Testimony of
Jim Hall, Chairman
National Transportation Safety Board
before the
Committee on Appropriations
Subcommittee on Transportation and Related Agencies
House of Representatives
Regarding
Aviation Safety
March 22, 2000

as presented | for the record

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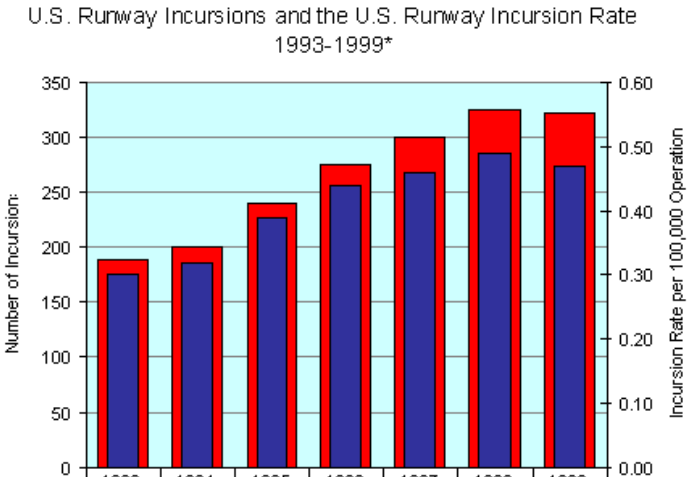
oral testimony as presented:

Good morning, Mr. Chairman and Members of the Committee. It is a pleasure to appear before you today regarding aviation safety.

My prepared testimony discussed three aviation issues - runway incursions, explosive mixtures in fuel tanks of transport category aircraft, and the need for updated flight recorders. I would like to focus my oral testimony on what is, in my opinion, one of the most significant safety issues facing us today.

According to FAA data, there were 322 runway incursions in the United States in 1999. This was a 71 percent increase over the number of runway incursions that occurred in 1993; the rate per 100,000 operations was 56 percent greater than that of 1993.



	1993	1994	1995	1996	1997	1998	1999
Number of Incursions	188	200	240	275	300	325	322
Rate Per 100,000 Operations	0.3	0.32	0.39	0.44	0.46	0.49	0.47

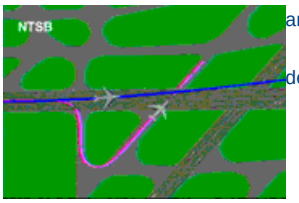
* Data Source: Federal Aviation Administration, U.S. Department of Transportation

In testimony presented before this subcommittee last March, I stated that, "We remain concerned that FAA efforts to address runway incursions through technological development falls short of what is needed." The Board's position, one year later, has not changed.

Although the Board is investigating a number of runway incidents, I briefly summarized just four of them in my prepared statement. Any one of them had the potential to be catastrophic to the over 1,000 people on the eight airplanes involved. Today, let me talk about one of them.

On April 1, 1999, a runway incursion occurred at O'Hare International Airport when a China Air Boeing 747 deviated from its assigned taxi route and inadvertently reentered a runway. As a Korean Air Boeing 747 approached rotation speed, the pilot saw the China Air airplane, abruptly rotated the aircraft, banking to the left as he did.

Safety Board staff have prepared an animation of this nighttime incident.



animation of runway incursion *(.AVI format, 2.7M)*

description

First, you'll see a top view showing the location of the two airplanes. The timeframe for this view is when the China Air 747 made a left turn back onto the active runway where it had landed just moments earlier.

There are two more views - one follows Korean Air as it takes off, and the other shows the point where the collision almost occurred.

Mr. Chairman, it was fortunate that the Korean Air aircraft was going fast enough for the pilot to lift off. It passed just 75 feet over the Air China aircraft and was only 3 seconds from a collision. There were 390 people on the two aircraft.

In its response to Safety Board recommendations dating back to 1991 that asked the FAA to expedite funding, development, and implementation of runway incursion efforts, the FAA indicated that one of their primary actions to reduce the runway incursion problem was the Airport Movement Area Safety System - or AMASS. It was not until recently that the FAA modified its position, indicating that AMASS, which will not be operational for at least another year, will not help prevent runway incursions, rather it will only help prevent runway collisions.

Indeed, the Board is concerned about AMASS' inability to perform as originally intended. Following the runway incursion at O'Hare International Airport last April, the Safety Board asked the FAA to demonstrate how AMASS would have performed had it been available.

Their simulation showed that the aural and visual alert parameters currently used might not have provided controllers and flight crews enough time to react and intervene to maintain safe separation. Therefore, the Board's staff is looking into the effectiveness of AMASS in preventing runway collisions under various conditions, and whether the FAA needs to conduct additional simulations of AMASS' performance to test its ability to meet the established standards.

We are also concerned about the potential for runway incursions at lower-activity airports, such as Providence. In March 1998, the FAA stated that it was continuing its research and development of low-cost Airport Surface Detection Equipment -- or ASDE -- alternatives.

However, two years after that response and nine years since the Board's recommendation, low-cost ASDE alternatives remain under development, and none have been commissioned for full operational use at any airport in the United States.

Mr. Chairman, the Board remains concerned that, despite nearly a decade of research and development and six different FAA Administrators, this issue is still not being adequately addressed. It is just a matter of time before we have a disastrous runway collision, if more is not done to address this issue soon.

After a series of runway incursions at some of our busiest airports, at a December 1999 conference held by the Department of Transportation on Aviation Safety and Security in the 21st Century, I urged Administrator Garvey to hold a summit to bring together all of those responsible for preventing runway incursions in an effort to reexamine the issue and find new solutions.

In your February 1, 2000, statement, Mr. Chairman, you also called for a National Summit Conference on Runway Incursions. I am gratified that the Administrator has responded to our call. I am confident that this Administrator, by applying the same direct leadership and focused attention on this issue as she did on the FAA's Y2K program, will be equally successful in implementing an effective runway incursion program.

That completes my testimony, and I will be happy to respond to any questions you may have.

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written testimony for the record:

Good morning, Chairman Wolf and members of the Committee. It is a pleasure to provide testimony today regarding aviation safety issues.

It came as no surprise to any of us when Federal Aviation Administration (FAA) Administrator Jane Garvey announced on March 7, 2000, that the commercial aviation industry ended the 1990s by recording its 8th consecutive year of air traffic growth, with significant increases in the general aviation fleet. According to the Administrator, by the year 2011 the number of air travelers will increase from 664.5 million to more than one billion. In addition, the FAA projects that aircraft operations at FAA air route traffic control centers will increase from 45.7 million in 2000 to 59.4 million in 2011, growing 2.4 percent each year. Similarly, the number of passengers on foreign flag air carriers traveling to or from the United States is expected to increase from approximately 137.6 million in 2000 to 239.4 million in 2011; a 5.1 percent rate of growth each year.

Along with the increase in air travelers will come an increase in transport category aircraft. According to the Boeing Aircraft Company, in 1995 there were 11,066 transport category aircraft operating around the world. In that same year, there were 21 hull losses. Boeing projects that in 2015, there will be 23,081 aircraft. They also project about 44 hull losses in 2015 -- more than double the 1995 figure.

We cannot emphasize strongly enough that a number of safety issues, some of which have been on our Most Wanted list since its inception in 1990, must be addressed to

prevent aviation catastrophes as operations increase. I would like to discuss three of those issues today: runway incursions; explosive mixtures in fuel tanks of transport category aircraft; and the need for updated flight recorders.

Runway Incursions

According to the FAA, there were 322 runway incursions in the United States in 1999. This was a 71 percent increase over the number of runway incursions that occurred in 1993; the rate per 100,000 operations was 56 percent greater than that of 1993. Below is a chart showing FAA's data regarding the number of runway incursions from 1993 through 1999, along with the rate per 100,000 operations.

(see chart above)

In testimony presented before this subcommittee last March, I stated that, "We remain concerned that FAA efforts to address runway incursions through technological development falls short of what is needed." The Board's position, one year later, has not changed. We are currently investigating several runway incursions, or possible runway incursions, and below is a brief description of four of them. I want to point out that over 1,000 people were on the eight aircraft involved.

On April 1, 1999, at 2:10 a.m. central standard time, a Boeing 747 operated by Air China as flight 9018, and a Boeing 747 operated by Korean Air as flight 036 were involved in a runway incursion on runway 14R at O'Hare International Airport (ORD), Chicago, Illinois. Air China flight 9018, an all-cargo flight, had just landed and was rolling out on runway 14R, when the ORD tower local controller instructed Korean Air flight 036 to taxi into position and hold on runway 14R. After Air China cleared runway 14R at taxiway T-10 and the crew acknowledged the taxi instructions to their cargo ramp, the local controller cleared Korean Air for takeoff. The crew of the China Air airplane deviated from their assigned taxi route and inadvertently reentered runway 14R at taxiway M. As Korean Air flight 036 approached rotation speed, the captain saw China Air flight 9018 crossing the runway ahead. He abruptly rotated the airplane, banking to the left as he did so. Korean Air flight 036 reached 9º of left bank shortly after takeoff -- passing directly over Air China flight 9018 within 3 seconds. Korean Air flight 036 cleared China Air flight 9018 by about 75 feet. The incident occurred during night visual meteorological conditions. No injuries were reported to the 390 on board the two aircraft, and neither aircraft was damaged.

On June 27, 1999, at 9:49 p.m. eastern daylight time, a Boeing 757 operated as Icelandair flight 614, and a Boeing 747 operated as Air France flight 6498, were involved in a runway incursion on runway 22R at John F. Kennedy International Airport (JFK), Jamaica, New York. Air France flight 6498 landed on runway 22L, and the JFK tower local controller instructed the flight crew to taxi via taxiway J and hold short of runway 22R. According to the air traffic control recording, the Air France flight crew responded, "okay straight ahead on juliet and no hold short on 22 right," and crossed runway 22R as Icelandair flight 614 was departing. Icelandair flight 614 cleared Air France flight 6498 by about 100 feet vertically. The incident occurred during night instrument meteorological conditions. No injuries were reported to the 196 people on board the two aircraft, and neither aircraft was damaged.

On November 22, 1999, at 10:36 p.m. pacific standard time, an MD-80 operated as Aeromexico flight 432, and a Boeing 757 operated as United Airlines flight 204, were involved in a runway incursion on runway 25R at Los Angeles International Airport, Los Angeles, California. The Los Angeles tower local controller cleared Aeromexico flight 432 to land on runway 25L. After the flight landed, the controller instructed the flight crew to turn right on taxiway N and to hold short of runway 25R so that United Airlines flight 204 could depart. According to the air traffic control recording, the crew of Aeromexico flight 432 read back, "November cross 25R." During an interview, the controller stated that she thought that the flight crew read back, "short 25R." The controller stated that she saw Aeromexico flight 432 slowing to turn on taxiway N but, after completing the turn, the airplane accelerated toward runway 25R. United Airlines flight 204 passed over Aeromexico flight 432 by about 100 feet. The controller restated the hold short instruction, but the incident had already occurred. The incident occurred during night visual meteorological conditions. No injuries were reported to the 212 people on board the two aircraft, and neither aircraft was damaged.

Although the following incident has not been confirmed to be a runway incursion, the following incident illustrates the need for technological assistance for tower controllers. On December 6, 1999, at 8:35 p.m. eastern standard time, a Boeing 757 operated as United Airlines flight 1448, and a Boeing 727 operated as Federal Express flight 1662, were involved in a possible runway incursion on runway 5R at Theodore Francis Green State Airport, Warwick, Rhode Island. After United Airlines flight 1448 landed on runway 5R, the local controller instructed the flight crew to exit the runway to the left, taxi to the ramp via taxiways N and T, and report when they crossed runway 16. The United Airlines flight crew became disoriented and inadvertently turned back toward runway 5R. The flight crew then stopped the airplane, advised the tower local controller of their position, and stated that they believed that they were on an active runway. Because the control tower is not equipped with Airport Surface Detection Equipment (ASDE), a radar system designed to provide tower air traffic controllers with position information on all aircraft and vehicles operating on airport runways and taxiways, controllers must rely on pilot position reports to locate aircraft during low-visibility operations. The reported visibility was 1/4 mile, and the runway visibility range was 1,400 feet. During the period that United Airlines flight 1448 was deviating from its cleared taxi route, Federal Express flight 1662 departed from runway 5R, passing near the United Airlines airplane. Despite being told by the United crew that they believed they were on an active runway, the tower local controller then cleared a Boeing 737, operating as US Airways flight 2998, to depart from runway 5R. Flight 2998's flight crew declined the clearance because of concern about the United airplane's position. The incident also occurred during night instrument meteorological conditions. No injuries were reported to the 205 people on board the two aircraft, and neither aircraft was damaged.

Since 1984, the Safety Board has issued 60 safety recommendations to the FAA regarding runway incursion issues. Although the FAA has taken numerous actions in response to not only Safety Board recommendations, but other runway incursion-related recommendations made by the Department of Transportation Inspector General, the MITRE Corporation, and other aviation industry groups as well, the hazard has not greatly diminished.

In 1991, the FAA stated that the cornerstone of the FAA's runway incursion efforts was the development and implementation of the Airport Movement Area Safety System (AMASS). Recently the FAA modified its position and stated that AMASS will not prevent runway incursions, but rather runway collisions. Unfortunately, since the FAA awarded its development contract for the system in September 1990, we have seen one delay after another:

- In May 1992, the FAA reported that the first delivery of an operational AMASS system to a field facility was planned for November 1994.

- In October 1993, the FAA confirmed the initial field delivery date as "early fiscal year 1995."

- In October 1995, the FAA revised the delivery schedule, reporting that the first field AMASS system would begin an operational requirements demonstration in October 1997, with all 40 contracted systems installed and operational by 2000.

- In August 1996, the FAA signed a modified contract for the AMASS project and reported that the delivery of production systems would be completed by August 2000.

- During 1997, 1998, and 1999, evaluation systems were delivered to Dallas/Fort Worth, Texas; St. Louis, Missouri; and Atlanta, Georgia.

- In an April 1999 letter, the FAA reiterated that the final delivery date would be August 2000.

- In October 1999, the FAA provided the Safety Board with a revised AMASS schedule, which stated that all 40 contracted systems were scheduled for installation by December 2000; however, it also stated that human factors and operational issues related to the system design had not yet been resolved.

- On October 6, 1999, during a briefing to the Safety Board on the National Runway Safety Program, the FAA stated that it anticipates that these issues will be resolved by January 2001 and that it expects that all 40 systems will become operational between August 2001 and October 2002.

AMASS generates an aural and visual alert when an aircraft or vehicle is occupying a runway and an arriving aircraft is 1/2 to 3/4 mile from the runway threshold or a departing aircraft on the runway is detected by the system and moving at 44 knots or greater. However, the visual and aural alert parameters were empirically determined based on a prototype AMASS system and were not based on human performance studis. At the request of the Safety Board, the FAA conducted a simulation of AMASS performance using data from the incident at Chicago O'Hare International Airport. The simulation showed that the AMASS would have generated both visual and aural warnings six seconds before the incident occurred. At that time, the Korean Air Boeing 747 was approximately 1,850 feet from the Air China Boeing 747 and moving at 172 knots; the Air China Boeing 747 was entering the runway.

Once an AMASS warning is generated, the controllers would need to detect the warning, determine the nature and location of the problem, decide the appropriate action, and contact the appropriate flight crew. The flight crew would then need to take the appropriate action to avert the collision. Six seconds probably would not have given the controllers and flight crews enough time to respond effectively and prevent the incident.

On the basis of this simulation and because of the arbitrary parameters determined by the FAA, the Safety Board is concerned that the current aural and visual alert parameters may not provide controllers and flight crews sufficient time to react and intervene to maintain safe separation in all circumstances. Therefore, the Safety Board is assessing the ability of AMASS to prevent runway collisions under various conditions, and the need for FAA to conduct additional simulations of AMASS performance to test its ability to provide effective alerts under real-world scenarios. Such simulations would need to take into account variables such as pilot-controller reaction times, aircraft performance, and meteorological factors (for example, visibility and wind speed).

The incident that occurred in Warwick indicates that the potential for runway incursions must also be addressed at lower-activity airports that are not scheduled to receive ASDE-3/AMASS. The Safety Board first raised this concern to the FAA on May 29, 1991. On August 12, 1991, the FAA responded that it planned to fund a series of technological demonstrations using magnetic loop sensors, infrared sensors, transponder systems, and global positioning system satellite technology during the following year. In October 1993, the FAA reported that it was evaluating several different technologies for managing airport surface movements, including differential global positioning systems, loop and magnetic sensors, and marine X-band radar systems, in lieu of full ASDE installations at lower-activity airports. On March 23, 1998, the FAA stated that it was continuing research and development of low-cost ASDE alternatives, including evaluation of marine X-band radar and phased-array radar systems. The FAA also stated that it was investigating the use of inductive loops for aircraft detection and collaborating with the National Aeronautics and Space Administration to test and demonstrate an integrated surface movement management system.

In the nearly nine years since the Board's 1991 recommendation, all of these systems remain under development, and none have been commissioned for full operational use at any airport in the United States. The Safety Board continues to be concerned that, despite many years of research and development, the FAA has been unable to procure surface surveillance equipment suitable for use at airports to prevent runway incursions. We believe that the FAA should establish criteria for installation of airport ground surveillance systems and commit to a specific date for completion of the acquisition and delivery of these systems.

Explosive Mixtures in Fuel Tanks of Transport Category Aircraft

Although our investigation into the tragic accident involving TWA flight 800 will not be completed until this summer, what has become clear from the investigation is that the presence of

heated, flammable vapors in an aircraft fuel tank is an inherent risk to safe flight. The investigation also has revealed much information about the extent and variety of potential sources of fuel vapor ignition.

The evaluation of the recovered TWA flight 800 wreckage, and a detailed evaluation of the sequence of events, have determined that the fuel/air vapor in the center fuel tank exploded and that the explosion of the tank initiated the breakup of the airplane. The investigation examined two main areas: first, the possible ignition sources of the fuel/air vapor in the center tank; and second, the composition and characteristics of the fuel/air vapor in the fuel tank. To accomplish these two tasks, extensive testing and research were conducted using a host of the best available independent laboratories and facilities.

The Safety Board's investigation has pursued numerous potential ignition sources, such as: the fuel quantity indicating system; static electricity; the fuel pumps; the electrical conduits; a small explosive charge; and high speed particle penetration (meteors or missile fragments).

Before the TWA flight 800 accident, very little was known about the temperatures in a Boeing 747 center fuel tank during normal operations or the composition and characteristics of Jet A fuel, despite its use for many years. We conducted tests at the California Institute of Technology and the University of Nevada at Reno to determine the chemical characteristics of Jet A fuel under a variety of conditions. These tests included measuring explosive temperatures and pressures, as well as determining the minimum ignition energy and fuel vapor composition.

As part of the investigation, we also leased a Boeing 747 to conduct flight tests. The airplane was instrumented with temperature and pressure sensors, and vapor sampling equipment to provide a detailed characterization of the environment in the center tank and the rest of the fuel system. The temperatures on the day of the tests were nearly identical to those on the day of the accident. The tests found that the temperatures inside the center fuel tank were much higher than expected, primarily due to heat from the air conditioning packs located directly below the tank. The analysis of the temperature profile and chemical composition of the fuel/air mixture in the center tank under conditions similar to those of TWA flight 800 found that it would have taken very little energy to ignite the fuel-air mixture.

Mr. Chairman, I need to point out that all of these tests that we have briefly described were extremely complex, and nothing of this magnitude has ever been conducted by the Safety Board. Because of the highly technical nature of the tests, and the potential danger posed to those conducting them, each phase of each test was very time-consuming and expensive. This activity was possible because of this Committee's support of supplemental appropriations for the investigation of TWA flight 800, and we thank you for that support.

As a result of the Board's investigation, we issued four safety recommendations in December 1996, five months after the accident, to the FAA that urged both short-term and long-term actions to reduce the potential for a fuel/air vapor explosion in the center fuel tanks of Boeing 747s, as well as in fuel tanks of other aircraft. We also suggested possible means to reduce the explosive potential of the fuel vapor, such as adding cold fuel to the center tank before takeoff, providing insulation or other methods to reduce the transfer of heat from the air conditioning units beneath the center tank, or inerting the tank by replacing the explosive vapor with a harmless gas.

We are disappointed that the FAA has still not taken action to develop operational procedures that will reduce the potential for explosive fuel-air mixtures or to require that fuel should be loaded in center wing tanks.

In November 1999, over three years after the TWA accident, the FAA proposed a major initiative that would affect the design, certification, and maintenance standards applied to transport category aircraft fuel tanks. This initiative would require: 1) operators to undergo a design review revalidating the fuel tank designs in their aircraft to make certain that failures could not ignite fuel vapors; 2) operators to develop and implement an FAA-approved maintenance and inspection program for fuel tanks; and 3) new certification standards that would apply to future aircraft designs to minimize the development of combustible vapors. FAA's proposal is currently under review by the Safety Board.

The Safety Board is fully aware that the safety record of the Boeing 747 and many other airplanes over the past few decades has been excellent, and fuel tank explosions have been extremely rare events. However, the evidence gathered during the investigation of TWA flight 800 and the previous accident that occurred May 11, 1990 in the Philippines involving a Philippine Airlines Boeing 737, indicates that they do occur and that extraordinary steps may need to be taken to prevent similar accidents. Our senior staff and investigators have been meeting regularly with the FAA and Boeing engineers, as well as outside specialists, to discuss the complex questions that have been raised by this tragic accident and to develop appropriate solutions. We believe it is imperative to initiate steps toward the reduction of explosive vapor in fuel tanks, and we will continue to work closely with the FAA and Boeing to devise corrective measures in a timely manner.

Mr. Chairman, as I said, we expect completion of the TWA flight 800 investigation this summer, and we will keep the Committee advised.

Next Generation Recorders and Protection from Release of Information

Cockpit voice recorders (CVRs) and flight data recorders (FDRs) have been in commercial aircraft for many years. They have played a major role in the Safety Board's accident investigations, and are probably the single most effective investigative tool we have. They provide us with critical information that can lead to determining the probable causes of accidents and, ultimately, to recommendations for safety improvements. It was through the good work of this Committee that FDRs are now required to have additional parameters.

The Board believes it is now time to move to the next generation recorder and, on February 8, 2000, the Safety Board recommended to the FAA that a crash-protective video recording system be required on all turbine-powered nonexperiemental, nonrestricted-category aircraft that are not currently required to be equipped with a crashworthy flight recorder device. This recommendation was the result of an accident that occurred October 8, 1997, near Montrose, Colorado, that involved an aircraft operated by the Department of Interior. As a single-engine, turbine-powered aircraft operating under 14 CFR Part 135, the accident airplane was not equipped, and was not required to be equipped, with a flight data recorder. Reconstructing the events that led to the accident was difficult for investigators because of limited data.

In the last decade, considerable progress has been made in video and flight recorder technologies, and the need for recording of cockpit images has become more evident.

Electronic image recording of the cockpit environment is now both technologically and economically feasible. Recent aviation accidents, including EgyptAir flight 990, have shown the need for documentation of the conditions that occur in a cockpit prior to an accident. The Board is currently reviewing the use of video recorders on all passenger-carrying aircraft.

There has been some reluctance on the part of industry and labor to endorse the use of these devices, as there was when CVRs were first introduced. As a result, the Safety Board has asked Congress to provide us with the authority to withhold these devices from public disclosure. We believe it is appropriate and timely to ensure that there are no legislatively-defined differences between the treatment of new video technology and existing voice recorders. We are pleased that the version of our reauthorization request approved by the House of Representatives will protect these important devices, and we will continue to work with our Senate authorizing committee to ensure this protection.

As previously mentioned, the collection of important investigative data often results in concerns regarding litigation, criminal indictments and employee privacy. In an effort to air the conflicts between the development of sophisticated data as a tool for improved safety performance, and the subsequent uses of that data in regulatory, enforcement, private litigation, criminal prosecution, and accident investigations, the Safety Board will host a "Transportation Safety and the Law" symposium on April 25 and 26. The symposium will involve all modes of transportation and will address:

- How the generation of data and information enhances transportation safety;
- The implications of government investigations and private litigation for information development;
- The proper government approach to encourage the availability of data safety assessment for accident investigations; and
- The proper relationships between accident investigation, regulatory enforcement, and criminal inquiry.

We believe the symposium will provide an opportunity to learn, participate, and collaborate on developing solutions aimed at facilitating the legitimate needs of all sectors.

Mr. Chairman, that completes my testimony, and I would be pleased to respond to any questions you may have.

Chairman Hall's Speeches & Testimony