

**GAO**

Report to the Chairman, Subcommittee  
on Aviation, Committee on  
Transportation and Infrastructure,  
House of Representatives

October 2010

# FEDERAL AVIATION ADMINISTRATION

Agency Is Taking  
Steps to Plan for and  
Train Its Technician  
Workforce, but a More  
Strategic Approach Is  
Warranted



**GAO**

Accountability \* Integrity \* Reliability

Highlights of [GAO-11-91](#), a report to the Chairman, Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

## Why GAO Did This Study

Since 2006, air traffic control (ATC) equipment outages and failures at Federal Aviation Administration (FAA) facilities have caused hundreds of flight delays and raised questions about FAA's maintenance capabilities. About 6,100 technicians maintain FAA's current (legacy) facilities and equipment and will be responsible for the Next Generation (NextGen) technologies planned for the next 15 years. Safe and efficient air travel will therefore partly depend on FAA's having technicians with the right skills now and in the future. As requested, GAO reviewed how (1) FAA incorporates key practices of leading organizations in its workforce planning for technicians, (2) FAA's technician training compares with key practices of leading organizations, and (3) the costs of technician training, including travel costs, have changed in recent years. GAO analyzed FAA workforce and training data, compared FAA planning and training practices with criteria identified in prior GAO work, and conducted focus group interviews with FAA technicians and FAA Training Academy instructors.

## What GAO Recommends

Among other things, FAA should develop a written technician workforce planning strategy that identifies needed skills and staffing, and a strategic training plan showing how training efforts contribute to performance goals. The Department of Transportation provided technical corrections.

View [GAO-11-91](#) or key components. For more information, contact Gerald L. Dillingham, Ph.D., at (202) 512-2834 or [dillinghamg@gao.gov](mailto:dillinghamg@gao.gov).

# FEDERAL AVIATION ADMINISTRATION

## Agency Is Taking Steps to Plan for and Train Its Technician Workforce, but a More Strategic Approach Is Warranted

### What GAO Found

FAA has followed some key practices of leading organizations in its strategic workforce planning for technicians but lacks a comprehensive, written strategy to guide its efforts. GAO assessed whether FAA followed those practices fully, mostly, or partially, or did not follow them. For example, FAA partially follows one practice—determining critical skills and competencies—because it assesses those skills and competencies its technicians now have to maintain legacy systems, but has just begun to identify those they will need to maintain NextGen systems. FAA also partially develops strategies to close the gap between the technician workforce it needs and the one that it has: It determines staffing needs annually, but lacks a longer-term strategy to address the hundreds of technician retirements projected through 2020. Without a comprehensive, written technician workforce planning strategy, FAA does not have a transparent road map to acquire and retain the right number of technicians with the right skills at the right time. FAA mostly follows other leading workforce planning practices, although it only partially involves key stakeholders—managers, but not technicians—in workforce planning and may thus be missing opportunities for improvement.

FAA at least partially follows key practices of leading organizations in its strategic training and development for technicians, but it lacks a strategic training plan, and workload issues limit its ability to fully incorporate key leading practices. With the transition to NextGen, technicians will need to be trained both to maintain new systems and to remain proficient in maintaining the legacy systems that FAA plans to continue operating. FAA has partially implemented a strategic approach to planning for training in that it has established annual training goals and incorporated employees' developmental goals in its planning processes. As noted, however, it has just begun to identify the skills and competencies technicians will need to maintain NextGen systems. FAA mostly follows other key practices for design and development, such as developing a mix of in-house and vendor training. FAA is studying the feasibility of having vendors provide certain courses that are currently offered through the FAA Training Academy and are filled to capacity. FAA partially follows leading practices for implementing training and development, but workload demands often limit technicians' opportunities to attend training. FAA also partially follows leading practices for demonstrating how training and development efforts contribute to improved performance and results. For example, FAA identifies annual training goals, but does not link them to specific performance goals. As a result, it is limited in its ability to assess the effectiveness of its investments in training.

Recent compensation costs for instructors at the FAA Training Academy have been roughly stable, while those for student travel to and from the academy and for training courses provided by vendors, exclusive of travel costs, have risen. The higher student travel costs reflect increases in air fares, and vendor training costs have grown as FAA has rolled out more courses for new equipment in preparation for the deployment of NextGen systems.

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### Abbreviations

ADS-B	Automatic Dependent Surveillance Broadcast
ARTCC	air route traffic control center
ATC	air traffic control
ATO	Air Traffic Organization
CATMT	Collaborative Air Traffic Management Technologies
CIP	Capital Investment Plan
CPDF	Central Personnel Data File
DALR	Digital Audio Legal Recorder
DoP	demonstration of proficiency
EHOT	enhanced hands-on training
ELMS	Electronic Learning Management System
ERAM	En Route Automation Modernization
FAA	Federal Aviation Administration
FIST	FAA Information Superhighway for Training
GNAS	general national airspace system
NASPAS	National Airspace System Performance Analysis System
NVS	National Airspace Voice Switch
OJT	on-the-job training
PASS	Professional Airways Safety Specialists
PC&B	personnel compensation and benefits
SFFAS	Statement of Federal Financial Accounting Standards
SWIM	System-Wide Information Management
TRACON	terminal radar approach control

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United States Government Accountability Office  
Washington, DC 20548

October 22, 2010

The Honorable Jerry F. Costello  
Chairman  
Subcommittee on Aviation  
Committee on Transportation  
and Infrastructure  
House of Representatives

Dear Mr. Chairman:

The Federal Aviation Administration (FAA) is the key federal agency responsible for maintaining the nearly 60,000 pieces of equipment that help to ensure that the national airspace system operates safely and efficiently. However, during the last few years, power outages and air traffic control equipment failures—for example, in Southern California in 2006, at the Atlanta Air Route Traffic Control Center in 2008, and at the Salt Lake City Air Route Traffic Control Center in 2009—have caused flight delays.<sup>1</sup> FAA’s equipment maintenance staff—referred to in this report as technicians—are responsible for minimizing the frequency, duration, and impact of such outages. Trained as systems specialists, electronics technicians, and computer specialists, they maintain, repair, and certify air traffic control equipment—including radar, navigation, communication, automation, and environmental systems deployed throughout the national airspace system. In 2009, FAA had approximately 6,100 technicians. This minimum technician staffing level was established under a 2000 contract between FAA and the Professional Airways Safety Specialists (PASS)—the technicians’ bargaining unit. The 5-year contract, which expired in 2005, remains in effect until a new contract is established.<sup>2</sup>

Today’s air traffic systems are primarily ground-based, and some date back to at least the 1970s. To modernize these systems while improving the safety, capacity, and efficiency of the national airspace system, FAA plans to develop and deploy satellite-based air traffic management technologies, collectively referred to as the Next Generation Air

<sup>1</sup>See, for example, FAA, Washington headquarters press release (Washington, D.C.: Nov. 19, 2009), [http://www.faa.gov/news/press\\_releases/news\\_story.cfm?newsId=10966](http://www.faa.gov/news/press_releases/news_story.cfm?newsId=10966) (accessed Aug. 20, 2010).

<sup>2</sup>The two parties had not begun to negotiate a new contract as of June 2010.

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Transportation System (NextGen). FAA has begun to deploy some NextGen technologies and has set 2025 as a target date for full implementation of NextGen capabilities. As it transitions to NextGen technologies, FAA plans to continue operating existing air traffic control technologies, referred to as legacy systems, while testing and integrating NextGen technologies. Safe and efficient air travel will therefore depend on, among other things, FAA's having a sufficient number of skilled technicians to ensure that both the legacy and the new systems are properly maintained and certified throughout the transition. Incorporating key workforce planning and training practices of leading organizations can help ensure that FAA has a highly functioning workforce and appropriate training capabilities as it manages the transition to NextGen.

In light of technicians' critical role in maintaining the nation's air traffic control infrastructure, you asked us to assess the extent to which FAA has the personnel with the right skills to maintain its equipment and facilities now and in the near term and how much FAA is spending on technician training. To achieve these objectives, we addressed the following research questions: (1) To what extent does FAA incorporate key practices of leading organizations in its workforce planning for technicians? (2) How does FAA's technician training compare with key practices of leading organizations? (3) How have the costs of technician training, including travel costs, changed in recent years?

To assess FAA's workforce planning for technicians, we analyzed FAA data from fiscal year 1999 through fiscal year 2009 to identify trends in staffing, hiring, and attrition; reviewed FAA's workforce planning documents; and compared the agency's workforce planning practices with criteria from our past work.<sup>3</sup> We selected key leading practices, listed in tables throughout the report, and assessed the extent to which FAA followed each practice by applying the following scale: "Fully" indicated that, in our judgment, all or virtually all aspects of the practice were followed; "mostly" indicated that more than half but less than all or virtually all were followed; "partially" indicated that less than half but more than a few were followed; and "minimally" indicated that few or no aspects of the practice were followed.

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<sup>3</sup>See GAO, *Human Capital: Key Principles for Effective Strategic Workforce Planning*, [GAO-04-39](#) (Washington, D.C.: Dec. 11, 2003), and *Human Capital: A Guide for Assessing Strategic Training and Development Efforts in the Federal Government*, [GAO-04-546G](#) (Washington, D.C.: March 2004).

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To assess training for technicians, we analyzed FAA training data from fiscal year 2006 through May 2010 to identify trends in course offerings and determine the number of classes, students, and instructors; reviewed end-of-course surveys and technician training documents; and compared FAA's development and delivery of technician training with key leading practices identified through our past work, as described above. In addition, to address both workforce planning and training, we conducted 12 focus group meetings—11 with FAA technicians and 1 with FAA Academy managers—at 11 locations and conducted semistructured interviews with FAA managers and PASS union officials. To identify the focus group locations, we considered the number of technicians at the facilities, geographic location, notable conditions (such as recent equipment outages), and agency and PASS recommendations. The information collected from the focus groups is not generalizable to all FAA technicians.

To determine how the costs of technician training have changed, including travel costs, we compiled and compared cost data for training provided at FAA's Training Academy in Oklahoma City and by vendors from fiscal year 2005 through May 2010. To address all three questions, we also reviewed documents from the Department of Transportation's Office of the Inspector General, the National Academy of Public Administration, and PASS. We assessed the reliability of FAA's workforce and training data that are pertinent to this effort by reviewing related documentation and internal controls and interviewing agency officials and determined that the data were sufficiently reliable for our purposes. We could not assess the reliability of cost data for vendor training, because FAA's cost accounting system does not provide costs for vendor training and travel-related activities. We conducted this performance audit from May 2009 through October 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. Appendix I contains more detailed information on our scope and methodology.

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## Background

FAA's roughly 6,100 technicians are part of the agency's Air Traffic Organization (ATO) and are located organizationally within ATO's Technical Operations Services. (See app. II for ATO's organization.) Physically, the technicians are located throughout the country at approximately 600 air traffic control facilities, which they are responsible



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for maintaining, repairing, and certifying, together with the systems and equipment the facilities contain.<sup>4</sup> Currently, FAA operates nearly 60,000 pieces of legacy equipment and has begun to deploy NextGen equipment. Technicians maintain the equipment, certify that it is working properly by conducting periodic performance checks, and repair malfunctioning equipment and return it to service. They conduct maintenance under various approaches depending on the equipment. Those approaches include (1) periodic maintenance (which includes periodic equipment inspections, performance checks, and routine maintenance), (2) condition-based maintenance (which includes proactive maintenance tasks to predict or prevent equipment failures), and (3) run-to-fault maintenance (which means maintenance is performed after the equipment stops functioning—an approach that, according to FAA, is normally applied when other types of maintenance actions will not reduce the probability of failure or extend the lifetime of the equipment). Since 2007, FAA has used reliability-centered maintenance to determine the most appropriate approach and timing for conducting maintenance activities for each type of equipment. Reliability-centered maintenance requires that data on the function and performance of specific equipment be collected and analyzed, including data on the causes and consequences of failure, in order to determine the maintenance approach needed to keep the equipment functioning effectively and prevent future failures. For example, performance data can be analyzed to determine whether a particular component wears out with age or fails randomly; this information is then used to decide the maintenance approach most appropriate for that item. (Fig. 1 shows a technician upgrading lighting on an approach lighting system.)

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<sup>4</sup>These air traffic control facilities include 22 air route traffic control centers, 163 terminal radar approach control facilities, and 466 air traffic control towers.

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**Figure 1: A Technician Conducting an Equipment Check**



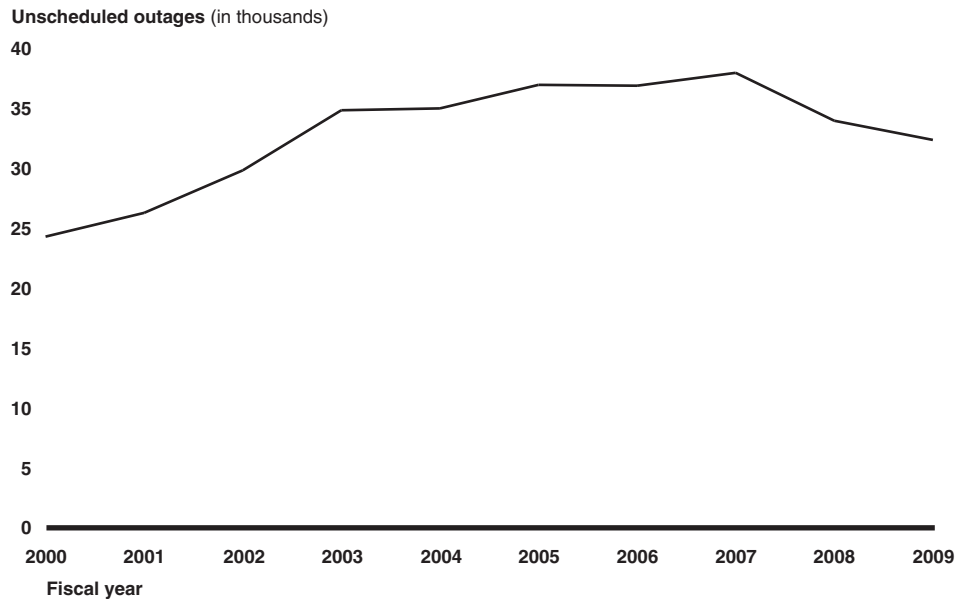
Source: GAO.

As mentioned previously, FAA's technicians are responsible for minimizing the frequency, duration, and impact of equipment outages. Over the last 10 years, the frequency and duration of unscheduled outages has generally increased.<sup>5</sup> (See figs. 2 and 3.) Age and the resulting deteriorating condition of equipment and facilities are contributing to the increase in outages and repair time. According to a senior FAA official, the number of outages decreased around 2008 because of changes in reporting practices.

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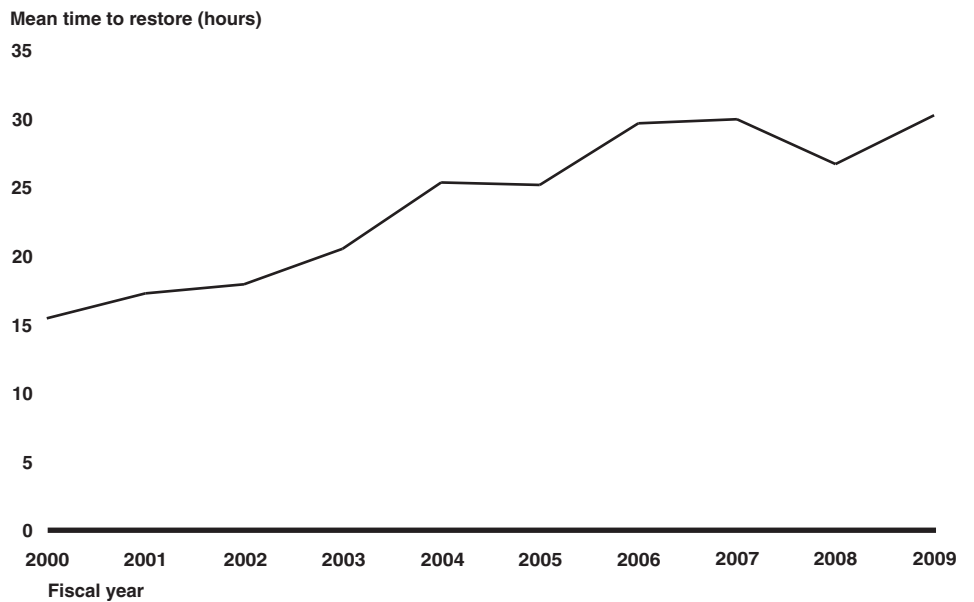
<sup>5</sup>Outages refer to the loss of a facility or service for 1 minute or more. Outages can be scheduled (for maintenance or other purposes) or unscheduled (such as when equipment fails).

**Figure 2: Unscheduled Outages, Fiscal Years 2000 through 2009**



Source: GAO analysis of FAA data.

**Figure 3: Average Duration of Outages, Fiscal Years 2000 through 2009**



Source: GAO analysis of FAA data.

Note: Mean time to restore represents the average duration per outage.

FAA is still determining technician responsibilities and maintenance requirements under NextGen. A senior FAA official noted that the agency plans to look at near-term system deployments and new system requirements to see what maintenance requirements are planned for new systems in the short term. The initial systems critical to implementing NextGen—En Route Automation Modernization (ERAM) and Automatic Dependent Surveillance Broadcast (ADS-B)—are currently being deployed, and FAA expects that several other systems will come online over the next several years. (See table 1 for FAA’s schedule for deploying NextGen systems.) Initially, FAA planned to decommission legacy equipment as it deployed related NextGen equipment, but it has since decided to retain much of the legacy equipment, according to a senior ATO manager. As a result, the technicians’ workload will increase in the near term.

**Table 1: NextGen Systems That FAA Expects to Deploy in the Near Term and Midterm**

System	Next major milestone
En Route Automation Modernization	Installed at 20 en route centers with software testing under way at several key sites; initial operating capability at all 20 sites scheduled for fiscal year 2011.
Automatic Dependent Surveillance Broadcast	Under deployment at several test sites; full deployment of ground-based transceivers expected in fiscal year 2013.
System-Wide Information Management (SWIM)	Deployment expected to start in fiscal year 2010.
Collaborative Air Traffic Management Technologies (CATMT)	Integration of weather data in 2011.
NextGen Data Communications (DataComm)	Deployment schedule not baselined until final investment decision, expected in fiscal year 2016.
National Airspace Voice Switch (NVS)	Market survey scheduled for 2010. <sup>a</sup>

Source: FAA.

Note: ERAM is foundational to NextGen.

<sup>a</sup>Market surveys involve collecting and analyzing information during the early stages of procurement planning to understand vendors’ capabilities to satisfy FAA’s requirements.

## Trends in Size of Technician Workforce

Over the last 11 years, staffing levels for technicians reached a high of 6,721 in fiscal year 2001 and, with some fluctuation, dropped to a low of 6,086 at the end of fiscal year 2008—a decline of about 9 percent. At the end of fiscal year 2009, the number of technicians increased to 6,147, slightly more than the minimum staffing level established in FAA’s contract with PASS. (See table 2.) Over the same period, the number of pieces of equipment increased from 40,360 in 1999 to 63,846 in 2009, while the number of air traffic control facilities decreased from 651 in 1999 to 581 in 2009. The number of technicians declined slightly during fiscal years

2006 through 2008 because separations exceeded hiring, as shown in table 3.

**Table 2: Technician Staffing, Equipment, and Facility Levels, Fiscal Years 1999 through 2009**

	Fiscal year										
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of technicians	6,198	6,416	6,721	6,692	6,513	6,345	6,437	6,215	6,109	6,086	6,147
Number of pieces of national airspace system equipment	40,360	40,921	40,910	40,746	40,997	41,082	40,847	40,639	59,140	60,851	63,846
Number of air traffic control facilities	651	653	621	622	622	690	690	689	675	593	581

Sources: Central Personnel Data File (CPDF) and FAA Administrator's Fact Book (years 2001-2010).

**Table 3: Comparison of Technician Separations and Hires, 2005 through 2009**

	2005	2006	2007	2008	2009
Number of separations	330	366	309	313	211
Number of hires	360	330	235	243	213
Net gain or loss	+30	-36	-73	-70	+2

Source: GAO analysis of CPDF and FAA data.

Note: Number of separations is for the fiscal year, and number of hires is for the calendar year.

During the past 11 years, the number of technician separations—primarily because of retirements—has averaged about 280 per year. The number peaked at 366 separations in fiscal year 2006 and then decreased to 211 separations in fiscal year 2009—a decline of 42 percent. (See table 4.)

**Table 4: Technician Separations, Fiscal Years 1999 through 2009**

	Fiscal year										
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Retirements (percentage of total separations)	216 (77)	178 (74)	186 (79)	185 (75)	213 (77)	238 (85)	279 (85)	279 (76)	225 (73)	238 (76)	160 (76)
Nonretirements <sup>a</sup>	57	59	44	53	50	38	44	74	71	63	40
Other <sup>b</sup>	6	5	5	6	14	3	6	13	13	12	11
<b>Total separations</b>	<b>279</b>	<b>242</b>	<b>235</b>	<b>246</b>	<b>277</b>	<b>279</b>	<b>330</b>	<b>366</b>	<b>309</b>	<b>313</b>	<b>211</b>

Source: CPDF.

<sup>a</sup>Includes resignations, firings, and deaths.

<sup>b</sup>Includes position changes, such as a technician's assumption of a supervisory or staff position.

The number of technicians eligible to retire each year over this period has ranged from about 800 to about 1,000. In 2005 and 2006, the largest numbers of technicians retired—about one-third of those eligible each year. (See table 5.) The relatively low number of technicians retiring in 2009 may be due to the downturn in the economy.

**Table 5: Number of Technicians Eligible to Retire Compared with Actual Number of Retirements, Fiscal Years 1999 through 2009**

	Fiscal year										
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number eligible to retire	798	905	922	975	984	997	963	842	843	799	851
Number of retirements	216	178	186	185	213	238	279	279	225	238	160
Percentage of eligible technicians who retired	27	20	20	19	22	24	29	33	27	30	19

Source: GAO analysis of CPDF data.

## Technician Training

ATO's Technical Operations Training and Development Group (Technical Operations Training) is responsible for training technicians. (See app. II for ATO's organizational chart.) Through the Technical Operations Training and Personnel Certification Program, FAA grants certification to technicians who have obtained a professional level and are responsible for the operation and performance of air traffic control facilities and equipment. The certification program consists of five types of training: (1) resident training taught in a classroom environment by an instructor; (2) distance learning, such as correspondence study or computer-based instruction; (3) refresher training, which can be provided through resident or distance learning courses, for technicians who hold a certification; (4) on-the-job training (OJT), providing direct experience in the work environment where the employee is required to perform his or her duties; and (5) enhanced hands-on training (EHOT) and demonstration of proficiency (DoP) training. To obtain certification, technicians must satisfactorily complete their training—including theory-of-operations training, OJT in the workplace, or EHOT and DoP<sup>6</sup>—at the training

<sup>6</sup>Theory-of-operations training covers the principles of equipment operation, periodic and corrective maintenance, and troubleshooting. EHOT includes the normal theory-of-operations instruction and covers additional material designed to develop the skills and knowledge needed to maintain and certify a system. DoP is an examination, administered at the FAA Academy or vendor location following successful completion of a theory-of-operations course that is designed using EHOT.

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location or pass a performance examination in the workplace.<sup>7</sup>

Technicians must also receive an endorsement, first by a manager and then by a second-level manager, that the preceding actions have been properly completed.

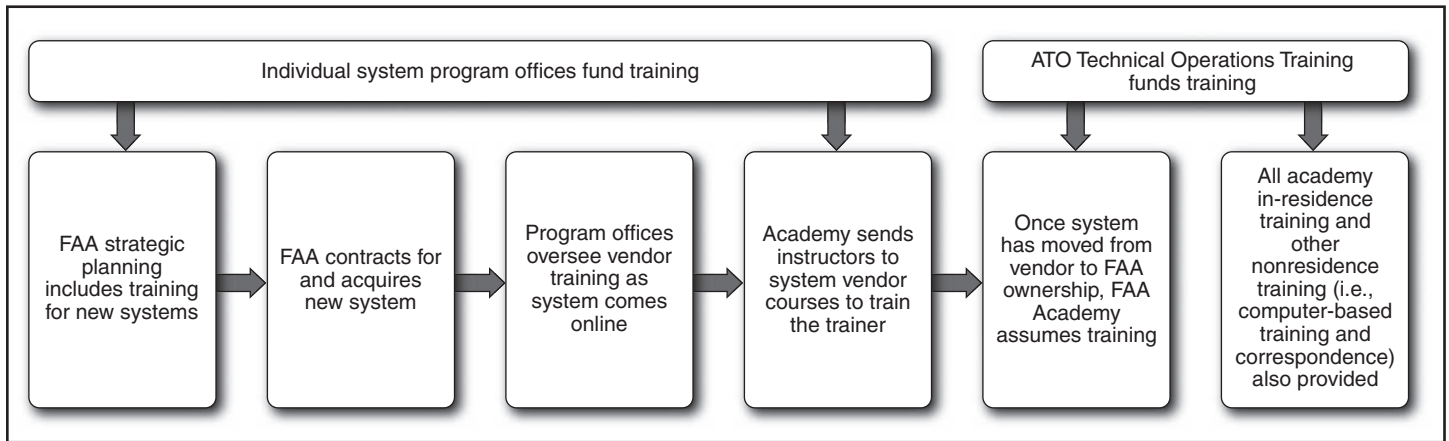
At the beginning of the year, Technical Operations Training works with FAA's human resource personnel to obtain an estimate of new hires' training needs. Technicians are earmarked for a piece of equipment at a particular facility when they are hired; over the course of their careers, they may be trained on many pieces of equipment. All new hires must get one equipment course in their first year, and that training is targeted to the needs of the facility to which they are assigned. Technicians need to pass two types of equipment courses to reach the full-performance level. New hires are at their facility for 30 days for familiarization and then go to the FAA Academy for theory-of-operations training and one equipment course. Afterwards, the technician's manager determines the additional equipment on which the technician needs training. Training to work on legacy equipment is provided at the academy, where technicians reside during the training.

When FAA acquires new air traffic control equipment, it follows an established process for training technicians. Vendor courses are the primary source of training for NextGen systems coming into the FAA inventory. Figure 4 shows how FAA plans and funds technician training.

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<sup>7</sup>Technicians previously received OJT and performance examinations in the field, whereas now a hands-on component is being built into existing formal training courses provided at the academy or vendor location to build proficiency without taking equipment out of service for training purposes. EHOT and DoP satisfy the requirements of the theory-of-operations course, OJT, and the performance examination, leading to the attainment of personnel certification authority.

**Figure 4: Process for Planning and Funding Technician Training**



Source: GAO analysis of FAA data.

## FAA Has Adopted Aspects of Some Leading Workforce Planning Practices but Lacks a Strategic Approach to Planning for Its Technician Workforce

FAA's workforce planning for technicians partially or mostly incorporates key practices of leading organizations, but no practices are fully incorporated, and FAA has no comprehensive, written strategy to guide its efforts. To the extent that the agency does not incorporate leading practices, it may be limited in its ability to plan effectively for the right number of technicians with the right skill sets, both now and in the near term.<sup>8</sup> Table 6 presents our analysis of the extent to which FAA has incorporated key practices of leading organizations in its workforce planning.

<sup>8</sup>Strategic workforce planning focuses on developing long-term strategies for acquiring, developing, and retaining a workforce to meet the needs of the future. Drawing on our previous work, we selected key leading practices most related to FAA's technician workforce. See [GAO-04-39](#).



**Table 6: Extent to Which FAA’s Technician Workforce Planning Follows Key Leading Practices**

Key leading practices in strategic workforce planning	Does FAA follow?
<b>Critical skills and competencies:</b> determine the critical skills and competencies that will be needed to achieve current and future programmatic results	Partially
<b>Gap-closure strategies:</b> develop strategies that are tailored to address gaps in number, deployment, and alignment of human capital approaches for enabling and sustaining the contributions of all critical skills and competencies	Partially
<b>Support capacity:</b> build the capacity needed to address administrative, educational, and other requirements important to support workforce planning strategies	Mostly
<b>Evaluation:</b> monitor and evaluate the agency’s progress toward its human capital goals and the contribution that human capital efforts have made toward achieving programmatic results	Partially
<b>Stakeholder involvement:</b> involve top management, employees, and other stakeholders in developing, communicating, and implementing workforce planning strategies	Minimally

Sources: [GAO-04-39](#) and GAO analysis of FAA practices.

**FAA Has Established Current Technician Skills and Competencies and Begun to Determine Those Critical for NextGen**

FAA is partially following a leading practice for workforce planning in the area of determining current and future critical skills and competencies. (See table 7.)

**Table 7: Extent to Which FAA’s Technician Workforce Planning Follows a Key Leading Practice in the Area of Critical Skills and Competencies**

Key leading practice in strategic workforce planning	Does FAA follow?
<b>Critical skills and competencies:</b> determine the critical skills and competencies that will be needed to achieve current and future programmatic results	
<ul style="list-style-type: none"> <li>Establish and maintain an inventory of employee skills and competencies (skills and supporting behaviors) and future needs</li> </ul>	Partially

Sources: [GAO-04-39](#) and GAO analysis of FAA practices.

To establish and maintain an inventory of employee skills and competencies, FAA assesses technicians’ skills and competencies at hiring and then biennially. Newly hired and on-board technicians complete competency-based technical training on legacy systems and equipment to establish a baseline level of technical proficiency on these systems and equipment. Additionally, since August 2007, FAA has assessed its technicians’ proficiency every 2 years as part of an Aviation Safety

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Oversight Credentialing Program to ensure that their skills are current and they remain competent to perform work on the equipment.

FAA's initial and biennial skills assessments evaluate technicians' readiness to meet the agency's current maintenance needs, but FAA has not determined whether its technician workforce has the skills and competencies needed to achieve future programmatic results. Such a determination will be critical as the transformation to NextGen proceeds and the agency faces organizational as well as technological changes. FAA's strategic plan for NextGen—the NextGen Implementation Plan—describes the technology changes planned through 2018 but does not mention workforce planning—including planning for critical skills and competencies—for technicians.

FAA officials stated that the agency has started to determine its maintenance requirements for NextGen equipment. This determination will affect the skills and competencies that technicians will need under NextGen. As part of this effort, FAA's NextGen Integration and Implementation Office is establishing a workgroup with members representing relevant FAA divisions and technician subject matter experts. According to FAA officials, this workgroup will look at changes in FAA's maintenance philosophy and NextGen equipment acquisitions and needs, both leading up to and during implementation. The officials said FAA will consider these factors as it develops NextGen planning documents that outline, among other things, changes needed in the technician workforce, including changes in skills, competencies, and training. In addition, Technical Operations Training officials have dedicated a staff member to compile technician job descriptions, tasks, and training courses. According to the officials, FAA will use this information to develop a skills and competency model for training purposes (modeling efforts are discussed later in this report).

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### FAA Has an Annual Process for Allocating Its Technician Workforce but Lacks a Succession Planning Strategy for Addressing Impending Retirements and a Staffing Model

FAA's workforce planning efforts partially address leading practices in developing strategies to close the gap between needed and actual skills and competencies. Although FAA has reasonable strategies in place to allocate staffing annually, it does not have a staffing model and has not developed succession plans to prepare for impending retirements. (See table 8.)

**Table 8: Extent to Which FAA’s Technician Workforce Planning Follows Key Leading Practices in the Area of Gap-Closure Strategies**

Key leading practices in strategic workforce planning	Does FAA follow?
<b>Gap-closure strategies:</b> develop strategies that are tailored to address gaps in number, deployment, and alignment of human capital approaches for enabling and sustaining the contributions of all critical skills and competencies	
• Develop human capital strategies and tools that can be implemented with the resources that can be reasonably expected to be available	Mostly
• Have succession plans for leadership and other critical positions	Partially
• Approach workforce planning strategically, basing decisions on mission needs, customer expectations, workload, and workforce	Partially
• Establish a process to address gaps between current and future skills and competencies needs	Partially

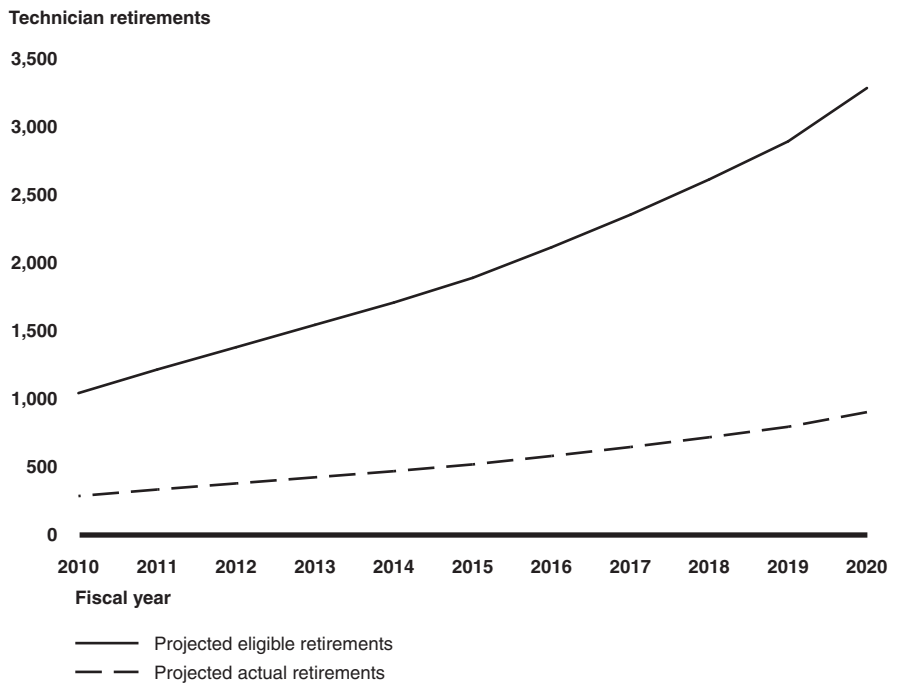
Sources: [GAO-04-39](#) and GAO analysis of FAA practices.

FAA has developed annual technician hiring and staff planning strategies that are derived from the budget—a human capital strategy that takes into consideration the resources that can be reasonably expected to be available, following a key practice of leading organizations. The staffing process, which is discussed in more detail later in this report, begins with a budgetary dollar amount that is used to determine how many new full-time technician positions can be filled. Top management, with input from front-line managers in the form of requests based on their facility needs, then distributes these positions across locations. According to FAA officials, these recommendations generally take into account FAA’s equipment inventory and restoration requirements and the varying levels of trained, certified, and experienced technicians at FAA facilities, although top management considers these factors in an ad hoc manner.

Foremost among the succession planning challenges ATO faces is the impending retirement of portions of the technician workforce. We updated FAA’s 2008 projections with the most current federal personnel data from the Office of Personnel Management’s Central Personnel Data File (CPDF) and found that 23 percent of the technicians on staff at the end of fiscal year 2009 would be eligible for retirement in 2012. Moreover, if the 2009 staffing level remained constant, 31 percent would be eligible for retirement in 2015 and over 50 percent in 2020. (See fig. 5.) From 2005 through 2009, FAA averaged 236 actual technician retirements annually, or 27 percent of those eligible. If actual retirements, estimated for existing staff, continued at that rate, FAA could face over 500 retirements in fiscal year 2015 and about 900 retirements in fiscal year 2020. As discussed previously, not all technicians that are eligible to retire will do so, and as seen in figure 5, the gap between the number of technicians who are

eligible to retire and those projected to actually retire will continue to expand at least through 2020.

**Figure 5: Projected Numbers of Technicians Eligible to Retire and Estimated to Retire, Fiscal Years 2010 through 2020**



Source: GAO analysis of CPDF data.

Note: Analysis of eligibility for retirement based on data for existing staff, as of the end of fiscal year 2009.

FAA does not have succession plans for technicians—that is, FAA lacks a pipeline to develop new technicians to respond to the impact on operations of retirements, attrition, and the implementation of midterm NextGen capabilities. Officials noted that new technicians are brought in only as others retire or leave the agency; however, this strategy does not factor in how long it takes new technicians to become fully certified and acquire skills and abilities on a par with those of the retiring technicians. A pipeline approach to workforce planning, which would create a steady flow of trained technicians with some on-the-job experience to replace experienced technicians as they retire, would help to alleviate the pressures resulting from FAA’s current approach. In all of the focus groups we conducted, participants raised concerns about this aspect of FAA’s

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workforce planning, noting that when an experienced technician trained to work on multiple systems is replaced by a new technician trainee, the new technician cannot fully replace the original employee for years, placing a burden on other technicians at the facility as well as the training program. FAA officials acknowledged that it can take 2 to 3 years for new technicians to attain the skills and abilities of more experienced technicians. According to FAA's analysis, 686 full-performance-level technicians with multiple certifications will be eligible to retire by the end of fiscal year 2011. (These retirements will also have an impact on training, as discussed later in this report.)

The expected increase in retirements could also affect FAA's implementation of midterm NextGen capabilities, scheduled for completion by 2018. Currently FAA plans to implement ERAM by 2011 and the initial segments of several other systems—including SWIM and DataComm—by fiscal year 2016, as well as continue to operate its legacy equipment. With both legacy and new systems to maintain, technicians could have more varied, if not more, responsibilities and therefore need a wider range of skills, further highlighting the importance of succession planning. FAA needs to continue to plan for these issues so that it can minimize the operational impact of projected retirements.

FAA plans to rely on hiring and training to address gaps between the skills and competencies that its technicians currently have and those that they will need in the future. Senior FAA officials recognize that, as NextGen technologies are introduced, technicians will need very broad, and perhaps difficult-to-find, skill sets that will allow them to maintain both old and new air traffic control technologies. According to ATO's strategic human capital planning document, technicians will continue to need the majority of their current skills to maintain legacy systems, and they will need to enhance many of these skills to maintain new computer networks and automated software tools. ATO's planning document identifies timely new hire selections and technical training as integral to maintaining and acquiring the correct knowledge and skill base for FAA's technician workforce. Moreover, the document states, technicians will need a full set of technical, business, and leadership skills to be successful in a rapidly changing environment. As the rate of technological change increases, it will be an ongoing challenge for ATO to acquire and maintain a technically current workforce able to integrate new technologies and respond effectively to changes in technology, as well as maintain legacy technologies. Additionally, to meet this challenge, FAA will have to address new and expanded training requirements and deliver that training in a cost-efficient and timely manner.

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FAA does not have a staffing model for technicians, and senior officials told us that FAA is currently not sure how many technicians are and will be needed to maintain the national airspace system. This uncertainty limits FAA's ability to plan strategically for the technician workforce. Senior FAA officials confirmed that there is no staffing standard for technicians. They noted that previous efforts to develop a staffing model for technicians were not completed because of too many variables and that FAA has not yet identified staffing requirements for the technician workforce. Those officials pointed to the technicians' union contract as the primary factor affecting FAA's annual technician staff planning process. They explained that the 6,100 staffing minimum established by the PASS contract was negotiated and is not based on equipment inventory or maintenance requirements. They further noted that this contractual staffing minimum has deterred FAA from implementing staffing requirements for the technician workforce. The 2000 contract has not been renegotiated since it expired in 2005; however, as of April 2010, the parties were reportedly discussing a return to the negotiating table.

Although the negotiated minimum staffing level may preclude changes below that level, it does not prevent FAA from examining the numbers of staff and the skills required for its technician workforce now and in the future. According to the Vice President of Technical Operations Services, FAA may require more technicians in the future to adequately maintain both legacy and NextGen systems. Conversely, FAA may require fewer technicians because of the digital nature of the new equipment and different maintenance approaches, such as reliability-centered maintenance. FAA recently hired staff to begin collaboratively developing an accurate, requirements-based predictive staffing model. A senior FAA official suggested that FAA will look at various NextGen planning documents to determine new maintenance requirements. FAA also plans to look at near-term system deployments and new system requirements to determine the short-term maintenance requirements for NextGen systems. Senior FAA officials said that FAA will not be taking as much equipment out of the national airspace system as previously thought; systems that were originally planned to be decommissioned are still in service and are expected to remain in service indefinitely. These officials further noted that the maintenance process requires administrative and business management personnel as well as technicians, and the staffing model will therefore identify and incorporate nontechnical as well as technical positions. The FAA Reauthorization Bill of 2009 contains a provision that would require the National Academy of Sciences to study the assumptions and methods FAA uses to estimate staffing needs for its technicians to ensure proper maintenance and certification of the national airspace

system.<sup>9</sup> If enacted, this provision could help address FAA’s staffing approach.

**FAA Has Taken Actions to Streamline the Technician Hiring Process, but May Need to Do More to Develop the Capacity Needed for NextGen**

According to our analysis, FAA has mostly developed the capacity needed to address requirements important to support its technician workforce planning strategies. (See table 9.)

**Table 9: Extent to Which FAA’s Technician Workforce Planning Follows Key Leading Practices in the Area of Supporting Capacity**

Key leading practices in strategic workforce planning	Does FAA follow?
<b>Support capacity:</b> build the capacity needed to address administrative, educational, and other requirements important to support workforce planning strategies	
• Educate managers and employees on the availability and use of flexibilities	Mostly
• Build transparency and accountability into the system	Partially
• Streamline and improve administrative processes	Mostly

Sources: [GAO-04-39](#) and GAO analysis of FAA practices.

FAA has taken steps to educate managers and employees on the availability and use of hiring flexibilities. For example, FAA provides managers with guidance on special appointing authorities, such as “on-the-spot” hiring and recruitment and retention incentives.<sup>10</sup> Moreover, FAA’s guidance for using specific hiring flexibilities provides clear and transparent rules to help ensure that managers and supervisors make fair and effective use of the flexibilities, further addressing this leading practice.

<sup>9</sup>FAA Reauthorization Act of 2009, H.R. 915, 111th Cong., § 708(b)(1). See also FAA Air Transportation Modernization and Safety Improvement Act, S. 1451, 111th Cong., § 708(b) (2010) as reported in the Senate.

<sup>10</sup>According to FAA, recruitment incentives may be used when, for a prolonged period, the agency has had extreme difficulty attracting an adequate number of candidates, or when incentives are necessary to attract candidates with unique competencies critical to an important agency mission. Retention incentives may be paid to current employees when they possess unique qualifications or their services meet a special agency need, making it essential to retain them, and the agency has determined they are likely to leave the federal service if they do not receive a retention incentive.

FAA has streamlined its process for hiring technicians, further building the capacity to support its workforce planning strategies. For example, FAA uses a Web-based automated rating and ranking system for screening applicants and making candidate selections for technician vacancies. According to FAA, it has created efficiencies in the hiring process for technicians by centralizing this function in Oklahoma City, Oklahoma, much as it has done to streamline its hiring of air traffic controllers. Additionally, according to FAA, it has the ability to expand the use of temporary pre-employment clearance processing centers to include technicians. These centers provide a centralized interview site and “one-stop” service for potential new hires, and their use can significantly shorten the hiring process, which can take up to 6 months, thus allowing FAA to get qualified applicants into academy training sooner. Managers at one location we visited nevertheless stated that, although management tries to hire and train new technicians as quickly as possible, the process takes time and is still too slow.

For the transition to NextGen, FAA has acknowledged that a new generation of personnel selection procedures may be needed. According to FAA, the next generation of selection procedures should be developed in parallel with the operational evolution of the national airspace system. Identifying those future requirements will be part of the agency’s overall strategic workforce planning effort, requiring the continued development and validation of a methodology for identifying gaps between current and future knowledge, skills, and abilities, and staffing profiles in safety-critical occupations.

**FAA Has Some Initiatives to Monitor and Evaluate Progress in Technician Workforce Planning Efforts**

FAA has partially implemented initiatives—such as developing strategic human capital goals and analyzing attrition—to monitor and evaluate its progress in workforce planning for technicians, but it does not have measures to evaluate the contribution that its technician human capital strategies have made toward achieving programmatic results. (See table 10.)

**Table 10: Extent to Which FAA’s Technician Workforce Planning Follows a Key Leading Practice in the Area of Evaluation**

Key leading practice in strategic workforce planning	Does FAA follow?
<b>Evaluation:</b> monitor and evaluate the agency’s progress toward its human capital goals and the contribution that human capital efforts have made toward achieving programmatic results	Partially

Sources: [GAO-04-39](#) and GAO analysis of FAA practices.



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FAA has put monitoring and evaluation initiatives in place to assess progress toward its human capital goals for technicians, such as its hiring, training, and retention goals. These initiatives are consistent with the practices of leading organizations and provide information for oversight by identifying performance shortfalls and options for corrective action. For example, FAA has a strategic initiative with activity targets and milestones in its human resource business plan to improve its external recruiting for several occupations, including technicians, and it has met these targets and milestones. FAA, as discussed earlier, also has completed an attrition analysis of its technical operations workforce, which includes technicians—an important step in identifying and addressing staffing goals. FAA plans to use this analysis to understand the unique characteristics of employee subgroups, including technicians, in an effort to better forecast specific staffing turnover and anticipate needs for new hires.

However, FAA needs to better link its human capital strategies and programmatic results to evaluate the contribution that technician human capital strategies have had on program results. As noted above, the agency has just begun to identify—and has no strategy to help ensure its technicians will have—the skills and competencies needed to maintain NextGen systems; linking FAA’s human capital strategies for the technician workforce to that workforce’s responsibilities in the transition to NextGen will be critical as the transformation proceeds. For example, a workforce plan can include measures that indicate whether the agency executed its hiring, training, or retention strategies as intended and achieved the goals for these strategies, and how these initiatives changed the workforce’s skills and competencies. It can also include additional measures that address whether the agency achieved its program goals and the link between human capital and program results. Without periodic measurement of the extent to which human capital activities contributed to achieving programmatic goals, FAA lacks information for identifying performance shortfalls and appropriate corrective actions for effective oversight.

**FAA Has Involved Management, but not Technicians, in Workforce Planning, Potentially Missing Opportunities to Improve Its Human Capital Strategies**

FAA involves top management, but minimally involves technicians, in developing, communicating, and implementing workforce planning strategies. (See table 11.)

**Table 11: Extent to Which FAA’s Technician Workforce Planning Follows Key Leading Practices in the Area of Stakeholder Involvement**

Key leading practices in strategic workforce planning	Does FAA follow?
<b>Stakeholder involvement:</b> involve top management, employees, and other stakeholders in developing, communicating, and implementing workforce planning strategies	
• Ensure that top management sets the overall direction and goals of workforce planning	Mostly
• Involve employees and other stakeholders in developing and implementing future workforce strategies	Minimally
• Establish a communication strategy to create shared expectations, promote transparency, and report progress	Minimally

Sources: GAO-04-39 and GAO analysis of FAA practices.

Consistent with a key leading practice, top management at FAA sets the overall direction and goals of workforce planning. More specifically, top FAA management, including resource management groups and service area directors, conducts FAA’s annual technician staff planning process, as discussed previously in this report. The resource management groups—ad hoc panels of district managers and representatives from administrative services and business services—make recommendations several times annually on the distribution of personnel and funding. The director of each of three service areas nationwide takes the recommendation made by that service area’s resource management group and, in conjunction with the area’s first-line managers, makes staffing allocation decisions.

While FAA has involved top management in developing and implementing workforce strategies, it has not involved technicians, notwithstanding a key leading practice calling for the involvement of employees and other stakeholders. The Vice President of Technical Operations Services, who is responsible for technician workforce planning, told us that technicians have not been included in any technician workforce planning efforts. The president of PASS and participants in all 12 focus groups we held also said that technicians had not been involved in workforce planning activities. By not involving employees in strategic workforce planning efforts, FAA may

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miss opportunities to develop new synergies and ways to streamline processes and improve human capital strategies.

FAA does not have a workforce planning communication strategy, a key practice designed to create shared expectations, promote transparency, and report progress. FAA has a strategic workforce plan for ATO, but it does not have one specifically for the technician workforce, although ATO has designated the technician workforce as mission-critical. In contrast, FAA does have a strategic workforce plan for nearly 16,000 air traffic controllers, another mission-critical workforce within ATO, and the only group of FAA employees larger than the technicians. Previous workforce planning documents for the technicians—including the National Airspace System Maintenance Workforce Plan, issued in July 2008—either primarily emphasized training or were never implemented. According to FAA officials, Technical Operations is in the process of collaboratively developing an accurate predictive staffing model, a draft of which will be completed in about another year. Without a final and public technician workforce plan, FAA’s approach to communicating about technician workforce planning has limited potential to create shared expectations, promote transparency, and report progress.

The technicians we spoke with described what they perceived as a lack of management communication and support in the area of planning. They raised concerns about how FAA plans for and communicates staffing and planning decisions. Negative morale, stemming from such concerns over management support and planning, could adversely affect FAA’s hiring and retention of technicians in the future. We have reported previously that FAA’s consistent ranking near the bottom in published lists of best places to work in the federal government (viewed as an indicator of employee morale) could pose challenges in recruiting, motivating, and retaining employees to replace those retiring and to meet current and future mission requirements.<sup>11</sup>

The PASS union president also expressed concerns about FAA’s communication of information on policy changes and new technologies throughout the agency. He stated that technical bulletins come from other organizations but not from Technical Operations and that FAA does not

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<sup>11</sup>GAO, *Federal Aviation Administration: Human Capital System Incorporates Many Leading Practices, but Improving Employee’s Satisfaction with Their Workplace Remains a Challenge*, GAO-10-89 (Washington, D.C.: Oct. 28, 2009).

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coordinate among the lines of business, resulting in a “stovepipe effect.” He suggested that FAA dedicate a person as a conduit for communication to help ensure that information gets passed along, which would help improve morale. In January 2010, PASS and Technical Operations management developed the Joint Leadership Team as a joint effort to rebuild their relationship and improve communication and collaboration. As part of this effort, through a contractor, PASS and Technical Operations management have conducted focus groups with employees, including management, to identify areas of concern that might affect employee morale. PASS and Technical Operations management plan to survey field technicians in the next few months to help identify opportunities to collaboratively address issues.

One way to address leading organizations’ key practices in the area of stakeholder involvement is to develop comprehensive workforce planning strategy documents, such as a workforce plan or policy statement, that reflect the human capital needs of an organization, any new initiatives or refinements to existing human capital approaches, and data on the organization’s workforce profile. Without a written workforce planning strategy, a staffing model, and a more strategic approach, including succession planning issues related to developing new technicians when experienced technicians leave, FAA lacks a fully considered analysis of the appropriate number and composition of its technician workforce, and it may not be able to meet future maintenance demands. Moreover, as FAA transitions from legacy to NextGen systems, it risks having too many technicians with legacy skills and not enough with NextGen skills. As this transition occurs, strategic plans for identifying and responding to changes in needed competencies and potential gaps in knowledge and skills will be critical to ensure that FAA acquires or develops the needed human capital resources and makes full and efficient use of them.

## FAA’s Ability to Plan for Technician Training Is Limited by Shortfalls in Its Workforce Planning and Identification of Needed Skills and Competencies

FAA at least partially follows key practices of leading organizations in its training and development for technicians.<sup>12</sup> Table 12 presents our analysis of the extent to which FAA has incorporated these key practices.

**Table 12: Extent to Which FAA’s Technician Training and Development Efforts Follow Key Leading Practices**

Key leading practices in strategic training and development	Does FAA follow?
<b>Planning:</b> develop a strategic approach that establishes priorities and leverages investments in training and development to achieve agency results	Partially
<b>Design and development:</b> identify specific training and development initiatives that, in conjunction with other strategies, improve individual and agency performance	Mostly
<b>Implementation:</b> ensure effective and efficient delivery of training and development opportunities in an environment that supports learning and change	Partially
<b>Evaluation:</b> for all three above practices: Demonstrate how training and development efforts contribute to improved performance and results	Partially

Sources: [GAO-04-546G](#) and GAO analysis of FAA practices.

## FAA Is Identifying Annual Training Goals but Needs to Identify Strategic Training Goals and Those Skills and Competencies Needed to Meet Such Goals

FAA has partially implemented initiatives—such as establishing annual training goals and incorporating employees’ developmental goals—to plan for strategic training and development of its technicians. (See table 13.)

<sup>12</sup>Strategic training and development focuses on four key components—planning, design and development, implementation, and evaluation. Drawing on our previous work, we selected key leading practices most related to FAA’s technician workforce. See [GAO-04-546G](#).

**Table 13: Extent to Which FAA’s Technician Training and Development Efforts Follow Key Leading Practices for Planning**

Key leading practices in strategic training and development	Does FAA follow?
<b>Planning:</b> develop a strategic approach that establishes priorities and leverages investments in training and development to achieve agency results	
• Establishes training goals and related performance measures that are consistent with the agency’s overall mission, goals, and culture	Partially
• Determines the skills and competencies its workforce needs to achieve current, emerging, and future agency goals and missions and identify gaps, including those that training and development strategies can help address	Partially
• Identifies the appropriate level of investment to provide for training and development efforts and prioritizes funding so that the most important training needs are addressed first	Partially
• Incorporates employees’ developmental goals in its planning processes	Partially

Sources: [GAO-04-54G](#) and GAO analysis of FAA practices.

FAA is taking action to ensure that its training goals are consistent with its overall mission, goals, and culture in that it plans to train annually at least the minimum number of technicians that it believes it needs to maintain air traffic management facilities; however, FAA has not identified future training needs beyond the annual cycle and has only just begun to determine the critical skills and competencies that it will need to maintain NextGen systems. In previous work, we have found that accountability mechanisms, such as an active training oversight committee and effective performance management systems, can help to ensure that sufficient attention is paid to planning for training and development needs and that those planning efforts are consistent with an agency’s mission, goals, and culture.<sup>13</sup> Line managers and supervisors can ensure that employees’ training goals are consistent with the agency’s overall mission and goals by keeping this alignment in mind as they work with employees to set training goals and approve employees’ training requests. For approximately the last 5 years, FAA has maintained a Technical Training Advisory Council, which includes training program support staff, a supervisory committee consisting of technician line managers, and representatives of three ATO service centers.<sup>14</sup> The council meets in person four times a year and has a monthly teleconference to provide training feedback to ATO Technical Training and review the agency’s

<sup>13</sup> [GAO-04-546G](#).

<sup>14</sup> The service centers, located in Atlanta, Fort Worth, and Seattle, provide shared services that promote standardization between Technical Operations and ATO’s three other service units, En Route, Terminal, and System Operations. The service centers are also an ATO contact point for other FAA organizations.

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training needs and goals. However, the president of PASS told us the union had not been approached in recent years to provide input into training planning and is not represented on the council. FAA training officials told us, and the PASS president confirmed, that the union provided a technician to work in Technical Operations Training to assist with training coordination between the two organizations through December 2009.

As discussed earlier in this report, FAA has begun to determine the critical skills and competencies that it will need to maintain NextGen systems; however, FAA officials stated that the agency has never previously had a robust competency model for technician training. With the transition to NextGen, technicians' training requirements—and thus critical skills and competencies—will increase, since technicians will have to learn how to maintain the new systems while remaining proficient in maintaining the legacy systems that FAA plans to continue operating indefinitely. The recent assignment of a staff member dedicated to compile technician job descriptions, tasks, and training courses for Technical Operations Training supports this effort to develop a skills and competency model. Technical Operations Training does not have a formal process to identify future needed skills and competencies beyond those that will be required to maintain new systems that are turned over in the near term from system program offices, and it lacks a strategic training plan or other document that presents a business case for proposed investments in training and development. When assessing investment opportunities for its training plan, an agency ought to consider the competing demands it faces, the resources available to it, and how those demands can best be met with available resources. Because FAA has not developed a longer-term strategic plan to prepare for impending retirements and determine how many technicians it will need to replace those who retire, the agency cannot determine how many technicians it will need to train in the future and what certifications will need to be replaced. For example, as mentioned earlier in this report, 686 full-performance-level technicians with multiple certifications will be eligible to retire by the end of fiscal year 2011, and those that do retire will be replaced by new technicians who might not acquire those skills and abilities for 2 to 3 years.

While FAA has a well-established process to identify current training and development needs annually and to prioritize training funds annually, its ability to plan longer-term training and funding is limited by Technical Operations Training's dependency on receiving timely and accurate planning information on FAA systems from the agency's individual program offices and NextGen office. Technical Operations Training officials told us they identify future training needs through coordination

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with the system program offices and independently monitor the status of new systems coming into the FAA inventory by reviewing the agency's Capital Investment Plan (CIP) to see when Technical Operations Training should start planning for training.<sup>15</sup> However, opportunities for coordination with the program offices have decreased with recent organizational changes, according to FAA Academy officials. Formerly, the program offices initially coordinated the contracts for new systems and equipment, and the academy could work with the program offices to develop training while the contracts were being negotiated. Now, however, responsibilities for the contracts have been consolidated within FAA's acquisition management offices, and there is less coordination between the academy and the program offices. Academy officials recognize that training development and funding for that training must await equipment development, but they stated that coordination during the contracting and development process would be extremely beneficial.

To incorporate employees' developmental goals into the planning process, employees develop their course requests annually, in conjunction with their managers. The agency uses individual development plans to identify specific developmental needs and areas for further enrichment for each employee. Technical Operations Training officials stated that they do not solicit additional input for training planning and development from technicians themselves because the line managers are the best source of information on training needs for their facilities.

Technicians in our focus groups told us they have had some difficulty obtaining the training they need for several reasons. First, they said, some courses on legacy systems needed for advancement have not been available at the academy. Technical Operations Training officials acknowledged that some academy courses on legacy systems were prematurely canceled because their subject matter was incorporated in course offerings for new systems, and then these new courses were postponed because of delays in rolling out the new systems. For example, plans for deploying ERAM led Technical Operations Training to cancel the training on two legacy systems that ERAM incorporates—En Route

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<sup>15</sup>The FAA Capital Investment Plan is a 5-year plan that describes national airspace system modernization projects and lists the activities FAA intends to accomplish during that period. The CIP contains both projects that modernize existing systems and projects that begin the transformation to NextGen. It also contains road maps that show FAA's timetable for introducing new technologies to achieve the planned NextGen capabilities and capacity increases. The CIP for fiscal years 2011 through 2015 was released in February 2010.



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Communications Gateway and the Display System Replacement—but then ERAM’s deployment was delayed, and no courses were available on the two legacy systems. Second, technicians said, the recent declines in technician staffing and a reduction in periodic maintenance under the reliability-centered maintenance approach have limited their ability to become familiar with new systems and acquire timely on-the-job training, as well as maintain proficiency in areas where they have already received training or gained experience. Finally, technicians told us, they often did not receive approval to attend the courses they have requested as a priority to meet their developmental needs. FAA officials stated that training requests are filled according to a facility’s priority, which is determined through a number of factors, such as the minimum number of trained people it takes to maintain the facility, the size of the airport where the equipment is maintained, or the amount of equipment at a facility that is operationally essential to maintain air traffic control. When a facility receives approval for a technician to attend a course and the technician then cannot attend, Technical Operations Training prioritizes the remaining requests to determine which technician from which facility should go instead. FAA officials estimate that, on average, 98 percent of operationally essential training requests in recent years have been met. For example, in fiscal year 2009, there were 5,100 requests for training, and 5,100 slots were provided. However, academy officials estimated that 50 to 70 percent of the courses are not filled to capacity. As mentioned below, technicians are not able to attend all training classes they receive approval to attend because of workforce staffing issues at their facility.

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### FAA Is Still Developing a Mix of Centralized and Decentralized Approaches for Technician Training

According to our analysis, FAA has mostly developed the capacity to identify design and development initiatives to improve individual and agency performance. (See table 14.)

**Table 14: Extent to Which FAA’s Technician Training and Development Efforts Follow Key Leading Practices for Design and Development**

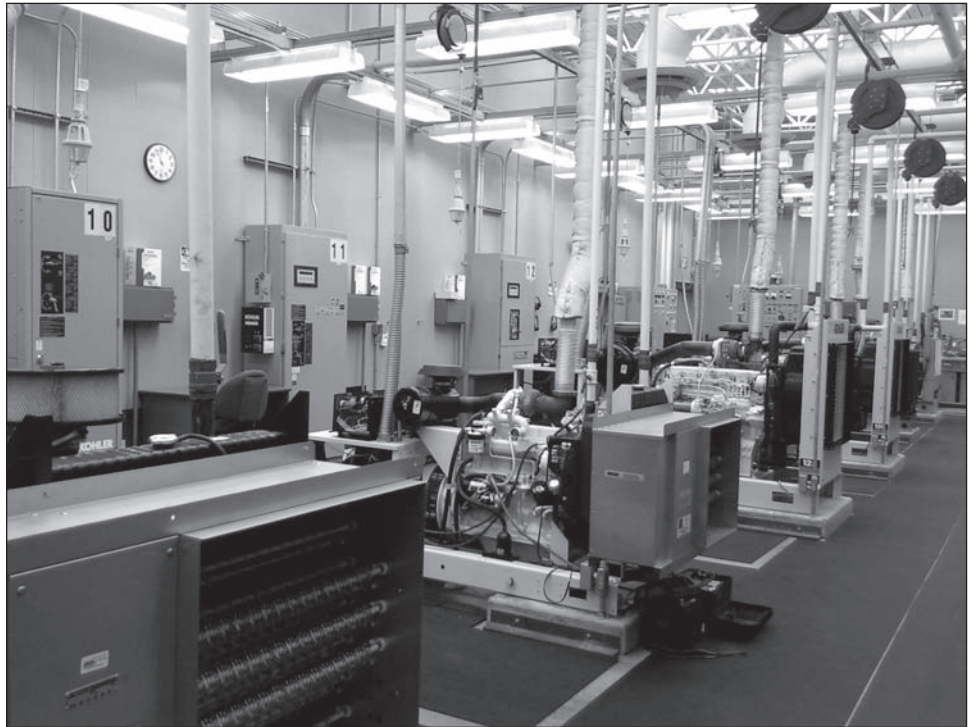
Key leading practices in strategic training and development	Does FAA follow?
<b>Design and development:</b> identify specific training and development initiatives that, in conjunction with other strategies, improve individual and agency performance	
• Uses the most appropriate mix of centralized and decentralized approaches for its training and development programs	Partially
• Uses criteria to determine whether to design training and development programs in-house or obtain these services from a contractor or other external source	Mostly
• Compares the merits of different delivery mechanisms (such as classroom or computer-based training) and determines what mix of mechanisms to use to ensure efficient and cost-effective delivery	Mostly

Sources: [GAO-04-54G](#) and GAO analysis of FAA practices.

FAA offers a mix of in-residence, centralized training at the academy and external, decentralized training at various locations provided by vendors whose equipment FAA has purchased. Training at the academy focuses on legacy equipment, while vendor courses are the primary source of training for next-generation systems coming into the FAA inventory.

FAA is limited in its choice of training delivery mechanisms because of the unique and complex nature of air traffic control system components. For example, the unique configurations of and modifications to FAA generators make it difficult to replicate their features and teach technicians how to maintain them at a field office or vendor location rather than at the academy, according to academy officials. (Fig. 6 illustrates the variety of generators available in the training classroom at the FAA Academy.) Overall, technicians in our focus groups maintained that, compared with the training offered at the academy, vendor training was less informative and more conceptual, offered less hands-on and problem-solving instruction, and was limited by proprietary considerations that restricted students’ access to some information. Additionally, they said, vendors could not teach FAA-specific safety issues or explain how their systems interacted with other components of air traffic management systems.

**Figure 6: Generator Training Classroom at the FAA Academy**



Source: GAO.

No vendor courses have been approved to replace academy training for legacy courses, although Technical Operations Training is studying the feasibility of having vendors provide certain courses that are currently offered through the academy and are filled to capacity. For example, evaluations are under way to determine if the engine generator courses can be taught by approved colleges and universities. In deciding how to provide these courses, FAA is considering capacity, quality, and cost criteria. Specifically, FAA is assessing whether (1) the academy courses have a sufficient number of seats to fulfill the training requests; (2) the replacement courses meet FAA's standards for training in the applicable subject areas; and (3) how the costs of academy training would compare with the costs of tuition, a per diem allowance, and travel for training at a local junior college. Technical Operations Training officials told us they will need to make a business case to ATO management that there will be cost savings from college training as well as demonstrate that the technicians' training needs can be met with that approach.

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FAA is also comparing the merits of different training delivery mechanisms, such as computer-based simulation training, but had adopted no such mechanisms as of April 2010. Some technicians told us that emerging FAA maintenance policies limit hands-on interaction with systems and that the combination of these policies and modifications to equipment over time make the technicians feel they are no longer qualified to work on certain systems. For example, some technicians stated that because they have been away from training for so long, they are unable to apply their now-dated knowledge and skill when doing their work. Others stated that preventive maintenance checks served as critical refresher training and familiarization tools, and they raised concerns about the effects on their proficiency of less frequent preventive maintenance checks resulting from the change in maintenance philosophy. Technicians suggested that different methods, such as the use of simulator training or the addition of detailed visuals or photographs in training and system manuals, would greatly aid their job knowledge in lieu of the reduced hands-on training. Technical Operations Training officials said they were aware of this issue and intend to evaluate additional methods for technicians to maintain proficiency, including the use of online videos for specific pieces of equipment.

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**Funding and Workload  
Issues Limit FAA's Ability  
to Implement Training and  
Development  
Opportunities**

FAA has partially implemented practices—such as adjusting work schedules so that employees can participate in developmental activities and taking actions to foster an environment conducive to effective training and development—when implementing training and development for technicians. (See table 15.)

**Table 15: Extent to Which FAA’s Technician Training and Development Efforts Follow Key Leading Practices for Implementation**

Key leading practices in strategic training and development	Does FAA follow?
<b>Implementation:</b> ensure effective and efficient delivery of training and development opportunities in an environment that supports learning and change	
• Communicates the importance of training and developing employees, and their expectations for training and development programs to achieve results	Partially
• Provides consideration for options to pay for employee training and development and adjusts employee work schedules so that employees can participate in these developmental activities	Partially
• Takes actions to foster an environment conducive to effective training and development and encourages employees to buy into the goals of training and development efforts, so that they participate fully and apply new knowledge and skills when doing their work	Partially

Sources: [GAO-04-546G](#) and GAO analysis of FAA practices.

FAA provides information on training opportunities to technicians but does not communicate the importance of training and development and its expectations for technicians in those areas. FAA publicizes training information through its comprehensive Web site, known as the FAA Information Superhighway for Training (FIST). FIST contains training and certification program information from Technical Operations Training, including policies and procedures, forms, course descriptions, and examinations. However, FAA does not use established mechanisms or written plans to communicate either the importance of training and development for technicians or its expectations for technician training and development programs to achieve results. As previously noted, FAA does not have a strategic training plan for technicians, and the agency has not included any expectations for, or discussion of, technician training and development needs in its planning document for NextGen, the March 2010 NextGen Implementation Plan.

FAA is limited in the options it can consider for paying for employee training and development to academy-provided training and vendor-provided training, primarily because of the unique training requirements of technicians. In addition, technicians’ workloads limit FAA’s ability to adjust their schedules for training. Technicians told us their high workload and a lack of staff to cover the work in their absence impedes their ability to take time from their positions to obtain training. Technical Operations Training officials confirmed that three to four times a week, on average, technicians who have requested and received approval to attend training have not been able to do so because of staffing issues at their facilities. In an effort to enhance training, increase technician proficiency, and avoid burdening technicians in the field while other technicians are in training, officials told us that they have been working to shorten the training time

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for certain technician courses by adjusting training methods and enhancing demonstrations of proficiency at the academy. In the case of one course, these efforts reduced the average time for certification from 240 days in fiscal year 2005 to 59 days in June 2007.

FAA does not consistently foster an environment conducive to Technical Operations Training's efforts to train and develop employees so that they can participate fully and apply new knowledge and skills when doing their work. For example, training is not always timed to coincide with the introduction of new systems. Technicians told us that they received training on ERAM—a foundation system for NextGen and one of the most recent additions to the technician curriculum—over 2 years ago, but the system has yet to come on line. FAA training officials confirmed that because of delays in the implementation of ERAM, some technicians were trained months and even years ago and have not touched the equipment since. As a result, Technical Operations Training is concerned about technicians' proficiency and is evaluating the need to retrain some staff on ERAM.

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**FAA Has a Formal Class Evaluation Process in Place but Needs to Incorporate Performance Data and Technician Feedback in Assessing the Impact of Training on Performance**

FAA has partially implemented practices—such as using some types of performance data to assess the results achieved and incorporating certain feedback perspectives—for evaluating its training and development of technicians. (See table 16.)

**Table 16: Extent to Which FAA’s Technician Training and Development Efforts Follow Key Leading Practices for Evaluation**

Key leading practices for strategic training and development	Does FAA follow?
<b>Evaluation:</b> demonstrate how training and development efforts contribute to improved performance and results for planning, designing, and implementing training	
• Systematically plans for and evaluates the effectiveness of its training and development efforts	Mostly
• Uses performance data (including qualitative and quantitative measures) to assess the results achieved through training and development efforts	Partially
• Incorporates evaluation feedback into the planning, design, and implementation of training and development efforts; and different perspectives (including those of line managers and staff, customers, and experts) in assessing the impact of training on performance	Partially

Sources: GAO-04-546G and GAO analysis of FAA practices.

Technical Operations Training has a formal evaluation program in place and amends the training or makes recommendations based on trends observed in student evaluations. For example, student critiques of ERAM training revealed that students had problems making the connection between academy equipment used in ERAM training and the actual equipment installed at their facilities. As a result, training officials recently identified a need to have training systems installed at the academy that would replicate the fielded systems whenever possible. Technical Operations Training also completed an audit on all technicians who had been trained in a course designated as a prerequisite to the current ERAM course. Training officials concluded that by the time ERAM was delivered and ready for commissioning, up to 40 percent of the technicians who had completed the prerequisite training could have left the technician workforce and thus a new developmental course would be needed.

FAA partially uses quantitative or qualitative measures to assess technician training results by using end-of-course evaluations and follow-on evaluations, as discussed below. Successful organizations typically develop and implement human capital approaches based on a thorough assessment of their specific needs and capabilities. To assess the results achieved through training and development, agencies can rely on hard (quantitative) data, such as indicators of productivity or output, quality, costs, and time, or soft (qualitative) data, such as feedback on how well a training program met employees’ expectations. While technicians provide feedback after completing a course, as discussed below, the additional use of quantitative data could help strengthen the linkages between training and development programs and improved performance.

FAA evaluates the effectiveness of its training efforts and incorporates formal evaluation feedback into the implementation of its training efforts, but it does not solicit or incorporate feedback from personnel other than

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line managers into its planning and design of technician training. Technicians are required to complete an evaluation for any course they attend before they can graduate from and become certified in that course. Additional evaluations go out 3 to 6 months after graduation to both the technicians and their supervisors for additional feedback. Technical Operations Training officials stated that the line managers who oversee the technicians, not the technicians themselves, are the critical training customers because the line managers are the best source of information on training needs for their facilities. FAA officials meet with these line managers to obtain training feedback through an FAA council that meets four times a year. However, to the extent possible, agencies need to ensure that they incorporate a wide variety of stakeholder perspectives in assessing the impact of training on employee and agency performance, including the receptiveness to and use of results from employees' feedback on developmental needs. Senior FAA training officials recognized they needed to develop additional measures to address supervisory feedback and opinions on training and stated that FAA will be developing additional measures to address these issues in the future.

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Certain Academy  
Training Costs Have  
Been Roughly Stable,  
while Those Vendor  
Training Costs That  
FAA Can Identify  
Have Risen with the  
Rollout of Courses for  
New Equipment



**Instructor Costs of Academy Training on Established Equipment Have Remained Stable, but Student Travel Costs Have Increased**

In the past few years, the academy has provided hundreds of training classes to thousands of FAA technicians. These courses are taught both by academy staff and by contractors hired to assist with instruction. The costs that FAA identified for academy training include those for instructor services and those for student travel to and from the academy in Oklahoma City.<sup>16</sup> As shown in table 17, the number of technicians who received training each year from fiscal year 2006 through fiscal year 2009 fluctuated, while the number of instructors providing that training declined slightly. Despite the small decline in the number of instructors, the cost for instructor services rose slightly over the 4 years, likely because of increases in the cost of salaries, benefits, and contractor fees. Overall, the data indicate that the instructor-based cost for academy training has remained fairly stable over the 4-year period, a result consistent with the relatively stable need for instructors.

**Table 17: Compensation-Related Academy Training Costs, Fiscal Years 2006 through 2009**

Fiscal year	Number of classes	Number of students	Number of academy instructors	Number of contractor instructors	Cost for academy instructors in millions of dollars <sup>a</sup>
2006	593	4,996	157	29	\$23.9
2007	704	4,981	151	19	23.9
2008	739	6,187	146	31	23.6
2009	768	5,644	146	32	\$24.7

Source: FAA.

<sup>a</sup>Costs for academy instruction include both personnel compensation and benefits (PC&B) for academy staff and payments for contract instructors. These are current dollars and are not adjusted for inflation.

Table 18 shows travel costs during the same 4 years for the students who attended academy courses. The total annual travel costs went up 34 percent from fiscal year 2006 through fiscal year 2009. During that period, the number of students attending training also rose, resulting in an 18 percent increase in the per student trip cost over the 4 years. In addition, according to Bureau of Labor Statistics data, airfares rose about 16

<sup>16</sup>According to FAA, any costs over and above instructor and travel costs for system technician-specific courses cannot be directly attributed to the Technical Operations Training Division of the academy, as this division shares the academy facilities with other FAA training divisions, such as those for air traffic controllers and inspectors.

percent during that period, while hotel fees slightly decreased. Thus, it appears that the increases in the number of students and in airfares likely drove the increases in travel costs.

**Table 18: Travel-Related Academy Training Costs, Fiscal Years 2006 through 2009**

Fiscal year	Total number of students	Cost of student travel to and from academy in millions of dollars <sup>a</sup>	Per student travel cost <sup>a</sup>
2006	4,996	\$12.6	\$2,515
2007	4,981	13.6	2,728
2008	6,187	17.4	2,806
2009	5,644	\$16.8	\$2,984

Source: FAA.

<sup>a</sup>These are current dollars and are not adjusted for inflation.

### Costs of Vendor Training on New Equipment Have Risen Quickly as FAA Prepares to Roll Out NextGen Systems, but FAA Is Unable to Account for Travel Costs Associated with Vendor Training

According to data provided by FAA, costs for vendors to provide training for technicians on new equipment have risen very quickly in the past few years.<sup>17</sup> This increase has been associated with the rollout of new equipment related to the implementation of NextGen, which has created new training needs for technicians. For example, as shown in table 19, the vendor began to offer courses for Digital Audio Legal Recorder (DALR) in 2007 and for ERAM in 2008. During the period of our review, the total number of vendor courses rose from fewer than 100 to over 200. Accordingly, training costs for vendor training have also grown substantially in the past few years. With other NextGen systems poised to go online in the near future, these costs may continue to rise as technicians require further training on other new equipment.

<sup>17</sup>According to an individual identified as a subject matter expert on the agency's cost accounting system, this system is not capable of accumulating costs for vendor training and travel-related activities. Accordingly, we cannot assess the reliability or completeness of the data. FAA's Finance Office confirmed that the cost accounting system does not have the data attributes needed to break out the training and travel costs we requested or to validate the cost information provided to us by training officials.

**Table 19: Cost of Vendor (Out of Agency) Technician Training, Fiscal Years 2005 through 2010**

Fiscal year	Number of students	Number of vendor courses	Number of DALR courses	Number of ERAM courses	Cost of training <sup>a</sup>
2005	247	64	0	0	\$45,508
2006	665	172	0	0	1,121,255
2007	605	130	11	0	1,195,728
2008	818	215	81	6	2,880,911
2009	1,325	308	146	18	5,285,025
2010 <sup>b</sup>	867	210	124	15	\$4,361,698

Source: GAO analysis of FAA data.

Note: Though the cost data are unaudited, at this level of detail we feel these data are adequately reliable for presenting a reasonable estimate of costs for vendor training provided to technicians. See appendix I for more detail.

<sup>a</sup>Cost of training is in addition to that which is included under system support contracts. These are current dollars and are not adjusted for inflation.

<sup>b</sup>Projected.

An FAA employee identified by the agency as a subject matter expert told us the agency’s cost accounting system is unable to accumulate costs for travel to vendor training courses and report trends in those costs because the funds for that travel are derived from multiple sources—including the system program office, a centralized training fund, and in some cases the local facility. FAA is subject to various laws and standards that have an effect on its development and use of cost information, including standards reported in the Statement of Federal Financial Accounting Standards (SFFAS) No. 4, Managerial Cost Accounting Standards and Concepts.<sup>18</sup>

<sup>18</sup>Additionally, the Chief Financial Officers Act of 1990, Pub. L. 101–576, 104 Stat. 2838, applies to the Department of Transportation, of which FAA is a part. 31 U.S.C. § 901(b)(1)(M). The Federal Financial Management Improvement Act of 1996, Pub. L. 104–208, Div. A, Title I, § 806, [Title VIII], 110 Stat. 3009–389, requires, among other things, that agencies covered by 31 U.S.C. § 901(b) have systems that comply substantially with federal accounting standards. One such standard is SFFAS No. 4, which states that essential uses of cost information include controlling costs, measuring performance, evaluating program costs and benefits, and making economic choice decisions. The standard states that costs, regardless of funding source, should be assigned to products or services that the entity provides, and that costs not directly assignable to specific outputs should be assigned on either a cause-and-effect basis or through reasonable allocation. In plain language, the principal purpose of cost accounting is to assess how much it costs to do whatever is being measured, thus allowing agency management, Congress, and others to analyze that cost information when making decisions.

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While SFFAS No. 4 does not specify the programs, services, or activities that federal entities should determine costs for, such as travel for vendor-provided training, the standards focus on developing information to help management and Congress understand the costs of operations and make informed decisions. The standards also provide that often a combination of a cost accounting system and cost finding techniques should be used to provide the cost information that is needed to address specific issues that arise. The lack of cost data available from FAA's cost accounting system or through cost analysis techniques to summarize travel to vendor training courses limits FAA's ability to manage the costs of such travel and evaluate all aspects of technician training costs and benefits. FAA could help provide information that addresses congressional concerns about the cost of in-house and vendor-provided training and of the travel related to those training activities by modifying its cost accounting system or cost finding techniques.

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## Conclusions

Technicians possess unique skills and are critical to the safety and efficiency of the nation's air transportation system, as well as the successful implementation of NextGen. FAA is not fully incorporating key leading practices, such as determining the critical skills and competencies that will be needed to achieve current and future results, in its strategic workforce planning for technicians. FAA does not have a comprehensive, written technician workforce strategy to help it identify and focus on the long-term technician human capital issues with the greatest potential to affect mission results. The lack of a written strategy limits transparency, and thus the ability to evaluate and measure performance, in FAA's workforce planning approach. Such a strategy would include, among other things, approaches to (1) identify the skills and competencies technicians need to address both current and future needs and (2) anticipate attrition and hire technicians with the requisite skills and abilities in time to accomplish agency missions, down to the facility level. FAA's practice of hiring replacements for technicians only after a vacancy occurs leaves the agency vulnerable to skills imbalances, with inexperienced, newly certified technicians replacing seasoned veterans. While the contractual staffing minimum has deterred FAA from developing staffing requirements for the technician workforce, it does not prevent FAA from incorporating leading practices to provide a strategic focus for technician workforce planning. Not having such strategies raises the risk of adverse effects on the safety and efficiency of the nation's air transportation system.

Furthermore, the training that technicians receive could lack prioritization because FAA has not developed a strategic training plan. Such a plan

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would need to be aligned with a written technician workforce planning strategy and should incorporate key leading practices in training and development. Without adequate planning, agencies cannot establish priorities or determine the best ways to leverage investments to improve performance. Additionally, including input into planning for any future NextGen systems training from a wide variety of employees—such as FAA’s NextGen Integration and Implementation Office, ATO’s Technical Operations Training and Development Group, technician supervisors, technical experts, and technicians—could help FAA develop integrated ways to address specific performance gaps or incorporate necessary enhancements in the technician training curriculum. Such an inclusive approach could create opportunities to develop solutions that FAA might otherwise miss. Finally, the lack of cost data to summarize travel to vendor training courses does not allow FAA to fully develop information about the cost of in-house and vendor-provided training and of the travel related to those training activities and therefore limits FAA’s ability to manage travel costs and evaluate all aspects of technician training costs and benefits.

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## Recommendations for Executive Action

To ensure that FAA can hire and retain the technician staff it needs to install, maintain, repair, and certify equipment and facilities in the national airspace system, in the current and NextGen environments, we recommend that the Secretary of Transportation direct the FAA Administrator to take the following four actions:

1. develop and implement a comprehensive, written workforce strategy or policy for the technician workforce that incorporates the key leading practices in strategic workforce planning that FAA has not fully incorporated, such as determining the critical skills and competencies that will be needed to achieve current and future results;
2. develop and implement a strategic training plan that is aligned with a written technician workforce strategy and incorporates key leading practices in training and development that FAA has not fully incorporated, such as determining how training and development efforts are expected to contribute to improved performance and results;
3. improve planning for any future NextGen systems training by including input from FAA’s NextGen Integration and Implementation Office, ATO’s Technical Operations Training and Development Group, technician supervisors, technical experts, and technicians to develop

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an integrated way to address specific performance gaps or incorporate necessary enhancements in the technician training curriculum; and

4. consider modifying FAA's cost accounting system or cost analysis techniques to develop information about the cost of in-house and vendor-provided training and of the travel related to those training activities to assist Congress in understanding the costs of operations and making informed decisions.

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## Agency Comments

We provided the Department of Transportation with a draft of this report for its review and comment. The department provided technical corrections, which we incorporated as appropriate.

We are sending copies of this report to interested congressional committees, the Secretary of Transportation, and the Administrator of the Federal Aviation Administration. In addition, this report will be available at no charge on GAO's Web site at <http://www.gao.gov>.

If you or your staff have any questions or would like to discuss this work, please contact me at (202) 512-2834 or [dillingham@gao.gov](mailto:dillingham@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Individuals making key contributions to this report are listed in appendix III.

Sincerely yours,



Gerald L. Dillingham, Ph.D.  
Director, Physical Infrastructure Issues

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# Appendix I: Objectives, Scope, and Methodology

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This report addresses the Federal Aviation Administration's (FAA) processes for carrying out workforce planning and training for the agency's technician workforce. It describes the processes and discusses the extent to which FAA's efforts incorporate key leading practices in workforce planning and training and how the costs of technician training, including travel costs, have changed in recent years. Specifically, we addressed the following questions: (1) To what extent does FAA incorporate key practices of leading organizations in its workforce planning for technicians? (2) How does FAA's technician training compare with key practices of leading organizations? (3) How have the costs of technician training, including travel costs, changed in recent years?

To describe the composition of FAA's technician workforce, we obtained information on its nature and scope, including job descriptions and job series information; the current, historical, and projected population of technicians; hiring trends; the current and projected numbers of technicians eligible to retire; the number of technicians who retire when eligible; and data on the geographic locations of work stations. We summarized FAA and federal personnel data from the Office of Personnel Management's Central Personnel Data File (CPDF) on the technician workforce and developed trends in staffing and attrition for fiscal years 1999 through 2009, as well as retirement projections through fiscal year 2020. We assessed the reliability of the CPDF data by reviewing related documentation and determined that those data were of sufficient quality to be used for the purposes of this report. We focused on the technicians in the 2101 job series because (1) according to FAA data about the technician workforce, the majority of technicians are in the 2101 job series and (2) the FAA reauthorization bill refers to systems specialists, the employees included in the 2101 job series.<sup>1</sup>

To determine the extent to which FAA has incorporated key practices of leading organizations in its workforce planning and training for technicians, we sought to compare FAA's efforts with those of leading organizations. We selected key leading practices in these areas by reviewing, in conjunction with subject matter experts, our past work to identify those most applicable.<sup>2</sup> To determine how FAA's technician-

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<sup>1</sup>FAA Reauthorization Act of 2009, H.R. 915, 111th Cong., § 708(b)(1). See also FAA Air Transportation Modernization and Safety Improvement Act, S. 1451, 111th Cong., § 708(b) (2010) as reported in the Senate.

<sup>2</sup>See [GAO-04-39](#) and [GAO-04-546G](#).

specific workforce planning and training components and practices compare with those of leading organizations, we reviewed FAA documents and regulations that detailed FAA policies and practices in the functional areas of workforce planning and training. We discussed the structure and processes of FAA’s workforce planning and training for technicians with FAA officials responsible for implementing those human capital procedures within the Air Traffic Organization (ATO) line of business, where the technicians are located. We interviewed FAA officials at FAA headquarters in Washington, D.C., and at FAA’s Training Academy in Oklahoma City, Oklahoma. Additionally, we obtained the perspectives of the bargaining unit that represents FAA technicians on FAA’s workforce planning and training for technicians through semistructured interviews with representatives of the Professional Airways Safety Specialists (PASS), the employee union representing technicians. We assessed the extent to which FAA followed each practice by applying the following scale: “Fully” indicated that, in our judgment, all or virtually all aspects of the practice were followed; “mostly” indicated that more than half but less than all or virtually all were followed; “partially” indicated that less than half but more than a few were followed; and “minimally” indicated that few or no aspects of the practice were followed. We conducted our comparison of FAA’s practices with leading practices at a high level: More detailed comparisons could disclose specific leading practices that FAA is not following, beyond those discussed in this report. We did not assess the effectiveness of FAA’s workforce planning, because factors other than FAA’s human capital system may also affect FAA’s performance.

To balance the views of FAA management and obtain perspectives of the technician workforce on FAA’s workforce planning and training efforts, we conducted 12 focus group meetings with 101 FAA technicians and 12 academy managers at 11 locations. These meetings involved structured small-group discussions designed to gain more in-depth information about specific issues that cannot easily be obtained from single or serial interviews. Consistent with typical focus group methodologies, our design included multiple groups with varying characteristics but some similarity in experience and responsibility. Most groups involved 7 to 10 participants. Discussions were structured, guided by a moderator who used a standardized list of questions to encourage participants to share their thoughts and experiences. Our overall objective in using a focus group approach was to obtain the views, insights, and feelings of FAA technicians on issues related to their workload, staffing, and training.

We conducted 12 separate focus group sessions—11 with FAA technicians, including a range of (1) technical specialties (Communications,



Automation, Navigation, Environmental, and Surveillance/Radar), (2) experience (less senior and more senior staff), and (3) operating environments (e.g., air route traffic control center [ARTCC], terminal radar approach control [TRACON], air traffic control tower, or general national airspace system [GNAS]).<sup>3</sup> By including GNAS participants in the focus groups, we ensured that the perspectives of technicians that perform their duties at geographically distant, isolated, or smaller facilities were included. One additional focus group was held with academy managers from all areas of technician instruction. Table 20 identifies the specialties included in the focus groups at each location. We traveled to FAA facilities in Baltimore, Chicago, Dallas, Los Angeles, Miami, and Oklahoma City to conduct the focus groups.

**Table 20: Specialties Represented in Focus Groups**

Focus Group Location	Communications	Automation/ Systems Operation Center	Navigation	Environmental	Surveillance/ Radar	General National Airspace System (GNAS)	Other
<b>Baltimore</b>							
Air Traffic Control Tower <sup>a</sup>	5		5		1	4	1
<b>Chicago</b>							
Air Route Traffic Control Center #1	2	2			1		
Air Route Traffic Control Center #2		6					
Air Traffic Control Tower			4		6		1
Terminal Radar Approach Control Center	10	2			1		2
<b>Dallas</b>							
Terminal Radar Approach Control Center	2	2			1	2	1

<sup>3</sup>ARTCCs are air traffic control facilities that provide air traffic control services to aircraft operating on instrument flight rules flight plans within controlled airspace, principally during the en route phase of flight. TRACONs are air traffic control terminals that provide radar-control service to aircraft arriving or departing the primary airport and adjacent airports, and to aircraft transiting the terminal's airspace.

**Appendix I: Objectives, Scope, and Methodology**

Focus Group Location	Communications	Automation/ Systems Operation Center	Navigation	Environmental	Surveillance/ Radar	General National Airspace System (GNAS)	Other
Air Route Traffic Control Center	3	5					1
<b>Los Angeles</b>							
Air Traffic Control Tower <sup>a</sup>	4		4		5		
Air Route Traffic Control Center	1	3			1		
<b>Miami</b>							
Air Route Traffic Control Center	2	3			5		1
Air Traffic Control Tower <sup>a</sup>	3		3		3	2	
<b>Oklahoma City</b>							
FAA Academy	2	2	1		1	3	3
<b>Total</b>	<b>34</b>	<b>25</b>	<b>17</b>		<b>25</b>	<b>11</b>	<b>11</b>

Source: GAO.

<sup>a</sup>Technicians here have a combination of Navigation and Communication specialties.

We developed a guide to assist the moderator in leading the discussions. The guide helped the moderator address several topics related to workforce planning (staffing levels, workload issues, the Next Generation Air Transportation System [NextGen], contract personnel, reliability-centered maintenance) and training (quality and quantity of training, FAA-provided and vendor-provided training). We assured participants of the anonymity of their responses, promising that their names would not be directly linked to their responses.

Methodologically, focus groups are not designed to (1) demonstrate the extent of a problem or to generalize results to a larger population, (2) develop a consensus to arrive at an agreed-upon plan or make decisions about what actions to take, or (3) provide statistically representative samples or reliable quantitative estimates. Instead, they are intended to generate in-depth information about the reasons for the focus group participants' attitudes on specific topics and to offer insights into their concerns about and support for an issue.

The projectability of the information produced by our focus groups is limited for several reasons. First, the information includes only the responses of FAA technicians from the 11 selected groups. Second, while

the composition of the groups was designed to ensure a range of specialties, experience, and operational environments, the groups were not randomly sampled. Third, participants were asked questions about their specific experiences with workload, staffing, and training. Other FAA technicians who did not participate in our focus groups may have different experiences. Because of these limitations, we did not rely entirely on focus groups, but rather used several different methodologies to corroborate and support our conclusions.

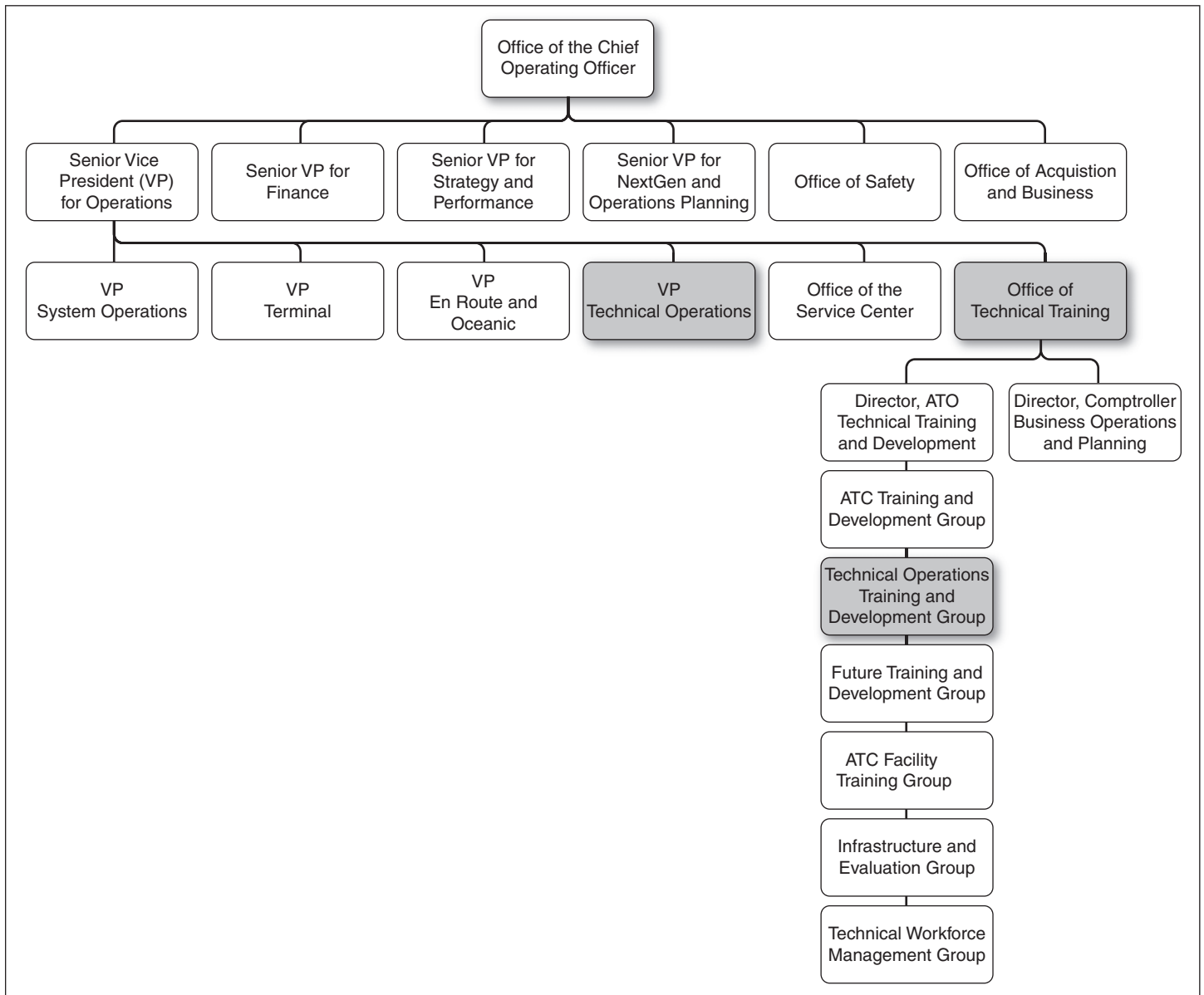
To determine how training funds, including travel funds, have changed in recent years, we obtained quantitative cost data (including travel costs) from ATO and FAA Academy officials from fiscal year 2005 through May 2010 and compared these data for FAA-provided and vendor-provided training. We also conducted semistructured interviews with FAA management about technician training costs. We analyzed student travel costs for academy training obtained from FAA's DELPHI system and personnel compensation and benefits of academy instructors data from the Federal Personnel and Payroll System. However, as FAA's cost accounting system is not sufficient to provide costs for vendor training and travel-related activities, the team had to analyze data provided from FAA's Electronic Learning Management System (ELMS) to summarize the cost of vendor technician training. We presented the data provided by FAA despite the fact that the data are unaudited at the level of detail needed for findings presented in table 19. As a result, this report identified a recommendation for FAA to consider modifying its cost accounting system or cost analysis techniques to develop information about the cost of in-house and vendor-provided training, and of the travel related to those training activities. We assessed the reliability of the data we obtained electronically by reviewing relevant documentation and internal controls, and interviewing agency officials, and determined that those data were of sufficient quality to be used for the purposes of this report.

To develop information on the occurrence and duration of scheduled and unscheduled outages, we obtained operational performance data from FAA for fiscal years 2000 through 2009. FAA outage data are collected in accordance with the reporting guidance contained in FAA Order 6040.15E, National Airspace Performance Reporting System, and are currently entered and stored in the Maintenance Management System. These data are validated and fed into the National Airspace System Performance Analysis System (NASPAS). NASPAS may be used for facility or service performance trend analysis. NASPAS is capable of extracting user-defined outage parameters, performing calculations, and generating graphics for report writing. To understand how such outages affect the national

airspace system's efficiency, safety, and costs; industry; and the flying public, we conducted structured interviews with FAA and PASS officials. We assessed the reliability of the outage data by reviewing relevant documentation and interviewing agency officials, and determined that those data were of sufficient quality to be used for the purposes of this report.

We conducted this performance audit from May 2009 to October 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Appendix II: ATO Organizational Chart



Source: FAA.

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

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## Staff Acknowledgments

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## GAO's Mission

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