

GAO

September 1987

FAA STAFFING

Challenges in Managing Shortages in the Maintenance Work Force



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**Resources, Community, and
Economic Development Division**

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September 25, 1987

The Honorable Norman Y. Mineta
Chairman, Subcommittee on
Aviation
Committee on Public Works and
Transportation
House of Representatives

The Honorable John P. Hammerschmidt
House of Representatives

As you requested in your June 26, 1986, letter, we have evaluated the Federal Aviation Administration's staffing for the maintenance of the nation's air traffic control system. This report presents our findings, conclusions, and recommendations regarding the adequacy of current staffing levels and the potential for future attrition in the maintenance work force.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days from the date of this letter. At that time, we will send copies to interested congressional committees, the Secretary of Transportation, and the Administrator, Federal Aviation Administration. We will also make copies available to others upon request.

This work was performed under the direction of Kenneth M. Mead, Associate Director. Major contributors are listed in appendix VI.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

The safe and efficient operation of the nation's air traffic control system depends in large part on the continuous operation of a network of sophisticated communications, radar, navigational, and computer equipment.

At the request of the Chairman and former Ranking Minority Member, Subcommittee on Aviation, House Committee on Public Works and Transportation, GAO evaluated

- the adequacy of staffing for the maintenance of this equipment and
- the potential impact of projected attrition of maintenance personnel.

Background

The specialists—technicians and engineers—who maintain and repair the equipment in the nation's air traffic system play a key role in ensuring the safety of the nation's airspace. They represent the second largest Federal Aviation Administration (FAA) work force.

The Congress has authorized FAA's plan to replace much of the equipment currently used to control air traffic with newer technology. This plan, called the National Airspace System (NAS) Plan, assumes that fewer technicians will be needed by the 1990s because new equipment will be more reliable and require less maintenance. Based on this assumption, FAA has used attrition to reduce the technician work force.

FAA has developed a staffing standard to project maintenance work load requirements. GAO evaluated maintenance staffing in relation to work load and the projected impact of attrition in four FAA regions: Eastern, Great Lakes, Southern, and Southwest.

Results in Brief

The number of FAA specialists who maintain and repair air traffic equipment has decreased faster than FAA had projected. Current technician shortages are beginning to negatively affect equipment performance and other operational areas, such as the completion of routine maintenance. In addition, the airline industry is experiencing an increase in flight delays caused by equipment failures.

Without hiring in anticipation of attrition, staffing will become more critical because of (1) the retirement profile of the technician work force, (2) extensive training required to develop replacements, and (3)

delays in the installation of new systems designed to reduce maintenance requirements. Unless corrective actions are taken, reduced staffing levels could result in a reduction in services.

The Department of Transportation indicated that corrective actions are planned or under consideration to preclude the potential for disruptions in service due to maintenance staffing levels. Actions taken to date include some limited hiring and review of the maintenance staffing standard process. However, these actions alone will not be sufficient to address attrition. In its planning FAA needs to develop a continued hiring program to begin rebuilding its technician work force.

Principal Findings

Critical Field Vacancies

Attrition of maintenance personnel has exceeded FAA's projections. Because of past hiring restrictions, other staffing priorities, and FAA's commitment to reduce maintenance staffing as part of the benefits of the NAS Plan, critical technician vacancies currently exist throughout the field. FAA has sought some additional maintenance staffing through the budget process, but the administration has not approved these requests. Furthermore, neither these requests nor actual staffing have been at the level of the maintenance staffing standard. At the end of fiscal year 1986, FAA's field maintenance staffing was 84 percent of what it should have been as estimated by the staffing standard.

Reduced Staffing Is Having an Effect

Of the four FAA regions GAO examined, the Eastern Region's ability to provide maintenance services to air traffic has been the most seriously impaired. Staffing shortages have been a factor in several radar and other equipment outages and in reduced levels of routine maintenance in fiscal years 1985 and 1986. Other regions are also showing signs of deteriorating performance.

Staffing shortages have resulted in less maintenance coverage at many locations which in the past had 24 hour maintenance coverage. Staffing levels and restrictions on the use of overtime have also caused scheduled maintenance shifts to go unstaffed. The effects of these open shifts have been to increase the time it takes to repair equipment and restore it to service from a few minutes to several hours. In turn, longer periods of equipment down time may be contributing to flight delays. Nationwide,

FAA experienced an increase between fiscal years 1983 and 1986 in the number of flights delayed because of equipment failures. Between 1985 and 1986, flight delays from equipment failures increased 22 percent more than total delays increased.

Increased work loads are also affecting technician morale and could have implications for sustaining high levels of performance. As measured by FAA's 1984 and 1986 attitude surveys, morale of the maintenance work force remains lower than that of any other FAA work force.

Future Staffing Outlook Is Not Good

The outlook for technician staffing is not good because of the large number of retirements FAA could experience in the near future and the long training period for replacements. In addition, staffing is already lower than NAS Plan projections for 1993. GAO found that by 1990 about 33 percent of the work force—2,500 engineers and technicians—are eligible to retire and, by 1995, this number will increase to almost 60 percent.

A pipeline of trainees is needed to replace these staff because it takes from 2 to 5 years to train a fully qualified technician. FAA had only about 400 technical staff in a developmental status as of September 30, 1986. These staff were hired to replace past vacancies. FAA plans to hire 110 staff in fiscal year 1987 in anticipation of attrition, but this level of hiring will not be sufficient to offset future retirements. FAA has several other options it could explore, including rehiring retired technicians and redistributing existing staff, in order to address its maintenance staffing needs before services are more seriously affected.

Problems With FAA Data

FAA needs performance data for management which identifies where current staffing shortages are affecting maintenance accomplishments before these shortages result in more equipment failures. However, data now used by headquarters to monitor maintenance activity do not accurately reflect current conditions in the field. For example, GAO identified instances where technicians are intentionally overstating their accomplishments because of pressures to complete a certain maintenance goal. GAO also found that the ways regions measure maintenance accomplishments vary due in part to the absence of standard reporting requirements. For example, the tasks associated with maintenance routines on the same equipment were being counted differently in sample locations.

In addition, FAA headquarters is not using the maintenance staffing standard in budgeting resources, because it does not believe that the administration would support staffing at these levels. GAO believes that generally the staffing standard is well designed. However, the field equipment inventory records which are used along with the values in this standard to estimate work load requirements are not being kept current. Also, headquarters has found problems with the way that the field projects its future inventories and staffing requirements.

Recommendations

Given the need to begin hiring and training more technicians and the time that will be required to refine FAA's staffing standard estimates, GAO is recommending that FAA develop a staffing plan based on authorized maintenance positions. This plan, including estimated funding levels to support a hiring effort, should be provided to the Congress. Once this plan is completed, GAO recommends that FAA also improve its equipment inventory records and staffing estimates. These data will enable FAA to refine its hiring plan.

Because it will take time for new technicians to be hired and trained, GAO also recommends that FAA review several options to deal with current shortages until such time as replacements can be fully trained. GAO makes additional recommendations concerning FAA's reporting system for routine maintenance. (See ch. 4.)

Agency Comments

Transportation's comments recognized that the transition to a modernized national airspace system presents a major challenge and stated that it is taking steps to manage this challenge. It plans to assess maintenance staffing requirements during the budget process and make recommendations on staffing and funding levels. The Department also stated that actions are being taken to revalidate FAA's maintenance staffing standard as GAO recommends. (See app. V.)

The Department notes that hiring has occurred during the past year. This hiring, however, has not significantly increased the maintenance work force to a level that will guard against attrition in the next several years. GAO believes that a significant benefit of a long-term staffing plan would be to provide congressional oversight committees with information on how, in the face of significant attrition, FAA will meet its maintenance staffing requirements through the early 1990s.

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Abbreviations

AF	Airway Facilities
ARTCC	air route traffic control center
DOT	Department of Transportation
FAA	Federal Aviation Administration
F&E	facilities and equipment
FTE	full-time equivalent
GAO	General Accounting Office
GNAS	General National Airspace System
MTBO	mean time between outages
MTTR	mean time to restore
NAS	National Airspace System
OJT	on-the-job training
O&M	operations and maintenance
PASS	Professional Airway System Specialists
PCS	permanent change of station
PM	preventive maintenance
SEIC	systems engineering and integration contractor
SFO	sector field office
TSC	Transportation Systems Center
VORTAC	very high frequency omnidirectional range tactical air navigation

Introduction

Aircraft from point of take off through landing rely on a network of equipment—commonly referred to as facilities—to keep pilots in communication with air traffic controllers on the ground and provide data on in-flight locations. (See fig. 1.1.) The Federal Aviation Administration's (FAA) maintenance work force is responsible for the upkeep of these facilities. Although this work force does not receive as much public visibility as other FAA work forces, for example, air traffic controllers, maintenance specialists perform a fundamental service both to FAA's air traffic organization and to pilots and the flying public whose safety depends on the operation of the numerous computers and navigational and landing aids throughout the United States. As of September 30, 1986, FAA's Airway Facilities (AF) work force was responsible for the upkeep of almost 21,000 major facilities throughout the United States.

FAA is in the process of modernizing these facilities, some of which are over 40 years old. This period of modernization is expected to last at least to the year 2000 and presents FAA with significant challenges in meeting its mission to ensure air safety while changing the way maintenance activities are conducted. This report examines the impacts of this transition period on the AF field work force and on the operation of the National Airspace System (NAS).

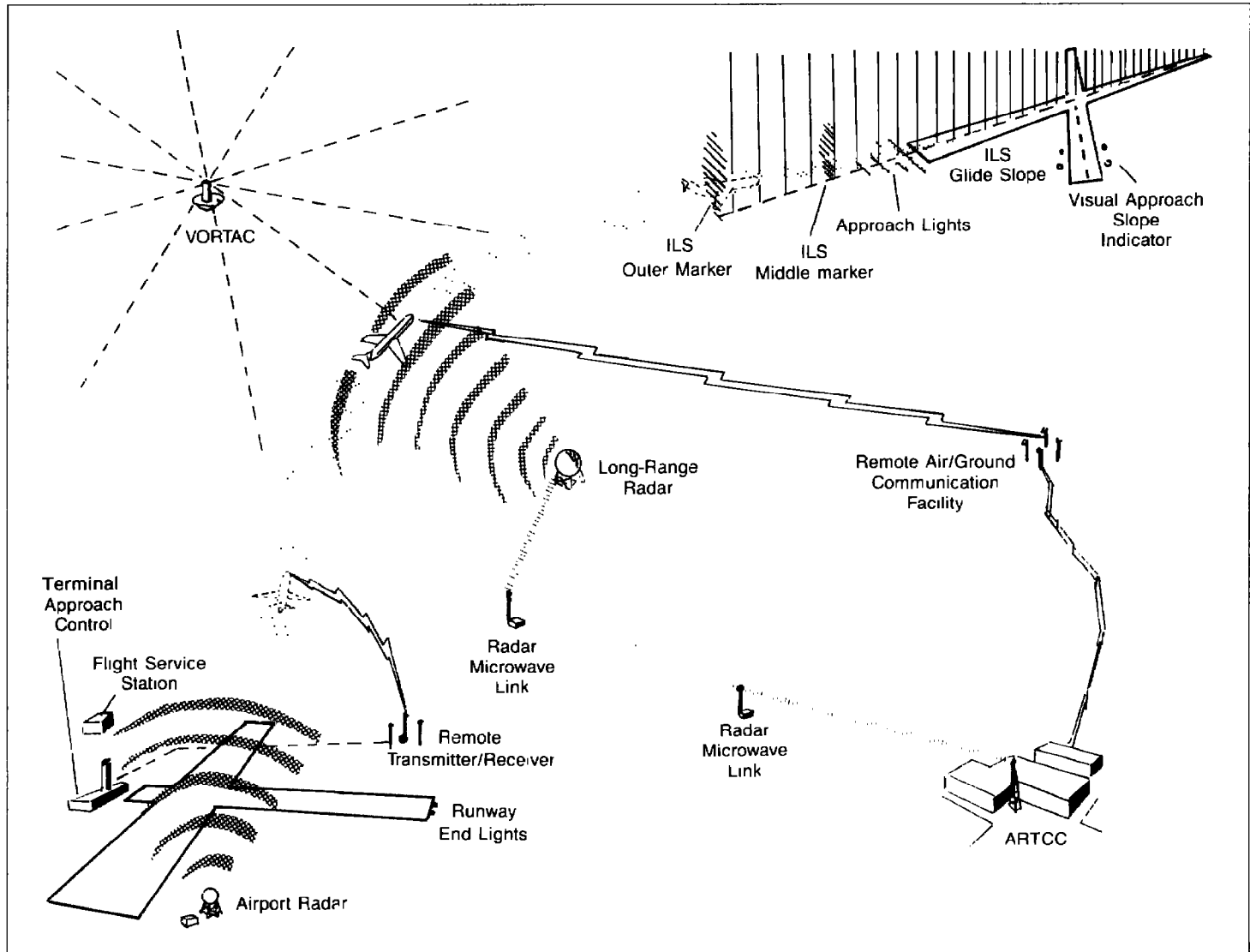
FAA in Transition to New Maintenance Operations

Beginning in 1981 FAA developed a multi-billion dollar plan to govern its modernization efforts through the year 2000. Modernizing the NAS brings change not only to the technological environment in which FAA operates but also to the role, size, and composition of its maintenance work force. Moving AF through this transition presents a challenge to FAA management as the maintenance function comes to rely more on computers and less on human resources.

The Role of Maintenance Technicians in FAA's Mission

The AF mission is to operate and maintain a safe, reliable, and cost-effective NAS. To this end, FAA employs a field maintenance work force that includes maintenance technicians, engineers, computer operators, and logistical support personnel to maintain the equipment that makes up the nation's air traffic control system and to correct problems with this equipment. This field maintenance work force, numbering 8,306 at the end of fiscal year 1986, is the second largest in FAA, with air traffic controllers being the largest work force.

Figure 1.1: Examples of FAA Facilities Used in Flight



Source FAA

Technicians maintain systems by monitoring equipment and by performing preventive and corrective maintenance actions. Currently, technicians are expected to diagnose equipment problems, isolate and replace defective components, and, in many cases, repair these parts. Electronic maintenance technicians—about 5,600 at the end of fiscal year 1986—constitute about two-thirds of the total AF work force and work in four

specialty areas: communications, navigational aids, radar, and automation.

The second largest group of technicians—about 1,200—are those who maintain the environmental systems that support FAA's electronic equipment. These environmental technicians maintain facilities such as electric power generating plants and air conditioning systems. Increasingly, FAA's newer environmental support systems are incorporating more electronics into their design, whereas in the past, these systems contained more mechanical equipment. Environmental technicians find themselves in transition from wage grade positions as maintenance mechanics to new skill requirements.

Maintenance of the 80s/ 90s

Because of the public's need for continuous air traffic operations, FAA maintenance has been built around preventive or periodic maintenance (PM) of the air traffic control system. This maintenance is designed to preserve equipment or to reduce its chance of failure in order to minimize service interruptions as well as extend the life-cycle of equipment. Once an equipment failure causes service to be interrupted, "replace now, repair later" techniques are used in order to minimize the duration of service interruptions. Traditionally, FAA has had a cadre of skilled technicians on site in the field to carry out these tasks.

Recognizing the need to keep pace with technological advances, FAA has developed a maintenance concept to govern a future, modernized air traffic system in the year 2000 and beyond. In 1979 FAA management adopted a new maintenance philosophy called "Maintenance of the 80's" based on conversion of all equipment to state-of-the-art technology. Remote maintenance monitoring and centralization of the work force with minimum PM tasks were two of the other primary elements of this philosophy. Essentially, maintenance was to rely more on computers monitoring and diagnosing other computers with technicians sent from central locations to restore failed equipment to service. Over time "Maintenance of the 90's" would evolve to three levels of maintenance: systems monitoring, restoration, and repair. Systems monitoring, largely through computers, would be the method for identifying equipment problems. The technician work force would be concentrated in restoration level activities, that is, restoring systems to service by replacing defective circuit boards with new ones. Repair of the defective parts would no longer be done by technicians on site but would be transferred to the private sector and managed through the FAA Depot. This approach represents a fundamental change in the way technicians currently are

trained and do their job, with less emphasis on individual skills in diagnosis and repair and more reliance on automation. This new maintenance philosophy is expected to result in productivity gains, thereby reducing the frequency of maintenance and the need for maintenance personnel.

The NAS Plan

To meet the projected increase in airspace system demand and to replace aging facilities and equipment, FAA's NAS Plan is to modernize and improve the nation's air traffic control system by the year 2000. In the June 1986 update to this plan, FAA projects that its greatest savings in AF personnel will come from modernization of the communications between FAA facilities (through new computer and radio communications links) and ground to air systems (such as navigation aids and radar). Some solid state equipment that has reduced maintenance requirements and improved productivity is already in place. However, as discussed in more detail in chapter 3, FAA is encountering problems in meeting its schedule for implementing this plan. As a result, many older, labor-intensive systems that FAA had expected to replace by now are still in operation.

Because of its changing maintenance philosophy and the shift to new technology, FAA has been in a period of transition. The AF work force is particularly affected by this transition period as new technology requires new skills and training, staff relocations, and fewer people. FAA officials recognize that these factors present the agency with a major challenge in overseeing maintenance of the NAS. FAA is faced with having to phase in new systems, people, and skills while keeping the air traffic system intact and efficiently managing current resources.

The Airway Facilities Organization

In fiscal year 1987, FAA's systems maintenance appropriation was \$752.8 million, of which \$513.3 million was for field maintenance—the activity that is the subject of this report. The systems maintenance budget was the second largest in FAA's operations appropriation. This budget provided for 10,397 congressionally authorized positions, 9,278 of which were in field maintenance. However, full-time equivalent (FTE) funding¹ was provided for approximately 9,400 employees, 8,306 of which were in field maintenance. Thus, FAA's congressionally approved

¹Control of federal agency civilian employment was shifted to a full-time equivalent or work-year basis in 1982. The distinction between authorized positions and FTEs is that a position may not be filled all 12 months of a year on a full-time basis, because of attrition, leave, etc. FTEs represent the number of employees actually employed for a 12-month period.

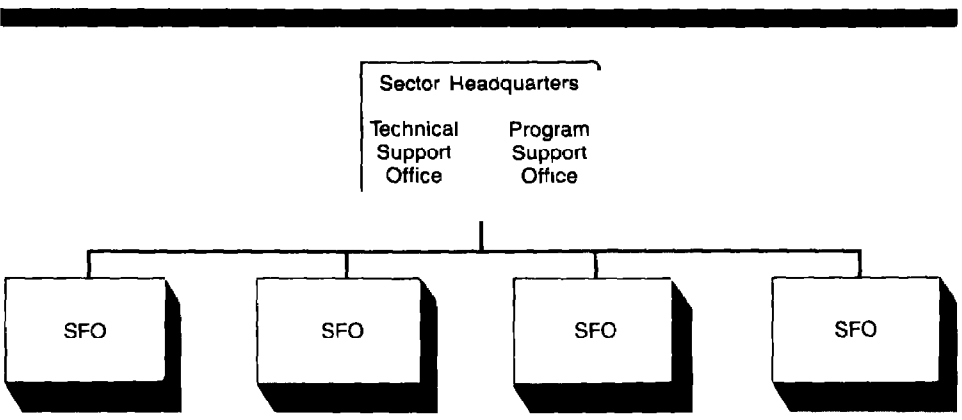
budget sets a ceiling for maintenance employment, in accordance with the administration's desire to contain the size of the federal work force.

FAA's AF organization is administered at the headquarters level by the Associate Administrator for Development and Logistics (hereafter referred to as the Associate Administrator). The Associate Administrator has an Evaluation Staff that performs reviews and evaluations of both national and regional performance. The maintenance functions rest with the Program Engineering and Maintenance Service primarily in the Maintenance Engineering Division.

In the field, the primary line maintenance organization is the AF sector. This organization is responsible for monitoring, controlling, maintaining, and certifying facilities. Sector headquarters will usually have a program support office, which provides staff assistance for personnel matters, including training and budget, and a technical support office which provides engineering and technical support to staff. As shown in figure 1.2, the sector is subdivided into one or more area offices or sector field offices (SFO).

Sectors are headquartered at the 20 air route traffic control centers (ARTCCs) in the continental United States and throughout the country at general NAS (GNAS) sectors. ARTCC sectors maintain the equipment in the centers whereas GNAS sectors are responsible for airport terminals and surrounding facilities. In 1986 there were 82 sectors in the AF field organization, and these sector managers report directly to the AF Division Manager in each region.

Figure 1.2: Airway Facilities Sector Organization



AF Sector Level Staffing Standard

According to FAA policy, "staffing standards are established as the basic method of determining, analyzing and distributing employee resources. . . ." FAA has traditionally used staffing standards to allocate human resources and has supported their use for other internal management processes such as assigning work and identifying training needs. Since 1976 FAA has had an engineered staffing standard that provides the basis for personnel allocations in the AF field organization. It defines what levels of staffing it "should take" to accomplish those tasks specified in FAA's maintenance orders. This staffing standard has achieved credibility both within and outside FAA. For example, in a 1978 report, the House Committee on Appropriations described the standard as "well engineered" and stated that with continued refinement, the standard should provide a basis for projecting staffing requirements.

The AF standard was revised in January 1986 to incorporate changes based on validation studies, as well as to incorporate new facilities and support staffing formulas. The standard gives regional directors the authority to request staffing that varies from it and to distribute authorized staffing among sectors when necessary. The standard also recognizes that while the development of the standard is a significant accomplishment, refinement and revalidation of the values in the standard are needed to ensure its credibility. Twice annually the field is requested to update its facility records and project staffing needs using the staffing values and formulas provided in this standard.

Objectives, Scope, and Methodology

On June 26, 1986, the Chairman and former Ranking Minority Member, Subcommittee on Aviation, House Committee on Public Works and Transportation, requested that we examine the adequacy of FAA's maintenance staffing. (See app. I.) At hearings earlier in June, the Subcommittee had heard testimony that FAA's technicians are rapidly approaching retirement and that FAA was not taking steps to plan for this attrition. The Subcommittee asked that we examine

- the current staffing situation and what impacts current staffing is having on the air traffic system and
- the projected attrition of maintenance personnel and its potential impacts on maintenance staffing requirements.

Chapter 2 discusses the current staffing condition in the field and the impacts of this staffing on system performance, air traffic, and the maintenance work force. Based on these examples, chapter 3 discusses the future outlook for maintenance staffing and the potential impacts of

future retirements. Our conclusions and recommendations to deal with both the current and future staffing situation are contained in chapter 4. Chapter 4 also discusses FAA's plans to test contract maintenance of selected facilities. Although this subject was addressed in an earlier report,² we now discuss this pilot test in terms of options available to FAA to address its staffing needs.

This report is based on field work conducted in four of FAA's nine regions: the Eastern, Great Lakes, Southern, and Southwest Regions. These FAA regions include four of the five largest and provide diversity in weather conditions and geographic coverage. Within these regions, a total of 10 sectors were used as case studies. These included an ARTCC in each region and at least one GNAS sector and corresponding SFO.

To address the question of potential impacts of future levels of maintenance staffing, we believed that it was necessary to conduct case studies both in sectors where there was an adequate staffing level and high performance as well as those with staffing vacancies and poor performance levels. Using this approach we were able to examine, in-depth, sectors that were currently experiencing maintenance problems due to staffing shortages. From this, we gained some insight to what might occur to the overall system, if staffing shortages increase in the future. We selected some sectors with adequate staffing levels (those in the Great Lakes Region) for case study in order to compare the situations in understaffed sectors (those listed below in the Eastern, Southern, and Southwest Regions) with sectors with adequate staffing. The 10 sectors (17 locations) selected for our field work are shown in table 1.1.

Table 1.1: Sectors in GAO Sample

Region	Sector	Sector field office
Eastern	New York ARTCC Metro GNAS	Islip, New York John F. Kennedy
Great Lakes	Minneapolis ARTCC Wisconsin GNAS	Madison, Wisconsin
Southern	Memphis ARTCC Jackson GNAS Memphis GNAS	Greenwood, Mississippi Nashville, Tennessee
Southwest	Houston ARTCC El Paso GNAS Oklahoma GNAS	Lubbock, Texas Wichita Falls, Texas

²Air Traffic System: Pilot Program to Contract Out Maintenance at Selected Facilities (GAO RCED-87-104BR, April 1987).

Our field work was conducted at both the regional headquarters and sector levels. To determine the impacts of current staffing, we examined AF's staffing standard and the factors that have been included in estimating work load. We analyzed staffing profile data, including vacancies and the status of efforts to fill them for each sector/sector field office. We also examined FAA orders and requirements for maintenance activity. In the field, we reviewed performance statistics on PM, equipment outages and restoration times, shift coverage documents, technical inspection reports, management evaluations, and other site data. To identify concerns of the technician work force, we reviewed the results of FAA's 1984 and 1986 attitude surveys and conducted structured interviews with technicians and representatives of the technicians' union—the Professional Airway Systems Specialists (PASS)—in each sector. We also interviewed users of AF services, primarily air traffic controller personnel, at each sector.

To identify potential impacts from future staffing, we analyzed historical attrition data, demographic data on the entire AF work force as well as data on the retirement eligibility of staff in the 10 sampled sectors. We examined FAA's training requirements and visited the FAA Academy in Oklahoma City to better understand the technician training program. Where available, we reviewed human resource plans and other documents that would describe training and hiring needs. We interviewed FAA managers in the field and at headquarters on all of the above issues.

In conducting our field work, we examined data covering fiscal years 1985 and 1986. Our review, conducted during the period July 1986 to February 1987, was carried out in accordance with generally accepted government auditing standards.

Current Staffing Shortages Are Affecting FAA's Ability to Fulfill Its Maintenance Responsibilities

In recent years, FAA has had to balance the competing priorities of controller, inspector, security, and other staffing needs within the agency's personnel ceilings. FAA has viewed maintenance staffing as less of a priority than staffing for these other work forces. At the same time, FAA is committed to its NAS modernization program which anticipates maintenance staffing reductions of over 3,000 by the year 2000. FAA has, therefore, allowed attrition to occur in the maintenance work force, not replacing many of the departing technicians. Overall, field staffing declined 26 percent from 1979 to 1986.

Moreover, field maintenance is not being staffed to meet work load requirements projected either by FAA's staffing standard or the NAS Plan. Although both the AF staffing standard and the NAS Plan project a reduction in maintenance staffing requirements, at the end of fiscal year 1986, field staffing was 16 percent lower than what the staffing standard and revised NAS Plan estimates called for.

The Administrator and other FAA headquarters officials believe that because statistics on equipment failures show a decline, AF staffing is a future rather than a current problem. We believe that

- weaknesses in performance data, including underreporting of equipment failures, are affecting headquarters' assessment of the current impacts of staffing reductions;
- both the quantity and quality of maintenance activities are being negatively affected because of a shortage of field technicians. These affected activities include watch coverage, routine maintenance, equipment modifications, repairs, and other duties. Reductions in these activities will over the long term adversely affect equipment performance and could lead to equipment failures. FAA has already experienced a 42-percent increase in flight delays from equipment failures between 1985 and 1986; and
- technician morale has been negatively affected by staffing shortages and the increased work load. In both the 1984 and 1986 FAA-wide attitude surveys, the AF work force had the lowest job satisfaction scores of any FAA work force.

Delays From Equipment Failures Increased From 1983 to 1986

The airline industry and the flying public have been experiencing an increasing number of flight delays. A small (2 to 3 percent) but increasing number of these delays are due to equipment failures. For example, between 1985 and 1986 delays from FAA equipment failures increased 42 percent from 7,395 to 10,473. (See fig. 2.1.) During this same period, total flight delays increased 20 percent.

This increase in flight delays caused by equipment failures is important since one of the primary roles of a technician is to restore equipment to service. Adequate technician staffing is needed to restore failed equipment in a timely manner in order to reduce the occurrence or length of flight delays. These delays also mean economic impacts to both the airline industry and the flying public. In commenting on a draft of this report, the Department of Transportation (DOT) stated that the growth in flight delays is directly attributable to increased air traffic. DOT believes that because the increase in delays occurred while unscheduled outages decreased and facility availability increased, this increase should not be considered as an indicator of maintenance staffing shortages. FAA officials also emphasized that the percent of total delays caused by FAA equipment failures has remained in the 2- to 3-percent range.

Figure 2.1: Flight Delays From Equipment Outages FY 1983 Through FY 1986



AF officials told us that it is difficult to attribute the cause of equipment failures (outages) directly to inadequate staffing. These officials do, however, believe that there is a direct relationship between routine maintenance and equipment failures. For example, headquarters officials said that there is "a lead-lag relationship" between PM and equipment outages—reduced levels of maintenance accomplishment mean more future outages. We believe that the increased delays from equipment failures could reflect deterioration in the quantity and quality of maintenance performed in the field.

Critical Staffing Shortages Exist in the Field

FAA's field technical personnel declined 26 percent from 1979 to 1986, leaving many regions with critical staffing shortages. Attrition had reduced the maintenance work force to the point where AF's ability to continue to service air traffic operations at past levels was being questioned. As a result, in April 1986, the FAA Administrator agreed that further attrition of this work force should be halted and authorized the regions to fill vacancies as they occur.

Attrition Ahead of FAA Forecasts

Anticipating reduced work loads from the NAS Plan, FAA has used attrition to reduce the technician work force. From a high of 10,227 field technical personnel¹ in 1979, FAA had 7,561 personnel in the field at the end of fiscal year 1986. Essentially, AF's total field maintenance staffing of 8,306 (which includes all clerical and support staff) had reached the level forecast in the NAS Plan for 1990 and was 824 personnel below the plan's projected 1987 staffing of 9,130. Thus, (1) attrition is running ahead of FAA's plans to improve technology and (2) staffing has been reduced to a level lower than that considered necessary to maintain current technology. In April 1986, FAA's Administrator testified that FAA is working to get back to planned attrition rates in a manner that does not "... allow equipment performance to reach a critical level."

In the four regions we visited, fiscal year 1986 vacancies exceeded the funding available to fill them. Because of these limited resources, managers were being asked to identify their most critical vacancies² which

¹As used throughout this report, field technical personnel include staff in the following series: GS 301, 801, 802, 810, 830, 850, 855, 856, 899, and WG 4742 and 4749. This term excludes all clerical, logistical, and computer support personnel.

²Because staffing is a fluid situation and regional definitions of critical vacancies varied, we were not able to compile comparable data on total critical vacancies in each region.

**Chapter 2
Current Staffing Shortages Are Affecting
FAA's Ability to Fulfill Its
Maintenance Responsibilities**

would be filled as funding allowed. Table 2.1 shows the range in vacancies in each of the four sample regions as of the end of fiscal year 1986.

Table 2.1: Field Maintenance Staffing
(September 30, 1986)

Staffing level	Region			
	Eastern	Great Lakes	Southern	Southwest
Staffing standard	1,238	1,566	1,926	1,414
Authorized positions	1,126	1,418	1,802	1,356
Personnel ceilings ^a	1,053	1,324	1,660	1,212
On-board staffing	1,050	1,218	1,652	1,190
Positions vacant ^b	76	200	150	166

^aRepresents region's share of the FTE positions provided for in FAA's budget.

^bVacant positions can be filled only as dollar limitations allow

Internal Signs of a Staffing Problem

While publicly FAA has remained committed to maintenance personnel reductions, briefings prepared for FAA management portray a more serious situation. In June 1985, AF officials briefed the Administrator that the agency was facing a shortfall of 600 personnel in fiscal year 1990 and that actions were needed to begin backfilling all vacancies in 1986 and to staff at 98 percent of authorized positions in order to fill a pipeline.

In March 1986, the Acting Associate Administrator wrote the Administrator that cost cutting had the potential to disrupt system capacity as facilities are shutdown for "lack of funds or personnel." A briefing document described the staffing situation as critical and projected that it would soon be impossible to continue to maintain the NAS at current levels and quality.

In April 1986, the Administrator gave regional directors the authority to backfill for attrition of maintenance technicians in critical areas only, up to the employment level of March 31, 1986. In December 1986 budget guidance, the Administrator again stated that the regions should continue to emphasize hiring to backfill for technician vacancies as they occur in fiscal year 1987, although no specific hiring target was set. According to the Acting Associate Administrator, the Administrator has approved a strategy of attempting to stop further attrition by maintaining the employment level of March 31, 1986.

Competing Staffing Priorities and Commitment to Modernization Key Factors Contributing to Staffing Shortfall

Competing budgetary priorities and FAA's commitment to reduce maintenance staffing as part of productivity gains from the NAS Plan have caused a shortfall in the funding available for FAA maintenance staffing. FAA's priorities have been to hire air traffic controllers, inspectors, and security personnel. Until recently, hiring freezes and restrictions have limited AF's ability to fill maintenance vacancies, and even during fiscal year 1987, FAA plans to maintain staffing at a level 16 percent below the field's work load as projected by AF's staffing standard.

While maintenance staffing reductions projected in the NAS Plan are not realistic, nevertheless, FAA remains committed to reducing the AF work force by one third. In addition, AF staffing reductions have not been accompanied by a commensurate reduction in the maintenance work load. Between 1979 and 1986, attrition of field maintenance personnel exceeded reductions in work load by about 5 percent.

Past Budgetary Actions Have Curtailed Hiring

As early as 1983, FAA's Administrator testified that the rate of technician retirements would exceed FAA's needs so that maintenance personnel would still need to be hired. FAA's staffing priorities since that time, however, have been to rebuild the air traffic controller and inspector work forces and to increase security staffing. Hiring for these work forces has been congressionally mandated. The Congress has not, however, mandated hiring for the maintenance work force. Rather, overall personnel ceilings have restricted technician staffing. Once goals for controller and inspector staffing were established, these work forces were protected from reductions. Consequently, the AF work force has had to absorb a large part of the impact of the administration's desire to reduce the federal work force.

Since 1984, FAA has been subject to FTE ceilings which have restricted technician staffing and limited the number of new maintenance personnel hired. Because these FTE ceilings control the number of people actually employed, the number of AF positions authorized through congressional appropriations is not being filled. As of September 30, 1986, because of FTE ceilings, FAA's total field maintenance staffing of 8,306 was 90 percent of the positions authorized by the Congress and 84 percent of what the staffing standard calls for. Moreover, from January 1985 until April 1986, the Administrator froze hiring of maintenance technicians because of budgetary constraints.

Funding for AF staffing has been below stated needs. Historically, by the time an appropriations request for field maintenance is submitted to the

Congress, it has already received several reductions. To begin with, FAA headquarters does not request a budget for maintenance staffing at the level of its staffing standard. According to headquarters officials, AF does not believe that the FAA Administrator would support a request at that level given other agency priorities. Even after FAA agrees on its proposed budget, both DOT and the Office of Management and Budget have made subsequent cuts in FAA's requests. For example, the AF staffing standard projected a fiscal year 1987 field maintenance work load of 9,886. FAA requested field staffing of 9,004 from DOT. DOT's appropriation request to the Congress provided for field staffing of 8,149—18 percent lower than FAA's work load estimate.

FAA officials testified during the 1987 appropriations process that additional staffing was not needed because of work load productivity gains. In restoring 178 FTEs to the 1987 appropriation which DOT had proposed to cut, the House Committee on Appropriations stated that testimony indicated attrition would exceed these productivity gains. The Senate Committee on Appropriations requested that FAA report "... on realistic field maintenance needs as part of the fiscal year 1988 budget." As discussed in chapter 3, FAA's 1988 budget request does not realistically reflect maintenance staffing needs.

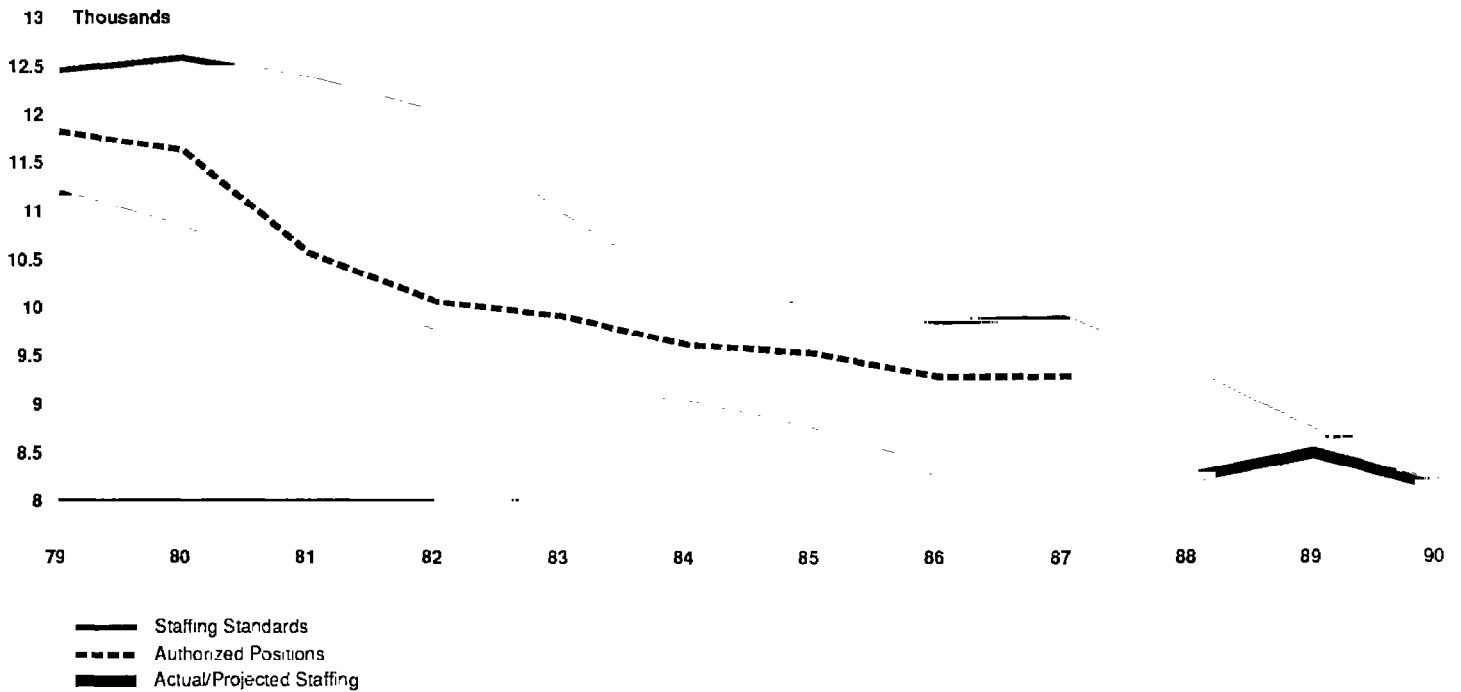
Figure 2.2 shows, for 1979 through 1990, the difference between field work load generated by AF's staffing standard and actual/projected staffing. Figure 2.2 illustrates that field maintenance has not been staffed in accordance with its staffing standard and that there has been a large gap between work load requirements and actual staffing levels. Since 1983 there has also been an increasing difference between congressionally authorized positions and the FTE ceilings provided for in FAA's budget, as the AF work force absorbed much of FAA's FTE reductions.

NAS Plan Has Contributed to Staffing Reductions

Estimated maintenance personnel savings associated with new technologies in the NAS Plan have contributed to reducing AF staffing levels. According to the Acting Associate Administrator, FAA has managed this reduction through attrition and by decreasing recruitment activities. However, during congressional hearings in April 1986, he stated that attrition was getting ahead of the planned reduction in the work force and FAA faced a prospective growing problem if the AF work force was not replenished. Since 1979 whereas staffing has decreased by 26 percent, work load estimated by AF's staffing standard has only declined by 22 percent.

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Figure 2.2: Field Maintenance Staffing v. Staffing Standard



As NAS Plan projects are delayed, AF's revised work load estimates have increased over the levels published in the plan. For example, the on-board population of the AF field maintenance work force at the beginning of fiscal year 1987 was 8,306. However, the NAS Plan projected a 1987 need for an AF field maintenance work force of 9,130 to maintain the system. Because equipment deliveries have been delayed and staffing standard allowances have been revised, NAS Plan work load estimates tracked internally by FAA now estimate 1987 maintenance at 9,643, 16 percent higher than on-board staffing levels.

FAA Has Not Used Performance Data That Would Enable Management to Identify Current AF Staffing Problems

FAA officials rely on equipment outage statistics as indicators of system performance. These officials have testified that because these statistics show a decrease in outages, the air traffic system is "robust" and current maintenance staffing is not considered to be a problem. FAA headquarters has based this assessment, in part, on equipment performance data that do not appear to accurately reflect field activities. Both differences in reporting practices and misreporting of field data have skewed some of the results reported to management. These data problems indicate that FAA management may not be in a position to accurately assess or address the impacts of current staffing.

Performance Data Should Be Comparable and Reliable

In comparing system performance among four regions, we found that maintenance data are not tracked the same way in any of the four regions. For example, PM data are filed with the regions for different periods (monthly, quarterly, or semiannually) and at different levels of aggregation, e.g., sector or SFO. We were unable to compare some aspects of AF activity between regions because similar data are not being collected. Managers did not use the same reports or have the same tracking systems for some elements of sector performance. For example, the time spent by technicians on installation work is not being tracked in all four regions. This problem is similar to a 1985 AF Evaluation Staff finding that it was difficult to draw concrete conclusions about the impacts of staffing reductions because ". . . most regions and sector locations did not have the types of data that were asked for. . . when these data were supplied by one sector, there was an absence of matching data at other locations." As a result, we believe that the examples used in this report represent only those that we could readily measure and could underestimate the impacts of current staffing.

Differences in Field Counts for Maintenance Tasks

FAA's PM reporting program is based on a tabulation of tasks completed. All tasks are given equal weight regardless of the level of effort required or importance of the tasks to the equipment's performance. FAA headquarters has delegated authority to the regions to decide which PM tasks are scheduled for each facility. The regions, in turn, have delegated authority to each sector and SFO to decide which tasks are scheduled.

FAA's decentralized PM system provides little incentive or assurance that tasks most critical to a system's performance will be completed. In our review, we found cases where because of increased work loads, major

equipment overhauls such as annual or semiannual tasks had been missed, but routines such as checking fire extinguishers were accomplished. Supervisors and technicians told us that in order to meet a certain percentage accomplishment, they will ensure that easier tasks are completed.

We compared the required monthly PM task counts for one common system throughout the four regions. We found that for the Mark 1F localizer,³ this task count for required electronic maintenance varied from 7 to 11. This means that although FAA orders define applicable routine maintenance tasks to be completed, each location was counting these tasks differently for the same piece of equipment.

Table 2.2: Comparison of Monthly Task Counts for Mark 1F Localizer

Sector	Monthly task count
Memphis	7
Metro	11
Wisconsin	8
Oklahoma	8

Differences in interpreting the total number of required PM tasks can affect a sector's PM performance since the greater the universe of scheduled tasks, the less that missed tasks impact on overall percentage accomplishment. For example, the Minneapolis ARTCC's environmental unit was not following regional policy on task counts. When this counting problem was corrected in July 1986, the unit's population of monthly scheduled tasks increased from 400 to over 2,100 although the work to be done remained the same. By increasing the number of scheduled tasks, the unit's PM accomplishment improved 3 percent. Of the four regions we visited, only the Southern Region had established a centralized, standard PM reporting system that identified tasks counts for facility maintenance.

Data Misreported in the Field

Data that are tracked are not standardized because of different reporting and interpretations of guidance in the field. For example, the AF Evaluation Staff report on the Eastern Region noted that all interruptions of 1 minute were not being reported by some sectors, although FAA's order requires that 1-minute interruptions be reported. According

³We selected this equipment because it is newer, solid state equipment found in many locations throughout the country

to the report, "This practice skews the actual regional and national averages and defeats the purpose of reporting."

Furthermore, we found instances in 4 of 10 sectors where PM was intentionally misreported. Technicians told us that they had written routine maintenance tasks, such as electronic tests of communications equipment and environmental checks on air conditioners, into the logs as accomplished that had not been done during that period but were accomplished at some later time. The technicians involved said that they felt pressured to complete a certain percent of maintenance on time and, therefore, had reported it as accomplished. FAA headquarters officials reiterated that FAA does not condone or encourage such behavior.

We also found that all outages were not being reported in two sectors. This underreporting was the result of practices between air traffic and AF whereby a technician was given some leeway to try to correct a problem before air traffic personnel reported the equipment out of service. Sector technical inspections and a 1985 special evaluation by AF's Evaluation Staff have similarly identified outage reporting problems. For example, the Evaluation Staff report found a high degree of accuracy with ARTCC outage reporting but less with GNAS reporting, where 16 percent of outages recorded in field logs were not reported to management through FAA's reporting systems.

According to FAA headquarters staff, policing some of these records which rely on the integrity of the technicians and their supervisors is impossible. Through more automated reporting systems, specifically, the Remote Maintenance Monitoring System anticipated to be in place by 1991, these officials believe many of these reporting deficiencies will be uncovered.

Staffing Levels Preventing Accomplishment of Many Duties

A technician's primary role is to restore failed systems to service and perform regular, routine maintenance for the upkeep of equipment. We found that staffing shortages (1) have already caused shift coverage at some major airports and facilities to be reduced, (2) are negatively affecting the amount of routine maintenance that is accomplished in the field and, (3) to at least some extent, are contributing to equipment failures. Of the four regions we visited, the Eastern Region is currently experiencing the most impact from staffing shortages both in terms of routine maintenance accomplishment and equipment outages.

In addition to direct maintenance duties, technicians are responsible for making equipment modifications, clearing action items from technical inspections, certifying systems for operation, and performing various administrative tasks. We found that many of these lower priority duties are suffering because available resources are inadequate. For example, backlogs of modifications due to staffing constraints existed in all four sample regions.

Staffing Is a Factor in Reducing Technician Coverage at Some Locations

One of the duties of a technician is to stand watch at air traffic control centers, long-range radar sites, and busy airports in case of equipment failure. Reduced staffing no longer permits FAA to cover some locations 24 hours per day, as has been done in the past. In the four regions we visited, shift coverage has been formally reduced at several locations because of staffing problems (see app. II).

In addition to formally reducing hours of scheduled coverage, some sectors are experiencing "open" watches that are not covered by a technician. Such watches can be either (1) scheduled where training or leave reduces the number of people available to cover a shift rotation or, more frequently, (2) unscheduled where a technician scheduled to work a particular shift takes leave unexpectedly. AF has constrained the use of overtime to cover such situations unless a supervisor determines the need is critical. As a result, supervisors will sometimes cover a shift themselves or leave the watch unstaffed. Open watches have occurred frequently in some locations. For example, at the John F. Kennedy Airport, New York, an average of 26 watches out of about 240 scheduled per month were open from January to June 1986.

The most significant impact of open watches has been when an outage occurs and a technician must be called in to fix the equipment. Restoration times have been longer in these situations—from a matter of minutes to hours—than would normally be the case if a technician were on duty. In June 1986, the Acting Associate Administrator testified that from 1979 to 1985 FAA experienced a "modest overall increase" in the mean time to repair systems (MTTR) attributed, in part, to local management decisions on watch coverage.

Some Locations Unable to Meet Regional Goals for Maintenance Accomplishments

FAA policy is that all scheduled PM—100 percent—should be accomplished. In our sampled regions, PM was the technician's main responsibility, second in importance only to corrective maintenance. Each region has established its own goal for maintenance accomplishment and its own reporting system. While overall these regions met their respective goals in 1985 and 1986, an increasing number of locations within these regions did not. For example, in the Great Lakes Region, two sectors were unable to meet the region's goal of 95-percent accomplishment in fiscal year 1985 and four sectors reported less than 95 percent accomplishment in fiscal year 1986.

On the other hand, the Southern Region, with a goal of 98-percent accomplishment, exceeded this goal in calendar years 1985 and 1986. Nationwide, the Southern Region was the only region to accomplish over 98 percent of its 1986 PM (see fig. 2.3). Management attributed this high PM accomplishment to the skill and dedication of the existing technical work force. If the maintenance accomplishments of the other three regions are measured against this higher standard, only 12 of 34 sectors could have met the Southern Region's PM goal.

PM accomplishment is becoming more difficult within sectors at the SFO level. Although the total maintenance accomplished by a sector may meet goals, accomplishment can vary widely within the sector's units and high performers average in with lower performers. For this reason, aggregate data reported to the region and then further aggregated for headquarters do not give a complete picture of what is occurring in the field. For example, the New York ARTCC, which has won FAA's ARTCC Sector of the Year awards both in 1984 and 1985, has been able to report total maintenance accomplishment above 95 percent although units within this sector have had periods of accomplishment as low as 82 percent. We found examples of SFO units in the Southwest Region with PM as low as 51 percent for one quarter.

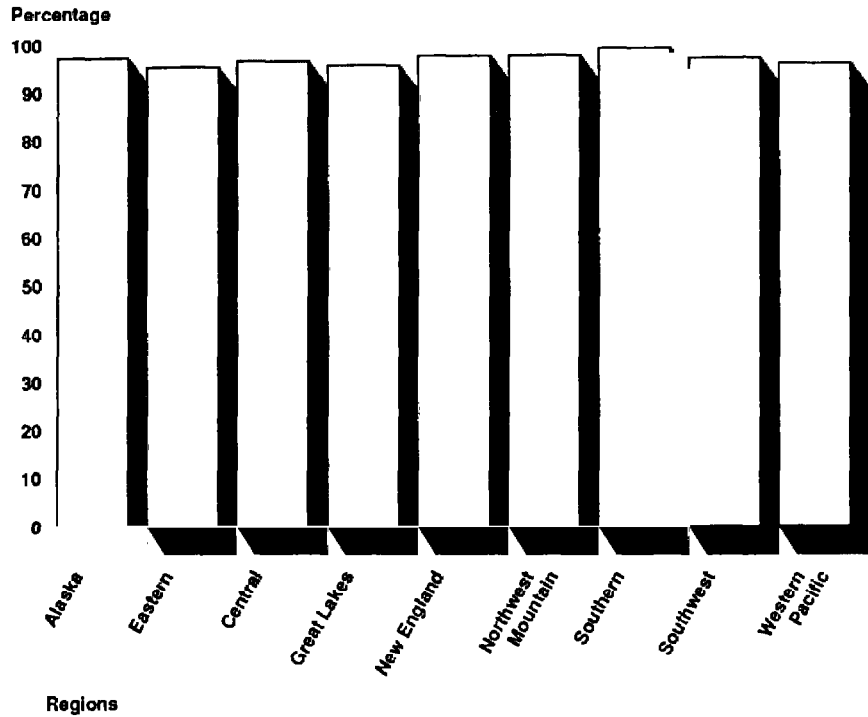
Staffing Has Contributed to Several Outages in FAA's Eastern Region

The Eastern Region had the poorest overall PM accomplishment both in fiscal years 1985 and 1986 at 95 percent. The region's 1986 average for environmental maintenance was only 93 percent accomplishment. Staffing shortages due to vacancies, training, and leave coverage problems have contributed to the region's reduced maintenance accomplishment.

Both our field work and an October 1986 evaluation of the Eastern Region by AF's Evaluation Staff found that outages in this region have already occurred or their length has been extended because of staffing

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Figure 2.3: 1986 PM Accomplishment by Region



shortages. At our two sample sectors in the Eastern Region, we identified a total of 17 outages, 13 of which occurred at John F. Kennedy Airport, where managers believed staffing was a contributing factor. These outages which involved radar, instrument landing systems, and the New York ARTCC's primary computer system, either occurred during open watches when no certified technicians were present to restore the equipment to service or on equipment that had not received a high level of required PM. Because of the time of day that these outages occurred and air traffic's ability to use backup equipment, only 2 of the 17 outages caused any air traffic delays. These delays to 193 aircraft averaged 31 minutes.

While we could not identify outages directly attributed to staffing in the other three regions, managers believe that such failures will occur. For example, the AF Division Manager, Great Lakes Region, said that before staffing shortages contribute to outages, they are reflected in PM accomplishment and completion of equipment modifications. The region is already experiencing a downturn in these two areas.

**Equipment Modifications
and Other Duties Suffering**

From our review, we found that the impact of staffing shortages varies depending on the philosophy and priorities of sector management. The Eastern Region's former AF Division Manager described managers in the field as pressured to make decisions about what to accomplish. FAA relies on field managers' judgment and has not dictated national work priorities beyond establishing some performance goals for merit pay purposes.

Management in both the Southwest and Great Lakes Regions told us that staffing shortages are affecting their ability to keep up with modifications to equipment. These equipment modifications are required for several reasons, including to correct deficiencies, improve performance, increase reliability, and minimize safety hazards. At the end of fiscal year 1986, the Great Lakes Region had a backlog of 686 modifications over 6 months old and was unable to meet its goal to complete 95 percent of its modifications within 6 months. The region was able to complete only 92.7 percent. Modifications were most affected by staffing in the Southwest Region's Oklahoma City sector. This sector had a backlog of 96 modifications over 6 months old, 51 of which were delayed because of staff shortages. Of the 874 available modifications to be done in the Southern Region, 117, or 13.4 percent, were attributed to staffing shortages.

Another technician responsibility is to certify systems periodically, that is, to verify and record in the log that equipment is providing the required service to the user. Technical inspection and other reports we reviewed for the El Paso, Metro, and New York ARTCC sectors indicate that some systems are not being certified within the prescribed intervals for reliable service. According to the El Paso sector manager, intervals are not only being missed but many are being extended from the normal period to the maximum certification interval (120 days). He sees this slippage in certifications leading to a potential deterioration in the air traffic system.

At other sectors we found evidence of increasing backlogs of (1) equipment components needing repair, such as a backlog of 213 items at the New York ARTCC, and (2) action items from technical inspections uncleared because of staffing shortages, including 50 items over 6 months old in the Oklahoma City sector. Similar conditions were described in the AF Evaluation Staff's report on the Eastern Region as follows:

"Some of the future problems the lower AF staffing levels will create are somewhat like the lower part of an iceberg. We have been shown and found evidence of not just lower preventive maintenance being accomplished in the scheduled windows, but completely missed preventive maintenance. We have seen evidence that modifications are not even being planned for accomplishment. We have found and seen evidence that critical special maintenance projects have been omitted or unfunded which have led to unscheduled outages. We have seen evidence that terminal radar facilities are now being restored through telephone availability response where, historically, they had 24-hour watch coverage."

Deterioration in Quality of Services a Concern to the Field

Our discussions with AF field managers and technicians as well as air traffic managers identified a common concern that the quality of service AF is providing to users is deteriorating. Data from the Great Lakes Region indicate that the number of deficiencies identified during technical inspections has increased.

Technicians and Field Managers Believe Staffing Shortages Are Negatively Affecting the Quality of Maintenance Performed

We asked technicians whether their work activities had been negatively affected by staffing shortages. Many technicians said that in addition to negatively affecting their ability to meet goals for PM accomplishment, staffing shortages were affecting the quality of maintenance performed. According to many technicians we talked to, they were not adhering to the same maintenance standards as in the past. A technician in the Great Lakes Region described this situation as "when you are pressed for time, the job done is not as good."

Management in the field shares these concerns. For example, one SFO manager wrote his sector manager that because of open watches the office always seemed to be "putting out fires" and less analysis and in-depth PM was being accomplished.

The number of deficiencies found during technical inspections also shows that the quality of the work being done in the field is deteriorating. The Great Lakes Region tracks both the number and type of deficiencies per inspection. From 1984 through 1986, Great Lakes data show an increase in the number of deficiencies per inspection, especially deficiencies related to documentation, such as logs and outage reports, and key performance parameters (critical indicators of equipment's operation) being out of tolerance. This means that during facility inspections, more problems than in the past were found, particularly with required recordkeeping, which is a quality control function, and with equipment not operating properly.

**Some Air Traffic Managers
Concerned About
Deteriorating Services
From AF**

We interviewed air traffic managers at each of the 10 sectors we visited. Generally, the more vacant maintenance positions in a sector the greater was air traffic managers' concern about the ability of AF to support operations, particularly in high activity locations. For example, air traffic managers in the Great Lakes sectors that had no vacancies voiced no problems with AF's support, on the other hand, managers in the Eastern Region and at Houston ARTCC were dissatisfied. For example, the Houston air traffic manager wrote the Southwest Region in June 1986 that reduced staffing has caused AF to schedule maintenance activity primarily on the day shift which forces air traffic to work without primary computers and other electronic equipment during peak traffic periods. "The lack of electronic equipment during prime user time decreases safety, increases problems, hardships and stress on the users and air traffic control personnel." AF managers at these locations believe that while air traffic has legitimate complaints, the instantaneous service air traffic has come to expect cannot be provided with current staffing levels.

**Work Load Pressures
From Reduced
Staffing**

More maintenance per individual as well as other duties is required today with fewer people. We found that in addition to performing required maintenance, field technicians are installing new equipment. To the extent that this installation work is occurring during regular work hours, it may be affecting some sectors' ability to complete required maintenance. In some field locations, the combined efforts of both supervisory and technician personnel are being used to accomplish the regular maintenance work load. In addition, electronic technicians are doing environmental maintenance in several locations because of staffing shortages. These practices in turn have negatively affected the accomplishment of regular supervisory and electronic technician duties.

FAA has also prematurely assumed productivity savings from new equipment and has taken staffing reductions before this equipment is fully operational. These reductions have increased the field's work load.

**Technicians Performing
Facility Installation Work**

In addition to maintenance duties, technicians are also being called upon, during both overtime and regular work hours, to remove old and install new equipment, a function usually performed by FAA's facilities and equipment (F&E) technicians. This installation was sometimes sector-initiated to improve a facility's performance by replacing old, vacuum tube equipment or was undertaken because the region's F&E technicians could not get to the project. The amount of time spent by technicians on

these projects varied considerably. For example, in the Minneapolis ARTCC no time was spent on F&E work in fiscal year 1986 while at the New York ARTCC about 2,700 hours (including over 1,300 regular work hours) were spent on F&E projects. A 1986 Eastern Region evaluation of the F&E program concluded that an increasing backlog of projects and inadequate F&E staffing has caused sectors in this region to pick up this work.

Shifting Tasks Among Personnel to Accomplish Work Load

One impact of the current AF environment of more work with less resources has been that field supervisors are assuming some technicians' duties. In our visits to SFOs, we found that in addition to covering watches, supervisors are completing PM and, in some cases, repairing equipment. At one SFO, for example, a nav aids unit supervisor routinely performs maintenance tasks because of vacancies in this unit and at another SFO, the SFO manager was in the field repairing a malfunctioning antenna. According to field officials, if supervisors are doing maintenance, their responsibilities—administrative and human relations work, log review, planning—suffer. Thus, current staffing levels do not allow supervisors to function as supervisors.

Shortages of staff have also caused electronic technicians in the Eastern Great Lakes, and Southwest Regions to assume some of the more routine environmental maintenance. This adds to the work load of these technicians and affects their ability to complete electronic maintenance. Because of shortages of environmental technicians, responsibility for the more routine environmental systems has been assigned to electronic technicians throughout the Southwest Region. In addition, because of the consolidation of sectors, technicians in GNAS sectors are often required to travel long distances between facility sites which decreases the time available to accomplish their work load.

NAS Plan Delays Have Caused Work Load Savings Projections to Be Unrealistic

FAA has prematurely cut maintenance staffing before new systems were operational in the field. One example of this has been the second generation VORTAC (very high frequency omnidirectional range/tactical air navigation) system. Anticipating reduced work loads from this new equipment, the field absorbed a cut of 791 authorized positions in 1981 although this equipment was still being installed in 1986. The Southwest AF Division Manager told us the AF work force was reduced before the maintenance productivity benefits of the new VORTAC were realized and the region's work load increased because they were required to keep the old system operating while de-bugging and training technicians on the

new system. According to the Eastern Region's former AF Division Manager, while new technology may reduce the need for people over time, headquarters has taken away staffing before new equipment is in the field and while older equipment is still there.

FAA headquarters officials acknowledged that staffing requirements for maintaining the new VORTAC may have been lowered prematurely. To prevent this from recurring, AF's 1986 revised staffing standard formula modified the way FAA estimates the maintenance work load requirements associated with installing and integrating new systems. In effect, the changes phase in reductions to the maintenance staffing allowance during a new system's initial operating period rather than taking full cuts immediately. FAA has also established a management review process to better link system deployment to preparations in the field, so that proper logistical support and training are provided before new systems are deployed.

Employee Morale in Airway Facilities Is Low

FAA's reduced maintenance staffing is affecting technician morale. Both FAA's national attitude survey and our interviews with technicians show that technicians are concerned about their current responsibilities and their future with FAA. Technicians attributed their poor morale to federal employee issues, such as retirement, pay, and contracting out; attrition; and work load. They stated that to improve morale FAA needed to hire more technicians.

It is important that AF sustain high levels of technician performance. FAA's Administrator has said that this dedication is what has kept the NAS operating safely and is needed to keep the system operating safely in the future. Deteriorating morale could have negative implications for future system performance.

AF Scored Below Other Work Forces in FAA National Attitude Survey

In 1984 and again in 1986, FAA conducted an attitude survey³ of all personnel. FAA has established a goal to reach a 75-percent job satisfaction level by 1992. In the 1984 survey, less than half (38.6 percent) of the AF specialists (technicians) reported satisfaction with their jobs as compared with 62.4 percent of the AF managers and supervisors. No other

³This survey was distributed to employees at their work sites and included 11 groups: Air Traffic, Airway Facilities, Flight Standards, Aircraft Certification, Security, Airports, Washington Metro Airports, regional offices, Aeronautical Center, technical centers, and headquarters.

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work group had a lower overall job satisfaction score than AF technicians. Headquarters attributed the low 1984 AF survey score to resentment of air traffic controllers' visibility and higher pay grades, along with a negative perception of federal retirement changes.

Two factors were reported nationally by work groups in the 1986 survey: job satisfaction and burnout.⁴ Although there was a slight increase in the number of AF technicians reporting satisfaction with their jobs in the 1986 survey,⁵ the AF specialists' score—41.3 percent satisfied—remained lower than any other FAA work group. Job satisfaction scores for specialists within FAA ranged from a low of 41.3 percent for AF specialists to a high of 67.1 percent for security specialists. In addition, as shown by figure 2.4, job satisfaction among each level of the AF work force was below FAA's overall average. In addition, AF technicians had the highest percent of any work group reporting burnout—9.8 percent. AF supervisors reported the third highest supervisory burnout score at 6.4 percent.

None of the four regions we visited had technician job satisfaction scores greater than 50 percent, although the Southwest Region experienced an 8-percent improvement in morale between 1984 and 1986. In addition, the Eastern Region work force, whose job satisfaction score declined slightly, had a burnout score of 11.5 percent, nearly 2 percentage points higher than the national average for AF technicians. Table 2.3 gives a breakdown of these two scores by region. For a comparison of individual sector office scores, see appendix III.

Table 2.3: Attitude Survey Scores Reported for AF Work Force

Figures in percent

Region	Specialists' job satisfaction		Burnout
	1984	1986	
Eastern	40.8	40.2	11.5
Great Lakes	30.0	31.6	9.8
Southern	41.3	44.5	8.0
Southwest	38.1	46.0	9.8

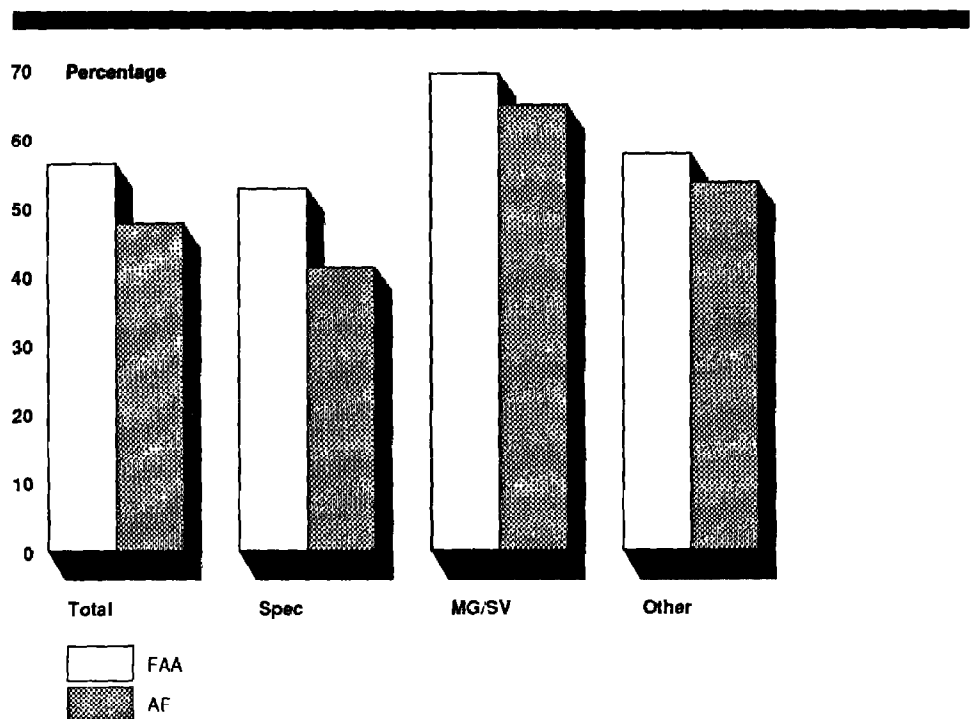
⁴Burnout was defined by several questions that measured an individual's ability to bounce back after being away from the job, ability to shift from peak to slow periods, and perceptions of work load and effectiveness. A score of 3.75 or higher was considered a measure of significant burnout.

⁵Out of 29,000 FAA employees responding, 7,231 AF employees participated in the 1986 survey.

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According to the Acting Associate Administrator, the 1986 AF survey scores are nothing to be proud of. He attributed the poor results to technicians' reaction to the possibility of contract maintenance, which has been an emotional issue, and to staffing concerns on the part of a work force that does not see younger people to whom they can pass their knowledge. The Associate Administrator⁶ told us that, as an organization, AF is experiencing a lot of changes and the field is trying to work through the impacts of these changes.

Figure 2.4: AF Job Satisfaction



**Federal Employee Issues
Seen as Hurting
Technician Morale**

In the four sampled regions, we interviewed technicians about their overall morale, factors that might be helping or hurting their morale, and what FAA could do to improve morale. The major factors cited by technicians as hurting morale were (1) federal employee issues (such as retirement benefits, pay, and contracting out), (2) attrition, (3) work load, and (4) supervisory/management practices. These results coincide

⁶A permanent appointment was made to the Associate Administrator's position effective February 8, 1987.

with the results of FAA's nationwide survey as shown in appendix III. (For examples of specific comments, see app. IV.)

The suggestion technician gave most often as a way to improve morale was for FAA to hire more people. Other responses included

- improving communications between technicians and management by placing emphasis on listening more to technicians' concerns and providing more information about the future;
- increasing/improving benefits to federal employees, such as retirement benefits; and
- increasing pay for technicians by implementing a higher grade structure.

The Acting Associate Administrator told us that getting new technology into the field quicker or hiring more people or both would likely improve technician morale.

A key element in sustaining system performance has been a dedicated technician work force. FAA officials recognize that there is a potential for a performance downturn or breaking point where maintenance goals and quality may suffer. One field manager described technicians as getting discouraged and said that it was unclear how long a good work attitude can be maintained. Another manager said that technicians' "can do" attitude could decline as resources are stretched thinner. A headquarters official said that FAA also recognizes that as retirements occur, replacement staff will not be proficient as the current, older work force, so reliability statistics may suffer. In appealing cuts to its 1987 budget request, FAA stated

"While we plan to fill vacancies that occur we will not be able to replace with technicians as experienced as those that leave. The cumulative effect of hundreds of such replacements is a significant loss of efficiency."

Conclusions

The transition to a modernized NAS is straining the AF work force. FAA management has been caught between priorities to increase staffing of certain work forces and at the same time show productivity savings from its modernization efforts. Internal analyses of the staffing situation have depicted a serious problem. Maintenance staffing is not receiving appropriate attention within the administration because of these competing priorities.

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Maintenance Responsibilities

Staffing shortages are already affecting the field's ability to complete many fundamental responsibilities. Sectors in the field are increasingly not meeting goals for PM accomplishment. Overtime, equipment performance will likely be affected by this lack of routine maintenance. For this reason, we believe that the staffing shortages being experienced in other regions will begin to result in effects, such as facility outages, that the Eastern Region is currently experiencing. By the time staffing shortages begin to contribute to equipment failures, there are few ways to improve the situation.

Lower priority activities, such as modifications and equipment repairs, have been backlogged because of staff shortages. At the same time, headquarters expectations for increased productivity and technicians' work loads have been increasing.

Additionally, technician morale is clearly below FAA's goals. Since successful system operation depends on continued high levels of technician performance, poor morale could have implications for attrition and for FAA's ability to provide quality maintenance services. Future challenges, such as the NAS Plan and contract maintenance, make morale a crucial factor in FAA's efforts to keep the NAS operating safely during the transition period.

Finally, statistical data reported to FAA headquarters do not accurately reflect what is occurring in the field. While we did not find data misrepresentation throughout our 10 sample sectors, we believe that the existence of some cases of misreporting in 5 of 10 sectors casts doubt on the reliability of FAA's performance indicators such as MTBO statistics. It also defeats the purpose of reporting systems that could help identify problem areas to management. The effects of reduced staffing are being felt at the sector and, particularly, the SFO level.

Future Outlook for Maintenance Staffing Is Not Good

Within the next few years, FAA could be faced with critical staffing shortages throughout its AF field maintenance work force. The future maintenance staffing situation is a critical problem that could significantly reduce AF services, with the potential for affecting the safe, efficient operation of the NAS.

Even with a significant technician hiring effort, the short-term maintenance staffing outlook is not good because of the extensive training periods needed before technicians can reach full performance level. Thus, FAA's strategy of replacing technicians after they leave could result in less efficient operations as a less experienced work force must maintain increasing numbers of sophisticated facilities during the transition to the modernized NAS. FAA's current highly skilled and experienced work force has an average age approaching 50, and many of these employees are expected to retire during the next few years. This fact combined with a lack of developmental technicians on board to replace retirees could pose serious future problems for both the quantity and quality of FAA's maintenance efforts.

Because of delays in developing and implementing NAS Plan systems, FAA's expected productivity savings from new automated systems will occur later than FAA had planned. Current FAA projections show significant work load benefits by the mid-1990s, but these estimates may be optimistic if new systems continue to experience implementation delays

FAA's Planned Hiring Will Not Increase AF Staffing

During the next 2 years, FAA plans to replace staff lost through attrition as they leave, but it has few plans to recruit for future attrition. Thus, staffing levels will remain significantly below AF's projected needs to sustain adequate maintenance of the NAS. FAA recognized the need to increase maintenance staffing levels for fiscal year 1988 and requested a 200-FTE increase, but was unable to gain the administration's support for a budget increase.

Current Hiring Plans Will Not Meet Staffing Needs

FAA's plan to backfill for attrition and corresponding budget requests do not provide for adequate staffing to meet maintenance staffing needs. A staffing analyses show that to maintain the NAS, hiring at a level greater than replacing attrition one-for-one would be needed. For example, a headquarters staffing analysis prepared in early 1986 stated that because employment levels have been below those assumed in the NAS Plan, AF staffing should be increased closer to congressionally authorized positions. This would mean hiring 218 more people a year, during

fiscal years 1987 and 1988, than just hiring to backfill for attrition in order to bring staffing up to projected needs. FAA would, therefore, need to hire over 500 field staff in both 1987 and 1988—more than double its actual 1986 hiring effort—to reach the levels recommended in this analysis.

To bring staffing closer to authorized positions also would require FTE ceilings substantially above current approved levels for 1987 and 1988. For example, hiring levels recommended in the 1986 staffing analysis would require an estimated additional 363 FTEs over the 1988 field maintenance budget submission of 8,226. Recognizing the need to increase staffing levels to provide for a training pipeline, FAA requested 200 additional FTEs for its fiscal year 1988 budget, but this request was not approved for the President's budget submission.

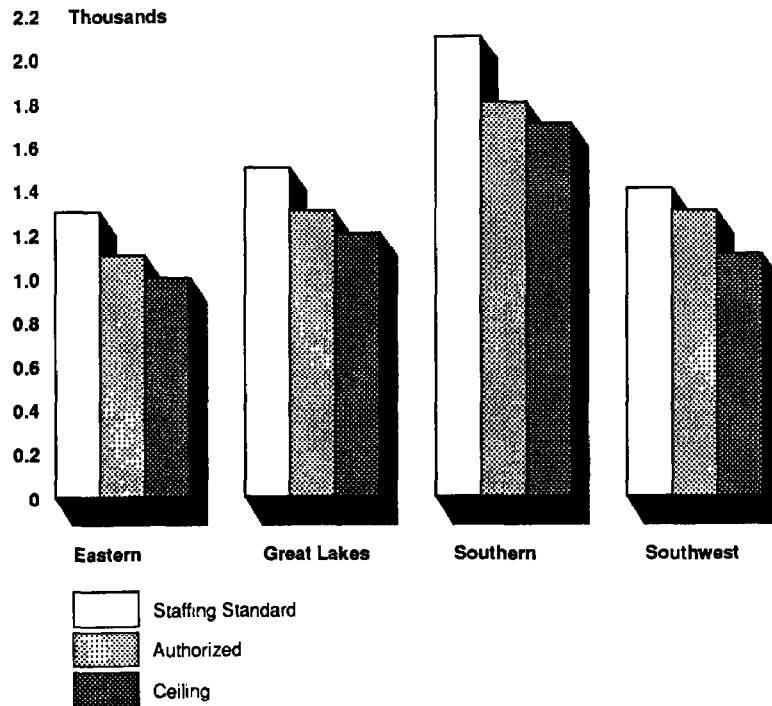
AF staffing ceilings established by the regions we reviewed are well below those that field managers believe are needed to sustain adequate facility maintenance and to replace technicians expected to retire. Figure 3.1 shows that FTE ceilings for 1987 range from 79 percent to 86 percent of the work load projected by AF's staffing standard.

A 1986 Eastern Region staffing analysis projected the need to hire 270 technicians and support personnel through fiscal year 1987. This projection was based on backfilling vacancies and providing sufficient new hires for the region to return to its 1983 level of maintenance accomplishments. The region hired 50 technicians in fiscal year 1986, and the AF Division Manager told us that little hiring was anticipated until at least March 1987 because the region started fiscal year 1987, 44 employees above its approved FTE ceiling.

The Great Lakes Region carried a similar staffing shortfall over to fiscal year 1987. The region initially planned to hire 166 new staff in fiscal year 1986 to cover 1986 and 1987 attrition. In 1986, however, a hiring level of only 20 was approved and the region actually hired 14 technicians. In fiscal year 1987 the region is projecting a hiring need of 180.

The Southern Region hired 70 new staff in fiscal year 1986 and is projecting a hiring level of 160 in fiscal year 1987. According to regional officials, hiring at this planned rate would replace 1987 attrition and some vacancies, but would not permit hiring a training pipeline of new technicians to replace future projected losses.

Figure 3.1: Fiscal Year 1987 Field Staffing Allowances



The Southwest Region plans to hire 120 technicians in fiscal year 1987, but, even if that hiring level is attained, it would only enable the region to backfill for attrition. This staffing level would be inadequate, according to the region's AF Division Manager, because it does not provide for a training pipeline. This rate of hiring would allow the region to continue at what he considers to be a "minimum staffing level" and jeopardizes the region's ability to maintain the system in the future.

AF Could Experience Significant Retirements

Within the next few years, FAA could experience a significant number of retirements in its field maintenance work force, which is one of the oldest work forces in the federal government. As discussed in chapter 2, technician shortages are already negatively affecting routine maintenance accomplishments, equipment outages, and other operational areas such as completion of modifications in some locations. These problems could worsen as more experienced technicians retire and trained technicians are not in the pipeline to take their place.

Demographics of AF Work Force

FAA headquarters officials acknowledged that AF retirements could create a staffing problem but generally described the problem as a prospective one. The Manager of the Maintenance Engineering Division told us that several factors had focused increased attention on the retirement issue within the past 2 years, including budget preparations and the Transportation System Center's (TSC) first reports on the demographic profiles of the AF work force. He added that the demographic data now available will allow FAA to develop staffing plans that focus on potential skill problems resulting from retirements.

Demographic data reported by TSC in July 1986 show a potentially significant overall problem with future retirements in the maintenance work force. The TSC data reveal that, at the end of fiscal year 1985, AF had a total of 7,849 field maintenance staff on-board and, at that time, the average age of this work force was about 47 years. As of October 1, 1986, over 11 percent of this work force was eligible to retire and in less than 2 years—by the end of fiscal year 1988—another 12 percent will become eligible. According to the TSC analysis, these percentages will increase significantly in the next several years—totalling about 36 percent by the end of 1990, and by the end of 1995 about 59 percent of these technicians and engineers will be eligible to retire. In fiscal year 1986, 338 technical staff retired. Table 3.1 shows a 10-year projection of retirement eligibles by technical specialty group.

Table 3.1: Retirement Eligibility for AF Field Work Force^a

Technical specialty groups	On-board 9/30/85	Through 1988	%	Through 1990	%	Through 1995	%
Navigation aids	1,751	437	25.0	656	37.5	1,046	59.7
Automation	1,383	347	25.1	552	39.9	917	66.3
Technical Management	1,235	353	28.6	572	46.3	929	75.2
Radar	1,187	282	23.8	428	36.1	726	61.2
Environmental ^b	1,159	185	16.0	252	21.7	432	37.3
Communications	435	117	26.9	171	39.3	243	55.9
Engineers	285	43	15.1	71	24.9	140	49.1
Director Management	167	58	34.7	89	53.3	150	89.8
Other ^c	247	32	13.0	47	19.0	75	30.4
Total	7,849	1,854	23.6	2,838	36.2	4,658	59.3

^aData compiled from Demographic Analysis of the Airway Facilities Systems Maintenance Work Force, Report No. WP-59-FA-626-9, dated July 1986, prepared by the Transportation Systems Center.

^bIncludes the GS-802 and WG-4749 job series.

^cIncludes other engineers and technicians and computer specialists and operators.

Although the retirement profiles of our four sample regions varied somewhat, they all reflected the high national retirement eligibility trends shown in table 3.1. As shown in table 3.2, through 1990 the Southern Region could experience the most retirements (about 36 percent) followed by the Southwest Region (about 35 percent) and the Eastern Region (about 31 percent).

Table 3.2: Retirement Eligibility Profiles for Field Technical Personnel

Region	On-board 9/30/86	Number eligible through 1988	Percent on-board	Eligible through 1990	Percent on-board
Southern	1,492	298	20.0	536	35.9
Southwest	1,001	223	22.3	350	35.0
Eastern	991	183	18.5	304	30.7
Great Lakes	1,152	188	16.3	329	28.6

Several AF sectors within these four regions expect to begin experiencing significant technician retirements in fiscal years 1987 and 1988. For example, the Memphis ARTCC could lose 7 of its 80 technicians and its sector manager by the end of fiscal year 1987. The problem could worsen because six more technical staff will become eligible through fiscal year 1988, and by the end of fiscal year 1990, the ARTCC could lose about half of its technical staff. Certain sectors in the Southwest Region could also experience severe staffing losses through retirements in the next 2 years. For example, the Oklahoma sector's Midwest City SFO—a long-range radar site—could lose three of its six radar technicians by the end of 1987.

Even the Great Lakes Region, which according to the TSC analysis had the second lowest projection of retirement eligibles through 1995 of any FAA region (Alaska was the lowest), faces some potentially significant problems in certain technical specialties. For example, it could lose 40 of the 90 technicians assigned to its long-range radar sites by 1990. This poses a significant problem for the region because of the extensive training time required for radar technicians.

Historically, about 55 percent of the work force has retired during the first year of eligibility and the remaining 45 percent will retire within the next 2 succeeding years. Applying these rates to FAA's demographic data shows over 1,800 actual retirements projected through 1990. A January 1987 TSC analysis projects that, based on 1986 retirement rates 787 AF personnel will actually retire in fiscal years 1987 and 1988. TSC's

projections for our four sample regions are: Eastern 98, Great Lakes 100, Southern 172, and Southwest 112. However, plans in some regions to use technician relocations to cover more critical staffing needs could increase the number of voluntary retirements in the next few years as technicians elect to retire rather than move to a new location.

Insufficient Developmental Technicians On-Board to Offset Anticipated Attrition

FAA has not hired a sufficient number of technicians to replace experienced technicians as they retire. As previously mentioned, in the last several years AF's hiring efforts have been limited to partial backfilling of existing vacancies. As a result, at the end of fiscal year 1986, AF had 434 field technical staff in developmental level positions nationwide. These staff have been hired to fill positions that have already been left vacant. At the end of fiscal year 1987, FAA planned to hire 110 staff to replace some of the 787 field staff it projects will retire through fiscal year 1988. A 1986 AF report stated that the pipeline "... has been effectively eliminated through unrealized productivity gains, new organizational work load, and attrition."

Filling vacancies after they occur (backfilling) will not permit AF to staff a developmental pipeline of trainee technicians to replace the experienced technicians who leave in the future. In effect, FAA's projected hiring will result in replacing experienced technicians who carry full work loads with inexperienced technicians who will need extensive training before they can assume a full work load.

Widespread Shortage of Developmental Technicians

As shown in table 3.3, all four regions we reviewed have very few developmental staff on-board compared with the number of experienced technicians they could lose during the next few years.

Table 3.3: Developmental Field Technical Personnel in Sample Regions

Region	Total On-Board 9/30/86	Number of developmentals	Year eligible to retire				Total
			1987 ^a	1988	1989	1990	
Southern	1,492	50	205	93	117	121	536
Southwest	1,001	71	155	68	60	67	350
Eastern	991	74	126	57	65	56	304
Great Lakes	1,152	63	127	61	65	76	329

^aIncludes those that became eligible in prior years but were on-board September 30, 1986

Officials in the four regions viewed the lack of a developmental pipeline as a severe short-term problem facing AF. Some AF officials believed the lack of a pipeline and the long period it takes to train and develop technicians could severely affect AF's ability to maintain the NAS. For example, Southern Region AF officials believe that because there are insufficient technicians in the pipeline, AF faces the prospect of having to significantly reduce services, including hours of coverage it currently provides air traffic. The Southwest Region AF Division Manager voiced similar concerns. He characterized the number of field technicians in developmental positions (71) as inadequate and expressed the concern that without replacement staff the region may not be able to continue to repair and maintain systems. The Metro sector manager summed up his concerns about the lack of a sufficient developmental pipeline in a memorandum to the Eastern Region in April 1986: "The pipeline is empty and to do nothing is a heavy risk to the safety and operation of the [New York] Traffic Control System."

The former Deputy Director of the Eastern Region told us that AF has had difficulty convincing FAA management that it has a "deficiency" or problem with a work force that has an average age approaching 50 and no pipeline of younger technicians to take their place. He said that since most of the work force is at full performance level, AF can make do now with less people; however, it will pay the price later. He added that in order to insure the continuity of system operations, the experienced work force needs to be able to pass on its inherent knowledge to a new generation of technicians.

Significant Period Required to Train Replacements

It takes a significant amount of time to train the technicians who maintain FAA facilities. Based on the anticipated retirements in the AF work force and the lack of a developmental pipeline, FAA may be unable to hire and train new technicians in time to assume the work loads of retiring technicians. Some regions hope to shorten the training periods by hiring more experienced recruits. Even if this is accomplished, substantial training is required before a technician hired at an advanced level can reach the full performance level. In addition, FAA is also facing extensive new equipment training for the existing work force. Providing facility coverage while training both new hires and experienced technicians will be difficult.

AF Training Program

Significant periods of time are required to train and develop all new technicians regardless of the background and experience of the person

hired, the person's technical specialty, or the job the person is recruited to fill. An environmental technician may reach the full performance level in about 2 years, whereas a radar technician who maintains more sophisticated equipment would require about 5 to 6 years before attaining full performance level.

These periods include computer-based instruction, formal training, on-the-job training (OJT), and time to gain needed experience and fulfill in-grade requirements to reach the full performance level. Experience is important because technicians at the full performance level must be able to rapidly identify, isolate, and correct malfunctions and certify systems for use in directing air traffic. Since the radar and automation specialties could be among the most affected by retirements, they will probably pose the largest training problem for AF because these technicians maintain equipment critical to NAS operations and require extensive training. Figure 3.2 shows two examples of different training periods required for developmentals based on the environmental and radar specialties.

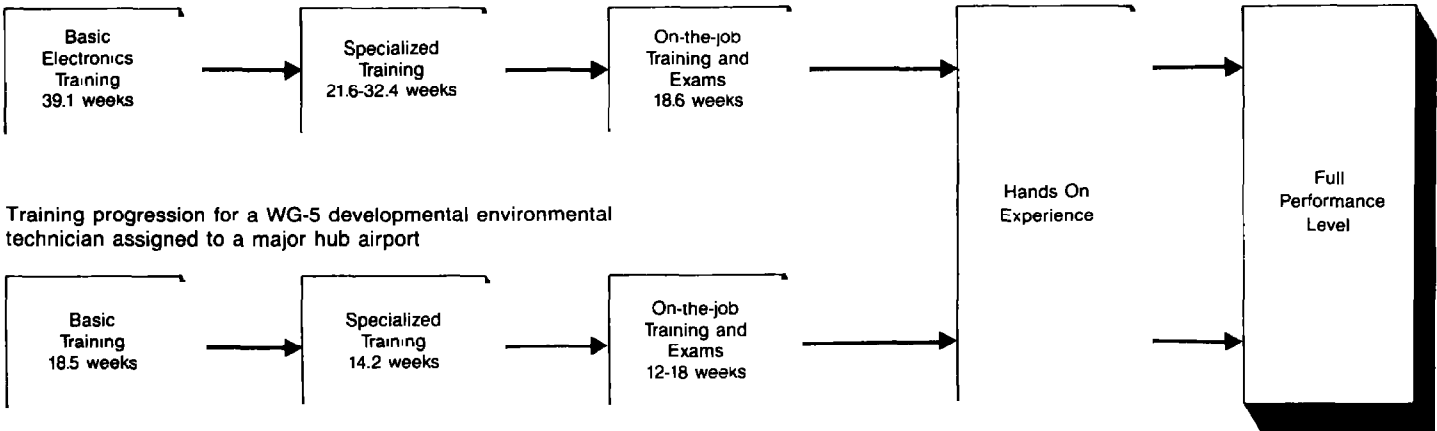
Officials in both the Great Lakes and Southwest Regions planned to shorten these training periods by hiring experienced personnel at a higher grade level (GS-9). Even so, substantial OJT will still be required before the technicians reach full performance level.

New Equipment Training

Not only is FAA faced with extensive training periods for new technicians, it is also faced with an extensive re-training effort on new systems. One of the primary management concerns mentioned in AF's 1984 Human Resource Plan was the training requirements necessary during NAS Plan transition. Training requirements will be heavy for new equipment and work load coverage will be difficult to maintain while both new recruits and current staff are being trained. For example, the New York ARTCC manager said that because of planned new system training and the sector's past backlog of training needs, coverage will become a problem and overtime usage will increase in fiscal year 1987. An official in the Southern Region said that training may not be fully utilized because some technicians who will be eligible to retire in the near future are being trained on sophisticated new NAS equipment and will take that training "to the fishing pond" with them when they retire. Moreover, attrition could create skill imbalances in some locations and could increase crosstraining requirements for existing personnel to provide adequate equipment coverage.

Figure 3.2: Examples of FAA Technician Training Periods

Training progression for a GS-5 developmental radar technician assigned to a major hub airport



NAS Plan Transition Period Longer Than Anticipated

The transition to the modernized NAS will take FAA longer than originally anticipated because of delays in developing and implementing new automated systems. Consequently, the maintenance savings expected from new systems will not be realized as quickly as planned.

Based on current projections of system implementation dates, FAA cannot expect the modernized NAS to significantly relieve AF's maintenance work loads until the mid-1990s at the earliest. During hearings in April 1986, the Acting Associate Administrator provided a list of NAS Plan projects that showed that 15 of 17 major projects had projected operational dates for the early to late 1990s. For example, the installation of one major NAS Plan system—the long-range radar—was originally scheduled to be completed in 1989; however, that date has been delayed about 4 years, and the last unit is not expected to be installed until December 1993. FAA will not realize savings associated with such modernized systems until these systems are installed and fully integrated into the NAS.

A recently completed GAO review of NAS schedule delays found that major system delays averaged about 3.5 years.¹ These delays translate directly into revised AF work load estimates. For example, revised estimates show that because of schedule delays maintenance work loads continue to be higher than planned after 1990. These revised estimates project reaching a reduced field work load of 8,359 in 1993 rather than in 1990 as the NAS Plan projects.

Introducing new systems has implications for maintaining the high skill levels that have characterized the maintenance work force. AF's 1984 Human Resource Plan anticipated that the NAS Plan would mean skill obsolescence and the need to change career fields and could adversely impact older workers who may be unable to become equally skilled in new occupations. New technology requires a work force with different skills and must be factored into FAA recruitment efforts.

Field Managers View Future Staffing as a Critical Problem

Many AF field managers have major concerns about FAA's future ability to maintain the NAS as more experienced technicians retire. The consensus of opinion among the regional and sector AF managers we interviewed was that continued delays in installing new equipment; the lack of hiring in recent years; the projected low future hiring; the virtually empty developmental pipeline; and the expected high retirement rate would culminate within 1 to 2 years into a critical staffing situation.

Many of these officials believed that AF services to system users would have to be reduced drastically. For example, the Nashville SFO manager expects to reduce watch coverage from 20 to 8 hours a day in the radar unit, a situation which he said could present a potentially dangerous situation for users, particularly if there are radar outages at night during bad weather. Some managers foresaw deterioration of system performance and even adverse safety implications unless sufficient hiring was undertaken to fill vacancies and replenish the developmental pipeline. For example, Memphis ARTCC management said that increased air traffic delays and a resulting decrease in public confidence in the air traffic system could be expected until new technicians become fully qualified on equipment. A 1986 AF staffing analysis stated, in essence, that failure to increase AF staffing levels would result in

** Lower levels of NAS performance due to:
1. Increased time to restore facility service.

¹Aviation Acquisition Improved Process Needs To Be Followed. (GAO/RCED-87-8, Mar. 26, 1987).

2. Increased frequency of equipment failure.
3. Reduction in quality control and quality assurance activities.
4. Reduction in maintenance engineering improvement activities

• Increases in air traffic delays and reduced system capacity when facility service is not available to users.

• Economic impact to system users.

• Delays in implementing new systems due to limited ability to participate in integration and training on new systems while maintaining the present system."

Conclusions

Personnel shortages are already negatively affecting maintenance accomplishments, equipment performance, and other operational areas. With retirements and delays in installing systems that could reduce maintenance requirements, the situation is likely to worsen within the next few years.

The AF work force currently has a significant number of field technical staff eligible to retire and that number will increase substantially in the next 2 to 3 years. Compounding this potential retirement problem is a lack of developmental staff being trained as replacements. Without significant hiring to replace attrition and replenish the developmental work force, FAA will be faced with losing much of the experience and expertise of its current work force. Timely hiring is also very important because of the extensive training period needed to develop technicians and to enable the older, experienced technicians to transfer some of their expertise to younger replacements. Even if AF immediately undertakes a significant hiring effort, it would still be 1990 and beyond before new technicians could assume a full work load.

Maintenance savings associated with NAS Plan technology have not been realized as fast as FAA's projections because of equipment implementation delays and early operational problems. Further, reductions in work load due to NAS advancements cannot be expected to significantly improve AF's staffing situation for several years.

Possible Approaches to Address FAA's Maintenance Staffing Problem

While attrition through retirements by its nature is a future problem, FAA needs to take actions now to ensure that enough experienced, trained staff are available to maintain necessary services. As we have already demonstrated, unless FAA replenishes its AF maintenance work force, system performance will likely deteriorate further. That, in turn, will result in fewer facilities being available to direct the increasing air traffic, causing increased flight delays and the potential safety implications that are associated with reductions in services.

In order to ensure continued smooth system operation, FAA needs to hire more maintenance technicians. Because of limited past hiring, however, it is unclear that FAA could absorb an immediate increase in maintenance personnel that would bring staffing up to the level of the staffing standard. Moreover, some refinement of the values in the maintenance staffing standard and an updating of FAA's equipment inventory files are needed in order to more accurately reflect field staffing requirements.

This chapter presents several options that could be used to mitigate current technician shortages until the work force has been replenished through hiring. Options available to FAA management to address maintenance staffing needs cover both the short term (next 2 years) and beyond. The extent to which each of these options will help alleviate problems until additional maintenance staff can be hired and trained will depend on the particular circumstances in each region.

FAA also needs to standardize its maintenance reporting system to provide some assurance that while new technicians are being trained, adequate levels of maintenance are being performed to sustain system performance. A standard reporting system would also help alleviate the problems we discussed in chapter 2 concerning differences in maintenance reporting.

FAA Needs to Increase Maintenance Staffing

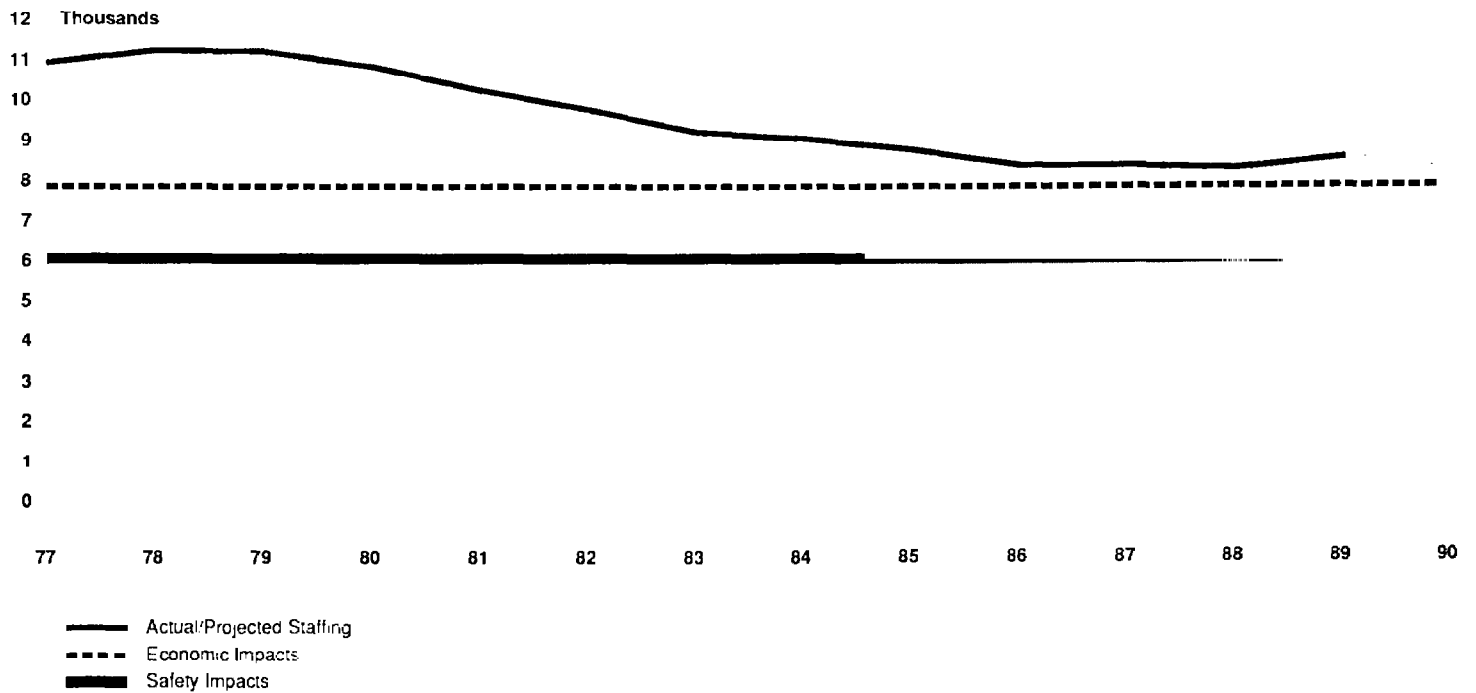
Our work and FAA's internal analyses and projections of retirements indicate the need for FAA to increase its maintenance staff. To some extent, FAA has recognized this need by attempting to increase its staffing levels for fiscal year 1988 but was unsuccessful in obtaining administration approval. FAA is already "behind the power curve" in hiring because a pipeline is not in place to backfill for the loss of experienced technicians.

What are the likely consequences of not increasing the work force to meet work load requirements? The implications of continued technician

attrition are illustrated in figure 4.1. Because maintenance is a service, the impacts of reduced services are felt first by the users and will usually result in economic impacts. As technician shortages either affect equipment outages or cause facilities to be shut down, the airline industry will experience increased flight delays. Thus, as shown in figure 4.1, before staffing reductions are likely to have safety impacts, they will have an economic impact. As discussed in chapter 2, equipment failures are already having an economic impact in the form of flight delays. A 1986 AF report on the staffing standard stated

"... staffing that is below that standard will result in nonaccomplishment of part of the maintenance program. If nonaccomplishment can be related to 'risk,' it is apparent that the greater the difference is between the staffing standard and the actual onboard staffing, the greater the risk is that can be expected. As the risk increases, some sort of delay, economic penalty, or an actual decrease in air safety will be assessed to the user—to general aviation and/or commercial aviation."

Figure 4.1: Implications of Continued Technician Attrition



Hiring will not resolve AF's problems in the short-term because for both budgetary and training reasons, hiring will be a long-term effort. The Congress is currently considering appropriations for fiscal year 1988. As with past appropriation requests, DOT has requested 1988 funding that would cut maintenance staffing further than in fiscal year 1987. These funding levels would support field maintenance staffing at a level of 8,226, or 89 percent of authorized positions. At this level, the work force would also be 12 percent below the staffing standard's projected work load. Many field managers we interviewed said that while it would be nice to be staffed at the staffing standard level, a staffing level closer to authorized positions was needed to continue to maintain system performance at an acceptable level.

Because of the extensive training needed for a technician to be certified at the journeyman level, hiring is unlikely to provide short-term relief to AF's staffing problem. It will also add to demands on experienced technicians to train and supervise new hires. Some of the options discussed later in this chapter could provide some relief from the pressures of training new hires while sustaining high levels of equipment performance.

FAA's Ability to Accommodate New Technicians

A decision to hire more people means that a supporting structure should be in place to accommodate them. Regional AF management noted, however, concern about FAA's willingness to provide adequate support for the technician work force—in such areas as supplies, training, and administration. For this reason, FAA probably could not support a hiring level that would bring the AF work force above its current authorized positions and closer to its staffing standard. Our recent report on inspectors¹ points out that despite FAA's intentions to improve inspector staffing, FAA may not be prepared to absorb an increase in this work force.

Similarly, efforts to recruit new technicians must recognize the limitations of FAA's training program. Basic training is being provided through computer-based instruction at most sectors, and the number and availability of computer terminals could limit the number of new hires that can be efficiently trained. We found that because of budgetary restraints, developmental training quotas for formal training at the FAA Academy have not been approved. For example, in our four sample regions we found that little training specifically for developmentals had

¹Aviation Safety: Needed Improvements in FAA's Airline Inspection Program Are Underway (GAO: RCED-87-62, May 19, 1987).

been approved. In most sectors, training requests for these trainees have been included under other training priority categories that supplant journeyman training quotas. In other words, AF can send a developmental technician to the FAA Academy primarily at the expense of an experienced technician. According to FAA Academy officials, no technician training courses have been budgeted in fiscal year 1987 for new hires. However, these officials believe that some fundamental electronics courses could be provided through a contractor if hiring occurs on a large scale. FAA's fiscal year 1988 budget request includes some limited funding for training new hires.

Existing Staffing Standard Underutilized and Needs Refinement

By not requesting staffing at the level of its staffing standard, AF has rendered the standard ineffective as a management tool. Although better designed than other FAA staffing standards, nonetheless, refinements to the standard are needed to improve the accuracy of its projections. Moreover, because FAA does not have an actual work-hour reporting system in place for the maintenance work force, there are limited checks in place to verify what work is actually done or to measure the efficiency of the AF work force.

Role of AF Staffing Standard

Although FAA policy is to use staffing standards to determine, analyze, and distribute personnel resources, FAA is not fully using the AF staffing standard in its planning and budgeting process. As discussed earlier, FAA headquarters is neither requesting personnel nor staffing field maintenance at the level of its staffing standard. The standard is being used, however, as the basis for allocating resources once they have been received. While the standard's estimates are within an estimating error range of + or -5 percent, overall staffing has been maintained at a level 16 percent below these projections.

Revalidation Efforts Needed

While AF's staffing standard is well designed, it may not be current because it has not been completely revalidated. For example, AF does not have a cyclical or periodic revalidation requirement. As a result, some elements of the standard have never been revalidated, according to FAA headquarters. A March 1986 AF report stated that the standard's staffing allowances for training, special nonrecurring program requirements, and auxiliary work (such as equipment modifications) needed to be reviewed. In addition, the standard does not have a pipeline allowance. According to AF officials, TSC is working on a pipeline analysis that will be incorporated into the standard in the future. Since 1983, resources

for revalidation efforts have been reduced by almost 60 percent which has precluded headquarters from undertaking some planned refinements.

The staffing values provided in the standard are multiplied by the number of facilities in FAA's inventory to obtain staffing estimates during semiannual staffing "merges." However, we found that these inventory records are not always well maintained. In the past, headquarters would visit sectors to verify this inventory on a sample basis; however, travel funding and staffing shortages have precluded headquarters from doing this verification for several years. Problems with field data are one reason why AF is using the results of its January 1986 staffing standard merge to project staffing requirements rather than more recent merges (August 1986 and January 1987).

Projecting staffing requirements could also be improved if detailed data on new, anticipated (precommissioned) facilities were incorporated into the merge process. Currently, regions estimate the number of facilities they expect to be commissioned in a given year. A data base maintained by FAA's systems engineering and integration contractor (SEIC), Martin Marietta, projects system commissioning dates, but this system has not been used to identify the numbers of facilities involved with each system.

Actual Work Not Measured by FAA Systems

While FAA has a staffing standard for field maintenance, FAA does not have another key component of a work measurement system--a system to track actual work expenditures. Thus, AF cannot determine the efficiency of its work force and would be unable to revise the staffing standard based on field productivity. Validating what work is actually done is also not possible without such a reporting system. Rather, AF has depended on the integrity of its technician and supervisory personnel for accurate reporting.

Output (actual work) measurement and periodic performance evaluation is a key step in work measurement. In a time of fiscal restraint, output measurement is also an important control over the work force. According to FAA headquarters officials, while such a reporting system may be needed, the costs and time required to implement such a system would make it expensive and could exceed its usefulness. FAA also hopes that the Maintenance Management System planned for 1991 will accomplish many of the same purposes as an actual time reporting system. In the absence of such reporting, periodic performance evaluation has been

accomplished largely through FAA's technical inspection program, which requires that each facility be inspected at least once every 3 years, and through regional management evaluation programs that assess the effectiveness of a sector's performance. However, because of budgetary constraints, especially travel restrictions, the sector evaluation programs in three of our four sample regions were inactive during 1986.

Options to Address AF Staffing Problem

FAA is facing a potentially large number of technician retirements in the next 5 years without sufficient trained personnel to replace them. In examining what actions could be taken to address this problem, it is important to remember that once they are hired, maintenance technicians must undergo a training period of 2 to 6 years to become fully certified in a specialty. Therefore, we have tried to identify possible ways to manage this problem within the next 2 years (short term) and beyond.

None of the options discussed below are new. FAA has taken similar actions to deal with shortages of inspectors and air traffic controllers. While we have not examined the success of these options when used in the past, we believe that they have provided some relief to other work forces' staffing problems. Therefore, depending on particular needs and circumstances in different regions, we believe that each may offer some opportunity to deal with critical technician shortages. We are presenting these options for FAA's consideration in helping to bridge the staffing gap until new technicians can be fully trained.

Short-Term Options

Redistribute the Technician Workforce

Several technicians we interviewed complained that too many technicians were in overhead positions—either support office staff at sector headquarters or supervisory positions—which decreases the number of technicians available to provide watch coverage. At the 10 sectors we visited, we found that the ratio of support office personnel to watchstanding technicians ranged from 1:2 to 1:7. The ratio of supervisors to technicians ranged from 1:3 to 1:5 as compared with FAA's goal of 1 to 7.

FAA could return some of these support office/supervisory staff who are familiar with the operation of existing equipment to watchstanding positions for an extended period until trained replacements are available.

Such a program was instituted for the air traffic controllers after FAA recognized that staffing problems existed at a number of locations. First, FAA adopted a cross-options program that provided for the voluntary movement of controllers between terminal or flight service specialties and understaffed air traffic control centers that had higher staffing priority. Second, FAA transferred some qualified controllers from its training staff back to air traffic control duties after awarding contracts for some training. Both of these efforts were undertaken, in part, to improve FAA's staffing of full performance level controllers.

A redistribution program could be instituted for AF either by (1) relocating technicians on a voluntary basis from fully or overstaffed locations to higher priority or critical need areas or (2) shifting the assigned responsibilities of on-board staff from technical or program support to standing watch. Relocations are not new to the AF work force which has experienced numerous relocations in response to changes in projected work loads from solid state technology.

Either option will have costs associated with it. For example, by relocating technicians FAA could incur expenses for permanent change of station (PCS) moves and retraining. FAA has already requested \$1 million in the 1987 supplemental appropriation for PCS moves, anticipating some relocations. Relocation usually leaves a new vacancy in the technician's old unit and has recently been discouraged by AF field management because it is seen as moving staffing vacancies around. If technicians are relocated within a facility, there is likely to be some impact on morale and on support functions such as trend analysis, training, and planning. In addition, as previously discussed in chapter 2, inadequate supervisory review has already contributed to errors in maintenance reporting. AF officials told us that classification and grade differences could affect the extent to which FAA could redistribute its field work force under this option.

Determine National Work Load Priorities

Although current staffing is lower than the work load generated by AF's staffing standard, FAA continues to expect all duties and responsibilities to be carried out. According to the former AF Division Manager, Eastern Region, if staffing and work load do not match, then it is only possible to do some lesser percent of the work. This view was echoed in the AF Evaluation Staff's evaluation of this region which recommended that headquarters allow the region deviations from PM requirements in light of the staffing situation. With reduced staffing, it may be unrealistic for FAA to continue to expect that all objectives will be accomplished. To assist

managers make decisions on the activities to emphasize, rather than relying on individual managers' judgments as is currently done, FAA should have a written policy on AF's work load priorities.

FAA has issued program guidelines for inspectors that specify work priorities, namely, inspecting air carriers and certifying air carriers. Similar guidelines may be beneficial for the technician work force to assist managers in establishing priorities and ensure that, at a minimum, all functions necessary for system performance and air safety are accomplished. Such guidelines could allow managers to decide what activities to delay in the face of reduced technician coverage. The Southern Region is in the process of updating contingency plans developed in response to a 1971 FAA order that defined activities to be dropped in the event of staff reductions. According to headquarters officials, however, this order was originally designed to respond to a strike or emergency situation and may not be appropriate for current planning.

Decommission Facilities

One way to reduce the maintenance work load to a more manageable level would be to shut down or decommission facilities that are not needed. Some sectors have already streamlined their work load by doing this. For example, both sectors we visited in the Great Lakes Region had inventoried their facility master files and decommissioned those that were no longer useful and expensive to maintain. At other sectors, facilities are still being maintained that AT or AF does not believe are needed. For example, the Memphis ARTCC is still maintaining broadband radar although other ARTCCs have decommissioned this system. The Acting Associate Administrator wrote to FAA's Administrator in March 1986 that shutting down facilities is preferable to operating facilities that do not meet FAA's standards. However, FAA headquarters has no plan that would accomplish this approach.

FAA's previous experience with decommissioning air traffic facilities was in response to the 1981 controllers strike. Faced with numerous facilities that could not be staffed, FAA shutdown or contracted out many air traffic control towers. Maintenance was also contracted at four of these towers. While the technician staffing situation is not currently as acute as the aftermath of the controllers' strike, this action is a precedent for FAA's reducing services at selected locations.

Decommissioning facilities could probably provide the most relief if applied on a case-by-case basis. FAA could (1) provide a general list of redundant facility types (those with multiple backups) that can be taken

out of service with the consent of local air traffic and (2) have a contingency plan in each region, with locations identified that would be shut down if staffing becomes more critical. Activating any such contingency plans would be an extreme response to the problem, but at the same time a documented plan will provide for quicker local management response and notification to the users.

Retain Technicians or Rehire Retired Ones

FAA's current maintenance staff represents a cadre of highly skilled technicians. These technicians are familiar with existing equipment and have the expertise that should be passed on to developmental staff so that high system reliability can continue and the system will not encounter a downturn in performance. An option which has been supported by the technicians' union would be to provide a salary bonus to encourage experienced technicians to stay in federal service. The union has requested that the Congress consider legislation to provide such a bonus. Another option to maximize these skills in the short term would be to rehire retired technicians.

The Congress has authorized FAA since 1982 to reemploy retired controllers with no loss of salary. These reemployed annuitants perform both training and actual traffic control duties. Such a program could be introduced for technicians until such time as trained replacements are productive. One internal AF study proposed that, in addition to hiring new technicians, FAA consider rehiring retired technicians on a short-term contract basis to assist in training and "bridging the gap until new recruits become productive."

Medium-Term Options

Contract Maintenance

FAA has spent the past 5 years planning a pilot test of contract maintenance in three regions. FAA has requested \$15 million in fiscal year 1988 towards this pilot, which is estimated to cost \$130 million. As discussed in our earlier report,² this option would take about 2 years from contract advertisement to full implementation. If funded in fiscal year 1988, therefore, contract implementation would not occur until late 1988 or fiscal year 1989.

²Air Traffic System: Pilot Program to Contract Out Maintenance at Selected Facilities. (GAO/RCED-87-104BR, April 1987)

As originally proposed, this pilot test would not necessarily relieve staffing shortages since it was designed to further reduce rather than add to the AF workforce. On the other hand, the contractor would be relieving AF of some work load during the 5-year test period. FAA officials estimate that the pilot, which would contract the work of about 430 employees, could free about 200 FAA employees for relocation elsewhere in FAA.

The contractor's success and FAA's goal to minimize the transition period between FAA and contractor maintenance are dependent on the contractor's ability to hire experienced FAA technicians. Thus, the pilot has the potential to accelerate attrition if technicians eligible for retirement elect to work for the contractor or if the pilot causes other technicians to leave FAA and seek careers elsewhere.

The feasibility of contracting for maintenance has been demonstrated in the past on a smaller scale. FAA has already employed contractor maintenance support in several areas, including grounds maintenance, air conditioning support, and new equipment maintenance. Contractors currently maintain three FAA air traffic control towers and have demonstrated the capability to do the job. Contractor support has also been used successfully by air traffic to free some instructors for traffic control duties.

In passing the fiscal year 1987 appropriation, the Congress denied funding for FAA's planned pilot test but introduced the idea of using contractors to "augment" or increase the current work force. If the Congress' desire is to have FAA use contractors to increase the existing maintenance work force, FAA's current pilot test has limitations, in particular,

- the work load at some pilot test locations might not support both FAA and contractor personnel. The locations selected were targeted so that FAA could remove its presence and turn over complete facility responsibility to the contractor. FAA would have to redesign the pilot or select other test locations more suitable to utilizing both FAA and contractor personnel and
- staffing needs, such as projected attrition and retirements, were not key factors in site selections. Other locations could probably benefit more from an opportunity to add to staffing. For example, the Great Lakes Region, which is one of the three test regions, has one of the lowest projected technician retirement profiles through 1995. FAA would have to better match test locations with vacancies and expected attrition if the goal is to increase the work force.

In addition, because there is an estimated 9-month transition period from FAA to contractor maintenance during which FAA and contractor personnel would be collocated, FAA personnel could not be relocated until the contractor has assumed facility responsibility. Thus, the contract maintenance test pilot would not provide for immediate relocation of personnel to assist with shortages.

If contract maintenance is considered to be an appropriate way for FAA to increase its current staffing, there may be other, more workable approaches that would better help to supplement the existing work force by placing some tasks currently required of technicians in the private sector. We found a wide diversion in the use of contractors in the field. Some field locations already contract for many services because of staffing shortages while other locations have kept these work loads. Options for contract maintenance could include contracting for logistics support, grounds and janitorial services, and maintenance of environmental systems. For example, several field locations we visited are contracting for maintenance of air conditioning equipment and engine generator repairs to reduce the work load of environmental technicians. Rehiring annuitants—either technicians or other specialists—would be another contract option to augment the existing work force.

Given the relatively recent introduction of this work force augmentation issue and the administration's continued support for the pilot program, AF officials were not prepared to discuss the contract alternatives FAA might consider the most practical for increasing the work force. According to headquarters officials, the best of all worlds would be to (1) implement the pilot program, in order to finally test the concept of contracting out this particular type of maintenance activity and (2) retain congressional approval to increase the work force through other contractors if this should become necessary due to unanticipated attrition.

Accelerate Technician Training

Another option to assist FAA during the transition period is to accelerate the training period for new hires. Some regions have attempted to do this by hiring developmental technicians with some previous experience at a higher grade level. As discussed in chapter 3, a trainee with some electronics experience can usually complete FAA's requirements quicker.

FAA has changed both the structure and timing of other training programs. For example, FAA is in the process of overhauling its training program for inspectors. Whereas, in the past, inspectors would receive their FAA Academy training in stages, courses have been combined to provide

both orientation and initial training at one time and make inspectors more useful sooner in the field. While initial training for new technicians usually begins in the field, FAA Academy officials told us that there may be opportunity to accelerate the sequence of some specialty courses at the Academy. In addition, the Southern Region plans to propose an accelerated developmental training program that would increase the on-the-job time allotted for completing self-directed correspondence courses from 4 hours to 8 hours each day. If this plan is implemented, developmental technicians should complete these required courses faster. To expedite the progression of new controllers once they have met training requirements, the Office of Personnel Management waived the time-in-grade requirements for employee promotion. Since most journeyman technicians do not certify complex systems until reaching a GS-12 level, there may be a similar need for FAA to request authorization to expedite the progression of talented developmental technicians.

Once new technicians are classroom trained, the requirement to provide OJT to trainees will tie up experienced technicians and detract from their other duties. To minimize the amount of OJT time needed from coworkers in all sectors, a centralized training approach may offer some benefits. AF has such a program in place in the Central Region whereby all the region's technician trainees are sent to one sector for initial training before being assigned in the field. As stated in a planning document for this program,

"If we continue training developmental technicians as we have in the past, we will be faced with overloaded training centers and one-on-one OJT training within the field offices that cannot be supported sufficiently with our declining direct work load staffing. To meet this training responsibility, it is essential that we consider methods of delivering developmental training that will require a minimum of direct work load staffing."

Conclusions

FAA budget submissions have not requested maintenance staffing either at the levels called for by its staffing standard or approaching the lower congressionally authorized levels. Currently, the bulk of FAA's operations and maintenance (O&M) expenditures, which include the costs of work force salaries, comes from general revenues rather than the Aviation Trust Fund. A policy issue currently before the Congress is whether the Fund, with a surplus in excess of \$4 billion, should be used to finance a greater percentage of O&M expenditures. We reported in 1986 that this would be one of several alternatives for significantly reducing the Fund's unused balance, but noted the competing policy issues

involved, including a change in the Fund's primary purpose—the financing of capital improvement projects.³

Regardless of the Congress' decision on what the appropriate funding source should be for FAA's O&M expenditures, FAA should be prepared to increase the AF work force in the immediate future in order to ensure smooth operation of the air traffic system during the transition between the loss of experienced technicians and the training of new hires. The Congress will need a hiring program proposal from FAA if this objective is to be achieved.

Hiring must be done within AF's capability to provide support—both logistical and technical—to new employees. It is unlikely that FAA could absorb an immediate maintenance staffing increase to the level of its staffing standard. Moreover, given the need to refine elements of the standard and the downward trend in work load projections, staffing to this level may be premature and necessitate future staffing reductions-in-force. While we cannot recommend a precise level of technician staffing needed, comparing end of 1986 staffing to fiscal year 1987 positions, about 1,000 additional staff are needed to bring employment levels up to authorized positions. (As discussed earlier, however, these field maintenance positions include supervisory and clerical support staff.)

A short-term option to meet staffing needs would be for FAA to use the services of retired annuitants. By rehiring retired technicians FAA could help to weather any transition period to more modern systems. This action could provide FAA with the opportunity to still benefit from the work force's skills, especially in providing on-the-job training to developmental technicians.

In addition to a hiring program, there are actions that FAA management could take to provide itself with better oversight of the impacts of staffing. Recognizing that the transition to new technology will be a difficult and perhaps lengthy period, FAA should have the management tools in place to monitor potential problems in the field. Actions such as standardizing maintenance reporting would help headquarters to more accurately track field accomplishments and identify problem areas. During a period of short staffing, FAA must have some assurance that work essential to NAS operations is being performed. For this reason we believe that FAA needs to (1) standardize its PM system and (2) set priorities within

³Aviation Funding: Options Available for Reducing the Aviation Trust Fund Balance. (GAO RCED-86-124BR, May 21, 1986)

the PM function. As discussed in chapter 2, regions have set their own PM performance goals that vary among regions, and sectors have established task counts for facilities that vary although the equipment and FAA maintenance requirements are the same. This means that FAA's expectations for accomplishments differ from region to region and would not ensure the same level of effort in all field locations. Moreover, we found that in order to meet PM completion goals, some technicians are selecting tasks that will increase their accomplishment but may not be the most important to the system's performance. FAA counts all maintenance tasks equally and some supervisors find that this encourages technicians to complete the easiest routines. To ensure that checks critical to a system's operation, such as grounding or voltage tests, are completed, FAA should weight these tasks so that they count more.

Recommendations to the Secretary of Transportation

FAA needs to be able to replenish its technician work force to prepare for continuous attrition. We recommend that the Secretary of Transportation

- direct that the Administrator, FAA, improve the AF staffing standard validation process by (1) requiring the field to review and verify facility inventories, (2) linking staffing projections to facility-specific data available through the SEIC data base, and (3) estimating pipeline staffing needs.

We recognize that while additional technicians are needed now, refining the staffing standard process will take time. Therefore, we recommend that, in the interim, the Secretary of Transportation

- establish staffing targets for field maintenance at a level approaching authorized positions to provide a technician pipeline to replace anticipated attrition over the next 5 years;
- submit these targets and a funding plan to support hiring to these levels to the appropriate congressional committees; and
- direct that the Administrator, FAA, consider the options discussed above, such as rehiring retirees and redistributing the work force, to deal with situations where field staffing is already critical.

Once the staffing standard process has been refined as we recommend, the Secretary should revise the maintenance staffing targets and funding requests recommended above, as appropriate.

FAA needs to be able to ensure that adequate levels of maintenance are being provided in the field. A standardized PM system would help FAA management identify where the field is unable to keep up with this work load. Therefore, to better control the maintenance work load and establish standard work priorities, we recommend that the Secretary of Transportation direct the Administrator, FAA, to standardize the PM reporting system. Needed revisions include setting standard regional PM performance goals, establishing standard counts for routines done on specific equipment, and weighing more critical tasks.

Agency Comments

The Department of Transportation recognizes that the transition to a modernized NAS presents a major challenge to the Department and states that it is taking steps to manage this challenge. The Department's comments on our draft report highlight the fact that progress has been made in achieving productivity gains in the maintenance work force while maintaining high levels of service to the traveling public. To meet the challenge of the future, DOT notes that significant efficiencies have and will be utilized through the use of remote maintenance monitoring. In addition, according to DOT, equipment reliability is increasing since the number of outages has decreased for several major systems from 1979 to 1986.

The Department's comments also point out that while productivity gains in the maintenance work force have occurred, attrition has outpaced efficiencies from new technology. DOT states that the Department is planning for appropriate corrective action, specifically, (1) asking for the personnel resources needed to maintain a safe system, (2) maintaining work force levels as an interim measure, and (3) supplementing the work force with new equipment contract maintenance where needed. FAA has already begun actions to improve its staffing standard validation process as we recommended.

Although DOT's comments do not directly deal with our specific recommendation that DOT establish staffing targets and submit a 5-year funding plan to the appropriate congressional committees, DOT says that it is reviewing staffing needs as part of the fiscal year 1989 and subsequent years' budget process and will make recommendations for staffing and funding levels. This assessment, however, does not differ from the budget evaluations DOT has done in the past and is not equivalent to the long-range planning we have recommended.

Maintenance staffing is a multi-year problem, and as this report demonstrates, it will worsen with future attrition. A long-term plan would provide information to the Congress on what FAA expects its staffing requirements to be and how, given significant attrition, FAA plans to increase its maintenance staffing to an adequate level to meet these requirements. It would also provide greater assurance to congressional committees that FAA has realistically assessed its staffing requirements. Such a plan could assist these committees in establishing reasonable staffing targets. For example, the House Committee on Appropriations recently restored DOT's proposed cuts in the fiscal year 1988 maintenance budget and, in the absence of a more realistic agency target, proposed funding for an additional 145 FTEs over 1987 levels. For these reasons, we continue to recommend that DOT project FAA's maintenance staffing needs over the next 5 years and submit staffing targets and a funding plan to support hiring to these levels to the Congress.

Concerning staffing, DOT cites (1) FAA's hiring of 110 staff above the level of attrition this year and (2) plans to transfer 200 temporary F&E employees to the maintenance work force at the end of fiscal year 1988. DOT believes that these actions will create "a substantial pipeline" to offset future attrition.

Hiring during fiscal year 1987 has not been sufficient to address the seriousness of the maintenance staffing situation. FAA needs to substantially increase maintenance staffing over current levels to ensure a smooth transition between the loss of experienced technicians and the training of new hires. We believe that field maintenance staffing should be closer to FAA's authorized positions of about 9,300 in order to provide both adequate equipment coverage and a training pipeline in anticipation of future attrition.

DOT's hiring actions since April 1986 have been taken primarily to backfill for vacancies rather than anticipate attrition. As of July 31, 1987, FAA's on-board field maintenance staffing of 8,358 represented a net increase of 52 staff over end of fiscal year 1986 levels. Of the 717 field employees DOT projects will be hired by the end of the current fiscal year, 110, according to DOT, are not linked to past attrition. This hiring pace is not adequate to meet FAA's needs because it represents only about 10 percent of the 1,000 staff shortfall we have described between current and authorized maintenance staffing levels.

DOT's comments also do not directly address our recommendation for a standardized PM reporting system. The Department's comments state

that for several reasons, including built-in redundancy in NAS equipment, there are adequate levels of maintenance being exerted. Nevertheless, they stated that they will continue to evaluate maintenance accomplishments and that, as we had noted, continue development of a maintenance management system that will automate reporting. However, this automated system will not address our specific concerns because its full-scale implementation is not anticipated until 1991, and because even when it is fully implemented, this system will not set regional PM performance goals or weight tasks as we have recommended. In the interim, we believe that FAA headquarters guidance could go a long way towards standardizing the PM reporting system. Direction from headquarters is needed to ensure that the most critical FAA systems receive the same level of maintenance nationwide.

Request Letter From the Chairman and Former Ranking Minority Member, Subcommittee on Aviation, Committee on Public Works and Transportation, House of Representatives

JAMES J. HOWARD, NEW JERSEY, CHAIRMAN

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Committee on Public Works and Transportation

U.S. House of Representatives
Room 2145, Rayburn House Office Building
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TELEPHONE: AREA CODE 202, 225-4472

June 26, 1986

Honorable Charles A. Bowsher
Comptroller General of the United States
General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Bowsher:

On June 5, 1986 the Subcommittee on Aviation held hearings on the adequacy of staffing of the Federal Aviation Administration's (FAA's) airways systems maintenance specialists. The Committee heard from a series of witnesses that many of these specialists are rapidly approaching retirement age and that FAA is not taking steps to plan for these retirements or backfill for attrition.

The questions and background information GAO provided for these hearings indicate that the system is not functioning as well as FAA has described. We are, therefore, seeking additional assistance from GAO to better define this situation. Specifically, we are interested in a report describing (1) the current staffing situation for airway systems maintenance specialists and what impacts this staffing is having on the National Airways System, if any; and (2) the projected attrition of maintenance personnel and its potential impact on future staffing requirements. The issues to be covered in this work should include

- whether performance of the National Airspace System is being affected by reduced watch coverage, and
- what plans FAA has to recruit, hire, and train new maintenance specialists.


Another subject raised at these hearings was FAA's plans to test the effectiveness of contracting out for maintenance

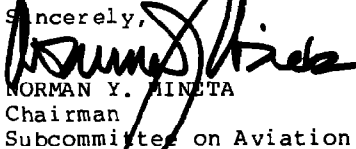
**Appendix I
Request Letter From the Chairman and
Former Ranking Minority Member,
Subcommittee on Aviation, Committee on
Public Works and Transportation, House
of Representatives**

-2-

of visual flight rule locations in the Great Lakes, Eastern and Southern regions. The Subcommittee is concerned that FAA's test may actually cost the government more than retaining the current work force. Therefore, we would like GAO to examine the reasonableness of FAA's rationale and approach to this pilot test, and contingency planning for the post-test period in the event the test is not successful. In addition, we would like to know how contracting out relates to FAA's staffing needs and projections.

Information on these issues that could be used during consideration of FAA's 1988 budget request early next year would be most helpful. The Committee staff is available to discuss further the scope and timing of this effort. We appreciate your continuing assistance on this subject.


JOHN PAUL HAMMERSCHMIDT
Ranking Minority Member
Subcommittee on Aviation

Sincerely,

NORMAN Y. MINETA
Chairman
Subcommittee on Aviation

Reductions in Watch Coverage Attributed to Staffing

Location	Unit affected	Schedule changed	
		From	To
Akron/Canton, Ohio	Navigations/ Communications	7 days	5 days
Alexandria, Louisiana	Long-range radar	24 hours	16 hours
Asheville, North Carolina	Radar	16 hours	8 hours
Atlanta, Georgia	Environmental	24 hours	16 hours
Baton Rouge, Louisiana	Radar	12 hours	8.5 hours
Canton, Michigan	Long-range radar	24 hours	16 hours
Colleyville, Texas	Radar	16 hours	8 hours
Dallas, Texas (Love Field)	Nav/Comm	7 days	5 days
Gettysburg, South Dakota	Long-range radar	24 hours	16 hours
Hanna City, Illinois	Long-range radar	24 hours	16 hours
Horicon, Wisconsin	Long-range radar	24 hours	16 hours ^a
Indianapolis, Indiana	Nav/Comm	7 days	5 days
		16 hours	8 hours
John F. Kennedy Airport, New York	ILS	24 hours	16 hours
	Nav/Comm	24 hours	16 hours
Keller, Texas	Long-range radar	24 hours	16 hours
Minneapolis, Minnesota	Radar	24 hours	16 hours
Nashville, Tennessee	Radar	24 hours	20 hours
Oklahoma City, Oklahoma	Long-range radar	24 hours	16 hours
Russellville, Arkansas	Long-range radar	24 hours	16 hours
San Antonio, Texas	Radar	7 days	5 days
		16 hours	16 hours
			2 days 8 hours
Sonora, Texas	Long-range radar	16 hours	8 hours
Toledo, Ohio	Radar	7 days	5 days
Waco, Texas	Radar	16 hours	12 hours

^aTemporary reduction during 1986. Prior schedule back in effect.

FAA Attitude Survey Scores for GAO Sample Sectors

Sector	Factors	Percent
Eastern Region:		
Metro GNAS	Job satisfaction	48.0
	Burnout	20.4
	Sources of stress:	
	federal issues	72.0
New York ARTCC	time to meet job demands	58.0
	Job satisfaction	41.9
	Burnout	13.6
	Sources of stress:	
federal issues	68.2	
	resources to do the job	59.1
Great Lakes Region:		
Minneapolis ARTCC ^a	Job satisfaction	59.1
	Burnout	13.6
	Sources of stress:	
	supervisory/management practices	72.7
Wisconsin GNAS	federal issues	68.2
	Job satisfaction	44.4
	Burnout	0 ^b
	Sources of stress:	
federal issues	57.8	
supervisory/management practices	57.8	
Southern Region:		
Jackson GNAS	Job satisfaction	50.0
	Burnout	5.0
	Sources of stress:	
	federal issues	70.0
Memphis ARTCC	supervisory/management practices	55.0
	Job satisfaction	45.1
	Burnout	9.8
	Sources of stress:	
federal issues	60.8	
resources to do the job	52.9	
Memphis GNAS	Job satisfaction	52.2
	Burnout	10.8
	Sources of stress:	
	federal issues	59.7
supervisory/management practices	36.4	
Southwest Region:		
El Paso GNAS	Job satisfaction	54.0
	Burnout	8.2
	Sources of stress:	
	resources to do the job	50.0
Houston ARTCC	federal issues	46.0
	Job satisfaction	39.5
	Burnout	13.5
	Sources of stress:	
federal issues	78.4	
resources to do the job	62.2	

(continued)

**Appendix III
 FAA Attitude Survey Scores for GAO
 Sample Sectors**

Sector	Factors	Percent
Oklahoma City GNAS	Job satisfaction	61.8
	Burnout	5.8
	Sources of stress: federal issues	52.9
	resources to do the job	42.0

^aScore represents a return rate of less than 40 percent which means that data may not be representative of the entire sector.

^bNo respondent scored over the 3.75 criterion.

Technicians' Interview Comments

Federal Employee Issues

Federal employee issues such as retirement, pay, and contracting out were cited by most technicians as hurting morale.

- One technician in the Eastern Region said that the benefits to federal employment are deteriorating and that this will make it difficult to hire new people.
- Technicians in the Great Lakes and Southern Regions were especially concerned about changes to the federal retirement system. "The retirement system is not stable; this affects my morale."
- Absence of pay raises was cited as a morale factor by several technicians. "People on the outside are making more than we are."

Contract maintenance was specifically noted as a concern by many technicians.

- "Contract maintenance is the number one issue affecting my morale."
- A technician in the Southern Region said that hearing rumors about your job being contracted out hurts morale.

Attrition

Technicians voiced the concern that FAA is losing equipment expertise and is not providing for new technicians to take the place of those who retire.

- In the Great Lakes Region, a technician said that attrition has reduced the number of people for callbacks when a system needs to be repaired.
- A technician in the Southern Region said that he has assumed an increased work load because of retirements which prevents him from doing as much PM as he would like.
- Technicians in both the Great Lakes and Southern Regions said that because people who leave are not being replaced, an extra burden is placed on those remaining.

Work Load

A common concern seemed to be that there was more work for fewer people than in the past.

- A technician in the Southern Region said that technicians working alone on shifts make it difficult to do certain PM tasks that require two people. "We have more equipment to maintain than before. In addition, the equipment is old and it takes more time to maintain it."
- Another stated that because work loads keep increasing, technicians cannot be as proficient as they were in the past.

- A technician in the Great Lakes Region said that PM is getting done but not when it is scheduled.
- Similarly, in the Southwest Region, a technician said that with the staff cut in half it is hard to get everything done.

Supervisory/ Management Practices

Supervisory/management practices were cited as hurting morale by a majority of technicians in the Great Lakes Region, and overall by half of the technicians we interviewed.

- Comments from the Great Lakes technicians on this factor were that managers were insensitive to morale and cared more about equipment performance than people. "We are not getting reinforcement or recognition."
- Several technicians in the Southwest Region cited problems with lack of communication between technicians and management.

Comments From the Department of Transportation



U.S. Department of
Transportation

Assistant Secretary
for Administration

400 Seventh St., S.W.
Washington, D.C. 20590

JUL 31 1987

Mr. J. Dexter Peach
Assistant Comptroller General
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

Enclosed are two copies of the Department of Transportation's
comments concerning the U.S. General Accounting Office draft
report entitled, "FAA Staffing: Challenges in Managing
Shortages in the Maintenance Work Force."

Thank you for the opportunity to review this report. If you
have any questions concerning our reply, please call Bill Wood
on 366-5145.

Sincerely,

Melissa J. Allen for

Jon H. Seymour

Enclosures

Attachment

DEPARTMENT OF TRANSPORTATION REPLY
TO
GAO DRAFT REPORT OF JUNE 1, 1987
ENTITLED:
"FAA STAFFING: CHALLENGES IN MANAGING SHORTAGES
IN THE MAINTENANCE WORK FORCE"

SUMMARY OF GAO FINDINGS AND RECOMMENDATIONS

The General Accounting Office (GAO) review was performed at the request of the Chairman and former Ranking Minority Member, Subcommittee on Aviation, House Committee on Public Works and Transportation. GAO was requested to evaluate the adequacy of the Federal Aviation Administration's (FAA) staffing for the maintenance of various air traffic control (ATC) equipment and the potential impact of projected attrition of maintenance personnel. The GAO report states that the safe and efficient operation of the ATC system depends on the continuous operation of a network of sophisticated communications, radar, navigational, and computer equipment. Also, FAA specialists--technicians and engineers--who represent the second largest FAA work force, are essential in maintaining and repairing this equipment. Further, when Congress authorized replacement of this equipment with newer technology under FAA's National Airspace System (NAS) plan, it was assumed that with newer, more reliable equipment less maintenance would be required and that by the 1990's fewer specialists would be needed. Furthermore, that based on the above assumption, FAA has used attrition to reduce the specialist work force.

GAO concludes that: (1) the number of specialists has decreased faster than FAA projected; (2) current specialist shortages are beginning to negatively affect equipment performance and other operational areas, such as completion of routine maintenance; and (3) the airline industry is experiencing an increase in flight delays caused by equipment failures. GAO also concludes that without hiring in anticipation of attrition, staffing will become more critical because of: (1) the retirement profile of the specialist work force; (2) extensive training to develop replacements; and (3) delays in the installation of new systems designed to reduce maintenance requirements.

GAO believes that unless corrective actions are taken, reduced staffing levels could result in a reduction in services, including fewer systems being available to support air traffic, and an associated increase in flight delays. GAO also believes that FAA needs a continued hiring program to begin replenishing its specialist work force. However, it states that FAA may not be able to absorb an immediate increase that would allow staffing at the level of its estimated maintenance work load and, moreover, elements of the staffing standard process used to estimate these requirements need to be improved.

Given the need to begin hiring and training more specialists and the time that will be required to refine FAA's staffing standard estimates, GAO recommends that: (1) FAA develop a hiring plan based on authorized maintenance positions; (2) this plan, including estimated funding levels to support such an effort, be provided to Congress; and (3) once this plan is completed, FAA should improve its equipment inventory records and staffing estimates which will enable FAA to refine its hiring plan.

Because it will take time for new specialists to be hired and trained, GAO recommends also that FAA review several options to deal with current shortages until such time as replacements can be fully trained. Also, GAO makes additional recommendations concerning FAA's reporting system for routine maintenance.

SUMMARY OF DEPARTMENT OF TRANSPORTATION POSITION

The FAA's systems maintenance activities are currently in a transitional phase. Today more equipment is being delivered to the field than ever before, and that equipment is, in many respects, far different than what our work force has dealt with in the past. The mix of skills that will be required of FAA maintenance personnel to operate in the future environment is changing, calling for a greater systems orientation and for more expertise in computer applications. Our efforts to attain greater productivity and efficiencies in our systems maintenance functions will continue to require changes in the traditional ways we have done business.

We recognize that all of these factors present a major challenge in overseeing the maintenance of the National Airspace System, and we have taken appropriate measures to manage this program in a way that will meet that challenge. One facet of this will be the use of remote maintenance monitoring (RMM) throughout the ATC system. This technique, already routine throughout most of the telephone industry, relies on a communications network of linking computer systems which monitor the status of equipment.

Engineers and technicians will be stationed at central locations to care for the on-site equipment and to ensure that there is a high level of service and performance throughout the system. RMM will provide continuous, real-time, on-line remote sensing of ATC equipment, to a degree that far exceeds our current capabilities to monitor today's less sophisticated equipment, and will result in tangible improvements in equipment monitoring, reliability, and performance. RMM has already been implemented in many facilities.

Importantly, the productivity increases we have made have been accomplished while maintaining high levels of service to the traveling public. In general, overall system performance has improved over the past 8 fiscal years, 1979 through 1986. For example, one performance indicator is mean time between outages (MTBO). This indicator measures the time between interruptions of service at a facility. In terms of MTBO, dramatic improvements have been realized over this period for major facilities such as our long range and terminal radar facilities as well as our en route and terminal automation equipment.

In the en route environment, air route surveillance radar (ARSR) and ATC radar beacon MTBO has essentially tripled over this period, and en route composite radar data processing service (CRAD) MTBO has nearly doubled. In the terminal environment, the airport surveillance radar (ASR) MTBO has improved gradually, while the terminal automated radar service (TARS) MTBO improved dramatically over the same period.

Appendix V
Comments From the Department
of Transportation

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GAO has pointed out that there has been an increase in the mean time to restore (MTTR). This increase in MTTR may be attributable to a variety of factors. For one thing, it parallels the decision made several years ago, that provides greater regional and local flexibility in determining when to respond to facility outages. Tailoring local practices to respond to facility outages was based on a recognition that different facilities have different criticalities to the operation of the ATC system, and that for some equipment there are significant redundancies. Programs for consolidation of work centers and implementation of RMM will result in increases in MTTR due simply to increases in travel time. Nonetheless, overall FAA investment properly supports this strategy because sufficient redundancy exists within the system to assure safety and to assure that service outages do not occur.

We recognize that attrition has outpaced efficiencies resulting from delivery of NAS equipment. We now have available to us a detailed, demographic analysis of our airways facilities work force that has formed the basis for our recent projections in this area. The average age of this work force is nearly 46. Over 12 percent could elect to retire now, with 35 percent eligible to retire in 5 years. The aging nature of this work force is a concern. Monitoring this situation is essential and planning for appropriate corrective action is what we are doing.

We will ask for the personnel resources we need to assure that proper maintenance and a safe system continue. We are prepared to maintain our work force levels as an interim measure to preclude the potential for disruptions in service due to the aging nature of that work force. This work force will be supplemented by contract support when it is warranted. Repair and restoration of HOST computers in our Air Route Traffic Control Centers and maintenance of integrated communications switching systems are performed by contract based on cost/benefit studies that indicate such a strategy is cost beneficial.

In short, we have already made significant progress in achieving productivity gains in our maintenance work force, and have done so in a way that protects the operation and efficiency of the system. We have a variety of measures under way that will assist in attaining further productivity in a reasoned and prudent manner.

With regard to the impact of maintenance staffing and facility performance on safety, the NAS facility configuration and ATC procedures constitute an integrated system designed in such a manner that random facility failures do not jeopardize air safety. Facility redundancy and alternative procedures are an integral part of this system design and provide a consistently high level of safety for all elements of the aviation community.

The GAO finding that flight delays from equipment failures increased 22 percent more than total delays increased between 1985 and 1986 should be put in perspective. The actual delays attributable to equipment failures during that time period rose from 2.2 percent to 2.6 percent. During this same time period, unscheduled outages actually decreased by 17 percent and facility availability rose from 99.78 to 99.80 percent. Because of these facts, it is apparent that the increase in delays is directly attributable to increased traffic volume and not an indicator of equipment failures caused by shortages in maintenance staffing. As GAO points out, the mean-time-to-restore facilities has increased. This is a result of implementation of remote monitoring and centralization of work centers. Although restoration time has increased because of this, it is more than counterbalanced by improved reliability and the net result is increased facility performance.

Prior to the GAO audit, the FAA had already initiated several recommended short-term actions to: (1) improve the Airways Facilities (AF) staffing standard validation process; and (2) develop a hiring plan based on authorized maintenance positions. Required additional long-term actions were also underway prior to the audit to standardize the preventive maintenance reporting system.

The specific GAO recommendations, along with the Department's position on each, are set forth below.

1. GAO Recommendation. Improve the AF staffing validation process by:
(1) requiring the field to review and verify facility equipment inventories;
(2) linking staffing projections to facility-specific data available through the Systems Engineering and Integration Contractor (SEIC) data base; and
(3) estimating pipeline staffing needs.

DOT Response. We are in the process of: (1) conducting a validation of the facilities master file. Field visits to each region will begin in August and will include on-site validation of facility inventories on a sampling basis. Regions have been requested to undertake their own review and correction of their portion of the facilities master file prior to being reviewed by the validation team. Three AF sector offices, including one air route traffic control center, will be visited in each region. The validation will be completed before the end of the calendar year.; (2) incorporating data into the SEIC maintained, facility-specific data base in order to make it compatible with the staffing standard system. An electronic interface will be developed between the SEI maintained master schedule system and the FAA maintained precommissioned facilities file that will result in an automatic update of equipment delivery dates. The precommissioned facilities file with updated equipment deliveries can then be merged with the facilities master file and the staffing standard to project future staffing requirements; and (3) assessing our pipeline staffing requirements through refinement and expansion of the demographic analysis of the work force and through continued implementation and refinement of the AF Human Resource Plan.

2. GAO Recommendation. Since refining the staffing standard process will take time and additional specialists are needed now, in the interim: (1) establish staffing targets for field maintenance at a level approaching authorized positions to provide a specialist pipeline to replace anticipated attrition over the next 5 years; (2) submit these targets and a funding plan to support hiring to these levels to the appropriate Congressional committees; (3) consider the options, such as rehiring retirees and redistributing the work force, to deal with situations where field staffing is already critical; and (4) revise the maintenance staffing targets and funding requests recommended above, as appropriate, once the staffing standard process has been refined.

DOT Response. The FAA, as part of its fiscal year (FY) 1989 budget process, is reviewing the staffing and funding levels of the Systems Maintenance Program for FY 1989 and subsequent years in relation to the levels generated by the staffing standard. FAA's budget submission to the Department and the Office of Management and Budget will include recommendations on staffing and funding. In April 1986, FAA lifted its freeze on field maintenance hiring and, in the short term (FY 1987), positions will be filled on a one-for-one basis behind attrition. The FAA has made additional funds and FTE's available, where necessary, for immediate and exclusive use in systems maintenance field staffing. This will result in hiring of 110 additional field employees above the level of attrition. These actions have resulted in the hiring of 518 field maintenance employees between April 1, 1986, and June 30, 1987. This number is projected to increase to 717 by the end of the current fiscal year. The FAA regions have also been granted authority to fill 200 temporary P&E positions to support NAS Plan implementation. The employees hired to fill these positions will transition to field maintenance positions by the end of FY 1988. These employees will receive training and will be directly involved in installing facilities for which they will eventually assume maintenance responsibilities. In essence, this action and the others described above will create a substantial pipeline designed to offset future attrition.

3. GAO Recommendations. (1) Ensure that adequate levels of maintenance are being provided in the field; and (2) standardize the periodic or preventive maintenance (PM) reporting system. (Needed revisions include setting standard regional PM performance goals, establishing standard counts for routines done on specific equipment, and weighting more critical tasks.)

DOT Response. We believe that because of the robustness of the NAS, the built-in redundancy and fail-soft/fail-safe technology, and the operational procedures related to responses to equipment failures that have been worked out with Air Traffic and Flight Standards interests, there are adequate levels of maintenance being exerted today. Nevertheless, we will ensure that our evaluations include an in-depth review of this function.

GAO states that it identified instances where technicians are intentionally overstating their accomplishments because of pressures to complete a certain maintenance goal. In this regard, our Office of Inspector General was requested to investigate allegations of overstating or falsifying records; however, it was unable to substantiate such allegations.

The FAA has had under development for several years a maintenance management system. The system will include automation of facility maintenance logs and a preventive maintenance scheduler. These will result in standardized definitions and reporting procedures for preventive maintenance accomplishment. They will provide a real time system for measuring maintenance accomplishment against established goals. Phase one of this system is currently being implemented.

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Glossary

Certification of Systems	Technically verifying that a system, subsystem, or equipment is providing the required or advertised service to air traffic personnel or the aviation public. This type of certification is done periodically as well as before a facility is formally accepted and placed into operational use in the NAS and when a system fails and is restored to service.
Certification of Technicians	Confirmation that the employee possesses the necessary minimum knowledge and skills to determine the operational status of particular equipment.
Corrective Maintenance	Maintenance performed when equipment fails in order to repair the equipment and get it back into service.
Facility	The total electronic, electric power generating or distribution system, and the structure used to house, support, and/or protect these systems. A facility may include a number of systems or may consist of a single piece of equipment.
Facility Master File	Inventory record of facilities within the jurisdiction of a sector.
Field Maintenance	The Airway Facilities maintenance work force below the regional office level.
Field Technical Personnel	A term we use to define field staff performing personnel direct maintenance work. Excludes all clerical, computer support, and logistical support personnel.
Key Performance Parameter	A selected critical indicator of equipment that determines whether or not it is performing its intended function. These parameters are clearly identified in maintenance technical directives and are a major concern of an inspector during a technical inspection.
Localizer	The component of an instrument landing system that provides course guidance to the runway.

Logs	FAA forms used as primary facility maintenance records. They can be either manual or automated records.
Logistical Support	The support of NAS operational requirements through acquisition, storage, distribution, and inventory control of instruments, supplies, spare parts, tools, and working equipment.
Modification	An alteration in a facility's electrical, mechanical, or physical characteristics, arrangement, configuration, or use.
MTBO	Measure of the mean or average time between outages or service interruptions.
MTTR	Mean or average time to restore equipment after a failure. (Also defined as the average time to repair equipment.) Used as a measure of efficiency in restoring service to users.
Navigation Aids	Facilities that define the location of principal airways and enable pilots to determine positive distance and direction information from ground stations.
Outage	When a facility is out of service for a period of time. Also called a service interruption.
Periodic or Preventative Maintenance	Any scheduled maintenance activities that include performance checks and/or other maintenance tasks. It is the routine scheduled maintenance designed to preserve equipment or reduce the chances of equipment failure.
Second Generation VORTAC	A vortac is a very high frequency omni-directional range air navigation system. A second generation vortac is an advanced vortac that is a solid state, remote maintenance, monitoring system.

Sector	A given geographical area that is established to efficiently manage, direct, and support operational, technical, and engineering requirements of the NAS.
Sector Field Office	A portion of a sector that contains a resident technical staff that may be located with or geographically removed from the sector's headquarters. A sector field office is established to provide more efficient operations where a sector encompasses a large geographical area.
Systems Maintenance	Budget category which includes the activities of the entire Airway Facilities work force. Includes all headquarters and regional office direction and engineering services related to maintenance operations.
Technical Inspection	Periodic formal examination of a facility to determine if that facility meets the required standards for operation. A written report is completed, identifying any discrepancies and their causes.
Technical Inspection Discrepancy	Any inconsistency with prescribed standards found with the equipment or the environment in which the equipment is placed during an inspection.
Watch	A portion of time during which a technician is on duty to observe and take care of equipment used directly or indirectly in air navigation and/or the control of air traffic (usually an 8-hour shift).

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