

**Before the Committee on Commerce, Science, and Transportation  
Subcommittee on Aviation Operations, Safety, and Security  
United States Senate**

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# **Key Safety Challenges Facing the Federal Aviation Administration**

**Statement of  
The Honorable Calvin L. Scovel III  
Inspector General  
U.S. Department of Transportation**



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Mr. Chairman and Members of the Subcommittee,

We appreciate the opportunity to testify today on the key safety challenges facing the Federal Aviation Administration (FAA) and its stakeholders. Aviation safety oversight is—and must remain—FAA’s highest priority. For more than 10 years, our work has focused on actions needed to maintain the integrity and safety of our aviation system. Our statement today is based on our previous reports and investigations as well as our ongoing work.

As this Committee is aware, safety is a shared responsibility among FAA, aircraft manufacturers, airlines, and airports. Together, all four form a series of overlapping controls to keep the system safe. The U.S. has achieved an impressive safety record over the past several years. This is a remarkable feat given all the changes that have occurred within the industry. For example, network carriers face considerable uncertainty with a softening economy, increasing fuel prices, and competition from low-cost carriers, who now possess one-third of the market in terms of available passenger seats.

Network carriers have moved aggressively away from high cost structures by reducing in-house staff, re-negotiating labor agreements, and increasing the use of outside repair facilities. There also is considerable discussion regarding mergers and further consolidation within the industry.

At the same time, demand for air travel has increased and aircraft load factors are nearly 80 percent—an all-time high. In 2007, U.S. airlines transported over 700 million passengers and this number is forecasted to grow to more than 1 billion by 2016.

However, a number of high-profile events, including fundamental breakdowns in FAA oversight at Southwest Airlines (SWA), have raised legitimate concerns about the effectiveness of FAA’s overall approach to safety oversight and what changes are needed. These concerns have been amplified by the fact that airlines have grounded nearly 700 aircraft since FAA began industry-wide assessments of compliance with safety directives. There is an urgent need to assess what went wrong, identify root causes, and proactively examine how to maintain and ultimately enhance the margin of safety.

Mr. Chairman, it is against this backdrop that we would like to discuss the following three key safety challenges facing FAA and its stakeholders, as we see them:

- Strengthening FAA’s oversight of the aviation industry,
- Improving runway safety, and
- Addressing attrition within two of FAA’s critical workforces.

**Strengthening FAA's Oversight of the Aviation Industry.** The recent events at SWA brought to light serious lapses in FAA's oversight of air carriers. As this Committee knows, FAA's handling of whistleblower concerns regarding SWA's failure to follow a critical FAA airworthiness directive (AD) has had a cascading effect throughout the industry. While the critical safety lapses indicated problems with the airline's compliance, they are symptomatic of much deeper problems in several key areas of FAA's oversight.

- We found FAA's SWA inspection office developed an overly collaborative relationship with the air carrier that allowed repeated self-disclosures of AD violations through FAA's partnership program. These programs are intended to facilitate cooperation between FAA and air carriers to identify and address safety issues. Yet, FAA allowed SWA to repeatedly self-disclose AD violations without ensuring that SWA had developed a comprehensive solution for reported safety problems—which is required for FAA to accept the disclosure and absolve the carrier of any penalty.
- We also found that the events at SWA demonstrate weaknesses in FAA's national program for risk-based oversight—the Air Transportation Oversight System (ATOS). This allowed AD compliance issues in SWA's maintenance program to go undetected for several years. As early as 2003, one of the whistleblowers expressed concerns to FAA about SWA's compliance with ADs. In 2006, he began urging FAA to conduct system-wide reviews, but FAA did not begin these reviews until after the details of the March 2007 disclosure became public. In fact, FAA inspectors had not reviewed SWA's system for compliance with ADs since 1999. At the time of SWA's disclosure, 21 key inspections had not been completed in at least 5 years. As of March 25, 2008, FAA still had not completed five of these required inspections, in some cases inspections had not been completed in nearly 8 years.

We previously identified system-wide problems with ATOS. In 2005,<sup>1</sup> we found that inspectors did not complete 26 percent of planned ATOS inspections—half of these were in identified risk areas. We recommended, among other things, that FAA strengthen its national oversight and accountability to ensure consistent and timely ATOS inspections. However, FAA has still not fully implemented our recommendations.

- Our ongoing work at SWA and our 2007 audit at Northwest Airlines (NWA) also have identified weaknesses in FAA's processes for conducting internal reviews and ensuring appropriate corrective actions. In the SWA case, FAA's internal reviews found, as early as April 2007, that the principal maintenance

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<sup>1</sup> OIG Report Number AV-2005-062, "FAA Safety Oversight of an Air Carrier Industry in Transition," June 3, 2005. OIG reports and testimonies are available on our website: [www.oig.dot.gov](http://www.oig.dot.gov).

inspector (PMI) was complicit in allowing SWA to continue flying aircraft in violation of the AD. Yet, FAA did not attempt to determine the root cause of the safety issue, nor initiate enforcement action against the carrier until November 2007.

- We also have concerns regarding FAA's failure to protect employees who report safety issues from retaliation by other FAA employees. For example, in the SWA case, after one whistleblower voiced his concerns to FAA, an anonymous hotline complaint was lodged against him. According to the inspection office manager, the PMI indicated that a SWA representative submitted the complaint. The complaint was non-specific and never substantiated, but the whistleblower was removed from his oversight duties for 5 months while he was being investigated. Yet, FAA did not suspend other inspectors who were subjects of similar complaints, including the PMI, who admitted that he allowed SWA to continue flying in violation of the AD.

Our work at NWA found the same problem with FAA's handling of the inspector who reported safety concerns. As with the inspector in the SWA case, FAA managers reassigned an experienced inspector to office duties, after a complaint from the airline, and restricted him from performing oversight on the carrier's premises. At NWA, FAA's reviews of an inspector's safety concerns were limited and overlooked key findings identified by other inspectors. Although some of the inspector's safety concerns were valid, FAA informed him that all of his concerns lacked merit.

Both the SWA and NWA cases demonstrate that FAA must pursue a more reliable internal review process and protect employees who bring important safety issues to light.

Recently, FAA announced several actions to address the SWA safety directive violation. These include initiating a review of AD compliance at SWA and other air carriers. FAA also proposed to fine SWA more than \$10 million. While FAA's actions are necessary, albeit long overdue, the issues we have identified will require immediate and comprehensive changes in FAA's air carrier oversight. These actions include the following:

- Ensuring that its Voluntary Disclosure Reporting Process requires inspectors to (a) verify that air carriers take comprehensive actions to correct the underlying causes of violations identified through self-disclosure programs, and (b) evaluate, before accepting a new report of a previously disclosed violation, whether the carrier developed and implemented a comprehensive solution.

- Implementing a process for second level supervisory review of self-disclosures before they are accepted and closed—acceptance should not rest solely with one inspector.
- Periodically rotating supervisory inspectors to ensure reliable and objective air carrier oversight.
- Revising its post-employment guidance to require a “cooling-off” period before an FAA inspector is hired at an air carrier he or she previously inspected.
- Implementing a process to track field office inspections and alert the local, Regional, and Headquarters offices to overdue inspections.
- Establishing an independent organization to investigate safety issues identified by its employees.
- Developing a national review team that conducts periodic reviews of FAA’s oversight of air carriers.

FAA committed to implement these recommendations. Follow through will be critical to demonstrate FAA’s commitment to providing effective oversight.

Our work also has shown that FAA needs to make similar improvements in its oversight of repair stations and its risk-based system for overseeing aircraft manufacturers’ suppliers. A key issue in both cases is that FAA’s oversight was inadequate in keeping up with dynamic changes occurring in those industries. We will continue to examine FAA’s oversight approach of the aviation industry from a national perspective, and will keep the Committee apprised of our progress with this review, as well as other actions FAA should take to ensure safety.

**Improving Runway Safety.** Aviation stakeholders are expressing growing concerns regarding the rise in severe runway incidents. Recent incidents such as close calls on the ground in Baltimore, Chicago, and San Francisco, underscore the need for proactive actions to improve runway safety. In fact, the last fatal commercial aircraft accident in the United States (in 2006) occurred because the pilots of Comair flight 5191 attempted to take off from the wrong runway.

A significant threat to runway safety is runway incursions (any incident involving an unauthorized aircraft, vehicle, or person on a runway). Reducing the risk of runway incursions has been on the National Transportation Safety Board’s (NTSB) Most Wanted List of Safety Improvements since the list’s inception in 1990. Because runway incursions can be caused by controllers, pilots, or ground vehicles, responsibility for their prevention falls on all users of the National Airspace System—FAA, airlines, and airport operators—and there are a mix of actions needed to address this critical safety issue.

- New technology is considered by many to be the primary solution for improving runway safety but is years away from effective deployment. Our work on three major FAA acquisitions for improving runway safety has shown that there are significant concerns as to what can be effectively deployed within the next several years. For example, a key technology for preventing runway accidents—the Airport Surface Detection Equipment-Model-X (ASDE-X)—may not meet its cost and schedule goals to commission all 35 systems for \$549.8 million by 2011.

One of the most promising technologies on the horizon is the Automatic Dependent Surveillance-Broadcast (ADS-B)—a satellite-based technology that allows aircraft to broadcast their position to other aircraft and ground systems. When displayed in the cockpit, ADS-B information can provide a “second set of eyes” by including the pilot in the loop to detect and alleviate hazardous surface situations. However, as we testified in October,<sup>2</sup> ADS-B ground infrastructure will not be in place until 2013, and users will not be required to equip with the needed avionics until 2020.

- The uncertain timeline of FAA’s runway safety technologies underscore the need to explore other near-term solutions to improve runway safety. We found that there are several relatively low-cost, simple, airport-specific changes that can help reduce the risk of runway incursions. These include airport infrastructure changes as well as procedural changes to daily airport operations.

In May 2007, we reported<sup>3</sup> on runway safety efforts at four airports that had experienced a surge in runway incursions in 2005 and 2006—Boston, Chicago, Philadelphia, and Los Angeles. We found that airport operators at all four locations responded to the rise in runway incursions by improving airport lighting, adding better signage, and improving runway and taxiway markings. This included upgrading surface-painted, hold-short surface markings in advance of FAA’s mandatory date of June 2008.

- FAA also needs to take actions to reinvigorate its national program for runway safety. This was a key focus in 2001 when runway incursions reached an all-time high. However, we found that many important national initiatives for promoting runway safety (undertaken by FAA as early as 2000) had waned as the number of incidents declined and FAA met its overall goals for reducing runway incursions.

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<sup>2</sup> OIG Testimony Number CC-2007-100, “Challenges Facing the Implementation of FAA’s Automatic Dependent Surveillance-Broadcast Program,” October 17, 2007.

<sup>3</sup> OIG Report Number AV-2007-050, “Progress Has Been Made in Reducing Runway Incursions, but Recent Incidents Underscore the Need for Further Proactive Efforts,” May 24, 2007.

- Finally, addressing human factors issues, such as fatigue and situational awareness, is important to improving runway safety. Training new controllers on human factor issues as well as technical aspects of air traffic control (such as airspace, phraseology, and procedures) will become increasingly important as FAA begins to address the vast influx of new controllers, as large numbers of veteran controllers retire.

**Addressing Attrition Within Two of FAA’s Critical Workforces.** A key issue that will affect FAA for at least the next 10 years is addressing attrition in two of its critical safety workforces—air traffic controllers and aviation safety inspectors. Since 2005, 3,300 controllers have left the Agency—23 percent more than projected. FAA has accelerated its hiring efforts and has hired 3,450 new controllers since 2005—25 percent more than projected. Still, FAA faces a major challenge as it must hire and train at least 17,000 new controllers through 2017.

- As a result of the high level of controller attrition, FAA is facing a fundamental transformation in the composition of its controller workforce. The overall percentage of controllers-in-training has grown substantially during the past 3 years. New controllers now represent about 25 percent of the workforce (up from 15 percent in 2004). However, that percentage can vary extensively by location—from as little as 2 percent (e.g., Boston TRACON ) to as much as 50 percent (e.g., Las Vegas TRACON).

A major challenge in addressing the attrition surge will be to train new controllers to the Certified Professional Controller (CPC) level at their assigned locations—a process that can take up to 3 years. Training new controllers to the CPC level is important for two reasons: (1) only CPCs are qualified to control traffic at *all* positions of their assigned area, and (2) only CPCs certified for at least 6 months (at their assigned location) can become on-the-job training (OJT) instructors for other new controllers. FAA must have enough OJT instructors at all locations if it is to achieve its ambitious hiring and training plans for the next 10 years and beyond.

- FAA also is facing challenges to its oversight mission due to attrition in its inspector workforce. FAA has about 4,100 inspectors to oversee a dynamic and rapidly changing industry, which includes 114 commercial air carriers, almost 5,000 foreign and domestic repair stations, more than 700,000 active pilots, and more than 1,600 approved manufacturers. Last year, FAA’s hiring efforts kept pace with retirements, and the Agency ended the year with 133 additional inspectors compared to fiscal year (FY) 2006 levels. However, FAA must continue to closely oversee this effort since nearly half of the inspector workforce will be eligible to retire in the next 5 years.

To maximize its limited inspector resources, FAA has been working toward risk-based safety oversight systems for air carriers, repair stations, and manufacturers. These systems target inspector resources to areas of greatest risk. However, unless FAA develops a reliable staffing model, it will not be able to effectively use its inspectors.

I would now like to discuss these areas in further detail.

# STRENGTHENING FAA'S OVERSIGHT OF THE AVIATION INDUSTRY

## ***Recent Events at Southwest Airlines Underscore System-wide Weaknesses in FAA's Oversight of Air Carriers***

The recent events at SWA have exposed significant weaknesses in FAA's oversight of air carriers and problems with its partnership programs. The FAA directive<sup>4</sup> in this case required SWA to inspect the fuselages of its Boeing 737s for potential cracks. FAA issued this directive after an Aloha Airlines 737 lost a major portion of its hull while in flight at 24,000 feet in 1988, resulting in one fatality and multiple injuries.

According to FAA, when an air carrier determines that it has not implemented an AD, it is required to immediately ground all non-compliant aircraft. FAA inspectors share this responsibility—if an inspector becomes aware that an air carrier has violated the terms of an AD, the inspector is required to ensure that the aircraft are grounded.

To meet this requirement, air carriers need a system to help them perform repetitive inspections of aircraft fuselages in a timely manner. However, we found that SWA did not have an adequate system to ensure it completed these inspections. As a result, SWA operated 46 aircraft that were not inspected for fuselage cracks. These aircraft flew in violation of the AD on more than 60,000 flights for up to 9 months. We estimate that these aircraft carried 6 million passengers during this period.

According to SWA, it discovered it had violated this directive on March 14, 2007. SWA notified an FAA PMI the following day. However, the inspector did not direct SWA to ground the affected planes, and SWA continued to operate them on 1,451 flights for 8 more days, carrying an estimated 145,000 passengers.

The PMI permitted—and encouraged—SWA to formally self-disclose the AD violation through its Voluntary Disclosure Reporting Program (VDRP), which would allow the airline to avoid any penalties. FAA accepted the self-disclosure, even though it had already accepted multiple disclosures on AD violations—this should have prompted concerns regarding whether underlying problems were corrected.

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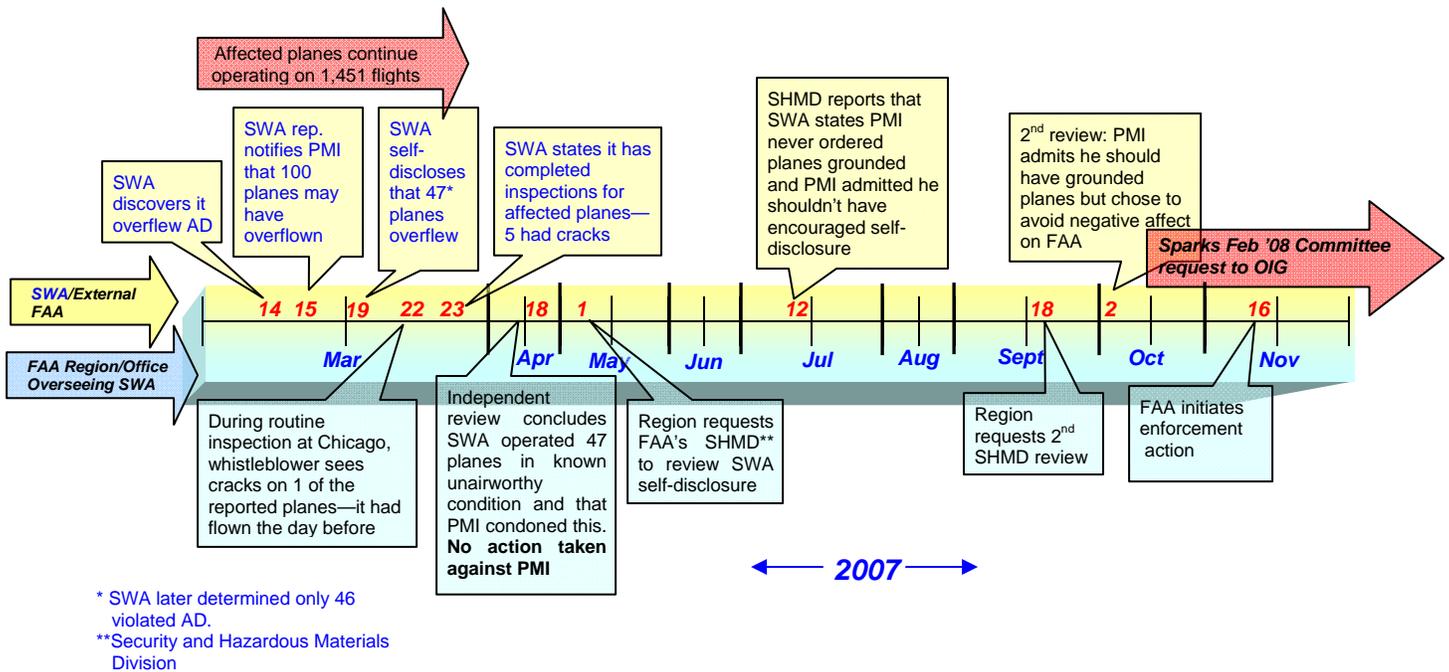
<sup>4</sup> FAA Airworthiness Directive 2004-18-06 requires that Boeing 737s (series 200, 300, 400, and 500) be inspected for fuselage cracks every 4,500 cycles (1 cycle equals 1 take-off and landing) after they reach 35,000 cycles.

Once it formally self-disclosed the violation on March 19, 2007, SWA stated that it was in compliance with the AD, meaning it had inspected or grounded all affected aircraft. However, two FAA inspectors (the whistleblowers in this case) reported that their supervisor, the PMI, knowingly permitted SWA to continue flying the identified aircraft even after SWA’s self-disclosure. SWA officials confirmed this and stated that the PMI gave them verbal permission to continue flying the aircraft.

During our review, we found that—after SWA self-disclosed the overflight—several of these aircraft flew into airports multiple times where they could have received the required inspections. When SWA finally inspected the aircraft, it found fuselage cracks in five of them. The AD specifies that these cracks could potentially lead to fuselage separation and rapid aircraft depressurization if left in disrepair.

While these critical safety lapses indicate problems with SWA’s ability to comply with safety directives, they are symptomatic of much deeper problems with FAA’s oversight (the timeline below shows the events of the SWA disclosure and FAA actions).

**Figure 1. Timeline of SWA Disclosure**



**We found that FAA’s SWA’s inspection office developed an overly collaborative relationship with the air carrier that allowed repeated self-disclosures of AD violations through its partnership program.** Partnership programs are intended to encourage data-sharing between FAA and air carriers to identify and address safety issues. Yet, FAA allowed SWA to repeatedly self-disclose AD violations without ensuring that SWA had developed a comprehensive solution for reported safety problems—which is required for FAA to accept the disclosure and absolve the carrier of any penalty.

However, SWA’s proposed solutions, which FAA has repeatedly accepted, have failed to solve AD compliance issues, as it has violated four different ADs eight times since December 2006, including five in 2008. FAA’s oversight in this case appears to allow, rather than mitigate, recurring safety violations.

FAA maintains that disclosure programs are valuable, as they can help to identify and correct safety issues that might not otherwise be obtainable. However, we are concerned that FAA relies too heavily on self-disclosures and promotes a pattern of excessive leniency at the expense of effective oversight and appropriate enforcement. Further, a partnership program that does not ensure carriers correct underlying problems is less likely to achieve safety benefits.

Our ongoing work at another carrier has identified concerns with employees using disclosures to avoid penalties for safety violations. FAA must take steps to maintain the safety objective of these programs by actively discouraging improper relationships between inspection offices and carriers so that these programs do not lapse into an easy amnesty path for perpetual safety violators.

**We also found that the events of SWA demonstrate weaknesses in FAA’s national program for risk-based oversight—the Air Transportation Oversight System (ATOS).** This allowed AD compliance issues in SWA’s maintenance program to go undetected for several years. As early as 2003, one of the whistleblowers expressed concerns to FAA about SWA’s compliance with ADs. In 2006, he began urging FAA to conduct system-wide reviews, but FAA did not begin these reviews until after the details of the March 2007 disclosure became public.

In fact, FAA inspectors had not reviewed SWA’s system for compliance with ADs since 1999. At the time of the Southwest disclosure, 21 key inspections had not been completed in at least 5 years. As of March 25, 2008, FAA still had not completed five of these required inspections, in some cases inspections had not been completed in nearly 8 years.

We have previously identified system-wide problems with ATOS. For example, in 2002,<sup>5</sup> we found inconsistent inspection methods across FAA field offices for various carriers. As a result, FAA inspectors were confused over how to conduct ATOS inspections and assess risks.

In 2005,<sup>6</sup> we found that inspectors did not complete 26 percent of planned ATOS inspections—half of these were in identified risk areas. We recommended, among other things, that FAA strengthen its national oversight and accountability to ensure consistent and timely ATOS inspections. However, FAA still has not fully addressed our recommendations.

**Further, our ongoing work and our 2007 report<sup>7</sup> at NWA have identified weaknesses in FAA’s processes for conducting internal reviews, ensuring corrective actions, and protecting employees who report safety concerns.** In the SWA case, FAA’s internal reviews found as early as April 2007 that the PMI was complicit in allowing SWA to continue flying aircraft in violation of the AD. Yet, FAA did not attempt to determine the root cause of the safety issue, nor initiate enforcement action against the carrier until November 2007. At NWA, FAA’s reviews of an inspector’s safety concerns were limited and overlooked key findings identified by other inspectors. Although some of the inspector’s safety concerns were valid, FAA informed him that all of his concerns lacked merit.

We also have concerns regarding FAA’s failure to protect employees who report safety issues from retaliation by other FAA employees. For example, in the SWA case, after one whistleblower voiced his concerns to FAA, an anonymous hotline complaint was lodged against him. According to the inspection office manager, the PMI indicated that a SWA representative submitted the complaint.

The complaint was non-specific and never substantiated, but the whistleblower was removed from his oversight duties for 5 months while he was being investigated. Yet, FAA did not suspend other inspectors who were subjects of similar complaints, including the PMI, who admitted he allowed SWA to continue flying in violation of the AD.

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<sup>5</sup> OIG Report Number AV-2002-088, “Air Transportation Oversight System,” April 8, 2002.

<sup>6</sup> OIG Report Number AV-2005-062, “FAA Safety Oversight of an Air Carrier Industry in Transition,” June 3, 2005.

<sup>7</sup> OIG Report Number AV-2007-080, “FAA’s Actions Taken To Address Allegations of Unsafe Maintenance Practices at Northwest Airlines,” September 28, 2007.

Both the SWA and NWA cases demonstrate that FAA must pursue a more reliable internal review process and protect employees that bring important safety issues to light. Recently, FAA announced several actions to address the SWA safety directive violation. These include initiating a review of AD compliance at SWA and other air carriers. FAA also proposed to fine SWA more than \$10 million.

**While FAA’s actions are necessary, albeit long overdue, the issues we have identified will require immediate and comprehensive changes in FAA’s air carrier oversight programs.** These actions include the following:

- Ensuring that its VDRP guidance requires inspectors to (a) verify that air carriers take comprehensive actions to correct the underlying causes of violations identified through self-disclosure programs, and (b) evaluate, before accepting a new report of a previously disclosed violation, whether the carrier developed and implemented a comprehensive solution.
- Implementing a process for second level supervisory review of self-disclosures before they are accepted and closed—acceptance should not rest solely with one inspector.
- Periodically rotating supervisory inspectors to ensure reliable and objective air carrier oversight.
- Revising its post-employment guidance to require a “cooling-off” period when an FAA inspector is hired at an air carrier he or she previously inspected.
- Implementing a process to track field office inspections and alert the local, Regional, and Headquarters offices to overdue inspections.
- Establishing an independent organization to investigate safety issues identified by its employees.
- Developing a national review team that conducts periodic reviews of FAA’s oversight of air carriers.

FAA committed to implement these recommendations. Follow through will be critical to demonstrate FAA’s commitment to providing effective oversight.

### ***Improvements Also Are Needed in FAA’s Oversight of Repair Stations and Aircraft Manufacturers’ Suppliers***

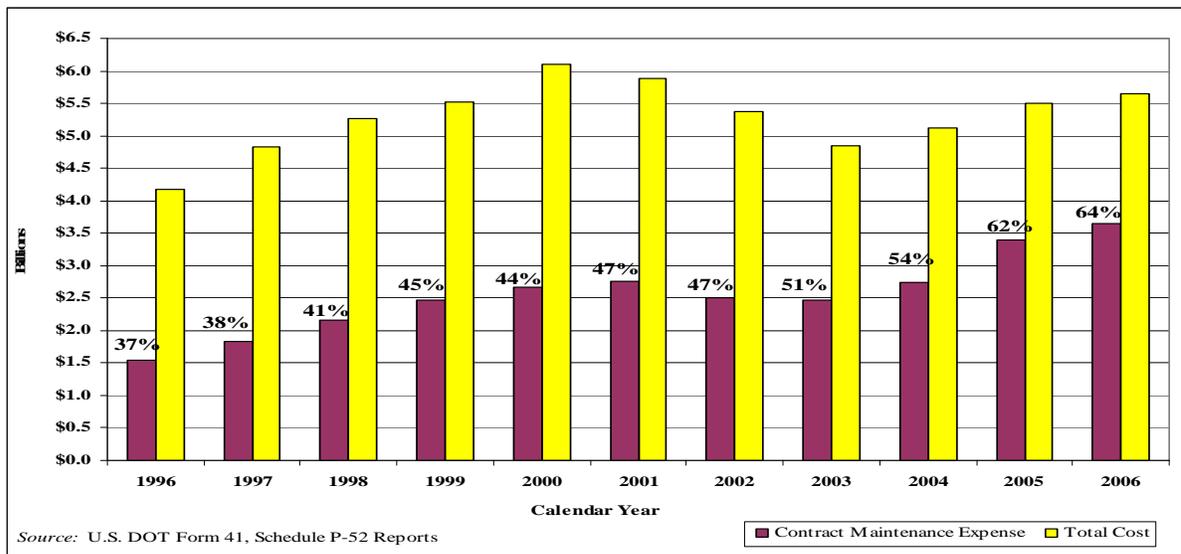
As with its oversight of air carriers, our work also has shown FAA must make similar improvements in its oversight of repair stations and its risk-based system for overseeing aircraft manufacturers’ suppliers. A key issue in both cases is that FAA’s oversight was inadequate in keeping up with dynamic changes occurring in those industries.

## Repair Stations

Air carriers have outsourced maintenance for years to both domestic and foreign repair facilities. These facilities can complete repairs for less cost and provide services in areas (such as engine repair) that otherwise would require air carriers to have specialized equipment and staff. Many air carriers outsource their engine work to the original equipment manufacturers because of the level of expertise the manufacturers can provide, and because the manufacturers provide warranties for their products. However, in recent years, use of external repair facilities has become more prominent.

As we testified before this Subcommittee in June,<sup>8</sup> from 1996 to 2006, while total maintenance costs have fluctuated, air carriers continued to increase the percentage of maintenance dollars spent on outsourced maintenance—from 37 to 64 percent. In 2006, \$3.7 billion of the \$5.7 billion spent on maintenance was outsourced (see figure 2).

**Figure 2. Percentage Increase in Outsourced Maintenance for Major Air Carriers From 1996 to 2006**



Neither FAA nor the Department maintains information on how much maintenance air carriers outsource to foreign facilities, but our work shows that the number of foreign FAA-certificated repair stations repairing U.S. aircraft has increased from 344 in 1994 to 698 in 2007. We have emphasized that the issue is not where maintenance is performed but that maintenance requires effective oversight.

<sup>8</sup> OIG Testimony Number CC-2007-076, “Aviation Safety: FAA Oversight of Foreign Repair Stations,” June 20, 2007.

However, we have identified challenges in FAA's ability to effectively monitor the increase in outsourcing. For example, in July 2003, we reported<sup>9</sup> that FAA had not shifted its oversight of aircraft maintenance to the locations where the maintenance was performed. Although air carriers were using external repair stations to perform more of their maintenance work, FAA still was focusing most of its inspections on the maintenance work that air carriers performed within their own facilities.

During the past 8 years, FAA has taken important steps to move its safety oversight for air carriers and repair stations to risk-based systems. FAA's new oversight system applies to both domestic and foreign repair stations. However, FAA cannot effectively implement a risk-based system for oversight of aircraft maintenance if it does not know where the maintenance is performed.

In July 2003 and again in December 2005,<sup>10</sup> we reported that FAA did not have good systems for determining which repair facilities air carriers were using to perform their most critical maintenance. FAA subsequently developed new inspector guidance and air carrier processes to address this problem. However, this system does not provide FAA with the information it needs to target inspections to where the most maintenance is done because FAA does not require air carriers to report these data.

When carriers *do* report the data, FAA does not require that they include all repair stations performing critical component repairs or that inspectors validate the information. These efforts fall short of providing FAA with the information it needs. FAA officials stated they are still formulating the guidance language, however, it is unclear whether FAA will require air carriers to report volume data for repair stations that perform critical component repairs and require inspectors to validate the data.

### **Aircraft Manufacturers' Suppliers**

In February, we reported<sup>11</sup> that since 1998 FAA has worked towards implementing a risk-based oversight system for aviation manufacturers. However, this system was implemented in FY 2003 and does not take into account the degree to which manufactures now use suppliers to make aviation products. FAA based the new system on historical manufacturing business models, in which manufacturers maintain primary control over the production of their aircraft rather than use suppliers to design and manufacture extensive portions of aircraft.

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<sup>9</sup> OIG Report Number AV-2003-047, "Review of Air Carriers' Use of Aircraft Repair Stations," July 8, 2003.

<sup>10</sup> OIG Report Number AV-2006-031, "Review of Air Carriers' Use of Non-Certificated Repair Facilities," December 15, 2005.

<sup>11</sup> OIG Report Number AV-2008-026, "Assessment of FAA's Risk-Based System for Overseeing Aircraft Manufacturers' Suppliers," February 26, 2008.

We found weaknesses throughout FAA’s oversight system for manufacturers and their suppliers. First, FAA has not ensured that manufacturers are providing oversight of their suppliers. Manufacturers are the first line of defense in ensuring the products used on their aircraft meet FAA and manufacturers’ standards. Yet, during the 24 months preceding our review, manufacturers had not audited 6 of the 21 critical parts suppliers we visited.

Second, FAA does not require inspectors to perform enough audits of suppliers to determine how well manufacturers’ quality assurance systems are working. FAA’s guidance for overseeing manufacturers’ quality assurance systems only requires inspectors to perform, at most, four supplier audits, regardless of how many suppliers the manufacturer uses.

Supplier control audits are a primary tool that FAA uses to assess how well manufacturers’ oversight systems are working. Equally important, these audits function as a second layer of control for preventing improperly produced parts from entering the market. However, as shown in the table below, in each of the last 4 years, FAA has inspected an average of *1 percent* of the total suppliers used by the five manufacturers we reviewed.

At FAA’s current surveillance rate, it would take inspectors at least 98 years to audit every supplier once. This is particularly troubling because manufacturers are not evaluating these suppliers frequently or comprehensively.

**Table 1. Number of Supplier Audits Completed by FAA for Five Major Manufacturers**

Manufacturer	No. of Supplier Facilities <sup>a/</sup>	Supplier Audits Completed by FAA				Avg. % Per FY
		FY 2003	FY 2004	FY 2005	FY 2006	
A	4,012	2	1	7	4	1%
B <sup>b/</sup>	2,553	31	26	15	27	1%
C	706	5	4	4	6	1%
D	489	5	3	1	2	1%
E	367	0	2	3	2	1%

<sup>a/</sup> Number of supplier facilities based on information obtained for 2004.

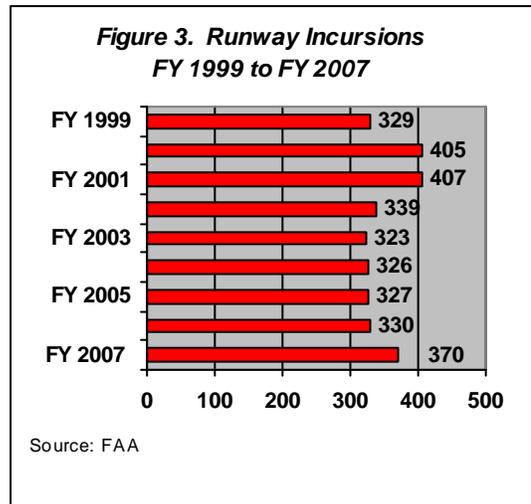
<sup>b/</sup> This manufacturer operates seven separate manufacturing divisions. As a result, FAA evaluated the seven divisions separately for risk assessment purposes, which resulted in more supplier control audits. Source: FAA’s National Supplier Control Audit Schedules, FY 2003-2006

Third, the systemic deficiencies we identified at the 21 supplier facilities we visited indicate that manufacturers and FAA need to strengthen their oversight of these facilities. For example, nearly half (43 percent) of the suppliers had deficiencies in their tool calibration and employee training programs. Deficiencies in these areas could impact the quality of the parts these suppliers produce.

## IMPROVING RUNWAY SAFETY

From 1999 to 2001, runway incursions increased at alarming rates. To its credit, FAA took decisive action that helped reduce these incidents—it established regional runway safety offices, and initiated aggressive educational programs for pilots. However, since 2003, the number of runway incursions has begun climbing again, reaching a high of 370 in FY 2007—a 12-percent increase over FY 2006 (see figure 3).

During the last 10 years, our work has showed that a range of actions are needed to enhance the margin of safety on the Nation’s runways. We have identified four specific areas where FAA and other aviation users should focus runway safety efforts.



- Implementing existing and new FAA systems to alert controllers and pilots to potential runway incursions.
- Making airport-specific infrastructure and procedural changes, such as improved runway signage and markings.
- Reinvigorating FAA’s national program for improving runway safety and identifying and correcting root causes of runway incursions.
- Addressing controller human factors issues, such as fatigue and attention, through improved training.

### Implementing Existing and New FAA Systems To Improve Runway Safety

New technology is considered by many to be a key factor in the mix of solutions for improving runway safety. However, our work on three major FAA acquisitions for improving runway safety has shown that there are significant concerns as to what can be effectively deployed within the next several years. For example, a key technology for preventing runway accidents—the Airport Surface Detection Equipment-Model-X (ASDE-X)—may not meet its cost and schedule goals to commission all 35 systems for \$549.8 million by 2011.

ASDE-X is a ground surveillance system intended to alert controllers to potential ground collisions. As of FY 2007, FAA expended about \$314 million (57 percent) and obligated about \$378 million (69 percent) of the planned funding. However, FAA only deployed 11 of 35 systems for operational use.

FAA must now deploy the last 24 systems at the more complex airports with less than half of the planned funds. We reported in October<sup>12</sup> that ASDE-X may not achieve all planned safety benefits. These include maintaining operational capability during inclement weather (when it is most needed) and alerting controllers to possible collisions on intersecting runways and taxiways (“hot spots” for runway incursions).

Another significant technology under development is Runway Status Lights (RWSL). RWSL technology uses automated, surveillance-driven lights that work as independent, direct warning systems to alert pilots in departing or crossing aircraft that the runway is occupied. Lights illuminate red when it is unsafe to cross or depart from a runway, thus increasing the crew’s situational awareness and decreasing the potential for runway incursions caused by pilot deviations.

In January, we reported<sup>13</sup> that RWSL is a viable technology for reducing runway incursions. At Dallas-Fort Worth International Airport (DFW), the test site for RWSL, the system met or exceeded all performance expectations. In addition, all system users we met with agreed that RWSL work as intended and have no known negative impact on capacity, communication, or safety.

However, the technology is still in the early stages of implementation, and much work remains for FAA to achieve full deployment. A key issue is that RWSL require ASDE-X fusion data for its surveillance capabilities and therefore depends on the successful deployment of that technology. In addition, RWSL have not been tested on intersecting runways.

One of the most promising technologies on the horizon is the Automatic Dependent Surveillance-Broadcast (ADS-B)—a satellite-based technology that allows aircraft to broadcast their position to other aircraft and ground systems. When displayed in the cockpit, ADS-B information can provide a “second set of eyes” by including the pilot in the loop to detect and alleviate hazardous surface situations.

In August 2007, FAA took an important step by awarding a contract for the development and installation of the ground infrastructure for ADS-B. However, as we testified in October,<sup>14</sup> ADS-B ground infrastructure will not be in place until 2013, and users will not be required to equip with the needed avionics until 2020. A clear transition path for moving forward with ADS-B with well-defined costs and benefits does not yet exist.

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<sup>12</sup> OIG Report Number AV-2008-004, “FAA Needs To Improve ASDE-X Management Controls to Address Cost Growth, Schedule Delays, and Safety Risks,” October 31, 2007.

<sup>13</sup> OIG Report Number AV-2008-021, “FAA’s Implementation of Runway Status Lights,” January 14, 2008.

<sup>14</sup> OIG Testimony Number CC-2007-100, “Challenges Facing the Implementation of FAA’s Automatic Dependent Surveillance-Broadcast Program,” October 17, 2007.

## **Making Airport-Specific Infrastructure and Procedural Changes**

The uncertain timeline and emerging risks of FAA's runway safety technologies underscore the need to explore other near-term solutions to improve runway safety. We found that there are several relatively low-cost, simple, airport-specific changes that can help reduce the risk of runway incursions. These include airport infrastructure changes as well as procedural changes to daily airport operations.

In May 2007, we reported<sup>15</sup> on runway safety efforts at four airports that had experienced a surge in runway incursions in 2005 and 2006—Boston, Chicago, Philadelphia, and Los Angeles. We found that airport operators at all four locations responded to the rise in runway incursions by improving airport lighting, adding better signage, and improving runway and taxiway markings. This included upgrading surface-painted, hold-short surface markings in advance of FAA's mandatory date of June 2008.

Some airports also added unique signage to prevent runway incursions. For example, at Chicago O'Hare, the airport operator added above-ground signage near the general aviation ramp instructing general aviation aircraft to hold and contact the ground controller before continuing. This will help prevent general aviation pilots from inadvertently taxiing onto an active runway.

We also found that airport operators and FAA managers made the following procedural changes to daily operations:

- Air Traffic managers adopted tools for tracking controller performance and increased the minimum time for management to work in the operational area.
- Airport operators tightly controlled the testing of drivers in the airfield driver certification process and imposed punitive action for non-compliance of driver rules.
- Airport operators and the FAA Runway Safety Office created maps or brochures to highlight potentially hazardous intersections (known as hot spots) on the airport movement area.

Results through FY 2007 at Boston and Philadelphia show a significant decrease in runway incursions (more than half at both locations). However, results are not as clear at Los Angeles International Airport (which is still completing airfield construction) and Chicago O'Hare (which is still struggling with extremely complex runway layouts). At Los Angeles, the number of runway incursions remained steady but at Chicago the number increased.

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<sup>15</sup> OIG Report Number AV-2007-050, "Progress Has Been Made in Reducing Runway Incursions, but Recent Incidents Underscore the Need for Further Proactive Efforts," May 24, 2007.

While the implementation of these actions varied among airports, they all had the potential to reduce runway incursions system-wide. However, other than informal networking, there were no formal means for the various users to share actions that had reduced or prevented runway incursions at their locations.

Our recommendations included developing an automated means, such as establishing an intranet site through the Regional Runway Safety Offices, to share best practices for reducing runway incursions with all users of the National Airspace System. In response, FAA implemented a best practices website for runway safety in December 2007.

In addition, in August 2007, FAA convened a task force of pilots, airport managers, and controllers to address runway safety issues. The group agreed on a short-term plan to improve runway safety, which focuses on (1) conducting safety reviews at airports based on runway incursion and wrong runway departure data, (2) deploying improved airport signage and markings at the 75 busiest, medium- to large-sized airports (ahead of the June 2008 mandated deadline), and (3) reviewing cockpit and air traffic clearance procedures.

In January 2008, FAA reported that the aviation industry has initiated and completed significant short-term actions to improve safety at U.S. airports. For example, safety reviews of the top 20 high-risk airports were completed, resulting in more than 100 short-term initiatives and numerous mid- and long-term initiatives. Also, 71 of the same 75 busiest airports completed enhancements to surface markings, and airlines committed to providing pilots with simulator training or other realistic training for taxiing aircraft from the terminal to the runway.

### **Reinvigorating FAA's National Program for Improving Runway Safety**

From 1998 to 2001, we reported that runway incursions were increasing at alarming rates. To its credit, FAA took decisive action, and the total number of runway incursions decreased from a high of 407 in FY 2001 to a low of 323 in FY 2003. During our review at the Boston, Chicago, Los Angeles, and Philadelphia airports, however, we found that many important national initiatives for promoting runway safety (undertaken by FAA as early as 2000) had waned as the number of incidents declined and FAA met its overall goals for reducing runway incursions.

For example, FAA established the Runway Safety Office in 2001 to provide central oversight and accountability for implementing runway safety initiatives throughout the Agency. However, at the time of our review, that office had not had a permanent Director for almost 3 years. In addition, the office was reorganized and realigned twice since FAA established the Air Traffic Organization in February 2004, and its staff was reduced by half, including the

elimination of two Headquarters Division offices within the Office of Runway Safety.

We also found that FAA no longer prepares its National Plan for Runway Safety, which defined the Agency's strategy and prioritized efforts to reduce runway incursions. The last time FAA prepared this plan was in 2002.

FAA has begun addressing many of our concerns. For example, in August 2007, FAA hired a permanent director for its Runway Safety Office and plans to reinstate its National Plan for Runway Safety. Although this is a good start, sustained commitment along with adequate resources and executive level attention will be key to achieving results.

### **Addressing Controller Human Factors Issues Through Improved Training**

Addressing human factors issues, such as fatigue and situational awareness, is important to improving runway safety. In its investigation of Comair flight 5191, the NTSB expressed concerns that the lone controller on duty at the time of the accident had about 2 hours of sleep before his shift. As a result of its investigation at Lexington, the NTSB added controller fatigue to its "Most Wanted List" in 2007 and made two recommendations to FAA concerning controller fatigue.

As we testified in February before the House Aviation Subcommittee,<sup>16</sup> controller staffing and training will be key watch items during the next 10 years as FAA begins executing its plans to hire and train 17,000 new controllers through 2017. Training new controllers on human factor issues (such as addressing fatigue and increasing attention) as well as technical aspects of air traffic control (such as airspace, phraseology, and procedures) will become increasingly important as FAA begins to address the large influx of new controllers.

We also reported in May that FAA needed to focus on controller human factors issues and training to improve individual, team, and facility performance. In its last National Plan for Runway Safety, FAA cited human factors and lack of controller teamwork as significant contributing factors of runway incursions caused by controller operational errors. However, we found that FAA had made little progress in addressing human factors training to help reduce the risk of runway incursions caused by controllers.

To its credit, FAA has successfully implemented an important training initiative—increasing the use of training simulators at towers. Tower simulators can improve overall facility performance by reducing runway incursions through enhanced initial and proficiency training. They provide controllers with a virtual replica of the tower environment, which can be used to train controllers using real-life

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<sup>16</sup> OIG Testimony Number CC-2008-043, "FAA's Fiscal Year 2009 Budget Request: Key Issues Facing the Agency," February 7, 2008.

scenarios such as day-versus-night operations, varying weather conditions, different runway configurations, or emergency situations.

Simulators also can be used to model changes in airport configurations and procedures. For example, Boston Logan used a tower simulator to help establish necessary safety procedures for a newly constructed runway. Likewise, the National Aeronautics and Space Administration used a tower simulator to study alternatives for improving runway safety at Los Angeles and evaluate the effectiveness of adding a center-field taxiway between its parallel runways. FAA recently installed tower simulators at four towers—Chicago O’Hare, Miami, Ontario, and Phoenix. Results thus far indicate that simulators are a valuable training tool.

FAA plans to install 12 additional simulators this year (6 at large airports and 6 at the FAA Academy) and 12 next year (at other airports). FAA needs to ensure that this initiative remains on track to capitalize on the significant success this training has demonstrated.

We are reviewing several other issues concerning controller human factors. At the request of the House Aviation Subcommittee Chairman, we are reviewing the rate and root causes of controller training failures (developmental controllers who fail training either at the FAA Academy or at their assigned facility). At the request of Senator Durbin of Illinois, we are reviewing factors that could affect controller fatigue. We are focusing our current efforts at Chicago O’Hare Tower, Chicago TRACON, and Chicago Center but may review other locations and FAA’s national efforts based on the results of our work at Chicago.

## **ADDRESSING ATTRITION WITHIN TWO OF FAA’S CRITICAL WORKFORCES**

A key issue that will affect FAA for at least the next 10 years is addressing attrition in two of its critical safety workforces—air traffic controllers and aviation safety inspectors. FAA currently is training more new controllers than it has in the past 15 years. The percentage of developmental controllers within the controller workforce has increased from about 15 percent in 2004 to about 25 percent in 2007.

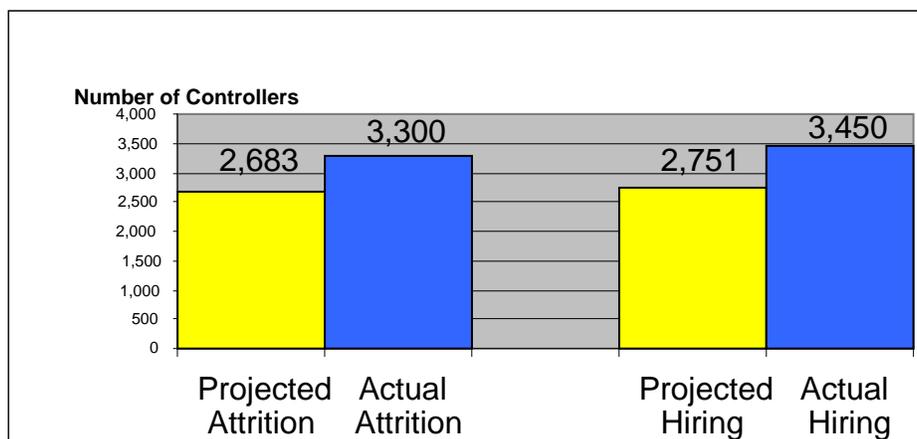
As a result, FAA is facing a fundamental transformation in the composition of its controller workforce that will require improvements in its facility training program. A critical piece for addressing controller attrition is facility training. However, we found that FAA’s facility training program continues to be extremely decentralized and the efficiency and quality of the training varies extensively from one location to another. We found similar problems in 2004.

FAA also is facing substantial safety oversight challenges due to potential attrition in its inspector workforce. FAA has about 4,100 inspectors to oversee a dynamic and rapidly changing industry, which includes 114 commercial air carriers, almost 5,000 foreign and domestic repair stations, more than 700,000 active pilots, and more than 1,600 approved manufacturers.

### Addressing Controller Attrition Through Improvements in Facility Training

The long-expected surge in controller attrition has begun. Since 2005, 3,300 controllers have left the Agency. The total rate of attrition was 23 percent higher than FAA projected; however, FAA has accelerated its hiring efforts to fill vacancies. Since 2005, FAA has hired 3,450 new controllers—25 percent more than projected. Still, FAA faces a major challenge as it must hire and train 17,000 new controllers through 2017. Figure 4 shows FAA’s estimates and actual numbers for controller attrition and new controller hiring from FY 2005 through FY 2007.

**Figure 4. Controller Attrition and Hiring Projected Versus Actual (FY 2005 to FY 2007)**



Source: FAA

As a result of the high level of controller attrition, FAA is facing a fundamental transformation in the composition of its controller workforce. The overall percentage of controllers in training has grown substantially during the past 3 years. From April 2004 to December 2007, the overall size of the controller workforce remained constant; however, during the same period, the number of controllers in training increased by 1,375, or 62 percent, while the total number of CPCs, decreased by 1,302. New controllers now represent about 25 percent of the workforce (up from 15 percent in 2004). However, that percentage can vary extensively by location—from as little as 2 percent (e.g., Boston TRACON ) to as much as 50 percent (e.g., Las Vegas TRACON).

As we testified in February,<sup>17</sup> a major challenge in addressing the attrition surge will be to train new controllers to the CPC level at their assigned locations. Facility training can take up to 3 years and is the most expensive part of new controller training. Training new controllers to the CPC level is important for two reasons: (1) only CPCs are qualified to control traffic at *all* positions of their assigned area, and (2) only CPCs certified for at least 6 months (at their assigned location) can become on-the-job training (OJT) instructors for other new controllers. FAA must have enough OJT instructors at all locations if it is to achieve its ambitious hiring and training plans for the next 10 years and beyond.

It is important to note that new controllers who have completed portions of training and have been certified on a position can independently staff that position. However, controllers are not qualified CPCs until they have certified on all positions within their assigned area. In addition, using position-qualified controllers extensively to staff positions can lengthen the time required for them to become CPCs since they are not training on other new positions.

We recently completed an audit of FAA's controller facility training program—our second review of this program since 2004. Overall, we found that the program continues to be extremely decentralized and the efficiency and quality of the training varies from one location to another. We found similar problems in 2004. FAA is taking actions at the national level to get this important program on track, but many of FAA's efforts are still in the early stages. To achieve its goals for the controller workforce, FAA will need to take the following actions:

- **Clarify responsibility for oversight and direction of the facility training program at the national level.** Facility training is primarily the responsibility of the Air Traffic Organization's Vice President for Terminal Services and Vice President for En Route and Oceanic Services. However, the Vice President for Acquisition and Business Services oversees new controller hiring and the FAA Academy training program, and the Senior Vice President for Finance oversees the development of the Controller Workforce Plan. Both have key roles in the controller training process as well. As a result of these overlapping responsibilities, we found there is significant confusion at the facility level.

During our review, facility managers, training managers, and even Headquarters officials were unable to tell us who or what office was responsible for facility training. FAA needs to clarify responsibility for oversight and direction of the facility training program at the national level and communicate those roles to facility managers.

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<sup>17</sup> OIG Testimony CC-2008-043, "FAA's Fiscal Year 2009 Budget Request: Key Challenges Facing the Agency," February 7, 2008.

- **Establish realistic standards for the level of developmental controllers that facilities can accommodate.** Given the various sizes and complexities of FAA’s more than 300 facilities, FAA needs to identify (by facility) how many developmental controllers facilities can realistically accommodate. FAA must consider several factors, such as: (1) the number of available OJT instructors, (2) available classroom space, (3) the number of available simulators, (4) all training requirements, and (5) the number of recently placed new personnel already in training.
- **Implement key initiatives proposed in its 2004 Controller Workforce Plan.** FAA has not implemented key initiatives to improve facility training that it proposed in the 2004 Controller Workforce Plan. These include, “developing, implementing, and enforcing a policy that assigns facility training as a priority second only to operations.” This was to be accomplished by “(1) placing developmental controllers only at facilities that had available training capacity, (2) requiring facility managers to suspend training *only* for critical operational necessities, and (3) establishing nominal time-to-certify metrics and holding managers accountable for achieving those targets.” However, FAA never issued this policy.

In addition, FAA has not comprehensively evaluated its facility training program. In its 2004 Controller Workforce Plan, FAA stated it would “conduct a thorough review of facility training to ensure it begins where the Academy ends. This review will take into consideration other efficiency gains identified in this plan and will result in facility training programs tailored to meet the needs of developmental controllers of the future.” FAA intended for this effort to help reduce the time it takes new controllers to become CPCs. However, FAA never conducted the evaluation. FAA must follow through with this evaluation and its Controller Workforce Plan initiatives.

### **Addressing Inspector Attrition and Implementing Staffing Models**

FAA is also facing substantial safety oversight challenges due to potential attrition in its inspector workforce. FAA has about 4,100 inspectors to oversee a dynamic and rapidly changing industry, which includes 114 commercial air carriers, almost 5,000 foreign and domestic repair stations, more than 700,000 active pilots, and more than 1,600 approved manufacturers. Last year, FAA’s hiring efforts kept pace with retirements, and the Agency ended the year with 133 additional inspectors compared to FY 2006 levels. However, FAA must continue to closely oversee this effort since nearly half of the inspector workforce will be eligible to retire in the next 5 years.

FAA will never have an inspector workforce that is large enough to oversee all aspects of the industry, so it is important for the Agency to place inspectors where they are most needed. To maximize its limited inspector resources, FAA has been working toward risk-based safety oversight systems for air carriers, repair stations, and manufacturers. These systems target inspector resources to areas of greatest risk. However, unless FAA develops a reliable staffing model, it will not be able to effectively use its inspectors. At the direction of Congress, the National Research Council completed a study<sup>18</sup> of FAA's current methods for allocating inspector resources in September 2006 and recommended that FAA develop a new staffing model.

It has been more than 1 year since the Council study, and FAA is still in the early stages of developing a new staffing method. FAA has established an interim target date to assess current staffing methods and begin identifying the elements of the next generation staffing tool by September 2008.

FAA recently finalized milestones to develop and implement the new model and plans to begin using it by October 2009. Making measurable progress toward a new staffing model is a key watch item, and we will continue to monitor this important initiative.

That concludes my statement, Mr. Chairman, I would be happy to address any questions you or other Members of the Subcommittee may have.

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<sup>18</sup> "Staffing Standards for Aviation Safety Inspectors," September 20, 2006.

The following pages contain textual versions of the graphs and charts found in this document. These pages were not in the original document but have been added here to accommodate assistive technology.

**Testimony Before the Committee on Commerce, Science, and Transportation  
Subcommittee on Aviation Operations, Safety, and Security  
United States Senate**

**Key Safety Challenges Facing the Federal Aviation Administration**

**508 Compliant Presentation**

**Figure 1. Timeline of the Southwest Airlines Disclosure and FAA Actions**

- March 14, 2007: Southwest Airlines discovers it overflowed.
- March 15, 2007: Southwest Airlines representative notifies Principal Maintenance Inspector that 100 planes may have overflowed.
- March 19, 2007: Southwest Airlines self-discloses that 47 planes overflowed Airworthiness Directive (Southwest Airlines later determined only 46 planes had violated the Airworthiness Directive).
- March 22, 2007: During routine inspection at Chicago, whistleblower sees cracks on 1 of the reported planes—it had flown the day before.
- March 23, 2007: Southwest Airlines states it has completed inspections for affected planes—five had cracks. (Note: Affected planes continue operating on 1,451 flights from March 14, 2007, to March 23, 2007.)
- April 16, 2007: Independent review (by inspectors for another office within the Federal Aviation Administration’s Southwest Region) concludes that Southwest Airlines operated 47 planes in known unairworthy condition and that the Principal Maintenance Inspector condoned this. No action taken against the Principal Maintenance Inspector.
- May 1, 2007: The Federal Aviation Administration’s Southwest Region requests the Federal Aviation Administration’s Security and Hazardous Materials Division to review the Southwest Airlines disclosure.
- July 12, 2007: Security and Hazardous Materials Division reports that Southwest Airlines stated that the Principal Maintenance Inspector never ordered the planes grounded and that the Principal Maintenance Inspector admitted he shouldn’t have encouraged the self-disclosure.

- September 18, 2007: The Federal Aviation Administration’s Southwest Region requests a second review from the Security and Hazardous Materials Division.
- October 2, 2007: Security and Hazardous Materials Division second review reports that the Principal Maintenance Inspector admitted he should have grounded planes but chose to avoid negative affect on FAA (results of this review spark February 2008 Committee request to the Office of Inspector General).
- November 16, 2007: The Federal Aviation Administration initiates enforcement action.

**Figure 2. Percentage Increase in Outsourced Maintenance Expense for Major Air Carriers From 1996 to 2006**

<b>(Year) 1996</b>	Of the total maintenance cost, 37 percent was outsourced maintenance expense.
<b>(Year) 1997</b>	Of the total maintenance cost, 38 percent was outsourced maintenance expense.
<b>(Year) 1998</b>	Of the total maintenance cost, 41 percent was outsourced maintenance expense.
<b>(Year) 1999</b>	Of the total maintenance cost, 45 percent was outsourced maintenance expense.
<b>(Year) 2000</b>	Of the total maintenance cost, 44 percent was outsourced maintenance expense.
<b>(Year) 2001</b>	Of the total maintenance cost, 47 percent was outsourced maintenance expense.
<b>(Year) 2002</b>	Of the total maintenance cost, 47 percent was outsourced maintenance expense.
<b>(Year) 2003</b>	Of the total maintenance cost, 51 percent was outsourced maintenance expense.
<b>(Year) 2004</b>	Of the total maintenance cost, 54 percent was outsourced maintenance expense.
<b>(Year) 2005</b>	Of the total maintenance cost, 62 percent was outsourced maintenance expense.
<b>(Year) 2006</b>	Of the total maintenance cost, 64 percent was outsourced maintenance expense.

Source: U.S. DOT Form 41, Schedule P-52 Reports

**Figure 3. Runway Incursions Fiscal Year 1999 to Fiscal Year 2007**

- In fiscal year 1999, there were 329 runway incursions.
- In fiscal year 2000, there were 405 runway incursions.
- In fiscal year 2001, there were 407 runway incursions.
- In fiscal year 2002, there were 339 runway incursions.
- In fiscal year 2003, there were 323 runway incursions.

- In fiscal year 2004, there were 326 runway incursions.
- In fiscal year 2005, there were 327 runway incursions.
- In fiscal year 2006, there were 330 runway incursions.
- In fiscal year 2007, there were 370 runway incursions.

Source: FAA

**Figure 4. Controller Attrition and Hiring Projected versus Actual, FY 2005 to FY 2007**

- For this period, projected controller attrition was 2,683. Actual controller attrition was 3,300.
- For this period, projected controller hiring was 2,751. Actual controller hiring was 3,450.

Source: FAA