RUNWAY SAFETY

(110–99)

HEARING

BEFORE THE

SUBCOMMITTEE ON
AVIATION

OF THE

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

FEBRUARY 13, 2008

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February 12, 2008

James W. Coon II, Republican Chief of Staff

SUMMARY OF SUBJECT MATTER

TO: Members of the Subcommittee on Aviation

FROM: Subcommittee on Aviation Staff

SUBJECT: Hearing on "Runway Safety"

PURPOSE OF HEARING

The Subcommittee on Aviation will meet on Wednesday, February 13, 2008, at 2:00 p.m., in room 2167 of the Rayburn House Office Building, to receive testimony regarding runway safety.

BACKGROUND

Record numbers of people are flying. In 2006, more than 740 million passengers flew in the United States and the Federal Aviation Administration (FAA) predicts that this figure will reach one billion by 2015, and 2 to 3 billion by 2025.[1]

During 2007, in support of this growing activity, the nation's air traffic control towers handled a total of 63.1 million flights and, based on current FAA projections, this number can be expected to grow by 2 percent annually in the years ahead.[2] That growth represents not only a dramatic increase in the demand on the air traffic control system as a whole, but will also result in a substantial and continuing increase in ground operations.

These ground operations include take offs and landings, taxiing operations, movement to and from gates, and the movement of airport ground vehicles to support aircraft and airport operations. Maintaining safe operations in this environment is a major concern. The National Transportation Safety Board (NTSB), beginning as far back as 1990, has annually listed runway

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[1] FAA, 2008 – 2012 FAA Flight Plan (2007), at 30.
[2] Data for both 2007 operations and projected growth provided by the FAA, Forecast and Statistics Branch, Aviation Policy and Plans (Jan. 14, 2008).

safety on its "Most Wanted List of Transportation Improvements."[3] Further, the Department of Transportation's Office of the Inspector General (DOT IG) in its fiscal year (FY) 2008 DOT *Top Management Challenges* stated that "the seriousness of these incidents underscores the need for continual proactive and concerted efforts, including actions to address technological as well as programmatic solutions for improving runway incursions." [4]

I. Runway Incursions

The Government Accountability Office (GAO) recently issued a report on *Aviation Runway and Ramp Safety*.[5] In its report, the GAO defines a runway incursion as, "any occurrence in the runway environment involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of required separation when an aircraft is taking off, intending to take off, landing, or intending to land."[6] GAO reports that the rate of runway incursions in 2007 had increased to 6.05 incidents per million operations. This is a 12 percent increase over 2006 and the highest since 2001 when the rate reached 6.1 incidents per million operations.[7] At the same time, the number of severe runway incursions dropped from 53 incidents in 2001 to 24 in 2007. [8] However, 10 severe runway incursions occurred during the first quarter of 2008.[9] The GAO also notes that between 2003 and 2006 general aviation aircraft were involved in 72 percent of all runway incursions.[10]

Runway incursions are measured as the "rate of incidents per million operations." However, FAA also categorizes each incident according to its severity using an A, B, C, and D scale. A is the most severe and D is the least. The following chart explains this classification system:[11]

Least Severe ——————→ **Most Severe**

Category D	Category C	Category B	Category A
Little or no chance of collision but meets the definition of a runway incursion.	Separation decreases but there is ample time and distance to avoid a potential collision.	Separation decreases and there is significant potential for collision.	Separation decreases and participants take extreme action to narrowly avoid a collision, or the event results in a collision.

Runway incursions, in addition to being classified according to severity, are also grouped according to the "type" or "cause" of the incursion. There are three types of incidents, which are:

[3] National Transportation Safety Board, Most Wanted Safety Improvements (November 2007) (The NTSB has recommended safer ground operating systems and direct warning to pilots of possible runway incursions).
[4] DOT IG Top Management Challenges for 2008, Report PT-2008-008 (Nov. 15, 2007), at 24.
[5] U.S. GAO, Aviation Runway and Ramp Safety: Sustained Efforts to Address Leadership Technology, and Other Challenges Needed to Reduce Accidents and Incidents (November 2007).
[6] Id. at 8. (According to an Oct. 1, 2007, FAA Fact Sheet, beginning in FY 2008, the FAA will use the International Civil Aviation Organization's more inclusive definition for runway incursions that covers "any unauthorized intrusion onto a runway, regardless of whether there is a potential conflict.")
[7] Id. at 9.
[8] Data provided by the Air Traffic Organization, FAA (Feb. 6, 2008).
[9] Listing of severe incursions, first quarter 2008, provided by the GAO (Feb. 4, 2008).
[10] GAO Runway Safety Report at 10.
[11] FAA, Runway Safety Report (September 2007), at 16.

(1) an operational error or deviation that involves an air traffic controller giving directions that fail to maintain separation or cause an aircraft to use an unauthorized runway; (2) a pilot deviation where a pilot does not follow the direction of the controller or violates a Federal Aviation Regulation; or (3) a movement of airport vehicles (including pedestrians), whose failure to obey directions or instructions results in a possible incident.[12]

The following chart lists some of the runway incursion events that have occurred during 2007. Each of these was either a severity level A or B event and each involved commercial airliners with passengers on board. Where possible, the number of passengers is listed.

Examples of Recent Runway Incursion Incidents [13]

Date of Incident	Airport	Aircraft Involved	# of Passengers	Severity
Jan. 5, 2007	Denver	Key Lime Air Swearingen SW4 and Frontier Airbus A319	59	A
Description: The landing Frontier aircraft conducted go-around procedure after seeing the Key Lime Air aircraft on the runway, missing each other by about 50 feet.				
Feb. 2, 2007	Denver	United Airlines B-737 and Snowplow	101	A
Description: The United aircraft was landing when it sighted a snowplow at the end of the runway. Crew reversed thrust and applied brakes to avoid colliding.				
May 4, 2007	Virgin Islands	American B-757 and Cessna C208	N/A	A
Description: The Cessna crossed a runway on which an American 757 was departing, causing the 757 to fly about 100 feet over the Cessna.				
May 6, 2007	Los Angeles	Skywest Embraer 120 and Virgin Air A346	N/A	B
Description: The Virgin Air aircraft received clearance and landed while the Skywest aircraft, which had just landed on the same runway, was still slowly exiting onto a taxiway.				
May 26, 2007	San Francisco	Republic Embraer 170, Skywest Embraer 120	27	A
Description: The departing Republic aircraft flew over the Skywest aircraft at intersecting runways, missing each other by an estimated 30-150 feet.				
July 11, 2007	Ft. Lauderdale-Hollywood	Delta B-757 and United Airbus A320	172	A

[12] Id. at 17.
[13] GAO Runway Safety Report at 80 (This table includes data provided by the GAO on the December 2 and December 6 incidents received after the GAO report was published. It also includes more precise categorization and description data provided by the GAO).

X

Description: The Delta aircraft touched down, but had to become airborne again when it sighted the United A320 approaching the same runway, missing each other by less than 100 feet.				
July 19, 2007	Chicago O'Hare	United B-737 and US Airways B-737	N/A	A
Description: The United aircraft exited the wrong taxiway and taxied underneath the path of the arriving US Airways aircraft, missing each other by 50 to 70 feet.				
Aug. 16, 2007	Los Angeles	WestJet 737 and Northwest Airbus A320	296	B
Description: The departing Northwest aircraft came within 37 feet of colliding with the taxiing WestJet aircraft that was about to cross the same runway.				
Dec. 2, 2007	Baltimore-Washington	US Airways/ America West Airbus A320 and ComAir Regional Jet1	N/A	B
Description: Two aircraft came within 300 feet of colliding at intersecting runways after the departing ComAir aircraft jet flew over the landing US Airways aircraft.				
Dec. 6, 2007	Newark Liberty	Continental Airlines B-737 and Continental Express Embraer E145	N/A	B
Description: Two aircraft came within 200-400 feet of colliding when the landing Continental aircraft flew over a Continental Express aircraft that was taxiing on the same runway.				

II. GAO Runway Safety Report Findings

The GAO's Runway Safety Report discusses the factors that may be contributing to the current increase in the runway incursion rate. It also identifies concerns with FAA's runway safety efforts.

A. Findings:

➢ ***FAA National Runway Safety Plan.*** The GAO states that the FAA National Runway Safety Plan is out of date and that the agency's runway safety incursion efforts are uncoordinated.

➢ ***Runway Safety Office Director's Position.*** The report questions the Runway Safety Office's effectiveness during the two years it was without a director. The position was filled in August of 2007.

➢ ***Controller Fatigue.*** GAO states that controller fatigue may play a role in runway safety, noting that controllers are working 6-day weeks due to staffing shortages.[14]

[14] The NTSB recommended that the FAA and the National Air Traffic Controllers Association (NATCA) work together to pursue strategies to reduce risks caused by controller fatigue. *See* April 10, 2007 memo from the Chairman of the NTSB to the FAA Administrator and the President of NATCA.

➢ *Delays in Deployment of Runway Systems.* The GAO raised concerns regarding delays in the deployment of runway safety systems. The Airport Surface Detection Equipment, Model X, (ASDE-X) was scheduled for deployment at 35 airports, but after four years, is only operational at eleven airports. GAO has also identified occasional problems with ASDE-X performance during periods of heavy rain and snow when it sometimes fails to locate an aircraft. However, FAA believes these are "break-in" problems associated with deploying a new system.

➢ *Improve Data Gathering and Analysis.* The GAO states that data gathered on runway incursion incidents is sometimes incomplete and does not provide analysts with enough information to draw conclusions about the cause and nature of an event. Gaps include the availability of more precise information on aircraft location, instrument settings, and conditions at the airport.[15]

➢ *Ramp Safety.* GAO states that incidents in the ramp areas are a potentially serious airport safety issue. However, there is insufficient data, and inadequate reporting, to make sound conclusions. Ramps are parts of the airport where controllers do not directly control aircraft and vehicle movements.

B. GAO Recommendations:

➢ *The Office of Runway Safety Should Lead the Agency's Runway Safety Efforts.* The FAA should prepare a new a national plan, setting near and longer term goals, with timeframes and resource requirements.

➢ *Develop a Mitigation Plan that Addresses Controller Overtime.* The FAA should develop incentives to attract controllers to high demand airports to lessen workload and overtime requirements.

➢ *Develop and Implement a Non-punitive Data Reporting System for Controllers.* A non-punitive data reporting system would allow controllers involved in an incident to contribute information about an incursion without fear of discipline or retribution. GAO considers this a priority in assuring accurate and complete data.

➢ *Develop a Mechanism to Collect and Analyze data on Ramp Accidents.* The FAA should work with the Occupational Safety and Health Administration and the aviation industry to develop a mechanism for improving the collection of data on ramp accidents. If the data gathered indicates that there is a safety issue, the FAA and the aviation industry should work together to develop a plan to deal with the problem.[16]

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[15] DOT IG, FAA Needs to Improve ASDE-X Management Controls, Report Number AV-2008-004 (Oct 31, 2007), at IV.

[16] Currently the Airports Council International and the International Air Transport Association are developing this type of database for their membership.

III. Technology

As a part of its overall strategy for improving runway safety the FAA has pursued several new technologies aimed at improving runway safety. These include:

A. *Airport Movement Area Safety System (AMASS)/Airport Surface Detection Equipment Model 3 (ASDE-3).*

AMASS/ASDE-3 is a radar-based system that tracks the movement of aircraft and ground vehicles in the airport environment and provides controllers with an automatically generated visual and audio warning of a possible runway incursion. The system is installed and operating at 34 airports.

B. *Airport Surface Detection Equipment Model X (ASDE-X)*

ASDE-X is being deployed as an upgrade to ASDE-3 equipped airports as well as for application at airports that currently do not have AMASS/ASDE-3 capabilities. ASDE-X is a surface surveillance system that processes information from radar and other sources to provide location and aircraft identification information to air traffic controllers. The FAA expects to complete system deployment in the next four years, but is considering accelerating this effort.[17] The total cost of the ASDE-X system is $806.4 million. The ASDE-X system was designed to operate using Automatic Dependent Surveillance Broadcast (ADS-B) supplied data as well so that these systems will continue in service when ADS-B systems come on-line. FAA has spent $404.8 million or just under 50 percent of these funds.[18] Deployment of ASDE-X systems is not based on the number of operations alone, airfield complexity and runway incursion risk play a significant role in deployment decisions.

C. *Runway Status Lights (RWSL)*

Runway Status Lights provide a direct visual warning to pilots when a runway is occupied. The concept behind this system is that colored lights on the runway, relying on input from ASDE-3 or ASDE-X, indicate whether or not it is safe for a pilot to proceed. RWSL systems provide "out of the loop" warnings to pilots that are supplemental to the verbal dialog with the controller. The system has been tested at Boston, Dallas/Fort Worth, and San Diego and, according to the FAA, the results have been positive. The FAA made an initial investment decision in July 2007 and is planning to make a final decision in June 2008.[19]

D. *Final Approach Runway Occupancy Signal (FAROS)*

FAROS, which is still in testing, uses the existing Precision Approach Path Indicator (PAPI) lights as a means to notify pilots of a possible incursion. The concept behind this system is that should ASDE-X or another surface detection system detect a possible incursion, the approach lights

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[17] Information provided by FAA Government and Industry Affairs Office (Jan. 29, 2008).
[18] Information provided by FAA ASDE-X Program Office (Jan. 29, 2008).
[19] DOT IG, FAA's Implementation of Runway Status Lights, Report Number AV-2008-021 (Jan. 14, 2008), at 2-5.

would begin flashing. A small scale evaluation has been underway at the Long Beach airport for over a year. The FAA is developing an application for larger airports and will begin operational trials at Dallas/Fort Worth by the end of FY 2008. [20]

E. *Situational Awareness Tools*

One of the challenges for a pilot operating in a complex airport environment or in poor weather is maintaining situational awareness. A new tool, recently certified by the FAA, is the moving map display in the "automated flight bag." It is a display that allows pilots to see where they are on the airport.[21]

Another tool is the Runway Awareness and Advisory System (RAAS). The product leverages the ground database capability of the Enhanced Ground Proximity Warning System. The RAAS provides audio updates on where the plane is at the airport, whether it is on a runway or a taxiway, and how much distance is between the aircraft and the end of the runway.[22]

F. *Lower Cost Surveillance Systems*

The FAA is examining the potential of two relatively low cost systems that can provide surveillance capabilities for small and medium-sized airports. One of these is the adaptation of weather band radar systems to provide controllers with aircraft location information during ground operations. It does not "identify" the aircraft, but it does give controllers needed data on an aircraft's location. The same is true for another technology that uses an array of millimeter wave sensors, positioned along taxiways and runways, to track aircraft position.[23]

G. *Engineering Arresting Materials Systems (EMAS)*

EMAS is a special surface at the end of a runway that is made out of a crushable material. By absorbing the forward momentum of an aircraft it helps mitigate the damage caused by a runway overrun. EMAS systems are particularly helpful at geographically constrained airports where it is not possible to purchase additional land for runway protection areas. EMAS has been installed on 35 runways at 21 airports.[24]

H. *Runway Safety Area Improvements*

Runway safety areas (RSA) provide additional open space that extends beyond the end of the runway. This enhances safety should an aircraft undershoot or overrun the runway. In 2002, the FAA developed a plan to extend RSA's at 453 commercial service airports; 63 percent of these airports are expected to have RSA's by the end of 2008, 88 percent will be completed by 2010, with the remainder to be completed by 2015.

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[20] Fact Sheet, FAA, Final Approach Runway Occupancy Signal (FAROS) (Jan. 8, 2008).
[21] GAO Runway Safety Report at 38.
[22] Honeywell Corp., briefing on the Runway Awareness and Advisory System (Jan. 30, 2008).
[23] Fact Sheet, FAA, Low Cost Ground Surveillance (Jan. 16, 2008).
[24] Fact Sheet, FAA, Engineered Material Arresting System (Jan. 31, 2008).

I. *Other Technologies*

Industry is testing new technologies that will provide a direct warning of a runway incursion to the cockpit with audio instructions, supplied by safety logic software, on how to avoid the incursion (e.g. "pull up," "brake"). One such technology links ASDE-X warning capability to an aircraft's Traffic Collision and Avoidance System. This concept was tested at Syracuse and is under consideration for future development. [25]

J. *Perimeter Taxiways*

Where land is available perimeter taxiways have proven an effective strategy for mitigating runway incursion risk. A perimeter taxiway allows landing aircraft to vacate the runway more quickly, and allows aircraft access to other parts of the airport without crossing an active runway. At Atlanta's Hartsfield Jackson Airport, a new taxiway was built that goes around the end of the runway. This reduced the number of runway crossings each day by 560. [26]

IV. Recent FAA Runway Safety Initiatives

On August 15, 2007, the FAA held a "Call to Action" meeting with industry, pilot unions, and aviation safety officials to address the issue of runway incursions. [27] Shortly after this session, on August 22, 2007, the FAA sent letters to key industry stakeholders outlining initiatives the FAA wants to undertake to improve runway safety. The letters recommended actions on the part of airports, air carriers, and the FAA's Air Traffic Organization. On January 14, 2008, Acting Administrator, Bobby Sturgell, conducted a conference call with the chief executives of the major U.S. carriers to follow up on the agency's call to action. Outlined below are the actions that the FAA has recommended:

A. Airports:

The FAA identified the top twenty airports that are considered to be at the greatest risk of surface accidents. The FAA requested that these airports convene a special meeting with all personnel involved in runway operations to review procedures, current runway markings, and other risk areas that need to be mitigated.

Two other airport related issues dealt with airport markings and the training of ground operations personnel. The FAA required all airports with emplanements of 1.5 million or more (approximately 75 airports) to upgrade their markings to the standard specified in the FAA's Advisory Circular on Airport markings. The circular includes a requirement that these airports upgrade their centerline markings by June 30, 2008. FAA requested that this work be carried out on an accelerated basis. In addition, the FAA is planning to require that all commercial service airports meet this standard. According to the FAA, all airports required to upgrade their markings will be

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[25] Honeywell Corp., briefing (Jan. 30, 2008).
[26] GAO Runway Safety Report at 23.
[27] Fact Sheet, FAA, Aviation Industry Responds to FAA's Call to Action (Jan 24, 2008).
[27] Id.

completed well ahead of schedule, and more than half of the commercial service airports not currently required to do so, voluntarily agreed.

Another action concerns training for personnel involved in ground operations. While airport operational personnel are trained on a recurrent basis, other personnel, such as contractors and various service providers, are only trained once. The FAA requested that training be made recurrent for these personnel as well. The FAA circular governing this training is also in the process of being updated to reflect this expectation.[28]

B. Air Carriers/Pilots:

The FAA asked air carriers to conduct reviews of their current procedures, specifically focusing on those activities undertaken by a flight crew between pushback and takeoff, with the objective of limiting the number of distractions for pilots during this critical phase of operations. These distractions can include check list activities, which should be done before pushback, conversations with airline dispatchers, as well as any other conversations not related to aircraft operations. The FAA requested that new procedures intended to reduce these distractions become a recurrent part of flight crew training. According to the Air Transport Association, air carriers have been supportive of these initiatives.[29]

C. Air Traffic Organization:

The FAA is conducting a safety risk assessment of all of its taxi clearance procedures to identify areas where improvements can be made to help reduce risk. In addition, the FAA plans to implement a non-punitive information system that will allow controllers to input information about incidents, on-line, without fear of disciplinary action or retribution.

V. H.R. 2881

The FAA Reauthorization Act of 2007, H.R. 2881, which passed the House on September 20, 2007, contains several provisions that focus on runway incursion issues. This includes significant funding increases for runway reduction efforts. Section 102 (f) of H.R. 2881 provides $42 million over four years for runway incursion reduction programs, as well as $74 million for the acquisition and installation of runway status lights.

In addition, section 305 requires that the FAA develop a Strategic Runway Plan that addresses goals to improve runway safety that are focused on near and long term needs to reduce the runway incursion rate. It also requires that the FAA identify the resources necessary to do this, and that it develop runway safety metrics and a tracking system.

H.R. 2881 also includes a requirement that systems be developed that provide accurate and timely warnings to controllers and flight crews of potential incursions.

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[28] Id.

[29] Air Transport Association Information Sheet, FAA Runway Safety Initiative (Jan. 29, 2008).

WITNESS LIST

PANEL I

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HEARING ON RUNWAY SAFETY

Wednesday, February 13, 2008

HOUSE OF REPRESENTATIVES,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
SUBCOMMITTEE ON AVIATION,
Washington, DC.

The Subcommittee met, pursuant to call, at 2:05 p.m., in Room 2167, Rayburn House Office Building, the Honorable Jerry F. Costello [Chairman of the Subcommittee] presiding.

Mr. COSTELLO. The Subcommittee will come to order.

The Chair will ask all Members, staff and everyone to turn electronic devices off or on vibrate.

The Subcommittee is meeting today to hear testimony on runway safety. I will give a brief opening statement and then yield to the Ranking Member, Mr. Petri, for his opening statement or any remarks he may have, and then we will go to our first panel of witnesses.

I welcome everyone to our hearing today on runway safety. This hearing highlights the Subcommittee's responsibility to ensure that the FAA is fulfilling its duties to provide comprehensive safety oversight in every aspect of the aviation system including runway safety.

While the United States has the safest air transportation system in the world, we can't rely on or be satisfied with our past success. We must continue to strive for greater success because one accident or near accident is one too many, especially when the FAA is predicting a tripling of passengers and cargo by the year 2025.

Late last year, the Government Accountability Office, the GAO, issued its report on runway and ramp safety which Chairman Oberstar and I requested. We will hear from Dr. Dillingham and others concerning the GAO report.

According to the GAO, the rate of runway incursions in fiscal year 2007 increased to 6.05 incidents per million operations. This is a 12 percent increase over 2006 and the highest since 2001 when the rate reached 6.1 incidents per million operations.

While the number of severe runway incursions dropped from 53 incidents in 2001 to 24 in 2007, in the first quarter of fiscal year 2008 alone, there have been 10 severe runway incursions. This is simply unacceptable.

The GAO has stated that the FAA's lack of leadership on this issue, including a director level vacancy in the Office of Runway Safety for over two years and an out of date national runway safety plan has impeded further progress. While the FAA has finally filled its Runway Safety Office Director position, this Subcommittee wants to know what the FAA's plan is on a national level to improve runway safety.

To ensure this issue remains at the forefront of the FAA safety agenda, I want the FAA to provide a progress report to this Subcommittee every three months, detailing each Category A and B runway incursion, how the FAA responded and what progress is being made to address these incidents and reduce the overall number of runway incursions.

The GAO also cited controller fatigue as a major factor in runway safety, and I am interested in hearing more from our witnesses including Mr. Pat Forrey, the President of the National Air Traffic Controllers Association, on this issue.

Around the Country, controllers are working longer hours to handle increasingly congested runways and airspace in part because of staffing shortages. While the FAA may not admit that there is a problem, I can assure you, after talking to all of the users of the system, there is a problem.

In addition to the 10 severe runway incursions in the first quarter of fiscal year 2008, there was also a near miss at the Chicago center in December of 2007. This should serve as a wake-up call to the aviation community that something needs to be done now to avoid a major disaster in the near future.

Human factors will always be a challenge, but with enough redundancy worked into the system, using technologies like the ones we will hear about today, we will be able to mitigate their effects. I am interested in learning more about near and long term technologies such as ASDE-X, runway safety lights and low cost surveillance systems.

In H.R. 2881, the FAA Reauthorization Act of 2007 which passed the House of Representatives on September 20th of 2007 and has yet to be acted on by the Senate, we included provisions to address runway safety. H.R. 2881 provides $42 million over 4 years for runway incursion reduction programs and $74 million over 4 years for runway status light acquisition and installation. Further, it requires the Administrator to submit a report to Congress, containing a strategic runway safety plan and a plan for the installation and deployment of systems to alert controller and flight crews to potential runway incursions.

Safety must not be compromised in an effort to save money or because of a lack of resources or attention. The FAA and the aviation community must do better.

I assure you that this Subcommittee will keep the FAA's feet to the fire to keep safety efforts on track. The American traveling public deserves nothing less.

With that, I will recognize our Ranking Member for his opening statement, but before I do I ask unanimous consent to allow two weeks for all Members to revise and extend their remarks and to permit the submission of additional statements and materials by Members and witnesses. Without objection, so ordered.

At this time, the Chair recognized the Ranking Member, Mr. Petri.

Mr. PETRI. I thank Chairman Costello, and I would like to thank our witnesses for appearing before the Subcommittee today to discuss the important aviation safety matter that is before us, and that is the issue of runway safety.

Though we are currently in the safest period in aviation history, as long as human beings endeavor to take to the skies, there will always be the potential for human error and for accidents, but the Federal Aviation Administration, this Subcommittee and, in fact, the entire aviation community are charged with ensuring the safest national airspace system that is humanly possible.

A recent Government Accountability Office report studied runway incursions as well as runway and ramp safety and found that while the rate for most serious categories of runway incursions is down from last year, 24 events out of 61 million aircraft operations, there was an anomalous uptick in runway incursions in the first quarter of this year. Therefore, we need to remain vigilant in our oversight of this issue.

I am looking forward to hearing about the steps that the Federal Aviation Administration, airports, airlines, pilots, avionics manufacturers, general aviation users and controllers are taking to reduce the risk for these potentially deadly runway incursions.

I believe that there are many ways to address runway safety. Clearly, there is no silver bullet to eliminate runway incursions. I am interested in hearing about the many technologies currently deployed to reduce runway incursions as well as those that are under development and may be deployed before long, technologies such as runway status lights, ASDE-X, TCAS, low cost surface surveillance, all have the potential to drastically reduce the incidence of runway incursions.

In addition to technological innovations, I am interested in hearing about the bricks and mortar type solutions. Crushable concrete engineered materials arresting systems that have been installed at 21 airports have proven effective. Increased painted markings and signage improvements at airports are also underway. End-around perimeter taxiways have been installed at Atlanta's airport, reducing runway crossings from roughly 650 to less than 100 per day.

The Federal Aviation Administration is currently evaluating these approaches, and I am interested in hearing from our witnesses what they think about these strategies and from the Federal Aviation Administration on their plan to deploy these and other measures.

Beyond the flashing lights, radar, alerting systems and concrete, it is important that we address human factors issues that affect runway safety. Pilot alertness and situational awareness are critical to safe flights. Also, as we seek to get more information to pilots, it is important that we strike a balance that does not overload or distract them.

Although the National Transportation Safety Board has not cited controller fatigue as a factor causing runway incursions that they have investigated, including last summer's tragic incident in Lexington, Kentucky, some have cited controller fatigue as an area of concern, and I am interested in hearing about these concerns as well.

However, as with all runway safety issues, it is critical that this discussion be based upon data and science. We must be cautious when discussing safety to avoid just raising extraneous issues. Otherwise, we won't achieve the safety benefits that we are all seeking.

Finally, I am interested in hearing about the FAA's call to action on runway safety. The agency has clearly taken steps to address this issue, but it will be important to keep their programs on scheduled and to continue to maintain the vigilant oversight that we are seeing now.

The number of enplanements is projected to rise and, of course, an increase in runway incursions would be absolutely unacceptable.

So I appreciate the efforts of all of our witnesses to address this important safety issue, and I look forward to your testimony.

With that, I yield back. Thank you, Mr. Chairman.

Mr. COSTELLO. The Chair thanks the Ranking Member and, at this time, will introduce our first panel of witnesses. As you may have noted, we have two panels of witnesses today.

The first panel: Dr. Gerald Dillingham, who is no stranger to this Subcommittee, he has testified before our Subcommittee many times, and I have referred to him in our statement concerning his runway safety report; Mr. Hank Krakowski who is the Chief Operating Officer of the Air Traffic Organization over at the FAA, accompanied by Mr. Jim Ballough, who is the Director of Flight Standards Service for the FAA; the Honorable Robert Sumwalt, the Vice Chairman of the National Transportation Safety Board; and the Honorable Calvin Scovel who is the Inspector General for the U.S. Department of Transportation.

Gentlemen on our first panel, we normally adhere to the five minute rule but because the GAO report will be detailed for us by Dr. Dillingham, we are going to be liberal with his time but probably enforce your time. So we will give Dr. Dillingham more time than our other witnesses.

Dr. Dillingham, thank you for being here—we thank all of the witnesses for being here—and you are recognized.

TESTIMONY OF DR. GERALD DILLINGHAM, DIRECTOR, PHYSICAL INFRASTRUCTURE ISSUES, U.S. GOVERNMENT ACCOUNTABILITY OFFICE; HANK KRAKOWSKI, CHIEF OPERATING OFFICER, AIR TRAFFIC ORGANIZATION, FEDERAL AVIATION ADMINISTRATION ACCOMPANIED BY JIM BALLOUGH, DIRECTOR, FLIGHT STANDARDS SERVICE, FEDERAL AVIATION ADMINISTRATION; THE HONORABLE ROBERT L. SUMWALT, VICE CHAIRMAN, NATIONAL TRANSPORTATION SAFETY BOARD; AND THE HONORABLE CALVIN L. SCOVEL, III, INSPECTOR GENERAL, U.S. DEPARTMENT OF TRANSPORTATION

Mr. DILLINGHAM. Good afternoon, Mr. Chairman, Mr. Petri, Members of the Subcommittee. Thank you for permitting GAO to provide the background for this important hearing and to present the highlights of our testimony in this format.

At the request of this Subcommittee, Chairman Oberstar and Senator Lautenberg, we undertook a study of runway safety. In our testimony this afternoon, we will first define and describe some key types of incursions. Second, we will present the key findings of the GAO study and, finally, we will offer some suggestions for actions that we think could be undertaken to address the problem.

Regarding the nature of incursions, a runway incursion is generally defined as an incident that occurs on the airfield when one aircraft comes too close to another aircraft, vehicle or person. It is not generally considered an aviation accident, but many aviation safety experts consider incursions as precursors or early warnings of accidents.

Incursions can occur in several ways. One of the more typical scenarios is shown here, illustrating the path of two aircraft that are proceeding towards intersecting runways. A second very typical scenario is one in which an aircraft attempts to land as a second aircraft taxis onto an active runway.

Runway incursions are categorized in terms of severity based on the distance between aircraft and the possibility of a collision. Categories A and B are the most serious types as both of these categories indicate near collisions.

The simulation you are about to see is an actual serious incursion that occurred July 11th, 2007 at the Ft. Lauderdale-Hollywood Airport. In this simulation, you will see a Delta 757 nearly touch down on a runway but have to become airborne again when the pilot sees a United A320 approaching the same runway.

[Video shown.]

Mr. DILLINGHAM. These aircraft missed each other by less than a hundred feet.

This next simulation illustrates the type of incursion that occurs when an aircraft attempts a landing on an occupied runway. This incursion occurred on July 5th, 2007 at the Denver International Airport. You will see a Frontier Airlines A319 having to conduct a go-around procedure after seeing another jet on the runway.

[Video shown.]

Mr. DILLINGHAM. These aircraft missed each other by about 50 feet.

Now I would like to turn to the key findings of our report. In our study, we looked back at incursions for 10 years. We found that the total number of all categories of incursions peaked in 2001 at 407.

Between 2002 and 2006, the total number of incursions declined and was relatively flat. This relatively flat line still indicates that there was at least one incursion some place in the U.S. every day.

In 2007, the overall incursion rate peaked again and was nearly as high as the 2001 peak.

This next graph shows only the serious incursions. This is Categories A and B. There are two key points that can be taken from this data.

First, the number of serious incursions followed a similar pattern as overall incursions with a significant drop in 2002 and a relative downward trend to 2006 when there were 31 serious incursions. This graph also shows a 24 percent drop in the number of serious incursions from 2006 to 2007.

The second key point is that about one-third of these serious incursions involved at least one commercial aircraft, each of which represents a potential catastrophic accident.

As this next graphic illustrates, this is a problem that will require sustained attention. It shows that in the first quarter of this year there were 10 serious incursions. This is five times the number of serious incursions from the same time period from the previous year.

With regard to the cause of incursions, our study found that over half were attributed to pilot error. Slightly more than a quarter were caused by controller error, oftentimes involving some kind of controller miscommunication between the pilot and the controllers. About 15 percent involved a vehicle or pedestrian error such as a service truck entering an active runway.

Turning now to the initiatives to address the incursion problem. As Mr. Petri said, there are no silver bullets and, as long as there are humans in the loop, there will probably never be zero incursions.

We think that a multi-faceted, layered approach has the best chance of minimizing the problem. Among the initiatives that we consider that could be done immediately are to continue the efforts that FAA has underway including the training, improving airport signage and markings, and individual airport reviews with stakeholders;

Second, develop and implement the national runway safety plan;

Third, address human factors issues such as controller overtime and fatigue issues and adopt international standards for controller communications; and

Fourth, accelerate the technological remedies such as runway status light, low cost surface surveillance systems and the deployment of ASDE-X.

In addition, we think that initiatives such as the development of a confidential reporting system should be expedited and, to the extent it is operationally feasible, runway crossing should be minimized.

Initiatives for the longer term include making infrastructure changes such as the perimeter taxiway that was recently opened at Atlanta Hartsfield. Another longer term initiative is the development of moving maps that will allow pilots to know where they are located on the airfield as well as the location of other aircraft and vehicles.

The last initiative which will be demonstrated in the next two video clips is one that the NTSB has been recommending for almost 10 years. This is an audible warning to the pilots in the cockpit. The first video shows the view from the cockpit, and you will hear the audible warning to the pilot about an aircraft approaching on a converging runway.

[Video shown.]

Mr. DILLINGHAM. The second clip will also be a view from the cockpit with the audible warning to the pilot. Take note of the arrow in the video that locates an aircraft approaching the runway on which another aircraft is about to land.

[Video shown.]

Mr. DILLINGHAM. In addition to the audible warning, the advantages of this technology are that it is radar-based and avoids any delay or miscommunications between the controller and the pilot.

Mr. Chairman, Members of the Subcommittee, with the current situation and forecasted increases in traffic, runway incursions are a safety problem that require actions that must be sustained beyond any temporary reduction in the number of incursions.

Thank you.

Mr. COSTELLO. We thank you, Dr. Dillingham. We will have a chance to come back and ask questions concerning not only your PowerPoint but other issues in the report, but let me quickly ask you a couple of questions before we move on to Mr. Krakowski.

The Ft. Lauderdale incident where the two aircraft came within 100 feet of each other, was that pilot error or was that controller error?

Mr. DILLINGHAM. I don't know the answer to that, but I will get back to you, sir.

[Information follows:]

Insert on page 17, after line 357:

Mr. DILLINGHAM: On July 11, 2007, a runway incursion occurred at the Ft. Lauderdale/Hollywood Airport involving United flight 1544, an Airbus A320, and Delta flight 1489, a Boeing 757. The arriving Boeing 757 that had just touched down was able to become airborne again to avoid hitting the Airbus A320 that was approaching the same runway. According to the National Transportation Safety Board (NTSB), the probable cause of the incident was the United flight crew's inadvertent entry onto the active runway.

On January 5, 2007, a runway incursion occurred at the Denver International Airport involving Key Lime Air flight 426, a Swearingen Metroliner, and Frontier flight 297, an Airbus A319. The arriving Airbus A319 initiated a go-around procedure after seeing the Swearingen Metroliner on the runway. According to NTSB, the probable cause of the incident was the Key Lime Air pilot's inadvertent entry onto the active runway.

Mr. COSTELLO. Okay. The second incident in Denver where the one plane had to go around, that came within 50 feet, was it controller or pilot?

Mr. DILLINGHAM. I believe that was pilot error where the pilot turned onto the wrong runway.

Mr. COSTELLO. Very good. Thank you. As I said, Dr. Dillingham, we will have other questions for you after we hear from the other witnesses. We thank you for your testimony and for the PowerPoint as well.

Mr. Krakowski, you are recognized for five minutes.

Mr. KRAKOWSKI. Good afternoon, Chairman Costello, Congressman Petri and Members of the Subcommittee.

I am Hank Krakowski. I am the Chief Operating Officer of FAA's Air Traffic Organization. With me today is Jim Ballough. Jim is our Director of Flight Standards Service, specifically working on the pilots' side of this issue.

I am honored to be here today to discuss ways that everyone can work together to improve runway safety. At FAA, safety is our top imperative. While 2007 was the safest year yet for aviation, we remain focused to make the safest system in the world even safer.

Runway safety starts with preventing runway incursions, whether these mistakes are made by pilots, controllers or ground staff. Our most recent efforts have made a difference. We have reduced serious runway incursions by 55 percent since 2001.

The next chart breaks down last year's runway incursions by severity. You will note a change in October when the FAA adopted the new international definition from when we began counting every single mistake on the runway or taxiway, even if another aircraft was not present. This was not previously done, and it appears that incursions are actually rising dramatically.

Actually, what we are doing is we are counting more incursions so we can understand the risks better. So, by getting this additional data of actually treating every single event as a serious issue to look at, I think we have a better shot at assessing our safety risk.

The FAA investigates every runway incursion so we can understand what causes it. As you heard, pilot error accounts for approximately 60 percent right now, air traffic controller error around 30 percent, and the remaining 10 to 15 by ground staff.

The call to action for runway safety which started last summer resulted in specific runway safety improvements at hundreds of airports across the Nation. We improved airport signage and runway markings, and our busiest airports have received satellite-based runway surveillance technology to help warn controllers of a possible collision. Chicago O'Hare is receiving this system a year ahead of schedule.

For pilots, we have installed runway status lights which were endorsed in the NTSB Most Wanted List. The lights turn red when there is traffic on or approaching the runway. Runway status lights are preventing potential accidents today and, in fact, just last week at Dallas-Ft. Worth, an incursion was avoided because the pilot saw the red lights and did not enter the active runway.

Not all measures to improve runway safety will involve installing new equipment, though. FAA runway safety action teams have visited 20 of the busiest airports to identify short term fixes such as new signs, better markings and, more importantly, training for pilots, controllers and ground staff. Our teams are headed to even more airports this year as a result of the success with these first 20.

Another critical component, though, of this program is to complete our work with NATCA, the controllers' union, to implement a non-punitive, voluntary reporting system for air traffic controllers, similar to the Aviation Safety Action Programs at the airlines.

In my previous role as Chief Safety Officer for United Airlines, I was responsible for four such programs for pilots, dispatchers, mechanics and flight attendants. Because of this experience, I am convinced that the information derived from this program will be extremely powerful in understanding the human factors involved in such errors.

The entire aviation community has a role in the solutions, and I am happy to report that they are stepping up to the plate.

I welcome the Committee's assistance in these efforts. This concludes my remarks, and I would be happy to answer any questions you may have.

Mr. COSTELLO. The Chair thanks you and now recognizes Mr. Ballough.

Mr. BALLOUGH. Mr. Chairman, I do not have any opening remarks, but I am here to answer questions regarding pilot issues.

Mr. COSTELLO. The Chair now recognizes Mr. Sumwalt.

Mr. SUMWALT. Thank you and good afternoon, Chairman Costello, Ranking Member Petri, Chairman Oberstar and Members of the Subcommittee. Thank you for the opportunity to present testimony on behalf of the National Transportation Safety Board.

As you know, the Safety Board is charged with investigating accidents and incidents, determining their probable cause and issuing safety recommendations to prevent their reoccurrence.

The Safety Board is especially concerned about runway incursions due to their number and potential severity. In fact, the world's largest aviation disaster was a result of a runway incursion. In that accident in 1977, 583 lives were lost because 2 jumbo jets collided on a runway in Tenerife, the Canary Islands.

Incursions occur because of human error. Pilots make mistakes. Controllers make mistakes as do those driving ground vehicles. So there is no single solution.

In 2000, the Safety Board made recommendations to address the issue in a variety of ways including procedural changes, educational changes and technological improvements that require a direct warning to the flight crews. This direct warning is critical because it would provide pilots with additional time to react.

Since 2005, the FAA has been conducting the field tests of the runway status lights at the Dallas-Ft. Worth International Airport. Initial test results are promising, and the FAA is planning to conduct tests at other airports.

The FAA has also promoted Automatic Dependent Surveillance-Broadcast, or ADS-B, as a method of mitigating the number and severity of runway incursions. For ADS-B to provide the maximum safety benefit, the system should support both ADS-B Out and ADS-B In.

With ADS-B In, surface conflict warnings are provided directly to the pilots in the cockpit, offering the greatest opportunity for improved situation awareness. The FAA's NPRM regarding ADS-B states that aircraft will be required to be equipped with ADS-B Out but not until the year 2020, and moreover the FAA does not plan to mandate ADS-B In at all, and this concerns the Safety Board.

While the Safety Board is encouraged the efforts of the FAA, their progress has been slow to responding to recommendations issued seven years ago. Further, national implementation of these technologies is still years away, and not all airports with passenger service would be equipped.

The FAA has made progress with lighting and improved signage at airports, but basic improvements in air traffic control procedures are needed.

The Safety Board has several outstanding recommendations to the FAA regarding clearances given to pilots when taxiing across runways. Although these recommendations mirror those contained in ICAO guidance used internationally for implementing runway safety programs, the FAA has not implemented them. If they had been implemented, the ComAir accident in Lexington, Kentucky, might not have occurred.

We need the extra protection of additional procedures and advanced technology to compensate for human errors. We strongly urge action on these critical safety issues.

I will now briefly turn to the issue of fatigue. Like runway incursions, fatigue has been on the Safety Board's Most Wanted List since this list was conceived, the inception of this list in 1990.

We have issued numerous recommendations regarding aviation fatigue regarding flight crews, mechanics and air traffic controllers. However, to date, the FAA has taken little regulatory action regarding directly related to revising existing regulations and work scheduling practices.

The FAA is in the process of convening a working group to develop scheduling practices that minimize controller impairment due to fatigue. The Safety Board supports these efforts and continues to believe that further action must be taken, especially in issuing scientifically-based duty time regulations and policies that minimize fatigue among flight crews, mechanics and air traffic controllers. Operating or controlling an aircraft without adequate rest presents an unnecessary risk to the traveling public.

Mr. Chairman, this completes my testimony, and I will be glad to answer questions at the appropriate time. Thank you.

Mr. COSTELLO. The Chair thanks the gentleman and now recognize General Scovel.

Mr. SCOVEL. Mr. Chairman, Ranking Member Petri, Chairman Oberstar, Members of the Subcommittee, we appreciate the opportunity to testify today on runway safety.

Aviation stakeholders are expressing growing concern over the rise in runway incidents. A significant threat to runway safety is runway incursions, which are defined as any incident involving an unauthorized aircraft, vehicle, or person on a runway. Since 2003, the number of runway incursions has begun climbing again, reaching a high of 370 in 2007, a 12 percent increase over the previous year.

While the most serious incidents decreased from a high of 69 in 1999 to a low of 24 in 2007, during the first 3 months of fiscal year 2008, 10 serious runway incursions occurred. If that rate were to continue, 40 serious incursions could occur before the end of this year, which would be the highest level in 6 years.

Over the last 10 years, our work has shown that a range of actions is needed to enhance the margin of safety on the Nation's runways. We see four specific areas where FAA and other aviation users should focus on runway safety efforts.

First, FAA must implement existing and new 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 significant concerns as to what can be effectively deployed within the next several years.

For example, ASDE-X, a ground surveillance system that warns controllers of possible runway conflicts, may not meet its cost and schedule goals to commission all 35 systems for $549.8 million by 2011. Questions have arisen as to whether it will be able to deliver all the planned safety benefits, such as providing alerts at intersecting runways.

Another promising technology is runway status lights, a "stoplight" system that alerts pilots when a runway is occupied. However, the system is in the very early stages of development, and a key issue is that it uses ASDE-X data for its surveillance capabilities. It is therefore dependent on successful deployment of ASDE-X.

One of the most promising technologies on the horizon is ADS-B. However, as we testified last October, ADS-B ground infrastructure will not be in place until 2013, and users will not be required to equip with some of the needed avionics until 2020.

Second, FAA must make 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. Several relatively low-cost, simple, airport-specific changes—such as better signage, improved runway markings and lighting, and procedural changes in daily airport operations—can go a long way to improve the margin of safety.

However, as we reported in May of last year, other than networking, NAS users had no official way to share actions that were successful at reducing runway incursions at their locations.

We recommended that FAA develop an automated means to share best practices among all users of the NAS. In response, FAA implemented a best practices website for runway safety in December 2007. We will now see how well it is being utilized.

Third, FAA must reinvigorate its national program for improving runway safety. From 1999 to 2001, runway incursions increased at alarming rates. To its credit, FAA then took decisive action that helped to reduce these incidents. It established regional runway safety offices and initiated aggressive educational programs for pilots.

However, we found that many of those important national initiatives 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, but until August 2007 it had not had a permanent director for almost 3 years. FAA also stopped preparing its national plan for runway safety, which defined the Agency's strategy and prioritized efforts to reduce runway incursions.

In response to our recommendations, FAA has begun addressing many of these concerns. In addition to hiring a permanent director for the Runway Safety Office, FAA plans to reinstate its national plan for runway safety. These are good steps, and the key now will be maintaining momentum.

Last, FAA must address controller human factors issues through improved training. As we testified last week, controller staffing and training will be key watch items over the next 10 years as FAA begins hiring and training 15,000 new controllers. Training new controllers on human factors issues such as fatigue and situational awareness will become increasingly important as FAA begins addressing the large influx of trainees.

FAA has successfully implemented an important initiative to address this type of required training: tower simulators. These simulators provide controllers with a virtual replica of the tower environment. The simulators use real-life scenarios such as day and night operations, varying weather conditions, and emergency situations. This is important technology to help new and veteran controllers hone their skills in conditions when runway incursions are most likely to occur.

That concludes my statement, Mr. Chairman. I would be happy to answer your questions or questions from other Members of the Subcommittee.

Mr. COSTELLO. Thank you, General Scovel.

Dr. Dillingham and Mr. Krakowski, let me ask Mr. Krakowski. It is clear from reading Dr. Dillingham's report that in fact he compliments the FAA for taking action in 2001, and then the report goes on to state that while the agency recognized when the ground incursions and runway safety issues reached their peak in 2001, that the FAA took action and they focused on the problem.

But, however, as the number of incursions started to decrease, the FAA took their eye off the ball, went on to other issues and no longer considered it a priority until in 2007 when the number of incursions reached almost its peak of 2001.

I think that is demonstrated very clearly by the fact that there was a vacancy in the Office of Director of Runway Safety for over two years and the safety plan at the FAA, the runway safety plan, clearly was outdated as Dr. Dillingham indicated.

So it is clear to me that when the FAA either recognizes a problem or someone says we have a problem and you need to address this, when the FAA acts, then in fact positive results can happen. It is only when you take your eye off the ball, the agency takes its eye off the ball, that we go back and we run into these problems again.

I was struck last night, reading your testimony, Mr. Krakowski. On page three, it says only 8 out of 24 serious incursions involved a commercial air flight and none of these 370 incursions resulted in a collision. While most of these incursions are Category C incidents, which pose little or no risk to the public, the increase in the incursions and the fact that the serious incursions are still occurring prompted the Administrator to issue a call to action on runway safety.

Two points: One is I question the fact that the Administrator implemented a call to action because of the number of incidents. I happen to believe it is because this Subcommittee requested the GAO to do a report on runway safety because we were concerned, and I think that prompted the agency then to take action in 2007. Chairman Oberstar and I were concerned in 2006, and that is why we requested the GAO report.

So I would just say that it is more than a coincidence that we requested the report in 2006, and in 2007 the Administrator said we better take a look at this and we better do something.

Having said that, what struck me in your testimony, and I hope that you didn't mean it to come off this way, only 8 of 24 serious incursions. It is almost like well, we have these incursions, but really there was not a loss of life or a serious disaster. So is it really that big of a deal?

I just want you to know that we on this Subcommittee and others in the aviation world believe that it is.

I happen to believe that it, along with runway incursions, along with the fatigue factor with pilots and with controllers, are the two biggest concerns that I have with safety in the aviation industry today. It is fatigue and runway incursions.

So we hope that you, in fact, are taking action to follow the GAO's plans, and I am going to get to that in just a few minutes.

Dr. Dillingham, you state in your testimony that the FAA indicates that they want to equip 35 airports with ASDE-X. However, the agency has equipped 11 out of the 35 airports that they intend to equip, and they have spent almost 60 percent of the allocated funds for these 35 airports.

Given that fact, are they going to be able to reach their goal of 35 airports, given the fact that they have already spent 60 percent of their money on one-third of the airports that they intend to equip?

Mr. DILLINGHAM. Mr. Chairman, it is a concern of ours not only in terms of the money spent but the time that it has taken them to put out the 11 that they have. The expectation is that the rest of them can be put out in half the time it has taken to put out the few that have been put out.

So it is unlikely at this point. At least, we don't see how this can happen on the budget and the schedule that is being presented to us.

Mr. Chairman, with your permission, I would like to come back to the first question and give you some details on the two simulations that we had. I had to refer to my notes. I am old, you know.

The Ft. Lauderdale incident, it occurred with visibility of 10 miles. It was daylight. The airport did not have ASDE-X or AMASS. The probable cause according to the NTSB is that the flight crew inadvertently entered into an active runway. They had missed a taxiway as they were on the airfield.

On the Denver incident, it was a combination of things. It was the fact that the aircraft turned onto the wrong runway, and the controllers could not identify them on the AMASS. It was a snowy day as such, but it was a combination of things in that case.

Mr. COSTELLO. You address the issue of fatigue in your report and, of course, the NTSB has listed that as a concern for many years. I guess since the early nineties. General Scovel has touched on it as well.

What, in your opinion, or what evidence are you seeing that the FAA is addressing the fatigue issue with air traffic controllers and others in the system?

Mr. DILLINGHAM. We have had numerous conversations with FAA with regard to what can be done about this because we think that this is one of the immediate things that needs to be done because it is a matter of moving controllers to these busy places where you have these six-day weeks and ten-hour days that you can relieve some of that fatigue.

FAA tells us that they are, in fact, studying where they have these few, relatively few places where the controllers are doing these six-day, ten-hour work days and intend to address that issue immediately.

Mr. COSTELLO. I recall in your testimony from last week, and you correct me if I am wrong, but I think that you cited the issue of new controllers as opposed to experienced air traffic controllers.

You, I think, testified, and correct me if I am wrong, that one facility you looked at where they had a small percentage of inexperienced air traffic controllers new to the job and another facility where half—Las Vegas as I recall—where half of the air traffic controllers were inexperienced and new to the job. It was either your testimony or General Scovel's, one of the two.

We have a problem in the system, and we would hope that the FAA will acknowledge the problem and attempt to address it. Now I understand that they are now offering bonuses up to $24,000 to retain experienced controllers, but there is a problem in the system.

Finally, before I turn over to my Ranking Member for his questions, General Scovel, would you like to comment on the fatigue issue as well? Do you see any evidence that the FAA is addressing this issue?

Mr. SCOVEL. Good afternoon, Mr. Chairman.

Fatigue is a concern, and the NTSB has properly highlighted it as a concern for many years, specifically when it comes to air traffic controllers.

By way of tagging fatigue as a direct or contributing factor to an aircraft incident or accident, it is my understanding that NTSB has not done so, although it closely examined that question in connection with the Comair accident in Lexington, Kentucky, in August 2006. Controller staffing in the tower at that incident and the degree of rest of the sole controller on duty at the time of that accident were factors that NTSB addressed, and I know Mr. Sumwalt can address those in more detail, should you wish.

One of the key factors that came out of that from NTSB, and which we would completely agree with, is NTSB's recommendations to FAA that they undertake these actions: First, that FAA reduce the potential for controller fatigue by revising controller work scheduling policies and practices and that they modify their shift rotations. Second, that FAA develop a fatigue awareness and countermeasures training program for controllers.

Mr. Chairman, it seems to us that there is a lot of bickering between controllers and the agencies regarding overtime and whether it contributes to fatigue.

It seems, to me at least, a matter within common human experience that if any individual works long hours at a tough and demanding job, that individual at some point may likely get tired. The real question is: What are we going to do about it?

NTSB has offered some very common-sense solutions to this, put the ball squarely in FAA's court, and we would endorse that and urge FAA to get on with it.

Mr. COSTELLO. Mr. Krakowski, finally, let me ask you to respond. What is the agency doing?

You indicate in your testimony that pilot error accounts for 55 percent of runway incursions, according to your testimony. What is the FAA doing to work with the pilot community on training and education?

Mr. KRAKOWSKI. Okay. I will have Jim Ballough actually assist me with this, but I would like to respond initially, sir.

I take these issues very seriously as I did at my airline before coming to FAA. The one thing you cannot ever do is let up on safety. You have to constantly keep pressure on it at all times which means well-running safety programs, data-driven data collection programs with involvement by everybody involved in the system.

That is what we are trying to construct with the ASAP, with the controllers which we hope to sign soon, integrating and the data that we are getting from the pilot community and those programs as well, as well as some of the other reporting mechanisms through the CAST, Commercial Aviation Safety Team and ASIAS work which is going to be kind of a center point for FAA and the user community to look at data and look for leading indicators. So we are doing some very sophisticated technological work with MITRE and some others to actually break some new frontiers in this area.

More immediately, though, on the pilots' side, the call to action last August was also recently supplemented by the Administrator, the Acting Administrator calling the CEOs and Chief Operating Officers of all the airlines to raise their alertness that the issue is still a concern to us. With the support of the highest level of those corporations, the Directors of Safety and the Directors of Flight Operations at those airlines are working on some programs that I will have Jim talk about.

Mr. BALLOUGH. Thank you, Mr. Chairman, for the opportunity.

As Hank mentioned, this past January, in fact beginning on the 18th of January, we had an outreach effort with the top officials from 116 of the major air carriers. We came together, and myself and my deputy personally did the sessions with the executives from the airlines, and we identified.

First, we talked about the issues, showed the data to establish why they were there and to establish the concerns the FAA has and we all should have as an industry together, to face the issues regarding runway incursions, but this effort was focused primarily on the pilot deviation aspect. So these are errors made by the pilots and, as Hank said, 60 percent of the incursions involve pilots in some capacity.

So we brought the executive together, and we asked them. We showed them the data. We went through 11 simulations or examples of runway incursions, some of which you saw here today, and we asked them to think about what it is we could do in the short term immediately to address the issues in the operational world.

What we learned from the United incident in Ft. Lauderdale was that potentially when you view the tape, it appears as though the crew was doing a checklist item with the flight controls. That was a distraction. So we have asked the carriers to go back and look at their checklists and revise and identify any distractions that may occur and then remove those distractions from the checklist.

We have a number of outreach efforts regarding training. We have asked them. There are some very good runway incursion training DVDs that are available. We have partnered with AOPA to develop some of those as well as ALPA, the Air Line Pilots Association. So those training materials are out there for the 120, for the air carrier world.

For the general aviation world, we have produced numerous DVDs as training materials, produced a number of pamphlets, continued to stress with all of our FAA safety team conferences that they hold. We have asked them to stress the issue of runway incursions, and we continue to look for new ways to also reach the pilots and provide more data to them as well.

Mr. COSTELLO. I thank you.

Mr. Krakowski, I appreciate your commitment to never letting up. As I said, there has been evidence that the FAA has moved on to other priorities in the past, and we are pleased to have you in the position that you are in and committed to not letting up.

With that, I would recognize the Ranking Member, Mr. Petri.

Mr. PETRI. Thank you very much, Mr. Chairman.

I wondered. I am going to spend my time and there are a number of other Members who will be asking broader questions, but my Senators in Wisconsin and my colleague, Gwen Moore and Dr. Kagen, who is a Member of this Committee from my State of Wisconsin, and several other representatives have been sending letters and raising concerns about changes in control of the airspace involving the Milwaukee air traffic control unit.

I really want to, if I could, Mr. Chairman, have permission to submit questions from Representative Moore and myself for a formal response after this hearing.

Mr. COSTELLO. Without objection.

Mr. PETRI. Then also to ask if Mr. Krakowski could respond or point out to a few areas of concern. What is happened is they are evidently consolidating or making changes in the air traffic control space which adds some 8,400 square miles to the direct so-called enroute aircraft flying through the airspace controlled by the Milwaukee unit.

I wonder if you could spend a minute describing the planning process for this airspace absorption and whether the controllers involved were informed or involved in the planning process and also what kind of training the controllers have received or will receive to effect this change.

Also, could you broadly describe what training, staffing and equipment needs the FAA has provided to ensure that when the switch takes place, air safety will not be compromised in any way?

And, if there are any benefits from this change, if you could address those, we would appreciate it as well.

This is a concern, obviously, in our region. People fly in and out of that region and, of course, everyone in the aviation community is aware that a lot of people fly through that area on their way to and from the largest general aviation festival in the world at Oshkosh each summer. So that puts extra strain on this whole part of the system.

I appreciate your addressing that.

Mr. KRAKOWSKI. I own a little airplane in Chicago and fly up in your airspace quite a bit. So I am intimately familiar with the airspace and the issues up there.

As you know, O'Hare Airport is under some significant reconstruction and, as a result of that, airspace changes are needed to accommodate the evolution of the O'Hare airspace. The determination was made to give Milwaukee more airspace to control which is the issue.

I am going to commit to you, first of all, that we will do it safely. We will make sure that we are monitoring the safety of the transition when it occurs and, again, we are not going to let up on that.

In terms of training, we have sent people to O'Hare to actually observe the operation of that airspace that actually is being controlled by Chicago right now. So quite a few of the Members from Milwaukee have gone down to O'Hare to actually observe how to control traffic. There is a one-day classroom training session. There are nine simulations in the radar laboratory that we provide to the controllers as part of the training.

Initially, there will be seven qualified people to man the new positions when we turn the switch. They, in turn, will get the other controllers the training and transition that they need to successfully work the airspace.

So we have a plan. We believe it is a good plan. We believe it is a safe plan, and we are going to execute on that. I will be happy to give you the details in a written response.

Mr. PETRI. Thank you very much.

Mr. COSTELLO. The Chair now recognizes the gentlelady from California, Ms. Richardson.

Ms. RICHARDSON. Yes, thank you, Mr. Chair.

Several questions, first of all, Mr. Dillingham, was your PowerPoint presentation included in here, the actual PowerPoint? I have your written, the other testimony, but is your PowerPoint?

Mr. DILLINGHAM. Ms. Richardson, if it is not included, we did bring CDs with that presentation on it. I don't know if it got included or not.

Ms. RICHARDSON. Okay. If we could, thank you.

My second question is what is the tenure of air traffic controllers at each major airport?

Mr. DILLINGHAM. I really couldn't answer that at this point, but we could certainly provide that for the record. Maybe Mr. Krakowski might be in a better position to answer that.

Ms. RICHARDSON. I would like it in writing for this Committee because I think when I listen I see a lot of this going on here, and to me it is this for those of you who missed it for the first time.

We either have people who have the tenure, who have the education, who have the training, who are prepared to work at the major airports or we don't. To me, I think that that is a critical piece of this.

[Information follows:]

Insert on page 43, after line 957:

Mr. DILLINGHAM: As agreed with the subcommittee, it was determined that FAA was the best source to respond to this question. We are providing FAA's response, which is also being submitted by FAA under separate cover:

According to officials from FAA's Air Traffic Organization:

"All controllers must be certified on a position before they are allowed to work live traffic on their own. Safety is the FAA's highest priority.

At the large airports, and at other facilities throughout the National Airspace System (NAS), position-certified developmentals work along side of Certified Professional Controllers in Training (CPCIT) and Certified Professional Controllers (CPC) to guide aircraft safely through the NAS. Just like the generations of controllers that have gone before them, these Developmentals work live traffic only on the positions they've been certified on. We require them to do this in order to maintain proficiency as they progress towards CPC status.

We closely monitor their progression and qualifications, and strive to maintain an appropriate number of trainees in the workforce. This month, we will publish updated FAA authorized staffing levels for each facility in the NAS in our 2008 Controller Workforce Plan.

Our plan keeps the percentage of trainees below 35 percent of the controller workforce. Before the 1981 controller strike, the FAA experienced trainee percentages ranging from 23 to 44 percent, Following the strike, through the end of the hiring wave in 1992, their trainee percentage ranged from 24 to 52 percent. Past experience has shown that the FAA can operate safely with higher percentages of trainees than we're seeing today."

Ms. RICHARDSON. On page 10 of your report, what was the reason for the two-year vacancy of the director position?

Mr. DILLINGHAM. FAA just did not fill the position. It is now filled, but it wasn't filled for almost three years.

Ms. RICHARDSON. Okay.

Mr. Chairman, some of these things that we are hearing today, is there going to be a process of how we will bring forward, potentially, legislation? If the FAA doesn't feel it is important enough to do some things, will we have the ability to talk about what we would like to do from a legislation perspective?

Mr. COSTELLO. I think one of the reasons why we are getting some action is I had mentioned earlier concerning the GAO report and the attention of the Administrator on this issue is because the Subcommittee is beginning to provide aggressive oversight on these issues. That is the best function that we can perform here, and that is to make sure that the FAA and everyone in the aviation industry, that they are doing their job, in particular the FAA.

As I indicated, I think that is an indication that we are not here to beat up on Mr. Krakowski. He has not been with the agency that long.

But if this runway safety was a priority for the FAA, they would not have left that position open for two years and they would not have an outdated runway safety plan. So one of the reasons why they, I think, have kicked it into gear is because we are providing the oversight that needs to be provided.

Mr. DILLINGHAM. Ms. Richardson?

Ms. RICHARDSON. Yes.

Mr. DILLINGHAM. I can convey to you the response that we obtained when we asked FAA why the position was vacant for so long. Basically, FAA told us that they had devolved runway safety down to the various lines of business and down further from headquarters.

Our response to that was that may be okay, but if there is no national strategy or national plan, you have a situation where different parts of the agency or different regions may be doing things differently. More importantly than that, the lessons that could be learned from good practices were not being shared on a national basis.

Ms. RICHARDSON. Thank you. I am glad that you are involved.

My other question had to do with the deployment of the software systems. When I look at, for example, Chicago Midway, they are not expected to have scheduled deployment until June of 2010. Some of these others on here, when you look at the most runway incursions, it seems like some of the biggest airports that are having the problems are still waiting to get this information.

Mr. KRAKOWSKI. What I would like to do is respond.

It is less important to look at necessarily the history of runway incursions that have happened. We actually look at the risk, the complexity of the operation, the operational tempo at that airport, how many runways and taxiways intersect because we believe that you prioritize in terms of safety risk, not kind of a historical incident. That is an important component, but it is not the only component.

Ms. RICHARDSON. Okay. I will hold the rest of my questions. Thank you, Mr. Chairman.

Mr. COSTELLO. The Chair thanks the gentlelady and now recognizes the gentleman from North Carolina, Mr. Coble.

Mr. COBLE. Thank you, Mr. Chairman.

Good to have you all with us today.

When someone mentioned, Mr. Sumwalt, the Lexington, Kentucky accident, was there evidence that the air traffic controller mentioned was a victim of fatigue at that time?

Mr. SUMWALT. Congressman Coble, it is a two-part answer. The controller likely was fatigued. We found that he had slept approximately 2 hours in the 24 hours prior to the accident.

However, in the NTSB's analysis of that accident, we determined that there was no causal relationship between the controller's fatigue and the accident's occurrence.

Mr. COBLE. I got you. I thank you for that.

I would like for you all to elaborate on the behavioral or the fatigue issue, what contributing factors may be involved.

Mr. Scovel, you mentioned common sense recommendations or suggestions. They were submitted by whom?

Mr. SCOVEL. By the NTSB, sir.

Mr. COBLE. What were some of the common sense recommendations?

Mr. SCOVEL. First—and these arose out of the Lexington accident—that FAA revise its controller work scheduling policies and practices in order to provide rest periods that are long enough to obtain sufficient restorative sleep.

Next, that FAA modify shift rotations for controllers so as to minimize disrupted sleep patterns and accumulation of sleep debt and increase cognitive performance.

Lastly, it recommended for the benefit of controllers themselves, since controllers have a responsibility to take themselves off the scope when they feel that they are too fatigued to perform effectively, NTSB recommended that FAA develop for controllers a fatigue awareness and countermeasures training program.

Mr. COBLE. Now, have those recommendations been embraced or in practice?

Mr. SCOVEL. I will defer to FAA on that, sir. It is my understanding that they are in the process of being implemented.

Mr. COBLE. All right, sir.

Mr. Scovel, would you elaborate on in your testimony on the FAA's use of tower simulators for training? Is it your opinion that this is an effective way to train controllers and what is the FAA's deployment plan?

Mr. SCOVEL. I can answer at least part of your question, sir, and if you would like I can take the rest for the record, or FAA may be able to respond here.

We consider tower simulator training to be a very effective tool, and we would encourage FAA to move out on that as quickly as it is able.

Our estimates are that simulators cost about $500,000 per facility plus approximately another $100,000 for individual software packages that may need to be configured for surrounding airports where controllers can also receive training on the tower simulator.

The benefits are that simulators allow evaluation of new operations. They can study alternatives for improving safety, and they are of great benefit for both new and seasoned controllers.

They have been proven in a couple of instances. At Boston Logan Airport, sir, a tower simulator was used to aid in establishing safety procedures to be implemented with a newly constructed runway. NASA used a tower simulator at Los Angeles Airport to study alternatives for improving runway safety as they looked at options for reconfiguring the layout of runways and taxiways at that airport.

Mr. COBLE. I thank you for that, sir.

Any FAA deployment? Can anybody respond to that?

Mr. KRAKOWSKI. Yes, Congressman. We have bought 24 of the systems. We will deploy 12 this year and 12 next year. I would be happy to submit the list of facilities to you formally.

I just finished a 33-year career as a commercial airline pilot, and that is how we trained. We trained in simulators. You have a big fan sitting here of this technology for a lot of reasons. So I am looking forward to putting this out to the workforce.

Mr. COBLE. Well, thank you for that.

Finally, Dr. Dillingham, in your view of the controller fatigue matters, did you find any evidence to support a causal link between runway incursions that you studied and controller fatigue?

Mr. DILLINGHAM. Mr. Coble, we did not find a causal link. We relied in large measure on the NTSB finding that basically said it was possible that it was a contributing factor, but no, we did not find a causal link. The NTSB was in reference to only four incidents, as I recall.

Mr. COBLE. I thank you, sir. Thank you all again.

Mr. Chairman, I yield back.

Mr. COSTELLO. Thank you.

The Chair now recognizes the other gentleman from North Carolina, Mr. Hayes.

Mr. HAYES. Thank you, Mr. Chairman. I hope people don't think North Carolina is getting an unfair advantage here.

I will have to admit at the beginning that this is an important safety issue, but for others of you in the audience there are other far more compelling safety issues. I hope we don't lose sight of them as we focus on this one.

Mr. Krakowski, what is the maximum allowable overtime for an air traffic controller? How many hours?

Mr. KRAKOWSKI. Ten hours, sir. Ten hours.

Mr. HAYES. Ten hours a day. How many hours a week?

Mr. KRAKOWSKI. Well, it would be 50 hours then. One day of overtime, I believe.

Mr. HAYES. So 10 hours in any one day.

Mr. KRAKOWSKI. A six-day week.

Mr. HAYES. Okay. So that would be 60.

Mr. KRAKOWSKI. Right. You could. Yes, you could.

Mr. HAYES. How many hours of overtime are being voluntarily worked by controllers?

Mr. KRAKOWSKI. About 80 percent of the current overtime, which is about 2 percent system-wide, is voluntary where controllers sign up to do it.

I have some facilities with virtually no overtime, some as high as 9 percent in some areas. Nine percent is too high, and we are working to get some staffing in those facilities, sir.

Mr. HAYES. Being an airline guy, you know it is important. The fatigue factor for controllers is important, but it is just as important for the crews in the aircraft, and we haven't mentioned that today.

Mr. KRAKOWSKI. Yes, and I would like to hand that over to Jim Ballough because he is working that issue not just for controllers but for the pilot community as well.

Mr. BALLOUGH. Yes, Mr. Hayes, we are working currently in the FAA. The Acting Administrator has asked us to look at this fatigue issue not just for controllers or pilots but across the board for mechanics, flight attendants as well.

We are in the final stages of planning a symposium that should be conducted somewhere in the June time frame to where we will bring all of the academia together, industry stakeholders together, labor and really tee up the issue of fatigue and how we can manage it now.

We know that we think there are science that is out there today that makes it doable, and so it is time to bring those parties together and to plan a strategy for how we use the fatigue science and apply it. We know that prescriptive flight and duty rules don't work. We know that they have served us well over the years, but we know now that we can make further progress to address this issue with fatigue.

So we look forward to working this issue later this year and hope to have some very positive results and use that conference as a springboard to move forward to address fatigue issues.

Mr. HAYES. Thank you for that.

I would like to emphasize, as I have many times before, there are glide slopes out of service. There are localizers out of service. There are AWAS and ADIs and other important day to day, hour to hour safety devices and procedures that the FAA is not keeping up with. That is troubling me far more than what we are talking about today, as important as it is.

Mr. Chairman, I look forward to the next panel because I want to hear. You all don't care what I think as a pilot as much as I want to hear the professionals speak to us from their perspective about what a pilot does, can and should do to be the number one runway incursion preventer in the whole process because very few examples. Tenerife is one example where there was no visibility and you could not see and be seen, but for the large majority, 95 plus percent, clear right and clear left is the number one preventive for runway incursions.

Thank you, Mr. Chairman. I yield back.

Mr. COSTELLO. The Chair thanks the gentleman and recognizes the gentleman from Tennessee, Mr. Duncan.

Mr. DUNCAN. Well, thank you very much, Mr. Chairman. Because I didn't get here in time to hear the testimony of the witnesses, I didn't think I was going to ask any questions, but I have a couple of things that I am curious about.

One is we have all been given a chart, and it says it is from the FAA, from the Air Traffic Control Organization, that runway incursions are less than half of what they were in 2001.

But then, at the same time, we were given a briefing memo that says GAO reports that the rate of runway incursions in 2007 has increased to 6.05 incidents per million operations. This is a 12 percent increase over 2006 and the highest number since 2001.

I am a little confused as to which it is. Are the incidents cut in half as this chart shows, in other words, meaning that it has gone way down, or have they gone way up?

Mr. KRAKOWSKI. Congressman, relative to the rate, you have to remember operations go up too, so rate is reflected against the number of operations in the NAS as well. But I think what is important to note on the last bar, the actual number of incidents, total incidents is up.

Mr. DUNCAN. The problem, though, what has confused me is both of these things say they are per million operations, both the memo and the chart. I don't know. Anyway, go ahead.

Mr. KRAKOWSKI. Okay. Well, I am not quite sure how GAO determined theirs.

Gerald?

Mr. DILLINGHAM. Well, we used the FAA data.

Mr. KRAKOWSKI. Right, okay.

[Laughter.]

Mr. DUNCAN. It is quite a difference.

Mr. KRAKOWSKI. Yes, but these are the serious. These are the As and Bs here. These are the most serious runway risks.

Mr. DUNCAN. All right. Well, maybe you could get an explanation or figure that out. It might be interesting for us to know which it is, whether they have gone way up or way down.

Then you got my curiosity when, Mr. Sumwalt, I believe it was you that said that the controller is Lexington had only slept 2 hours in the last 24 hours. Was that due to his own personal, private behavior or did the FAA have something to do with that in the scheduling they had done?

If the FAA is responsible for that, then that is something that I hope we have eliminated. That shouldn't happen any place.

But if it is something that was just a matter on his own private time he stayed up, then there is not much we can do about that. I just was curious as to which it was. What would have caused him to sleep only 2 hours out of the last 24 before that happened, that accident happened?

Mr. SUMWALT. Congressman Duncan, it was a combination of both things that you mentioned.

The scheduling factors, he had worked a shift that had gotten off duty earlier in the day, 1:30 or 2:00 in the afternoon. Then he was off for his, I guess, eight hours, but then he did personal things during that time off, including going out and running and apparently only slept about two hours. Then he showed up to work again to work the shift in which the accident occurred, which I think that shift started around 11:00 at night.

So it was a combination of the schedule that he maintained and the inability to manage his own personal schedule such that he could maximize opportunities for rest.

Mr. DUNCAN. How common is something like that, Mr. Krakowski? Is this an aberration or how common is it that controllers get off and then only have eight hours between when they are due at work again?

Mr. KRAKOWSKI. Let me answer this in a couple ways. If you are really going to study fatigue as we were just starting to do that at United Airlines before I retired, there is new science that we have now that really knows how to look at this in ways that 10 years ago we didn't have. It is applicable to controllers, pilots and everybody.

If you are really going to study fatigue, it is everything. It is scheduling practices. It is what people do with their time off. It is how patterns of schedules are put together. That is what this conference that Mr. Ballough will be sponsoring later this spring is going to address to really take a scientific look at this.

The other issue about fatigue that is a bit concerning is there is a lot of anecdotal stories about it, but the data are important.

Mr. DUNCAN. Let me ask you this. What the staff is telling me is they are telling me this comes from a 221 air traffic control scheduling practice that the controllers themselves have asked for or want or is popular with them. Is that right?

Is this happening because this is what the controllers want?

Mr. KRAKOWSKI. We understand it is a popular scheduling practice, yes, but I think again if we can get into this spring to understand. You know popular scheduling practices, if you know how to rest and you know how to use your time off during those periods, it may or may not be a risk at all. So that is what we have to get into.

The other part of this, as I mentioned earlier, the Aviation Safety Action Program that we want to start with the controllers is the kind of mechanism that allow us to take a look at just these sorts of issues. So I really hope we get that signed soon.

Mr. DUNCAN. It seems to me there ought to be more time in between shifts than eight hours unless these controllers are sleeping there at the facility because by the time somebody leaves and drives home and does all the things that people ordinarily do, you could run into some problems there.

Thank you very much, Mr. Chairman.

Mr. COSTELLO. I thank the gentleman.

To clarify a point just so we understand, I know, Mr. Krakowski, you are saying that if the person knows how to rest. But if you are working 16 out of 24 hours, during that 8-hour period that you are off I am sure there are other personal things, family things that you have to attend to, that you just don't go home and get 8 hours sleep.

So, regardless if it is the agency forcing the controller to work 16 hours in a 24-hour period or if it is on the part of the controller wanting to work that schedule, it seems to me that it is an issue that needs to be addressed.

The other point that I would make to Mr. Duncan's question about is this increased or decreased between 2001 and 2006, regardless of how you look at the numbers, we do know for a fact that in the first quarter of fiscal year 2008 we have had 10 severe runway incursions, just in the first quarter of fiscal year 2008. So it is an issue and is a problem, and again we are pleased that you are moving forward to make some progress.

The gentleman from Missouri, Mr. Graves?

The gentleman from North Carolina, Mr. Hayes, would like to be recognized for a comment.

Mr. HAYES. Thank you, Mr. Chairman.

We talked about the situation in Lexington, and I think it is important to understand there is an issue about the controller, but we haven't talked about what happened with the airplane.

Mr. Krakowski, refer back to the time when you were flying in the line so that members of the panel and the audience can understand. When that aircraft pushed back, the first officer and the captain, how would they brief each other?

I mean I know, but I think it is important for the record. This is not just about controllers. What did the pilots do that led them to take off on an unlighted short runway?

Here is Lexington. Long runway, short runway. Lighted, unlit. What happened when they pushed back? What did they say to each other? Where did this go wrong?

Mr. KRAKOWSKI. So I would say that based on what I know of, and I think Mr. Sumwalt actually would be able to give you the detail on this. So I will defer to him. But I think the cockpit did have some distraction going on.

Robert?

Mr. HAYES. Well, before you answer, let me ask the question a different way. When done right, what would the brief between the captain and the first officer have sounded like to get to the correct runway and to make the right decision? Obviously, that came apart.

Mr. KRAKOWSKI. A crew has to work together. The captain is in command of the aircraft. The captain sets the atmosphere in the cockpit for running your checklist, doing your briefings efficiently and making sure you are going in the right direction.

At least at my company, you had the taxi chart in front of you. You briefed these routes. You validated that the heading of the aircraft was on the assigned runway before you actually took off.

So that is how you do it right. You have really good cockpit procedures reinforced by training and reinforced by good training and good checking standards.

Mr. HAYES. But that obviously broke down.

Do you want to comment, Mr. Sumwalt?

Mr. SUMWALT. I would, Congressman, because I am just a neophyte compared to Captain Krakowski. He had 33 years with the airline. I only had 24, most of which were based in Charlotte Douglas International Airport.

So the NTSB did determine the probable cause of the Comair accident was to be the failure of the flight crew to use available cues and aids to identify the airplane's location on the airport surface during taxi and their failure to cross check and verify the airplane was on the correct runway.

Contributing to the accident was, in fact, distractions that the crew enabled themselves to get into due to violations of the sterile cockpit rule. We also did take an opportunity to point out that if the FAA had required that all runway crossings be authorized by specific air traffic control clearances. We listed that as a contributing factor as well.

Mr. HAYES. Okay. Thank you, Mr. Chairman.

I think it is just important to know what that part of it is. If there are two pilots, they are going to say: Where is the runway? How are we going to get there. That is just common language, and that is where we had a major breakdown.

The controller issue is a part of it, but again that is critically important.

Once you get where you think you are supposed to go, the number on the end of the runway should correspond with your magnetic compass which, oh, by the way, you are going to check with your directional gyro which should be the same number. If any of the three don't agree, something is wrong here.

Mr. COSTELLO. The final comment or question is the other gentleman from North Carolina. North Carolina is getting a lot of time today.

Mr. COBLE. You are very generous to us, Mr. Chairman. I appreciate that.

I want to be very brief. I want to extend the gentleman from Tennessee's questioning regarding facilities for berthing.

I complete my tour, and I get eight hours off. My house is 2 miles away. Do I have facilities on board to sleep before I stand my next watch?

Mr. KRAKOWSKI. Typically, no, sir.

Mr. COBLE. Typically, no?

Mr. KRAKOWSKI. At the facilities.

Mr. COBLE. Thank you.

I thank you, Mr. Chairman.

Mr. COSTELLO. The Chair thanks the gentleman and thanks all of the witnesses on our first panel.

Mr. Sumwalt, you had a final comment?

Mr. SUMWALT. I would, sir, and thank you for the extra time.

The question has come up, has the NTSB established a causal link between certain runway incursions and fatigue?

In fact, in our April 10th safety recommendation letter that we issued the recommendations that General Scovel mentioned, we did point out four runway incursions, four runway incidents that provided clear and compelling evidence that controllers are sometimes operating in a state of fatigue because of their work schedules and because of their poorly managed utilization of rest periods between shifts.

So we have found runway incursions that we have attributed to controller fatigue.

Thank you.

Mr. COSTELLO. The Chair thanks you and thanks all of you on our first panel for being here and testifying, for your testimony today. Thank you.

The Chair will now ask the members of the second panel to come forward in just a few minutes. I will do the introductions right now.

We are expecting in about 15 minutes a vote on the Floor of the House. I don't know how many votes. So we will try and get our second panel at the witness table. I will do introductions now as we are making the transition.

The first witness that I will introduce is Captain John Prater, the President of the Air Line Pilots Association; Mr. Patrick Forrey, the President of the National Air Traffic Controllers Association; Mr. Basil Barimo who is the Vice President of Operations and Safety at the Air Transport Association of America; Mr. Greg Principato, the President of the Airports Council International-North America; Mr. John Duval, who is the Airport Safety and Security Coordinator for Beverly Municipal Airport; Mr. Phil Boyer, President of AOPA; and Mr. T.K. Kallenbach, who is the Vice President at Honeywell Aerospace.

Mr. Prater, your time is up. No. I am just kidding.

[Laughter.]

Mr. COSTELLO. Mr. Prater, you are recognized under the five-minute rule. Please begin your testimony.

TESTIMONY OF CAPTAIN JOHN PRATER, PRESIDENT, AIR LINE PILOTS ASSOCIATION; PATRICK FORREY, PRESIDENT, NATIONAL AIR TRAFFIC CONTROLLERS ASSOCIATION; BASIL J. BARIMO, VICE PRESIDENT, OPERATIONS AND SAFETY, AIR TRANSPORT ASSOCIATION OF AMERICA; GREG PRINCIPATO, PRESIDENT, AIRPORTS COUNCIL INTERNATIONAL—NORTH AMERICA; JOHN K. DUVAL, A.A.E., AIRPORT SAFETY AND SECURITY COORDINATOR, BEVERLY MUNICIPAL AIRPORT AND FORMER DEPUTY DIRECTOR FOR AVIATION AND OPERATIONS, MASSACHUSETTS PORT AUTHORITY AND AMERICAN ASSOCIATION OF AIRPORT EXECUTIVES; PHIL BOYER, PRESIDENT, AIRCRAFT OWNERS AND PILOTS ASSOCIATION; T.K. KALLENBACH, VICE PRESIDENT, MARKETING AND PRODUCT MANAGEMENT, HONEYWELL AEROSPACE

Mr. PRATER. Thank you and good afternoon, Mr. Chairman, Ranking Member Mr. Petri, Members of the Subcommittee. Thank you for the opportunity to provide the pilots' perspective on runway safety.

As you know, our pilots operate in complex airport environments every day. They fly in all types of adverse weather and with limited visibility conditions. They complete the demanding task of a safe landing over and over, often after being on duty for more than 16 hours and being awake for more than 20 hours.

All of these tasks demand vigilance and high situational awareness. These are the challenges we face every day in delivering our passengers safely to their gate.

But the risk for a runway incursion in this environment is constantly increasing. It is an issue that must become a national aviation safety priority and ALPA thanks the Chairman for putting it onto the Subcommittee's agenda.

According to the FAA's statistics, during the last three months of last year, there was an average of 2.5 runway incursions every day in the United States, providing the potential for a catastrophe. The FAA categorizes this risk as unacceptable.

We agree, but I am taking it a step further. This rate of occurrence is inexcusable.

The FAA categorizes runway incursions as either a pilot deviation or an operational error, but those classifications don't tell the whole story. While it may be convenient to assign blame due to the pilot or the controller, it doesn't address the root of the problem. We must understand why these runway incursions take place and then put mitigations into the system so that we can help pilots and controllers avoid these errors.

Dozens of experts in several countries have studied the runway incursion risk over the years and devised mitigations that can greatly lessen the risk in ground operations today. In fact, according to the Commercial Aviation Safety Team, the problem can be reduced by as much as 95 percent with the implementation of new technologies, new training and operational techniques that increase both pilots' and controllers' situational awareness.

Technological solutions include cockpit moving map displays similar to the GPS device that many people have in their cars today, the integration of ADS-B to enable pilots and controllers to track all aircraft and vehicles on the surface and up to 1,000 feet above ground level, automatic runway occupancy alerting and digital datalink clearances that are then displayed on the cockpit moving map.

Most airline pilots, however, are still flying aging airlines with none of this technology available to them.

Other ALPA-recommended improvements include the installation of red runway status and hold lights. These simple and inexpensive lights automatically provide direct indication of runway status and warn pilots of landing and departing aircraft. With ALPA's help, the MIT Lincoln Laboratory tested this system at the Dallas-Ft. Worth International Airport and, since its implementation in 2005, runway incursions there have decreased by 70 percent.

Not all runway safety solutions involve high tech gadgets. Some low tech solutions involve something as simple and cheap as a can of paint which can be used to improve our runway and taxiway markings.

The FAA issued an advisory circular in 2005, requiring that the 75 busiest airports enhance their taxiway centerline markings near runway intersections by June of this year. All but four of these airports have completed that requirement.

But our pilots and our passengers fly to hundreds of airports, and ALPA strongly recommends that these airport surface markings become standard for all Part 139 airports. That is a total of 566 airports.

Sixty-two of these airports have voluntarily made these improvements, unfortunately, some spurred by fatal accidents. That still leaves roughly two-thirds of America's airports that need better ground markings for pilots.

Some airports have found that installing perimeter taxiways also reduces runway incursion risk. Atlanta Hartsfield is a good example of that. They have eliminated 600 runway crossings a day and reduced delays by 60 percent.

Our union is doing its part for runway safety. ALPA is reaching out to our 60,000 pilots in both the United States and Canada through a new communications initiative that we call for Hold

Short for Runway Safety. It is designed to educate pilots on what we can do now to prevent runway incursions.

Our initiative includes a web site, educational material, a series of newsletters going out, starting this Friday, and we will keep them sending them out to try to keep the focus on runway safety.

In coordination with the FAA, ALPA and United Airlines produced a video for a training video to highlight the problems and how we can reduce operational errors.

But in order to adequately prepare for the increase in airport operations and the increased runway incursion risk, ALPA urges the government to commit proper funding to improve our National airspace System. Every stakeholder and every passenger deserves it. They deserve it now.

Thank you, sir.

Mr. COSTELLO. Thank you, Captain Prater.

The Chair now recognizes Mr. Forrey under the five-minute rule.

Mr. FORREY. Chairman Costello, Ranking Member Petri and the distinguished Members of the Subcommittee, let me begin by first thanking the leadership of the Transportation Committee in passing a comprehensive FAA reauthorization bill and package in a timely fashion, moving it through the House last September and the bipartisan support of 267 Members of this House.

I further applaud your efforts earlier this week in passing a short term extension rather than putting this important legislation off until next year.

It is NATCA's hope that the Senate will yield to the House and forego efforts to move an extension that goes beyond June 30th. Our fear is that doing so would undermine the hard work this Committee as well as of the Senate Finance and Commerce Committees and fail to address the immediate and future needs of the National Airspace System.

Aviation is vital to this Nation's economy, and H.R. 2881 maintains important provisions to keep our system the safest and most efficient in the world.

NATCA urges the Senate to take FAA reauthorization out of a holding pattern and act swiftly on passing a comprehensive long term bill.

Turning to the topic of today's hearing, NATCA's mission is to preserve, promote and improve the safety of air travel within the United States and to serve as an advocate for air traffic controllers and other aviation safety professionals.

Air traffic controllers and pilots, more than anyone else here today, are responsible for the safety of the runways at America's airports.

NATCA has been trying to direct attention to the decreasing safety margins in our skies and on our runways for years. We are no longer alone. In the past few months, a host of independent Federal watchdogs have joined the chorus of rising concerns about aviation safety.

In November, the GAO issued a report that warned of a high risk of a catastrophic runway collision occurring in the U.S. In December, the Transportation Department Inspector General launched an investigation on the role that workplace conditions played in several close calls at the FAA facilities in Illinois. And, the NTSB recently added runway incursions and incidents caused by air traffic controllers fatigue to their 2008 list of most wanted aviation safety improvements.

In addition, last April, NTSB Chairman Rosenker called on both NATCA and the FAA to work together to combat controller fatigue. NATCA's response was to welcome that recommendation and to work with the agency and offered our assistance to help the FAA to make our runways safer. The agency's response, however, was to not follow the NTSB's Chairman's recommendation to work with the controllers but rather to create a working group that didn't include NATCA.

Despite the FAA's sound rejection of our input, NATCA offers its recommendations for improving runway safety today to the Aviation Committee:

First, because each airport represents unique challenges which negate the usefulness of broad, universal solutions, NATCA recommends the creation of a runway incursion prevention committee for each airport. These groups would be comprised of the local stakeholders including pilots, air traffic controllers, airport management, vehicle driver operators and the FAA.

Second, NATCA recommends that controller staffing at our Nation's FAA facilities be adequately addressed. Today, there are 1,500 fewer fully certified controllers than there were on 9/11, leaving fewer eyes to watch more planes, and the result is increased controller fatigue.

If the FAA would return to the bargaining table where the parties left off and negotiate in good faith with NATCA, the effort would make staying in the FAA more attractive to both newly hired controllers and those eligible for retirement. Unfortunately, the current rate of controller attrition is 6.2 a day, and the system can't sustain that rate much longer.

Third, NATCA's recommendation that the FAA work in cooperation with the union in the development of deployment of new technology. Under the liaison program, the FAA and NATCA work side by side in creation of new technologies. ASDE-X, an effective surface surveillance system is a product of that collaboration.

NATCA recommends the deployment of this technology in all airports throughout the Country with mid to high traffic density. NATCA further recommends that the liaison program dismantled by the FAA in 2005 be reinstituted.

Fourth, because runway incursions often occur when the layout of a taxiway forces aircraft to cross runways on route to a second runway or gate, NATCA recommends that end-around taxiways be constructed and utilized at all airports where such construction is possible.

Mr. Chairman, NATCA is not alone in sounding the alarm on passenger safety. The NTSB and the GAO have determined that the threat of controller fatigue is real.

The increase in runway incursions is real too. There have been 12 serious A and B runway incursions in the first 4 months of fiscal year 2008 compared to 3 during the same time last year.

The warnings of the GAO, the IG and the NTSB should not go unheeded. NATCA stand ready, willing and able to offer real solution. We can only hope that the FAA is really listening.

I, once again, thank the Subcommittee for the opportunity to testify here today. I look forward to answering whatever questions you might have.

Mr. COSTELLO. The Chair thanks you, Mr. Forrey.

Mr. Barimo, do you think you can get your testimony in, in five minutes?

Mr. BARIMO. Yes, sir.

Mr. COSTELLO. Very good. You are recognized.

Mr. BARIMO. Good afternoon, Mr. Chairman and Members of the Subcommittee. My name is Basil Barimo, and I am the Vice President of Operations and Safety at the Air Transport Association of America. Thank you for the opportunity to join you today and discuss runway safety issues.

Airlines have been focused on reducing runway incursions since well before it was in vogue and appreciate the Subcommittee's interest in this matter. Runway incursions are a serious threat to civil aviation safety both to airlines and to general aviation, but we are making progress.

I would like to concentrate my remarks today on three areas: first, on the data as it pertains to serious commercial incursions, you heard the definitions earlier; second, on our strategy for achieving these improvements; and third, actions that are underway to reduce the risk of incursions.

Before proceeding further, though, I would like to mention that we have only yesterday reemphasized our commitment to improve safety in the airport operating environment. On Tuesday, ATA member airlines, ALPA, FAA and other interested members of the aviation community held a Runway Safety Awareness Day. Roughly 70,000 pilots represented by 50 airlines received a letter from senior management, reinforcing the industry's collective commitment to improving runway safety.

As a starting point in this discussion, what do the FAA data tell us? According to the FAA, the frequency of serious runway incursions, A or B, have decreased steadily since 2001 with commercial operations accounting for approximately a third of the total. The chart on page two of my written statement depicts this data.

But narrowing the focus further, the number of serious incursions involving commercial operations that were attributable to pilot deviation has also declined.

How did we achieve these improvements? In this, as with so many other safety-based endeavors, the aviation community looks to data to identify what aspects of a problem it needs to concentrate on. We can call upon multiple sources of safety-related information like ASAP and FOQA and CAST and ASIAS to better understand the nature and the extent of the risks that confront us.

Our analytical abilities have advanced to the point where we can assess future vulnerabilities and therefore don't have to rely exclusively on what has happened in the past. This means that in the context of airport surface operations, we cannot only spot overall trends but can pinpoint specific locations that are prone to incursions.

The decline in serious runway incursions is a result of well thought out collaboration among stakeholders. Recognizing this achievement, of course, does not mean that we should be satisfied with it. We most emphatically are not. But it does give us the confidence to work toward greater improvements. That is the task before us.

What actions are underway to reduce the risk of incursions? Because of the data evaluation efforts, we understand far better the airport surface operating environment than we ever have.

The more informed perspective has resulted in an array of initiatives designed to decrease runway incursion risk, including elevating the awareness of risks, reducing flight-crew distractions during the taxi phase of flight, emphasizing the use of standardized ATC verbiage and clearances, enhancing pilot training, leveraging the work of the existing Runway Safety Action Teams, enhancing signage, lighting and markings, reconfiguring taxiways to eliminate confusing intersection and runway crossings.

In addition to these initiatives, several emerging technologies will improve the operating environment, things like ASDE-X, cockpit moving map and head-up displays, automated lighting systems and, finally, we all look to ADS-B to provide greater airport surface safety improvements. Each of the foregoing is an important initiative that will contribute to improving safety.

However, we believe that three items are worthy of special attention as short-term, high priority initiatives, and they are:

Continuing to eliminate cockpit distractions for crews during the taxi-out and taxi-in phase;

Continuing to eliminate confusing taxiway and runway intersections, adding signage and lighting, and introducing technologies that link ASDE-X to TCAS and put the warning directly into the flight deck; and

Finally, tapping into critical safety information by implementing an ASAP program for air traffic controllers, similar to those used so effectively within the airline community.

These three initiatives can be accomplished in the short run and promise to improve the safety of the airport and operating environment. They shouldn't be regarded as supplanting the other initiatives that I have mentioned but are worthy of further immediate emphasis.

The Subcommittee's interest in the issue of runway incursions is always welcome and always timely. The threat is real. The need for continued action is indisputable. The aviation community remains ready and committed to reducing the risk of runway incursions.

Thank you.

Mr. COSTELLO. Thank you, Mr. Barimo.

We have four to five votes on the Floor right now, which means that the Subcommittee will stand in recess until we would ask you to be back by 4:20, 20 minutes after 4:00.

So if you want to get a cup of coffee, we will be back here at approximately 4:20. We would ask you to be here. We would ask our witnesses to stay, to those of you who have already given your testimony, so that Members have the ability to ask questions.

The Subcommittee will stand in recess.

[Recess.]

Mr. COSTELLO. The Subcommittee will come to order.

First, let me say we thought we would be back by 4:20, but strange things happen when you are having fun. We had a couple of extra votes that we didn't count on.

The Chair now recognizes, under the five-minute rule, Mr. Principato.

Mr. PRINCIPATO. Chairman Costello, Ranking Member Petri, thank you for allowing ACI-North America the opportunity to participate in this important hearing on runway safety.

As you know, I am Greg Principato, and I am the President of Airports Council International-North America. Our 360 member airports enplane more than 95 percent of the domestic and virtually all of the international passenger and cargo traffic in North American, and nearly 400 aviation-related businesses are also members of ACI.

We applaud the Committee for its tireless work on H.R. 2881. The resources the bill provides will fund many critical projects to bring important safety benefits. We thank you for your leadership and commitment to both airports and the aviation industry, and we commend both you and the House of Representatives for passing this bill.

In fiscal year 2007, the FAA reported 24 serious runway incursions out of more 61 million operations. Although the Nation's airport runways remain safe, reducing the risk of runway incursions is a top priority. Airports have taken a particularly aggressive stance in addressing this safety concern.

Last August, more than 40 aviation leaders including ACI-North America, participated in the call to action. The purpose of the call to action was to reach consensus on a number of short, medium and long term initiatives that could be undertaken to further improve the safety of operations at America's airports.

By June 30th, 2008, the FAA was requiring 75 large and medium airports to paint red markings on the taxiway hold line to identify the approach of a specifically marked runway. FAA is also requiring these airports to improve centerline painting and markings on all airport taxiways to give differential color distinctions to ensure taxiways are easily seen by taxiing pilots at night or under poor weather conditions.

To date, actually, the number is 72 out of 75. Another has complied. Airports have completed this, and three airports will be finished by May, ahead of the deadline.

Now the FAA is not requiring new taxiway painting and markings for smaller airports certificated under Part 139. However, the call to action plan calls on those smaller airports to voluntarily do so, and I am pleased to say that by the end of this year 251 will have done so.

Midterm runway safety actions specific to airports include the accelerated installation of runway status lights, which use runway and taxiway centerline illuminated lights to warn pilots of potential runway conflicts and prompt them to notify the tower before proceeding if a contradicting clearance has been issued.

The FAA has tested runway status lights at Dallas, and a DOT Inspector General report or audit showed that runway incursions on that test runway at DFW decreased by 70 percent after runway status lights were installed. Due to this success, in early December, DFW began construction of runway status lights on two additional runways.

Additional midterm action includes final approach runway occupancy status lights. FAROS is a test concept that flashes the existing lights to give direct notification to the pilots that the runway is occupied and unsafe for landing. Test airports include Dallas and Long Beach.

Longer term actions include full deployment of ASDE-X by 2010, moving map displays in cockpits, ADS-B In and Out as well as cockpit display of traffic information, things you have heard about already today.

Independent of the FAA requirements and technological evaluations, airports are taking independent action to enhance runway safety. Last year, Atlanta completed its end-around perimeter taxiway, essentially eliminating 650 daily runway crossing, 650. Minneapolis, Grand Rapids and Pittsburgh have constructed tunnels under their respective runways to eliminate the need for vehicles to cross runways on the surface.

Airports also continue to provide recurrent training for all airport employees who operate vehicles on the movement area of the airfield.

In addition to airport-specific actions, we recently joined the Commercial Aviation Safety Team, or CAST, which was discussed earlier, a cooperative voluntary partnership consisting of all commercial aviation stakeholders with a mission to increase safety, using an integrated, data-driven approach based on analyzing accident causes, identifying ways to make positive changes and implementing improvements to help address runway safety and incursion issues.

Before wrapping up, let me also say we have heard a lot about various systems that I have just mentioned and earlier people have mentioned. I think it is important that down the road we look for consistent applications and uniform deployment of those systems.

Pilots work in a lot of different airports. They don't just work in one airport. They go from airport to airport. It is particularly important that when they come to an airport, what they see is consistent from airport to airport eventually, especially a lot of focus on the larger airports. But a lot of regional pilots will fly back and forth between a large hub and a smaller non-hub, six or seven or eight times a day, and having that consistency is important.

So I conclude by thanking you for holding this hearing and allowing us to participate.

Mr. COSTELLO. We thank you for being here and giving us your testimony today.

The Chair now recognizes Mr. Duval.

Mr. DUVAL. Thank you, Chairman Costello, Ranking Member Petri and Members of the House Transportation and Infrastructure Subcommittee on Aviation. Thank you for inviting me to participate in this hearing on runway safety.

I am John Duval, the Airport Safety and Security Coordinator at Beverly Municipal Airport, a GA airport and a reliever airport located approximately 22 miles north of Boston. I am testifying today on behalf of Beverly Airport and the American Association of Airport Executives.

Mr. Chairman, before I proceed, I would like to thank you and the other Members of this Committee for your leadership on H.R. 2881, the FAA Reauthorization Act of 2007. Airports are particularly grateful that the bill would raise the PFC cap to $7 and increase AIP funding by $100 million a year. These two funding provisions will help airports improve safety, prevent runway incursions and accommodate increasing demand.

Since the Senate has yet to complete its action on a multi-year FAA reauthorization bill, I would also like to thank you for helping to pass a short term extension bill yesterday.

As Members of this Subcommittee well know, AIP contract authority has already expired and the aviation excise taxes are slated to expire at the end of this month. I hope the Senate will follow your lead and approve H.R. 5270, so airports can begin to receive the funds that they need for critical safety projects.

Today, we are here to focus on runway safety. As passenger numbers continue to rise and takeoffs and landings increase, it is imperative that we redouble our efforts to improve runway safety. I would like to describe just a few of the steps that airports are now taking to improve runway safety and some of the technology that could help prevent further runway incursions.

Airports around the Country are using the enhanced taxiway centerline markings and surface hold position signs to prevent runway incursions. Commercial airports with more than 1.5 million enplanements per year are required to have these markings installed by June 30th.

Standardization, as you have already heard, as long been a crucial tenet at all of our commercial airports, and I commend the FAA for recently issuing a draft advisory circular that would extend these enhanced surface markings to all Part 139 airports.

Airports are also beginning to add perimeter taxiways to reduce runway crossings and the potential for runway incursions. The Atlanta Airport installed an end-around taxiway earlier this year, and according to the FAA the new taxiway is expected to eliminate nearly 700 runway crossings per day.

DFW is also engaged in a perimeter taxiway project that will include perimeter taxiways in all four quadrants of the airport. The first one is expected in the southeast quadrant to be completed by the end of this year. When all four are completed, this will eliminate as many as 1,700 runway crossings per day at DFW.

Both taxiway projects will help to prevent runway incursions at two of the busiest airports in the United States.

The FAA points out that training is one of the keys to reducing the severity and frequency of runway incursions. I agree, and I am very proud of the computer-based interactive employee training system that AAAE has developed to better train airport and airline employees and other airport tenants. AAAE has delivered nearly 1 million training sessions at 55 airports around the Country.

IET training programs are highly effective in training because employees receive a video component that features the actual work environment at their airport. Some of the topics include movement and non-movement driver training area as well as airfield safety and incursion prevention.

One of the most promising technology improvements to prevent runway incursions is the runway status light system. The system uses radar to anticipate the use of a runway by an arriving or departing aircraft and then controls a series of lights to provide information to pilots and vehicle drivers regarding the runway status.

The FAA has been testing this at DFW and San Diego. Runway incursions, as you have heard, in the test case has decreased by 70 percent on the test runway at DFW. I hope that FAA will continue to work with airports and other aviation stakeholders in an effort to expedite the deployment of this system.

We should also use new technology to improve runway safety at smaller airports. Toward that goal, the FAA is testing two low cost ground surveillance systems at Spokane Airport that could improve runway safety at small to medium size airports. One uses millimeter wave sensors. The other uses X-band radar to detect motion on the airports runways and taxiways.

I am encouraged by reports that these systems are effective, relatively inexpensive and easy to install. I hope the additional evaluations will yield positive results and that the FAA will be able to expedite the deployment of this system as well.

Mr. Chairman and Members of the Aviation Subcommittee, thank you again for inviting me to attend today's hearing on runway safety, and I look forward to answering any of your questions.

Mr. COSTELLO. We thank you, and the Chair now recognizes Mr. Boyer under the five-minute rule.

Mr. BOYER. Well, thank you, Mr. Chairman, and thank you for the witness rest period. I must admit that I did not sleep or use it for personal time, but if I am a little incoherent, that is probably the reason.

I am here today, unlike usually, to represent not only AOPA, of which I am the President, but the AOPA Air Safety Foundation. I can think of no single organization outside of government, perhaps in government when I am through here, that has spent more time, energy and materials and dollars on runway safety.

First of all, we haven't talked at all about GA statistics. So I am not going to spend a lot of time. It is in our testimony. I just want to put up one graph.

With all due respect to the end of the table, this isn't a competition, but just to put it in perspective. You have been hearing a lot about air carrier airports and airline pilots. There are about 79,000 airline pilots, 273 pilot deviations during the three-year period covered by the FAA numbers.

There are almost a half a million GA pilots and, yes, there are more deviations, about 580. But if you look at the ratio of GA pilots, it is a group that has a lower propensity to this kind of an accident and many times due particularly to the types of airports they use.

One runway incursion, whether it be by an airliner, a GA airplane or a combination or a ground vehicle, I have to say, 800 Independence Avenue, we, and I put in that everyone at the table—airports, ground operators, airline pilots, airlines themselves—we do have a problem because the statistics should be at zero if they could be, and that is what we all strive to do.

I want to concentrate on just one area, and that is FAA leadership. It came out in the IG. It came out in the GAO testimony you heard.

I am going to go off this slide just a little bit and talk about 1997 when then-FAA Administrator Jane Garvey called me when she realized this was one of the five top issues she had to deal with during her administration and said, "Phil, can you do something? AOPA can work so much faster than the FAA."

We stepped in at that time, and we did a lot of things. I provided a packet for the Committee of all those things we have done.

I have to tell you, the Administrator at that time, the late nineties, she formed a taskforce. I was on it. The head of ALPA was on it. Others were on it.

She met with us personally almost every single month. We looked at the metrics together.

She said, what are you doing? I don't want to hear the BS. I want to know what you are actually doing.

The FAA embarked on what I would say in my 18 years was the biggest effort on safety that I have seen them undertake. The program was well funded. Other divisions of FAA, and they will tell you this today, were jealous of the kind of money this project was given.

Regional meetings were held around the Country with the airports that my two friends here to the right represent, with the airlines, pilots that went to those airports—I remember Los Angeles which had a language problem, et cetera—and with the GA community.

But it all boils down to just what you and Chairman Oberstar said in your rebuttal to the USA editorial today. It is not about aviation infrastructure having a lack of money. You were talking about and the words were FAA leadership.

I can even remember the name of the person who headed the program back in 1997.

But then it sort of dropped off the radar map. Frankly, as a group that has done a lot with aviation and runway safety, when you are not being prodded, when you are not being asked for more like we were for those five years, it went off the table.

So what have we done? Well, we have educated our pilot members on, hey, the House bill is a good bill for the FAA financing. The Senate bill has a few problems. We have been spending our time at things like that.

Well, you refocused them with the GAO study. The FAA got your attention again, but frankly let's call a spade, a spade. We haven't had the FAA's leadership on this issue and, believe me, industry is ready to go. We have been ready to do all kinds of things.

I want you to look, as you look at the solution list, at the low tech things. You have heard a lot of high tech things that will take years to happen. There are a lot of low tech things too.

We need those AIP funds that you have put in your bill. This is just a shot of taxiway. If you look below there in the lower right, no one with a propeller or a turbine aircraft wants to go across fog like that, and they are waiting for AIP funding to become available. Hopefully, the Senate matches what you did. We can get some of that started.

In the end, I just want to say we are here. We are ready to help. We are ready to take all the things we have done, like our magazine where we bound in 400 runway safety brochures in the past.

We certainly are getting the message now from your Committee, and we certainly see now that the FAA in the earlier panel will respond.

Thank you.

Mr. COSTELLO. The Chair thanks you and recognizes Mr. T.K. Kallenbach.

Mr. KALLENBACH. Thank you, Mr. Chairman.

Mr Boyer, I think you got plenty of rest. You didn't appear fatigued to me.

Thank you, Mr. Chairman, Ranking Member Petri, Members of the Subcommittee. Good evening.

My name is T.K. Kallenbach. I am the Vice President of Marketing and Product Management for Honeywell Aerospace, and my responsibilities include development and deployment of safety technologies for Honeywell.

Runway safety is not a new concern, but as our Nation's skies and runways become more crowded, one that absolutely requires new solutions. We can build on existing technologies to implement these solutions both in the short and long terms. This will require active and vigorous support from the FAA, aircraft operators, airports and manufacturers, and perhaps most critical will be your continued oversight and vigilance to hold everyone's feet to the fire to get this done in a timely fashion.

Mr. Chairman, I come before you representing Honeywell's history of addressing NTSB safety recommendations, and we are proud of those accomplishments, proven solutions that have saved lives.

From the 1970s through the 1990s, the leading cause of aviation accidents was controlled flight into terrain or CFIT. Since the introduction of our Enhanced Ground Proximity Warning System, or EGPWS, CFIT accidents have dropped over 500 percent and, most importantly, not one aircraft operating with our system has been involved in a CFIT accident.

Today, I want to show you that similar solutions are available to address runway safety issues and endorse some of the technology comments from NTSB, GAO and FAA. There are a couple of solutions available now that assist pilots in tracking their position on the airport surface.

One solution is Honeywell's Runway Awareness and Advisory System, or RAAS. RAAS provides verbal announcements over the cockpit's audio system, indicating the aircraft's position relative to the runways, allowing pilots to remain heads up and visually alert to immediate surroundings. RAAS is a software upgrade to the EGPWS computers that are installed in over 95 percent of the commercial aircraft.

RAAS is FAA-certified and has been incorporated in over 2,000 aircraft that have already been upgraded. You heard RAAS announcements on the GAO video that was used earlier.

Another short term solution is moving map displays. They provide pictures of the airport's runways and taxiways with a symbol indicating where the airplane is located. Like RAAS, airport moving maps improve pilots' situational awareness and the systems are complementary with RAAS providing verbal cues and the moving map matching them up with a picture of their position.

Short term solutions help pilots avoid placing their airplane in runway incursion situations. The longer term objective is to provide pilots with better information about what other aircraft are doing and warn pilots and controllers simultaneously when a collision is imminent. We call this breaking the chain of events that could ultimately lead to an accident.

Today's surface detection systems generate alerts only for air traffic controllers. With the aircraft traveling at high rates of speed, the seconds needed for the verbal relay between controller and pilot can be the difference between a catastrophic collision and safe resolution. Consider that an aircraft on approach covers a quarter mile in six seconds.

Honeywell and Sensis Corporation, the FAA's supplier for ASDE-X, have worked in partnership to develop an integrated alerting solution. In our prototype system, as you saw in the testimony from Dr. Dillingham from GAO, alerts are provided directly and automatically to pilots, maximizing the time available to resolve the incursion before an accident. This technology was successfully demonstrated to senior FAA and NTSB officials in the summer of 2007 in Syracuse, New York.

Another longer term solution involves the deployment of Automatic Dependent Surveillance-Broadcast, or ADS-B. As more aircraft are modified to broadcast and receive this information, the ability to identify potential conflicts becomes viable.

While the FAA's currently proposed rule doesn't require aircraft to broadcast their ADS-B information until 2020, FAA's traffic information service can accelerate the practical use of aircraft-based incursion detection alerting.

Mr. Chairman, I described a series of short and long term solutions for improving runway safety. The key question is: When?

Accelerating the deployment requires a cooperative effort among a number of stakeholders, and Honeywell recommends this Committee aggressively pursue the following three actions:

One, strongly encourage the adoption of better pilot situational awareness capabilities including the preparation of certification criteria and financial incentives for equipping.

Two, accelerate the implementation of traffic information service at airports throughout the National Airspace.

Three, require regulatory and procedural changes that will allow ASDE-X to broadcast alerting signals for use in the cockpit.

Mr. Chairman, Members of the Subcommittee, thank you again for the opportunity to present our recommendations to address aviation safety.

Mr. COSTELLO. We thank you for your testimony.

Mr. Prater, I have a few questions. Then I will turn it over to Mr. Petri.

In your testimony, you talk about a mitigation strategy in order to avert runway incursions. You talk about moving maps as an important part of that strategy. I wonder if you might elaborate a little bit on that.

Mr. PRATER. Well, I would compare it most to the GPS in your car that would show intersections. You could easily place the crossings, the runway crossings, the potential caution areas so that they are more easily seen and recognized from inside the cockpit instead of depending just upon the exterior cues, the limited markings that many places have, especially in low visibility conditions.

It would certainly increase the situational awareness. A problem, of course, is driving the airplane, taxiing along at 20, 25 knots while observing it.

So one of the basic mitigations that we spoke about earlier is much simpler. It is to slow down. It is to slow down. It is do the same thing we teach our kids at the railroad crossings. Stop, look, and listen.

We need to slow it down once in a while when these airports get too crowded, when too many operations are taking place. That will help just as much as the high tech solutions.

Mr. COSTELLO. Thank you.

Mr. Boyer, you are exactly on point, and I am in total agreement with you. I gather that you picked that up earlier in my comments about a lack of leadership at the FAA.

Up until 2001, they had their eye on the ball. They engaged with the users of the system and made them participants to try and come up with a system to reduce runway incursions. When the numbers started coming down, the FAA went off and concentrated on other things.

It is unfortunate, but we know that when you leave the director's position open for over two years and you have a runway safety plan that has not been updated since 2002, we know that it is not a priority for the agency.

I hope that Mr. Krakowski, his testimony here today. He is committed. He has over 30 years experience in the cockpit. We hope that that will change.

Let me ask you. You mentioned what you had done with your membership, with the foundation in developing educational materials for general aviation pilots. How closely have you and the foundation worked with the FAA concerning the Runway Office and development in order to get this information out to the pilots?

Is it strictly AOPA doing this or are you coordinating this with the FAA?

Mr. BOYER. That is a very good question. I guess the first five years, it was in total cooperation. The brochures that we submitted, I think, to the Committee have the FAA and AOPA Air Safety Foundation logos on them. Then, it has been pretty much unilateral.

Actually, after the Lexington accident that you have already talked about today, which was an air carrier problem, but you know could happen to any general aviation pilot. Actually, it did happen last week in St. Augustine. They only had a 300 foot runway, so the situation was even exacerbated which was left.

But we put out 200,000 CDs of our course on runway safety after that accident at our expense and mailed them to members to call attention to runway safety.

I think now, boy, this week a lot has gone on. We have been getting calls. Yet, still, there are people in the Runway Safety Office today that yesterday called our office and said, we didn't know you folks did a CD with the airlines on runway safety, and it was funded by the very office that was calling. So, no coordination

Mr. COSTELLO. It is a consistent pattern here that concerns me, and I am not here to beat up on the FAA. I am just here to look at the facts and try and make certain that the system gets better.

We have found a lack of communication, coordination and reaching out to the users of the system, and that takes me to the question of the air traffic controllers. I want to ask Mr. Forrey.

We understand that we don't want to renegotiate the contract here today, and we understand that there is a large divide between where NATCA is and where the FAA is, but earlier we heard the NTSB testify that after the accident occurred in Lexington the FAA said that they recognized. I don't know if they said they recognized it, that there is a fatigue issue and that they were working with NATCA concerning controller fatigue.

I just wonder what action has the FAA taken to reach out to your controllers to address the issue of fatigue.

Mr. FORREY. Mr. Chairman, the NTSB made two recommendations to the FAA and to us to look at the fatigue issue and controller scheduling and things of that nature. We wrote a letter to the Administrator, Blakey at the time, and said we would be more than happy to do that. That was probably in 2007, May of 2007, somewhere in that time frame.

We did not hear back from the Administrator until September where she said she would like to do that at some point in time and they would let us know what kind of requirements or subject matter experts they would like from us to participate.

In the meantime, they had sent a letter to the Chairman of the NTSB, stating that we were working together, sometime in August.

The agency has created their own work group. They are already doing investigations on, I would imagine, scheduling or controller scheduling. They have not included us all in those subjects or those discussions.

Mr. COSTELLO. Mr. Hayes and I had talked about NextGen many times. You have heard, many of you, in testimony in hearings that we have had here in this room last year of the need, both Mr. Dillingham and the Inspector General encouraging the FAA to work with user groups to get their input.

Obviously, they have dropped the ball regarding what you are doing at AOPA with your foundation, that they are not working as closely as they have in the past. Obviously, if they say they are working with NATCA to try and address these issues and they have not, it is an issue.

It brings up not only runway incursion and safety issues but also NextGen, where we are going with NextGen.

As I said today in the USA op-ed is that my concern is about a leadership. It is not about money. I mean we provide more money in the FAA Reauthorization Bill than the Administration calls for in its own proposal.

My concern is not what we are getting in the end but how we get there so that we don't spend a lot of money and go back and say, oh, we have to retrofit this now and go back and backtrack.

My concern about that is the users of the system are not being consulted and ample input is not being given through JPDO and the FAA.

A final question and then I will let you, Mr. Forrey, since there was talk about the fatigue issue not only on the part of the controllers but also the pilots. So I will ask you to quickly summarize, Mr. Forrey, and you, Mr. Prater.

Mr. Forrey, on the issue of staffing, understaffing and the additional hours that controllers are being forced to work, some would have us believe that these hours are forced on them. Others would have us believe that this is of their choosing, that they choose to work the overtime. I want to know your response.

Mr. FORREY. Mr. Chairman, thank you. I appreciate the opportunity to answer that question.

The facility manager calls in overtime because they require overtime to work the shift. It is not because a controller wakes up in the morning and says, you know what, I feel like working overtime today. I will tell the manager I will be in to work.

That is not how it works.

That is just a way of controllers deciding how they are going to work overtime. If they volunteer for it, they will call them first. If they don't, they assign it.

There are many facilities in this Country where they are signing that overtime. Southern California TRACON, Atlanta Tower and TRACON, Miami Center, just to name a few. Those people are forced to work.

What that does is because they are working short shifts, controllers are working positions, combined positions that would normally take two or three people to work. That means they are working more traffic. They are working more frequency. They are working more airplanes. There has to be a greater situational awareness.

That kind of wears you out, especially if you are working six days a week or you are working ten hours in a day. That is the impact of working overtime and the fatigue that it creates.

Now the agency likes to plump in these numbers, that it is only 2 percent of the entire Country. They like to generalize in that respect.

But the fact of the matter is at some of our busiest airports and some of our busiest facilities in the Country, there is a lot of overtime being worked and there is a lot of tired controllers. That is the opportunity to make mistakes.

As Captain Prater stated, you have inexperienced pilots now infiltrating the system and they are working 16 to 20-hour days. Even though they are not flying it, they are still busy doing something for that period of time.

Someone is going to make a mistake. We rely on each other, pilots and controllers, to catch each other when we make mistakes. In most cases, it works. Like in Ft. Lauderdale, the pilot made a mistake, and the controller caught it. In LaGuardia, the controller made a mistake. The pilot caught it, and they avoided near disaster.

That is the kind of system we have in place, but when you start reducing that or you start lowering the experience levels of the people working it, like the agency is doing right now, it is a recipe for disaster.

Mr. COSTELLO. Captain Prater, would you like to comment on pilot fatigue?

Mr. PRATER. Very briefly, even though I would like to talk for about 16 hours which is what the FAA says a standard duty day can be for an airline pilot, I will try to keep it a little shorter than that.

But the fact is we can do 16 hours followed by 8 hours away from the airplane. Go through the airport. Find a hotel. Get a couple hours rest and come back 8 hours later. Go through security. All of you travel well, so you know it is going to be 20 or 30 minutes. Walk through the airport. Then start another 16-hour duty day.

At the end of several of those, you are making the most important decision of your life every day. You are landing an airplane full of passengers, full of cargo, in the weather, and the fatigue catches up with you.

What we have seen more since 2001 is that we are seeing many pilots flying longer days, being pushed to those maximums. Some of it is economics. Some of it is shortage of pilots. Some of it is because there is not enough pilots staffed to fly that full schedule.

We are seeing the cumulative effects, and I can say easily in my 35, 36 years flying, I have made a few mistakes. Other people have caught them: the first officer, a controller. We do depend upon each other, but we also depend upon trying to be as rested as possible.

Congressman Hayes, I think talked about it earlier. A well rested, well experienced, well trained pilot is how we prevent incidents from happening.

Thank you, sir.

Mr. COSTELLO. Thank you.

The Chair now recognizes the Ranking Member, Mr. Petri.

Mr. PETRI. Thank you.

I have a couple areas to explore. I happened to have the opportunity to get a briefing from something I guess is referred to as the NextGen Institute that is a kind of industry-community consortium to help plan and think through. It has a series of working groups for doing NextGen as effectively as possible.

One of the, I think, nine working groups they have is a safety working group. I am just curious to know if any of the organizations that you are involved with are involved with that or if you could discuss that, if you are being consulted, if there are problems with it or if it can be improved or how that all stands.

If any of you would care to address that, I would be happy.

Mr. FORREY. I just started getting involved about a year ago with NextGen.

The problem with the IMC, the Institute Management Council, is that industry are the people that make up these subgroups. So they have to take people from their companies to try and work and volunteer while they pay them while they do that to work on certain projects.

I can't pull people out of the FAA facility to go do that, so I am kind of limited on what we can do based on what staff I have available nationally. It is a good concept. Just, we don't get that much participation other than the main group.

Mr. PRATER. From the airports' side, we have been very involved from the beginning. Phil is actually the co-chair of the IMC, so maybe I should let him talk in greater detail.

But from the airports' side we have been very involved. Like Pat said, you have to go out and get some folks from airports and so forth to participate in some of the groups.

I have to say it got off to a slow start, but over the last year or so, it has gotten a lot better. I think Charlie Leader has done a good job of moving it along. So we have been involved in it from the beginning.

Mr. BOYER. I would like to talk as a co-chair, and my other co-chair is a strange bedfellow, the head of the airlines association, but we do take this pretty seriously.

Greg is right. We were off to a slow start. I think it is still fairly slow. I mean for you in Congress to be able to articulate what it is going to cost, what it is going to be, what it is going to do in capacity, you could hold hearings after hearings right now and you wouldn't get there.

The thing that I have sort of adopted and actually the airlines have jumped on this. So, once again, we are together on this too. We need a little NowGen, and that is what we were talking about here. Not NextGen, not 2025, 2020 for ADS-B or some of the other things. We need to take some practical solutions as are happening now with runway safety because of your interest in the subject.

We need to also look at what we can do for your constituents in your districts who travel on the airlines, travel in general aviation, that we can do now at low cost, no cost, and there are plenty of things. I think that is what the industry—and that are safe—will be working on also.

You are going to hear that term emerge in the coming weeks, not only NextGen but NowGen.

Mr. PETRI. Just one other area, maybe two, that I was kind of curious about. You would expect—but it may not be right—that with a global aviation environment, people flying to a lot of airports, say into Milwaukee International Airport or whatever, to Toronto and so on, that there could be problems in communication or safety and runway collisions that occur because of people being relatively less familiar with how people interact and all that.

Is there any variation on international flights to the United States or is it as safe? Is that really not a factor? Is it so obvious that people have dealt with it successfully?

Secondly, how do we compare, if anyone has any information, on airport runway safety here in the United States, the dominant market for aviation, compare with other countries around the world in safety?

Our pilots fly all over the world. It is something that is of concern to us for them and so do our citizens. How are they doing when they land in London or in Ankara or somewhere?

Mr. PRATER. Congressman, I know Pat will want to weigh in on this because communications are key to safety.

There are requirements for improved or enhanced English language. There is also an ICAO standard that we have not yet adopted fully in this Country, and it may have prevented one of the most recent accidents just to use it as a point. It is the use of standard language, standard phraseology.

In the case of ICAO, which we are used to operating under in most foreign countries, specific ATC clearances would be required to cross a runway. So we would never be given clearance to cross, to taxi out, cross one or two runways and take off on another runway.

It might have prevented Lexington because that crew would have been cleared to the first runway and held short and would not have been able to misidentify it for the active runway, the lighted runway. But that is not used here.

Overseas, we fly to many airports, and it can be a challenge. There are many times going into an airport like de Gaulle or Gatwick or Rome. If we have problems, what do we do? What did he say?

Query the co-pilot. What did he say? Wait a minute, let's just stop until we find out what the instructions are. Sometimes the controller there will slow down and make sure that we are able to understand the direction.

So I think the key to it is taking the time, standard phraseology, the ICAO standards. I think we would see an increased runway safety environment back here in the States if we did it.

Thank you, sir.

Mr. PRINCIPATO. You had asked, Congressman, about airports. We are part of a global organization, Airports Council International, and they did a global survey of this kind of thing. I think we provided the information to the staff, but it showed that this region has the best rate or the lowest rate of these incidents of any of the ACI regions.

Just one other thing that might be worth thinking about if you are looking at the global industry is in other parts of the world. The U.S. airlines typically do their ground handling. Here, the airlines do the ground handling. In other parts of the world, airports typically do it, and so there is a difference. If you look at apron safety and so forth, you might find some things overseas that don't stack up quite as well either.

I think we do a pretty good job here.

But we did provide the international information to the staff, and we would be happy to elaborate on it if you like.

Mr. COSTELLO. Thank you.

The Chair now recognizes the gentleman from North Carolina, Mr. Hayes.

Mr. HAYES. Back again.

Captain Prater, President Forrey, is there any formal or informal along the lines of runway incursion prevention talk between controllers and pilots?

They have the best perspective of anybody. Are there any talks going on or any plan there?

I am lucky. I have you all come and see me all the time, so I can talk about it. But is there something happening there?

Mr. PRATER. Well, there is, but again it is between our two unions. NATCA conducts a Communications for Safety seminar ever year that we are proud to participate in. Some of the regionals are starting to have more air traffic control-pilot interaction.

We used to get to see our controllers a lot more because they had the right to ride our jumpseat, and that is a real serious safety tool that we no longer enjoy.

Controllers, probably, and pilots have the same type of relationship maybe as doctors and nurses at times. There might be a little bickering, but they straighten us out and we listen to them.

When they can ride our jumpseat and see the view from the cockpit window and we can talk about problems, it used to be a pretty good safety tool. FAA took it away from us. We need that back, sir.

Mr. FORREY. Mr. Hayes, I would say that what we have started doing, because the agency doesn't want to include us, is we have reached out to industry and, of course, our fellow union brothers and sisters in the pilots association.

We have started meeting in major hubs now. We just started this year with our safety committee and their safety committee, and we are trying to explain the airspace to these guys and gals, understand what they are going through and what they can expect, and we are just starting to build those relationships. It is quite impressive what these people are doing.

So we are creating that dialogue ourselves. We are reaching out and doing that. It is important, and it is something we should have been doing a long time ago.

Mr. HAYES. I think it would be very important to Phil and everybody else at the table if you would come back to the Committee with some practical things. We sometimes get paralysis by analysis around here, but to me that would be very, very helpful. Watch out for Congressional fatigue as we deal with some of these issues. That is also an issue.

Let me switch over to Mr. Kallenbach.

You have a multi-tasking guy sitting beside you. He can go steam gauge or he can go technology. Honeywell is obviously an innovator as are many with gadgets. Sam understands, and it is second nature to him but a little bit foreign to me.

Once you go into the development stage, we are going to switch over to ADS-B in a minute, how do you take information from the field and translate that into technology to solve problems and make things safer? Kind of give us your perspective on how that works.

Mr. KALLENBACH. Okay.

Mr. HAYES. Lessons learned, if you will.

Mr. KALLENBACH. Sure, I would be happy to.

Maybe one of the best examples is a recent product we have come out with called Synthetic Vision which by taking information that we have in our terrain database, our EGPWS database. We take that information and we fuse that graphically and portray that on your primary flight display, still the same primary flight display information that has always been in the cockpit. By doing this, what we have been able to do is give the pilot better situational awareness inside the cockpit.

The methodology is that we basically sit with pilots, crew, controllers, members of NTSB, for instance, to try and understand what is the problem we are trying to solve in the case of pilot awareness. Through a series of interviews, we develop a voice of the customer and kind of an assessment of what really would help them solve their problem. So you don't want to give them too much information. You want to just give them the exact relevant information they need at the time.

Then we develop a prototype. That prototype then becomes something we can test with similar or same groups. Take it flying. Take it into a pre-production phase and ultimately, working with the FAA and the certification authorities, globally come up with a certified system.

In general, that process can take anywhere from three to five years.

Mr. HAYES. Good point. There are so many things that are available now that enhance safety and make flying easier. The more communications we have within interested groups, the better off we are going to be.

Taking all that and putting it in a nice round package, what do the industry and all the groups at the table and the FAA going to do to bring the advantages at a reasonable price to the flying public, be it airlines or general aviation, with ADS-B?

I mean that is just sitting there, waiting to happen. If we would get all the folks to really give it their best effort, that could be implemented and technologically a lot of our issues would be dealt with. Any thoughts on that, Phil or Mr. Kallenbach or anybody?

Mr. BOYER. I think, first of all, I want to go on the record in answering the question you asked earlier with Prater and Forrey.

Pat was very instrumental. Actually, I think he attended and worked with a couple of them. A seminar series our Air Safety Foundation did around the Country and still is doing, called ATC and You, and it was done in conjunction with NATCA. Pat had some of his controllers each evening.

This was put on around the Country, and this was probably the biggest audience-drawing set of seminars we have ever done because of the interest of the pilots in hearing and being able to talk directly with Pat's membership.

But in answer to your question, I think we have to get into what needs to be certified by the agency and what is supplemental to flying the airplane.

We sit today in most of our GA planes that are new with the plot of the runway environment and the taxiways in the airplane on them, so that we can taxi at busy airports. Prater would be jealous of this today, but it is the certification level. In a Part 91 operation, it is supplemental.

So what needs to go through years and years of study to say isn't the GPS in the car good enough to know we are coming on this street, we are coming up on this taxiway or this runway.

So a lot of the slowdown is trying to channel the FAA into saying everything that is in the cockpit that is for the safety of flight, the basic safety of flight, yes, needs to be certified.

But supplemental information like datalink radar, like the moving map displays, don't really need to go through that same level of certification if you still have a paper chart. You still have a copilot. You are still looking out the window. This is just that extra information like it is on your car GPS.

Mr. HAYES. Great point.

I have used up all my time, Mr. Chairman.

But, again, thank you. You all hit on some really good things. I know Captain Prater would love to have NEXRAD.

Anyway, take your controller out to lunch. That works.

[Laughter.]

Mr. COSTELLO. The Chair now recognizes the gentleman from Missouri, Mr. Graves.

Mr. GRAVES. Thank you, Mr. Chairman. I am going to have to bolt real quick. I have to handle a bill panel over on the Floor, but just a comment.

I would love to explore some things in this, and I do want to applaud, obviously, Honeywell for the technology you are working on. I don't know if it can be afforded by GA pilots. It probably can't, unfortunately.

But it goes back to and it kind of dovetails on what Mr. Prater said and Mr. Boyer just said, and we all learned it in basic flight training. You have to look out the window. That is the bottom line. You have to look out the window. All the technology in the world isn't going to replace that simple thing.

When we took advanced flight training and when I have taken advanced flight training, you learned to bury your head in the panel, but it is that basic flight training stuff when you are on the ground. Slow down, but you have to look out the window and see what is coming and what is out there.

Too many times we do just exactly what I said. We bury our heads in the panel and aren't paying attention. It goes for the controllers too. That is the reason the tower is so tall, so you can look out the window and see what is going on.

I know I am oversimplifying this to a great deal, but the fact of the matter remains that is simple technology. Enhanced runway markings work. The stop lights work. But look out the window.

Thanks, Mr. Chairman.

Mr. COSTELLO. Thank you.

That concludes the testimony of our witnesses.

The hearing went on a little bit longer than we anticipated because of votes on the Floor, but we appreciate all of our witnesses staying here to answer questions from members of the panel.

I can assure not only our friends at the FAA but all of you and everyone in the industry that we are going to continue to provide aggressive oversight to make certain that the FAA is moving forward and doing everything they possibly can do, working with all of the stakeholders so that we can improve the runway incursions that we have recently seen and have experienced.

That concludes this hearing. Again, we thank you very much. The Subcommittee stands adjourned.

[Whereupon, at 5:50 p.m., the Subcommittee was adjourned.]

Russ Carnahan

OPENING STATEMENT OF
THE HONORABLE RUSS CARNAHAN (MO-3)
SUBCOMMITTEE ON AVIATION
TRANSPORTATION AND INFRASTRUCUTRE COMMITTEE

Hearing on
Runway Safety
February 13, 2008

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Chairman Costello and Ranking Member Petri, thank you for holding this hearing on improving runway safety. I want to thank our witnesses for joining us today and look forward to hearing from you what needs to be done to improve runway safety.

As the volume of air traffic has increased over the past several years the number of runway incursions has steadily grown too. For example, at St. Louis-Lambert International Airport there have been thirty incursions over the past seven years. This is simply unacceptable and makes clear that improving the safety of our runways must be one of our top priorities.

As was noted in the Government Accountability Office (GAO) report there are several factors that are contributing to the recent increases in runway incursions and draws attention to shortfalls in the Federal Aviation Administration's (FAA) runway safety efforts. Specifically, I am concerned about the large number of controllers forced to work overtime because of the vast staffing shortages. It is unacceptable to ask any of these controllers to work ten hour shifts six days a week. We cannot fault these controllers to be fatigued. I am deeply saddened that our shortfalls in recruiting more controllers could cause accidents on our runways. Clearly, we must recruit more controllers to lesson the workload and overtime requirements. Additionally, I find it truly disturbing that the GAO found the FAA's National Runway Safety Plan is out of date, causing poor response to runway incursions. The FAA must develop an up to date plan to respond to runway accidents and outline the resources needed to improve their plan. I glad to see the FAA has started to pursue new technology aimed at improving runway safety. This is an important first step, but much more must be done.

I very much appreciate today's testimony and look forward to working with the Chairman Costello and Ranking Member Petri to address this important issue.

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OPENING STATEMENT OF REP. STEVE COHEN

Transportation and Infrastructure Subcommittee on Aviation

"Runway Safety"

February 13, 2008

I look forward to hearing from officials with the Government Accountability Office, the Federal Aviation Administration, the National Transportation Safety Board (NTSB) and others regarding runway safety.

NTSB, beginning as far back as 1990, has annually listed runway safety on its "Most Wanted List of Transportation Improvements." The Department of Transportation's Office of the Inspector General's "DOT Top Management Challenges" report for fiscal year 2008 stated that "the seriousness of these incidents underscores the need for continual proactive and concerted efforts, including actions to address technologies as well as programmatic solutions for improving runway incursions."

Northwest Airlines operates its third largest hub out of Memphis International Airport, located in Tennessee's 9th Congressional District. Northwest alone offers a combined total of 221 flights to and from 90s cities every day. Consequently, runway safety is an important issue for me as it is an important issue for Memphis Airport.

I am consequently eager to hear from our witnesses today on current plans underway to improve our runways and overall customer service for passengers in Memphis Airport and other facilities across the nation.

OPENING STATEMENT OF
THE HONORABLE JERRY F. COSTELLO
AVIATION SUBCOMMITTEE
RUNWAY SAFETY
FEBRUARY 13, 2008

- I want to welcome everyone to our hearing today on Runway Safety.

- This hearing highlights the Subcommittee's responsibility to ensure that the Federal Aviation Administration (FAA) is fulfilling its duties to provide comprehensive safety oversight in every aspect of the aviation system, including runway safety.

- While FAA and others will say the United States has the safest air transportation system in the world, we cannot rely on, or be satisfied with, our past success. We must continue to strive for greater success, because one accident or near accident is one too many. This is especially true when the FAA is predicting a tripling of passengers and cargo by 2025.

- Late last year, the Government Accountability Office (GAO) issued its report on Runway and Ramp Safety, which Chairman Oberstar and I requested.

- According to the GAO, the rate of runway incursions in fiscal year (FY) 2007 increased to 6.05 incidents per million operations. This is a 12 percent increase over 2006 and the highest since 2001 when the rate reached 6.1 incidents per million operations. While the number of severe runway incursions dropped from 53 incidents in 2001 to 24 in 2007, in the first quarter of FY 2008 alone, there have been 10 severe runway incursions. This is simply unacceptable!

- The GAO has stated that the FAA's lack of leadership on this issue, including a Director level vacancy in the Office of Runway Safety for over two years, and an out of date National Runway Safety Plan, has impeded further progress.

- While I am pleased that the FAA has finally filled its Runway Safety Office Director position, I want to know what the FAA's plan is, on a national level, to improve runway safety. To ensure this issue remains at the forefront of FAA's safety agenda, I request that the FAA provide a progress report to this Subcommittee every three months detailing each Category A and B runway incursion; how the FAA responded; and what progress is being made to address these incidents and reduce the overall number of runway incursions.

- The GAO also cites controller fatigue as a factor in runway safety, and I am interested in hearing more from the panelists, including Pat Forrey, President of the National Air Traffic Controllers Association, on this issue.

- Around the country, controllers are being asked to work longer hours to handle increasingly congested runways and airspace, in part because of staffing shortages. While the FAA may not admit that there is a crisis, I strongly disagree. In addition to the 10 severe runway incursions in the first quarter of FY 2008, there was also a "near miss" at the Chicago Center in December 2007. This should serve as a wake up call to the aviation community that something needs to be done <u>now</u> to avoid a catastrophe in the future.

- Human factors will always be a challenge, but with enough redundancy worked into the system using technologies like the ones we will hear about today, we will be able to mitigate their effects. I am interested in learning more about near-and long-term technologies such as the Airport Surface Detection Equipment, Model X, (ASDE-X), runway safety lights and low cost surveillance systems.

- In H.R. 2881, the FAA Reauthorization Act of 2007, which passed the House on September 20, 2007, and has yet to be acted on by the Senate, we included provisions to address runway safety. H.R. 2881 provides $42 million over four years for runway incursion reduction programs; and $74 million over four years for runway status light acquisition and installation.

- Further, it requires the Administrator to submit a report to Congress containing a Strategic Runway Safety Plan and a plan for the installation and deployment of systems to alert controllers and flight crews to potential runway incursions.

- We must confirm that we are meeting the challenges within our system to maintain the highest level of safety. As I have stated time and again, safety must not be compromised in an effort to save money or for a lack of resources and attention.

- The FAA, and the entire aviation community, must do better. You can rest assured that this Subcommittee will keep the aviation communities' feet to the fire to ensure our safety efforts remain on track. The American traveling public deserves no less.

- With that, I want to again welcome the witnesses today and I look forward to your testimony.

- Before I recognize Mr. Petri for his opening statement, I ask unanimous consent to allow 2 weeks for all Members to revise and extend their remarks and to permit the submission of additional statements and materials by Members and witnesses. Without objection, so ordered.

Representative John Hall, Opening Statement
Subcommittee on Aviation
Runway Safety Hearing
February 13, 2008

Thank you Mr. Chairman. I'd like to welcome our guests here today and thank them for coming to testify on the vitally important issue of Runway Safety. Only a few months ago the increased number of near misses on America's runways led GAO to warn of the "high risk of a catastrophic runway collision occurring in the United States." As the single most deadly accident in the history of aviation happened as a result of a runway incursion, this is a threat none of us may take lightly.

I look forward to hearing the testimony you will offer today, however I cannot help but think the best solution is the most obvious. We need our airport towers to be fully staffed with highly qualified controllers. Those controllers need to be fully rested and have an adequate number of breaks and downtime so they can provide the flying public with the best service possible. Only the best controllers can provide sufficient levels of experience and know-how. Every day we go without controllers at their peak form is a continued danger and a disservice to the American people.

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Statement of Rep. Harry Mitchell
House Transportation and Infrastructure Committee
Subcommittee on Aviation
2/13/08

--Thank you Mr. Chairman.

--As we consider steps to stop runway incursions, I believe it is important for us to carefully review the GAO's findings and address both human and technological factors.

--Our air traffic controllers are retiring at an alarming rate -- 70 percent are eligible to retire over the next 10 years. Staffing shortages are already forcing many of them to work overtime, often 6-days a week. This creates fatigue and, according to the GAO, may be posing a risk to runway safety.

--Technologically, I believe it is important to support innovations that promise to increase runway safety. For example, the FAA is currently planning to install the Airport Surface Detection Equipment, Model X (ASED-X), a system designed to give air traffic controllers better visibility and help prevent collisions, at 35 airports nationwide.

-- If this technology can perform as promised, and be deployed nationally, it would greatly enhance passenger safety.

--Today we will be hearing from air traffic controllers as well as witnesses familiar with this exciting new technology. I look forward to their testimony, and at this time, I yield back.

OPENING STATEMENT OF
THE HONORABLE JAMES L. OBERSTAR
SUBCOMMITTEE ON AVIATION
HEARING ON RUNWAY SAFETY
FEBRUARY 13, 2008

I want to thank Chairman Costello and Ranking Member Petri for calling today's hearing on Runway Safety.

The issue of runway incursions has been a matter of continuing concern to this Committee. One of our first hearings on runway incursions was in 1987 when I was Chair of the Investigations and Oversight Subcommittee. During the hearing, we investigated a disturbing trend, just as we are experiencing today, of a rapid increase in the annual rate of runway incursions.

The Federal Aviation Administration's (FAA) approach to managing runway safety, and reducing the runway incursion rate, seems to follow a predictable pattern. When runway incursions become a serious issue, as they were in the late 1980's and early 90's, the FAA takes aggressive action. However, once there has been some modest improvement, the emphasis on the problem quickly shifts. Once again it appears that FAA is following that same pattern.

In December 2007, the Government Accountability Office (GAO) released its report on Runway Safety. The findings in this report made it clear that the nation's air traffic system continues to face a serious safety issue from runway incursions. According to the GAO, the rate of runway incursions reached 6.05 incidents per million operations in 2007. This is a 12% increase over 2006 and the largest increase in the rate of runway incursions since 2001.

In 2007, there were 24 "severe" incursions. This number has been cited as an improvement over the year before. However, during just the first quarter of fiscal year (FY) 2008, there have already been ten "severe" runway incursions.

Without aggressive and decisive action, this problem is only going to get worse. The number of operations in the National Airspace System is steadily rising, and by 2015 one billion passengers are expected to be flying. That means more takeoffs and landings and more chances for runway incursions.

GAO identified controller fatigue as an issue in runway safety. There are serious concerns regarding the current level of controller staffing, and what that means to the length of a controller's work week and the amount of overtime controllers have to work. In addition, the amount of time being logged by pilots and air crews is also a major concern; they too are working longer and more difficult schedules. The FAA needs to work with the aviation community to develop strategies for addressing fatigue and other human factors issues.

The FAA, in approaching the issue of runway incursions, has placed considerable emphasis on technology as the means to mitigate the problem at some of the nation's busier airports. This is a step in the right direction. Airport Surface Detection Equipment, Model X (ASDE-X), a platform which integrates radar and sensor information to provide runway incursion warnings, has been deployed at eleven of the planned 35 airports. The initial response to the system has been generally positive. However, I am concerned about the FAA's ability to install these systems at the remaining 24 airports in a timely manner, as well as limiting it to just these 35 airports. However, this technology is not suitable for all airports. That is why FAA must continue its efforts to develop additional runway safety technologies for airports that are not scheduled to receive ASDE-X. These systems, while not as sophisticated as ASDE-X, can still provide substantially improved runway surveillance capabilities at a lower per unit cost.

To that end, the FAA Reauthorization Act of 2007, H.R. 2881 authorizes $43 million for runway incursion programs through 2012, with an additional $74 million for the acquisition and installation of runway status lights. H.R. 2881 also directs that the FAA to prepare a strategic plan for runway safety.

The FAA must make a long-term commitment to ensuring runway safety. The traveling public deserves no less.

Thank you again Mr. Chairman, for holding this hearing. I look forward to hearing from our witnesses.

John T. Salazar

Opening Statement
Congressman John T. Salazar
T&I Aviation Subcommittee Hearing
Runway Safety
February 13, 2008

Thank you, Mr. Chairman, for calling this hearing.

We have all seen the recent news stories about congestion, near collisions, and miscommunication between pilots and air traffic controllers on our nation's runways.

It's clear that more attention needs to be dedicated to the issue of runway safety.

AIP funding is a key component in making improvements to airports which enhance runway safety.

I know that CDOT's Aeronautics division has worked with the FAA Runway Safety Teams in implementing solutions to airport hot spots.

Currently they are working on a runway safety issue at Pueblo Airport.

But while they have come up with a list of good projects identified during Runway Safety Action Team evaluations, there is little or no money to implement them.

So it falls on the states to fill in the funding gaps.

FAA needs to raise the importance of runway safety and they need to financially support this issue with a strong AIP program.

A few months ago, I wrote a letter to the FAA, asking to move the ASDE-X (Airport Surface Detection Equipment) up in priority for DIA.

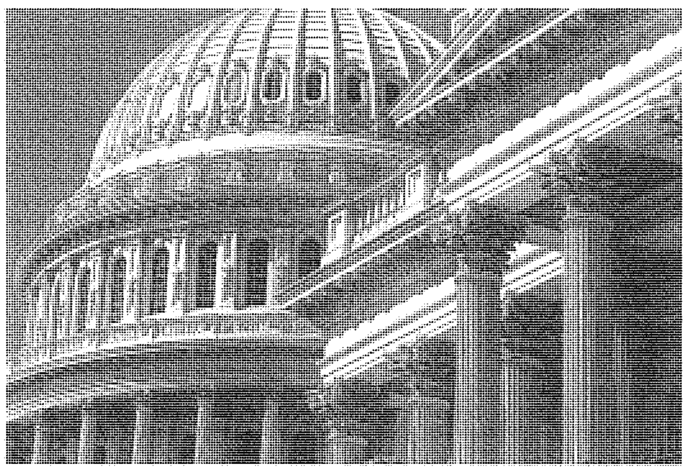
ASDE-X improves runway safety, so the more funding support this program has the faster equipment like ASDE-X will be installed at places like DIA and other airports around the country.

If we are serious about improving runway safety, we have to provide the funding support needed to implement the projects that will improve the system.

Thank you, Mr. Chairman.

ATA TESTIMONY

Runway Safety



Statement of the
Air Transport Association of America, Inc.
before the
Aviation Subcommittee
of the
House Transportation and Infrastructure Committee

February 13, 2008

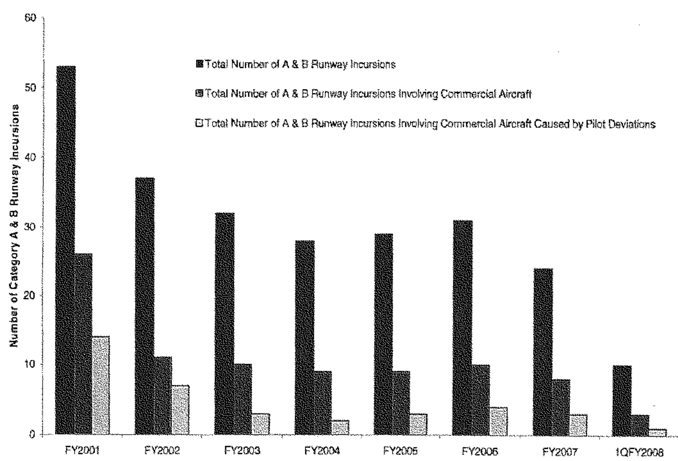
AIR TRANSPORT ASSOCIATION

The aviation community for years has been working hard to continuously improve runway safety. This effort is both critical and collaborative. All involved realize the importance of reducing the risk of runway incursions and that this responsibility is never ending. Today's hearing is a welcome added focus on the aviation community's unrelenting effort to make the airport operating environment as safe as possible.

We have reemphasized our efforts. Indeed, yesterday ATA member airlines and other interested members of the aviation community held a Runway Safety Awareness Day. Roughly 70,000 pilots at 50 airlines each received a letter reinforcing the industry's collective commitment to improving runway safety.

FAA data indicate that the frequency of serious runway incursions – those classified as Category A or B – has decreased steadily since 2001, with commercial operations consistently accounting for approximately one-third of the total. Narrowing the focus further, the number of serious incursions involving commercial operations that are attributed to pilot deviations has also declined.

Pilot Deviations Remain a Small Contributor to Serious Commercial Runway Incursions



Source: Federal Aviation Administration

This is the result of well-thought-out collaboration among stakeholders. Recognizing this achievement, of course, does not mean that we should be satisfied with it. But it does give us the confidence to know how to work toward greater improvements. That is the task before us.

In this, as in so many other safety-driven endeavors, the aviation community looks to data to proactively identify what aspects of a problem require additional scrutiny. We can call upon multiple, systematic sources of safety-related information to understand better the nature and extent of the risks that confront us. Our analytical abilities have advanced to the point where we can assess future vulnerabilities and, therefore, do not have to rely exclusively on what has happened in the past. This means that, in the context of airport surface operations, we can not only identify overall trends but also the locations on airfields that conld be prone to incursions.

Much of this information comes from an array of aviation safety databases, some compiled within airlines and many created by other stakeholders. Ongoing human factors research is also a very useful tool. As this suggests, we rely on the empirical, not the anecdotal. This is as it should be. Runway incursions are a serious risk. We must properly comprehend the different facets of the problem and determine how best to respond to them. We cannot fritter away valuable resources by acting on uninformed notions of what must be done.

Using this knowledge and disciplined analysis, we can effectively shape the additional measures needed to lessen incursion risks and to refine those measures that have already been undertaken. Enhanced taxiway and runway signage, lighting and markings; special emphasis pilot and air traffic controller training; and accelerated installation of state-of-the-art airport surface detection systems are some of the tangible products of this comprehensive approach.

Our joint responsibility is to build upon these and other accomplishments. This is a continuous process; we recognize that there is more to do. We have the tools and the commitment to do so.

ACTIONS UNDERWAY TO REDUCE THE RISK OF INCURSIONS

As previously mentioned, thorough data evaluation is the indispensable first step in reducing the risk of surface movement incursions. The Aviation Safety Action Partnership (ASAP) and the Flight Operational Quality Assurance (FOQA) programs have been used to identify runway safety risks. These are longstanding voluntary programs that reflect the aviation community's commitment to improving safety collaboratively. ASAP is designed to encourage voluntary reporting of safety issues and events that come to the attention of employees of certificate holders. FOQA programs involve the collection and analysis of data recorded during taxi and flight to improve the safety of operations, air traffic control procedures, and airport and aircraft design and maintenance.

The Commercial Aviation Safety Team (CAST) and Aviation Safety Information Analysis and Sharing (ASIAS) are also important parts of this effort. CAST began its invaluable work in 1997 with the mandate from the then-FAA administrator to reduce dramatically the commercial aviation fatality rate. Despite a 40 percent increase in air carrier operations in the last decade, that fatality rate has plummeted. ASIAS is a system developed cooperatively by FAA and industry that enables users to share, integrate and analyze aviation safety information.

Because of these data evaluation efforts, we understand the airport surface operating environment far better than we ever have. That more informed perspective has resulted in an array of initiatives designed to decrease runway incursion risks, including:

- Reducing distractions during the taxi phase of the flight
    - Streamlining flight deck procedures to eliminate unnecessary workload
    - Accomplishing as much flight deck work as possible at the gate prior to pushback
    - Keeping crew members 'heads up' at crossings of runways and taxiways
    - Reinforcing sterile flight deck procedures
- Emphasizing the use of consistent, standardized air traffic control verbiage and clearances
- Elevating awareness of incursion risks
    - Reinforcing the longstanding CEO commitment to safety
    - Partnering with unions to focus attention on risks
    - Depicting 'hot spots' on pilots' airport diagrams
    - Participating in regional meetings with FAA and conducting local flight crew meetings involving chief pilots
    - Coordinating an industry wide Runway Safety Awareness Day
- Enhancing pilot training
    - Including runway incursion simulations in recurrent simulator training
- Leveraging the work of existing Runway Safety Action Teams (RSATs)
    - Established at regional and local levels to address airport-specific risks

    - Active participation by all key stakeholders
- Accelerating the installation of ASDE-X (advanced surface movement detection equipment)
- Enhancing signage, lighting and markings on operating surfaces
    - Installing runway lead-on lights
        - Modified color pattern of in-pavement lights provides visual indication that the aircraft is approaching a runway
    - Enhancing surface markings
        - Modified taxiway paint markings provide a visual indication that the aircraft is approaching a runway
    - Developing Final Approach Runway Occupancy Signals
        - Automated system being tested at Long Beach Airport
    - Developing runway status lights
        - Surface and terminal surveillance systems, such as ASDE-X and Airport Movement Area Safety System, detect the presence and motion of aircraft and vehicles on or near a runway. In-pavement runway entrance lights are illuminated if the runway is unsafe for entry or crossing, and in-pavement takeoff hold lights are illuminated if the runway is unsafe for departure.
        - Tested at Dallas-Fort Worth; being tested at San Diego Lindbergh Field
- Reconfiguring taxiways to eliminate confusing intersections and reduce runway crossings (reconstructing taxiways and adding runway end-arounds)
    - Runway 8R end-around taxiway at Atlanta Hartsfield-Jackson International Airport opened in 2007
        - The FAA estimates that the runway 8R end-around taxiway will eliminate an average of 700 runway crossings per day at Hartsfield-Jackson
        - Similar initiative at Dallas-Fort Worth International Airport

EMERGING TECHNOLOGIES THAT WILL IMPROVE THE OPERATING ENVIRONMENT

Considerable research and evaluation is being devoted to determining how best to apply technology to enable pilots and air traffic controllers to have better situational awareness in the airport surface environment. The introduction of NextGen, particularly the application of ADS-B, is the ultimate goal in this effort to leverage technology to make the airfields safer. In the meantime, the following initiatives are underway:

- ASDE-X
    - Enhanced portrayal of the airfield for controllers
    - Controller must still convey warnings to the crews of threatened aircraft (although efforts to link to existing Traffic/Collision Avoidance System to provide real-time warning directly to the crew show promise)
    - ASDE-X is viewed as an interim measure pending ADS-B deployment
- Flight deck moving map displays
    - Resemble navigational displays on automobile dashboards
    - Real-time information about location of aircraft on airport surface
- Head-up displays
    - Provide pertinent operational information to flight deck crew on a transparent, fold-down device in front of the windshield
    - Reduces need for the crew to scan the instrument panel and therefore allows greater concentration on the outside environment

SHORT-TERM EMPHASIS INITIATIVES

The foregoing initiatives represent a broad spectrum of undertakings involving crews, controllers, air carriers, airport operators and the FAA to improve the safety of the airport surface operating environment. We believe that three items are worth special attention as short-term initiatives to lessen further the incursion risk. They are:

- Focusing on eliminating flight deck distractions for crews during the taxi-out and taxi-in phases of the flight
- Improving the airport physical operating environment by continuing to eliminate confusing taxiway and runway intersections, adding signage and lighting, and introducing technology such as the linked ASDE-X and TCAS system
- Implementing a voluntary safety reporting system for air traffic controllers, similar to ASAP programs employed by airlines

CONCLUSION

Solving the runway incursion risk requires an ongoing collaborative effort by all aviation industry stakeholders. We have the means to further improve our safety record; those means need to continue to be applied in a systematic way. ATA and its members are committed to this endeavor.

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Testimony of

Phil Boyer
President

Aircraft Owners and Pilots Association

before the

U.S. House of Representatives

Transportation & Infrastructure Subcommittee on Aviation

Runway Safety

February 13, 2008

Good morning, Chairman Costello and Congressman Petri. Thank you for the opportunity to testify today on Runway Safety. I am Phil Boyer, President of the Aircraft Owners and Pilots Association (AOPA).

AOPA is a not-for-profit individual membership organization of more than 415,000 pilots. AOPA's mission is to effectively serve the interests and needs of its members as aircraft owners and pilots and establish, maintain, and articulate positions of leadership to promote the economy, safety, utility, and popularity of flight in general aviation aircraft. Representing two thirds of all pilots in the United States, AOPA is the largest civil aviation organization in the world.

As head of AOPA, I also serve as president of the AOPA Air Safety Foundation (ASF), a tax-exempt, non-profit 501(c)(3) educational organization supported by generous donations from individual donors, companies in the aviation industry as well as government grants. ASF materials are available online to all pilots, not just AOPA members. The ASF is the principal nongovernmental general aviation accident prevention, safety education, instructor training, and research organization. ASF management spends considerable time serving on Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), the National Weather Service (NWS) and special committees to provide technical and educational expertise from a general aviation perspective. The ASF is a powerful vehicle for carrying the message of improving general aviation safety to pilots across the country.

The United States is currently experiencing the safest period in aviation history. The December 2007 AOPA Air Safety Foundation *Joseph T. Nall Report*, using data from government sources, shows general aviation accidents continue on a downward trend. The number of accidents per 100,000 flight hours decreased from 7.19 in 1997 to an all-time low of 6.32 in 2006, while the fatal accident rate dropped 7.4 percent during the same period. However, we cannot rest on our laurels. Safety requires constant vigilance. And this is evident in the area of runway incursions.

In September 2007, the FAA released its *Runway Safety Report* examining runway incursions at towered airports between FY2003 and FY2006. The report states that 72 percent of all runway incursions (937 of 1306) involved a general aviation aircraft but that general aviation only accounted for 55 percent of National Airspace System (NAS) activity. However, we looked behind those numbers and determined that only 44 percent (580 of the 1306) of all incursions were pilot deviations involving a general aviation aircraft. And, of those 580 pilot deviations, the FAA classified 92 percent as less severe (Category C and D). While the FAA report notes the rate of incursions has remained relatively constant, the November 2007 Government Accountability Office (GAO) *Aviation Runway and Ramp Safety* report notes that preliminary FAA data for FY2007 indicate a disturbing upward trend.

Clearly, we have a problem. And, the "we" refers to the airlines, general aviation, the FAA, the air traffic controllers, the airports -- every member of the aviation community. The number of reported incursions may be low when compared to the total number of operations conducted each year, but the potential for a catastrophic accident, makes runway safety an area of special concern for the aviation community. The potential for a runway incursion will exist as long as aircraft are operated. Unfortunately, there is no quick fix or easy solution. But one thing is apparent, what has been done and what is being done is not good enough.

FAA Leadership

The November 2007 Government Accountability Office (GAO) *Aviation Runway and Ramp Safety* report states "FAA's Office of Runway Safety has not carried out its leadership role." While runway safety is a shared responsibility, the AOPA Air Safety Foundation believes the FAA must once again make it a national priority and a first step would be to have the Director of the Office of Runway Safety reporting directly to the Administrator.

A cursory look at history shows that during times of inadequate leadership from the FAA, the number of runway incursions increases. In 1990, an all-time high of 281 runway incursions occurred and the National Transportation Safety Board (NTSB) added the prevention of runway incursions to its Most Wanted Safety list. Under FAA leadership and coordination, progress was made and 1993 marked a low with 186 incursions. However, we quickly saw FAA's focus and resources shift to other priorities and the result was a dramatic increase in runway incursions through the mid-90s.

Back as a top priority, in 1999, the FAA announced a new runway safety initiative, created a new program office, reestablished runway incursion action teams, held regional workshops, and created new pilot programs. A great deal of time, energy and resources was devoted to runway safety. Runway safety was an industry government partnership, and the AOPA Air Safety Foundation worked very closely with the FAA's Office of Runway Safety on training, outreach, and education. It was a cooperative and effective campaign. Progress was being made but unfortunately FAA's attention was once again diverted and existing partnerships dissolved.

As the GAO report noted, the FAA's Office of Runway Safety has not updated the national runway safety plan since 2002 despite policy that it be upgraded every two to three years. During this time the office was without a permanent director for two years and its staff was reduced by almost half. With the FAA forecasting an increase in the number of operations over the next decade, the AOPA Air Safety Foundation believes the FAA needs to once again make runway safety a national priority. Long-term, sustainable improvements in runway safety require constant, consistent and continual FAA leadership.

Pilot Training and Regulation

All pilots must pass a written FAA computerized knowledge test, and pass an oral and practical test (check ride) administered by an FAA Designated Flight Examiner. The FAA Private Pilot Airplane Practical Test Standards (PTS) manual outlines the standards used by

FAA inspectors and designated pilot examiners when conducting private pilot airplane practical tests.

Pilots are required to demonstrate proficiency in airport and traffic pattern operations, including operations at controlled airports, radio communications, and collision avoidance precautions. Pilots must exhibit knowledge of the elements related to safe taxi procedures and compliance with airport/taxiway markings, signals, air traffic control clearances and instructions. The PTS also states that examiners shall place special emphasis upon areas of aircraft operations considered critical to flight safety including operations on the ground and runway incursion avoidance.

Pilots are also required to undergo a biannual flight review conducted by a flight instructor. Flight instructors use the same test standards (PTS) and special focus areas that are used to test new pilots. Previous studies indicate there is no correlation between runway incursions and pilot certificate type. In addition, incursions are not related to flight time or pilot experience. Virtually all runway incursions are inadvertent and unintentional. It can happen to any pilot at any time because of confusion, ignorance, inattention or complacency.

General operating and flight rules for private pilots are outlined in the Federal Air Regulations (FAR). In the case of runway incursions, pilots are most often cited for violating *FAR 91.123 Compliance with ATC clearances and instructions* and the "catch-all" *FAR 91.13 Careless or reckless operation.* Under the Aeronautical Information Manuel (AIM), when air traffic control clears an aircraft to "taxi to" an assigned takeoff runway, in absence of holding instructions, that aircraft is authorized to "cross" all runways that the taxi route intersects. However, the aircraft is not authorized to taxi onto or cross the assigned takeoff runway at any point. This situation creates significant confusion.

The National Transportation Safety Board's (NTSB) runway incursion prevention recommendations dating back to 2000 called for the FAA to require that, when aircraft need to cross multiple runways, air traffic controllers issue an explicit crossing instruction for each runway. While this will increase the workload on the air traffic controllers - and we are sympathetic to that concern - it will improve understanding, allow for better control, and reduce the number of incursions. The AOPA Air Safety Foundation recommends this be evaluated and carefully studied to determine whether it is feasible to require a specific air traffic control clearance to cross all runways.

When a pilot deviation occurs, the pilot is contacted by air traffic control and the incident is reported to the FAA Flight Standards District Office. The pilot is then contacted and interviewed by an FAA inspector. The outcome could be remedial training, civil penalties or further enforcement action resulting in certificate suspension or revocation. Regardless, the incident is a blemish on the pilot's record.

Additional pilot training standards and/or additional FAA regulations are not the answer to reduce runway incursions. What is needed is to focus resources on the behavior and better application of the existing regulations. Often we know what happened, but we need to determine "why." In order to help identify factors and events that contribute to runway incursions, the AOPA Air Safety Foundation encourages pilots to file a report with National Aeronautics and Space Administration's Aviation Safety Reporting System (ASRS). Reports made under the ASRS are confidential and anonymous. The data is compiled and used by the FAA and industry in developing educational and training initiatives to reduce runway incursions.

The AOPA Air Safety Foundation also strongly supports the FAA's Runway Incursion Information Evaluation Program (RIIEP). Under the program, pilots involved in runway incursions are interviewed by aviation safety inspectors to help identify the cause(s) of incursions so proper risk reduction strategies can be implemented. Pilot participation in the program is voluntary but likely will result in no enforcement action against the pilot for the incident in question. RIIEP was created in March 2000, renewed in July 2004 and again in July 2006. The current program expires in July 2008, and the AOPA Air Safety Foundation encourages the FAA to continue the program.

However, according to the November 2007 Government Accountability Office (GAO) *Aviation Runway and Ramp Safety* report, only 19 percent of pilots involved in incursions participated in the program between 2004 and 2006. The AOPA Air Safety Foundation considers RIIEP to be a valuable program and will continue to actively promote pilot participation. The GAO report also questions what, if anything, the FAA has done with the data collected. The AOPA Air Safety Foundation is willing to work with the FAA to ensure the data collected is being analyzed and used to implement cost-effective corrective measures in a timely manner.

Airport Infrastructure

Runway incursions have a variety of causes and are often the result of a combination of factors. The best analogy is to the roads. When there is limited visibility, poor lighting, bad weather, inadequate paint lines, confusing signs or a combination of these, there is a greater risk of an accident. In this area, runway incursions can be reduced with relatively inexpensive, low technology methods -- better markings, more reflective paint, lights and signage.

The November 2007 Government Accountability Office (GAO) *Aviation Runway and Ramp Safety* report cites a survey of experts who agreed and ranked the following among the three most effective FAA actions to address runway incursions:

1. enhancing airport markings and lighting;
2. enhancing airport signage; and
3. approving perimeter taxiways that provide aircraft with access to gates without crossing runways.

These activities can be funded through the FAA's Airport Improvement Program (AIP). AIP grants play a critical role in funding airport safety projects. They help fund airfield reconfigurations and the construction of end-around taxiways designed to reduce the number and severity of runway incursions. These projects, at some of the nation's largest and busiest airports, eliminate the need for an aircraft to cross an active runway in order to reach its gate. According to the FAA, more than $170 million in AIP grants were awarded to implement recommendations made by Runway Safety Action Teams in FY2005 and FY2006.

Yet, for the past two fiscal years, the Administration's budget request has proposed to cut nearly a billion dollars from this vital program. And last week, we were again disappointed to see that the Administration's FY09 budget request for AIP is $765 million below the FY08 enacted level. AOPA strongly supports robust AIP funding. We commend Congress for its wisdom in rejecting these shortsighted cuts and specifically thank this Subcommittee for its leadership in providing $15.8 billion for AIP in your bill, the FAA Reauthorization Act of 2007 (H.R. 2881).

Unfortunately, FAA reauthorization is stalled in the Senate and we are currently operating under an extension that does not include AIP contract authority. While the FY08 Consolidated Appropriations Act provides $3.5 billion in obligation limitation for AIP, the FAA lacks the authority to access the money. With each passing day, important airport safety projects are being delayed. For example, Centennial airport near Denver, Colorado, cannot complete the reconstruction of taxiway Charlie because they are waiting to receive $2.7 million in FY08 AIP grants. This project provides new connections to the runway that improve surface flow and will reduce the potential for aircraft on aircraft incursions.

The current FAA extension expires on February 29, 2008. As Congress contemplates future action, AOPA encourages the Subcommittee to support a 60 to 90 day extension that includes AIP contract authority. We believe that a multi-year FAA reauthorization bill is not only obtainable but also essential to FAA's modernization efforts aimed at improving system safety and efficiency. AOPA is committed to working with the Subcommittee, Congress, the FAA and the aviation community toward that goal.

Ongoing Pilot Education and Outreach

AOPA through the AOPA Air Safety Foundation plays a vital role in improving general aviation safety. Our ongoing campaign in the area of runway safety includes the following activities.

1. Airport Taxi Diagrams

Instrument pilots have access to airport taxi diagrams because they are included as part of the instrument approach procedure charts. However, the only way for visual flight rule pilots to obtain these airport taxi diagrams was to purchase an instrument flight rule chart subscription.

In an effort to reduce runway incursions and improve surface navigation, the AOPA Air Safety Foundation (ASF), in partnership with the FAA Runway Safety Program Office, began providing airport taxi diagrams for the busiest airports in the United States. Today, airport diagrams are available for over 330 of the busiest airports. These airport diagrams are free to the public, available online (www.aopa.org/asf/publications/taxi/) and are updated regularly, so pilots can download the most current diagram(s). All pertinent information about the airport is provided, including elevation, navigation aids and communications frequencies, as well as a small diagram of the runway, taxiways and ramps.

One area for improvement is for the FAA to identify problem areas otherwise known as "hot spots" on charts. The September 2007 *Runway Safety Report* states the FAA developed a definition of a "hot spot" that went through International Civil Aviation Organization (ICAO) final review at the end of 2006 for applicability in November 2007. The report states that "hot spots" will be added to National Aeronautical Charting Office (NACO) diagrams in November 2007. As of today, "hot spots" do not appear on NACO charts, although the hotspots appear on Jeppesen airport taxi diagrams, available through paid private subscription services. The ASF strongly encourages the FAA to identify these areas on government charts as soon as possible. The ASF will then be able to post the information online and make it available to pilots and the public.

2. Safety Advisors discussing Runway Safety

The AOPA Air Safety Foundation's 14 *Safety Advisors* describe aviation specific topics in subjects ranging from aircraft icing to weather strategies. Safety Advisors are free to the public, available online (www.aopa.org/asf/publications/advisors), distributed by ASF by mail, and available at safety seminars.

To help combat runways incursions, the *Operations at Towered Airports Safety Advisor* gives pilots the information they must know to operate more safely at busy towered airports. First published in 1998, this Safety Advisor has been updated and republished three times most recently in May 2007. In 2007, ASF distributed almost 17,000 copies of the *Operations at Towered Airports Safety Advisor* by mail and more than 34,000 copies have been download over the past three years.

Since collision avoidance – both in the air and on the ground - is one of the most basic responsibilities of a pilot operating an aircraft in visual flight rule conditions, the *Collision Avoidance Safety Advisor* shows pilots how to visually identify potential collision threats and covers procedures that can lessen the risk of a runway incursion. First published in 2001, this Safety Advisor was last updated in August 2006. More than 20,000 copies have been downloaded over the past three years.

In August 2004, a 27-page pocket size brochure on A Pilots Guide to Safe Surface Operations was included in *AOPA Pilot* magazine that was distributed to approximately 410,000 members. The brochure was produced by the FAA Office of Runway Safety in coordination with the AOPA Air Safety Foundation.

In August 2005, a second 27-page pocket size brochure on Safe Flight Communications was included in *AOPA Pilot* magazine that was distributed to approximately 410,000 members. The brochure was produced by the FAA Office of Runway Safety in coordination with the AOPA Air Safety Foundation.

3. Runway Safety Flash Cards
In 2004, the AOPA Air Safety Foundation created Runway Safety Flash Cards (supported by a grant from the FAA Office of Runway Safety) to help pilots better understand runway signage and markings. Flash cards are an effective way for pilots to learn about complex topics, and a helpful testing tool for flight instructors and pilot examiners. The front of each card displays an airport sign or pavement marking, while the back provides a description and information on the required pilot action. In 2007, the ASF distributed over 24,600 Runway Safety Flash Cards by mail alone. Flash cards are free to the public, available online (www.aopa.org/asf/publications/flashcards/), distributed by ASF by mail, and available at safety seminars.

4. Runway Safety Online Interactive Course
Created in 2003 by the AOPA Air Safety Foundation (supported by a grant from the FAA Office of Runway Safety), the Runway Safety online course is designed to help pilots avoid and prevent runway incursions by studying the various factors involved. It is a comprehensive program designed to train pilots by using interactivity, graphics, sound and animation. Flight instructors and others can also use the course in ground school and safety classes. Completion of the program takes approximately 45 to 60 minutes. The Runway Safety Course is free to the public, available online (www.aopa.org/asf/online_courses/), distributed by ASF by mail, and available at safety seminars. Since 2003, there have been over 65,000 course completions.

Impressed by the Runway Safety Course, the Airline Pilots Association (ALPA) and the FAA asked ASF to create a version for commercial pilots. This was completed in August 2005. Several airlines have made the course mandatory for their pilots.

In response to the 2006 tragic accident in Lexington, KY, the ASF distributed the Runway Safety Course to over 200,000 general aviation pilots in order to promote runway safety. In addition, the November 2006 edition of *AOPA Pilot* contained an article discussing the accident and some techniques that pilots can use to avoid similar problems. That edition of *AOPA Pilot* was distributed to approximately 412,000 members.

5. Air Safety Foundation Online Quizzes
Every two weeks, the AOPA Air Safety Foundation posts a new quiz that gives pilots a quick, easy, and interactive way to continually assess and expand their knowledge from the privacy of their own personal computer. In 2007, over 10,000 pilots participated in the Runway Safety quiz.

Action Plan
Recognizing that runway safety is a community wide issue that needs to be addressed, AOPA and the Air Safety Foundation commit to the following activities in 2008.

- The AOPA Air Safety Foundation will expand runway safety awareness in the June 2008 edition of *AOPA Pilot*. The magazine will feature an editorial on general aviation runway safety: the statistics; review of some of the more memorable close calls; operations at towered airports; techniques for operating safely; and a view from the tower/air traffic control observations. The edition will also contain a "never again" article by a pilot who has had an incursion.

- The AOPA Air Safety Foundation will expand emphasis on runway safety in the more than 90 Flight Instructor Refresher Clinics conducted by the ASF in 2008 (about 4,000 instructors/attendees annually).
- The AOPA Air Safety Foundation will include an article in its *Instructor Report* that is distributed to all current certified flight instructors (over 90,000).
- In April, June and July, AOPA and the Air Safety Foundation will actively promote the Runway Safety Course through *ePilot* which is a weekly electronic newsletter sent to approximately 290,000 subscribers.
- The AOPA Air Safety Foundation will include a special runway safety module in the approximately 60 safety seminars scheduled for fall 2008.

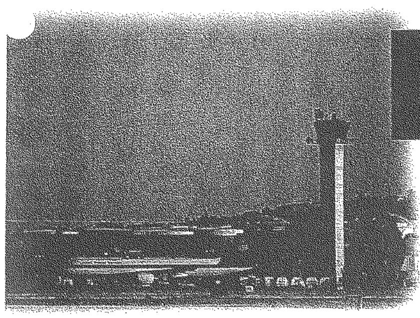
We also recommend the following items as important actions the FAA can take in the short term to address the problem of runway incursions.

- The FAA must once again make runway safety a national priority. The Director of the Office of Runway Safety should report directly to the FAA Administrator.
- The FAA should examine the feasibility of requiring a specific air traffic control clearance to cross each runway as recommended by the NTSB.
- The FAA should continue the Runway Incursion Information Evaluation Program (RIIEP) that is set to expire in July 2008. In addition, the FAA needs to ensure that the data collected is being analyzed and used to implement cost-effective corrective measures in a timely manner.
- The FAA should identify "hot spots" on National Aeronautical Charting Office (NACO) charts as soon as possible.
- The FAA should work closely with the aviation community on an educational and outreach campaign to pilots to prevent runway incursions.

Conclusion

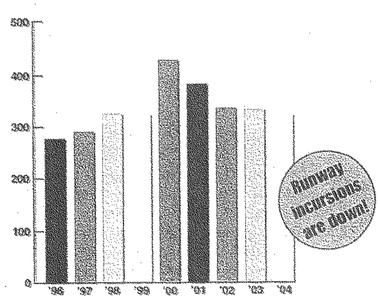
As I stated at the beginning, safety requires constant vigilance. Safety and education are at the heart of AOPA's and the Air Safety Foundation's mission. We look forward to working with the Subcommittee and the aviation community to ensure our runways are safe. And, we will look to the FAA for their leadership and partnership in this critical endeavor.

SAFETY ADVISOR
Operations & Proficiency No. 2



Operations at Towered Airports

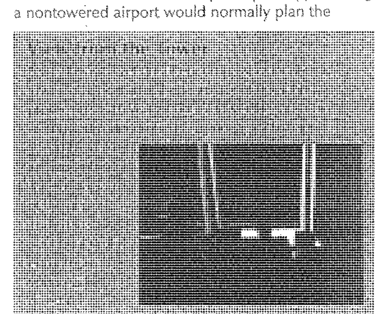
Every year, there are more than 40 million arrivals and departures at FAA ATC towered airports. Nearly half of these are general aviation operations.



There are two kinds of airports—those with an operating control tower and those without. When a part-time tower is closed, the airport is considered nontowered. Every year, there are more than 40 million arrivals and departures at FAA ATC towered airports. Nearly half of these are general aviation operations.

Although it's possible for a pilot to avoid towered airports, doing so impacts the flexibility and utility of flying. Two things distinguish a towered airport. One is the presence of air traffic controllers (ATC), whose primary function is to coordinate traffic flow and prevent collisions. The second is that a pilot must maintain two-way radio contact with ATC and obtain clearances to land, taxi, and take off.

Because ATC coordinates traffic at towered airports, pilots generally follow different procedures than at nontowered fields. For example, a pilot approaching a nontowered airport would normally plan the



arrival to make a 45-degree entry to the downwind leg of the active runway. As you approach a *towered* airport, however, ATC can clear you to enter the pattern at any leg. The entry point will depend on the runway in use, the direction of arrival, and the locations of other arriving aircraft.

The key to safe operations at towered airports, both in the air and on the ground, is **awareness.** Good preflight planning is essential. Focus on the task at hand, organize the cockpit to minimize your work load, and know where you are in relation to other aircraft in the vicinity.

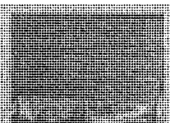
Planning Your Flight

The basic aircraft requirement for operating at a towered airport is a two-way radio. If your flight involves a takeoff or landing at a Class B or C airport, the aircraft also must be equipped with a Mode C transponder.

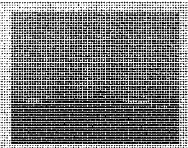
Basic planning should include knowledge of local departure and arrival procedures for noise abatement, obstacle clearance, and traffic flow in busy terminal areas. When obtaining your preflight weather briefing from flight service, ask for any special procedures, and if you are unsure, check with an instructor based at the airport. FBOs sometimes post notices about special noise-abatement departure procedures and routes that avoid obstacles or controlled-access airspace.

When planning your flight to or from a towered airport, look at the big picture. Is the airport near or within Class B or C airspace that will require you to communicate with approach/departure controllers, in addition to tower controllers? If you want to avoid entering Class B or C airspace (assuming that the towered airport you are using is not within the airspace), be sure you are aware of any altitude restrictions. Know the route you will use and how you will navigate—visually using landmarks depicted on the chart, or with VORs or GPS. Do large aircraft operate from your departure or destination airport? Be aware of potential jet or propeller blast from larger aircraft when taxiing, and avoid wake turbulence on takeoff and approach.

Noise Abatement



Wake Turbulence



Information about individual towered airports can be found in the (Airport/Facility Directory), as well as in *AOPA's Airport Directory*. Changes will be publicized in notices to airmen—notams—which should be included in your preflight briefing from a flight service station or DUATS.

Charts

You'll need the appropriate sectional aeronautical charts and, if the airport is within or under Class B airspace, the appropriate terminal area chart. Towered airports are depicted in blue. Information printed next to the airport symbol includes: (see terminal area chart next page)

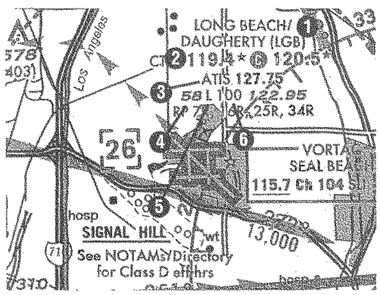
1. The airport name and location identifier;
2. Control tower frequency;
3. ATIS (automated terminal information service), ASOS (automated surface observation system), or

AWOS (automated weather observation system) frequency, whichever is applicable to the airport;

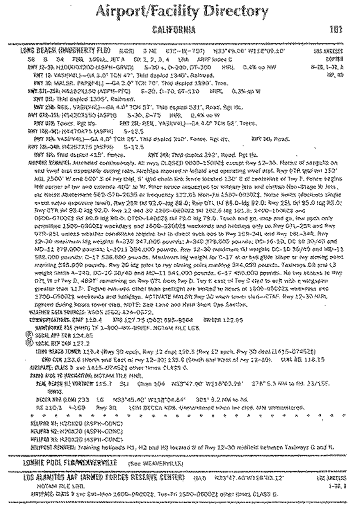
4. Airport elevation in feet;
5. Runway lighting; and
6. Length of longest runway in hundreds of feet.

VFR charts also note if a flight service station facility is on the field, airport surveillance radar is available, the tower is part-time or a non-federal facility, if special VFR is not permitted, and the unicom and VFR advisory frequencies, if applicable. A complete explanation is printed on the chart's legend and in the NACO *Aeronautical Chart User's Guide*.

VFR Terminal Area Chart



Airport/Facility Directory

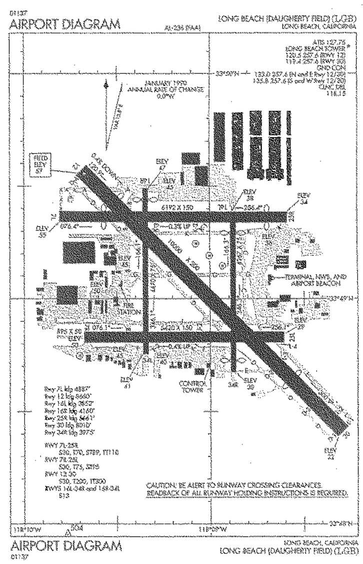

CALIFORNIA 101

LONG BEACH (DAUGHERTY FLD) (LGB)

LUNDIE POOL FLD (See WEAVERVILLE)

LOS ALAMITOS AAF (ARMED FORCES RESERVE CENTER) (SLI)

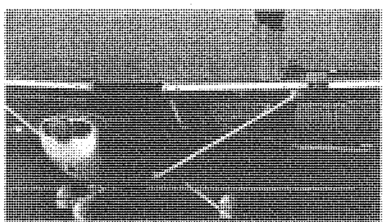
Airport Diagram Page



NOT TO BE USED FOR NAVIGATION

Study the airport layout so you can taxi to and from the active runway without getting lost. ***Instrument approach procedure (IAP) charts are required for IFR operations, and they are also a great reference for the VFR pilot.*** All pertinent information about the airport is provided, including elevation, navigation aids and communications frequencies, as well as a small diagram of the runway, taxiways and ramps. If the airport has a complex runway or taxiway configuration, the IAP charts will include a separate, detailed airport diagram page. These airport diagrams are invaluable for finding your way around large airports, but never hesitate to ask for progressive taxi instructions if needed. Airport diagrams can also be found online (www.aopa.org/asf/taxi/) or in the back of the Airport/Facility Directory (A/FD).

Navigation Aids
Become familiar with the terminal area navigation aids—the VOR, ADF, localizer, and glideslope—at the airports you'll be using. They are critical to instrument operations and can be very helpful to VFR pilots as well. It can be a challenge to find an unfamiliar airport if it's immersed in an urban sea of

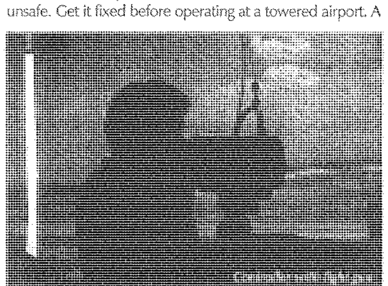


buildings and lights or hidden among hills. On-airport navaids, or GPS, make the job a lot less stressful.

Communication

Because two-way communication is required to operate at towered airports, good radio skills go a long way toward ensuring smooth operations.

A good communications system includes at least one 720- or 760-channel transceiver with enough power to transmit and receive communications without static or interference. If the aircraft transceiver is not working properly, the communications process will be difficult and could be unsafe. Get it fixed before operating at a towered airport. A



Light Gun Signals

Color and Type of Signal	Aircraft on the Ground	Aircraft in Flight
Steady green	Cleared for takeoff	Cleared to land
Flashing green	Cleared for taxi	Return for landing (to be followed by steady green at the proper time)
Steady red	Stop	Give way to other aircraft and continue circling
Flashing red	Taxi clear of the runway in use	Airport unsafe do not land
Flashing white	Return to starting point on airport	Not applicable
Alternating red and green	Exercise extreme caution	Exercise extreme caution

headset with an attached boom microphone and a push-to-talk switch greatly simplifies the task of flying and communicating simultaneously. Just be sure the airplane is equipped with a handheld microphone and speaker as backup in the event the headset or intercom system fails.

Even the best radios fail occasionally. When that happens, you can still receive tower instructions via light gun signals. Because we get very little practice with these signals, they're easily forgotten. We suggest you copy the light gun signal chart above and tape it to your clipboard. Acknowledge the signals by rocking your wings or flashing your landing light.

Clearances

Flying to and from towered airports involves a series of controller instructions and clearances. It's vital that both the pilot and the controller recognize and understand each instruction, clearance, and acknowledgment. Communications should be simple and clear. You'll take up minimum time on the frequency, and controllers will understand you the first time. A misinterpretation by either party can have serious consequences. *To ensure mutual understanding, read back the clearance.* **Controllers are required to get an acknowledgment of "hold short" instructions, so a "hold short" clearance must be read back—but you should really read back every clearance.**
Controllers issue clearances using specific words and phrases. If you don't fully understand a controller's instructions, ask for clarification. The "Pilot/Controller Glossary" in the AIM is an excellent source for reviewing the terms and phrases.

ATC Instructions

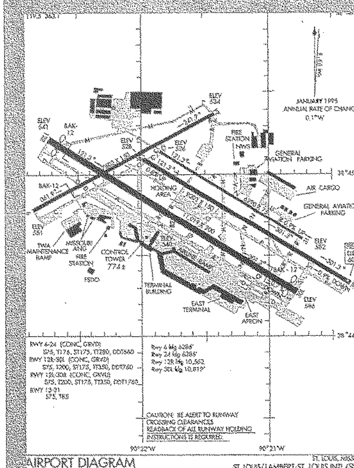
ATC instructions common at towered airports include:

- **"Taxi to...."** In the absence of holding instructions, a clearance to "taxi to" any point other than an assigned takeoff runway is a clearance to cross all runways that intersect the taxi route to that point. It does not include authorization to taxi onto or cross the assigned takeoff runway at any point.
- **"Taxi to—hold short of...."** A clearance to begin taxiing, but enroute to the taxi clearance limit you *must* hold short of another taxiway or a crossing runway as specified by the controller.
- **"Cross runway...."** You are cleared to taxi across the runway that crosses your taxi route and continue to the taxi clearance limit.
- **"Hold short...."** *Do not* enter or cross the taxiway or runway specified by the controller. If there is a painted hold line, do not cross it.
- **"Cleared for immediate takeoff."** A clearance to initiate the takeoff without delay. This clearance usually means another aircraft is on final approach. If you are not ready, do not accept this clearance.
- **"Report location...."** Identify your location on the airport ("Five-Eight Quebec at the transient ramp") or in the air with respect to the airport ("Five-Eight Quebec is seven miles southeast of the airport at one thousand five hundred").
- **"Squawk...."** Tune a discrete four-digit code into your transponder (the controller will specify the code or say "VFR," which is 1200). Make sure the transponder is in the "alt" mode.

- **"Report entering...."** Call the tower when you are turning onto a leg in the airport pattern specified by the controller. For example, "Report entering left downwind for Runway Two-Three."
- **"Cleared to land ... cleared for touch and go ... cleared for the option."** A controller may issue this clearance, even though one or more aircraft will land ahead of you.
  "Cleared for the option" is usually requested by instructors during training flights. It means you are cleared for either a full-stop landing, a stop and go,

Ground Fatality
St. Louis, MO

During the takeoff roll on Runway 30R, an MD-82 with 140 people on board collided with a Cessna 441 with two people on board. The Cessna pilot had received clearance to back-taxi into position and hold on Runway 31. The pilot taxied into position at an intersection of Runway 30R, which was the assigned departure runway for the MD-82. Both people aboard the Cessna were killed; there were a few minor injuries to the passengers on the MD-82.



AIRPORT DIAGRAM

NOT TO BE USED FOR NAVIGATION

Departure Procedures

P Plan	R Radios	O Organize	C Clearance	E Exercise Caution	E Expedite	D Depart
Plan your route. Get a preflight weather briefing. Consider filing a VFR flight plan.	Tune before taxiing or at the runup pad— *not* while taxiing or in the terminal area.	Have charts and notes handy for ready reference. Minimize cockpit distractions.	Get ATIS, AWOS, or ASOS before calling clearance or ground control. Read back all clearances.	Heed all taxiway and runway hold markings. Be extra careful at night or in low visibility.	When cleared to cross an active runway, or for takeoff, scan the area and comply quickly or notify ATC of the delay.	Scan the final approach area as you taxi into position for takeoff.

touch and go, low approach, or missed approach—whatever you or an instructor aboard the aircraft decides to do.

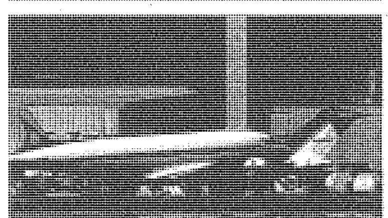
- **"Go around!"** Abort the final approach! The tower controller may issue the instructions, or the pilot can state the fact. Unless otherwise instructed, the pilot should overfly the runway while climbing to traffic pattern altitude and reenter the pattern on a crosswind leg.
- **"Contact...."** Switch frequencies and communicate with another specified controller.
- **"Expedite...."** Comply promptly to avoid a conflicting situation.
- **"Traffic...."** Other aircraft are in your vicinity. For example, "Traffic, nine o'clock, one-two miles, southeast bound, one thousand feet below you."
- **"Report traffic/runway/airport in sight."** Advise the controller when you visually identify the other aircraft, runway, or airport.
- **"Land and hold short."** At busy airports with intersecting runways, controllers often use more than one runway for arrivals and/or departures. Be prepared for a controller to issue a "land and hold short" (LAHSO) restriction when flying to such an airport. You can ask the controller for the landing distance available to you. That information, along with details on land and hold short operations, can be found in the (Airport/Facility Directory) listing for the airport. Configure the airplane for a short-field landing if necessary, and fly a precise final approach airspeed. If you have doubts about being able to comply with the hold-short restriction, inform the controller immediately. Don't wait until you're rolling out too fast and too far down the runway to stop before the hold-short line.

Nonstandard Procedures

Be flexible. Controllers at busy airports use a variety of techniques to keep traffic flowing smoothly. You may be asked to:

- Fly a faster than normal final approach;
- Extend your downwind;
- Switch to another runway at the last minute;

Safety Tip



Safety Tip

- Do a 360-degree turn or S-turns on final to allow preceding traffic to clear; or
- Taxi around another aircraft in the runup area.

Be proficient so you can handle such unusual procedures safely. Remember: The pilot in command has the right to decline *any* procedure that may put the flight in jeopardy. Cooperate, but don't hesitate to decline a request or to *change your mind* if something isn't working out.

How the Pros Do It

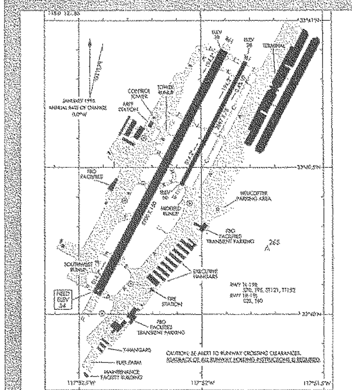
The airlines and many corporate pilots have detailed procedures for operations at towered airports. While the following list of procedures is not exhaustive, it gives many useful piloting techniques that will make all ground operations more professional.

- The airport diagram is reviewed during preflight planning.
- The current position of the aircraft is noted relative to the active runways, the most likely route to the runway, and any special notes. (Many of the airlines provide notes and list restricted taxiways.)
- The first officer communicates with ground control, while the captain taxis the aircraft. When communicating with ATC, both pilots focus on what is being said and no other cockpit duties are accomplished during this time.

Runway Incursion

Santa Ana, CA

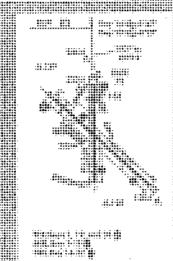
A C-188 Agwagon was told to taxi across 19L and hold short of Runway 19R. The pilot correctly read back the instructions but proceeded across the hold bars and did not stop. A Boeing 757 had been cleared for takeoff on Runway 19R and successfully aborted its takeoff 1,000 feet into the takeoff roll.



NOT TO BE USED FOR NAVIGATION

Arrival Procedures

ATIS	Review	Radios	Inbound	Visual Check	Arrival	Landing
Before calling approach or tower controllers, check ATIS, AWOS, or ASOS.	Study the airport diagram, anticipate the active runway, and visualize your taxi route.	Preset the tower and ground frequencies.	Turn on lights when 5-10 miles out. Begin the before-landing checklist.	Look for traffic when approaching the airport. Be accurate in your position reports.	Complete the before-landing checklist. Follow tower's instructions for landing.	Clear the runway ASAP. Don't switch to ground control until instructed.



- If there is any doubt by either pilot about what is said or intended by ATC, they ask for clarification.
- The first officer writes down complex taxi instructions and asks for a repeat, if needed.
- A full readback of all ATC instructions on the ground is required.
- An airport diagram is used while taxiing, and both pilots listen to ATC and visualize the positions of other aircraft.
- Other cockpit duties stop just prior to crossing a runway to focus on the event. Both pilots must agree that ATC has cleared them to cross, and both pilots must visually check the runway in both directions.
- Taxi lights are used day and night to communicate with other aircraft on the ground. If the aircraft is moving, or has received clearance to taxi, the taxi light is turned ON. When the aircraft stops, the taxi light is turned OFF. When ATC issues a takeoff clearance, landing and strobe lights are turned ON to let other aircraft know they are beginning the takeoff roll.

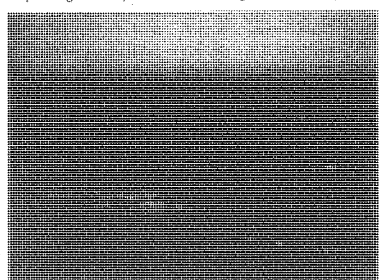
Once you understand towered airport operating rules and procedures and have thoroughly prepared, you should have no trouble working with tower and approach controllers.

When things get busy in the cockpit, stay focused on the critical task—flying the airplane. Trying to do too many things at once—shuffle through charts, read the airport diagram, tune the radios, program the GPS, configure the aircraft, jot down a clearance—can quickly overwhelm a single pilot. The result may be a missed critical clearance, such as "hold short of the runway," and a potentially disastrous runway incursion. **Aircraft control takes priority over communication.** Act first, talk second. Think ahead of the aircraft and stay flexible, ready to change to plan B if necessary.

Let's Go Flying!

Preflight

Our flight plan calls for flying VFR into Long Beach, California's Daugherty Field (LGB) and then departing the airport. LGB is a large Class D airport



that lies under the floor of Los Angeles Class B airspace and in close proximity to several Class C airports in the busy Los Angeles Basin. Long Beach has six published instrument approaches, scheduled airline service, and a high volume of general aviation piston and jet aircraft, including flight training activity. With two sets of parallel runways—one set perpendicular to the other—and a long, main runway that bisects the other four, LGB presents a significant challenge, both on the ground and in the air, to any pilot not familiar with it.

Our aircraft more than meets the minimum equipment requirements for operating at a Class D airport and within a Class B Mode C veil—two-way communications transceiver and Mode C transponder. For navigation guidance, we'll use the current Los Angeles VFR Terminal Area Chart for maximum detail and scale.

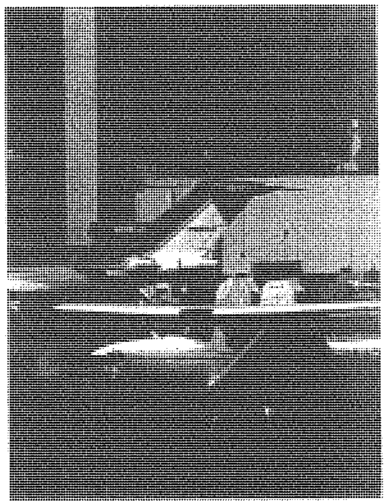
Given the complexity and activity level at LGB, referring to an airport diagram from an instrument approach booklet is an excellent idea, even though we'll be flying VFR. Both NACO *Terminal Procedures* and *Jeppesen's Airway Manual* devote a separate page to a plan view graphic of LGB's airport/taxiway configuration. (Refer to the airport diagram for LGB on pg. 3.) It'll be a big help in planning the arrival and negotiating the complex taxiway layout. The frequency listing for the airport will also be helpful in planning and preparing for controller handoffs.

Arrival

We're arriving from the east, and because of the traffic congestion, we ask for and receive traffic advisories from SoCal Approach Control. About 15 minutes east of our destination, we tune LGB's ATIS frequency on the number-two radio and listen to the current report, "Hotel," while also monitoring the approach control frequency on radio number one.

ATIS says that runways 25L, 25R, and 30 are active. Separate tower frequencies are in effect for the north and south runways. Because intersecting runways are in use, we mentally prepare for a "land and hold short" instruction.

About five miles east of the airport, we inform SoCal Approach that we have Long Beach in sight, we have ATIS information Hotel, and we're requesting 25L, the runway most convenient to our destination on the airport. The controller says to expect 25L and instructs us to switch to the Long Beach Tower—south frequency. We've already obtained the frequency from the airport diagram page and loaded it in the standby



window on the number-one com, so we're prepared for the handoff.

"Long Beach Tower, Cessna Seven-Zero-Five-Eight Quebec, five east, inbound to Two-five Left."

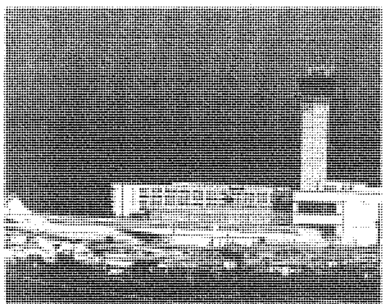
"Cessna Five-Eight Quebec, Long Beach Tower. Make straight in Runway Two-five Left."

"Cleared for the straight-in to Two-five Left. Five-Eight Quebec." Great! This is going to be easier than we thought. We'll be able to exit the runway right onto the ramp where we'll be parking to refuel. Then the tower controller throws us a curve.

"Cessna Five-Eight Quebec, change to Runway Two-five Right. I have an aircraft stopped on Two-five Left. Contact tower one-two-zero point five."

"Roger, contact tower on one-two-zero point five. Five-Eight Quebec." We don't know what the trouble is on 25L, but there's no point in worrying about it. As we bank into a right turn and then back to the left to line up with 25R, we tune the tower frequency and check in. The tower controller is ready for us.

"Cessna Seven-Zero-Five-Eight Quebec, Runway Two-five Right, cleared to land. Hold short Runway Three-zero."



"Cleared to land Two-five Right. Five-Eight Quebec." The controller immediately responds to my readback with an insistent voice, "Five-Eight Quebec, HOLD SHORT RUNWAY THREE-ZERO."

"Roger, hold short Three-zero. Five-Eight Quebec." Oops. Fortunately, the controller caught my negligence. I shudder as I think about the potentially catastrophic consequences of rolling out on Runway Two-five Right and blithely crossing Runway Three-zero—just as another airplane comes barreling down the crossing runway.

As it turns out, the hold-short restriction is unnecessary because we easily slow and exit the runway long before reaching the intersection of 25R/30. After completing the after-landing checklist, we are told to contact ground control. "Long Beach Ground, Cessna Seven-Zero-Five-Eight Quebec off of Two-five Right, going to the south ramp. Request progressive taxi instructions." It looks like a long, complicated route to the south side of the airport, and we can use the controller's help in getting there safely.

"Five-Eight Quebec, Ground. Taxi west on Kilo, hold short of Runway Three-zero."

"West on Kilo, hold short of Three-zero. Five-Eight Quebec."

Just as we roll to a stop on Kilo at the hold line for 30, a Learjet glides past on the runway. If we hadn't stopped....

A few seconds later, the ground controller instructs us to "Cross Three-zero, then left on Bravo. Taxi south on Bravo, hold short of Runway Two-five Left."

"Roger, cross Three-zero, left on Bravo, hold short of Two-five Left. Five-Eight Quebec."

Evidently the problem that forced us to switch runways has cleared, because we watch an airplane slow on 25L and exit the runway to the south.

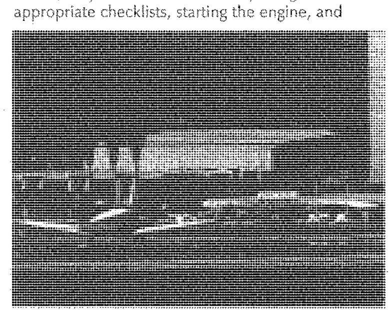
"Five-Eight Quebec, cross Two-five Left, turn left on Foxtrot. The south ramp will be on your right."

"Cross Two-five Left, left on Foxtrot to the ramp. Five-Eight Quebec. Thanks for your help."

After turning left on Foxtrot, we confirm that we can cross the approach end of 34L and then taxi onto the ramp. A lineman directs us to a parking spot, and we shut down. Time to refuel and grab some lunch before heading back out.

Departure

The drill on departure will be the same as the arrival, only in reverse. After completing the appropriate checklists, starting the engine, and



powering up the avionics, we configure the communications radios based on the frequencies specified on the airport diagram, with LGB ATIS in the active window and ground control in the standby window. Next we set up the navigation radios with the appropriate VOR frequencies and radials for the outbound course. We want to have everything done before leaving the ramp so that all we have to do is taxi to the assigned runway—a difficult enough challenge when the airport is as large and complex as LGB.

The first task is to get the current ATIS information. According to "India," land and hold-short operations are still in effect for 25 Right and 30. Because LGB is a Class D airport, a VFR departure clearance isn't necessary, but local procedure recommends we call clearance delivery. The controller there prepares a "flight strip"—a document that includes information about our aircraft and runway assignment. This is passed to ground control. Because the strip is prepared for them, ground controllers can keep focused on the aircraft and vehicles moving on the field. So, we call clearance, tell the controller our position on the airport and that we have India, and will be departing to the east. We then contact ground control.

"Cessna Five-Eight Quebec, Long Beach Ground. Taxi to Runway Two-five Left at Delta via Foxtrot. Would you like to depart Two-five Left from intersection Delta?"

Hmmm. I study the airport diagram and see that an intersection takeoff from Delta would give me approximately 4,000 feet of runway. Based on my preflight planning, I know that's plenty of runway for the airplane's weight and the weather conditions, but if more runway is available, why not use it?

"Ground, thanks, but I'd like full length on Two-five Left."

"Five-Eight Quebec, Runway Two-five Left. Taxi via Foxtrot and Delta to Delta Three, hold short Runway Three-zero."

"Roger, taxi to Two-five Left via Foxtrot and Delta to Delta Three. Hold short of Three-zero. Five-Eight Quebec."

At the hold line on Taxiway Delta Three, we watch a DC-10 on final for 30 sink toward the runway. Twin puffs of blue smoke trailing from the main gear bogies announce the touchdown.

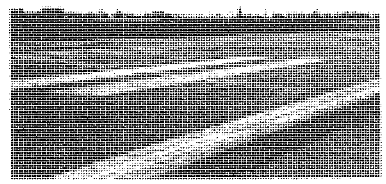
"Cessna Five-Eight Quebec, cross Runway Three-zero, left on Lima to Lima Four, call the tower when ready to depart."

"Roger, cross Three-zero, left on Lima to Lima Four, contact the tower. Five-Eight Quebec."

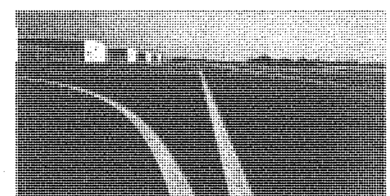
We contact the tower and are issued a clearance to take off. Following takeoff and initial climb, we turn left to an easterly heading as instructed by the tower on our takeoff clearance. Soon we've flown out of the LGB terminal area and are heading east toward our home base. It's been a hard-working lunch flight but worth it. We've negotiated Long Beach for the first time, with no trouble. In fact, the flight was virtually without error—an accomplishment we rightfully attribute to the study and preparation done before ever climbing into the airplane.

Airport Pavement Markings

(For further information, refer to the Aeronautical Information Manual, Chapter 2, Section 3.)

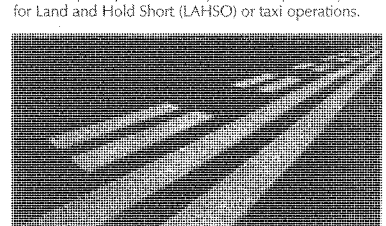


All runway markings are white.

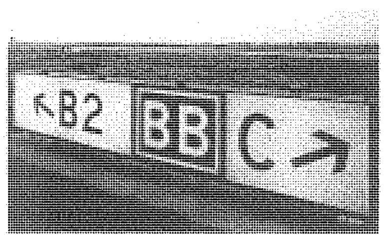


Taxiway markings are yellow. The centerline is a single yellow line, and the taxiway edge is marked by a double yellow line. Dashed edge markings allow the aircraft to cross to the adjoining apron.

Runway holding position markings consist of four yellow lines—two solid and two dashed (see picture below). Aircraft should stop on the solid-line side. ***A pilot should not cross this marking without ATC clearance.*** An aircraft exiting the runway is not clear of the runway until all parts of the aircraft have crossed the holding position marking. These markings are installed on runways only if the runway is normally used by ATC for Land and Hold Short (LAHSO) or taxi operations.

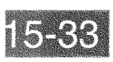


Airport Signs

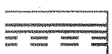


There are many types of signs on airfields. The information on the signs may also be painted on the airport pavement. The following examples are described as if you were on the taxiway or runway, looking at the sign.

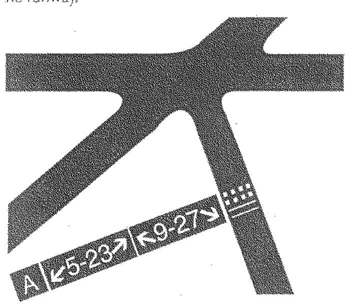
Taxiway location sign: Indicates the taxiway you are on.



Holding position sign: Hold here. From your position on the taxiway, the threshold for Runway 15 is to your left and the threshold for Runway 33 is to your right. This sign is located next to the yellow holding position markings painted on the taxiway pavement.



Runway boundary sign: This sign faces the runway and is visible to pilots exiting the runway. Taxi past this sign ("dash past the dashed lines") to be sure you are clear of the runway.



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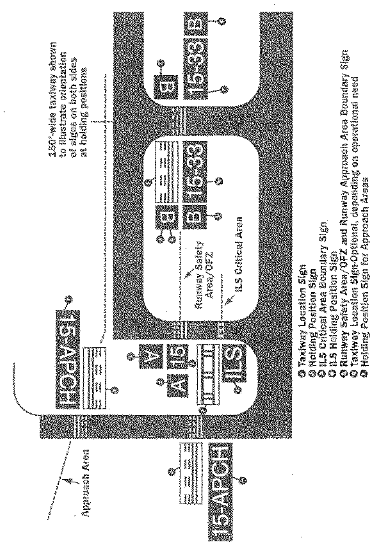

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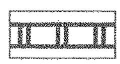
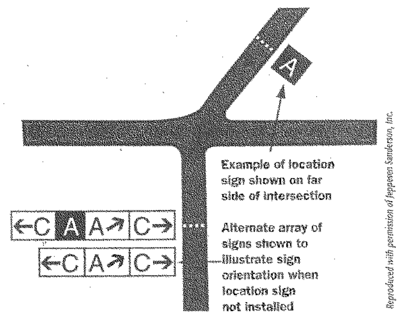
ILS holding position sign: ATC may hold you at this sign when the instrument landing system is being used at the airport. Aircraft taxiing beyond this point may interfere with the ILS signal to approaching aircraft.



ILS critical area boundary sign: Seen when **exiting the runway**, this sign marks the boundary of the ILS critical area. When ILS approaches are in use, be sure your aircraft has passed beyond this sign before stopping on the taxiway.

Holding position sign for approach areas: If instructed by ATC, hold here until cleared to cross. Taxiing past this sign may interfere with aircraft arriving on Runway 15 or departing on Runway 33.

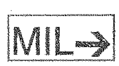
Taxiway entrance at intersection of two runways (see left). You are on Taxiway A. The arrows pointing to



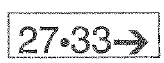
Runways 5-23 and 9-27 indicate the approximate alignment of the runways relative to you and point to each runway threshold.

Taxiway intersection (see above). You are on Taxiway A. The orientation of these signs is from left to right in a clockwise manner. Left turn signs are on the left side of the location sign and right turn signs are on the right side of the location sign.

No entry sign: Do not enter this area. Aircraft are prohibited. This sign would be found at the entrance to a one-way taxiway or at the intersection of a road intended for vehicles.



Inbound destination sign: The military installation is to your right. Other information signs are "Cargo," "Term" (Terminal), "Ramp," etc.



Outbound destination sign to different runways: Runways 27 and 33 are to your right.

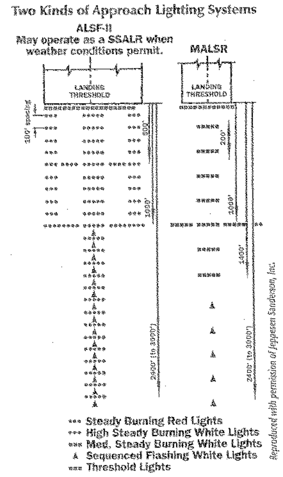
For more information, see www.faa.gov/runwaysafety.

Airport Lighting

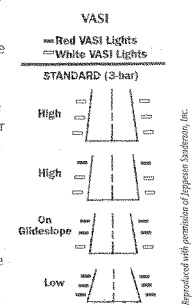
(For further information and a complete set of approach lighting system diagrams, refer to the Aeronautical Information Manual, Chapter 2, Section 1.)

Approach lighting systems provide the basic means to transition from instrument flight to visual flight for landing.

Two Kinds of Approach Lighting Systems



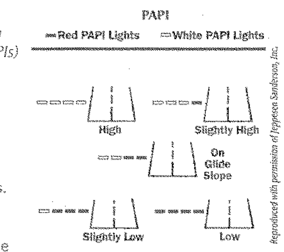
Approach light systems are a configuration of signal lights starting at the landing threshold and extending into the approach area a distance of 2,400 to 3,000 feet for precision instrument runways and 1,400 to 1,500 feet for nonprecision runways.



Visual approach slope indicators (VASIs) provide visual descent guidance during the approach to a runway. The lights are arranged in bars and vary in number from two to 16.

The lights are arranged so that the pilot will see the combination of lights shown here.

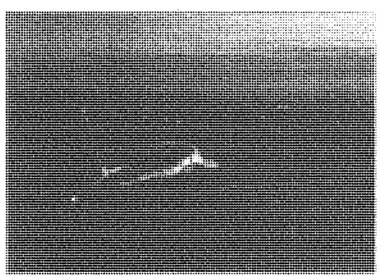
Precision ɜpproach path ïndicators (PAPIs) use light units similar to the VASI but are installed in a single row of either two or four light units. They are normally nstalled on the eft side of the runway, and the glidepath ndicators are shown below.



Runway end identifier lights (REILs) consist of a pair of synchronized flashing lights located on each side of the runway threshold.

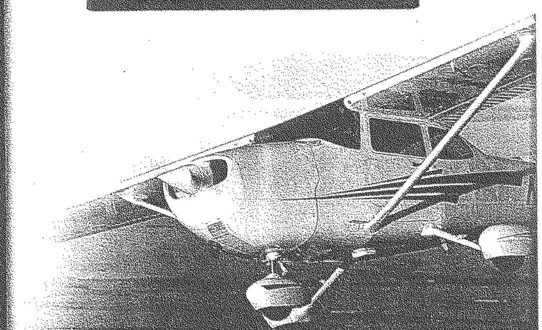
REIL

Runway edge lights are white and outline the edges of runways at night or in restricted-visibility conditions. On nstrument runways, yellow replaces white on the last 2,000 feet or half the runway length. The lights marking the ends of the runway are red for departing aircraft and green for landing aircraft.



Blue *taxiway edge lights* outline the taxiways. Green lights mark the taxiway centerline as well as taxi paths. Yellow *clearance bar lights* are installed at holding positions on taxiways and at the location of an intersecting taxiway. Flashing yellow *runway guard lights* are installed at taxiway/runway intersections. *Stop bar lights* consist of a row of red lights that extend across the taxiway at the runway holding position. Following the ATC clearance to proceed, the stop bar is turned off and the lead-on lights are turned on. **Pilots should never cross a red illuminated stop bar, even if an ATC clearance has been given to proceed.**

Note: Not all airports are equipped with taxiway centerline lights, yellow clearance bar lights, runway guard lights, or stop bar lights.



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Editors: David Wright, Brian D. Peterson
Statistician: Kristen Hummel
Consultants: Mark Twombly, Captain Jeff Jones

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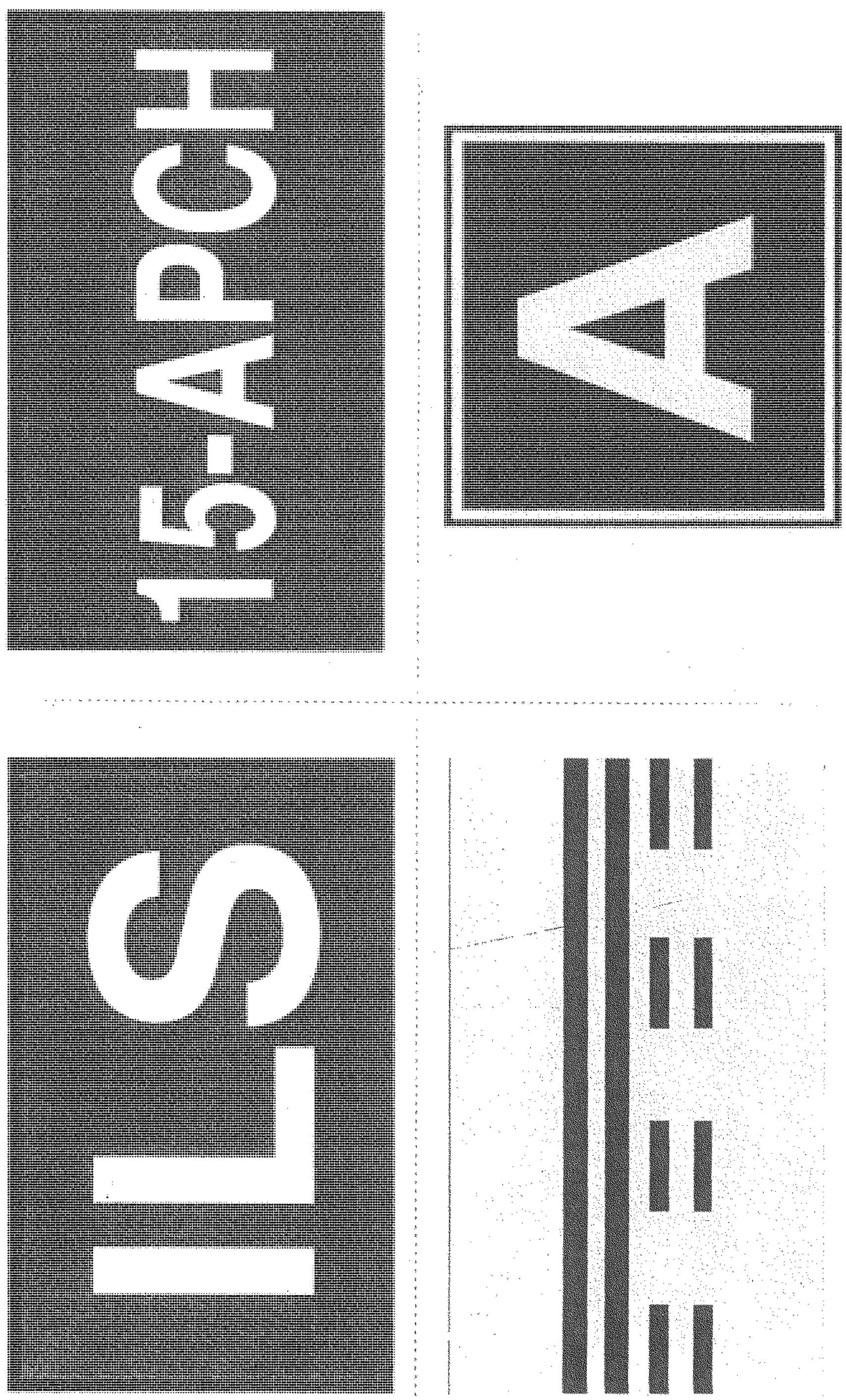
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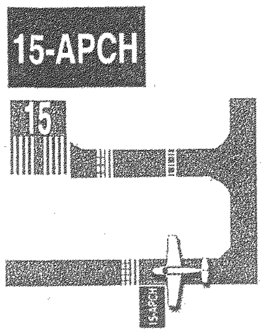
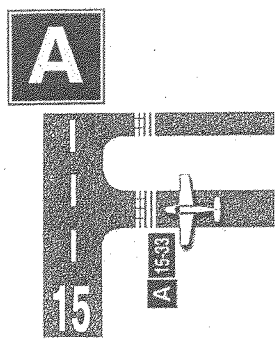


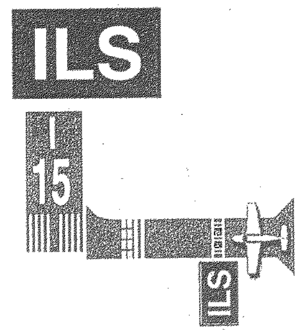
Runway Approach Area Holding Position Sign:
Taxiing past this sign may interfere with operations on the runway. (In this case, aircraft arriving to runway 15 or departing from runway 33.) It is located next to the yellow holding position markings painted on the taxiway pavement.

Ref. AIM Para. 2-3-8



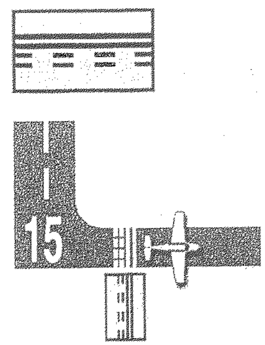
Taxiway Location Sign:
Indicates the taxiway you are on. (May be co-located with direction signs or runway holding position signs, as shown in graphic.)

Ref. AIM Para. 2-3-9



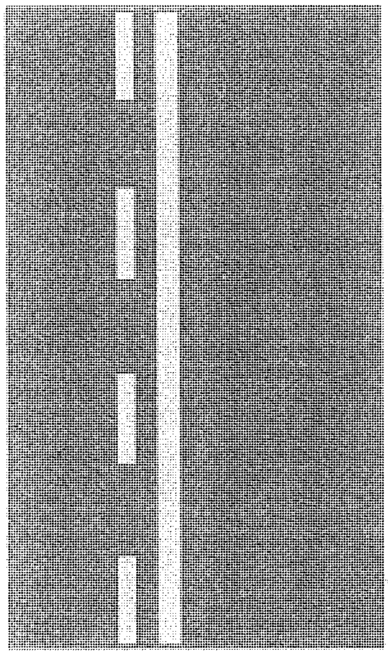
ILS Critical Area Holding Position Sign:
Hold at this sign on a taxiway when the ILS is in use *and* the weather is less than 800 feet and 2 miles. Aircraft taxiing beyond this point may interfere with the ILS signal to approaching aircraft.

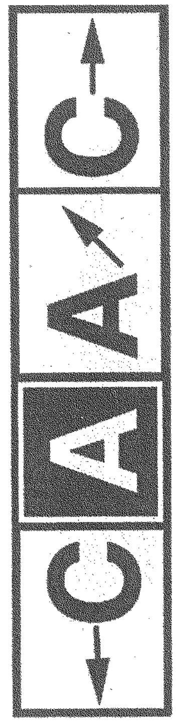
Ref. AIM Para. 2-3-8



Runway Boundary Sign:
This sign faces the runway and is visible to pilots exiting the runway. It is located next to the yellow holding position markings painted on the taxiway pavement. Taxi past this sign to be sure you are clear of the runway.

Ref. AIM Para. 2-3-9

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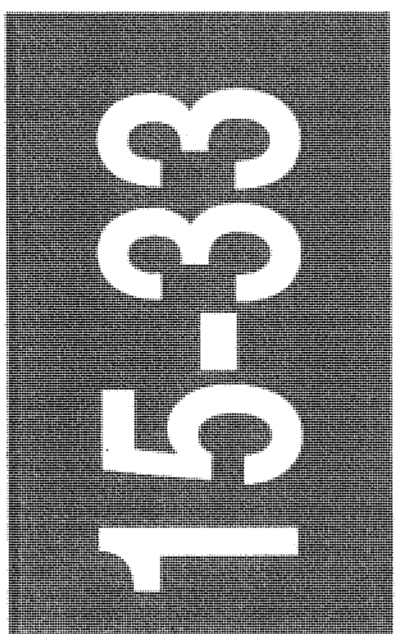
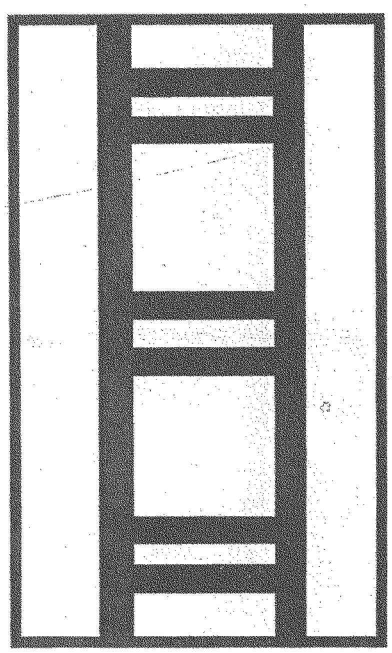
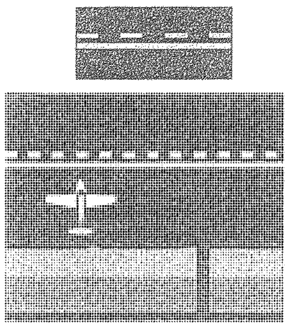
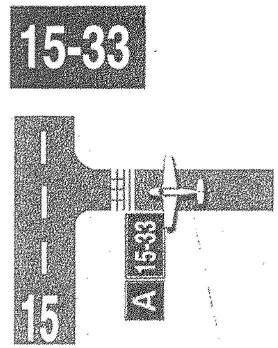

15-33





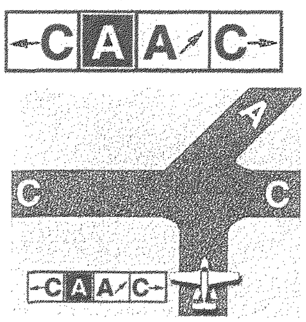
Non-Movement Boundary Area:
The solid side of the line indicates the non-movement area, which is not under ATC control, and the dashed side indicates the movement area, which is under ATC control. This marking can be seen at airports where hangar areas are located adjacent to a taxiway at a tower-controlled airport.

Ref. AC 150/5340-1J



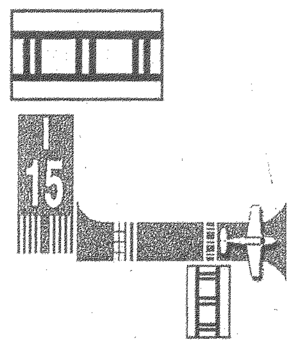
Runway Holding Position Sign:
Hold here. In this example, the threshold for runway 15 is to your left and the threshold for runway 33 is to your right. This sign is located next to the yellow holding position marking painted on taxiways.

Ref. AIM Para. 2-3-8



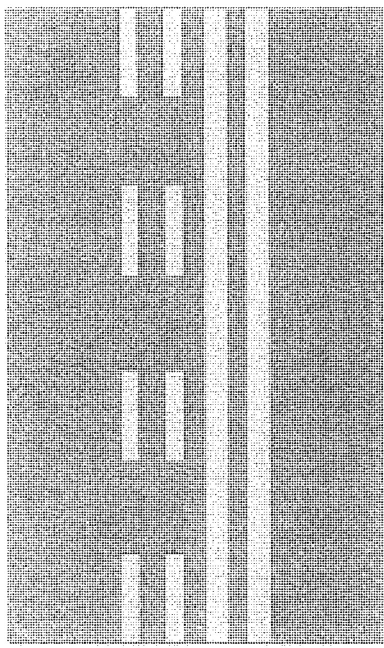
Taxiway Direction:
The yellow direction signs, usually seen next to a taxiway location sign, indicate the direction of intersecting taxiways. In this example, taxiway Charlie is to the left and right, and Alpha takes a turn to the right ahead.

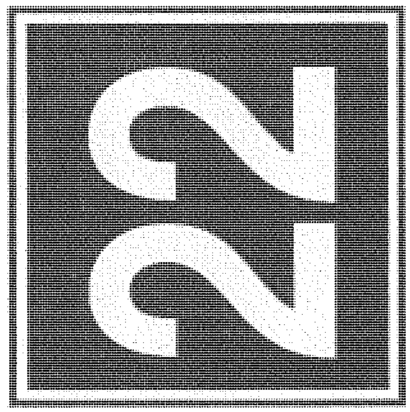
Ref. AIM Para. 2-3-9 and 2-3-10

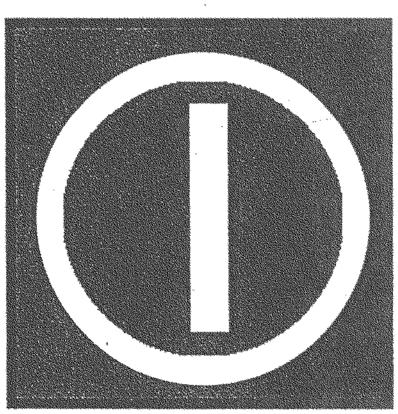


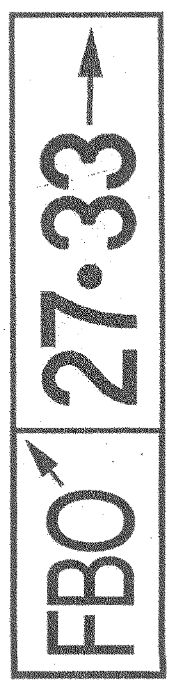
ILS Critical Area Boundary Sign:
Located next to the ILS holding position markings and is seen by pilots leaving the ILS critical area. When the ILS is in use *and* the weather is less than 800 feet and 2 miles, be sure your aircraft has passed beyond this sign before stopping on the taxiway.

Ref. AIM Para. 2-3-9




22

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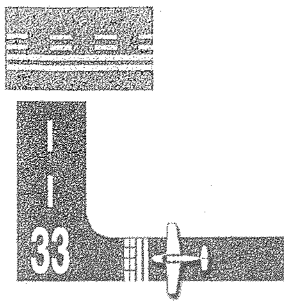
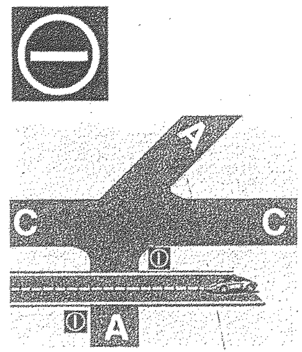


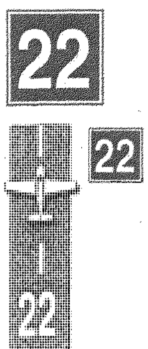
Runway Holding Position Markings:
This marking is found on taxiways at runway intersections and indicates where an aircraft is to stop. The solid lines are on the side where the aircraft is to hold and the dashed lines are on the side toward the runway. Do not cross this marking until cleared.

Ref. AIM Para. 2-3-5



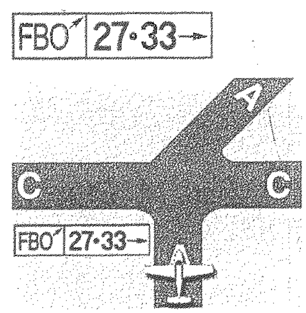
No Entry Sign:
Prohibits an aircraft from entering an area, such as a one-way taxiway or at the intersection of a road intended for vehicles.

Ref. AIM Para. 2-3-8



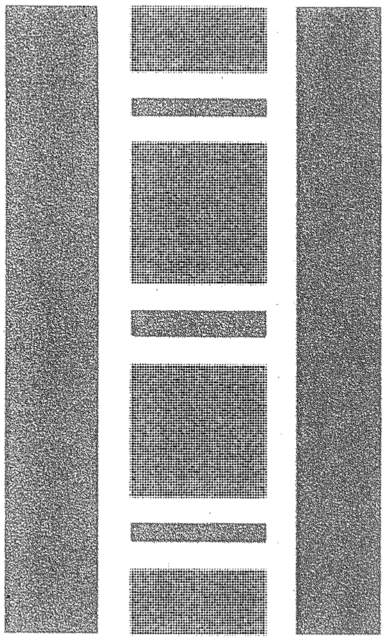
Runway Location Sign:
Identifies the runway on which your aircraft is located.

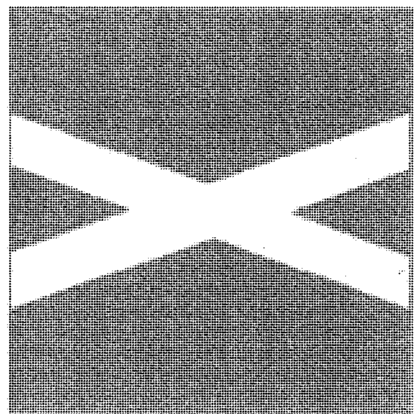
Ref. AIM Para. 2-3-9

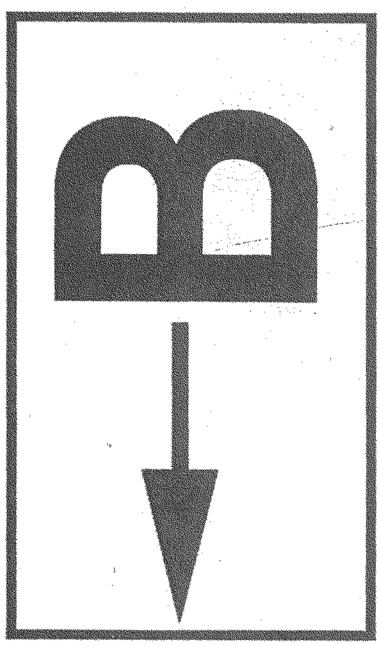


Destination Sign:
Indicates the direction of a taxi route to a runway(s) or other location. In this example, the FBO is ahead and to the right, and runways 27 and 33 are to the immediate right.

Ref. AIM Para. 2-3-11



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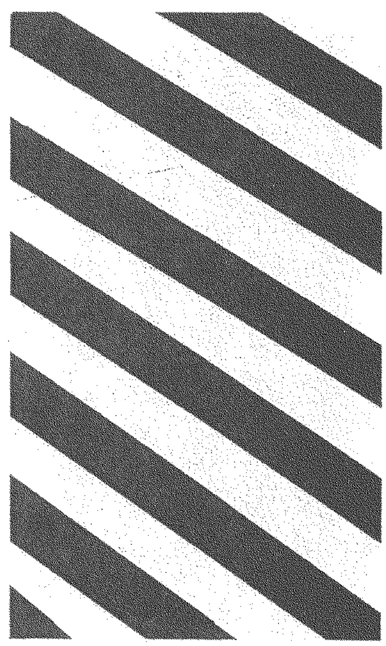
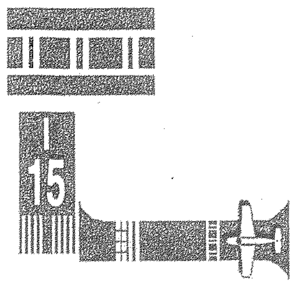
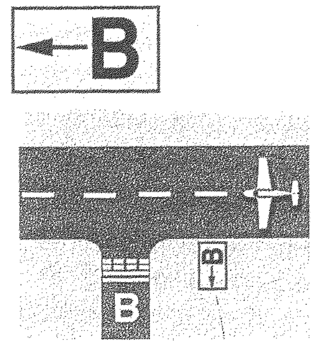




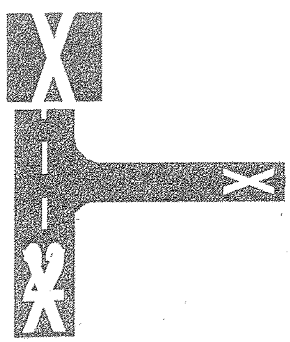
Holding Position Marking for ILS:
Indicates the boundary of the ILS critical area. Don't cross when the ILS is in use *and* the weather is less than 800 feet and 2 miles.

Ref. AIM Para. 2-3-5



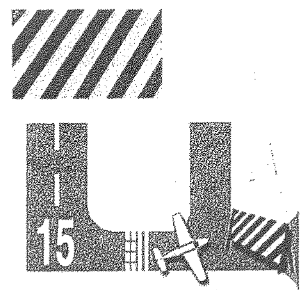
Direction Sign for Runway Exit:
Indicates an exit from a runway. Located just prior to the intersection on the same side of the runway as the exit.

Ref. AIM Para. 2-3-10



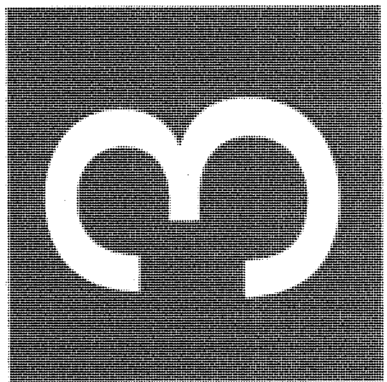
Closed Runway and Taxiway Marking:
Indicates a closed runway or taxiway. It will also be placed at each entrance of a permanently closed taxiway. A raised-lighted **X** may be used in lieu of a pavement marking.

Ref. AC 150/5340-1J



Taxiway Ending Marker:
Indicates the taxiway does not continue. Located on the far side of the intersection.

Ref. AC 150/5340-18C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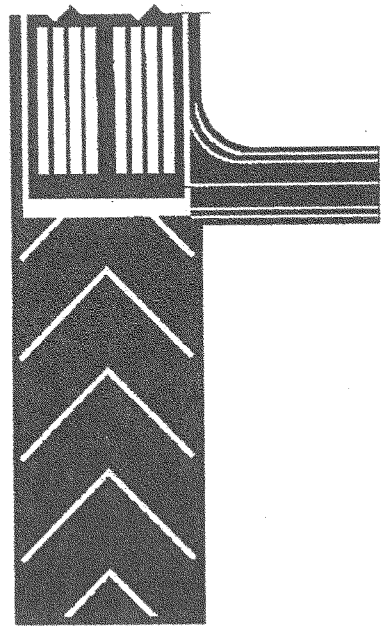
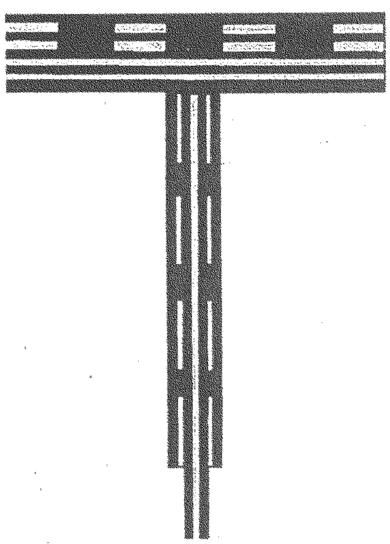
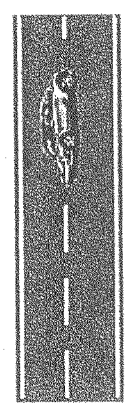
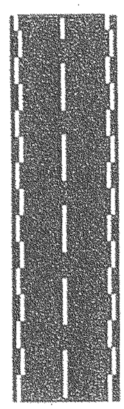
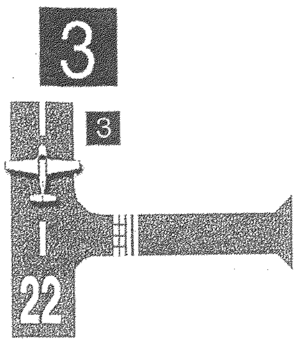




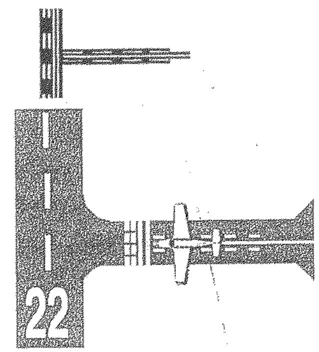






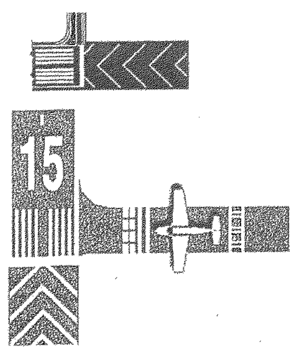
Runway Distance Remaining Sign:
Indicates the distance of runway remaining in thousands of feet. In this example, 3,000 feet remain on the landing runway.

Ref. AIM Para. 2-3-13



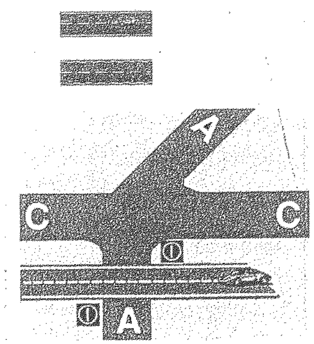
Enhanced Taxiway Centerline Markings:
Used mostly at larger airports, these markings indicate that the aircraft is approaching a runway. One hundred fifty feet prior to a runway holding position marking, the taxiway centerline will be "enhanced" to include an additional set of yellow dashed lines.

Ref. AIM Para. 2-3-4



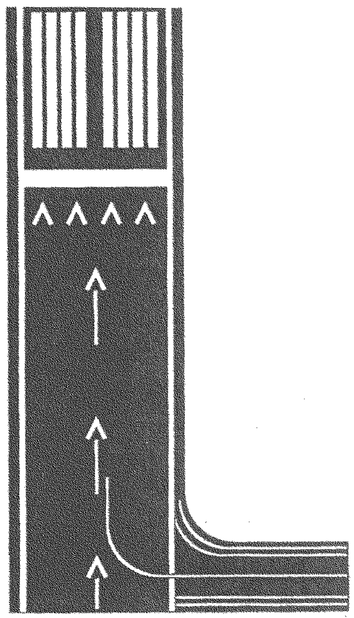
Chevron Markings:
Indicates areas of pavement aligned with the runway that are unusable for taxi, takeoff, or landing. Chevrons cover blast pads or stopways, which are constructed to protect areas from erosion caused by jet blasts (blast pad) and to provide extra stopping distance for aircraft (stopways).

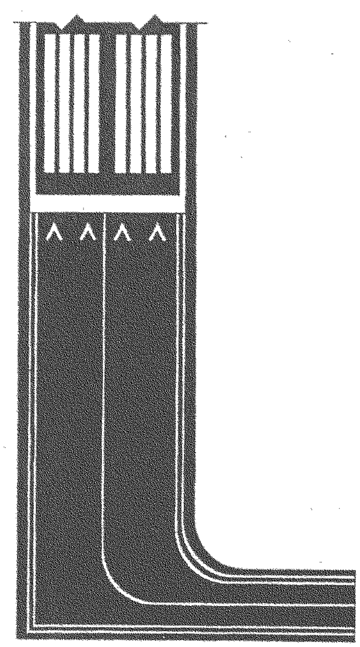
Ref. AIM Para. 2-3-3

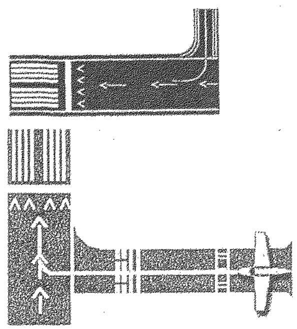


Vehicle Roadway Markings:
Used to define a vehicle pathway (non-aircraft) that is on, or crossing, an area also used by aircraft. The outer boundaries will consist of either a single solid white line or white "zippered" lines.

Ref. AIM Para. 2-3-6

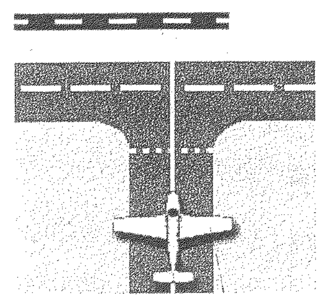






Displaced Threshold:
Indicates the beginning of the available landing runway. The area before the displaced threshold is available for takeoffs (in either direction) and landings (from the opposite direction).

Ref. AIM Para. 2-3-3



Holding Position Markings for Taxiway/Taxiway Intersections:
Indicates an area where aircraft can be held short of a taxiway intersection. If instructed by Air Traffic Control to hold short of a taxiway, the pilot must stop the aircraft before it crosses the taxiway holding lines.

Ref. AIM Para. 2-3-5

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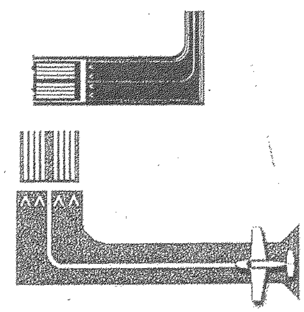


Relocation of a Threshold:
Indicates that the runway threshold has been relocated. Possible causes for threshold relocation include construction or other airport maintenance.

Ref. AIM Para. 2-3-3

United States Government Accountability Office

GAO

Testimony
Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

For Release on Delivery
Expected at 2:00 p.m. EST
Wednesday, February 13, 2008

RUNWAY SAFETY

Progress on Reducing Runway Incursions Impeded by Leadership, Technology, and Other Challenges

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

GAO
Accountability * Integrity * Reliability

GAO-08-481T

GAO

Highlights

Why GAO Did This Study

What GAO Recommends

February 13, 2008

RUNWAY SAFETY

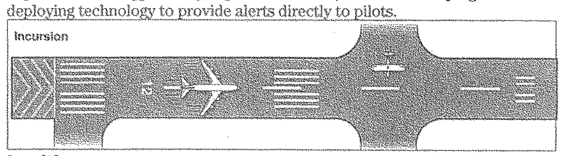
Progress on Reducing Runway Incursions Impeded by Leadership, Technology, and Other Challenges

What GAO Found

Recent data indicate that runway incursions, which are precursors to aviation accidents, are growing. Although the number and rate of incursions declined after reaching a peak in fiscal year 2001 and remained relatively constant for the next 5 years, they show a recent upward trend. From fiscal year 2006 through fiscal year 2007, the number and rate of incursions increased by 12 percent and both were nearly as high as their 2001 peak. Furthermore, the number of serious incursions—where collisions are narrowly or barely avoided—increased from 2 during the first quarter of fiscal year 2007 to 10 during the same quarter in fiscal year 2008.

FAA has taken steps to address runway safety, but further progress has been impeded by the lack of leadership and coordination, technology challenges, lack of data, and human factors-related issues. FAA's actions have included deploying and testing technology designed to prevent runway collisions and promoting changes in airport layout, markings, signage, and lighting. However, until recently, FAA's Office of Runway Safety did not have a permanent director. Also, FAA has not updated its national runway safety plan since 2002, despite agency policy that such a plan be prepared every 2 to 3 years, resulting in uncoordinated efforts within the agency. Moreover, runway safety technology currently being installed, which is designed to provide air traffic controllers with the position and identification of aircraft on the ground and alerts of potential collisions, is behind schedule and experiencing cost increases and operational difficulties with its alerting function. FAA also lacks reliable runway safety data and the mechanisms to ensure that the data are complete. Furthermore, air traffic controller fatigue, which may result from regularly working overtime, continues to be a matter of concern for the National Transportation Safety Board (NTSB) and others.

FAA could take additional measures to improve runway safety. These measures include implementing GAO's recommendations to prepare a new national runway safety plan, address controller overtime and fatigue, and start a nonpunitive, confidential, voluntary program for air traffic controllers to report safety risks in the national airspace system, which would be similar to a program that FAA has already established for pilots and others in the aviation community. Such a program could help the agency to understand the causes and circumstances regarding runway safety incidents. Additional improvements, suggested by experts and NTSB, include developing and deploying technology to provide alerts directly to pilots.



Source: GAO.

Mr. Chairman and Members of the Subcommittee:

Thank you for the opportunity to testify today on runway safety. While aviation accidents in the United States are relatively infrequent, recent incidents have heightened concerns about safety on airport runways. On August 16, 2007, for example, at Los Angeles International Airport—one of the nation's busiest airports—two commercial aircraft carrying 296 people came within 37 feet of colliding, resulting in an incident that is called a runway incursion. As the nation's aviation system becomes more crowded every day, increased congestion at airports may exacerbate ground safety concerns. At airports, the Federal Aviation Administration (FAA) focuses its safety oversight on the movement areas—runways and taxiways[1]—where the chances of catastrophic accidents are greater than other areas.

My testimony today is focused on (1) the trends in runway incursions, (2) what steps FAA has taken to improve runway safety, and (3) what more could be done. This statement is based on our November 2007 report on runway safety[2] and work that we conducted between January 2008 and February 2008 to obtain updated information on recent incursions and actions taken by FAA since our report was issued. Our work on the November 2007 report included surveying experts on the causes of runway incidents and accidents, the effectiveness of measures that are being taken to address them, and what additional measures could be taken. We conducted this work in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives.

Summary

- Recent data indicate that runway incursions, which are precursors to aviation accidents, are growing. Although the number and rate of incursions declined after reaching a peak in fiscal year 2001 and remained relatively constant for the next 5 years, they show a recent upward trend. From fiscal years 2006 through 2007, the number and rate of incursions increased by 12 percent and were nearly as high as when they reached

[1]Taxiways are routes that aircraft follow to and from runways.

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

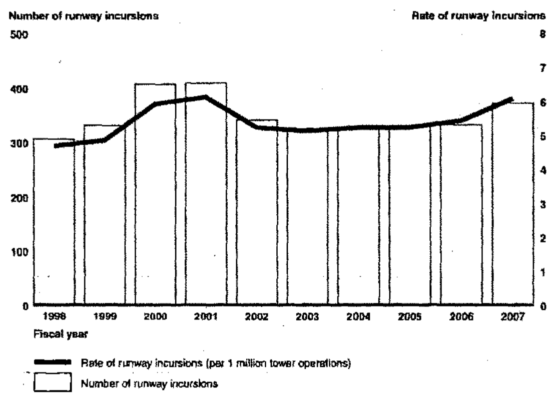
their 2001 peak. Furthermore, the number of serious incursions—where collisions were narrowly or barely avoided—increased substantially during the first quarter of fiscal year 2008, compared to the same quarter in fiscal year 2007.

- FAA has taken steps to address runway safety, but the lack of leadership and coordination, technology challenges, lack of data, and human factors-related issues impede further progress. To improve runway safety, FAA has deployed and tested technology designed to prevent runway collisions; promoted changes in airport layout, markings, signage, and lighting; and provided training for pilots and air traffic controllers. However, until recently, FAA's Office of Runway Safety did not have a permanent director. Also, FAA has not updated its national runway safety plan since 2002, despite agency policy that such a plan be prepared every 2 to 3 years, which resulted in uncoordinated runway safety efforts by individual FAA offices. Moreover, the runway safety technology that FAA is currently installing, which is designed to provide air traffic controllers with the position and identification of aircraft on the ground and alerts of potential collisions, is behind schedule and experiencing cost increases and having operational difficulties with its alerting function. Additional technology to prevent runway incursions is years away from deployment. FAA also lacks reliable runway safety data and the mechanisms to ensure that the data are complete. Furthermore, air traffic controller fatigue, a human factors issue that may result from regularly working overtime, continues to be a matter of concern for the National Transportation Safety Board (NTSB) and other aviation stakeholders.
- FAA could take additional measures to improve runway safety. In our November 2007 report, we recommended that FAA prepare a new national runway safety plan; address controller overtime and fatigue; and start a nonpunitive, confidential, voluntary program for air traffic controllers to report safety risks in the national airspace system, similar to a program that FAA has already established for pilots and others in the aviation community. Such a program could help the agency to understand the causes and circumstances regarding runway safety incidents. The agency agreed to consider our recommendations. Additional improvements, suggested by experts we surveyed and NTSB, include developing and deploying technology that provided alerts of potential incursions directly to pilots.

Number and Rate of Incursions Show Upward Trend

Runway safety is a longstanding major aviation safety concern; prevention of runway incursions, which are precursors to aviation accidents, has been on NTSB's list of most wanted transportation improvements since 1990 because runway collisions can be catastrophic. Recent data indicate that runway incursions are growing and may become even more numerous as the volume of air traffic increases. The number and rate of incursions declined from a peak in fiscal year 2001 and remained relatively constant for the next 5 years. However, from fiscal years 2006 through 2007, the number and rate of incursions increased by 12 percent and nearly regained the 2001 peak (see fig. 1).

Figure 1: Number and Rate of Runway Incursions from Fiscal Year 1998 through Fiscal Year 2007



Source: FAA.

Note: Table 1 in the appendix shows data for fig. 1.

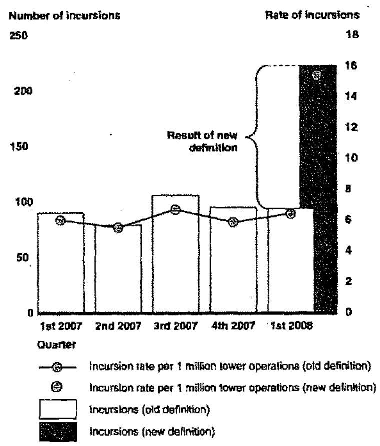
Additionally, data for the first quarter of fiscal year 2008 show that the number of incursions increased substantially after FAA began using a definition of incursions developed by the International Civil Aviation

Organization (ICAO), a United Nations specialized agency.[3] Using the ICAO definition, FAA is now counting some incidents as incursions that had been formerly classified as surface incidents.[4] During the first quarter of fiscal year 2008, using the ICAO definition, FAA counted 230 incursions. If FAA had continued to use its previous definition, it would have counted 94 incursions. According to an FAA official, by adopting the ICAO definition, FAA expects to report about 900 to 1,000 incursions this year. Fig. 2 shows the number and rate of incursions, by quarter, during fiscal year 2007 and during the first quarter of fiscal year 2008.

[3]ICAO's definition of an incursion is any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing or take-off of aircraft. Through September 2007, FAA defined a runway incursion as "any occurrence in the runway environment involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of required separation when an aircraft is taking off, intending to take off, landing, or intending to land."

[4]Runway incidents that were classified as surface incidents can be serious, including an August 2006 crash of a Comair regional jet in Lexington, KY. That aircraft crashed after taking off on a runway that was too short for the aircraft, killing all but one of the 50 people aboard. FAA had defined a surface incident as any event where unauthorized or unapproved movement occurs within a movement area associated with the operation of an aircraft that affects or could affect the safety of flight.

Figure 2: Incursions, by Quarter, during Fiscal Year 2007 and the First Quarter of Fiscal Year 2008



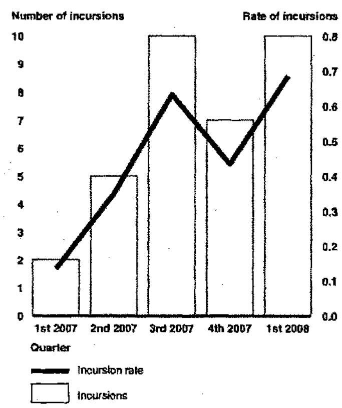
Source: FAA.

Note: Table 2 in the appendix provides the data for fig. 2.

Moreover, the number and rate of serious incursions—where collisions were narrowly or barely avoided—increased substantially during the first quarter of fiscal year 2008, compared to the same quarter in fiscal year 2007.[5] During the first quarter of fiscal year 2008, 10 serious incursions occurred, compared to 2 serious incursions during the first quarter of fiscal year 2007. (See fig. 3.)

[5]FAA classifies the severity of runway incursions into four categories. FAA defines category A as separation decreases and participants take extreme action to narrowly avoid a collision, or the event results in a collision; category B, separation decreases and there is a significant potential for a collision; category C, separation decreases but there is ample time and distance to avoid a potential collision; and category D, there is little or no chance of collision. Category A and B incursions are considered serious.

Figure 3: Serious Incursions, by Quarter, during Fiscal Year 2007 and the First Quarter of Fiscal Year 2008

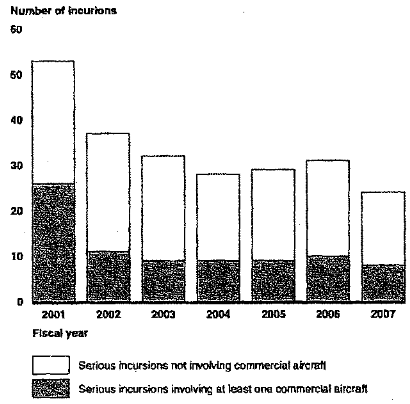


Source: FAA.

Note: FAA's adoption of the ICAO definition of incursions during the first quarter of fiscal year 2008 did not affect the number or rate of serious incursions. Table 2 in the appendix provides data for fig. 3.

Most runway incursions involve general aviation aircraft. According to FAA, 72 percent of incursions from fiscal years 2003 through 2006 involved at least one general aviation aircraft. However, about one-third of the most serious incursions from fiscal years 2002 through 2007—about 9 per year—involved at least one commercial aircraft that can carry many passengers. That number includes two serious incursions that occurred just two months ago, in December 2007. (See table 3 in the appendix for additional information on recent serious incursions.) Figure 4 shows the number of serious incursions involving commercial aircraft from fiscal years 2001 through 2007.

Figure 4: Total Number of Serious Incursions and Number of Serious Incursions Involving At Least One Commercial Aircraft, Fiscal Year 2001 through Fiscal Year 2007

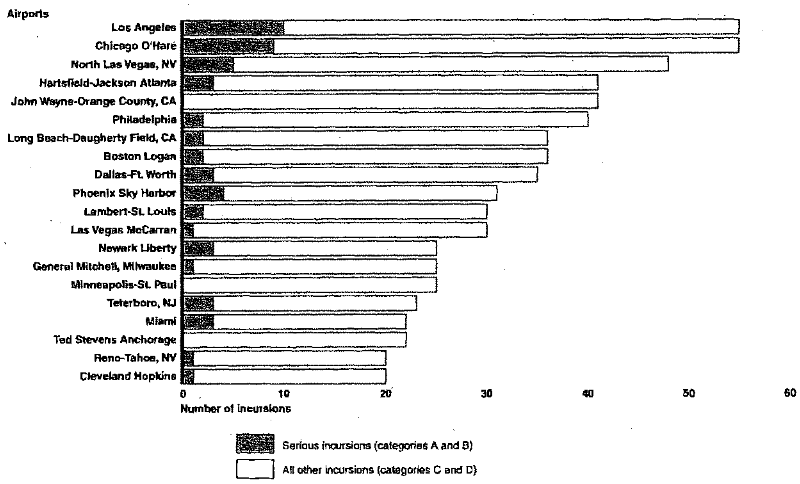


Source: FAA.

Note: Table 4 in the appendix provides the data for fig. 4.

In the United States, most incursions have occurred at major commercial airports, where the volume of traffic is greater. Los Angeles International Airport and Chicago O'Hare International Airport had the greatest number of runway incursions from fiscal years 2001 through 2007, as shown in fig. 5.

Figure 5: U.S. Airports that Experienced the Most Runway Incursions from Fiscal Year 2001 through Fiscal Year 2007

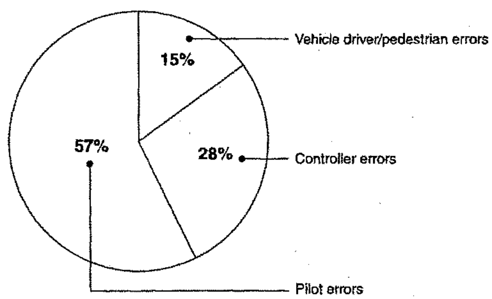


Source: GAO analysis of FAA data.

Note: Information was compiled from a list of airports that experienced 20 or more incursions from fiscal year 2001 through fiscal year 2007 and were certificated under 14 CFR Part 139. This information expands upon the information we presented in GAO-08-29 (fig. 4), which only included the top 10 airports experiencing incursions from fiscal years 2001 to 2006. In addition, we now include three airports—Long Beach-Daugherty Field, John Wayne-Orange County, and North Las Vegas—which were previously identified as general aviation airports. Table 5 in the appendix provides the data for fig. 5.

The primary causes of incursions, as cited by experts we surveyed and some airport officials, include human factors issues, such as miscommunication between air traffic controllers and pilots, a lack of situational awareness on the airfield by pilots, and performance and judgment errors by air traffic controllers and pilots. According to FAA, 57 percent of incursions during fiscal year 2007 were caused by pilot errors, 28 percent were caused by air traffic controller errors, and 15 percent were caused by vehicle operator or pedestrian errors (see fig. 6).

Figure 6: Causes of Incursions during Fiscal Year 2007



Source: FAA.

Challenges Remain Despite Numerous Efforts to Address Runway Safety

FAA, airports, and airlines have taken steps to address runway safety, but the lack of leadership and coordination, technology challenges, lack of data, and human factors-related issues impede further progress. To improve runway safety, FAA has deployed and tested technology designed to prevent runway collisions; promoted changes in airport layout, markings, signage, and lighting; and provided training for pilots and air traffic controllers. In addition, in August 2007, following several serious incursions, FAA met with aviation community stakeholders and agreed on a short-term plan to improve runway safety. In January 2008, FAA reported on the status of those actions, which included

- accelerating the upgrading of airport markings, which were originally required to be completed by June 30, 2008, at medium and large airports,
- upgrading markings at smaller commercial airports, which had not been required,
- completing a runway safety review of 20 airports that were selected on the basis of runway incident data, and
- requiring that nonairport employees, such as airline mechanics, receive recurrent driver training at 385 airports.

According to FAA, since the August 2007 meeting, all 112 active air carriers have reported that they are (1) providing pilots with similar or other training that incorporates scenarios from aircraft pushback through taxi, and (2) reviewing procedures to identify and develop a plan to address elements that contribute to pilot distraction while taxiing. FAA also indicated that it had completed an analysis of air traffic control procedures pertaining to taxi clearances and found that more explicit taxi instructions are needed, and that it had signed a partnership agreement with the National Air Traffic Controllers Association to create a voluntary safety reporting system for air traffic controllers.

In our November 2007 report, we found that FAA's Office of Runway Safety had not carried out its leadership role to coordinate and monitor the agency's runway safety efforts. Until recently, the office did not have a permanent director for the previous 2 years and staffing levels declined. FAA took a positive step by hiring a permanent director at the Senior Executive Service level for the office in August 2007. The new director has indicated he is considering several initiatives, including establishing a joint FAA-industry working group to analyze the causes of incursions and track runway safety improvements. In our November 2007 report, we also found that FAA had not updated its national runway safety plan since 2002, despite agency policy that such a plan be prepared every 2 to 3 years. The lack of an updated plan resulted in uncoordinated runway safety efforts by individual FAA offices. For example, in the absence of an updated national runway plan, each FAA office is expected to separately include its runway safety initiatives in its own business plan. However, this practice does not provide the same national focus and emphasis on runway safety that a national plan provides. Furthermore, not all offices with runway safety responsibilities included efforts to reduce incursions in their business plans. Until the national runway safety plan is updated, the agency lacks a comprehensive, coordinated strategy to provide a sustained level of attention to improving runway safety.

The deployment of surface surveillance technology to airports is a major part of FAA's strategy to improve runway safety, but it has presented challenges. To provide ground surveillance, FAA has deployed the Airport Movement Area Safety System (AMASS), which uses the Airport Surface Detection Equipment-3 (ASDE-3) radar,[6] at 34 of the nation's busiest airports and is deploying an updated system, ASDE-X, at 35 major airports. The current deployment schedule will result in a total of 44 airports having AMASS and/or ASDE-X (see table 5 in the appendix). Both systems are

[6]AMASS is essentially the safety logic, which is designed to detect potential collisions, for ASDE-3. This combined technology is usually referred to as ASDE-3/AMASS.

designed to provide controllers with alerts when they detect a possible collision on the ground. As of January 2008, ASDE-X was commissioned[7] at 11 of the 35 airports scheduled to receive it. FAA is also testing runway status lights, which are a series of lights embedded in the runways that give pilots a visible warning when runways are not clear to enter, cross, or depart on, at the Dallas-Ft. Worth International Airport and the San Diego International Airport. The agency made an initial investment decision last year to deploy the system at 19 airports, starting in November 2009, and is planning to make a final investment decision in June 2008. In addition, FAA is testing the Final Approach Runway Occupancy Signal at the Long Beach-Daugherty Field airport in California, which activates a flashing light visible to aircraft on approach as a warning to pilots when a runway is occupied and hazardous for landing.

However, FAA risks not meeting its current ASDE-X cost and schedule plans, which have been revised twice since 2001, and the system is experiencing operational difficulties with its alerting function. Although it took about 4 years for ASDE-X to be commissioned at 11 airports, FAA plans to deploy the system at the remaining 24 additional airports by 2010.[8] In addition, not all 11 ASDE-X airports have key safety features of the system. For example, as of January 2008, two ASDE-X airports did not have safety logic, which generates a visible and audible alert to an air traffic controller regarding a potential runway collision. Furthermore, the ASDE-X airports are experiencing problems with false alerts, which occur when the system incorrectly predicts an impending collision, and false targets, which occur when the system incorrectly identifies something on the airfield as an aircraft or vehicle and could generate a false alert. Moreover, most airports in the United States have no runway safety technology to supplement a controller's vision of the airfield and will not have such technology even after FAA completes its plan to deploy ASDE-X at 35 major airports. While FAA is testing additional technology to prevent runway collisions, such as the Final Approach Runway Occupancy Signal, the systems are years away from deployment. Another technology, runway status lights, have had positive preliminary test evaluations, but need a surface surveillance system such as ASDE-3/AMASS or ASDE-X to

[7]FAA refers to ASDE-X as being commissioned after the system has been tested at an airport and demonstrated that the field site personnel can fully operate and maintain it.

[8]According to FAA, the agency's ability to meet its accelerated ASDE-X deployment schedule depends on several factors such as the availability of funding and the cooperation of external organizations.

operate. In addition, FAA is still testing a low cost surface surveillance system that already is being used at 44 airports outside of the United States. Furthermore, systems that provide direct collision warnings to flight crews, which NTSB and experts have recommended, are still being developed.

FAA lacks reliable runway safety data and the mechanisms to ensure that the data are complete. Although FAA collects information about runway incursions and classifies their severity, its tabulation of the number of incursions does not reflect the actual number of incidents that occur. FAA only counts incursions that occur at airports with air traffic control towers, so the actual number of incursions, which includes those that occurred at airports without air traffic control towers, is higher than FAA reports. While the change in definition of incursions that FAA adopted at the beginning of fiscal year 2008 will increase the number of incursions counted, it will not address this problem. In addition, an internal agency audit of 2006 incursion data questioned the accuracy of some of the incursion severity classifications. FAA plans to start a nonpunitive, confidential, voluntary program for air traffic controllers similar to a program that FAA has already established for pilots and others in the aviation community. The new program will enable air traffic controllers to report anything that they perceive could contribute to safety risks in the national airspace system. The benefit of such program is that the information obtained might not be reported otherwise, and could increase the amount of data collected on the causes and circumstances of runway incursions. However, FAA has not indicated when such a program would be implemented.

FAA has also taken some steps to address human factors issues through educational initiatives, such as developing simulated recreations of actual incursions to enhance air traffic controller training. However, air traffic controller fatigue, which may result from regularly working overtime, continues to be a human factors issue affecting runway safety. NTSB, which investigates transportation accidents, has identified four instances from 2001 through 2006 when tired controllers made errors that resulted in serious incursions. We found that, as of May 2007, at least 20 percent of the controllers at 25 air traffic control facilities, including towers at several of the country's busiest airports, were regularly working 6-day weeks. (See table 7 in the appendix for additional information.)

Experts we surveyed indicated that the actions that FAA could take with the greatest potential to prevent runway incursions, considering costs, technological feasibility, and operational changes, were measures to provide information or alerts directly to pilots. Experts believed that lighting systems that guide pilots as they taxi at the airport, and technology that provides enhanced situational awareness on the airfield and alerts of potential incursions, would be of particular importance.

Recommendations

In our November 2007 report, we recommended that FAA (1) prepare a new national runway safety plan, (2) develop an implementation schedule for establishing a nonpunitive voluntary safety reporting program for air traffic controllers, and (3) develop a mitigation plan for addressing controller overtime. The agency agreed to consider our recommendations.

In closing, although FAA has taken many actions to improve runway safety, the number of serious incursions that are continuing to occur—many of which involved aircraft carrying hundreds of passengers—suggests that this country continues to face a high risk of a catastrophic runway collision. FAA must provide sustained attention to improving runway safety through leadership, technology, and other means. As the volume of air traffic continues to increase, providing sustained attention to runway safety will become even more critical.

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

GAO Contact and Staff Acknowledgments

For further information on this testimony, please contact Dr. Gerald L. Dillingham at (202) 512-2834 or dillinghamg@gao.gov. Individuals making key contributions to this testimony include Teresa Spisak, Bob Homan, and David Goldstein.

Appendix: Additional Runway Incident Data

Table 1: Number and Rate of Runway Incursions from Fiscal Year 1998 through Fiscal Year 2007

Fiscal year	Number of incursions	Rate per 1 million tower operations
1998	304	4.66
1999	329	4.83
2000	405	5.9
2001	407	6.1
2002	339	5.2
2003	323	5.1
2004	326	5.2
2005	327	5.2
2006	330	5.4
2007	370	6.05

Source: FAA.

Table 2: Number and Rate of Incursions, by Quarter, during Fiscal Year 2007 and the First Quarter of Fiscal Year 2008

Quarter and fiscal year	Number of incursions	Incursion rate per 1 million tower operations	Number of serious incursions	Rate of serious incursions per 1 million tower operations
First quarter 2007	90	6.03	2	0.134
Second quarter 2007	79	5.533	5	0.3502
Third quarter 2007	106	6.709	10	0.6329
Fourth quarter 2007	95	5.891	7	0.4341
First quarter 2008, using previous FAA incursion definition	94	6.434	10	0.685
First quarter 2008, using ICAO incursion definition	230	15.744	10	0.685

Source: FAA.

Table 3: Serious Incursions Involving At Least One Commercial Aircraft from Fiscal Year 2006 through the First Quarter of Fiscal Year 2008.

Date	Location	Airline(s) and aircraft involved	Number of air passengers
October 13, 2005	Gulfport-Biloxi International, MS	Northwest Airlines DC9 and Cessna C172	N/A
March 21, 2006	Chicago O'Hare International	Lufthansa Airbus A319 and Chautauqua Embraer E145	78
April 29, 2006	Phoenix Sky Harbor International	US Airways Airbus A320 and pedestrian	N/A
May 25, 2006	Miami International	Boeing 747 and American Eagle Aerospatiale AT43	N/A
July 18, 2006	Chicago O'Hare International	American Eagle Canadair CRJ-700 and US Airways Boeing 737	N/A
July 23, 2006	Chicago O'Hare International	ATLAS Boeing 747 and United Airlines Boeing 737	131
July 26, 2006	Los Angeles International	Mesa Canadair CRJ-200 and Skywest Embraer E120	N/A
August 8, 2006	Southwest Florida International, Ft. Myers, FL	Southwest Boeing 737 and vehicle	N/A
September 30, 2006	Los Angeles International	Gulfstream GLF5 and Skywest Canadair CRJ-700	N/A
January 5, 2007	Denver International	Key Lime Air Swearingen SW4 and Frontier Airbus A319	50
February 2, 2007	Denver International	United Boeing 737 and snowplow	101
May 4, 2007	Cyril E. King Airport, Charlotte Amalie, VI	American Airlines Boeing 757 and Cessna C208	N/A
May 6, 2007	Los Angeles International	Skywest Embraer 120 and Virgin Air Airbus A340	N/A
May 26, 2007	San Francisco International	Republic Airlines Embraer 170 and Skywest Airlines Embraer 120	27
July 11, 2007	Fort Lauderdale-Hollywood International, FL	Delta Air Lines Boeing 757 and United Airlines Airbus A320	172
July 19, 2007	Chicago O'Hare International	United Airlines Boeing 737 and US Airways Boeing 737	N/A
August 16, 2007	Los Angeles International	WestJet Boeing 737 and Northwest Airlines Airbus A320	296
December 2, 2007	Baltimore-Washington International	US Airways/America West Airbus A320 and Comair Canadair CRJ-100	N/A
December 6, 2007	Newark Liberty International	Continental Airlines Boeing 737 and Continental Express Embraer E145	N/A

Source: GAO analysis of FAA and NTSB data.

Note: N/A indicates that the information was not contained in the National Transportation Safety Board (NTSB) incident reports.

Table 4: Total Number of Incursions and Number of Serious Incursions Involving at Least One Commercial Aircraft, Fiscal Year 2001 through Fiscal Year 2007

Fiscal year	Serious incursions	Serious incursions involving at least one commercial aircraft
2001	53	26
2002	37	11
2003	32	9
2004	28	9
2005	29	9
2006	31	10
2007	24	8

Source: FAA.

Table 5: U.S. Airports that Experienced the Most Runway Incursions from Fiscal Year 2001 through Fiscal Year 2007

Airport	Number of serious incursions	Number of total incursions
Los Angeles International	10	55
Chicago O'Hare International	9	55
North Las Vegas, Las Vegas, NV	5	48
Hartsfield-Jackson Atlanta International	3	41
John Wayne-Orange County, Santa Ana, CA	0	41
Philadelphia International	2	40
Long Beach-Daugherty Field, CA	2	36
Boston Logan International	2	36
Dallas-Ft. Worth International	3	35
Phoenix Sky Harbor International	4	31
Lambert-St. Louis International	2	30
Las Vegas McCarran International	1	30
Newark Liberty International	3	25
General Mitchell International, Milwaukee, WI	1	25
Minneapolis-St. Paul International	0	25
Teterboro, NJ	3	23
Miami International	3	22
Ted Stevens Anchorage International	0	22
Reno-Tahoe International, NV	1	20
Cleveland Hopkins International	1	20

Source: FAA.

Note: Information was compiled from a list of airports that experienced 20 or more incursions from fiscal year 2001 through fiscal year 2007 and were certificated under 14 CFR Part 139. This information expands upon the information we presented in GAO-08-29 (fig. 4), which only included the top 10 airports experiencing incursions from 2001-2006. In addition, we now include three airports—Long Beach-Daugherty Field, John Wayne-Orange County, and North Las Vegas—which were previously identified as general aviation airports.

Table 6: Airports with Airport Surface Detection Equipment Model 3 (ASDE-3)/Airport Movement Area Safety Systems (AMASS) or the Airport Surface Detection Equipment, Model X (ASDE-X) or Scheduled to Receive ASDE-X

Airport	ASDE-3/AMASS	ASDE-X commissioned	Scheduled ASDE-X deployment[a]
Baltimore Washington International	✓		April 2010
Boston Logan International	✓		July 2009
Bradley International, Windsor Locks, CT		✓	
Camp Springs Andrews Air Force Base	✓		
Charlotte Douglas International		✓	
Chicago Midway			June 2010
Chicago O'Hare International		✓	
Cleveland Hopkins International	✓		
Covington/Cincinnati Northern Kentucky International	✓		
Dallas-Ft. Worth International	✓		April 2010
Denver International	✓		November 2009
Detroit Metro Wayne County	✓		June 2008
Ft. Lauderdale-Hollywood International, FL			April 2009
General Mitchell International, Milwaukee, WI		✓	
George Bush Intercontinental, Houston, TX	✓		November 2009
Hartsfield-Jackson Atlanta International		✓	
Honolulu International-Hickam Air Force Base			May 2010
John F. Kennedy International, New York, NY	✓		August 2008
John Wayne-Orange County, Santa Ana, CA			February 2010
Kansas City International	✓		
Lambert-St. Louis International		✓	
Las Vegas McCarran International	✓		December 2009
Los Angeles International	✓		June 2009
Louis Armstrong New Orleans International	✓		
Louisville International-Standiford Field		✓	
Memphis International	✓		April 2011
Miami International	✓		March 2010
Minneapolis-St. Paul International	✓		March 2010

Airport	ASDE-3/AMASS	ASDE-X commissioned	Scheduled ASDE-X deployment[a]
New York LaGuardia	✓		December 2010
Newark Liberty International	✓		July 2009
Orlando International		✓	
Philadelphia International	✓		December 2009
Phoenix Sky Harbor International			December 2008
Pittsburgh International	✓		
Portland International	✓		
Ronald Reagan Washington National	✓		June 2010
Salt Lake City International	✓		May 2010
San Diego International	✓		August 2010
San Francisco International	✓		
Seattle-Tacoma International		✓	
Ted Stevens Anchorage International	✓		
Theodore Francis Green State, Providence, RI		✓	
Washington Dulles International	✓		July 2008
William P. Hobby, Houston, TX		✓	

Source: FAA.

[a]Represents when the facility first declares the system ready for conditional use. Once the system is formally accepted by the facility, the system is commissioned. FAA's draft accelerated schedule, shown in this table, targets completing ASDE-X deployment by the Fall of 2010, with the exception of the New York LaGuardia and Memphis International airports, where the agency is coordinating ASDE-X implementation with the completion of new air traffic control towers.

Note: As indicated above, 28 airports currently have ASDE-3/AMASS. Six additional airports (Seattle-Tacoma International, Lambert St.-Louis International, Hartsfield-Jackson Atlanta International, Louisville International-Standiford Field, Chicago O'Hare International, and Charlotte Douglas International) originally had ASDE-3/AMASS, but the equipment has since been upgraded to ASDE-X.

Table 7: Air Traffic Control Facilities with 20 Percent or More Employees Working 6-Day Weeks from February through May 2007

Facility	Average percentage of controllers working 6-day weeks	Average percentage of controllers who volunteered to work overtime
Hartsfield-Jackson Atlanta International	52.09	85
Long Beach-Daugherty Field, CA	44.01	27
Atlanta Terminal Radar Approach Control (TRACON)	42.65	48
Shreveport Regional, LA	40.94	83
Jacksonville International, FL	39.77	66
Daytona Beach International, FL	39.62	65
Helena Regional, MT	38.89	100
Buchanan Field, Concord, CA	34.64	100
Boise, ID	33.39	81
Orlando International	32.53	30
Blue Grass, Lexington, KY	32.38	90
Ft. Lauderdale-Hollywood International, FL	31.12	65
Palm Beach International, West Palm Beach, FL	30.87	61
Reno-Tahoe International, NV	29.01	65
Camarillo, CA	29.00	43
Ted Stevens Anchorage International	28.66	58
Nashville International	28.63	75
Las Vegas TRACON	27.66	49
Bradley International, Windsor Locks, CT	26.98	62
Monroe Regional, LA	26.90	82
Sioux Gateway, IA	26.83	0
Los Angeles International	25.73	53
Phoenix TRACON	24.77	75
George Bush Intercontinental Houston, TX	23.28	97
Southern California TRACON	21.96	64

Source: FAA.

Note: Also represents facilities where 4 percent or greater of the employees' work hours were covered by overtime.

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Report to Congressional Requesters

November 2007

AVIATION RUNWAY AND RAMP SAFETY

Sustained Efforts to Address Leadership, Technology, and Other Challenges Needed to Reduce Accidents and Incidents

G A O

Accountability * Integrity * Reliability

GAO-08-29

GAO Highlights

Highlights of GAO-08-29, a report to congressional requesters

Why GAO Did This Study

While aviation accidents in the United States are relatively infrequent, recent incidents have heightened concerns about safety on airport runways and ramps. As the nation's aviation system becomes more crowded every day, increased congestion at airports may exacerbate ground safety concerns. To safely handle the anticipated larger volumes of air traffic, the Federal Aviation Administration (FAA) is implementing the Next Generation Air Transportation System (NextGen) to better manage air traffic both in the air and on the ground. GAO was asked to evaluate (1) the progress being made in addressing runway safety and what additional measures, if any, could be taken and (2) the factors affecting progress in improving ramp safety and what is being done by FAA and others to address these factors. We reviewed runway and ramp safety data, interviewed agency officials and industry stakeholders, and surveyed experts.

What GAO Recommends

GAO recommends that FAA take several measures to enhance runway and ramp safety, such as updating its national runway safety plan, collecting data on runway overruns, and working with OSHA and industry to collect and analyze better information on ramp accidents. DOT agreed to consider the report's recommendations.

To view the full product, including the scope and methodology, click on GAO-08-29. For more information, contact Gerald L. Dillingham, Ph.D. at (202) 512-2834 or dillinghamg@gao.gov.

November 2007

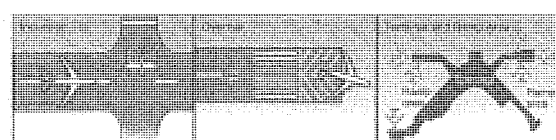
AVIATION RUNWAY AND RAMP SAFETY

Sustained Efforts to Address Leadership, Technology, and Other Challenges Needed to Reduce Accidents and Incidents

What GAO Found

FAA and aviation stakeholders have taken steps to address runway and ramp safety, including deploying and testing technology designed to prevent runway incursions, which occur when aircraft enter the runway without authorization, and overruns, which occur when aircraft run off the ends of runways; helping to change airport layout, markings, signage, and lighting; and providing training for pilots and air traffic controllers. In addition, FAA has made progress in addressing runway overruns and reports that 70 percent of the runways at U.S. commercial airports substantially comply with runway safety area standards, up from 55 percent in 2000. However, the rate of runway incursions has not decreased over the last 5 years. In addition, FAA has not prepared a national runway safety plan since 2002, despite agency policy that it be updated every 2 to 3 years, resulting in uncoordinated efforts within the agency. Runway safety technology currently being installed is experiencing some operational difficulties with its alerting function, while additional technology to prevent runway collisions is years away from deployment. FAA also lacks data on runway overruns that could be used to analyze the causes and circumstances of such incidents. Air traffic controller fatigue, which may result from regularly working overtime, continues to be a matter of concern for the National Transportation Safety Board (NTSB), which investigates transportation accidents, and other aviation stakeholders.

Efforts to improve safety in airport ramp areas, where departing and arriving aircraft are serviced by baggage, catering, and fueling personnel, are hindered by a lack of complete accident data and standards for ground handling, but the aviation industry is taking steps to address these problems with the goal of reducing ramp accidents. Data from 2001 through 2006 from the Occupational Safety and Health Administration (OSHA), which investigates occupational accidents, NTSB, and FAA indicated that these agencies had investigated 29 fatal ramp accidents during that time. The majority of the fatalities in these accidents were ramp workers. GAO found no comprehensive nonfatal injury data on ramp accidents and neither federal nor industrywide standards for ramp operations. The federal government has generally taken an indirect role overseeing ramp safety; airlines and airports typically control the ramp areas using their own policies and procedures. Meanwhile, some airlines and airports have initiated their own efforts to address ramp safety, and aviation organizations have begun collecting ramp accident data.



Source: Lincoln Laboratory, Massachusetts Institute of Technology, and GAO.

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Abbreviations

ADS-B	Automatic Dependent Surveillance-Broadcast
AMASS	Airport Movement Area Safety System
ASDE-3	Airport Surface Detection Equipment, Model 3
ASDE-X	Airport Surface Detection Equipment, Model X
CAST	Commercial Aviation Safety Team
EMAS	Engineered Materials Arresting System
DOT	Department of Transportation
FAA	Federal Aviation Administration
ICAO	International Civil Aviation Organization
JPDO	Joint Planning and Development Office
NextGen	Next Generation Air Transportation System
NTSB	National Transportation Safety Board
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
OSH Act	Occupational Safety and Health Act

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United States Government Accountability Office
Washington, DC 20548

November 20, 2007

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

The Honorable Frank R. Lautenberg
United States Senate

While aviation accidents in the United States are relatively infrequent, recent incidents have heightened concerns about safety on airport runways and ramps.[1] On August 16, 2007, for example, at Los Angeles International Airport—one of the nation's busiest airports—two commercial aircraft carrying 296 people came within 37 feet of colliding, resulting in an incident called a runway incursion. In another example, in 2005, an aircraft departing from Seattle-Tacoma International Airport, carrying 142 people, experienced sudden cabin depressurization caused by a ramp vehicle having punctured the aircraft fuselage while on the ramp. As the nation's aviation system becomes more crowded every day, increased congestion at airports may exacerbate ground safety concerns. To safely handle the anticipated larger volumes of air traffic, the Federal Aviation Administration (FAA) is implementing the Next Generation Air Transportation System (NextGen) to better manage air traffic both in the air and on the ground. At airports, FAA focuses its safety oversight on the movement areas—runways and taxiways[2]—where the chances of catastrophic accidents are greater than other areas. By contrast, safety oversight of operations in the ramp areas of airports is handled primarily by airlines and airports.

To respond to your request, our objective was to determine how well FAA and others are addressing runway and ramp safety issues. To accomplish this, we focused on the following questions: (1) What progress is being made in addressing runway safety, and what additional measures, if any,

[1]Ramps are areas of airports where aircraft are readied for arrival and departure.

[2]Taxiways are routes that aircraft follow to and from runways.

could be taken? and (2) What factors affect progress in improving ramp safety and what is being done by FAA and others to address those factors?

To answer these questions, we reviewed data on runway and ramp safety incidents and accidents from FAA, the National Transportation Safety Board (NTSB), and the Department of Labor's Occupational Safety and Health Administration (OSHA) and Bureau of Labor Statistics; relevant laws, regulations, and agency policies; and federal government and aviation industry efforts to address runway and ramp safety, including the development of new technology. We also looked at how taxiways affect runway safety. In addition, we interviewed FAA, NTSB, OSHA, airport, and aviation trade organization officials reflecting various segments of the industry, as well as pilots, air traffic controllers, and ramp workers and their union representatives. We also surveyed experts[3] on the causes of runway and ramp incidents and accidents, the effectiveness of measures that are being taken to address them, and what additional measures could be taken. A majority of the experts was selected with the assistance of the National Academy of Sciences, and we identified additional experts during our review. The individuals were selected on the basis of their expertise in areas such as technology and procedures used to address runway incursions, overruns, and ramp accidents; international aviation safety practices; human factors issues; general aviation; airports; and ground operations. We report the survey results in terms of actions that are most effective or future actions that have the greatest potential. Through our analyses, the actions that we report as being most effective or having the greatest potential were ones that a majority of respondents indicated were very or extremely effective for the effectiveness questions or great or very great potential for the questions asking about potential. Because we asked the experts to answer questions only within their areas of expertise, a different number of responses were received for various survey questions. Based on interviews with officials knowledgeable about the data contained in this report, we determined that runway and ramp safety data were sufficiently reliable for the types of analyses that we performed for this report such as trends in runway incursions, the incidence of fatalities in airport ramp areas, and frequency of air traffic controller overtime. We conducted our work in Atlanta, GA; Atlantic City, NJ; Boston, MA; Burbank, Long Beach, Los Angeles, and San Diego, CA; Newark, NJ; Seattle and Spokane, WA; and Washington, D.C. These locations included

[3]The survey consisted of two phases. Twenty-five experts responded to the first phase survey and 22 responded to the second phase survey.

airports that have experienced higher rates of runway incursions or where new aviation safety technology was being researched or tested. We conducted our work from October 2006 through November 2007 in accordance with generally accepted government auditing standards. Appendix I contains additional information about our methods. Detailed information about our survey methodology and the survey questions are contained in appendix II.

Results in Brief

FAA and other aviation stakeholders have taken steps to address runway and ramp safety, but the lack of coordination and leadership, technology challenges, the lack of data, and human factors-related issues impede further progress. Our analysis showed that FAA had completed or was in the process of implementing 34 of the 39 initiatives contained in its 2002 national runway safety plan; 4 initiatives were canceled and 1 pertaining to deploying certain technology was not met. The completed initiatives included deploying and testing other technology designed to prevent runway collisions and overruns; helping change airport layout, markings, signage, and lighting; and providing training for pilots and air traffic controllers. Of the measures that FAA is taking to address runway incursions, the results of our survey of experts indicated that the most effective actions were lower-cost ones, such as enhancing airport markings, lighting, and signage. In addition, FAA has made progress in addressing runway overruns and reported in May 2007 that 70 percent of the runways at U.S. commercial airports substantially comply with runway safety area standards, up from 55 percent in 2000. Runway safety areas reduce the chance of aircraft being damaged from overruns. While the number and rate of incursions declined after reaching a peak in fiscal year 2001 and remained relatively constant for the next 5 years, preliminary data for fiscal year 2007 indicate that the overall incursion rate increased during fiscal year 2007 and is nearly as high as the fiscal year 2001 peak. FAA's Office of Runway Safety has also not carried out its leadership role in recent years. The office's role is to lead the agency's runway safety efforts by coordinating and monitoring runway safety activities to ensure that goals are met. Those goals were established in 2002 in a national runway safety plan. However, FAA has not updated the plan, despite agency policy that such a plan be prepared every 2 to 3 years. The lack of an updated plan has resulted in uncoordinated runway safety efforts by individual FAA offices. Moreover, runway safety technology currently being installed, the Airport Surface Detection Equipment, Model X (ASDE-X), which is designed to provide air traffic controllers with the position and identification of aircraft and alerts of potential collisions, has faced cost increases and schedule delays from its original baselines and is experiencing operational difficulties with its alerting function. At the same time, additional technology to prevent runway collisions is years away from deployment. FAA also lacks reliable runway safety data and the mechanisms to ensure that the data are complete. Furthermore, air traffic controller fatigue, which may result from regularly working overtime, continues to be a matter of concern for NTSB, which investigates transportation accidents, and other aviation stakeholders. We found that, as of May 2007, at least 20 percent of the controllers at 25 air traffic control facilities, including towers at several of the country's busiest airports, were regularly working 6-day weeks. FAA could take additional measures to improve runway safety. These measures include starting a nonpunitive, confidential, voluntary program for air traffic controllers to report safety risks in the national airspace system, which includes runways and taxiways, similar to a program that FAA has already established for pilots and others in the aviation community, and could help the agency to understand the causes and circumstances regarding runway safety incidents. The results of our survey of experts indicated that the action FAA could take with the greatest potential for preventing runway incursions was encouraging the use of lighting systems that guide aircraft on their airport taxi routes. The results of our survey of experts also indicated that the actions with the greatest potential that FAA could take to prevent runway overruns included addressing the causes and circumstances of overruns, such as improving communication of runway conditions and weather information to flight crews, and encouraging improvements in and use of runway condition and friction measurements, which provide data regarding the slickness of a runway.

Efforts to improve airport ramp safety are hindered by a lack of complete accident data and standards for ground handling. Such data could help FAA and the aviation industry to understand the nature and extent of the problem, as a first step to identifying what actions are needed to reduce ramp accidents. We found no complete source of data on ramp accidents, but reviewed ramp fatality data from 2001 through 2006 from FAA, OSHA, and NTSB, and found that these agencies had investigated 29 fatal ramp accidents during that time. The majority of the fatalities in these accidents were ramp workers. We found no complete nonfatal injury data on ramp accidents. In addition, we found no federal or industrywide standards for ramp operations. The federal government has generally taken an indirect role in overseeing ramp safety; airlines and airports typically control the ramp areas using their own policies and procedures. Meanwhile, some airlines and airports have initiated their own efforts to address ramp safety, and aviation organizations have begun collecting ramp accident data. We asked experts to provide their views on those industry efforts, and they indicated that the most effective ones were being taken mainly by airlines, for example, by setting safety targets and using ramp towers. In addition, an international aviation association plans next year to start a safety audit program of companies with employees who work in airport ramp areas, which would be a step toward applying standardized criteria to these companies. Officials from a union representing ramp workers said that FAA should increase its safety oversight of ramp areas, while other aviation industry officials said that FAA's resources are more appropriately focused on the runways and taxiways, where there are greater safety risks to passengers. The results of our survey of experts indicated that the action FAA, OSHA, airport, or airlines could take with the greatest potential for preventing ramp accidents was promoting a safety culture in the ramp area.

We are recommending that FAA take several measures to enhance runway and ramp safety, which include preparing a new national runway safety plan, improving data collection on runway overruns and ramp accidents, and addressing air traffic controller overtime and fatigue issues that may affect runway safety. We provided the Department of Transportation (DOT) and the Department of Labor with drafts of this report for their review and comment. DOT agreed to consider the report's recommendations and provided technical corrections and clarifications, which we incorporated as appropriate. The Department of Labor had no comments but provided a technical correction, which we incorporated.

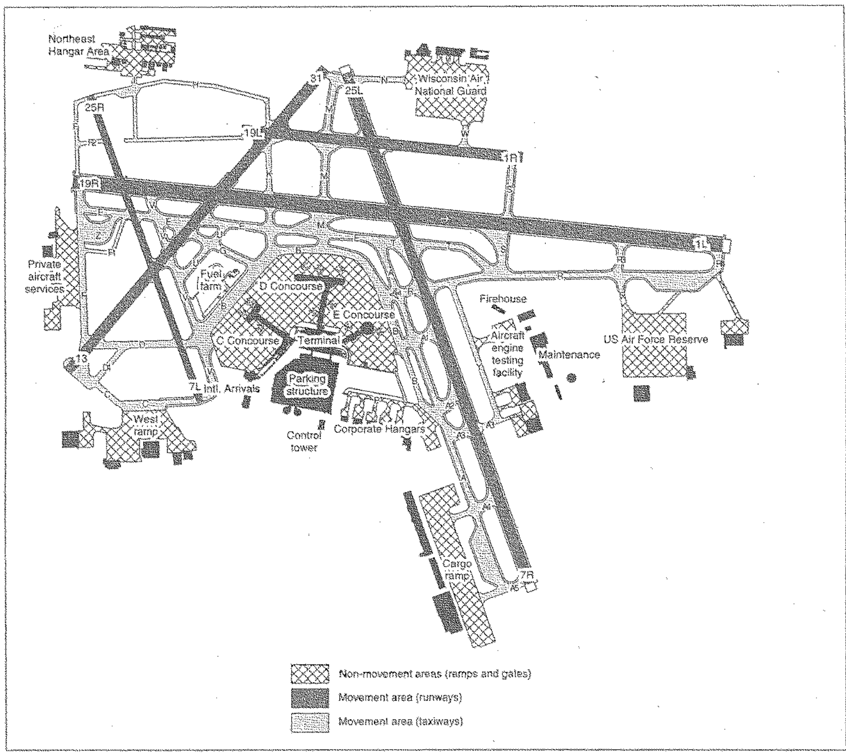
Background

Demand for air travel has increased in recent years, with over 740 million passengers flying in the United States in fiscal year 2006, and is expected to climb to an estimated 1 billion passengers per year by 2015. To meet this demand, the Joint Planning and Development Office (JPDO), housed within FAA and created to plan and coordinate the transition to NextGen, has developed a strategy to establish the needed national airspace system infrastructure, including airports. JPDO's objectives include providing air traffic control and airport authorities with greater flexibility to match capacity with demand, reducing congestion, and establishing a comprehensive safety management approach. Implementing the plan will include deploying Automatic Dependent Surveillance-Broadcast (ADS-B), a satellite-based technology that broadcasts aircraft identification, position and speed with once-per-second updates, which will provide pilots with greater situational awareness and help to keep aircraft at safe distances from each other on the runways.

Safety at airports in the United States is a shared responsibility among FAA, airlines, and airports. FAA air traffic controllers oversee activity in the movement areas—runways and taxiways—but airlines and airports provide primary safety oversight in the nonmovement areas—ramps and gates.[4] Figure 1 shows the movement and nonmovement areas of the General Mitchell International Airport in Milwaukee, WI.

[4]Ramp towers, staffed by airline, airport, or contractor personnel, are used to control the ramps at some airports.

Figure 1: Movement and Nonmovement Areas of the General Mitchell International Airport in Milwaukee, WI



Source: General Mitchell International Airport and GAO.

Runway safety is a major aviation safety concern that involves measures to prevent runway incursions and overruns. Through September 2007, FAA defined a runway incursion as "any occurrence in the runway environment involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of required separation when an aircraft is taking off, intending to take off, landing, or intending to land." On October 1, 2007, FAA began using a definition of a runway incursion developed by the International Civil Aviation Organization (ICAO), a United Nations specialized agency.[5] ICAO's definition of an incursion is any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing or take-off of aircraft. Runway incursion prevention has been on NTSB's list of most wanted transportation improvements since 1990 because runway collisions can have serious consequences. Six runway collisions have occurred in the United States since 1990, resulting in 63 deaths. The worst runway accident in the United States occurred at the Los Angeles International Airport in 1991, when an aircraft that was landing collided with another that was holding on the same runway, killing 34 people. The most recent fatal runway collision in the United States occurred in 2000, when two general aviation aircraft collided on the runway at the Sarasota Bradenton International Airport in Florida, resulting in 4 fatalities.[6] Other runway incidents, which FAA did not classify as incursions, also can have serious consequences. On August 27, 2006, for example, a Comair regional jet crashed in Lexington, KY, after taking off from a wrong runway that was too short for the aircraft, killing all but one of the 50 people onboard.[7]

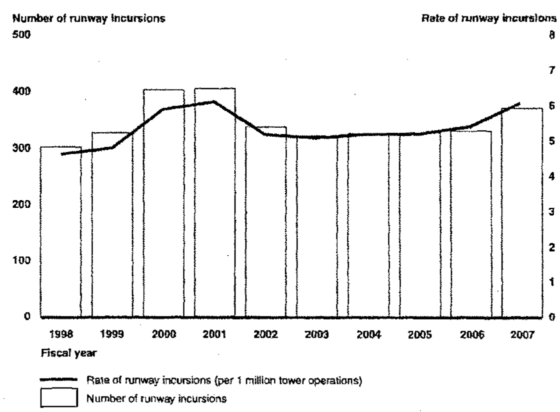
[5]Among other things, ICAO develops standards and recommended practices, procedures, and guidance material related to all aspects of civil aviation, including safety and security.

[6]The worst accident in aviation history occurred in 1977 when a KLM Boeing 747 collided with a Pan Am Boeing 747 on a runway in Tenerife, the Canary Islands, killing 583 passengers and crew. The Spanish government, which investigated the accident, determined that the accident was caused by a miscommunication between the KLM pilot and the control tower that take-off clearance had been provided, as well as several other factors.

[7]FAA classified this accident as a surface incident, which it had defined as any event where unauthorized or unapproved movement occurs within a movement area associated with the operation of an aircraft that affects or could affect the safety of flight. After adopting ICAO's definition of a runway incursion, FAA began classifying some incidents formerly classified as surface incidents as incursions.

The number and rate of runway incursions rose in the 1990s before peaking in fiscal year 2001 (see fig. 2). In fiscal year 2001, there were 407 incursions at a rate of 6.1 incursions per 1 million air traffic control tower operations, compared to fiscal year 2006, when there were 330 incursions at a rate of 5.4 incursions per 1 million tower operations. As shown in fig. 2, the rate of incursions remained relatively constant from fiscal year 2002 through fiscal year 2006, at an average rate of 5.2 incursions per 1 million tower operations. However, preliminary FAA data indicate 370 incursions occurred during fiscal year 2007, representing a rate of 6.05 incursions per 1 million air traffic control tower operations. The preliminary rate of incursions for fiscal year 2007 is about 12 percent higher than during fiscal year 2006 and is nearly as high as when the rate of incursions reached a peak in fiscal year 2001.

Figure 2: Number and Rate of Runway Incursions from Fiscal Year 1998 through Fiscal Year 2007



Source: FAA.

Note: Fiscal year 2007 data are preliminary.

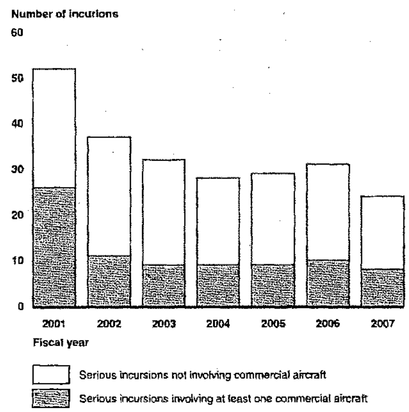
Since 2001, FAA has classified the severity of runway incursions into four categories—A through D.[8] The number and rates of serious incursions—categories A and B, where collisions were narrowly or barely avoided—have continued to occur at about the same level from fiscal year 2002 through fiscal year 2006 at an average of about 30 serious incursions per year and an average rate of 0.5 serious incursions per 1 million air traffic control tower operations. Preliminary data indicate that 24 serious incursions occurred during fiscal year 2007, compared to 31 during fiscal year 2006. The preliminary rate of serious incursions for fiscal year 2007 is 0.39 per 1 million air traffic control tower operations, which is about 24 percent less than during fiscal year 2006, when the rate of serious incursions was 0.51 per 1 million tower operations.

Although most runway incursions involve general aviation aircraft,[9] about one-third of the most serious incursions from fiscal year 2002 through fiscal year 2007 (categories A and B)—about 9 per year—involved at least one commercial aircraft that can carry many passengers (see fig. 3). For example, on July 11, 2007, a collision between two aircraft carrying 172 people was narrowly averted at the Fort Lauderdale-Hollywood Airport in Florida, when a Boeing 757 that had just touched down was able to become airborne again to avoid hitting an Airbus A320 aircraft that was approaching the same runway. An NTSB preliminary report indicated that the two aircraft missed each other by less than 100 feet. According to NTSB, it has investigated several near collisions in recent years that could have been catastrophic if they had not been averted through pilot skill and luck. Appendix III contains a list of serious incursions involving at least one commercial aircraft during fiscal year 2006 and fiscal year 2007.

[8] FAA defines category A as separation decreases and participants take extreme action to narrowly avoid a collision, or the event results in a collision; category B, separation decreases and there is a significant potential for a collision; category C, separation decreases but there is ample time and distance to avoid a potential collision; and category D, there is little or no chance of collision.

[9] According to FAA, 72 percent of incursions from fiscal year 2003 through fiscal year 2006 involved at least one general aviation aircraft.

Figure 3: Total Number of Serious Incursions, Fiscal Year 2001 through Fiscal Year 2007



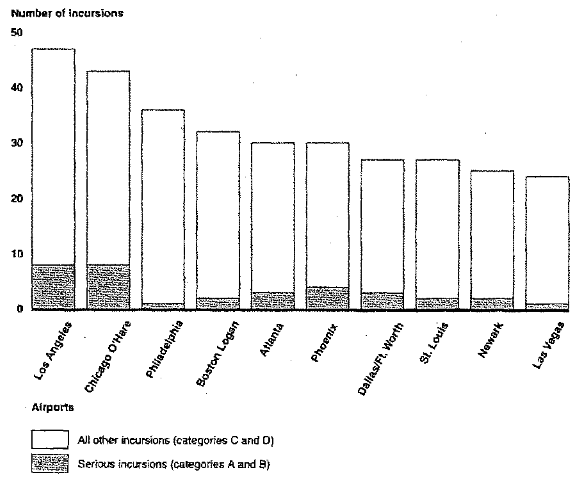
Source: FAA.

Note: Fiscal year 2007 data are preliminary.

FAA officials, experts we surveyed, and officials at some airports that have experienced the most incursions said that runway incursions were caused by many different factors, including airport complexity, frequency of runway crossings, the amount of air traffic, miscommunication between air traffic controllers and pilots, a lack of situational awareness on the airfield by pilots, and performance and judgment errors by air traffic controllers and pilots. According to FAA, 54 percent of incursions from fiscal year 2003 through fiscal year 2006 were caused by pilot errors, 29 percent were caused by air traffic controller errors, and 17 percent were caused by vehicle operator or pedestrian errors.

In the United States, most runway incursions have occurred at major commercial airports. Figure 4 shows the 10 U.S. commercial airports that have experienced the most runway incursions from fiscal year 2001 through fiscal year 2006 and the overall number of incursions and the number of serious incursions that occurred at those airports during that time.

Figure 4: U.S. Commercial Airports that Experienced the Most Runway Incursions from Fiscal Year 2001 through Fiscal Year 2006



Source: GAO analysis of FAA data.

In addition to incursions, overruns are a runway safety concern. When an aircraft overruns the end of a runway during an aborted takeoff or while landing, the results can be serious. In December 2005, for example, a Southwest Boeing 737 overran the runway at the Chicago Midway Airport during a snowstorm, ran through airport fencing, and collided with a car on an adjacent roadway, resulting in one fatality (see fig. 5).[10] Since 2001, NTSB has investigated 12 runway overruns that resulted in 18 fatalities, usually involving smaller general aviation aircraft. NTSB attributed the overruns primarily to pilot error, such as misjudgments of speed and distance.

[10]NTSB determined that the probable cause of that accident was the pilots' failure to use available reverse thrust in a timely manner to safely slow or stop the airplane after landing.

Figure 5: Photograph of the December 2005 Runway Overrun at Chicago Midway Airport

Source: © Allan Goldstein, Aerial Images Photography (Illinois). Reprinted with permission. All rights reserved.

FAA has established standards for runway safety areas, which are unobstructed areas surrounding a runway, to enhance safety in the event that an aircraft overruns, undershoots, or veers off a runway. FAA airport design standards generally require commercial airports to establish, to the extent practicable, 1,000-foot runway safety areas at both ends of a runway.[11] In 1999, FAA established its Runway Safety Area Program, administered by the Office of Airport Safety and Standards, to help commercial airports meet runway safety area standards.[12] In 2005, FAA set a goal of having commercial service airports make all practicable

[11]The 1,000-foot runway safety area standard was based on the results of an FAA study of overruns from 1975 to 1987, which indicated that about 90 percent of overruns occurred within 1,000 feet of the runway end. FAA runway safety area standards depend on the type of aircraft using a runway and range from 120 feet wide by 240 feet beyond the end of the runways used for smaller aircraft to 500 feet wide by 1,000 feet beyond the end of the runways for larger aircraft.

[12]In 2000, FAA started a program to accelerate the construction of runway safety area improvements. Prior to 2000, FAA required that when certificated airports undertook a major runways construction project, the runway safety areas would be brought up to current standards to the extent practicable.

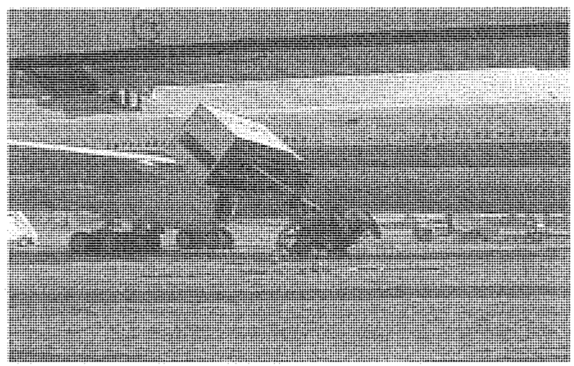
improvements to runway safety areas by 2015.[13] Also in 2005, Congress enacted legislation requiring the owner or operator of a commercial service airport[14] to meet FAA runway safety area standards by December 31, 2015. The importance of establishing a runway safety area was demonstrated during the crash of an American Airlines MD-82 in Little Rock, AR, on June 1, 1999, when it overran the runway, went down a rock embankment, and collided with a structure supporting a lighting system, killing 11 passengers and crew. According to NTSB, the airport had a runway safety area that was only 550 feet in length beyond the end of the runway. Experts we surveyed said that runway overruns are caused by factors such as pilot misjudgments about speed, altitude, or distance; inadequate information on weather and runway conditions; and aircraft equipment failure.

Although not considered part of the movement area of an airport, ramp areas can be dangerous for ground workers and passengers. Airport ramps are typically small, congested areas in which departing and arriving aircraft are serviced by ramp workers, including baggage, catering, and fueling personnel. Other personnel present on ramps include airport police, FAA officials, and other airport, airline, and vendor staff. The presence of a large number of people utilizing equipment in a relatively small area, often under considerable time pressure, creates an environment in which injuries and fatalities and aircraft and equipment damage can occur. Figure 6 shows an example of a ramp accident.

[13]In a May 24, 2007, report to Congress, FAA indicated that it had hoped that all runway safety area improvements would be complete by 2010 but that 42 projects would not be completed until after 2010 because they are often large and complex, requiring several years to complete.

[14]The runway safety area requirement in Public Law 109-115, 119 Stat. 2401 (2005) is applicable to owners or operators of an airport that have received an operating certificate under 49 U.S.C. § 44706.

Figure 6: Example of an Accident in an Airport Ramp Area



Source: © Rogério Carvalho. Reprinted with permission. All rights reserved.

Activities in the ramp area can also affect the safety of air crew and passengers once they leave the ramp area. Undetected aircraft damage from ramp activities can cause in-flight emergencies. In December 2005, for example, an Alaska Airlines MD-80 that had departed from Seattle to Burbank, CA, experienced a sudden cabin depressurization. After the aircraft safely returned to Seattle, it was discovered that a ramp vehicle had punctured the aircraft fuselage, but the incident had not been reported.

Aviation organizations have attempted to quantify the nature, extent, and cost of ramp accidents. According to the experts we surveyed, these errors occur as a result of multiple causes, such as carelessness, distractions, confusion, and inadequate training of ramp workers; lack of supervision; and time pressure. The Flight Safety Foundation, an aviation safety research organization, has estimated that ground accidents worldwide cost air carriers $10 billion annually, including costs associated with injuries and fatalities and other indirect costs such as cancelled flights.[15] However, these research efforts have also been hindered by a lack of data. In a 2002 study of ramp worker accidents, FAA noted the difficulty of obtaining nonfatality data.[16] The Flight Safety Foundation also noted the limited amount of data available for its 2004 study of damage and injury on airport ramps.[17]

Federal Roles in Runway and Ramp Safety

FAA has primary federal responsibility for runway safety. Several FAA offices carry out these responsibilities, including

- the Air Traffic Organization, which manages air traffic control—including the hiring, training, and managing of more than 14,300 air traffic controllers—and develops and maintains runway safety technology;
- the Office of Runway Safety, created in 1999 as part of the Air Traffic Organization to lead and coordinate the agency's runway safety efforts—including developing a national runway safety plan and metrics for runway safety—and evaluate the effectiveness of runway safety activities;
- the William J. Hughes Technical Center in Atlantic City, NJ, which conducts aviation safety research;[18]
- the Office of Airports—which, as of July 2007, employed 45 safety inspectors to check airports' compliance with regulations—develops standards for airport signage, markings, and lighting, and manages the agency's Runway Safety Area Program to address runway overruns;
- the Office of Aviation Safety, which conducts safety inspections of airlines, audits air traffic safety issues, and administers a program to obtain

[15]Flight Safety Foundation officials noted that this estimate assumes 27 million departures annually, includes only International Air Transport Association airlines, and is based mostly on foreign airline data. They also noted that to determine injury costs, they extrapolated U.S. injury costs across the world, perhaps resulting in injury cost estimates higher than they actually would be.

[16]FAA, *Report to Congress: Injuries and Fatalities of Workers Struck by Vehicles on Airport Aprons*, (Washington, D.C.: July 2002).

[17]Flight Safety Foundation, *Equipment Damage and Human Injury on the Apron: Is It a Cost of Doing Business?* (Alexandria, VA: 2004).

[18]Other federal agencies such as DOT's Volpe National Transportation Systems Center and the National Aeronautics and Space Administration also conduct runway safety research.

information from pilots about the circumstances of runway incursions; and

- the Civil Aerospace Medical Institute in Oklahoma City, which conducts aerospace medical and human factors research.

FAA's oversight of ramp areas is provided indirectly through its certification of airlines and airports.[19] FAA has statutory authority to investigate aviation accidents including those that occur in ramp areas.[20] Pursuant to an FAA order, it is responsible for "ensuring that all facts, conditions, and circumstances leading to the accident are recorded and evaluated and action is taken to prevent similar accidents."[21] According to NTSB officials, that agency also investigates aviation accidents, including incursions and overruns that result in accidents, and selected runway incursions—those that are the most severe or those that the board believes represent the most safety benefit. NTSB investigates ramp accidents when someone is onboard the aircraft, when flight is intended or when a death or serious injury or substantial damage to the aircraft occurs. Under the Occupational Safety and Health Act (OSH Act), OSHA has statutory authority to govern the occupational safety and health of employees.[22] According to OSHA officials, the agency investigates ramp accidents when they involve fatalities or the hospitalization of three or more employees and conducts workplace inspections in response to complaints from workers.[23] According to a 2000 memorandum of understanding between OSHA and FAA relating to coordination and enforcement of the OSH Act, OSHA does not investigate accidents involving crew members on aircraft in operation.

[19]Primarily through 14 C.F.R. parts 119, 121, 135, and 139.

[20]49 U.S.C. § 46101(a)(2).

[21]FAA Order 8020.11B.

[22]29 U.S.C. §§651 et seq.

[23]OSHA conducts its work pursuant to the 1970 Occupational Safety and Health Act and the general industry safety and health standards outlined in 29 C.F.R. part 1910; however, neither contains provisions that pertain specifically to the aviation industry.

Challenges Remain Despite Numerous Efforts to Address Runway Safety

FAA has undertaken a number of efforts to address runway safety problems involving incursions and overruns. The agency has taken a layered approach to meet many of the runway safety strategic objectives it set in 2002. However, the lack of coordination and leadership among FAA's runway safety efforts, technology challenges, the lack of data, and human factors issues impede further progress in addressing runway safety. Because the number and rate of runway incursions did not decrease from fiscal year 2002 through fiscal year 2006 and remains at a level higher than any time during the 1990s, FAA could take additional cost-effective measures to improve runway safety. These measures include ensuring that FAA's Office of Runway Safety operates as a coordinating entity for the agency's runway safety efforts, as well as establishing a new voluntary safety incident reporting program for air traffic controllers.

FAA Uses a Layered Approach to Reduce the Risks of Runway Incursions and Overruns

FAA's layered approach to addressing runway safety includes a range of actions, such as deploying, researching, and testing new technology; encouraging airport improvements, such as changes to layout, markings, signage, and lighting; and providing human factors training for pilots and air traffic controllers. Our analysis found that FAA completed or was in the process of implementing 34 of the 39 runway safety objectives it set in its most recent national runway safety plan, issued in 2002, as a means of reducing the severity, number, and rate of runway incursions[24] (see app. IV). Most of the completed objectives involved (1) developing and distributing runway safety education and training materials to controllers, pilots, and other airport users; (2) supporting and developing new technologies intended to reduce the potential for runway collisions; and (3) assessing and modifying procedures to enhance runway safety.[25] The results of our survey of experts indicated that the most effective actions that FAA was taking were lower-cost measures, such as enhancing airport markings, lighting, and signage (see table 1). Some experts noted that markings, lighting, and signage help keep aircraft from becoming lost on the airfield and accidentally entering an active runway. The testing of runway status lights—technology that is more expensive to deploy than

[24] FAA's 2002 national runway safety plan was developed in cooperation with the Commercial Aviation Safety Team (CAST), a joint government-aviation industry group formed to study aviation safety issues, and encompassed 11 of the safety enhancements CAST identified as having the greatest potential for improving runway safety from its Runway Incursion Joint Safety Implementation Team.

[25] Of the remaining 5 objectives not implemented, 4 were cancelled, and 1 objective concerning the deployment of technology was not met.

improving airport markings, lighting, and signage—is another action that a majority of the experts rated as being most effective. Further, one expert noted that all of FAA's actions in addressing runway incursions must be continued because one fix alone will not improve safety.

Table 1: Experts' Ranking of the Most Effective FAA Actions to Address Runway Incursions

Ranking	Action
1	Enhancing airport markings and lighting
2	Enhancing airport signage
3	Approving perimeter taxiways, which provide aircraft with access to gates without crossing active runways
4	Establishing Runway Safety Action Teams, groups of airport safety stakeholders to identify and implement safety improvements
4	Testing runway status lights, which provide a visible warning when runways are not clear to enter or cross

Source: GAO analysis of responses from survey of experts.

Note: Rankings are based on responses from 22 experts and reflect the actions that a majority of experts indicated were "very effective" or "extremely effective."

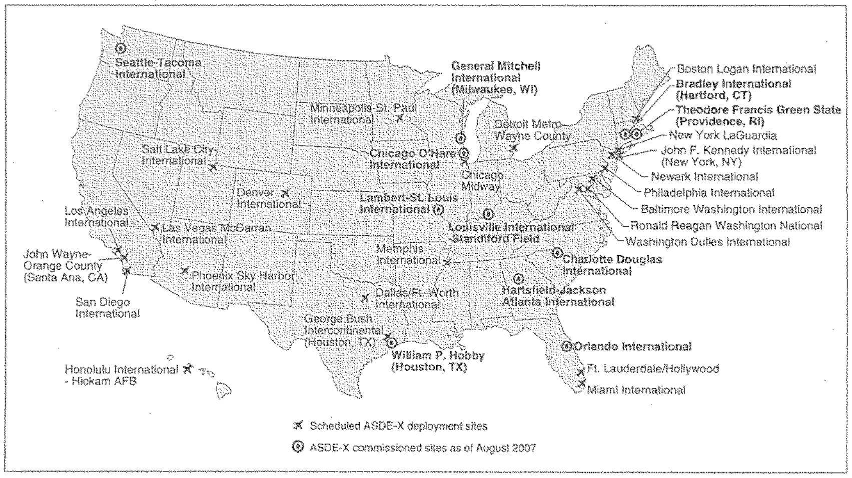
FAA Is Using Technology as a Major Part of its Risk Reduction Strategy

Surface surveillance technology is a major part of FAA's strategy to improve runway safety. FAA has deployed the Airport Movement Area Safety System (AMASS), which uses the Airport Surface Detection Equipment, model 3 (ASDE-3) radar,[26] and is deploying the Airport Surface Detection Equipment, Model X (ASDE-X) to provide ground surveillance, both of which give air traffic controllers better visibility of activity on the airfield and could help prevent collisions. FAA completed the deployment of ASDE-3/AMASS at 34 of the nation's busiest airports (see app. V) in 2003, and is now deploying ASDE-X at 35 major airports (see fig. 7). Although ASDE-3/AMASS and ASDE-X are both radar-based, ASDE-X integrates data from a variety of sources, including radars and aircraft and vehicle transponders, to give controllers a more complete view of airport activities.[27] ASDE-3/AMASS and ASDE-X are both designed to provide controllers with alerts when the system detects a possible collision.

[26]AMASS is essentially the safety logic, which is designed to detect potential collisions, for ASDE-3. This combined technology is usually referred to as ASDE-3/AMASS.

[27]Other sources of ASDE-X data include multilateration, which is a group of antennas used to obtain position information on aircraft. Each ASDE-X airport has between 10 and 20 antennas.

Figure 7: Airport Surface Detection Equipment, Model X (ASDE-X) Deployment Sites



Source: FAA and GAO.

Note: ASDE-X-commissioned airports identified in bold.

Runway status lights, which FAA is testing at the Dallas-Ft. Worth International Airport and the San Diego International Airport, are a series of lights embedded in the runways that give pilots a visible warning when runways are not clear to enter, cross, or depart on.[28] They are a fully automatic, advisory safety system requiring no input from controllers, and

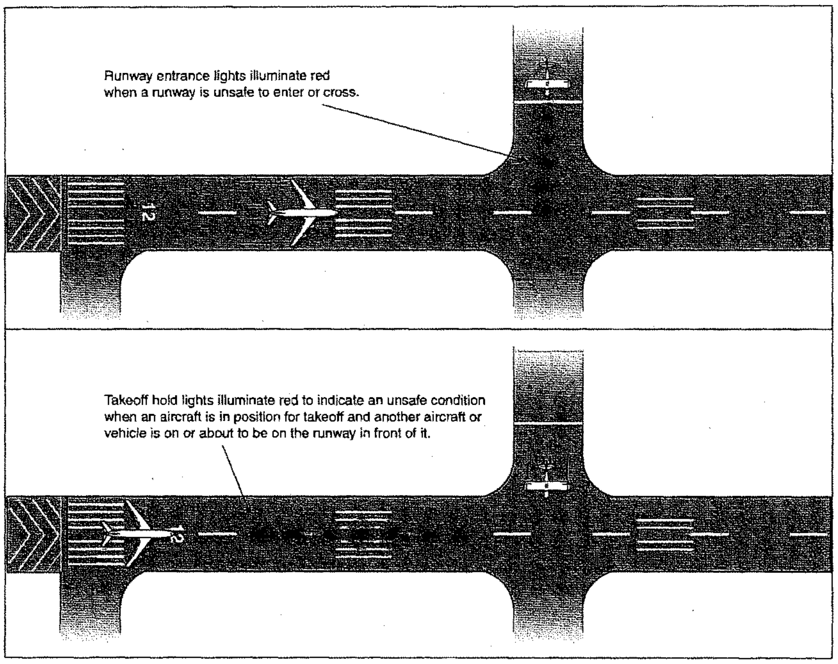
[28]FAA is testing both takeoff hold lights and runway entrance lights with ASDE-X at the Dallas-Ft. Worth International Airport and is testing runway entrance lights with AMASS at the San Diego International Airport.

currently consist of takeoff hold lights and runway entrance lights (see fig. 8).[29] Ten of 17 experts[30] we surveyed indicated that FAA's testing of runway status lights was very or extremely effective in addressing runway incursions. Surface surveillance systems, such as ASDE-3/AMASS and ASDE-X, provide the data needed to operate runway status lights, and the systems' safety logic assesses any possible conflicts on the airfield and provides alerts of potential collisions.

[29]According to FAA, future additions to the runway status lights system could include runway intersection lights and lights to warn pilots exiting at high speeds about traffic on closely-spaced parallel runways.

[30]Twenty-two experts responded to our survey, but the number of respondents for each question varies because we asked them to answer questions only within their areas of expertise. In addition, some respondents answered "don't know/no basis to judge" to certain questions.

Figure 8: Runway Status Lights System



Source: Lincoln Laboratory, Massachusetts Institute of Technology, and GAO.

Another technology that FAA is testing, the Final Approach Runway Occupancy Signal, is designed to provide a visible warning to aircraft on approach. This system, which is being tested at the Long Beach (Daugherty Field) airport in California, activates a flashing light visible to aircraft on approach as a warning to pilots when a runway is occupied and hazardous for landing. FAA is also testing low cost surface surveillance systems for small to medium airports at the Spokane International

Airport.[31] FAA would need to certify a low cost surface surveillance system before it could be used at airports in the United States. A low cost surface surveillance system is being used at 44 airports outside of the United States.

Infrastructure Improvements and Research Efforts Are Being Made to Prevent the Risk of Collisions

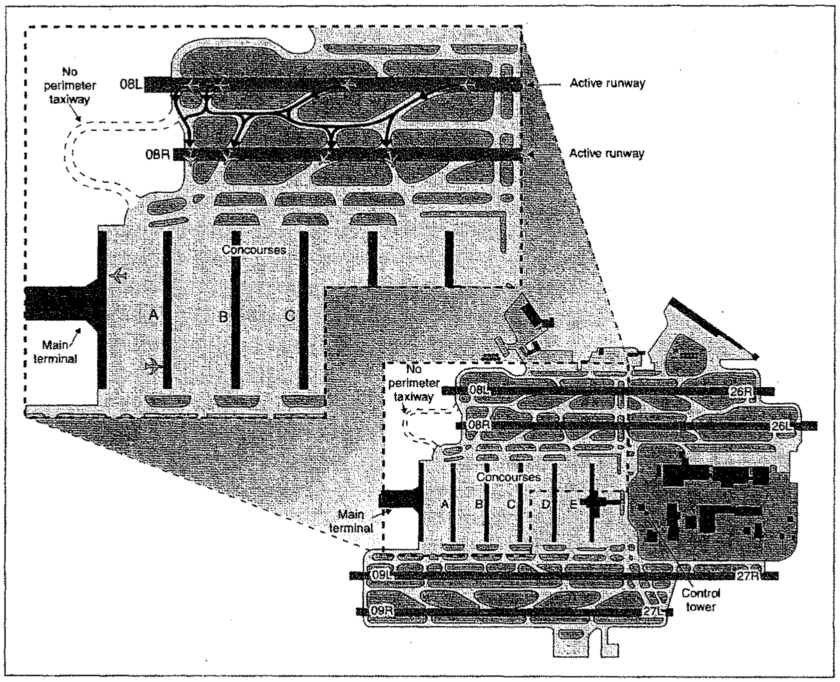
Some airports are also making changes to their runways and taxiways to reduce the risk of collisions. FAA has helped fund, for example, the construction of perimeter taxiways (also called end-around taxiways) that provide aircraft with access to gates without crossing active runways. As discussed earlier in this report, the crossing of active runways is one of the many causes of incursions. The Hartsfield-Jackson Atlanta International Airport opened a perimeter taxiway in April 2007, and the Dallas-Ft. Worth International Airport plans to open one in October 2008.[32] According to Atlanta airport officials, use of the perimeter taxiway eliminates about 560 aircraft runway crossings per day, or about one-third of the airport's total daily runway crossings.[33] Figure 9 shows the typical route that aircraft landing on the northern runways at the Hartsfield-Jackson Atlanta International Airport would take to taxi to the gate without using the perimeter taxiway. Figure 10 shows that, by using the perimeter taxiway, aircraft landing on the northernmost runway no longer need to cross a parallel runway to reach the gates. Eleven of 16 experts we surveyed indicated that FAA's approval of perimeter taxiways was very or extremely effective in addressing runway incursions.

[31]According to an FAA official, by contrast to ASDE-X, which uses multiple sensors, low cost surface surveillance systems collect data using a single sensor.

[32]Hartsfield-Jackson Atlanta International Airport officials said the perimeter taxiway cost \$48 million. An official from the Dallas-Ft. Worth International Airport said its perimeter taxiway will cost about \$63.8 million. FAA indicated that it provided about \$26 million in Airport Improvement Program funds for the perimeter taxiway at the Hartsfield-Jackson Atlanta International Airport and about \$47.3 million for the perimeter taxiway at the Dallas-Ft. Worth International Airport.

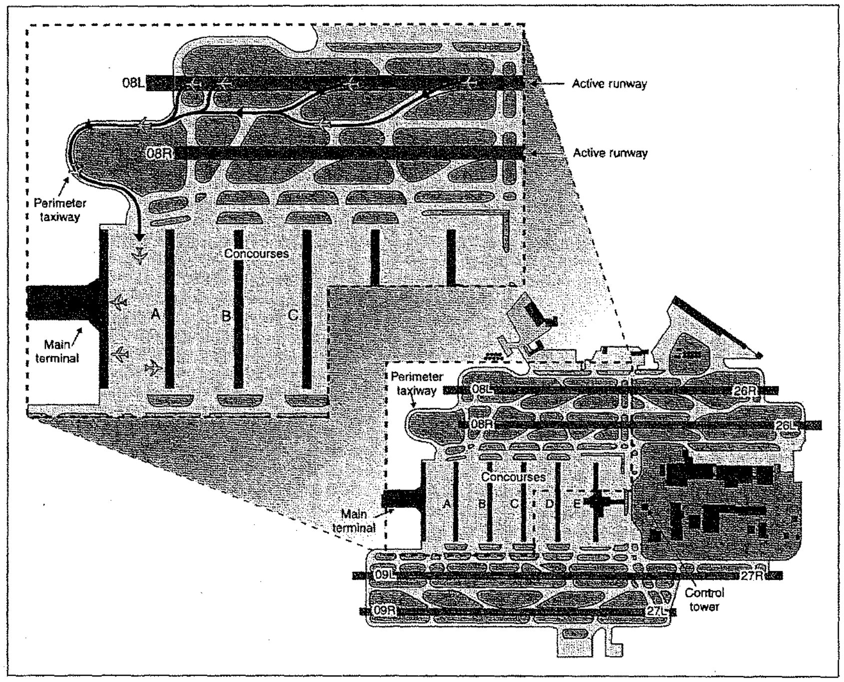
[33]Certain large aircraft, such as the Boeing 747, Boeing 777, Airbus A330, and Airbus A340 cannot use the perimeter taxiway because of their large wingspans.

Figure 9: Aircraft Taxiing Routes at the Hartsfield-Jackson Atlanta International Airport Without Using the Perimeter Taxiway



Source: Hartsfield-Jackson Atlanta International Airport and GAO.

Figure 10: Aircraft Taxiing Route at the Hartsfield-Jackson Atlanta International Airport Using the Perimeter Taxiway



Source: Hartsfield-Jackson Atlanta International Airport and GAO.

FAA has also helped fund other runway and taxiway changes at various airports. For example, the Los Angeles International Airport, the U.S. commercial airport that has experienced the most runway incursions in recent years, is modifying its runway and taxiway configuration in an area where many of the incursions have occurred.[34] FAA and airports have made many runway safety improvements at airports that were identified by local and regional Runway Safety Action Teams, which are groups of FAA and airport officials, as well as other aviation safety stakeholders, which were formed as part of the agency's runway safety program in 2002. In addition, FAA has standardized airport signage and markings, including issuing new standards for surface markings that require the use of glass beads for better reflectivity, requiring new taxiway markings that alert pilots that they are approaching runway entrances, and doubling the size of markings indicating where aircraft should hold before proceeding onto the runway. A majority of the experts we surveyed confirmed the measures' effectiveness, indicating that FAA's enhancement of airport markings, lighting, and signage was very or extremely effective.[35]

FAA has funded runway safety research that has led to the testing and deployment of new technology and other measures. During fiscal year 2006, FAA spent about $3.5 million on runway incursion prevention research at its William J. Hughes Technical Center on projects such as visual guidance, including signs and lighting; and about $55,000 on research at its Civil Aerospace Medical Institute regarding vehicle incursions and operational errors. Also during fiscal year 2006, FAA funded about $1 million for runway safety-related research that was conducted at DOT's Volpe National Transportation Systems Center on projects such as runway status lights, analyses of runway incursion data, FAA's runway incursion severity calculator, and the electronic flight bag.[36]

[34]This modification is being made by moving the southernmost runway 55 feet farther away from its parallel runway to accommodate the construction of a centerfield taxiway between the two runways. According to a Los Angeles World Airports official, the Los Angeles International Airport is spending $333 million for the south airfield improvements, of which FAA funded $98 million, including $29.6 million for the new center taxiway.

[35]Fifteen of 22 respondents indicated that FAA's enhancement of airport markings and lighting was very or extremely effective and 14 indicated that FAA's enhancement of airport signage was very or extremely effective.

[36]An electronic flight bag is an electronic display system that gives pilots a variety of aviation data such as aircraft operating manuals and navigational charts. Electronic flight bags range from laptop-like devices that are independent of the aircraft for use on existing fleets to displays permanently installed in the cockpits of newer aircraft.

FAA Training and Industry Outreach Includes Human Factors Issues

Because most incursions are caused by human error, FAA is making outreach and awareness efforts to address errors made by pilots, air traffic controllers, and airport vehicle operators. The agency issued booklets in 2004 and 2005 for pilots that highlight communication procedures for safe surface operations at towered and nontowered airports. In collaboration with the aviation industry, FAA helped to create two online courses that educate pilots on runway safety and conducts safety seminars for pilots across the country to encourage safe practices on the airfield. To enhance air traffic supervisor and controller education, FAA is developing for training purposes simulated recreations of actual incursions. In addition, in recent years, FAA developed and initiated controller training on human factors, including skills enhancement regarding teamwork, communication, problem solving, situational awareness, and managing workloads. FAA also provided airline maintenance personnel operating "tug and tow" vehicles with best practices while operating on the airport surface and requires driver training programs for all airport workers who access the airfield movement areas at commercial airports. Many of the items implemented as a result of recommendations made by Runway Safety Action Teams also involved human factors. FAA data indicated that Runway Safety Action Teams recommended 4,441 action items for implementation between April 2001 and mid-December 2006. Of these, 3,338 actions, or about 75 percent, were completed, with the largest combined grouping (945 actions) relating to pilots, air traffic controllers, and vehicle drivers regarding actions such as training and improved procedures. Ten of 19 experts we surveyed indicated that FAA's establishment of Runway Safety Action Teams was very or extremely effective in addressing runway incursions. Only 5 of 22 experts we surveyed indicated that FAA's pilot educational initiatives were very or extremely effective and 8 of 21 experts said that FAA's air traffic controller training was very or extremely effective in addressing runway incursions.

FAA and Airports Have Improved Runway Safety Areas in Case of Overruns

To address runway overruns, FAA and airports have made progress in recent years to bring runway safety areas into compliance with FAA standards. According to FAA, as of May 2007, 70 percent of the 1,014 runways at 573 commercial airports in the United States substantially comply[37] with runway safety area standards, up from 55 percent in 2000. Progress has also been made in bringing runways at the nation's busiest airports into compliance with FAA runway safety area standards pursuant

[37]FAA considers runway safety areas that meet 90 percent of the standards to be in substantial compliance.

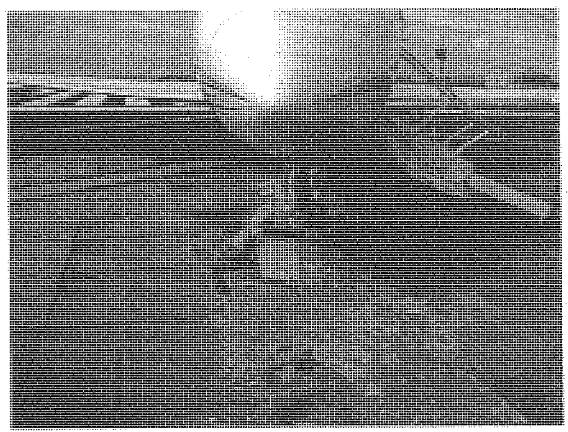
to the congressional mandate to have all airports in compliance by December 31, 2015. As of June 2007, 21 of 47 runways at the 10 busiest U.S. commercial airports did not meet FAA runway safety area standards,[38] down from 30 runways at those airports that did not meet standards in October 2006. Increased compliance with runway safety area standards reduces the chance of aircraft being damaged from overruns.

Recognizing the difficulties of meeting the runway safety area standards at airports that do not have enough space to establish 1,000-foot runway safety areas, FAA conducted research during the 1990s that led to the development of the Engineered Materials Arresting System (EMAS), a bed of crushable concrete designed to stop overrunning aircraft. In 1999, FAA began accepting EMAS as an alternative to constructing a runway safety area when its construction is not practicable and, in 2004, began considering EMAS as generally equivalent to a full-length runway safety area. As of June 2007, EMAS was installed at 24 runway ends at 19 U.S. airports and 12 additional EMAS systems were under contract at 8 airports. In addition, EMAS had successfully stopped four aircraft that had overrun runways, including a Boeing 747 that overran a runway at the John F. Kennedy International Airport in January 2005 and was traveling at an exit speed of about 70 knots, or about 80 miles per hour. Figure 11 shows an example of how EMAS can stop an aircraft. The effectiveness of this measure was supported by a majority of experts we surveyed, who indicated that FAA's acceptance of EMAS as an alternative to constructing a runway safety area when its construction is not practical was very or extremely effective in addressing runway overruns.[39] One expert, for example, said that because many airports no longer have the ability to expand existing runway safety areas, EMAS may be the only practical solution. Other experts noted that preventive measures, such as training to improve pilot skills, are also needed.

[38]Those airports include Chicago O'Hare International Airport, with six runways that did not meet runway safety area standards as of June 2007; Houston's George Bush Intercontinental Airport, with five runways that did not meet standards; and Los Angeles International Airport, with four runways that did not meet standards. Busiest airports were identified from preliminary 2006 enplanement data.

[39]Twelve of 16 experts indicated that FAA's acceptance of EMAS as an alternative to constructing a runway safety area when its construction is not practical was very or extremely effective in addressing runway overruns.

Figure 11: Example of How EMAS Can Stop an Aircraft



Source: Bob Hope Airport, Burbank, CA. Reprinted with permission.

Since 2000, about $300 million per year from FAA's Airport Improvement Program has been spent on runway safety area improvements, and $1.1 billion is expected to be needed to complete the remaining 207 projects. FAA officials told us that, if the current funding levels are maintained for the Airport Improvement Program, sufficient resources will be available to complete the planned runway safety area improvements. An official from an airport association said that even if sufficient airport improvement funds are available for runway safety area improvements, all airports will not be able to acquire the land needed to establish the safety areas. Eleven of 14 experts we surveyed indicated that FAA's use of airport improvement funds to construct runway safety areas was very or extremely effective in addressing runway overruns.

Lack of Coordination and Leadership, Technology Challenges, Lack of Data, and Human Factors Issues Impede Further Progress in Improving Runway Safety

Although FAA took many steps to address runway safety problems involving incursions and overruns, especially since the number and rate of incursions peaked in fiscal year 2001, its efforts have waned in recent years, and the number and rate has remained steady. Additional measures by FAA would enhance the coordination and leadership of runway safety issues, technology, data collection and analysis, and human factors issues.

FAA's Office of Runway Safety Is Not Carrying Out its Coordination and Leadership Functions

FAA is not following its order, issued in 2002, that directs the Office of Runway Safety to coordinate and monitor activities throughout the agency to ensure that runway safety goals are met.[40] The absence of coordination and national leadership impedes further progress on runway safety because no single office is taking charge of assessing the causes of runway safety problems and taking the steps needed to address those problems. Under the FAA order, FAA's Office of Runway Safety is to prepare a national runway safety plan every 2 to 3 years and to provide updates as needed. However, we found that the most recent national runway safety plan, issued in 2002, is no longer being used and the status of its objectives are not being tracked. FAA officials told us the national runway safety plan has been replaced by the FAA Flight Plan, which is a high-level planning document covering all of FAA's programs. However, we agree with the conclusion in a May 2007 audit report by the DOT Office of Inspector General[41] that replacing the national runway safety plan by the higher-level FAA Flight Plan, with the goal of having each FAA office separately include its runway safety initiatives in its own business plan, does not have the same national focus and emphasis on runway safety that a national plan for runway safety provides. In addition, although the Airports Office and the Air Traffic Organization included runway safety objectives in their business plans, the Office of Aviation Safety's business plan for fiscal year 2007 did not include plans to reduce runway incursions.[42] Moreover, the lack of a comprehensive, targeted plan has resulted in uncoordinated efforts that may not be the most effective.

[40]FAA Order 7050.1.

[41]DOT Office of Inspector General, *Progress Has Been Made in Reducing Runway Incursions, but Recent Incidents Underscore the Need for Further Proactive Efforts*, Report No. AV-2007-050 (Washington, D.C.: May 24, 2007).

[42]Under the 2002 national runway safety plan, 11 of the 39 objectives were assigned to the Office of Aviation Safety's Flight Standards Service.

In addition, although FAA hired a permanent director at the Senior Executive Service (SES) level for the Office of Runway Safety in August 2007, the Office of Runway Safety did not have a permanent director for the previous 2 years, resulting in a lack of national program leadership, and its staff was reduced by about 45 percent over the last 4 years. Before 2004, the runway safety office had 66 full-time staff led by an SES-level manager in headquarters, compared to about 37 full-time runway safety staff led by a non-SES-level acting director as of May 2007.[43] Moreover, although contractors represented about 60 percent of the Office of Runway Safety staff in 2004,[44] funding for the office's contract employees was reduced from about $4 million in 2005 to about $2.5 million per year in 2007. An FAA official told us that because the Office of Runway Safety relied heavily on contractors for staff, it lacked a career path for potential managers in the field and at headquarters and lost expertise that the contractors had developed when their contracts expired. In addition, as of May 2007, the Office of Runway Safety no longer had as many full-time detailees from other FAA offices with runway safety responsibilities, including FAA's Airports and Air Traffic Organization's Terminal Service offices, as it had in the past.

Several FAA officials and others said that the lack of leadership in the Office of Runway Safety had negatively affected the program. A regional runway safety program manager said, for example, that having had no permanent director for the office resulted in a lack of direction from headquarters, leaving regions to carry out runway safety efforts in different ways. This situation prevents FAA from identifying systemwide causes of runway safety problems that may require coordinated solutions. Furthermore, an official currently working on the runway safety program said that no quarterly performance review meetings were held between the Acting Director of Runway Safety and the regional runway safety program managers for over a year during 2006 and 2007. These meetings had been held, for example, to discuss regional initiatives. Such sharing of information between regions could help address runway safety issues from a national perspective and implement changes systematically. FAA research officials also told us that after having completed a study for the

[43]In addition to his duties as acting director of the Office of Runway Safety, this official was also a regional runway safety director. Officials in the Air Traffic Organization's Office of Safety Services assisted the acting director in carrying out his duties.

[44]Contractors represented 40 of the 66 Office of Runway Safety employees before 2004 and 21 of the 37 employees in 2007.

Runway Safety Office, they could not find anyone to give it to in FAA headquarters. The new permanent director of the Office of Runway Safety indicated that the office plans to restart some initiatives, including conducting quarterly runway safety performance reviews, starting in December 2007. However, other plans for the office are still being developed.

Technology Challenges Impede Progress in Improving Runway Safety

FAA has faced significant challenges in deploying and developing technology for runway safety. Technology currently being installed, ASDE-X, has experienced cost increases and schedule delays from its original baselines, and is encountering some operational difficulties.[45] At the same time, additional technology to prevent runway collisions is years away from deployment. Because FAA relies heavily on technology as part of its runway safety strategy to supplement a controller's vision of the airfield, these challenges impede progress in addressing runway safety.

FAA has revised its cost and schedule plans twice since 2001 to deploy ASDE-X at 35 airports by 2011. The current program costs have increased by about $125 million over the 2001 estimate, as FAA added nine airports to its deployment schedule (see table 2). FAA currently estimates that the total ASDE-X program cost will be about $806 million, including the cost to operate and maintain the system through fiscal year 2030. This includes facilities and equipment costs of about $550 million, which is approximately $40 million more than what we reported in 2005, plus about $257 million in operations and maintenance costs. As of August 2007, ASDE-X was commissioned[46] at 11 airports. Regarding their plans to deploy ASDE-X to the remaining 24 airports by 2011, FAA officials said that they had focused their efforts at the beginning of the program on software development, which is nearly complete, and on system enhancements, which have been completed, allowing them now to concentrate on system deployment. In addition, FAA officials said in November 2007 that ASDE-X deployment is ahead of the agency's revised 2005 schedule and that costs have remained consistent with its revised 2005 cost estimate. Nonetheless, as discussed below, our concerns about the schedule plans for ASDE-X remain.

[45] We are conducting ongoing work on how FAA factors cost increases and schedule delays for systems such as ASDE-X into its acquisition performance measurement.

[46] FAA refers to ASDE-X as being commissioned after the system has been tested at an airport and demonstrated that the field site personnel can fully operate and maintain it.

Table 2: Changes in ASDE-X Equipment Cost and Deployment Completion Dates

	2001 estimate	2002 estimate	2005 estimate	2007 estimate
Cost targets	$424.3	$505.2	$549.8	$549.8
Number of planned operational systems	26	33	35	35
Deployment completion targets	2007	2007	2011	2011

Source: GAO analysis of FAA data.

Note: Cost is millions of dollars.

Although it took about 4 years for ASDE-X to be commissioned at those 11 airports, FAA plans to deploy the system at the remaining 24 additional airports in less than 4 years (see app. V). Furthermore, not all 11 ASDE-X commissioned airports have key safety features of the system. For example, as of August 2007, three of the ASDE-X commissioned airports did not have safety logic, which generates a visible and audible alert to an air traffic controller regarding a potential runway collision. Moreover, five airports, including the three lacking safety logic, do not have a system enhancement that allows ASDE-X to alert controllers of potential collisions on intersecting runways or runways intersecting taxiways during inclement weather (see table 3). Because of these issues, the DOT Inspector General reported,[47] and we agree, that the program is at risk of not meeting its current cost and schedule plans to deliver ASDE-X systems at 35 airports by 2011.

[47]DOT Office of Inspector General, *Actions Needed To Reduce Risk with the Next Generation Air Transportation System*, CC-2007-047 (Washington, D.C.: May 9, 2007) and *FAA Needs to Improve ASDE-X Management Controls to Address Cost Growth, Schedule Delays, and Safety Risks*, AV-2008-004 (Washington, D.C.: Oct. 31, 2007).

Table 3: ASDE-X Commissioned Airports as of August 2007

Airport	Commissioned date	Safety logic	System enhancements[a]
General Mitchell International Airport (Milwaukee, WI)	October 30, 2003	Yes	Yes
Orlando International Airport	September 30, 2004	Yes	Yes
Theodore Francis Green State Airport (Providence, RI)	May 16, 2005	No	No
William P. Hobby Airport (Houston, TX)	August 31, 2005	No	No
Seattle-Tacoma International Airport	February 24, 2006	Yes	No
Lambert-St. Louis International Airport	May 24, 2006	Yes	No
Hartsfield-Jackson Atlanta International Airport	June 7, 2006	Yes	Yes
Bradley International Airport (Hartford, CT)	June 21, 2006	No	No
Louisville International-Standiford Field	July 19, 2007	Yes	Yes
Chicago O'Hare International Airport	August 29, 2007	Yes	Yes
Charlotte Douglas International Airport (Charlotte, NC)	August 30, 2007	Yes	Yes

Source: FAA.

[a]These enhancements include rain configuration, which maintains the system functioning during inclement weather such as moderate or heavy rain; converging taxiway logic, which generates an alert when an aircraft or vehicle on a taxiway is predicted to enter a runway; intersecting runway alerts, which generate alerts when aircraft are predicted to collide at intersecting runways; and tower configuration, which directs an alert regarding potential conflicts on particular runways to certain controllers.

Recent serious runway incursions at airports with fully operational runway safety technology reveal persistent problems with their alerting functions. For example, air traffic controllers at eight airports with ASDE-3/AMASS told us that the alerting function does not work well during heavy precipitation and that they disable the alerting function during inclement weather.[48] As a result, air traffic controllers at those airports with ASDE-3/AMASS do not have the benefit of an incursion alerting system in poor weather conditions, when it may be most needed. Furthermore, the ASDE-X commissioned airports are experiencing problems with false alerts, which occur when the system incorrectly predicts an impending collision, and false targets, which occur when the system incorrectly identifies something on the airfield as an aircraft or vehicle and could generate a false alert. (These problems are discussed in more detail below.) Although FAA officials acknowledged that ASDE-X is experiencing problems with false alerts, they said the system is operating

[48]FAA officials said that due to the nature of radar, heavy rain has the potential to degrade system performance, but that all radar systems have similar limitations. However, they also said that ASDE-X performs much better in all levels of rain than the ASDE-3/AMASS system.

within specifications. An April 2007 FAA internal audit of the ASDE-3/AMASS and ASDE-X safety logic systems concluded that the runway safety logic system was not providing consistent information to controllers, creating a lack of confidence in the system.[49] Furthermore, NTSB, after several investigations of incursions at airports equipped with ASDE-3/AMASS, determined that the alerting process was ineffective because the delay was too long before pilots would receive the alert relayed by controllers. As a result, NTSB asked that FAA develop a system that provides a direct warning to the cockpit.[50]

Of the 11 ASDE-X commissioned airports, the control tower at the Seattle-Tacoma International Airport reported the most problems with false targets.[51] In addition, of the eight ASDE-X commissioned airports with the alerting function, the control tower at the Hartsfield-Jackson Atlanta International Airport reported the most problems with false alerts.[52] When an ASDE-3/AMASS or ASDE-X alert sounds, air traffic controllers are required to instruct landing aircraft to follow a go-around procedure, sending the aircraft back into the airspace for another landing attempt, even if nothing is visible on the runway that could cause a collision.[53] The controllers said the effect of this practice is to increase air traffic and flight times. Officials from the ASDE-X manufacturer said an elevated number of false targets, on average, at the Seattle-Tacoma International Airport is caused primarily by the location of the surface movement radar relative to the airport facility structures, the movement area, and the airport's configuration. The location of these structures is determined by FAA and the airports. Officials from the manufacturer also said ASDE-X at the Hartsfield-Jackson Atlanta International Airport is experiencing an

[49] *Audit of Runway Safety Logic Systems*, FAA Air Traffic Safety Oversight Service, Audit Project Number: ADT-FY-07-001 (Washington, D.C.: April 16, 2007).

[50] According to NTSB, simulations of ASDE-3/AMASS performance using data from actual incursions showed that alerts may occur as little as 8 to 11 seconds before a potential collision.

[51] The air traffic control tower at the Seattle-Tacoma International Airport reported 306 false targets from January 27, 2006, though May 17, 2007. According to FAA, 261 of these false targets have been addressed by an adaptation or software change, and very few were related to system malfunctions.

[52] We reviewed the daily records of air traffic control tower operations at the Hartsfield-Jackson Atlanta International Airport and found that 41 false alerts were recorded from June 7, 2006, to May 16, 2007.

[53] FAA Order 7110.65R.

elevated number of nuisance alerts, which are caused by real conditions that are not safety threats, such as a vehicle on a runway, but landing aircraft are far enough from the airport not to constitute a threat. They said the nuisance alerts being experienced at the Hartsfield-Jackson Atlanta International Airport are caused by the site-specific configuration parameters of the system, and that they are working with air traffic controllers, FAA engineers, and the ASDE-X program office to adjust the parameters of the system to minimize the nuisance alerts while maintaining the required performance. The officials noted the difference between nuisance alerts and false alerts, which are issued after the system detects potential threats that are not real. The officials said they examine false alerts very closely with FAA and determine whether to make design modifications to the system to ensure that they are minimized.

FAA ASDE-X program officials said that the problems with false alerts and false targets are site-specific, rather than systemic issues, relating to the location of sensors and radar towers. The officials said they are working to address the problems by adjusting the sensitivity of the systems, which they described as a time-consuming, continuous process with no single fix. For example, they said that at the Seattle-Tacoma International Airport, the system's level of sensitivity was increased at the site's request because of its experience with heavy fog, and that a certain number of false targets cannot be eliminated without sacrificing the sensitivity. At the same time, FAA officials acknowledged that the location of the ASDE-X surface movement radar at the Seattle-Tacoma International Airport has affected system performance much more than originally anticipated. FAA also noted that all radar systems experience false targets as a function of detection and that the majority of false targets at the Seattle airport occurred on taxiways near the terminal. They also said that new software being deployed at airports starting in September 2007 would help address the problems involving false alerts and that with the addition of the new software, ASDE-X is operating under system requirements not to generate more than two false alerts within 24 hours. This software enhancement was deployed at the Hartsfield-Jackson Atlanta International Airport in September 2007, and FAA program officials said they believe it has resulted in improved ASDE-X system performance. We were not able to confirm this information.

Only 3 of 17 experts we surveyed indicated that FAA's deployment of ASDE-3/AMASS was very effective,[54] and 4 of 17 experts said that ASDE-X was very or extremely effective in addressing runway incursions.[55] One expert, for example, said that ASDE-X appears to be a great technology to aid controllers, but is not trustworthy at this point because the rate of false alerts is somewhat high. In addition, this expert said that because ASDE-X has been deployed only to a few airports, it is not doing much to address runway incursions within the national airspace system as a whole. Another expert said that ASDE-X and runway status lights would greatly enhance both pilot and air traffic controller awareness, particularly at complex airports.

Most airports in the United States have no runway safety technology to supplement a controller's vision of the airfield and will not have such technology even after FAA completes its plan to deploy ASDE-X at 35 major airports. FAA's original plans called for 34 airports to receive ASDE-3/AMASS and 35 airports to receive ASDE-X. In total, 59 airports[56] were to receive either technology, but this number was reduced to 44 in August 2006 after FAA canceled plans to deploy ASDE-X at 15 of the originally scheduled airports.[57] The 35 major airports to receive ASDE-X handle 70 percent of the enplanements at U.S. airports but represent only 6 percent of all U.S. commercial airports,[58] leaving most airports without this type of

[54]Of the 17 respondents, 3 said ASDE-3/AMASS was very effective, 9 moderately effective, 4 slightly effective, and 1 not at all effective.

[55]Of the17 respondents, 1 said ASDE-X was extremely effective, 3 said it was very effective, 10 said it was moderately effective, and 3 said it was slightly effective.

[56]Ten airports that were scheduled to receive ASDE-X already had ASDE-3/AMASS.

[57]FAA's rebaseline of the ASDE-X program, which was approved by the agency's Joint Resources Council, was conducted on the basis of analyzing the safety and efficiency benefits of deploying the system at the 59 top-tier airports. The analysis assumed that maximum benefit was derived from deploying ASDE-X at airports with larger traffic counts and/or more complex operations. Sunk costs, such as site preparation that was already underway, were also considered. However, we found that FAA's ASDE-X business case did not include year-by-year estimates of benefits and costs or a sensitivity analysis, as required for all investment decisions by Office of Management and Budget (OMB) Circular A-94. A sensitivity analysis is a quantitative assessment of the effect that a change in an assumption—the numerical value of a single parameter—will have on net present value. In commenting on a draft of this report, FAA officials said that they had computed year-by-year analyses and conducted a sensitivity analysis. However, this information was not included in FAA's business case for ASDE-X for the entire 30-year lifecycle investment, as required by OMB.

[58]There were approximately 570 airports used by commercial service aircraft in 2006.

technology. Six of 12 experts who indicated that they had knowledge of or experience with the deployment of ASDE-X indicated that, considering the benefits and problems with ASDE-X, including false alerts and false targets, deployment of the system at the remaining 27 airports[59] by 2011 should be kept as planned, 4 said that deployment should be accelerated, and 2 said that deployment should be slowed down. One expert, for example, who indicated that the deployment of ASDE-X should be kept as planned, said that the problems with the system will be worked out as the system is deployed.

FAA is testing additional runway safety technology, but these systems are still years from being deployed in the United States. Runway status lights, which warn pilots when runways are unsafe to enter or cross, have had positive preliminary test evaluations, but need a surface surveillance system such as ASDE-3/AMASS or ASDE-X to operate. FAA officials expect to decide in 2007 whether to deploy runway status lights at the 35 ASDE-X airports at an estimated cost of $300 million but do not expect to make a final investment decision on another runway safety lighting technology, the Final Approach Runway Occupancy Signal, which provides a visible warning to aircraft on approach, for another 2 years. In addition, an FAA official said the agency is still exploring the capabilities of the low cost surface surveillance system and does not yet have a deployment schedule. Only 2 of the experts we surveyed indicated that FAA's testing of the low cost surface surveillance system was very effective in addressing runway incursions.[60] FAA announced in March 2007 that it was changing the certification process to enable the use of electronic flight bags (electronic display systems that give pilots a variety of aviation data such as aircraft operating manuals and navigational charts) and airport moving maps,[61] which can show an aircraft's position on an airfield, but a system that shows the location of other aircraft on the airfield is still under development. In addition, although officials from the Hartsfield-Jackson Atlanta International Airport cited the benefit of reducing aircraft runway crossings from using the airport's new perimeter taxiway, FAA officials said that few U.S. airports have the space to

[59]At the time the survey was administered, ASDE-X had not yet been commissioned at 27 of the 35 airports.

[60]Of 8 respondents, 2 said it was very effective, 3 moderately effective, and 3 slightly effective.

[61]Most electronic flight bags contain moving maps, which help pilots identify and anticipate an airplane's location on runways and taxiways.

construct perimeter taxiways and noted that they are expensive to construct.

Lack of Runway Incident Data Impedes Causal Analysis

In addition to its technological challenges, FAA lacks reliable runway safety data and the mechanisms to ensure that the data are complete. FAA's tabulation of the number of incursions does not reflect the actual number of incidents that occur. FAA only counts incursions that occur at airports with air traffic control towers, so the actual number of incursions, including those that occurred at airports without air traffic control towers, is higher than FAA reports. In addition, FAA's information on incursions that occurred at towered airports may not be complete, according to some experts we surveyed. For example, one expert said that the airline industry's reporting of runway incursions is higher than FAA's data and that most or all air carriers are aware of significant events that controllers failed to report. Although the airline industry provides data to FAA on safety incidents that may involve runway incursions, the information lacks sufficient specificity for FAA to use in its tabulation of incursions.

Furthermore, although FAA requires errors[62] that may result in incursions to be reported, the information collected does not always contain complete data on the causes and circumstances involved. Without more complete data, FAA cannot conduct in-depth analyses to ensure that the most effective corrective measures that address the causal factors are being implemented. An FAA program to obtain detailed information about the circumstances regarding runway incursions by administering questionnaires to pilots involved in incursions—the Runway Incursion Information and Evaluation Program—could help to identify root causes of pilot deviations and provides a mechanism to obtain information that may not otherwise be reported. However, only 19 percent of pilots involved in runway incursions and surface incidents participated in the

[62]These errors include operational errors, which FAA defines as an action by an air traffic controller that results in less than the required minimum separation between two or more aircraft, or between an aircraft and an obstacle (e.g., vehicles, equipment, personnel on runways); operational deviations, which are defined as an occurrence attributable to an element of the air traffic system in which applicable separation minima were maintained, but an aircraft, vehicle, equipment, or personnel encroached upon a landing area that was delegated to another position of operation without prior coordination or approval; pilot deviations, which are defined as actions by pilots that violate any Federal Aviation Regulation; and vehicle/pedestrian deviations, which are defined as vehicles, pedestrians, or other objects interfering with aircraft operations by entering or moving on the movement area without authorization from air traffic control.

program during 2004 through 2006, and FAA did not provide any evidence that it analyzed the data that were collected.

Certain FAA efforts that are in the early stages have the potential to improve runway safety data. For example, FAA plans to start a nonpunitive, confidential, voluntary reporting program for air traffic controllers, similar to the Aviation Safety Action Program[63] as part of the FAA safety management system.[64] The program will enable air traffic controllers to report anything that they perceive could contribute to safety risks in the national airspace system. The benefit of such program is that the information obtained might not be reported otherwise, and could increase the amount of data collected on the causes and circumstances of runway incursions. Many industry stakeholders such as the National Air Traffic Controllers Association, the Air Transport Association, the Air Line Pilots Association, and the Air Safety Foundation, support establishing such a program, which could also help reduce any underreporting of incidents. FAA has been working on establishing such a program since 2004, and indicated at a runway incursion meeting with the aviation community in August 2007 that it would implement a short-term runway safety plan that included implementing such a voluntary self-reporting program. According to FAA, it signed a partnership agreement with the National Air Traffic Controllers Association regarding the program in October 2007; however, the agency did not indicate when the plan would be implemented.

We also found that FAA's categorization of the severity of runway incursions involves a level of subjectivity, raising questions about the accuracy of the data. An internal FAA audit of 2006 runway incursion data

[63]This program seeks to improve aviation safety through the voluntary self-reporting of safety incidents. Participants include employees of air carriers and repair stations that have entered into a memorandum of understanding with FAA. FAA does not take enforcement action against employees who voluntarily self-reported safety violations for reports that are sole-source and will pursue administrative action only for reports that are not sole-source. Incidents that involve alcohol, drugs, criminal activity, or intentional disregard for safety are not eligible for self-reporting under the program. See GAO, *Aviation Safety: FAA's Safety Oversight System Is Effective but Could Benefit from Better Evaluation of Its Programs' Performance*, GAO-06-266T (Washington, D.C.: Nov. 17, 2005) and *Aviation Safety: Better Management Controls are Needed to Improve FAA's Safety Enforcement and Compliance Efforts*, GAO-04-646 (Washington, D.C.: July 6, 2004).

[64]Safety management is a systematic, explicit, and comprehensive approach for managing safety risk at all levels and throughout the entire scope of an operation and lifecycle of a system.

found that the subjectivity of the severity classifications has the potential to affect the accuracy of the classifications. The audit found that incursion severity classifications were subjective and partially incomplete. In addition, 18 percent of the incursion severity classifications for 2006 were found not to be in compliance with FAA severity classification requirements or could not be classified accurately.[65] The audit also found that since August 31, 2006, the Office of Runway Safety has been using a computer program called Runway Incursion Severity Classification to calculate initial assessments of severity.[66] FAA indicated that use of the computer program ensures consistent ratings based on available data. However, most of the information regarding incursions, which is entered into the computer model, is based on observations of incidents, rather than instrument readings, because many airports do not have the technology needed to collect such information or the information is not available to FAA, according to agency officials.[67] Observations regarding matters such as how close two aircraft came to colliding on a runway may be less accurate than instrument readings and, therefore, raise questions about the accuracy of the severity assessments. These findings were supported by the experts we surveyed. The majority of the experts who responded to a question about the accuracy of FAA's incursion severity classifications indicated that, based on their knowledge of specific incidents, FAA classified the incidents as being less severe than they actually were.[68]

[65]Auditors found that 82 percent of the runway incursion assessments complied with the severity classifications, 4 percent were not in compliance, and that 13 percent of the incursions could not be accurately classified due to insufficient guidance contained in FAA Order 7050.1, which defines the severity classification categories.

[66]The current method of evaluation is for the program to assign a severity rating and then have the Air Traffic Organization assessment team members vote to reach a consensus. If the assessment team's rating is different from the program, then the Air Traffic Organization's Director of Operational Services will make the final determination of severity. FAA plans to complete its validation of the computer program in fiscal year 2008.

[67]An FAA official said, for example, that the agency usually does not receive information from aircraft flight recorders for its runway incursion assessments.

[68]Seven of 11 experts questioned the classifications and 4 said that the incidents tended to be correctly classified.

Furthermore, FAA does not have complete information on ASDE-3/AMASS and ASDE-X system abnormalities, which could be used to analyze the performance of the systems' alerting functions. An internal FAA audit[69] concluded that 54 percent of all alerts—false and real—from the ASDE-3/AMASS and ASDE-X systems and 40 percent of instances when the systems' alerting functions were disabled were not recorded.[70] The audit also found no evidence of alerting standards for the runway safety logic systems, which limits the systems' capability of assessing risks and providing timely alerts to air traffic controllers.

We also found that FAA does not systematically collect data on the number of runway overruns that do not result in damage or injury that could be used for analytical purposes to study trends and causes of these incidents. FAA officials said it would be useful to collect such data because it would help them tailor standards to what has actually occurred, for example, how far an aircraft overran a runway before stopping.

Controller Fatigue Continues to Be a Runway Safety Concern

Air traffic controller fatigue continues to be a human factors issue affecting runway safety. In April 2007, for example, NTSB recommended that FAA mitigate concerns about air traffic controller fatigue by (1) working with the National Air Traffic Controllers Association to revise controller work-scheduling policies and practices so controllers would have enough sleep and to modify shift rotations to minimize disrupted sleep patterns for controllers, and (2) developing a fatigue awareness and countermeasures training program for controllers and for the personnel involved in scheduling their work. In supporting its recommendation, NTSB cited four instances from 2001 through 2006 when tired controllers made errors while performing their duties that resulted in serious incursions. NTSB said that although FAA regulations and policies place limits on controller work schedules, for example, by requiring that controllers be provided at least one full 24-hour day off per week, they do not adequately consider the potential effect of work scheduling on fatigue and performance. FAA officials said they were analyzing NTSB's recommendations on air traffic controller fatigue but that implementing them would require renegotiating the agency's contract with the union representing the controllers.

[69] *Audit of Runway Safety Logic Systems*, FAA Air Traffic Oversight Service, Audit Project Number: ADT-FY-07-001 (Washington, D.C.: April 16, 2007).

[70] FAA Order 7210.3 requires that when the safety logic system generates any alert or is offline, it should be documented on the facility's air traffic log.

According to FAA data, as of May 2007, at least 20 percent of the controllers at 25 air traffic control facilities, including towers at several major airports, were working 6-day weeks,[71] which could cause fatigue. FAA officials said that it may take 2 to 3 years before controller overtime can be reduced at some facilities, as the agency acts to replace retiring controllers. In the meantime, the agency officials indicated that they had no plan to mitigate the effects of air traffic controller fatigue.

While FAA has taken some actions to address controller fatigue, problems have been identified with some efforts. For example, an FAA human factors initiative, the National Air Traffic Professional Program, is aimed at identifying how controllers' performance can be affected by factors such as fatigue and distraction. The program consists of training designed to sharpen and maintain controllers' mental skills most closely associated with visual attention and scanning. However, the DOT Inspector General reported in May 2007[72] that the program had not been implemented at towers where visual attention and scanning are key factors in preventing runway incursions. Although FAA has taken some steps to address human factors issues through the educational initiatives that were discussed earlier, progress on addressing runway safety will be impeded until the human factors issues involving fatigue are addressed.

[71]FAA identified 25 facilities with 20 percent or greater of the employees working a 6-day week and 4 percent or greater of the hours were covered by overtime. The 25 facilities included 21 control towers and 4 terminal radar approach control facilities. Of 25 facilities, 12 had between 20 and 29 percent of their controllers working 6-day weeks, 7 had between 30 and 39 percent of their staff working 6-day weeks, and 6 facilities had between 40 to 52 percent of their controllers working 6-day weeks. The 25 facilities included 7 control towers at airports that were ranked among the 50 busiest FAA air traffic control towers in the country, including Hartsfield-Jackson Atlanta International Airport, which is the busiest airport in the country and had 52 percent of its controllers regularly working 6-day weeks.

[72]DOT Office of Inspector General, *Progress Has Been Made in Reducing Runway Incursions, but Recent Incidents Underscore the Need for Further Proactive Efforts*, Report No. AV-2007-050 (Washington, D.C.: May 24, 2007).

FAA Has Not Implemented NTSB's Runway Safety Recommendations

FAA has not implemented any of NTSB's six runway incursion prevention recommendations, made in 2000,[73] that FAA

- require all airports with scheduled passenger service to deploy a ground movement safety system that will prevent runway incursions and provide a direct warning capability to flight crews;
- require that all runway crossings be authorized by specific air traffic control clearance;
- require that, when aircraft need to cross multiple runways, air traffic controllers issue an explicit crossing instruction for each runway;
- discontinue the practice of allowing departing aircraft to hold on active runways at night or at any time when visibility conditions preclude arriving aircraft from seeing traffic on the runway in time to initiate a safe go-around maneuver;
- adopt an ICAO landing clearance procedure that forbids multiple landing clearances for the same runway; and
- require the use of ICAO phraseology for airport surface operations, and periodically emphasize to controllers the need to use this phraseology and to speak at reasonable rates when communicating with flight crews.

Since NTSB made these recommendations 7 years ago, FAA has made some efforts to address them, but NTSB has not accepted FAA's responses. Regarding NTSB's recommendation that a direct incursion warning capability be developed for flight crews, FAA indicated in 2006 that, among other efforts, it had successfully completed promising initial field tests of runway status lights at the Dallas-Ft. Worth International

[73]On August 28, 2007, NTSB made five additional runway safety recommendations to FAA and others. These recommendations included (1) requiring crewmembers on the flight deck to positively confirm and cross-check the airplane's location at the assigned departure runway before crossing the hold short line for takeoff, (2) requiring aircraft operators install on their aircraft cockpits moving map displays or an automatic system that alert pilots when a takeoff is attempted on a taxiway or a runway other than the one intended, (3) requiring airports implement enhanced taxiway centerline markings and surface painted holding position signs at all runway entrances, (4) prohibiting the issuance of a takeoff clearance during an airplane's taxi to its departure runway until after the airplane has crossed all intersecting runways, and (5) suggesting that controllers refrain from performing administrative tasks, such as the traffic count, when moving aircraft are in the controller's area of responsibility.

Airport but that additional tests would be needed to determine if the system could be deployed to airports throughout the country. An NTSB official told us that the board would need to evaluate the runway status lights system before it could determine whether the system would satisfy this recommendation. Regarding NTSB's recommendations that FAA change certain air traffic control procedures, FAA said that implementing the recommendations could possibly transfer the risk to another segment of the operation by increasing pilot and controller workload and radio frequency congestion, and causing unexpected and unnecessary go-around procedures. However, NTSB disagreed, indicating that it remained concerned about situations where pilots may be lost, or believed they have received permission to move to different positions other than those that air traffic controllers intended and that air traffic controllers should not clear aircraft to land on runways that are occupied by other aircraft.

Regarding NTSB's recommendation that FAA adopt ICAO phraseology, FAA indicated in 2004 that adopting certain ICAO phraseology would create inconsistency and nonstandardization throughout the national airspace system. However, NTSB noted that by not adopting the ICAO phraseology, FAA has not harmonized its phraseology with the rest of the world. Two of our survey respondents also suggested that FAA adopt ICAO phraseology in communications between the air traffic controllers and pilots. In August 2007, FAA announced that it plans to assess whether it needs to change the phraseology of taxi clearances given by controllers to better align with ICAO standards, among other planned actions.

FAA Has Opportunities to Improve Runway Safety

The results of our survey of experts indicated that the actions that FAA could take with the greatest potential to prevent runway incursions, considering costs, technological feasibility, and operational changes, were measures to provide information or alerts directly to pilots (see table 4). For example, the actions that FAA could take with the most potential were lighting systems that guide pilots as they taxi at the airport and technology that provides enhanced situational awareness on the airfield and alerts of potential incursions.

Table 4: Experts' Ranking of the Actions that FAA Could Take with the Most Potential to Address Runway Incursions

Ranking	Action
1	Encourage the use of a taxi guidance lighting system
2	Encourage the development of runway incursion warnings in the cockpit
2	Encourage the development of cockpit moving maps that show the location of other aircraft and vehicles on the airfield
2	Encourage the use of yellow embedded lights for hold short lines[a]
3	Encourage the use of Runway Awareness and Advisory System technology, which provides aural situational advisories to pilots on the airfield
3	Improve airport markings

Source: GAO analysis of responses from survey of experts.

[a]Hold short lines are markings indicating where aircraft should hold before receiving permission from air traffic control to enter a runway.

Note: Rankings are based on responses from 22 experts and reflect actions that a majority of experts indicated had "great potential" or "very great potential." Although other actions also received a majority of positive responses, this table reports those that received the highest number of positive responses.

Our survey respondents and international aviation safety experts also said that certain runway safety procedures in other countries have the potential, if adopted, to improve runway safety in the United States. International aviation organization officials said that there is some benefit to having air traffic controllers clear aircraft to holding points—a practice being followed at some airports outside of the United States—rather than directly to runways but that it would increase already-busy radio communications between pilots and the air traffic control tower. In addition, some experts suggested that because of the safety risks involved, FAA should stop using land and hold short procedures, which are mainly used in the United States and involve instructing landing aircraft to land and hold on their runway before crossing an intersection or another runway. Officials from an international aviation organization said that U.S. carriers are generally comfortable with land and hold procedures and understand that they are necessary to manage the large volume of traffic at certain airports. However, they added that the procedures would be greatly improved if they could be agreed upon and promulgated internationally. An expert also suggested that FAA consider deploying progressive taxiway lights that activate as aircraft taxi to or from the runway to help keep aircraft from making wrong turns or entering the runway environment. However, other experts said that progressive taxiway lights are difficult to see in the daytime.

Recognizing the need for additional actions to improve runway safety, on August 15, 2007, FAA met with the aviation community and agreed on a short-term plan, which included some measures that our experts had also recommended. The participants decided to take the following actions during the subsequent 60 days: (1) conduct safety reviews at the airports where runway incursions and wrong runway departures are the greatest concern, (2) disseminate runway safety information and training across the entire aviation industry, (3) accelerate the deployment of improved airport signage and markings at the top 75 airports, and (4) review cockpit and air traffic control procedures, which could include changing cockpit procedures to minimize pilot activities and distractions while an aircraft is moving on the ground and to make air traffic control procedures more precise. On October 22, 2007, FAA announced that among the actions taken, (1) safety reviews at 20 airports had been completed, (2) 104 of 112 air carriers provided pilots with simulator and other training incorporating runway scenarios, (3) runway markings had been upgraded at 52 of 75 medium- and large-sized airports, and (4) 101 of 112 air carriers had reviewed cockpit procedures to identify and develop a plan to address pilot distractions when taxiing to runways. In addition, FAA indicated that it had completed analyzing air traffic control procedures regarding taxi clearances and found that more explicit taxi instructions were needed.

The experts we surveyed also provided suggestions to prevent runway overruns. They said the actions that FAA could take with the greatest potential, considering costs, technological feasibility, and operational changes, included improving communication of runway conditions and weather to flight crews and encouraging improvements in and use of runway condition and friction measurements (data regarding the slickness of a runway). Regarding overseas practices to help prevent overruns, some survey respondents said that more detailed information about runway conditions is provided to pilots in some other countries, which could be communicated to pilots in the United States as they prepare to land. Furthermore, on October 4, 2007, NTSB recommended that FAA require pilots to conduct landing distance assessments before every landing on the basis of existing aircraft performance data, actual conditions, and incorporating a minimum 15 percent safety margin. FAA has not yet responded to this recommendation.

Progress in Addressing Ramp Safety Is Affected by a Lack of Data and Standards, but the Industry Is Taking Action to Address these Issues

The aviation industry has made efforts in recent years to address the incidence of ramp accidents. However, these efforts have been hindered by a lack of data on the nature, extent, and cost of ramp accidents and the absence of industrywide ground handling standards. In response, the federal government and the aviation industry have undertaken additional steps to collect data and develop standards as a means of understanding the problem and reducing the number of accidents.

Lack of Complete Accident Data Hinders Efforts to Address Ramp Safety

We found no source of comprehensive data on airport ramp accidents. Various aviation entities collect ramp accident data, but they are not complete enough to be useful for industrywide analyses, and, in many cases, the entities were not willing for competitive reasons to publicly disclose the data. Many industry stakeholders indicated to us that they lack complete ramp accident data. Without such data, it will be difficult for the aviation industry to understand the nature, extent, and cost of ramp accidents and to allocate appropriate resources and methods to improve ramp safety.

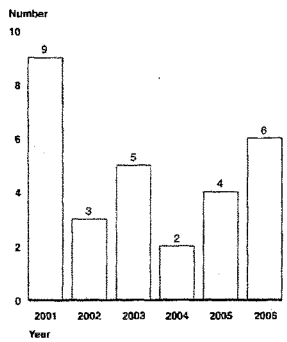
We found that data on ramp fatalities was more readily available than data on nonfatal injuries and accidents without injuries. We reviewed FAA, NTSB, and OSHA ramp fatality data[74] from 2001 through 2006 and determined that these agencies investigated 29 fatal ramp accidents during that time. (See fig. 12.) These accidents occurred at airports of various sizes—from large hubs to small general aviation airports.[75] No airport experienced more than 2 fatalities during this time period. (See app. VI.) Of the 29 fatalities, 17 were ground workers, 8 were passengers, and 4 were pilots. The ramp fatalities generally occurred when these employees were struck by objects (such as vehicles), were crushed, or fell. Most aviation safety officials told us that ramp accidents represent little or no danger to passengers, although a potential danger exists if, for example,

[74]FAA, NTSB, and OSHA have the authority to investigate accidents that occur on the ramp.

[75]Primary commercial service airports are categorized based on the percentage of total annual passenger boardings (enplanements) for all operations of U.S. carriers within the United States. General aviation airports are small airports that do not receive scheduled commercial service.

damage to an aircraft is left unreported. Of the 8 passengers who were killed in ramp accidents from 2001 through 2006, 5 were struck by propellers. Although we obtained data on fatal accidents, it is difficult to determine the true nature and extent of all ramp accidents, including those that result in injuries, because OSHA, the primary source of ramp fatality data, does not collect or report data on occupational injuries other than fatalities that occur in ramp areas. Furthermore, because FAA and NTSB only investigate certain ramp accidents, as discussed earlier, they do not have complete ramp accident data.

Figure 12: Annual Number of Ramp Fatalities at U.S. Airports from 2001 through 2006



Source: GAO analysis of FAA, NTSB, and OSHA data.

Lack of Standards for Ramp Operations Could Hinder Safety

We found no federal or industrywide standards for ramp operations. Each airport authority has its own rules and regulations, which may be based on local ordinances or state laws. In the United States, airlines typically control the ramp areas, and each operates its ramps with its own specific set of policies and procedures. In addition, in recent years, more airlines have been contracting out some or all of these services, and often one ground handling company services the aircraft of several airlines at an airport. In this situation, ground handling companies must carry out their duties in accordance with each airline's policies and procedures, and, because there is no standard for ramp operations, this could lead to confusion about operating procedures and safety rules and increases the likelihood of accidents.

The Federal Government and the Aviation Industry Are Taking Some Measures to Address Ramp Safety

FAA, OSHA, airports, and airlines are taking various measures to address ramp accidents. According to experts we surveyed, three of the four most effective actions are being taken by airlines, for example, by setting safety targets and using ramp towers (see table 5).

Table 5: Experts' Ranking of the Most Effective Actions by FAA, OSHA, Airports, and Airlines to Address Ramp Accidents

Ranking	Action
1	Airlines setting safety targets for reducing injuries in ramp areas
1	FAA's use of Runway Safety Action Teams
2	Airlines' use of ramp towers
2	Airlines entering into safety alliances with OSHA

Source: GAO analysis of responses from survey of experts.

Note: Rankings are based on responses from 15 experts and reflect the actions that received the highest number of responses indicating that they were "very effective" or "extremely effective." However, none of these actions received a majority of positive responses.

The federal government has generally taken an indirect role in addressing ramp safety. Since August 2000, FAA and OSHA have operated under a memorandum of understanding that gives FAA responsibility for investigating occupational accidents involving flight attendants; in the memorandum, OSHA agreed to continue its enforcement efforts on behalf of other aviation employees, such as ramp workers. However, neither agency has developed a plan or policy to reduce ramp accidents and address ramp safety in a strategic, coordinated manner. FAA's primary tool for enhancing ramp safety is the promotion of a safety management system for aviation service and airport operators through advisory circulars issued in 2006 and 2007.[76] FAA defines a safety management system as the application of a systematic, proactive approach to identifying and mitigating safety risks. The use of safety management systems increases the likelihood that safety problems would be detected and corrected before they result in an accident. However, advisory circulars are voluntary in nature. Although FAA expects to issue a Notice

[76]Advisory Circular 120-92 (June 22, 2006) and Advisory Circular 150/5200-37 (February 28, 2007).

of Proposed Rulemaking in 2008, which would make this guidance mandatory for airport operators, rulemakings often take years to complete.

According to an official with the Air Transport Association, a trade organization representing the airline industry, the safety management system concept invites FAA's acceptance of the continuous improvement process adopted by the carrier and its airport stakeholders. The official added that measuring the effectiveness of mitigation efforts is an essential part of safety management systems. However, only two of the experts we surveyed indicated that FAA's issuance of advisory circulars on safety management systems for airport operators and aviation service providers was very effective in addressing ramp accidents.[77] One expert said that FAA's issuance of an advisory circular does not prompt change, but is a way to reduce the agency's inspection workload. However, another expert said that when safety management systems are required, airports and air carriers will assume a larger role in oversight, data collection, and safety assurance.

OSHA uses industry participation in its voluntary programs to promote ramp safety while also conducting workplace inspections and taking enforcement actions when needed. Twelve[78] airlines and the National Safety Council, a nonprofit, nongovernmental, public service organization dedicated to protecting life and promoting health, maintained a national alliance addressing ergonomic issues associated with customer checked baggage handling with OSHA from November 2002 to November 2006. This alliance resulted in several tools for enhancing ramp safety, including an OSHA e-Tool on baggage handling safety and an OSHA Web page detailing the agency's assistance for the airline industry. The Air Transport Association has initiated discussions with OSHA about forming an alliance to address ramp vehicle safety. Three of 13 experts we surveyed indicated that airlines entering into safety alliances with OSHA to address ramp

[77]Of the 14 respondents to the question regarding the effectiveness of FAA's issuance of advisory circulars on safety management systems for airport operators, 2 said that it was very effective, 3 moderately effective, 7 slightly effective, and 2 not at all effective. Of the 13 respondents to the question regarding the effectiveness of FAA's issuance of advisory circulars on safety management systems for aviation service providers, 2 said it was very effective, 3 moderately effective, 7 slightly effective, and 1 not at all effective.

[78]Thirteen airlines originally entered into this alliance with OSHA. When the alliance was renewed, 12 airlines participated in the alliance.

accidents was very or extremely effective.[79] One expert, for example, said that OSHA safety alliances are an extremely effective way for air carriers to develop mitigation strategies in concert with OSHA. However, another expert said that airlines entering into alliances with OSHA have no real effect on ramp safety because OSHA's focus is on preventing personal injury, not aircraft damage.

OSHA's workplace inspections—which are initiated in response to fatalities or serious injuries, such as amputations, complaints, or data indicating that an industry is experiencing a high rate of illness or injury—may result in OSHA proposing that the employer be fined. For example, on July 25, 2007, OSHA proposed fines totaling about $72,500 against an airline for alleged violations of workplace safety standards in its ramp area at one airport.[80] According to OSHA safety enforcement officials, proposed fines are intended to serve as a deterrent to unsafe practices in the workplace and are sometimes reduced after the employers take corrective actions, show good faith, or have a favorable safety history.[81] However, as we reported in 2005 on FAA's safety enforcement efforts, reductions in proposed fines may weaken any deterrent effect that would be expected from sanctions.[82] Only 2 of 13 experts we surveyed indicated that OSHA's safety enforcement actions were very effective in addressing ramp accidents.[83]

[79]Of the 13 respondents, 1 said it was extremely effective, 2 very effective, 3 moderately effective, 6 slightly effective, and 1 not at all effective.

[80]OSHA's inspection of this airline's worksite was done as part of the agency's Site-Specific Targeting Program. The worksites that OSHA inspects under this program are identified from data on employee illness and injuries that the agency collects each year from about 80,000 nonconstruction employers.

[81]OSHA does not routinely maintain data on the number of safety inspections conducted in airport ramp areas or the amount of fines that it proposed regarding violations in those areas. At our request, OSHA officials broke out how much the fine indicated above pertained to violations in the ramp area. According to the 2005 Bureau of Labor Statistics' Survey of Occupational Injuries and Illnesses, scheduled air transportation industry employees had the eighth highest rate compared to other industries, but the data are not broken out to identify the portion represented by ramp workers.

[82]GAO, *FAA's Safety Oversight System is Effective but Could Benefit from Better Evaluation of Its Programs' Performance*, GAO-06-266T (Washington, D.C.: Nov. 17, 2005).

[83]Of the 13 respondents, 2 said it was very effective, 4 moderately effective, 3 slightly effective, and 4 not at all effective.

Several airport officials we interviewed had initiated efforts to improve ramp safety at their airports, even though their ramp areas are typically under the control of one or more airlines. For example, a Massachusetts Port Authority official said that ramp accidents at the Boston Logan International Airport were reduced by 50 percent during a 6-month period during 2004 and 2005 after they implemented a ramp safety program. Other airport officials said they had used their local Runway Safety Action Teams as forums or initiated their own efforts for addressing ramp safety issues. In addition, the Seattle-Tacoma International Airport uses a ramp tower and ASDE-X surface movement radar to monitor ramp activities. Of 15 survey respondents, 4 experts indicated that the use of Runway Safety Action Teams was very or extremely effective in addressing ramp accidents, and 2 indicated that surface surveillance technology was very effective.[84] One expert indicated that Runway Safety Action Teams are an extremely important venue that can involve all airport stakeholders in a collaborative process to identify hazards, perform a risk assessment, and develop mitigation strategies and measure their effectiveness. Of 15 survey respondents, 2 experts indicated that airports' use of ramp towers was very or extremely effective in addressing ramp accidents,[85] and 3 indicated that airlines' use of ramp towers was very effective.[86] One expert said that ramp towers improve operational safety but that all operations are still not completely visible.

We spoke with officials from two U.S. airlines about measures they were taking to improve ramp safety. One of those airlines is using and the other plans to use a Web-based surface surveillance system at certain hubs to track the movements of ground vehicles and aircraft. Although the airline's purpose for purchasing the system was for greater efficiencies in its ground operations, an official from that airline said he believed that increased safety was an additional benefit of the system because it significantly improved situational awareness. Although not specifically tracked, the airline believes it has had fewer ground accidents and

[84]Of the 15 respondents, 1 said the use of Runway Safety Action Teams was extremely effective, 3 very effective, 7 moderately effective, and 4 slightly effective. In addition, of 15 respondents, 2 said that airports' use of surface surveillance was very effective, 8 moderately effective, and 5 slightly effective.

[85]Of the 15 respondents, 1 said it was extremely effective, 1 very effective, 7 moderately effective, 4 slightly effective, and 2 not at all effective.

[86]Of the 15 respondents, 3 said it was very effective, 7 moderately effective, 3 slightly effective, and 2 not at all effective.

incidents since implementing the system. Officials at another airline said they were addressing ramp safety further by incorporating a safety management system into the ramp procedures in the airline's operations manual, including specific ground safety training as a component of recurrent training required annually. In addition, the airline has established annual goals for reducing employee injuries and ground damage. The airline reported the setting of a goal appears effective and has resulted in a significant decrease in employee injuries and ground damage over the prior year. Officials from this airline also said that the airline had formed a safety action team to share best practices with its ground handling partners and to review their safety performance, resulting in an incident rate for the airline's partners that has been greatly reduced in the last two years and continues to improve. The experts we surveyed had mixed views on the effectiveness of airlines setting safety targets for reducing injuries in ramp areas in addressing ramp accidents. Four of 15 experts indicated that it was very effective, 6 said it was moderately effective, and 5 indicated it was slightly or not at all effective. One expert said that airlines have set safety targets for reducing injuries in ramp areas for years and failed to achieve discernable results.

Aviation industry groups also have efforts under way to address the lack of data for ramp accidents as well as the lack of standards for ramp operations. In 2003, the Flight Safety Foundation, an international nonprofit membership organization that researches and promotes aviation safety, started the Ground Accident Prevention Program to "analyze equipment damage and human injuries and develop methods of preventing such accidents." The program is now in its third phase, in which it will identify and encourage technical solutions to ramp safety problems along with continued data collection and analysis. Next year, the International Air Transport Association, an international airline association, plans to start a safety audit program of ground handling companies with the aim of improving operational safety by establishing a "worldwide ground operational safety benchmark and standard." The program will be available to all ground service providers, who, after successfully completing the audit, will be placed on a registry for an agreed-upon period. In addition, the National Air Transportation Association, which represents companies that own, operate, and service aircraft primarily for the general aviation community, has launched an industry-wide effort to collect ramp incident data and has goals of identifying best practices, reducing insurance claims, and lowering insurance costs. The Airports Council International, an organization that represents airports worldwide, publishes the *Airside Safety Handbook* as one component of its efforts to help airports operate more safely. Finally, the Air Transport Association collects, aggregates, and shares ground incident damage and injury data to its members. The data are reviewed at the association's quarterly Ground Safety Committee meetings and form a basis for assessing risk, developing mitigation strategies, and measuring effectiveness. According to the association, airlines freely share best practices concerning safety and many airlines perform ground servicing of aircraft (fuel, potable water, baggage handling, etc.) for one another.

Additional Measures May Improve Ramp Safety

The results of our survey of experts indicated that the actions that FAA, OSHA, airports, or airlines could take with greatest potential of preventing ramp accidents, considering costs, technological feasibility, and operational changes, included promoting a safety culture, standardizing airport ramp markings, improving or increasing training of ramp workers, increasing the supervision of ramp workers, and developing safer equipment designs (see table 6).

Table 6: Experts' Ranking of the Actions that FAA, OSHA, Airports, or Airlines Could Take with the Most Potential to Address Ramp Accidents

Ranking	Action
1	Promote a safety culture in ramp areas
2	Standardize airport ramp markings
2	Improve or increasing training of ramp workers
2	Increase supervision of ramp workers
3	Develop safer designs of ramp equipment

Source: GAO analysis of responses from survey of experts.

Note: Rankings are based on responses from 15 experts and reflect the actions that a majority of respondents indicated had "great potential" or "very great potential."

One expert said that as part of an improved safety culture—which experts in our survey indicated was the most effective action to address ramp accidents—management must recognize the connection between the occurrence of ramp incidents and accidents and its demand for quick aircraft turnaround times. Turnaround times are an important cost factor for airlines. Another expert said that standardizing ramp markings would be beneficial because the markings can be confusing for pilots. One of the experts indicated, however, that while improving and increasing the training of ramp workers would be beneficial, high job turnover among ramp employees is also part of the problem. Furthermore, a report prepared by an aviation industry group in 2004[87] cited inadequate training and high turnover of ramp workers, particularly aircraft fuelers, as contributing factors in ramp accidents. The report also indicated that low wages contributed to high rates of employee turnover. One of the experts we surveyed indicated that poor pay attracts a group of ramp workers that exhibit high turnover rates, language issues, and work ethic challenges. Similarly, in reports that we issued before the September 11, 2001, terrorist attacks, we cited high turnover and low wages among airport security screeners as factors affecting the effectiveness of performing their security duties.[88]

Some aviation industry officials and experts said that ramp safety in the United States might be improved through the use of new technology. One example is a ground pop-up system[89] to handle aircraft fueling and other ramp services, which is used at airports in Zhuhai, China, and Stockholm, Sweden. An expert said that a ground pop-up system reduces ramp congestion and the chance of vehicle collisions and injuries. In addition, some aviation officials said that new baggage loading technology could help make the ramp environment safer for ramp workers. New baggage loading technologies include the sliding carpet[90] and RampSnake®.[91] However, an international aviation safety official said that although these new baggage loading devices could improve working conditions and effort required by baggage loaders, it is not readily apparent how such devices could help prevent ramp accidents. This official also noted the high cost of a ground pop-up system and that it is inflexible to accommodate changed aircraft parking arrangements and different aircraft types. The potential effectiveness of safer designs of ramp equipment was supported by the experts we surveyed, the majority of whom said that developing safer

[87] Airport Operations Safety Panel, *Reducing Accidents and Improving Safety on the Ramp* (Palm Beach Gardens, FL: June 15, 2004).

[88] GAO, *Aviation Security: Long-Standing Problems Impair Airport Screeners' Performance*, GAO/RCED-00-75, (Washington, D.C.: June 28, 2000) and *Aviation Security: Vulnerabilities Still Exist in the Aviation Security System*, GAO/T-RCED/AIMD-00-142 (Washington, D.C.: April 6, 2000).

[89] Equipment to service aircraft pops up from beneath the ramp when needed and returns below afterwards.

[90] The sliding carpet is an aircraft-based system for positioning cargo once it is placed in the hold of a commercial aircraft.

[91] The RampSnake® is a ramp-based system that delivers cargo into the cargo hold and is capable of turning 90 degrees once inside the aircraft.

designs of ramp equipment had great or very great potential in addressing ramp accidents.[92] An International Air Transport Association official also indicated that high-density airports outside of the United States typically have a higher degree of control and coordination between the ramp and air traffic controllers, which can contribute to safety.

Aviation industry stakeholders expressed diverse views about whether the federal government should increase ramp safety oversight and if so, which agency should carry out that increased oversight. Officials from a union representing ramp workers favored increased FAA and OSHA oversight of ramp operations because they felt this would lead to more and better training for ramp workers, the implementation of standardized procedures, and a focus on ramp safety equal to that provided to runway safety. However, an airport association official said that increasing FAA's oversight in the ramp area would not be the best use of the agency's resources because the safety risks are greater on the airfield, where an aircraft collision could result in many fatalities. In addition, a Flight Safety Foundation official said that additional FAA ramp safety oversight is not needed because FAA's focus is on passenger safety and that the agency would have difficulty identifying additional resources to oversee ramps. An author of reports on ramp accidents issued by an aviation industry group said that OSHA should do more to regulate safety on the ramp because, in his view, FAA lacks knowledge of industrial safety issues. However, an airline association official said that increased OSHA oversight of ramp operations would have little potential until OSHA develops national standards and appropriate regulations for airport ramp operations. This airline association official also said that the lack of a voluntary disclosure reporting program for OSHA-regulated incidents impedes improving safety in the ramp area. OSHA officials, however, said that very few industries have their own workplace safety standards, and that the agency is devoting the appropriate amount of resources for inspecting airport ramps because its safety inspections overall are selected largely on the basis of injury and illness data and complaints. However, they were not able to identify how many inspections of ramp areas were prompted by data. FAA officials said that they do not have responsibility for ramp safety and that their jurisdiction is limited to the movement areas. They also noted that ramp areas are normally under the jurisdiction of state and local authorities but that ultimately the airport operator has

[92]Of 15 respondents, 10 said that it had great or very great potential, 3 moderate potential, and 2 little potential.

responsibility for ramp safety unless the area is leased to an air carrier or fixed-base operator.

Conclusions

FAA took a number of actions to address runway safety since the number and rate of incursions reached a peak in fiscal year 2001. However, as runway safety incidents declined, FAA's runway safety efforts subsequently waned. During that period of decreased attention, the number and rate of incursions remained relatively constant and at a level higher than any time during the 1990s. Moreover, preliminary data for fiscal year 2007 indicate the overall incursion rate increased to a level nearly as high as the 2001 peak. In addition, serious incursions, where collisions were narrowly or barely avoided, continue to occur—about 30 per year since fiscal year 2002—suggesting a high risk of a catastrophic runway collision occurring in the United States. Furthermore, in recent years, FAA's Office of Runway Safety has not been fulfilling its mission to coordinate and lead the agency's runway safety efforts. The absence of national leadership and a current national runway safety plan impede further progress on runway safety because no single office is taking charge of assessing the causes of runway safety problems. This situation has resulted in uncoordinated runway safety efforts by individual FAA offices. FAA recently hired a runway safety director, which is a good first step. However, other plans for the program are still being developed, and it is too early to know if the office will provide sustained attention to runway safety problems.

FAA's runway safety program also lacks certain data on the causes and circumstances of incursions and overruns. FAA has planned since 2004 to develop a voluntary reporting system for air traffic controllers, which would increase the amount of data available on runway incursions, but it is not clear when such a program will be established. Without additional data, FAA cannot conduct additional analysis of the causes and circumstances of runway incidents to ensure that the most effective corrective measures that address the causal factors are used. In addition, the fact that air traffic controllers at some of the nation's busiest airports are regularly working 6-day weeks due to staffing shortages raises questions about the extent to which regularly working overtime may cause fatigue, which NTSB has cited as a contributing factor in air traffic control errors. Furthermore, the nature and scope of ramp accidents are unknown. FAA is not working with the aviation industry and OSHA to help collect and analyze ramp accident data, which could identify the causes and circumstances of ramp accidents, and identify corrective actions. Without such data, FAA and the aviation industry will be hindered in understanding the nature and extent of ramp accidents, which would help identify measures to improve ramp safety.

Recommendations

To advance efforts to improve runway safety, we recommend that the Secretary of Transportation direct the FAA Administrator to take the following five actions:

- Implement the FAA order establishing the Office of Runway Safety to lead the agency's runway safety efforts, including preparing a new national runway safety plan. The plan should include goals to improve runway safety; near- and longer-term actions designed to reduce the severity, number, and rate of runway incursions; timeframes and resources needed for those actions; and a continuous evaluative process to track performance towards those goals. The plan should also address the increased runway safety risk associated with the expected increased volume of air traffic.

- Develop an implementation schedule for establishing a nonpunitive voluntary safety reporting program for air traffic controllers.

- Develop and implement a plan to collect data on runway overruns that do not result in damage or injury for analyses of trends and causes such as the locations, circumstances, and types of aircraft involved in such incidents.

- Develop a mitigation plan for addressing controller overtime that considers options such as shift changes and incentives to attract controllers to facilities with high volumes of air traffic and high rates of controller overtime.

- Work with the aviation industry and OSHA to develop a mechanism to collect and analyze data on ramp accidents and, if the analysis shows it is warranted, develop a strategic plan aimed at reducing accidents involving workers, passengers, and aircraft in the ramp area. The plan should include a discussion of roles and responsibilities, performance measures, data collection and analysis, and milestones, and consider ramp safety practices being followed in other countries.

Agency Comments

We provided DOT and the Department of Labor with drafts of this report for their review and comment. FAA agreed to consider the report's recommendations and provided technical corrections and clarifications, which we incorporated as appropriate. The Department of Labor had no comments but provided a technical correction, which we incorporated.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies of this report to interested congressional committees and to the Secretary of Transportation and the Secretary of Labor. We will make copies available to others upon request. In addition, this report will be available at no charge on our Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me on (202) 512-2834 or at dillinghamg@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix VII.

Gerald Dillingham

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

Appendix I: Objective, Scope, and Methodology

Our objective was to review how well the Federal Aviation Administration (FAA) and others are addressing runway and ramp safety issues. To accomplish this, we established the following questions: (1) What progress is being made in addressing runway safety, and what additional measures, if any, could be taken? and (2) What factors affect progress in improving ramp safety and what is being done by FAA and others to address those factors?

For background information on runway and ramp safety issues, we reviewed reports prepared by FAA, the National Transportation Safety Board (NTSB), the Department of Transportation's (DOT) Inspector General, and others; FAA orders, advisory circulars, and regulations; and applicable laws. We also determined the roles and responsibilities involving runway and ramp safety of FAA, NTSB, the Occupational Safety and Health Administration (OSHA), airports, and airlines. Regarding runway incursions, we obtained data on the number and rates of incursions from fiscal year 1998 through fiscal year 2007 and reviewed NTSB accident reports on incursions that resulted in collisions during that time. We also obtained runway incursion data from fiscal year 2001 through fiscal year 2006 broken down by severity, error types, and frequency of incursions involving general aviation and commercial aircraft. Regarding runway overruns, we collected data on overruns that NTSB investigated from fiscal year 2001 through fiscal year 2006. Regarding ramp accidents, we obtained information on ramp accident fatalities that were investigated by FAA, NTSB, and OSHA from 2001 through 2006. Based on interviews with officials knowledgeable about the data contained in this report, we determined that runway and ramp safety data were sufficiently reliable for the types of analyses that we performed for this report such as trends in runway incursions, the incidence of fatalities in airport ramp areas, and frequency of air traffic controller overtime.

To determine what progress is being made in addressing runway safety and what additional measures could be taken, we reviewed the status of FAA's implementation of objectives contained its 2002 national runway safety plan and the status of the runway safety recommendations that NTSB made to FAA. We also evaluated FAA's compliance with orders establishing the agency's runway safety and runway safety area programs; FAA's collection and analysis of runway safety data, including the process that the agency follows to assess the severity of runway incursions; and findings made by FAA's Air Traffic Safety Oversight Service on the agency's runway incursion severity classification process and runway safety technology. We also looked at how taxiways affect runway safety.

To help identify the causes of runway incursions and measures being taken to prevent them, we interviewed FAA and airport officials at five airports that have experienced more runway incursions than other airports in recent years.[1] Because technology is a major part of FAA's strategy to improve runway safety, we discussed the agency's efforts to develop and deploy technology with program officials, visited five airports where new technology was being tested and used to observe their operation, reviewed data on the systems' performance, and interviewed FAA air traffic controllers and managers and aviation industry officials about their views on the effectiveness of the technology. In addition, we reviewed the implementation status of Public Law No. 109-115, which requires commercial service airports to bring their runway safety areas into compliance with FAA standards by 2015. We also interviewed officials from FAA's William J. Hughes Technical Center, DOT's Volpe National Transportation Systems Center, and the National Aeronautics and Space Administration's Ames Research Center about their runway safety research projects. In addition, we interviewed officials from international aviation organizations about runway safety practices and technologies being used overseas that could be used in the United States.

To determine the factors affecting progress in improving ramp safety and what is being done by FAA and others to address those factors, we interviewed officials from FAA, airports, and aviation industry organizations; members of the Airport Operations Safety Panel, an aviation industry group that issued reports on ramp accidents in 2004 and 2005; union officials representing ramp workers and pilots; and other individuals knowledgeable about ramp safety. In addition, we interviewed OSHA officials about the agency's industry alliance program and enforcement efforts. We also interviewed officials from international aviation organizations about ramp safety practices and technologies being used overseas that could be used in the United States.

Table 7 lists the organizations that we visited or contacted regarding runway and ramp safety.

[1]They included Los Angeles International Airport, Boston Logan International Airport, Dallas-Ft. Worth International Airport, Hartsfield-Jackson Atlanta International Airport, and Newark Liberty International Airport. These five airports were among the 10 U.S. airports that experienced the most runway incursions from fiscal year 2001 through fiscal year 2006.

Table 7: List of Organizations that GAO Visited or Contacted Regarding Runway and Ramp Safety

Industry category	Organization interviewed
U.S. government agencies	Department of Labor Bureau of Labor Statistics
	Department of Labor Occupational Safety and Health Administration
	Department of Transportation Volpe National Transportation Systems Center
	Federal Aviation Administration
	Joint Planning and Development Office
	National Aeronautics and Space Administration
	National Transportation Safety Board
FAA regional runway safety program managers	Eastern Region
	New England Region
	Southeast Region
	Western Region
FAA air traffic control personnel	Bob Hope Airport, Burbank, CA
	Bradley International Airport, Hartford, CT
	Dallas-Ft. Worth International Airport
	General Mitchell International Airport, Milwaukee, WI
	Hartsfield-Jackson Atlanta International Airport
	Lambert-St. Louis International Airport
	Long Beach Airport, Long Beach, CA
	Los Angeles International Airport
	Newark Liberty International Airport
	Orlando International Airport
	San Diego International Airport
	Seattle-Tacoma International Airport
	Spokane International Airport, Spokane, WA
	Theodore Francis Green State Airport, Providence, RI
	William P. Hobby Airport, Houston, TX
Airports	Bob Hope Airport, Burbank, CA
	Boston Logan International Airport
	Dallas-Ft. Worth International Airport
	Hartsfield-Jackson Atlanta International Airport
	Long Beach Airport, Long Beach, CA
	Los Angeles International Airport

Industry category	Organization interviewed
	Newark Liberty International Airport
	San Diego International Airport
	Spokane International Airport, Spokane, WA
Industry organizations	Air Line Pilots Association
	Air Safety Foundation
	Air Transport Association
	Airports Council International
	International Air Transport Association
	International Association of Machinists and Aerospace Workers
	National Air Traffic Controllers Association
	National Air Transportation Association
	Regional Airline Association
Others	Airport Operations Safety Panel
	Boeing
	Commercial Aviation Safety Team
	Continental Airlines
	Flight Safety Foundation
	International Civil Aviation Organization
	Northwest Airlines
	Robinson Aviation
	Sensis Corporation

Source: GAO.

We conducted our work from October 2006 through November 2007 in accordance with generally accepted government auditing standards.

Appendix II: Survey Methodology

We administered a 2-phase Web-based survey to gather the professional views of experts on runway incursions, runway overruns, and ramp safety. The structured survey questions ensured that all individuals had the opportunity to provide information in response to the same questions and enabled us to quantify the results. Moreover, the iterative nature of the 2-phase survey provided the experts with the opportunity to identify future actions that could be taken to prevent incursions, overruns, and ramp accidents and then to evaluate the potential of the future actions that they and the other experts identified.

We contracted with the National Academy of Sciences to identify experts to participate in our survey. Using criteria to ensure adequate representation across the criteria that we had specified, the National Academy identified 19 experts and we identified ten. The criteria ensured that we achieved

- balance in terms of the type and depth of expertise (i.e., pilots, airline officials, aircraft manufacturing officials, association representatives, academics, foreign civil aviation authorities, unions representing airlines, air traffic controllers, ramp workers, Federal Aviation Administration (FAA) maintenance and safety inspectors, professors and researchers involved in aviation safety);
- balance of knowledge across relevant content areas (i.e., effectiveness of measures being used to address runway incursions, overruns, and ramp accidents; technology research, testing, and use; FAA air traffic control practices and procedures; international aviation safety practices, human factors issues; general aviation; airports; and ground operations); and
- balance in representing relevant organizations (i.e., academia, business, government, and professional organizations).

The survey responses represent the professional views of the experts. Their expertise can be derived from formal education, professional experience, or both. The experts were identified by the National Academy and us as individuals who are recognized by others who work in the same subject matter area as having knowledge that is greater in scope or depth than that of most people working in the area.

We recognize that it is likely that no one individual possessed complete knowledge in each of the content areas addressed in the survey: runway incursions, runway overruns, and ramp accidents. However, through our selection criteria, we attempted to identify a set of individuals who, when their responses were considered in the aggregate, could be viewed as representing the breadth of knowledge in each of the areas addressed in the survey.

We identified the information to collect in our surveys based on our congressional request, Internet and literature searches, professional conferences we attended, and background interviews. A social science survey specialist collaborated with staff with subject matter expertise on the development of the surveys.

We developed a 2-phase Web-based survey. The first survey contained open-ended questions asking respondents to identify the primary causes of runway incursions, runway overruns, and ramp accidents; overseas practices and technologies that could be used in the United States; and future actions, including the development of new technology that FAA could take in the future to prevent incursions, overruns, and ramp accidents. The responses to the questions on future actions were analyzed and coded into categories that were then used as the basis for the questions on future actions in the second survey. A reviewer checked the resulting categories and coded responses and, where interpretations differed, agreement was reached between the initial coder and the reviewer. As an extra step to check the completeness of the list of future actions that was generated by the experts we corroborated the list with other evidence we had collected as a part of our study and found that many of the same actions the experts identified were also identified through our other study efforts.

The same set of respondents was also sent the second survey. As mentioned above, the second survey contained closed-ended questions asking respondents to evaluate the potential of the future actions that could be taken to prevent runway incursions, runway overruns, and ramp accidents. Other closed-ended questions addressed the effectiveness of specific actions that FAA and others are taking to address runway incursions, runway overruns, and ramp accidents; the accuracy of FAA reporting on runway incursions that have occurred since January 1, 2001; and whether the deployment schedule of the Airport Surface Detection Equipment, Model-X (ASDE-X) at 27 additional airports by 2011 should be kept as planned or changed, considering some of the benefits and problems associated with the system.

Both surveys were pretested to ensure that the questions appropriately addressed the topics, were clearly stated, easy to comprehend, unbiased, and did not place undue burden on respondents. We also evaluated the usability of the Web-based surveys. Based on the pretest results, we made necessary changes to the surveys prior to implementation.

We administered the Web-based surveys between June and September 2007. We used e-mail to inform the respondents of the survey administration, and provided them with the Web link for the survey and their log-in name and password. In the e-mail message, we informed respondents that our report will not contain individual survey responses; instead, it would present the aggregated results of all participants. To maximize the response rate, we sent follow up e-mail reminders and followed up by telephone as necessary to encourage survey participation.

The first survey was sent to 27 experts. Two experts did not respond and were not included in the second survey. As a result, 25 of 27 experts responded to the first survey for a response rate of 93 percent.

The second survey was sent to the 25 experts who responded to the first survey. Twenty-two of the 25 experts responded for a response rate of 88 percent.

The number of responses varied for each of the survey content areas—runway incursions, runway overruns, and ramp accidents—because we asked the experts to answer questions only within their areas of expertise. In addition, the number of responses may vary by question because we do not report the number of experts who responded "Don't know" or "No basis to judge." We report the survey results in terms of actions that are most effective or future actions that have the most potential. For tables 1 and 6, the actions that we report as being the most effective or having the most potential were the ones that a majority of respondents indicated were very or extremely effective for the effectiveness questions or great or very great potential for the questions asking about potential. For table 4, the actions that we report as having the most potential reflect the ones that a majority of experts indicated as having great potential or very great potential. Although other actions also received a majority of positive responses, this table reports the ones that received the highest number of positive responses. For table 5, the actions that we report received the highest number of responses indicating that they were very effective or extremely effective. However, none of these actions received a majority of positive responses.

The first survey, which was administered via the Web, included 12 questions shown in figure 13.

Figure 13: Questions Asked in First Survey

1. Do you have expertise in runway incursions to be able to answer the following three questions on the causes of runway incursions, overseas practices and technology, and future actions to prevent runway incursions?
2. In your opinion, what are the primary causes of runway incursions?
3. What practices or technologies that are currently being used overseas could be used in the United States to prevent runway incursions?
4. What actions, including the development of new technologies, could FAA take in the future to prevent runway incursions?
5. Do you have expertise in runway overruns to be able to answer the following three questions on the causes of runway overruns, overseas practices and technology, and future actions to prevent runway overruns?
6. In your opinion, what are the primary causes of runway overruns?
7. What practices or technologies that are currently being used overseas could be used in the United States to prevent runway overruns?
8. What actions, including the development of new technologies, could FAA take in the future to prevent runway overruns?
9. Do you have expertise in ramp accidents to be able to answer the following three questions on the causes of ramp accidents, overseas practices and technology, and future actions to prevent ramp accidents?
10. In your opinion, what are the primary causes of ramp accidents?
11. What practices or technologies that are currently being used overseas could be used in the United States to prevent ramp accidents?
12. What actions, including the development of new technologies, could FAA take in the future to prevent ramp accidents?

Source: GAO.

The second phase of the survey was also administered via the Web and is reproduced as a graphic image on the following pages.

Survey on Runway and Ramp Safety - Second Phase

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Click here to learn more about navigating, saving, and exiting the survey, copying and pasting text responses, and printing all your responses at one time.

Please be aware that you can print your responses to all the questions at one time using the link at the end of the survey.

RUNWAY INCURSIONS

1. **Do you have expertise in *runway incursions* to be able to answer questions on actions to address *runway incursions*?**

(Check one.)

1. ○ Yes
2. ○ No (Click here to skip to question 7.)

Actions to address runway incursions

2. **In your opinion, how effective, if at all, are the following FAA actions to address *runway incursions*?**

(Choose one answer for each row.)

	Extremely effective	Very effective	Moderately effective	Slightly effective	Not at all effective	Don't know/No basis to judge
a. [illegible]	○	○	○	○	○	○
2b. Deploying the Airport Surface Detection Equipment, Model X (ASDE-X)	○	○	○	○	○	○
c. [illegible]	○	○	○	○	○	○

2d. Testing the Low Cost Surface Surveillance System (LCSS)

2e. Enhancing airport markings

2f. Enhancing airport signage

2g. Enhancing airport lighting

2h. Establishing Runway Safety Action Teams

2i. Testing the Runway Status Lights System

2j. Approving perimeter taxiways

2k. Conducting pilot educational initiatives, such as seminars

2l. Conducting air traffic controller training

If you would like to expand on any of your responses, please provide your comments below. Be sure to indicate which FAA action you are discussing.

Future actions to prevent runway incursions

3. In your opinion, what is the potential—considering costs, technological feasibility, and operational changes—of the following actions that FAA could take to prevent *runway incursions*?

(Choose one answer for each row.)

	Very great potential	Great potential	Moderate potential	Little potential	No potential	Don't know/No basis to judge
3a. Improve airport signage						

3b.	Improve airport markings	○	○	○	○	○
3c.	Improve airport lighting	○	○	○	○	○
3d.	Encourage use of taxi guidance lighting systems	○	○	○	○	○
3e.	Encourage use of yellow embedded lights for hold short lines	○	○	○	○	○
3f.	Deploy the Runway Status Lights System	○	○	○	○	○
3g.	Deploy the Final Approach Runway Occupancy Signal (FAROS), which provides a visual warning to arriving aircraft that the runway is occupied	○	○	○	○	○
3h.	Work toward common layouts of runways and taxiways	○	○	○	○	○
3i.	Encourage construction of additional perimeter taxiways	○	○	○	○	○
3j.	Encourage use of pop-up physical barriers at hold short lines	○	○	○	○	○

		Very great potential	Great potential	Moderate potential	Little potential	No potential	Don't know/No basis to judge
3k.	Stop using land and hold short operations that require aircraft to stop before intersecting runways	○	○	○	○	○	
3l.	Require use of aircraft landing lights for takeoff	○	○	○	○	○	
3m.	Require aircraft to keep transponders on at all times on runway and taxiways	○	○	○	○	○	
3n.	Require airport vehicles to use transponders at all times while on runways and taxiways	○	○	○	○	○	
3o.	Encourage use of slower radio communication between air traffic controllers and pilots	○	○	○	○	○	
3p.	Adopt International Civil Aviation Organization phraseology	○	○	○	○	○	
3q.	Use data-linked communication between air traffic controllers and pilots	○	○	○	○	○	

3r. Deploy ASDE-X at more airports than the *8 that currently have the system and the 27 scheduled to receive it* (Click link to see list of airports.)						

	Very great potential	Great potential	Moderate potential	Little potential	No potential	Don't know/No basis to judge
3s. Refine the ASDE-X safety logic (alerting system)						
3t. Deploy ground radar at all FAA-controlled airports						
3u. Deploy the Low Cost Surface Surveillance System						
3v. Encourage development of certified cockpit heads up display						
3w. Encourage the development of cockpit moving map displays that show the location of other aircraft and vehicles on the airfield						
3x. Encourage the development of runway incursion warnings in the cockpit						
3y. Encourage the use of Runway Awareness and Advisory System technology, which provides aural runway situational advisories to flight crews						
3z. Require greater emphasis on ground operations training for pilots						

If you would like to expand on any of your responses, please provide your comments below. Be sure to indicate which action you are discussing.

FAA reporting on runway incursions

4. Based on your knowledge of specific incidents, how accurate or inaccurate are the severity classifications FAA has made regarding runway incursions that have occurred since January 1, 2001?

(Check one.)

1. ○ Incident(s) tend to be classified as more severe than they actually were
2. ○ Incident(s) tend to be correctly classified
3. ○ Incident(s) tend to be classified as less severe than they actually were
4. ○ Don't know/No basis to judge

Please explain your answer.

ASDE-X deployment

5. Do you have knowledge of and/or experience with the deployment of ASDE-X?

(Check one.)

1. ○ Yes
2. ○ No (Click here to skip to question 7.)

6. **The preliminary information GAO has gathered indicates that, to varying extents, at the 8 airports where ASDE-X has been deployed, there have been operational problems with false targets and false alerts. We have also learned that for airports that did not previously have ground radar, ASDE-X now provides them with that capability. Considering the benefits and problems of ASDE-X, what is your opinion of FAA's plan to deploy ASDE-X at 27 additional airports by 2011?**

(Check one.)

1. ○ Deployment should be accelerated
2. ○ Deployment should be kept as planned
3. ○ Deployment should be slowed down
4. ○ Deployment should be stopped
5. ○ Don't know/No basis to judge

Please explain your answer.

RUNWAY OVERRUNS

7. **Do you have expertise in *runway overruns* to be able to answer questions on actions to address *runway overruns*?**

(Check one.)

1. ○ Yes
2. ○ No (Click here to skip to question 10.)

Actions to address runway overruns

8. **In your opinion, how effective, if at all, are the following FAA actions to address *runway overruns*?**

(Choose one answer for each row.)

	Extremely effective	Very effective	Moderately effective	Slightly effective	Not at all effective	Don't know/No basis to judge
8a. Accepting Engineered Materials Arresting Systems (EMAS) as an alternative to constructing a runway safety area when its construction is not practicable	○	○	○	○	○	○
8b. Using Airport Improvement Funds to construct runway safety areas	○	○	○	○	○	○

If you would like to expand on any of your responses, please provide your comments below. Be sure to indicate which FAA action you are discussing.

Future actions to prevent runway overruns

9. **In your opinion, what is the potential--considering costs, technological feasibility, and operational changes--of the following actions that FAA could take to prevent *runway overruns*?**

(Choose one answer for each row.)

	Very great [illegible]	Great [illegible]	Moderate [illegible]	Little [illegible]	No [illegible]	Don't know/No basis to [illegible]
[illegible]	○	○	○	○	○	○
9b. [illegible] development of improved airport lighting	○	○	○	○	○	○
[illegible]	○	○	○	○	○	○

9d. Encourage lengthening of runways	○	○	○	○	○	○
9e. Encourage deployment of EMAS	○	○	○	○	○	○
9f. Improve communication of runway conditions and weather to flight crews	○	○	○	○	○	○
9g. Encourage improvements in pilot calculations of aircraft performance	○	○	○	○	○	○
9h. Encourage buffer zones between airports and neighboring communities to reduce obstacles that aircraft might hit	○	○	○	○	○	○

If you would like to expand on any of your responses, please provide your comments below. Be sure to indicate which action you are discussing.

RAMP ACCIDENTS

10. **Do you have expertise in *ramp accidents* to be able to answer questions on actions to address *ramp accidents*?**
(Check one.)
   1. ○ Yes
   2. ○ No (Click here to skip to question 13.)

Actions to address ramp accidents

11. **In your opinion, how effective, if at all, are the following actions by FAA, the Occupational Safety and Health Administration (OSHA), airports, or airlines to address *ramp accidents*?**
(Choose one answer for each row.)

	Extremely effective	Very effective	Moderately effective	Slightly effective	Not at all effective	Don't know/No basis to judge
11a. FAA's use of Runway Safety Action Teams	○	○	○	○	○	○
11b. Airports' use of surface surveillance technology	○	○	○	○	○	○
11c. Airports' use of ramp towers	○	○	○	○	○	○
11d. Airlines' use of ramp towers	○	○	○	○	○	○
11e. FAA's issuance of advisory circulars on Safety Management Systems for airport operators	○	○	○	○	○	○
11f. FAA's issuance of advisory circulars on Safety Management Systems for aviation service providers	○	○	○	○	○	○
11g. Airlines setting safety targets for reducing injuries in ramp areas	○	○	○	○	○	○
11h. Airlines entering into safety alliances with OSHA	○	○	○	○	○	○
11i. OSHA's safety enforcement actions, such as its Site-Specific Targeting Program	○	○	○	○	○	○

If you would like to expand on any of your responses, please provide your comments below. Be sure to indicate which FAA action you are discussing.

Future actions to prevent ramp accidents

12. **In your opinion, what is the potential—considering costs, technological feasibility, and operational changes—of the following actions that FAA, OSHA, airports, or airlines could take to prevent *ramp accidents*?**
(Choose one answer for each row.)

	Very great potential	Great potential	Moderate potential	Little potential	No potential	Don't know/No basis to judge
12a. Standardize airport ramp markings	○	○	○	○	○	○
12b. Use moving maps on aircraft	○	○	○	○	○	○
12c. Use moving maps on airport vehicles	○	○	○	○	○	○
12d. Improve or increase training of ramp workers	○	○	○	○	○	○
12e. Increase supervision of ramp workers	○	○	○	○	○	○
12f. Require certification of ramp workers	○	○	○	○	○	○
12g. Promote safety culture in the ramp area	○	○	○	○	○	○
12h. Use transponders on airport vehicles	○	○	○	○	○	○
12i. Use collision warning systems for airport vehicles	○	○	○	○	○	○
12j. Increase FAA oversight of ramp operations	○	○	○	○	○	○
12k. Increase OSHA oversight of ramp operations	○	○	○	○	○	○
12l. Develop safer designs of ramp equipment	○	○	○	○	○	○

If you would like to expand on any of your responses, please provide your comments below. Be sure to indicate which action you are discussing.

Submit Your Completed Questionnaire

13. **Are you ready to submit your final completed questionnaire to GAO?** (Clicking "Yes" tells GAO that your answers are final and are being officially submitted. Follow-up email messages will not be sent to those who answer "Yes" below.)

(Check one.)

1. ○ Yes, I have completed the questionnaire
2. ⊙ No, the questionnaire is not yet complete

14. **Would you like to print all of your answers?**

(Check one.)

1. ○ Yes (Click here to go to Get a Copy of Your Responses)
2. ○ No (Click on the "Save responses and close" button below to send your answers to GAO)

Get a Copy of Your Responses

Click here to get a copy of your responses: Once you open the copy of your responses, scroll to the end of the document and click on "Print".

Click on "Save responses and close" below to send your answers to GAO.

Thank you for your participation in GAO's Survey on Runway and Ramp Safety.

[Print this page]

[Save Responses and Close]

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Questionnaire Programming Language - Version 5.0
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Appendix III: Serious Incursions Involving Commercial Aircraft

Table 8: Serious Incursions Involving At Least One Commercial Aircraft during Fiscal Year 2006 and Fiscal Year 2007

Date	Airport	Airline(s) and aircraft involved	Number of air passengers
October 13, 2005	Gulfport-Biloxi International, MS	Northwest Airlines DC9 and Cessna C172	N/A
March 21, 2006	Chicago O'Hare International	Lufthansa Airbus A319 and Chautauqua Embraer E145	78
April 29, 2006	Phoenix Sky Harbor International	US Airways Airbus A320 and pedestrian	N/A
May 25, 2006	Miami International	Boeing 747 and American Eagle Aerospatiale AT43	N/A
July 18, 2006	Chicago O'Hare International	American Eagle Canadair CRJ7 and US Airways Boeing 737	N/A
July 23, 2006	Chicago O'Hare International	ATLAS Boeing 747 and United Airlines Boeing 737	131
July 26, 2006	Los Angeles International	Mesa Canadair CRJ2 and Skywest Embraer E120	N/A
August 8, 2006	Southwest Florida International, Ft. Myers, FL	Southwest Boeing 737 and vehicle	N/A
September 30, 2006	Los Angeles International	Gulfstream GLF5 and Skywest Canadair CRJ7	N/A
January 5, 2007	Denver International	Key Lime Air Swearingen SW4 and Frontier Airbus A319	50
February 2, 2007	Denver International	United Boeing 737 and snowplow	101
May 4, 2007	Cyril E. King Airport, Charlotte Amalie, VI	American Airlines Boeing 757 and Cessna C208	N/A
May 6, 2007	Los Angeles International	Skywest Embraer 120 and Virgin Air A346	N/A
May 26, 2007	San Francisco International	Republic Airlines Embraer 170, Skywest Airlines Embraer 120	27
July 11, 2007	Fort Lauderdale-Hollywood International, FL	Delta Air Lines Boeing 757 and United Airlines Airbus A320	172
July 19, 2007	Chicago O'Hare International	United Airlines Boeing 737 and US Airways Boeing 737	N/A
August 16, 2007	Lost Angeles International	WestJet Boeing 737 and Northwest Airlines Airbus A320	296

Source: GAO analysis of Federal Aviation Administration and NTSB data.

Note: N/A indicates that the information was not contained in the National Transportation Safety Board (NTSB) incident reports.

Appendix IV: Status of the National Runway Safety Plan Objectives

Table 9: Implementation Status of the Objectives Contained in Federal Aviation Administration's (FAA) National Runway Safety Plan for 2002-2004

Runway Safety Objective	Status
1. Develop new training courses or informational briefings for controllers to reduce operational errors.	Complete
2. Facilitate use of surface operations training for air carriers and general aviation.	Complete
3. Distribute mechanic runway safety taxi training to major airlines.	Complete
4. Complete over 1,000 safety seminars per year, including runway safety topics.	Ongoing
5. Publish airport vehicle surface operations advisory circular with best practices and standard operating procedures.	Complete
6. Conduct research on improving controller training related to memory limitations. Review existing course materials.	Complete
7. Require all tower controllers to complete training emphasizing team effectiveness and situational awareness.	Ongoing
8. Develop course material and conduct training for aviation safety inspectors and enhance awareness of certified flight instructors and pilot examiners on pilot surface operations.	Complete
9. Develop and implement enhanced training for tower controllers.	Complete
10. Implement a foreign air carrier pilot training program.	Cancelled
11. Expand role of flight service station specialists to provide runway safety information for general aviation at towered and nontowered airports.	Complete
12. Publish series of letters to all pilots discussing runway safety.	Cancelled
13. Provide airport diagrams for towered airports to pilots via a link or other means.	Complete
14. Conduct at least one annual media emphasis project with trade or association periodicals.	Complete
15. Assess selected air traffic control procedures to enhance runway safety.	Ongoing
16. Implement national standardized requirements for tower positions.	Complete
17. Implement standardization of national equipment and procedures for runway incursion devices.	Cancelled
18. Publish and disseminate best practices and standard operating procedures as appendixes to pilot surface movement advisory circulars.	Complete
19. During inspectors, ensure that pilots have current surface movements charts available and are being used.	Complete
20. Develop advisory circulars addressing procedures, best practices, and standard operating procedures for airline maintenance taxi operators and tug and tow vehicles on airport surface.	Complete
21. Disseminate and provide training to all safety inspectors for the Runway Incursion Information Evaluation Program.	Ongoing
22. Improve runway safety data collection, storage retrieval, and distribution.	Ongoing
23. Improve collection and analysis of operational error data with human factors tool, using technique to identify root causes.	Cancelled
24. Complete and publish results from phraseology workgroup.	Complete
25. Evaluate and, if appropriate, implement national procedures requiring pilot read-backs to controllers for certain clearances or instructions.	Complete
26. Publish guidance on standard surface operations phraseology for pilots and mechanics moving aircraft.	Complete
27. Issue guidance on vehicle operations near active runways.	Complete
28. Complete airport paint marking study and revise advisory circular standards, if appropriate.	Complete
29. Complete airport design and operations study. Enhance design standards and improve procedures as appropriate.	Complete

Runway Safety Objective	Status
30. Ensure towered airports have current airport diagrams. Clarify process, roles, and responsibilities for development and maintenance of airport diagrams.	Complete
31. Maintain the published ASDE-3/AMASS deployment waterfall schedule.	Complete
32. Develop high-level requirements for runway status lights and validate implementation methods through field demonstrations.	Ongoing
33. Conduct evaluations of existing low-cost technologies.	Complete
34. Meet published ASDE-X milestones.	Not met
35. Evaluate moving map technologies in an operational environment, using either aircraft or surface vehicles.	Complete
36. Develop and evaluate visual signal for direct warning to aircraft on final approach when the runway is occupied.	Ongoing
37. Develop a surface "road map" for low-cost technology architecture and issue Broad Agency Announcements to solicit industry ideas.	Complete
38. Create and accomplish periodic regional runway safety plans for each FAA region, including Runway Safety Action Team site visits to airports in each region.	Ongoing
39. Implement an aggressive runway safety "special emphasis" program at selected airports that results in reducing runway incursions.	Ongoing

Source: GAO analysis of FAA data.

Appendix V: Airports with Surface Surveillance Technology

Table 10: Airports with Airport Surface Detection Equipment, Model 3 (ASDE-3)/Airport Movement Area Safety Systems (AMASS) or the Airport Surface Detection Equipment, Model X (ASDE-X) or Scheduled to Receive ASDE-X

Airport	ASDE-3/ AMASS	ASDE-X Commissioned	Scheduled ASDE-X Deployment[a]
Baltimore Washington International	✓		June 2010
Boston Logan International	✓		July 2009
Bradley International, Hartford, CT		✓	
Camp Springs Andrews Air Force Base	✓		
Charlotte Douglas International		✓	
Chicago Midway			July 2010
Chicago O'Hare International		✓	
Cleveland Hopkins International	✓		
Covington/Cincinnati Northern Kentucky International	✓		
Dallas-Ft. Worth International	✓		April 2010
Denver International	✓		November 2009
Detroit Metro Wayne County	✓		June 2008
Ft. Lauderdale/Hollywood			April 2009
General Mitchell International, Milwaukee, WI		✓	
George Bush Intercontinental	✓		November 2009
Hartsfield-Jackson Atlanta International		✓	
Honolulu International - Hickam Air Force Base			August 2010
John F. Kennedy International, New York, NY	✓		July 2009
John Wayne-Orange County, Santa Ana, CA			February 2010
Kansas City International	✓		
Lambert-St. Louis International		✓	
Las Vegas McCarran International	✓		December 2009
Los Angeles International	✓		June 2009
Louis Armstrong New Orleans International	✓		
Louisville International-Standiford Field		✓	
Memphis International	✓		January 2011
Miami International	✓		August 2010
Minneapolis-St. Paul International	✓		February 2010
New York LaGuardia	✓		December 2010
Newark International	✓		July 2009
Orlando International		✓	
Philadelphia International	✓		December 2009
Phoenix Sky Harbor International			December 2008
Pittsburgh International	✓		

Airport	ASDE-3/ AMASS	ASDE-X Commissioned	Scheduled ASDE-X Deployment[a]
Portland International	✓		
Ronald Reagan Washington National	✓		December 2010
Salt Lake City International	✓		May 2010
San Diego International	✓		January 2011
San Francisco International	✓		
Seattle-Tacoma International		✓	
Ted Stevens Anchorage International	✓		
Theodore Francis Green State, Providence, RI		✓	
Washington Dulles International	✓		July 2008
William P. Hobby, Houston, TX		✓	

Source: FAA.

[a]Represents when the facility first declares the system ready for conditional use. Once the system is formally accepted by the facility, the system is commissioned.

Note: As indicated above, 28 airports currently have ASDE-3/AMASS. Six additional airports (Seattle-Tacoma International, Lambert-St. Louis International, Hartsfield-Jackson Atlanta International, Louisville International-Standiford Field, Chicago O'Hare International, and Charlotte Douglas International) originally had ASDE-3/AMASS, but the equipment has since been upgraded to ASDE-X.

Appendix VI: Airports Where Ramp Accident Fatalities Occurred

Table 11: U.S. Airports at which Ramp Fatalities Occurred from 2001 through 2006

Airport	Location	Type[a]	Number of fatalities
Addison	Dallas, TX	Reliever	1
Burke Lakefront	Cleveland, OH	Reliever	1
Logan International	Boston, MA	Large hub	1
Baltimore/Washington International	Baltimore, MD	Large hub	1
Casa Grande Municipal	Casa Grande, AZ	General aviation	1
Cincinnati/Northern Kentucky International	Covington, KY	Large hub	1
Ronald Reagan Washington National	Arlington, VA	Large hub	2
Denver International	Denver, CO	Large hub	1
Detroit Metropolitan Wayne County	Detroit, MI	Large hub	1
El Paso International	El Paso, TX	Small hub	1
Newark Liberty International	Newark, NJ	Large hub	2
Forrest City Municipal	Forrest City, AR	General aviation	1
Hayward Executive	Hayward, CA	Reliever	1
Chicago O'Hare International	Chicago, IL	Large hub	2
Norfolk International	Norfolk, VA	Medium hub	1
Philadelphia International	Philadelphia, PA	Large hub	2
Richmond International	Richmond, VA	Small hub	1
Louisville International-Standiford Field	Louisville, KY	Small hub	1
Scappoose Industrial Airpark	Scappoose, OR	General aviation	1
Nut Tree	Vacaville, CA	General aviation	1
Total			**24[b]**

Source: GAO analysis of Federal Aviation Administration, National Transportation Safety Board, and Occupational Safety and Health Administration data.

[a]Primary commercial service airports are categorized based on the percentage of total annual passenger boardings (enplanements) for all operations of U.S. carriers within the United States. General aviation airports are small airports that do not receive scheduled commercial service.

[b]Five additional fatalities occurred from 2001 through 2006, but the data sources did not specify the airports.

Appendix VII: GAO Contact and Staff Acknowledgments

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Staff Acknowledgments

In addition to the individual named above, Teresa Spisak (Assistant Director), Ashley Alley, Nancy Boardman, Colin Fallon, Evan Gilman, Bob Homan, Dave Hooper, Richard Hung, Rosa Leung, Sara Ann Moessbauer, Josh Ormond, and Pamela Vines made key contributions to this report.

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Before the

Subcommittee on Aviation

Committee on Transportation and Infrastructure

U.S. House of Representatives

February 13, 2008

Chairman Costello, Ranking Member Petri and members of the House Transportation and Infrastructure Subcommittee on Aviation, thank you for inviting me to participate in this hearing on runway safety. I am John K. Duval, A.A.E., the Airport Safety and Security Coordinator for the Beverly Municipal Airport, a general aviation and reliever airport located approximately 22 miles north of Boston.

Prior to joining the team in Beverly, I was the Deputy Director for Aviation & Operations at the Massachusetts Port Authority (Massport). I am also proud to serve on the Executive Committee of the American Association of Airport Executives (AAAE). AAAE is the world's largest professional organization representing the men and women who manage primary, commercial service, reliever and general aviation airports.

I would like to commend this subcommittee for using this hearing to focus on runway safety. As passenger numbers continue to increase and the number of aircraft operations rise, concerns about runway safety continue to grow. Aviation growth is critically linked to the economic health of our country. The ability to deliver goods and services at a reasonable cost is an important element of nearly all business success. Even more critical is the impact to the nation's economy when the cost and the confidence in air travel falters.

Government investment in aviation infrastructure and aviation safety reflects sound fiscal policy. The fastest growing nations on earth have recognized this and are spending vast sums of capital to develop their aviation infrastructure. The United States invented aviation, and we cannot afford to coast on our past accomplishments while other countries outpace our innovations and investments and capitalize on the global economy.

While our own aviation system continues to expand, aviation safety must continue to be our top priority. The National Transportation Safety Board (NTSB) rightfully cites the need to improve runway safety and reduce runway incursions on its list of Most Wanted Transportation Safety Improvements. As passenger enplanements, aircraft and operations rise, it is imperative that all of us -- the Administration, aviation stakeholders and Congress -- redouble our efforts to improve runway safety.

Mr. Chairman, before I proceed I would like to thank you, Ranking Member Petri, Chairman Oberstar and Ranking Member Mica for the leadership that you provided on H.R. 2881, the FAA Reauthorization Act of 2007. The four-year Federal Aviation Administration (FAA) reauthorization bill includes a number of provisions that would help improve aviation safety and particularly runway safety.

Airports are particularly grateful that the FAA reauthorization bill, which the House of Representatives passed last year, would raise the Passenger Facility Charge (PFC) cap from $4.50 to $7.00 and increase funding for Airport Improvement Program (AIP) by $100 million per year. If enacted into law, these two funding provisions would help airports build the infrastructure they need to improve runway safety and accommodate increasing demand.

Increasing Demand, Operations and Runway Incursions

Increasing Demand: Last March, the FAA released its Aerospace Forecast for 2007 to 2020. As members of this subcommittee are well aware, the Forecast indicates that passenger enplanements will increase from approximately 740 million in 2006 to more than one billion passengers by 2015. The FAA will be releasing updated projections at its 33rd Annual Aviation Forecast Conference, which AAAE is cosponsoring, on March 10th and 11th here in Washington, DC.

The FAA's current Aerospace Forecast predicts that the number of U.S. mainline carrier jets will increase from approximately 3,886 in 2006 to 6,041 by 2020 -- an increase of 55.5 percent. According to the agency, the number of regional jets used by U.S. regional carriers will increase by 1,000 between 2006 and 2020. When coupled with turboprop aircraft, the overall fleet for U.S. regional carriers is expected to increase from 2,743 to 3,694 -- an increase of 34.7 percent.

The demand for air cargo is also increasing. The FAA is predicting that total Revenue Ton Miles -- or the measurement of moving one ton of cargo one mile -- will increase from 39.7 billion in 2006 to 81.3 billion in 2020. To handle that increased load, the number of cargo aircraft is expected to increase from approximately 1,000 in 2006 to 1,468 in 2020, which is an increase of approximately 47 percent.

The FAA is also predicting that the general aviation fleet will increase by almost 50,000 aircraft between 2006 and 2020. Very Lights Jets (VLJs) are expected to begin filling the skies, too. The agency expects 350 VLJs will join the fleet this year and increase by 400 to 500 per year through 2020. In other words, approximately 5,000 VLJs may be operating by 2017.

Increasing Operations: As the numbers of passengers, cargo and aircraft increase so do operations at airports around the country. Overall, the number of take-offs and landings at the nation's towered airports will increase dramatically from approximately 61.1 million in 2006 to 81.1 million by 2020 -- 20 million more operations than there are today.

"As more planes carry more passenger and cargo, FAA and contract towers will need to handle an average of 1.4 million more U.S. operations each year between now and 2020," Secretary of Transportation Mary Peters said at the FAA Aviation Forecast Conference last year. "To put this number in perspective, imagine adding twice the traffic at Dallas-Fort Worth airport into the system every year."

According to the FAA's latest Terminal Area Forecast, operations at Los Angeles International Airport are expected to increase almost 63 percent between 2006 and 2020. Operations are expected to increase by more than 34 percent at Hartsfield-Jackson Atlanta International Airport and by more than 31 percent at Dallas Fort Worth (DFW) International Airport during the same time period.

Increasing Number of Runway Incursions: In Fiscal Year 2001 (FY01) there were 407 runway incursions at a rate of 5.9 incursions per million operations. The number of runway incursions declined in FY02 and again in FY03 when there were 323 incursions at a rate of 5.1 incursions per million operations. Since then, however, the number of runway incursions and the rate of incursions have been slightly rising.

In FY07, there were 370 runway incursions at a rate of 6.05 incursions per 1 million operations. This translates into approximately one runway incursion per day. If runway incursions continue at a rate of approximately 6 incursions per million operations and the overall number of operations increases by 20 million per year by 2020 there would be an additional 120 runway incursions per year.

Although the number of Category A runway incursions -- or the most serious -- are a small percentage of the total runway incursions, the number of Category A runway incursions has been increasing in recent years. In FY03 there were 10 Category A runway incursions at a rate of 0.16 incursions per million operations. The number and rate of incursions more than doubled in FY06 to 24 at a rate of 0.39 incursions per million operations.

According to the FAA, pilot deviations caused 54 percent of runway incursions between FY03 and FY06. Operational errors and deviations, which are air traffic controller actions, accounted for 29 percent. Vehicle and pedestrian deviations caused 17 percent. Although the number of pilot deviations increased 9 percent between FY03 and FY06, the number of vehicle and pedestrian deviations declined 15 percent during the same four-year period.

Airports are Working with the FAA and Aviation Stakeholders to Improve Runway Safety

During my career I have investigated countless runway incursions and spent many hours in aircraft cockpits, air traffic control towers and in vehicles on the airfield. I have participated in numerous meetings with aviation stakeholders and FAA sponsored Tiger Teams in an effort to reduce runway incursions. One thing that has become very clear to me is that each incident is unique in one way or another.

There is no easy fix and no magic bullet to improving runway safety and reducing runway incursions. As in security, runway safety must be a multi-layered approach with numerous checks and balances. Airports, airlines, FAA and industry must continue to work together to make safety improvements. Runway Safety Action Teams and other forums are bringing together the best and brightest minds in aviation to focus on runway safety issues.

Although we don't have all the answers yet, we are making progress on improving runway safety through a variety of means including the use of new technology, enhanced taxiway markings, airfield changes and improved training. The following describes some of the steps that airports are taking to help improve runway safety and reduce runway incursions.

New Runways, Taxiways and Design Changes: In an effort to improve runway safety and to keep up with increasing demand, airports are using PFC revenue and AIP funds to build more airside capacity enhancing projects at their facilities. As the number of passengers, aircraft and operations continue to increase, it is critical that we continue to provide airports with the tools to invest in airside projects such as runways and taxiways to increase capacity on the ground.

When FAA Acting Administrator Bobby Sturgell testified before this subcommittee last September, he indicated that 13 new runways have opened at 35 Operational Evolution Partnership (OEP) airports since 2000. He also pointed out that eight OEP airports are in the process of constructing airfield projects. Airports are relying on PFC revenue to help build those projects. According to the FAA, approximately 32 percent of PFCs approved in FY06 are being used for airside projects including those at OEP airports. Fifteen OEP airports have used more than $4.6 billion in PFC revenue to help build new runways and increase capacity.

Taxiway design changes in Atlanta, San Diego and Boston are also underway to provide safer routing of aircraft and minimize the potential for incursions. The Boston Logan International Airport even installed 175,000 square feet of artificial turf in a taxiway reconfiguration project to make its airfield safer. The artificial turf makes it easier and safer to maintain taxiway shoulders and small "islands" between busy taxiways. The airport installed most of the artificial turf over existing hard surfaces, which eliminates the need to repaint those areas. Replacing painted surfaces with artificial turf also makes the airfield safer by creating greater visual contrasts for pilots.

Runway Safety Areas/Engineered Materials Arresting System: The FAA requires that commercial service airports, where possible, have Runway Safety Areas that are 500 feet wide and extend 1,000 feet beyond both ends of the runway. Airports are working with the FAA to add runway safety areas to runways at commercial service airports around the country and installing a relatively new technology at airports with space restrictions.

According to a recent Government Accountability Office (GAO) report on runway safety, "70 percent of the 1,014 runways at the 573 commercial airports in the United States substantially comply with runway safety standards, up from 55 percent in 2000." The report also indicates that airports have used approximately $300 million per year in AIP funds for runway safety area improvements and that "$1.1 billion is expected to be needed to complete the remaining 207 projects."

There are a number of airports around the country where it is not physically possible to extend their runways by 1,000 feet on each end. Consequently, many airports are using AIP funds and PFC revenue to install Engineered Materials Arresting Systems (EMAS). EMAS is a bed of lightweight, crushable concrete that is used to stop aircraft in overrun incidents where adequate runway safety areas are not feasible. Currently, 21 airports in the United States are using EMAS at 31 runway ends.

Massport installed two EMAS systems at Boston Logan International Airport – one in 2005 and the other the following year. Each cost approximately $3 million. Logan is a space constrained airport that is surrounded on three sides by water and one side by a densely populated residential community. Since filling Boston Harbor was not a viable solution and the runway lengths could not be shortened without significant impacts on capacity, EMAS was the only solution to maintaining capacity and increasing safety.

According to the FAA, the agency has plans "to install 14 EMAS systems at 8 additional airports." EMAS technology has already proven its worth by saving passengers and aircraft in four separate incidents. The most recent incident occurred in July 2006 when a malfunction of an antiskid braking system caused a Falcon 900 to overrun the runway at the Greenville Downtown Airport in South Carolina.

Perimeter/End-Around Taxiways: Airports are also beginning to add perimeter and end-around taxiways to reduce runway crossings and the potential for runway incursions. The Hartsfield-Jackson Atlanta International Airport, the world's busiest airport, installed an end-around taxiway early last year. The FAA indicates that the new taxiway is "expected to eliminate an average of 700 runway crossings per day…." Aviation officials expect that the taxiway will also save the airlines at least $27 million per year.

DFW International Airport, the world's third busiest airport, is also engaged in a perimeter taxiway project that will include perimeter taxiways in all four quadrants of the airfield. The perimeter taxiway in the southeast quadrant is approximately 42 percent complete, and airport officials expect to finish the first perimeter taxiway by the end of the year. The entire project is expected to eliminate as many as 1,700 runway crossings per day.

Last year, the Flight Safety Foundation presented its annual Airport Safety Award to officials at DFW International Airport for their leadership on aviation safety issues and for advancing the concept of perimeter taxiways. The well-deserved citation indicates that perimeter taxiways are "expected to reduce runway incursion accidents, reduce the volume of pilot-controller communications and increase airport efficiency."

The perimeter and end-around taxiways at DFW and Hartsfield-Jackson International Airports provide good examples of how airports are using AIP funds and PFC revenue on airside capacity projects to increase safety and reduce airline delays. The end-around taxiway at the Atlanta airport cost approximately $47 million to build. The airport will receive $26 million in AIP funds through a Letter of Intent program, and the airport plans to use PFC revenue to pay for the remaining $21 million.

The southeast quadrant of the DFW perimeter taxiway project is expected to cost more than $66 million. The airport plans to use $43.3 million in AIP funds and an additional $22.8 million in PFC revenue to pay for that phase of the project. DFW intends to add three additional perimeter taxiways to its facility during the next ten years. The remainder of the project is expected to cost approximately $220 million, and the airport is planning to use AIP funds and PFC revenue for this safety project.

Enhanced Surface Markings: Airports around the country are helping to improve runway safety and reduce the potential for runway incursions by using enhanced taxiway centerline markings and surface holding position signs. The FAA and the MITRE Corporation tested the enhanced surface markings at the T.F. Green State Airport in Providence, Rhode Island in 2003 and at Boston Logan in 2004.

The test results were overwhelmingly positive, and the FAA subsequently issued an Advisory Circular in 2005 that requires commercial service airports with more than 1.5 million enplanements per year to enhance their surface markings by June 30, 2008. According to the FAA, 71 of the top 75 airports are already complying with that requirement, and "the remaining four will have their markings in place well before the 2008 deadline."

I am pleased that the FAA recently issued a draft Advisory Circular that would extend the enhanced surface marking requirement to all Part 139 airports as recommended by the NTSB. Standardization has long been a crucial tenet at all of our commercial airports, and I commend the FAA for adopting this change. I am also encouraged by FAA's report that 62 smaller airports have already enhanced their surface markings and that "121 airports plan to complete the work by the end of the year...."

While this may seem like a relatively inexpensive way to improve runway safety, members of this subcommittee should know that that simply painting these markings can cost nearly $500,000 at a large hub airport. Requiring all Part 139 airports to enhance their surface markings will place additional funding requirements on smaller airports with limited AIP funds and PFC revenue.

Driver Training/Interactive Employee Training: In its latest Runway Safety Report, the FAA points out that "technology, training, safety promotion and situational awareness are key to reducing the severity and frequency of runway incursions." I completely agree and am very proud of the work that AAAE is doing to improve aviation safety by offering customized training programs to airports around the country.

AAAE has developed a patented computer-based Interactive Employee Training (IET) system that is being used to train airport employees, airline employees and other airport tenants. Employees begin the training course by viewing a digital video on an airport-related topic at a computer terminal. After watching the customized video, which is recorded on-site at the airport, employees use touch-screen technology to answer questions that test employees' understanding of the course material.

Since 2001, AAAE's IET systems have delivered almost 1 million training sessions at 55 airports around the country. IET training programs are highly effective in training employees because each video features an airport's actual work environment. Many of the training programs focus on airport operational safety topics such as movement and non-movement area driver training, airfield safety and incursion prevention, driver training for general aviation areas and Part 139 recurrent training.

AAAE's IET system provides comprehensive training, and the interactive testing ensures that the employees truly understand the topic of the course. There are distinct disadvantages of accepting different driver training programs from hundreds of different airport tenants. Airports have recognized this and are voluntarily adopting the standardization that is possible through AAAE's technological approach to training large groups of employees.

Annual Runway Safety Conferences: AAAE holds more than 80 workshops and conferences every year on a wide variety of aviation-related topics. Many of those meetings -- including our 80th Annual Conference and Exposition that will be held in New Orleans in June -- provide airport employees, other aviation stakeholders and Administration officials with a helpful forum to discuss ways to improve aviation safety.

In November, AAAE, MITRE and others held a two-day Runway Safety Summit. At the annual conference, FAA and NTSB officials, airport representatives and aviation stakeholders discussed advancements in runway safety, new technology and lessons learned from recent accidents and incidents. Our next Runway Safety Summit is scheduled for November.

Last year, AAAE also joined with the FAA to hold the 14th Annual Airfield Safety, Sign Systems and Maintenance Management Workshop. This workshop is designed to educate airfield maintenance personnel about runway safety, runway and EMAS maintenance and new technologies. The 15th Annual Airfield Safety, Sign Systems and Maintenance Management Workshop will be help in April in Los Angeles.

New Technology

Airport Movement Areas Safety System: In an effort to help air traffic controllers reduce runway incursions, the FAA has deployed the Airport Movement Area Safety System (AMASS) at the top 34 airports. When she testified before this subcommittee last year, Peggy Gilligan, the Deputy Associate Administrator for Aviation Safety at the FAA, described how AMASS "tracks ground movements and provides an alert so controllers can notify the crew if evasive action is required."

Airport Surface Detection Equipment, Model X: The Airport Surface Detection Equipment, Model X (ASDE-X) is another system being used to reduce runway incursions at busy airports. The FAA indicates that this system "enables air traffic controllers to detect potential runway conflicts by providing detailed coverage of movement on runways and taxiways. By collecting data from a variety of sources, ASDE-X is able to track vehicles and aircraft on the movement area and obtain identification information from aircraft transponders." The ASDE-X is now operational at 11 airports, and the agency plans to deploy the system at all 35 OEP airports by 2010.

Runway Status Lights: Although the NTSB credits the FAA for installing AMASS and ASDE-X to help inform air traffic controllers of potential runway incursions, the board indicates that these two systems "are not sufficient as designed to prevent all runway incursions." In 2000, the NTSB recommended that all airports with scheduled passenger service have "a ground movement safety system that will prevent runway incursions" and "provide a direct warning capability to flight crews."

One of the most promising technological improvements to prevent runway incursions and provide information directly to flight crews is the use of Runway Status Lights (RWSL). The system uses radar to anticipate the use of a runway by an arriving or departing aircraft and then controls a series of lights to provide information to pilots and vehicle drivers regarding the runway status. It can also provide information to a departing or taxing aircraft regarding conflicts on the intended runway.

The system consists of runway entrance lights and take-off hold lights. The runway entrance lights, which are located on taxiways near runway intersections, turn red to warn pilots when a runway is unsafe to enter or cross. Take-off hold lights, which are located on runways near the departure point, similarly turn red to warn pilots that a runway is unsafe to use. The beauty of this system is that it is not intended to replace the interaction between the ATC and the aircraft or vehicles on the airfield. But it does provide another layer of information that is independent of human error.

The FAA began testing RWSL technology at DFW in 2003 and later at San Diego International Airport. The FAA also plans to begin testing runway intersection lights at Chicago O'Hare International Airport this year. While it may seem that using RWSL is a new idea, the use of runway safety lights was originally developed and tested more than 10 years ago at Boston Logan International Airport. Unfortunately, however, the system failed to receive the support needed to move it forward.

Chairman Rosenker indicated in his testimony before this subcommittee last year that "initial test results have been promising…." Last month, the Department of Transportation (DOT) Inspector General's office released its review of the FAA's progress in implementing RWSL. The Inspector General's office concluded that runway status lights are a "viable and important technology for reducing runway incursions…." The report also indicated that runway incursions at the test runway at DFW decreased 70 percent.

It is clear from the test results that RWSL can be an effective tool in helping reduce runway incursions. I hope that the FAA will continue to work with airports and other aviation stakeholders in an effort to expedite the deployment of this system. I also commend the members of this subcommittee for designating funds from the FAA's Facilities and Equipment account to pay for acquisition and installation of Runway Status Lights in the House version of the FAA reauthorization bill.

Low Cost Ground Surveillance: Not surprisingly, developing, deploying and maintaining new technology to improve runway safety at airports can be extremely expensive. The GAO indicates that total ASDE-X program, which the FAA plans to deploy at the top 35 airports, will cost more than $800 million. The FAA is currently testing the use of Low Cost Ground Surveillance (LCGS) systems that could be very beneficial in improving runway safety at small- to medium-sized airports at a fraction of the cost of ASDE-X.

The FAA has been testing two LCGS options at the Spokane International Airport. One is the Critical Area Management System, which consists of five millimeter wave sensors that detect motion on the airport's runway, taxiways and ramp areas. The other is the Nova 9000 Surface Management System, which uses X-band radar to detect ground movements. I know airport officials are excited about these two systems because they appear to be effective, relatively inexpensive and easy to install.

It is my understanding that the testing at the Spoke International Airport is expected to conclude in 2009 and that the FAA is planning to expand the LCGS test to six additional airports in different parts of the country this year. I know some of my airport colleagues are very encouraged by the prospect of this low-cost technology and have offered to work with the FAA and volunteer their respective airports to participate in the LCGS test. I hope the additional evaluations will yield positive results and that the FAA will be able to expedite the deployment of this system, too.

Foreign Objects or Debris: In July 2000, an Air France Concorde flight taking off from Charles DeGaulle International Airport crashed into a hotel, killing 113 people. The crash occurred after one of the aircraft's tires hit a piece of titanium that had fallen off a previously departed aircraft. While this is the most extreme example of an incident caused by foreign objects or debris (FOD) on a runway, airlines report hundreds of millions of dollars annually in damage and delays caused by FOD ingestion.

Several companies have focused on this problem and have developed radar and optical solutions to instantly detect potentially damaging FOD on runways. The FAA has been very supportive of these technologies and has worked with airports and universities to conduct pilot programs in Vancouver, Providence and Boston. These programs are showing the products' viability in preventing accidents such as the one that occurred near Paris.

What Congress Can Do
To Help Airports Improve Runway Safety

Pass a Multi-Year FAA Reauthorization Bill; Short-Term Extension: Mr. Chairman, I would again like to thank you and your colleagues on the House Transportation and Infrastructure Committee for the leadership you have provided on H.R. 2881, the FAA Reauthorization Act. As I mentioned previously, airports are particularly grateful that the House-passed version of the FAA reauthorization bill would raise the PFC cap to $7.00 and increase AIP funding by $100 million per year.

In addition to the increased funding levels, H.R. 2881 includes a number of provisions that would help to improve aviation safety in general and runway safety in particular. Unfortunately, however, the reauthorization bill has been stalled on the other side of the Capitol largely over a debate about how to pay for Air Traffic Control modernization. Airport executives around the country hope that lawmakers will be able to work out their differences and pass a multi-year FAA reauthorization bill as quickly as possible.

Vision 100, the previous FAA reauthorization bill, expired almost five months ago. Although Congress appropriated more than $3.5 billion for AIP in FY08, AIP contract authority expired at the end of December. Unless Congress acts soon, funds that airports need to increase capacity, reduce airline delays and build other critical safety and security projects will continue to be held up. We simply cannot afford to delay funding for these vital infrastructure projects any longer.

Airports are asking Congress to quickly pass a multi-year FAA reauthorization bill that raises the PFC cap to $7.00 and increases AIP funding by $100 million per year as this subcommittee proposed. If that is not possible, we urge you to quickly approve short-term legislation that would extend AIP contract authority so the FAA can begin to release AIP funds to airports throughout the country. It is also critical that Congress extend the aviation excise taxes, which expire at the end of February, and the airport and airway trust fund expenditure authority.

FAA's Chief Financial Officer Ramesh K. Punwani talked about the severe consequences of not passing a multi-year FAA reauthorization bill or short-term extension when he testified before this subcommittee last week on the Administration's FY09 budget request. He indicated that the FAA will not be able distribute AIP funds to "62 airports that have requested approximately $256 million in FY 2008 to upgrade their runway safety areas or make almost $250 million in discretionary letter of intent (LOI) payments."

Airport sponsors need assurances quickly that the FAA will release grants soon so they can issue bids for projects and take advantage of the construction season. As Punwani suggested, we are quickly nearing the point at which a portion of the construction season could be lost for many airports -- a fact that could delay critical safety and capacity projects. He also indicated that the agency's "airports, facilities and equipment and research personnel (approximately 4,000 employees) will be sent home" on March 1st unless Congress acts.

Considering the severe consequences of not passing a multi-year FAA reauthorization bill or short-term extension, I would like to thank the leaders of this committee and Rep. Charles Rangel, the Chairman of the House Ways and Means Committee, for joining together and introducing H.R. 5270. This bill would extend AIP contract authority, the aviation excise taxes and the airport and airway trust fund expenditure authority through the end of June and allow the FAA to begin distributing AIP funds. I hope Congress will quickly pass this critical legislation.

Raise the PFC Cap, Increase AIP Funding: Congress can help airports improve safety and accommodate increasing demand by approving a multi-year FAA reauthorization bill that raises the PFC cap to $7.00 and increases AIP funding by $100 million per year. Due to the leadership on this subcommittee, the House of Representative has done its part by passing H.R. 2881, the FAA Reauthorization Act of 2007. Airports around the country truly appreciate your efforts.

Given the increasing demand, rapidly rising construction costs and the need to fund safety projects at airports around the country, airport executives are dismayed that the Administration is only requesting $2.75 billion for AIP in FY09. That is more than $1.1 billion less than the amount included in H.R. 2881 and in the FAA reauthorization bill passed by the Senate Commerce, Science and Transportation Committee. It is also $765 million less than the amount Congress appropriated for the current fiscal year.

We realize that this subcommittee has already spoken out about the need to increase funding for airport infrastructure projects by recommending record-level funding for AIP and raising the PFC cap. But we hope that you will work with your colleagues to reject the Administration's proposal to drastically cut AIP funding as Congress considers the FY09 Department of Transportation Appropriations bill.

Invest in the Airport Cooperative Research Program: I am privileged to sit on the oversight committee for the Airport Cooperative Research Program (ACRP). This program, which this subcommittee helped to create and fund as part of Vision 100, is fashioned after the very successful research programs developed for highway and rail. We are currently in the third year of a four-year pilot program that has focused on research aimed at finding solutions for many of the safety, security and environmental challenges facing today's airports.

Although the ACRP has been operating for only a short period of time, I am pleased to report that it is already actively engaged in research on nearly 100 topics. In fact, the first results of some of this research are coming off the presses now. We have nearly a dozen published reports and expect to more than double that in the coming year. Earlier in my statement I discussed how some airports are using Engineered Materials Arresting Systems. As a result of the ACRP program, research is being conducted on alternative civil aircraft arresting systems.

Congress appropriated $10 million for ACRP in FY08. Airports are grateful that the House-passed version of the FAA reauthorization bill would authorize another $15 million per year for the program between FY09 and FY11. The reauthorization bill also includes recommendations endorsed by the House Science and Technology Committee that would specify how that funding is distributed. In FY09, for instance, the bill calls for $5 million for capacity research, $5 million for environmental research and $5 million for safety research.

Some of my colleagues who are involved with ACRP have expressed concerns that the bill would unnecessarily prescribe how limited funding for the program is to be spent. They would prefer that the final version of the FAA reauthorization bill eliminate those restrictions so more funding could be spent on safety research or one of the other proposed categories depending on the research needs of airports. We hope that you will consider making this modification in conference and truly appreciate your support for the ACRP.

Increase Funding for the Contract Tower Programs: The FAA's Contract Tower Program and Contract Tower Cost Share Programs have also improved runway safety at airports in small communities. The Contract Tower Program has been in place since 1982 and currently provides for the cost-effective operation of air traffic control towers at 239 smaller airports in 46 states. AIR-21 included a provision that created the Contract Tower Cost Share Program, which currently allows 26 airports in 22 states that fall slightly below the eligibility criteria to participate in the program if they provide local funds.

We are grateful that H.R. 2881 includes $8.5 million for the Contract Tower Cost Share Program in FY08, increases the amount by $500,000 per year and includes other provisions to improve the program. The reauthorization bill will keep the existing towers operating, allow additional airports to participate in the program and maintain the high-level of safety that comes with air traffic control services. Without the Contract Tower Programs many if these smaller airports simply would not have the added safety that comes with air traffic control services.

Conclusion

Again, Chairman Costello, Ranking Member Petri and members of the House Transportation and Infrastructure Subcommittee on Aviation, thank you for inviting me to participate in today's hearing. I know I speak on behalf of my colleagues at airports around the country when I say we look forward to working with you, the Administration and aviation stakeholders to improve runway safety.

Runway Safety

Testimony of

Patrick Forrey, President
National Air Traffic Controllers Association, AFL-CIO

Before the House Transportation and Infrastructure Subcommittee on Aviation

Wednesday, February 13th, 2008

NATCA®

INTRODUCTION

The National Air Traffic Controllers Association (NATCA) is the exclusive representative of over 14,000 air traffic controllers serving the Federal Aviation Administration (FAA), Department of Defense and private sector. In addition, NATCA represents approximately 1,200 FAA engineers, 600 traffic management coordinators, 500 aircraft certification professionals, agency operational support staff, regional personnel from FAA's logistics, budget, finance and computer specialist divisions, and agency occupational health specialists, nurses and medical program specialists. NATCA's mission is to preserve, promote and improve the safety of air travel within the United States, and to serve as an advocate for air traffic controllers and other aviation safety professionals. NATCA has a long history of supporting new aviation technology, modernizing and enhancing our nation's air traffic control system, and working to ensure that we are prepared to meet the growing demand for aviation services.

EXECUTIVE SUMMARY

A host of independent federal watchdogs have recently warned that the Federal Aviation Administration (FAA) should be concerned with issues impacting aviation safety.

- The National Transportation Safety Board (NTSB) recently added runway incursions and incidents caused by air traffic controller fatigue to their 2008 List of Most Wanted Aviation Improvements.
- In November of 2007, the Government Accountability Office (GAO) issued a report that warned of "a high risk of a catastrophic runway collision occurring in the United States."
- The Department of Transportation's Inspector General, on the heels of near-collisions on runways at O'Hare, launched an investigation into the role that workplace conditions played at FAA facilities in Illinois.

The National Air Traffic Controllers Association (NATCA) offers the following recommendations specific to the issue of runway safety.

1. **Local Airport Committees for Runway Incursion Prevention**
   - It is imperative that each airport has the opportunity to employ a set of solutions that address specific local issues. Therefore, NATCA recommends that we establish Runway Incursion Prevention Committees for each airport throughout the country that would be run and structured on the level of the individual airport. These groups would be composed of representatives from the local stakeholders, including Pilots, Air Traffic Controllers, Airport Management, and Airport Vehicle Drivers as well as a national representative from the FAA.

2. **Proper Staffing of Air Traffic Control Towers**
   - It is also important that we address at the national level those system-wide problems which occur most frequently and whose effects are most detrimental to runway safety. First among these system-wide problems is the understaffing of Air Traffic Control Towers. The first step to relieving the staffing shortage and

alleviating controller fatigue is to stem the flow of Air Traffic Controllers out of the FAA workforce. Therefore, NATCA recommends to this committee that the FAA be instructed to return to the bargaining table to bargain in good faith with NATCA and produce a ratifiable agreement for the Air Traffic Controllers. This gesture of good faith, combined with the removal of some of the more heinous provisions of the imposed work rules, will make staying in the FAA workforce more attractive to both newly hired Controllers and those eligible for retirement, slowing the rate of attrition.

3. Technology and Modernization

- *Collaboration:*
  When NATCA and the FAA worked collaboratively on modernization projects through the Liaison Program, they were able to successfully identify the technological needs of the Air Traffic system and develop and deploy the technology to meet those needs. Unfortunately this collaborative program with the controllers was disbanded in 2003 by the FAA.
- *ASDE-X:*
  NATCA recommends that surface radar, whether ASDE-X or a low-cost surface surveillance system, be installed at all airports throughout the country with mid to high traffic density. Air Traffic Controllers should be given the opportunity to provide feedback and guidance on the local level during the implementation and deployment of the technology.
- *Additional Technologies:*
  NATCA recommends that each of the following technologies: Runway Status Lights, Data Link Systems, and Taxiway monitoring systems be tested and adapted for use in the U.S. airport environment. Testing should be done swiftly, efficiently and cooperatively, and once completed, the technologies should be implemented at all major airports.

4. Runway Crossing

- *End Around Taxiways:*
  Runway incursions commonly occur when the layout of taxiways force aircraft to cross a runway in route to a second runway or the gate. Therefore it is NATCA's final recommendation to this committee that End-Around Taxiways be constructed and utilized at all airports where such construction is possible.

RUNWAY SAFETY

Runway incursions are not, as they may seem, a single problem that can be addressed with a single solution. Runway incursions are the unfortunate manifestations of many obstacles working in tandem to create unsafe situations at the nation's airports. These obstacles include: airport design, controller fatigue, frequency congestion, understaffing, poor visibility, equipment limitations, and an emphasis on system efficiency and capacity over safety. The following recommendations address each of these obstacles.

Local Airport Committees for Runway Incursion Prevention

The causes of runway incursions are often as specific and local as lighting, signage and an airport's unique taxiway layout. Thus it is imperative that each airport has the opportunity to employ a set of solutions that address these specific local issues.

At the Atlanta Hartsfield-Jackson Airport for example, runway incursions are often caused by confusion relating to hold-short lines for two parallel runways, Runway 26R and Runway 26L, which are separated by less that 2500 feet. An aircraft located on the North side of 26R may be instructed to cross runway 26R, but hold short of 26L. Instead of stopping at the northern hold short line for 26 L, an aircraft may stop at the southern hold short line for 26R. The mistake is easy to make, as these two lines are very close together. However, holding short at the wrong line may mean that a larger aircraft is stopped where its tail is not clear of the first runway.

Lexington Airport, which has no parallel runways, could not experience this same confusion. However, an aircraft leaving the gate at Lexington via taxiway Alpha to depart from runway 22 needs to pass by the entryway of runway 26 before reaching its destination. A pilot, realizing he is approaching the entryway of a runway may mistakenly believe he has already reached runway 26 and try to depart from the incorrect runway. This scenario was one of the contributing factors that led to the accident at Lexington Airport in August of 2006.

The solutions for Lexington Airport, therefore, differ significantly from those for Atlanta, just as solutions for each airport will differ from every other. Even those airports that experience common challenges due to, for example, similarities in climate, experience them differently as these challenges interact with airport layout and traffic patterns.

Yet this does not create an insurmountable task. Each airport has a set of local experts: the Air Traffic Controllers, Pilots, Tug Drivers, Traffic Management Coordinators, Engineers, airport authorities, local management and other aviation safety professionals who work there every day. Through their first hand experience, these local professionals are able to identify runway incursion "hot spots." They have witnessed breakdowns of communication, inadequate procedures, and failures of airport markings. They have learned when and where visibility becomes limited and have devised methods of coping with these limitations. They know the optimal runway configurations, are familiar with the weather and traffic patterns, and have experienced the technological glitches as well as the successes. These experts possess a wealth of knowledge that would be an invaluable asset to the process of minimizing runway incursions.

Therefore, NATCA recommends that we establish Runway Incursion Prevention Committees for each airport throughout the country that would be run and structured on the level of the individual airport. These groups would be composed of representatives from the local stakeholders, including Pilots, Air Traffic Controllers, Airport Management, and Airport Vehicle Drivers as well as a national representative from the FAA. They would meet monthly to identify specific local causes and contributing factors to runway incursions and to posit potential solutions to those problems. This would be the full charge of each meeting, until such time as solutions have been established. These groups would reconvene during the implementation phase in order to fine-tune the solutions and deal with any complications that arise during execution.

Proper Staffing of Air Traffic Control Towers

It is also important that we address at the national level those system-wide problems which occur most frequently and whose effects are most detrimental to runway safety. First among these system-wide problems is the understaffing of Air Traffic Control Towers.

In 1998, NATCA and the FAA jointly authorized a level of staffing for each Air Traffic Control facility throughout the country, based on scientific studies that identified the number of controllers necessary to maintain the National Airspace System (NAS) safely and efficiently. As of January 5, 2008, the NAS is operating with only 70% of the authorized number of controllers. At many of the major airport towers, the numbers are even more staggering: McCarran Airport in Las Vegas is authorized to employ 57 Certified Professional Controllers (CPCs), but as of last month had only 27. At LaGuardia, there are 22 CPCs instead of the 36 that were authorized, and at Philadelphia International Airport there are 70 CPCs instead of the authorized 109.[1]

This understaffing leads to mandatory overtime for controllers, who are often called upon to work 10 hour days and six day weeks to cover these short shifts. In December 2007, the Government Accountability Office released a report that found "at least 20 percent of the controllers at 25 air traffic control facilities, including towers at several major airports were working 6 day weeks." Excessive overtime causes fatigue among controllers, and therefore increases the likelihood of mistakes being made. The National Transportation Safety Board listed the reduction of "accidents and incidents caused by human fatigue" among their 10 most wanted improvements to aviation safety, and the GAO report identified controller fatigue as a major cause of runway incursions, stating, "Air traffic controller fatigue continues to be a human factors issue affecting runway safety."

Overtime is not the only cause of controller fatigue. In addition to working longer days and weeks, controllers must also work on short-staffed shifts. On a short-staffed shift, a controller has to work more time on position with shorter and less frequent opportunities for rest. On such a shift, controllers at radar positions are often forced to work without a radar assistant, as there are not enough controllers to cover these duties separately. A controller working without an assistant is responsible not only for communication with aircraft, but also coordination with other controller positions and entering flight progress information. Short-staffed shifts also frequently combine positions, forcing a single controller to work, for example, both ground control and local control, creating increased frequency congestion and an increased risk of runway incursions. The increased complexity and workload can also lead to less situational awareness, meaning that a controller is less likely to realize pilot error in time to prevent runway incursions.

Atlanta Hartsfield-Jackson Airport is a prime example. The GAO report found that 52% of that tower's controller workforce regularly worked 6 day weeks. The GAO report also cited 30 runway incursions at Hartsfield-Jackson Airport in the past four years, the fifth most of any U.S. airport. There were 11 controller errors at ATL in 2007, including one involving a Delta flight that blew out its tires while aborting a takeoff into incoming traffic headed to an adjacent, parallel runway. Both controllers involved in that incident

[1] All staffing information is based on data supplied by the FAA to NATCA in accordance with provisions of the Imposed Work Rules. Data is current as of January 5, 2008.

had recently worked overtime shifts. More recently, on January 13, 2008 a Delta Airlines Boeing 757 almost collided with a commuter jet when it crossed over the runway in front of the Boeing. The 757 was accelerating on a takeoff roll, and traveling over 100 mph. The Delta B757 was not able to stop, and the commuter jet expedited their taxi, avoiding a collision by only seconds.

A similar story can be told at Los Angeles International Airport, a facility where controllers must work an average of 2.3 overtime shifts a month to compensate for staffing shortages. Last August, two aircraft carrying close to 300 people stopped within 37 feet of each other there. As of January 10, 2008 this tower has had 18 close calls. Today there are only 33 controllers working in the tower, down from 46 in past years when there were fewer close calls.

Short-staffing at smaller airports means that there may only be one controller on duty who is responsible for all operations and controller-pilot communications at that airport. In August 2006, management at Lexington Airport violated FAA guidelines and left a single controller responsible for all ATC operations and responsibilities. As a result, he failed to notice the Pilot of ComAir flight 5191 deviated from his instructions and entered the wrong runway, resulting in the death of 49 passengers. NATCA is concerned that short staffing scenarios such as this are being recreated throughout the country. On December 4, 2007, for example, a controller at Syracuse Tower was forced to work a 13 hour 40 minute shift when another controller suffered an injury and no others were available for overtime due to understaffing.

The shortage of air traffic controllers nationwide is a direct result of attrition caused by FAA implementation of the imposed work rules (IWR) in September of 2006. The agency's refusal to fairly negotiate a fair labor agreement with NATCA caused, and is continuing to cause, unprecedented attrition from the ATC workforce. The FAA missed their total attrition projection for fiscal year 2007 of 1,197 by 425 when 1,622 controllers and trainees left – working out to an average of 4.4 controllers leaving the workforce per day. As of January 5, 2008, three months and five days into the new fiscal year, the total workforce attrition was 603, or 6.2 controllers per day – putting the country on track to lose 2,269 in total attrition by the end of the fiscal year.

Much of this attrition is attributable to an increase in controller retirements. So far this fiscal year, there have been over 316 retirements, only 8 of which occurred when an individual reached the mandatory retirement age. Each of these retiring controllers represents over 20 years of invaluable experience, and they are leaving the ATC workforce with time still left on the table. As these experienced controllers leave, the next generation of air traffic controllers is left without the proper training and mentoring they require to in order to learn to work air traffic safely and efficiently. Additionally, the system depends increasingly on inexperienced controllers and on individuals who have not yet achieved full certification to work control positions. At Seattle Tacoma International Airport, for example, if every controller who is eligible to retire by the end of FY2008 does so, they will have only 11 controllers with more than 1.5 years of experience.

The first step to relieving the staffing shortage and alleviating controller fatigue is to stem the flow of Air Traffic Controllers out of the FAA workforce. Therefore, NATCA recommends to this committee that the FAA be instructed to return to the bargaining table to bargain in good faith with NATCA and produce a ratifiable agreement for the Air Traffic Controllers. This gesture of good faith, combined with the removal of some of the more heinous provisions of the imposed work rules, will make staying in the FAA workforce more attractive to both newly hired Controllers and those eligible for retirement, slowing the rate of attrition.

Technology

Repairing the relationship between the FAA and the Controller workforce would have positive implications for safety beyond stemming the flow of controllers from the workforce. Working together, NATCA and the FAA have been able to successfully identify the technological needs of the Air Traffic system and develop and deploy the technology to meet those needs. Some of the most successful initiatives of the now-defunct liaison program were the development of certain technologies that could – if widely and properly implemented – combat some of the most common deficiencies that lead to runway incursions.

ASDE-X, the current state-of-the-art surface radar, is the perfect example. ASDE-X is designed to combat visibility limitations of tower controllers by providing radar-based visualizations of the position and movement of aircraft on the ground and in the air within 5 miles of the airport. This is particularly valuable at night and during inclement whether when visibility from the tower is limited. By taking input from radar sources in several different locations around the airport, ASDE-X has been able to reduce coverage gaps and false targets that plagued some of the predecessor technology.

As of today, surface radar has been implemented at only eleven airports. The FAA has created a list of 35 airports that should receive the technology by 2010. While NATCA applauds the implementation of this technology at these airports, the FAA has not gone far enough. Lack of visibility poses a threat to runway safety at all airports, not only the 35 busiest.

It is also vitally important that Air Traffic Controllers be consulted locally during the implementation process in order to avoid or quickly resolve technological glitches. For example, the ASDE-X at Chicago O'Hare (ORD) has six portions of the non-movement area where radar coverage has been blocked. This action was taken without coordination or input from the Air Traffic Controllers. Even though these blocked areas are not on taxiways or runways, coverage of these areas would give Controllers greater insight into airport activity and allow them to more accurately track and predict aircraft movement. Cooperation in this endeavor would allow the users of this technology to fine-tune the installation in order to maximize the utility of ASDE-X according to their specific needs.

Accordingly, NATCA recommends that surface radar, whether ASDE-X or a low-cost surface surveillance system, be installed at all airports throughout the country with mid to high traffic density. The process should begin by expanding the list of 35 airports to include the 60 busiest airports, so that they may receive this technology in the near term. Air Traffic Controllers should be given the opportunity to provide feedback and guidance on the local level during the implementation and deployment of the technology.

In addition to ASDE-X, there are other pre-existing technologies available that would help combat causes of runway incursions. These include: Runway Status Lights to combat controller-pilot miscommunication and taxiway monitoring systems to cut through operational complexity. Controller Pilot Data Link Communication (CPDLC) should be modified for surface operations to reduce frequency congestion.

Runway status lights function by alerting pilots as to whether a runway that they are about to enter or cross is currently occupied. These lights have an appearance similar to that of ordinary traffic lights. When a runway is occupied, the runway status light would show a red stoplight that would warn a pilot not to enter.

Runway status lights would serve as an additional line of defense in cases of miscommunication between Air Traffic Controller and pilot. Pilots unfamiliar with the layout of particular airports may misunderstand instructions given by Controllers, and taxi to an incorrect runway, resulting in an incursion. Additionally, Air Traffic Controllers frequently issue clearances to pilots instructing them to taxi to the intersection of a runway, but to "hold short" of the runway itself. Often, a pilot will see that a runway is not occupied and infer the next step of the Air Traffic Controller's instructions, neglecting to first hold short of the runway. Most often, this action is harmless. However, if the runway in question is occupied, it could result in a runway incursion. Runway status lights would serve as an additional warning to pilots, and provide an opportunity for corrective action prior to the occurrence of a runway incursion.

Frequency congestion is another problem that can be at least partially alleviated by existing technological solutions. An Air Traffic Controller is responsible not only for delivering the correct clearance to each pilot, but also for confirming that each pilot reads back the clearance correctly. At a busy airport, a controller is responsible for monitoring and responding to many different communications on multiple frequencies from a number of different pilots simultaneously. Sometimes a frequency can become so congested that a pilot's communication may not come through at all. Controller Pilot Data Link Communication (CPDLC) was a program that would have allowed controllers to issue routine clearances and other instructions to pilots via data transfer. Although it has never been developed for use in the terminal environment, this new system could be adapted to provide a visual readout of taxi instructions for pilots, eliminating the need for read-back monitoring and minimizing the opportunity for miscommunication. This technology would function much like the GPS systems used by many automobile drivers. A controller would input a pre-coded route, and the device would then issue step by step instructions to the pilot based on that route and the pilot's position.

Technology can also be utilized to enhance a controller's situational awareness, particularly when issues of short-staffing increase the complexity of an individual Controller's operation. Taxiway monitoring systems, for example, have been deployed at airports in India. These work as follows: Common taxi routes are coded at each airport. The controller then instructs the pilot to follow, for example, the green taxi route. When that command is given it is also entered into the monitoring system, which would immediately alert the controller if the pilot deviates from the assigned route. This would help a controller maintain situational awareness, particularly at busy times, or when inclement weather or other mitigating circumstances increases the complexity of the ATC operation.

NATCA, therefore, recommends that each of these technologies: Runway Status Lights, Data Link Systems, and Taxiway monitoring systems be tested and adapted for use in the U.S. airport environment. Testing should be done swiftly, efficiently and cooperatively, and once completed, the technologies should be implemented at all major airports. As with ASDE-X, NATCA believes that it is important for the users of this technology – Air Traffic Controllers and Pilots in particular – be consulted throughout the testing and implementation process in order to maximize the benefit of the technology.

Minimize Runway Crossings

Runway incursions commonly occur when the layout of taxiways force aircraft to cross a runway in route to a second runway or the gate. Many airports with multiple runways are constructed so as to frequently require pilots to make this dangerous maneuver.

Los Angeles International Airport (LAX), for example, has two sets of parallel runways: Runway 24L and 24R and Runway 25L and 25R. In order for an aircraft that has landed at 25L to reach the gate, it must first cross 25R. Similarly, an aircraft that has landed at 24R must cross 24L in order to reach the gate. Though aircraft taxiing to and from the more distant runways should be instructed to hold short before being cleared to cross the nearer runway, these intersections are still runway incursion hot-spots.

In order to combat this problem, some airports have constructed End-Around Taxiways. These are additions to current taxiways that allow an aircraft to detour around the end of a runway rather than cut directly across it. Atlanta Hartsfield-Jackson Airport, for example, unveiled a new end-around last spring that allowed aircraft landing on runway 26R to reach the gate without crossing runway 26L, which runs parallel. By doing so, they were able to eliminate more than 600 runway crossings per day according to FAA data.

The construction of End-Around Taxiways is not a simple proposal. It requires the usurpation of land, a valuable resource that is often scarce, particularly in airport areas. Runway safety requires that some land be set aside for runway overruns, or areas that provide additional space for aircraft to stop in the event of a runway overshoot. These spaces help diminish the collateral damage incurred in these events and help protect the communities surrounding the airport. End-Around construction may be forced, in some situations, to compete with these buffer zones for land, and in these cases an assessment must be made based on which provides the greatest safety benefit.

The key to the success of End-Around Taxiways does not lie simply with their construction, though that is the clear first step. In order for these to be effective in the reduction of runway incursions they must be regularly utilized. Using the End-Around Taxiway instead of crossing runways lengthens the taxi route, sometimes by over a mile. Although it is never the intention of any aviation professional to be involved in a runway incursion, pilots also feel pressure to conserve both time and fuel. It is therefore important to remember that safety must always be the first consideration, even when it is at odds with the maximization of efficiency.

Therefore it is NATCA's final recommendation to this committee that End-Around Taxiways be constructed and utilized at all airports where such construction is possible.

These taxiways must be built at a lower altitude than the nearby runway so that the tail of the aircraft on the taxiway will be below the obstruction zone for the departure runway.

CONCLUSION

The National Air Traffic Controllers Association believes each of these recommendations should be acted on by the Agency to ensure that aviation safety is not only preserved, but improved upon. NATCA offers its expertise and resources to aid the Agency in their implementation of these recommendations on inclusion of frontline employees' expertise, implementation of specific technologies, and the minimizing of runway crossings. NATCA's warning on controller staffing has been consistent and clear: When there are fewer, more tired eyes watching more planes, safety suffers. The Agency must properly staff towers and correct the unjust imposed work and pay rules that have aggravated an already existing staffing problem.

Our hope is that the FAA will change course and be interested in the solutions as well as the participation of the men and women that make our National Airspace System the safest and most efficient in the world.

STATEMENT OF

TK KALLENBACH

VICE PRESIDENT, MARKETING & PRODUCT MANAGEMENT

HONEYWELL AEROSPACE

BEFORE THE

SUBCOMMITTEE ON AVIATION

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

U.S. HOUSE OF REPRESENTATIVES

FEBRUARY 13, 2008

RUNWAY SAFETY

The airport surface is one of the highest risk environments in aviation today. This is not some potential crisis looming on the distant horizon; it is a problem right now. And it is not a new problem, but as our Nation's skies and runways become more crowded, one that requires some new solutions. There is no option to do "nothing." In this testimony, Honeywell offers our unique perspective as a decades-long leader in safety avionics technology. We will show how, working together, government and industry can improve runway awareness and safety for pilots and passengers – right now, and for the future.

RUNWAY INCURSIONS

Runway incursions are one of the most significant on-going risks to aviation safety. The issue has been included in the National Transportation Safety Board's "Most Wanted" list since its inception in 1990 and remains there today. While the Federal Aviation Administration has made some progress in airport markings, training, and the deployment of ground systems (Airport Movement Area Safety System (AMASS) and Airport Surface Detection Equipment Model X (ASDE-X)), these solutions are insufficient to prevent all runway incursions. Over the past five years, the incursion rate in the U.S. has remained relatively constant (Table 1). *Serious incidents* have actually increased ten percent since 2004.

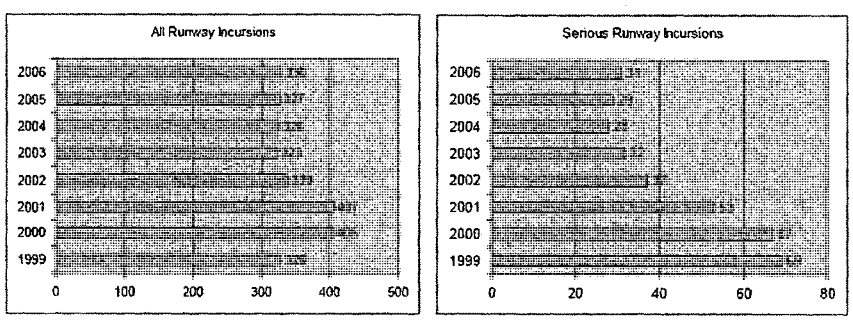


Table 1: Runway Incursion Rates in U.S, 1999 – 2006

Primary factors contributing to runway incursions include human errors that position an aircraft in the path of another aircraft or vehicle, or on a runway or taxiway not designed for the intended operation.

For the past several years, the NTSB has consistently stated that incursion alerts must be made available *directly to the pilot.* Existing solutions generate alerts *only for the air traffic controllers,* who must then verbally notify the pilot of the potential collision via radio. With aircraft traveling at high rates of speed and with limited ability for course alterations or rapid deceleration, response time dependent on this "pass along" verbal communication between controller and pilot can be the difference between a catastrophic collision and a safe resolution. Consider: an aircraft traveling at 150 miles per hour during final approach for landing will cover a quarter mile in just six seconds.

To generate a significant reduction in the runway incursion rate, it is imperative that: (1) Emphasis be placed on providing strategic situational awareness information to the pilot, including aircraft position relative to runways and other aircraft; and (2) In the event of a potential incursion, instantaneous alerting is provided directly to the pilot.

To approach this issue, it is necessary to look at both *short-term* and *long-term solutions.* In the short term, there are applications available now that can improve pilot awareness of their position on the airport surface, reducing the potential for confusion that could lead to an aircraft being in the wrong place at the wrong time. In the long term, technology currently in development will improve pilot awareness of the positions of other aircraft and alert pilots of potential collisions.

Both phases are critically important to reducing the risk of runway accidents; both will require proactive support from the FAA, aircraft operators, airports, labor and manufacturers.

Before a review of these short- and long-term solutions, it may be helpful to have an understanding of Honeywell's history in aviation safety.

HONEYWELL AEROSPACE AND AVIATION SAFETY TECHNOLOGY

Honeywell Aerospace has a long history as a leader in the development and application of avionics safety technology. Our legacy weaves through virtually every aspect of modern aviation history, from the earliest navigational gyroscopes to leadership in the development of technology for the Next Generation Air Transportation System (NextGen).

Our products range from mechanical systems and components for jet engine and airframe manufacture to environmental controls, power distribution, communications and navigation equipment and integrated cockpit controls. Honeywell's leadership in the development of mechanical and electrical aviation technology gives us unique insight into the big picture of challenges facing the aerospace industry worldwide.

Specific to this discussion, Honeywell Aerospace has been a driving force in research, development and application of safety avionics technology. From our earliest involvement in the invention and development of Traffic Alerting and Collision Avoidance Systems (TCAS) in the late 1950s to our leadership in industry-changing Ground Proximity Warning Systems and Enhanced Ground Proximity Warning Systems, Honeywell has been a major contributor to advancements in aviation safety technology.

GROUND PROXIMITY WARNING TECHNOLOGY

One key to increased airport runway awareness rests in understanding the core avionics safety technology Honeywell invented and developed into a standard product, which is now installed aboard 95 percent of all commercial aircraft flying today, or approximately 42,000 aircraft. This technology, **Enhanced Ground Proximity Warning System (EGPWS),** utilizes a combination of hardware, software, GPS signals and a global terrain database that assists in avoidance of a class of aviation accident that occurs when a disoriented pilot simply flies a properly functioning aircraft into the ground. This type of accident is known as "controlled flight into terrain," or CFIT.

With EGPWS, pilots can see an indication of terrain and tall structures on a cockpit display. As a result, pilots are less likely to continue flying toward that terrain or structure. Even if the terrain display is turned off as the aircraft approaches terrain, EGPWS will sound an audible alert about a minute away from the terrain, providing ample opportunity for evasive action (e.g. "PULL UP! PULL UP!").

The predecessor to EGPWS, the Ground Proximity Warning System (GPWS) – also developed by Honeywell – significantly reduced CFIT accidents in the U.S. after the FAA mandated its use in 1974 for airlines. Following the GPWS mandate, the U.S. CFIT rate fell to about one to two per year. Since airlines have begun to install EGPWS, the rate has dropped to less than one per year (see Table 2: EGPWS and CFIT, Major Airlines).

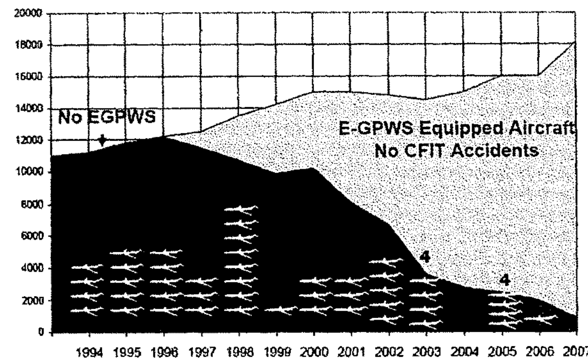


Table 2: EGPWS and CFIT, World Airlines

EGPWS has logged more than 300 million flight legs, or nearly 800 million flight hours, since its inception, without a single aircraft operating with an EGPWS being involved in a CFIT accident.. There have been 30 officially documented instances where EGPWS has broken the chain of events that would have led to CFIT, with an additional 75 incidents anecdotally captured.

Along with vast areas of terrain, the EGPWS database contains *runway information for all known commercial airports worldwide* – a critical factor in the development of automated runway awareness systems.

SITUATIONAL AWARENESS ON THE RUNWAY

Fundamentally, there are three levels of situational awareness for runways and taxiways. At a basic level, the pilot knows the location of his/her aircraft relative to the fixed immediate surroundings. At an intermediate level, the pilot knows there are other objects moving towards, around or away from their own aircraft, including the other objects' direction, speed and velocity. At the highest level of awareness, every pilot within the defined space knows the identity of every other moving object around them, as well as the supposed intent of the other objects' movements.

In order to respond to hazards or threats of incursion, a pilot needs to be able to receive alerts – visual or audible – that inform them of the situation. At that point, the pilot can take appropriate action to correct an error or take evasive action.

Short-term solutions – those currently available – provide a basic level of situational awareness to the pilot. These solutions include systems providing *audible alerts* to pilots, such as Honeywell's Runway Awareness & Advisory System (RAAS); and systems that provide *visual data* to pilots in the cockpit, such as Honeywell's interactive INAV "moving map" applications.

Honeywell's **Runway Awareness & Advisory System (RAAS)** is a software upgrade to the Enhanced Ground Proximity Warning System that provides verbal announcements to pilots of their relative runway position on the ground, on approach and on take-off. These warnings are audio announcements sounded in the cockpit ("Approaching runway 2L" or "On runway 2L" for example), allowing pilots to remain "heads up" and visually alert to immediate surroundings without depending on looking down at a specific cockpit display.

During landing or take-off, RAAS provides immediate verbal feedback if there is improper runway distance. This assists the pilot in making split-second decisions to reject a take-off or abort of a landing. RAAS provides 10 aural advisories to maintain maximum situational awareness (see *Appendix 1- RAAS Advisories*).

The FAA certified RAAS in 2003 and the product is commercially available now. Several Honeywell customers have elected to install it, including Air France, Alaska Airlines, Emirates, FedEx, Lufthansa, Malaysia (approximately 1,200 commercial jets total), and approximately 1,500 business jets.

In RAAS, aircraft operators find an affordable modification to existing equipment that can quickly be installed, providing the immediate benefit of enhanced runway situation awareness for the pilot. Operators can choose the RAAS call-outs that best maximize their operations and reduce pilot workload. Customization can be based on where an aircraft usually flies, the length of flights, and even factors such as the average pilot age and native languages. For those operators frequently flying long distances and into unfamiliar airports (e.g. international flights), the RAAS call-outs confirm the aircraft position relative to the runway. This is true for business jets as well, which often fly into smaller, unknown locations. RAAS is a useful option that helps mitigate other factors as well, from pilot fatigue to unusual or unexpected runway congestion

Airlines are purchasing RAAS for a variety of reasons. Operations with younger pilots find RAAS useful for crews with less experience at certain airports. Some operators place a greater emphasis on safety and technology, and are consistent early adopters. But they share one common goal – a desire to proactively find a near-term solution for runway situational awareness. These operators are leaders in the incorporation of aviation safety technology. They see the value in this technology and they are willing to implement it now.

Interactive moving maps provide another short-term solution. Similar to the GPS mapping systems found in newer automobiles, the moving map presents a graphical representation of a pilot's location and surroundings. The display changes as the aircraft moves across the airport surface (see *Appendix 2 – Moving Maps*).

Interactive maps allow a pilot to quickly review and analyze 2D information, with an emphasis on "quickly." While pilots can get distances from other onboard sensors, the moving map shows the context of other environmental variables – such as other aircraft or obstacles – so the pilot is looking at all the pieces in one place. Good decisions are dependent upon complete data. With a moving map centered on your aircraft, you are right in the middle of the big picture.

Honeywell has been on the forefront of moving map technology with our Primus EPIC INAV system, which provides a full flight depiction of the aircraft, the environment including potential hazards such as weather, terrain and traffic, and a graphical method for adapting the flight plan. This system sets the stage for an intuitive controller-pilot datalink interface that can avoid communication errors.

Honeywell's INAV system provides airport maps for many airports. Aircraft without Honeywell's INAV can display airport maps using Electronic Flight Bags (EFB) which can be as simple as a device similar to a "tablet computer" to a more sophisticated display mounted in the cockpit. These devices, provided by many different manufacturers are being adopted by operators in part because of their ability to show airport maps. These devices and Honeywell's INAV system each provide a depiction of the airport's runways and taxiways with a symbol showing where the airplane is currently located.

Newer moving map software, such as that provided by Jeppesen, can provide enhanced features including automatic loading of runway data and system arming just prior to landing, panning and tracking controls, "north up" or "track up" orientation controls, and the capability to browse the airport map database.

Like RAAS, airport moving maps improve pilots' situational awareness. And the systems are complementary – with RAAS providing verbal cues while the pilots are looking out the windows and the moving map backing them up with picture of their position on the airport.

As noted, these short-term solutions help pilots avoid placing their airplane in a runway incursion situation. The next step, and the objective of the longer term solutions is to provide pilots with better information about what other aircraft are doing and warn them when a collision is imminent.

AIRPORT SURFACE DETECTION

Longer-term solutions for enhanced runway situational awareness require additional data inputs from airport-based surveillance systems and other aircraft. These systems include **Airport Surface Detection Equipment – Model X (ASDE-X)** and **Automatic Dependent Surveillance Broadcast (ADS-B).** Both of these systems are currently available, but are not comprehensively installed at all airports in the National Air Space.

To explore one potential long-term solution, we will consider ASDE-X technology and how it can be combined with TCAS and EGPWS, leveraging the benefits of each system and creating a higher level of situational awareness.

The Sensis Corporation is the FAA's supplier for Airport Surface Detection Equipment – Model X (ASDE-X), which uses multilateration, surface radar, and Automatic Dependent Surveillance Broadcast (ADS-B) technology to monitor activity on the ground and transmit real-time information to air traffic controllers. ASDE-X does not provide direct signals to aircraft.

The FAA is currently in the process of installing ASDE-X at 35 of the busiest airports across the United States.

BRINGING THE SYSTEMS TOGETHER

Honeywell and Sensis Corporation have been working in partnership to develop and prototype an integrated real-time runway incursion advisory solution using existing Traffic alert and Collision Avoidance System (TCAS) and ASDE-X technology. By integrating the two solutions, controllers and pilots simultaneously receive alert warnings if there is a runway conflict or potential incursion. This technology was demonstrated to senior FAA and NTSB officials in the summer of 2007.

A primary point of the demonstration was to illustrate that existing ground and airborne technologies can easily be adapted to interact with each other. TCAS provides airborne alerts and warnings of potential aircraft collisions; ASDE-X provides monitoring and alerts to air traffic controllers.

The demonstration included two scenarios: 1) two aircraft simulating simultaneous take-offs on converging runways, and 2) one aircraft simulating a landing while the other aircraft taxis onto the active runway.

[EXAMPLES ILLUSTRATED ON FOLLOWING TWO PAGES]

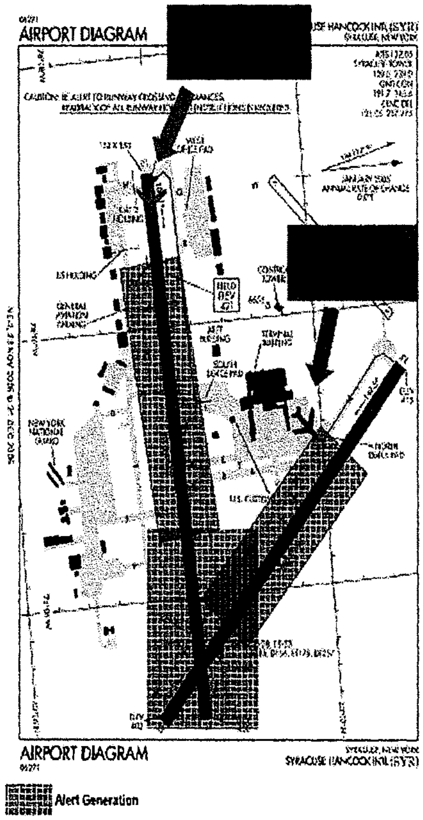


Figure 1 – "Converging Traffic" Scenario

Scenario 1

Converging Traffic (Figure 1)

- Aircraft N670H (BLUE aircraft) taxis onto runway 10 after ATC clearance

- Aircraft N3GC (RED aircraft)is positioned near runway 15

- N670H begins take-off roll upon ATC release

- Simultaneously, N3GC also starts take-off roll on converging runway

- ASDE-X Safety Logic detects approaching conflict; issues alert code to both aircraft; Honeywell avionics translate alert code to audible alert for both pilots: "CONVERGING TRAFFIC! CONVERGING TRAFFIC!"

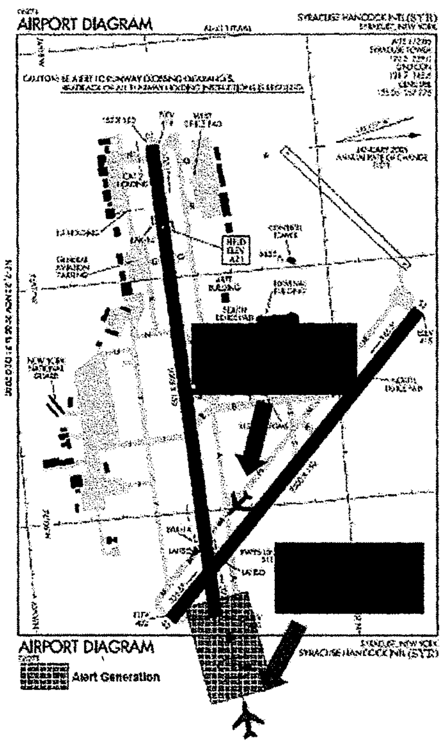


Figure 2 – "Runway Occupied" Scenario

Scenario 2

Runway Occupied (Figure 2)

- Aircraft N3GC (BLUE aircraft) flies short final approach to runway 28

- Aircraft N670H (RED aircraft) is positioned on taxiway "Mike"

- When N3GC is approximately three nautical miles from the end of the runway, N670H begins rolling across runway 28 from taxiway Mike hold line.

- At approximately 1.5 nautical miles, ASDE-X Safety Logic detects the runway incursion; sends an alert code to both aircraft; Honeywell avionics translate the code to an audible alert for both pilots: "RUNWAY OCCUPIED! RUNWAY OCCUPIED!"

Another longer term solution involves the deployment of Automatic Dependent Surveillance – Broadcast (ADS-B). ADS-B technology provides air traffic controllers and pilots alike with actual real-time positions of individual aircraft and surface vehicles, including the vehicle's direction and velocity. ADS-B also supports the active exchange of this data between aircraft and air traffic controllers. With the ability to identify individual vehicles and a one-second refresh rate, ADS-B is a more robust monitoring system than traditional ground radar, and may eventually serve as the primary means of airport surface monitoring.

As more and more aircraft are modified to broadcast and receive this information, the ability to identify and resolve potential conflicts on-board the aircraft will become viable. The currently proposed rule from FAA doesn't require aircraft to broadcast their ADS-B information until 2020, potentially delaying the practical use of this capability for runway incursion prevention until that date. However, the FAA's roll-out of ADS-B services includes a capability referred to as Traffic Information Service – Broadcast (TIS-B) that essentially creates a 100% ADS-B environment using radar and ASDE-X information wherever the TIS-B service is provided. Accelerating TIS-B deployment at ASDE-X and other high risk airports would facilitate the practical use of aircraft-based incursion detection and alerting capabilities at an earlier date.

ADDRESSING TODAY'S CHALLENGE

Airport surface safety will benefit from a continuous evolution in automation for both pilots and air traffic controllers.

- In the short term, enhanced situational awareness systems such as RAAS can provide better safety information to pilots; the FAA is also providing improved tools for controllers, such as ASDE-X.
- In the longer term, integration between ASDE-X and aircraft systems could enable alerts directly to both the pilots and controllers (a long-standing NTSB recommendation). In addition, the availability of Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Service – Broadcast (TIS-B) coupled with RAAS or similar technology and surface traffic overlays ("moving maps") for display in the cockpit will provide even better information to pilots.

As this technology matures, additional opportunities will emerge to leverage runway awareness systems with other existing and in-development applications for even greater levels of aviation safety. Honeywell is continually on the forefront of these new applications, including:

- Synthetic Vision – Honeywell has recently introduced civil and military applications of 3-D displays of Integrated Primary Flight Display (IPFD) moving maps, which provide real-time images of actual terrain, giving pilots a "clear day" view regardless of actual visibility. Synthetic vision technology could be integrated with on-ground situational awareness applications to create a seamless combination of high-resolution visual displays and audible alerts when aircraft land in bad weather or challenging airport approaches (see *Appendix 3 – Synthetic Vision*);
- Stable Approach Monitoring – a software upgrade to EGPWS that advises a pilot during landing with alerts for improper airspeed, angle of approach, and aircraft configuration (flaps and landing gear) to reduce the chances of runway overrun accidents.

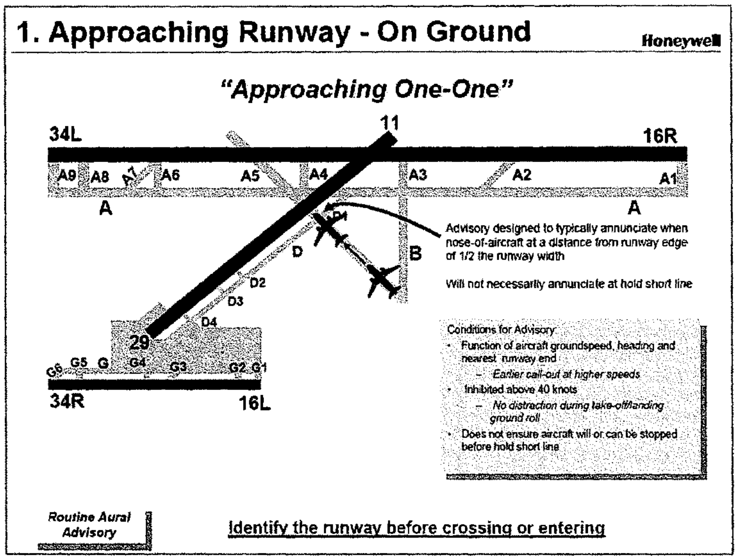
RECOMMENDATIONS

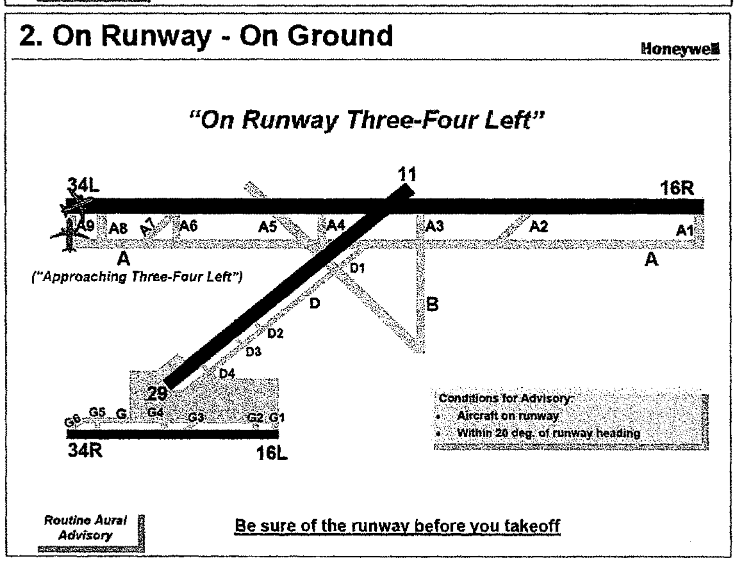
The shared objective of all stakeholders should be to create a safer runway environment. This can be accomplished by establishing systems that allow pilots and air traffic controllers to simultaneously receive real-time data and alerts. Honeywell recommends this Committee aggressively pursue solutions to runway safety challenges that include the following actions:

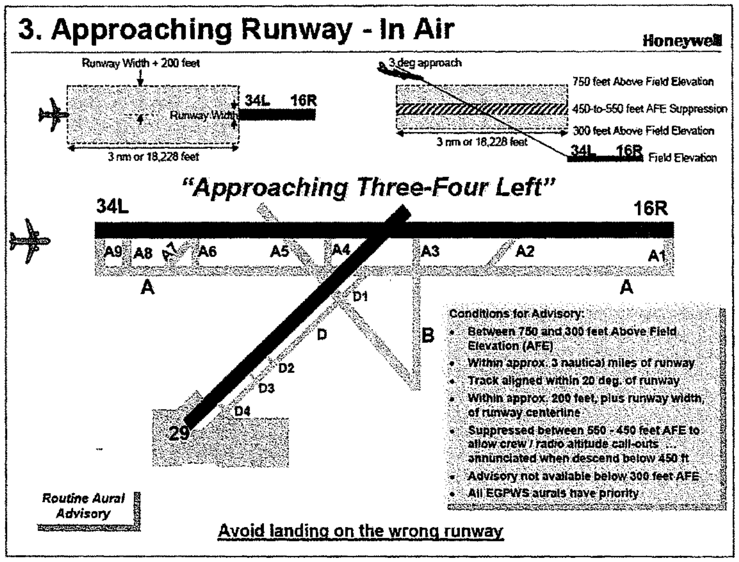
- Strongly encourage the adoption of better pilot situational awareness capability including the preparation of certification criteria and financial incentives for equipping.
- Accelerate the implementation of Traffic Information Service at airports in the National Air Space.
- Require the regulatory and procedural changes that would allow ASDE-X to broadcast alerting signals for use in the cockpit.

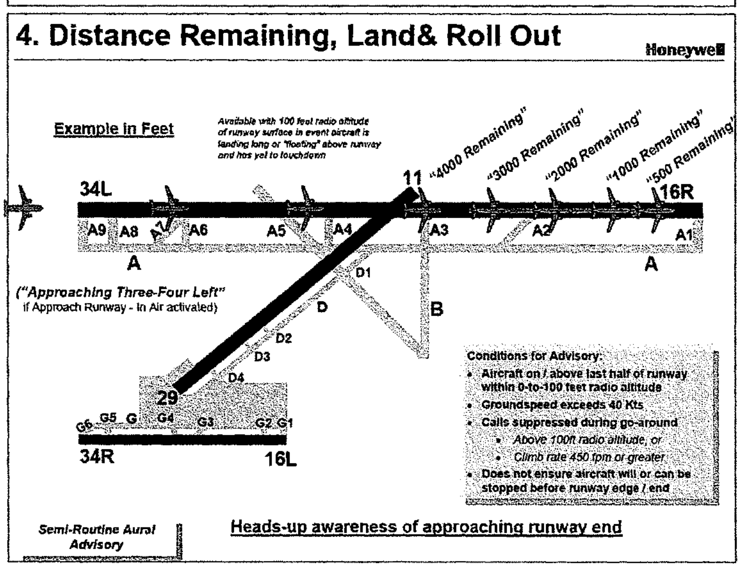
Reaching our shared objectives for runway awareness and safety requires a commitment to applying available technology now, as well as building for the future. As a proven global leader in system solutions for aerospace, Honeywell will continue to play an active role in turning the vision into reality.

APPENDIX 1 – RAAS Advisory Messages






3. Approaching Runway - In Air
Honeywell
Runway Width + 200 feet
Runway Width
34L 16R
3 nm or 18,228 feet
3 deg approach
750 feet Above Field Elevation
450-to-550 feet AFE Suppression
300 feet Above Field Elevation
3 nm or 18,228 feet
34L 16R
Field Elevation
"Approaching Three-Four Left"
34L
16R
A9 A8 A7 A6 A5 A4 A3 A2 A1
A
A
D1
D
B
D2
D3
D4
29
Conditions for Advisory:
• Between 750 and 300 feet Above Field Elevation (AFE)
• Within approx. 3 nautical miles of runway
• Track aligned within 20 deg. of runway
• Within approx. 200 feet, plus runway width, of runway centerline
• Suppressed between 550 - 450 feet AFE to allow crew / radio altitude call-outs ... annunciated when descend below 450 ft
• Advisory not available below 300 feet AFE
• All EGPWS aurals have priority
Routine Aural Advisory
Avoid landing on the wrong runway

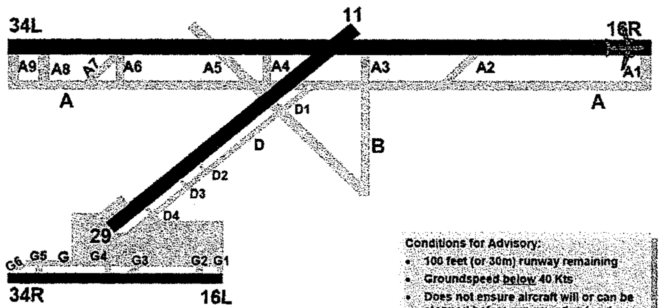

4. Distance Remaining, Land& Roll Out
Honeywell
Example in Feet
Available with 100 feet radio altitude of runway surface in event aircraft is landing long or "floating" above runway and has yet to touchdown
"4000 Remaining"
"3000 Remaining"
"2000 Remaining"
"1000 Remaining"
"500 Remaining"
11
34L
16R
A9 A8 A7 A6 A5 A4 A3 A2 A1
A
A
D1
("Approaching Three-Four Left"
if Approach Runway - In Air activated)
D
B
D2
D3
D4
29
G6 G5 G G4 G3 G2 G1
34R
16L
Conditions for Advisory:
• Aircraft on / above last half of runway within 0-to-100 feet radio altitude
• Groundspeed exceeds 40 Kts
• Calls suppressed during go-around
• Above 100ft radio altitude, or
• Climb rate 450 fpm or greater
• Does not ensure aircraft will or can be stopped before runway edge / end
Semi-Routine Aural Advisory
Heads-up awareness of approaching runway end

5. Runway End - Aid in Low Visibility Turn-off

Honeywell

Example in Feet

"100 Remaining"



Conditions for Advisory:
- 100 feet (or 30m) runway remaining
- Groundspeed below 40 Kts
- Does not ensure aircraft will or can be stopped before runway edge / end

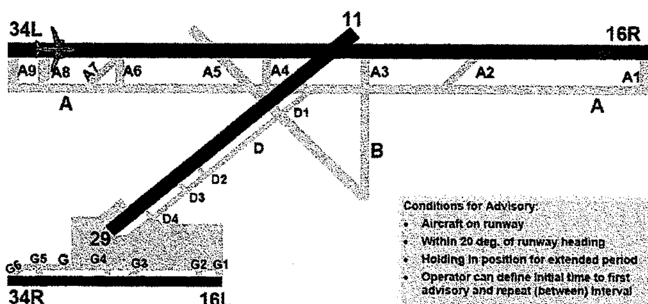
Semi-Routine Aural Advisory

Optional advisory at the last 100 ft of runway remaining

6. Extended Holding On Runway

Honeywell

"On Runway Three-Four Left,
On Runway Three-Four Left"



Conditions for Advisory:
- Aircraft on runway
- Within 20 deg. of runway heading
- Holding in position for extended period
- Operator can define initial time to first advisory and repeat (between) interval
  - Initial: 60, 90, 120, 180, 240, 300
  - Repeat: 30, 60, 90, 120, 180, 240, 300

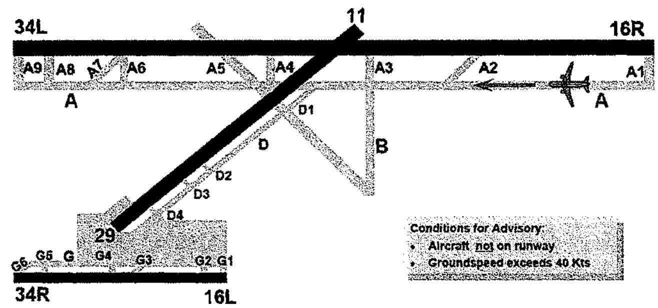
Non-Routine Aural Advisory

How long have we been sitting here awaiting T/O clearance?

7. Taxiway Take-off

Honeywell

"On Taxiway ! On Taxiway !"



Conditions for Advisory:
- Aircraft not on runway
- Groundspeed exceeds 40 Kts

Non-Routine Aural Advisory

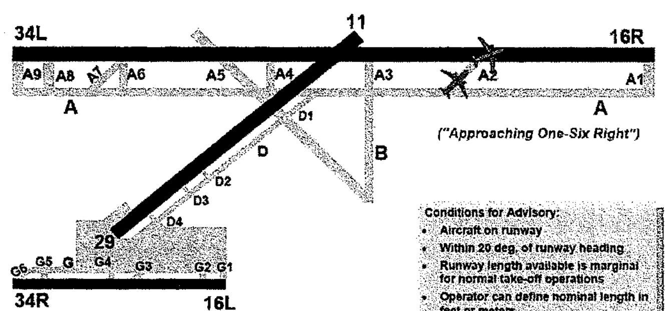
Warns of excessive speed outside runway surfaces

8. Insufficient Runway Length - On Ground

Honeywell

Example in Feet

"On Runway Three-Four Left, Two-Thousand Remaining"



Conditions for Advisory:
- Aircraft on runway
- Within 20 deg. of runway heading
- Runway length available is marginal for normal take-off operations
- Operator can define nominal length in feet or meters

Non-Routine Aural Advisory

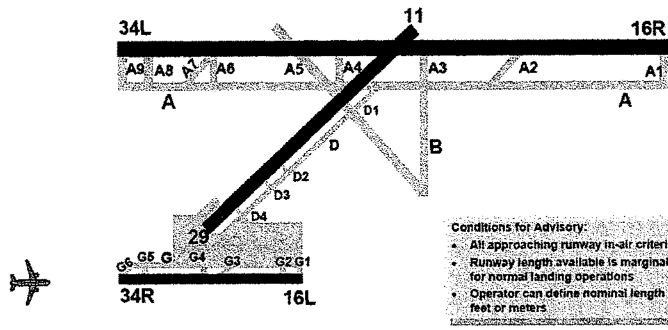
Advises crew of possible insufficient runway for takeoff

9. Approaching Short Runway - In Air

Honeywell

Example in Feet

"Approaching Three-Four Right, Three-Thousand Available"



Conditions for Advisory:

- All approaching runway in-air criteria
- Runway length available is marginal for normal landing operations
- Operator can define nominal length in feet or meters

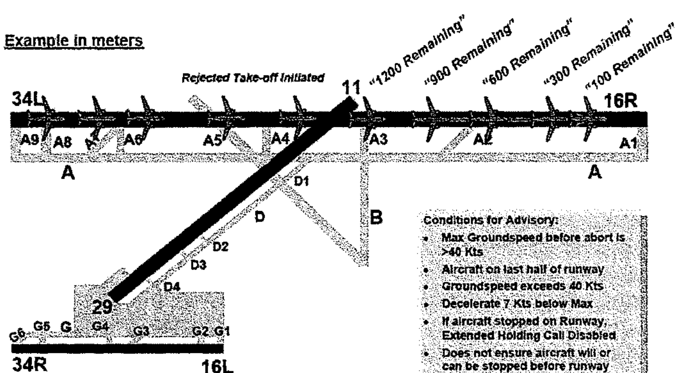
Non-Routine Aural Advisory

Advises crew of possible insufficient runway for landing

10. Rejected Take-off

Honeywell

Example in meters



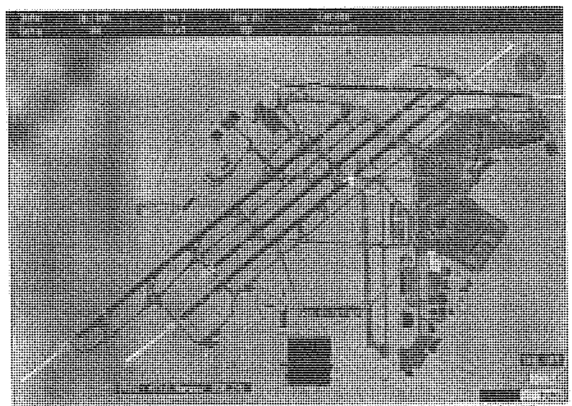
Conditions for Advisory:

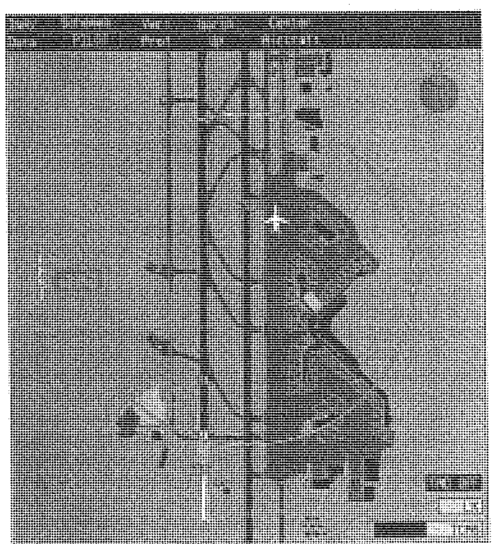
- Max Groundspeed before abort is >40 Kts
- Aircraft on last half of runway
- Groundspeed exceeds 40 Kts
- Decelerate 7 Kts below Max
- If aircraft stopped on Runway, Extended Holding Call Disabled
- Does not ensure aircraft will or can be stopped before runway edge / end

Non-Routine Aural Advisory

Distance remaining announced in a high-workload situation

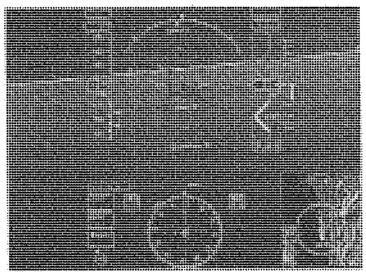
APPENDIX 2 – MOVING MAPS

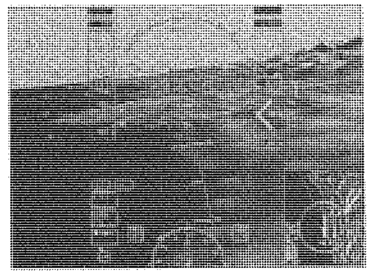




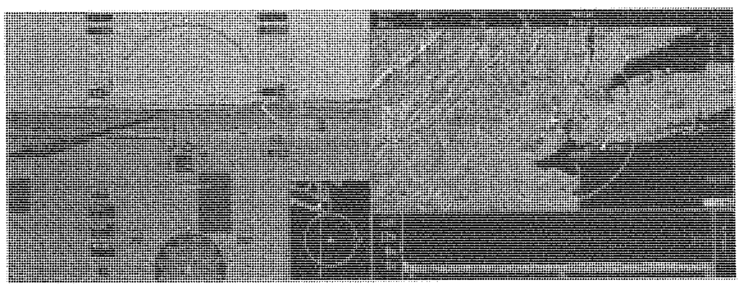
Honeywell INAV moving map displays

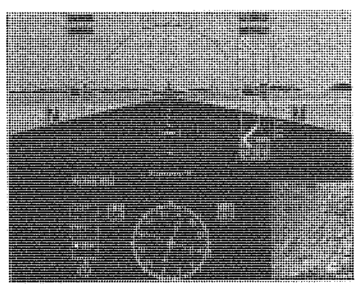
APPENDIX 3 – SYNTHETIC VISION





ABOVE – On the left, a primary flight display with traditional, standard "blue & brown" display of earth, horizon and sky. At right, the Honeywell IFPD Synthetic Vision System (in commercial business jet application) showing actual terrain and a moving map in real-time, 3-D display. SVS, coupled with RAAS-type technology, could provide seamless integration of terrain and threat advisories in both visual and audible formats.





Examples of Honeywell IPFD Synthetic vision including landing approach and airport surface movement.

TESTIMONY OF HANK KRAKOWSKI, CHIEF OPERATING OFFICER, AIR TRAFFIC ORGANIZATION, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE SUBCOMMITTEE ON AVIATION ON IMPROVING RUNWAY SAFETY

February 13, 2008

Good Afternoon, Chairman Costello, Congressman Petri, and Members of the Subcommittee, my name is Hank Krakowski, and I am the Chief Operating Officer of the Air Traffic Organization of the Federal Aviation Administration. I appreciate the opportunity to come before you today to discuss a topic of vital importance to every American who travels by aircraft: the issue of improving runway safety.

At the Federal Aviation Administration, safety is our first priority. I am pleased to report that 2007 was the safest year yet for aviation in our Nation's history. We work around the clock to continually improve safety. We look at all areas to improve safety, including airports and markings, operational procedures, and equipment. In recent years, the FAA has formally incorporated this culture of safety into our strategic plan, called the Flight Plan, and we have devoted millions of dollars in research and procuring technology to aid our controllers and pilots in moving America safely. We place such a high priority on runway safety that this is part of the performance plan for the Air Traffic Organization, and we hold our employees accountable for improvement. We have also reached out to the National Airspace System stakeholders, from controllers to pilots to airport managers to airlines to partner with us to improve runway safety.

Recently, the National Transportation Safety Board (NTSB) and the Government Accountability Office (GAO) have issued recommendations on areas where the FAA could make improvements in runway safety. In November, the NTSB announced that improving runway safety will remain on the Board's "Most Wanted" list of improvements for 2008. FAA believes that the technologies we are now testing and deploying will be responsive to address the problem of runway incursions. Also, the GAO reported on how the FAA has taken steps to address runway and ramp safety. We appreciate the work that the GAO and NTSB have done, and we welcome their analysis and feedback. While runway safety has received more public attention in recent months, it is important to remember that for many years, the FAA has actively invested in programs and technology development to address this serious aviation safety issue.

To help understand the following discussion, let me explain the categories of runway incursions. Category A incursions are the most serious incidents, in which a collision was narrowly avoided. Category B incursions are incidents in which separation decreases, and there is a significant potential for a collision, which may result in a time critical corrective or evasive response to avoid a collision. Category C incidents are characterized by ample time and/or distance to avoid a collision, and Category D is an incident which meets the definition of runway incursion, such as the incorrect presence of single vehicle/person/aircraft on the protected area of a surface designated for the take-off or landing of an aircraft, but with no immediate safety consequences.

An aggressive and effective FAA runway safety program has reduced the number of serious runway incursions by 55 percent since 2001(see slide 1). In Fiscal Year 2007, we saw a 25 percent reduction in serious runway incursions from 2006. There were 24 serious runway incursions--that's Category A and B incursions--during 61 million aircraft operations, a significant reduction from the 31 incursions in FY 2006, and the 53 incursions in FY 2001. But while we have made improvements with the most serious of the runway incursions, overall runway incursions increased in FY 2007 to 370, up from 330 in FY 2006. Only 8 of the 24 serious incursions involved a commercial airline flight, and none of these 370 incursions resulted in a collision. While most of these incursions are Category C and D incidents, which pose little or no risk to the public, the increase in incursions and the fact that serious incursions are still occurring, prompted the Administrator to issue a "Call to Action" on runway safety.

This chart (see slide 2) breaks down the runway incursions since October 1, 2006 by category. Beginning with Fiscal Year 2008, which began on October 1, 2007, the FAA adopted the definition of runway incursion as used by the International Civil Aviation Organization (ICAO), a United Nations organization charged with promoting safety and security in international aviation. This new definition, which FAA helped develop for ICAO, is much more inclusive and counts every single mistake made on the airport operational surface, even if another vehicle, pedestrian or aircraft is not involved. As a result, we will have more data to analyze trends and improve safety.

By redefining what a runway incursion is, the total number of what we now report as a runway incursion is expected to triple. This explains the spike in Category C incidents beginning in October 2007—Category C now includes data that we used to classify as Category C and D incursions. The new Category D accounts for incursions which we previously tracked as surface incidents. However, Category A and B incidents, the most serious incursions, continue to be defined and tracked as before.

The FAA investigates every reported runway incursion and assigns a reason for the incursion. We send a team to the facility to review the airport information; radar data and voice tapes, if they are available; and interview the individuals involved, often controllers, pilots and/or vehicle operators. This next chart (see slide 3) shows the three broad categories to which we attributed runway incursions that happened since October 1, 2006. The line represents when the FAA adopted the broader international definition for runway incursions. As you can see, most of the runway incursions, about 55 percent, are as a result of pilot error. Operational errors and deviations by air traffic controllers represent about 30 percent of causes of runway incursions. The rest are attributed to pedestrian or vehicle errors.

The FAA continues to work with aviation industry leaders to research and implement new technologies, and mine and interpret safety data with the focus on improving airport safety. I'd like to highlight some of our recent efforts in this area. On August 15, 2007, more than 40 representatives from a cross-section of the aviation industry agreed to an ambitious plan focused on solutions in improving cockpit procedures, airport signage and markings, air traffic procedures, and technology. Within 60 days of the "Call to Action" on runway safety, Acting FAA Administrator Bobby Sturgell announced that the aviation community had completed significant short-term actions and were making strides in the mid- and long-term goals.

The next chart (see slide 4) shows some of the improvements we have made. Our nation's busiest airports have runway surveillance technology installed that improves controller situational awareness on the airport movement area. The FAA has spent over $404 million to date to acquire and deploy the next generation of ground surveillance technology, known as Airport Surface Detection Equipment – Model X or ASDE-X for short. Eleven towers in the system have ASDE-X installed, and we have accelerated our installation schedule by one year—the target completion date for the last system is now September 2010. The FAA will commit more than $806 million over a 30-year period on equipment, installation, operations and maintenance of the 35 ASDE-X systems.

Runway Status Lights (see slide 5), which were developed as a result of the NTSB's "Most Wanted" list of safety improvements, are a full-automated system that integrates airport lighting equipment with surveillance systems to provide a visual signal to pilots and vehicle operators when it is unsafe to enter/cross/or begin takeoff roll on a runway. Airport surveillance sensor inputs are processed through light control logic that command in-pavement lights to illuminate red when there is traffic on or approaching the runway. The FAA has spent nearly $25.8 million on this initiative.

There are two types of Runway Status Lights currently being tested; Runway Entrance Lights and Takeoff Hold Lights. Runway Entrance Lights provide signals to aircraft crossing or entering a runway from an intersecting taxiway. Takeoff Hold Lights provide a signal to aircraft in position for takeoff that another aircraft is crossing or entering the runway.

The system is being tested at Dallas/Fort Worth and San Diego airports, and we are working to select other large airports to begin to test this equipment. The system is preventing potential accidents today. Just last week, at Dallas-Ft. Worth, a plane was cleared for take-off, while at the same time air traffic control cleared another aircraft to cross that same runway on a taxiway. The first plane did not initiate its takeoff roll, because the pilot, "saw the red lights" of the Runway Status Light System.

We are also testing a system at the Long Beach Airport, known as the Final Approach Runway Occupancy Signal (FAROS), which will further enhance runway safety. This system is similar to Runway Status Lights in that it provides immediate information to pilots on approach to land that the runway is occupied or otherwise unsafe for landing. The FAROS system determines the occupancy of the runway by detecting aircraft or vehicles on the runway surface. If a monitored area on the runway is occupied, FAROS activates a signal to alert the pilot that it is potentially unsafe to land. We are developing a plan for implementing FAROS at larger airports, and expect to begin operational trials at Dallas-Fort Worth by the end of FY 2008.

The FAA is testing two low-cost ground surveillance systems at Spokane, Washington, that would provide ground situational awareness to controllers at airports other than the 35 slated to get ASDE-X systems. One system, the Nova 9000 Surface Management System, involves using X-band radar to detect movement on the airport surface, and the other system, the Critical Area Management System, would place millimeter wave sensors along runways and taxiways to detect movement on the airport surface. We plan on expanding this test to more sites this year. To date, we have spent $4.5 million on this project and we are assessing if it is an alternative safety measure for less busy airports not scheduled to receive the ASDE-X system.

Twenty of the busiest airports in America were identified for targeted Runway Safety Action Team visits based on a combination of a history of runway incursions, wrong runway events and wrong runway risk factors. The Runway Safety Action Team visits involved service analysis meetings with air traffic control, both management and controllers, safety inspectors from FAA and the airports, and airport managers and operators. Just through the interaction and discussion among these groups, action plans to mitigate identified risks were finalized. These meetings identified over 100 short term fixes that could be accomplished within 60 days, including new or improved signage, improved marking, driver training, and other actions. This proves that a "common sense" approach to curbing runway incursions exists. Not all measures to improve runway safety will involve fielding expensive equipment and new systems. Quick and relatively inexpensive solutions include improving airfield markings, adding targeted training for controllers and aircrews, and fine-tuning air traffic procedures. Incorporating the lessons learned through the meetings with the initial 20 airports, FAA has identified a second tier of 22 airports we will be expanding this program to cover next.

FAA has also continued to make progress in improving Runway Safety Areas (RSAs). RSAs enhance safety in the even of an undershoot, overrun, or excursion from the side of the runway. In FY 2000, FAA started an ambitious program to accelerate RSA improvements for commercial service runways that do not meet standards. The FAA developed a long-term completion plan that will ensure that all practicable improvements are completed by 2015.

When the RSA improvement initiative began in FY 2000 there were a total of 453 RSAs requiring improvement. Since then, significant progress has been made and 63 percent of the RSA improvements have been completed. By the end of 2010, 88 percent of RSA improvements will be completed, leaving only 54 to meet the 2015 goal. Twenty-one of these improvements included the use of Engineered Materials Arresting Systems (EMAS), a relatively recent technology of crushable material placed at the end of a runway, and designed to absorb the forward momentum of an aircraft. EMAS offers a significant RSA improvement where the land off the ends of the runway is constrained and a conventional RSA is not practicable. To date, 4 aircraft overruns have been caught by EMAS applications, a 100 percent success rate.

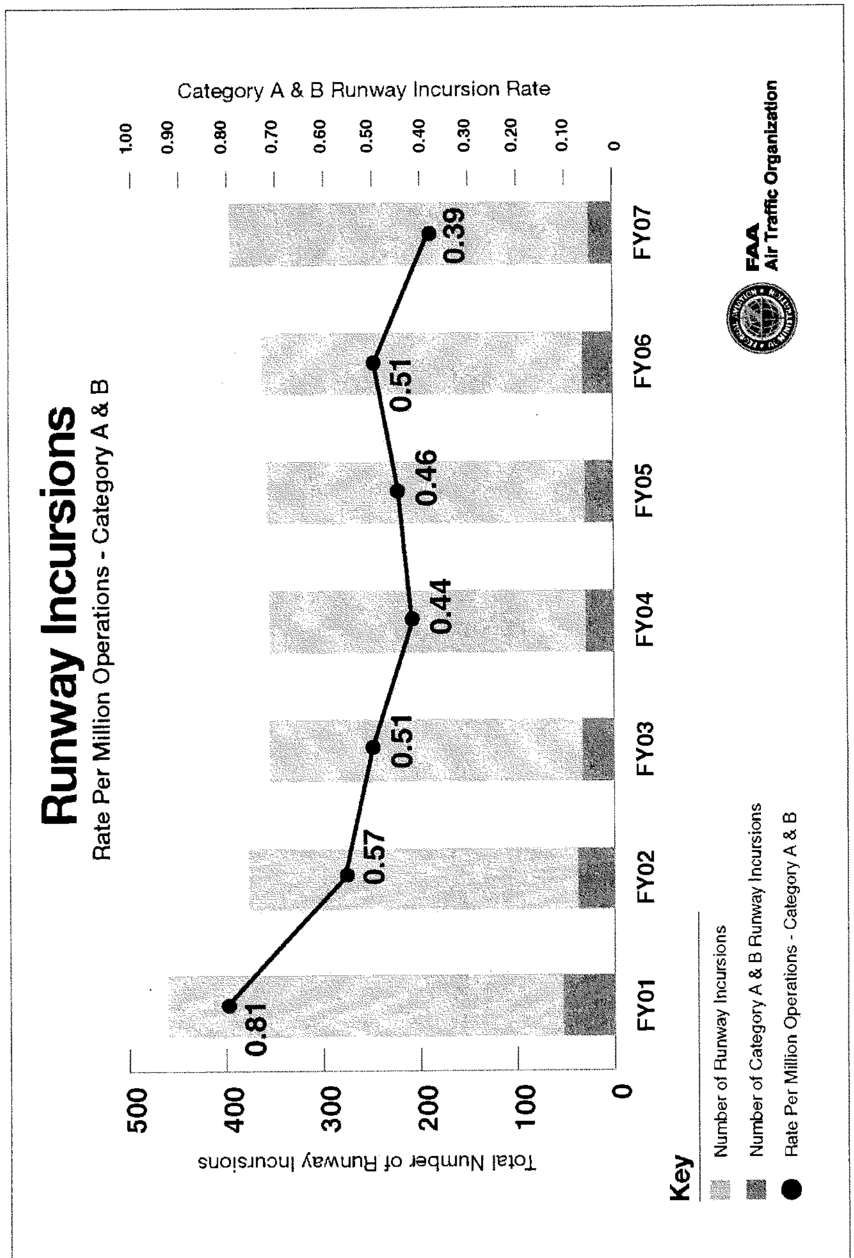
As part of the Administrator's "Call to Action" the FAA required all airports with enplanements of 1.5 million or more (75 airports) to enhance airport markings by June

30, 2008, and urged airports to provide recurrent training to contractors and service providers that drive on aircraft movement areas. Airports have been responsive; 71 of the 75 airports required to upgrade their markings are already complete, and the remaining 4 will be completed well ahead of schedule. More than half of the commercial service airports not currently required to upgrade their markings have voluntarily agreed to do so. In addition, roughly 85 percent of all commercial service airports currently have or plan to provide recurrent training for all who have access to the aircraft movement area.

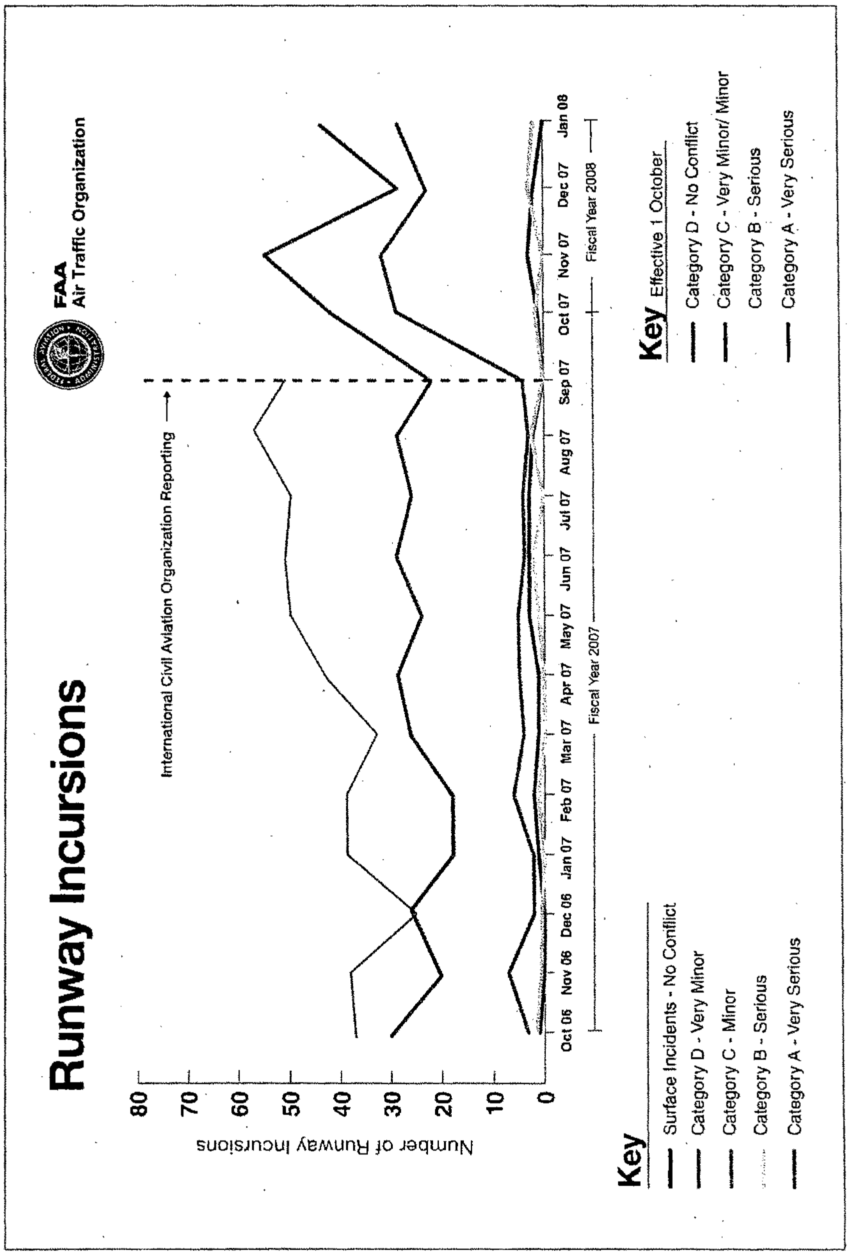
Finally, the FAA is seeking input from NATCA on revamping policies for issuing taxi clearances. We are also working with NATCA to implement a voluntary reporting system for air traffic controllers similar to the Aviation Safety Action Program (ASAP) with airlines, pilots, airport operators and the FAA. In my role at United, I was responsible for 4 ASAP programs for pilots, dispatchers, mechanics and flight attendants. Because of this work, I am convinced that information from a voluntary reporting system will help us to spot trends and prevent future runway incursions.

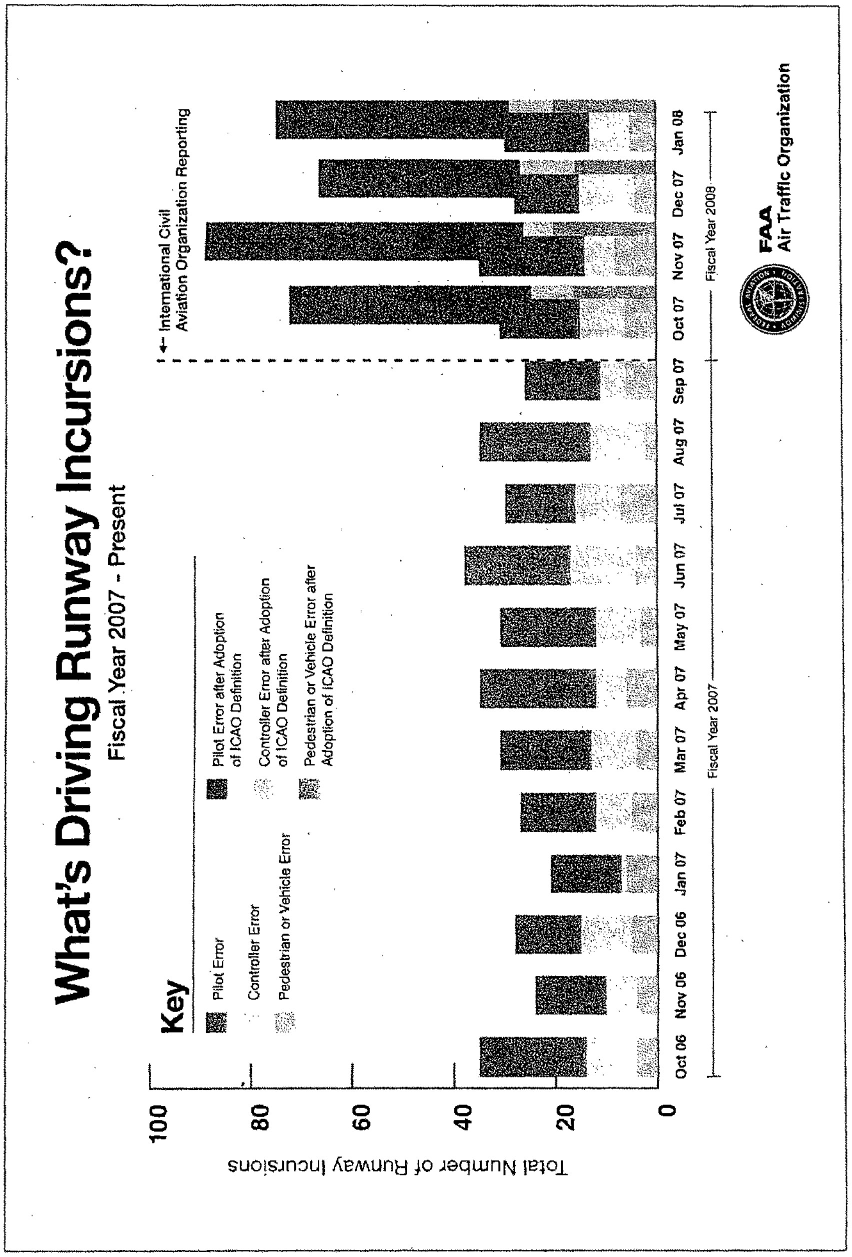
The FAA is committed to designing an end-to-end system that seeks to eliminate runway incursions while accommodating human error. The FAA plans on creating a standing Runway Council Working Group to look at the data and address root causes, and continue to involve all who play a part in runway safety. We all have a role in the solution. Every reported runway incursion will be taken seriously, investigated thoroughly, and analyzed to determine the causal factors. The FAA continues to seek ways to improve awareness, training, and technologies and we look forward to our collaboration with airlines, airports, air traffic control and pilot unions, and aerospace manufacturers to curb runway incursions. We appreciate the Committee's interest in safety, and welcome your counsel and assistance in our efforts to reduce runway incursions and improve safety in our nation's aviation system.

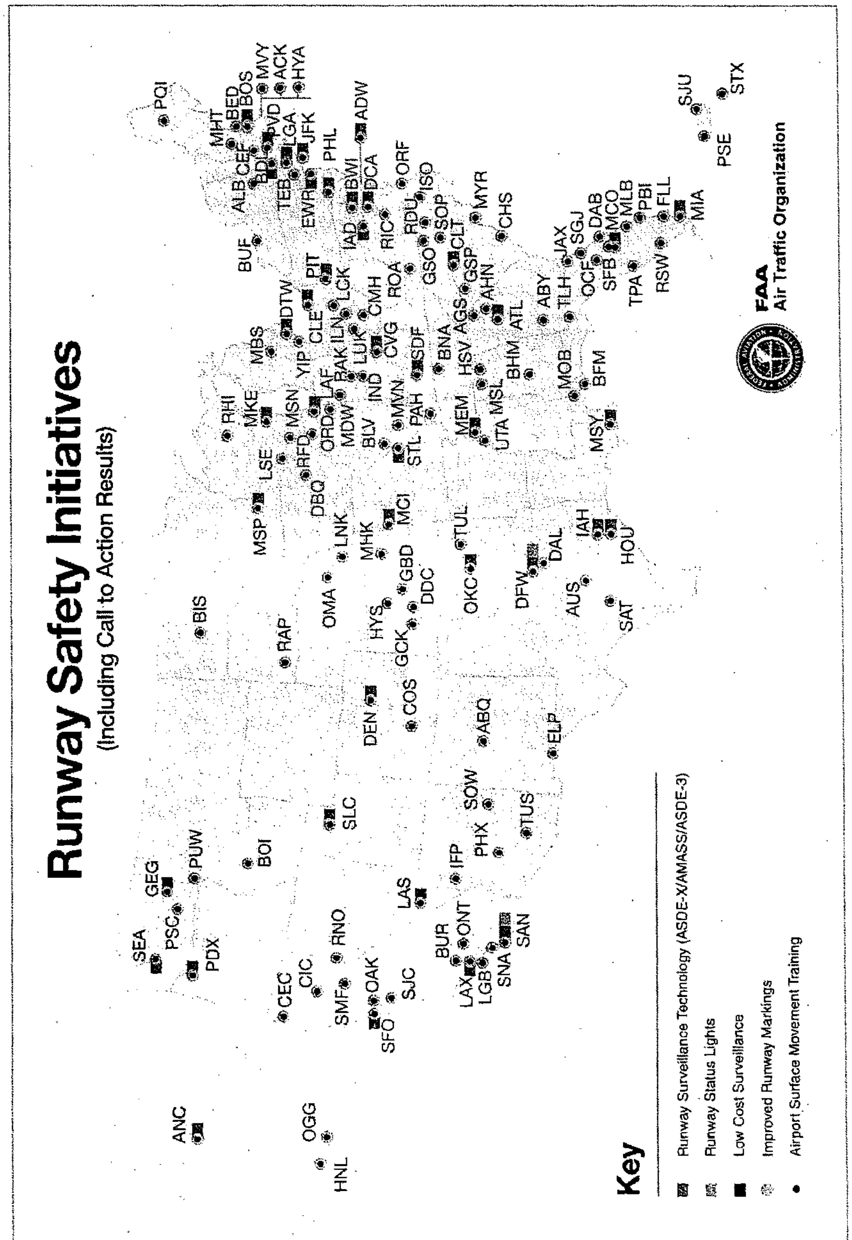
This concludes my remarks, and I would be happy to answer any questions the Committee may have.



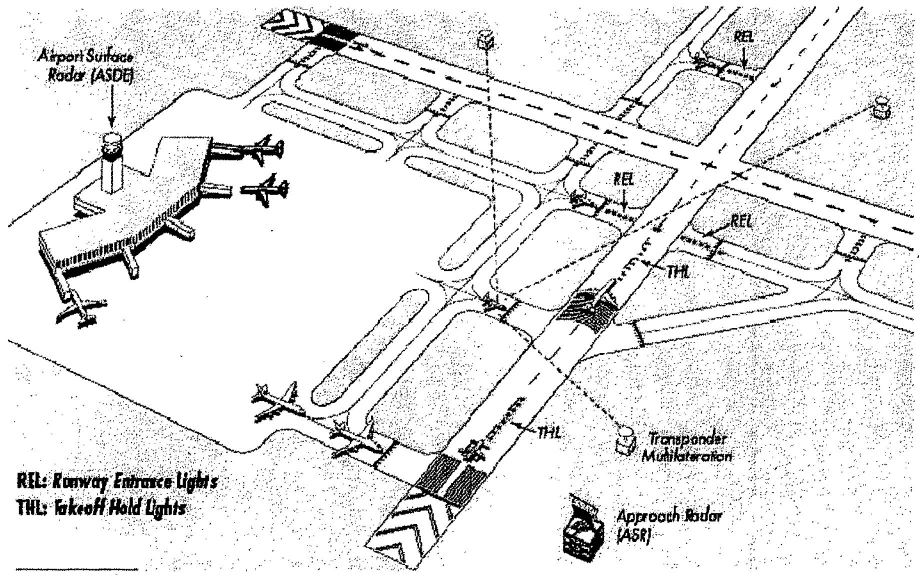
Runway Incursions
Rate Per Million Operations - Category A & B
Category A & B Runway Incursion Rate
Total Number of Runway Incursions
500
400
300
200
100
0
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0
0.81
0.57
0.51
0.44
0.46
0.51
0.39
FY01
FY02
FY03
FY04
FY05
FY06
FY07
Key
Number of Runway Incursions
Number of Category A & B Runway Incursions
Rate Per Million Operations - Category A & B
FAA
Air Traffic Organization


Runway Incursions
FAA
Air Traffic Organization
International Civil Aviation Organization Reporting
Number of Runway Incursions
80
70
60
50
40
30
20
10
0
Oct 06
Nov 06
Dec 06
Jan 07
Feb 07
Mar 07
Apr 07
May 07
Jun 07
Jul 07
Aug 07
Sep 07
Oct 07
Nov 07
Dec 07
Jan 08
Fiscal Year 2007
Fiscal Year 2008
Key
Surface Incidents - No Conflict
Category D - Very Minor
Category C - Minor
Category B - Serious
Category A - Very Serious
Key Effective 1 October
Category D - No Conflict
Category C - Very Minor/ Minor
Category B - Serious
Category A - Very Serious

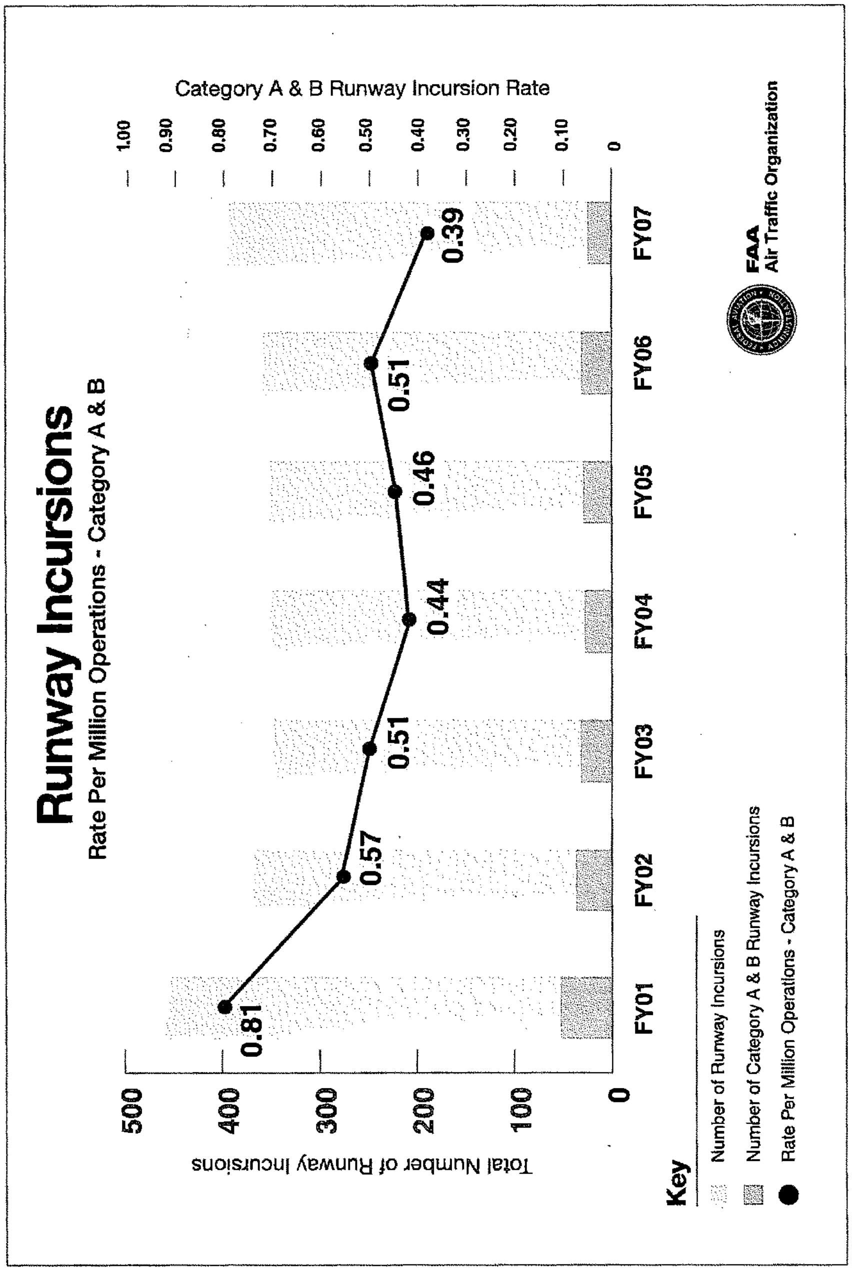

What's Driving Runway Incursions?
Fiscal Year 2007 - Present
Key
Pilot Error
Controller Error
Pedestrian or Vehicle Error
Pilot Error after Adoption of ICAO Definition
Controller Error after Adoption of ICAO Definition
Pedestrian or Vehicle Error after Adoption of ICAO Definition
International Civil Aviation Organization Reporting
Total Number of Runway Incursions
100
80
60
40
20
0
Oct 06
Nov 06
Dec 06
Jan 07
Feb 07
Mar 07
Apr 07
May 07
Jun 07
Jul 07
Aug 07
Sep 07
Oct 07
Nov 07
Dec 07
Jan 08
Fiscal Year 2007
Fiscal Year 2008
FAA
Air Traffic Organization

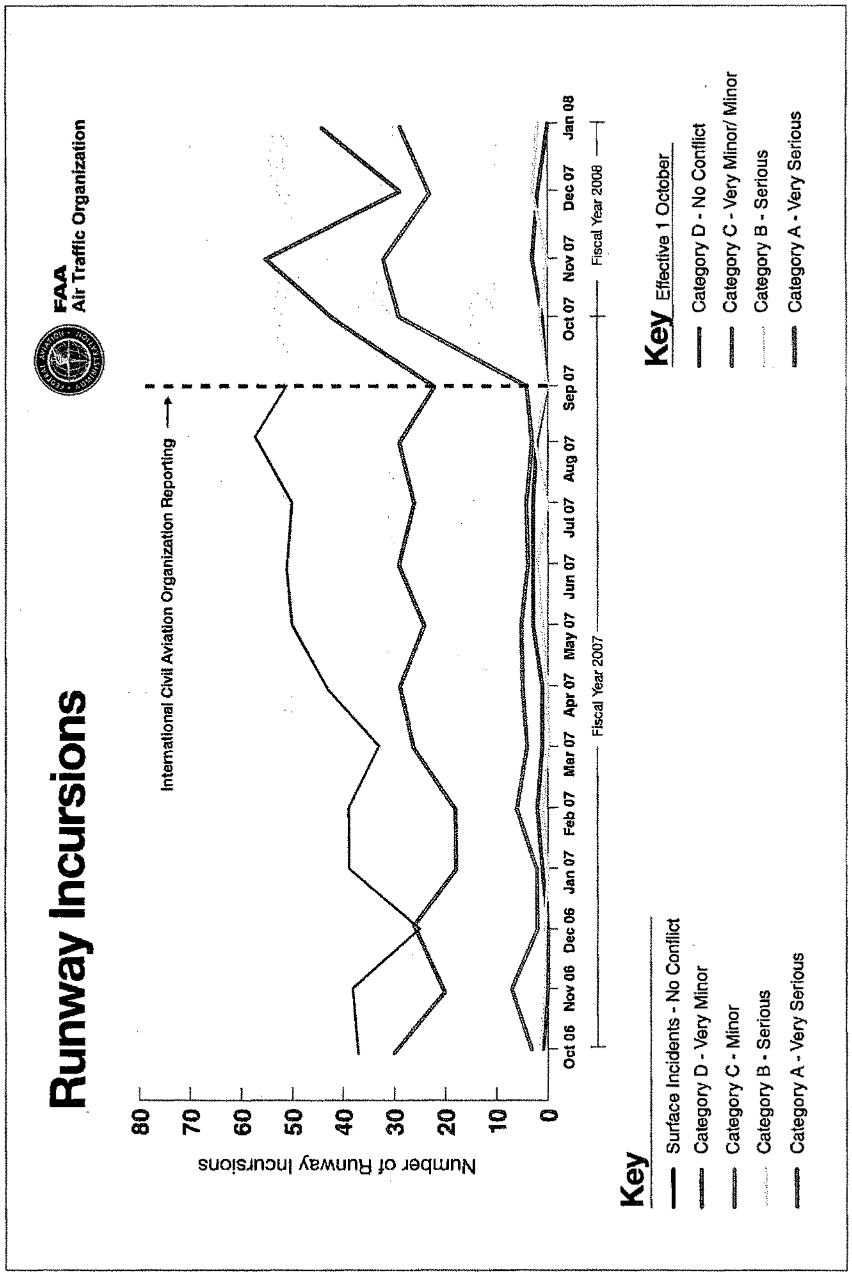

Runway Safety Initiatives
(Including Call to Action Results)
Key
Runway Surveillance Technology (ASDE-X/AMASS/ASDE-3)
Runway Status Lights
Low Cost Surveillance
Improved Runway Markings
Airport Surface Movement Training
FAA
Air Traffic Organization

Runway Status Lights System



FAA
Air Traffic Organization


Runway Incursions
Rate Per Million Operations - Category A & B
Category A & B Runway Incursion Rate
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0
Total Number of Runway Incursions
500
400
300
200
100
0
0.81
0.57
0.51
0.44
0.46
0.51
0.39
FY01
FY02
FY03
FY04
FY05
FY06
FY07
Key
Number of Runway Incursions
Number of Category A & B Runway Incursions
Rate Per Million Operations - Category A & B
FAA
Air Traffic Organization



Runway Incursions
FAA
Air Traffic Organization
International Civil Aviation Organization Reporting
Number of Runway Incursions
80
70
60
50
40
30
20
10
0
Oct 06
Nov 06
Dec 06
Jan 07
Feb 07
Mar 07
Apr 07
May 07
Jun 07
Jul 07
Aug 07
Sep 07
Oct 07
Nov 07
Dec 07
Jan 08
Fiscal Year 2007
Fiscal Year 2008
Key
Surface Incidents - No Conflict
Category D - Very Minor
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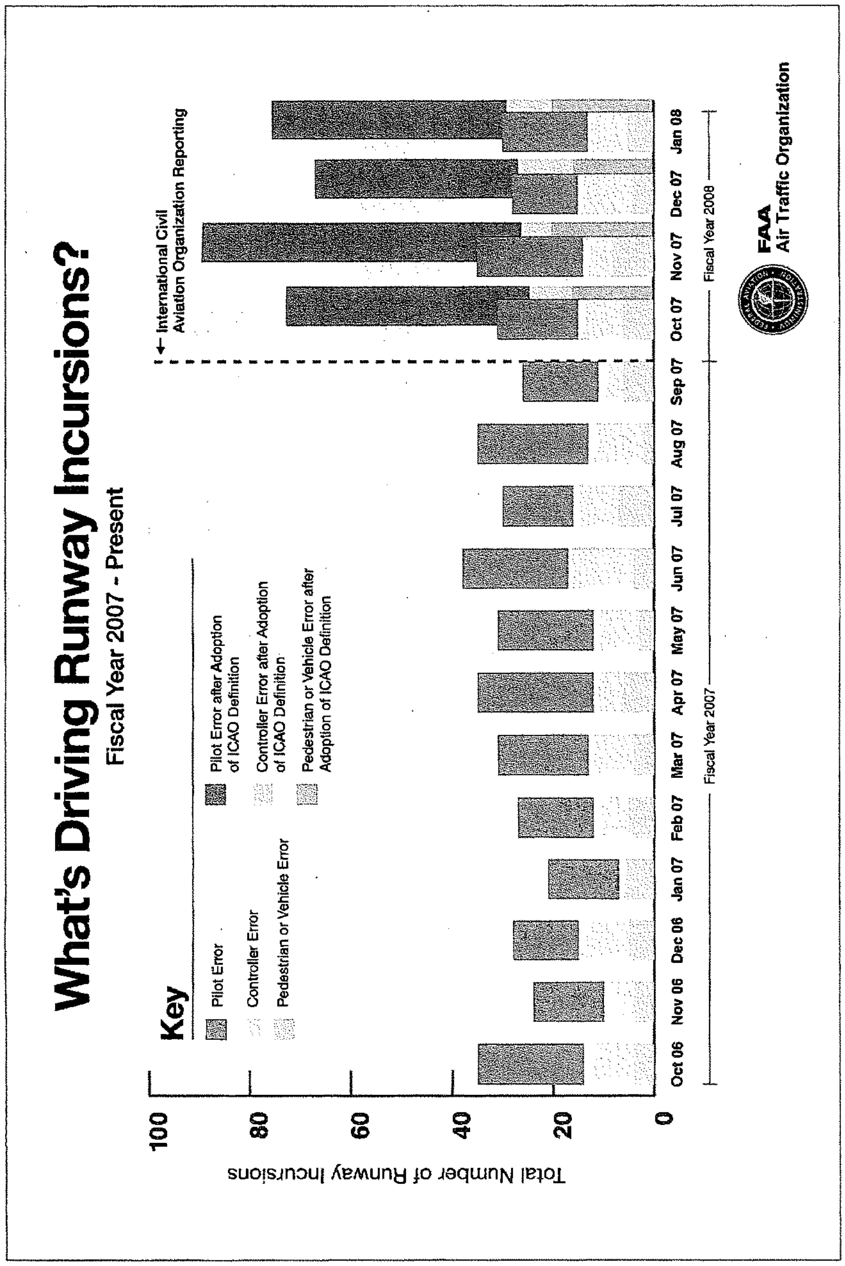
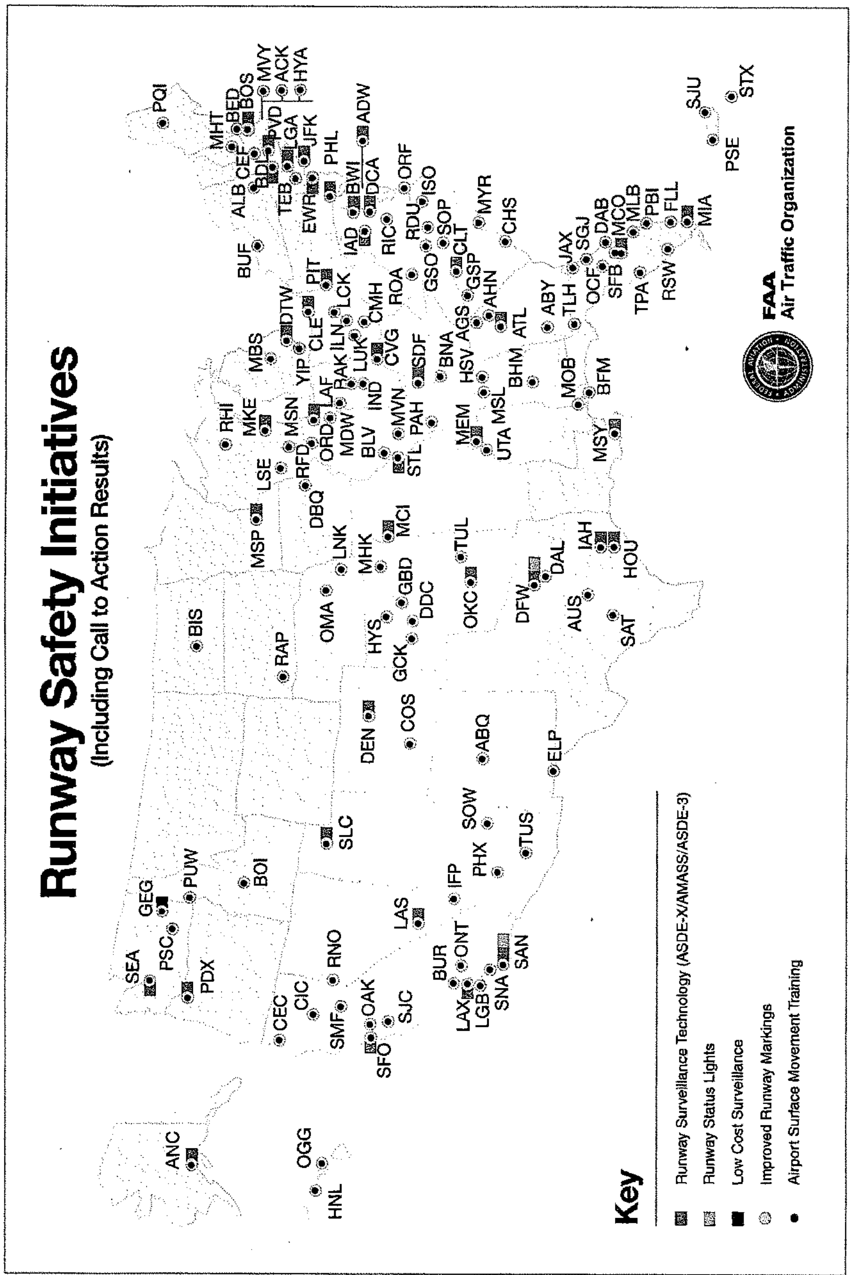
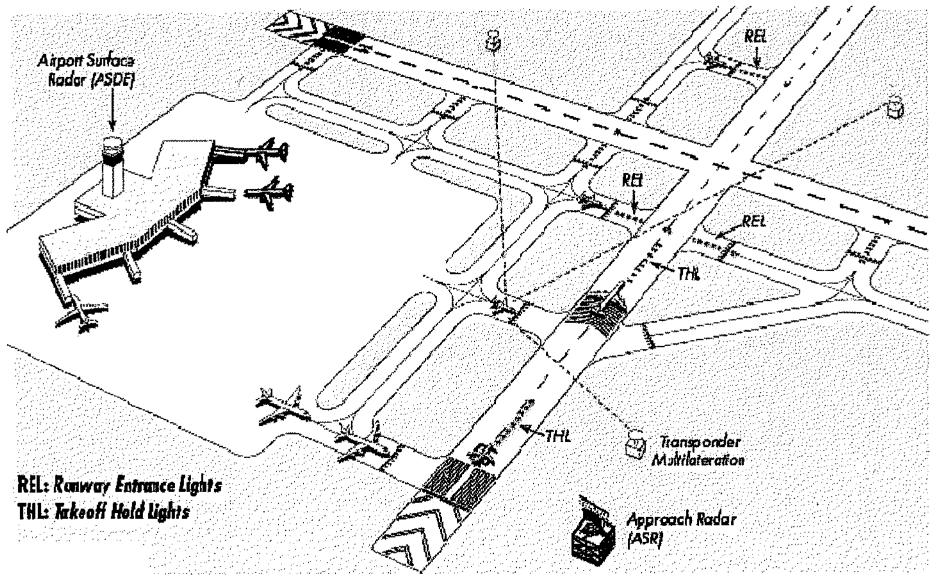
Category A - Very Serious
Key Effective 1 October
Category D - No Conflict
Category C - Very Minor/ Minor
Category B - Serious
Category A - Very Serious


What's Driving Runway Incursions?
Fiscal Year 2007 - Present
Key
Pilot Error
Controller Error
Pedestrian or Vehicle Error
Pilot Error after Adoption of ICAO Definition
Controller Error after Adoption of ICAO Definition
Pedestrian or Vehicle Error after Adoption of ICAO Definition
International Civil Aviation Organization Reporting
Total Number of Runway Incursions
100
80
60
40
20
0
Oct 06
Nov 06
Dec 06
Jan 07
Feb 07
Mar 07
Apr 07
May 07
Jun 07
Jul 07
Aug 07
Sep 07
Oct 07
Nov 07
Dec 07
Jan 08
Fiscal Year 2007
Fiscal Year 2008
FAA
Air Traffic Organization


Runway Safety Initiatives
(Including Call to Action Results)
SEA
PSC
GEG
PUW
PDX
BOI
SLC
CEC
CIC
RNO
SMF
OAK
SFO
SJC
LAS
BUR
ONT
IFP
LAX
LGB
SNA
SAN
PHX
SOW
TUS
DEN
COS
ABQ
ELP
BIS
RAP
OMA
HYS
GCK
GBD
DDC
MSP
LNK
MHK
MCI
OKC
TUL
DFW
DAL
AUS
SAT
IAH
HOU
DBQ
LSE
RFD
RHI
MKE
MSN
ORD
MDW
BLV
STL
MVN
PAH
IND
LAF
LUK
RAK
ILN
LCK
CMH
CVG
SDF
BNA
MEM
UTA
MSL
HSV
BHM
ATL
MOB
BFM
MSY
YIP
DTW
CLE
PIT
MBS
BUF
ALB
CEF
BDL
PVD
BED
BOS
MHT
PQI
MVY
ACK
HYA
TEB
LGA
JFK
EWR
PHL
IAD
BWI
DCA
ADW
ORF
RIC
ROA
RDU
ISO
GSO
SOP
CLT
GSP
AGS
AHN
MYR
CHS
ABY
TLH
JAX
SGJ
OCF
DAB
SFB
MCO
MLB
TPA
PBI
RSW
FLL
MIA
SJU
PSE
STX
ANC
OGG
HNL
Key
Runway Surveillance Technology (ASDE-X/AMASS/ASDE-3)
Runway Status Lights
Low Cost Surveillance
Improved Runway Markings
Airport Surface Movement Training
FAA
Air Traffic Organization

Runway Status Lights System



FAA
Air Traffic Organization

Questions for the Record
From February 13, 2008
Hearing on Runway Safety

Question
Have runway incursions gone down or up? GAO said (citing FAA data) that the runway incursion rate went up in 2007. Meanwhile, FAA's chart shows the RATE of SERIOUS RUNWAY INCURSIONS had gone down since 2001. Which is right, the GAO or the FAA?

Answer
Both FAA and GAO are using the same data and agree that the total number of runway incursions increased in 2007. The difference is that in their testimony, the GAO presented the rate of the total number of incursions. The FAA presented both the total number of runway incursions, with the number of serious incursions shaded within each bar, and the rate of the most serious runway incursions plotted as a line graph on top of the total number of incursions. Thus, you can see the bar for 2007 is slightly higher than 2006 but the number and rate of serious incursions continued to decline.

The FAA's point was that while the total number did go up, the most serious runway incursions were down. The chart attached shows the rate of runway incursions for the most serious (Category A and B) has gone from a rate of 0.81 for every million operations to a rate of 0.39 for every million operations in 2007.

<u>Question from Rep. Richardson originally sent to GAO</u>

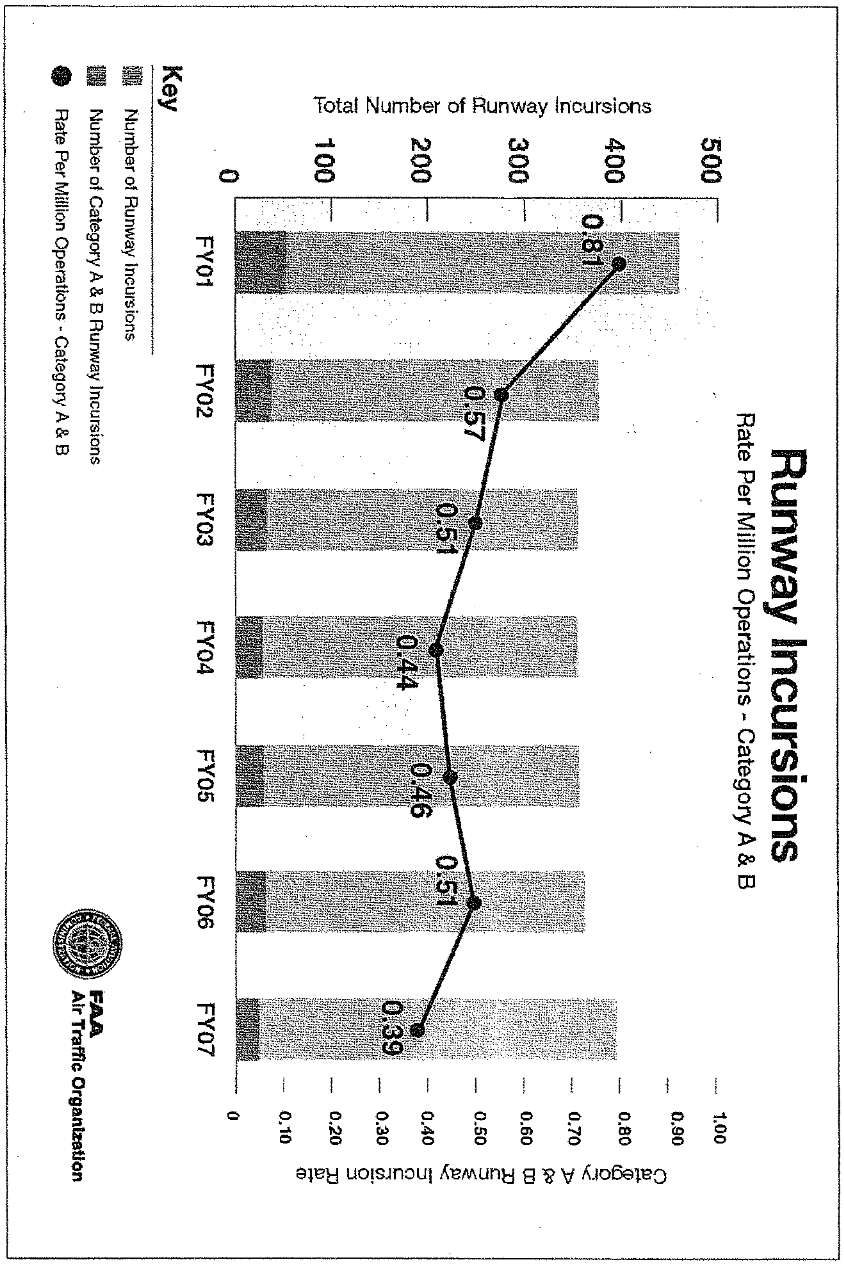
Question
What is the tenure of air traffic controllers at each major airport? We either have people who have the tenure, who have the education, who have the training, who are prepared to work at the major airports or we don't.

Answer
All controllers must be certified on a position before they are allowed to work live traffic on their own. Safety is our first priority.

At the large airports, and at other facilities throughout the National Airspace System (NAS), position-certified developmentals work along side of Certified Professional Controllers in Training (CPCIT) and Certified Professional Controllers (CPC) to guide aircraft safely through the NAS. Just like the generations of controllers that have gone before them, these developmentals work live traffic only on the positions they've been certified on. We require them to do this in order to maintain proficiency as they progress towards CPC status.

We closely monitor their progression and qualifications, and strive to maintain an appropriate number of trainees in the workforce. This month, we will publish updated FAA authorized staffing levels for each facility in the NAS in our 2008 Controller Workforce Plan.

Our plan keeps the percentage of trainees below 35 percent of the controller workforce. Before the 1981 controller strike, the FAA experienced trainee percentages ranging from 23 to 44 percent. Following the strike, through the end of the hiring wave in 1992, their trainee percentage ranged from 24 to 52 percent. Past experience has shown that the FAA can operate safely with higher percentages of trainees than we're seeing today.



Runway Incursions
Rate Per Million Operations - Category A & B
Total Number of Runway Incursions
0
100
200
300
400
500
FY01
FY02
FY03
FY04
FY05
FY06
FY07
0.81
0.57
0.51
0.44
0.46
0.51
0.39
0
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Category A & B Runway Incursion Rate
Key
Number of Runway Incursions
Number of Category A & B Runway Incursions
Rate Per Million Operations - Category A & B
FAA
Air Traffic Organization

Questions for the Record - Mr. Petri for Ms. Moore
to Mr. Hank Krakowski - FAA
Milwaukee Control Tower
Aviation Subcommittee Hearing, February 13, 2008

My colleague, Congresswoman Gwen Moore, is troubled by reports of inadequate training and ongoing staffing needs at Milwaukee control tower that controllers have said should have been but have not been provided prior to taking control of this airspace on February 14, tomorrow. I have a series of questions on this issue from my colleague, Congresswoman Moore that I will submit them and would ask you to respond in writing. Thank you.

QUESTIONS SUBMITTED FOR THE RECORD by Congresswoman Gwen Moore to be answered in writing

Q) Could you describe what training, staffing, and equipment needs the FAA has provided to ensure that when the switch takes place, air safety will not be compromised? What assurances can you provide that the training provided has been adequate? What actual live training in the airspace has occurred? How many of the Mitchell tower controllers have been sent to Chicago tower for temporary periods to learn the airspace from those who are currently controlling it?

Q) Can you explain why as this transition is about to occur, there are only 38 controllers at MKE compared to 48 controllers on 9/30/2006 even as the FAA's own business plan for this airspace redesign called for additional staff at MKE, not less? What is FAA doing to increase the number of air controllers at MKE ATCT?

Q) Why weren't those steps implemented earlier or why have they failed to ensure that an adequate number of trained controllers are available on Feb 14th?

A) The FAA has sufficient staff certified to manage this airspace and to train others toward certification. The staffing range for MKE is 37 to 48, and currently there are 47 controllers on board. The staffing target increased during FY 2006 (by four additional controllers) specifically for the planned change in airspace.

Of the 47 on board, there are 3 certified professional controllers in-training (CPCIT) that were previously certified in FAA facilities, and 3 developmental controllers. In addition, MKE has two new hire developmentals presently at the FAA Academy in Oklahoma City who will arrive at MKE next month.

Our staffing ranges provide the number of controllers needed to perform the work and include all position-qualified controllers. Managing the airspace at MKE is accomplished with a combination of certified professional controllers (CPCs), CPCITs, and developmental controllers who are proficient, or checked out in specific sectors or positions. Developmental controllers have always handled live traffic. In fact, this is a requirement to maintain proficiency as they progress towards CPC status. It generally takes two years to fully certify throughout the tower and approach control functions.

We have seven additional controllers selected for arrival in 2008, four of whom have been certified in other FAA facilities. With these new selections, the numbers of controllers on board at the end of the calendar year should be approximately 56.

We will continue to hire new employees at MKE in the coming years.

Training is clearly one of the more important issues surrounding this move. As we do with all new procedures and airspace designs, we ensure that the appropriate levels of training are provided to our workforce.

To prepare for the airspace change at MKE, every controller receives one day of classroom training, duty time to study the training manual prepared by the facility, and nine simulated scenarios in the radar lab. The scenarios used in the MKE lab training were the same used by Chicago Air Route Traffic Control Center (ZAU) and were adapted for MKE. It is important to note that MKE developed procedures, letters of agreement and training with input from local union representatives. The facility sent five controllers, one staff specialist and two managers to the Chicago Center to observe the evening and the morning traffic at the en route sector, and they validated the accuracy of each training scenario.

The controllers are given the option to certify in the lab, although most have opted to wait until the airspace transfers to certify. As of today, we have three fully certified controllers, three Front Line Managers, and one Operations Manager certified on the sector. We have completed training for all but four of the controllers.

We successfully implemented the cutover as scheduled on February 14 and there have been no operational impacts.

Q) There have also been concerns that additional radar equipment that would help the air traffic controllers at Mitchell better manage this large airspace has not been provided. Can you explain why this equipment was not provided prior to February 14th and when it will be provided?

A) Controllers have access to better radar information with the transfer of airspace to MKE. The radar used before the transfer was the Horicon Air Route Surveillance Radar (ARSR) or long range radar. Because MKE has Standard Terminal Automation Replacement System (STARS) equipment, they are able to use radar inputs from several additional radar assets, including the Horicon ARSR. For example, the existing Airport Surveillance Radar (ASR)-7 at Green Bay (GRB) was upgraded so that the radar data could be merged with the Madison (MSN) ASR-9, the MKE ASR-9, and the Horicon ARSR.

We will be replacing the ASR-7 at GRB with an ASR-11, but the project has been delayed because of environmental and real estate issues associated with private ownership and an Indian reservation. However, because the existing ASR-7 was upgraded to interface with the STARS equipment and because of the distance, an ASR-11 at GRB would not significantly increase the radar coverage over the current ASR-7. In the meantime, we are working to resolve these issues as quickly as possible so that we can finish the replacement project.

STATEMENT OF

CAPTAIN JOHN PRATER

PRESIDENT

AIR LINE PILOTS ASSOCIATION, INTERNATIONAL

BEFORE THE

SUBCOMMITTEE ON AVIATION

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

UNITED STATES HOUSE OF REPRESENTATIVES

WASHINGTON, DC

February 13, 2008

RUNWAY SAFETY

Air Line Pilots Association, International
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STATEMENT OF
CAPTAIN JOHN PRATER
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ON
RUNWAY SAFETY

FEBRUARY 13, 2008

Good afternoon, Mr. Chairman and members of the Subcommittee. I am Captain John Prater, President of the Air Line Pilots Association, International (ALPA). ALPA represents 60,000 professional pilots who fly for 43 passenger and all-cargo airlines in the United States and Canada. On behalf of our members, I want to thank you for the opportunity to testify today about the need for enhanced runway safety.

ALPA is a world-renowned aviation safety advocate, dedicated to protecting the interests of passengers, crew members and cargo. Many in the industry, including a former Federal Aviation Administration (FAA) Administrator, refer to us as "the conscience of the industry." Today, I would like to address three runway safety topics: runway incursions; runway excursions; and runway confusion.

Runway Incursions

We need to remember that it was a runway incursion over 30 years ago that still stands as the most deadly accident in the history of airline flying. On March 27, 1977, two Boeing 747s collided on an airport runway in Tenerife, Canary Islands while operating in very poor visibility conditions. In that single accident, 583 lives were lost. Although Tenerife was a landmark event in aviation history and much has been done to mitigate the risk of incursions since then, the potential for another runway incursion which could kill hundreds of people in a single accident is real and growing in view of current and forecast increases of traffic within the National Airspace System (NAS).

U.S. airlines safely completed 19.4 million flights in 2007. Of these, only a few hundred experienced a runway incursion and most of those were not "close calls." But despite this relatively low number, when considering the consequences of a high-speed collision, the potential for catastrophe is high.

The problem of runway incursions has been exhaustively studied by dozens of aviation experts and numerous, effective mitigation solutions have been devised that can greatly lessen the inherent risk associated with airport ground operations. The question that remains to be answered is whether government and industry are truly committed and willing to invest in the resources that are required to eradicate this problem.

Demanding schedules, inadequate rest periods and insufficient or inaccurate information related to weather or airport conditions can degrade the performance of even the most seasoned and dedicated pilot. While the Federal Aviation Administration (FAA) has made efforts to address a number of these issues by emphasizing improvements to crew operating procedures and training, the number of runway incursions has increased, not decreased, over the past few years. Although it may be easy to say that nearly all runway incursions are caused by human error, it is more important to look for the root causes of those errors and develop strategies to eliminate them. Clearly, the focus on human factors should continue, but there is also a need to invest in available technological improvements, system design enhancements and procedural changes to reduce pilot and air traffic controller errors, all of which contribute to the problem of runway incursions.

ALPA's safety volunteers have assisted a number of airline managements in determining the causes of runway incursions which have identified a variety of contributing factors. One airline found the following contributing factors to runway incursions from data that it collected over a year: runway and taxiway marking confusion; airport configuration/layout issues; runway change impact on performance parameters; crewmember/ATC verification; implied runway crossing clearance; and "follow" clearances. Another airline found this list of contributing factors from 2006-2007 for Level D (i.e., the most dangerous type) incursions: distractions; runway and taxiway markings and signs; misunderstood ATC clearances; taxi speed; and closely spaced parallel runways.

Ingenious technology, combined with political will and monetary resources, have virtually thwarted two of the deadliest types of accidents: midair collisions and controlled flight into terrain (CFIT). Numerous midair collisions, resulting in hundreds of deaths over several decades, occurred when air traffic controllers and pilots relied solely on basic ground-based radar and see-and-avoid techniques to maintain required separation between aircraft. The development of the traffic alert and collision avoidance system (TCAS) equipped pilots with an invaluable tool that warns them of an impending collision and gives instructions on how to avoid it. Since the introduction of TCAS, many midair collisions have been averted, and many lives have been saved.

CFIT accidents have been similarly catastrophic and caused perhaps thousands of casualties during the era when controllers and pilots relied solely on radar coverage, charts, and ground visual references to maintain adequate clearance from the ground in low visibility conditions and periods of darkness. The invention, development, and implementation of the ground proximity warning system (GPWS), and its newer supplement, the enhanced GPWS, or EGPWS/TAWS, has had the same powerful effect on reducing the number of CFIT accidents that TCAS has had on reducing the number of midair collisions. In both instances, existing technologies, training, and procedures were insufficient to satisfactorily meet the challenge of preventing incidents and accidents. In both instances, enhanced situational awareness and conflict alerting capability were combined for a powerful one-two punch to the heart of the problem. In both instances, recommendations for great risk mitigations were ignored until several high-profile accidents occurred.

So it is with runway incursions. The risk posed by runway incursions can be significantly reduced—by as much as 95 percent according to the U.S. Commercial Aviation Safety Team (CAST)—with a combination of technologies which greatly improve the flight crew's situational awareness and provide conflict-alerting capability during ground operations.

We must not wait for another Tenerife accident before we get serious about solving the problem of runway incursions. Aviation stakeholders must make a commitment as an industry to field effective mitigations, whether they are low-tech solutions, such as painting runways and taxiways with enhanced markings, improving airport signage and lighting, or more sophisticated, such as providing Automatic Dependent Surveillance Broadcast (ADS-B) technology in the cockpit. We need to provide the best equipment in control towers and cockpits that will improve situational awareness at both ends of the radio. Installing systems like runway status lights (RWSL) that have already been proven to reduce or eliminate runway incursions in real operations will have a great effect on improving safety.

Following is a list of expanded action items which will substantially reduce the potential for a runway incursion accident:

Implement CAST Recommendations

In ALPA's white paper on Runway Incursions, published in March 2007, we recommended that the U.S. government and aviation industry fulfill the commitments that were made to implement the recommendations of the Commercial Aviation Safety Team (CAST) Runway Incursion Joint Safety Implementation Team (R-I JSIT). Unfortunately, government and industry have yet to act on many of those proposals.

CAST determined that 95 percent of all runway incursions could be prevented by having (1) a cockpit moving map display with own-ship position for improved situational awareness, (2) integration of ADS-B to enable pilots and controllers to see all aircraft and vehicles on the surface and aircraft up to 1,000 feet above ground level, (3) automatic runway occupancy alerting, and, (4) digital data-linked clearances that are displayed on the moving map. Electronic flight bags, which provide computer-generated displays of aircraft and flight information, can be used to display moving maps and own-ship position. Last year, the FAA announced its intention to amend its policies on the use of EFBs with moving maps and own-ship position to give airline pilots the safety benefits from these EFBs as soon as possible. Only a very few airliners have EFBs with moving maps and own-ship position installed, but it is widely used on general aviation and corporate aircraft. Installation of this vital equipment on airliners should become a national aviation safety priority. The FAA recently lowered the certification requirements for EFBs with aircraft moving maps which should result in a reduced cost to implement this technology on U.S. airliners. However, the equipment manufacturers and airlines have yet to collaborate on installing this technology in our cockpits.

Improve Air Traffic Controller Training

In 2000, CAST made recommendations to improve air traffic controller training. Subsequently, the FAA issued guidance for the development of a curriculum which has been incorporated into initial and recurrent controller training programs. ALPA is alarmed that despite this increased emphasis on training and procedural best practices, the number of incursions has not diminished.

In order to rectify this situation, ALPA recommends that the FAA develop a Controller Resource Management (CRM) training curriculum for tower cab controllers that mirrors similar programs currently in place for flight crews and aircraft dispatchers. Particular emphasis should be placed on effective coordination techniques during high workload conditions.

On February 6, 2008, the FAA announced that over the next 18 months, it will deploy new air traffic tower simulators to a number of domestic airports to assist in the training of thousands of new air traffic controllers. The Tower Simulation Systems (TSS) will provide more realistic depictions of an airfield and its surrounding areas and are programmable to replicate varying traffic, weather, lighting and visibility conditions. ALPA applauds the FAA for this effort and encourages it to continue to supply the most realistic training available to its air traffic control work force. This recent development is clearly a positive step toward solving the problem of runway incursions.

Airport Design and Enhanced Airport Signage and Markings

The FAA's action to require all commercial airports to implement enhanced taxiway markings is another positive step toward assisting pilots in maintaining awareness that a runway intersection is being approached. In the population of airports with more than 1.5 million annual passenger enplanements, 71 have accomplished this goal, 62 other airports have voluntarily made the improvements, with 121 more airports planning to finish the task by the end of the year.

ALPA recommends that all FAR Part 139 airports with commercial (Part 121) air carrier operations install enhanced taxiway markings, to include a red runway identifier that is not part of FAA's required improvements.

Implementing enhanced surface markings will clearly assist pilots in identifying approaching runway intersections, but their usefulness is limited when an airport surface is obscured by snow or other forms of precipitation or contaminants. Because surface markings have limited application, a number of other technologies have been developed which are intended to improve the situational awareness of pilots traversing an airport's surface. Use of these directional aids takes on added meaning when pilots are navigating airfields with which they have little familiarity (not an uncommon occurrence), or are operating in adverse meteorological or high traffic conditions.

The following recommendations on available technologies are contained in the CAST 2002 RI-JSIT report wherein it is noted that substantially improved ground movement navigation guidance is needed to prevent runway incursion accidents and incidents.

- Variable electronic message boards which display critical clearance related instructions such as "hold," "cross," or "takeoff."
- Provision of runway occupancy information to pilots on final approach to prevent "land over" accidents and incidents in which an arriving aircraft jeopardizes, or collides with, an aircraft positioned on a runway awaiting takeoff clearance.
- "Smart" ground movement lighting that indicates the cleared taxi route, substantially reducing runway incursions which result from pilots taking an incorrect path and proceeding onto a runway or taxiway without a clearance.

In addition to these technologies, there are a multitude of less sophisticated solutions for improving airport surface safety, many of which are similar to aids provided to motorists to assist in navigation and warn of impending hazards. We urge the FAA to exercise its authority and responsibility to support research and installation of improved signage systems in the airport ground environment.

End-Around and Center Taxiways

ALPA supports the installation of perimeter (i.e., end-around) taxiways as they enhance both safety and capacity; perimeter taxiways drastically reduce opportunities for runway incursions. Atlanta Hartsfield (ATL) airport has already completed construction of an end-around taxiway that allows traffic to proceed from arrival runways to terminal gates without crossing other arrival or departure runways. Dallas-Ft. Worth (DFW) is in the process of constructing several of these taxiways. Atlanta's airport experiences 500–600 fewer runway crossings daily due to its end-around taxiway; that's 500-600 fewer opportunities for a runway incursion. Additionally, operational data has demonstrated that perimeter taxiways can actually increase airport efficiency.

The record of runway incursions includes numerous cases involving parallel runways, where a landing aircraft exited the runway via a high-speed taxiway onto an occupied parallel runway causing a runway incursion in the process. This is a very high-risk accident scenario, but one which can be mitigated by implementing a center taxiway between parallel runways. ALPA is urging the Los Angeles World Airport authority to include a center taxiway between parallel runways at LAX during their modernization program so as to enhance both safety and efficiency.

Airport Surface Detection Equipment Model X (ASDE-X)

ASDE-X, which operates on the principle of multi-lateration, provides tower controllers with increased situational awareness of the airport surface by displaying a wide variety of targets, including aircraft and ground vehicles. Currently, only 11 airports in the U.S. have ASDE-X installed. ALPA supports an accelerated plan to implement ASDE-X at all OEP airports. While there are still issues associated with its operational use, we believe that this technology offers controllers a high fidelity presentation of the airport surface movement area so as to provide reliable data via which yields better quality decisions. One manufacturer has demonstrated a runway occupancy alerting capability for the flight crew which obtains its signals from ASDE-X. As was noted previously, a runway occupancy alerting capability combined with other technologies aimed at increased situational awareness could reduce incursions by 95%.

Runway Status Lights (RWSL)

Runway Status Lights work in conjunction with an airport's ASDE-X radar system. These lights provide pilots with a direct indication of runway status, a recommendation endorsed by the NTSB. In a recent operational evaluation conducted by MIT's Lincoln Laboratory at Dallas-Fort Worth International Airport (DFW), runway incursions on the test runway decreased by 70 percent. Recently, San Diego's Limburgh Field (SAN) installed a RWSL system. We are encouraged that both Los Angeles (LAX) and Chicago O'Hare (ORD) airports are also considering these installations as part of their airport modernization efforts.

ALPA has recommended that the RWSL system become a standard technology upgrade for all large air carrier hub airports. We believe that Airport Improvement Plan (AIP) funds should be allocated to expedite implementation for all candidate airports. As part of this effort, it is important that clear and definitive action is taken to ensure the incorporation of RWSL in the proposed ORD modernization plan.

Automatic Dependent Surveillance – Broadcast (ADS-B)

ADS-B, unlike radar, does not rely on a ground-based surveillance system. Three-dimensional, Global Positioning Satellite (GPS)-derived aircraft positioning reports will provide air traffic controllers with greatly enhanced air traffic surveillance capabilities. Additionally, the use of ADS-B will enable pilots and controllers to see all aircraft and vehicles on the airport surface and aircraft up to 1,000 feet above ground level.

A recently issued FAA Notice of Proposed Rulemaking (NPRM) requires mandatory ADS-B equipage for National Airspace (NAS) operations after the year 2020. ALPA believes that this mandate for ADS-B OUT should be accelerated and that it is imperative that increased emphasis should be placed on the development of technology and procedures for display of traffic information on the flight deck, via ADS-B IN. The current NPRM mandates ADS-B OUT by 2020. This improves controller surveillance, but would provide pilots no additional information. Operational safety enhancement will only be gained with equipage of aircraft with ADS-B IN and Cockpit Display of Traffic Information (CDTI). Once the safety and efficiency gains for this technology are analyzed, it is our expectation that there will be compelling data to suggest a mandate for ADS-B technology in an accelerated timeframe.

Non-Standard Air Traffic Phraseology

ALPA believes the U.S. should align itself with ICAO guidance for air traffic controllers and pilots regarding airport surface operations and runway holding instructions. The U.S. is one of just a few countries that does not comply with certain ICAO standards for phraseology or taxi instructions. The ICAO guidance is more succinct than the FAA's and requires a specific affirmation of a clearance to cross all active runways that cross their assigned taxi route. It also provides standardized phraseology when instructing a flight to enter the runway and hold its position until a takeoff clearance can be issued.

On any given day there are hundreds of internationally based flight crews operating at our nation's busiest airports. With multiple accents on busy radio frequencies and the lack of a common understanding as to what is expected of everyone, we fear that safety is being compromised.

Standard Operating Procedures (SOPs)

ALPA recommends improved standard operating procedures (SOPs) and improved training for aircraft ground operations throughout the aviation industry. One prudent SOP is to complete as much "heads down" activity as possible prior to departing the gate. To accomplish this goal, ALPA recommends that all airlines standardize their procedures and implement the guidance contained in FAA Advisory Circular (AC) 120-74A, *SOPs for Ground Operations*. Completing all pre-departure checklists and briefings before leaving the gate will significantly reduce crew distractions during the taxi phase. Similarly, executing post-landing checklists after safely clearing the active runway, but before initiating taxi to the gate, will ensure that both crewmembers are focused on taxi clearance instructions and the safe transiting of the prescribed route.

One major airline has noted that complex taxi routes and pilots' misunderstanding of taxi instructions account for over 90% of their runway incursions. This miscommunication is due in part to the necessity for aircrews to complete complicated checklists as they taxi their aircraft. Frequently, flight crews must process changes to navigation routings given by air traffic controllers (ATC), or prepare the aircraft for flight as they determine correct aircraft trim settings based on actual weight and balance factors of the plane. Such information is often known only minutes before leaving the gate.

We know of at least two airlines that have changed their taxi procedures to facilitate the completion of all checklists items that can be accomplished prior to departing the gate area. Particularly in the event of a short taxi route, this practice will prevent crews from rushing completion of their checklist items while navigating their aircraft on the airport surface.

Runway Excursions

Rejected takeoffs and poor landings are high-risk maneuvers which may lead to a runway excursion. Recent data shows that over 28% of accidents from 1995 to 2007 involved runway excursions. Three quarters (75%) of those were on landing, and 25% were on takeoff. Fifty-one percent (51%) of landing accidents occurred on a runway contaminated with snow, rain or ice, while only 10% of usual aircraft movements are on wet or contaminated runways.

Aircraft flight manuals do not contain actual flight-test determined data for takeoff or landing performance under wet or slippery runway conditions. Flight crews are also not provided reliable data on the effect of a contaminated runway on aircraft braking, and stopping information is vague and subjective. Although provision of such information is mandated in Europe, it is not required in the U.S. ALPA believes that in the interest of safety, manufacturers must be required to provide flight crew with takeoff and landing performance data for all runway conditions expected to be encountered in service.

Pressure on flight crews to complete scheduled operations can play a role in runway excursions as well. We have seen instances of "pilot pushing," wherein a company dispatcher insists that a landing is legal when it may not be, due to ambiguity in aircraft performance data in unfavorable conditions. This dynamic potentially puts pilots, passengers and cargo in harm's way.

This issue could be resolved if pilots were provided aircraft takeoff and landing performance data as a function of existing runway conditions. For in-flight computation, pilots should be provided data in the form of required landing distances, rather than in terms of weight limits. When in flight, the weight factor is unchangeable, and the runway length is the controlling factor.

In the event that an aircraft is unable to stop before reaching the end of the runway due to mechanical, weather, or other operational problems, a runway safety area (RSA) is intended to ensure that an incident does not become an accident. ICAO recommends that runways have a defined runway safety area free of obstacles and extending well past the end of the actual runway. In the U.S., FAA Advisory Circular 150/5300-13, *Airport Design*, provides the criteria for an acceptable RSA.

Unfortunately, hundreds of airports in the U.S. that serve both domestic and international air carrier operations do not meet U.S. or international standards in this regard. According to recent FAA statistics, 45% or 460 of the 1,024 certificated airport runways in the U.S. must be improved with regard to RSAs.

Three solution methodologies exist for those US airports that do not meet current RSA standards:

1. Airport authorities should remove obstacles, fill ravines or level ground to create adequate RSAs. This option may not be possible for urban airports or others in a confined geographic area.
2. Airports can decrease the effective runway length of certain runways to create adequate runway safety areas. This option may not be attractive because it could potentially mean reducing the size and weight of aircraft that use the airport.
3. If the physical space simply does not exist to create the recommended runway safety area, an Engineered Materials Arresting System (EMAS) could be installed. This system uses aerated, frangible concrete to bring an aircraft to a quick but controlled stop, much like runaway truck ramps on steep mountain highways. EMAS is a solution that has proven successful in actual operation. It is worth noting that EMAS has the advantage of being generally unaffected by snow and/or ice contamination and functions to the same level of arresting capability as if it is bare and dry.

Runway Confusion

Although this issue has rarely been the cause of a catastrophic accident, it has been identified as a definite weakness in our nation's runway safety system. The regional jet accident in Lexington, Kentucky in 2006 and the Singapore Airlines 747-400 which crashed during takeoff from Taiwan in 2000 represent the real risks of this scenario. Other runway confusion-related incidents have occurred, but in those cases, safety was not compromised to the point of causing an accident.

Known causes of runway confusion include one or more of the following factors: mistaken situational awareness; crew in "heads down" operations; lack of advisory information on airfield configuration changes; obscuration of markings and signs; inaccurate charting when construction is occurring; and, poor quality automated terminal information service (ATIS) broadcasts.

Solutions for preventing runway confusion can be found in many of the systems offered for mitigating runway incursions, but challenges remain in eradicating this safety problem. Technology for crew alerting and awareness systems such as the runway alerting awareness system (RAAS) appears very promising, but it is only being purchased by a small number of airlines. Electronic Flight Bag (EFB) with Aircraft Moving Map Displays (AMMD) offers great potential, but is not planned for retrofit except at a few progressive airlines. Requisite operational information frequently is not provided to flight crews prior to departing the gate, necessitating crew attention and action during taxi. However, few airlines provide crews with training scenarios involving taxi challenges.

Recommendations

We urge Congress to assist the industry in its efforts to mitigate the risks of runway incursions, runway excursions, and runway confusion. Following are our recommendations in this regard.

Runway Incursions

- Provide improved ground movement training for air traffic controllers, particularly with the use of high-fidelity visual tower simulators, which are similar in quality to aircraft flight simulators routinely used for pilot training.
- Require that all airports with commercial air carrier operations have the enhanced taxiway markings, including the red runway identifier that is not yet part of FAA's required improvements.
- Direct the FAA to exercise its authority to support research to improve signage systems around the airport.
- Support the expenditure of funds to install perimeter taxiways, which enhance both safety and capacity.
- Airlines should work with equipment manufacturers to install Electronic Flight Bags (EFBs) with Aircraft Moving Map Displays in our cockpits. The FAA has lowered the certification requirements for them thereby reducing the cost to implement EFBs.
- FAA is scheduled to implement ASDE-X at 7 airports in 2008; this schedule should be accelerated.
- Include Runway Status Lights (RWSLs) as a standard technological upgrade for large hub airports and support Airport Improvement Plan (AIP) funding to quickly implement RWSLs at the nation's busiest airports. It is important that there be clear and definitive action taken immediately to ensure that the Chicago O'Hare, Los Angeles International, and other hub airport modernization plans incorporate RWSLs.
- Aircraft must be adequately equipped, and regulators must develop and implement procedures, for ADS-B technology. The government and industry should push for the development of air-to-air ADS-B applications that benefit the users.
- All airlines should standardize their procedures and implement the guidance contained in the FAA Advisory Circular (AC) 120-74A, SOPs for Ground Operations.
- Change procedures to require crews to complete all pre-departure checklists and briefings before leaving the gate to significantly reduce distractions to the crew during the taxi process.
- Change procedures to require crews to complete after landing checklists and briefings before taxiing begins from the landing runway.
- Airlines should be encouraged to conduct thorough root cause analysis of all runway incursion events that involve their flight crews to ensure a complete understanding of why the event took place and implement strategies to eliminate them.

Runway Excursions

- Manufacturers must be required to provide flight crew with performance data for takeoff and landing for all runway conditions expected in service. Pilots should be provided data in the form of required landing distances, rather than in terms of weight limits.

- Airport runways with runway safety areas less than 1,000 feet in length should be improved to provide at least this size. If the physical space simply does not exist to create the recommended runway safety area, an Engineered Materials Arresting System (EMAS) should be installed.

Runway Confusion

- All airlines should standardize their procedures and implement the guidance contained in the FAA Advisory Circular (AC) 120-74A, SOPs for Ground Operations.
- Change procedures to require crews to complete all pre-departure checklists and briefings before leaving the gate will significantly reduce distractions to the crew during the taxi process.
- Provide improved ground movement training for air traffic controllers, particularly with the use of high-fidelity visual tower simulators, which are similar in quality to aircraft flight simulators routinely used for pilot training.
- Require that all airports with commercial air carrier operations have the enhanced taxiway markings, including the red runway identifier that is not part of FAA's required improvements.
- Direct the FAA to exercise its authority to support research to improve signage systems around the airport.

Thank you for the opportunity to testify today. I would be pleased to address any questions that you may have.

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AIRPORTS COUNCIL INTERNATIONAL

Testimony of Greg Principato
President, Airports Council International-North America

before the

House Transportation and Infrastructure Committee
Subcommittee on Aviation
"Runway Safety"

February 13, 2008

Chairman Costello, Ranking Member Petri, members and staff of the House Transportation and Infrastructure Subcommittee on Aviation, thank you for allowing Airports Council International-North America (ACI-NA) the opportunity to participate in this important hearing on runway safety. My name is Greg Principato and I serve as President of ACI-NA. Our 360 member airports enplane more than 95 percent of the domestic and virtually all of the international airline passenger and cargo traffic in North America. Nearly 400 aviation related businesses are also members of ACI-NA.

ACI-NA applauds the Committee for its tireless work on H.R. 2881, the "Federal Aviation Administration Reauthorization Act of 2007." We especially thank the Committee for including a provision on runways incursions, as found in Section 305, which requires the FAA Administrator to submit a report containing a plan for the installation and deployment of systems to alert flight crews and air traffic controllers of runway incursions. ACI-NA thanks you for your leadership and commitment to both airports and the aviation community and we commend both the Committee and House of Representatives for passing H.R. 2881 in expeditiously and timely manner.

In Fiscal Year 2007, the Federal Aviation Administration (FAA) reported 24 serious runway incursions out of more than 61 million operations in fiscal year 2007. Although the nation's airport runways remain safe, reducing the risk of runway incursions is a top priority and airports have taken a particularly aggressive stance in addressing this safety concern.

FAA "Call to Action" Meeting

Last August, more than forty aviation leaders including ACI-NA, airports, airlines, aerospace manufacturers, as well as air traffic control and pilot unions participated in FAA's "*Call to Action*" Task Force meeting, which provided an important forum for focusing the industry's attention on runway safety. ACI-NA was pleased to work with FAA to organize and facilitate airport participation in this important meeting, to reach a consensus on an achievable list of short, medium and long term initiatives that could be undertaken to further improve the safety of operations at America's airports. Additionally, the Task Force agreed to quickly implement a five-point, short-term plan to improve runway safety.

Short-Term Actions

One component of the *Call to Action* plan included a sixty-day initiative to review runway safety procedures, airport markings and other potentially confusing areas at twenty airports with a history of runway issues. Some of this nation's busiest airports were included, such as Atlanta, Boston, Chicago O'Hare, Dallas/Fort Worth, Fort Lauderdale, Las Vegas, Los Angeles, Miami, New York Kennedy, Orlando, Philadelphia, and San Francisco. Within sixty days, all twenty airports identified by FAA as having high incursions potential completed intensive runway safety reviews of runway incursion and factors leading to the potential use of a wrong runway.

In addition, by June 30, 2008, the FAA is requiring 75 large and medium airports to paint red markings on the taxiway side of the traditional black and yellow hold line to identify the approach of the specifically marked runway. FAA is also requiring these airports to improve centerline painting and markings on all airport taxiways to give differential color distinctions to ensure taxiways are easily seen by taxiing pilots at night or under poor weather conditions.

Short-term actions in the *Call to Action* plan include voluntarily accelerating the June 30, 2008 deadline requirement. Although the call to accelerate these new markings and signs is voluntary, to date, seventy-one of the targeted seventy-five airports have completed painting. An additional four airports have committed to completing the upgrade well before the June deadline.

The FAA is not requiring new taxiway painting and markings for small airports certificated under Part 139. However, the *Call to Action* plan calls upon smaller airports to develop plans to voluntarily upgrade existing markings. I am pleased to inform you that as of today, 28 small airports have already voluntarily upgraded their markings, 173 airports plan to upgrade by June 2008, and an additional 50 airports plan to complete the work by the end of 2008. Another, 29 airports have committed to enhancing their markings in 2009, while 28 airports have expressed interest but have not yet provided a target completion date. As you may know, many smaller airports work with private contractors for painting and, given the fact that no Airport Improvement Program (AIP) grants are being approved or distributed, airports are unable to contract for these services at this time.

In general, ACI-NA supports FAA's proposed Advisory Circular that would extend the enhanced taxiway centerline requirements to all certificated airports. However, we have heard from some of our members at smaller airports that, because of issues like their need to contract for painting services, acceleration of this requirement may entail hardship, which should certainly be given consideration in implementing the final requirements.

Mid-Term Actions

• **Runway Status Lights (RWSL**): Mid-term runway safety actions specific to airports include the accelerated installation of runway status lights (RWSL). RWSL uses runway and taxiway centerline illuminated lights to warn pilots of potential runway conflicts and prompt them to notify the tower before proceeding if a contradicting clearance has been issued. Using Airport Surface Detection Equipment-Model X (ASDE-X) technology, external surveillance information is taken from three sources that provide position and other vital information for aircraft vehicles on or near the airport surface. RWSL processes the surveillance information and commands the field lighting system to turn the runway status lights on and off in accordance with the motion of the detected traffic. Essential attributes of RWSL include timely warning of potential conflicts, automated information and no interference with air traffic operations.

Since March 1, 2005 the FAA has tested runway safety lights at Dallas/Forth Worth (DFW), as well as installed the experimental light system on San Diego's single oceanfront runway (December 2006). Just recently, the Department of Transportation's Office of the Inspector General (DOT OIG) conducted an audit to determine RWSL's viability for reducing runway incursions at DFW. The January 17, 2008 report noted that runway incursions on DFW's test runway (18L/36R) decreased by 70 percent after runway safety lights were installed. Due to this success, in early December DFW began construction of runway safety status light systems on two additional runways. The Massachusetts Port Authority has also committed to fast track the implementation of runway status light and ASDE-X at Boston.

• **Final Approach Runway Occupancy Status Lights (FAROS):** Similar to runway status lights, Final Approach Runway Occupancy Status Lights (FAROS) is a test-concept, utilizing surveillance via commonly used highway pavement traffic sensors to provide pilots on final approach to an airfield notification that their identified runway for landing is occupied. FAROS flashes the existing Precision Approach Path Indicator (PAPI) lights to give direct notification to the pilots that the runway is occupied and unsafe for landing. FAA continues FAROS operational evaluation at both Dallas/Fort Worth and Long Beach.

Whether RWSL, FAROS or other runway safety technological advancements, ACI-NA strongly encourages uniform deployment at all commercial service airports. The absence of such technological improvements could create inverse effect as pilots may become more reliant on such technology where it is available.

Long-Term Actions

• **Full Deployment of ASDE-X by 2010:** We recognize that technological solutions including ASDE-X will be a key component of airport runway safety programs and ACI-

NA supports FAA's decision to accelerate full deployment of ASDE-X by a full year from 2011 to 2010.

• **Moving Aircraft Maps**: Additionally, there is a growing universal acceptance of the adoption of moving map displays in cockpits to further facilitate pilots' situational awareness. ACI-NA supports moving map displays as a first step to enable pilots to better understand where they are on the airfield, with other capabilities added over time.

• **ADSB-IN:** FAA recently issued a NPRM that would require the installation of ADSB-OUT as a means of providing high quality, rapid update rate surveillance information to ATC facilities. However, in order to fully realize the safety and efficiency capabilities of ADS-B, it is essential that the program be expanded to include ADS-B-IN capability in a timely manner. ADS-B-IN provides the crucial ability for aircraft to see the location, not only of their own ship on an airport's surface, but also the position of all other equipped aircraft, whether on the airport surface or about to touch down. In addition it provides the ability for both controllers and air crews to see the position of equipped airport surface vehicles, such as maintenance, police, operations or crash fire rescue vehicles operating n the airport at night or in low visibility conditions.

• **Cockpit Display of Traffic Information:** CDTI is a crucial technology that fuses information from GPS and ADS-B-IN to provide air crews with situational awareness of all aircraft and vehicles in their vicinity. The benefit lies in reduced risk of runway incursion and increased ability for air crews to maintain optimal separation from traffic.

In turn, this has been demonstrated in the UPS Louisville demonstration to increase airport efficiency.

<u>**Airport Specific Actions**</u>

Independent of the FAA mandates and technological evaluations, airports are taking independent action to mitigate runway safety.

• **Perimeter Taxiways**: One of the most effective ways to prevent runway incursions is to minimize the need for aircraft to cross runways. Last year, Atlanta completed its end-around perimeter taxiway, essentially eliminating 650 daily runway crossings on the north side of the airfield. Additionally, the new perimeter taxiway has helped alleviate congestion in airport ramps and reduced the amount of fuel burned while aircraft sit idling, waiting for a clearance to cross an active runway. Dallas/Fort Worth has begun construction of a perimeter taxiway that mirrors Atlanta's end-around design.

• **Construction Program Enhancements:** Airports are also examining creative ways to enhance runway safety. As part of their airport expansion program, Minneapolis, Pittsburgh and Grand Rapids have constructed tunnels under their respective runways to eliminate the need to cross runways on the surface. Airport personnel can now completely eliminate potential vehicle-aircraft conflict situations.

• **Increased Driving Training on Airports***:* In order to eliminate vehicle and pedestrian deviations, airports continue to provide recurrent training for all airport employees who operate vehicles on the movement area of the airfield. Additionally, ACI-NA supports

FAA proposed Advisory Circular, which strongly recommends regular recurrent driver training for all persons with access to the AOA.

• **Commercial Aviation Safety Team (CAST):** In addition to airport specific actions, ACI-NA's Senior Advisor, Richard Marchi, recently joined the Commercial Aviation Safety Team (CAST), a cooperative government/industry initiative co-chaired by FAA's Deputy Associate Administrator for Aviation safety. CAST is a voluntary partnership consisting of all commercial aviation stakeholders — government agencies, airlines, aircraft manufacturers, aviation associations , employee representatives, and others—with a mission is to increase safety using an integrated, data-driven approach based on analyzing accident causes, identifying ways to make positive changes and implementing improvements.

CAST continues to apply its integrated, data-driven strategy to reduce the risk of commercial aviation fatalities in the United States and promote new government and industry safety initiatives throughout the world. Using aviation industry data, CAST is identifying emerging airport safety concerns and, working with ACI-NA, will take a more proactive risk assessment role.

Summary

In closing, ACI-NA and its member airports thank you for the opportunity to share our views on this important matter. We look forward to working with you as addressing this important issue is critical for the future of the aviation industry.

Before the Transportation and Infrastructure Committee
Subcommittee on Aviation
United States House of Representatives

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Actions Needed To Improve Runway Safety

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

DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

Mr. Chairman and Members of the Subcommittee:

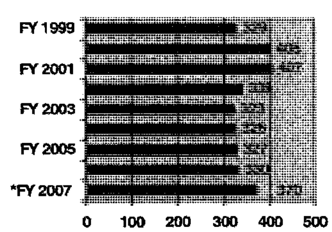
We appreciate the opportunity to testify today on runway safety. Since 1997, our office has issued 11 audit reports and testified numerous times before Congress on actions needed for improving runway safety. Our testimony today is based on our prior and ongoing work in this important area.

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).

Figure 1. Runway Incursions FY 1999 to FY 2007



Source: FAA

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 October[2] 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 reported[3] 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 reported[5] 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

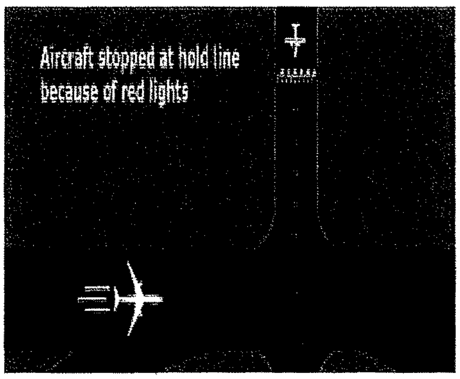


Figure 3. OIG Photo of Entrance Lights at DFW

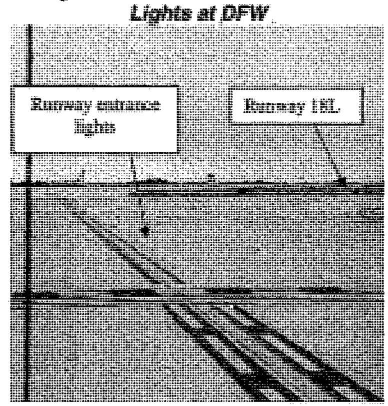
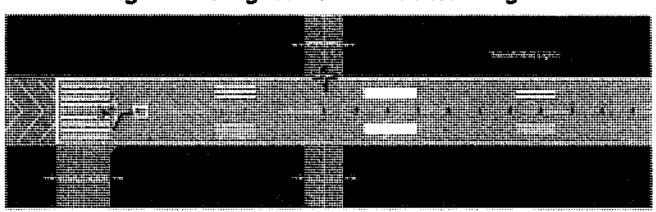


Figure 3 shows the view pilots see when runway 18L is unsafe to enter due to an aircraft taking off. Take-off hold lights illuminate red to indicate an unsafe condition when an aircraft is in position for take-off and another aircraft or vehicle is either on or about to enter the runway in front of it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

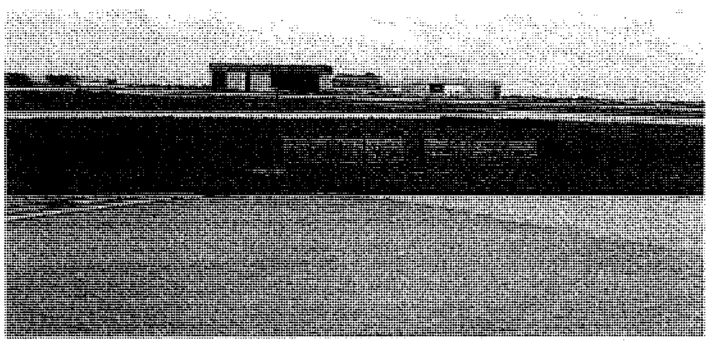
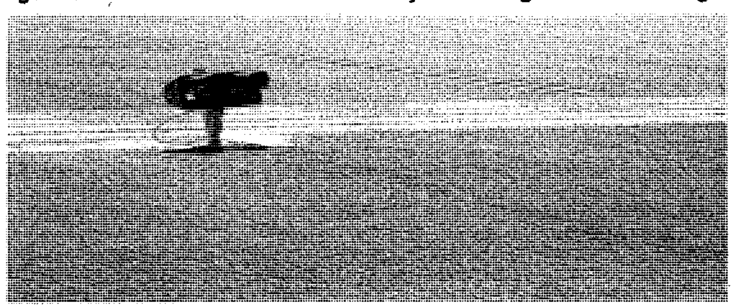


Figure 6. Picture of an Elevated Runway Guard Light at Boston Logan



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.

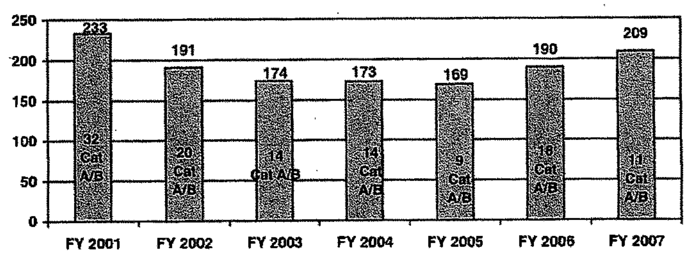
For instance, FAA does not require each line of business to include goals in its business plan that are specific to its oversight responsibility, and this may diminish accountability for achieving results within each line of business. For example, while FAA met its FY 2006 overall goal of no more than 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 carries, 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.

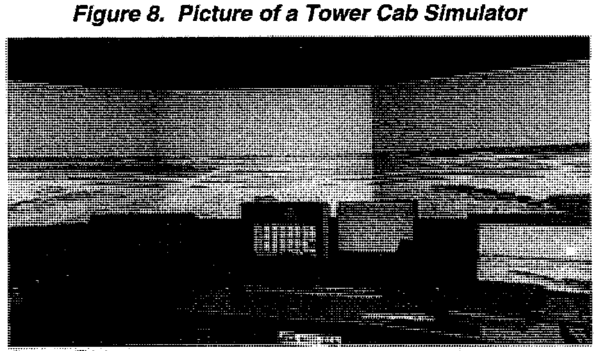
The program was tested in FY 2003, and FAA provided this training at its en route centers and plans to begin using it at its large TRACON facilities in FY 2008. However, it has not been implemented at towers where visual attention and scanning are key factors in preventing runway incursions.

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.

National Transportation Safety Board

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Robert L. Sumwalt
Vice Chairman

Testimony of Robert Sumwalt, Vice Chairman
National Transportation Safety Board
before the
U.S. House of Representatives
Subcommittee on Aviation
Committee on Transportation and Infrastructure
on
Runway Safety
February 13, 2008

Good afternoon, Chairman Costello, Ranking Member Petri, and Members of the Subcommittee. Thank you for allowing me the opportunity to present testimony on behalf of the National Transportation Safety Board on runway safety. I am truly privileged to represent an agency that is dedicated to the safety of the traveling public.

As you know, the Safety Board is charged with investigating aviation accidents and incidents, determining the probable cause, and making recommendations to prevent similar accidents from happening again. The Safety Board is especially concerned about runway safety, including runway incursions and runway excursions, due to the number of and potential severity of such events.

In March 1977, in what remains the world's deadliest aviation accident, two passenger jumbo jets collided on a runway at Tenerife, Canary Islands, causing the deaths of 583 passengers and crew. The deadliest runway incursion accident on U.S. soil involving two aircraft was a collision between a USAir 737 and a Skywest Metroliner commuter airplane at Los Angeles International (LAX) Airport in February 1991, which killed 34 people. Another accident, involving a Comair Bombardier CL600 that departed the wrong runway, killed 49 people in Lexington, Kentucky, in 2006. The Safety Board has also investigated numerous runway excursions, including the accident involving a Southwest Boeing 737 that killed one person at Chicago's Midway Airport in 2005.

Runway Incursions

On October 1, 2007, the Federal Aviation Administration (FAA) adopted the International Civil Aviation Organization's (ICAO) definition of runway incursion. Prior to that date, the FAA classified events that did not result in a loss of required separation as "surface incidents" not incursions. Incursions at that time involved a loss of separation with another aircraft, person, object, or vehicle. Since October 1, however, all surface incidents are now classified as runway incursions and are categorized based on the severity of the incident. Category A and B incursions represent the highest likelihood of a collision. Between October 1, 2007, and January 31, 2008, 300 runway incursions were reported, with 10 of those classified as a category A or B. The current number of reported As and Bs are 3 times as many as occurred in the same period last year.

From May 2007 to the present, the Safety Board investigated 11 serious runway incursions involving over 1,000 people on board the airplanes involved. Most notably, in May 2007, there was a runway incursion that happened at approximately 1:30 in the afternoon at San Francisco International Airport involving a Republic Airlines Embraer 170 and a Skywest Embraer 120 Brazilia. These two aircraft, carrying a total of 92 people, nearly collided at the intersection of runways 1 left (L) and 28 right (R). The tower controller forgot about the Skywest airplane when he cleared the Republic airplane for takeoff from an intersecting runway. The Skywest airplane came to a stop in the runway intersection and the Republic airplane lifted off and overflew the Skywest airplane by about 35 feet. Another incident occurred on July 11, 2007, at approximately 2:30 in the afternoon when a United Airlines Airbus 320 and a Delta Airlines Boeing 757 almost collided in the intersection of runway 9L and taxiway Mat at Fort Lauderdale-Hollywood Airport, Florida. The Delta 757 was inbound for landing on runway 9L and United A320 was taxiing for departure on the same runway. The United crew missed a turn, and was heading toward the runway when the tower controllers told United to stop and told the Delta pilots to go around. Although the Delta 727 touched down briefly, the crew was able to depart again and a collision was averted. Alert controllers and quick actions by the crew saved 307 people from a catastrophic accident.

The runway safety issue has been on the Safety Board's Most Wanted List of Transportation Safety Improvements since its inception in 1990. In the late 1980s, the Board issued numerous safety recommendations addressing this issue due to an inordinate number of runway incursions/ground collision accidents that resulted in substantial loss of life. As a result of the Comair accident at Bluegrass Airport in Lexington, Kentucky, in 2006, the Board issued several more recommendations to the FAA regarding runway safety. Additionally, the Safety Board held a Runway Incursion Forum on March 27, 2007, with a goal to promote runway safety.

Incursions occur because both pilots and controllers make mistakes. Improper or misunderstood instructions continue to place aircraft, vehicles, and their passengers in danger despite improved signage, more visible painted runway and taxiway markings, ongoing safety briefings and seminars for controllers and pilots, and informational brochures. The reason is simple and complex – human error. Pilots may misunderstand a clearance or read it back incorrectly and controllers fail to catch the error. Pilots may take a wrong turn when they are taxiing. Controllers may clear an aircraft to take off or land on a runway already occupied by a vehicle or another aircraft.

There isn't any single solution that will eliminate the problem of runway incursions. In July 2000, the Safety Board made recommendations to address the issue in a variety of ways, including procedural changes, educational efforts, and technology improvements that require a direct warning of an incursion to the flight crews. This direct warning is critical because it would give both controllers and those operating the aircraft increased time to react. Information needs to be provided directly to the flight crews as expeditiously as possible to prevent runway accidents.

The issue is one of reaction time. Safety Board investigations have found that AMASS/ASDE-X alone are not adequate to prevent serious runway collisions, because too much time is lost routing valuable information through air traffic controllers. After an alert, the controller must determine the nature of the problem, determine the location, identify the aircraft involved, and determine what action to take. Only after all of these determinations have been made can appropriate warnings or instructions be issued. The flight crew must then respond to the situation and take action. Simulations of AMASS performance using data from actual incursions show that alerts may occur as little as 8 to 11 seconds before a potential collision. In recent incidents, AMASS did not alert controllers in time to be effective, and the situations were instead resolved by flight crew actions. Additionally, during periods of heavy precipitation, the ASDE-III radar data can provide false returns to AMASS. AMASS treats the false returns as an errant aircraft which results in nuisance alarms. When that occurs, controllers put the system into "limited mode" which disables the alerting functions. However, controllers still have a display, but will not get any alarms, valid or nuisance. Until there is a system in place to control ground movements of all aircraft with direct warning to pilots, the potential for this type of disaster will continue to be high.

On-going Initiatives

Since 2005, the FAA has been conducting field tests of runway status lights at Dallas/Fort Worth International Airport. Runway status lights are red lights that activate on the runway when an aircraft is taking off, landing, or crossing an active runway. Initial test results have been promising and the FAA is expecting to extend those tests to more complex airports, such as Chicago O'Hare and LAX. The FAA is also testing final approach runway occupancy signals that alert pilots on final approach when the runway is occupied. They are also reviewing a flight deck–based direct warning system.

The FAA has also promoted Automatic Dependent Surveillance – Broadcast (ADS-B) as a method of mitigating the number and severity of runway incursions. On September 9, 2005, the FAA officially committed to establishing ADS-B as the basis for air traffic control in the future. On October 5, 2007, the FAA published a Notice of Proposed Rulemaking (NPRM) that proposed performance requirements for certain avionics equipment on aircraft to facilitate the use of ADS-B. According to the NPRM, ADS-B will be available nationwide in 2013 for aircraft surveillance by FAA and Department of Defense air traffic controllers. ADS-B will be beneficial for expanding surveillance coverage to areas of the United States that are not covered now, such as the Gulf of Mexico, Hawaii, and Alaska.

For ADS-B to provide maximum safety benefits, the system should support both ADS-B Out and ADS-B In. ADS-B Out provides basic aircraft information (location, altitude, etc) to air traffic controllers to provide traffic separation. ADS-B In would permit users access to additional services, such as data-linked weather and traffic information, and would also provide a means of transmitting surface conflict warnings directly to pilots via the ADS-B In communications link. However, the NPRM states that aircraft will not be required to be equipped with ADS-B Out until 2020, and the FAA will not mandate ADS-B In at this time because, according to the NPRM, it "has not been identified as a requirement for maintaining the safety and efficiency of National Air Space (NAS) operations." The NPRM only states that operators may equip their aircraft with ADS-B In "if they so choose." The Safety Board is concerned that this NPRM does not require ADS-B In. The ability of ADS-B In to support data sharing between aircraft and controllers would be a major contributor to improved situational awareness and would reduce the likelihood of both airborne and surface conflicts.

The Safety Board believes that many of these technologies available today may offer added safety benefits. And although the Safety Board is encouraged by the efforts of the FAA, its progress has been slow in responding to the recommendations issued 7 years ago. Further, national implementation for any one of these technologies is many years away, and not all airports with passenger service would be equipped.

Actions Remaining

The FAA has made progress with lighting and improved signage at airports, but some improvements in air traffic control procedures are needed. In July 2000, the Safety Board recommended that all runway crossings be authorized only by specific air traffic control clearance and that controllers issue a takeoff clearance only after previous runways have been crossed. Both of those recommendations are contained in the Manual on the Prevention of Runway Incursions prepared by the ICAO, which is the guidance material used internationally for implementing national or local runway safety programs. Yet, the FAA has not implemented either procedural change. In completing its investigation of the Comair accident in Lexington, Kentucky, the Safety Board concluded that if those procedures had been implemented, the Comair accident might not have occurred.

The Safety Board supports the use of ADS-B and believes that ADS-B Out will provide a safety benefit in the NAS in areas without sufficient radar coverage. However, the adoption of ADS-B In, direct delivery of warnings to aircraft pilots via datalink, as well as recommended procedural changes, will increase the level of safety during ground operations and should be expeditiously incorporated in FAA's ongoing regulatory process.

Runway Excursions

Recent accidents, such as the December 2005 Southwest Airlines runway excursion at Chicago's Midway Airport, indicate that more efforts are needed to prevent these types of accidents. Over the last 10 years, 73 runway excursion accidents involving turbine-engine-equipped aircraft were reported in the United States, resulting in 15 fatalities. Because runway excursions only are reported to the Safety Board if there is substantial damage to the airplane, serious injury to a person, or if an emergency evacuation is required, it is likely that the number of runway excursions is under-reported.

Landing distance calculations are critical to flight safety, especially when runway conditions limit braking effectiveness. As a result of the Southwest Airlines accident, the Safety Board issued an urgent recommendation on January 27, 2006, asking the FAA to prohibit operators from using reverse thrust credit in landing performance calculations to ensure adequate landing safety margins on contaminated runways. The FAA responded that it would issue an Operations Specification that would have established mandatory actions by aircraft operators and met the intent of the recommendation; however, the FAA subsequently issued a Safety Alert For Operators (SAFO). SAFOs are not regulatory and compliance is therefore voluntary. On

October 4, 2007, the Safety Board superceded the previous urgent recommendation, issuing a new recommendation asking that the FAA require crews to make a landing distance assessment with an adequate safety margin for every landing. To date, the FAA has not made this a requirement. We cannot continue to depend on the last minute alertness of pilots and controllers. We need the extra protection of additional procedures and advanced technology to compensate for human mistakes. We strongly urge action on these critical safety issues.

Fatigue

The Safety Board has long been concerned about the effects of fatigue on persons performing critical functions in all transportation industries including flight crews, aviation mechanics, and air traffic controllers. In 1989, the Board issued three recommendations to the Secretary of Transportation calling for research, education, and revisions to existing regulations. These recommendations were added to the Safety Board's Most Wanted List of Transportation Safety Improvements in 1990, and the issue of fatigue has remained on this List since then.

The Board's recommendations on the issue of human fatigue and hours-of-work policies have had a substantial effect on encouraging the modal agencies to conduct research and take action towards understanding the complex problem of operator fatigue in transportation and how it can affect performance. However, the modal administrations, and FAA in particular, have taken little if any action directly related to revising existing regulations and work scheduling practices.

Currently, the Board has several objectives for the FAA related to human fatigue that can directly impact runway safety:

- set working hour limits for flight crews, aviation mechanics, and air traffic controllers based on fatigue research, circadian rhythms, and sleep and rest requirements; and

- develop fatigue awareness and countermeasures training programs for controllers and those who schedule them for duty.

The FAA has recently indicated its intention to convene a working group to develop workable scheduling practices that minimize controller impairment due to fatigue, and the National Air Traffic Controllers Association has indicated its willingness to support this effort. The Safety Board supports these efforts and continues to believe that further action must be taken, especially in issuing scientifically based duty-time regulations and policies that minimize fatigue among air traffic controllers, flightcrews, and maintenance personnel. Operating or controlling an aircraft without adequate rest for the flightcrew or controller presents an unnecessary risk to the traveling public.

That concludes my prepared testimony and I would be happy to answer any questions you may have.