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Subcommittee on Aviation
United States House of Representatives**

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Actions Needed To Improve Runway Safety

**Statement of
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Mr. Chairman and Members of the Subcommittee:

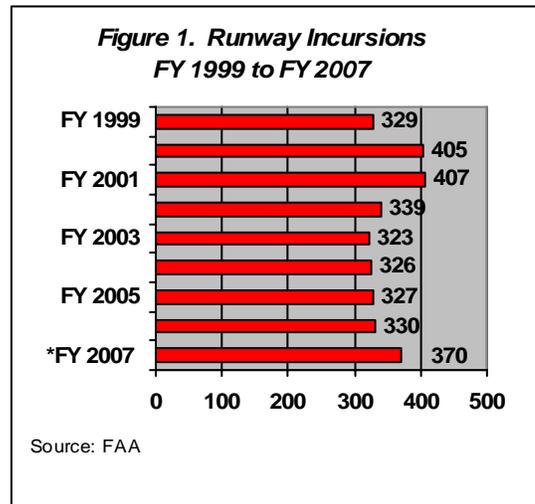
We appreciate the opportunity to testify today on runway safety. Since 1997, our office has issued 11 audit reports and testified numerous times before Congress on actions needed for improving runway safety. Our testimony today is based on our prior and ongoing work in this important area.

Safety is the Federal Aviation Administration’s (FAA) highest priority, and the United States has experienced one of the safest periods in aviation history. However, we continue to see incidents such as the recent close calls on the ground in Baltimore, Chicago, and San Francisco, which serve as reminders that we must work to make our system even safer. Aviation stakeholders are expressing growing concerns regarding the rise in severe runway incidents. 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).¹ This critical safety issue requires continual action and heightened attention. 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.

From 1999 to 2001, runway incursions increased at alarming rates. To its credit, FAA took decisive action that helped to 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 fiscal year (FY) 2007—a 12-percent increase over FY 2006 (see figure 1).

Of the 370 runway incursions that occurred in FY 2007, 209 (57 percent) were caused by pilots, 105 (28 percent) by controllers, and 56 (15 percent) by ground vehicles.



¹ Effective October 1, 2007, FAA began categorizing runway incursions using the International Civil Aviation Organization definition. The new definition of runway incursions includes incidents that were previously defined by FAA as “surface incidents” (where a potential conflict did not exist).

The most serious incidents (Categories A and B) decreased from a high of 69 in FY 1999 to a low of 24 in FY 2007. However, very serious close calls involving commercial aircraft continue to occur. For example:

- On December 2, 2007, at Baltimore Washington International Airport, a collision was barely avoided when a controller cleared a Comair aircraft for take-off while simultaneously clearing an America West aircraft to land on an intersecting runway. The Comair aircraft passed in front of the America West aircraft by about 150 feet at the runway intersection.
- On July 19, 2007, at Chicago O'Hare International Airport, a collision was barely avoided when a United Airlines aircraft exited the wrong taxiway and taxied directly under an arriving US Airways aircraft. Although the controller instructed the US Airways aircraft to go around and then re-attempt the landing, it overflew the nose of the United aircraft by about 50 to 70 feet.
- On May 26, 2007, at San Francisco International Airport, a controller mistakenly cleared a Republic regional aircraft to depart while a Skywest regional aircraft was landing on an intersecting runway. The Skywest aircraft was unable to stop short of the runway intersection, and the Republic aircraft overflew it by about 50 feet.

During the first 3 months of FY 2008, 10 serious runway incursions occurred. If that rate continues, there could be 40 serious runway incursions before the end of FY 2008, which would be the highest level in 6 years.

Over 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 (see exhibit). 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 had expended about \$314 million (57 percent) and obligated about \$378 million (69 percent) of the planned funding. However, FAA had 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 October² 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 an independent, direct warning system 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.

Last month, we reported³ 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 works as intended and has 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 requires ASDE-X fusion data for its surveillance capabilities and therefore depends on the successful deployment of that technology. In addition, RWSL has 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

² 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. OIG reports and testimonies are available on our website: www.oig.dot.gov.

³ OIG Report Number AV-2008-021, “FAA’s Implementation of Runway Status Lights,” January 14, 2008.

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,⁴ 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.

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 reported⁵ 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.

However, at all four locations, the actions were taken only after an increase in the number and severity of incidents at those airports. For example, at Boston Logan International Airport, significant corrective actions did not occur until after a Category A runway incursion happened on June 9, 2005, when 2 aircraft came within 171 feet of a collision. That marked the ninth runway incursion in FY 2005—a significant increase over the previous year when only one runway incursion occurred during the entire year.

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 had made the following procedural changes to daily operations:

⁴ OIG Testimony Number CC-2007-100, “Challenges Facing the Implementation of FAA’s Automatic Dependent Surveillance-Broadcast Program,” October 17, 2007.

⁵ 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.

- 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 (over 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 increased at Chicago.

While the implementation of these actions varied among the 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 over 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.

We also recommended that FAA work with the pilot and airline communities to establish a process for sharing the redacted information on runway incursions and surface incidents in the Aviation Safety Action Program (ASAP). We believe this could help to identify trends, root causes, and possible local solutions. FAA agreed with our recommendation and tasked the MITRE Center for Advanced Aviation Systems Development to develop archives of ASAP data with airlines. FAA plans to implement the analytical tools and methodologies required for detailed analyses by October of this year.

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.

As we testified last week before this Subcommittee,⁶ controller staffing and training will be key watch items over the next 10 years as FAA begins executing its plans to hire and train 15,000 new controllers through 2016. FAA is facing a fundamental transformation in the composition of its controller workforce. New controllers now represent 23 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 terminal radar approach control facility, or TRACON) to as much as 50 percent (e.g., Las Vegas TRACON).

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.

For example, the National Air Traffic Professionalism Program (NATPRO) is a human factors initiative that we reviewed in 2003.⁷ NATPRO training is designed to sharpen and maintain controllers' mental skills most closely associated with visual attention and scanning. Participants thus gain personal insight into how performance can be influenced (e.g., by distraction, fatigue, and boredom) and how those factors increase the opportunity for operational errors.

The program was tested in FY 2003, and FAA provided this training at its en route centers and will begin using it at its TRACON facilities in FY 2008. However, at the time of our review, it had not been implemented at towers where visual attention and scanning are key factors in preventing runway incursions. Since we issued our report, FAA has provided NATPRO cadre training to representatives from 42 facilities so they can use NATPRO training at their facilities. Tower facilities are required to start NATPRO training in FY 2009.

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 scenarios such as

⁶ OIG Testimony Number CC-2008-043, "FAA's Fiscal Year 2009 Budget Request: Key Issues Facing the Agency," February 7, 2008.

⁷ OIG Report Number AV-2003-040, "Report on Operational Errors and Runway Incursions," April 3, 2003.

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

Simulators can also 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 Chairman Costello, we are reviewing the rate and root causes of controller training failures (developmental and transferring 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.

I would now like to discuss these four areas in greater detail.

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. We have completed or are reviewing three important new technologies on the horizon—ASDE-X (a ground surveillance system that warns controllers of possible runway conflicts), RWSL (a “stop-light” technology that warns pilots when a runway is occupied by another aircraft), and ADS-B (an advanced technology that periodically broadcasts the vertical and horizontal position of an aircraft). ASDE-X is the closest to near-term deployment, while ADS-B is planned for the 2020 timeframe.

ASDE-X: ASDE-X is an important safety initiative to reduce the risks of accidents on runways. FAA designed ASDE-X in response to the NTSB recommendation to require ground movement safety systems at airports to provide direct warnings to flight crews. However, in November 2006, the NTSB reported that ASDE-X is an unacceptable response to its longstanding (6 years) safety recommendation because it does not provide direct warnings of potential ground collisions to flight crews.

In October 2007, we reported that the ASDE-X program may not meet its cost and schedule goals to commission all 35 ASDE-X systems for \$549.8 million by 2011 or achieve all planned safety benefits. As of FY 2007, FAA had expended about \$314 million (57 percent) and obligated about \$378 million (69 percent) of the planned funding. However, FAA had only deployed 11 of 35 systems for operational use. FAA must now deploy the 24 remaining systems at the more complex airports with less than half of the planned funds.

In July 2007, FAA commissioned its ninth ASDE-X system for operational use at Louisville International Airport after addressing several longstanding technical problems. The Louisville system was the first to be deployed with the capability to alert controllers to potential collisions on intersecting runways and converging taxiways. However, under certain circumstances, when aircraft are operating on intersecting runways, the system still does not provide timely alerts to controllers. Moreover, FAA did not test the converging taxiway capability before operations began, and the system is susceptible to dropping targets during heavy precipitation.

FAA also faces challenges in meeting the unique needs of airports scheduled to receive ASDE-X. For example, in August 2007, FAA accelerated ASDE-X deployment at Chicago O’Hare. However, in January 2008, air traffic controllers expressed concern about the system’s ability to accurately detect aircraft and vehicles during snow storms. FAA must focus on resolving operational performance issues before implementing key ASDE-X safety capabilities.

FAA concurred with our recommendations to help the Agency achieve ASDE-X program goals and improve program management. These include: (1) improving ASDE-X management controls to reduce the risk of further cost growth and schedule delays; (2) resolving operational performance issues with key ASDE-X safety capabilities to reduce the risk of ground collisions on intersecting runways and taxiways, including during inclement weather; and (3) working with airlines and airports to provide safety enhancements that were excluded from the program re-baseline but are vital to reducing the risk of ground collisions caused by pilot and vehicle operator errors. We intend to follow up on these important issues next year.

Runway Status Lights: Another promising technology on the horizon is RWSL. RWSL technology uses automated, surveillance-driven lights that work as an independent, direct warning system to alert pilots in departing or crossing aircraft that the runway is occupied. The lights are installed at runway/taxiway intersections and at departure points along the runways. 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 a runway incursion.

We found that RWSL is a viable technology for preventing runway incursions. While FAA has made progress in developing RWSL, this technology is still in the early stages of implementation; much work remains for FAA to achieve full deployment. Essential attributes of RWSL include the following:

- Timely warnings of potential conflicts—RWSL promptly and clearly indicates to pilots and vehicle operators when it is unsafe for aircraft to enter or cross a runway or to commence take-off.
- Automated information—RWSL provides this information at all times without human input.
- No interference with Air Traffic operations—RWSL acts as an independent safety enhancement. It does not increase controller workload and does not interfere with the normal flow of airport traffic or rhythm of controller movement of traffic.
- Lights indicate status only—RWSL indicates runway status and does not convey an Air Traffic Control clearance. Clearance is still provided by Air Traffic Control.
- Illuminated lights warn pilots of potential runway conflicts and prompt them to notify the tower before proceeding if a contradicting clearance has been issued; therefore, the system may also help to identify potential controller operational errors.

During operational evaluations and subsequent modifications at DFW for runway entrance lights and take-off hold lights, RWSL met or exceeded all performance criteria specified in the RWSL Research Management Plan. In addition, all system

users we met with at DFW agreed that RWSL works as intended and has no known negative impact on capacity, communication, or safety.

Further, runway incursions on the test runway at DFW (runway 18L/36R) have decreased by 70 percent: during the 29 months before testing (October 1, 2002, through February 28, 2005), 10 runway incursions occurred at DFW; during the 29 months after testing (March 1, 2005, through July 31, 2007), only 3 occurred.

While RWSL at DFW has performed extremely well thus far, we identified several challenges that FAA must address to ensure the effective and timely implementation of this important safety technology. For example,

- RWSL depends on ASDE-X, and the interface between the two systems will need to be modified to address the differences between the ASDE-X prototype system used at DFW for RWSL and the version of ASDE-X being deployed nationally at other airports.
- Some of the airports where FAA plans to deploy RWSL are undergoing or will undergo airfield improvements. It will be important for the RWSL program office to work with FAA's Airports line of business to identify those airports and coordinate the deployment of RWSL in-ground infrastructure concurrently with airfield construction. This will help to save investment dollars by avoiding duplicative construction and ensure timely implementation of infrastructure improvements and RWSL.
- Part of the early success of RWSL testing has been immediate input and corrective actions by the research and development staff (including the federally funded research contractor that created the system) when problems were identified. A key factor for maintaining project momentum will be ensuring that similar "hands-on" knowledge is retained during the transition from research and development to the acquisition phases of the RWSL life cycle.

FAA's Joint Resource Council (JRC) approved the RWSL initial investment decision in July 2007. The initial investment decision document recommended that FAA finalize its acquisition strategy and return it to the JRC for the final investment decision (which sets the stage for system-wide implementation) no later than November 2007. However, the target date for the final investment decision is currently set for July 2008. In our opinion, setting the target date for the final investment decision 1 year after the initial investment decision to complete the acquisition package was approved did not meet the JRC's direction.

Meeting these challenges in the early phases of RWSL implementation will be critical for keeping it on track. Our January 2008 recommendations focused on the actions FAA needs to take now to ensure that the system remains a viable tool for reducing runway incursions and that future deployment remains on schedule. FAA agreed with

our recommendations and has established appropriate milestones for beginning the acquisition of the system. The first step is the Request for Offer release, which FAA expects to issue later this month.

As shown below, RWSL consists of both runway entrance lights and take-off hold lights. Runway entrance lights illuminate red when a runway is unsafe to enter or cross (see figure 2). Runway entrance lights are visible to aircraft from taxiways holding short of runway intersections.

Figure 2. Diagram of Entrance Lights

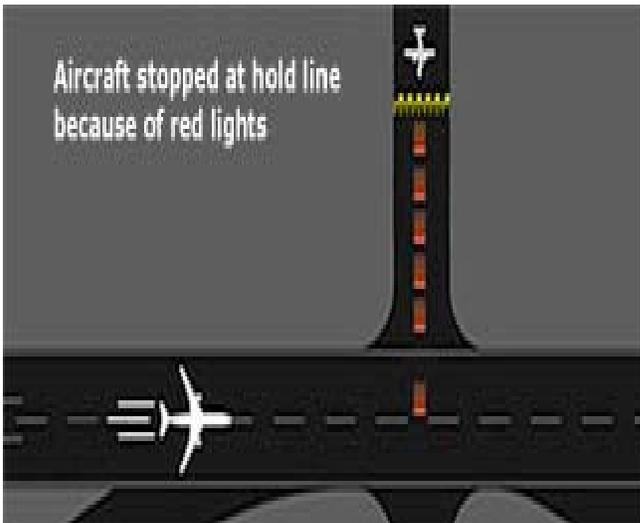


Figure 3. OIG Photo of Entrance Lights at DFW

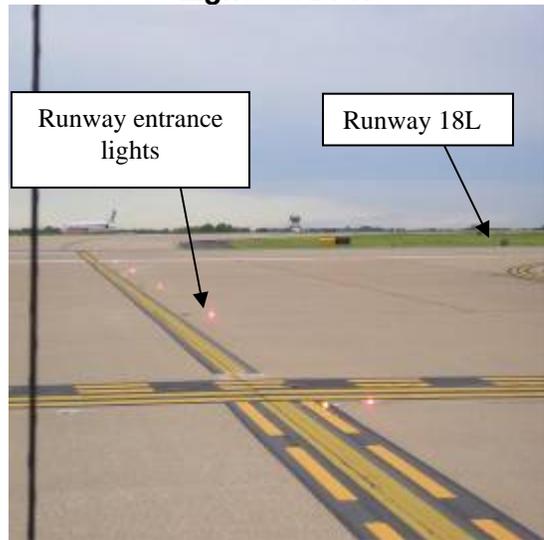
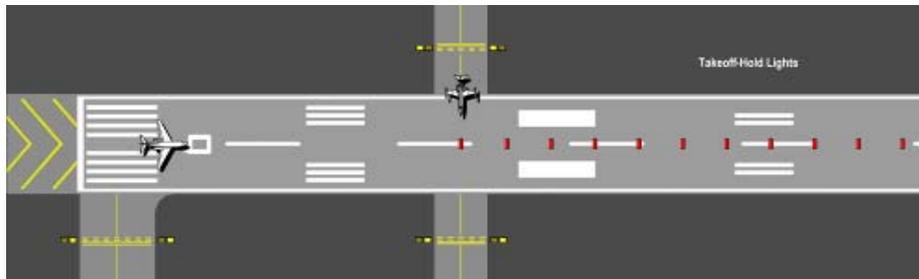


Figure 3 shows the view pilots see when runway 18L is unsafe to enter due to an aircraft taking off. Take-off hold lights illuminate red to indicate an unsafe condition when an aircraft is in position for take-off and another aircraft or vehicle is either on or about to enter the runway in front of it (see figure 4).

Figure 4. Diagram of Take-Off Hold Lights



FAA is also developing a third type of runway status lights, runway intersection lights. These lights are designed to warn pilots on a runway when another aircraft is departing from or landing on an intersecting runway. FAA plans to begin testing these lights at Chicago O'Hare later this year.

ADS-B and In-Cockpit Moving Map Displays: As we reported in 2001,⁸ technologies that help pilots know their and others' locations on the runway (e.g., in-cockpit moving map displays and ADS-B) must be expedited to avoid close calls that continue to pose a serious safety risk to airline crews and passengers. In March 2007, FAA announced plans to expedite the certification and use of in-cockpit moving map displays to show pilots their actual position on the airport surface.

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. FAA plans to mandate "ADS-B Out," which allows aircraft to broadcast their position to ground systems, but does not intend to mandate the use of "ADS-B In" or cockpit displays. FAA hopes the industry will voluntarily equip with the technology.

Over the next several years, FAA plans to work with the United Parcel Service at Louisville to develop air-to-air and surface applications for ADS-B In and cockpit displays. FAA plans to integrate the use of ADS-B, cockpit displays, and ASDE-X. This presents FAA with a unique opportunity to determine whether these three technologies can be combined to simultaneously alert controllers and pilots to potential ground collisions. FAA should then determine the cost and timeline for implementing this capability at all ASDE-X airports.

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, 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.

FAA must address several challenges to realize the benefits of ADS-B. These include: (1) gaining stakeholder acceptance and aircraft equipage, (2) addressing broadcast frequency congestion concerns, (3) integrating with existing systems, (4) implementing procedures for separating aircraft, and (5) assessing potential security vulnerabilities in managing air traffic.

⁸ OIG Report Number AV-2001-066, "Despite Significant Management Focus, Further Actions Are Needed To Reduce Runways Incursions," June 26, 2001.

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, such as better signage, lighting, and markings as well as procedural changes to daily airport operations. Another important infrastructure component is the installation of runway safety areas, which provide a safety net for aircraft undershooting, overrunning, or veering off a runway during a landing or an aborted take-off.

In May, we reported on actions taken at Boston, Chicago, Philadelphia, and Los Angeles airports in response to increased runway incursions. However, at all four airports, the actions were taken only after an increase in the number and severity of incidents. For example, at Boston Logan, significant actions did not occur until after a Category A runway incursion happened on June 9, 2005, when 2 aircraft came within 171 feet of a collision. That marked the ninth runway incursion in FY 2005—a significant increase over the previous year when only one runway incursion occurred during the entire year.

At all four locations, we found that airport operators had improved airport lighting (see figure 6 on page 15), signage, and markings in response to runway incursions. For instance, the airports upgraded surface-painted, hold-short surface markings in advance of FAA's mandatory implementation date of June 2008.

The 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 to prevent general aviation pilots from inadvertently taxiing onto an active runway (see figure 5).

Figure 5. Picture of Ground Signage at Chicago O'Hare Instructing General Aviation Pilots To Hold and Contact Ground Control Before Proceeding



Figure 6. Picture of an Elevated Runway Guard Light at Boston Logan



At Los Angeles, airport operators are making major infrastructure changes to reduce runway incursions. The airport moved one runway 55 feet farther away from a parallel runway so that a center-field taxiway could be added. This action has the most potential for preventing runway incursions because most pilot deviations occurred when aircraft were exiting one runway but, due to the close proximity of the parallel runway, were unable to hold short of the second runway as instructed. The center-field taxiway is expected to be completed later this year.

We also found that, at all four locations, airport operators and FAA managers had made procedural changes to daily operations. Examples of effective actions include the following:

- Air Traffic managers adopted tools for tracking controller performance. At Boston Logan, managers implemented the use of an automated software program for performance oversight, while the other facilities adopted the use of other tools or forms to better track employee performance until automated software is available.
- Air Traffic managers also increased the minimum required time for management to work in the operational area. At Chicago O’Hare, managers implemented a requirement for operational managers to spend at least 80 percent of their time in the operational area.
- Airport operators tightly controlled the testing of drivers in the airfield driver certification process. Each airport operator imposed punitive action for non-compliance of driver rules, some resulting in revocation of driver privileges or enforcement of fines.
- 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. At Philadelphia International Airport, the airport operator created user-specific hot-spot maps, which identified different hot spots for vehicle drivers and for pilots.
- At Boston Logan, Regional Runway Safety Program Managers developed a high-alert intersection brochure that identified hot spots and distributed it to airport users.

While the implementation of these actions varied among the 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 effectively reduced or prevented runway incursions at their locations. Regional Runway Safety Managers in particular expressed frustration at their inability to share best practices through a formal channel, such as an intranet posting site specifically dedicated to runway safety issues.

We recommended that FAA develop 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 over 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.

Another important infrastructure component is the installation of runway safety areas. Runway safety areas are cleared and graded terrain surrounding a runway that provide a safety net for aircraft undershooting, overrunning, or veering off a runway during a landing or an aborted take-off. The importance of having unobstructed runway safety areas was demonstrated on December 8, 2005, when a Southwest Airlines plane skidded off the end of a runway, killing 1 person and injuring 12. The accident occurred at Chicago Midway Airport, which at that time did not have a standard runway safety area.⁹

The operators of commercial service airports must upgrade their runway safety areas to FAA design standards by 2015—a requirement of the DOT Appropriations Act of FY 2006. In November 2007, we initiated an audit to review FAA’s Runway Safety Area Improvement Program and plan to issue a report later this year.

REINVIGORATING FAA’S NATIONAL PROGRAM FOR IMPROVING RUNWAY SAFETY

The serious risks associated with runway incursions underscore the need for maintaining a proactive approach for preventing these incidents. This will depend on strong program oversight that identifies systemic issues and resolves them in a timely manner.

We identified opportunities that could help further reduce runway incursions system-wide. Specifically, we found that (1) renewed focus at the national level was needed to ensure that runway safety remains a priority for all FAA lines of business and (2) better information sharing was needed to identify root causes of pilot deviations.

Renewed Focus at the National Level Is Needed To Ensure That Runway Safety Remains a Priority for all FAA Lines of Business

During our review of the Chicago, Philadelphia, Boston, and Los Angeles airports, however, we found that several national initiatives for promoting runway safety (undertaken by FAA as early as 2000) had waned as the number of incidents declined

⁹ In November 2007, the airport improved its runway safety area by installing an arresting system.

and FAA met its overall goals for reducing runway incursions. For example, FAA's Runway Safety Office was established in 2001 to provide central oversight and accountability for implementing runway safety initiatives throughout the Agency.

However, until August 2007, that office had not had a permanent Director for almost 3 years. In addition, the office was reorganized and realigned twice since the FAA established the Air Traffic Organization in February 2004. Further, the office staff was reduced by half (from 18 to 9 staff members), including the elimination of two Headquarters Division offices within the Office of Runway Safety.

Another example is FAA's National Plan for Runway Safety. This plan defined FAA's strategy and prioritized its efforts to reduce runway incursions by including specific activities, milestones, and the organization responsible for those activities. FAA believed that this plan, along with quarterly status briefings to the Administrator, would improve program accountability by ensuring that initiatives were completed in a timely manner. However, we found that this plan was no longer prepared, and the last time FAA prepared one was in 2002.

FAA officials we spoke with told us that the FAA Flight Plan took the place of the National Plan for Runway Safety and that each line of business is responsible for including runway incursion initiatives in its own annual business plan. The individual business plans, however, do not have the same national focus and emphasis that the National Plan for Runway Safety provided. In addition, fragmented authority can lead to reduced focus and accountability.

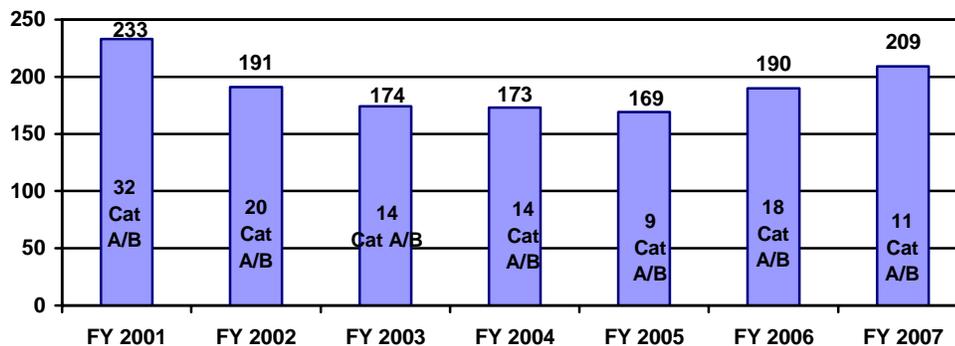
For instance, FAA does not require each line of business to include goals in its business plan that are specific to its oversight responsibility, and this may diminish accountability for achieving results within each line of business. For example, while FAA met its FY 2006 overall goal of no more than 34 serious runway incursions, pilot deviations (the responsibility of the Aviation Safety line of business) experienced a 100-percent increase—rising from 9 in FY 2005 to 18 in FY 2006. To improve accountability, we recommended that FAA require each line of business to establish quantitative runway incursion goals specific to its oversight responsibility.

FAA agreed with our recommendation and plans to develop a comprehensive strategy to address runway safety that each line of business will be accountable to, similar to the 2002-2004 National Plan for Runway Safety. FAA plans to complete a draft of the plan by the end of this fiscal year.

Better Information Sharing Is Needed To Identify Root Causes of Pilot Deviations

Pilot deviations have historically been the cause of 50 percent or more of all runway incursions. In FY 2006, both the total number of and the most serious runway incursions caused by pilots increased to their highest levels since FY 2002 (see figure 7). In FY 2007, the total number of pilot deviations continued to rise. Given these statistics, it is important that FAA have mechanisms in place to share information about pilot deviations that could be used to identify trends and potential causal factors.

**Figure 7. History of Pilot Deviations
FY 2001 to FY 2007**



Source: FAA data

FAA has two programs that could help to identify root causes of pilot deviations—the Runway Incursion Information and Evaluation Program (RIIEP) and the Aviation Safety Action Program. Both programs provide a mechanism to obtain information that may not otherwise be reported. However, we found that the data in these programs were either ineffectively utilized or inaccessible to users. In our opinion, analyzing this data is key to identifying potential causal factors and solutions for reducing runway incursions caused by pilots at both the national and local levels. In addition, the success of the RIIEP and ASAP programs depends on strong national oversight.

RIIEP: RIIEP was designed to provide data on the causes of runway incursions and surface incidents caused by pilot deviations. The RIIEP questionnaire gathers human factors information from pilots involved in a runway incursion about activity in the cockpit as well as pilots' comprehension of air traffic instructions and physiological conditions. For example, a RIIEP report filed for a recent Los Angeles pilot deviation provided valuable insight that was not included in the investigation report, such as crew communication information, the impact of fatigue, and a suggestion on how to prevent the reoccurrence of a similar pilot deviation.

The program, which is voluntary, was originally tested in FY 2000 for a 1-year period. Based on the results of that test, FAA believed that the program could provide valuable safety information that would help determine root causes and develop effective corrective actions to reduce runway incursions caused by pilot deviations. As a result, FAA renewed the program for a 2-year period in July 2004. However, we found that the program was not being utilized effectively.

For example, only 19 percent of all runway incursions and surface incidents that occurred during that 2-year period had a completed program questionnaire. In addition, FAA was unable to provide us with evidence that any data analyses were performed on the information that was collected.

FAA has subsequently initiated efforts to revitalize RIIEP. In October 2006, FAA renewed RIIEP for another 2 years. FAA also established goals to increase pilot participation by 10 percent annually over the next 2 years. In addition, FAA plans to provide all regional and field inspectors with training on the program to increase its utilization. The program manager for RIIEP stated that, given these improvements, he believes the program will be more successful at identifying root causes and solutions to reduce runway incursions.

Renewing RIIEP is, in our opinion, an important component of reducing runway incursions. In order to meet its participation goals, we recommended that FAA establish initiatives to promote increased voluntary pilot participation in RIIEP so that the necessary data can be accumulated and appropriately analyzed to identify and mitigate runway incursion causal factors.

FAA agreed with our recommendation and in response has (1) tasked a team to enhance FAA inspectors' and pilots' education regarding the RIIEP program and (2) established appropriate management controls to ensure that collected data are analyzed. FAA established a goal of at least a 10-percent increase in program participation by September 30 of each fiscal year (over a baseline of 19 percent participation as of September 30, 2006). FAA successfully met this goal in FY 2007, with 38 percent program participation. The key now will be for FAA to thoroughly analyze the data and use the results to reduce pilot deviations.

ASAP: ASAP is a program that allows air carrier employees to report potential safety issues without fear of enforcement action from FAA. An intended benefit of ASAP is that the information obtained may not otherwise be reported. We are reviewing ASAP as part of a separate audit to determine the appropriateness of including certain incidents or accidents that by their nature would be known and reported to FAA, such as runway incursions.

As part of our review of runway safety efforts at Boston, Chicago, Philadelphia, and Los Angeles airports, however, we found that existing ASAP data could help to

identify root causes and corresponding solutions related to commercial pilot deviations. However, detailed information related to many of these incidents is kept by the individual air carriers participating in the program and is protected from disclosure. This is the case even if the runway incursion is serious.

For example, on July 18, 2006, a serious pilot deviation occurred at Chicago O'Hare when an American Eagle regional jet turned onto the wrong taxiway and conflicted with an arriving US Airways Boeing 737 on a short final approach to an intersecting runway. The 2 aircraft came within 100 feet of a collision. The final report on the incident, however, provides no details about why the American Eagle pilot was on the incorrect taxiway. It simply states that the investigation is being handled under ASAP and that the airline failed to respond to a request for additional information concerning the pilot deviation.

Obtaining the detailed information in ASAP reports could identify possible common causes that may exist among different air carriers, which an individual air carrier may not see as a trend.

For example, at Boston Logan, where pilot deviations represent the largest percentage of runway incursions, stakeholders recognized and acted upon the need for pilot deviation information to be shared. As a result, a team of pilot and air traffic representatives meet regularly to review tapes of local pilot deviations and develop solutions specific to Boston Logan. However, the amount of information available to the team is limited since any pilot deviation reported under ASAP is restricted and kept by the individual participating air carriers.

Key stakeholder personnel we interviewed (Regional Runway Safety Program Managers, Flight Standards personnel, and pilot representatives) agreed that ASAP information could help in identifying effective mechanisms to reduce runway incursions. Since our audit of ASAP is not complete, we recommended that FAA work with the pilot and airline communities to develop a process whereby Regional Runway Safety Program Managers can request site-specific, redacted ASAP information on runway incursions and surface incidents to identify trends and root causes of runway incursions.

FAA agreed with our recommendation and tasked the MITRE Center for Advanced Aviation Systems Development to develop archives of ASAP data with airlines. FAA plans to implement the analytical tools and methodologies required for detailed analyses by October 2008.

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 we testified last week before this Subcommittee, controller training and staffing will be a key watch items over the next 10 years as FAA begins executing its plans to hire and train 15,000 new controllers through 2016. FAA is facing a fundamental transformation in the composition of its controller workforce. The overall percentage of controllers in training has grown substantially over the past 3 years. New controllers now represent 23 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).

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.

In May 2007, we reported that FAA needed to focus controller human factors issues and training to improve individual, team, and facility performance. In its last National Plan for Runway Safety (for 2002-2004, issued in 2002), FAA cited human factors and lack of controller teamwork as significant contributing factors of runway incursions caused by controller operational errors. The report also stated that those types of errors could be mitigated through training and procedural interventions. However, we found that FAA has made little progress in addressing human factors training to help reduce the risk of runway incursions caused by controllers.

NATPRO: The National Air Traffic Professionalism Program is a human factors initiative that we reviewed in 2003. NATPRO training is designed to sharpen and maintain controllers' mental skills most closely associated with visual attention and scanning. Participants thus gain personal insight into how performance can be influenced (e.g., by distraction, fatigue, and boredom) and how those factors increase the opportunity for operational errors.

The program was tested in FY 2003, and FAA provided this training at its en route centers and plans to begin using it at its large TRACON facilities in FY 2008. However, it has not been implemented at towers where visual attention and scanning are key factors in preventing runway incursions.

Facility managers we spoke with expressed an interest in this training, but FAA had not established milestone dates for implementing NATPRO at air traffic control towers at the time of our audit. Since we issued our report, FAA has provided NATPRO cadre training to representatives from 42 facilities so they can use NATPRO training at their facilities. Tower facilities are required to start NATPRO training in FY 2009.

Simulators: Tower simulators also have significant potential to 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 scenarios such as day-versus-night operations, varying weather conditions, different runway configurations, or emergency situations (see figure 8). Simulators are being tested at the Miami, Ontario, Phoenix, and Chicago O’Hare airports and have been used by other facilities to mitigate safety risks of proposed and existing operations and to improve runway safety.

Simulators can also be used to model changes in airport configurations and procedures. For example, Boston Logan used a tower simulator to help establish necessary safety procedures in conjunction with the use of a newly constructed runway. Likewise, the National Aeronautics and Space Administration used a tower simulator to study several alternatives for improving runway safety at Los Angeles and to evaluate the effectiveness of adding a center-field taxiway between its parallel runways.

Figure 8. Picture of a Tower Cab Simulator



Source: FAA

Tower simulators have also been identified as effective tools for training new controllers and providing proficiency training for experienced controllers. Simulator training can help reduce the risk of runway incursions that are caused by new

controllers in training (such as the March 21, 2006, incursion at Chicago O'Hare) and more experienced controllers.

For example, at Philadelphia, we found that 70 percent (14 of the 20) runway incursions caused by controllers over a 4-year period occurred when an infrequently used runway configuration was in use. We found that this particular configuration was used only 30 percent of the time at Philadelphia. Therefore, it was difficult for controllers to maintain their proficiency on that particular configuration. According to Air Traffic officials, proficiency training using a simulator has a high potential for eliminating such errors.

The need for tower simulators for controller training was originally identified in FAA's 2000 National Plan for Runway Safety; yet, over 6 years later, only four towers have simulators installed. While FAA is still in the testing phase of this initiative, it must keep it on track and install simulators in a timely manner. This is especially important in light of the fact that FAA will be hiring over 15,000 new controllers (many of which will be for tower facilities) to replace those expected to leave over the next 10 years. In December, FAA entered into a contract to purchase 24 new tower simulators; deployment is expected to be complete by the end of FY 2009.

Crew Resource Management (CRM): Another tool with a high potential for improving performance is CRM training. Crew Resource Management (CRM) training focuses on teamwork in the tower with an emphasis on operations. Therefore, it has the potential to reduce runway incursions through improved team performance. This initiative was originally included in FAA's 2000 National Plan for Runway Safety; yet, only three facilities have completed this training through FY 2006.

At Philadelphia, which is one of the three air traffic control towers to complete this training nationwide in FY 2006, CRM training was used as a tool to reduce runway incursions. The CRM training at Philadelphia was site-specific and geared toward open discussions that would improve teamwork, improve individual performance, and manage operational errors. According to managers at Philadelphia, CRM was extremely effective at improving overall team performance and a contributing factor in reducing controller errors.

FAA needs to keep this valuable training on target. In FY 2007, nine additional tower facilities have completed CRM training. FAA plans to complete CRM at 11 additional towers in FY 2008.

We are reviewing several issues concerning controller human factors issues. At the request of Chairman Costello, we are reviewing the rate and root causes of controller training failures (developmental and transferring 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.

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

EXHIBIT. PRIOR OIG REPORTS AND TESTIMONIES ON RUNWAY SAFETY

Reports

- “FAA’s Implementation of Runway Status Lights,” January 14, 2008, OIG Report Number AV-2008-021.
- “FAA Needs To Improve ASDE-X Management Controls To Address Cost Growth, Schedule Delays, and Safety Risks,” October 31, 2007, OIG Report Number AV-2008-004.
- “Progress Has Been Made in Reducing Runway Incursions, but Recent Incidents Underscore the Need for Further Proactive Efforts,” May 24, 2007, OIG Report Number AV-2007-050.
- “Review of Staffing at FAA’s Combined Radar Approach Control and Tower With Radar Facilities,” March 16, 2007, OIG Report Number AV-2007-038.
- “Review of Operations, Capacity, and Runway Safety Areas at Chicago Midway Airport,” February 15, 2007, OIG Report Number CC-2006-013.
- “Operational Errors and Runway Incursions,” April 3, 2003, OIG Report Number AV-2003-040.
- “Despite Significant Management Focus, Further Actions Are Needed To Reduce Runway Incursions,” June 26, 2001, OIG Report Number AV-2001-066.
- “Actions To Reduce Operational Errors and Deviations Have Not Been Effective,” December 15, 2000, OIG Report Number AV-2001-011.
- “Follow-Up Review of FAA’s Runway Safety Program,” July 21, 1999, OIG Report Number AV-1999-114.
- “Runway Incursion Program,” February 9, 1998, OIG Report Number AV-1998-075.

Testimonies

- “Challenges Facing the U.S. Department of Transportation,” October 18, 2007, OIG Report Number CC-2008-007.
- “FAA’s FY 2008 Budget Request: Key Issues Facing the Agency,” May 10, 2007, OIG Report Number CC-2007-054.
- “Top Management Challenges Facing the Department of Transportation,” March 6, 2007, OIG Report Number CC-2007-021.
- “Review of Operations, Capacity, and Runway Safety Areas at Chicago Midway Airport,” February 15, 2007, OIG Report Number CC-2006-013.
- “Observations on FAA’s Oversight of Aviation Safety,” September 20, 2006, OIG Report Number CC-2006-074.

- “Perspectives on FAA’s FY 2007 Budget Request and the Aviation Trust Fund,” March 28, 2006, OIG Report Number CC-2006-027.
- “Aviation Safety – Observations on FAA’s Oversight and Changes in the Airline Industry,” November 17, 2005, OIG Report Number CC-2006-003.
- “Key Issues for the Federal Aviation Administration’s FY 2005 Budget,” April 22, 2004, OIG Report Number CC-2004-038.
- “FAA’s FY 2005 Budget: Opportunities To Control Costs and Improve Effectiveness of Programs,” March 17, 2004, OIG Report Number, CC-2004-040.
- “Opportunities To Control Costs and Improve the Effectiveness of Department of Transportation Programs,” July 9, 2003, OIG Report Number CC-2003-132.
- “The State of the Aviation Industry and the Federal Aviation Administration,” April 2, 2003, OIG Report Number CC-2003-095.
- “DOT FY’04 Budget and Management Challenges,” March 13, 2003, OIG Report Number CC-2003-080.
- “The State of the Federal Aviation Administration,” February 11, 2003, OIG Report Number CC-2003-068.
- “Department of Transportation Budget for Fiscal Year 2003,” February 13, 2002, OIG Report Number CC-2002-102.
- “Further Actions Are Needed To Reduce Runway Incursions,” June 26, 2001, OIG Report Number CC-2001-224.
- “DOT Management Challenges,” March 8, 2001, OIG Report Number CC-2001-112.
- “Management Oversight Issues,” February 14, 2001, OIG Report Number CC-2001-089.
- “Key Safety, Modernization, and Financial Issues Facing FAA,” March 22, 2000, OIG Report Number CC-2000-072.
- “Management Oversight Issues,” March 9, 2000, OIG Report Number TW-2000-064.
- “Improving Aviation Safety, Efficiency, and Security: FAA’s Fiscal Year 2001 Request for Research, Engineering, and Development,” March 1, 2000, OIG Report Number AV-2000-054.
- “FAA—Aviation Safety,” March 10, 1999, OIG Report Number AV-1999-069.
- “DOT’s 10 Top-Priority Management Issues,” February 25, 1999, OIG Report Number TW-1999-031.
- “FAA’s Runway Incursion Program,” November 13, 1997, OIG Report Number AV-1998-015.

The complete text of the above reports and testimonies can be found at <http://www.oig.dot.gov>.

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.

Actions Needed To Improve Runway Safety

Section 508 Compliant Presentation

Figure 1. 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: Federal Aviation Administration

Figure 2. Diagram of Entrance Lights

Diagram shows aircraft stopped at hold line by red lights. This alerts the pilot to wait until runway is clear before entering.

Figure 3. OIG Photo of Entrance Lights at DFW

At Dallas-Forth Worth International Airport, the audit team observed illuminated runway entrance lights signaling that an intersecting runway, Runway 18L, was not clear for entrance due to a departing aircraft on the runway.

Figure 4. Diagram of Take-Off Hold Lights

Diagram shows take-off hold lights illuminating red to alert a pilot waiting to take off that another aircraft or vehicle is either on or about to enter the runway in front of the aircraft.

Figure 5. Picture of Ground Signage at Chicago O'Hare Instructing General Aviation Pilots To Hold and Contact Ground Control Before Proceeding

Photograph shows a large sign on the ground near runway. The sign message is, "HOLD HERE CONTACT GROUND."

Figure 6. Picture of an Elevated Runway Guard Light at Boston Logan

Photograph shows guard light elevated from the runway.

Figure 7. History of Pilot Deviations Fiscal Year 2001 to Fiscal Year 2007

- In fiscal year 2001, there were 233 pilot deviation runway incursions. Thirty-two of these were rated as Category A or B incidents.
- In fiscal year 2002, there were 191 pilot deviation runway incursions. Twenty of these were rated as Category A or B incidents.
- In fiscal year 2003, there were 174 pilot deviation runway incursions. Fourteen of these were rated as Category A or B incidents.
- In fiscal year 2004, there were 173 pilot deviation runway incursions. Fourteen of these were rated as Category A or B incidents.
- In fiscal year 2005, there were 169 pilot deviation runway incursions. Nine of these were rated as Category A or B incidents.
- In fiscal year 2006, there were 190 pilot deviation runway incursions. Eighteen of these were rated as Category A or B incidents.
- In fiscal year 2007, there were 209 pilot deviation runway incursions. Eleven of these were rated as Category A or B incidents.

Source: FAA data

Figure 8. Picture of a Tower Cab Simulator

Photograph shows the screens and other equipment used for tower cab simulation.

Source: FAA