point prior to the AUTM/EUTM.
- Use the Stop Converge function on the TDC to resume the bias plots.
- Place the TDC in Automatic control.
- Make the appropriate log/chart entries.

Transmitting Station Actions

After the AUTM/EUTM period the transmitting station will:

- Remain in Bravo/Delta Control until the control station is ready to assume control.
- Synchronize the ABS unit(s).
- Make the appropriate log/chart entries.

Section D

Test Transmissions

LSU Test Transmissions

Introduction

The following are procedures for conducting Loran test transmissions by the Coast Guard Loran Support Unit (LSU) and apply to LSU, NAVCEN, and COCO NEUS/GLKS. Loran test transmissions by LSU are authorized on a case by case basis by COCO NEUS/GLKS to test equipment modifications. Test transmissions are authorized in specific test slots, either on currently operational Loran chains or on two test rates. Test transmission procedures are stated on the following pages, and must be followed to prevent disruption of Loran service to users.

Authorized Chains for Test Transmissions

Test transmissions are only authorized in the TANGO slots of the Northeast U.S. (NEUS 9960) and in the Master and secondary slots on 8090 and 5030 test rates.

Note

Authority for test interval transmissions on 9960(T), 5030(M, S) and 8090(M, S) applies only to LSU and only to their transmitting antenna located at Wildwood, NJ. Requests from any other entity shall be referred to NAVCEN for disposition.

Authorized Rates for Test Transmissions

Test transmissions will be authorized on the following test rates only:

- 5030 (Master, Secondary)
- 8090 (Master, Secondary)
- 9960 (Secondary TANGO slot)

LSU Test Transmissions, Continued

Test Transmissions Specifications

Test transmissions will conform to the following requirements:

- Phase Code: Loran secondary format only; use of master coding is prohibited.
- Power: Various.
- Location of transmitter: Wildwood, NJ
- 38 56 58.3N
- 74 52 01.0W
- Number **of Pulses:** Eight per Group Repetition Interval (GRI). The transmission of additional communications pulses may be authorized as requested – not to interfere with operational signals.

Tango Specifications

The table below provides further information:

Function	NEUS 9960 Tango	GLKS 8970 Tango
Coding Delay (CD)	80,000 microseconds	72,000 microseconds
A-1 Site	Sandy Hook, NJ. (Preferred Site)	Plumbrook, OH.
A-1 Site TD/CSTD	80973.64	74556.80
A-2 Site	Cape Elizabeth, ME.	N/A
A-2 Site TD	81824.88	N/A
LSU Tolerance (TD)	+/- 500 nanoseconds	+/- 500 nanoseconds

Test Transmissions on Existing Operational Rates

LSU Responsibilities

Below are LSU responsibilities:

- Request permission from COCO NEUS/GLKS to commence test transmissions in the 9960/8970 TANGO slots at least three days in advance.
- Keep a record of all transmissions, time of transmission and chain used. This information may be needed in case of any "post test" user complaints.
- Check with COCO NEUS/GLKS one hour prior to actual transmission to see if there are any problems.
- Meet the test interval requirements previously specified. Test transmissions shall be immediately secured any time transmissions do not meet these requirements.

COCO NEUS/GLKS Responsibilities

Below are COCO NEUS/GLKS responsibilities:

- Normally grant LSU authority to transmit upon request.
- Ensure that LSU comes On-Air in the proper test slot (+/- 10 usec) with proper secondary Phase Code and eight pulses.
- Advise LSU prior to the test period if chain operations are abnormal or marginal and if control station personnel cannot be diverted from chain operations. If necessary, alternate times shall be arranged.
- Direct LSU to stop testing if chain operations are degraded by the test transmissions or chain operations are abnormal.
- Test transmissions will not be permitted on 8970 when the A-1 monitor receiver site is not available.

Test Transmissions on Non-Operational Rates

Introduction

LSU is authorized to use test transmissions on specific non-operational test rates to reduce the risk of interference to operational Loran transmissions.

Authorized Rates for Test Transmissions

Test transmissions will be authorized on the following rates only:

- 5030 (Master, Secondary)
- 8090 (Master, Secondary)

Note

Authority for test interval transmissions applies only to LSU and only to their transmitting antenna located at Wildwood, NJ. Requests from any other entity shall be referred to NAVCEN for disposition.

LSU Responsibilities

Below are LSU responsibilities:

- Obtain permission from NAVCEN for each use of the test rate at least seven days in advance; the original request may be made by telephone if a confirming letter/message follows. LSU shall ensure the cognizant COCO receives a copy of the request.
- Keep a record of all transmissions including time of transmission and rate used. This information may be needed in case of any "post test" user complaints.

NAVCEN Responsibilities

Below are NAVCEN responsibilities:

- Normally grant LSU authority to transmit on the test rate.
- Direct LSU to stop testing if Loran operations are degraded by the test transmissions.
- Notify users by message of upcoming test transmissions.

Section E

Heavy Weather/Natural Disasters

Overview

Introduction

The objective of preparing for heavy weather or natural disaster is to ensure personnel safety while maintaining optimum signal availability. Radionavigation may be critical to ensure the safety of some users during these events. ADCONs coordinate and maintain Heavy Weather/ Natural Disaster Plans for units within their AOR. These plans include policy and procedures for warnings, alerts, preparations, and post-storm activities to protect government property.

Preparation

Each transmitting station will develop and maintain a Heavy Weather and Natural Disaster plan. Each plan will vary station-by-station depending on location, the type and severity of the disaster/storm encountered, amount of warning received, and support available. Generally, the better prepared we are the better we will come through the disaster.

The following minimum guidelines apply:

- Contact your local Emergency Management Office or American Red Cross Chapter for more information concerning local disaster procedures.
- Review District SOP.
- Ensure transmitting station equipment, buildings, grounds, and personnel are prepared.

Personnel Safety

A major concern is the safety of personnel positioned near the tower during heavy weather conditions. The CO/OIC shall monitor conditions carefully to ensure avenues of escape are not cut off. The CO/OIC shall ensure personnel are evacuated from within the tower fall radius while it is safe to do so.

Note

In NO case shall personnel remain within the fall radius of the tower when wind conditions exceed safety limits prescribed by the Tall Tower Coordination Center.

Control Station Heavy Weather/Natural Disaster

Control Station Actions

The control station will attempt to maintain control for as long as possible. Once the control station can no longer maintain control, the control station watchstander will:

- Recall the Master transmitting station watchstander to assume control.
- Recall Secondary transmitting station watchstanders.
- Pass the past hours deviation values if available.
- The TDC will be placed in the Manual Mode.
- Notify the control station Duty Technician and the CSDO.
- Evacuate when directed by competent authority.
- Maintain hourly contact with transmitting station personnel until operations are restored.

Transmitting Station Actions

The transmitting station watchstander will be recalled to the station in case of heavy weather or a natural disaster at the control station.

The transmitting station watchstander will perform the following:

- Obtain past hours deviation values from the control station if available.
- The Master transmitting station watchstander will assume Bravo Control of the chain and correlate the TINOs. If Bravo communications are working, the Master transmitting station will assume B-REM(TS). If not, contact all Secondary transmitting stations and have them assume B-LOC(TS).
- Upon arrival, all Secondary transmitting station watchstanders will contact the Master transmitting station.
- If communications cannot be established or maintained, the transmitting station will assume the appropriate mode of control (Delta) and correlate the TINOs.
- Perform a communications check every 60 minutes.

Transmitting Station Heavy Weather/Natural Disaster

Control Station Actions

The control station will attempt to maintain control for as long as possible. Once the control station can no longer maintain control, the control station watchstander will:

- Recall the transmitting station watchstander to assume control.
- Pass past hour's deviation values if available.
- Notify the CSDO.
- Maintain hourly contact with transmitting station personnel until operations are normal.

Transmitting Station Actions

The transmitting station watchstander will be recalled in case of heavy weather or a natural disaster at the station.

The transmitting station watchstander will perform the following:

- Obtain past hours deviation values from the control station if available.
- Attempt to return to the transmitting station as directed. If the roads are impassable or travel is restricted, notify the control station immediately.
- Notify the control station when on board to determine the present mode of control.
- If communications cannot be established or maintained, the transmitting station will assume the appropriate mode of control (Bravo/Delta) and correlate the TINOs
- Perform a communications check every 60 minutes.
- Notify the control station if ordered to evacuate.
- Upon arrival at the evacuation site, pass the location and contact telephone number to the control station.

Chapter 6

Propagation Anomalies

Overview

Chapter Introduction

This chapter provides operational guidance to the control station watchstander in identifying and responding to these propagation anomalies.

Definition of a Anomaly

Phenomena such as a Sudden Ionospheric Disturbance (SID), Polar Cap Absorption (PCA), geomagnetic storm or a weather front may affect signal propagation in the user area. These events may change the signal timing, pulse shape, or amplitude. Solar induced events can be confirmed by the Space Environmental Center.

Detecting an Anomaly Condition

Any station detecting an anomalous condition, regardless of control mode, will immediately contact the controlling station and all of the stations involved.

Note

If the discrepancy cannot be resolved or doubt exists as to whether the baseline is In-Tolerance, **start blink**, and notify the CSDO immediately.

Table of Contents

This chapter contains the following topics.

Section A Definitions and Procedures 6-1
Solar Event Descriptions 6-1
Sudden Ionospheric Disturbance (SID) 6-1
Polar Cap Absorption (PCA) 6-1
Geomagnetic Storms 6-1
Non Solar Event Descriptions 6-2
Atmospherics 6-2
Weather 6-2
Interference 6-2
Solar Event Procedures 6-3
Verification 6-3
Blink 6-3
Notification 6-3
Control Shifts 6-3
Solar Event LPA Policy 6-3
TDC 6-3
Non-Solar Event Procedures 6-4
Non-Solar Event Verification 6-4
Example 6-4

Section A

Definitions and Procedures

Solar Event Descriptions

Sudden Ionospheric Disturbance (SID)

A SID is a solar induced phenomenon normally occurring during daylight hours. Generally, East-West baselines are affected more than North-South baselines. The Loran signal is affected by changes in the ionosphere causing abnormally strong and early arriving skywaves that affect the receivers' ability to properly track. This is generally characterized by the sudden shift in TD and ECD tracks as seen at the monitor receiver sites, followed by a short period of relative stability, then a sudden return to normal. Generally, Bravo and Delta tracks will shift in opposite directions.

Polar Cap Absorption (PCA)

A PCA is a solar induced phenomenon occurring after a SID. They occur during daylight hours with normal conditions returning at night. A PCA affects the groundwave propagation speed and generally lasts for several days. The symptoms appear strongest in regions close to the poles. This is generally characterized by a medium to slow (usually several hours) shift in TD and ECD, similar to that of a SID, followed by a period of reasonable stability and a slow return to normal.

Geomagnetic Storms

These are disturbances in the Earth's magnetic field caused by solar events. Generally, the affects of these storms will be characterized by a medium to slow (usually several hours) shift in ECD, similar to that of a SID, followed by a period of reasonable stability and a slow return to normal.

Non Solar Event Descriptions

Atmospherics

Atmospherics usually cause high background noise. The affect at the monitor receiver site will generally be seen as erratic or unstable ECD and TD tracks and low signal to noise ratio numbers.

Weather

These events are generally due to severe weather near the monitor receiver site. The affect at the monitor receiver site will generally be seen as erratic or unstable ECD and TD tracks and high noise numbers.

Interference

Receiver operations may be affected by transmissions near the Loran frequency spectrum usually within the 50Khz to 150Khz frequency band. COCO will follow up on reports of interference as appropriate. Chapter 9 provides guidance for handling reports of interference events. Interference to Loran can be categorized in two ways:

- **Synchronous:** Synchronous interference will cause a sudden constant offset in the ECD or TD Tracks. There may also be an increase in the noise numbers. Receiver acquisition and tracking may be impaired.

- **Asynchronous:** Asynchronous interference will cause erratic or sine wave patterns to appear on the ECD or TD tracks. There may also be an increase in the noise numbers. Receiver acquisition and tracking may be impaired.

Note

See Appendix J for examples of Synchronous Interference.

Solar Event Procedures

Verification

Any two of the following conditions confirms that a solar event is affecting the coverage area:

- The Alpha-1 monitor receiver site shows the effect.
- The Alpha-2 monitor receiver site shows the effect.
- Bravo receiver tracks show the effect.
- Delta receiver tracks show the effect.
- Notification by NOAA Space Environmental Service Center, Boulder CO that a solar event is in progress in the coverage area.

Note

Confirmation of the event can also be initiated by contacting NOAA at (303) 497-3171 or via the Web Site at http://sec.noaa.gov.

Blink

Blink will be initiated on a baseline affected by a solar event when an Out-of-Tolerance condition is detected.

When in doubt, start blink, and contact the CSDO and COCO.

Notification

The CSDO and COCO will be notified immediately when a solar event is verified. The CSDO will send a user notification if the event meets the requirements for notification.

Control Shifts

Baseline control will not be shifted from the controlling receiver upon confirmation of a solar event. TMCNs for Alpha monitor receiver sites will not exceed 120 unless authorized by the CSDO.

Solar Event LPA Policy

Once a solar event has been confirmed, LPAs will not be entered until the event is over. All LPAs entered within three hours prior to and during an event will be investigated to ensure they were not inserted to compensate for the event. LPAs inserted to compensate for tracks affected by a solar event will be removed.

TDC

The TDC will be placed in Manual Mode during the solar activity to prevent LCCS from inserting LPAs.

Non-Solar Event Procedures

Non-Solar Event Verification

For propagation anomalies other than confirmed solar events, control should be shifted when appropriate, based on local conditions and policy established by COCO.

Example

If interference or weather events made the Alpha-1 monitor receiver site unusable, control should be shifted to the Alpha-2 monitor receiver site.

Chapter 7

Casualty Recovery

Overview

Chapter Introduction

This chapter contains instructions for casualty recovery operations. Recovery procedures are divided into control and transmitting station procedures.

Casualty Definition

A casualty is any failure to transmit a properly timed and formatted signal.

Detecting a Casualty Condition

Any station detecting a casualty condition, regardless of control mode, will immediately contact the controlling station and all stations involved.

Note

System integrity, the ability of the system to provide timely warnings to users that the system should not be used, is the paramount operational consideration.

If there is any doubt as to whether a baseline or signal is In-Tolerance, **start blink** immediately, and notify the Control Station Duty Officer (CSDO).

Table of Contents

This chapter contains the following topics.

Section A Casualty Recovery Procedures 7-1
- Control Station 7-1
  - Blink 7-1
  - Casualty Verification 7-1
  - Blink During Master Off-Air 7-2
  - CSDO Responsibility 7-2
  - Control Station Recovery Flowchart 7-3
- Transmitting Station 7-4
  - Blink 7-4
  - Casualty Verification 7-4
  - Blink During Master Off-Air 7-4
  - Stopping Blink 7-5
  - Transmitter Emergency Stop 7-5
  - Returning to Alpha Control 7-5
  - Transmitting Station Recovery Flowchart 7-6

Section A

Casualty Recovery Procedures

Control Station

Blink

Secondary **blink** will be initiated to provide system integrity during the following casualty conditions:

- TD Out-of-Tolerance
- ECD Out-of-Tolerance
- Output power is less than 70.7% of Nominal
- Improper phase coding
- Improper GRI
- Master Off-Air (Note: see below procedures for Master Off-Air)

Note

The five Casualty Recovery Parameters are:

- **TINO**
- **Antenna current**
- **Steady Cycle Comp**
- **ECD**
- **SYNC**

Casualty Verification

An equipment failure or low signal to noise ratio condition at a receiver site may initially appear to be a baseline or signal casualty. However, in nearly all cases a baseline or signal casualty will affect more than one monitor source.

A baseline or signal casualty can be confirmed using the data and alarms available from both the monitor receiver sites and RAIL. During a casualty, use all available sources to verify if the transmitting station is Off-Air or Out-of-Tolerance.

Control Station, Continued

Blink During Master Off-Air

A time jump can produce indications that are similar to an Off-Air condition. While a Master Off-Air condition does not present the possibility of an Out-of-Tolerance condition without proper user notification, the misinterpretation of a Master time jump as a Master Off-Air poses considerable risk to users.

The following procedures are designed to minimize that risk:

- **Blink** will be initiated for all Master Off-Air events that are not momentaries.
- **Blink** will be stopped when Master Off-Air has been verified.
- **Blink** shall be re-started prior to Master being brought On-Air.
- Following a Master Off-Air, **blink** shall continue until all baselines and signal parameters are In-Tolerance.

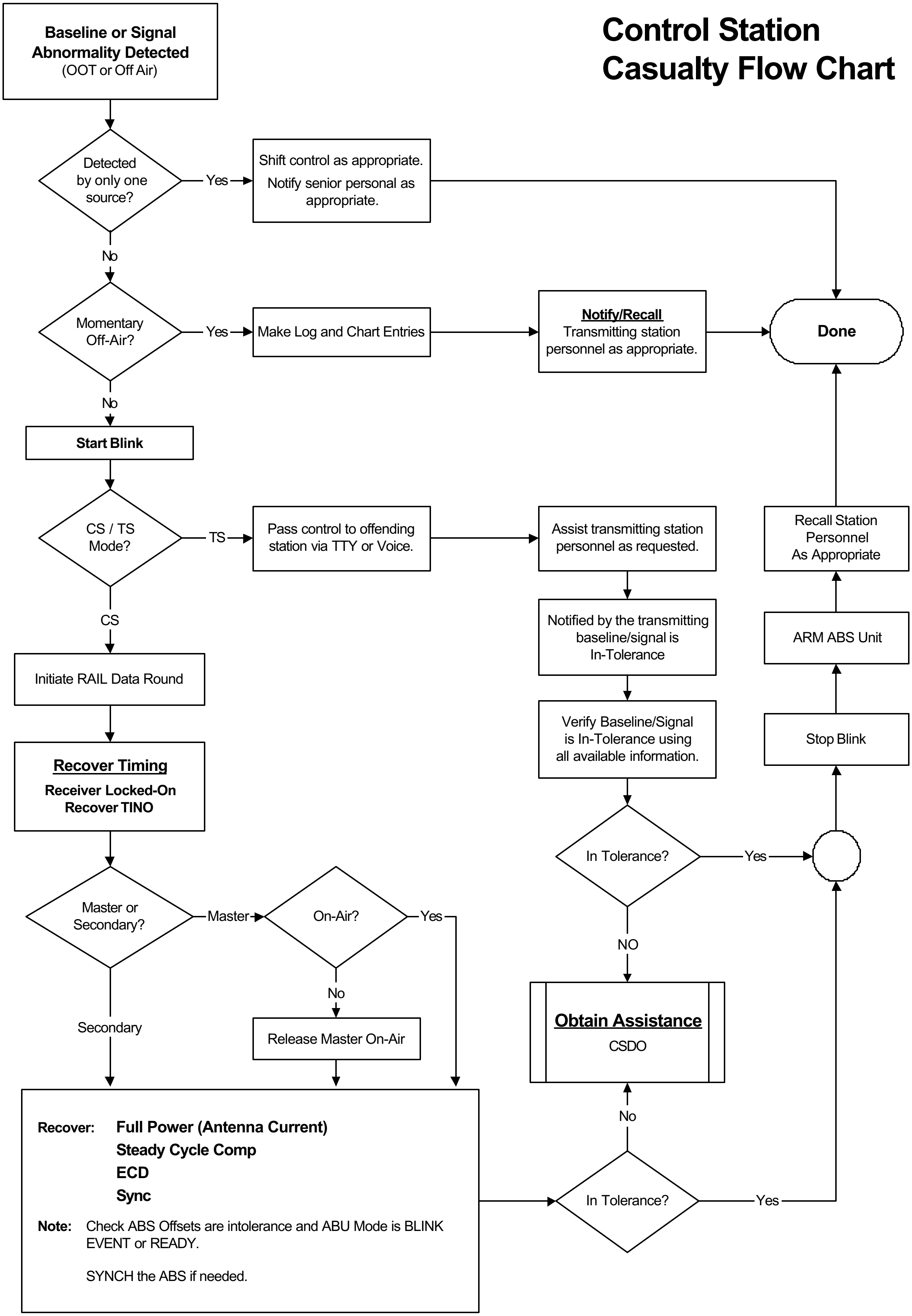
CSDO Responsibility

The CSDO is responsible for resolving casualties that are beyond the capability of the Control watchstander or transmitting station personnel. COCO may promulgate additional guidance concerning COCO notification requirements.

Control Station Recovery Flowchart

The following flow chart will be used as a guide during casualty recovery process.

Control Station Casualty Flow Chart



Transmitting Station

Blink

Secondary **blink** will be initiated to provide system integrity during the following casualty conditions:

- TD Out-of-Tolerance
- ECD Out-of-Tolerance
- Output power is less than 70.7% of Nominal
- Improper phase coding
- Improper GRI
- Master Off-Air (Note: see below procedures for Master Off-Air)

Note

The five Casualty Recovery Parameters are:

- **TINO**
- **Antenna current**
- **Steady Cycle Comp**
- **ECD**
- **SYNC**

Casualty Verification

When notified that a baseline or signal casualty has been detected, the transmitting station watchstander shall check with Control watch stander, If needed assume control, start or continue **blink**, and then verify the Out-of-Tolerance condition using local parameters.

Blink During Master Off-Air

A time jump can produce indications that are similar to an Off-Air condition. While a Master Off-Air condition does not present the possibility of an Out-of-Tolerance condition without proper user notification, the misinterpretation of a Master time jump as a Master Off-Air poses considerable risk to users.

The following procedures are designed to minimize that risk:

- **Blink** will be initiated for all Master Off-Air events that are not momentaries.
- **Blink** will be stopped when Master Off-Air has been verified.
- **Blink** shall be re-started prior to Master On-Air being brought On-Air.
- Following a Master Off-Air, **blink** shall continue until all baselines and signal parameters are In-Tolerance.

Stopping Blink

LCCS provides the Control watchstander with the most complete set of information on the condition of a baseline. The Control watchstander has access to information from two monitor grade receivers, and from the LSOS of each Master and Secondary for a baseline.

To reduce the risk of an Out-of-Tolerance condition occurring following casualty recovery, the Control watchstander has the responsibility for determining that all baselines and signal parameters are in tolerance prior to stopping **blink**.

Transmitter Emergency Stop

During periods when the transmitting station is unmanned, the decision to use the transmitter emergency stop **will** be made by the CSDO.

The transmitter emergency stop should only be used under the following conditions:

- Transmitting station is On-Air and Out-of-Tolerance and blink cannot be started.
- Suspected fire at the transmitting station.

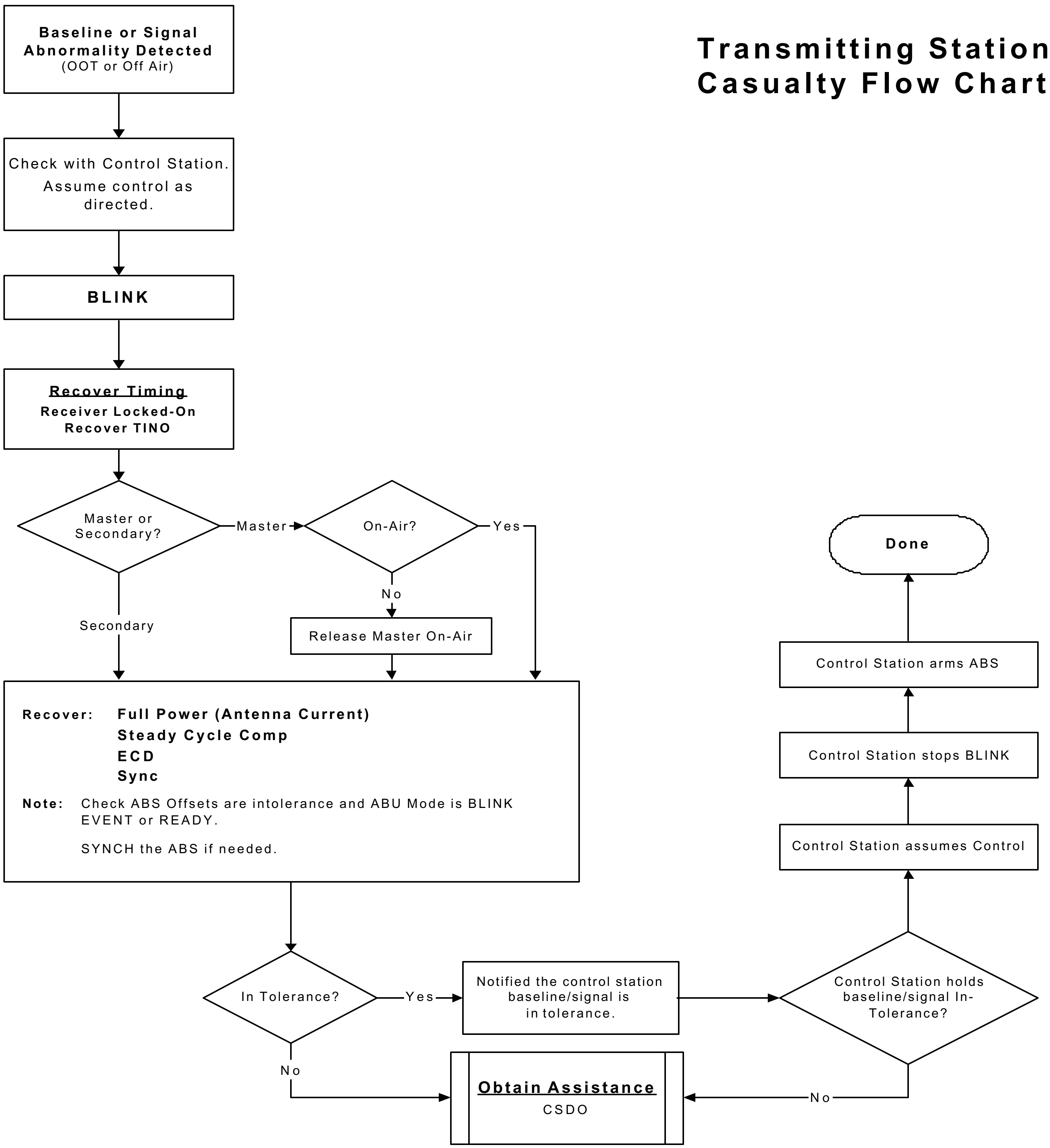
Returning to Alpha Control

Once transmitting station personnel have restored local parameters, the Control watchstander will be notified that the casualty has been corrected. The Control watchstander will use all available sources of information to verify that the baselines and signals are in tolerance. When this verification process is complete, the Control watchstander will assume control of the baseline(s) and stop blink.

Transmitting Station, Continued

Transmitting Station Recovery Flowchart

The following flow chart will take the watchstander through the casualty recovery process.



Chapter 8

Loran Chain Timing

Overview

Chapter Introduction

This chapter covers Loran/UTC timing and Oscillator management.

Table of Contents

This chapter contains the following topics.

Section A Chain Synchronization 8-1
Introduction 8-1
UTC Synchronization 8-1
Time of Transmission Monitor Equipment 8-1
Section B Oscillator Adjustments 8-2
Oscillator Timing/Frequency Adjustments 8-2
Introduction 8-2
Phase Microstepper Adjustments 8-2
Chain Time Step 8-2
Section C Oscillator Control 8-3
Oscillator Timing/Frequency Control 8-3
Introduction 8-3
TTM Data 8-3
Master Station Timing Adjustment Criteria 8-4
Master Transmitting Station Operate Oscillator Adjustment Criteria 8-5
Secondary Transmitting Station Operate Oscillator Adjustment Criteria 8-6
Operate Oscillator 8-7
Installation 8-7
LOIS Data Reset 8-7
Section D Oscillator Management Procedures 8-8
Transmitting Station Oscillator Management 8-8
Introduction 8-8
Environment 8-8
Rack Access 8-8
Temperature Monitoring 8-8
Magnetic Environment 8-9
Vibration 8-9
Adjustments 8-9
Oscillator Readings 8-9
Oscillator Tolerances 8-9
New Oscillator 8-10
Procedure For Oscillator Failure 8-10

Table of Contents

This chapter contains the following topics.

Section E Cross- Baseline, Cross-Chain and 1PPS References....8-12
Procedures....8-12
Introduction....8-12
Cross- Baseline Procedures for Secondary Transmitting Stations....8-12
Cross-Chain Procedures for Dual Rated Transmitting Stations....8-12
Cesium 1PPS Procedures....8-13
Cross-Chain Timing for Transmitting Station Cape Race and Fox Harbor....8-14

Section A

Chain Synchronization

Introduction

UTC Synchronization	Master transmitting stations' operate oscillators are adjusted as needed to synchronize the Loran chains' transmissions to Universal Time Coordinated (UTC) as measured by the U.S. Naval Observatory's (USNO) Master Clock. This time scale is commonly referred to as UTC-USNO. (UTC).
Time of Transmission Monitor Equipment	Time of Transmission Monitor (TTM) equipment utilizes a Global Positioning System (GPS) receiver, Reference Timing Generator (RTG), Time Interval Counter (TIC) and measurement of the transmitting stations antenna current to provide an accurate and reliable means to synchronize Loran chains to UTC.

Section B

Oscillator Adjustments

Oscillator Timing/Frequency Adjustments

Introduction

This section applies to those LORSTAs which have 5071 Oscillators installed. The goal of Oscillator timing and frequency control is to synchronize a Loran chain with UTC. Control of Oscillator frequency is the preferred method of maintaining synchronization.

There are two methods of synchronizing a Loran chain with UTC and they are:

- **Master transmitting stations Operate Oscillator frequency adjustments using the steering adjustments.**
- Chain Time Steps (requires CO authorization).

Note

Refer to Tab 8 of Appendix “C” for the 5061A operations

Steering Adjustments

Steering adjustments are used to make fine corrections to the frequency of the Operate Oscillator. COCO can direct steering adjustments of 1200 femtoseconds per second or less. User notification is not required for this type of adjustment.

Chain Time Step

Commanding Officer Authorization is required prior to a Chain Time Step. This adjustment does not impact the frequency of the Oscillator. COCO has the authority to direct chain Time Steps of not less than 120 nanoseconds and not more than 300 nanoseconds per day. User notification is not required for Time Steps less than 300 nanoseconds. If a Time Step greater than 300 nanoseconds are required, user notification will be issued 14 days in advance. Users see Chain Time Steps as sudden shifts in timing data; therefore, they should be kept to a minimum.

Section C

Oscillator Control

Oscillator Timing/Frequency Control

Introduction

This section applies to those LORSTAs which have 5071 Oscillators installed. Refer to Tab 8 of Appendix "C" for the 5061A operations. Steering adjustments for the 5071 Oscillators can be calculated using the worksheets contained in Tab 4 to Appendix C. Prior to making any corrections, COCO(s) should verify the Oscillator readings to ensure they are In-Tolerance and the environmental conditions have been stable. Ideally, 30 days of data should be collected before an adjustment is made. Using less data in determining the drift will result in a less accurate drift rate determination.

COCO(s), using LOIS and TTM data, should synchronize the Oscillators in the following order:

- Synchronize the Master Operate Oscillator to UTC (USNO).
- Synchronize the Secondary Operate Oscillator to the Master transmitting station Operate Oscillator.
- Synchronize the Standby and Tertiary Oscillators to the Operate Oscillator.

Note

For the 5061 oscillator, the higher the noise or standard deviation should be taken into account to determine if you want to use 100% or 80% of the calculated adjustment.

TTM Data

The control station watchstander will obtain the Current Mean value from each transmitting station. The value will be reported to COCO. COCO will use these values to determine the masters' operate oscillator drift and to calculate steering adjustments.

Oscillator Timing/Frequency Control, Continued

Master Station 5061 Timing Adjustment Criteria

The decision table below provides instructions to determine whether to use a steering adjustment or a Chain Time Step for a Master transmitting station.

For 5061	**If DRIFT is *less* than 10 nsec per day and**	**If DRIFT is *more* than 10 nsec per day and**
OFFSET from UTC is ***less*** than 100 nanoseconds. Average over 7 days minimum.	No adjustment is necessary	steering adjustment is necessary
OFFSET from UTC is ***more*** than 100 nanoseconds. Average over 7 days minimum	Present Time Step recommendation to CO	steering adjustment and/or present Time Step recommendation to CO

Master Station 5071 Timing Adjustment Criteria

The decision table below provides instructions to determine whether to use a steering adjustment or a Chain Time Step for a Master transmitting station.

For 5071	**If DRIFT is *less* than 5 nsec per day and**	**If DRIFT is *more* than 5 nsec per day and**
OFFSET from UTC is ***less*** than 100 nanoseconds. Average over 7 days minimum.	No adjustment is necessary	steering adjustment is necessary
OFFSET from UTC is ***more*** than 100 nanoseconds. Average over 7 days minimum	Present Time Step recommendation to CO	steering adjustment and/or present Time Step recommendation to CO

Master Transmitting Station Operate Oscillator Adjustment Criteria

If the steering adjustments would result in a cumulative correction exceeding 1200 femtoseconds per second, COCO should look for hardware problem.

Oscillator Timing/Frequency Control, Continued

Secondary Transmitting Station Oscillator Adjustment Criteria

LOIS contains data for each Secondary transmitting station's Oscillators. Steering adjustments can be calculated using the worksheets contained in Appendix C. The decision table below provides instructions to determine whether to use a steering adjustment for a secondary transmitting station.

For 5061	**If DRIFT is *less* than 10 nsec per day and**	**If DRIFT is *more* than 10 nsec per day and**
Cumulative steering adjustments are ***less*** than 1200 femtoseconds per sec.	No adjustment is necessary	steering adjustment is necessary
Cumulative steering adjustments are ***more*** than 1200 femtoseconds per sec.	No adjustment is necessary	steering is necessary

For 5071	**If DRIFT is *less* than 5 nsec per day and**	**If DRIFT is *more* than 5 nsec per day and**
Cumulative steering adjustments are ***less*** than 1200 femtoseconds per sec.	No adjustment is necessary	steering adjustment is necessary
Cumulative steering adjustments are ***more*** than 1200 femtoseconds per sec.	No adjustment is necessary	steering is necessary

---

Operate Oscillator Installation

The transmitting station technician will alert the control station watchstander when a new oscillator is placed in the operate path. The control station watchstander will closely monitor the number of secondary LPAs associated with that baseline and contact COCO if the cumulative total of secondary LPAs is higher than 100 nanoseconds.

LOIS Data Reset

Reset the number of days to zero when any of the following occurs:

- A new oscillator is installed
- Any oscillator steering adjustments.
- Number of days since last reset is greater than 60.

Master MPAs

It is extremely important to insert MPAs into master to return the secondary stations to their original TD tracks after a master equipment switch or casualty. If not corrected, the master to UTC synchronization will be offset due to equipment problems rather than oscillator drift.

Section D

Oscillator Management Procedures

Transmitting Station Oscillator Management

Introduction

This section applies to those LORSTAs which have 5071 oscillators installed. Refer to Tab 8 to Appendix “C” for the 5061A operations. It is each transmitting station’s responsibility to ensure the environment, control, and routine maintenance of all oscillators and equipment is accomplished.

Environment

All transmitting stations shall strive to minimize disturbances to the oscillator environment.

Rack Access

Transmitting stations will keep the doors closed when not performing maintenance.

Temperature Monitoring (5061s Only)

The Frequency Standard Rack shall be equipped with a thermometer, which can measure the maximum/minimum temperature inside the rack without opening the door. Frequency Standard Rack temperature should vary over a narrow range (less than 4 degrees). If wider swings are encountered, the cause should be investigated and corrected.

Magnetic Environment

Transmitting stations shall be aware of the Frequency Standard Rack magnetic environment and attempt to keep it stable. In particular, equipment within the Frequency Standard Rack shall not be disturbed unless necessary. Care shall be taken to avoid moving metal masses near the Frequency Standard Set.

Vibration

Transmitting stations shall ensure the Frequency Standard Rack is not subjected to vibration.

5061 Adjustments

Transmitting stations shall contact COCO prior to performing any 5061 Frequency Standard Set adjustments.

Oscillator Readings

Oscillator readings will be taken weekly.

5071 Oscillator Tolerances

The COCO will be notified if any of the following readings exceed the tolerances listed in the table below:

Function	Reading
Pump	0-40uA
Cesium Oven	0-10V
VCXO Oven	-5 to –10V
VCXO Control	-20 to 45%
C-Field	10-14.05mA
Ampl	0-100%
E-Mult	1000-2553V
Gain	14.4-58% of max

Note

Notify COCO immediately if the E-Mult reading changes by more than 10 from the previous readings. E-Mult will reach it's maximum value (2553) when the tube has reached the end of its life. Signal gain will read 14.4 when a new tube is installed, this reading will gradually increase when the E-Mult reading reaches 2553. At this point the cesium beam tube has reached the end of its life and the frequency standard will need to be replaced.

Transmitting Station Oscillator Management, Continued

New Oscillator

Upon receipt of a replacement Oscillator, it will be installed in place of the failed Oscillator and patched as the tertiary. It shall be monitored for 30 days and appropriate timing corrections shall be made by COCO to stabilize Oscillator drift. After thirty days, providing there are no further failures, the Frequency Standard Set will be returned to normal configuration which is:

- OP top
- STBY middle
- TERT bottom

Procedure For Oscillator Failure

Under no circumstances will transmitting station personnel physically move the Oscillators in the rack for anything other than a direct replacement. Any Oscillator failures will be resolved in the following manner:

- Send the Degraded command to the Automatic Blink System (ABS) equipment. Ensure the ABS unit responds with the Degraded State Pending message.
- Simultaneously reset the two PTMs for the Oscillators to be patched on the off-line Automatic Blink Unit (ABU). The ABU should respond with the Degraded State Locked message.
- Switch ABUs
- Simultaneously reset the two PTMs for the Oscillators to be patched on the off-line ABU. The ABU should respond with the Degraded State Locked message.
- Patch 5 MHz via the Frequency Patch Panel. Upon failure of the Operate Oscillator, the Tertiary Oscillator will be patched into the Operate path and the Frequency Standard Steering to 0.
- Once the Oscillator maintenance is complete, ensure the ABS Unit is synchronized and the PTM State and Status codes are 00 and 88 respectively.
- Send the Release Degraded State command to the ABS equipment. Request a full status message to ensure there are No Active Alarms.

Cesium 5071 Failure Procedures

When an HP-5071A fails, does not meet specifications, or is determined to be defective, the following procedures apply.

- A CASREP will be sent to the appropriate COCO(s), Loran Support Unit and other appropriate units. Reference Appendix "D" Tab 3.
- Follow the procedures outlined in the "LORAN FREQUENCY STANDARDS SETS OPERATOR'S GUIDE" chapter 5.1.3 and 5.1.5
- The unit returns the malfunctioning HP-5071A to Agilent Technologies for repair and return. Cesium Warranty Repair: 1-800-403-0801 (Need to provide cesium model and serial number).
- Record the Return Merchandise Authorization (RMA) on all tracking documentation and in the warranty log.
- Request the current shipping address when calling for the RMA.
- Record all warranty actions on the Unit Warranty Log.
- Concerns relating to proper equipment operation and vendor support may be referred to Loran Support Unit, Wildwood for support.
- The cesium must be packaged and labeled in the original factory packaging. This requirement ensures safe transport and compliance with HAZMAT transportation requirements.
- There is no charge during the 10 year extended warranty period for evaluating units in which no trouble is found, provided that no more than six no-trouble-found units are returned in any one-year period. If more than six no-trouble-found units are returned, Agilent technologies may invoice the Coast Guard for the cost of the evaluation.
- Repaired HP-5071A Primary Frequency Standards will be shipped from the Agilent Technologies Support Center to the desired station or its designee, no later than 60 calendar days from its receipt by the repair center. If the failed unit cannot be repaired within 60 days of receipt, Agilent Technologies shall provide the Coast Guard with a HP-5071A loaner unit.
- The U.S. Coast Guard shall pay inbound freight costs to the repair center. Agilent Technologies shall pay the return shipment costs.
- Each station is responsible for enforcing the provisions of the warranty. Each station should designate a single point of contact for cesium support that will be available while a cesium is away for servicing.

Section E

Cross- Baseline, Cross-Chain and 1PPS References

Procedures

Introduction

Cross-Baseline, Cross-Chain, and Cesium 1 Pulse Per Second (1PPS) Time Difference (TD) numbers provide supplementary references during periods when normal timing reference numbers are unusable. Cross-Baseline, Cross-Chain, and Cesium 1 PPS TDs are measured on the Time Interval Counter (TIC) and may be used to indicate timing shifts of 100 nanoseconds or more.

Cross- Baseline Procedures for Secondary Transmitting Stations

On a **weekly** basis establish the Cross-Baseline TD (CBTD) number using the following procedures:

- Secondary transmitting stations will not measure the CBTD during System Sample.
- Lock the R-2240/FSN-2(V) Austron Loran receiver onto one of the other Secondary transmitting station signals in the chain. Choose the Secondary transmitting station that offers the strongest signal under adverse conditions.
- Start the TIC measurement with LPCI and stop with RPCI.
- Post the CBTD number on the transmitting station status board.

Cross-Chain Procedures for Dual Rated Transmitting Stations

On a **weekly** basis establish the Cross-Chain Time Difference (CCTD) number using the following procedure:

- The TIC measurement starts with the high rate LPCI and stops with the low rate LPCI.
- The TIC will display two values alternately. Record the last three digits, (e.g., XX.X of the lowest number).
- Post the CCTD number on the transmitting station status board.

Cesium 1PPS Procedures

On a **weekly** basis establish the Cesium 1PPS Time Difference (1PPS TD) number using the following procedure:

- Use the same Cesium for all the measurements.
- Dual rated transmitting stations shall measure both rates.
- Starting the TIC with the LPCI and stopping with the Cesium 1PPS.
- The 1PPS TD will help determine if your transmitting station, the monitored transmitting station, or the other Operate timer has changed time. (The exception is if the cesium with a 1PPS output is the transmitting station Operate Oscillator and it is causing the problem).
- Post the Cesium 1PPS TD number on the transmitting station status board.

Procedures, Continued

Cross-Chain Timing for Transmitting Station Cape Race and Fox Harbor

On a **daily** basis, transmitting station Cape Race and Fox Harbor use the following procedures to allow the Canadian COCO to determine the Cross-Chain Timing of the Newfoundland East Coast (NEC) chain.

To determine the Cross-Chain Timing of the Newfoundland East Coast (NEC) chain, with respect to UTC, the following procedures are used. Transmitting station Cape Race and Fox Harbor must take daily readings between the standard sampling points of the antenna current waveforms of the Canadian East Coast (CEC) 5930 rate and the Newfoundland East Coast (NEC) 7270 rate and report these readings to the Canadian COCO. From these readings the Canadian COCO can determine the Cross-Chain Timing of the NEC chain because they are taking direct daily readings on the CEC chain.
To properly measure and report Cross Chain Timing readings, Loran transmitting station Cape Race shall make measurements daily at 1600Z following these procedures:

- Define Local Cycle Number (LCN), measured on the Time Interval Counter (TIC) by starting with the positive trigger LPCI and stopping on the positive trigger EPA envelope trigger on the same rate.
- Define Cross Chain Time Difference (CCTD) as measured on the TIC, by starting with the positive trigger of the CEC (5930) LPCI and stopping with the positive trigger of the NEC (7270) LPCI. Record the last three digits (xx.x uSec) when the TIC reading is as small as possible.
- Compute: CCTD - LCN(CEC) + LCN(NEC)
- Report the resultant number daily to COCO Canada. On weekends and official Canadian holidays, report on the next working day.

Chapter 9

Administration

Overview

Chapter Introduction

This chapter provides operational administration guidance to transmitting and control stations.

Table of Contents

This chapter contains the following topics.

Section A Record Keeping....9-1
Overview....9-1
Introduction....9-1
Control Station Records....9-1
Control Station Log....9-2
Control Station Log Signature Requirements....9-2
Control Station Log Retention Requirements....9-3
LCCS Data....9-3
Control Station Minimum Chart Markings....9-4
Control Station TELCO Outage Log....9-4
Control Station General Records Retention....9-4
Record Retention Table....9-5
Control Station Historical Records Retention....9-5
Transmitting Station Records....9-6
Transmitting Station Log....9-6
Transmitting Station Log Entries....9-7
RAIL Data....9-7
Transmitting Station Minimum Chart Markings....9-8
Oscillator Records....9-8
Distribution Amplifier Log....9-9
Transmitter Maintenance Log....9-8
Transmitting Station General Records Retention....9-10
Record Retention Table....9-10
Transmitting Station Historical Records Retention....9-11
Section B Casualty Reporting Procedures....9-12
Casualty Reporting....9-12
Overview....9-12
Message Precedence and Release Time....9-12
Routing....9-12
CASREP Categories....9-12
Requesting Assistance....9-13
Canadian Coast Guard CASREP Instructions....9-13
Discrepancy Report (DISREP)....9-13

Table of Contents

This chapter contains the following topics.

Section C Unusable Time (UUT) Notification and Analysis 9-14
UUT User Notification 9-14
Overview 9-14
User Notification Requirements 9-14
UUT Analysis 9-14
Overview 9-14
UUT Analysis Requirements 9-14
Types of UUT Analysis 9-15
Criteria for Simplified UUT Analysis 9-15
Simplified UUT Analysis 9-15
Simplified UUT Analysis Report Content 9-15
Simplified UUT Analysis Review Process 9-15
Detailed UUT Analysis Submission 9-16
Detailed UUT Analysis Criteria 9-16
Detailed UUT Analysis Report Format 9-17
Detailed UUT Analysis Review Process 9-17
Detailed UUT Analysis Report Enclosures 9-18
Section D AUTM/EUTM 9-19
Authorized Unusable Time 9-19
Overview 9-19
Definitions 9-19
Requesting AUTM 9-20
Requesting EUTM 9-19
AUTM Proposal/User Objections 9-19
Approval of AUTM 9-21
Approval of EUTM 9-21
General Rules for AUTM Messages 9-20
NOTAMs 9-20
Post AUTM/EUTM Notification 9-21
Sample AUTM Message 9-22
Chain Specific Additional Notification 9-21
Section E Training and Qualification Programs 9-23
Overview 9-23
Introduction 9-23
Training Responsibilities 9-23
ADCON 9-23
Headquarters Program Manager 9-23
OPCON 9-23
COCO 9-23
Transmitting Station CO/OIC and Control Station Supervisor 9-24
CONUS Transmitting Station Personnel 9-24
OCONUS Transmitting Station Personnel 9-24
Transmitting and Control Station Personnel 9-24
Types of Training 9-25
Formal 9-25
Informal 9-25
Drills 9-25
Operational Training Requirements 9-26
Training Topics 9-26
Training Schedule 9-26
Periodic Evaluation 9-26
Training Records 9-27

Table of Contents

This chapter contains the following topics.

Qualification Program........9-28
Overview........9-28
Check-off List........9-28
Certification Exam........9-28
Duty Personnel Qualification........9-28
COCO Evaluation........9-28
Revoking Duty Qualification........9-29
Re-Qualification Procedure........9-29
Section F Personnel........9-30
Overview........9-30
Introduction........9-30
CO/OIC Evaluations........9-30
Transmitting Station CO/OIC Personnel Evaluations........9-30
Off Duty Employment........9-31
Off Duty Employment Guidelines........9-31
Request for Approval for Off Duty Employment........9-31
Section G Awards........9-32
Operational Performance Award........9-32
Transmitting Station Operational Performance Award........9-32
Award Submission........9-32
Award Criteria........9-32
Control Station Operational Performance Award........9-33
Award Submission........9-33
Award Criteria........9-33
Non-Operational Awards........9-34
Unit Awards........9-34
Multiple Awards........9-34
Section H Station Visits/User Inquiries........9-35
Station Visits........9-35
Public Affairs........9-35
User Inquiries........9-35
User Inquiries........9-35
Simple Data Request........9-35
Operational Data Request........9-35
Minimum Information for Requests........9-36
Request for Uninterrupted Operational Periods........9-36
Affidavit........9-36
Witnesses........9-36
Section I Operational Reports........9-37
Reports........9-37
Overview........9-37
Monthly Report........9-37
Monthly Report Format........9-37
Report of Interference to Loran........9-38
COCO Actions........9-38
Report of Interference from Loran........9-39
COCO Actions........9-39

Table of Contents

This chapter contains the following topics.

Section J Operational Inspection Program....9-40
Station Inspection....9-40
Overview....9-40
Schedule....9-40
Inspection Check-off List....9-40
Pre-Inspections....9-40
Inspection Procedures....9-41
Outbrief....9-41
Inspection Weighting Factors....9-41
Inspection Ratings....9-41
Inspection Ratings Table....9-41
Inspection Report....9-42
Action Item Follow-up....9-42
Follow-up Visits....9-42
Inspection Report....9-43
Action Item Follow-up....9-43
Follow-up Visits....9-43
Section K Technical Archives....9-44
Library....9-44
Overview....9-44
Technical Archive....9-44
SMEF Advisories....9-44
Section L NAVCENINST M16562.1 (series) Changes....*9-44*
Procedure....9-44

Section A
Record Keeping

Overview

Introduction

The importance of proper record keeping cannot be **overemphasized**. Loran operations records document performance of the system. These records must be preserved to protect the legal and financial rights of the Coast Guard. This section provides guidance for creation and retention of Loran records.

Control Station Records

Control Station Log

The control station watchstander shall create and maintain a log of the day's events for each chain under their control. The Loran Control Station Log is a legal document that must be complete and accurate. The log shall be opened at 0000Z and closed at 2359Z

The following, for each chain, shall be included as enclosures to the log:

- LCCS Daily Control Monitor Report
- LCCS Bias Plot
- LOIS Control Station Daily Detailed Report

The following minimum Loran entries will be made in the log:

- Watch relief which includes signatures of off-going and on-coming watchstanders
- Beginning and end of abnormal conditions
- Equipment switches
- Adjustments (e.g., LPA, MPA, ETA, etc.)
- Equipment maintenance
- Failure or repair of equipment
- Time Checks at system sample.
- Start and stop of **blink** times
- Loss and restoration of communications
- Changes of baseline control and times
- Any event that impacts the transmitted signal or equipment readiness.
- Recall or notification of station personnel.

.

Note

Appendix D contains an example of the Control Station log.

Control Station Log Signature Requirements

The Loran Control Station log shall be signed by the watchstander :

- at the beginning and end of each Loran day
- when they assume responsibility for control of the chain(s)
- when relieved of that responsibility

The Watch Supervisor shall review and sign the log. The Control Station Supervisor will then approve and sign the log.

Control Station Records, Continued

Control Station Log Retention Requirements

The Control Station Log shall be retained for **three years**. A paper copy of the enclosures to the log do not need to be retained if an electronic copy is retained for the same period of time.

Should the record become a substantive part of litigation, the retention requirement for that record will be extended to **ten years**.

LCCS Data

The Loran Consolidated Control System (LCCS) maintains an electronic record of chain operations. A record of chain parameters, TTY communications, equipment status, and events are all maintained within the LCCS database.

LCCS will automatically annotate the following events:

- **Alpha Charts:**
  - All watch reliefs
  - All changes in Control, along with the Correlated Number.
  - Start and Stop **blink** times
  - System Sample TD and ECD Averages and Peak to Peak Swings.
  - All LPAs
  - End Loran Day, including the watchstander on watch.

Control Station Records, Continued

Control Station Minimum Chart Markings

The following chart markings are not automatically performed by LCCS and **will** need to be entered into the LCCS database by the control station watchstander in order to be displayed on the charts.

- Record changes in equipment status (e.g., changes in TMCN, AVG, ECDCR, Transmitting Station operate equipment status, etc.).
- Indicate equipment tests and adjustments on any chart that might be affected (e.g., receiver calibration, pulse building, etc)
- Clearly indicate when chart data might not be valid, and the reason (e.g., interfering frequencies, local weather, etc.).
- All MPAs
- Any signal irregularities (MOAs, SIDS, Weather)
- Any equipment casualties, indicating the signal status (e.g. Off-Air, **blink**) and actions taken.

Control Station TELCO Outage Log

The control station shall maintain a TELCO Outage Log of all communications outages requiring a TELCO Trouble Ticket to be opened.

The minimum log entries shall include the following:

- Date
- Circuit Number
- Ticket Number
- TELCO POC
- Time Ticket Opened
- Time Ticket Closed

Control Station General Records Retention

The records, logs, charts, and teletype rolls held by the control station will be retained as outlined below. If any doubt exists as to retaining the material, consult NAVCEN before disposition. All records are considered the property of NAVCEN.

Control Station Records, Continued

Record Retention Table

The table below provides further information on record retention.

Record Retention Table	
Document	**How long to retain**
COCO Monthly Reports (Control Station)	1 Year
Simple UUT Analysis (Control Station)	3 Years
Detailed UUT Analysis (Control Station)	3 Years
LCCS data	3 Years
TELCO Outage Log	3 Years
Operations Data Request if used for litigation	10 Years
Simple UUT Analysis (COCO)	Permanent
Detailed UUT Analysis (COCO)	Permanent
COCO Monthly Reports (COCO)	Permanent
All LOIS data	Permanent
Unit Award/Recognition (COCO)	Permanent
Notch Filter Amplitude vs Frequency Plots (COCO)	Permanent
Technical Archive (Control Station)	Permanent

Note

Permanent is 5 years after the station is closed.

Control Station Historical Records Retention

Historical Records are defined as records that explain significant events involving chain operations. Any document recording events of historical significance will be retained as long as a transmitting station exists. Contact COCO for direction if there are any questions on the historical value of any documents. Disposition instructions for historical records will be provided in the Operational Order when a transmitting station is decommissioned.

Transmitting Station Records

Transmitting Station Log

The Transmitting Station Log shall contain a record of all significant data pertaining to the system and all adjustments or irregularities during a 24-hour day. The information required for the LOIS daily report shall be entered in the Transmitting Station Log.

Log entries are as follows:

- The Loran day is from 0000Z to 2359Z.
- Station: Enter station proper name (e.g., LORSTA Raymondville, TX).
- Rate and Transmit Designation: Record the rate and function (e.g.,7980-X)
- System Parameters: Stations shall record the values of the parameters (LEN, SYNC, TINO, and ECD) under their function column.
- Time: All entries shall be made in GMT to the nearest minute**.**
- Log Entries: Stations shall only log those actions they perform or observe and shall not attempt to reconstruct and log events that occurred during CS Mode.
- Begin/End Loran day: Each station shall open and close the log for each day. The entry shall include the watchstanders name, operate equipment status, CASREPS, and if the station is operating in a mode other than A-REM-CS.
- System Sample: Enter system sample information
- Unusable Time: Enter the number of minutes off-air and the total UUT (in minutes) while in TS mode.

Note

Refer to Appendix D for more information on LOIS Daily Reports

Transmitting Station Records, Continued

Transmitting Station Log Entries

Significant occurrences while the transmitting station is in TS Mode will be recorded, including but not limited to the following:

- Watch relief which includes signatures of off-going and on-coming watchstanders
- Beginning and end of abnormal conditions
- Equipment switches
- Adjustments (e.g., LPA, MPA, ETA, PGEN, DROOP, etc.)
- Equipment maintenance
- Failure or repair of equipment
- Time Checks
- Start and stop of **blink** times
- Loss and restoration of communications
- Changes of baseline control and times
- Any event that impacts the transmitted signal or equipment readiness

RAIL Data

Each transmitting station shall ensure that RAIL is properly archiving daily data.

Transmitting Station Records, Continued

Transmitting Station Minimum Chart Markings

The Remote Automated Integrated Loran (RAIL) equipment replaces the function of Bravo/Delta strip chart recorders and cannot be annotated. The following are non-RAIL equipped transmitting station minimum required chart markings that shall be annotated at the beginning and end of each chart:

- Dates Covered
- Name of Station
- Data recorded (e.g., TINO or ECD as applicable station parameter, e.g., 9960-X TINO ECD, CYCLE COMP, or AMPLITUDE).
- TINO Charts shall be marked with the full TINO Center Track value (e.g. 11345.60) daily at system sample and when changed.

Other events which require chart markings at non-RAIL equipped transmitting stations are:

- Correlated numbers and tolerances during periods of Bravo Local and Delta Local control.
- Changes in assigned parameter values.
- Receiver and chart alignment and calibrations.
- As directed by the COCO, Commanding Officer, or Officer in Charge.

The reduction in required chart markings does not relieve transmitting station personnel from reviewing their charts in a timely manner.

Oscillator Records

Station personnel will generate an Excel spreadsheet for each 5071 oscillator. These spreadsheets are a detailed history of the standard and shall remain for the life of the Oscillator.

The following shall be entered in the spreadsheet:

- Weekly Oscillator meter readings
- Any steering adjustments
- Any abnormal Oscillator operations

Note:

See Appendix C, Tab 4 for an example of spreadsheet

Transmitting Station Records, Continued

Distribution Amplifier Log

Each transmitting station shall establish a Distribution Amplifier Logbook. This Logbook shall be used to record the following:

- Distribution Amplifier Levels as displayed on the front panel meter
- Weekly Distribution Amplifier meter readings
- Any adjustments
- Any abnormal Distribution Amplifier operations

Note

This Logbook is historical in nature and must be retained.

Transmitter Maintenance Log

Each transmitting station shall establish a Transmitter Maintenance Logbook. This Logbook shall be used to record the following:

- Dated narrative summary of all maintenance performed
- Daily Transmitter readings

Note

This Logbook is historical in nature and must be retained.

Transmitting Station Records, Continued

Transmitting Station General Records Retention

The records, logs, charts, RAIL data, and teletype rolls held by the transmitting station shall be retained as outlined in below. When any doubt exists as to retaining the material, consult NAVCEN before disposition. All records are considered the property of NAVCEN.

Record Retention Table

The table below provides further information on record retention.

Record Retention Table	
Document	**How long to retain**
RAIL data	3 Years
Charts/ Teletype Roll	1 Year
Station Logs	3 Years
LSOS Printer Roll	3 Years
TELCO Outage Log	3 Years
Operations Data Request if used for litigation	10 Years
COCO Monthly Reports	Permanent
Simple UUT Analysis	Permanent
Detailed UUT Analysis	Permanent
Distribution Amplifier Logbook	Permanent
Transmitter Maintenance Log	Permanent
Unit award/recognition	Permanent
Notch Filter Amplitude vs Frequency Plots	Permanent
Technical Archive	Permanent

Note

1. Stations shall archive the data on the RAIL system at least monthly and retain the media for three years. Archive will be completed with 5 working days at the beginning of the month.

2. Permanent is 5 years after the station is closed.

Transmitting Station Records, Continued

Transmitting Station Historical Records Retention

Historical Records are defined as records that explain significant events involving chain operations. Any document recording events of historical significance will be retained as long as a transmitting station exists. Contact COCO for direction if there are any questions on the historical value of any documents. Disposition instructions for historical records will be provided in the Operational Order when a transmitting station is decommissioned.

Section B

Casualty Reporting Procedures

Casualty Reporting

Overview

The reporting of equipment casualties and their repair status is necessary to notify others of decreased operational capabilities. This is also used to ensure COCO, NAVCEN, and the electronics or civil engineering support units get sufficient data to properly evaluate the casualty.

Message Precedence and Release Time

All Casualty Report (CASREP) messages will be sent with Priority Precedence.

CASREPs will be sent when:

- Repair will take longer than four hours.
- Repair is beyond the capability of the transmitting station/monitor site maintenance personnel.
- Outside assistance is required.

Routing

All CASREP messages, which include Initial, Update, Correct and Cancel will be sent to NAVCEN/NAVCEN Western Operations Detachment.

ESU, CEU, MLC, ELC or LSU will be listed as an Action addressee as required for assistance, otherwise; they will be listed as Info addressees.

ELC Baltimore will be included as an action addressee on all CASREPs requiring parts.

Note

See COMDTINST M3501.3 (series) for more information.

CASREP Categories

CASREP categories used for most casualties are listed below:

- **Category 2** -- CASREPs that are minor in nature or do not require personnel to remain on board are CAT 2.
- **Category 3** -- CASREPs that have major operational impact or require personnel to remain on board are CAT 3.

Casualty Reporting, Continued

Requesting Assistance

If assistance is required, use the Amplifying Remarks line to explain who you need the assistance from, what type of assistance is required.

Canadian Coast Guard CASREP Instructions

Canadian Stations are not under the U.S. Navy's Readiness condition reporting system. However, reporting of equipment casualties and their repair status is necessary to notify NAVCEN/NAVCEN Western Operations Detachment of decreased operational capabilities.

Note

Canadian Loran Stations will follow their local instructions for CASREP message content and formatting.

Discrepancy Report (DISREP)

Discrepancy Reports are used to inform the appropriate Civil Engineering Unit of a major problem with the transmitting station building(s), grounds, and auxiliary systems.

Section C

Unusable Time (UUT) Notification and Analysis

UUT User Notification

Overview

COCO issues UUT User Notification messages to protect the users and notify OPCON of Out-of-Tolerance conditions. If a casualty is ongoing, COCO will provide an estimated time of repair.

User Notification Requirements

A UUT User notification message is required for:

- Any period of Out-of-Tolerance **without blink** of **2 minutes** or **greater.**
- Any period of Out-of-Tolerance **with blink** or unscheduled Off-Air **30 continuous minutes** or greater.

Note
Appendix D contains examples of the User Notification messages.

UUT Analysis

Overview

A UUT Analysis is required and is used to determine the cause(s) of extended UUT. The analysis will document the cause of the UUT and any recommended corrective measures.

UUT Analysis Requirements

A UUT Analysis is required when:

- Any period of Out-of-Tolerance **without blink** in excess of **5 minutes**.
- Any period of Out-of-Tolerance **with blink** or unscheduled Off-Air exceeding **1 hour.**

UUT Analysis, Continued

Types of UUT Analysis

When a UUT Analysis is required, COCO will determine the type of analysis that is to be completed. The two type of UUT Analysis are:

- Simplified
- Detailed.

Criteria for Simplified UUT Analysis

A Simplified UUT Analysis may be used if a UUT event meets the following criteria:

- The UUT event is easily explained in a brief paragraph
- Documentation; (e.g., RAIL charts, logs, statements, etc), would merely confirm the explanatory paragraph vice being necessary to the explanation
- Problem areas and corrective actions, if any.

Simplified UUT Analysis

This report will be submitted via letter to the Operations Officer with copies to the affected control station(s) and transmitting station(s) within 5 working days of the UUT event.

Simplified UUT Analysis Report Content

The letter will contain the following information:

SUBJ: *Brief description of UUT event*.

1. This report is submitted in lieu of a formal analysis.
2. Nature Of Event
3. Station(s) Involved
4. Date/Times Of Event
5. Narrative Summary
6. Corrective Action Recommended/Taken
7. CASREP's

Simplified UUT Analysis Review Process

The Operations Officer will review each letter report. If the review indicates a Detailed UUT Analysis is required, COCO will be directed to prepare one. Significant events will be briefed to the Commanding Officer as soon as practicable.

UUT Analysis, Continued

Detailed UUT Analysis Submission

This report will be submitted via letter to NAVCEN Operations Officer with copies to the affected control station(s) and transmitting station(s) within 30 working days of the UUT event.

Note

This Detailed UUT Analysis format cannot be used if punitive action under the UCMJ is anticipated. If punitive action is probable, stop working on the Detailed UUT Analysis and request an Investigating Officer. Under no circumstances may a statement be obtained from parties to an investigation without following the procedures for advising the members of their rights.

Detailed UUT Analysis Criteria

If the complexity of the abnormality precludes a brief explanatory paragraph or requires documentation (e.g., RAIL charts, logs, statements, etc) a Detailed UUT Analysis is required.

UUT Analysis, Continued

Detailed UUT Analysis Report Format

The letter shall be formatted in 3 Sections as follows:

Section 1 -- Describes the event chronologically. This section shall be a factual presentation of the event. Do not offer opinion/conclusions or corrective action requirements in this section. Simply stating, "1603Z M Off-Air", is not sufficient. Describe in detail all events and their causes.

- **Example** – " 1603Z M Off-Air, Transmitter #1 failure. Log entries state the cause was failure of CB1. Transmitter #2 inoperative due to previous failure of primary power feed cables".

Section 2 -- Contains opinions/conclusions concerning the event. Opinions/conclusions shall be supported by reference to the initial section and the appropriate enclosure(s).

- **Example** – " The watchstander was clearly inattentive and failed to respond properly to the situation (Encl's 1, 2 and 4)".

Section 3 -- Will address corrective action. After careful review, COCO will identify any problem areas. Once identified, COCO will determine the appropriate corrective action. Corrective actions will fall in one of the three categories listed below:

- Recommended, i.e., beyond COCO's scope of authority.
- Taken, i.e., those which have already been implemented. Indicate when and what action was taken.
- Planned, i.e., those which Operations Division Chief plans to implement. Include an estimate of when and what action will be taken.

Detailed UUT Analysis Review Process

The Operations Officer will review these reports. A response will be provided within 15 working days after receipt of the Detailed UUT Analysis report. Significant and unusual events will be briefed to the Commanding Officer as soon as practicable.

UUT Analysis, Continued

Detailed UUT Analysis Report Enclosures

Specifics regarding each type of enclosures are as follows:

Enclosure 1 -- Transmitting Station CO/OIC/Station Leader Analysis of the UUT event: Include information that provides useful information. The determination as to what constitutes "useful" information is left to the judgment of COCO.

Enclosure 2 -- Statements of involved personnel: These can be very informative regarding the course of a UUT event. The following are required:

- Statements will be typewritten, signed, and dated.
- If a statement is vague or poorly written, return it to the transmitting station and require that it be rewritten and resubmitted.
- All involved USCG personnel shall submit a statement to COCO with a copy to the local command. COCO will determine who shall be considered "involved".
- COCO will request all involved host nation personnel submit a statement via the station leader. Again, COCO will determine who shall be considered "involved".

Enclosure 3 -- Logs and RAIL data: As with the other sections, forward only the relevant portions of the logs and RAIL data. The following instructions apply:

- Ensure RAIL printouts are clear and easily legible. If the station must forward originals, advise them to annotate their records with the location of the missing sections.

Section D

AUTM/EUTM

Authorized Unusable Time

Overview

Authorized Unusable Time (AUTM) causes more loss of service to the users than any other factor. However, by close supervision and control, AUTM can be kept to the minimum necessary to accomplish needed maintenance, training, and testing. Approving authorities must weigh the transmitting station's occasional need for AUTM against the loss of service to the user. Service to the user must take priority.

Definitions

AUTM: This is necessary for routine maintenance, training or testing. Failure to perform this maintenance, training, or testing will not immediately jeopardize the transmitting station's operational mission. The approving authority must determine if there is sufficient time to solicit objections and receive responses. The decision process must also take the reason for the AUTM into account. If the reason for the AUTM is urgent (e.g. needed repairs or contractor work that cannot be rescheduled) then the minimum times will be used. The minimum times are:

AUTM request received at least 10 days prior to the AUTM.

Solicitation of objections deadline to be at least 3 days prior to the event.

EUTM. Emergency Unusable Time (EUTM) is necessary for urgent equipment maintenance. Failure to perform this maintenance will jeopardize the transmitting station's operational mission

Authorized Unusable Time, Continued

Requesting AUTM

A transmitting station requiring an AUTM shall make the request by routine message 45 days prior to the requested time. The request shall be Action addressed to the applicable COCO. Information addressees shall include, NAVCEN, NAVCEN Detachment, MLCLANT, MLCPAC, CEU, LSU, and ADCON as appropriate.

The message shall include:

- Exact nature of the work to be performed.
- Date requested and the alternate date.
- Absolute minimum time required.
- Impact on transmitting station operations and/or equipment if the request is denied.
- The requesting message shall contain the name, address, and phone number for any POCs involved (including contractors).

Requesting EUTM

EUTM is required for emergency repairs and cannot be delayed. A transmitting station requiring EUTM shall make a request to COCO as soon as the need is known. In addition to the information required for EUTM, the request shall include a statement of the impact if the EUTM is delayed beyond 10 days.

AUTM Proposal/User Objections

COCO will send an AUTM proposal message at least 30 days before the requested date. This message will advise the District Office to issue to appropriate information in the Local Notice to Mariners (LNM). The message will also instruct the Navigation Information Service (NIS) watch to include the appropriate information on the NAVCEN Web Site. Users will be notified that objections will be considered up to 5 days prior to the event and provide a point of contact.

Authorized Unusable Time, Continued

Approval of AUTM

Approval of AUTM will normally be granted by message. COCO shall notify users of the AUTM, by priority message, 5 days prior to the event. When the transmitting station returns On-Air and the actual time of the AUTM period varies by more than 5 minutes from the advertised time, COCO will send a message advising the users of the total AUTM. If more than one chain is involved (i.e., a dual-rated LORSTA), the primary COCO will normally send a message with the times for both rates.

Approval of EUTM

Approval of EUTM shall normally be granted by message. If approval is passed by telephone, a follow-up confirmation message shall be sent as soon as possible. COCO shall notify users of EUTM, by priority message. If the EUTM will require UUT before a message can disseminated (less than 12 hours), COCO will contact the impacted District Operations Centers. COCO will ensure there are no ongoing Search and Rescue (SAR) cases that would be impacted by the loss of Loran. When the transmitting station returns On-Air and the actual time of the EUTM period varies by more than 5 minutes from the advertised time, COCO will send a message advising the users of the total EUTM. If more than one chain is involved (i.e., a dual-rated LORSTA), the primary COCO will normally send a message with the times for both rates.

General Rules for AUTM Messages

- 30 days prior to the event a Proposal Message is sent by COCO to solicit objections from users.
- User response must be received 5 days prior to the AUTM.
- 5 days prior to the AUTM, COCO sends a notification message that the AUTM has been granted and will occur.
- A notification message shall be sent if:
  - The alternate date will be used vice the originally scheduled date.
  - The AUTM is canceled.
  - The AUTM is rescheduled to another date other than the alternate date.

NOTAM

COCOs shall ensure appropriate NOTAMs are issued prior to AUTM/EUTM events.

Authorized Unusable Time, Continued

Post AUTM/ EUTM Notification

When the transmitting station returns On-Air and the actual time of the AUTM period varies by more than 5 minutes from the advertised time, COCO will send a message advising the users of the total AUTM. If more than one chain is involved (i.e., a dual-rated LORSTA), the primary COCO will normally send a message with the times for both rates.

Sample AUTM Message

Appendix D contains examples of AUTM messages.

Chain Specific Additional Notification

In some instances, the FAA uses Loran-C as the primary clocking on their telecommunications systems. For this reason, ensure the following PLADs are included on messages pertaining to AUTM and EUTM.

FAA ALASKAN RGN HQ ANCHORAGE AK//AAL-470/AAL-530//
FAA ANCHORAGE ARTCC ANCHORAGE AK//MCC/MCC-ANICS//

Section E

Training and Qualification Programs

Overview

Introduction

Training is the most effective method to eliminate personnel error as a source of UUT. The importance of a good training program cannot be over emphasized.

Training Responsibilities

ADCON

ADCON responsibilities include training in all aspects of transmitting station operations that do not specifically pertain to Loran operational/technical matters. The ADCON Training Officer is responsible for reviewing all training requests for Class "C" and commercial schools.

Headquarters Program Manager

The Program Manager (G-OPN) is responsible for coordinating the Officer in Charge and RNAV Engineering Course. The Program Manager also coordinates the training for personnel assigned to NAVCEN including COCO.

OPCON

NAVCEN shall ensure that operating and training standards are met, support resources are adequate and training is uniform among Loran Chains. TQC coordinates all requests for CO/OIC/XPO training for newly assigned transmitting station personnel.

COCO

COCO will review each transmitting station's training program and training records for compliance with current instructions. COCO will also advise OPCON/ADCON on the adequacy of all operational training.

Training Responsibilities, Continued

Transmitting Station CO/OIC and Control Station Supervisor

The Transmitting Station CO/OIC/Control Station Supervisor will:

- Ensure the unit has a documented training and qualification program for watchstanders, technicians and engineers.
- Ensure Informal and On-the-Job training (OJT) is documented and conducted weekly.
- Review all periods of Unusual Time (UUT) for possible training deficiencies.
- Newly assigned personnel are scheduled for formal training.

CONUS Transmitting Station Personnel

All transmitting station personnel will be qualified as a Safety Observer, Loran Watchstander, and Engineering Watchstander. All Electronics Technicians will be qualified Duty Technicians.

OCONUS Transmitting Station Personnel

All transmitting station personnel will be qualified as a Safety Observer. All Electronics Technicians will be qualified Loran Watchstanders and Duty Technicians. All engineering personnel will be qualified as Duty Engineers. Additional qualifications are at the discretion of the OIC/CO.

Control Station Personnel

All control station personnel will be qualified as a Safety Observer and Loran Watchstander. All senior Electronics Technicians will be qualified Duty Technicians.

Types of Training

Formal

Formal training refers to classroom courses available on equipment or systems. Class "C" courses for Loran equipment are listed in COMDTINST 1540.6 (series). Commercial sources may also be utilized for formal training.

Informal

Informal training must be properly documented and consists of the following:

- **Unusable Time (UUT) Review** – All UUT will be reviewed during scheduled training. All control and transmitting station watchstander actions will be reviewed and any lessons learned from the casualty will be discussed. This will also be a review of operations and assist in identifying training deficiencies.
- **Lectures** – Lectures will cover all station systems, equipment, and station operations. The individual assigned to provide the training will develop or update an existing lesson plan as outlined below.
  - Title
  - Author
  - Date
  - References
  - Purpose
  - Objectives
  - Body of the lecture
  - Test of knowledge or skill.
- **OJT** – Every effort should be made to combine the lectures with practical experience. During watches and while performing maintenance, every effort will be made to provide all personnel with as much practical experience as possible.

Note

1. Appendix E contains the minimum training requirements.
2. OJT is not to be considered part of the scheduled training.

Drills

Transmitting stations will conduct Casualty Recovery Drills at least one hour per week.

Note

Drills cannot be used in place of lectures.

Operational Training Requirements

Training Topics

The topics listed in Appendix E are the minimum requirements for a unit-training program. Transmitting Station COs/OICs and Control Station Supervisors will ensure their training program includes lectures, OJT, and drills on all systems and equipment at their unit. The Appendix is divided into control and transmitting station topics then further divided into technician, watchstander and safety observer. Transmitting Station COs/OICs and Control Station Supervisors shall use this list of training topics as a guideline in developing and administering a training program to meet their specific needs.

Training Schedule

Stations will develop an annual schedule of training. Training will be held a minimum of **1 hour** a week. Training will consist of the UUT review and scheduled lectures. Monthly schedules will be posted at least one month in advance to allow the instructor enough time to prepare. The schedule will include the date, topic and the name of the assigned instructor.

Periodic Evaluation

Periodic testing will be used to measure and evaluate the effectiveness of the Unit operational training program. Transmitting Station COs/OICs or the Control Station Supervisors will identify the training deficiencies beyond the unit's capability to correct. The Transmitting Station CO/OIC or the Control Station Supervisor will request assistance from NAVCEN via COCO outlining the deficiencies and the impact on operations. NAVCEN will evaluate the deficiency and forward any recommendations to the appropriate program manager as needed.

Operational Training Requirements, Continued

Training Records

Individual Training Records. Standardization of individual training records is necessary to permit an orderly review of training accomplished and to evaluate the effectiveness of the unit training program. Individual training records shall be maintained for all personnel in folder CG-5285. Officers shall maintain their own training records. All members shall hand carry their training records between units. The individual training record shall be structured as follows:

1. **Inside Front Cover**–Personal Profile form & Completed indoctrination check-off sheets.

2. **Section I** - Copies of Administrative Remarks (CG-3307) regarding PQS/JQR qualification and/or re-qualification. Copies of Individual's Record of Small Arms Training (CG-3029A). This section will contain a copy of all qualification checklists completed by the individual. This section will contain a copy of all qualification letters held by the individual.

3. **Section II** - Formal school completion letters or certificates. Copies of correspondence course completion letters.

4. **Section III** - Copies of Performance Based Qualifications including practical factors for the individual’s rating and military requirements. These forms are the responsibility of the individual to ensure they are completed. Sheets and correspondence related to advancement or promotion.

5. **Section IV** - Record of lectures attended on general military training, departmental/divisional training or those associated with professional development programs (law enforcement, OOD training, etc.). This section will contain a listing, including dates, of all lectures, drills, and OJT attended by the individual. Test scores should be included if applicable.

6. **Section V** - Miscellaneous training records and information. This section will contain copies of course completion certificates, college transcripts, and any other material relevant to the continuing education of the individual.

Qualification Program

Overview

To qualify as watchstanders, individuals must satisfy the Transmitting Station CO/OIC or Control Station Supervisor that the integrity of the station and the Loran system will be maintained during their watch.

Check-off List

At a minimum, the watchstander will complete the appropriate qualification checklist. The minimum qualification requirements are listed in Appendix E.

Certification Exam

The Transmitting Station CO/OIC or Control Station Supervisor will administer a certification exam to each watchstander as part of the qualification program. The exam will cover all aspects of the watchstanders responsibilities.

Duty Personnel Qualification

Qualified watchstanders must posses a thorough knowledge of the Loran system, station equipment, and their responsibilities. They must demonstrate proficiency in routine tasks and casualty recovery procedures. The Transmitting Station CO/OIC or Control Station Supervisor will certify each watchstander in writing. A copy of the qualification CG-3307 will be placed in the individual's training record. The individual has the responsibility to remain proficient in their duties. The Transmitting Station CO/OIC or Control Station Supervisor will ensure personnel maintain their proficiency by periodically reviewing each watchstanders performance.

COCO Evaluation

During inspections, COCO will verify each individual's certification by conducting drills and administering a written or practical exam. COCO will evaluate the training program effectiveness and documentation. COCO will recommend changes in the training program as needed. COCO will also recommend re-certification of any duty personnel not meeting performance standards.

Qualification Program, Continued

Revoking Duty Qualification	The Transmitting Station CO/OIC or Control Station Supervisor will remove, in writing, an individual's certification at any time an individual's performance is unsatisfactory. Continued unsatisfactory performance will be documented by CG-3307 and entered into the individual's records.
Re-Qualification Procedure	The Transmitting Station CO/OIC or Control Station Supervisor will implement a training schedule to restore the individual's proficiency required to regain certification. Once the individual meets the required performance standards, they will be certified in writing.

Section F
Personnel

Overview

Introduction

Most personnel issues are addressed by ADCON. This section provides further clarification on the responsibilities of OPCON regarding personnel matters.

CO/OIC Evaluations

Transmitting Station CO/OIC Personnel Evaluations

To ensure the transmitting station CO/OIC evaluations reflect their performance, NAVCEN/COCO will provide a set of recommended marks with a detailed narrative supporting the marks to ADCON.

Off Duty Employment

Off Duty Employment Guidelines

Active duty Coast Guard personnel are in a 24-hour duty status. However, subject to certain conditions outlined in the Coast Guard Personnel Manual, COMDTINST M1000.6 (series), personnel may engage in legitimate and ethical employment during their off-duty hours. Personnel who accept off-duty employment must realize that although they are on liberty or leave, they are subject to recall at any time. At no time will off-duty employment interfere with the unit's mission.

Request for Approval for Off Duty Employment

Personnel shall not seek nor participate in employment outside the Coast Guard duties without the express written permission of the Transmitting Station CO/OIC or Control Station Supervisor. Requests made by the Transmitting Station CO/OIC will route their requests to ADCON via COCO. Requests will be made by letter.

Section G

Awards

Operational Performance Award

Transmitting Station Operational Performance Award

The objective of the Transmitting Station Operational Performance Award is to recognize operational performance that results in outstanding signal availability to the user, beyond the published signal availability goal of 99.9%. This award recognizes outstanding operational performance associated with the transmitting stations and is not intended to replace personal, unit or team awards.

Award Submission

COCO shall continually monitor transmitting station operational performance, and collect information from the LOIS database to evaluate whether a station meets the criteria for the Transmitting Station Operational Performance Award. Once an award is earned, the appropriate COCO shall prepare a congratulatory memo for signature by the Commanding Officer or designated representative and an award plaque (or brass plate) to the station.

Award Criteria

- Signal Availability of 100% for a 90-day period for a single rate(rolling window starting from end of last award period or disqualifying UUT, dual-rated stations may qualify for concurrent awards for each rate).
- Unusable time due to AUTMs, solar interference, weather or control station difficulties are not counted against the station.

Control Station Operational Performance Award

This establishes a control station Operational Performance Award program. The objective of the control station Operational Performance Award is to recognize performance that results in a perfect performance record. This award recognizes outstanding operational performance. It is not intended to replace personal or team awards.

Award Submission

The COCOs, with assistance from the Control Station Supervisors, shall monitor control station operational performance to evaluate whether the control station meets the criteria for the award. Once an award is earned, the appropriate COCO shall prepare a congratulatory memo for signature by the Commanding Officer or designated representative and an award plaque (or brass plate) to the station.

Award Criteria

- No period of unusable time attributable to personnel error for a 90-day period (rolling window starting from end of personnel error or the end of the last award period).
- This award is for the entire Control Station, not just one rate or baseline as was done in the past. However, Petaluma and Alexandria will be considered two separate units for award purposes.

Non-Operational Awards

Unit Awards

Because of special circumstances, events, or exceptional performance, a transmitting or control station may be deserving of special recognition. On these occasions, the COCO may initiate recognition via official correspondence (e.g.. letter from District or Area Commander), or recommend a Coast Guard Unit award IAW of the Medals and Awards Manual, COMDTINST Ml650.25

Multiple Awards

Receipt of a Unit award does not prohibit a deserving individual from receiving a personal award, nor does it prohibit a group of individuals from receiving a Team award, nor does it prohibit a transmitting station or control station from receiving an Operational Performance Award.

Section H

Station Visits/User Inquiries

Station Visits

Public Affairs

The public, media, personnel from other government agencies, or other USCG entities may visit the stations. These visits may be for the purpose of conducting measurements, indoctrination, training, or simply familiarization with Loran system operations. Unit personnel may be asked questions that are beyond their ability or authority to answer. In these cases, contact the ADCON Public Affairs Officer for guidance. Requests for media interviews or transmitting station visits will be coordinated with the ADCON Public Affairs Officer.

User Inquiries

User Inquiries

From time to time control and transmitting stations will receive requests to obtain operational data or conduct field tests. All user inquiries will be forwarded to COCO.

Simple Data Request

COCO may respond to simple, easily met requests for data as they occur. An example of such a request would be for information that is on the chain data sheet or coverage diagram. These requests will be forwarded to NIS.

Operational Data Request

Requests made to COCO for operational data or field tests (including extension of an already approved test period) will be forwarded to the CO NAVCEN via the Operations Division Chief. When the CO NAVCEN has verified that the material should be released, COCO will provide the information. Generally, the control station will be tasked to provide an affidavit concerning the operational performance of a particular Loran signal or baseline.

User Inquiries, Continued

Minimum Information for Requests

The minimum information necessary to process a request is:

- Name, address, and telephone number of requestor
- What data or testing is desired
- How will the data be used
- If testing, what is being tested and why
- When is the data or testing required and for how long
- What is the impact if the data or testing is not provided

Request for Uninterrupted Operational Periods

Organizations may request that operations be carried out with no unnecessary interruptions to the Loran signals. Generally, the transmitting stations from which the signals originate will not be allowed to perform any planned maintenance, transmitter shifts, or any other equipment change or adjustment which will affect the On-Air signal during the requested period. If operations are adversely affected at anytime during the period, the action requested will be immediately suspended, corrective action and **blink** begun if necessary, and COCO will be notified. The requestor will be contacted and advised of the difficulty in complying with their request. Alternate actions or times maybe scheduled.

Affidavit

The Coast Guard may be required to provide definitive statements regarding Loran signal stability and usability for use in litigation.

Note

Appendix D contains an example of an Affidavit.

Witnesses

All requests for expert witnesses will be referred to the CO NAVCEN. The Coast Guard does not provide expert witnesses except in very rare instances.

Section I

Operational Reports

Reports

Overview

Reports are used to manage chain operations, identify problem areas and trends, and develop corrective measures.

Monthly Report

After the end of each calendar month, COCO will prepare the monthly report of chain operations. The format of the report is set forth in two sections:

- **Section One –** LOIS Long Term Detailed Report, Chain CASREP status and timing information, and LOIS Unusable Time Reports for each station within the chain.
- **Section Two –** Graphs for synchronization, envelope and all oscillators within the chain.

Note

The Monthly report shall be sent to the Operations Division Chief. Copies of the report will be forwarded to all stations in the chain, ADCON, Systems Management Loran Branch Chief and to the COCO for the other chain for all dual rated transmitting stations.

Monthly Report Format

The format for the Monthly Report is contained in Appendix D. Each field of the report also has an explanation of the information needed in the report.

Reports, Continued

Report of Interference to Loran

A message will be sent to COCO to notify OPCON of any harmful interference. The message format is:

R (Date Time Group)
FM (Unit making report)
TO COCO
INFO (All other control and transmitting stations in the chain(s))
BT
UNCLAS //N16577//
SUBJ: INTERFERENCE TO LORAN
A. LORAN OPERATIONS MANUAL

1. Baseline(s) affected
2. Degree of interference: annoying. Marginal or disruptive and Chart peak-to-peak activity
3. Inclusive dates and (GMT) times of the interference
4. Offending transmitting station data, report only if known
5. Call sign
6. Frequency
7. Location
8. Signal strength at the receiving site.
9. Equipment used for measuring signal strength
10. Remarks or comments pertaining to the interference.

COCO Actions

COCO will attempt to locate the interfering source and resolve the issue. It may be necessary to set permanent notches in the monitor receiver.

Reports, Continued

Report of Interference from Loran	Control and transmitting stations receiving reports of interference to other entities from Loran will forward the report to COCO.
COCO Actions	After contacting the entity reporting the interference, COCO will request LSU assistance to resolve the issue.

Section J

Operational Inspection Program

Station Inspection

Overview

Periodic inspections/visits are necessary to determine the transmitting and control stations' operational readiness and to identify problem areas or trends before they adversely impact operations. Inspections/visits are intended to help the transmitting and control stations perform their mission.

Schedule

COCO shall inspect all USCG Loran transmitting and control stations at least annually. The Transmitting and control stations' CO/OIC/Station Leader, all technicians, and all watchstanders will be onboard for the duration of the inspection visit. Any conflicts with leave or TAD must be brought to the attention of the inspector prior to their arrival.

Inspection Check-off List

Inspecting Officers will use the current version of the Quality Assurance Checklist.

Pre-Inspections

Approximately 45 days prior to arrival, COCO will provide the transmitting station with a copy of the current check-off list, and advise the dates of the inspection/visit. Transmitting stations will complete the administrative sections of the checklist and provide the working copy to the inspection party upon arrival. If inspecting a transmitting station, COCO has the option to send an AUTM Proposal message for a two-hour period. This AUTM period would be used for transmitting and control station casualty recovery training.

Station Inspection, Continued

Inspection Procedures

The inspecting officer will brief the transmitting station CO/OIC/station leader/control station supervisor on the inspection schedule. The transmitting or control station supervisor and inspector will coordinate their activities to ensure minimum disruption to operations.

Outbrief

Upon completion of the inspection/ visit, the inspecting officer will meet with the Transmitting Station CO/OIC/Station Leader/Control Station Supervisor and provide a summary of the inspection findings.

Inspection Weighting Factors

The weighting factors are intended to provide an objective basis for the fair evaluation of transmitting station performance. The Inspecting Officer shall use the weighting factors listed in the Quality Assurance Checklist as a guide when computing the rating of the transmitting station.

Note

These are coarse rating schemes and will not solely determine the transmitting station's final grade. In all cases, inspectors shall use good judgment and common sense in assigning the weighting factors for the transmitting stations.

Inspection Ratings

The ratings specified in the table below provide an objective basis for the fair evaluation of a transmitting station. Inspecting officers shall use the weighting factors as directed in the Quality Assurance Checklist when assigning inspection rating.

Inspection Ratings Table

The table below provides further information concerning Inspection ratings.

Rating	Factor Scores
Outstanding	4.50-5.00
Excellent	3.50-4.49
Satisfactory	2.01-3.49
Unsatisfactory	1.01-2.00
Fail	0.00- 1.00

Station Inspection, Continued

Inspection Report

The inspecting officer will submit a transmitting station inspection report to the inspected transmitting station with copy to the Operations Officer within 15 working days. The report shall include the following:

- A cover letter addressing overall unit evaluation, material condition, personnel, training, administration, and supply. Include a brief summary of procedures performed and any problems encountered.
- A list of discrepancies/action items with the responsible entity
- The completed checklist
- Supporting photographs, drawings, graphs, charts, printouts, and other appropriate documentation if available.

Action Item Follow-up

Within 30 days following the receipt of the inspection report, the transmitting station shall provide the COCO with a letter concerning the status of all action items. This report shall be required every 30 days thereafter until all action items have been completed.

Follow-up Visits

A follow-up visit will be made to any transmitting station that receives a rating of Unsatisfactory or below. This visit will be made approximately six months after the inspection.

Station Inspection, Continued

Inspection Report

The inspecting officer will submit a control station inspection report to the inspected Control Station Supervisor with copy to the Operations Officer within 15 working days. The report shall include the following:

- A cover letter addressing overall unit evaluation, material condition, personnel, training, administration, and supply. Include a brief summary of procedures performed and any problems encountered.
- A list of discrepancies/action items with the responsible entity
- The completed checklist
- Supporting photographs, drawings, graphs, charts, printouts, and other appropriate documentation if available.

Action Item Follow-up

Within 30 days following the receipt of the inspection report, the control station shall provide the COCO with a letter concerning the status of all action items. This report shall be required every 30 days thereafter until all action items have been completed.

Follow-up Visits

A follow-up visit will be made to any control station that receives a rating of Unsatisfactory or below. This visit will be made approximately six months after the inspection.

Section K

Technical Archives

Library

Overview It is vital that each transmitting station maintains a file of technical archives.

Technical Archive

Each station will maintain a technical archive consisting of:

- Trip/Inspection reports including tower inspections
- Certification Reports
- Frequency Scans
- Notch Filter Scans
- Installation Reports
- LORDAC/Signal Specification Test results.
- Civil Engineering Project Reports

SMEF Advisories

The SMEF Advisory may direct transmitting station personnel to place a copy in the affected technical manual(s).

Note

A copy of all SMEF Advisories will be kept in Appendix I.

SMEF Advisories may also be found on the LSU web site.

Section L

NAVCENINST M16562.1 (series) Changes

Procedure

Changes to The Loran Operations Manual, NAVCENINST M16562.1 (series), shall be submitted action to the respective COCOs in electronic format. Information copies will be sent electronically to all other COCOs, the Operations Officer, and the Assistant Operations Officer. Submissions will address items (1) through (3) below and include the submitter's analysis of benefits and risks which may be encountered with implementing the proposed change.

The submitter's primary COCO shall prepare the following:

(1) The affected text of NAVCENINST M16562.1 (series),
(2) The proposed text of NAVCENINST M16562.1 (series),
(3) Other COMDTINST or directives by higher authority that may be affected,
(4) A synopsis of the benefits, risks, and comments received, and
(5) Copies of received comments.

The Primary COCO will gather comments from the other COCOs and send these for action to the Operations Officer. The Operations Officer will be responsible for briefing the Commanding Officer.

Submitters shall take particular care to specifically identify the portion(s) of NAVCENINST M16562.1 (series) for which a change is sought and identify those portions of COMDTINST M16500.13 (series), COMDTINST M10550.25 (series), and any other instructions issued by higher authority (e.g. District Instructions) that may be affected by the suggested change.

The package will be forwarded to the Commanding Officer via the Executive Officer. The Operations Officer is responsible for incorporating any changes into NAVCENINST M16562.1 (series) approved by the Commanding Officer.

Chapter 10

Acronyms & Abbreviations

A1	Alpha-1 Monitor
A2	Alpha-2 Monitor
ABS	Automated Blink System
ACQ	Acquisition
AECD	Assigned Envelope-to-Cycle Difference
AIG	Address Indicator Group
Alpha	Alpha Control
ANMS	Automated Notices to Mariners System
Ant Curr	Antenna Current
ARTCC	Air Route Traffic Control Center
ARU	Alarm Repeater Unit
ASF	Additional Secondary Factors
ATON	Aid to Navigation
AUTM	Authorized Unusable Time
BK	Blink
BL	Baseline
BLL	Baseline Length
Bravo	Bravo Control
CASREP	Casualty Report
CCG	Canadian Coast Guard

Acronyms & Abbreviations, Continued

CCTD	Cross Chain Time Difference
CCZ	Coastal Confluence Zone
CD	Coding Delay
CEC	Canadian East Coast Loran Chain
CEP	Circular Error Probable
CFR	Code of Federal Regulations
Charlie	Charlie Control
CINCNORAD	Commander-In-Chief North American Defense
CO	Commanding Officer
COCO	Chain Operations Control Officer *formerly* Coordinator Of Chain Operations
COMDTINST	Commandant Instruction
COMLANTAREA	Commander Atlantic Area
COMMS	Communications

Acronyms & Abbreviations, Continued

COMPACAREA	Commander Pacific Area
CONPOL	Control Policy
CORRECT	Casualty Correction
CPR	Cardiopulmonary Resuscitation
CPU	Central Processing Unit
CS	Control Station *also* Cesium
CSECD	Controlling Standard Envelope-to-Cycle Difference
CSTD	Controlling Standard Time Difference
CW	Continuous Wave
CWC	Canadian West Coast Loran Chain
Delta	Delta Control
DESLOT	De-Energized Standby Loran Transmitter
DLR	Depot Level Repairable
DMAHTC	Defense Mapping Agency Hydrographic and Topographic Center
DOD	Department Of Defense
DOS	Department Of State
DOT	Department Of Transportation
DHS	Department Of Homeland Security
DR	Dead Reckoning

Acronyms & Abbreviations, Continued

DTG	Date Time Group
E/GICP	Electronics/General Inventory Control Point
ECD	Envelope-to-Cycle Difference
ED	Emission Delay
EDD	ECD Deviation
ELC	Engineering Logistics Center, Baltimore, MD
ECDN	ECD Nominal
ENV	Envelope
ECDCR	ECD Correction Value
ESD	Electronic Systems Support Detachment
ESU	Electronic Systems Support Unit
ET	Electronics Technician
ETA	Envelope Timing Adjustment
EUTM	Emergency Unusable Time
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FRP	Federal Radionavigation Plan

Acronyms & Abbreviations, Continued

fs/s	femtosecond per second
FSS	Flight Service Station
GD	Gain Deviation
GLKS	Great Lakes Loran Chain
GMT	Greenwich Mean Time
GOA	Gulf Of Alaska Loran Chain
GPS	Global Positioning System
GRI	Group Repetition Interval
HCG	Half-Cycle Generator
HDOP	Horizontal Dilution of Precision
HF	High Frequency
HMI	Hazardous & Misleading Information
HQ	Headquarters
Hz	Hertz
I	Current
I/F	Interface
I/O	Input / Output
IAIN	International Association of Institutes of Navigation
IALA	International Association of Lighthouse Authorities

Acronyms & Abbreviations, Continued

IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
ISSA	Interservice Support Agreement
JMSA	Japanese Maritime Safety Agency
K	Kilo
KHz	Kilohertz
LANTAREA	Coast Guard Atlantic Area
Lat	Latitude
LCCS	Loran Consolidated Control System
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEN	Local Envelope Number
LF	Low Frequency
Long	Longitude
LOIS	Loran Operations Information System
LOP	Line Of Position
LORAN	Long Range Navigation

Acronyms & Abbreviations, Continued

LORDAC	Loran Data Acquisition Set
LORMONSITE	Loran Monitor Site
LORSTA	Loran Station
LPA	Local Phase Adjust
LSM	Local Status Monitor
LSOS	Local Site Operating Set
M	Master
MF	Medium Frequency
MHz	Megahertz
MOA	Momentary off air
MOM	Momentary
MON	Monitor
MPA	Maintenance Phase Adjust
MTTR	Mean Time To Repair
NAVELEX	Naval Electronic System Command
NEC	Newfoundland East Coast Loran Chain

Acronyms & Abbreviations, Continued

NECD	Nominal Envelope-to-Cycle Difference
NEUS	Northeast U.S. Loran Chain
NM	Nautical Mile
NOCUS	North Central U.S. Loran Chain
NORAD	North American Defense
NORPAC	North Pacific Loran Chain
NOSC	Naval Ocean Systems Center
NOTAM	Notice To Airmen
ns	Nanosecond
nsec	Nanosecond
nSSX	New Solid State Transmitter
OIC	Officer-In-Charge
OJT	On-the-Job Training
OLM	Organizational Level Maintenance
OOT	Out-of-Tolerance
OPORDER	Operation Order
OPR	Operate
OTBK	Out Of Tolerance Without Blink
PACAREA	Coast Guard Pacific Area
PATCO	Pulse Amplitude Timing Controller
PC	Phase Coding

Acronyms & Abbreviations, Continued

PCA	Polar Cap Absorption
PCI	Phase Code Interval
PCMS	Primary Chain Monitor Set
PGEN	Pulse Generator
PM	Program Manager *also* Preventative Maintenance
PPS	Pulse(s) Per Second
PRP	Peak Radiated Power
PRR	Pulse Repetition Rate
ps	Picosecond
pSec	Picosecond
PTTI	Precise Time and Time Interval
RA	Radio Aids
RAC	Russian American Loran/CHAYKA Chain
RAIL	Remote Automated Integrated Loran
RNAV	Radionavigation
RCI	Remote Control Interface
RCVR	Receiver
RDD	Required Delivery Date

Acronyms & Abbreviations, Continued

RF	Radio Frequency
RMS	Root Mean Square
ROS	Remote Operating System
S	Secondary
SAM	System Area Monitor
SAU	Status Alarm Unit
SCATANA	Security Control of Air Traffic and Air Navigation Aids
SDA	Signal Distribution Amplifier
SEUS	Southeast U.S. Loran Chain
SGP	Station Generated Power
SID	Sudden Ionospheric Disturbance
SITREP	Situation Report
SLT	Sectionalized Loran Tower
SM	Statute Mile *also* Support Manager
SMEF	Systems Management and Engineering Facility
SSD	Signal Strength Deviation

Acronyms & Abbreviations, Continued

SSN	Signal Strength Nominal
SNR	Signal-to-Noise Ratio
SOCUS	South Central U. S. Loran Chain
SOP	Standard Operating Procedures
SSIC	Standard Subject Identification Code
SSMR	Shore Station Maintenance Request
SSP	Standard Sampling Point
SSX	Solid-State Transmitter
STBY	Standby
SYNC	Synchronization Number
SZC	Standard Zero Crossing
TAC	Transmitter Automatic Controller
TCC	Transmitter Coupler Controller
TCE	Timing & Control Equipment
TCS	Transmitter Control Set
TD	Time Difference
TDC	Time Difference Controller
TDD	Time Difference Deviation
TDE	Time Difference Error
TDN	Time Difference Nominal
TECH	Technician
TELCO	Telephone Company

Acronyms & Abbreviations, Continued

TFE	Timing & Frequency Equipment
TIC	Time-Interval Counter
TINO	Timing Interval Number
TIP	Top-Loaded Inverted Pyramid
TMCN	Timing Control Number
TMR	Timer
TOA	Time of Arrival
TOC	Time Of Coincidence
TOL	Tolerance
TOPCO	Transmitter Operation Controller
TTM	Time of Transmission Monitor
TS	Transmitting Station
TTX	Tube-Type Transmitter
TTY	Teletype
UNK	Unknown
UPS	Uninterruptible Power Supply
Us	Microsecond
US	United States
USC	United States Code
uSec	Microsecond
USNO	United States Naval Observatory

Acronyms & Abbreviations, Continued

USWC	United States West Coast Loran Chain
UT	Usable Time
UTC	Coordinated Universal Time
UTS	Universal Time Second
UUT	Unusable Time
V	Victor (Baseline or Station)
VDOP	Vertical Dilution of Precision
VHF	Very High Frequency
VLF	Very Low Frequency
Vp	Peak Voltage
W	Whiskey LORSTA or signal
WGS	World Geodetic System
X	Xray (Baseline or Station)
XMTR	Transmitter
Y	Yankee (Baseline or Station)
Z	Zulu (Baseline or Station)

Chapter 11

Glossary

Accuracy	Specifications of radionavigation system accuracy generally refer to one or more of the following definitions: predictable, relative, or repeatable.
Accuracy, repeatable	The accuracy with which a user can return to a position whose coordinates have been measured at a previous time with the same navigation system.
Accuracy, predictable	The accuracy of a position with respect to the geographic, or geodetic, coordinates of the earth (Also called absolute or geodetic accuracy.)
Accuracy, relative	The accuracy with which a user can measure position relative to that of another user of the same navigation system at the same time. This may be expressed also as a function of the distance between the two users. Relative accuracy may also refer to the accuracy with which users can measure position relative to their own positions in the recent past.
Acquisition (ACQ)	The reception and identification of transmitted Loran signals from Master and selected Secondary stations to permit reliable measurement of TDs. The requisite signal-to-noise ratio for the original signal acquisition is generally greater than for tracking.
Additional Secondary Factors (ASFs)	Land path delay factors, due to variation in the conductivity of the earth's surface, that alter the speed of propagation of Loran signals over land compared to over water. Variation of propagation velocities over land degrade the absolute accuracy of a Loran system (unless compensated for), but do not affect the repeatable accuracy. ASFs can change due to seasonal variations.
Address Indicator Group (AIG)	A distribution list used in the DOD record message system.
Administrative Control (ADCON)	Authority over subordinate unit with respect to administrative matters, such as personnel management, supply, services, and other matters not included in the operational mission of the subordinate unit.

Glossary, Continued

Aid to Navigation (ATON)	Any device external to a vessel or aircraft specifically intended to assist navigators in determining their position or safe course, or to warn them of dangers or obstructions to navigation.
Alpha Control	Baseline control performed by the designated control station using information from an Alpha Monitor site.
Alpha Monitor	A monitor grade receiver suite, typically remotely controlled, that is located in the far-field.
Alpha-1 Monitor (A1)	The primary far-field monitor site for a baseline or signal.
Alpha-2 Monitor (A2)	The secondary far-field monitor site for a baseline or signal.
Ambiguity	In certain areas, particularly in the vicinity of Loran baseline extensions, there is the possibility that two positions will satisfy two observed Loran TDs.
Antenna	That component of a radio transmitter or receiver suite that radiates or receives electromagnetic waves.
Antenna Coupler	A radio frequency transformer and other electronic circuit (s) used to connect an antenna to a transmission line or to connect a transmission line to a radio receiver. The purpose of an antenna coupler is to match the impedance of the antenna with the receiver or transmitter.
Antenna Current	The signal at a Loran transmitting station taken from the transmitting antenna ground return. This waveform is used to monitor and measure the Loran pulse.
Assigned Envelope-to-Cycle Difference (AECD)	The value displayed on the Electrical Pulse Analyzer (EPA) Digital Panel Meter (DPM) when the pulse shape of the transmitted signal is at Nominal Envelope-to Cycle Difference (NECD).

Glossary, Continued

Atomic Time	A time scale based on atomic or molecular resonance phenomena. Elapsed time is measured by counting cycles of a frequency locked to an atomic or molecular transition. Other scales use mechanical reference devices such as quartz crystals or are based on the rotation rate of the earth.
Attenuation	A lessening in amount, particularly the reduction in amplitude of an electromagnetic wave with distance from the origin.
Authorized Unusable Time (AUTM)	An off-air period approved and scheduled by OPCON after users have been given an opportunity to comment or object.
Automatic Blink System (ABS)	A device in the Loran transmitting equipment suite that monitors the relative timing of the local signal and automatically initiates blink when a timing anomaly is detected.
Availability	The availability of a navigation system is the percentage of time that a signal within pre-established tolerances is being broadcast throughout the coverage area. Availability is an indication of the ability of the system to provide usable service within the specified coverage area.
Baseline Delay	The length of time, in microseconds, that it takes a Loran signal to travel along the baseline from the Master to a Secondary station.
Baseline Extension	The extension of the baseline beyond the two joined stations. Loran positions in baseline extension areas are problematic and ambiguous.
Baseline Length (BLL)	The distance between a Master and Secondary stations that may be expressed in microseconds, nautical miles, statute miles, or kilometers.
Baseline (BL)	The shortest-distance segment of a great circle that joins the Master and a Secondary station in a Loran chain. Also used to describe a Master-secondary pair.

Glossary, Continued

Blanking (Priority, Alternate)	The suppression of pulse generation on one rate due to the periodic phenomenon that occurs when a dual rated transmitting station has to transmit two pulse groups of different rates at the same (or nearly the same) time. During the period of overlap, the pulses of one rate are suppressed. In Priority Blanking, the same rate is always blanked. In Alternate Blanking the two rates are blanked in an alternating manner.
Blink (BK)	The periodic suppression of pulse(s) within a pulse group. The first two pulses are suppressed in a Secondary pulse group, while the ninth pulse is suppressed in a Master pulse group. Secondary blink is an indication that the Loran signal or baseline timing is out of tolerance and can not be used. Loran receivers detect Secondary blink and warn the user that the indicated positions may not be reliable. Secondary blink contributes to the integrity of the Loran system. Master blink can be used as a means of communications.
Bravo Control	Baseline control is being performed using information from the Master station.
Bravo TINO	At the Master station, a pseudo-Time of Arrival (TOA) generated by comparing the Secondary's received signal to a timing waveform from the TCE.
Calculated ECD	An estimated ECD of the transmitted pulse determined by measuring the deviation between the actual waveform, the amplitude of the first eight half cycles of the pulse sampled at the ground return of the transmitter, and the leading edge of a standard pulse.
Calculator-Assisted Loran Controller (CALOC)	A calculator based system that was used to automate control of baseline timing. The algorithm used in CALOC is now called the Time Difference Controller (TDC), a component of the Loran Consolidated Control System (LCCS).
Calibration	The process of identifying and measuring time or frequency errors, offsets, or deviations of a clock/oscillator relative to an established standard.

Glossary, Continued

Canadian East Coast Loran Chain (CEC)	GRI – 5930 M Caribou, Maine X Nantucket, Massachusetts Y Cape Race, Newfoundland, Canada Z Fox Harbor, Canada
Canadian West Coast Loran Chain (CWC)	GRI – 5990 M Williams Lake, British Columbia, Canada X Shoal Cove, Alaska Y George, Washington Z Port Hardy, British Columbia, Canada
Casualty Report (CASREP)	A group of standardized record message formats used to inform the operational commander and support structure that there is degradation in the capability of the unit to meet an operational mission.
Cesium	Loran timing reference oscillator. HP –5071 .(American spelling)
Chain Operations Control Officer (COCO)	The individual responsible for supervision of Loran chain operations. *formerly* Coordinator Of Chain Operations
Charlie Control	Baseline control is being performed by a non-baseline Secondary transmitting station.
Circular Error Probable (CEP)	In a circular normal distribution (the magnitudes of the two one-dimensional input errors are equal and the angle of cut is 90 degrees), circular error probable is the radius of the circle containing 50 percent of the individual measurements being made.
Civil Engineering Unit (CEU)	A Coast Guard unit that provides engineering support for buildings, grounds, and tall towers.

Glossary, Continued

Coastal Confluence Zone (CCZ)	Harbor entrance to 50 nautical miles offshore or the edge of the Continental Shelf (100 fathom curve), whichever is greater.
Coding Delay (CD)	The interval of time a Secondary station waits after it receives the Master's pulse before it transmits.
Commandant	Refers to the Commandant of the United States Coast Guard.
Common-use Systems	Systems that are used by both civil and military sectors.
Continental U.S.	Forty-eight adjoining states and the District of Columbia.
Control Policy (CONPOL)	A set of values used by the Time Difference Controller (TDC) of the Loran Consolidated Control System (LCCS) to determine the amount of effect TD Error (Ki) and Cumulative TD Error (Ks) will have on LPA recommendations.
Control Station Duty Officer (CSDO)	The officer on duty who has the responsibility for providing immediate operational guidance and direction to the control and transmitting station watches.
Control Station Mode (CS)	A control mode modifier that indicates the control station has the responsibility to initiate casualty recovery action.
Control Station (CS)	A station at which system monitoring and control is carried out. Control stations receive real-time system data from far-field monitor sites, Master transmitting stations and Secondary transmitting stations. The system data is monitored to ensure baseline timing and signal quality is maintained. When an abnormality is detected in either baseline timing or signal quality, the control station watch initiates user notification. Through remote control of transmitting station equipment, the control station has a limited ability to correct baseline timing and signal quality abnormalities. This remote control capability allows system operation with unattended and unwatched transmitting stations.

Glossary, Continued

Controlling Standard Envelope-to-Cycle Difference (CSECD)	The reference standard against which the control station compares the ECD observations of the Alpha-1 Monitor.
Controlling Standard Time Difference (CSTD)	The reference standard against which the control station compares the Time Difference observations of the Alpha-1 Monitor.
Coordinated Universal Time (UTC)	A coordinated time scale, maintained by the Bureau International des Poids et Mesures (BIPM), which forms the basis of a coordinated dissemination of standard frequencies and time signals. A UTC clock has the same rate as a Temps Atomique International (TAI) clock or international atomic time clock but differs by an integral number of seconds called leap seconds. The UTC scale is adjusted by the insertion or deletion of seconds (positive or negative leap seconds) to ensure approximate agreement with UT1 (also known as the Julian Date).
Coverage Area	The coverage provided by a radionavigation system is that surface area or space volume in which the signals are adequate to permit the navigator to determine position to a specified level of accuracy and at a specified SNR. System geometry, signal power levels, receiver sensitivity, atmospheric noise conditions, and other factors that affect signal propagation influence coverage.
Coverage Diagram	A diagram showing the area where a given Loran chain enables reliable reception (at an acceptable SNR) and satisfies specified accuracy criteria.
Cross Chain Time Difference (CCTD)	A supplementary timing reference that can be developed at a dual rated station by measuring the time difference between the two Local Phase Code Interval (LPCI) waveforms.
Cross Rate (Cross Chain) Interference	Interference in the reception of radio signals from one Loran chain caused by signals from another Loran chain.

Glossary, Continued

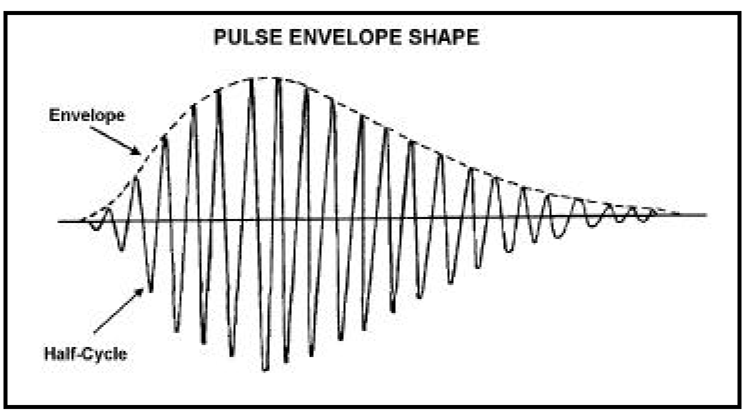
Crossing Angle	Generally, the smaller of the angles between two LOPs that determine a fix. The closer this angle is to 90 degrees, the better the fix.
Cyclan	The designation of Loran in the earliest stage of development later superseded by the term *Cytac*.
Cycle Compensation (C/C)	A feedback loop that compensates for variation in the path delay between the Timer and the radiated signal.
Cycle Slip	Failure of the Loran receiver to lock on the proper sampling or tracking point. In cases of cycle slip, the receiver will lock on to another sampling point that differs from the proper sampling point by integer multiples of 10 microseconds.
Cycle Step	A Manual Mode of altering the sampling point of the signal, in 10 microsecond increments.
Cytac	The designation of Loran in an earlier stage of development.
De-Energized Standby Loran Transmitter (DESLOT)	A mode of operation of the AN/FPN-44/45 Tube Type Transmitter (TTX) in which the transmitter is placed in standby mode without power to the filament circuits of the tubes. The result is a slightly longer run-up time when the transmitter is made operate, but DESLOT reduces the energy consumption of the transmitter while in standby mode.
Delta Control	Baseline control is being performed by the secondary transmitting station.
Delta TINO	At the Secondary station, a pseudo-Time of Arrival (TOA) generated by comparing the master's received signal to a timing waveform from the TCE.
Depot Level Repairable (DLR)	A system for centralized repair of non-expendable maintenance components.

Glossary, Continued

Differential	A technique used to improve radionavigation system accuracy by determining positioning error at a known location and subsequently transmitting the determined error, or correction factor, to users of the same radionavigation system operating in the same area.
Differential Loran	A method of increasing the accuracy of Loran, which operates by broadcasting a correction signal to users in a fixed geographic area to adjust measured TDs, compensating for seasonal, diurnal, chain control, transmitter, and other effects. Differential Loran was proven feasible in tests by the Coast Guard, but has not been implemented.
Discrepancy Report (DISREP)	A means of informing the appropriate Civil Engineering Unit (CEU) of a major facilities problem.
Drift, frequency	The linear (first-order) component of a systematic change in frequency of an oscillator over time. Drift is due to aging plus changes in the environment and other factors external to the oscillator.
Droop (DP)	A measure of the pulse-to-pulse amplitude change in a single Group Repetition Interval (GRI).
Dual Rate	A Loran transmitting station operating in more than one chain.
Dual Rate Blanking	To provide continuous service from one Loran chain to the next, some stations are dual rated. A dual-rated station is faced periodically with an impossible requirement to radiate two overlapping pulse groups at the same time. During the time of overlap, the subordinate signal is blanked or suppressed. Priority blanking occurs when the same rate is always blanked, whereas alternate blanking occurs whenever the two rates are blanked in an alternate manner.
Dual Rated Station	Term used to describe a master or secondary station in one Loran chain that is also used as a master or secondary in another chain. The Dana, Indiana, Loran transmitter is one example, serving as the Zulu secondary in the 9960 (Northeast US) chain as well as the master in the 8970 (Great Lakes) chain.

Glossary, Continued

Electrical Pulse Analyzer (EPA)	A component of the transmitting station's electronics suite that provides precise measurement of the Loran pulse shape and amplitude.
Electronic Systems Support Detachment (ESD)	A unit that provides electronic maintenance support.
Electronic Systems Support Unit (ESU)	The command unit of a group of Electronic Support Detachments.
Emission Delay (ED)	The time difference, in microseconds, between when a master Loran station transmits and a given secondary station transmits. The emissions delay (ED) is equal to the sum of the baseline travel time plus the secondary coding delay.
Envelope	The shape of the Loran pulse as defined by the peaks of the individual half cycles.



Glossary, Continued

Envelope Timing Adjustment (ETA)	An adjustment made within the waveform control section of the timer that is used to alter the shape of the pulse envelope by controlling the start time of the pulse. The ETA is not used with a Solid State Transmitter.
Envelope-to-Cycle Difference (ECD)	The time relationship between the phase of the Loran RF carrier and the time origin of the envelope waveform. Zero envelope to cycle difference is defined as the signal condition occurring when the 30 microsecond point of the Loran pulse envelope is in time coincidence with the third positive zero crossing of the 100kHz carrier.
EUTM	Emergency Unusable Time – AUTM that did not give the users sufficient time to comment or object.
Far Field	The far field is typically greater than 5 to 10 wavelengths from the transmitting antenna.
Far Field ECD (F/F ECD)	The time relationship between the phase of the Loran carrier and the time origin of the envelope waveform as measured at the monitor receiver site.
Federal Radionavigation Plan (FRP)	A plan that is jointly published by DOD and DOT that delineates policies and plans for radionavigation services provided by the U.S. Government.
Femto-	Prefix meaning one-quadrillionth, 1×10^{-15}.
Femto-second (fsec)	One-quadrillionth of a second, 1×10^{-15} of a second.
Fix	A known position determined by passing close aboard an object of known position or determined by the intersection of two or more lines of position (LOPs) adjusted to a common time, determined from terrestrial, electronic, and/or celestial data.

Glossary, Continued

Fix Dimensions	This characteristic of a navigation system defines whether the navigation system provides a linear, one-dimensional line-of-position, or a two- or three-dimensional position fix.
Fix Rate	The fix rate is defined as the number of independent position fixes or data points available from the system per unit time.
Frequency Offset	The difference between the measured frequency value and a reference frequency value.
Frequency Standard	A precise frequency generator such as a rubidium, cesium, or hydrogen maser whose output is used as a frequency reference.
Fringe Area	The region at or beyond the published range and accuracy limits for a Loran chain. Attainment of published accuracy limits may be difficult or impossible because of geometric limits or noise. Reception of ground wave signals may be compromised by skywave contamination in this region.
Geocentric	Relative to the earth as a center, measured from the center of the earth.
Geodetic Accuracy	Term meaning the same as absolute or predictable accuracy.
Geometric Dilution of Precision (GDOP)	Term used to include all geometric factors (gradient, crossing angle) that degrade the accuracy of position fixes from externally referenced navigation systems, such as Loran. GDOP can be calculated from an equation that summarizes these effects in one single measure.
Global Positioning System (GPS)	GPS is a satellite-based radionavigation and time transfer system developed by the Department of Defense and available for use worldwide.
Gradient	Mathematically the rate of change of distance with respect to time differences. It is measured as the ratio of the spacing between adjacent Loran TDs, as measured in nautical miles, yards, or feet, and the number of microsecond difference between these lines. Most commonly, this is expressed as ft/uSec or meters/uSec. Generally speaking, the smaller the gradient, the better the fix. The Loran gradient

Glossary, Continued

is smallest along the baseline, where it is numerically equal to 491.62 ft/usec.

Great Circle

The intersection of a sphere and a plane through its center.

Great Lakes Loran Chain (GLKS)

GRI – 8970

M Dana, Indiana
W Malone, Florida
X Seneca, New York
Y Baudette, Minnesota
Z Boise City, Oklahoma

Great-Circle Distance

The length of the shorter arc of the great circle joining two points on a sphere. It is usually expressed in nautical miles (NM).

Greenwich Mean Time (GMT)

A 24-Hour system based on mean Solar time plus 12 hours at Greenwich, England. Greenwich Mean Time can be considered approximately equivalent to Coordinated Universal Time (UTC), which is broadcast from all standard time and frequency radio stations.

Groundwave

The groundwave signal propagates in the atmosphere below the ionosphere (an electrified layer of the atmosphere) and is relatively well understood and quite predictable. However, the signal strength of the groundwave is attenuated as it follows the contour of the earth. At great distances from the transmitter, the groundwave signal is substantially weaker than at the transmission point. Groundwaves are preferred over skywaves for accurate navigation because the propagation conditions (in the ionosphere) are not stable and can change from day-to-day or even hour-to-hour.

Glossary, Continued

Group Repetition Interval (GRI)

The stations in the Loran chain transmit in a fixed sequence, which ensures that TDs can be measured throughout the coverage area. The length of time between successive transmissions of the master's pulse groups is termed the group repetition interval (GRI), and is expressed in microseconds (μ-sec). The GRI designator is the GRI divided by ten, and is used as a symbol to identify and designate the Loran chain. The GRI is chosen for each chain to be sufficiently large so that the signals from the master and each secondary in the chain have sufficient time to propagate throughout the chains coverage area before the next cycle of pulsed transmissions begins.

Gulf Of Alaska Loran Chain (GOA)

GRI – 7960

M Tok, Alaska
X Kodiak, Alaska
Y Shoal Cove, Alaska
Z Port Clarence, Alaska

Hertz (Hz)

Name for a derived unit of frequency in the international system of units. One Hertz is equal to one cycle per second.

High Frequency (HF)

The portion of the radio frequency spectrum occupying the 3MHz to 30MHz band.

Hyperbolic Grid

Lattice of curved (hyperbolic) lines of position produced by a hyperbolic system.

Hyperbolic, radionavigation

Hyperbolic navigation systems function by measuring the time differences in reception of signals form the Master and Secondary transmitters. The locus of points of constant difference in distance from two stations is described by a hyperbola. The same is true for time differences, so lines of position (LOP) of constant time differences (TD) are also hyperbolas.

Integrity

Integrity is the ability of a navigation system to provide timely warnings to users when the system should not be used for navigation. For the Loran system, integrity is affected by secondary blink.

Glossary, Continued

Ionosphere	The region of the atmosphere extending from about 40 to 250 statute miles above the earth's surface, in which there is appreciable ionization. The presence of charged particles in this region affects the propagation of certain electromagnetic radiation.
Kilohertz (kHz)	1,000 cycles per second
Latitude (L or Lat)	Angular measure north or south of the equator (typically expressed in degrees from zero to ninety), north or south, e.g., L 073N or as degrees, minutes, and seconds.
Line of Position (LOP)	A line of bearing to a known origin or reference, upon which a vessel is assumed to be located. An LOP is determined by observation (visual bearing) or measurement (RDF, Loran, radar, etc.). An LOP is assumed to be a straight line for visual bearings, or an arc of a circle (radar range), or part of some other curve such as hyperbola (Loran).
Local Envelope Number (LEN)	The time interval between Local Phase Code Interval (LPCI) and the Envelope Strobe.
Local Notice to Mariner (LNM)	A written document issued by each U.S. Coast Guard district to disseminate important information affecting aids to navigation, dredging, marine construction, special marine activities, and bridge construction on the waterways within that district. Scheduled Loran system outages are published in *Local Notice to Mariners.*
Local Phase Adjust (LPA)	A timing adjustment of the signal at a Secondary station that is used to compensate for frequency standard (oscillator) drift or short term changes in the propagation path.
Local Station Operating Set (LSOS)	A component of the transmitting station equipment suite that provides an interface for remote data acquisition and control by the control station.
Locus	All possible positions of a point or curve satisfying stated conditions.

Glossary, Continued

Long Range Navigation (LORAN)	Loran is a pulsed, hyperbolic radionavigation system operating in the 90 to 110 kHz radio frequency band. The system is based upon the measurement of the differences in time of arrival of pulses of radio frequency energy radiated by a chain of synchronized transmitters that are separated by hundreds of miles.
Longitude (Long)	Distance east or west of the prime meridian expressed in degrees from zero to 180 east or west; e.g., Long 123W, or as degrees, minutes, and seconds.
Loran Chain	Series of three to six transmitting stations consisting of a Master station and two to five Secondary stations used in the Loran system.
Loran Consolidated Control System (LCCS)	The major component of the control station equipment suite, providing the ability to monitor and control all aspects of the system including: master station parameters and equipment status, secondary station parameters and equipment status, and far field parameters observed by Primary Chain Monitor Set (PCMS) sites. The LCCS equipment monitors system parameters, recommends baseline-timing corrections and provides a warning when system tolerances are exceeded. To aid system control, LCCS organizes, displays, and archives system data.
Loran Day	Loran dates are recorded as if all stations were located at the (0) meridian of UTC. Thus, the Loran date (and time) is the same at all stations regardless of physical location. This also means that the Loran date may be different from the local (or civil) date.
Loran Monitor Site (LORMONSITE)	A remotely operated site, located in the user area, consisting of a monitor grade receiver, control and communications equipment. A Monitor Site is used to observe baseline timing, individual signal strengths, and pulse shapes. The information gathered from Monitor Sites is used for chain control and integrity.

Glossary, Continued

Loran Operations Information System LOIS	An administrative tool that is used to gather, store and analyze data on the performance of the system.
Loran Pulse	The Loran pulse exhibits a characteristic (and well-controlled) waveform that can be identified and timed by a receiver. The Loran signal from a master station actually consists of nine pulses. The first eight pulses are spaced 1,000 microseconds apart, followed at an interval of 2,000 microseconds by the ninth pulse. Secondary stations transmit only eight pulses, each separated by 1,000 microseconds. Pulsed transmission saves on the power required for signal transmission and facilitates signal identification. Multiple-pulse transmission is used rather than single-pulse transmission to increase the average power of the Loran signal. The appearance of the pulse is discussed elsewhere in this handbook.
Loran Station (LORSTA)	Facility housing Master or Secondary timing equipment and transmitter.
Loran Support Unit (LSU)	A Coast Guard unit established to provide support for Loran specific electronics equipment. LSU is the System Maintenance Engineering Facility for all Loran equipment.
Loran Time	All time kept by the Loran stations is based on UTC or Universal time. This is often referred to as Z or Zulu Time. This means that the Loran time will be different from the local (or civil) time.
Loran Data Acquisition Set (LORDAC)	A set of precision instruments used to measure performance of a Loran transmitter.

Glossary, Continued

Loran Signal Availability

The design minimum availability for a Loran triad is 99.7%, computed on an approximately monthly basis. For purposes of computing availability, a baseline (station pair) is considered unavailable when any of the following conditions exist:

- TD out of tolerance,
- ECD out of tolerance,
- improper phase code or GRI, or
- Master or Secondary station off-air or operating at less than 50% of specified power output.

Low Frequency (LF)

The portion of the radio frequency spectrum occupying the 30 kHz to 300 kHz band. The Loran system is a low-frequency system.

Maintenance Phase Adjust (MPA)

A timing adjustment of the signal at a Secondary or Master station that is used to compensate for equipment switches, time steps, casualties, or maintenance.

Master Station (M)

Essential component of a Loran chain. This station broadcasts the signal that is used to identify the chain (the GRI) and is the common base against which all time differences are calculated.

Medium Frequency (MF)

The portion of the radio frequency spectrum occupying the 300 kHz to 3 MHz band

Megahertz (MHz)

1,000,000 cycles per second

Micro-

Prefix meaning one millionth,

Microsecond (us or usec)

One millionth of a second, 1×10^{-6} second.

Microstepper

Instrument for adjusting frequency in small steps.

Glossary, Continued

Momentary (MOM)	Signal abnormality lasting less than sixty seconds.
Monitor Receiver	A receiver located within the coverage area of a chain that measures gain, ECD, TD, signal-to-noise ratio SNR and time of receipt. Used to measure performance of system.
Nano	Prefix meaning one-billionth, $1x10^{-9}$.
Nanosecond (ns or nsec)	One billionth of a second, $1x10^{-9}$ second.
Nautical Mile (nm)	A unit of distance used principally in maritime and aviation navigation. It is based on one minute of arc of a great circle. The international nautical mile is 1,852 meters long or about 6,076 feet.
Navigation	The art and science of conducting a vessel or aircraft safely from one point to another.
Navigation Center (NAVCEN)	The command that has Operational Control (OPCON) responsibility for all U.S. Loran chains.
Near Far-Field	The boundary between the near field and the far field, typical 2 to 5 wavelengths from the antenna. When the distance from the transmitting antenna exceeds 5 wavelengths, the radial electric field becomes negligible with respect to the tangential field. This region is called the far field.
Newfoundland East Coast Loran Chain (NEC)	GRI – 7270 M Comfort Cove, Newfoundland, Canada W Cape Race, Newfoundland, Canada X Fox Harbor, Newfoundland, Canada
Nominal Envelope-to-Cycle Difference (NECD)	The calculated ECD held at the transmitting station which, given the identical propagation conditions which existed during the chain calibration, would result in the CSECD being observed at the monitor.

Glossary, Continued

Nominal value	In a device that realizes a physical quantity, it is the specified value of such a quantity. It is an ideal value and free from tolerance.
North Central U.S. Loran Chain (NOCUS)	GRI – 8290 M Havre, Montana W Baudette, Minnesota X Gillette, Wyoming Y Williams Lake, British Columbia, Canada
North Pacific Loran Chain (NORPAC)	GRI – 9990 M Saint Paul, Pribilof Island, Alaska X Attu, Alaska Y Port Clarence, Alaska Z Kodiak, Alaska
Northeast U.S. Loran Chain (NEUS)	GRI – 9960 M Seneca, New York W Caribou, Maine X Nantucket, Massachusetts Y Carolina Beach, North Carolina Z Dana, Indiana
Notch Filters	Filters in a Loran receiver that are either fixed or capable of being tuned to reduce (notch out) the effects of interfering signals
Notice To Airmen NOTAM	A means of disseminating Loran notification and information to the aviation community.
Operation Order (OPORDER)	A formal document issued by OPCON that establishes mission objectives. A Loran OPORDER specifies chain configuration and establishes the parameters necessary for proper chain performance.

Glossary, Continued

Operational Control (OPCON)	Authority over subordinate unit with respect to the composition of subordinate forces, the assignment of tasks, the designation of objectives and the authoritative direction necessary to accomplish the mission.
Oscillator	An electronic circuit designed to produce an ideally stable alternating voltage or current.
Out of Tolerance (OOT)	A condition in which a Loran signal or time difference exceeds established tolerances. An out-of-tolerance (OOT) condition causes the secondary transmitter to blink.
Out Of Tolerance Without Blink OTBK	A baseline timing or signal abnormality during which system integrity has not been maintained through proper user notification, Secondary blink.
PCMS	Primary Chain Monitor Set
Pico-	Prefix meaning one-trillionth, $1x10^{-12}$.
Pico-second (psec)	One- trillionth of a second, $1x10^{-12}$ of a second.
Phase	A measure of a fraction of the period of a repetitive phenomenon measured with respect to some distinguishable feature of the phenomenon itself.
Phase Code Interval (PCI)	That interval over which the Phase Code repeats itself. For the Loran system, phase codes repeat every two GRIs.
Phase Coding	This is a scheme of changing the phase of the pulses in a transmitted Loran signal to minimize pulse-to-pulse skywave interference and to

Glossary, Continued

reject synchronous interfering signals. Master and secondary transmitters use different phase codes for signal identification.

GRI Interval	Master	Secondary
A	++--+-+-+	++++++--+
B	+--++++++-	+-+-++--
(+) Indicates zero degrees carrier phase. (-) Indicates 180 degree carrier phase. Loran intervals A & B alternate in time.		

Phase Jump

A sudden phase change in a signal.

Phase Shift

An intentional change in phase of a periodic signal from a reference.

Phase Velocity

Term used to describe the velocity of the leading edge of the Loran wave at its point of contact with the earth's surface. Conductivity and atmospheric effects affect this velocity.

Polar Cap Absorption (PCA)

Strong solar particle events produce intense ionization in the D-region (between 50 and 90 km altitude) of the ionosphere over the polar caps. These events are called polar cap absorption (PCA) events because the increased ionization absorbs radio waves in the HF and VHF bands. The effect that a PCA has on the LF band is seen during daylight hours and is characterized by a slow onset followed by a stable offset in timing.

Glossary, Continued

Position

On the earth, this refers to the actual geographic location of a vessel defined by two parameters called coordinates. Those customarily used are latitude and longitude. Position may also be expressed as a bearing and distance from an *object,* the position of which is known, or by Loran TDs.

Precise Time and Time Interval (PTTI)

Precise Time- A time requirement accurate to within 10 milliseconds.

Time Interval - the duration of a segment of time without reference to where the time interval begins or ends.

Predictable Accuracy

Term meaning the same as absolute or geodetic accuracy.

Preventive Maintenance (PM)

Equipment maintenance designed to reduce the risk of equipment failure.

Primary Phase Factor (PF)

A correction to a Loran reading due to signal propagation through the atmosphere as opposed to propagation through free space. The speed of Loran signals through the atmosphere is equal to the speed through free space divided by the atmospheric index of refraction. This speed is taken as 2.99691162 times 10^8 meters per second.

Pulse Analysis

The Pulse Analysis function is used to calculate the Peak Amplitude change, ECD, Percent of ECD error and other factors affecting the transmitter pulse.

Pulse Generator (PGEN)

A component of the transmitting stations Loran equipment suite that is used to develop a Transmitter Drive Waveform (TDW). The TDW is used to drive a Tube Type Transmitter (TTX) and is shaped within the PGEN to ensure the transmitter radiates a standard Loran pulse.

Pulse Leading Edge

That portion of the Loran pulse from the beginning to the peak (about the first 65 microseconds).

Glossary, Continued

Pulse Repetition Rate (PRR)

The average number of pulses per unit of time. For the Loran system, the PRF or PRR is the reciprocal of the GRI. Thus, a chain with a GRI of 50,000 μsec would have a PRR of 20 Hertz.

Pulse Trailing Edge

That portion of the Loran pulse following the peak or 65 μsec, whichever occurs first. The trailing edge is controlled in order to maintain spectrum requirements.

Radionavigation

The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves. Used for the purposes of navigation including obstruction warning.

Radionavigation System Parameters

Navigation systems described are defined in terms of system parameters that determine the use and limitations of the individual navigation system's signal in space. These parameters are:

- Ambiguity
- Accuracy
- Availability
- Capacity
- Coverage
- Fix Dimension
- Fix Rate
- Integrity
- Reliability
- Signal Characteristics

Rate

Generic term sometimes used to describe a Loran LOP or family of LOPs from a given station pair. Nautical charts, for example, will identify the rates shown, e.g., 9960-W, 9960-X, 9960-Y, 9960-Z, 7980-W, etc.

Reliability

The reliability of a navigation system is a function of the frequency with which failures occur within the system. It is the probability that a system will perform its function within defined performance limits for a specified period of time under given operating conditions. Formally, reliability is one minus the probability of system failure.

Glossary, Continued

Remote Control Interface (RCI)
A component of the transmitting station equipment suite that provides a rudimentary means of remote control of the station. The RCI interface with the control station is through the Teletype (TTY) communications circuit. The RCI enables remote access to phase adjustments and blink commands.

Remote Operating System (ROS)
System developed by the U.S. Coast Guard to permit remote control of Loran stations and reduce the manning requirements. ROS consists of two individual sets of equipment:

- the local station operating set (LSOS) which is located at the transmitting station, and
- the remote site operating set (RSOS) which is located at the remote (or control) station. ROS permits the operation of a transmitting station to be controlled from a remotely located station.

Remote Phase Code Interval (RPCI)
A pseudo phase code interval generated by the casualty receiver at a transmitting station. RPCI is the waveforms used in the time interval measurements of TINO and SYNC.

RHO-RHO (ranging mode)
A mode of operating a radionavigation system in which the times for the radio signals to travel from each transmitting station to the receiver are measured rather than their differences. This is based upon the known correspondence of the transmission time to UTC. In principle, Loran can be used in the RHO-RHO mode (see attached references), but this requires special equipment not used by the typical user.

Root Mean Square (RMS)
The square root of the arithmetical mean of the squares of a group of numbers.

Russian American Loran/CHAYKA Chain (RAC)
GRI –5980

M Petropavlosk, Kamchatka, Russia
X Attu, Alaska
Y Alexandrovsk, Sakhalen Island, Russia

Glossary, Continued

Secondary Phase Factor (SF)	The secondary phase factor (SF) reflects the fact that the Loran groundwave is further retarded when traveling over sea water as compared to through the atmosphere. When the Loran signals are transmitted, part of the electromagnetic wave is in the air, and part penetrates the earth's surface. Seawater is not as good an electrical conductor as air, so the signals are slowed as they travel over sea water. The amount of time required for travel over a specified distance will exceed that calculated using the PF by an amount equal to the SF.
Secondary Station (S)	One of the two to five other transmitters in the Loran chain (designated V, W, X, Y, and Z) that transmits a signal, referenced in time to that of the master, used to compute a time difference.
Sectionalized Loran Tower (SLT)	A multi-tower array antenna.
Signal	Detectable transmitted energy that can be used to carry information. As applied to electronics, any transmitted electrical impulse.
Signal Availability	The goal of the Loran system is to have each transmitting station on-air for 99.9% of the time. Each triad should be available at least 99.7% of the time as computed on a monthly basis. These goals include authorized off-air time. Routine equipment switches, which take less than 60 seconds are, considered as continuous transmissions.
Signal Characteristics	Power levels, frequencies, signal formats, data rates, and any other information sufficient to completely define the means by which a user derives navigational information characterize signals in space.
Signal-to-Noise Ratio (SNR)	The ratio of the signal strength to that of the electronic noise (background) in a defined frequency spectrum. Loran coverage diagrams are calculated so that the SNR is at least 1:3, although many receivers are capable of processing weaker signals. Signal-to-noise is sometimes expressed in decibels (dB). The SNR in decibels is mathematically equal to 20 log (SNR), so that an SNR of 1:3 works out to approximately –9.54 – often rounded to –10.

Glossary, Continued

SITE	Normally an unwatched, unstaffed facility.
Skywave	Skywave is an indirect radio wave that reflects off the ionosphere, rather than traveling a direct path from transmitter to receiver. Because these waves travel a different distance (in particular a longer distance), skywaves will give an erroneous TD reading in a Loran receiver. The shape of the Loran pulse and phase coding are used to attempt to minimize or eliminate the effects of skywave contamination.
Skywave Delay	The time interval between the arrival of the groundwave and the various skywave reflections. Typically, skywaves can arrive as early as 35 microseconds, or as late as 1,000 microseconds after the groundwave.
Solid-State Transmitter (SSX)	A type of Loran transmitter that uses pulse compression techniques and feedback loops to produce a Loran Pulse.
South Central U. S. Loran Chain (SOCUS)	GRI – 9610 M Boise City, Oklahoma V Gillette, Wyoming W Searchlight, Nevada X Las Cruces, New Mexico Y Raymondville, Texas Z Grangeville, Louisiana
Southeast U.S. Loran chain (SEUS)	GRI – 7980 M Malone, Florida W Grangeville, Louisiana X Raymondville, Texas Y Jupiter, Florida Z Carolina Beach, North Carolina
Spectrum Specification	The spectrum specification relates to the amount of energy allowed outside the authorized 90 to 110 kHz band. The maximum out of band energy is constrained to be no more than 1% of the total radiated energy, with subsidiary constraints than no more than 0.5% of the total radiated energy be less than 90 kHz nor greater than 110 kHz.

Glossary, Continued

Standard Deviation (SIGMA)	A measure of the dispersion of random errors about the mean value. If a large number of measurements or observations of the same quantity are made, the standard deviation is the square root of the sum of the squares of deviations from the mean value divided by the number of observations less one.
Standard Sampling Point (SSP)	In the calculation or measurement of Loran field strength, it is necessary to specify the point on the pulse to which the calculation or measurement relates. This point is termed the standard sampling point and is the point on the Loran pulse envelope 25 microseconds after the beginning of the pulse. For the standard Loran pulse with zero ECD, the amplitude at the standard sampling point is 0.506 of the peak amplitude.
Standard Zero Crossing (SZC)	The positive zero crossing at 30 microseconds of a positively phase coded pulse on the antenna-current waveform. This zero crossing is phase-locked to the Loran station's cesium reference. The standard zero crossing is used as a timing reference for measurement of Loran signal specifications.
Standardized Color Coding (Charts)	Standardized colors used to show Loran lines of position on nautical charts. These colors codes for the various Secondaries in the Loran chain are W = blue, X = magenta, Y = black, and Z = green.
Station	Normally a staffed facility, either watched or unwatched.
Station-Pair	A master and secondary station in a Loran chain from which it is possible to derive a LOP.
Statute Mile (SM)	A unit of distance on land used in English speaking countries equal to 5,280 feet.

Glossary, Continued

Sudden Ionospheric Disturbance (SID)	Sudden ionospheric disturbances (SIDs) are caused by sudden changes in the ionosphere that are marked by sudden enhancements of signals propagation in the VLF band. Ionospheric disturbances scatter trans-ionospheric radio signals that can be picked up by antennas. This scattering causes a temporary, random fluctuation in both phase and amplitude of the radio signals. The mechanism that affects the Loran signals is a depression of the ionosphere causing abnormally strong and early skywaves.
Synchronization Number (SYNC)	The time interval measured between remote Phase Code Interval (RPCI) and the Standard Zero Crossing (SZC) of the first transmitted pulse (Envelope Strobe).
Synchronization (time)	The process of measuring the difference in time of two time scales such as the output signals generated by two clocks. In the context of timing, synchronization means to bring two clocks or data streams into phase so that their difference is 0.
System Ambiguity	System ambiguity exists when the navigation system identifies two or more possible positions of the vehicle, with the same set of measurements, with no indication of which is the most nearly correct position.
System Capacity	System capacity is the number of users that a system can accommodate simultaneously. The Loran system could theoretically allocate an infinite number of users.
System Maintenance Engineering Facility (SMEF)	A unit that is responsible for configuration and maintenance management of equipment that is used in support of a common purpose. CG Loran Support Unit is responsible for configuration and maintenance management of all electronic equipment used in support of the Loran mission.
System Sample (S/S)	A standardized daily on-hour sample period representative of typical system performance. It is the primary source of data for use in the Loran Operations Information System LOIS

Glossary, Continued

Time Difference (TD)	The interval in time between the receipt of a master station’ s signal and secondary station’ s signal of the same rate.
Time Difference Controller (TDC)	A component of the Loran Consolidated Control System (LCCS) that is used to manage the time difference of each baseline.
Time Difference (TD)	In the Loran system, the time difference (in microseconds) between the receipt of the master and secondary signals.
Time of Arrival (TOA)	A time interval measurement of the time between a local time source and the arrival to a received Loran signal.
Time of Coincidence (TOC)	Loran transmissions are synchronization to UTC by determining the point in time at which the first pulse of a Master Phase Code Interval is coincident with a specified Universal Time Second, this is a TOC. The first Time Of Coincident (TOC) was arbitrarily defined for all Master stations as 00:00:01, 1 January 1958.
Time Step	A discontinuity in a time scale at some instant. NOTE: A step is positive (+) if the time scale reading is increased and negative (-) if the reading is decreased at that instant.
Time-Interval Counter (TIC)	A component of the transmitting station equipment suite used to measure time intervals.
Timer (TMR)	A component of the transmitting station equipment suite that develops the rate to be transmitted, accommodates timing adjustments, stabilizes variations in the delay through the transmitter, and provides a means of user notification (blink) of an abnormality.
Timing & Control Equipment (TCE)	The components of the transmitting station equipment suite used to generate the timing and signals and drive waveforms used to generate a Loran signal in the transmitter.

Glossary, Continued

Timing Number (TINO)
The time interval between arrival of the Remote Phase Code Interval (RPCI) generated by the casualty receiver and the Local Phase Code Interval (LPCI) generated in the timer.

Timing of Secondary Pulse Groups
The emission delays of secondary stations are selected to ensure that the following criteria are met within each chain wherever signals can be received:

- The minimum time difference between any secondary and master is 10,900 microseconds.
- The minimum difference of any two-time differences is 9,900 microseconds.
- The maximum time difference is the GRI minus 9,900 microseconds.

Tolerance (TOL)
An allowable variation from nominal.

Top-Loaded Inverted Pyramid (TIP)
A multi-tower array antenna.

Tracking
The process of measuring time differences from an acquired master-secondary Loran pair. The signal-to-noise ratio required for tracking of a pre-identified signal is generally less than that required for signal is acquisition.

Transmitter (XMTR)
A device for sending electromagnetic waves: that part of the broadcasting apparatus, which generates and modulates the radio frequency current and coveys it to the antenna.

Transmitting Station
A station from which Loran signals are broadcast.

Transmitting Station Mode (TS)
A control mode modifier that indicates the transmitting station has the responsibility to initiate casualty recovery action.

Glossary, Continued

Tube-Type Transmitter (TTX)	A type of radio transmitter that uses vacuum tubes to amplify and modulate the signal.
Two-Pulse Communications (TPC)	A form of communication achieved by pulse-position modulation of the seventh and eighth pulse in each group.
Unattended	A station is operating in the unattended mode when there is no one standing an operational Loran watch on board the station. Personnel are usually not physically aboard.
Uninterruptible Power Supply (UPS)	A device that provides a constant source of electrical power, usually used as a backup for commercially provided electrical power.
United States West Coast Loran Chain (USWC)	GRI – 9940 M Fallon, Nevada W George, Washington X Middletown, California Y Searchlight, Nevada
Universal Time (UT) Family	Universal Time (UT) is the general designation of time scales based on the rotation of the Earth. In applications in which a precision of a few tenths of a second cannot be tolerated, it is necessary to specify the form of UT such as UT1 that is directly related to polar motion and is proportional to the rotation of the Earth in space. The UT1 is further corrected empirically for annual and semiannual variations in the rotation rate of the earth to obtain UT2. • Universal Time is the mean solar time of the prime meridian plus 12 hours, determined by measuring the angular position of the Earth about its axis. The UT is sometimes designated GMT, but this designation should be avoided. • Communicators use the designation (Z) or (Zulu). • Timekeepers should use UTC of the national standard, for example, UTC(USNO) rather than GMT.

Glossary, Continued

Unmanned	A facility with no personnel assigned for full time duties to maintain the site. Maintenance personnel are usually shared on an as needed basis with a nearby facility.
Unusable Time	The time during which a station's signal was not usable. Assigned by the COCO.
Unusable Time (UUT)	The period of time during which baseline timing or signal quality is not within prescribed tolerances.
Unwatched	A station is in the unwatched mode when there is someone physically present, but not observing the Loran equipment/baseline status at all times.
Usable Time (UT)	The period of time during which baseline timing or signal quality is within prescribed tolerances.
Very High Frequency Radio (VHF)	The portion of the radio frequency spectrum occupying the 30 MHz to 300 MHz band. The VHF system is essentially a line-of-sight system limited in range to only a little beyond the horizon. Early hyperbolic systems e.g., Gee, operated at these frequencies.
Very Low Frequency (VLF)	The portion of the radio frequency spectrum occupying the 10 kHz to 30 kHz band.
Victor (V)	A designation for a Secondary station or signal.
Voltage, Peak (Vp)	The instantaneous voltage measured at the peak of a half cycle or pulse.
Watched	A station is watched when someone is physically present, and actively monitoring equipment/baseline alarms and parameters.

Glossary, Continued

WGS-84	The location of Loran transmitters is specified according to longitude and latitude in the WGS 84 system (or datum). The World Geodetic WGS 84 is the DODs basic reference frame (coordinate system for the earth's surface. WGS 84 is the primary geodetic system used in DOD systems and Mapping, Charting and Geodesy (MC&G) products.
Whiskey (W)	A designation for a Secondary station or signal.
World Geodetic System (WGS)	A consistent set of parameters describing the size and shape of the earth, the positions of a network of points with respect to the center of mass of the earth, transformations from major geodetic datums, and the potential of the earth (usually in terms of harmonic coefficients).
Xray (X)	A designation for a Secondary station or signal.
Yankee (Y)	A designation for a Secondary station or signal.
Zulu (Z)	A designation for a Secondary station or signal.

Index

A

ABS
- Control Station Actions for Time Step 5-7
- Control Station Checks to Ensure Proper Operation 4-17
- Control Station Daily Routine 4-8
- Control Station Daily Routine (CS) Mode 4-11
- Degraded State 5-9
- Procedures During Oscillator Failure 8-9
- Transmitting Station Actions After AUTM/EUTM 5-32
- Transmitting Station Actions Before (CS) Mode 4-29
- Transmitting Station Actions for Time Steps 5-8
- Transmitting Station Configuration 4-21

ABU 4-21

ADCON 2-3
- Flowchart East 2-5
- Flowchart West 2-5
- Heavy Weather/Natural Disaster Plan 5-37
- Personnel Augmentation 2-10
- Public Affairs 9-35
- Training Responsibilities 9-22

Administrative Control .... *See* ADCON

Affidavit 9-36

Alpha Charts 9-2

Alpha Control 3-9

Alpha Monitor Receiver Sites
- A-1 and A-2 Assignments 2-26
- Alarm Tolerances 4-3
- Alpha One (A-1) 4-3
- Alpha Two (A-2) 4-3

Assigned ECD 3-6
- SAU Alarm Limits 4-21

Asynchronous Interference 6-2

Augmentation .... *See* Personnel Augmentation

Authorized Unusable Time .... *See* AUTM/EUTM

AUTM 5-29

AUTM/EUTM
- Definitions 9-18
- General Rules for AUTM Messages 9-20
- Procedures After AUTM/EUTM 5-32
- Procedures During AUTM/EUTM 5-31
- Procedures Prior to AUTM/EUTM 5-30
- Proposal/User Objections 9-19

Automatic Blink System .... *See* ABS

Automatic Blink Unit .... *See* ABU

B

Bias Plots 4-9
Blanking 4-23
  Alternate Rate Blanking 4-23
  Blanking Scheme Assignments 4-24
  Priority Rate 4-23
  Priority Rate Blanking 4-23
Blink 3-1
  ABS Degraded State 5-9
  Blink Antenna current 3-8
  Control Station Casualty Recovery 7-1
  ECD Blink Tolerances 3-14
  Master Off-Air 7-2, 7-4
  Remote/Local Control 3-10
  Responsibility During Different Modes of Control 3-13
  Solar Event Procedures 6-3
  Timing Blink Tolerances for Specific Control Modes 3-14
  Tolerances from Correlated CSTD 5-2
  Transmitting Station Casualty Recovery 7-4
  User Notification Requirements 9-13
  UUT Analysis Requirements 9-13
Blink Antenna current 3-8
Bravo Control 3-9

C

C/C 3-7
Calculated ECD 3-5, 5-4
Canadian Coast Guard CASREP Instructions 9-12
CASREP Categories 9-11
Casualty Recovery
  Control Station 7-1
  Transmitting Station 7-4
Casualty Recovery Responsibility Modes 3-10
Casualty Reporting 9-11
CCTD 8-11, 8-13
CDFO-5000A Loran Receiver 4-13
Cesium 1PPS Procedures 8-12
CEU 2-8
  Discrepency Reports (DISREP) 9-12
  Engineering Support for Monitor Receiver Sites 2-9
  Engineering Support for Transmitting Stations 2-8
CFR .... *See* Code of Federal Regulations
Chain Awards 9-33
Chain Instructions 2-3
Chain Operating Order .... *See* OPORDER
Chain Operations Control Officer .... *See* COCO
Chain Synchronization 8-1
Charlie Control 3-9

Index, Continued

Chief, Eastern/Western Operations Division
Duties and Responsibilities 2-14
Chief, Systems Management Division
Duties and Responsibilities 2-13
Civil Engineering Unit .... *See* CEU
CO Transmitting Station .... *See* CO/OIC
CO/OIC
Duties and Responsibilities 2-18
Evaluations 9-29
Operational Inspections 9-40
Operational Training Requirements 9-25
Personnel Augmentation 2-10
Qualification Program Responsibilities 9-27
Request for Off Duty Employment 9-30
Responsibilities during Heavy Weather/Natural Disaster 5-37
Training Responsibilities 9-23
UUT Analysis Enclosures 9-17
COCO
Assigned ECD 3-6
Duties and Responsibilities 2-16
LCCS Initialization Parameters 4-1
Monthly Report 9-37
Operating Parameters of the TDC 4-1
Operational Inspections 9-40
Personnel Augmentation 2-10
Primary COCO Oscillator Assignments 2-25
Report of Interference from Loran 9-39
Report of Interference to Loran 9-38
Code of Federal Regulations 1-2
Title 33, Part 62.1(c) - Navigation and Navigable Waters 1-2
Commandant 2-1
Commanding Officer, NAVCEN .... *See* NAVCEN CO
CONPOL 4-2
Control Policy .... *See* CONPOL
Control Receiver Modes 3-9
Control Station
Chain Awards 9-33
General Records Retention 9-3
Heavy Weather/Natural Disaster 5-38
Historical Records Retention 9-4
Modes of Control 3-9
Non-Operational Awards 9-34
Off Duty Employment 9-30
Power Failure 5-19
Primary Comms Failure 5-14
Qualification Program 9-27
Record Retention Table 9-4
Report of Interference from Loran 9-39
Report of Interference to Loran 9-38
Technical Archive 9-43
Telco Outage Log 9-3
Training Records 9-26
Transmitting Station EPA Failure 5-27
Transmitting Station Standby Timing Path Failure 5-26
Transmitting Station Tower Lighting System Failure 5-28

User Inquiries 9-35
Control Station (CS) Mode 3-10
Control Station Duty Officer ....*See* CSDO
Control Station Duty Tech
  Duties and Responsibilities 2-20
  LCCS Failure 5-13
Control Station Supervisor
  Duties and Responsibilities 2-17
  Operational Training Requirements 9-25
  Qualification Program Responsibilities 9-27
  Request for Off Duty Employment 9-30
  Training Responsibilities 9-23
Control Station Watchstander
  Casualty Recovery Flowchart 7-3
  Chart Markings 9-3
  Control of Baseline using LCCS 4-1
  Control Station Log 9-1
  Control Station Primary and Secondary Watch Responsibilities for Dual Rated Stations....2-24
  Control Station Primary Communications Failure 5-14
  Coordinating Equipment Switches 4-12, 4-30
  Daily Routine 4-8
  Documenting LCCS Initialization Data 4-1
  Documenting Monitor Receiver Nominal Values 4-4
  Duties and Responsibilities 2-21
  EPA Failure 5-27
  Equipment Checks 4-17
  LCCS Database Backup 4-13
  LOIS Daily Operations Report 4-10
  LSOS Station Alarms 5-11
  Maintaing Control Station Log 4-9
  Monitor Receiver Site Maintenance/Failure 5-18
  Monitor Receiver Site Primary Comms Failure 5-17
  Monitoring Message Traffic 4-10
  Monitoring transmitting Stations Using LSOS 4-5
  Operate Oscillator Installation 8-6
  Propagation Anomalies i
  Reference Book 4-16
  Responsibilities During LCCS Failure 5-13
  Responsibilities During Pulse Building 5-5
  Responsibilities During Time Steps 5-7
  SSX Failure 5-24
  System Sample 4-14
  Timing Path Failure 5-26
  Tower Lighting System Failure 5-28
  Transmitting Station Power Failure 5-21
  Transmitting Station Primary Communications Failure 5-16
  Transmitting Station Receiver System Failure 5-25
  TTX Failure 5-23
Controlling Standard ECD ....*See* CSECD
Controlling Standard Time-Difference ....*See* CSTD
Cross-Chain TD ....*See* CCTD

Index, Continued

CSDO
  Authorization to Operate in Open Loop....4-21
  Authorize Frequency Standard Set Adjustments....8-8
  Authorize Non-DESLOT Mode....4-21
  Authorize Transmitter Emergency Stop....7-5
  Casualty Recovery Responsibilities....7-2
  Disputes During Watch Relief....4-8
  Duties and Responsibilities....2-19
CSECD....3-4, 4-4, 5-4
  A-2 CSECD....4-4
CSTD....3-2
  A-1 CSTD....4-4
  Correlated CSTD/Correlated Number....5-2
CUM TDE....4-1
Cumulative Time Difference Error....*See* CUM TDE
Cycle Compensation....*See* C/C

D

De-energized Standby Loran Transmitter....*See* DESLOT
Delta Control....3-9
DESLOT....4-16, 4-21, 4-34
Detailed UUT....9-16
Digital Panel Meter....*See* DPM
Digital Panel Meter ECD....*See* DPM ECD or ECD
Discrepancy Report....*See* DISREP
DISREP....9-12
Distribution Amplifier Logbook....9-8
District Commander....2-10
  Administrative Support....2-10
DPM....3-8, 3-14, 4-22
DPM ECD....3-6
Drills....9-24

E

ECD
  Assigned ECD....3-6
  Calculated ECD....3-5
  CSECD....3-4
  Definition....3-3
  Digital Panel Meter ECD (DPM ECD)....3-6
  ECD Blink Tolerances....3-14
  EPA ECD....9-6
  F/F ECD....3-4
  LCCS Alarm Tolerance....4-5
  Monitor Receiver Site Nominal Values....4-4
  Nominal ECD (NECD)....3-6
  Routine Equipment Switches....4-12
  Status Alarm Unit (SAU)....4-21
  When to Pulse Building....5-4

Electrical Pulse Analyzer .... *See* EPA
Electronic Support Responsibilities .... *See* ESU
Electronic Support Unit .... *See* ESU
Emergency Unusable Time .... *See* AUTM/EUTM
Envelope Timing Adjustment .... *See* ETA
Envelope to Cycle Difference .... *See* ECD
EPA 4-22
EPA DPM 3-14
EPA ECD 9-6
EPA Failure 5-27
ESU 2-6
  Maintenance Responsibility of Monitor Receiver Sites 2-7
  Maintenance Responsibility of Transmitting Stations 2-6
ETA 5-4
EUTM 5-29, 9-18

F

F/F ECD 3-4, 5-4
FAA 1-2, 2-7
  Contacting FAA During Transmitting Station Tower Lighting Failures 5-28
  Maintenance Responsibility of Monitor Receiver Sites 2-7
Far Field Envelope-to-Cycle Difference .... *See* F/F ECD
Federal Aviation Administration .... *See* FAA
Flight Service Station .... *See* FSS
Formal Training 9-23
Frequency Rack Logbook 9-9
Frequency Standard Set 8-7, 8-8, 8-9
FSS 5-28

G

Gain Deviation 4-3
General Records Retention 9-3, 9-9
Geomagnetic Storms 6-1

H

Heavy Weather/Natural Disaster Plan 5-37
Historical Records 9-4, 9-9
Historical Records Retention 9-4, 9-9
Hyperbolic Lines of Position .... *See* LOP
Hyperbolic Radionavigation System 3-1

I

Informal Training 9-24
Inspection Ratings Table 9-41
Inspection Weighting Factors 9-41
Interference 6-2, 6-4
Interference from Loran 9-39
Interference to Loran 9-38
International Agreement 1-1

Index, Continued

K

Ki 4-2
Ks 4-2

L

LCCS 4-1
  Actions During AUTM/EUTM 5-31
  Actions During Control Station Comms Failure 5-14
  Actions During Control Station Power Failure 5-19
  Actions During LCCS Failure 5-13
  Actions During Pulse Building 5-5
  Actions During Receiver Site Failure/Maintenance 5-18
  Actions During Solar Event 6-3
  Actions During Time Steps 5-7
  Actions During Transmitting Station Comms Failure 5-16
  Actions During UPS Failure 5-22
  Actions Prior to AUTM/EUTM 5-30
  Battery Backup 5-19
  Bias Plots 4-9
  Chart Marking 4-9
  Chart Markings Not Done By LCCS 9-3
  Communications 4-2
  Configuration 4-1
  Control Policy 4-2
  Control Station Log Enclosures 9-1
  Control Station LSOS Data Alarm Tolerances 4-5
  Daily Archive 4-13
  Daily Control Monitor Report 4-9
  Data Intervals 4-6
  Equipment Checks 4-17
  Intermediate Maintenance Support 2-7
  LCCS Data 9-2
  Primary Maintenance Support 2-7
  Review Bias Plots 4-9
  SMEF Responsibility 2-7
LCN 8-13
LEN 3-7
Lines of Position .... *See* LOP
LOC 3-10
Local Control .... *See* LOC
Local Cycle Number .... *See* LCN
Local Envelope Number .... *See* LEN
Local Phase Adjustment .... *See* LPA
Local Phase Code Interval .... *See* LPCI
Local Station Operating Set .... *See* LSOS

LOIS....4-10, 4-14
Calculates Phase Microstepper & C-Field Adjustments....8-3
Control Station Daily Report....9-1
Daily Report....4-28
Data Reset....8-6
Long Term Detailed Report....9-37
Secondary Transmitting Station Operate Oscillator....8-5
Standby and Tertiary Oscillator....8-5
Transmitting Station Log....9-5
LOP....3-1, 3-2
Loran Consolidated Control System....*See* LCCS
Loran Operations Information System....*See* LOIS
Loran Support Unit....*See* LSU
Loran
Chain....3-1
Chain Control....3-1
Report of Interference from Loran....9-39
Report of Interference to Loran....9-38
System....3-1
Loran Engineering Course....9-22
Loran Timer(s) Configuration....4-21
Low Power....3-8
LPA....4-10
LPCI....3-7
LSOS
Alarm Assignments....4-6
Alarm Tolerances....4-7
Control Station....4-5
Control Station Equipment Checks....4-17
Failure....5-12
Retention of Logs and Data....9-4
Retention of Printer Rolls....9-9
Station Alarms....5-11
Transmitting Stations....4-18
UPS Failure....5-22
LSU
LCCS Intermediate Support....2-7
LCCS SMEF....2-7
Loran SMEF....2-6
Test Transmissions....5-33

M

Maintenance and Logistics Command....*See* MLC
Maintenance Phase Adjustment....*See* MPA
Maximum Antenna current....3-8
Microstepper....8-2
M-L∅....3-7
MLC....2-6, 2-7
Maintenance Responsibility for Transmitting Stations....2-6
Maintenance Responsibility of Monitor Receiver Sites....2-7

Index, Continued

Modes of Control 3-9
  Alpha 3-9
  Alpha Monitor Receiver Site 4-3
  Blink Tolerances for Specific Modes 3-14
  Bravo 3-9
  Casualty Recovery Responsibility Modes 3-10
  Changes in Control Result from 5-1
  Charlie 3-9
  Delta 3-9
  Mode of Control Examples 3-11
  Modes of Control and Responsibility 3-13, 5-3
  Precedence of Control 3-10
  Preferred Mode of Control 3-10
  Remote/Local 3-10
  Returning to Alpha Control 7-5
Monitor Receiver Site
  A1 and A2 Assignments 2-26
  A-1 and A-2 Definitions 4-3
  Alarm Tolerances 4-3
  Assignments 2-26
  Calibration 4-13
  Civil Engineering Support 2-9
  Control Station Equipment Checks 4-17
  Electronic Support 2-7
  LCCS 4-1
  Maintenance and Failure 5-18
  Non-Solar Event Descriptions 6-2
  Normal Operations & Configuration 4-3
  OPCON 2-3, 2-11
  Primary Communications Failure 5-17
  Retention of Rolls and Charts 9-4
  Solar Event Descriptions 6-1
Monthly Report 9-37
Monthly Report Format 9-37
MPA 4-10

N

NAVCEN 2-11
NAVCEN Awards Board 9-33
NAVCEN CO 2-1
  Duties and Responsibilities 2-11
NAVCEN Operations Divisions 2-1
  Flowchart 2-2
NAVCEN Systems Management 2-1
NECD 3-6, 5-4
Nominal ECD .... *See* NECD
Nominal Antenna current 3-8
Non-DESLOT .... *See* DESLOT
NOTAM 9-20

O

Off Duty Employment 9-30
Off Duty Employment Guidelines 9-30
OIC .... *See* See CO/OIC
OJT 9-23, 9-24
On-the-Job training........ *See* OJT
OPCON 2-1, 2-3
  Chain Control Parameters 3-1
  Flowchart East........ 2-4
  Flowchart West........ 2-4
  Report of Interference from Loran 9-39
  Report of Interference to Loran........ 9-38
Operational Control .... *See* OPCON
Operational Data Request........ 9-35
Operational Inspection Program........ 9-40
Operational Performance Award Program 9-31
Operations Officer 2-1, 2-12
Operations Manual Changes 9-44
OPORDER 2-3, 4-4
Oscillator Logbook........ 9-7
OTBK 9-13
Out-Of-Tolerance Without Blink .... *See* OTBK

P

PATCO 4-30
PCA 6-1
Antenna current, as measured by the EPA 3-8
Periodic Evaluation 9-25
Personnel Augmentation........ 2-10
Phase Microstepper 8-2
Phase Microstepper Adjustment........ 8-4
Polar Cap Absorption........ *See* PCA
Precedence of Control 3-10
Preferred Mode of Control 3-10
Program Manager 2-1, 9-22
Public Affairs 9-35
Pulse Amplitude Timing Controller .... *See* PATCO
Pulse Building 5-4

R

Radiated Signal Strength 3-8
REM 3-10
Remote Control .... *See* REM
Remote Phase Code Interval .... *See* RPCI
Remote/Local Control........ 3-10
Report of Interference from Loran 9-39
Report of Interference to Loran 9-38
Requesting AUTM 9-19
Requesting EUTM 9-19
RNAV Loran Branch 2-15
RPCI........ 3-7

Index, Continued

S

SAM 4-3
SAU....4-21
SID....6-1
Signal Strength (Gain) 3-4
Simple Data Request....9-35
Simplified UUT....9-14
SMEF 2-6, 2-7, 9-42
Standard Zero Crossing....*See* SZC
Status Alarm Unit ....*See* SAU
Sudden Ionospheric Disturbance....*See* SID
Support Manager....2-1
SYNC....3-7
Synchronization Number....*See* SYNC
Synchronous Interference....6-2
System Area Monitoring ....*See* SAM
System Sample 4-14
Systems Management Engineering Functions....*See* SMEF
SZC....3-5

T

TD....4-2
  Ki 4-2
  Ks 4-2
TDC....4-1, 5-10
  Operating Mode....4-2
TDC Reset....5-10
TDE....4-1
  Ki/Ks....4-2
Technical Archive....9-43
TELCO Outage Log 9-3
Test Transmissions 5-33
  LSU Test Transmissions....5-34
  Non-Operational Rates 5-36
  On Exsisting Operational Rates 5-35
TIC....4-21
Time Difference ....*See* TD
Time Difference Controller....*See* TDC
Time Difference Error....*See* TDE
Time Interval Counter....*See* TIC
Time Interval Number....*See* TINO
Time of Transmission Monitor....*See* TTM
Time Steps....5-7
Timing Blink Tolerances 3-14
Timing Control Number ....*See* TMCN
Timing Receiver....4-22
TINO
  Coarse TINO 3-7
  Fine TINO....3-7

TMCN........4-14, 6-3
Training Records........9-26
Training Schedule........9-25
Training Topics........9-25
Transmitting Station
Chain Awards........9-33
CO/OIC Evaluations........9-29
Daily Routine........4-27
DISREP........9-12
Distribution Amplifier Log........9-8
Duty Personnel........4-25
EPA Failure........5-27
Frequency Rack Logbook........9-8
General Records Retention and Table........9-9, 9-10
Heavy Weather/Natural Disaster........5-39
Interference from Loran........9-39
Minimum Chart Markings........9-7
Modes of Control........3-9
Off Duty Employment........9-30
Operational Inspections........9-40
Operational Performance Award........9-31
Oscillator Logbook........9-8
Power Failure........5-21
Primary Comms Failure........5-16
Public Affairs........9-35
Qualification Program........9-27
Receiver System Failure........5-25
Remote/Local Control........3-10
Report of Interference to Loran........9-38
Routine Equipment Maintenance........4-31
Routine Equipment Switches........4-30
Standby Timing Path Failure........5-26
Station Charts........9-6
Station Log........9-5
Status Board........4-34
System Sample........4-32
Technical Archive........9-43
Tower Lighting System Failure........5-28
Training........9-23
Training Records........9-26
Transmitter Maintenance Log........9-8
Unit Awards........9-34
User Inquiries........9-35
UUT for Award Purposes........9-33
Transmitting Station (TS) Mode........3-10
Transmitting Station Commanding Officer........*See* CO/OIC
Transmitting Station Duty Tech
Duties and Responsibilities........2-22
Transmitting Station Officer in Charge........*See* CO/OIC

Index, Continued

Transmitting Station Watchstander
Casualty Recovery Flowchart 7-6
Control Station Power Failure 5-19
Control Station Primary Comms Failure 5-15
Daily Routine 4-27
Duties and Responsibilities 2-23
LCCS Failure 5-13
LSOS Failure 5-12
Message Traffic 4-28
Prior to Assuming CS Mode 4-29
Pulse Analysis 3-5
Time Steps 5-8
Transmitting Station Log 4-28
Transmitting Station Primary Comms Failure 5-16
Transmitting Stations
Blanking at Dual Rated Stations 4-23
Blanking Scheme Assignments 4-24
CCTD Procedures for Dual Rated Stations 8-11
Control Station Watch Assignments for Dual Rated Stations 2-24
TTM 8-1
TTX DESLOT Operation 4-21
TTX Feedback Operation 4-21

U

U.S. Coast Guard Navigation Center .... *See* NAVCEN
U.S. Code 1-2
Title 14, Section 81 - Aids to Navigation Authorized 1-2
Title 14, Section 82 - Cooperation with Administrator of the FAA 1-2
U.S. Code of Federal Regulations .... *See* Code of Federal Regulations
U.S. Naval Observatory .... *See* USNO
U.S. Public Law 1-2
100-223, Section 310 - Radio Navigation Systems 1-2
Universal Time Coordinated .... *See* UTC
Unusable Time .... *See* UUT
User Inquiries 9-35
USNO 5-7, 8-1
UTC 8-1, 8-2
UTC Synchronization 8-1
UUT 9-13
Detailed UUT 9-15
Detailed UUT Analysis Report Enclosures 9-17
Simplified UUT 9-14
UUT Analysis 9-13
UUT for Award Purposes 9-33
UUT Review 9-24