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National Airspace System

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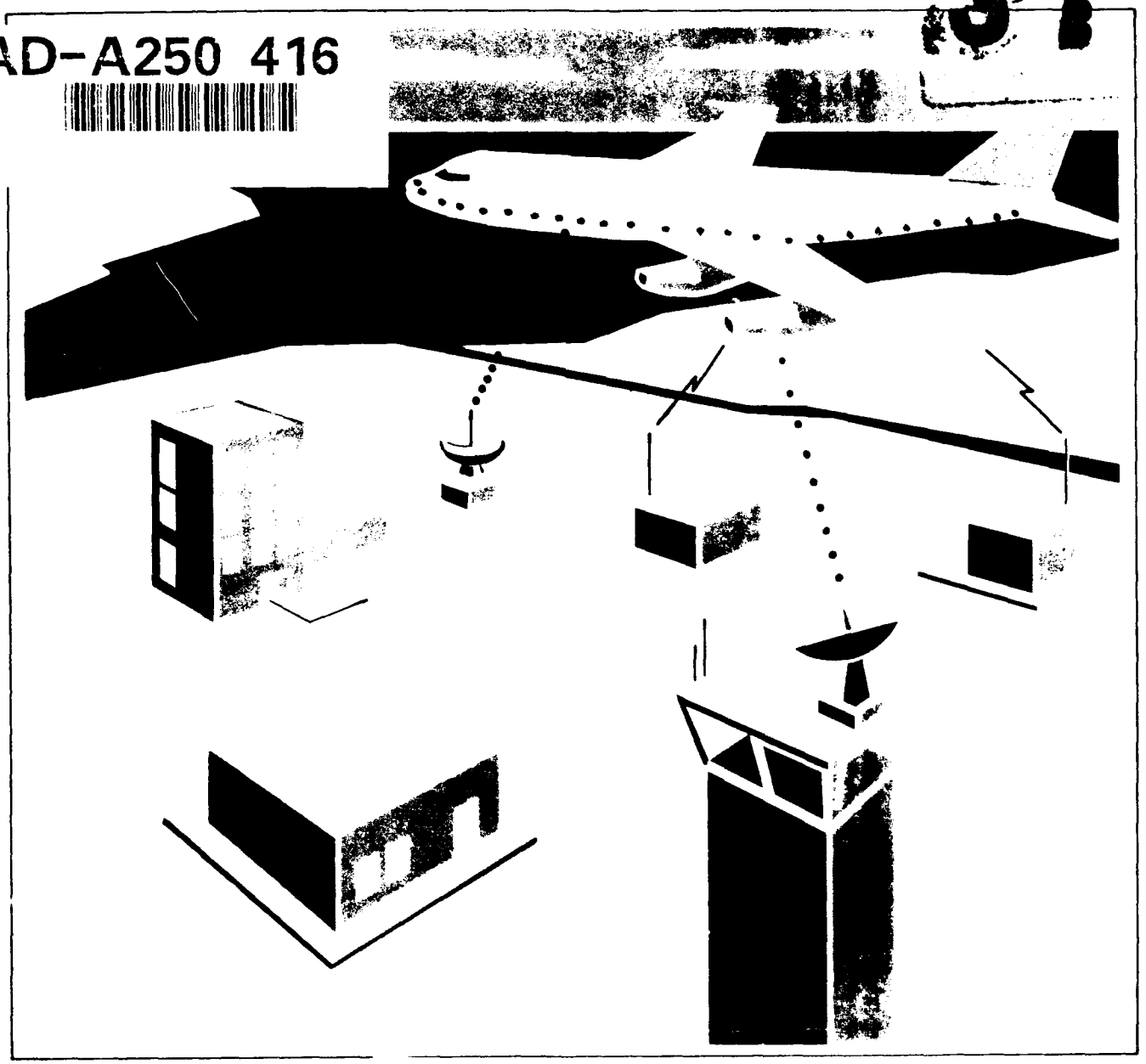
Maintenance and Support Operational Concept NAS-SR-137



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16. Abstract

A requirement for the National Airspace System (NAS) is to provide for the maintenance and support of the NAS, as identified in the NAS System Requirement Specification, NAS-SR-1000. This document presents a concept of operations for maintenance and support. It describes these capabilities and shows the relationships between subsystems, facilities, information, and operators/users. It is intended to provide a common perspective for personnel involved in maintenance and support services, assist in determining whether procedures meet formal requirements, and support coordination among the organizations involved.

This concept, along with seven other operational concepts, will complete the description of the system requirements as described in the NASSRS.

The eight operational concepts are: Communications (NAS-SR-136); Navigation (NAS-SR-134); Monitoring (NAS-SR-133); Maintenance and Support (NAS-SR-137); System Effectiveness (NAS-SR-138); Air Defense (NAS-SR-135); Flight Planning (NAS-SR-131); and Traffic Control and Airspace Management (NAS-SR-132).

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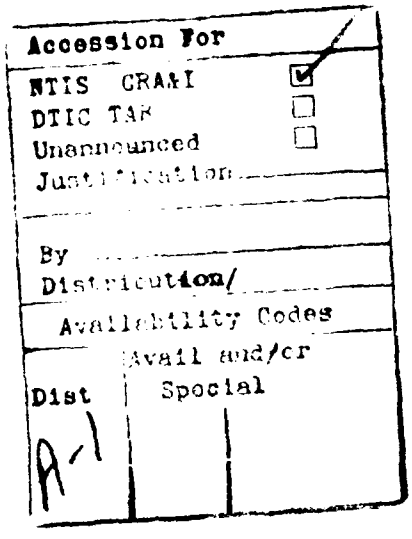

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1.0 INTRODUCTION

This document is one of a set of operational concepts that, together, describe the operation of the National Airspace Systems in its end-state (1995 and beyond). Each operational concepts is based on NAS requirements as stated in sections of the NAS System Requirements Specification (NAS-SR-1000 - NASSRS). This operational concept document has been developed using an established standard format and is consistent in structure and content with the other NASSRS operational concepts.

1.1 Background

The principle responsibility of the Federal Aviation Administration (FAA) is to provide for the safe and efficient use of the National Airspace System (NAS). Reliable, responsive, and timely maintenance and support allow the FAA to achieve this important objective.

The NASSRS is a compilation of requirements that describe the operational capabilities of the NAS as it is envisioned to exist in its end-state. It includes requirements to provide maintenance and operational support, as stated in Section 3.7, such as maintenance and monitoring, training support, testing support, facility design, and frequency and spectrum engineering to assure the quality of services being provided to the users/specialist.

1.2 Objective

The purpose of this document is to present an operational concept for Maintenance & Support in the end-state NAS. This operational concept is intended as an interpretive tool to support the transition from NASSRS requirements to NAS design. Also, it provides to management and technical personnel of the FAA and other involved organizations, a general description of end-state maintenance and support operations.

1.3 Scope

This document covers the maintenance and support requirements as delineated in Section 3.7 of the NASSRS. All aspects of maintenance and support operations are considered. The operational concept presented focuses on system connectivities, types of information passed, and human-machine interactions.

An outline of NASSRS Section 3.7 follows:

- 3.7.1 Maintenance and Monitoring
  - 3.7.1.A Monitoring and Control of Parameters
  - 3.7.1.B Flight Inspections
  - 3.7.1.C Provision of Maintenance Facilities
  - 3.7.1.D Integrated Logistics Support, Maintenance Management and Logistics Inventory Management
- 3.7.2 Training
  - 3.7.2.A Training for Implementation of Maintenance Philosophy
  - 3.7.2.B Training for Transition to New System and Procedures
  - 3.7.2.C Training for Improvement in Skills
- 3.7.3 Testing Support
  - 3.7.3.A Development Test and Evaluation
  - 3.7.3.B Operational Test and Evaluation
  - 3.7.3.C Production Acceptance Test and Evaluation

3.7.4 Facilities
- 3.7.4.A NAS Facility Consolidation
- 3.7.4.B Design of Manned Facilities
- 3.7.4.C Design of Unmanned Facilities

3.7.5 Frequency and Spectrum Engineering
- 3.7.5.A Program for New Systems to Ensure Compatibility
- 3.7.5.B Compliance with Standards and Non-Interference with Existing Systems

1.4 Methodology

The following operational concept is presented through four different types of diagrams. Supplemental information about each diagram is provided in the text. A description of each four types of diagrams follows.

1. Operational Block Diagram. The operational block diagram illustrates the connectivity between major elements of the NAS that are involved in maintenance and support operations, i.e., processors, workstations, maintenance and support and other NAS personnel. Each NAS personnel shown is assigned a number. This number remains the same in every NASSRS operational concept document. Principle features of a NASSRS operational block diagram include the following:

   a. Dotted lines segregate facilities.

   b. The blocks shown within each facility represent the major processors and workstations.

   c. Solid lines show digital data flow.

2. Operational Flow Diagrams. For each of the NAS personnel positions appearing in the operational block diagram, there is an associated operational flow diagram. The operational flow diagrams provide information about data inputs and outputs, interfaces, and processes associated with each operator. Operational flow diagrams are used to describe the responsibilities of individual NAS personnel. The major functions are listed in the white boxes at the center of each diagram. Ancillary actions are not shown. Principle features of an operational flow diagram include the following:

   a. Dotted lines segregate facilities.

   b. Non-shaded function boxes at the center of each diagram show major functions.

   c. The shaded boxes in the diagrams show hardware.

   d. The functions listed by lower case alphabetic characters in the boxes are explained in the text.

   e. Solid lines show digital data flow.

3. Operational Sequence Diagrams. The operational sequence diagram shows a typical sequence of steps taken by Airways Facilities Maintenance (AF) personnel. Principle features of an operation sequence diagram include the following:

a. NAS personnel involved with providing maintenance and support are listed along the vertical axis. When required for clarity, NAS facilities, processors, or outside organizations may be listed on the vertical axis.

b. The horizontal axis represents time. Sequential events or functions performed by NAS personnel are shown within separate boxes. Events which may occur simultaneously or near simultaneously are shown vertically.

c. Decision points or points where alternate paths may be followed are indicated by a diamond shape.

4. Operational Scenarios. The operational scenario depicts a specific predefined situation and illustrates a particular subset of the generalized operational sequence. Principle features of the operational scenario diagram include the following:

a. NAS personnel involved with providing maintenance and support are listed along the vertical axis. When required for clarity, NAS facilities, processors, or outside organizations may be listed on the vertical axis.

b. The horizontal axis represents time. Sequential events or functions performed by NAS personnel are shown within separate boxes. Events which may occur simultaneously or near simultaneously are shown vertically.

c. Circles are connectors and indicate exit to, or entry from a diagram.

1.5 Document Organization

The remainder of this document is organized in the following manner. Section 2.0 Operations is divided into six subsections:

Section 2.1 Support provides an operational block diagram that illustrates the connectivity and information flow between major NAS elements that are involved in maintenance and support operations. A summary of the roles played by the involved NAS personnel is given. Services provided by organizations outside the NAS are covered in this section.

Section 2.2 Information describes the information used for maintenance and support.

Section 2.3 Functions presents the operational flow diagrams and describes the functions of each position, the associated automation, and information inputs and outputs.

Section 2.4 Correlation provides a tabular summary of the correlation of operational requirements, as stated in the NASSRS, with the functions described in this document.

Section 2.5 Operational Sequences contains a set of operational sequence diagrams that depict the actual steps taken for maintenance and support.

Section 2.6 Operational Scenarios uses operational scenario diagrams to illustrate specific hypothetical maintenance and support actions.

2.0 OPERATIONS

2.1 Support

Figure 2-1, Maintenance and Support block diagram illustrates all the NAS facilities, systems and user systems that are involved with Maintenance and Support operations. These systems are discussed in more detail in the following paragraphs.

The maintenance and support element is composed of the following two sub-elements: the remote maintenance monitoring system (RMMS), and the system support facilities. RMMS includes performance monitoring, equipment control and certification by which Airways Facilities (AF) personnel provides effective and timely support for the continuous reliable operation of NAS equipment. System support facilities include training, testing, facilities management, logistics support and spectrum engineering. Additionally, support services provide assistance in finding optimum designs for NAS air traffic control facilities. This concept as applied to communications, navigation, surveillance, and automation systems will assure that high quality services are provided to the users and specialists.

Maintenance and Monitoring Remote maintenance monitoring of equipment is the ability to remotely monitor the performance of a facility, measure equipment parameters, predict imminent failures, and to make adjustments or corrections. This requires sensors at the remote facility feeding up-to-date information over a telecommunications network to a central processor, at an ACF, terminal facility, or sector office. It would collect, process, analyze data, and present the necessary information to the technician via a portable terminal at the remote facility or where there is access to a telephone or stationary terminal at a work center.

Equipment critical to safety requires continuous real-time monitoring with the capability for periodic airborne flight inspections for systems involving ground-air and air-ground communications, navigation, and surveillance. Flight inspection/certification of Navigational Aids (NAVAIDS) is conducted on a periodic basis by FAA inspection aircraft. These flights perform in-flight inspection and evaluation of a NAVAID to determine whether it meets established tolerances.

Training Facilities, equipment, and materials to support an extensive training program are required to affect the implementation of the maintenance philosophy embodied in the NAS. These factors include; to facilitate the transition to new NAS equipment, computer software, and procedures; and to provide for the progressive improvement and consistent maintenance of the knowledge and skill levels of all NAS personnel.

Testing All NAS projects shall complete a Test and Evaluation (T&E) process to assure the system/subsystem requirements of the NAS, including operational effectiveness and operational suitability, are verified prior to commissioning. As much of this testing as possible is accomplished prior to installation at field facilities. It is the intent that all subsystems or subsystem interfaces necessary to establish a system test environment for the NAS be available, physically or by electronic means, at the FAA Technical Center, or the FAA Aeronautical Center, as appropriate, to support required T&E prior to field implementation and to sustain the test environment for future testing.

Facilities The effective and efficient operation of the NAS is related to the adequacy of the facilities provided for FAA personnel, equipment, and furnishings employed in the system. These facilities must be designed and

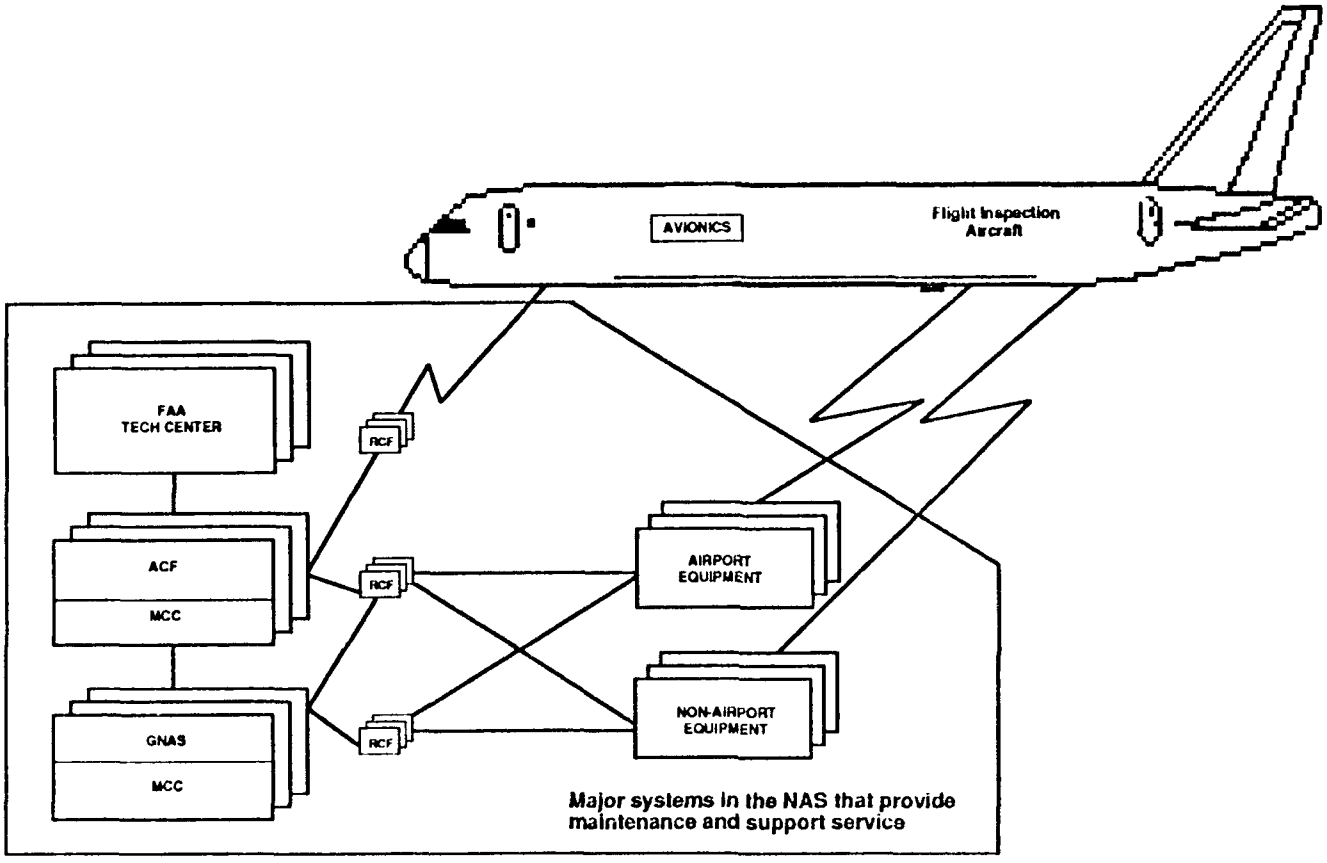

Figure 2-1
OVERVIEW OF NAS/USER SYSTEM FOR MAINTENANCE AND SUPPORT

located to optimize system cost and system effectiveness, provide suitable working and environmental conditions for NAS personnel, and provide appropriate operating conditions for NAS equipment.

Frequency and Spectrum Engineering present national policy dictates that prior to the procurement of telecommunications systems that involve the use of radio frequencies, the developers ensure that adequate radio spectrum is available and that harmful interference from such systems will be neither caused to nor received from other authorized users. This establishes the requirement for frequency and spectrum allocation and management assistance programs.

The NAS facilities, systems, major information paths, and specialists' positions that may become involved in maintenance and support are shown in Figure 2-2.

2.1.1 Positions

A statement and description of the functions provided by each specialist position that supports maintenance and operations is provided below. All of the following positions exist both in the General NAS Airway Facilities Sector (GNAS) organization and at Area Control Facilities (ACFs). While the basic function is similar in both organizations, there are many differences in terms of specific duties and official titles. These differences and specific duties are beyond the scope of this document, but are enumerated at length in some of the referenced documents. References to existing procedures, manuals, or other appropriate documentation is provided with each description.

Position 24: Maintenance Control Center (MCC) Specialist
Function: Remotely monitors and controls all critical parameters; monitor system status, equipment status and performance.
Description: MCC specialists are located at ACF MCCs and MCCs located at GNAS offices. The MCC Specialist uses the Maintenance Control Center equipment or maintenance data terminal (MDT) to detect when one or more selected parameters are out of tolerance, equipment fails, or smoke or fire alarms are activated. The MCC Specialist sends control commands to the equipment in an attempt to solve the problem. The specialist notifies the appropriate Work Center Specialists of those problems that cannot be fixed remotely.

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1, 4, 5; Chapter 3, Sections 2, 3; Chapter 5, Section 1, 2, 3, 4; FAA Order 6000.39, MCC Operations Concept

Projects: Capital Investment Plan, Chapter 2, Section 6: Maintenance and Operations: Project 26-01, Remote Maintenance Monitoring System (RMMS) Project 26-04, Maintenance Control Center (MCC); Chapter 4; Section 6, Project 46-01 RMMS, Project 46-04 MCC

Position 25: Work Center (WC) Specialist
Function: Enter data into portable/fixed Maintenance Data Terminals (MDTs) to provide the NAS specialists with process control and management information associated with the Remote Maintenance Monitoring System (RMMS).
Description: WC Specialists access applications on the Maintenance Processor Subsystem (MPS) via the MDT, input status data, retrieve data, and initiate queries. They perform certification and flight inspection. In the ACF, work center specialists are referred to as facility operations specialists/ technicians.

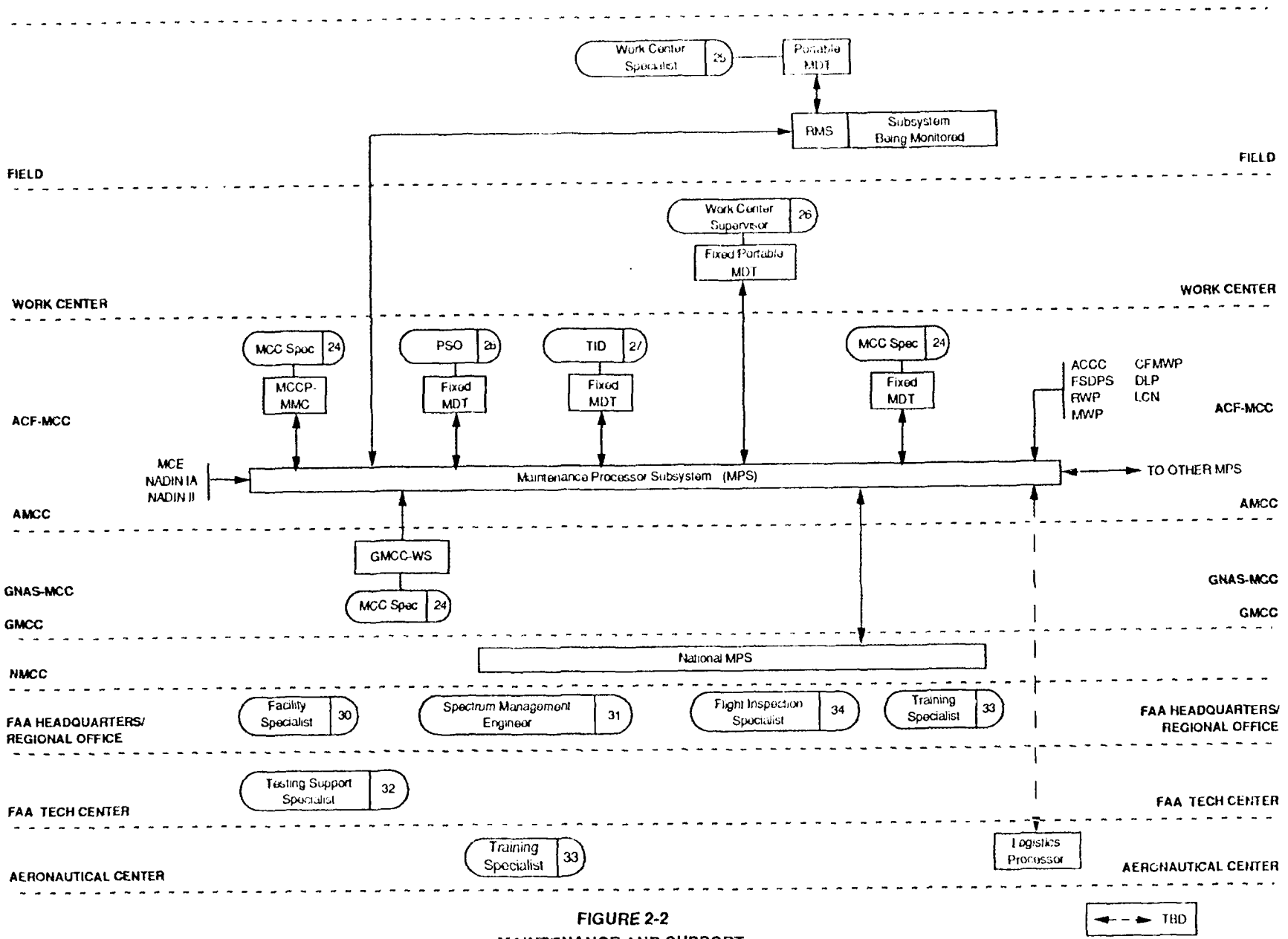

FIGURE 2-2
MAINTENANCE AND SUPPORT
OPERATIONAL BLOCK DIAGRAM

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Sections 1, 4, 5; Chapter 3, Section 1, 2, 3; Chapter 4; Chapter 5, Section 1, 2, 3, 4; Chapter 6

Order 1100.127B Airway Facilities Sector Configuration

Projects: Capital Investment Plan, Chapter 2, Section 6: Maintenance and Operations: Project 26-01, Remote Maintenance Monitoring System (RMMS) Project 26-02, Computer Based Instruction (CBI); Chapter 4, Section 6: Project 46-01, RMMS; Project 46-02, CBI

Position 26: Work Center Supervisor (WCS)
Function: Coordinate the activities of the technicians assigned to a work center, report status, and coordinate local logistics.
Description: The WC Supervisor manages the work center specialists and facilities. When a very difficult problem occurs, the WC Supervisor coordinates with the Technicians in Depth (TID). The WC Supervisor is also responsible for parts inventory at the sector field office and getting inventory from FAA depot. Note, ACF and field work centers may use different titles.

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1, 2, 3, 4, 5; Chapter 3, Section 1, 2

Order 1100.127B Airway Facilities Sector Configuration

Projects: Capital Investment Plan, Chapter 2, Section 6: Maintenance and Operations: Project 26-01, Remote Maintenance Monitoring System (RMMS) Project 26-02, Computer Based Instruction (CBI); Chapter 4, Section 6: Project 46-01, RMMS; Project 46-02 CBI

Position 27: Technicians In Depth (TID)
Function: Provide expert support in the areas of: navigation, surveillance, communications, and automation.
Description: TIDs support the work center specialists when they need some in-depth information on the failed equipment. TIDs may occasionally use MDTs and MMCs when assisting remotely located work center specialists on a specific problem.

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1, 2, 3, 4, 5; Chapter 3, Section 1, 2; Chapter 4; Chapter 5, Section 1, 2, 3, 4; Chapter 6

Order 1100.127B Airway Facilities Sector Configuration

Projects: Capital Investment Plan, Chapter 2, Section 6: Maintenance and Operations: Project 26-01, Remote Maintenance Monitoring System (RMMS) Project 26-19, Technical Support Services

Position 28: Program Support Officer (PSO)
Function: Develop specialists, purchase material, provide logistics, and support the general management of programs.
Description: The PSO is responsible for various sector level training programs, logistics, purchasing, and other administrative support for an ACF or GNAS office.

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1, 2; Chapter 3, Section 2; Chapter 5, Section 1, 4; Chapter 6, Section 1, 2, 3, 4

Order 1100.127B Airway Facilities Sector Configuration

Projects: Capital Investment Plan, Chapter 2, Section 6: Maintenance and Operations: Project 26-16, General Support

Position 30: Facility Specialists
Function: Design facilities and implement NAS facility consolidation.
Description: These specialists work in local and national headquarters on facility plans.

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1, 3; Chapter 3, Section 1, 2, 3; Chapter 6, Section 4

Projects: Capital Investment Plan, Chapter 2, Section 6: Maintenance and Operations: Project 26-08, Modernize and Improve FAA Facilities Buildings and Equipment

Position 31: Spectrum Management Engineer
Function: Perform all FAA work related to Frequency and Spectrum Engineering.
Description: These specialists belong to the Spectrum Engineering Division, and are located at the national and regional FAA headquarters.

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1; Chapter 3, Section 2

Projects: Capital Investment Plan, Chapter 2, Section 6: Maintenance and Operations: Project 26-15, NAS Spectrum Engineering; Chapter 5, Section 6: Project 56-15 NAS Spectrum Engineering

Position 32: Testing Support Specialist
Function: Support determination of the degree to which specifications are attained, determination of a system's operational effectiveness, suitability, and verification that the procured items fulfill the requirements and specifications of the procuring contract.
Description: Testing Support Specialists work at the FAA Technical Center.

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1, 2, 3; Chapter 3, Section 1, 2, 3

Projects: NAS Plan, Maintenance and Operations Support Systems
Project 17, System Support Laboratory
Project 18, General Support Laboratory

Position 33: Training Specialists
Function: Support training programs to effect the implementation of the NAS maintenance philosophy, to facilitate the transition to new equipment, new software, and new systems, and to improve NAS personnel's knowledge and skill level.
Description: Trainers teach classes and support the preparation of educational material. In-house training is provided, as well as training at the FAA Academy and computer based instruction.

Procedures: FAA, Training (3000.6B); General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1; Chapter 3, Section 2, Chapter 5, Section 4

Projects: Capital Investment Plan, Chapter 5, Section 6: Maintenance and Operations: Project 56-02, Computer Based Instruction (CBI); Project 56-13 Aircraft Flight Simulators; Project 56-29 On-Site Simulation-Based Training Systems

Position 34: Flight Inspection Specialist
Function: Check the operation and performance of NAS ground equipment and systems from airborne aircraft.
Description: Flight Inspection Specialist verifies from the air, that equipment critical to safety, such as navigation, approach and landing aids are performing within system parameters. Noted discrepancies by Flight Inspection Specialists are corrected by work center specialists.

Procedures: FAA, General Maintenance Handbook For Airway Facilities (6000.15B): Chapter 2, Section 1; Chapter 3, Section 1, 2, 3; Chapter 5, Section 1

Projects: Capital Investment Plan, Chapter 5, Section 6: Maintenance and Operations: Project 56-11, Aircraft Fleet Modernization

2.1.2 Maintenance and Monitoring Systems/Facilities

Maintenance and monitoring systems/equipment include, RMS, RMMS, RMSC, MPS, MDT, and MMC. Remote monitoring subsystems/equipment (RMS) collect, store, and transmit performance data to the MPS. RMMS provides the means to either assign local control, or to remotely adjust, certify, and/or configure the monitored facilities and equipment. RMS concentrators (RMSCs) collect data from groups of RMSs, typically at airports, for the transmission to the control and monitoring locations. Maintenance Processor Subsystems (MPSs) process, store, and route facility data to and from maintenance data terminals (MDTs). Maintenance Data Terminals (MDTs) provide the means for the sector workforce to access the remote maintenance and monitoring network. Portable MDTs provide access to RMSs and the network from remote sites.

There are three major functional types of facilities related to maintenance and monitoring: Maintenance Control Centers, Work Centers, and General NAS Airway Facilities Sector (GNAS) offices. These facilities may or may not be collocated, depending on the circumstances of the specific sector.

The Maintenance Control Center (MCC) is a centralized operational office located in each sector, whose purpose is to make the most effective use of the FAA's RMMS. MCC is further defined as a centralized control point for remote monitoring/correcting of field equipment performance, and for dispatching ASM specialists as required for equipment restoration. MCCs can service one or more GNAS sectors and can be located in ACFs, at selected major towers, and at selected GNAS sector field offices.

The MCC Functional requirements are to:

1. Assure the quality of service on real time basis
2. Direct and coordinate restoration activities
3. Direct and coordinate scheduled service interruption
4. Coordinate activities following aircraft accident/incident
5. Coordinate flight inspection activities
6. Provide operational status to users

7. Coordinate with utility companies
8. Act as a single point of contact in emergencies

The MCC will be located at or near the Sector Office. The MCC also provides secondary or backup quality assurance for maintenance functions.

Work Centers are the base of operations for Work Center Specialists.

2.1.3 Support Facilities

The primary test facility is the FAA Technical Center located in Atlantic City. The Technical Center is the national scientific test base for FAA research and development programs. Center activities involve test and evaluation in air traffic control, communications, navigation, airports, and aircraft safety and security. Activity includes long-range development of innovative systems and concepts, development of new equipment and software, and in-service modification of existing systems and procedures. The Aeronautical Center, located in Oklahoma City, OK, also provides testing and evaluation and in-service modifications of existing systems and procedures.

The Aeronautical Center also serves as the primary training facility. The Aeronautical Center conducts centralized training and central warehousing and supply and provides certain automatic data processing services for national and local programs. The Aeronautical Center operates the FAA Academy which provides training for FAA employees and other governmental and nongovernmental employees. Additionally, the Aeronautical Center provides for the management and distribution of FAA material and for the operation and maintenance of the centralized material system.

National and regional FAA headquarters are the primary locations out of which facility design and spectrum and frequency engineering are done.

2.1.4 Logistics Support

Logistics support is provided in accordance with the National Airspace Integrated Logistics Support (NAILS) policy. NAILS is the disciplined, systematic, and iterative approach to the management and technical activities necessary to: integrate support considerations into subsystem and equipment design; develop support requirements that are related consistently to system requirements, to design, and to each other; acquire the required support for the subsystem; and provide the required subsystem support during the operational life at minimum cost.

An important logistics support facility is the FAA Depot located at the Aeronautical Center in Oklahoma City. The Aeronautical Center Depot provides a mechanized logistics and inventory system (LIS), including on-line field requisitioning.

2.2 Information

Information in maintenance and support can be divided into two parts: maintenance and monitoring, and other supportive information. The other supportive information includes information about training, testing, facilities, and frequency and spectrum engineering.

2.2.1 Maintenance and Monitoring Information

Information about the critical parameters and equipment status are monitored. Also, information associated with surveillance, navigation, and approach and landing equipment is monitored. Control commands are sent to correct, adjust,

or certify equipment in the field. Flight inspection and maintenance data are also maintained.

2.2.2 Operational Support Information

The training support personnel provide information about all the facilities, equipment, methods, and materials to the specialists through training materials, direct phone calls, and classes.

Test support personnel provide all the information about test and evaluation results to logistics personnel. The test and evaluation information includes functional engineering specifications, effectiveness and suitability of operation measurements and criteria, and requirements associated with the procuring contract or agreement. Shakedown testing, as part of the Operational Test and Evaluation (OT&E) process, is conducted by the maintenance organization (ASM-400, ASM-600, AF work force) which provides information to the receiving organization (AF) on acceptability as well as to the logistic personnel.

Facility information conveys mainly the operating condition of facilities. The operating condition of unmanned facilities will be remotely monitored and operating conditions of manned facilities will be monitored and controlled by on-site specialists and MCC specialists. Preventive maintenance, scheduled corrective maintenance, and real-time maintenance activity data are sent to the MPS.

Spectrum Management Engineers send information about the requirements for meeting frequency and spectrum guidelines to the project offices which procure systems that use the radio frequency (RF) spectrum, and to the logistics or testing people. Spectrum Engineers also work with other offices on issues related to frequencies or radio frequency interference (RFI).

2.3 Functions

The following subsections describe in more detail the functions provided by the specialist positions introduced in 2.1.3. The Operational Flow Diagrams accompanying each paragraph illustrate the informational flow between specialists, and between specialists and data processing equipment. The functions of the specialists are related to paragraphs in the NASSRS. Pertinent references from the NASSRS that specify the functions performed by the specialists are included with each description.

2.3.1 MCC Specialist (Position 24)

The MCC Specialist monitors, controls, and maintains NAS subsystems from centralized locations through Maintenance Monitoring Console (MMC). The MMC will provide access to the RMMS for status of all subsystems, status and control of remote ground-to-air subsystems, and access to all RMMS management information system capabilities. MCC specialist will judge the real-time situations based on the MMC provided information such as data base information, situation appraisals, decision analysis, and failure effects.

Figure 2-3 is an operational flow diagram describing the functions and services provided by the MCC Specialist. Lettered blocks identify the functions performed by the specialist or the terminal, which are described in the corresponding paragraphs below.

a. MPS Processing. MPS processes information for users located at MCCs and MDTs. The software from the Monitoring Control Software (MCS), resident in the MPS, provides the primary facility

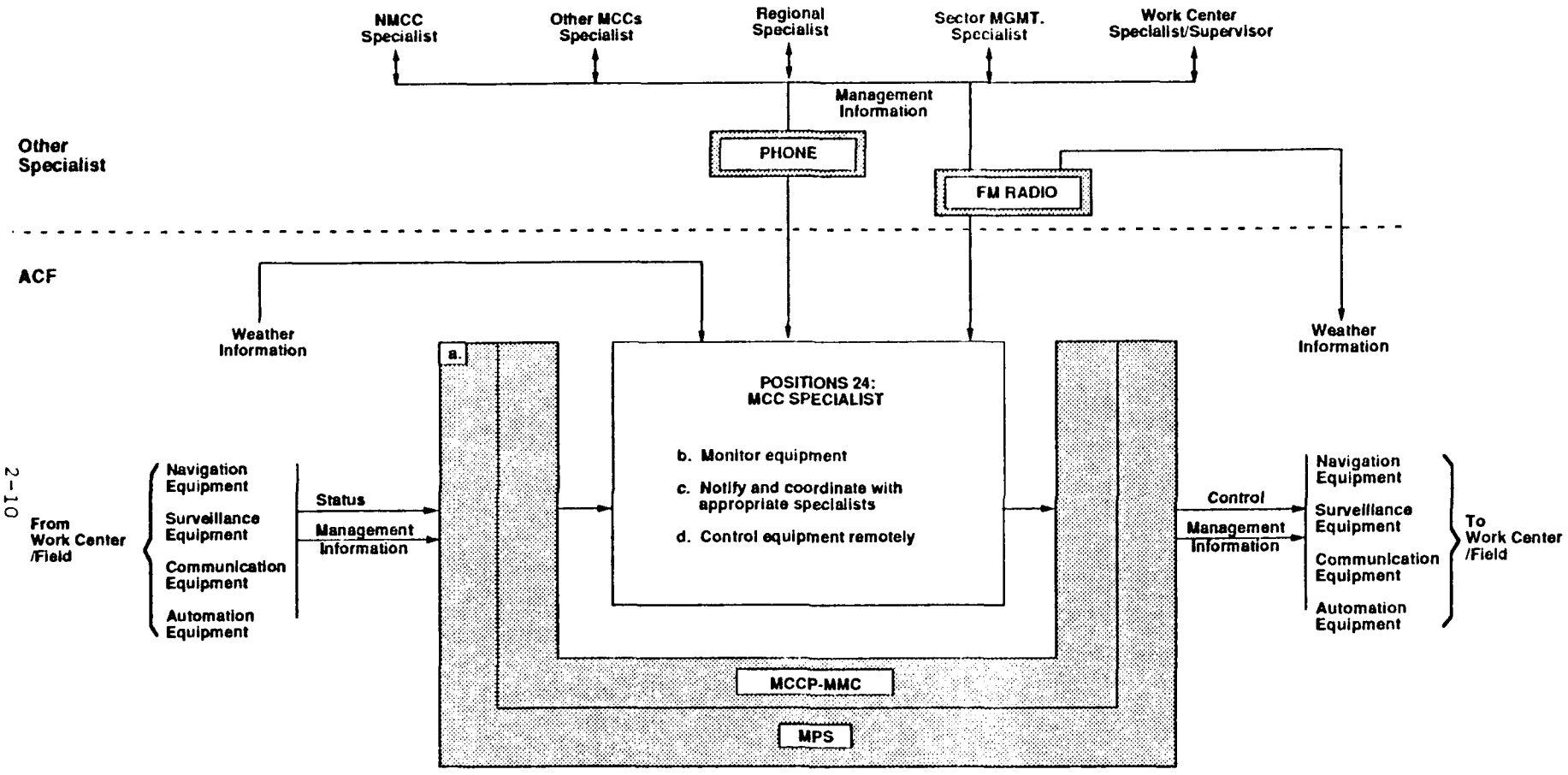

FIGURE 2-3
MCC SPECIALIST OPERATIONAL FLOW DIAGRAM

monitoring and control functions. The Maintenance Management System (MMS) software, also resident in the MPS, provides information gathering functions, such as automated facility logs,performance reporting, preventive maintenance scheduling, facility, service and equipment profile database, facility modifications, inspections, configuration management, energy management, national test equipment data base and personnel training and certification.

NASSRS requirement 3.7.1.A; 3.7.1.C

b. MCC Processor - Maintenance Monitor Console (MCCP-MMC) The MCCP-MMC provides system engineers with the capability to monitor and control NAS subsystems. Status and performance data from collocated and remote NAS subsystem/equipment is provided through an interface with the MPS.

NASSRS requirement 3.7.1.A; 3.7.1.C

c. Notify and Coordinate With Appropriate Specialists. Notifies appropriate specialists whenever an equipment parameter is outside of a pre-specified range. The MCC Specialist will also provide all information to the GNAS sector office, WC specialists, and air traffic specialists through RMMS.

NASSRS requirement 3.7.1.A

d. Control Equipment or Adjust Parameters Remotely. Run diagnostic and/or certification tests from the MMC. Corrective maintenance actions are taken, such as resetting the equipment itself.

NASSRS requirement 3.7.1.A

2.3.2 Work Center Specialist (Position 25)

WC Specialists log status reports about the equipment, which they are maintaining, to the MPS at the MCC through portable/fixed MDTs. This status information is then made available to the MCC Specialists and other WC Specialists.

Figure 2-4 is an operational flow diagram describing the functions and services provided by the Work Center Specialist. Lettered blocks identify the functions performed by the specialist or the terminal, which are described in the corresponding paragraphs below.

a. MPS Processing. MPS processes information for users located at MCCs and MDTs. The Monitoring Control Software (MCS) software, resident in the MPS, provides the primary facility monitoring and control functions. The Maintenance Management System (MMS) software, also resident in the MPS, provides information gathering functions, such as automated facility logs, performance reporting, facility, service and equipment profile database, test equipment data base, facility modifications, and inspections. The WC Specialist can retrieve data and initiate queries using the MDT.

NASSRS requirement 3.7.1.A; 3.7.1.C

b. Corrective Maintenance. The WC Specialist replaces or repairs equipment in the field. As part of the repair process, the WC Specialist runs diagnostics and sends control commands to adjust

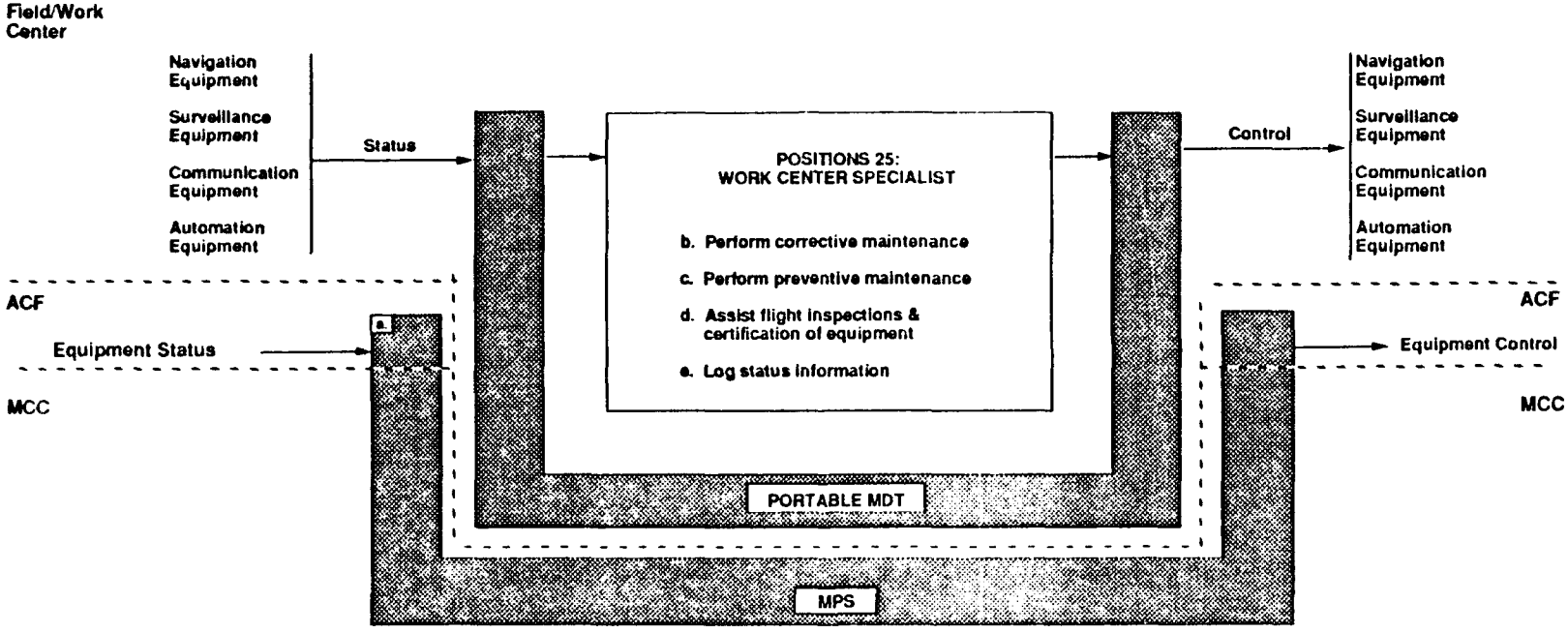

FIGURE 2-4
WORK CENTER SPECIALIST OPERATIONAL FLOW DIAGRAM

parameters or to reset the system from his portable MDT to the Remote Monitoring Subsystem (RMS). The MDT may be connected directly to the RMS or it can be connected through the RMMS network.

NASSRS requirement 3.7.1.C

c. Preventive Maintenance. The WC Specialist checks the status of the equipment regularly using the portable MDT and identifies equipment likely to fail or to need adjustment in the near future. The WC Specialist may send control commands from his MDT to adjust parameters as part of his preventive maintenance actions.

NASSRS requirement 3.7.1.C

d. Flight Inspection and Certification of Equipment. The WC Specialist assists in flight inspection activities, which verify the operation and performance of equipment and systems critical to safety. They include electronic and visual navigation aids, approach and landing aids, surveillance, and communications for each initial commissioning, at periodic intervals and after certain maintenance actions. The WC Specialist performs certification of new equipment, recertification of repaired equipment and periodic certifications.

NASSRS requirement 3.7.1.B

e. Logging Status Information. The WC Specialist will enter data for the maintenance log. The logged data is available to ASM personnel in the form of database information accessible through MDTs.

NASSRS requirement 3.7.1.A, 3.7.1.C

2.3.3 Work Center (WC) Supervisor (Position 26)

WC Supervisors receive alarms and status reports via their MDTs. They use this information to schedule and assign tasks to the work centers specialists under their control. WC Supervisors perform management information functions using MDTs, such as scheduling of preventive maintenance and the creation of status reports.

Figure 2-5 is an operational flow diagram describing the functions and services provided by the supervisors. Lettered blocks identify the functions performed by the supervisor or the terminal, which are described in the following corresponding paragraphs.

a. MPS Processing. MPS processes information for users located at MMCs, high resolution graphics terminals, and MDTs. The Monitoring Control Software (MCS), resident in the MPS, provides the primary facility monitoring and control functions. The Maintenance Management System (MMS) software, also resident in the MPS, provides information gathering functions, such as automated facility logs, performance reporting, facility, service and equipment profile database, test equipment data base, configuration management, energy management, and personnel training.

NASSRS requirement 3.7.1.A; 3.7.1.C

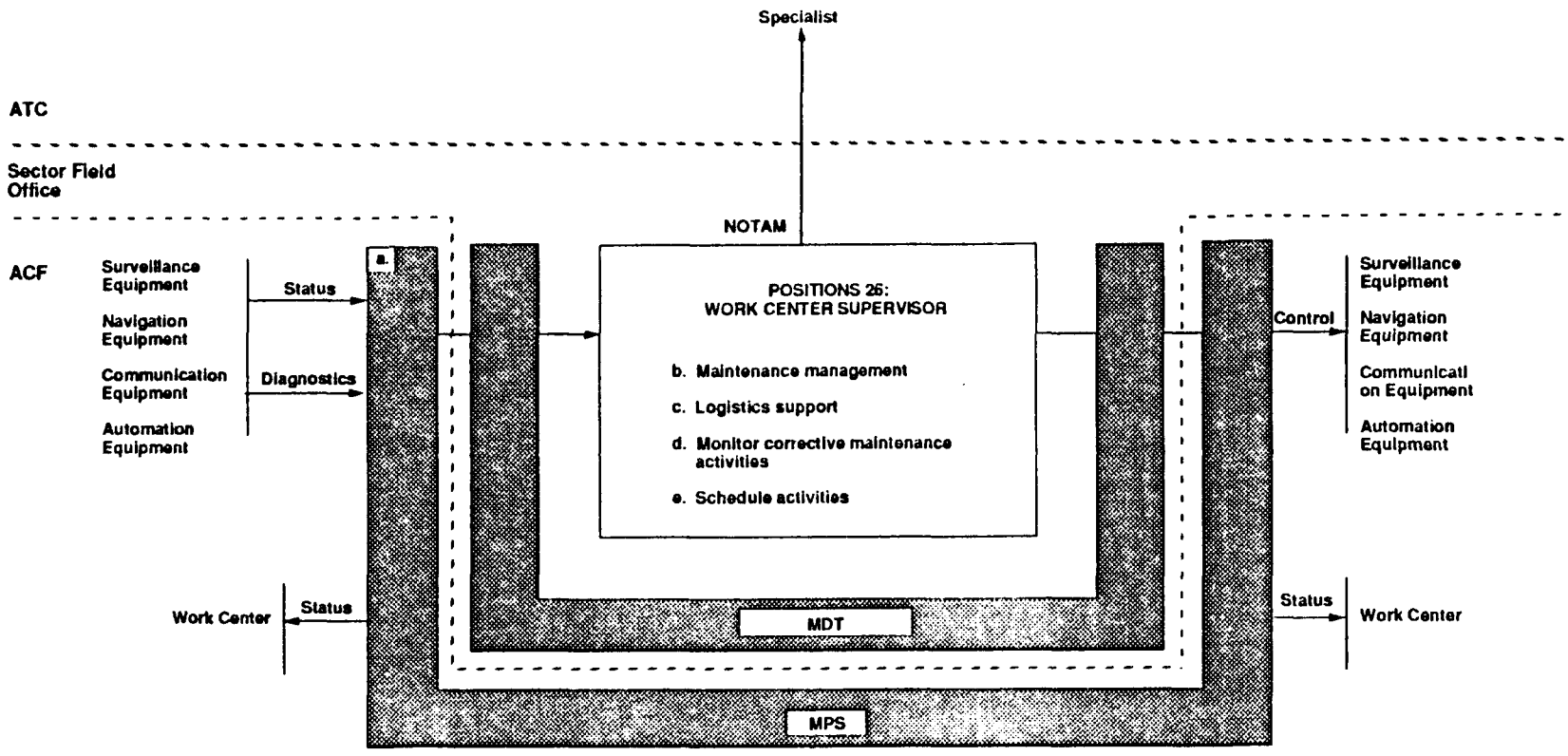

FIGURE 2-5
WORK CENTER SUPERVISOR OPERATIONAL FLOW CHART

b. Maintenance Management. The WC Supervisor analyzes repair reports and looks for trends or problems and forwards their status. This information is entered into the national data base of problems and their solutions and preserves maintenance and failure records for history and trend analysis.

NASSRS requirement 3.7.1.D

c. Logistics Support. The WC Supervisor utilizes the integrated logistics support system to ensure that the work center has the parts required and that they are readily available. In addition, calibrated test equipment, tools, supply support, and technical data is also available to the technicians.

NASSRS requirement 3.7.1.D

d. Monitor Corrective Maintenance Activities. The WC Supervisor monitors the collection of information related to the effectiveness of preventive and corrective maintenance tasks by specialists.

NASSRS requirement 3.7.1.D

e. Schedule Activities. The WC Supervisor will schedule events or tasks integral to the integrated logistics support functions.

NASSRS requirement 3.7.1.D

2.3.4 Technicians In Depth (TID) (Position 27)

The TID is located at GNAS offices and ACFs. The TID provides expertise in a particular area, such as navigation, communication, or surveillance equipment.

Figure 2-6 is an operational flow diagram describing the functions and services provided by the TID specialists. Lettered blocks identify the functions performed by the TID or the terminal, which are described in the corresponding paragraphs below.

a. MPS Processing. MPS processes information for users located at MMCs, high resolution graphics terminals, and MDTs. The Monitoring Control Software (MCS), resident in the MPS, provides the primary facility monitoring and control functions. The Maintenance Management System (MMS) software, also resident in the MPS, provides information gathering functions, such as status and performance reporting, service and equipment profile database, and configuration management.

NASSRS requirement 3.7.1.A; 3.7.1.C

b. Provide Expertise. TIDs provide the first level of technical support in the resolution of unique technical problems within and outside the sector.

NASSRS requirement 3.7.1.A; 3.7.1.C

c. Perform Technical Inspections and Personnel Certification. The TID develops and administers the sector technical inspection program and provides certification performance examiners as

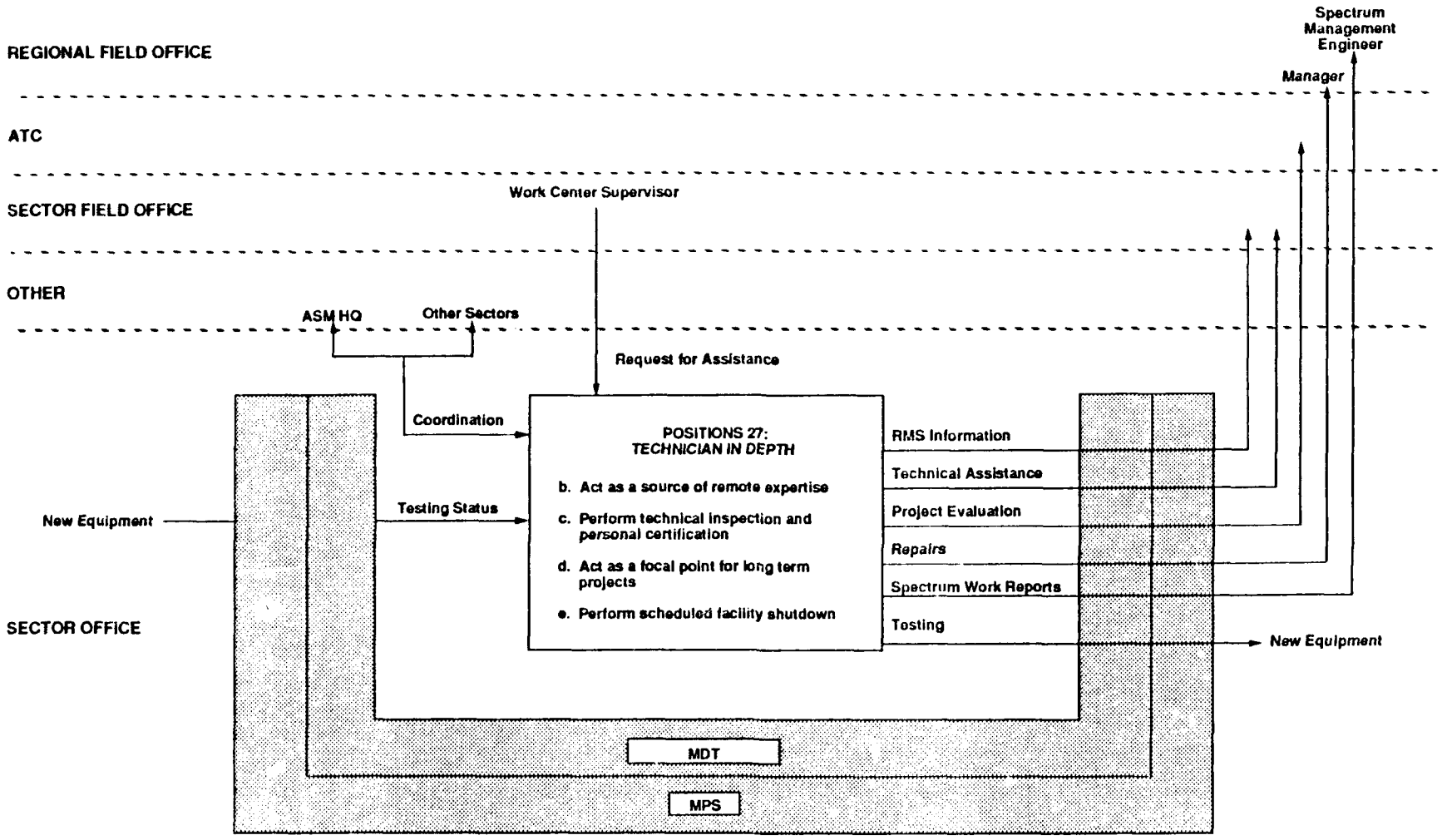

FIGURE 2-6
TECHNICIAN IN DEPTH OPERATIONAL FLOW CHART

assigned in support of sector personnel certification/training programs.

NASSRS requirement 3.7.1.C

d. Act as a Focal Point for Joint Programs. The TID provides a focal point in the sector for joint FAA/military and non-federal facility programs.

NASSRS requirement 3.7.1.C

e. Perform Scheduled Facility Shutdown. The TID coordinates and directs extended scheduled facility shutdowns of any/all facilities, systems, or equipment which could have a major or extended impact on the movement of aircraft.

NASSRS requirement 3.7.1.A

2.3.5 Program Support Office (PSO) Specialist (Position 28)

The PSO specialist serves as the principle sector element to provide support for programs pertaining to manpower, training, material, and money. Figure 2-7 describes the functions and services of PSO specialists.

a. MPS Processing. MPS processes information for users located at MMCs, high resolution graphics terminals, and MDTs. The Monitoring Control Software (MCS), resident in the MPS, provides the primary facility monitoring and control functions. The Maintenance Management System (MMS) software, also resident in the MPS, provides information gathering functions, such as automated facility logs, performance reporting, configuration management, energy management, and personnel training.

NASSRS requirement 3.7.1.A; 3.7.1.C

b. Train Technicians. The PSO specialist administers the education of the sector technicians.

NASSRS requirement 3.7.2.A, B, C

c. Manage the Sector's Logistics Program. PSO specialists manage property accountability, motor fleet management, contract administration, supply support, central supply, and other related functions.

NASSRS requirement 3.7.1.D

d. Staffing. PSO maintains records and manages the staffing resources for the sector including the MMS data base for administrative functions.

NASSRS requirement 3.7.2.B, C

2.3.6 Facility Specialists (Position 30)

Facility Specialists consist of FAA personnel from different organizations who design and implement facilities. Figure 2-8 lists the functions performed by Facility Specialists.

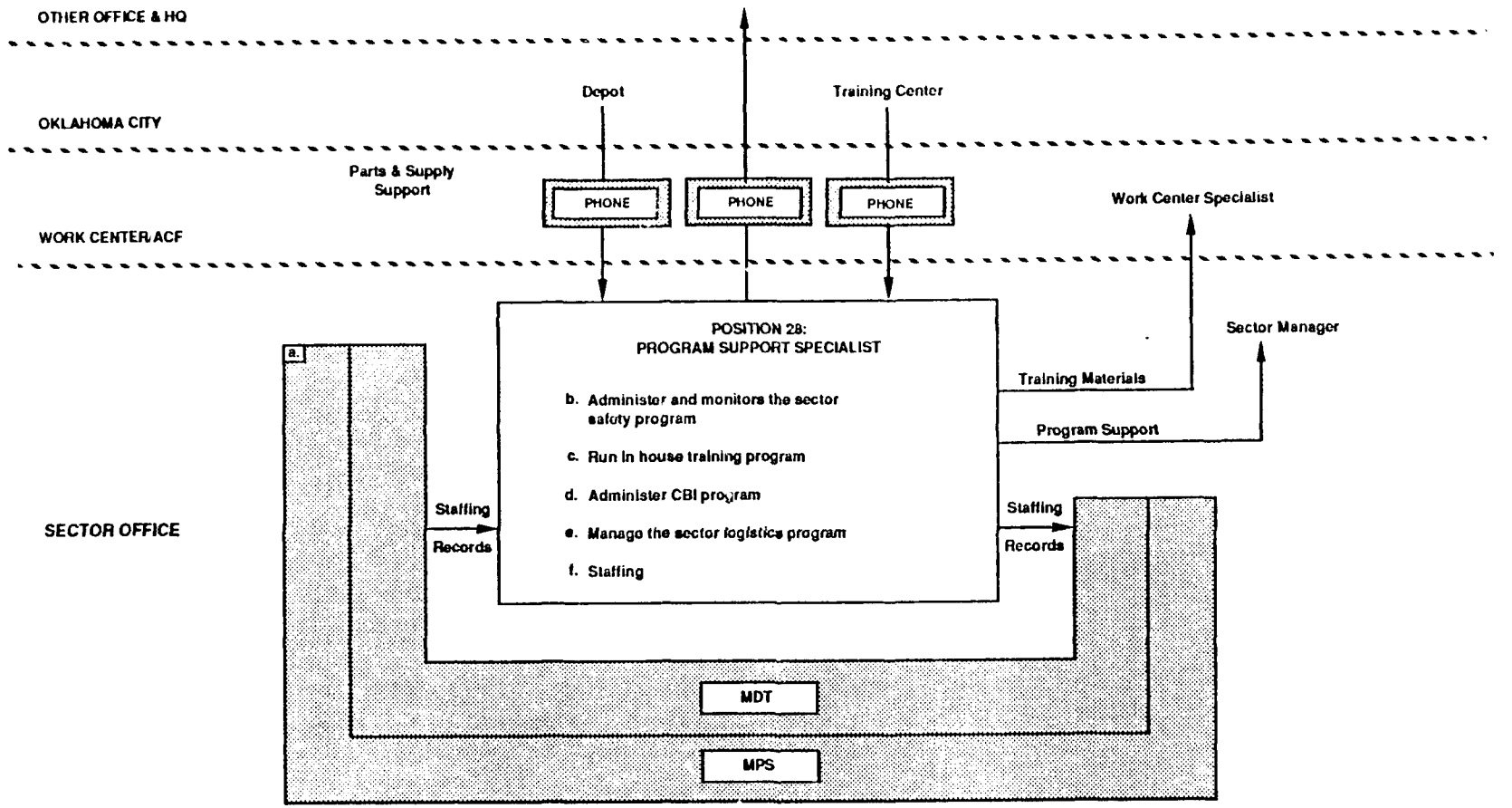

FIGURE 2-7
PROGRAM SUPPORT SPECIALIST
OPERATIONAL FLOW DIAGRAM

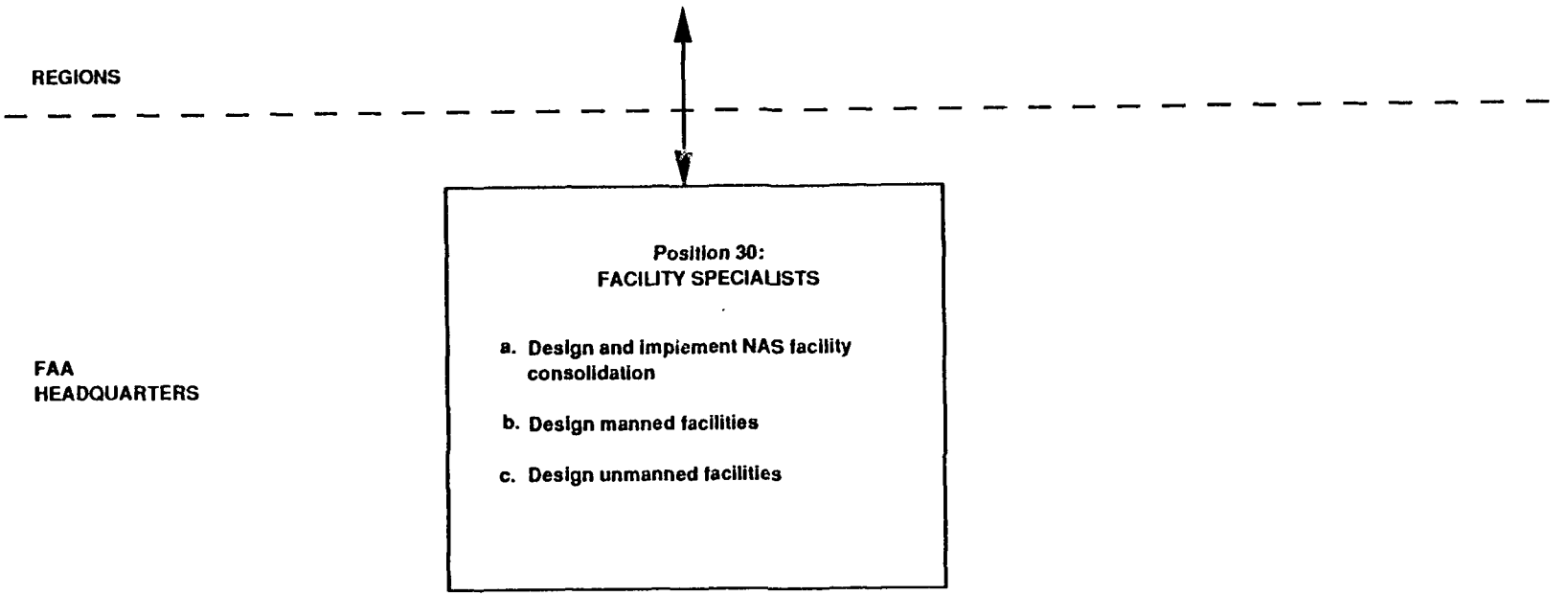

FIGURE 2-8
FACILITY SPECIALIST
OPERATIONAL FLOW DIAGRAM

a. Design and Implement NAS Facility Consolidation. The facility specialist designs and implements the consolidation of NAS facilities in such a way, so as to maximize total system-cost effectiveness. Additionally, these specialists ensure that maintenance sites are located in areas to support maximum system availability by providing efficient restoration of service and to provide economical preventative maintenance service.

NASSRS requirement 3.7.4.A

b. Design Manned Facilities. The facility specialists design manned facilities to be in accordance with human engineering practices to provide a safe, secure, reliable, and adequate work environment for assigned personnel and installed equipment.

NASSRS requirement 3.7.4.B

c. Design Unmanned Facilities. The facility specialists design unmanned facilities to provide a safe, secure, and adequate operating environment for installed equipment and to provide suitable working and environmental conditions for NAS personnel when on-site.

NASSRS requirement 3.7.4.C

2.3.7 Spectrum Management Engineers (SMEs) (Position 31)

Spectrum Management Engineers ensure that adequate radio spectrum is available for the National Airspace System (NAS). The Spectrum Management Engineers also ensure that the NAS systems operate in an interference free environment.

Figure 2-9 lists the functions and shows the information flows associated with the Spectrum Management Engineer position.

a. Perform Spectrum Engineering. SMEs ensure that adequate radio frequencies are available for new systems and that harmful interference from such systems will be neither caused to nor received from other authorized users.

NASSRS requirement 3.7.5.A

b. Coordinate with Organizations Outside the FAA on Spectrum Management Issues. Spectrum Management Engineers obtain frequency authorization and formal spectrum approval for new systems and ensure their compatibility with current and projected use by national and international aviation interests.

NASSRS requirement 3.7.5.A

c. Provide Guidance & Technical Support to Project Offices. Spectrum Management Engineers support project offices by ensuring that development and implementation of systems in the NAS are in conformance with national and international regulations and agreements.

NASSRS requirement 3.7.5.B

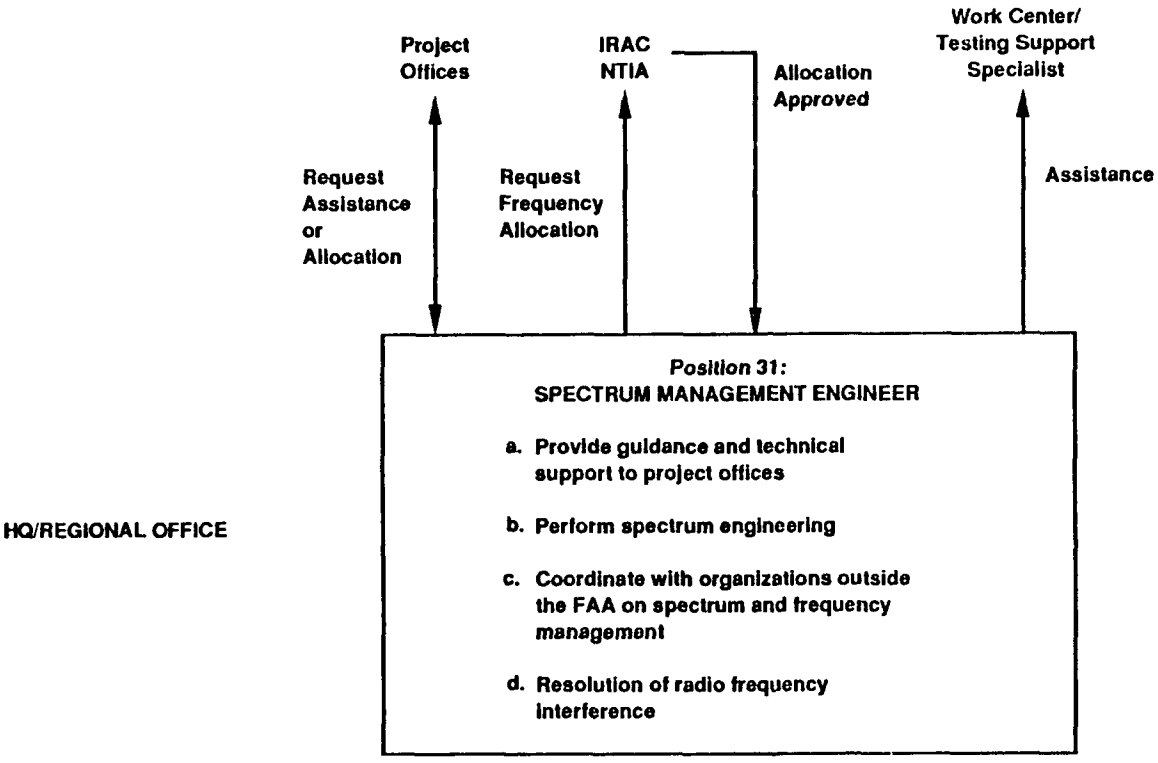

FIGURE 2-9
SPECTRUM MANAGENT ENGINEER
OPERATIONAL FLOW DIAGRAM

2.3.8 Testing Support Specialists (Position 32)

Testing support specialists support determination of the degree to which functional, engineering specifications are attained, determination of a system's operational effectiveness and suitability, and verification that the procured items fulfill the requirements and specifications of the procuring contract or agreement. Figure 2-10 lists the functions performed by Testing Support Specialists.

a. Prepare Test Plans and Procedures. Testing Support Specialists participate in the planning of testing and in the incremental determination of the degree to which functional engineering specifications are attained for Development Test and Evaluation (DT&E).

   NASSRS requirement 3.7.3.A

b. Validation of Operational Requirements (OT&E). Testing Support Specialists validate that operational requirements are met including the determination of a system's operational effectiveness and suitability to be part of the NAS and identification of needed modifications.

   NASSRS requirement 3.7.3.B

c. Provide Assistance, Observe, or Participate in Tests. These specialists provide assistance in testing functional integration of units, subsystems, and systems; test functional integration of hardware with software and operational hardware; and test functional compatibility and integration with operational systems on sites and with the NAS.

   NASSRS requirement 3.7.3.A, B

d. Evaluate Test Results. Testing Support Specialists review test data, and evaluate test results to ensure contractual compliance and to ensure that specified improvements have been incorporated into the item.

   NASSRS requirement 3.7.3.A, B, C

e. Update Plans and Procedures Based on the Results. Testing Support Specialists identify needed modifications.

   NASSRS requirement 3.7.3.B

f. Operate and Maintain Test Environments. Testing Support Specialists operate and maintain test items during operational test and evaluation at sites.

   NASSRS requirement 3.7.3.B

g. Production Acceptance Test & Evaluation (PAT&E). Support for PAT&E is also provided to determine whether serial production items consistent are of the same quality and have the same technical and operational characteristics as items previously accepted.

   NASSRS requirement 3.7.3.C

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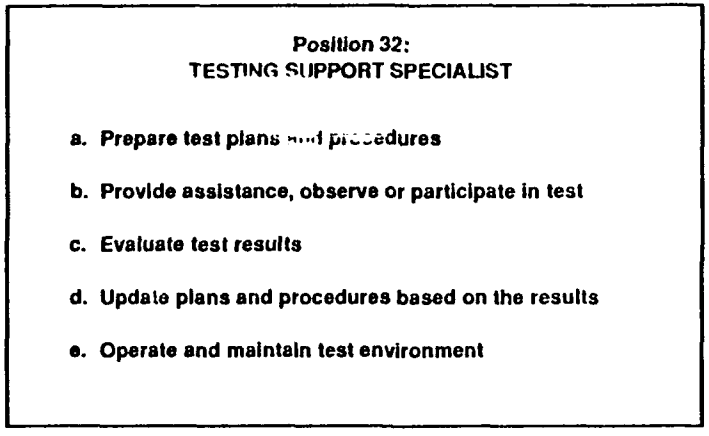

FIGURE 2-10
TESTING SUPPORT SPECIALIST
OPERATIONAL FLOW DIAGRAM

2.3.9 Training Specialists (Position 33)

Training Specialists support training programs to effect the implementation of the NAS maintenance philosophy, to facilitate the transition to new equipment, new software, and new systems, and to improve NAS personnel's knowledge and skill level. Figure 2-11 lists the functions performed by Training Specialists.

a. Provide Training Programs. Training specialists provide training programs which prepare technicians to accomplish their primary mission of the monitoring, identification and diagnosis of failures and control of equipment at remote sites. These training programs also prepare specialists to accomplish highly specialized maintenance tasks at intermediate and depot repair facilities and to utilize automated maintenance management systems.

   NASSRS requirement 3.7.2.A

b. Provide Transition Training Programs. Training specialists provide training programs, including facilities, equipment, methods, and materials, which prepares specialists for the transition to new NAS equipment, computer software, and procedures.

   NASSRS requirement 3.7.2.B

c. Improve Skill Levels of Specialists. Training Specialists produce training programs, including facilities, equipment, methods, and materials, which results in the continuous and productive improvement in the skill level of specialists.

   NASSRS requirement 3.7.2.C

d. Distributed Training System. Training Specialists produce Computer Based Instruction (CBI) disks, other instructional materials and self-paced materials and distribute them among local training facilities, the centralized FAA training facility(i.e the FAA Academy), and external facilities, as appropriate.

   NASSRS requirement 3.7.2.C

2.3.10 Flight Inspection Specialist (Position 34)

Flight Inspection Specialist checks on the operation and performance of equipment and systems critical to safety, from aircraft. The Flight Inspection Specialist in the airplane communicates what he observes to either WC or MCC specialists located on the ground. Figure 2-12 shows the functions and information flows associated with the Flight Inspection Specialist.

a. Verify the Operation and Performance of Equipment and Systems. Flight inspection specialist verifies the operation and performance of equipment and systems critical to safety, including electronic and visual navigation aids, approach and landing aids, surveillance, and communications for each initial commissioning, at periodic intervals and after certain maintenance actions.

   NASSRS requirement 3.7.1.B

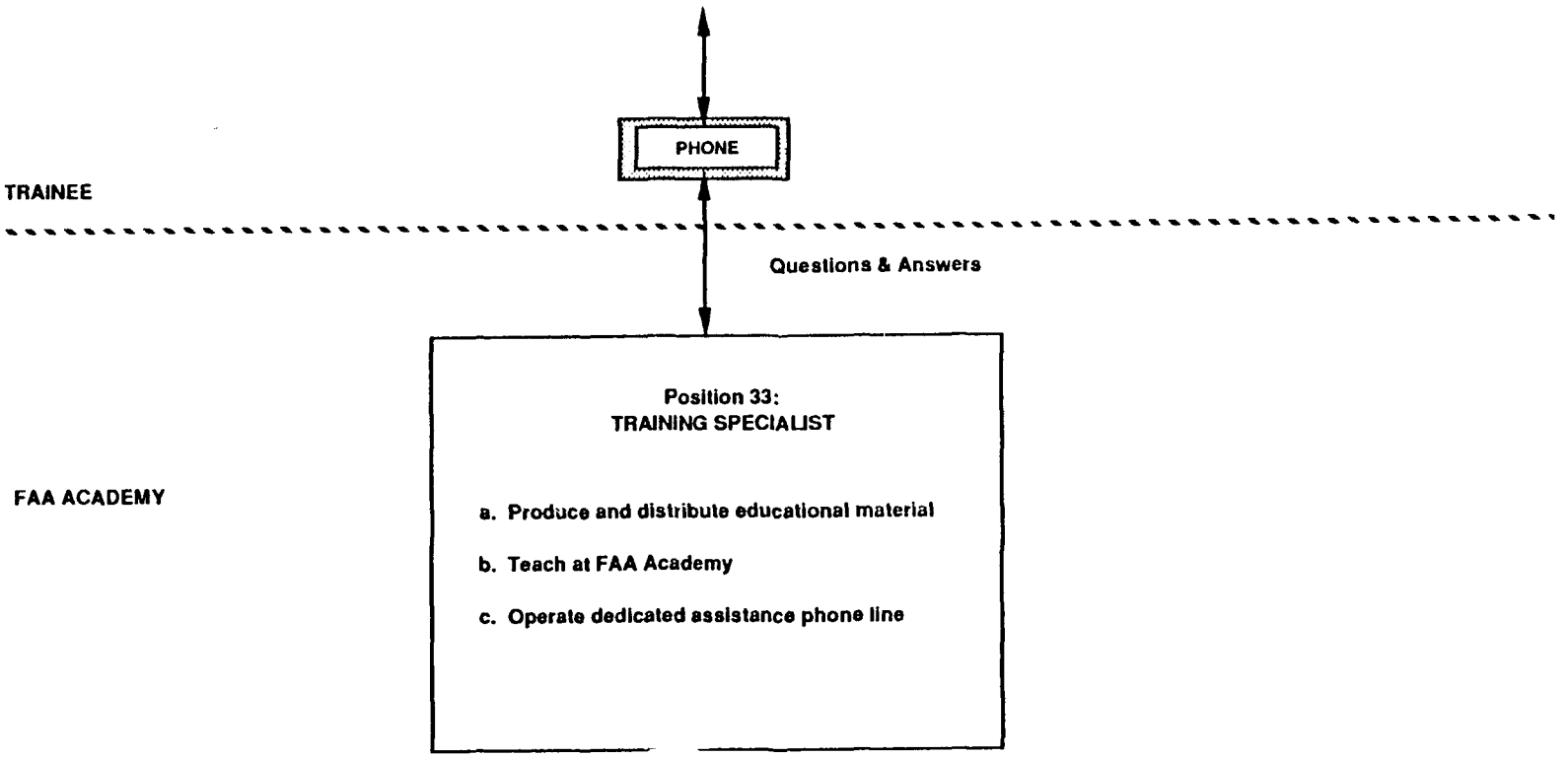

FIGURE 2-11
TRAINING SPECIALIST
OPERATIONAL FLOW DIAGRAM

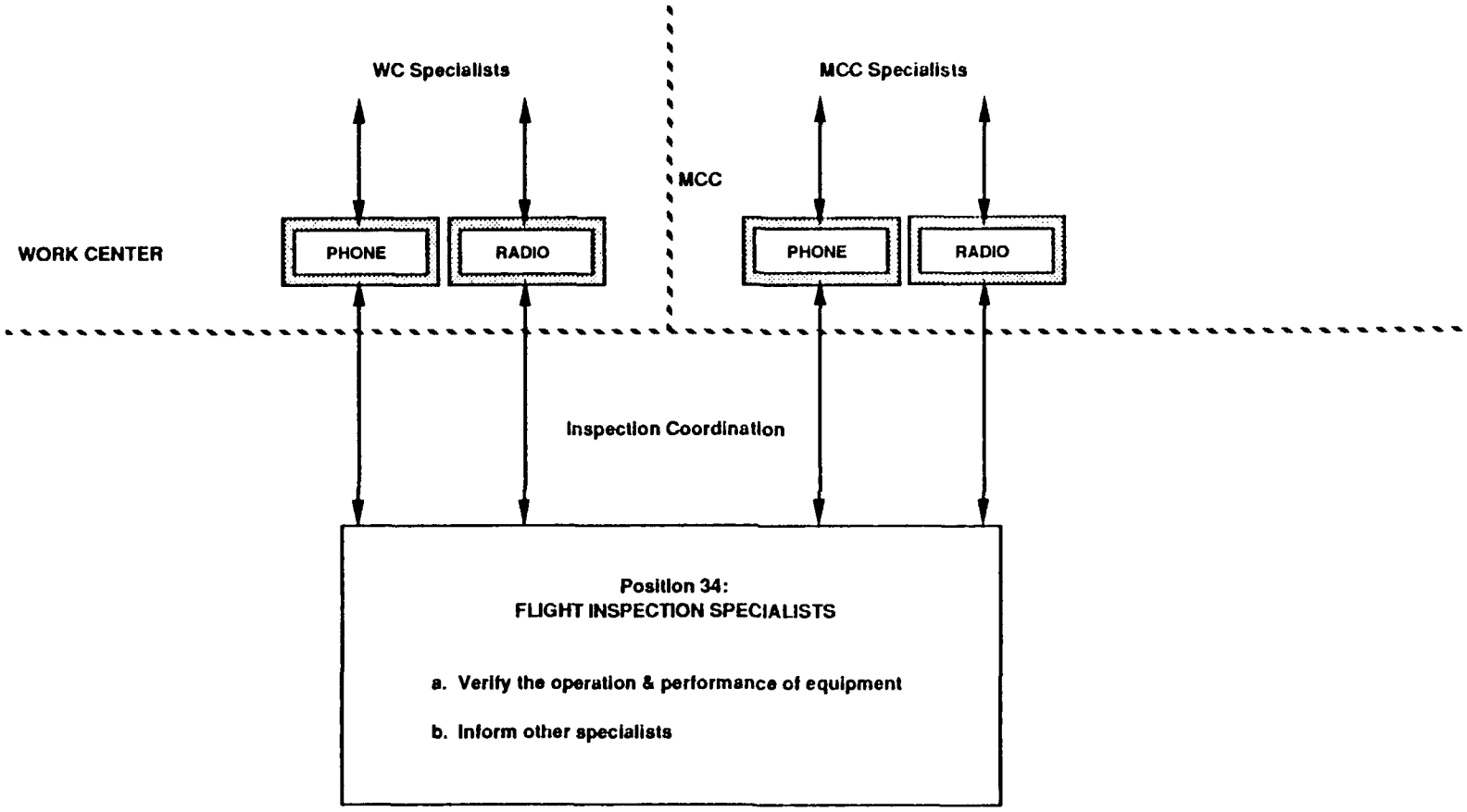

FIGURE 2-12
FLIGHT INSPECTION SPECIALIST
OPERATIONAL FLOW DIAGRAM

b. Inform Other Specialists Flight inspection specialist initiates correction procedures by telling WC or MCC specialists what has been observed.

NASSRS requirement 3.7.1.B

2.4 Correlation with Operational Requirement

Table 2-1 summarizes the correlation of the maintenance and support operational requirements of NASSRS with the paragraphs describing the functions being performed by NAS specialists. All Maintenance and Support paragraph numbers of NASSRS are listed. The fact that a correlation is shown between a requirements paragraph and a paragraph describing the functions performed should not be construed as indicating that the requirement is completely fulfilled.

2.5 Operational Sequences

The following describes maintenance & operations support activities in terms of functional/activity sequences.

Interleaved with the descriptive text are operational sequence diagrams which identify both the function performed and the corresponding activities. Each activity is numbered sequentially and referenced by the text.

2.5.1 Remote Real-time Monitoring and Corrective Maintenance Operational Sequence

Figure 2-13 illustrates this operational sequence. A MCC Specialist detects an alarm on the MMC (1). When this happens, the specialist determines whether the problem can be fixed remotely (2). If the problem can't be fixed remotely by the MCC Specialist then the MCC Specialist refers the problem to the appropriate Work Center Specialist. The specialist determines whether the problem requires spare parts (3) and attempts repair (4). Spare parts are supplied through the Work Center (5). At ACFs, when spare parts are not available (6), the PSO orders the needed parts (7). FAA Logistics Center sends the spare parts back to the problem sector (8). The Work Center Specialist attempts repair using new spare parts (4). If the WC Specialist is not able to fix the problem (9), a TID is called in to provide additional technical assistance (10). Upon completion, the work center specialist logs the status in the MPS database via a MDT (11).

2.5.2 Testing Support Operational Sequence

Figure 2-14 illustrates the sequence of events that must take place for new equipment from a testing perspective.

The project office prepares a requirements document and the Master Test Plan (MTP). The MTP will also include Development Test & Evaluation (DT&E)/ Production Acceptance Test & Evaluation (PAT&E), Operational Test & Evaluation (OT&E) and Shakedown, and NAS Integration test plans (1). The Program Manager has the primary responsibility for test plans and testing until initial operating capability (IOC), after which time the field organizations, Air Traffic and Airway Systems Maintenance, have the primary responsibility. The Program Manager requires of the contractor that certain subsystem tests be completed prior to moving to the next phase (2). The FAA Systems Engineering organization is responsible for the OT&E requirements (3). The field organizations, Air Traffic and Airway Systems Maintenance, support the

Table 2-1

MAINTENANCE AND OPERATIONS SUPPORT OPERATIONAL REQUIREMENTS CORRELATION

NAS-SR-1000 PARAGRAPH / POSITION	MCC SPECIALIST				WORK CENTER TECHNICIAN					WORK CENTER SUPERVISOR					TECHNICIAN IN DEPTH (TID)					PSO SPECIALIST				
	2.3.1.a	2.3.1.b	2.3.1.c	2.3.1.d	2.3.2.a	2.3.2.b	2.3.2.c	2.3.2.d	2.3.2.e	2.3.3.a	2.3.3.b	2.3.3.c	2.3.3.d	2.3.3.e	2.3.4.a	2.3.4.b	2.3.4.c	2.3.4.d	2.3.4.e	2.3.5.a	2.3.5.b	2.3.5.c	2.3.5.d	2.3.5.e
3.7 Maintenance and Support																								
3.7.1 Maintenance and Monitoring	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.7.1.A Monitoring	X	X	X	X	X			X	X	X					X	X			X	X				
3.7.1.B Flight Inspection								X																
3.7.1.C Provision of Maintenance Facilities	X	X			X	X	X		X	X					X	X	X	X		X				
3.7.1.D Integrated Logistics Support, Maintenance Managemet and Logistics Inventory Mgmt.											X	X	X	X								X		
3.7.2 Training Support	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.7.2.A Training for Implementation of Maint. Philosophy																					X			
3.7.2.B Traiing for Transition to New System & Process																					X			
3.7.2.C Training for Improvement in Skills																					X			
3.7.3 Testing Support	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.7.3.A Development Test & Evaluation																								
3.7.3.B Operational Test & Evaluation																								
3.7.3.C Production Acceptance Test & Evaluation																								
3.7.4 Facilities	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.7.4.A NAS Facility Consolidation																								
3.7.4.B Design of Manned Facilities																								
3.7.4.C Design of Unmanned Facilities																								
3.7.5 Frequency & Spectrum Engineering	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.7.5.A Program for New Systems to Ensure Compatability																								
3.7.5.B Compliance with Standards & Non-Interference with Exisiting Systems																								

Table 2-1

MAINTENANCE AND OPERATIONS SUPPORT
OPERATIONAL REQUIREMENTS CORRELATION (CONT'D)

NAS-SR-1000 PARAGRAPH / POSITION	FACILITY SPECIALIST				SPECTRUM MGT. ENGINEER					TESTING SUPPORT SPECIALIST								TRAINING SPECIALIST					FLIGHT INSPECTION SPECIALIST					
	2.3.6.a	2.3.6.b	2.3.6.c		2.3.7.a	2.3.7.b	2.3.7.c			2.3.8.a	2.3.8.b	2.3.8.c	2.3.8.d	2.3.8.e	2.3.8.f	2.3.8.g		2.3.9.a	2.3.9.b	2.3.9.c	2.3.9.d		2.3.10.a	2.3.10.b				
3.7 Maintenance and Support																												
3.7.1 Maintenance and Monitoring	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–
3.7.1.A Monitoring																							X	X				
3.7.1.B Flight Inspection																												
3.7.1.C Provision of Maintenance Facilities																												
3.7.1.D Integrated Logistics Support, Maintenance Managemet and Logistics Inventory Mgmt.																												
3.7.2 Training Support	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–
3.7.2.A Training for Implementation of Maint. Philosophy																		X										
3.7.2.B Training for Transition to New System & Process																			X									
3.7.2.C Training for Improvement in Skills																				X	X							
3.7.3 Testing Support	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–
3.7.3.A Development Test & Evaluation										X	X	X	X															
3.7.3.B Operational Test & Evaluation												X	X	X	X													
3.7.3.C Production Acceptance Test & Evaluation													X			X												
3.7.4 Facilities	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–
3.7.4.A NAS Facility Consolidation	X																											
3.7.4.B Design of Manned Facilities		X																										
3.7.4.C Design of Unmanned Facilities			X																									
3.7.5 Frequency & Spectrum Engineering	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–
3.7.5.A Program for New Systems to Ensure Compatability					X	X																						
3.7.5.B Compliance with Standards & Non-Interference with Exisiting Systems							X																					

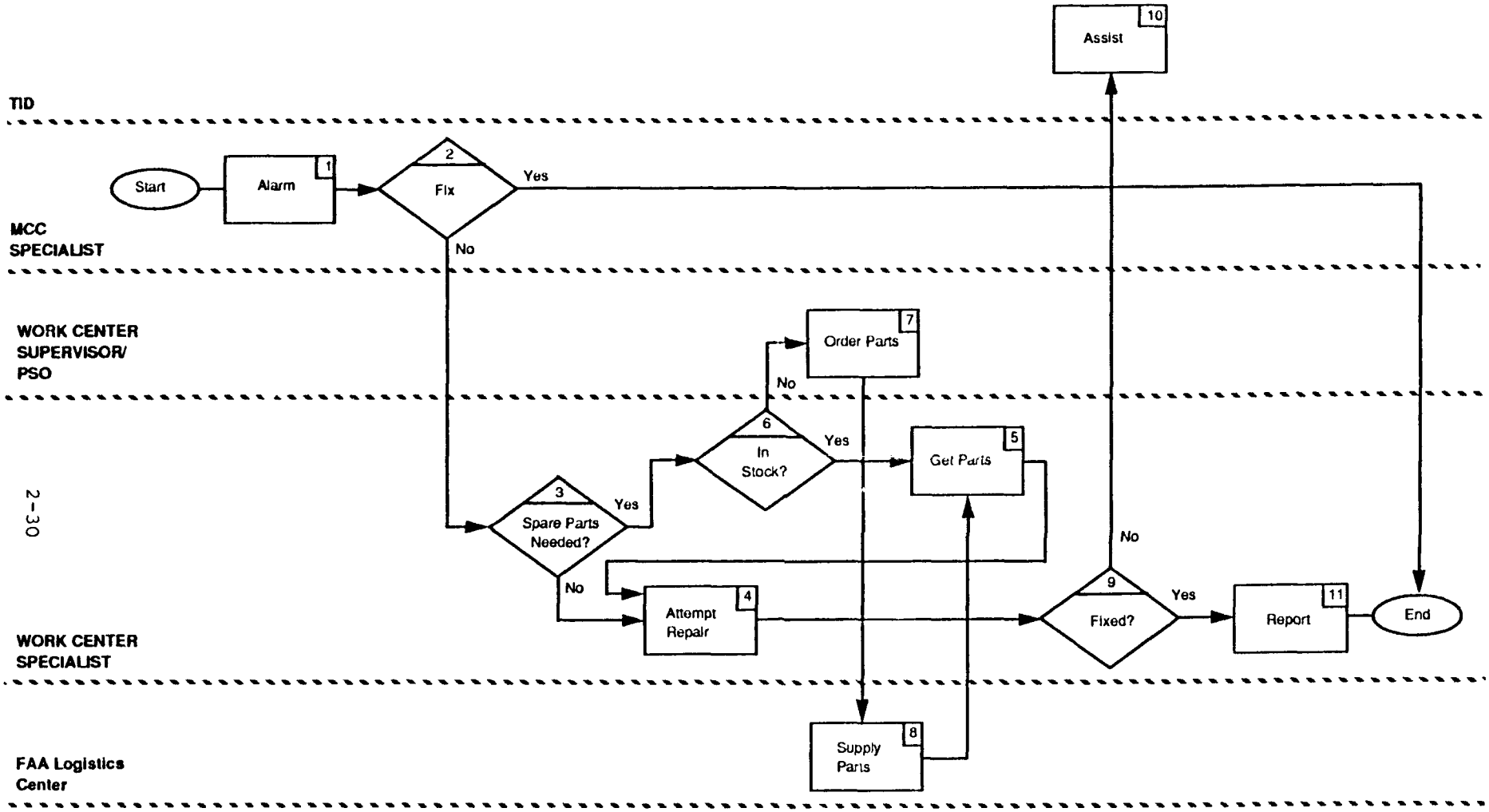

FIGURE 2-13
REMOTE REAL-TIME MONITORING AND CORRECTIVE MAINTENANCE OPERATIONAL SEQUENCE

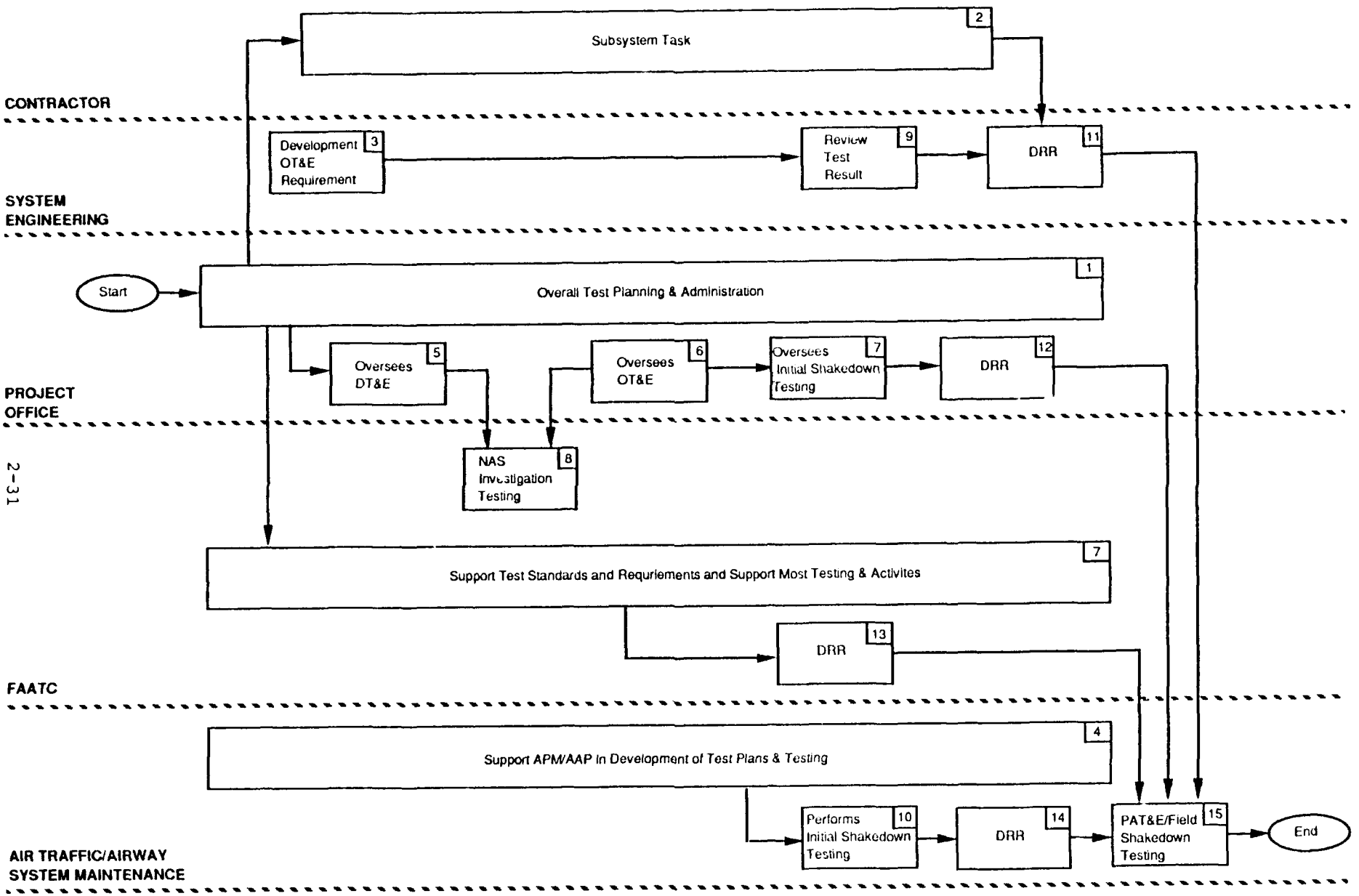

FIGURE 2-14
TESTING SUPPORT OPERATIONAL SEQUENCE

developers of test plans throughout the process (4). Project Office oversees DT&E (5), OT&E (6), and initial shakedown testing (7). The FAATC is heavily involved in supporting the test activities up to the commissioning of the first piece of equipment (8). Often, the first delivery will be made to the FAATC for testing. FAATC is responsible for NAS integration/operational testing. FAA Systems Engineering has the responsibility of reviewing OT&E test results (9). Before the system is deployed initial shakedown testing is performed by ASM (10), then a Deployment Readiness Review (DRR) is held where all the participating organizations can comment (11),(12),(13), (14). Lastly, the IOC ASM conducts PAT&E and shakedown testing (15).

2.5.3 Spectrum and Frequency Engineering Operational Sequence

Figure 2-15 illustrates the spectrum engineering process to establish an initial system operating frequency certification.

The Spectrum Engineering Division (SED) evaluates the system specification and determines if the request is a new or modified spectrum certification. A modified frequency spectrum certification requires that the SED identify the specific modification and forward a request to NTIA for an updated spectrum certification (1). The NTIA reviews the modification (2), approves and awards an updated spectrum certification or returns the request to SED for further engineering action and re-submittal (3).

A new system frequency spectrum certification requires a complete system spectrum developmental package (4) be prepared by SED and forwarded to the Spectrum Planning Subcommittee for review (5) which will prepare the NTIA/SPS application (6). The package is then reviewed by NTIA (7) and awarded a developmental stage 1, 2, or 3, to the FAA (8). Once approved, the technical design package (TDP) is completed (9) and evaluated to ensure it meets NTIA specification requirements (10). Once this step is complete the spectrum certification is awarded (3).

The APME meanwhile, separately continues the system procurement process with the development of a procurement package (13) and the issuance of the proposal (14). Systems using the RF spectrum require and evaluation of the technical proposal by the SED (16). The SED reviews the proposal TDP and forwards a request to NTIA for stage 4 review (9) and system certification with any specific "FAA only" technical comments transmitted directly to the proposal technical evaluation team (18).

NTIA reviews the TDP and determines if the system meets all spectrum requirements (10). If the system meets all requirements, a spectrum certification is awarded to the FAA (3). A spectrum stage 4 certification may also be awarded with conditions that must be met in order to continue the certification and progress to a full certification without conditions.

If the TDP does not meet requirements sufficiently to award a system certification with conditions (10), the proposal TDP will be returned to the SED (17) for update by the proposer (18,. After update, the TDP may be resubmitted to the SED (16) and NTIA (9) for review and further processing toward spectrum certification (10) and award (3).

2.5.4 Preventive and Corrective Maintenance (Facilities)

Both unmanned facilities and manned facilities require preventive and corrective maintenance. Unmanned facilities will be monitored and controlled remotely by MCC specialists. Manned facilities will be monitored and controlled by MCC specialists and/or on-site WC Specialists. The preventive and corrective maintenance operational sequence is illustrated in Figure 2-16.

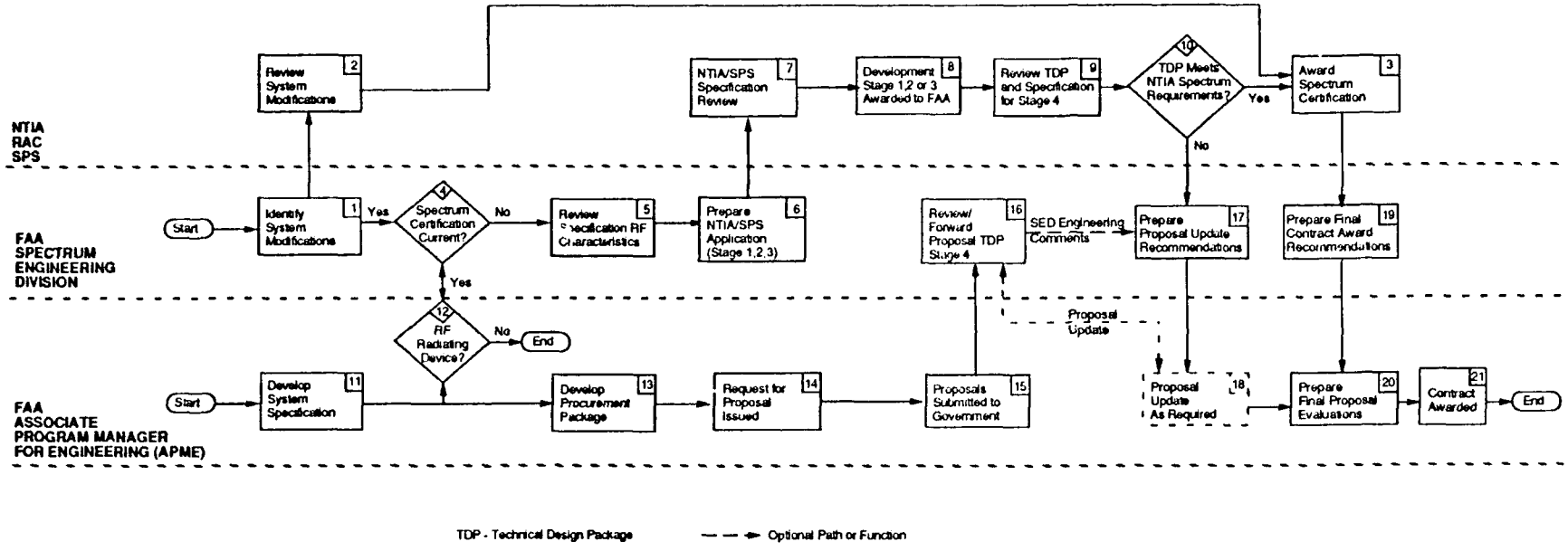

FIGURE 2-15
SPECTRUM AND FREQUENCY
ENGINEERING OPERATIONAL SEQUENCE

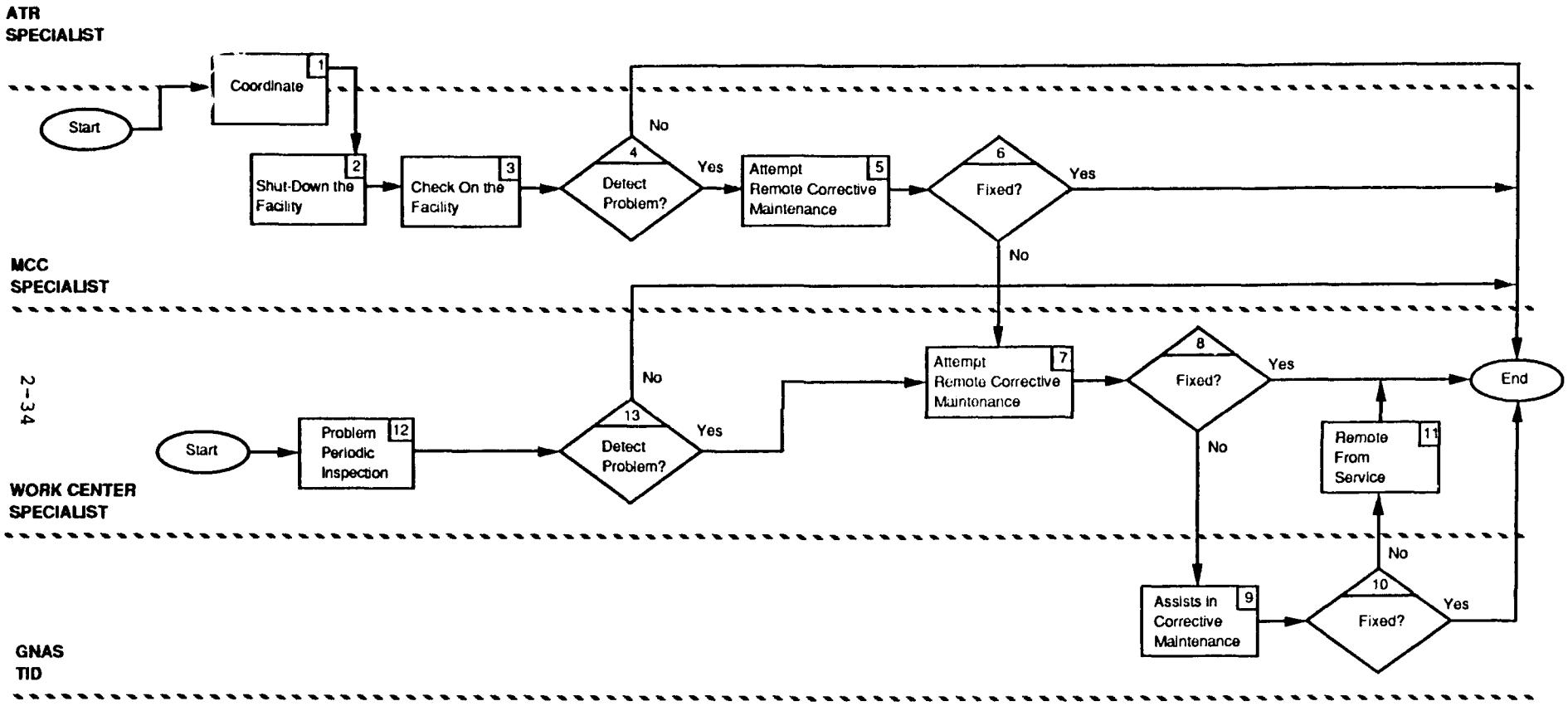

FIGURE 2-16
PREVENTIVE MAINTENANCE OPERATIONAL SEQUENCE

For the unmanned facilities, MCC specialists coordinate with Air Traffic (1) in order to shut a facility down for scheduled periodic inspections (2). The MCC Specialists check the functioning of the facilities remotely (3). If an MCC Specialist detects that one of the facilities does not operate within specified tolerance ranges (4) then the MCC Specialist tries to fix the problem remotely (5). If the problem cannot be fixed remotely (6) then theMCC Specialist contacts an appropriate WC Specialist, who tries to fix the problem (7). When a problem is beyond a WC Specialist's ability, a TID is called in to provide expert assistance (8). The TID assists in performing corrective maintenance (9). If the equipment still does not function (10) then it may have to be temporarily removed from service (11).

For the manned facilities, Work Center Specialists perform periodic inspections (12). Upon detection of a problem (13), attempts are made to fix the problem as described in steps (7) through (11).

2.6 Operational Scenarios

The following figures present operational scenarios for specific hypothetical situations. They are similar to the operational sequence diagrams in figures 2-13 through 2-16; however, the scenarios show more detail and represent hypothetical interactions between operators/specialists for specific cases. Scenario 1 depicts the Real-time Monitoring and Remote Corrective Maintenance under End-State MCC Concept. Scenario 2 describes the Real-time Monitoring and Remote Corrective Maintenance under the case of the "fold down". Scenario 3 describes the Training Support Operational Scenario.

2.6.1 Real-time Monitoring and Remote Corrective Maintenance Scenario

Figure 2-17 depicts the real-time monitoring and remote corrective maintenance scenario. A MCC Specialist in GNAS sector #15 detects an operational failure of a VOR near work center #K (1). The specialist notifies Air Traffic, who in turn, submits a NOTAM (2). Since the VOR is a piece of navigation equipment, the MCC specialist obtains advice from the TID associated with navigation (3). Following the TID's advice (4), the MCC Specialist runs diagnostic packages (5). Upon examining the results, the navigation specialist tries to fix the VOR remotely by doing a system reset (6). This still does not fix VOR, so the MCC Specialist then informs a specialist at work center #K of the problem (7). After the VOR is fixed (8), the MCC specialist informs Air Traffic about the restoration of service (9). The Air Traffic specialist will then repeal the NOTAM (10).

2.6.2 Fold-down Maintenance Scenario

Figure 2-18 shows a maintenance scenario under a "fold down" situation. The term "fold down" can be defined as the planned act of temporarily ceasing to operate out of 1 or more facilities (MCCs) during non-administrative hours and the temporary shifting of responsibilities to 24 hour facilities. The MCC Specialist coordinates the day's activities and the associated equipment shutdowns with Air Traffic before the evening traffic rush (1). In this particular scenario an MCC "folds down" into the ACF's MCC after administrative hours (2). During the night the MCC specialist detects a failure of a radar system near work center #3 (3). The MCC Specialist tries to remotely fix the radar, but fails (4). The MCC specialist then decides whether a WC Specialist needs to be called in or not (5). Since the radar failure is a critical problem, the MCC specialist decides to call back a WC Specialist, who is on a 24 hour call (6). The MCC Specialist monitors the progress of the restoration. The MCC Specialist informs Air Traffic about restoration of service (7).

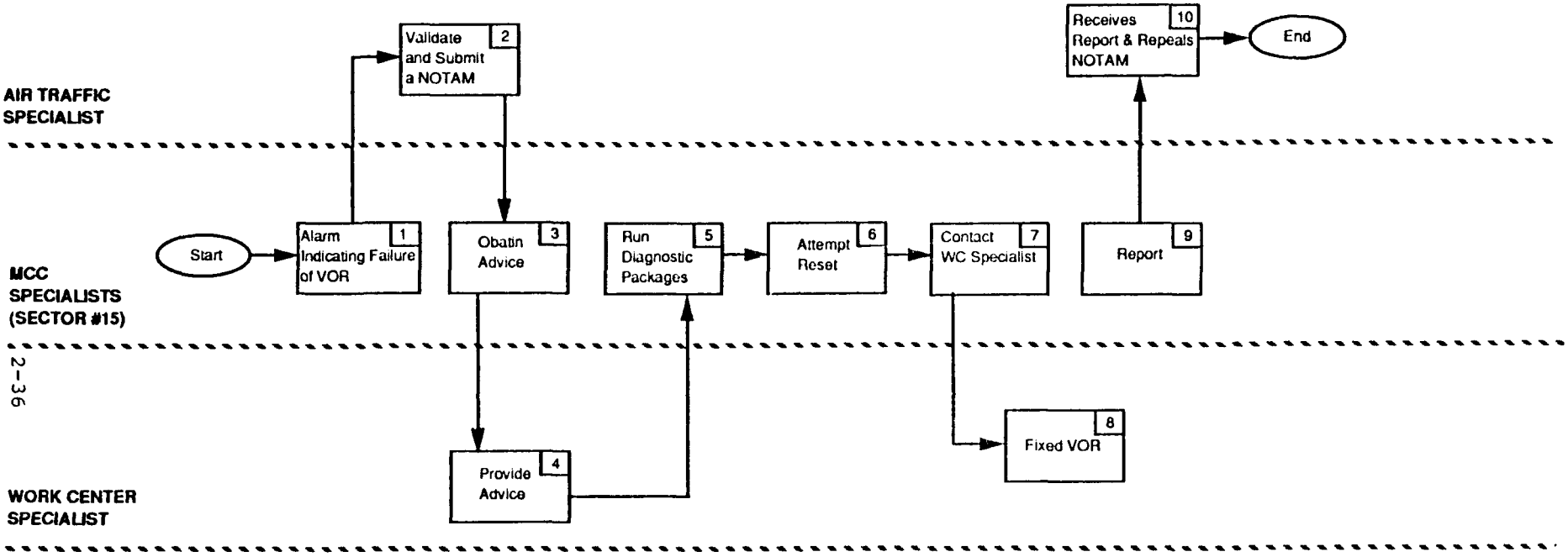

FIGURE 2-17
REAL-TIME MONTORING AND REMOTE CORRECTIVE MAINTENANCE OPERATIONAL SCENARIO

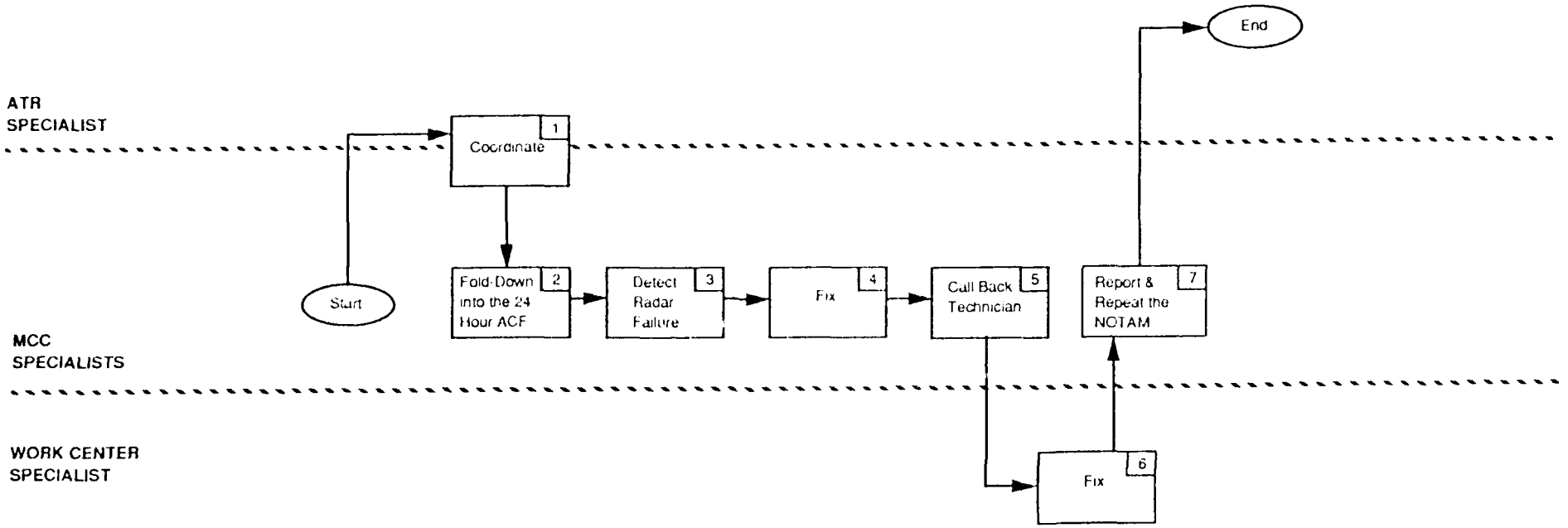

FIGURE 2-18
"FOLD-DOWN" MAINTENANCE
OPERATIONAL SCENARIO

2.6.3 Training Support Operational Scenario

Figure 2-19 describes the training support operational scenario. Because of the complexity of understanding a particular piece of equipment, training is required (1). Because the contractor is responsible for training on the piece of equipment (2), the Oklahoma FAA Academy instructors are trained at the customer site (3). The contractor prepares training materials and classes. If the material can be taught using self-study methods, then self-study manuals and computer based instruction (CBI) programs are written (4) and distributed to the field (5). CBI courses are distributed by floppy disk and run on special CBI terminals. When resident training is needed, the training will be done at the FAA Academy in Oklahoma City (6). When resident training is not needed, the training will be done at the local training facilities (7).

2.6.4 Spectrum Engineering Operational Scenario

In Figure 2-20 the system Associate Program Manager for Engineering (APME) must request engineering assistance from the SED when any new or replacement system requirements indicate the system requires an operating frequency in the RF spectrum (1) or otherwise could potentially create an electromagnetic compatibility (EMC) problem. The process is initiated by the APME formally requesting an operating frequency through the SED (2).

Before the new system is installed and commissioned at a geographic location maintained by an airways facilities sector, the system operating frequency must be approved by NTIA. The frequency assignment request is delegated to an engineer within the SED (3) or forwarded directly to a regional Spectrum Management Officer (SMO) (4) to engineer specific frequency assignment (s) for the new system. The spectrum engineer develops, with the aid of one or more engineering tools, a frequency assignment (5) that does not interfere with, nor be interfered by, adjacent facilities or systems.

The SED forwards the completed frequency assignment request (6) to the NTIA (7) for government inter-agency review. If NTIA encounters any difficulty with the proposed assignment, the request is returned to the SED for additional engineering rework (5). Approved NTIA requests are returned to the SED for the Frequency Transmitting Authorization (FTA) license. The SED forwards the frequency assignment approval to the APME for installation in the new system and notifies the cognizant regional SMO (9), who in turn issues an FTA to the airway facilities sector involved (10).

Once the new system is installed and the assigned frequency implemented (11) at the airway facilities geographic location it undergoes system tests. If EMC problems are encountered (14), responsibility and appropriate engineering assistance level is determined (15). The correction may require assistance within the FAA at the regional (16) or headquarters level. If the problem is beyond regional capability it is forwarded to headquarters for problem identification and assistance (18). If it is determined to be a system design problem then it is forwarded to the government contractor for correction (19). The contractor forwards the findings to the SED (18) and the system is retested (13).

When the EMC problem has been corrected, the system then undergoes further compatibility testing to determine if NAS EMC requirements have been met and the problems have been resolved (14). As all system and acceptance tests are satisfactorily completed, the system is commissioned by the airway facilities sector and placed in service.

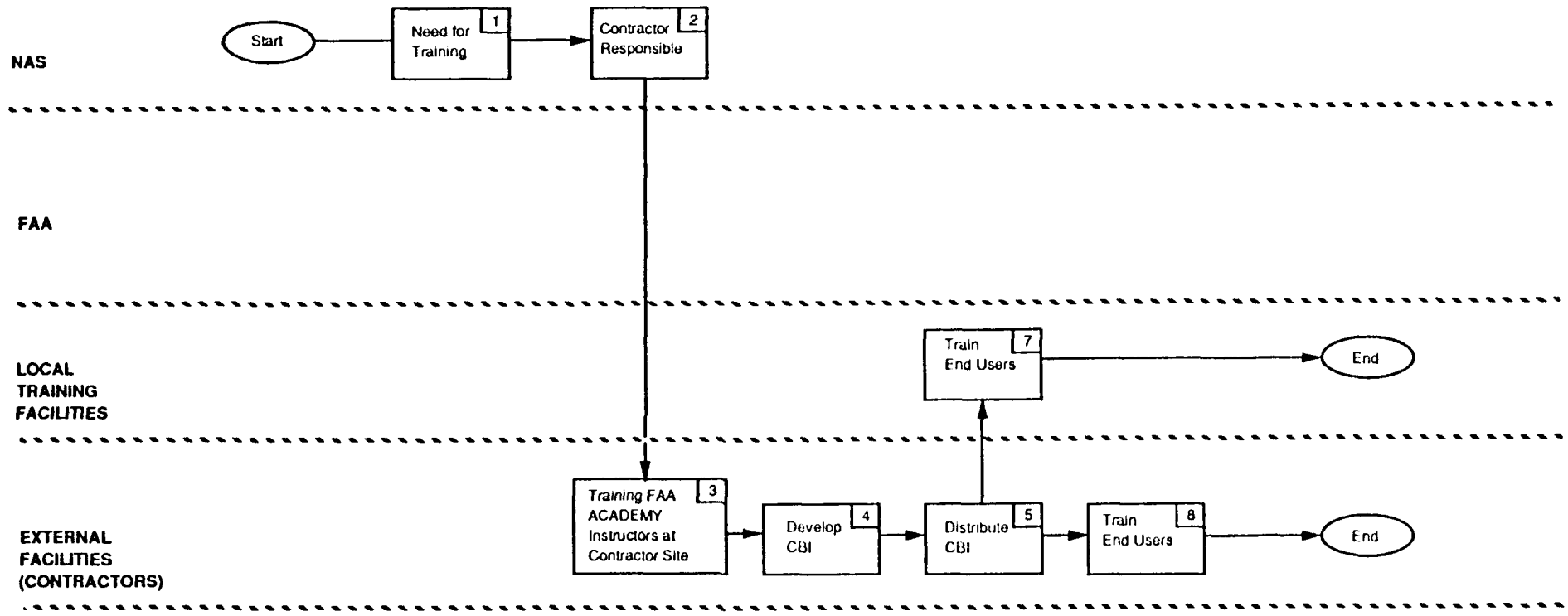

FIGURE 2-19
TRAINING SUPPORT
OPERATIONAL SCENARIO

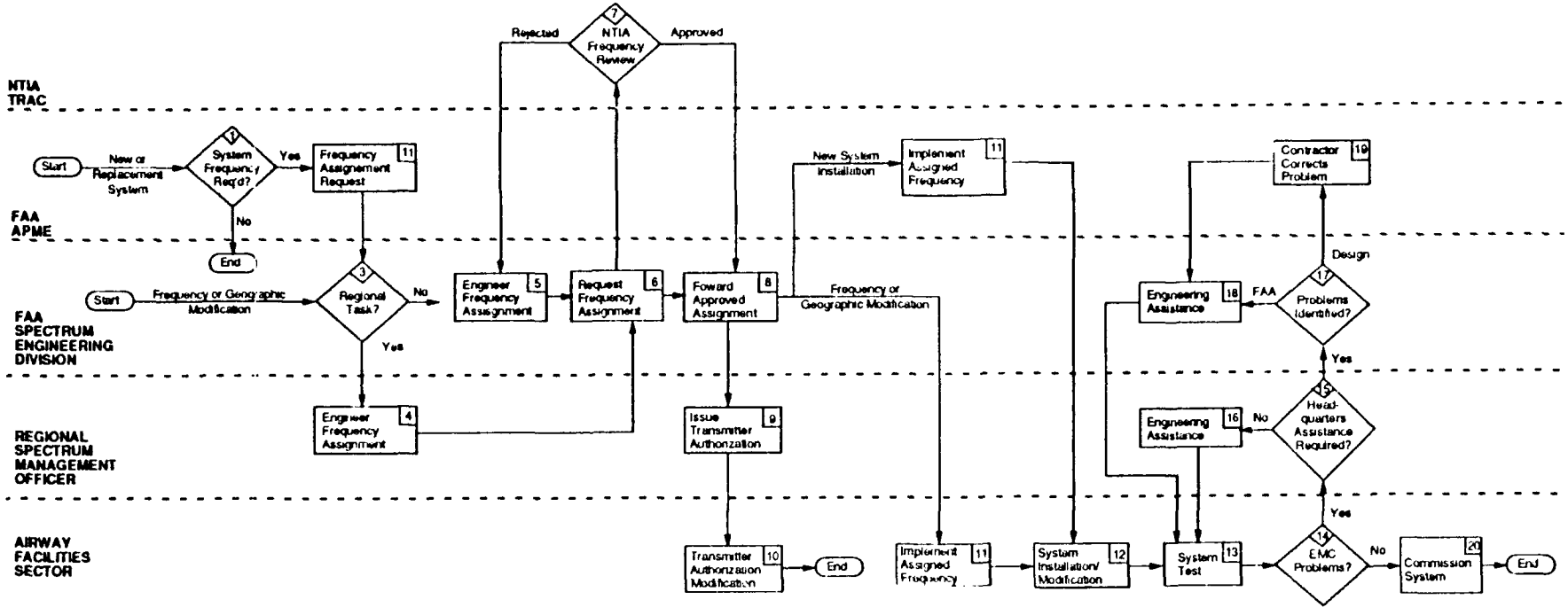

FIGURE 2-20
SPECTRUM AND FREQUENCY
ENGINEERING OPERATIONAL SCENARIO

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ACRONYMS/ABBREVIATIONS

Acronym	Meaning
ACCC	Area Control Computer Complex
ACF	Area Control Facility
AMCC	Area Control Facility MCC
ASM	Airway Systems Maintenance
ATC	Air Traffic Control
CBI	Computer Based Instruction
CFMWP	Central Flow Meteorologist Weather Processor
CM	Corrective Maintenance
DLP	Data Link Processor
DRR	Deployment Readiness Review
DT&E	Development Test and Evaluation
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FAATC	FAA Technical Center
FSDPS	Flight Service Data Processing System
GMCC-WS	GNAS MCC Work Station
GNAS	General NAS Airway Facilities Sector
IOC	Initial Operating Capability
IRAC	Inter-Department Radio Advisory Committee
LCN	Local Communications Link
LIS	Logistics and Inventory System
MCC	Maintenance Control Center
MCE	Monitor and Control Equipment
MCCP-MCC	MCC Processor - Maintenance Monitor Console
MCS	Monitoring Control Software
MDT	Maintenance Data Terminal
MLS	Microwave Landing System
MMC	Maintenance Monitoring Console
MMS	Maintenance Management System
MPS	Maintenance Processor Subsystem
MTP	Master Test Plan
NADIN	National Airspace Data Interchange Network
NAILS	National Airspace Integrated Logistics Support
NAS	National Airspace System
NASSRS	NAS Systems Requirements Specification
NAVAIDS	Navigational Aids
NMCC	National Maintenance Control Center
NOTAM	Notice To Airman
NTIA	National Telecommunications and Information Administration
OT&E	Operational Test and Evaluation
PAT&E	Production Acceptance Test and Evaluation
PM	Preventive Maintenance
PSO	Program Support Officer

RCF	Remote Communications Facility
RMS	Remote Monitoring Subsystem
RMMS	Remote Monitoring Maintenance System
RMSC	RMS Concentrator
RWP	Real Time Weather Processor
SE	Systems Engineer
SED	Spectrum Engineering Division
SFO	Sector Field Office
SME	Spectrum Management Engineer
TE	Test and Evaluation
TID	Technician In Depth
UHF	Ultra High Frequency
VHF	Very High Frequency
VOR	VHF Omni-Directional Range, a navigation system
WC	Work Center
WCS	Work Center Supervisor

GLOSSARY

AREA CONTROL FACILITY - MAINTENANCE CONTROL CENTER (AMCC) - The designation of an MCC established in an ACF.

CORRECTIVE MAINTENANCE - Corrective maintenance is the restoration of a system, system element, unit, or part to normal operation from a fault condition. Corrective maintenance is normally performed on a nonscheduled basis.

GENERAL NAS AIRWAY FACILITIES SECTOR MAINTENANCE CONTROL FACILITY (GMCC) - The designation of an MCC established in a GNAS Sector Office.

MAINTENANCE CONTROL CENTER (MCC) - The MCC is the single focal point for coordination of the maintenance activities within a specified geographical area. MCCs are equipped with the necessary workstations, processing capacity, and interface to enable real-time monitoring and control of remote or collocated NAS subsystems/equipment.

MAINTENANCE DATA TERMINAL (MDT) - The MDT provides an input and output capability for equipment within the RMMS. Fixed terminals are located at all MPS sites, other work centers, and regional offices. Portable terminals are primarily used by technicians either at a remote site or via the dial-up capability to an MPS.

MAINTENANCE PROCESSOR SUBSYSTEM (MPS) - the MPS is the primary processor for the RMMS. It performs data processing and storage, and communications interfacing and control for designated RMSCs and RMSs.

PREVENTATIVE MAINTENANCE (PM) - Maintenance accomplished on a scheduled basis to ensure top efficiency in system, subsystems, and equipment performance, to minimize unwanted interruptions in service, to minimize major breakdowns, and to extend the useful life-cycle of the equipment.

REMOTE MONITORING SUBSYSTEM (RMS) - The RMS is the basic unit of the RMMS performing real-time monitoring of important operational functions of NAS subsystems and providing the interface between the remote subsystems to be monitored and other elements of the RMMS.

REMOTE MONITORING MAINTENANCE SYSTEM (RMMS) - The RMMS provides maintenance monitoring and control equipment for FAA facilities so that performance monitoring, certification, and control can be accomplished from centralized work centers. It also provides for automated record-keeping and outage reporting, trend analysis, and other related technical and administrative functions. RMMS consists of Remote Monitoring Subsystems (RMSs), Remote Monitoring Subsystem Concentrators (RMSCs), Maintenance Processor Subsystem (MPSs), and portable and fixed maintenance data terminals (MDTs).

REMOTE MONITORING SUBSYSTEM CONCENTRATOR (RMSC) - The RMSC receives data from multiple RMS facilities concentrated geographically, such as at airports, and combines the data into a composite data response for transfer to the MPS (next level processor).