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National Transportation Safety Board
before the
Commerce, Science, and Transportation Committee
Aviation Operations, Safety, and Security Subcommittee
U.S. Senate
April 10, 2008

Good morning, Chairman Rockefeller and Ranking Member Hutchison. Thank you for allowing me the opportunity to present testimony on behalf of the National Transportation Safety Board. I am 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 incidents and accidents, determining their probable cause, and making recommendations to prevent similar accidents from happening again. The Board is concerned about key safety issues including: runway incursions, runway excursions, icing conditions, fuel tank inerting, human fatigue, and maintenance of aircraft.

The world's deadliest runway incursion accident, which remains the world's deadliest aviation accident, occurred in March 1977 when two passenger jumbo jets collided on a runway at Tenerife, Canary Islands, causing the deaths of 583 passengers and crew. The deadliest U.S. runway incursion accident involving two aircraft was a collision between a USAir 737 and a Skywest Metroliner commuter airplane at Los Angeles International Airport (LAX) in February 1991, which killed 34 people. Another accident, involving a Comair Bombardier CL600 that departed the wrong runway on August 27, 2006, killed 49 people in Lexington, Kentucky. The Safety Board has also investigated several other runway excursions including the accident involving a Southwest Boeing 737 that killed one person at Chicago's Midway Airport.

Runway Incursions

On October 1, 2007, the Federal Aviation Administration (FAA) adopted the International Civil Aviation Organization's 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 required 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. From January 2007 through March 31, 2008, 441 runway incursions were reported, with 15 of those classified as a category A or B. That's more than twice as many as were reported during the same time last year (7).

Between May and October 2007, the Safety Board investigated seven serious runway incursions involving 792 people on board those airplanes. Most notably, in May 2007, there was a runway incursion that occurred about 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 92 people, nearly collided in the intersection of runways 1 left (L) and 28 right (R). The tower controller forgot about Skywest when he cleared Republic for takeoff from an intersecting runway. Skywest came to a stop in the runway intersection and Republic lifted off and overflew Skywest by about 35 feet. Another incident occurred on July 11, 2007 at about 2:30 in the afternoon when a United Airbus A320 and a Delta Airlines Boeing 757 almost collided in the intersection of runway 9L and taxiway M at the Fort Lauderdale-Hollywood Airport, Florida. Delta was inbound for landing on runway 9L and United 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 Delta to go around. Although Delta touched down briefly, the crew was able to initiate a go-around and a collision was averted by less than 100 feet. Alert controllers and quick actions by the crews saved 307 people from a catastrophic accident.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 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 one single solution that will eliminate the problem of runway incursions. In July 2000, the Safety Board made recommendations to attack the issue in a variety of ways, including procedural changes, educational efforts, and technology improvements that provide a direct warning to the flight crews. This direct warning is crucial because it gives 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 are not adequate to prevent serious runway collisions, because too much time is lost routing valuable information through air traffic control. 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-initiated actions. An example of this was the San Francisco accident previously mentioned. 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.

Since 2005, the FAA has been conducting field tests of runway status lights at the Dallas/Fort Worth International Airport and San Diego International Airport since 2006. Red lights activated on the runway when an aircraft was taking off, landing, or crossing an active runway giving information directly to the pilots. Initial test results have been promising and the FAA is extending those tests to more complex airports such as Boston, Chicago O'Hare and Los Angeles International Airports The FAA is also testing final approach runway occupancy signals that alert pilots on final approach when the runway is occupied. It is also reviewing a

flight deck–based direct warning system. The Safety Board has provided favorable assessments of that technology.

Although the Board has been encouraged by the recent progress, it has been over seven years since these recommendations were issued. Yet it has been only in the past few years that the FAA has started evaluating technologies that provide direct warnings to the cockpit. Further, while these technologies may offer added safety, they are many years away from possible national implementation.

Additionally, since 2007, the FAA has stated that ADS-B (Automatic Dependent Surveillance – Broadcast) would mitigate 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 very 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. However, in order 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 in order to provide traffic separation. ADS-B In would permit users to use additional services such as obtaining datalinked 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 are not 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 Airspace System (NAS) operations." The NPRM further states that operators may equip their aircraft with ADS-B In "if they so choose."

The Safety Board is disappointed that this NPRM does not require ADS-B In which would be instrumental in providing additional safety information that would prevent incidents such as runway incursions. All of the runway incursion prevention technology being developed and tested by the FAA that would give a direct warning to the cockpit, such as runway status lights and the final approach occupancy signal, and ADS-B are years from being installed and they will not be installed at all airports with passenger service. The Safety Board believes that 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.

Actions Remaining

The FAA has made progress with lighting and improved signage at airports, but some basic 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 the previous runway has been crossed. Both of those recommendations are contained in the Manual on the Prevention of

Runway Incursions prepared by the International Civil Aviation Authority and is the guidance material used internationally for implementing national or local runway safety programs. Yet, the FAA has not implemented either procedural change. If those procedures had been implemented, the Comair accident in Lexington, Kentucky may 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, and recommended procedural changes will increase the level of safety during ground operations and should be expeditiously incorporated in the FAA's development planning.

Runway Excursions

Recent accidents, such as the December 2005 Southwest Airlines runway excursion at Midway Airport, indicated that the Safety Board should broaden its runway safety efforts to include runway excursions. Over the last 10 years, 73 accidents involving turbine-engined aircraft were reported resulting in 15 fatalities. Runway excursions only need to be reported to the Safety Board if there was substantial damage to the airplane, serious injury to a person, or if an emergency evacuation was required, so there are most likely additional excursions during this period that we are not aware of.

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 establish mandatory actions by aircraft operators and meet the intent of the recommendation; however, it subsequently decided to issue only 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.

In the U.S. during the last two years, there were five runway excursion accidents involving turbine-powered aircraft, resulting in one fatality. However, these events involved 247 other crewmembers, passengers, or people on the ground who happened to be in the area when the excursions occurred. The NAS cannot continue to depend on the last minute alertness of pilots and controllers, whose actions have helped avoid several runway incidents that could have been catastrophic. We need the extra protection of additional procedures and advanced technology to compensate for human mistakes.

Action Remaining

- Require operators to conduct arrival landing distance assessments before every landing based on existing performance data, actual conditions, and incorporating a minimum safety margin of fifteen percent.

Reduce Dangers to Aircraft Flying in Icing Conditions

The 1994, in-flight icing encounter and subsequent loss of control and crash of a commuter airliner in Roselawn, Indiana, which claimed 68 lives, prompted the Safety Board to examine the issue of airframe structural icing and conclude that the icing certification process has been inadequate because the process has not required manufacturers to demonstrate the airplane's flight handling and stall characteristics under a realistic range of adverse ice accretion/flight-handling conditions. The FAA did not have a systematic and proactive approach to the certification and operational issues of turbine-engine-driven transport-category airplane icing.

The consequences of operating an airplane in icing conditions without first having thoroughly demonstrated adequate handling/controllability characteristics in those conditions are sufficiently severe that they warrant a thorough certification test program, including application of revised standards to airplanes currently certificated for flight in icing conditions.

As a result of the Roselawn accident, the Safety Board called on the FAA to revise the icing criteria and icing testing requirements necessary for an airplane design to be approved within the United States, and the operational requirements that specify under what icing conditions it is permissible to operate an aircraft.

On July 25, 2007, the FAA issued a final rule titled "Airplane Performance and Handling Qualities in Icing Conditions," which became effective October 9, 2007. On September 10, 2007, the FAA issued advisory circular (AC) 25-25, "Performance and Handling Characteristics in the Icing Conditions Specified in Part 25, Appendix C." The AC provides detailed guidance on acceptable means of compliance with the new requirements. These actions were responsive to some aspects of the recommendations from the Roselawn accident. The FAA still needs to take the following actions:

- Revise Part 121, applicable to airplanes with takeoff weights less than 60,000 pounds, to address when to activate the ice protection system and when the flight crew should exit icing conditions.

- Develop Part 25 rules that include requirements to demonstrate that an airplane can safely operate in certain super-cooled large drop (SLD) conditions for an unrestricted time or can detect SLD and enable the flight crew to exit icing conditions; and

- Development of similar Part 23 rules after completing the Part 25 rulemaking.

The ARAC is still working on regulations concerning SLD and mixed-phase icing for both Part 25 and Part 23. The Safety Board has learned of FAA activities in response to recommendations concerning icing issued as a result of the February 16, 2005, crash of a Cessna Citation 560 during approach to landing in icing conditions at Pueblo, Colorado. This accident occurred in SLD conditions, and FAA and Cessna flight testing in response to the investigation used procedures and tests suggested by the ARAC to analyze airplane handling characteristics in SLD conditions. This suggests that the FAA may be near developing and issuing regulations concerning SLD. However, the FAA has not provided any projected dates for development and issuance of an NPRM and final rule. The pace of the FAA's activities in response to these recommendations remains unacceptably slow, despite recent encouraging action.

Actions Remaining

- Complete efforts to revise icing certification criteria, testing requirements, and restrictions on operations in icing conditions; and

- Evaluate all aircraft certified for flight in icing conditions using the new criteria and standards.

Eliminate Flammable Fuel/Air Vapors in Fuel Tanks on Transport-category Aircraft

Center wing fuel tank explosions have resulted in 346 fatalities. Operating transport-category airplanes with flammable fuel/air vapors in fuel tanks presents an avoidable risk of explosion. A fuel tank design and certification philosophy that relies solely on the elimination of all ignition sources, while accepting the existence of fuel tank flammability, is fundamentally flawed because experience has demonstrated that all possible ignition sources cannot be predicted and reliably eliminated. As a result of the TWA flight 800 accident that occurred in July 1996, the Safety Board asked the FAA to develop and implement both long-term and short-term solutions to the fuel tank issue. Previously, fuel tank explosions occurred somewhere in the world approximately once every 52 months, but two explosions in the last 3 years have changed the average for the worse. In the 10 years since the TWA flight 800 accident, there have been three additional fuel tank explosions, illustrating the continuing need for reforms in this area.

In response to the long-term solution—preventing flammable fuel/air vapors in fuel tanks—the FAA commissioned the ARAC to evaluate design modifications, such as inerting, that would satisfy this recommendation. In its July 1998 final report, the ARAC concluded that inerting would achieve this goal, but at a cost of over $20 billion. The ARAC also concluded that inerting systems would be very difficult to retrofit into existing airplanes and recommended that the FAA continue to investigate a more cost-effective approach to reducing explosive vapors. A 2001 followup study also concluded that the benefit of inerting could not be reasonably balanced by its cost. In May 2002, in contrast to the ARAC's reports, the FAA developed a prototype inerting system that required no moving parts, weighed less than 200 pounds, and could be retrofitted into existing airplanes at a fraction of the industry-estimated cost: the cost of this prototype system was only $100,000. The system has been flight tested by the FAA, NASA, Boeing, and Airbus, and the results indicate that fuel tank inerting is both practical and effective.

Although 11 years have passed since this recommendation was issued, the FAA's recent actions indicate positive movement, particularly in the development of a practical fuel tank inerting system. Boeing is making a flammability reduction system a basic feature in the design of the new 787 Dreamliner aircraft. Boeing has also designed a flammability reduction system and delivered these systems on production models of the 747 and 737 NG. Although the first B-737 equipped with a flammability reduction system was delivered on December 8, 2005, to Southwest Airlines, this system is an option, and many 737's currently being delivered are not equipped with this system. The next design to receive a flammability reduction system will be the B-777.

The FAA has developed a final rule to do some, but not all, of what the Safety Board has recommended. The proposed final rule is somewhat controversial and received close scrutiny from OST and OMB. The latest word is that OMB's review of the final rule will be completed by May 2008.

Action Remaining

- Complete rulemaking efforts to preclude the operation of transport-category airplanes with flammable fuel/air vapors in the fuel tank on all aircraft

Cockpit and Flight Data Recorders/Require Cockpit Video Recorders

Flight recorders have proven themselves invaluable in providing crucial information during accident and incident investigations. Last month, the FAA issued a final rule, titled "Revisions to Cockpit Voice Recorder and Digital flight Data Recorder Regulations." The Board was pleased to see that all larger passenger airliners will be required to carry 2-hour cockpit voice recorders (CVRs), greatly expanding the current 30-minute requirement. But the rule stopped short of what the Board has recommended by not requiring that older 30-minute CVRs be replaced on existing commuter and corporate jet aircraft. The FAA did require that newly manufactured commuter and corporate jets come equipped with 2-hour CVRs.

The Board had asked that airliners be retrofitted with cockpit voice recorders that had an emergency 10-minute power supply in case of an electrical interruption, such as occurred on ValuJet flight 592 in 1996 and Swiss Air flight 111 in 1999. The FAA rule will require that newly manufactured airliners be so equipped, but declined to require retrofits again as recommended by the Board. The Board also called for certain configurations of microphones and dedicated channels in airliner cockpits, and for dual combination recorders, one in the front and one in the back of the plane, however those items are not addressed in the new rule. The FAA also did not address the Board's recommendations concerning cockpit video recorders.

The new rule calls for increased flight control position sampling rates on flight recorders, which should improve the quality of data available to investigators. Improvements in flight recorders has been on the Board's list of Most Wanted Safety Improvements since 1999.

Reduce Accidents and Incidents Caused by Human Fatigue

The Safety Board has long been concerned about the issue of operator fatigue in transportation and has stressed its concerns in investigation reports issued throughout the 1970s and 1980s. 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 Board's Most Wanted list in 1990, and the issue of fatigue has remained on the Most Wanted list since then. The Safety Board's 1999 safety study of DOT efforts to address operator fatigue continued to show that this problem was widespread. Operating a vehicle without the operator's having adequate rest, in any mode of transportation, presents an unnecessary risk to the traveling public. The laws, rules, and regulations governing this aspect of transportation safety are archaic in many cases and are not adequate to address the problem.

Flight Crews

In December 1995, the FAA issued an NPRM to update the flight and duty regulations for airline pilots; however, in the intervening 12 years, the regulations have not been revised. The FAA has attempted on three occasions to reach consensus with the industry on a proposed rule but has not succeeded. FAA's ARAC upon reviewing Part 135 regulations has recently made some recommendations to simplify and improve the duty time regulations for flight crews covered by Part 135. The FAA recently advised the Safety Board that it is developing an NPRM that incorporates the ARAC's recommendations; the NPRM will include a fatigue risk management system that provides an alternative to prescriptive limitations.

The Safety Board recommended 14 years ago that the FAA close a loophole in the regulations regarding hours of duty for flight crews that allowed crews to be on duty flying for much longer periods of time than allowed under Part 121 or part 135. The 1995 NPRM proposed revisions that were responsive, however, those revisions resulted in considerable controversy and the FAA withdrew the NPRM. The Safety Board's concern that flight crew fatigue is a significant aviation safety issue continues today, yet little or no action has been taken by the FAA and they have not indicated any firm plans to take the recommended action.

Maintenance Personnel

In 1999, the FAA issued a report entitled *Study of Fatigue Factors Affecting Human Performance in Aviation Maintenance*. The FAA completed the first phase of the expanded study and issued a report in April 2000 entitled *Evaluation of Aviation Maintenance Working Environments, Fatigue, and Maintenance Errors/Accidents*. The expanded study looked at multiple and combined environmental factors of temperature, noise, light, vibration, and sleep, which are known to accelerate fatigue onset, as well as the effects of lifestyle habits on fatigue and human performance. The study was designed to collect data in the aviation maintenance work environment on known factors that affect human fatigue and performance. The data were intended for use in predicting situations that are conducive to fatigue, accidents, incidents and errors.

The FAA's findings suggest that fatigue is an issue in this work force. Data from "mini-logger monitors" that recorded data from the selected parameters of light, noise levels, and temperature; activity monitors that monitored physical activity, sleep, and sleep quality; and the answers to background questions that employees were asked clearly indicate that sleep durations are inadequate to prevent fatigue. For most aviation maintenance technician specialties, 30-40 percent of respondents reported sleep durations of less than 6 hours, and 25 percent of respondents reported feeling fatigued or exhausted.

The DOT stated that the findings of its studies indicate that the extreme complexity of the issue of maintenance crew fatigue and duty time do not present appropriate material for regulatory activity, and education and training in fatigue management are the most appropriate actions for the FAA to sponsor and foster. The FAA has consequently conducted education and training activities on fatigue management for aircraft maintenance personnel. The Safety Board reviewed Advisory Circular (AC) 120-72, "*Maintenance Resource Management (MRM) Training,*" which seems to be the primary focus of the FAA's education and training initiatives related to fatigue among aviation maintenance crews. We found little in AC 120-72 that provides guidance on human fatigue in maintenance crews other than generalized warnings that attention to fatigue is important and should be considered in MRM Training. AC 120-72 contains little guidance as to how an employer should design a program to ensure that maintenance crews are not fatigued. In addition, the web site referenced in the reports to Congress (http://hfskyway.faa.gov) is in fact nothing more than a single page with a very general description of the FAA's aviation maintenance human factors research program. It contains no useful information to educate and train someone in the aviation community on the issues of fatigue management in aircraft maintenance personnel.

The Safety Board disagrees that regulating hours of service for aviation maintenance crews is not appropriate. In addition, the Board's reviews of the FAA's education activities related to reducing fatigue among maintenance crews shows them to be limited and of questionable value

Air Traffic Controllers

In 2007, the Safety Board issued recommendations to the FAA and the National Air Traffic Controllers Association regarding air traffic controller fatigue. The Safety Board had investigated four incidents that provided clear and compelling evidence that controllers are sometimes operating in a state of fatigue because of their work schedules and poorly managed utilization of rest periods between shifts and that fatigue has contributed to controller errors. Controller fatigue decreases aviation safety. FAA policies and controllers' off-duty habits can contribute to the problem. Although the FAA and other organizations have conducted a great deal of research on this issue resulting in an improved scientific understanding of the causes of fatigue, its effects on controller performance, and strategies for reducing controller fatigue, the FAA has been slow to change controller-scheduling practices.

The FAA has convened a working group to develop shift rotation and scheduling guidelines, and it is our understanding that last month the National Air Traffic Controllers Association (NATCA) provided information on fatigue and scheduling practices. The FAA

plans to develop and implement a fatigue awareness and countermeasures training program to be used by all FAA Air Traffic Organization operational service units. NATCA has informed the FAA and the Safety Board of its eagerness to participate in this group, and indicated its commitment to developing workable scheduling practices that minimize controller impairment due to fatigue.

Action Remaining

- Issue regulations that establish scientifically based duty time limitations for air carrier maintenance personnel and flightcrews
- Develop a fatigue awareness and countermeasures training program for controllers and those who schedule them for duty.

Maintenance Oversight

In the course of Safety Board investigations – particularly those involving air carrier operations – Board investigators routinely examine issues related to regulatory oversight; policy and procedures; certification; and inspection and enforcement. Safety Board investigation reports typically include a characterization of regulatory policies and oversight as they relate to the circumstances of the accident or incident investigated. In some cases, deficiencies are identified in FAA regulation or oversight. In other cases, Safety Board investigations have identified local deficiencies in the actions of personnel responsible for enacting FAA policy. In those cases when the identified deficiencies were determined to have contributed to the circumstances in an accident or incident, the Safety Board has cited the FAA or FAA personnel as part of the probable cause of the accident. Therefore, a summary of the Safety Board's historic assessment of FAA oversight requires a review of the Board's findings of probable cause as well as the discussions of FAA policy and effectiveness in the text of Board reports.

The Safety Board records its findings of probable cause for aviation investigations in its aviation accident and incident database. Database records include the Board's probable cause statement in its original narrative form as well as a categorically coding of the causal findings. Attached is a summary of records from the Safety Board's aviation accident database in which the FAA or FAA personnel have been cited with regard to oversight functions. Included in the summary are cases from 1983 to the present in which the Board cited FAA oversight or functions associated with oversight of operators and aircraft maintenance. Excluded form this attachment are cases in which FAA functions not directly related to oversight, such as air traffic services.

That concludes my testimony and I would be happy to answer any questions you may have.