

GAO

Testimony

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Committee on Transportation and
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FEDERAL AVIATION ADMINISTRATION

Efforts to Hire, Staff, and Train Air Traffic Controllers Are Generally on Track, but Challenges Remain

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





Highlights of [GAO-08-908T](#), a testimony to the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

Why GAO Did This Study

Each day, the Federal Aviation Administration (FAA) controls the take-offs, landings, and flights of over 50,000 aircraft. To accomplish this mission safely and efficiently, FAA must have a sufficient number of adequately trained air traffic controllers working at its air traffic control facilities. Over the next decade, FAA will need to hire and train nearly 17,000 controllers to replace over 15,000 current controllers, most of whom will be retiring. This massive hiring effort will occur as FAA begins to implement the next generation air transportation system (NextGen), which will integrate new technologies and procedures into air traffic operations and fundamentally change the role of air traffic controllers from controlling individual aircraft to managing air traffic flow. Hence, FAA will need to train experienced controllers to use the new technologies at the same time that it hires and trains new controllers to operate both the current and the new technologies.

This testimony addresses FAA's progress and challenges in hiring, staffing, and training air traffic controllers in the current air traffic control system and in preparing them for NextGen. It is based on prior GAO work, updated with reviews of FAA documents and interviews with FAA officials, controller union representatives, and other stakeholders.

To view the full product, including the scope and methodology, click on [GAO-08-908T](#). For more information, contact Gerald L. Dillingham at (202) 512-2834 or dillingham@gao.gov.

FEDERAL AVIATION ADMINISTRATION

Efforts to Hire, Staff, and Train New Air Traffic Controllers Are Generally on Track, but Challenges Remain

What GAO Found

To prepare for the projected departure of over 15,000 air traffic controllers between 2008 and 2017, FAA began significantly increasing the number of new hires in fiscal years 2006 and 2007, when it hired 1,116 and 1,815 controllers, respectively. By contrast, in fiscal years 2002 through 2005, it had hired an average of 467 controllers per year. Retirements are taking place sooner than FAA expected. As a result, FAA has had to adjust its hiring targets upward—from 1,420 in fiscal year 2008 to 1,877, for example. While FAA has met its hiring targets so far and is on track to meet its target for fiscal year 2008, it has had to expand its applicant pool, in large part because fewer military controllers have sought civilian employment since the Department of Defense began to offer reenlistment bonuses of up to \$60,000.

As FAA brings new controllers on board, it faces the challenge of ensuring that its control facilities are adequately staffed to meet their unique traffic demands. In 2007, FAA established staffing ranges for each facility based on facility-specific information, such as air traffic operations, productivity trends, expected retirements, and number of controller trainees. However, FAA's staffing is not aligned with the new ranges at about half of its facilities. While overstaffing will provide trained replacements as retirements occur, understaffing has potential safety and efficiency implications. As the proportion of new hires increases over time, FAA will face further challenges in balancing the numbers of trainees and fully certified controllers at each facility. Furthermore, with fewer fully certified controllers and greater on-the-job training demands, controllers may work more overtime hours. Overtime can lead to fatigue, and many controllers routinely work overtime, raising safety concerns. Both GAO and the National Transportation Safety Board have found that controllers' work schedules can contribute to fatigue and have made recommendations to mitigate it. FAA is taking steps to address these recommendations.

In the training area, FAA faces the dual challenge of certifying its new hires to operate today's air traffic control system as quickly as possible and of preparing to train both experienced controllers and new hires to operate NextGen technologies. Through training improvements, scheduling efficiencies, and greater use of simulators, FAA has, it says, reduced the amount of time controllers remain in trainee status; however, attrition among controllers in developmental training is increasing. It will be important for FAA to monitor the attrition and ensure that performance problems are addressed as early as possible to avoid unnecessary costs. Preparations for NextGen training are still in the early stages—as FAA observes, it is difficult to develop training for systems that have not yet been defined. However, GAO's work has shown that further research is needed to determine what training will be required to support the transition to NextGen—a transition that will involve changes in the roles and responsibilities of air traffic controllers as well as changes in technologies.

Mr. Chairman and Members of the Subcommittee:

Thank you for the opportunity to testify today on air traffic controller staffing. The Federal Aviation Administration (FAA) is responsible for managing the national airspace system and ensuring the safe and efficient movement of air traffic. Each day, FAA controls the take-offs, landings, and flights of over 50,000 aircraft. To accomplish this mission, FAA must have a sufficient number of adequately trained air traffic controllers working at its air traffic control facilities. Over the next decade, FAA will need to hire and train nearly 17,000 controllers to replace over 15,000 current controllers who are expected to retire from or leave the agency.¹ As FAA brings these new employees on board, it will be important for the agency to manage the process carefully and expeditiously and to maintain the highest levels of safety in the national air space system. Furthermore, FAA will be dealing with this massive hiring need at the same time that it transforms the current air traffic control system into the next generation air transportation system (NextGen), which will integrate new technologies and procedures into air traffic operations and fundamentally change the role of air traffic controllers from controlling individual aircraft to largely managing air traffic flow. Hence, FAA will need to train existing controllers to use the new technologies at the same time that it hires and trains new controllers to operate both the existing and the new technologies.

My testimony today focuses on FAA's progress and challenges in hiring, staffing, and training air traffic controllers in the current air traffic control system as well as preparing them for NextGen. This statement is based on prior GAO studies and work we conducted in May and June 2008, including reviews of FAA's annual controller workforce plans and other key documents; discussions with senior FAA officials and representatives of FAA's controllers union—the National Air Traffic Controllers Association (NATCA)—and aviation industry groups; and updates of the results of prior GAO studies. We conducted all of our work 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

¹In 1981, over 11,000 air traffic controllers went on strike and were subsequently fired by President Ronald Reagan. Between 1982 and 1990, FAA hired thousands of individuals to permanently replace the fired controllers. Most of this hiring took place between 1982 and 1986. Many of these controllers, as well as those controllers who did not participate in the strike, are now eligible or will soon be eligible to retire from FAA.

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.

FAA Is Making Progress in Hiring Air Traffic Controllers, but New Hires May Have Less Experience Than in Prior Years

During the coming decade, FAA will be challenged to continue hiring thousands of air traffic controllers to replace those who will retire and leave for other reasons. In March 2008, FAA projected that between 2008 and 2017, it will lose a total of 15,483 controllers through retirement and other reasons, and our analysis of FAA data indicates that about 63 percent of the current controller workforce will become eligible for retirement by 2017. However, FAA's data indicate that more controllers are retiring sooner than FAA anticipated. As table 1 shows, the percentage of controllers retiring within 2 years of eligibility has increased from about 33 percent in 2005 to 42 percent in 2007. For fiscal year 2006, FAA estimated that 467 controllers would retire, but 583 actually retired—about 25 percent more than planned. For fiscal year 2007, FAA anticipated 700 controller retirements, while 828 controllers actually retired—an 18 percent increase over anticipated retirements.

Table 1: Years beyond Earliest Retirement Eligibility in Which Retirement Occurred, 2005 through 2007

Number of years beyond earliest retirement eligibility	Percentage of controllers retiring		
	2005 retirements ^a	2006 retirements ^b	2007 retirements ^c
0-1	23.4 %	24 %	28.9 %
1-2	9.3 %	11 %	12.7 %
Total	32.7 %	35 %	41.6 %

Source: GAO analysis of FAA data.

^aBased on 2005 data.

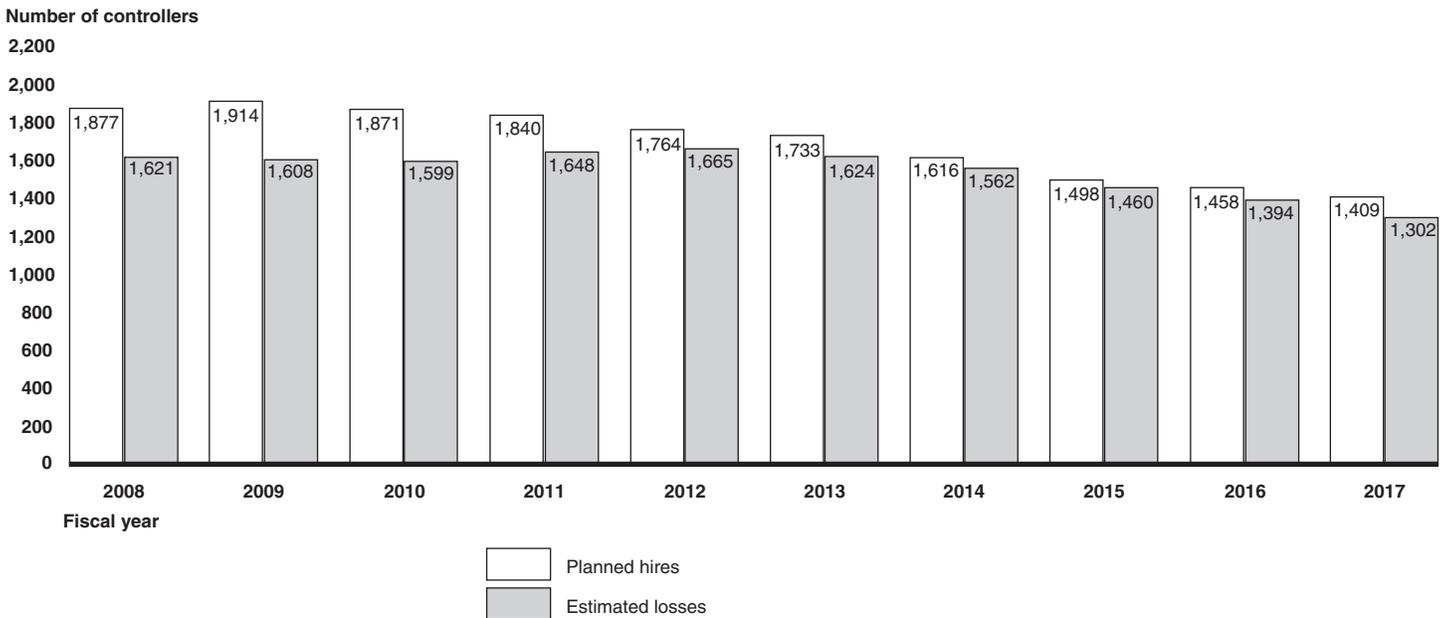
^bAverage annual percentage based on 2005 and 2006 data.

^cBased on 2007 data.

To replace these controllers, FAA started making significant increases in controller hiring in fiscal years 2006 and 2007, when it hired 1,116 and 1,815 controllers, respectively. (By comparison, during fiscal years 2002 through 2005, FAA hired an average of 467 controllers each year.) FAA plans to hire about 16,980 new controllers during fiscal years 2008 through 2017. FAA anticipates hiring 1,877 controllers in fiscal year 2008, which would bring the total number of air traffic controllers to 15,130. Figure 1 shows the estimated numbers of losses and planned hires for fiscal years

2008 through 2017. FAA projects the total number of controllers will gradually increase from 15,130 in fiscal year 2008 to 16,371 in fiscal year 2017.²

Figure 1: FAA's Projected Air Traffic Controller Losses and Hiring, Fiscal Years 2008-2017



Source: FAA.

FAA incorporates each year's retirement numbers into its plans for future years and has increased its hiring to compensate for the larger-than-expected numbers of retirements. For example, the 1,877 controllers that FAA plans to hire in fiscal year 2008 represent a 28 percent increase over the 1,420 hires for 2008 that the agency planned for a year ago. According to FAA data, the agency is on track to meet its hiring target for fiscal year 2008. As of May 30, 2008, it had hired 1,290 controllers—about 62 percent of the planned hires. FAA recognizes that some of these increases in retirements may be attributable to recent labor disputes and disagreements over the contract that went into effect in 2006.

²Although air traffic is expected to increase significantly over the next decade, FAA expects that NextGen technologies and procedures will allow air traffic controllers to be more productive. Thus, FAA does not currently plan for any dramatic increases in overall controller staffing through 2017.

To keep on track with hiring controllers, in 2007 FAA expanded its applicant pool to include the general public. Previously, FAA had generally limited its hiring to individuals with prior FAA or Department of Defense (DOD) air traffic control experience and graduates of FAA's Air Traffic Collegiate Training Initiative (AT-CTI) program. The agency began looking farther afield, FAA officials said, because fewer military controllers have been seeking civilian employment since DOD established incentives to retain its controllers. For example, in 2007, the Air Force began offering reenlistment bonuses of up to \$60,000 for military air traffic controllers, and the Marine Corps offers reenlistment bonuses of up to \$40,000. By comparison, FAA offers recruitment incentives of up to \$20,000 for air traffic controllers with experience and retention incentives of up to \$24,000 for controllers who have submitted papers indicating that they plan to retire. To further expand its hiring pool, in October 2007, FAA added nine new colleges and universities to AT-CTI, bringing the total number of schools to 23. Students who have successfully completed aviation-related programs of study from these schools are an increasing source of FAA hires. The number of AT-CTI graduates hired as controllers increased from 195 in fiscal year 2005 to 1,019 in fiscal year 2007, or 56 percent of hires.

Hiring a Large Number of Controllers Presents a Staffing Challenge for FAA

As FAA brings new controllers on board, it faces the challenge of ensuring that its control facilities are adequately staffed to meet their unique traffic demands. In 2007, the agency established staffing ranges for each facility that considered facility-specific information, such as air traffic operations, productivity trends, expected retirements, and the number of controllers in training. These new ranges are an improvement over FAA's historical approach, which was to compute the number of controllers needed systemwide and negotiate the distribution of these totals to the facility level. In 2007, we found that FAA's staffing was not aligned with the new ranges at 104 facilities—about one-third of FAA's 314 facilities. At that time, 93 facilities were overstaffed and 11 were understaffed.³ Our review of updated staffing ranges and on-board levels contained in FAA's 2008 controller workforce plan indicates that staffing is not aligned at 45 percent of the facilities. As of April 2008, 145 facilities are overstaffed and 12 are understaffed. According to FAA, the agency is purposefully

³GAO, *Federal Aviation Administration: Key Issues in Ensuring the Efficient Development and Safe Operation of the Next Generation Air Transportation System*, GAO-07-636T (Washington, D.C.: Mar. 22, 2007).

overstaffing facilities with new hires so that they are trained and ready to replace retiring controllers over the next few years. However, the understaffing at some facilities has potential safety and efficiency implications.

Within the next several years, the balance of experienced and newly hired controllers will shift dramatically, adding a layer of complexity to FAA's determination of proper controller staffing levels for its air traffic control facilities. Although the projected number of new hires each year represents a relatively small proportion of the total controller workforce—about 12 percent per year—in a few years, the cumulative effect of hiring at that rate on the experience level of the workforce can be large. According to FAA, about one quarter of the controller workforce had less than 5 years of experience at the end of fiscal year 2007. Our analysis of FAA's hiring and retirement projections indicates that by 2011, up to 59 percent of the controller workforce will have less than 5 years of experience and by 2016 that percentage will remain over 50 percent. With such a high percentage of newly hired controllers, fewer experienced controllers will be available to provide on-the-job instruction to trainees and more time may be needed to train and certify newly hired controllers, according to FAA. In addition, newly certified controllers may be less efficient than experienced controllers in handling the large volume of traffic that occurs at large and congested airports. However, the current and forecasted decline in air traffic that is being attributed to the rising cost of aviation fuel, the subsequent rise in costs to passengers, and the nation's general economic condition may provide a window of opportunity for hiring new controllers and providing experience in a less congested environment.

Managing air traffic safely and effectively while training new controllers will require balancing the numbers of trainees and fully certified controllers at each facility. Fully certified controllers have completed their training and are qualified to control traffic at all positions at their assigned location, and those who are fully certified for at least 6 months can become on-the-job instructors for new controllers. Our analysis of staffing at the 50 busiest airports showed that the percentage of fully certified controllers at each facility ranged from 56 percent to 94 percent. (See app. I.) The facilities with the lowest percentage of fully certified controllers include William P. Hobby Airport (Houston) (56 percent fully certified controllers), LaGuardia Airport (61 percent), Dallas-Ft. Worth Airport (62 percent), and Cleveland Hopkins Airport and Tampa Airport (both 63 percent). Facilities with the highest percentage of fully certified controllers include St. Louis Airport (94 percent), San Francisco Airport

(93 percent), Portland Airport and Logan Airport (both 92 percent), and Minneapolis/St. Paul Airport(90 percent).

FAA recognizes the importance of balancing the numbers of trainees and fully certified controllers. Historically, trainees have accounted for less than 35 percent of the controller workforce, but the agency is working to determine target ranges for the number of trainees that individual facilities can accommodate. These ranges are likely to depend on factors such as the size and workload of the facility. The speedy development and verification of these data will help to ensure that facilities have a sufficient number of fully certified controllers to instruct trainees and to safely and efficiently manage air traffic. For transparency, it will be important for FAA to include such data in its annual controller workforce plan.

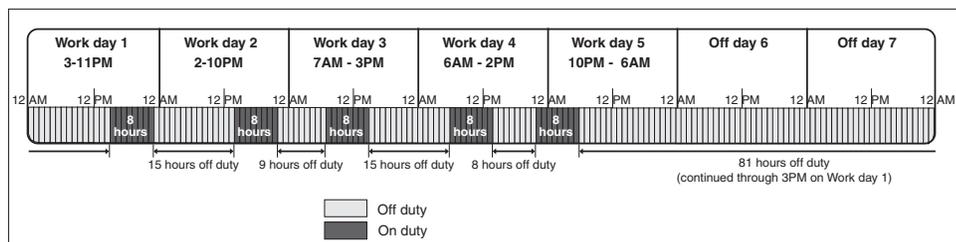
To the extent that retirement rates and the proportion of trainees at individual facilities leads to greater use of overtime, the potential for fatigue can increase, raising safety concerns. We previously reported⁴ that air traffic controllers at some of the nation's busiest airports were regularly working 6-day weeks because of staffing shortages, raising questions about the extent to which this situation may cause fatigue. In November 2007, we identified controller fatigue as an issue affecting runway safety and recommended that FAA develop a mitigation plan for addressing controller overtime by adopting strategies to attract controllers to facilities with high volumes of air traffic and high rates of controller overtime. In response to our recommendation, FAA has established a working group to develop a mitigation plan and identify recruitment and retention tools. FAA has already taken positive steps toward implementing the mitigation plan by offering pay and relocation incentives of up to \$25,000 to controllers who volunteer to relocate to facilities that are short-staffed. FAA's initial offerings have had generally positive results; volunteers accepted FAA's relocation offer for 11 locations but 1 location had no volunteers. It remains to be seen whether future planned offerings will be successful in achieving the needed staffing levels.

In addition, the National Transportation Safety Board (NTSB) has cited controller work schedules as contributing to fatigue and raising safety concerns. Since 1990, NTSB has placed efforts to address fatigue on its list

⁴*Aviation Runway and Ramp Safety: Sustained Efforts to Address Leadership, Technology, and Other Challenges Needed to Reduce Accidents and Incidents*, [GAO-08-29](#) (Washington, D.C.: Nov. 20, 2007).

of “most wanted” transportation safety improvements, citing safety concerns about the effects of fatigue on air traffic controllers and other persons performing critical functions in the aviation industry. NTSB noted in 2007 that about 61 percent of controllers work rapidly rotating 8-hour shifts⁵ with progressively earlier start times (see fig. 2), and about 40 percent of the controllers in this group (about 25 percent of all controllers) are assigned at least one midnight shift per week. Many controllers in this latter group work what is commonly referred to as a “2-2-1” schedule, which consists of two afternoon shifts, followed by two day shifts, followed by one midnight shift. For controllers, this schedule provides a longer weekend, eliminates the need to work more than one midnight shift in a single week, and allows a long recovery period after that one midnight shift. However, NTSB found that the schedule is problematic because it typically includes short rest periods of just 8 or 9 hours between shifts, allows minimal time for sleep when other necessary daily activities are taken into account, and may include rest periods during daytime hours when quality sleep may be difficult to obtain.

Figure 2: Example of “2-2-1” Rotation Schedule



NTSB has recommended that FAA mitigate air traffic controller fatigue by working with NATCA to revise controller work-scheduling policies and practices so controllers will have enough sleep and to modify shift rotations to minimize sleep disruptions for controllers. The recommendation was jointly addressed to NATCA because NTSB found that the contract between NATCA and FAA stipulated certain scheduling practices, such as shift swapping, that had not been evaluated for their effect on controller fatigue. In addition, NTSB recommended that FAA develop a fatigue awareness and countermeasures training program for controllers and for the personnel involved in scheduling their work. In

⁵Rapidly rotating shift schedules are characterized by varying start and stop times that change too rapidly for circadian rhythms to adapt.

supporting its recommendation, NTSB cited four instances from 2001 through 2006 when tired controllers made errors while performing their duties that resulted in serious runway incursions.⁶ In each case, NTSB linked controller fatigue to the work schedule. NTSB said that FAA regulations and policies do not adequately consider the potential effect of work scheduling on fatigue and performance.⁷

To address NTSB's recommendations, FAA plans to develop and implement a fatigue awareness and countermeasures training program. The agency also plans to convene a working group that includes NATCA to develop shift rotation and scheduling guidelines. However, NATCA and FAA disagree on the level of cooperation that is taking place between them on this initiative. It is critical that FAA and NATCA work together on this issue to mitigate the potential effects of fatigue on controller performance and aviation safety.

Training Program Has Expedited Certification of New Controllers, but Potential Hurdles Could Affect Further Progress in Training for New Controllers and Training for NextGen

Quickly training the newly hired controllers will be critical to FAA's ability to expeditiously replace the retiring controllers. FAA trains controllers in stages, starting with classroom training at its academy in Oklahoma City. Upon graduation from the academy, controllers are assigned to an air traffic control facility as "developmental" controllers, where they receive on-the-job training for specific air traffic control positions. Fully certified controllers conduct this training by observing and instructing the trainee. Controllers receive certification for each position as they progress through the training program.

According to FAA's 2008 controller workforce plan, the agency has been making progress in reducing the amount of time controllers remain in trainee status, which includes time spent at the academy and in a developmental role. In fiscal year 2005, it took 3 to 4 years to train an air traffic controller. In fiscal year 2007, it took about 1.9 years at terminal facilities and about 3.1 years at en route facilities, according to FAA's 2008

⁶A runway incursion is any incident involving an unauthorized aircraft, vehicle, or person on a runway.

⁷FAA regulation (14 CFR § 65.47) allows tower controllers to be scheduled for up to 10 consecutive hours of operational duty and requires that they be given a rest period of at least 8 hours between shifts and be provided at least 1 full 24-hour day off per week. An FAA order (7210.3) requires that controllers be provided a rest period of at least 12 hours after a midnight shift.

controller workforce plan.⁸ The agency attributes this reduction in training time to improved training and scheduling processes and increased use of simulators. However, as of May 2008, about 2,700 controllers were in trainee status, and it is too early to tell how the length of their training will be affected by factors discussed previously in this statement, such as the decreasing proportion of fully certified controllers available to provide on-the-job training.

Figure 3: Air Traffic Controller



Source: FAA.

⁸Terminal facilities include air traffic control terminals at airports and terminal radar approach control (TRACON) facilities, which provide radar-control service to aircraft arriving or departing a primary airport and adjacent airports and to aircraft transiting the terminal's airspace. En route facilities provide air traffic control service to aircraft operating during the en route phase of flight.

While trainees appear to be moving through the training program faster, attrition among developmental controllers is increasing, from about 6 percent of new hires in fiscal year 2006 to about 9 percent in fiscal year 2007. According to FAA's projections, developmental attrition will rise to 14 percent in fiscal year 2008. As of May 2008, the attrition rate for the year for developmental controllers was about 7 percent. FAA has incorporated this information into its hiring forecasts, but a high attrition rate has budgetary implications for FAA—FAA projects that the average cost of a developmental controller will be \$78,095 in fiscal year 2008. It will be important for FAA to monitor the attrition rate, track the reasons for attrition, and release poor performers as soon as possible to avoid unnecessary costs.

To achieve further efficiencies in training controllers, FAA has initiated a contracting effort—called the Air Traffic Control Optimum Training Solution (ATCOTS). ATCOTS would consolidate two existing contracts—one with the University of Oklahoma, which provides controller training at FAA's training academy in Oklahoma City, and the other with Washington Consulting Group (WCG), which provides controller training throughout the country at air traffic control facilities. FAA plans to award the contract in June 2008 and have it implemented by the end of fiscal year 2008. According to FAA, the consolidated contract will allow for more consistent training and potential improvements and efficiencies in the training. During the first year of the 10-year contract, FAA's training program is to remain unchanged. After the first year, the contractor may suggest changes to increase the efficiency of the training program. These changes would require FAA's approval, according to FAA officials. FAA's transition plans for the ATCOTS contract allow for 3-month extensions of the University of Oklahoma contract and 1-month extensions of the WCG contract to cover any gaps between the end of the current contracts and the start of ATCOTS.

FAA employees and other stakeholders have raised concerns about ATCOTS. According to FAA employees at the training academy, FAA has not addressed how current academy employees would be used under ATCOTS or determined what cost and time efficiencies could be achieved through the contract. An industry stakeholder maintained that ATCOTS will not provide a sufficient change from the current training and said it was not clear how the program would meet FAA's training needs over the next 10 years, especially any unique needs arising from FAA's

implementation of NextGen. In addition, because of concern that FAA has not sufficiently examined the costs and benefits of ATCOTS, a provision in FAA's fiscal year 2008 appropriation legislation⁹ prohibits FAA from using any money in fiscal year 2008 for ATCOTS to displace, reassign, reduce the salary of, or take any other action that would result in a reduction in force for employees at FAA's academy or a discontinuation of the academy as the primary training facility for controllers. According to FAA, ATCOTS will not affect FAA personnel at the academy in any of these ways. FAA also does not anticipate much change in the contractor personnel at the academy, since the agency anticipates they would be retained by the ATCOTS awardee. With the current training contracts scheduled to expire in July and September 2008, the contract extensions that FAA has in place will be important in case the ATCOTS contract is delayed. If ATCOTS is delayed or cannot meet its objectives, FAA's workforce plan may not be achievable.

Both New and Experienced Controllers Will Need Training for NextGen, and Further Human Factors Research Is Needed to Support the Transition

Further work is needed to develop training for both new hires and fully certified controllers to deal with the paradigm shift that will come with NextGen. That paradigm shift calls for an increased reliance on automation and changed roles for both air traffic controllers and pilots under NextGen. In a more automated environment, controllers will be less responsible for controlling air traffic—that is, for directing specific aircraft movements—and more responsible for managing air traffic—that is, for monitoring conditions as pilots control their aircraft to maintain safe separation and perform other tasks now performed by controllers. Human factors¹⁰ will be an important aspect of training air traffic controllers to handle both the old and the new equipment as the new systems are gradually brought online. Our past work has shown that when human factors are not adequately addressed, delays and cost overruns have occurred in implementing new air traffic control technology.¹¹

While some industry stakeholders told us it was too early to begin training for NextGen systems that are not close to coming online, others said that it

⁹§ 110-161.

¹⁰Human factors refers to what is known about people, their abilities, characteristics, and limitations in the design of the equipment they use, the environments in which they function, and the jobs they perform.

¹¹GAO, *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).

was time to begin developing the training to prepare FAA personnel and others for the paradigm shift that will be required to implement NextGen. Furthermore, a change of this magnitude and complexity will require adequate lead time. For example, one stakeholder noted that the educational community needs to be engaged now so that it can design training and be prepared to teach future air traffic controllers and pilots.

In response to these issues, FAA told us that it is difficult to develop training for systems that are not yet fully defined. However, according to FAA, it is in the early stages of talking to the educational community. Also, the simulation laboratories currently used to train controllers can be modified to reflect changes as NextGen technologies are deployed, according to FAA. In addition, in fiscal year 2008, FAA began a strategic analysis to determine how the controller's job will be expected to change as a result of NextGen. In fiscal year 2009, FAA expects that this effort will include an identification of changes to training for the existing workforce and for new controllers. It will be important for FAA to complete this effort expeditiously, because NextGen technologies and procedures are already being implemented. Furthermore, it remains to be seen how this effort will be affected by the lack of human factors research needed to support it.

In prior work, we have identified human factors research as a critical research need for NextGen.¹² The changes in roles and responsibilities for air traffic controllers that will be central to NextGen technology raise significant human factors issues for the safety and efficiency of the national airspace system. According to FAA, verbal communication is a human factors area that requires further research and development. Currently, air traffic controllers primarily rely on verbal communication to direct aircraft. Because NextGen will rely on automated communications, controllers will require training in both understanding and operating in an automated communication environment. The research to support such training has not been conducted, according to FAA. In addition, several stakeholders that we interviewed expressed concern that NextGen plans do not adequately address human factors research. Although the National Aeronautics and Space Administration (NASA) has historically been a primary resource for human factors and other aeronautical research and development, its ability to provide human factors research for NextGen

¹²GAO, *Next Generation Air Transportation System: Status of the Transition to the Future Air Traffic Control System*, [GAO-07-784T](#) (Washington, D.C.: May 9, 2007).

will be limited because it recently lost a significant proportion of its human factors staff, according to a NASA official. Understanding what skills air traffic controllers will need will help FAA develop an appropriate training curriculum for them.

In conclusion, a safe and efficient national airspace system is an essential part of the nation's critical infrastructure. It is a key element for domestic mobility and participation in the global economy. The steps and initiatives that have been initiated by FAA's Air Traffic Organization management team to ensure that there is an adequate and competent air traffic controller workforce show progress and are commendable. Going forward, it is imperative that both FAA management and the bargaining unit find ways to improve their ability to work together to ensure that the steps and initiatives are sustained, monitored, and periodically revised to ensure progress for years to come.

Mr. Chairman, this concludes my prepared statement. I would be pleased to respond to any questions from you or other members of the Subcommittee.

GAO Contact and Staff Acknowledgments

For further information on this testimony, please contact Dr. Gerald L. Dillingham at (202) 512-2834 or dillingham@gao.gov. Individuals making key contributions to this testimony include Teresa Spisak, Kevin Egan, Bess Eisenstadt, Bert Japikse, Taylor Reeves, and Richard Scott.

Appendix I: Additional Information on Controller Staffing

Facility name	Number of fully certified controllers	Number of controllers	Percentage of fully certified controllers
Lambert-St. Louis International Airport	29	31	94
San Francisco International Airport	27	29	93
General Edward Lawrence Logan International Airport	36	39	92
Portland International Airport	22	24	92
Minneapolis/St. Paul International Airport	38	42	90
San Diego International Airport - Lindbergh Field	17	19	89
Baltimore-Washington International Airport	25	28	89
Phoenix Deer Valley Airport	16	18	89
Orlando/Sanford Airport	16	18	89
John Wayne Airport-Orange County Airport	21	24	88
Centennial Airport	19	22	86
Salt Lake City International Airport	29	34	85
Metropolitan Oakland International Airport	22	26	85
Washington Dulles International Airport	34	41	83
Seattle/Tacoma International Airport	26	32	81
Covington/Cincinnati International Airport	62	77	81
Philadelphia International Airport	69	87	79
Tucson International Airport	15	19	79
Los Angeles International Airport	36	46	78
Charlotte/Douglas International Airport	61	79	77
Honolulu Control Facility	64	83	77
McCarran International Airport	26	34	76
Miami International Airport	66	87	76
Chicago Midway Airport	25	33	76
The William B. Hartsfield Atlanta International Airport	37	49	76
Phoenix Sky Harbor International Airport	30	40	75
Detroit/Wayne County International Airport	27	36	75

Facility name	Number of fully certified controllers	Number of controllers	Percentage of fully certified controllers
Newark/Liberty International Airport	27	36	75
Memphis International Airport	51	68	75
Fort Lauderdale/Hollywood International Airport	21	28	75
Raleigh/Durham International Airport	33	44	75
Denver International Airport	28	38	74
Dallas/Love Field	19	26	73
George Bush Intercontinental Airport	29	40	73
Mesa/Falcon Field	13	18	72
Daytona Beach International Airport	40	56	71
Ronald Reagan - Washington National Airport	21	30	70
Ted Stevens Anchorage International Airport	16	23	70
David Wayne Hooks Memorial Airport	9	13	69
Chicago O'Hare International Airport	47	68	69
John F. Kennedy International Airport	24	35	69
Long Beach/Daugherty Field Airport	18	27	67
Orlando International Airport	50	75	67
Van Nuys Airport	15	23	65
Boeing Field/King County International Airport	15	23	65
Tampa International Airport	44	70	63
Cleveland Hopkins International Airport	40	64	63
Dallas/Ft. Worth International Airport	37	60	62
La Guardia International Airport	22	36	61
William P. Hobby Airport	14	25	56

Source: GAO analysis of FAA data.

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