ORDER

6580.1

SYSTEM PROGRAM PLAN
AND SYSTEM IMPLEMENTATION PLAN
REMOTE COMMUNICATIONS FACILITIES

OCTOBER 28, 1965

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

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CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE	CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE

FOREWORD

This order sets forth in one document management direction for planning and implementing the remote communications facilities (RCF) in all FAA regions and is limited to the domestic portion of the National Airspace System. This order contains a description of the required activities and assignments of specific responsibilities for various tasks to ensure successful project implementation.

for Martin T. Pozesky
Director, Program Engineering
and Maintenance Service

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CHAPTER 1. GENERAL

1. **PURPOSE.** The order transmits the system program plan, chapter 2, and the system implementation plan, chapter 3, for execution.

2. **DISTRIBUTION.** This order is distributed to division level in the Program Engineering and Maintenance, Systems Engineering, Air Traffic Plans and Requirements, and Acquisition and Materiel Services in Washington headquarters; to branch level in the regional Airway Facilities divisions; to branch level in the FAA Academy and FAA Depot at the Mike Monroney Aeronautical Center; to branch level in the Facilities and Engineering Divisions at the FAA Technical Center; and a standard distribution to all Airway Facilities field offices.

3. **BACKGROUND.** The very high and ultra high frequency air/ground national communications network is maintained and operated by the FAA as a direct analog voice communications service for aircraft pilots. The network is composed of geographically dispersed radio communications antenna facilities. This document provides management direction, program reference material, and project guidelines for this multiyear effort to consolidate remote communications facilities.

4.-9. **RESERVED.**

CHAPTER 2. SYSTEM PROGRAM PLAN

SECTION 1. INTRODUCTION

10. SCOPE AND PURPOSE.

a. Remote Communications Facilities (RCF). The RCF project is one step in the overall process of consolidating/networking existing air/ground (a/g) communications facilities by providing evolutionary configurations and performance capabilities that meet National Airspace System (NAS) Plan requirements. Flight service station (FSS) communications not already at very high frequency omnidirectional range tactical air navigation system (VORTAC) facilities will be collocated/consolidated at Federal Aviation Administration (FAA)-owned facilities. New and existing remote center air/ground (RCAG) facilities will be collocated/consolidated with FAA owned facilities. Generally, the new consolidated/networked facilities will provide altitude coverage down to 2,000 feet above ground level, except in areas of low activity. Other RCF requirements include collocation/consolidation with existing facilities, operation with a maximum facility size of 24 frequencies, and transparency to users.

b. Air/Ground (a/g) Communications Program. This program approach is expected to correct operational deficiencies, satisfy current user demands, and offset the maintenance staffing and logistics costs associated with continued use of the existing system. As a result, the system is expected to provide the future services, flexibility, and performance required as the NAS becomes increasingly automated and as corresponding facility consolidations of air traffic control (ATC) and flight advisory operations are implemented.

c. Communications Facilities Consolidation/Network. Consolidation of communications facilities provides a/g communications from larger, more cost-effective consolidated RCF, in lieu of the existing greater number of facilities. Specifically, consolidation and relocation of existing a/g communications facilities will provide facilities that service the combined a/g communication needs of both ATC and FSS facilities. The consolidation of facilities into FAA-owned facilities is one step in FAA's program to provide a modern solid-state, remote monitored, radio communications network. These efforts provide reductions in building costs, land leases, maintenance staff, travel, power consumption, electronics and environmental maintenance, and leased services.

d. National Network Plan. A national networking plan has been developed from regional studies. The goal is to provide en route communications coverage down to 2,000 feet above ground level (except in areas of low activity) and to provide lower altitude coverage in areas of special concern. The results of the regional networking studies have been distributed for internal FAA use only, as an AES-1 memorandum, dated August 22, 1984, Subject: Advance Copy of Network Plans, transmitting the Advance Copy National Airspace System Remote Facilities Air/Ground Communications Network Plan.

11. BACKGROUND INFORMATION.

a. Air/Ground Communications System. The a/g communications system provides all analog voice communications between air traffic service personnel and both civil and military aircraft operating under instrument flight rules (IFR) or visual flight rules (VFR) in domestic airspace. The system also provides recorded voice weather broadcasts to aircraft over selected frequencies and antenna site locations. The a/g communications system provides communication services to civil aircraft primarily via very high frequency (vhf) and to military aircraft via ultra high frequency (uhf). The present a/g communications system encompasses en route, terminal, and flight service operations. A/G communications facilities originally were established according to regional requirements for each of the three air traffic functions, i.e., en route, terminal, and flight service operations (see figures 2-1, 2-2, 2-3, and 2-4). Control facilities in each of the three operations are connected to dedicated or shared local or remote radio sites in which the vhf and uhf radio transmitters, receivers, and antennas are located. The location of the antenna sites is dependent upon the air space coverage assigned to particular frequencies and upon overall air space coverage assigned to the control facilities.

b. Air/Ground Communications Program. This program is based upon identified programs and planning guidelines established in the NAS Plan and upon associated activities that contribute to a/g communications modernization required by the Plan and which currently are being implemented. There are four program elements in the a/g communications program:

(1) The replacement of tube-type radio transmitters/receivers with solid-state transmitters/receivers (including antennas) encompassing en route, terminal, and FSS radio outlets;

(2) The replacement of existing electromechanical/vacuum-tube channel voice recorders with solid-state voice recorders;

(3) The replacement of tube/relay tone radio signaling and control equipment with solid-state equipment encompassing en route, terminal, and FSS radio outlets and their associated control facilities; and

(4) The consolidation/network of existing a/g radio communication sites into a lesser number of FAA owned remote communications facilities.

c. Related Programs. Programs interfacing with the a/g communications program include the flight service modernization program, including weather dissemination via a/g communications outlets, the remote maintenance monitoring system (RMMS) program, the voice switching and control system (VSCS) program, and the integrated communications switching system (ICSS) program.

FIGURE 2-1. THE ARTCC AND ITS TRIBUTARY FACILITIES

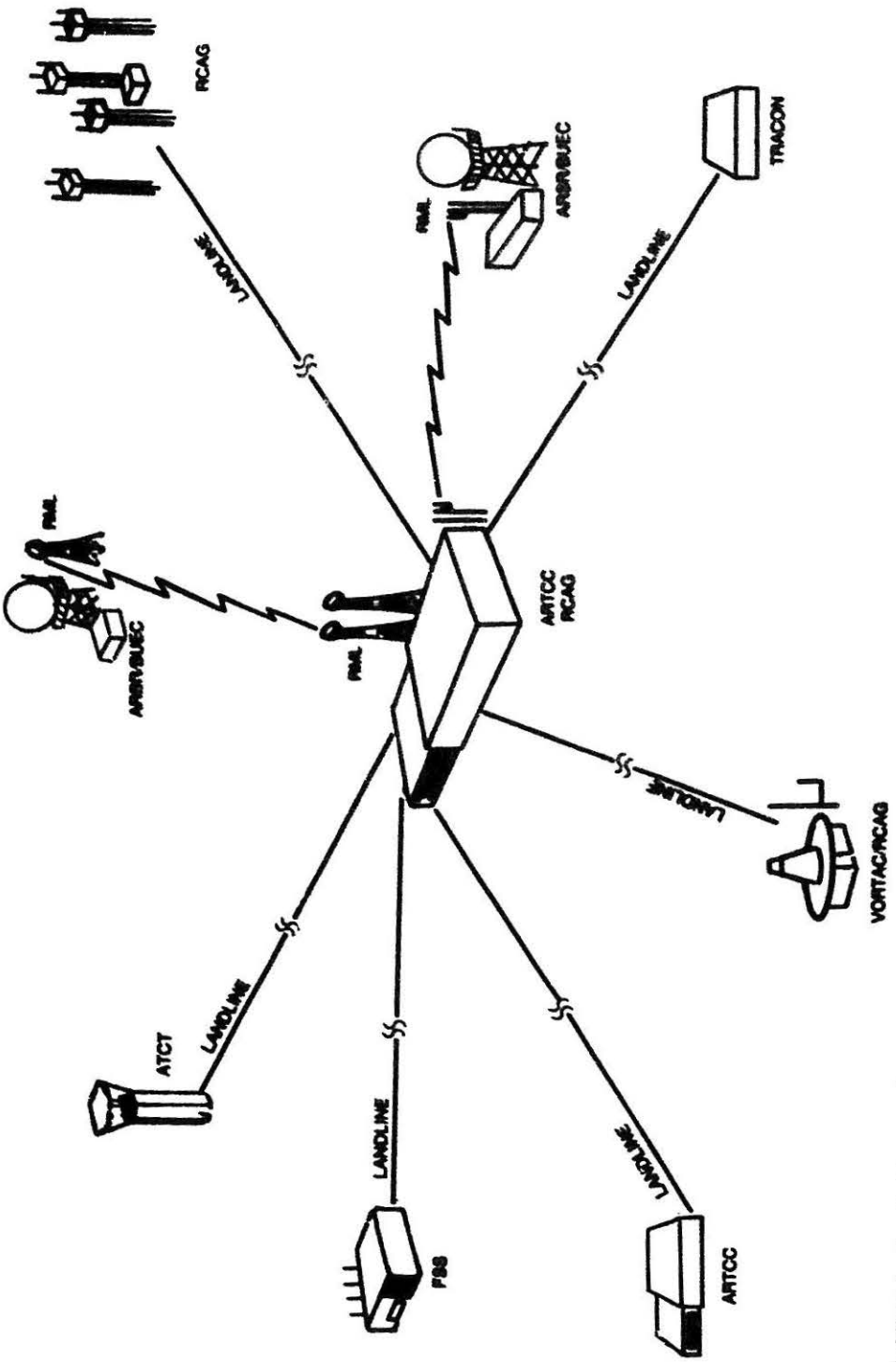


FIGURE 2-2. THE ATCT AND ITS TRIBUTARY FACILITIES

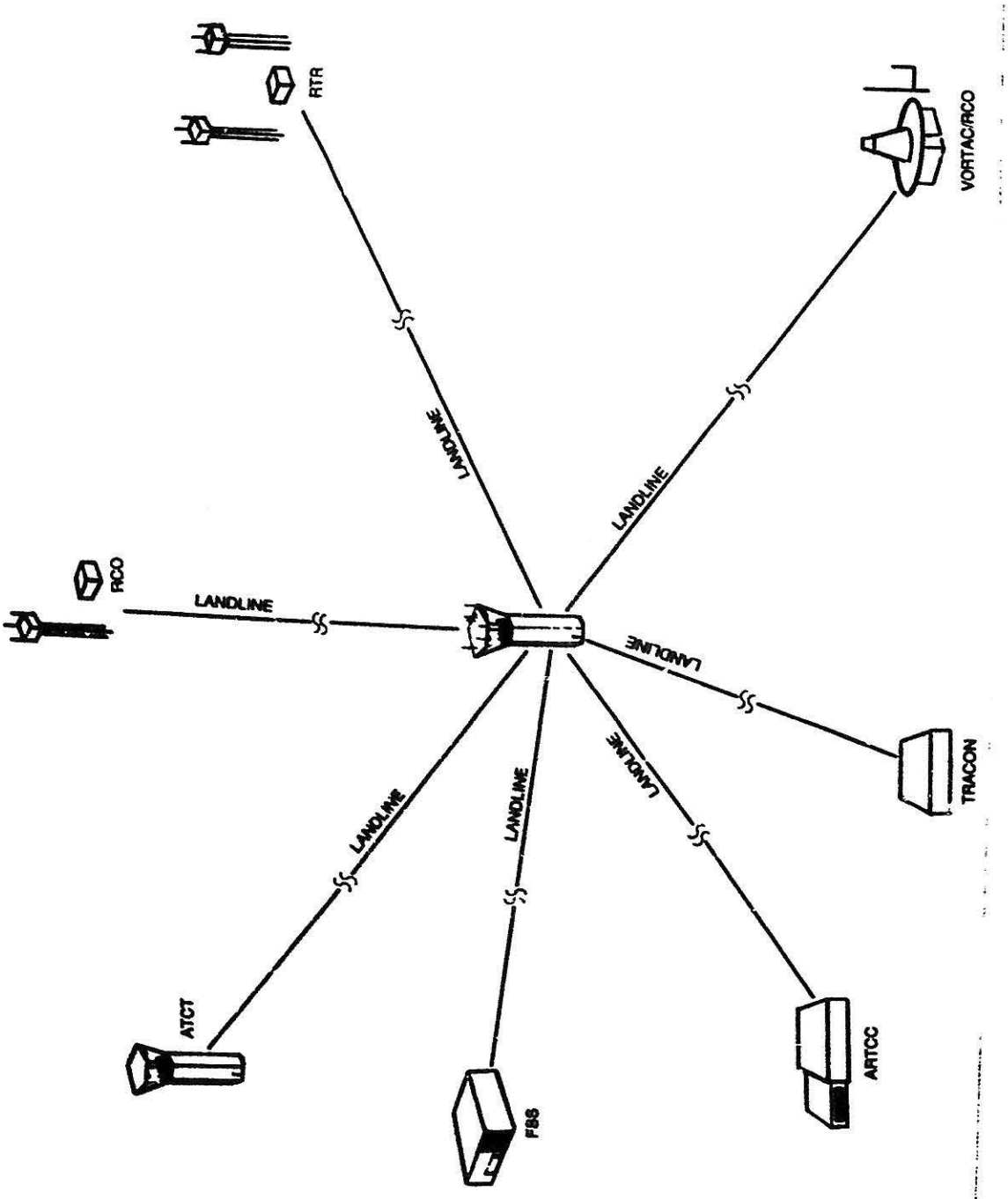


FIGURE 2-3. THE FSS AND ITS TRIBUTARY FACILITIES

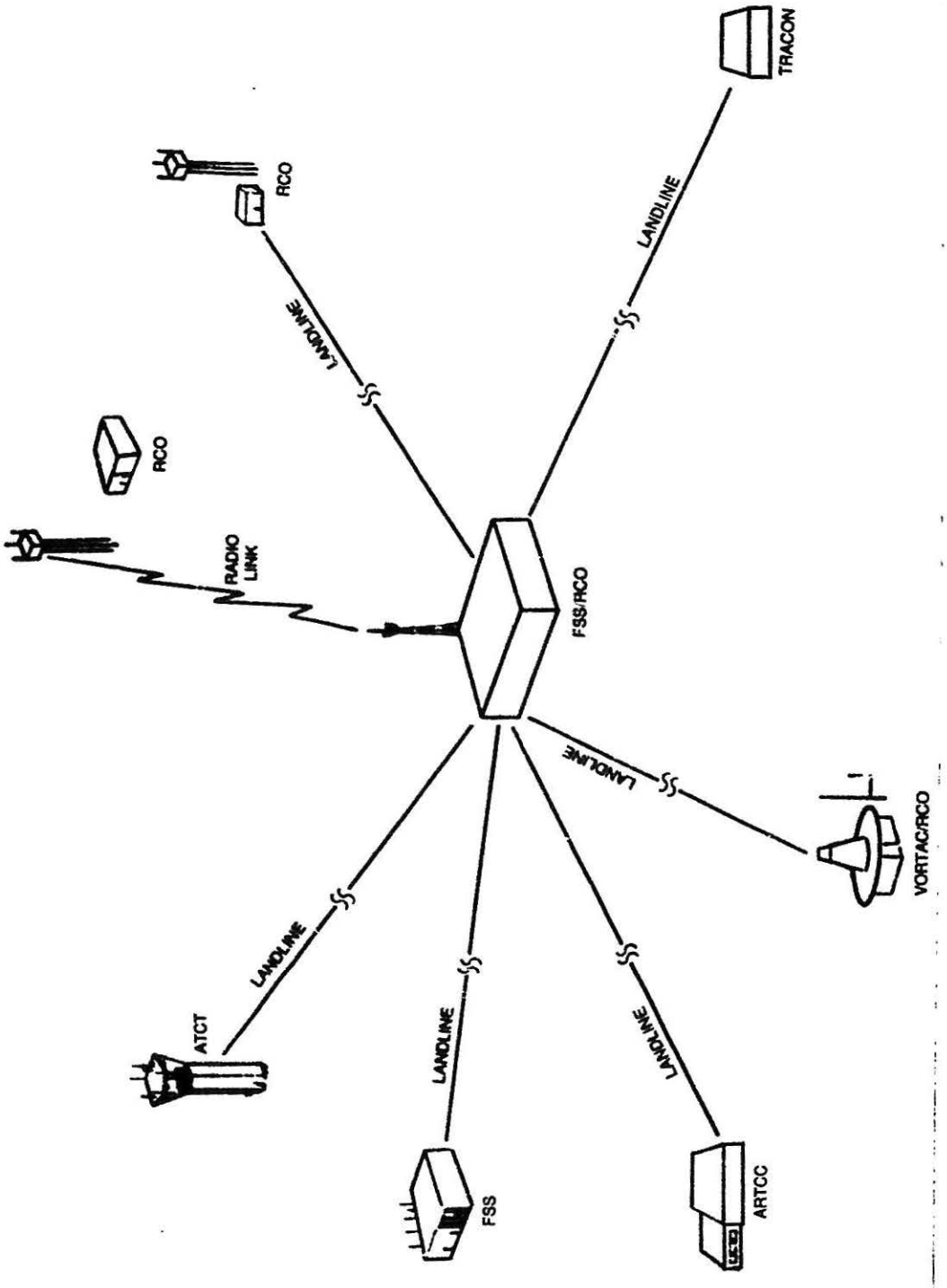
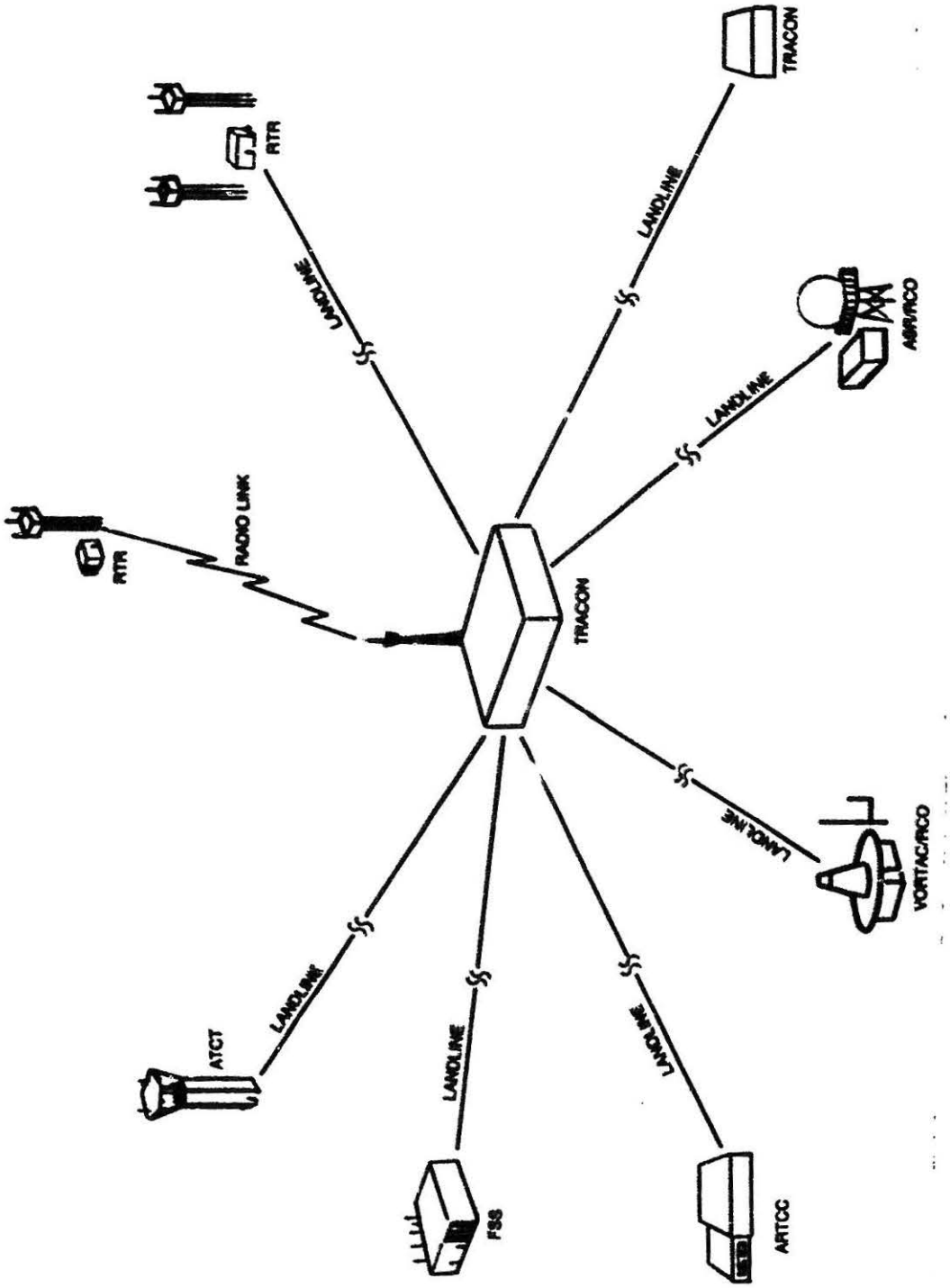


FIGURE 2-4. THE TRACON AND ITS TRIBUTARY FACILITIES



d. Air/Ground (a/g) Communications Equipment Modernization Program. The a/g communications equipment modernization program facilitates the RCF consolidation/network, remote maintenance monitoring, and other modernization efforts. This project will replace obsolete tube-type transmitters and receivers with solid-state models capable of operating with lower transmitter output power and in a 25 kilohertz (kHz) spacing environment. In order to provide the 25 kHz frequency spacing environment for RCFs, all transmitters located at RCF, shall operate at a maximum output of 10 watts; lower output power may be used in keeping with the FAA's power reduction program. Coverage requirements should be achieved by facility placement and/or antenna selection. This project was planned as a multiyear procurement to be implemented in three phases:

(1) At en route facilities (completed).

(2) At terminal facilities (almost completed).

(3) At flight service station facilities (1984-1985). Additionally, this program provides standardized replacement state-of-the-art vertical dipole antennas.

e. Radio Control Equipment (RCE) Project. The a/g Communications Radio Control Equipment (RCE) Project enhances the RCF consolidation/network project and the RMMS Project. Existing FAA-owned and maintained tone signal and control equipment is located at both the control facility and the antenna sites. This equipment enables air traffic personnel to control the FAA-owned and maintained radio transmitters and receivers at the antenna sites. Early models of tone control equipment were designed in the mid-1950s and utilize vacuum-tube and electromechanical relay technology. This equipment gradually will be replaced with modern solid-state equipment. The RCE Project has started. It will replace all existing radio signaling and tone control equipment with modern solid-state digital equipment. This new equipment will be used for control and remote maintenance monitoring of remote communications facilities.

f. RCF Implementation Plan. The RCF implementation plan was drafted in 1984. The current plan provides for communication facility consolidation into a lesser number of FAA owned facilities. Project implementation is in accordance with this document, the budget, and the National Networking Plan, which is the product of consolidated regional a/g communications network studies.

12. SYSTEM CONCEPT.

a. Modernization of Transmitters/Receivers. All tube-type radio transmitters and receivers will be replaced with solid-state equipment. Additionally, vacuum-tube tone signaling and control equipment is being replaced on an emergency case-by-case basis with interim solid-state control equipment until such time as the RCE project is close to delivery. This strategy permits the first transition from existing communication facilities into RCFs. This strategy will afford minimum impact of consolidation/networking on the air traffic facilities and provide greater independency and flexibility in scheduling and implementing the RCF.

b. Benefits of Solid-State Equipment. The replacement of existing vacuum-tube/relay equipment with state-of-the-art digital and analog logic elements, microprocessors, and associated firmware and software eliminates the use of obsolete labor intensive equipment and inefficient procedures and practices. Removal of deficiencies and constraints in service, flexibility, and performance supports automation advancement and the consolidation of air traffic operations covered in the NAS Plan, and also supports the maintenance objectives required for the maintenance program as defined in FAA Order 6000.30, Airway Facilities Service Policy Decisions For The Maintenance Program of the 1980's. The new equipment also provides standard solid-state configurations at en route, terminal, and (automated) flight service station control facilities and their associated a/g communications outlets. The present solid-state transmitters and receivers and transceivers were not designed to work in a consolidated environment. It may become necessary to upgrade the equipment to meet future operational requirements. The utilization of digital signaling and control techniques provides functional enhancements such as faster push-to-talk keying responses resulting in improved voice intelligibility, positive remote feedback indica-tions to the control facility, automatic service restoral capability, loopback of remote facility control circuitry for maintenance testing, automatic remote frequency and channel signal assignments, and standardization of impedance and audio levels at all interfaces. Additional capabilities are provided by the digital solid-state replacement of the existing tone signaling and control equipment. These capabilities are required to be consistent with the objectives of the NAS Plan. They provide the following:

(1) A remote maintenance monitoring (RMM) data interchange channel between the remote site RMM equipment and the maintenance processor subsystem (MPS).

(2) Transmission of 1,200 baud cockpit weather dissemination data via selected vhf or uhf radio transmitter.

(3) Standard interfaces with integrated communication switching system (ICSS) and future voice switching and control system (VSCS) radio position equipment.

(4) Flexibility due to modular construction and standard interfaces for easy relocation of equipment from existing sites to consolidated RCF facilities.

(5) Optimization of transmission facility networking by providing trunk tandeming capability at antenna sites. This allows any site to connect any two trunks together, under the control of the associated control facility, to provide a path from the control facility to a second site via the first site.

(6) Programmable selective channel operation for up to 12 frequencies per trunk.

c. Communications Network Planning. Network planning allows review of operational requirements to determine current RCF requirements. Requirements include combining the functional types of communications facilities, where possible, in other FAA-owned buildings such as very high frequency omnidirectional range (VOR), radar, and radio communications link (RCL) facilities to minimize the overall number of facility locations. Combined a/g communications facilities may consolidate up to 24 operational frequencies at a single a/g communications facility.

d. Air/Ground Communications Coverage. Coverage will be provided down to 2,000 feet above ground level in all areas except where there is little air traffic activity. In certain specifically defined areas, coverage will be required to or approaching ground level.

e. Antenna Site Consolidation. The antenna site consolidation phases of the a/g communications program will be implemented in planned steps. This will occur subsequent to site selection of the RCF locations and the construction of buildings. Construction of buildings at RCF locations will be determined by requirements of the regions. Siting criteria will be provided by FAA headquarters. Relocation of selected existing remote communications outlet (RCO), RCAG, and remote transmitter/receiver (RTR) frequencies into preselected RCFs will be based on coverage criteria, priorities, and scheduling as furnished by FAA headquarters and coordination with the regions.

13. PROGRAM REFERENCES.

a. National Airspace System Plan, Project 4-02, Communications Facilities Consolidation/Network.

b. Smart Sheets Project Identification.

c. National Network Plan.

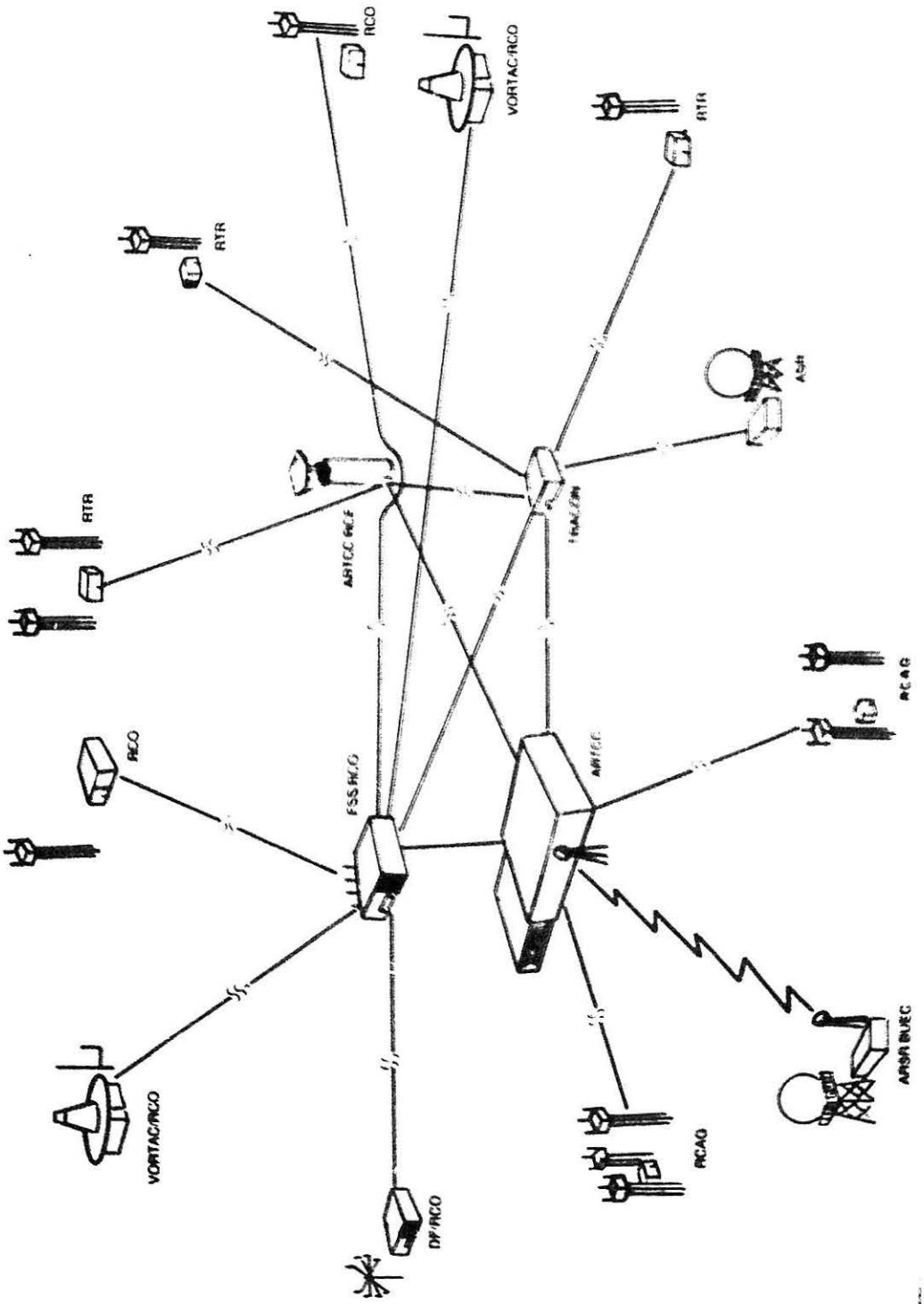
14.-19. RESERVED.

SECTION 2. SYSTEM DESCRIPTION

20. BASIC CHARACTERISTICS (EXISTING SYSTEM). All analog voice communications are provided by the a/g communications system between ATC controllers or flight service specialists and civil or military aircraft operating under IFR or VFR procedures. This system also provides recorded voice weather broadcasts to aircraft over selected frequencies and antenna site locations. The a/g communications system provides services to civil aircraft primarily via vhf, and to military aircraft via uhf. The present a/g communications system encompasses en route, terminal, and flight service operations (see figure 2-5). Control facilities in each of these operations are connected to dedicated or shared local or remote antenna sites in which the vhf and uhf radio transmitters, receivers, antennas, and control equipment are located. The location of the antenna sites is dependent upon the air space coverage assigned to particular frequencies and overall air space coverage assigned to the control facilities. The 23 air route traffic control centers (ARTCC) are connected to approximately 558 RCAG facilities, each having from 1 to 12 radio frequencies. Typically, multifrequency RCAG are remote stand-alone facilities. A total of approximately 175 terminal radar approach control (TRACON) facilities and 465 air traffic control towers (ATCT) are connected to a total of 773 RTR, each having from 1 to 24 radio frequencies. Additionally, there is a number of single frequency outlets (SFO) typically located at satellite airports. About 300 FSS are connected to about 1,000 RCO. Control by the ATC controllers or flight service specialists of the FAA-owned and maintained radio transmitters and receivers at these sites is accomplished by FAA-owned and maintained analog tone signal and control equipment located at both the control facility and the antenna sites. In most cases, the analog tone signal and control equipment requires specially conditioned leased transmission landlines which connect the control facility with the controlled site. Some Alaskan antenna sites are maintained by contract. These landlines vary in length dependent upon the site location with respect to the control facility.

a. VORTAC. The basic VORTAC is comprised of a single VOR and tactical air navigation (TACAN) equipment. The present design specifies a 21-foot round metal building to house the above equipment and an engine generator, if required. Engine generators are installed to provide three phase backup power to the TACAN antenna at VORTAC facilities that either support the jet route structure or serve an operational requirement for the continuous power airports; all VOR/VORTACs have a battery/dc power distribution system. The VOR antennas are housed inside a 16-foot high cone with the TACAN antenna affixed at the top. The VOR provides azimuth information and the distance measuring equipment (DME) provides distance information to properly equipped civil aircraft. The TACAN provides azimuth and distance information to military aircraft.

FIGURE 2-5. A/G RADIO COMMUNICATIONS SYSTEM (EXISTING)



b. Remote Transmitter/Receiver (RTR). An RTR consists of at least one remotely controlled transmitter or receiver. An RTR is defined as a facility that is controlled by an ATCT or a TRACON facility. The combined RTR site has two features that may be used to advantage. One is that more intermodulation product-free transmit frequencies can be found or used at a terminal or en route facility if the transmit frequencies can be divided among all of the antenna sites. The number of intermodulation product interference-free frequencies within the ATC vhf bands found for use at one antenna site is extremely limited, typically from 10 to 12 vhf frequencies per antenna site. The exact number depends on direct interference with other facilities as well as intrafacility intermodulation products. Thus, when transmitters are located at all remote sites, the assignment of frequencies to each site requires extreme care in order to avoid interference-prone combinations.

c. Remote Center Air/Ground (RCAG) Facilities. An RCAG is the primary communication outlet for an ARTCC. An RCAG may have up to 12 radio frequencies located at the facility. RCAG may be stand-alone or collocated with other facilities such as FSSs, long range radars (LRRs), VORs, or the ARTCC itself. Transmit audio and control information is sent from the ARTCC to a remote RCAG over either a leased landline or FAA-owned radar microwave link (RML) system. The audio received at the remote RCAG from the aircraft is sent to the ARTCC over leased landline or FAA-owned RML system. In order to provide a backup to the audio and control links between ARTCC and RCAG, either an FAA-owned backup emergency communication (BUEC) system and/or a special leased landline selective signaling (SS-1) system is provided.

21. BASIC CHARACTERISTICS (FUTURE SYSTEM). The a/g radio communications system of the future is depicted in figure 2-6. It is characterized by facilities consolidation, a communications network, solid-state equipment, remote maintenance monitoring, and radio control equipment. Most of these characteristics have already been discussed in detail and are briefly summarized below.

a. Facilities Consolidation. The consolidation and relocation of existing a/g communications facilities into RCF (see figure 2-7) will serve the combined a/g communications needs of both air traffic control and flight advisory facilities.

b. Air/Ground Communications/Network Plan. Network planning is the means used to identify facility requirements which support the current and projected growth of the aviation industry through the year 2000. A special networking team was formed in each region early in 1983. These regional teams were composed of FAA employees from every discipline within the major operational elements. The compilation and specifics of the plan represent the results of each team's intensive and extensive intraregional coordination. Regional responsibilities include selection of site, construction of the environmental facility, and relocation of existing communications equipment and antennas, or acceptance of contractor relocation and installation of radio communications equipment cables, antennas, batteries/dc distribution system, antenna towers, and flight inspection as may be required. Abandonment of obsolete sites is required to effect the cost savings and cost avoidance in future years.

FIGURE 2-6. A/G RADIO COMMUNICATIONS SYSTEM (FUTURE)

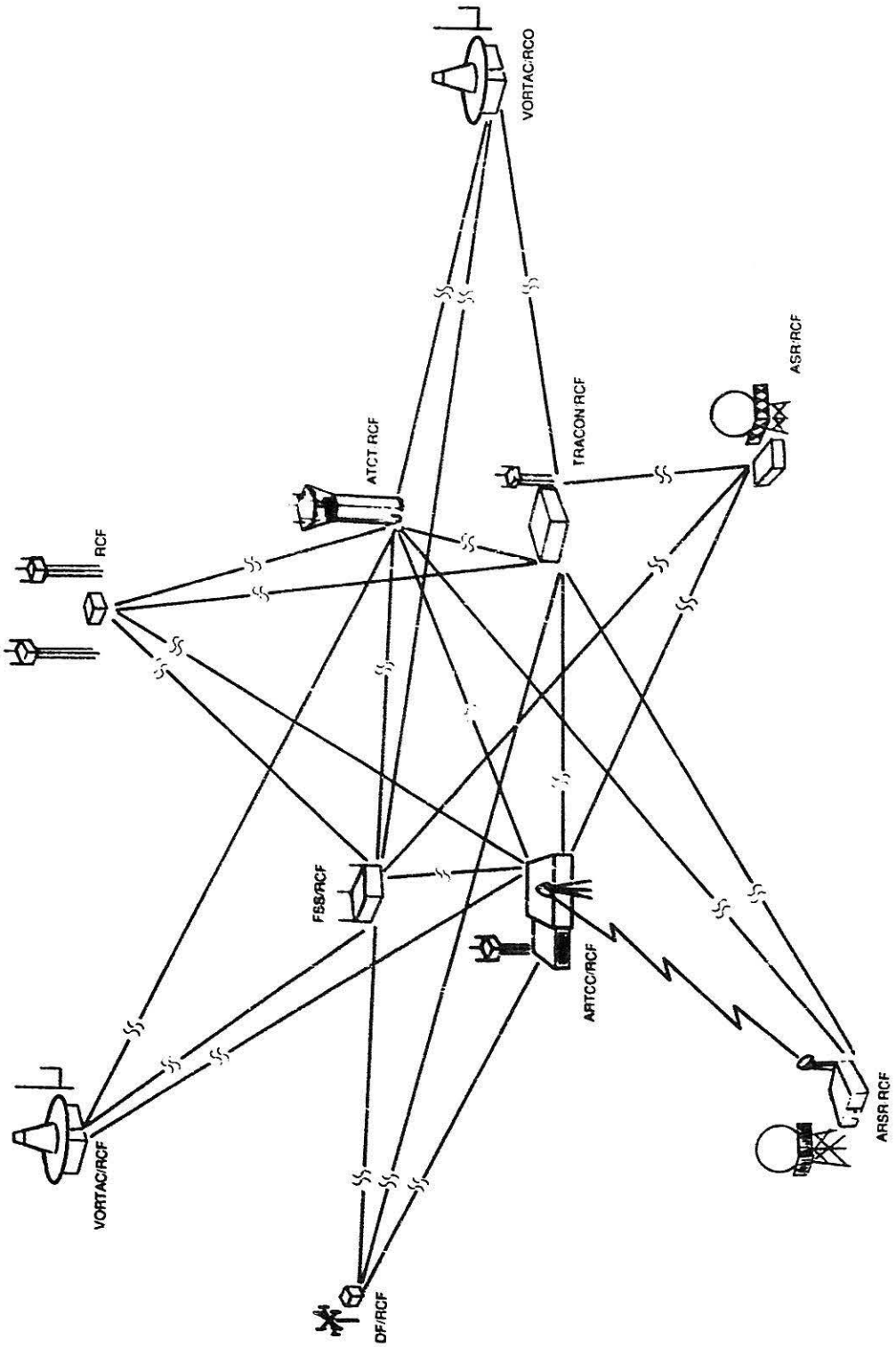
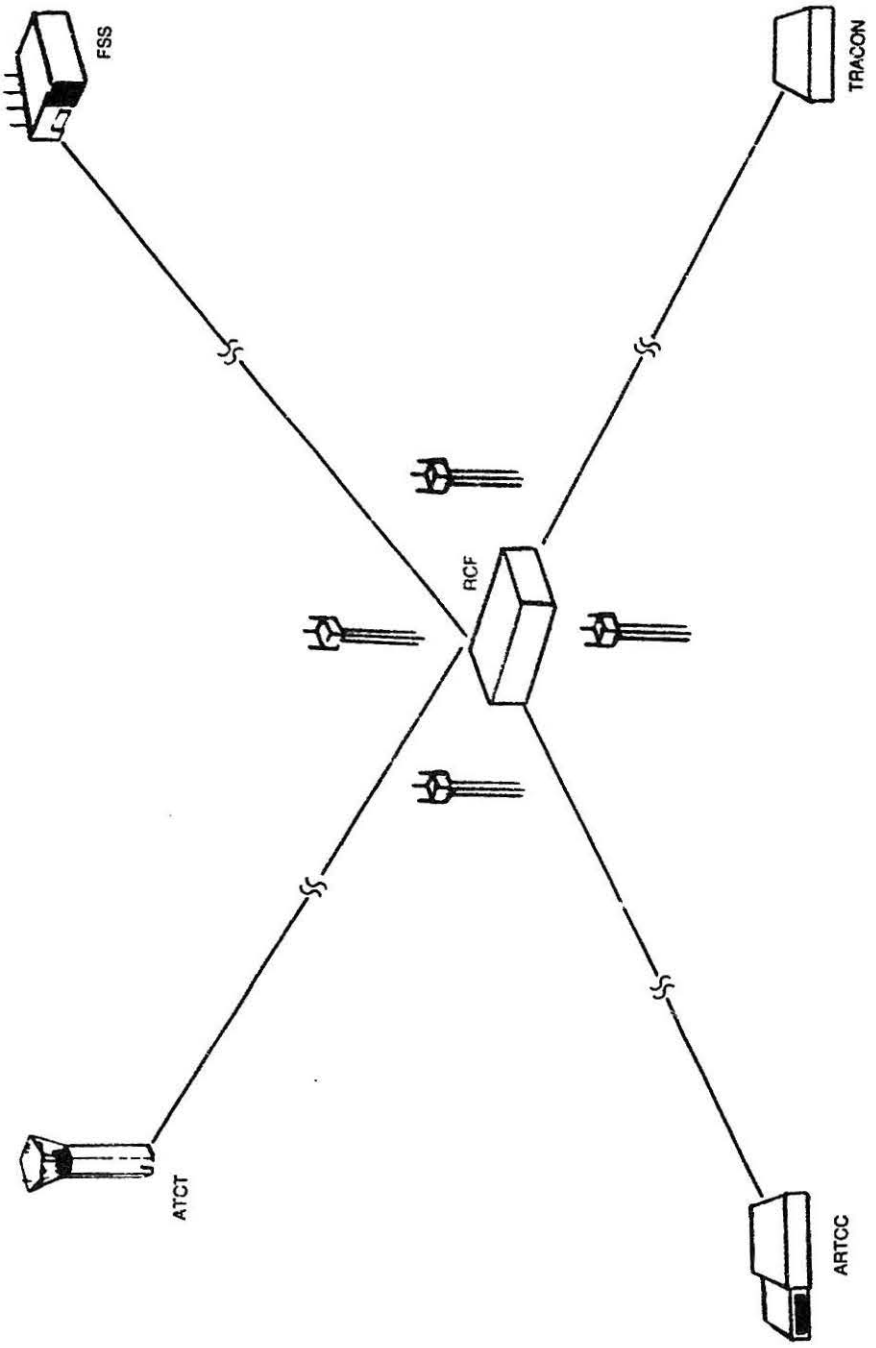


FIGURE 2-7. THE RCF AND ITS TRIBUTARY FACILITIES



c. Solid-State Equipment. Concurrent with facilities consolidation will be the replacement of obsolete tube-type transmitters and receivers with solid-state equipment.

d. Remote Maintenance Monitoring. Remote monitoring and control equipment must be provided for remote FAA facilities so that equipment performance monitoring, control, and certification can be accomplished from centralized work centers. Remote maintenance monitoring will permit improved work force utilization and the quality of worklife and increase work force productivity. The system will establish a network of maintenance processor subsystems (MPS) at ARTCC and general national airspace sectors (GNAS). It will also provide standardized remote monitoring subsystems (RMS) and incorporate these into existing solid-state systems.

e. Radio Control Equipment (RCE) provides for the replacement of the present radio signaling and tone control equipment to improve operational performance and reduce maintenance cost. The replacement of obsolete radio control equipment will eliminate operational deficiencies and improve air/ground service. This equipment will be used for control and remote maintenance monitoring of RCAG, RTR, RCO, and RCF facilities. Additionally, it will standardize the interface with VSCS, tower communications system, and ICSS. This equipment will include the line-combining function (multiplexing) required for FSS modernization and the facility consolidations.

22. STUDIES.

a. Frequency Interference Study. A frequency interference study is in progress, prior to combining large numbers of transmitters and receivers. Development of receiver multicouplers and transmitter combiners is needed to reduce the number of antennas required, expecially at VORTAC. This effort also includes development of requirements for ancillary devices, such as multicouplers, combiners, filters, and cavities.

b. Electromagnetic Compatibility (EMC) Studies. EMC studies are being conducted to develop EMC guidelines necessary for the design of interference-free NAS facilities and compatible collocated/consolidated antenna sites.

c. Electromagnetic Interference Analysis. Electromagnetic interference studies are underway to determine limitations to RCF consolidation. The effect of various antenna arrangements installed at a VOR will also be analyzed. The effect of specific frequency collocations in an actual antenna siting environment will be determined on an individual basis. Communications channels spaced 25 kHz apart will be considered available for network coverage planning below 18,000 feet mean sea level (MSL).

d. Antenna Deployment Study. The antenna deployment feasibility study is the pacing item for RCF implementation. The study began in February 1984 and is scheduled to end in December 1985.

23.-29. RESERVED.

SECTION 3. PROGRAM FUNDING

30. GENERAL. Implementation of the consolidation/network project for RCF corresponds with policies and guidelines established in DOT Order 4200.14B, Major Systems Acquisitions Review and Approval, and FAA Order 1810.1D, Major Systems Acquisition. The regions will implement the project in accordance with this order. The project will include relocations, consolidations, establishments, and decommissionings outlined in chapter 2 of the A/G Communications Network Plan. Planning and programing estimates for fiscal years (FY) 1983, 1985, and 1986 were accomplished by headquarters with no regional input. FY 1987 and future years' estimates will be based on regional estimates to implement the network plan.

31. RCF ACQUISITION PLAN. Major elements in the acquisition plan that will impact funding are as follows:

a. Specialized ancillary devices will be procured as determined by the program office for the remote communications facilities.

b. Regional funding will be provided in block assignments. The regions are responsible for implementing the project in accordance with the national network plan, program plan, siting criteria, and installation standards. Based on regional priorities, funds will be allocated to establish the RCF.

32.-39. RESERVED.

SECTION 4. PROGRAM SCHEDULE AND STATUS

40. INTRODUCTION. This project will reduce the cost of operating analog a/g radio communications facilities. This project allows for the provision of analog a/g radio communications from larger, more cost-effective consolidated RCFs in lieu of the existing large number of facilities (approximately 3,000 RTR, RCAG, RCO, and BUEC equipments).

41. MAJOR EVENTS. The status of milestones are as follows:

a. Accomplishments.

(1) Identified and submitted 450 "first cut" remote locations to Electro Magnetic Compatibility Analysis Center (ECAC) for processing.

(2) Received charts from ECAC.

(3) Submitted project request to the FAA Technical Center for antenna study.

(4) Requested Great Lakes Region be the lead region for developing site selection criteria for future RCF.

(5) AES-500 Antenna Deployment Feasibility Study (Start).

(6) AES-4 Network Plan for review.

b. Planned:

(1) AES-500 Antenna Deployment Feasibility Study.

(2) RCF Siting Criteria Handbook.

(3) RCF Installation Standards Handbook.

(4) RCF Maintenance Handbook.

(5) RCF Modification Handbook.

42. REGIONAL ACTIVITIES. The individual regions are responsible for preinstallation planning, coordination, equipment acceptance, and certification in their areas based on FAA engineering requirements and guidance. Equipment installation itself is expected to be the same for all efforts, but relocation and establishment installations will have to be integrated with the total facility installation and construction as applicable. Installation by contractor personnel is to be determined.

43. SUPPORT FACTORS. Training may be required. Information will be made available prior to enrollment.

44. LOGISTICS SUPPORT. Logistics support is a phase of the remote communications facilities consolidation operation. Logistics support begins with development of a maintenance/support concept for documentation, and is followed by preparation of a procurement request (PR). The PR includes a requirement for the contractor to provide certain hardware deliverables and associated documentation. Logistics support is essentially completed when the initial provisioning requirements, documentation, and materials are delivered, and stored. Individual item quantity requirements are predicated on the maintenance/support concept. Quantity requirements are based on operational considerations, equipment redundancy, and reliability factors derived from the approved system design and announced by APM-540. The responsible regional office provides storage space for supply stock. Storage plans are coordinated with APM-540 and ALG-200. Order 4620.3C, Initial Support for New or Modified Equipment Installation, establishes procedures for providing the initial allowances of spares, supplies, and working equipment required for the operation and maintenance of new FAA facilities and equipment installations. Site spares are provided on a one-for-one basis for replaceable modules and printed wiring boards. Requirements are to be determined.

45. INSTRUCTION BOOKS. Copies of instruction books are provided and delivered with each system. These instruction books are reviewed in both preliminary and camera-ready forms by the FAA for adequacy prior to acceptance from the contractor as a deliverable item. Regional offices, sector offices, and the FAA Depot are provided copies of the instruction books. Requirements are to be determined.

46. INSTALLATION. Reserved.

47. ACCEPTANCE TEST. Reserved.

48. ENGINEERING SUPPORT SERVICES. The FAA objective is to accomplish engineering services with in-house resources. It may be necessary, however, to require engineering support from the contractor during the early part of program implementation. The contract provides for field services on an as-required basis to provide engineering support in the event hardware or software problems are encountered during system operation. APM-540 will coordinate support needs with the regions, the Mike Monroney Aeronautical Center, the FAA Technical Center, and the Acquisition and Materiel Service.

49. COST VERIFICATION. Data will be collected for use in comparing the projected life-cycle cost savings with costs from a statistically valid sample of actual sites. At a later date, specific direction will be provided to the regions and sectors as a result of the comparison.

SECTION 5. MANAGEMENT

50. PROGRAM DIRECTION. Program direction for the RCF consolidation/network project is provided by the Federal Aviation Administration (FAA) policies and procedures as defined by current FAA orders and directives, and by active direction from management at the FAA headquarters service director level.

a. The RCF consolidation/network project is now being implemented in accordance with the applicable provisions of Order 1810.1D, Major Systems Acquisition.

b. Overall responsibility for implementation of the RCF consolidation/network project has been assigned to the Director, Program Engineering and Maintenance Service, APM-1. This order directs the F&E program manager assignments and program review procedures.

c. Policy direction and guidance for implementation of the RCF consolidation/network project is provided by the following FAA orders:

1100.1A	FAA Organization - Policies and Standards
1100.2B	FAA Organization - FAA Headquarters

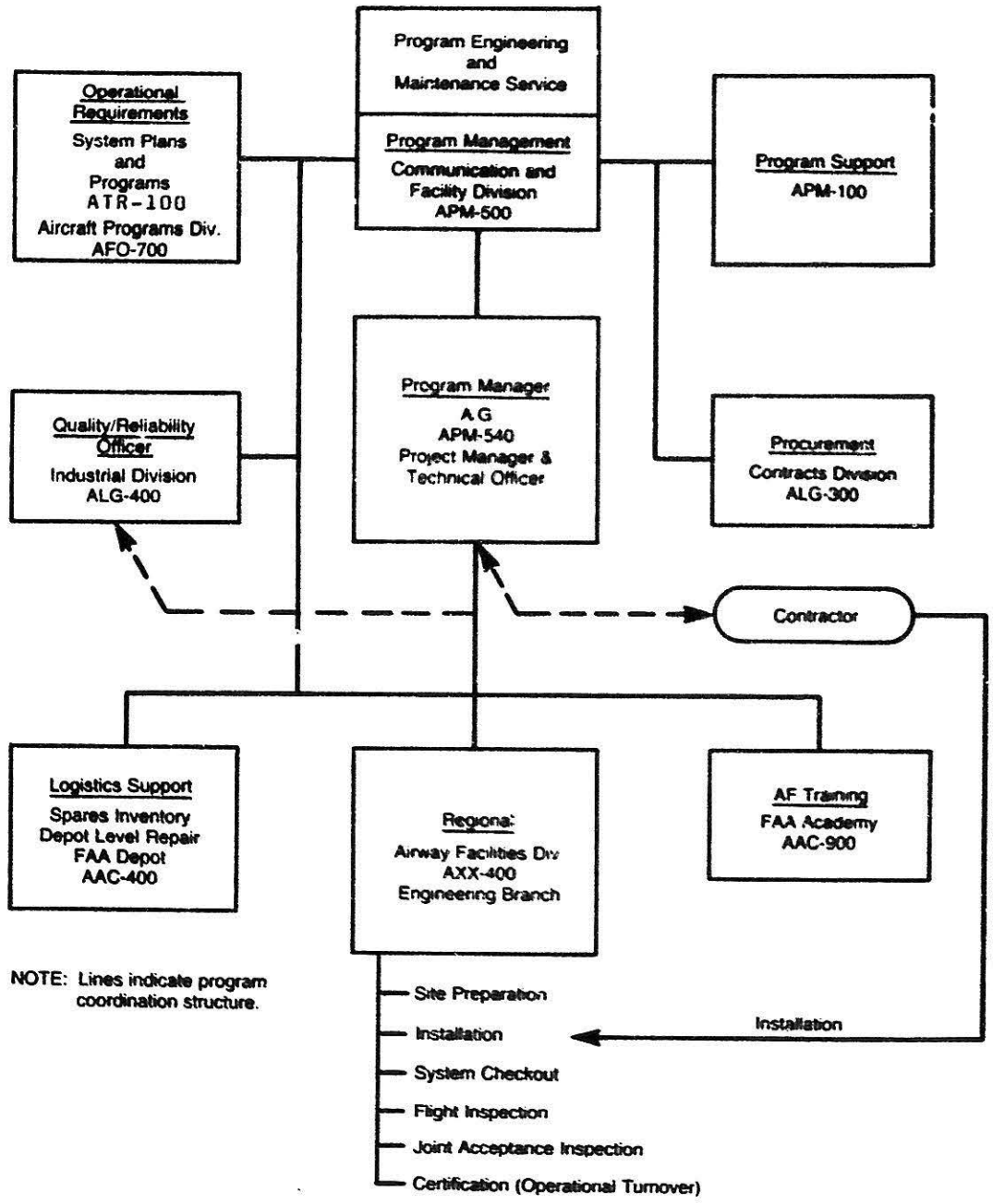
1100.5B	FAA Organization-Field
1800.8D	National Airspace System Configuration Management
1810.1D	Major Systems Acquisition
6000.30	Airway Facilities Service Policy Decisions for the Maintenance Program of the 1980s
6010.6	National Airspace System Coverage Network Plan - Remote Facilities
6510.4A	Radio Communications Requirements for Air Traffic Control Facilities

d. Active direction of the consolidation/network project planning is provided by the Systems Engineering Service (AES), which has overall system design planning responsibility for the program.

51. PROGRAM MANAGEMENT STRUCTURE. Program direction for implementation of the RCF consolidation/network project has been assigned to the Program Engineering and Maintenance Service, Air/Ground Communications Program, APM-540. The Acquisition and Materiel Service (ALG), is the procuring office for FAA headquarters procurements. Implementation of the RCF consolidation/network project requires coordination and cooperation from all offices, services, regions, and support organizations of the FAA. At the operating level, the Program Manager, APM-540, coordinates with the Systems Engineering Service, AES-1, and is responsible to the Director, Program Engineering and Maintenance Service, APM-1, for cost-effective implementation requirements. These requirements are defined in specifications FAA-G-1210D, Provisioning Technical Documentation, and FAA-G-1375A, Spare Parts-Peculiar for Electronic, Electrical, and Mechanical Equipment. Implementation will be accomplished within established schedule and budget constraints. In order to accomplish this mission, key organizational elements have been assigned specific RCF consolidation/network project functions and responsibilities. Figure 2-8 depicts the program management structure for the implementation of the RCF consolidation/network project. Other organizational elements, in their normal functional roles as established by FAA policies and procedures, will be involved in the project. The depicted organizational structure has one primary mission--to implement the RCF consolidation/network project system to the point of operational turnover with operational support elements in place to ensure FAA self-sufficiency in continuing operations. The following general statements of functions and responsibilities are in agreement with present FAA policies and procedures.

a. Director, Program Engineering and Maintenance Service, APM-1, has overall responsibility for the implementation of the RCF consolidation/network project and provides program direction.

FIGURE 2-8. FAA PROGRAM MANAGEMENT STRUCTURE FOR RCF PROJECT



b. Program Office, APM-540, will develop, coordinate, and monitor the program from the engineering/development cycle through the operation cycle.

c. Divisions:

(1) Policy and Standards Division (AES-100) has the responsibility for the long range development, transition, and guidance for the implementation of the NAS plan.

(2) Systems Requirements and Design Division (AES-200) has the responsibility to establish requirements and develop a functional design for the National Airspace System.

(3) Test and Evaluation Division (ACT-500) has the responsibility to design verification and validation measurements to verify ECAC, ARINC, and Ohio University studies.

(4) Spectrum Engineering Division (AES-500) has the responsibility to manage the frequency spectrum and develop guidelines for minimizing the effect of radio frequency interference (RFI) and EMI. AES-500 is conducting and coordinating five studies and a test modification of ITT receivers:

(a) The ARINC study (completed April 1984) concluded that 12 vhf and 12 uhf channels can be collocated at a single site through the use of external isolation devices such as combiners, multicouplers, etc.

(b) The ECAC study considered the development of EMC guidelines for use in the design of compatible consolidated NAS sites. Study topics are:

1 Potential block type collocation interference problems.

2 Interference prediction
Computer model (cosite analysis model no. 2, COSAM II).

3 Interference control methods.

(c) Ohio University study considered the investigation of VOR errors due to RCF antennas/masts and investigation of effects of radar antenna on RCF coverage.

(d) FAA Technical Center study considered verification of ARINC and ECAC study by actual measurements.

(e) In-house study by AES-500.

1 Study of RFI suppression devices currently in use in the field.

2 Survey of air/ground communications installation at VORTAC sites.

3 Evaluation of Wulfsberg a/g equipment.

4 Recommendations for new equipment standards and siting criteria from a spectrum engineering standpoint.

(f) ITT test modifications to improve the RFI immunity of GRR-23 and 24 equipment. Two test modifications are being developed by ITT.

d. Air Traffic Plans and Requirements Service, ATR-1, establishes operational requirements for a/g communications.

e. Materiel Management Division, ALG-200, provides coordination of logistics support concurrent with the delivery of all articles of equipment.

f. FAA Academy, AAC-900, will establish and maintain a training course for site personnel involved with the installation and maintenance of all equipment and software delivered under appropriate contracts under the program.

g. FAA Depot, AAC-400, will provide logistics and engineering support, including the establishment and maintenance of a spares inventory and provision of repairs for returned modules. In addition, the FAA Depot will provide engineering support for the establishment of the training site.

h. Regional offices have responsibility for each designated site. This responsibility includes the site peculiar engineering and implementation activities of site relocation, site preparation, checkout, joint acceptance inspection, and certification for operational turnover, as well as training and staffing. Regions are responsible for facility construction and for all RCF equipment relocations and installations. Each region will appoint a regional coordinator and an alternate. The regional coordinator will act as a focal point for coordination and scheduling during the implementation of RCF.

i. Office of Personnel and Technical Training. Reserved.

j. Office of Budget. Reserved.

52. PROGRAM PROCEDURES. The RCF projects will be implemented in accordance with existing FAA procedures, as defined in applicable orders.

a. Planning and Scheduling. The program manager is required to develop a coordinated program/implementation plan that identifies all activities, schedules, and funding required/available to accomplish the program. This system implementation plan (SIP) and its subsequent issues serve as a vehicle for the coordination process and as a means for disseminating program information to all affected elements. Revisions, updates, and reissues of the SIP will be disseminated by the program office.

b. Fiscal status will be provided during program reviews. Monthly reviews are primarily for status accounting. Quarterly reviews, tied closely to F&E procurement planning, include both physical status accounting and fiscal status.

c. Logistics support procedures established by Order 4620.3C, Initial Support for New or Modified Equipment Installation, will be used for providing the initial allowances of spares, supplies, and working equipments required for the operation and maintenance of new FAA facilities and equipment installations. The Acquisition and Materiel Service will coordinate logistics support requirements in accordance with this order.

d. Configuration management will use the policies and procedures established by Order 1800.8D, National Airspace System Configuration Management, for the end items specified in NAS-MD-001, NAS ATC Subsystem Baseline Configuration. The RCF system hardware baseline will be established in the installation standards handbook. Changes to this baseline, up to the date of initial site operational availability, will not require FAA change proposal activity, only concurrence by the program manager. Subsequent to initial site operational availability, all change proposals will be coordinated in accordance with Order 1800.8D.

53. COST VERIFICATION PLAN. A plan will be developed by the program office to assess the validity of the life-cycle cost (LCC) projections made during the system requirements process. The output of this validation effort will provide feedback for updating the LCC procedures for future programs and will provide early factual information on possible areas for improvement in the RCF system.

54.-59. RESERVED.

CHAPTER 3. SYSTEM IMPLEMENTATION PLAN

SECTION 1. FIELD DEPLOYMENT

60. INTRODUCTION. The remote communications facilities (RCF) projects will be implemented by each of the nine regional Airway Facilities divisions having cognizance over the designated sites. The National Airspace System (NAS) Remote Facilities Network Plan lists proposed action locations for RCF.

61. RELOCATIONS. RCF site relocations are listed in the Advance Copy National Airspace System Remote Facilities, Air/Ground Communications Network Plan, table 2, page v. Some of these proposed relocations are required for air traffic operational requirements and do not require a cost versus benefit study. The remaining proposed relocations may require a cost versus benefit study based on APM-100 operation and cost figures and regional/APM-500 cost estimates for relocation.

62. ESTABLISHMENTS. The construction requirements for RCF sites will be determined by Advance Copy National Airspace System Remote Facilities, Air/Ground Communications Network Plan, table 3, page v. Scheduling agreements by regions and the facility criteria will be provided by FAA headquarters in FAA orders.

63. REPLACEMENTS. Vacuum-tube radio communications transmitters and receivers are being replaced with solid-state equipment under the existing replacement program. The following types of obsolete equipment are also scheduled for replacement:

a. Obsolete antennas are being replaced with state-of-the-art vertical dipole antenna designs to enhance the air/ground (a/g) communications system.

b. Multichannel tube-type backup equipment will be replaced with one-for-one equipment.

c. Analog on-off tone control equipment will be replaced with solid-state digital radio control equipment (RCE).

64. DECOMMISSIONINGS. The proposed decommissionings of existing sites are listed by region in the Advance Copy National Airspace System Remote Facilities, Air/Ground Communications Network Plan, table 4, page vi.

65. CONFIGURATION MANAGEMENT PLAN. The FAA is concerned with the baseline data for existing equipment configurations and with change control procedures that provide for change coordination before changes to baseline data are authorized. The NAS configuration management identification and control data base is maintained by AES-400. The data base is maintained in three parts:

a. NAS-MD-001, NAS Air Traffic Control (ATC) Subsystem Baseline Configuration.

b. NAS-MD-002, Configuration Identification Documentation Listing.

c. NAS-MD-003, Summary Listing, NAS Change Proposals (NCP) and Configuration Control Decisions (CCD).

66.-69. RESERVED.

SECTION 2. PROGRAM RESPONSIBILITIES

70. INTRODUCTION. The RCF will be implemented in accordance with FAA policies and procedures for the acquisition of facilities and equipment modernization and expansion. The Systems Engineering Service (AES) is responsible for the overall system engineering for the National Airspace System Plan. The Interfacility and Auxiliary Division, APM-500, will provide program management and technical direction at the national level. Affected regions have the responsibility for site implementation from site acquisition to operational turnover. In summary, organizational elements from FAA headquarters, the Mike Monroney Aeronautical Center, the FAA Technical Center, and the regions will be involved in this project. The following paragraphs define the major project responsibilities of the affected organizational elements.

71. WASHINGTON HEADQUARTERS RESPONSIBILITIES. AES is responsible for overall system engineering of the National Airspace System. For the a/g communications program, this includes defining the coverage network necessary for fulfilling the operational requirements, defining system interfaces, providing for frequency management, and providing for configuration management. The program manager for a/g communications located within the Program Engineering and Maintenance Service (APM) is responsible for developing, coordinating, and monitoring the a/g communications program from the engineering/development cycle through the operation cycle within the constraints placed on the program by the overall system design. The program office (APM-540) has responsibility for all aspects of ground/ground (g/g) radio communications and air/ground a/g radio communications for each of FAA's operational functions: en route, terminal, and flight services. The program office has been divided into two teams: voice and recording and remote site. The voice and recording team has responsibility for communications and recording systems at the control facility, i.e., air route traffic control center (ARTCC), air traffic control tower (ATCT), terminal radar approach control (TRACON), and flight service station (FSS). The remote site team has responsibility for communications at the antenna facility, i.e., remote center air/ground communications (RCAG), remote transmitter receiver (RTR), remote communications outlet (RCO), etc. Supporting the program manager are managers from the principal participating organizations. Each manager is responsible for coordinating those efforts associated with that organization's stated mission. The organizations providing the managers are:

a. Other divisions within the Program Engineering and Maintenance Service.

b. Regional offices.

c. Systems Engineering Service.

d. FAA Technical Center.

e. Air Traffic Plans and Requirements Service.

f. Acquisition and Materiel Service.

g. Mike Monroney Aeronautical Center.

h. Office of Personnel and Technical Training.

i. Office of Budget.

72. MIKE MONRONEY AERONAUTICAL CENTER (AAC). The AAC will provide support to all site personnel involved with the installation and maintenance of all equipment and software delivered under the appropriate contracts under this program.

73. FAA TECHNICAL CENTER. The FAA Technical Center (ACT) will support the System Engineering Service (AES) in the systems engineering of the communication network. The initial major activity will be the validation of electro magnetic compatibility analysis center (ECAC) developed software, cosite analysis model no. 2 (COSAM II). The COSAM II will be used to design regional facilities for the communication network. The ACT will establish a stand-alone RCF with 24 frequencies having transmitters and receivers in the same building. Several configurations of antennas, multicouplers, and combiners will be tested. The 24-frequency facility will also be established at a second generation VORTAC to validate antenna configurations, locations, and mounting at the VORTAC site. Additional testing to provide system engineering data will be conducted at radar, RCL, and DF sites. Problems encountered during the tests will be resolved through use of state-of-the-art hardware.

74. REGIONS. Regional responsibilities include site selection, construction of the environmental facility, and relocation of existing radio communications equipment and antennas, or acceptance of contractor relocation and installation of radio communication equipment cables, antennas, batteries/dc distribution systems, antenna towers, and flight inspections as may be required. Abandonment of obsolete sites is required to effect the cost savings and cost avoidance in future years. Regional tracking of reduced land leases, reduced maintenance travel, reduced power consumption, and reduced leased services is required. The regions need to submit the following information to FAA headquarters:

a. FAA Form 2500-70-2 showing a prioritized list of proposed actions, contractor or FAA installations, and estimated FAA start date following receipt of funds. Costs to restore abandoned sites should be identified.

b. FAA Form 4650-1 (PML) showing types and quantities of cable required and functional capacity of the battery/dc distribution system required.

c. A floor plan sketch of the proposed RCF facility.

d. FAA Forms 2500-70-1 and 2500-40 PG-1 if the regional cost estimate is substantially different from the headquarters cost estimate.

75.-79. RESERVED.

SECTION 3. COMMUNICATIONS

80. GENERAL COMMUNICATIONS. The a/g communications program manager (APM-540) is the focal point for all internal communications. In order to successfully proceed with the system deployment and operational cutover, APM-540 must be aware of all significant program activities. In addition to this direct interface with the project manager/technical officer (TO), the program manager must ensure that the necessary program information is made available to the organization that has action responsibility. APM-540 will maintain a program information distribution list. This list will be distributed by functional organizations to branch or section level as necessary. Each responsible organization will designate in writing to APM-540 a consolidation/network coordinator and an alternate for the regional implementation activities. The coordinator will be identified by name, organization code, and phone number.

81. CONTRACTOR COMMUNICATIONS. In accordance with FAA policy, interface with and communications to contractors is authorized for specific purposes. The contracting officer (CO) has the direct contract responsibility and is responsible for all contractual matters. The CO is the only person authorized to approve changes that will impact price, delivery, or schedule.

a. The contracting officer has been designated in the Acquisition and Materiel Service (ALG), ALG-321. As such, ALG-321 is the office responsible for all contractual matters.

b. The program manager has been designated as the Manager, APM-540. A project manager has been designated from the APM-540 staff and will also be a technical officer (TO). Thus, APM-540 is authorized to perform technical interface with the contractor's representatives.

82. INTERNAL COMMUNICATIONS. The communication channels focus on APM-500. Contractual communications are authorized for the CO, TO, quality reliability officer (QRO), and TO representative. The program manager has the primary responsibility for designating organizational elements and individuals who will perform and/or coordinate program activities. Nothing in this chapter is intended to inhibit normal FAA internal communications. Instead, the intent is to emphasize the offices which are primarily concerned with the a/g communication program. ALG-321 (CO) and APM-540 (TO) have responsibility for contract matters and are the internal offices to contact for contract communications.

83.-89. RESERVED.

SECTION 4. ACCEPTANCE INSPECTIONS

90. GENERAL. Final inspection of the RCF production units will be at the contractor's facility. Currently, acceptance will occur at the FAA Depot but may change to acceptance at the contractor's facility.

91. INITIAL EQUIPMENT TESTS. Tests performed on the initial units at the equipment contractor's facilities will include design qualification tests and Federal Communications Commission (FCC) acceptance tests (type tests). Following acceptable completion of these tests, a set of equipment will be tested to the production test requirements, which is a subset of the design qualification tests, and shipped to the FAA Academy for installation. The installed unit, following interim site acceptance, will be used for operational evaluation tests conducted by FAA personnel. Subsequent sets of equipment will have production tests performed and then will be used for reliability and maintainability demonstrations at the factory. Any design changes required will be incorporated into all equipment, with an appropriate test and demonstration.

a. The design qualification tests are conducted on the first production units after quality control inspection to verify that all detailed equipment specification requirements are met and to establish the performance baseline for the equipment. All failures are analyzed and resolved by repair, redesign, and rework or, as a last resort, by a change to the equipment specification. Occasionally, it may be that the failure was because of test methodology. In that case, the failure is absolved and testing continues using a different methodology. Completion of the design qualification tests establishes the initial equipment configuration baseline.

b. Type test requirements are established by the FCC for all radio frequency transmitters and receivers. At least two sets of equipment, following quality control inspection and normal production tests, will be subjected to type tests. The test results will be forwarded to the FCC for type approval.

c. The initial equipment set installed at the FAA Academy will be operated and maintained by FAA personnel. Suitable logs and reports will be maintained as the basis for an independent operational evaluation report that will be submitted to APM-540.

92. INSPECTION AND ACCEPTANCE. Inspection of the RCF will occur at the equipment contractor's facility. Quality control inspections, in accordance with FAA requirements, will be at the discretion of the QRO. Production tests will be performed by contractor personnel, with QRO concurrence, prior to shipment. Currently, acceptance of the RCF equipment will occur at the FAA Depot, but may change to the contractor's facility.

93. **SITE TEST.** The equipment contractor will prepare and submit for FAA concurrence test procedures for the equipment as installed prior to certification. APM-540 will review these procedures and amend them as necessary, and provide the FAA approved site tests required for certification. These site tests will be conducted by FAA personnel following regional installation.

94.-99. **RESERVED.**

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: Suggested Improvements to System Program Plan/System Implementation Plan Remote Communications Facilities

From:

To Manager, Communications and Facilities Division, APM-500

Problems with present handbok:

Recommended Improvements:

Signature

Facility Identifier and AF Address