National Transportation Safety Board

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Testimony of Mark V. Rosenker
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National Transportation Safety Board
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Subcommittee on Aviation
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Good morning 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 regarding the agency's Most Wanted list of Safety Improvements. It is my privilege to represent an agency that is dedicated to the safety of the traveling public.

As you know, the Safety Board is an independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation. Since its inception in 1967, the Safety Board has investigated about 130,000 aviation accidents. To date, 4,704 recommendations have been issued to the Federal Aviation Administration (FAA) with an overall acceptance rate of 81.6%. Of those 4,704 recommendations, 2,802 have been closed acceptable action. Presently there are 376 open recommendations to the FAA; 97 of those are classified open unacceptable response. FAA's initial response time to Board-issued safety recommendations over the last 5 years typically takes 97 days.

The Most Wanted list of Safety Recommendations was initiated in 1990 as an additional way for the Safety Board to focus attention on a group of safety recommendations selected for intensive follow-up. The recommendations selected for the Most Wanted list would impact or enhance the safety of the national transportation system, receive a high level of public visibility and interest, and benefit from this special form of encouragement and heightened attention.

The 2007 list of Most Wanted safety improvements issued to the FAA currently includes:

- Reduce dangers to aircraft flying in icing conditions;
- Eliminate flammable fuel/air vapors in fuel tanks on transport category aircraft;
- Stop runway incursions/ground collisions of aircraft;
- Improve audio and data recorders/require video recorders;
- Reduce accidents and incidents caused by human fatigue; and
- Improve crew resource management.

I would now like to discuss in detail the objective, summary and status of each of the Safety Board's aviation recommendations currently on our Most Wanted list.

Reduce Dangers to Aircraft Flying in Icing Conditions

Objectives

- Use current research on freezing rain and large water droplets to revise the way aircraft are designed and approved for flight in icing conditions;

- Conduct additional research with the National Air and Space Administration (NASA) to identify realistic ice accumulations and incorporate new information into aircraft certification and pilot training requirements.

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.

Summary

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. Ten years ago, this work was referred to an Aviation Rulemaking Advisory Committee (ARAC) that provides input to the FAA on new regulations. The ARAC has recommended to the FAA changes to the design requirements for new airplanes to evaluate performance and handling characteristics in icing conditions. In March 2002, 6 years after it started this work, the ARAC approved a concept to revise the icing criteria in the design requirements for new airplanes.

Currently, there are five rulemaking activities in progress or needed concerning icing:

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

- A revision to Part 25 that addresses when to activate the ice protection system (on April 26, 2007, the FAA issued this NPRM);

- A revision to Part 25 for evaluating airplane performance and handling characteristics in the icing conditions of Appendix C. The NPRM and Advisory Circular (AC) were published in the *Federal Register* on November 4, 2005;

- Development of 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 mixed-phase icing rulemaking; and

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

Overall, the 5 projects the FAA has in progress are responsive to this recommendation, but the interminable delays are not acceptable. The planned date of June 2007 for issuance of the final rule and AC for Part 25 requirements related to performance and handling in icing conditions is welcome news of which the Board was not previously aware. More than 10 years after this recommendation was issued, the FAA finally received recommendations from the harmonization working group, and to date, the required regulatory analysis has not been completed, nor has an NPRM been prepared. In January 2003, the ARAC proposed revisions to Part 121 for activation of the ice protection system and exiting icing conditions. The FAA did not act on these ARAC recommendations due to other higher priority rulemaking projects, and their current response to Congress does not discuss any planned action in this regard. The FAA has taken no action on Part 121 regulations regarding when to exit icing conditions, and when to activate de-icing and anti-icing systems since 2000. The Safety Board continues to investigate icing accidents and incidents where activation of these systems and exiting the icing conditions were factors in the accident. The NPRM in 2005 was positive, but progress has been unacceptably slow.

Additionally, as a result of the Safety Board's investigation of the in-flight encounter with icing and subsequent uncontrolled collision with terrain of Comair flight 3272, an Embraer 120RT, near Monroe, Michigan, on January 9, 1997, in which all 29 persons onboard the airplane were killed, the Safety Board asked the FAA to review the icing certification of all turbopropeller-driven airplanes currently certificated for operation in icing conditions and to perform additional testing. On August 16, 2006, the FAA issued AC 20-73A, "Aircraft Ice Protection" which includes certification guidance relative to the effects and criticality of deicing boot intercycle and residual ice accumulations, and ice accumulations on unprotected surfaces aft of protected surfaces. The FAA and NASA conducted testing and research on these issues in 1999 and 2000, and stated to the Safety Board in September 2001 that additional testing and research were necessary to develop the needed guidance, and that it was developing and pursuing this research. In an October 26, 2005, letter, the FAA indicated that the revisions to the AC were based on the testing and research performed in 1999 and 2000. As part of its evaluation of the revised AC, the Safety Board has asked the FAA whether additional research and testing were conducted after the FAA's September 2001 letter.

The icing certification regulations and advisory material developed by the FAA are sufficiently developed to determine whether additional action is required for any turbo-propeller-driven airplanes currently certificated and in service. The FAA has stated that no unsafe

conditions exist that warrant actions beyond those that have already been completed or are in the process of being completed. The Board is concerned that the FAA has reached this conclusion based on a lack of accidents or serious incidents. During the 1990s, a number of accidents occurred involving airplanes that had passed the certification standards and for which the FAA believed there was no unsafe condition requiring action. Before another accident or serious incident occurs, the FAA should evaluate all existing turbo-propeller driven airplanes in service using the new information available, such as critical ice shapes and stall warning margins in icing conditions.

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

Objective

- Implement design changes to eliminate the generation of flammable fuel/air vapors in all 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 800 accident that occurred in July 1996, the Safety Board asked the FAA to address 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-800 accident, there have been three additional fuel tank explosions, illustrating the continuing need for reforms in this area.

Summary

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.

On December 9, 2003, the FAA published a Notice of Proposed Special Conditions (NPSC) for this system in Boeing 747s. A similar NPSC for Boeing 737s was published on June 15, 2005. While this system reduces flammability, rather than inerting the vapors, the reduction in flammability is substantial, and the Safety Board commends the FAA for developing and demonstrating this system. This is a major advancement in air safety. The Board is concerned that the FAA currently intends to use this system only for some, not all, fuel tanks on an aircraft, and not on cargo aircraft. This is a reduction in scope from what the Board recommended.

Although 10 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. The first B-737 equipped with a flammability reduction system was delivered on December 8, 2005, to Southwest Airlines. The next design to receive a flammability reduction system will be the B-777. The European Aviation Safety Agency (EASA) will certify the new Airbus A380 transport aircraft without a fuel tank inerting system, instead relying on minimizing ignition sources and maintaining the fuel tank temperature below the ignition point. Ironically, Airbus has been investigating the use of inerting systems for cargo compartments, rather than staying with the increasing cost of Halon fire protection, implying that Airbus sees the value of inerting systems. Both the Safety Board and the FAA submitted comments opposing the Airbus approach.

A notice of proposed rulemaking (NPRM) was published in the Federal Register on November 23, 2005 to require the installation of the flammability reduction system in commercial aircraft. The NPRM closed in May 2006, and we hope the FAA is drafting the final rule. In testimony before Congress on September 20, 2006, the FAA stated that a rule concerning flammability reduction means, although not specifically inerting, would be issued by the end of 2007.

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

Stop Runway Incursions/Ground Collisions of Aircraft

Objective

- Give immediate warnings of probable collisions/incursions directly to flight crews in the cockpit

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 U.S. runway incursion accident 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.

On January 5, 2007, a Frontier Airlines A319 passenger jet, and a Key Lime Air Fairchild Metroliner turbo-prop were involved in a near collision at Denver International Airport. The pilot of the Key Lime Metroliner inadvertently entered the runway while the Frontier A319 was on approach to the same runway. As the Frontier flight descended out of the clouds, the pilot noticed the Metroliner on the runway and executed a missed approach. The airplanes missed colliding by about 50 feet.

The runway incursion issue has been on the Safety Board's Most Wanted list since its inception in 1990. In the late 1980s, an inordinate number of runway incursions/ground collision accidents resulted in substantial loss of life, and the Board issued numerous safety recommendations addressing the issue. The FAA has since taken action to inform controllers of potential runway incursions, improve airport markings, and install the Airport Movement Area Safety System (AMASS) and Airport Surface Detection Equipment Model X (ASDE-X). These systems are an improvement, but are not sufficient as designed to prevent all runway incursions. The runway incursion rate in the United States has not appreciably changed over the past 4 years, and stands at about 5.2 runway incursions per 1,000,000 tower operations, despite these improvements.

Information needs to be provided directly to the flight crews as expeditiously as possible to prevent runway incursions. The issue is one of reaction time. Safety Board investigations have found that AMASS is not adequate to prevent serious runway collisions, because too much time is lost routing valuable information through air traffic control. After an AMASS 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 that sometimes bordered on heroics or just plain luck.

Until there is a system in place to positively control ground movements of all aircraft with direct warning to pilots, the potential for this type of disaster will continue to be high.

Summary

In FY 2005, the FAA conducted a study to determine whether a direct warning capability to flight crews could be developed. A solution set with three technology levels was proposed and simulations were conducted in May 2005 to assess the proposal's effectiveness. Thirty-six commercial and general aviation pilots participated in simulations of 15 different incursion scenarios. The FAA found that a significant reduction of runway incursion risk was possible. The same year, the FAA initiated field tests of a Runway Status Lights system at the Dallas/Fort Worth International Airport. Initial test results have been promising and the FAA is performing additional testing to determine the extent to which this technology can be applied nationwide. In FY 2006, MITRE/CAASD, in conjunction with the FAA, was scheduled to coordinate the findings from the simulations with airports, pilots, representatives of other aviation user groups, and experts in runway safety technology. The FAA plans to explore alternative operational and system solutions to address shortcomings with the systems evaluated in the simulation study. The FAA also plans an analysis of a flight deck–based direct warning system.

The Safety Board has been favorably impressed by demonstrations of the technologies recently developed and tested. Although the Board has been encouraged by the progress, it has been 7 years since this recommendation was issued yet it has been only in the past 2 years that the FAA has started evaluating technologies that are responsive to the recommendation. Further, while these technologies may offer added safety by providing information directly to cockpit crews, they are many years away from possible national implementation.

Action Remaining

- Implement a safety system for ground movement that will ensure the safe movement of airplanes on the ground and provides direct warning capability to the flight crews

Since 1990, the FAA has made progress with lighting and signage at airports, but some basic improvements in air traffic control procedures are needed. For example, in 2000, the Board recommended that all runway crossings be authorized only by specific air traffic control clearance. Although this specific recommendation is not on our Most Wanted list, it bears mention because the Air Line Pilots Association stated they wanted this provision at the Board's recent Runway Incursion Forum; the Transportation Safety Board of Canada testified that they require it, and we have recommended it. Yet, the FAA has not implemented the recommendation.

Improve Audio and Data Recorders/Require Video Recorders

Objectives

- Require cockpit voice recorders to retain at least 2 hours of audio;

- Require back-up power sources so cockpit voice recorders collect an extra 10 minutes of data when an aircraft's main power fails;

- Install video recorders in cockpits to give investigators more information to solve complex accidents;

- Install dual combination recorders; and

- Expand parameters recorded on Boeing 737 airplanes.

CVR/FDR Parameters and Operating Features

The lack of valuable cockpit information during the investigations of several aircraft accidents, including the crash of USAir flight 427, a Boeing 737 at Aliquippa, Pennsylvania, on September 8, 1994; the crash of USAir flight 105, a Boeing 737, on September 8, 1989, in Kansas City, Missouri; the crash of ValuJet flight 592 in the Florida Everglades shortly after takeoff from Miami International Airport on May 11, 1996; the SilkAir flight 185 crash on December 19, 1997; the crash of Swissair flight 111 on September 2, 1998; and the crash of EgyptAir flight 990 on October 31, 1999, prompted the Safety Board to issue several recommendations addressing specific improvements to CVRs and FDRs that are essential to accident investigation data collection and analysis.

On February 28, 2005, the FAA published an NPRM, "Revisions to CVRs and Digital FDR Rules." The NPRM comment period closed June 28, 2005. A year and a half after the comment period closed, the FAA is drafting a final rule that is expected to be published in July 2007. The NPRM proposed to increase the duration of CVR and FDR recordings, increase the sampling rate of certain FDR parameters, require physical separation of the FDR and CVR, require improved reliability of the CVR and FDR power source, and require the recording of data-link-communications. On April 29, 2005, the Safety Board provided comments to the docket for this NPRM. The Board stated that the NPRM contains positive actions that are responsive to several of its recommendations.

Two-Hour CVR

The Safety Board is pleased with the FAA's NPRM, in that it proposes to require that all CVRs record a minimum of 2 hours of audio information. The Board also endorses the timeline in the NPRM that requires all newly manufactured aircraft to be equipped with a 2-hour CVR within 2 years of the rule date, and a 4-year phase-in to retrofit the existing fleet.

Recorder Independent Power Supply (RIPS)

The NPRM proposes a requirement for the installation of a 10-minute independent power source for the CVR that will engage when electrical power to the CVR is lost. However, this requirement will apply only to newly manufactured aircraft. The Board believes that a 4-year retrofit similar to that being considered for the 30-minute-to-2-hour CVR conversion should also be applied to RIPS.

Separate Power for CVR and FDR

The NPRM is consistent with the Board's recommendation that the FDR and CVR be on separate generator busses with the highest reliable power so that any single electrical failure does not disable both. However, the proposed change applies only to newly manufactured aircraft, even though the recommendation was aimed at existing aircraft as well.

Several other Board recommendations, however, were not addressed by the proposed rulemaking. Among these rejected recommendations are several on the Most Wanted list, including the use of forward- and aft-mounted combination voice and data recorders.

Dual Combined FDR/CVR Recorders

The Safety Board takes exception to the FAA's NPRM, which states that, "After a careful analysis of the benefits of having two systems, the FAA is unable to justify the excessive cost that would be incurred in the installation of two complete systems." Although Safety Recommendations A-99-17 and A-00-31 specify two combined (CVR/FDR) recording systems, the intent of these recommendations was to have two redundant recorders—not to require two flight data acquisition units and two sets of cockpit microphones. The Board believes that the FAA's cost estimates are unnecessarily inflated. The Board also disagrees with the NPRM that "in the case of an accident so catastrophic that neither recorder survives [meaning the currently required, aft-mounted recorders], a second set of recorders located in the front of the aircraft would probably not survive either." In fact, there are a number of catastrophic accidents that could have resulted in a forward-mounted recorder surviving and the aft-mounted recorder being lost to fire or impact. Embraer is currently delivering its model EMB-170/190 to U.S. operators with forward-and-aft-mounted combined CVR/FDRs, and Boeing is also using a similar design in its new 787 aircraft.

The NPRM also does not address the Board's image recorder recommendations.

Video Recording - Small Aircraft

An image recording system would provide critical information to investigators about the actions inside the cockpit immediately before and during an accident on aircraft not required to have a CVR or FDR. Such systems, estimated to cost less than $8,000 installed, typically consist of a camera and microphone located in the cockpit to continuously record cockpit instrumentation, the outside viewing area, engine sounds, radio communications, and ambient cockpit sounds. As with conventional CVRs and FDRs, data from such a system is stored in a crash-protected unit to ensure survivability. Public Law 106-424, signed November 1, 2000, provides for withholding from public disclosure voice and video recorder information for all modes of transportation.

Video Recording - Large Aircraft

The Safety Board asked for the installation of cockpit image recorders in large transport aircraft to provide information that would supplement existing CVR and FDR data in accident

investigations. This kind of additional information would have been extremely valuable in a number of important accident investigations, including ValuJet 592 near Miami, Silk Air 185 in Indonesia, Swissair 111 near Peggy's Cove, Nova Scotia, and EgyptAir 990. The RTCA Future Flight Data Collection Committee (FFDCC) considered the issue of video recording and concluded that this methodology would provide useful information to accident investigation, and that it was technologically feasible. The Committee did note concerns about the protection from disclosure outside of accident investigation, particularly for international flights. The Board's last reauthorization extended the protections that have long been in place for CVRs to image recorders.

Boeing 737 FDR Recommendations

The FAA's Febuary 2005 NPRM also did not address the Board's recommendations related to additional flight control parameters for Boeing 737 airplanes. However, on September 5, 2006, the FAA published a supplemental NPRM (SNPRM), "Revisions to Digital FDR Regulations for Boeing 737 Airplanes and for Part 125 Operators." The SNPRM seeks additional data and comments on the cost and feasibility of proposed changes to the parameters required to be recorded for Boeing 737 aircraft, and announces several decisions made by the FAA with regard to data that will be required. The Safety Board submitted comments on this SNPRM on October 18, 2006. The SNPRM announced that the FAA will not require the recordation of each rudder pedal force (4 sensors total), but rather will require a single rudder pedal force sensor located "midstream" in the rudder control system. The Safety Board has previously commented that the rudder pedal force exerted by each crew member is critical to loss of control problems on the B-737, and use of a single "midstream" rudder sensor cannot identify whether flightcrew control inputs are in opposition to each other or some other system anomaly forward of the sensor was responsible for the problem.

Actions Remaining

- Require the retrofit of existing aircraft CVR systems with RIPS;
- Require that for existing aircraft, the FDR and CVR be on separate generator busses with the highest reliable power so that any single electrical failure does not disable both;
- Require the installation of video recording systems in small and large aircraft; and
- Require the recording of additional needed FDR data for Boeing 737s.

As I mentioned earlier, the FAA completed the TSO on video recorders (a recommendation previously on the Most Wanted list) in 2006, but they are not going to encourage installation of video recorders; they will permit voluntary installation.

Reduce Accidents and Incidents Caused by Human Fatigue

Objective

- Set working hour limits for flight crews and aviation mechanics based on fatigue research, circadian rhythms, and sleep and rest requirements

Summary

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 (aviation limits were addressed in the Civil Aeronautics Act of 1938 and the Federal Aviation Act of 1958) 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 11 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 13 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 limiting fatigue among maintenance crews shows them to be limited and of questionable value.

Action Remaining

- Issue regulations that establish scientifically based duty time limitations for air carrier maintenance personnel and flightcrews

Improve Crew Resource Management

Objective

- Require commuter and on-demand air taxi flight crews to receive crew resource management training

Summary

In April 2004, the FAA stated that the ARAC was reviewing Part 135 in many respects, including requiring CRM training for Part 135 operators. At that time, the FAA indicated that an NPRM for the Part 135 revisions, including requiring CRM training, was scheduled to be issued in fiscal year 2005. In June 2006, the FAA briefed Safety Board staff on its activities to require CRM training for Part 135 on-demand flight crews. At that time, the FAA repeated that these requirements would be included as part of the comprehensive revisions to Part 135, and that an NPRM with the Part 135 revisions was scheduled to be issued by mid-2007.

To date, the NPRM has not been issued and the Board is concerned that the CRM revisions will be part of a comprehensive revision to part 135 that will be slow moving.

Action Remaining

- Implement a requirement for Part 135 on-demand operators to establish and implement a CRM training program in accordance with the CRM training requirements in part 121.

Conclusion

Let me say that the issues on our Most Wanted list tend to be those that are among the most complex and difficult to implement. While the FAA has made some progress, I am disappointed that there are so many recommendations on this list that are in an unacceptable status.

In closing, I would, however, like to mention those activities the FAA has responded to over the past five years:

With regard to the recommendations issued from the Air Midwest accident in Charlotte, North Carolina, the FAA substantially revised and improved weight and balance guidance and procedures; in the Alaska Airlines accident, the lubrication procedure for the jackscrew assembly on DC-9/MD-80/90/B-717 was substantially revised and improved and this improved procedure is being required by the FAA; and in American 587, revised guidance to pilots to avoid full deflection, alternate rudder inputs and improve adverse attitude training has been issued. The Capstone project in Alaska, which is the basis for ADS-B, has been substantially completed, and has shown very good results. The requirement for TCAS has been extended to cargo aircraft; a TSO for a video recorder system was developed and issued; guidance to cabin and flight crews was issued on the need to aggressively fight in-flight fires and that use of Halon fire extinguishers did not pose a serious safety risk; and FAA established an organization to review air traffic control incidents, which is independent of the Air Traffic Service.

This completes my statement and I will be happy to respond to any questions you may

have.