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AVIATION SAFETY

FAA's Safety Efforts Generally Strong but Face Challenges

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Highlights

Highlights of GAO-06-1091T, a testimony before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

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Why GAO Did This Study

The U.S. commercial aviation industry has had an extraordinary safety record in recent years. However, expected increases in air-traffic—including the introduction of new vehicles into the national airspace, such as unmanned vehicles and very light jets—and human resource issues, present challenges that have the potential to strain the existing safety oversight system. GAO's testimony focuses on these questions: (1) How is the Federal Aviation Administration (FAA) ensuring that the areas of highest safety risk are addressed? (2) How is FAA ensuring that its staff maintain the skills and knowledge to consistently carry out the agency's oversight programs? and (3) What are the key safety challenges facing FAA? This statement is based on our recent reports on FAA's inspection oversight programs, industry partnership programs, and enforcement and training programs. It is also based on interviews with FAA and relevant industry officials.

What GAO Recommends

To help FAA fully realize the benefits of its safety oversight system, GAO has made several recommendations to address the weaknesses identified in GAO's reviews. Although FAA has begun addressing the recommendations, many have not been fully implemented.

www.gao.gov/cgi-bin/getrpt?GAO-06-1091T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Gerald L. Dillingham, Ph.D., at (202) 512-2834 or dillinghamg@gao.gov.

What GAO Found

FAA's aviation safety oversight system includes programs that focus on identifying and mitigating risks through a system safety approach and by leveraging resources, but as FAA is still developing evaluations for some of these programs, it remains unclear the extent to which they are achieving their intended effects. FAA's system safety approach for overseeing airlines—through the Air Transportation Oversight System (ATOS) and Surveillance and Evaluation Program (SEP)—uses inspection staff efficiently by prioritizing workload based on areas of highest risk and ensuring that corrective actions have been taken. However, recent and planned changes that would move inspections of about 100 airlines from SEP to ATOS will shift inspector workload and might affect FAA's capability to oversee the industry. FAA also concentrates its limited staff resources on the most safety-critical functions and through its designee programs delegates other, less critical activities to designees. Designees perform about 90 percent of certification-related activities, and thus allow FAA to better leverage resources. GAO's recent work found some weaknesses in FAA's system safety approach and recommended that FAA develop effective evaluative processes and accurate nationwide data on its safety oversight programs to address these weaknesses so that program managers and other officials have assurance that the programs attain their intended effect. FAA has begun implementing those recommendations but does not plan to evaluate SEP, which it intends to discontinue after December 2007.

Training—including mandatory training requirements for FAA's workforce as well as designees—is an integral part of FAA's safety oversight system. GAO has reported that FAA has generally followed effective management practices for planning, developing, delivering, and assessing the impact of its technical training for safety inspectors, although some practices have yet to be fully implemented. However, several actions could improve the results of its training efforts. For example, FAA develops technical courses on an ad hoc basis rather than as part of an overall curriculum for each type of inspector, such as inspectors of operations or cabin safety, because the agency has not systematically identified the technical skills and competencies each type of inspector needs to effectively perform inspections. FAA has recognized the need to improve its training program in this and other areas.

FAA faces several key safety challenges, including not meeting its performance target for commercial air carrier safety this year because of recent fatal accidents. Further, FAA's ability to oversee aviation safety will be affected by recent and anticipated trends in inspector and air traffic controller attrition. Also, FAA intends to enhance runway safety by relying on new technologies that are expected to reduce runway accidents. However, schedule delays and cost increases challenge FAA's ability to deploy this technology. Finally, new types of aviation vehicles are changing the aviation industry and will require new areas of expertise for FAA's inspectors and controllers.

Mr. Chairman and Members of the Subcommittee:

Thank you for the opportunity to testify today on issues related to aviation safety. The U.S. commercial aviation industry has had an extraordinary safety record in recent years. In order to maintain a high level of safety, it is important for the Federal Aviation Administration (FAA) to have a safety oversight system that is comprehensive, efficient, and effective and can provide an early warning of hazards that can lead to accidents. It is equally important to have a skilled, well-trained workforce to implement and monitor this safety oversight system. However, expected increases in air traffic—including the introduction of new vehicles into the national air space, such as unmanned vehicles and very light jets—and human resource issues present challenges that have the potential to strain the existing safety oversight system. My testimony today focuses on these questions: (1) How is FAA ensuring that the areas of highest safety risk are addressed? (2) How is FAA ensuring that its staff maintain the skills and knowledge to consistently carry out the agency's oversight programs? and (3) What are the key safety challenges facing FAA? We will also discuss our related recommendations that FAA has not fully addressed. This statement is based on our recent reports on FAA's inspection oversight programs, industry partnership programs, and enforcement and training programs. Additionally, we met with FAA officials and relevant industry groups and reviewed their documentation to obtain information on challenges facing FAA. We conducted this work in accordance with generally accepted government auditing standards.

Following is a summary of our findings:

- FAA's safety oversight system has programs that focus on identifying and mitigating risk through a system safety approach, leveraging resources, and enforcing safety regulations, but concerns exist with each aspect of the system. FAA's system safety approach for overseeing airlines—through the Air Transportation Oversight System (ATOS) and Surveillance and Evaluation Program (SEP)—has many strengths. Both programs, for example, use inspection staff efficiently by prioritizing workload based on areas of highest risk and ensuring that corrective actions have been taken. However, the full potential of SEP is not being realized because the inspection workload for the 81 airlines included in SEP is heavily oriented to nonrisk based activities. Of additional concern is that recent and planned changes to transfer about 100 airlines from SEP to ATOS will affect inspector workload that may affect FAA's capability to oversee the aviation industry. FAA leverages resources and saves money through its "designee" programs, in which individuals and organizations have been delegated to act on FAA's behalf to perform about 90 percent of certification-related activities. The designee program allows FAA to better concentrate its limited staff resources on the most safety-critical functions. However, planned changes to some designee programs that would create a new "organizational designation authorization" will result in FAA focusing on the performance of organizations rather than the individuals within the organization who carry out the delegated functions. As FAA moves from direct oversight of the individuals performing delegated activities, it will be important for the agency to have valid and reliable data and strong evaluative processes to monitor any program changes that have implications for safety. FAA's enforcement program, which is an outgrowth of its inspection process, is intended to ensure industry compliance with safety regulations and is another important element of its safety oversight system. A key objective of FAA's policy of assessing legal sanctions against entities or individuals that do not comply with aviation safety regulations is to deter future violations. However, we found that recommendations for sanctions are sometimes reduced on the basis of factors that are not associated with the merits of the case, and the economic literature on deterrence suggests that the goal of preventing future violations is weakened when the penalties for violations are lowered for reasons not related to the merits of the case. For fiscal years 1993 through 2003, we found that civil monetary penalties were reduced by 52 percent from a total of $334 million to $162 million. It is important for FAA to have effective evaluative processes and relevant data on its numerous safety programs so that the agency has assurance the programs are having their intended effect, especially as FAA's oversight becomes more indirect and as significant program changes are made. Our most recent work has shown the lack of evaluative processes and limitations with data for FAA's SEP program, designee programs, industry partnership programs, and enforcement program.

- FAA has made training an integral part of its safety oversight system and has established mandatory training requirements for its workforce as well as designees, but several actions could improve the results of its training efforts. We have reported that FAA has generally followed effective management practices for planning, developing, delivering, and assessing the impact of its technical training for safety inspectors, although some practices are still early in the implementation phase. For example, in developing its training curriculum for inspectors, FAA followed effective management practices, such as developing courses that support changes in inspection procedures resulting from regulatory changes or agency initiatives. On the other hand, FAA develops technical courses on an ad hoc basis rather than as part of an overall curriculum for each type of inspector, such as inspectors of operations or cabin safety, because the agency has not systematically identified the technical skills and competencies each type of inspector needs to effectively perform inspections. FAA has recognized the need for improvements to its training program in this and other areas and has begun taking some action to address these and other training issues.

- FAA faces a number of key safety challenges, including meeting its performance target for commercial air carrier safety, which it will not meet in fiscal year 2006 because of recent fatal accidents. The challenge of meeting its performance target will be exacerbated by other challenges in human capital management, the acquisition and operation of new safety enhancing technologies, and new types of vehicles, such as very light jets (VLJ), that may place additional workload strains on FAA inspectors and air traffic controllers. FAA's ability to oversee aviation safety will be affected by recent and anticipated trends in inspector and air traffic controller attrition. For example, FAA estimates it will lose 10,291, or about 70 percent of the controller workforce, over the next 10 years, primarily due to retirements. FAA intends to enhance runway safety by relying on new advanced technologies that are expected to reduce runway accidents. However, schedule delays and cost increases have affected FAA's ability to deploy this technology. Finally, if predictions about new types of aviation vehicles are borne out, it will change the aviation landscape and will require new areas of expertise for FAA's inspectors and controllers. For example, the industry predicts there may be as many as 5,000 to 10,000 VLJs operating in the national airspace by 2020, which would further congest the national airspace system especially at and near smaller airports, where VLJs are expected to be prevalent because of their smaller size.

Background

The U.S. commercial aviation industry, with less than one fatal accident per 5 million flights from 2002 through 2005 has an extraordinary safety record. However, when passenger airlines have accidents or serious incidents, regardless of their rarity, the consequences can be tragic. In addition, according to Bureau of Transportation Statistics data, flight arrival delays have increased from 15 percent in 2003 to 22 percent in 2006. Increases in flight delays can be viewed as evidence of strain in the aviation system, as a loss of efficiency in the air system is a symptom of increased strain. Losses of efficiency and the corresponding strain on the system could potentially result in hazards that decrease safety. In order to maintain a high level of aviation safety, it is critical to have well-established, efficient, and effective systems in place to provide an early warning of hazards that can lead to accidents.

FAA has established a number of systems and processes to inspect and oversee various aspects of passenger airline safety, such as aircraft maintenance and flight operations. In 1998, the agency implemented the Air Transportation Oversight System (ATOS), which currently oversees 35 commercial airlines and cargo carriers; the goal is for ATOS to oversee all commercial passenger and cargo airlines. ATOS emphasizes a system safety approach that extends beyond periodically checking airlines for compliance with regulations to using technical and managerial skills to identify, analyze, and control hazards and risks. For example, under ATOS, inspectors develop surveillance plans for each airline, based on data analysis and risk assessment, and adjust the plans periodically based on inspection results. Our review of ATOS's early implementation found weaknesses, which FAA addressed by improving guidance to inspectors and increasing data usefulness.

FAA's inspection process for the 81 commercial airlines not covered by ATOS has two components. The National Work Program Guidelines (NPG) is the original oversight program for these airlines. Under NPG, an FAA-wide committee of managers identifies an annual minimum set of required inspections to ensure that airlines comply with their operating certificates; this process is not risk-based. In 2002, FAA added another component, the Surveillance and Evaluation Program (SEP), to the inspection process to incorporate principles of ATOS into its oversight of commercial airlines. The two components are used together to establish the number and types of annual inspections for airlines. Inspections can encompass many different activities, such as visually spot-checking an airplane at a gate, monitoring procedures on a scheduled flight, or observing maintenance performed on an aircraft. Each year, FAA headquarters establishes a baseline number and type of inspections for each airline through NPG. Through SEP, teams of FAA inspectors analyze the results of an airline's prior inspections at periodic meetings and, based on their assessment of specific risks, establish other inspections that may be needed.

Since 1990, FAA has emphasized industry partnership programs that allow participants, such as airlines and pilots, to self-report violations of safety regulations and help identify safety deficiencies and potentially mitigate or avoid fines or other legal action. For example, the Voluntary Disclosure Program encourages the self-reporting of manufacturing problems and safety incidents by participants that can include air carriers and repair stations.[1]

When violations of statutory and regulatory requirements are identified through inspections, partnership programs, or other methods, FAA has a variety of enforcement tools that it may use to respond to the violations, including administrative actions (such as issuing a warning notice or a letter of correction that includes the corrective actions the violator is to take) and legal sanctions (such as levying a fine or suspending or revoking a pilot's certificate or other FAA-issued certificate).

The achievement of FAA's mission is dependent in large part on the skills and expertise of its workforce, whose aviation safety activities include air traffic control, maintenance of air traffic control equipment, and certification and inspection of various industry participants. As of 2006, 714 of FAA's approximately 3,400 inspectors were dedicated to overseeing the 35 airlines in ATOS. Approximately 1,100 inspectors[2] oversee other entities and individuals, including the remaining 81 commercial airlines that are included in the SEP inspection program, about 5,200 aircraft repair stations, and approximately 625,000 pilots. FAA's safety oversight programs for other aspects of the aviation industry—including manufacturers of aircraft and aircraft parts, repair stations, flight schools, aviation maintenance technician schools, pilots, and mechanics—involve certification, surveillance, and inspection by FAA's safety inspectors, engineers, flight surgeons, and designated representatives. FAA authorizes about 13,400 private individuals and 218 organizations (called "designees") to act as its representatives to conduct many safety certification activities that FAA considers to be nonsafety critical, such as administering flight tests to pilots, inspecting repair work by maintenance facilities, conducting medical examinations of pilots, and approving designs for aircraft parts. These designees are grouped into 18 different programs and are overseen by three FAA offices—Flight Standards Service, Aerospace Medicine, and Aircraft Certification Service—all of which are under the

[1]Other industry partnership programs include the Aviation Safety Action Program, which allows for the self-reporting of safety incidents by employees of air carriers and repair stations; the Aviation Safety Reporting Program, which allows any participant in the national airspace system, such as air traffic controllers, pilots, and flight attendants, to self-report safety incidents; and the Flight Operation Quality Assurance Program, whose participant airlines equip their aircraft to record flight data, which the airlines analyze for safety trends that are provided to FAA.

[2]The remaining approximately 1,500 inspectors oversee general aviation.

Office of Aviation Safety. In addition, FAA's Air Traffic Organization (ATO) includes the approximately 16,700 air traffic controller workforce[3] and nearly 7,200 field maintenance technicians responsible for maintaining ATO's equipment and facilities, which include 21 air traffic control centers, 518 airport control towers, and 76 flight service facilities.

While overall commercial aviation safety trends have been generally positive over the last several years, recent safety trends may warrant scrutiny. On the positive side, the number of serious runway incursions[4] has decreased since fiscal year 2002. Specifically, in fiscal year 2002, there were 37 serious runway incursions, compared with 29 in fiscal year 2005. Recent fiscal year 2006 data also continue the downward trend, with 25 serious runway incursions as of August 1, 2006—fewer than at the same time in the previous fiscal year. However, with four fatal accidents in fiscal year 2006,[5] FAA will not meet its performance target for fiscal year 2006 for commercial air carrier safety.[6] Although general aviation accidents have decreased from 1,715 in 2002 to 1,669 in 2005, general aviation safety continues to be a concern because it represents a significant number of fatal accidents every year. (See fig. 1.) For example, 321 of the 1,669 general aviation accidents in 2005 were fatal. Additionally, the poorer safety records of cargo and air ambulances services, compared with the commercial passenger airline accident rate, point out the safety vulnerabilities in this area. According to FAA, from 1998 through 2005, the accident rate for scheduled air cargo operators declined significantly, but was still about 2.5 times higher than the accident rate for scheduled passenger operators. Further, in instances where there was not an isolated injury to a single individual, the accident rate for cargo was about 6.3

[3]As of June 2006. This number includes about 2,380 traffic management coordinators and operations supervisors.

[4]A runway incursion is any occurrence at an airport involving an aircraft, vehicle, person or object on the ground that creates a collision hazard or results in a loss of separation with an aircraft taking off, intending to take off, landing, or intending to land.

[5]In December 2005, a Southwest Airlines airplane slid off a runway at Chicago's Midway Airport, went through a barrier fence and onto a roadway, killing a passenger in a passing automobile. Also in December 2005, a Chalk's Ocean Airways aircraft experienced an in-flight breakup shortly after takeoff in Miami, resulting in 20 fatalities. On January 16, 2006, a Continental Airlines ground worker was fatally injured in El Paso, Texas. In August 2006, a Comair flight crashed while attempting take-off from the Lexington, Kentucky, airport, resulting in 49 fatalities.

[6]FAA's performance target for fiscal year 2006 is 0.018 fatal accidents per 100,000 departures over the last 3 years.

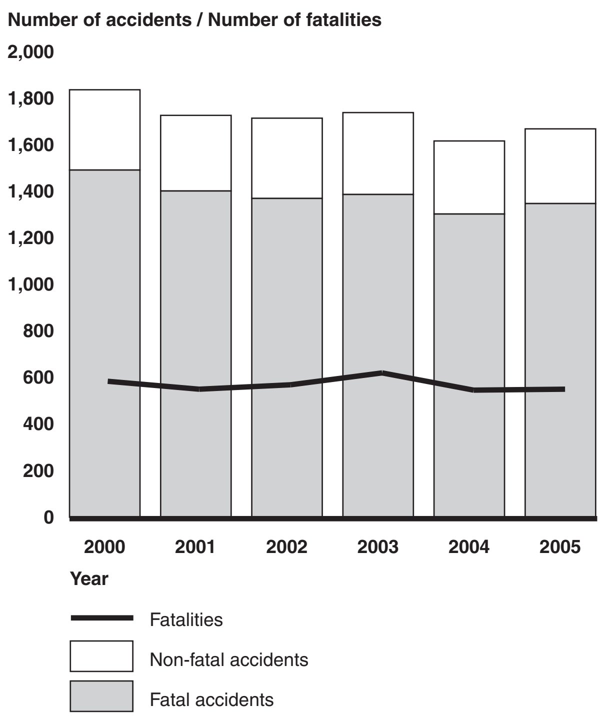
times higher than for commercial passenger aviation.[7] In addition, from January 2002 to January 2005, there were 55 emergency medical services or air ambulance accidents, with 54 fatalities, the highest number of accidents since the 1980s.[8] In addition, FAA did not meet its performance target with regard to operational errors[9] for fiscal years 2003 through 2005. While operational errors continued an upward trend in 2006, FAA was below the fiscal year 2006 target of 4.27 operational errors per million activities as of June 2006.

[7]According to FAA, accidents impacting a single person, although they may be serious, are isolated to ground workers or a single passenger who may walk into a propeller or who may fall while boarding or deplaning. Removing these isolated risk accidents from the data helps achieve a more informative comparison of accident data, according to the agency.

[8]Comprehensive activity data regarding emergency medical services operations (for example, exposure rates and missions flown) are limited because the sources for these data are generally poor. Therefore, accident rates cannot be calculated.

[9]An operational error is a violation of FAA separation standards that define minimum safe distances between aircraft, between aircraft and other physical structures, and between aircraft and otherwise restricted airspace.

Figure 1: Number of General Aviation Accidents and Fatalities, 2000 through 2005



Source: NTSB.

FAA's Safety Oversight System Includes Programs That Focus on Risk Management and Leveraging Resources, but System Is Hindered by Data Limitations and Lack of Evaluations

FAA's safety oversight system has programs that focus on identifying and mitigating risk through a system safety approach, leveraging resources, and enforcing safety regulations, but the programs lack fully developed evaluative processes. As mentioned previously, FAA oversees commercial airlines by one of two programs—ATOS, which includes 35 airlines, and SEP, which includes the remaining 81 airlines. Both programs emphasize a system safety approach of using risk analysis techniques, which allow for the efficient use of inspection staff and resources by prioritizing workload based on areas of highest risk and require that inspectors verify that corrective actions are taken. For example, FAA has developed risk assessment worksheets for both programs that guide inspectors through identifying and prioritizing risks associated with key airline areas, such as flight operations and personnel training. Information from the worksheets is then used to target resources to mitigating those risks.

In recent work we found that the benefits of FAA's system safety approach for the inspection of airlines covered under SEP could be enhanced if FAA more completely implemented the program and addressed other challenges.[10] Most of FAA's inspections of those airlines were not risk-based. For example, as shown in figure 2 from fiscal years 2002 through 2004, SEP—a risk-based approach—guided only 23 percent of the inspection activities for the top 25 SEP airlines in terms of the number of enplanements. The remaining 77 percent of inspection activities were identified through NPG, a process that is not risk-based or system safety oriented. Although inspectors can replace NPG-identified activities with SEP-identified activities that they deem address a greater safety risk, we found that FAA inspectors interpret agency emphasis on NPG as discouraging this practice. To address this issue, we recommended that FAA improve communication with and training of inspectors in areas of system safety and risk management. In response to our recommendations, FAA revised its guidelines to require inspectors and managers to ensure that risk information is used and updated its SEP training course to reflect that change. Since FAA's focus on system safety represents a cultural shift in the way the agency oversees the aviation industry, it will be important for FAA to monitor the implementation of system safety and risk management principles. We recommended that FAA establish a continuous evaluative process for its activities under SEP, but the agency does not intend to set up a process since it expects to eliminate the SEP program after December 2007, which is its deadline for moving all commercial airlines to the ATOS program. If the deadline slips, we believe our recommendation remains valid.

[10]GAO, *Aviation Safety: System Safety Approach Needs Further Integration into FAA's Oversight of Airlines*, GAO-05-726 (Washington, D.C.: Sept. 28, 2005).

Figure 2: SEP- and NPG-Initiated Required Inspections for the Top Airlines Covered by the Programs, Fiscal Years 2002-2004

Type of inspection	2002	2003	2004	Total
SEP-initiated	1,261	1,567	927	**3,755 (23%)**
NPG-initiated	5,470	3,623	3,338	**12,431 (77%)**
Total	**6,731**	**5,190**	**4,265**	**16,186 (100%)**

Source: GAO analysis of FAA information.

Note: Top airlines ranked in terms of number of enplanements.

Furthermore, FAA's plans to dissolve the SEP program after moving all commercial airlines to ATOS will shift the inspectors workloads and present a challenge to FAA's inspection oversight process. As FAA shifts airlines to ATOS, it will also move inspectors to the program. Unlike SEP inspectors, ATOS inspectors are dedicated to an airline and generally cannot be used to inspect other entities. SEP inspectors, on the other hand, have other duties in addition to overseeing airlines—such as certifying and approving aircraft types; overseeing repair stations, designees, and aviation schools; and investigating accidents. For example, our analysis of FAA data indicated that, for fiscal years 2002 through 2004, about 75 percent of SEP inspectors had responsibility for more than 3 entities, and about half had responsibility for more than 15. As inspectors are transitioned to ATOS, the remaining SEP inspector workforce will have to add those other entities to their workload. Furthermore, ATOS requires more inspectors per airline than SEP. For example, when FAA recently transitioned four airlines to ATOS,[11] the total size of the four inspection teams increased 30 percent, from 73 to 95 inspectors. With the expansion of the ATOS program, it will be important to monitor the magnitude of the shift in resources and the effect it may have on FAA's overall capability to oversee the industry as well as any changes to the current ATOS program that may be required by the expansion.[12]

[11]The airlines are Champion, American Eagle, ExpressJet, and SkyWest.

[12]For example, we found that when Champion Airlines became part of ATOS in January 2005, FAA has, in this one case, revised its procedures to allow the Northwest Airlines inspection team to share its data analyst and manager with the Champion inspection team.

FAA's Oversight Focuses on Leveraging Inspector Resources, Which Results in Less Direct Oversight of the Industry

An important part of FAA's safety oversight system are designee programs, through which FAA authorizes about 13,400 private individuals and 218 organizations to act on its behalf to conduct safety certification activities that FAA considers to be non-safety critical. We reported that designees perform about 90 percent of certification-related activities, thus greatly leveraging the agency's resources and enabling inspectors to concentrate on what FAA considers the most safety-critical activities.[13] However, concerns about the consistency and adequacy of designee oversight by FAA have been raised by experts and other individuals we interviewed. For example, designees and industry officials that we spoke with indicated that FAA's level of oversight and interpretation of rules differ among regions and among offices within a region, which limits FAA's assurance that designees' work is performed uniformly in accordance with FAA's standards and policy, the primary goal of which is the safety of U.S. aviation. To improve management control of the designee programs, and thus increase assurance that designees meet FAA's performance standards, we recommended that FAA develop mechanisms to improve the compliance of FAA program and field offices with existing policies. In response to our recommendations, FAA has, among other things, established a designee quality assurance office to address inconsistent and nonstandard oversight issues among offices. FAA has also developed a survey that will collect information from individuals who recently worked with designees, such as pilots who recently received their license through a designee, to gather information that can be used to continually improve designee programs.

To increase FAA's assurance that its designees are meeting FAA's safety standards, it will be important for FAA to continue these activities, which are in the early stages of development or implementation, especially as the agency moves to replace certain designee programs with an organizational designation authorization (ODA). ODA would expand the number and types of organizational designees and further transform FAA's role to that of monitoring the performance of others. In October 2005, FAA issued a final rule that established the ODA program and provides for the phasing out of organizational designees by November 2009. By that time, the current 218 organizational designees will have to apply for and be granted status as an ODA.[14] In August 2006, FAA issued an order that establishes

[13]GAO, *Aviation Safety: FAA Needs to Strengthen the Management of Its Designee Programs*, GAO-05-40 (Washington, D.C.: Oct. 8, 2004).

[14]Examples of companies that are organizational designees include Boeing, Gulfstream, United Airlines, and Continental Airlines, as well as smaller companies.

procedures for the ODA program, including the capability to expand the activities that may be delegated out. Under the program, FAA will focus on the performance of organizations rather than the individuals within the organization who carry out the delegated functions. As FAA makes these changes to its designee programs that remove FAA from direct oversight of the individuals performing the delegated activities, it will be important for the agency to adhere to its policy of using designees only for less safety-critical work. It will also be important for FAA to have the data and evaluative processes, which we discuss later in this testimony, to effectively monitor the new program.

FAA is also becoming increasingly removed from overseeing airline maintenance. In recent years, in an attempt to reduce costs, airlines have increasingly contracted out maintenance. For example in 2000, 44 percent of major air carriers' maintenance expenses were attributable to outsourcing; in 2004, it had increased to 54 percent. However, FAA's inspection activities have remained focused on air carriers' in-house maintenance, according to DOT's Inspector General.[15]

Enforcement Is an Important Element of FAA's Safety Oversight System, but Deterrent Effect of Sanctions Is Unclear

FAA's enforcement process, which is intended to ensure industry compliance with safety regulations, is another important element of its safety oversight system. FAA assesses legal sanctions against entities or individuals that do not comply with aviation safety regulations. Such sanctions are intended to deter future violations. However, we found that the effect of FAA's legal sanctions on deterrence is unclear, and that recommendations for sanctions are sometimes changed on the basis of factors not associated with the merits of the case.[16] For fiscal years 1993 through 2003, attorneys in FAA's Office of the Chief Counsel authorized a 52 percent reduction in the civil monetary penalties assessed (from a total of $334 million to $162 million). FAA officials told us the agency sometimes negotiate lower fines, thereby reducing sanctions to close cases more quickly and reduce FAA attorneys' caseloads. Economic literature on deterrence suggests that although negative sanctions (such as fines and certificate suspensions) can deter violations, if violators expect sanctions to be reduced, they may have less incentive to comply with

[15]DOT Inspector General, *Air Carriers' Use of Aircraft Repair Stations* (Washington, D.C.; July 8, 2003).

[16]GAO, *Aviation Safety: Better Management Controls Are Needed to Improve FAA's Safety Enforcement and Compliance Efforts*, GAO-04-646 (Washington, D.C.: July 6, 2004).

regulations. In effect, it becomes more difficult to achieve the goal of preventing future violations when the penalties for present violations are lowered for reasons not related to the merits of the case.

Recent changes that FAA has made to its enforcement program may lead to more uniformly set fines and, thus, potentially less need to revise fines. Prior to September 2005, the initial recommendation to use administrative actions (such as warning notices and letter of correction) or legal sanctions (such as fines or suspension of operating certificates) was based on the judgment of the inspectors. If inspectors recommended a legal sanction, they then consulted FAA's sanction guidance policy to determine the amount of the proposed penalty. In September 2005, FAA adopted changes to its enforcement program that incorporated system safety risk management principles and established explicit criteria for inspectors to use in making an initial enforcement recommendation. As soon as FAA investigators have gathered sufficient information to categorize the safety risk and the conduct (i.e., whether it was intentional, reckless, or systemic), they prepare a risk statement that describes the hazard created by the act and the potential consequence of that hazard. An example of a risk statement is "an aircraft that operates in Class B airspace without a clearance providing separation from other aircraft could cause a mid-air collision." The investigators then review the risk statement to determine the severity of the hazard (using a scale of catastrophic, critical, marginal, or negligible) and the likelihood of the worst credible outcome (using a scale of frequent, occasional, or remote). Based on these assessments, investigators apply a decision tool that determines the type of action (legal or administrative) to take against an individual or business. Inspectors no longer have the responsibility of recommending a specific fine level. It is too early to determine if these changes to the enforcement program have resulted in a more uniform application of penalties and fewer penalty reductions.

Data Limitations and Lack of Evaluations Limit FAA's Ability to Manage Risk and Are Particularly Critical as FAA's Oversight Becomes More Indirect

Effective processes for evaluating FAA's safety oversight programs, along with accurate nationwide data on those programs would provide FAA's program managers and other officials with assurance that the programs are having their intended effect, especially as FAA's oversight becomes more indirect. Such processes and data are also important because FAA's workforce is dispersed worldwide—with thousands of staff working out of more than 100 local offices—and because FAA's use of a risk-based system safety approach represents a cultural shift from its traditional inspection program. The experiences of successful transformations and change management initiatives in large public and private organizations suggest that it can take 5 to 7 years or more until such initiatives are fully implemented and cultures are transformed in a sustainable manner. As a result, evaluation is important to understanding if the cultural shift has effectively occurred. Our most recent work has shown that FAA had not evaluated its safety programs, and we recommended that the agency establish continuous evaluative processes for the SEP program, designee programs, industry partnership programs, and enforcement program. FAA has made recent progress in implementing some of these recommendations. For example, FAA has scheduled audits of all its designee programs, to be completed by the end of fiscal year 2009, and established a delegation steering group that first met in August 2006 and will be responsible for agencywide monitoring of the designee programs for compliance with program policies and evaluating the effectiveness of the designee programs. Additionally, as FAA implements its new enforcement policy, it has established procedures to monitor the new policy on a quarterly basis and to recommend process improvements based on the information collected. However, FAA does not plan to evaluate the SEP program because it intends to discontinue the program after December 2007.

Yet, FAA's ability to evaluate its programs is hindered by its lack of useful nationwide data. For example, we found that FAA's oversight of designees was hampered, in part, by the limited information of designee's performance contained in the various designee databases.[17] These databases contain descriptive information on designees, such as their types of designations and status (i.e., active or terminated). More complete information would allow the agency to gain a comprehensive picture of whether staff are carrying out their responsibilities to oversee designees. To improve management control of the designee programs, and thus increase assurance that designees meet the agency's performance standards, we recommended that FAA improve the consistency and completeness of information in the designee databases. To address this recommendation, FAA has established the Designee Integration User Group, which expects to begin work in September 2006 on an automated information tool that will track data on all designees. We also found problems with the accuracy or completeness of data in the SEP and

[17]These databases are the Program Tracking and Reporting Subsystem, National Vital Information Subsystem, Designee Information Network, and Airmen Medical Certification Information Subsystem.

enforcement programs, which FAA has recently taken steps to begin addressing.

Training Is an Integral Part of FAA's Safety Oversight System, but Several Actions Could Improve Results

FAA's use of a risk-based system safety approach to inspections requires inspectors to apply data analysis and auditing skills to identify, analyze, assess, and control potential hazards and risks. To effectively identify safety risks, inspectors must be well-trained in the system-safety approach and have sufficient knowledge of increasingly complex aircraft, aircraft parts, and systems. It is also important that FAA's large cadre of designees is well-trained in federal aviation regulations and FAA policies. FAA has made training an integral part of its safety inspection system by establishing mandatory training requirements for its workforce as well as designees. Although FAA provides inspectors with extensive training in federal aviation regulations; inspection and investigative techniques; and technical skills, such as flight training for operations inspectors, we have identified weaknesses with the training program. The agency provides designees with an initial indoctrination that covers federal regulations and agency policies, and refresher training every 2 to 3 years.

We have reported that FAA has generally followed effective management practices for planning, developing, delivering, and assessing the impact of its technical training[18] for safety inspectors, although some practices have yet to be fully implemented.[19] Appendix I describes the extent to which FAA follows effective management practices in each of these four areas. Some examples follow:

- In developing its training curriculum for inspectors, FAA has developed courses that support changes in inspection procedures resulting from regulatory change or agency initiatives. On the other hand, FAA develops technical courses on an ad hoc basis rather than as part of an overall curriculum for each inspector specialty—such as air carrier operations,

[18]We define technical training as training in aviation technologies. FAA includes in its definition of technical training topics such as system safety and risk analysis, inspector job skills, data analysis, and training in software packages.

[19]GAO, *Aviation Safety: FAA Management Practices for Technical Training Mostly Effective; Further Actions Could Enhance Results*, GAO-05-728 (Washington, D.C.: Sept. 7, 2005). We compared FAA's management of its inspector technical training efforts with effective management practices in GAO, *Human Capital: A Guide for Assessing Strategic Training and Development Efforts in the Federal Government*, GAO-04-546G (Washington, D.C.: Mar. 1, 2004).

maintenance, and cabin safety—because the agency has not systematically identified the technical skills and competencies each type of inspector needs to effectively perform inspections.

- In delivering training, FAA has established clear accountability for ensuring that inspectors have access to technical training, has developed a way for inspectors to choose courses that meet job needs and further professional development, and offers a wide array of technical and other courses. However, both FAA and its inspectors recognize the need for more timely selection of inspectors for technical training.

To address some of these issues, we recommended, among other things, that FAA ensure that inspector technical training needs are identified and met in a timely manner by systematically assessing inspectors' technical training needs and better aligning the timeliness of training to when inspectors need the training to do their jobs. In addition, we have identified gaps in the training provided to SEP inspectors, and have recommended that FAA improve inspectors' training in areas such as system safety and risk management to ensure that these inspectors have a complete and timely understanding of FAA's policies in these areas. We identified similar competency gaps related to designee oversight. For example, FAA does not require refresher training on how to oversee designees, which increases the risk that inspectors do not retain the information, skills, and competencies required to perform their oversight responsibilities. We recommended that FAA provide additional training for staff who directly oversee designees.

FAA has begun to address these recommendations. For example, FAA plans to release five Web-based courses by the end of 2006, which will allow the agency to provide training closer to the time that employees need it. Also, FAA has instituted an electronic learning management system that provides for employee input to their own learning plans. FAA has also updated the SEP training course to reflect recent policy changes that emphasize the importance of risk management. Finally, FAA has begun developing a new designee oversight training course that is planned to be ready by the summer of 2007.

It is important that FAA's inspection workforce, designees, and FAA-certified aviation mechanics are knowledgeable about the latest technology changes. While we did not attempt to assess the technical proficiency that FAA's workforce requires and will require in the near future, FAA officials said that inspectors do not need a substantial amount of technical training courses because inspectors are hired with a high degree of technical knowledge of aircraft and aircraft systems. They further indicated that inspectors can sufficiently keep abreast of many of the changes in aviation technology through FAA and industry training courses and on-the-job training. Similarly, we did not identify any specific gaps in the competencies of designees. However, in its certification program for aviation mechanics, we found that FAA standards for minimum requirements for aviation courses at FAA-approved aviation maintenance technician schools and its requirements for FAA-issued mechanics certificates do not keep abreast with the latest technologies. In 2003, we reported that those standards had not been updated in more than 50 years.[20] We recommended that FAA review the curriculum and certification requirements and update both. In response to this recommendation, Vision 100—Century of Aviation Reauthorization Act, which was passed December 12, 2003, required FAA to update the standards 1 year after enactment of the law and to conduct reviews and updates every 3 years after the initial update. FAA issued an Advisory Circular in January 2005 that described suggested curriculum changes; however, the agency has not updated the certification requirements for mechanics.

FAA Faces a Number of Challenges in Overseeing Aviation Safety

FAA faces a number of key safety challenges, including meeting its performance target for commercial air carrier safety, which it will not meet in fiscal year 2006 because of recent fatal accidents. With four fatal commercial air carrier accidents in fiscal year 2006, the agency will not meet its target of 0.018 fatal accidents per 100,000 departures.[21] Moreover, for the past 3 years, FAA did not meet its performance target for severe operational errors, which occur when aircraft do not maintain safe distances in the air; as of June 2006, the agency was slightly below its target level of 4.27 severe operational errors per million activities. In addition, although general aviation accidents have, on the whole, decreased in recent years, general aviation safety is also a concern because of the large number of fatal accidents every year—an average of 334 fatal accidents have occurred annually since 2000. Furthermore, other

[20]GAO, *Aviation Safety: FAA Needs to Update the Curriculum and Certification Requirements for Aviation Mechanics*, GAO-03-317 (Washington, D.C.: Mar. 6, 2003).

[21]After a fourth fatal accident occurred in August 2006, FAA estimated that 0.023 fatal accidents per 100,000 departures had occurred over the last 3 years. Since the fatal accident rate is small and could significantly fluctuate from year to year due to a single accident, FAA's performance measure is a 3-year average, which helps to smooth the fluctuation that may occur in any given year.

industry sectors, such as cargo operations[22] and on-demand air ambulances,[23] have poor safety records, as mentioned earlier. It will be important for FAA to develop the appropriate strategies to deal with the challenges posed by these safety records and to continuously monitor safety information to identify trends and early warnings of other safety problems.

Also as described earlier, FAA also faces a number of challenges to several of its oversight programs. Specifically, FAA's rapid expansion of ATOS, by transferring about 100 airlines and additional inspectors to the program over about 2 years, will cause shifts in inspector workload that may affect the agency's ability to oversee other parts of the industry. Furthermore, some activities, such as FAA's creation of ODAs and the trend for airlines to outsource maintenance, will remove FAA from direct oversight. It will be important for FAA to have robust data and continuous evaluative processes to monitor such activities and program changes in order to ensure they are not having a negative effect on safety.

Meeting the challenges posed by recent safety trends and program changes will be exacerbated by other challenges in human capital management; the acquisition and operation of new safety enhancing technologies; and new types of vehicles, such as very light jets (VLJ), that may place additional workload strains on FAA inspectors and air traffic controllers.

FAA Faces Challenges in Human Resources

FAA's ability to oversee aviation safety will be affected by recent and anticipated trends in attrition of its inspectors compounded, in some cases, by delays in hiring and increased workload. For example, for fiscal years 2005 through 2010, FAA estimated that over 1,100 safety inspectors who oversee commercial airlines and general aviation will leave the agency, with an average loss due to attrition of about 195 inspectors per year. However, FAA's efforts to hire more inspectors have been hindered by a budget situation in 2005 that resulted in a hiring freeze during part of that year. During the hiring freeze, FAA filled safety-critical positions, such

[22]The risk factors that may affect the safety record of cargo carriers include operating a large number of flights at night and the age of cargo aircraft. FAA estimates the median age of in-service passenger jets was 6.25 years, compared with the median age of cargo jets of over 25 years.

[23]We have ongoing work for this subcommittee that is examining in detail FAA's oversight of air ambulances.

as principal inspectors, through internal appointments. As other safety inspectors left, they were not replaced and their workload was divided among the remaining inspectors.

Concerned about the need for additional safety inspectors, for fiscal year 2006, Congress provided additional funding over the budget request to FAA with the expectation that the funding would increase the safety staff by 248. This increase in funding would allow for hiring an additional 182 safety inspectors in Aviation Flight Standards (AFS) and an additional 66 inspectors and engineers in Aircraft Certification Service (AIR). However, as a result of a rescission and unfunded pay raises for fiscal year 2006, FAA lacks the funds to hire 67 staff of the expected 248 new staff. As a result, FAA's revised hiring target is 139 AFS staff and 42 AIR staff. As of August 2006, FAA has hired an additional 25 AFS and 28 AIR staff. (See fig. 3.) According to FAA, it has a pipeline of applicants and expects to reach its goal of filling the 181 slots by the end of the fiscal year. However, the actual number of aviation safety inspector slots needed is unknown, because FAA lacks staffing standards for safety inspectors. The National Academy of Sciences, under a congressional mandate, has just completed a study for FAA to estimate staffing standards for inspectors to ensure proper oversight over the aviation industry.

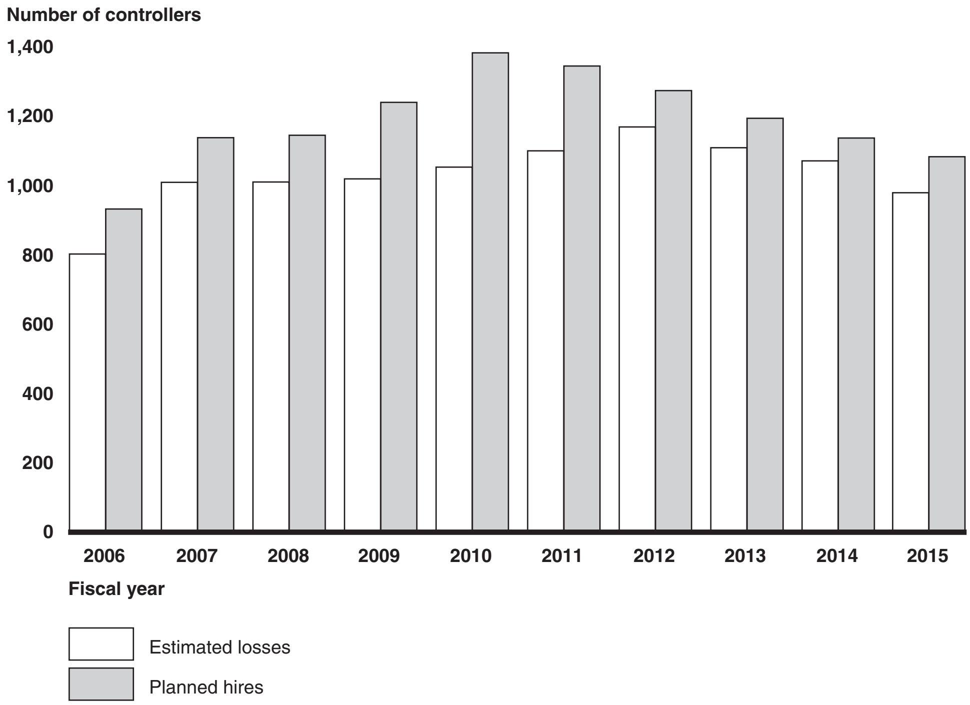
Figure 3: Number of Additional Staff for AFS and AIR, Fiscal Year 2006

Office	Additional staff funded by Congress	FAA revised target	Hired as of August 2006
AFS	182	139	25
AIR	66	42	28
Total	**248**	**181**	**53**

Source: GAO analysis of FAA information.

During the coming decade, FAA will need to hire and train thousands of air traffic controllers to replace those who will retire and leave for other reasons. FAA estimates it will lose 10,291 controllers, or about 70 percent of the controller workforce, for fiscal years 2006 through 2015, primarily due to retirements.[24] To replace these controllers and to accommodate forecasted increases in air traffic and expected productivity increases, FAA plans to hire a total of 11,800 new controllers over the next 10 years, or 1,180 per year, on average.[25] By the end of fiscal year 2006, FAA expects to hire 930 controllers. As of August 2006, FAA had hired 920. Figure 4 shows the estimated losses each year as well as the number of planned hires.

Figure 4: Estimated Controller Losses and Planned Hires, Fiscal Years 2006-2015



Source: FAA.

Recent events may exacerbate the staffing situation. New data indicate that controllers are retiring at a faster rate than FAA anticipated. In its

[24]The high percentage of retirements is attributable to the 1981 controller strike, when President Ronald Reagan fired over 10,000 air traffic controllers, and the consequent need to quickly rebuild the controller workforce. From 1982 through 1991, FAA hired an average of 2,655 controllers per year. These controllers will become eligible for retirement during the next decade.

[25]FAA, *A Plan for the Future, 2006-2015* (Washington, D.C.: June 2006).

2004 workforce report, FAA projected 341 retirements for fiscal year 2005; 465 controllers actually retired—36 percent more than FAA's estimate. In addition, a new contract with the air traffic controllers union was recently implemented by FAA after lengthy negotiations. Under this new contract, most current air traffic controllers would continue to receive their existing base salaries and benefits, which may remove a financial incentive to continue working past their retirement eligibility date, while newly hired controllers would be hired at lower wage rates, which may affect FAA's ability to hire new controllers. FAA has maintained that this contract will result in significant cost savings, freeing up resources for other critical agency needs. It is too soon to know what effect, if any, the new contract may have on retirement decisions.

In addition to the challenge of hiring large numbers of controllers, FAA will face a challenge in training its new hires expeditiously so that it can plan to have the right number of controllers in the right facilities when they are needed. According to FAA, its ability to train the new controllers depends upon several factors, including hiring a relatively even number of controllers each year, reducing the time it takes to hire a controller, and reducing the duration of training. FAA estimates that because of the long training time, it must hire enroute controllers[26] an average of 3 to 5 years in advance of when they are needed. FAA is taking actions to address these issues. For example, in line with our recommendation, a recent change to the training program allows individuals who complete collegiate requirements under the Air Traffic Collegiate Training Initiative[27] to bypass the first 5 weeks of initial FAA Academy training required for controllers.

FAA also faces the challenge of ensuring that control facilities have adequate staffing based on their unique traffic demands and the accuracy of FAA's retirement forecast. Historically, FAA has computed staffing standards, which are the number of controllers needed on a systemwide basis, but distribution of these totals to the facility level was a negotiated process. The staffing standards did not take into account the significant differences in complexity and workload among FAA's 300 terminal and enroute control facilities, which can lead to staffing imbalances. FAA has begun developing and implementing new staffing standards that use an

[26]Enroute air traffic controllers issue clearances and instructions for airborne aircraft.

[27]To bypass initial Academy training, individuals must have successfully completed an aviation-related program of study from a school under FAA's collegiate training initiative program. FAA has agreements with 13 schools for this program.

algorithm that incorporates traffic levels and complexity of traffic at the facility level to determine the number of controllers needed, according to an FAA official. As FAA further refines its process for determining controller staffing needs, the ultimate objective is to assess the traffic level and complexity on a sector-by-sector basis to develop more accurate controller staffing requirements.

FAA Faces Challenges in Implementing Advanced Technology to Increase Air Traffic Safety

To enhance runway safety, FAA intends to rely on new technologies—beginning with the Airport Movement Area Safety System (AMASS) and Airport Surface Detection Equipment Model X (ASDE-X)—that are expected to reduce runway accidents.[28] AMASS and ASDE-X are instrumental in mitigating runway incursions and operational errors. However, FAA faces challenges—such as a reduced number of airports scheduled to receive the equipment, schedule delays, and cost increases—that affect its reliance on the technologies.

FAA's original plans called for 34 airports to receive AMASS[29] and 35 airports to receive ASDE-X (see app. II).[30] In total, 59 airports were to receive one or both technologies, but this number was reduced to 44 in August 2006 after FAA canceled plans to deploy ASDE-X at 15 of the originally scheduled airports. FAA plans to take these 15 systems and upgrade certain airports that already have AMASS based on the rationale that maximum benefit is achieved by deploying ASDE-X to airports with larger traffic counts or more complex operations. This decision leaves 15 airports (see fig. 5) that were supposed to receive ASDE-X without either advanced technology system. Since the anticipated future increase in air traffic from commuter airlines and very light jets are likely to be at smaller airports that lack the advanced technologies, it will be important for FAA to periodically re-evaluate its deployment strategy.

[28]AMASS processes data from Airport Surface Detection Equipment Model 3 (ASDE-3) systems and uses visual and sound signals to warn controllers of potential conflicts between arriving aircraft, and aircraft and vehicles on the ground. ASDE-X is the upgraded digitally based technology that enables air traffic controllers to detect potential runway conflicts by providing detailed coverage of movement on runways and taxiways. Both systems warn the controllers of potential incursions. Among the systems, only ASDE-X works in poor weather conditions.

[29]By December 2003, FAA had installed AMASS at the 34 airports.

[30]Ten airports that were scheduled to receive ASDE-X already had AMASS.

Figure 5: Airports Scheduled to Receive ASDE-X before Deployment Was Canceled by FAA

Airport
Albuquerque International Sunport Airport
Austin-Bergstrom International Airport
Burbank-Glendale-Pasadena Airport
Port Columbus International Airport (Columbus, OH)
Colorado Springs Municipal Airport
Indianapolis International Airport
Metropolitan Oakland International Airport
Ontario International Airport (Ontario, CA)
Raleigh-Durham International Airport
Reno/Tahoe International Airport
San Antonio International Airport
San Jose International Airport
San Juan International Airport
Sacramento International Airport
Tampa International Airport

Source: FAA

In addition to reducing the number of facilities selected to receive the newer technology, FAA has amended the cost and extended the implementation dates for the ASDE-X program (see fig. 6). The 35 ASDE-X systems were originally scheduled to be implemented by 2007. As of August 2006, FAA had moved that date to 2011. FAA estimates the total facilities and equipment cost of the ASDE-X program at about $550 million, which is approximately $40 million more than we reported in 2005.[31] The costs of these new technologies mean that they may never be deployed at all airports; therefore, it will be important for FAA to continue prioritizing and maximizing its resources.

[31]GAO, *National Airspace System: FAA Has Made Progress but Continues to Face Challenges in Acquiring Major Air Traffic Control Systems*, GAO-05-331 (Washington, D.C.: June 10, 2005).

Figure 6: Changes in Cost and Schedule Targets for ASDE-X

Dollars in millions

	2001 estimate	2005 estimate	Current estimate, 2006
Cost targets	$424.3	$510.2	$549.8
Last-site implementation targets	2007	2009	2011

Source: GAO analysis of FAA information.

FAA Faces Challenges in Having Controllers Prepared for the Next Generation Air Transportation System

To ensure a national airspace system that is safe, efficient, and capable of meeting a growing demand of air transportation that is expected to triple by 2025, the Joint Planning and Development Office (JPDO) was created within FAA to plan for and coordinate the longer-term transformation to the "next generation air transportation system" (NGATS). JPDO was created in 2003 to develop an integrated plan for NGATS and to include in the plan, among other things, a description of the demand and required performance characteristics of the future system, as well as a high-level, multiagency road map and concept of operations for the future system.

FAA and JPDO face the challenge of adequately involving stakeholders in the development of NGATS to ensure that the system meets users' needs, especially air traffic controllers who will be end users of the new technology and responsible for using it to maximize safety and efficiency. In the past, air traffic controllers were permanently assigned to FAA's major system acquisition program offices and provided input into air traffic control modernization projects. In June 2005, FAA terminated this arrangement because of budget constraints. According to FAA, it now plans to obtain the subject-matter expertise of air traffic controllers or other stakeholders as needed in major system acquisitions. It remains to be seen whether this approach will be sufficient to avoid problems such as FAA experienced when inadequate stakeholder involvement in the development of new air traffic controller workstations (known as the Standard Terminal Automation Replacement System (STARS)) contributed to unplanned work, significant cost growth, and schedule delays.[32]

[32] GAO-05-331.

FAA's Inspector and Controller Workload Will Be Challenged by Emerging Industries and Established Sectors That May Need More Safety Oversight

The changing aviation landscape poses further challenges for FAA. It is expected that within the next few years several hundred VLJs[33] will be in operation. FAA estimates that if 2 percent of airline passengers switch to VLJs, air traffic controllers will have to handle three times more take-offs and landings than currently. Additionally, the industry predicts there may be as many as 5,000 to 10,000 VLJs operating in the national airspace system by 2020. VLJ manufacturers are reporting advance sales of thousands of these new jets, their customers include air taxis, charter operators, and private owners. In July 2006, FAA granted the first provisional certificate for a VLJ to Eclipse Aviation Corporation. The provisional certificate allows existing planes to be flown, but new ones cannot be delivered to customers until the FAA grants a type certificate. According to Eclipse Aviation, it has orders for over 2,350 aircrafts. DayJet, which provides on-demand jet service, expects to be operating 50 Eclipse VLJs by the end of 2007. In September 2006, FAA granted the first type certificate to Cessna Aircraft Company. (See fig. 7.) Five other companies are in the process of being issued certificates by FAA. If this sector expands as quickly as expected, FAA inspectors could face workload challenges to expeditiously issue and monitor certificates. In addition, air traffic controllers could face the challenge of further congested air space, especially at and near smaller airports, where VLJs are expected to be prevalent because of their smaller size and shorter runway requirements.

[33]Very light jets are jet aircraft weighing 10,000 pounds or less maximum certificated take-off weight and certificated for single pilot operations. Aircraft possess at least some of the following features: (1) advanced cockpit automation, such as moving map GPS and multifunction displays; (2) automated engine and systems management; and (3) integrated auto-flight, autopilot and flight-guidance systems.

Figure 7: Cessna's Citation Mustang VLJ

Source: FAA.

Unmanned aerial vehicles[34] (UAV) are another emerging sector that will add to FAA's workload and may require additional FAA expertise. While historically UAVs have been used primarily by the Department of Defense in military settings outside the United States, there is growing demand to operate UAVs domestically in the national airspace system. (See fig. 8.) Federal agencies such as the Customs and Border Protection Service and the Federal Emergency Management Agency and state and local law enforcement agencies are interested in UAVs for purposes such as border security, search and rescue, firefighting, and other law enforcement and homeland security initiatives. Some of these activities are taking place today. For example, Customs conducts surveillance along the border with Mexico. UAVs are also an emerging sector of the commercial aviation industry, and possible commercial uses include fire detection and

[34]Unmanned aerial vehicles do not carry a human operator; they are either programmed for autonomous flight (called a "drone") or are flown remotely by a ground operator.

firefighting management, digital mapping, communications and broadcast services, and environmental research and air quality management control. Currently, few regulations or guidelines exist for UAVs or UAV-related technology. FAA issues a certificate of authorization for the operation of a UAV and the airspace is restricted during the period of operation.[35] In 2006, FAA has issue 62 certificates of authorization for UAVs and another 35 applications are pending review. FAA is receiving numerous inquiries from federal agencies, and from local, county, and state governments about how to operate UAVs in the national airspace system. FAA has established an Unmanned Aircraft Program Office, responsible for developing the regulatory framework and plan for the safe integration of UAVs into the national airspace system. FAA faces the challenge of working with industry to develop consensus standards for command and control redundancies in case there is a disruption in communication with the UAV, and detect and avoid capabilities so that UAVs can sense and avoid other aircraft. Such standards will be necessary before UAVs can be routinely integrated into the national airspace system. Until UAVs are completely integrated into the national airspace system, FAA will continue to evaluate each flight on a case-by-case basis, adding to the agency's workload.

[35]A certificate of authorization allows an operator to use defined airspace for a specified time (up to one year, in some cases) and includes special provisions unique to each operation. For instance, a certificate may include a requirement to operate only under visual flight rules.

Figure 8: U.S. Air Force's Global Hawk UAV

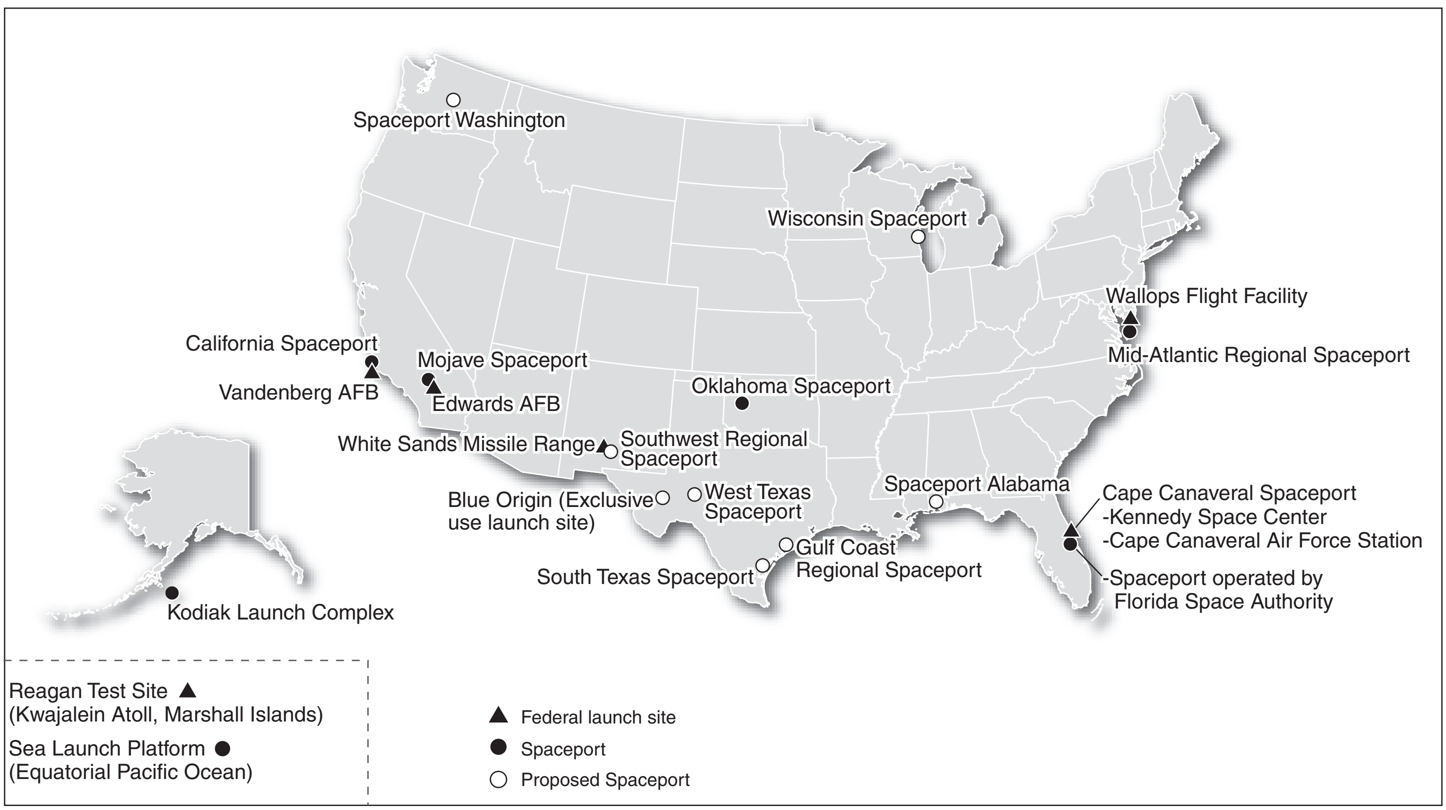
Source: Department of Defense.

Space tourism is an additional emerging sector that FAA is beginning to respond to. Tourist launches are expected to take place at inland locations and may have more impact on the national airspace system than previous unmanned commercial space launches, which occurred at federal launch sites near or over oceans. While UAVs pose a learning curve for safety inspectors, engineers, and air traffic controllers, space tourism launches pose a learning curve for FAA's commercial space engineers who are responsible for licensing and monitoring commercial space launches and nonfederal launch sites (called spaceports). The prospect for commercial space tourism materialized in 2004 when SpaceShipOne, developed by Scaled Composites, flew to space twice, achieving a peak altitude of about 70 miles to win the Ansari X Prize.[36] Several entrepreneurial launch

[36]The X Prize Foundation was established in 1995 to award $10 million to the first team to launch a suborbital reusable launch vehicle capable of carrying three people to an altitude of 70 miles, return safely to Earth, and repeat the exercise within 2 weeks using the same vehicle. Twenty-seven teams from seven countries competed.

companies are planning to start taking paying passengers on suborbital flights within the next few years. Virgin Galactic intends to enter commercial suborbital space flight service around 2008, launching from a spaceport in New Mexico, and according to the company, plans to carry 3,000 passengers over 5 years, with 100 individuals having already paid the full fare of $200,000. Several other companies, including former Ansari X Prize competitors, continue to develop their vehicles for space tourism. Several spaceports are being developed to accommodate anticipated commercial space tourism flights and are expanding the nation's launch capacity. As of August 2006, the United States had seven federal launch sites, and seven spaceports, and an additional eight spaceports have been proposed (see fig. 9). We will be issuing a report later this year on FAA's oversight of commercial space launches.

Figure 9: Existing and Proposed Federal and Nonfederal Spaceports in the United States, April 2006



Sources: FAA; GAO.

FAA Needs to Retain Its Leadership Role in International Safety Standard Setting

Maintaining U.S. position as a global leader in aviation safety calls for robust participation in the setting of international safety standards. The International Civil Aviation Organization (ICAO), a United Nations organization, develops standards and recommended practices for aviation safety and security for 188 member states.[37] In 2002, the Commission on the Future of the United States Aerospace Industry[38] reported that the United States had not devoted enough resources to ICAO and was, therefore, losing its position as the de facto standard setter. Furthermore, the position of U.S. ambassador to ICAO, which was filled earlier this year, had been vacant for more than a year, which may have affected the U.S. impact on international aviation issues. To ensure that qualified U.S. applicants apply for U.S. positions at ICAO, FAA has supported a number of activities, including outreach efforts, incentive pay programs, and a fellowship program that sends FAA employees to work at ICAO for up to 12 months. However, as of December 2005, FAA had filled only 13 of the 31 positions allocated to the United States at ICAO. FAA faces difficulty in filling the allocated positions for reasons beyond its control. For example, while FAA can recruit applicants, it does not make the final hiring decisions. With unfilled positions at ICAO, it will remain important for FAA to continue these efforts to enhance the presence of the United States in the international aviation community.

GAO Contact and Staff Acknowledgments

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[37] ICAO also addresses issues such as air navigation, airspace capacity, and environmental concerns such as engine noise and emissions.

[38] *Final Report of the Commission on the Future of the United States Aerospace Industry* (Arlington, Va.; November 2002).

Appendix I: Extent to Which FAA Follows Effective Management Practices for Inspector Training

Figure 10: Extent That FAA Follows Effective Management Practices in Planning Technical Training

Effective management practices	Extent followed
Ensures training goals and related performance measures and targets are consistent with overall mission and goals	Fully followed
Ensures human capital professionals work in partnership with agency leadership in addressing agency priorities, including training, in strategic and annual performance planning processes	Fully followed
Determines skills and competencies its workforce needs to achieve current and emerging agency goals and identifies gaps -- including those training strategies can help address	Mostly followed
Identifies appropriate level of investment for training and prioritizes funding so that the most important training needs are addressed first	Partially followed
Ensures agency strategic and tactical changes are promptly incorporated into training efforts	Fully followed

Not followed | Partially followed | Mostly followed | Fully followed

Source: GAO.

Figure 11: Extent That FAA Follows Effective Management Practices in Developing Technical Training

Effective management practices	Extent followed
New courses developed to meet emerging demands and improve performance	
Course development teams enable stakeholders to provide input	
Guidelines provide progressive course development steps with ongoing evaluation at each step	
Merits of different course delivery methods are considered	
Criteria used for decisions regarding outside training providers	
Analysis of training needs and course development linked to overall curriculum approach[a]	

Not followed | Partially followed | Mostly followed | Fully followed

Source: GAO.

[a]This management practice is not specifically identified in our assessment guide. However, a management approach that assesses training needs holistically rather than on a course-by-course basis can provide for a more systematic assessment of whether and how training will help meet organizational needs.

Figure 12: Extent That FAA Follows Effective Management Practices in Delivering Technical Training

Effective management practices	Extent followed
Clearly delineates accountability for achieving agency training goals	
Uses a suitable and timely process for selecting inspectors for technical training given inspectors' current duties and existing skills	
Fosters an environment that is conducive to learning	
Takes steps to encourage employee buy-in to goals and priorities of technical training	

Not followed	Partially followed	Mostly followed	Fully followed
			

Source: GAO.

Figure 13: Extent That FAA Followed Effective Management Practices in Evaluating Its Training Program

Effective management practices	Extent followed
Systematically plans for and evaluates the effectiveness of training and development efforts	Mostly followed
Uses the appropriate analytical approaches to assess its training and development programs	Mostly followed
Uses appropriate performance data (including qualitative and quantitative measures) to assess the results achieved through training and development efforts	Partially followed
Incorporates evaluation feedback into the planning, design, and implementation of its training and development efforts	Fully followed
Incorporates different perspectives (including those of line managers and staff, customers, and experts in areas such as financial, information, and human capital management) in assessing the impact of training on performance	Mostly followed
Assesses the benefits achieved through training and development programs	Partially followed

Not followed | Partially followed | Mostly followed | Fully followed

Source: GAO.

Appendix II: Deployment of Surface Detection Equipment at Airports

Figure 14: Airports with Airport Movement Area Safety System (AMASS)

Airport
Camp Springs Andrews AFB
Ted Stevens Anchorage International
Hartsfield Jackson Atlanta International Airport
Boston Logan International Airport
Baltimore Washington International Airport
Cleveland Hopkins International
Charlotte Douglas International Airport
Covington/Cincinnati Northern Kentucky International
Ronald Reagan Washington National Airport
Denver International Airport
Dallas / Ft. Worth International Airport
Detroit Metro Wayne County
Newark International Airport
Washington Dulles International Airport
George Bush Intercontinental Airport
John F. Kennedy International Airport
Las Vegas McCarran International Airport
Los Angeles International Airport
New York La Guardia Airport
Kansas City International
Memphis International Airport
Miami International Airport
Minneapolis-St. Paul International Airport
Louis Armstrong New Orleans International
Chicago O'Hare International Airport
Portland International
Philadelphia International Airport
Pittsburgh International
San Diego International Airport
Louisville International Airport-Standiford Field
Seattle-Tacoma International Airport
San Francisco International
Salt Lake City International Airport
Lambert-St. Louis International Airport

Source: FAA.

Figure 15: Airport Surface Detection Equipment Model X (ASDE-X) Deployment Sites

Airport
Hartsfield-Jackson Atlanta International Airport O R
Bradley International Airport (Hartford, CT) O
Boston Logan International Airport R
Baltimore Washington International Airport R
Charlotte Douglas International Airport R
Ronald Reagan Washington National Airport R
Denver International Airport R
Dallas/Ft. Worth International Airport R
Detroit Metro Wayne County Airport R
Newark International Airport R
Ft. Lauderdale/Hollywood Airport
Honolulu International - Hickam AFB Airport
William P. Hobby Airport (Houston, TX) O
Washington Dulles International Airport R
George Bush Intercontinental Airport R
John F. Kennedy International Airport R
Las Vegas McCarran International Airport R
Los Angeles International Airport R
New York LaGuardia Airport R
Orlando International Airport O
Chicago Midway Airport
Memphis International Airport R
Miami International Airport R
General Mitchell International Airport (Milwaukee, WI) O
Minneapolis-St. Paul International Airport R
Chicago O'Hare International Airport
Philadelphia International Airport R
Phoenix Sky Harbor International Airport
Theodore Francis Green State Airport (Providence, RI) O
San Diego International Airport R
Louisville International Airport-Standiford Field R
Seattle-Tacoma International Airport O R
Salt Lake City International Airport R
John Wayne-Orange County Airport
Lambert-St. Louis International Airport O R

O ASDE-X is operational at these sites as of July 2006

R Locations where ASDE-X is replacing ASDE-3 and AMASS

Source: FAA.

Related GAO Products

Aviation Safety: FAA's Safety Oversight System Is Effective but Could Benefit from Better Evaluation of Its Programs' Performance. GAO-06-266T. Washington, D.C.: November 17, 2005.

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