



1996

ANNUAL REPORT

To CONGRESS



National Transportation Safety Board

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FOREWORD

This report provides a summary of National Transportation Safety Board (NTSB) investigative activities for calendar year 1996.

The NTSB is an independent federal agency charged with determining the “probable cause” of transportation accidents and promoting transportation safety. The Board investigates accidents, conducts safety studies, evaluates the effectiveness of other government agencies' programs for preventing transportation accidents, and reviews appeals of enforcement actions involving airman certificates and civil penalties by the Federal Aviation Administration and seaman certificates by the U.S. Coast Guard.

To help prevent accidents, save lives and reduce injuries, the Board develops safety recommendations, based on its investigations and studies, which are issued to federal, state and local government agencies, and to industry and other organizations in a position to improve transportation safety. These recommendations are the focal point of the Board's efforts to improve safety in the nation's transportation system.

The NTSB's origins can be found in the Air Commerce Act of 1926, in which Congress charged the Department of Commerce with investigating the causes of aircraft accidents. Later, that responsibility was given to the Civil Aeronautics Board's Bureau of Safety. In 1967, Congress consolidated all transportation agencies into a new Department of Transportation (DOT), and established the National Transportation Safety Board as an independent entity within DOT. In creating the NTSB, Congress envisioned that a single agency with a specific mission could promote a higher level of safety than the individual modal agencies working separately.

Since 1967, the Board has investigated accidents in the aviation, highway, marine, railroad and pipeline/hazardous materials modes.

In 1974, Congress re-established the NTSB as a completely separate entity, outside of DOT, reasoning that “...no federal agency can properly perform such (investigative) functions unless it is totally separate and independent from any other agency of the United States.” As DOT is responsible for both the regulation and promotion of transportation in the U.S., and accidents may suggest deficiencies in the transportation system, the Board's independence was deemed necessary for proper oversight.

FOREWORD

The NTSB, which has no authority to regulate, fund or be directly involved in the operation of any mode of transportation, conducts investigations and makes recommendations from a totally objective viewpoint. Under current operating criteria, the Board's response to an accident primarily is determined by:

- the need for independent investigative oversight to ensure public confidence in the transportation system;
- the need to concentrate on the most significant and life-threatening safety issues;
- the need to maintain a data base so that trends can be identified and projected; and,
- the need to participate in foreign investigations as the lead U.S. agency to fulfill U.S. obligations under the Convention on International Civil Aviation.

The NTSB consists of five Members nominated by the President and confirmed by the Senate to non-concurrent five-year terms. In 1996, the Board's authorized staffing level (investigators and support personnel) was 360 full-time equivalent positions. The NTSB operating budget for fiscal year 1996 was \$38.7 million.

Since its inception, the NTSB has investigated more than 100,000 aviation accidents, and over 10,000 surface transportation accidents. On call 24 hours a day, 365 days a year, NTSB personnel travel throughout the United States and to every corner of the world to investigate significant accidents, developing a factual record and safety recommendations with one aim – to ensure that such accidents do not happen again.

To date, the NTSB has issued about 10,300 safety recommendations pertaining to the various transportation modes to more than 1,250 recipients. As the Board has no regulatory or enforcement powers, its effectiveness depends on its ability to conduct thorough and accurate investigations, and produce timely, well-considered remedial recommendations.

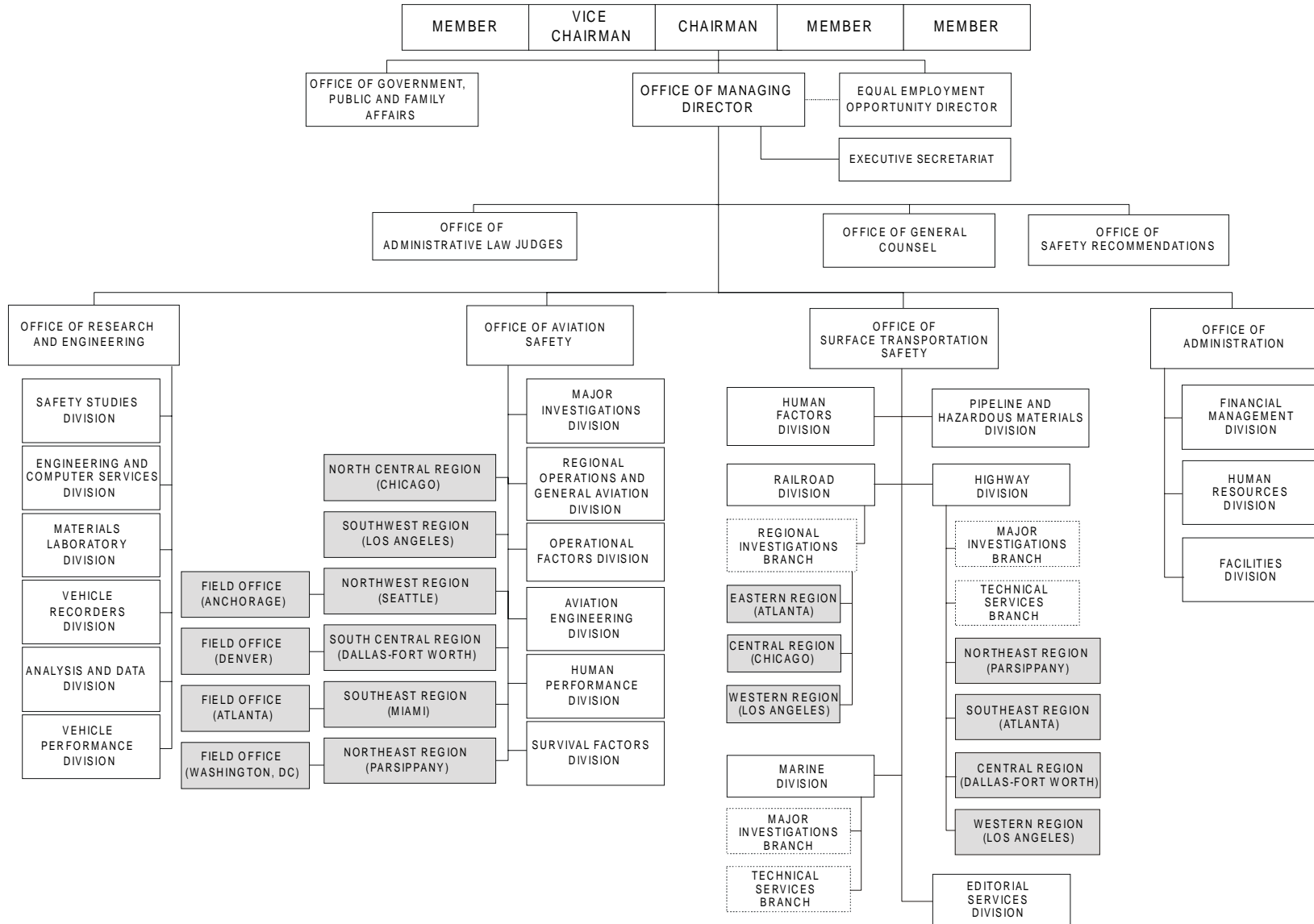
The NTSB's role in fostering advances in transportation safety has been significant. Examples of safety improvements in aviation resulting from Board recommendations include: floor exit lighting in airliners; smoke detectors in lavatories; fire-blocking cabin materials; stronger passenger seats; ground proximity warning systems; anti-collision technology; windshear detection equipment and enhanced

windshear training for pilots; crew resource management training; and the upgrading of safety rules for commuter airlines to a level comparable to the major air carriers.

For the surface modes: head shields, shelf couplers and thermal protection on railroad tank cars; age-21 drinking laws, which have saved over 15,000 lives since enactment in all the states in the 1980s, and mandatory seat belt use laws; nationwide Operation Lifesaver programs that have helped cut crashes at highway-rail grade crossings in half; rear-seat shoulder belts in all automobiles; personal flotation devices for children in recreational boats and emergency locating devices on marine vessels; and pipeline failure detection equipment.

Overall, more than 82 percent of the Board's safety recommendations have been adopted by the regulatory authorities and the transportation industry.

NATIONAL TRANSPORTATION SAFETY BOARD



MEMBER PROFILES



JAMES EVAN HALL
CHAIRMAN

James Evan Hall of Tennessee became a Member of the National Transportation Safety Board in October 1993. He has been the Board's Chairman since June 1994.

Mr. Hall's Chairmanship has seen a period of extraordinary activity for the NTSB, including investigations into the crashes of ValuJet flight 592 in the Florida Everglades and TWA flight 800 off Long Island, NY. Among the accidents for which he was the on-scene Board Member were the January 1994 derailment of the Ringling Brothers Circus train in Florida; the October 1994 crash of an American Eagle ATR-72 in Roselawn, IN; the December 1994 accident of an American Eagle Jetstream in Raleigh-Durham, NC; and the February 1995 crash of a cargo plane in Kansas City.

Mr. Hall also served as the Chairman of the Board of Inquiry for public hearings on three major accidents: the September 1994 crash of USAir flight 427 near Pittsburgh; the November 1994 runway collision in St. Louis; and the February 1996 commuter train/Amtrak collision in Maryland. He also chaired a safety forum on commercial air service in Alaska, as well as symposiums on the impact of fatigue on transportation safety and prevention of pipeline excavation damage. During his Chairmanship, the Board has issued landmark safety studies on commuter airlines and on the dangers to children of passenger side automobile air bags.

MEMBER PROFILES

In September 1996, President Clinton named Chairman Hall to the White House Commission on Aviation Safety and Security.

In January 1996, Chairman Hall was honored by Aviation Week and Space Technology, which presented him with an Aviation Laurel for "relentlessly pursuing every avenue available in an attempt to resolve what happened to USAir Flight 427." The magazine wrote "Hall has exhibited exemplary leadership . . . and has professionally and respectfully addressed the concerns of the accident victims' families." It also lauded him for his efforts to upgrade flight data recorders on U. S. airliners.

Chairman Hall received his law degree from the University of Tennessee and served for several years as counsel to the U.S. Senate Subcommittee on Intergovernmental Relations and on the staff of U.S. Senator Al Gore, Sr. He later maintained a private legal practice in Chattanooga, Tennessee.

Chairman Hall returned to Washington in early 1993 to serve as chief of staff for U.S. Senator Harlan Mathews. Before that, he was in the Cabinet of Tennessee Governor Ned McWherter and served for five years as director of the Tennessee State Planning Office. As a member of the Governor's Cabinet, Chairman Hall developed Tennessee's first comprehensive anti-drug effort.

An army veteran, Chairman Hall received the Bronze Star for Meritorious Service in Vietnam. He and his wife, the former Anne Stewart Impink, have two daughters.



ROBERT TALCOTT FRANCIS II
VICE CHAIRMAN

Robert Talcott Francis II has been the Vice Chairman of the National Transportation Safety Board since January 1995, when he was appointed to the Board by President Clinton. He was confirmed by the United States Senate in August 1995.

Since joining the NTSB, Mr. Francis has been involved in a number of transportation accident investigations, including the explosion and crash of TWA flight 800 off Long Island, NY, in July 1996; the crash of ValuJet Flight 592 in the Florida Everglades in May 1996; the crash of a DC-8 cargo carrier in Kansas City; and a major parachuting accident in Virginia. He also has chaired an NTSB public hearing on a New York subway accident. In addition to his accident investigation work and other NTSB duties, he has been actively involved as a member of the Air Transport Association of America's Steering Committee on Flight Operations Quality Assurance programs, and the Flight Safety Foundation's ICARUS Committee, which is a group composed of worldwide aviation experts who gather informally to share ideas on reducing human error in the cockpit.

Prior to his appointment to the Board, Mr. Francis served as Senior Representative for the Federal Aviation Administration (FAA) in Western Europe and North Africa and was based in Paris, France. Representing the FAA Administrator, he worked extensively on aviation safety and security issues with U.S. and foreign air carriers, government transportation officials, aircraft manufacturers, and airport authorities. At the NTSB, he continues to be actively involved in international aviation issues, and has spoken about the Board to the French Academy of Air and Space and an Italian Parliamentary Committee. In conjunction with his work at the Board, he is a recipient of an Aviation Week and Space Technology 1996 Laurel Award and was recognized by both the U.S. Navy and the U.S.

MEMBER PROFILES

Coast Guard for meritorious service in the TWA flight 800 investigation.

A native of Cohasset, Massachusetts, Mr. Francis received his A.B. from Williams College and attended Boston University and the University of Ibadan, Nigeria. An active general aviation pilot, he holds a commercial pilot certificate with instrument and twin-engine ratings. He is a fellow of the Royal Aeronautical Society, and a member of both the Wings Club of New York and the AeroClub of Washington, DC. Mr. Francis and his wife, Judy, have two daughters, Allison and Carolyn.



JOHN ARTHUR HAMMERSCHMIDT
MEMBER

John A. Hammerschmidt became a Member of the National Transportation Safety Board in June 1991 and is now serving his second 5-year term. Prior to becoming a Board Member, Mr. Hammerschmidt had extensive senior-level NTSB experience, serving as Special Assistant to the Board Chairman and Member during 1985-91.

Mr. Hammerschmidt is a private pilot, and is the senior Board Member. He has participated on-scene in more than four dozen major accident investigations and public hearings, involving all modes of transportation: highway, aviation, rail, marine, pipeline, and space.

On-scene investigations include: the 1996 collision of the bulk carrier BRIGHT FIELD with the Port of New Orleans' River Walk Shopping Mall; the 1995 Atlantic Southeast Airlines EMB-120 commuter accident at Carrollton, GA; the 1994 USAir DC-9 accident at Charlotte, NC; and the 1993 Amtrak accident near Mobile, AL, the worst in Amtrak history.

In 1996, Mr. Hammerschmidt chaired the NTSB's public hearing into the Fox River Grove, IL, grade crossing accident that killed 7 high school students in a school bus. In 1995, he chaired the 5-day public hearing in Indianapolis on the American Eagle ATR-72 accident near Roselawn, IN. In 1994, he chaired the public hearing in Charlotte, NC, on the USAir DC-9 accident there, and he chaired a public hearing in Ypsilanti, MI, on the American International Airways DC-8 accident at the U. S. Naval Air Station, Guantanamo Bay, Cuba.

Prior to 1985, Mr. Hammerschmidt served in the Office of the Vice President of the United States (1984), and from 1974-83, he was the Chief

MEMBER PROFILES

Executive Officer of the Hammerschmidt Lumber Company, Inc., Harrison, AR. Mr. Hammerschmidt was president of the Boone County (Arkansas) Industrial Development Corporation.

In 1971, Mr. Hammerschmidt earned a bachelor of arts degree from Dartmouth College, graduating "with highest distinction" in a history honors program. At Dartmouth, he was named a Rufus Choate Scholar, and was a member of the varsity football and wrestling teams. Later, he attended Vanderbilt University's Law School (1971-72) and Harvard University's Master of Business Administration program (1973-74). He also studied at the Catholic University of Ecuador in Quito as part of Georgetown University's foreign study program.

Mr. Hammerschmidt is a native of Harrison, AR. He resides in Arlington, VA.



JOHN J. GOGLIA
MEMBER

John Goglia is an internationally recognized expert in aviation maintenance and aircraft operations. In August 1995, he was sworn in as a Member of the U. S. National Transportation Safety Board.

Mr. Goglia is the first working airframe and powerplants mechanic to serve on the Board, with over thirty years of aviation experience. Before his Senate confirmation, he was based with USAir and was the recipient of the prestigious 1994 Industry Aviation Mechanic of the Year Award.

With a wealth of experience, Mr. Goglia is a leading advocate regarding the evaluation of human factors in the aviation workplace. He developed the Maintenance Resource Management Program, combining management, labor, regulatory agencies and academia into what has become the premier human factors program in aviation maintenance.

Mr. Goglia served as the Governor's appointee to the Massachusetts Workers Compensation Board and to the Boston Area Second Airport Site Selection Board.

Mr. Goglia also served as Team Coordinator of the International Association of Machinists and Aerospace Workers' (IAM) Accident Investigation Team and, for over 21 years, was the IAM's Flight Safety Representative. As the IAM's principal specialist on aviation issues, he served as liaison to the FAA, NTSB, the Department of Transportation (DOT) and other executive branch agencies as well as the U. S. Congress, and represented the IAM on the Aviation Rulemaking Advisory Committee, which evaluates and recommends changes regarding aviation safety and operational regulations.

MEMBER PROFILES

Mr. Goglia served as Chair and a founding member of the National Coalition for Aviation Education, an industry organization that advances aviation education among America's youth and aviation workforce. He was an original member of the Steering Committee to establish the International Society of Aviation Maintenance Professionals, an organization dedicated to advancing safety and professionalism throughout the aviation maintenance industry. He is an internationally known speaker and author addressing aviation safety issues, lecturing at world symposiums and serving as contributing editor to several industry periodicals. In 1960, Mr. Goglia learned to fly in a Piper J2-J3 and, for over ten years, he was owner/operator of an aircraft service company.

Mr. Goglia was the Member on-scene for the Board's investigation of the grade crossing accident in Fox River Grove, IL, in October 1995 that killed 7 high school students on a school bus. In January 1996, he chaired a briefing for government and industry representatives regarding the problem of ingestion of birds in the new generation of airliner engines.



GEORGE WASHINGTON BLACK, JR.
MEMBER

George W. Black, Jr., P.E., of Georgia became a Member of the National Transportation Safety Board on February 22, 1996, and is the first practicing highway engineer to be a Board Member.

Mr. Black is a 1968 graduate of the Georgia Institute of Technology, with a Bachelor of Civil Engineering degree, and is a registered professional engineer. While at Georgia Tech, Mr. Black worked on one of the original Multi-Disciplinary Traffic Crash Investigation Teams funded by DOT.

Mr. Black served as an Aircraft Maintenance Officer in the U.S. Air Force while stationed in Texas and southeast Asia. He was assigned to the supervision of flight line maintenance of B-52D and KC-135A aircraft.

Mr. Black returned to traffic safety engineering in 1973 when he became the first traffic engineer for Gwinnett County, GA, in the Atlanta metropolitan area. The county has a population of 475,000 persons and 2,500 miles of roadway. Mr. Black remained with Gwinnett County for 23 years, retiring as Director of Transportation in 1996.

Mr. Black helped found the county police department's fatal accident investigation unit in 1974. He was a member of that unit for the next 22 years and assisted in the investigation of 2,000 fatal or critical-injury traffic crashes and rail-highway grade crossing incidents. He also taught accident investigation and reconstruction in the county and state police academies for 23 years.

Mr. Black is a fellow of the Institute of Transportation Engineers and a member of the American Society of Civil Engineers, the Society of

MEMBER PROFILES

Automotive Engineers, the Transportation Research Board, the National Committee on Uniform Traffic Control Devices (technical committee) and other professional organizations. He was the recipient of the Institute of Transportation Engineers' Karl Bevins Award, the Gwinnett County Chamber of Commerce's Public Service Award, and the American Society of Civil Engineers' National Civil Government Award.

Since his appointment to the Board, Mr. Black has been on-scene Board member for several accidents including Delta flight 1288 at Pensacola, FL; United Express flight 5926 at Quincy, IL; and a gas explosion in San Juan, PR.

Mr. Black is married to Karen Marshall Black and they have two daughters, Karen Lane and Kathryn Marie.

TRANSPORTATION FATALITIES IN 1996

Deaths from transportation accidents in the United States totaled 44,525 for calendar year 1996. The overall number, derived from all modes of transportation, showed an increase over the 1995 total of 44,437 fatalities, according to preliminary figures.

Highway-related deaths, which account for more than 90 percent of all transportation fatalities, increased by 109, reaching a total of 41,907 for the year.

The number of persons killed in aviation accidents rose in 1996 to 1,089 from 970 the year before. Scheduled carrier (major airlines and commuters) accident fatalities increased from 177 in 1995 to 394 in 1996. The majority of these fatalities resulted from two accidents: the ValuJet DC-9 crash in Florida on May 11 (110 fatalities) and the TWA B-747 explosion off Long Island, NY on July 17 (230 fatalities). Fourteen people died in a United Express commuter runway collision with a private aircraft on November 19 in Quincy, IL. General aviation fatalities declined to 631 in 1996 from 733 in 1995.



Quincy, IL. Runway collision between commuter aircraft and a private airplane resulted in 14 fatalities.

TRANSPORTATION FATALITIES IN 1996

Deaths due to recreational boating accidents showed a decline to 714 in 1996 from 832 the preceding year. Preliminary U.S. Coast Guard data also indicate that there were 29 marine cargo transport deaths last year, down from 41 in 1995, and 26 commercial fishing fatalities, a decrease from 39 a year earlier.

Rail fatalities increased to 740 from 736 in 1995. The largest share of these deaths – 567 – continued to be as a result of persons walking on or near railroad tracks. There were 12 passenger fatalities last year on railroads that report to the Federal Railroad Administration (FRA); there were none the previous year. The Federal Transit Administration (FTA) reported that there were 120 fatalities from all types of accidents associated with the operations of light and commuter rail companies, compared to 98 in 1995. Motor vehicle occupants killed in grade crossing accidents totaled 472, down from 579 in 1995.

Pipeline-related deaths totaled 20, against 21 in 1995. (Note: The number of pipeline-related fatalities for 1996 could increase by 33, pending official determination of the probable cause of the explosion in San Juan, Puerto Rico, on November 21, 1996.)

National Transportation Safety Board 1996 U.S. Transportation Fatalities

	1995	1996 ¹
Highway: Passenger cars	22,358	22,416
Light trucks and vans	9,539	9,901
Pedestrians	5,585	5,412
Motorcycles	2,221	2,160
Pedalcycles	830	761
Medium and heavy trucks	644	621
Buses	32	21
All other	589	615
Total	41,798	41,907
Grade Crossings: ²	(579)	(472)
Rail: Trespassers and nontrespassers ³	595	567
Employees and contractors	43	41
Passengers on trains	0	12
Light and commuter rail	98	120
Total	736	740
Marine: Recreational boating	832	714
Cargo transport	41	29
Commercial fishing	39	26
Total	912	769
Aviation: General aviation	733	631
Airlines	168	380
Air taxi	52	59
Commuter	9	14
Foreign / unregistered ⁴	8	5
Total	970	1,089
Pipeline: Gas ⁵	18	15
Liquids	3	5
Total	21	20
Grand Total:	44,437	44,525

¹All 1996 figures are preliminary estimates supplied by the modal agencies within the Department of Transportation.

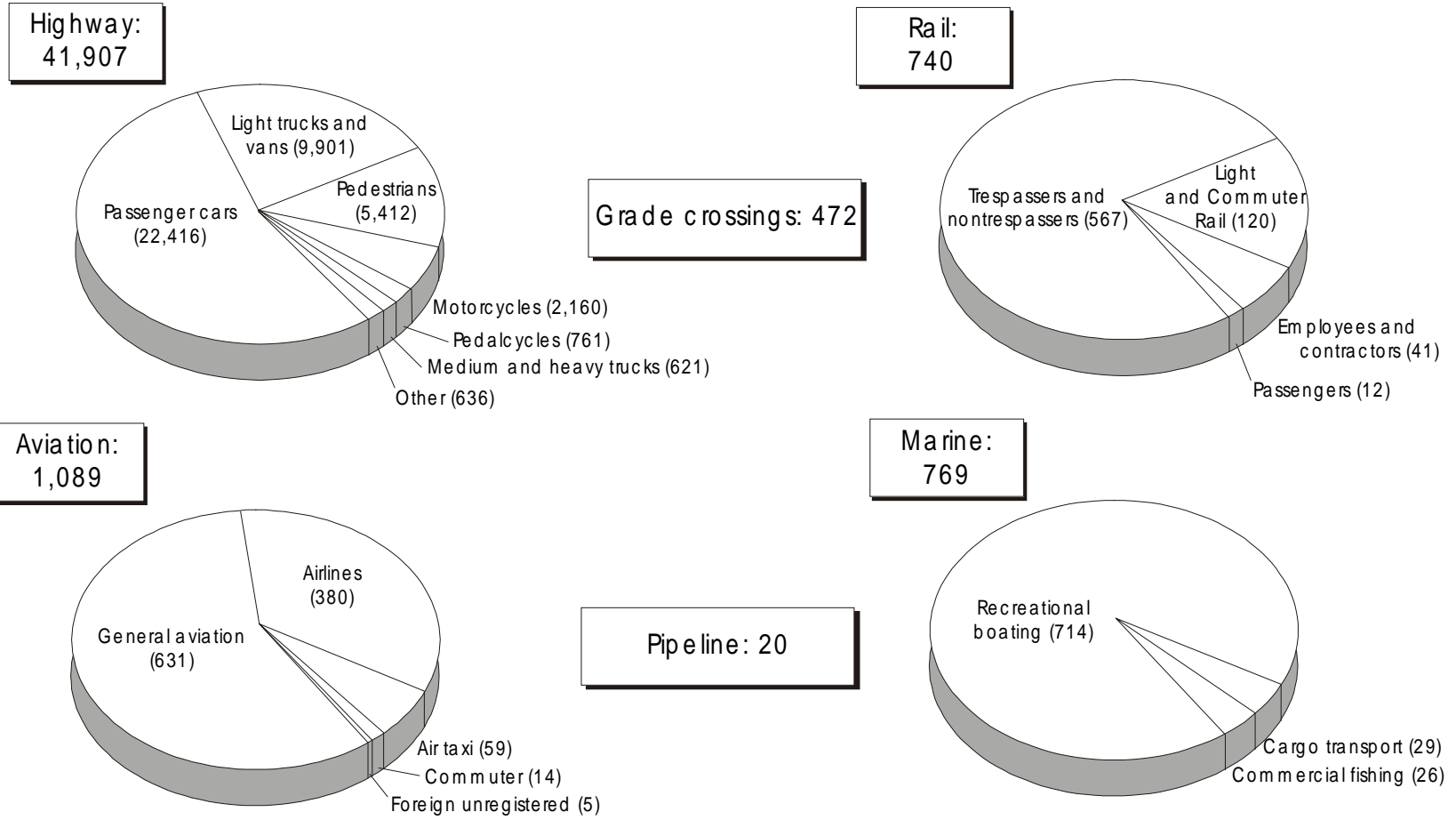
²Grade crossing fatalities are not counted as a separate category for determining the grand totals because they are included in the highway and rail categories, as appropriate.

³Does not include motor vehicle occupants killed at grade crossings.

⁴Includes non-U.S. registered aircraft involved in accidents in the U.S.

⁵The number of pipeline-related fatalities could increase by 33, pending official determination of the probable cause of the explosion in San Juan, Puerto Rico on November 21, 1996.

National Transportation Safety Board 44,525 Transportation Fatalities in 1996



Note: All data are preliminary estimates. Grade crossing fatalities are not included in the grand total because they were counted in the rail and highway categories, as appropriate. The pie charts are not drawn proportionately to each other. Aviation data comes from the NTSB; all other data are from the U.S. Department of Transportation (DOT). Pipeline-related fatalities could increase by 33, pending official determination of the probable cause of the explosion in San Juan, Puerto Rico on November 21, 1996.

THE NTSB & CONGRESS

Members and staff of the NTSB testified 14 times before congressional committees in 1996.

Vice Chairman Francis testified before the House Transportation and Infrastructure Committee's Subcommittee on Aviation, February 26, regarding the need for Traffic Alert and Collision Avoidance Systems (TCAS) on cargo aircraft. The Vice Chairman noted that the NTSB had issued many recommendations on the subject of collision avoidance and supported the development of an airborne collision avoidance system independent of ground-based air traffic control. He stated that the Board believed that TCAS installation has played a major role in the decline in the number of reported near midair collisions. Given the changes in the air traffic environment, with overnight package delivery firms operating several hundred transport category aircraft to high density destinations, the Board believed that regulations requiring TCAS should be extended to cover cargo aircraft. Mr. Francis also discussed several incidents of military aircraft approaching civilian airliners, noting that these events were potentially dangerous and that the Board would be making some remedial recommendations.

On February 27, Chairman Hall appeared before the Senate Committee on Commerce, Science and Transportation to discuss railroad safety. The Chairman briefed the Committee on a series of railroad accident investigations in the early months of 1996 including: the Washington Metrorail accident in Gaithersburg, MD; the Burlington Northern Santa Fe runaway train near Cajon Junction, CA; the New Jersey Transit collision in Secaucus; and the Maryland Transit Administration's MARC train/Amtrak collision in Silver Spring. In all, there were 14 accidents, resulting in 19 fatalities, 226 injuries, and over \$62 million in property damage. Chairman Hall noted that in each accident important and recurring safety issues were involved, and he detailed the need for rapid implementation of remedial measures such as positive train separation, signal calling, two-way end-of-train braking devices, improved procedures for testing and inspecting air brakes, and upgrading the design and crashworthiness of rail passenger cars.

Chairman Hall testified, March 6, before the House Transportation and Infrastructure Committee's Subcommittees on Aviation and Railroads regarding the NTSB's authorization request for funding levels for fiscal years 1997, 1998 and 1999. Chairman Hall also explained the Board's request for procedural changes in a number of areas, including temporarily protecting from disclosure information regarding foreign accident

investigations, protecting information on safety assessment programs provided by industry, and conducting and funding accident investigation training. On April 16, the Chairman made a similar presentation to the Senate Committee on Commerce, Science and Transportation.

On March 6, Chairman Hall also met with the House Transportation and Infrastructure Committee's Subcommittee on Railroads regarding human factors in railroad accidents. The Chairman's testimony focused on three major commuter rail accidents to illustrate a number of important human performance safety issues, and highlighted fatigue in train operators, positive train separation, signal calling, and training and communication as areas needing urgent attention. Six days later, Chairman Hall appeared before the same subcommittee discussing mechanical issues in railroad accidents. Drawing on a string of recent significant rail accidents, the Chairman stressed Board recommendations regarding two-way end-of-train braking systems, air brake inspection and testing, and passenger car design and crashworthiness.

Chairman Hall testified, March 7, before the House Appropriations Committee's Subcommittee on Transportation and Related Agencies on the NTSB's fiscal year 1997 budget request. Reviewing transportation safety developments over the past year, the Chairman noted that the Board's funding request represented an increase of about \$1.5 million over the FY 1996 appropriation, an amount just sufficient to maintain current staffing levels. In May, a statement providing a similar presentation was submitted to the Senate Appropriations Committee's Subcommittee on Transportation and Related Agencies.

James A. Arena, Director of the Office of Surface Transportation Safety, testified before the House Transportation and Infrastructure and Science Committees' Subcommittees on Railroads and Technology, March 27, regarding automatic train control. Mr. Arena noted that, for over two decades, the NTSB has advocated high technology train control devices that can provide positive train separation. Such devices can override a train operator's action to prevent collisions and overspeed derailments. Mr. Arena said that accident investigations repeatedly had pointed up the need for such devices, and that the Board considered positive train separation systems, which act as a safety net for human performance failures, to be vital to the long-term safe operation of our railroads.

On June 19, Chairman Hall testified before the House Committee on Transportation and Infrastructure's Subcommittee on Aviation regarding the treatment of victims' families after airline accidents. Drawing on his experience at three major, non-survivable airline crashes (American Eagle/Roselawn, IN; USAir/Aliquippa, PA; ValuJet/Florida Everglades), the Chairman discussed the need to improve the process of providing authoritative information and addressing the concerns of family members of accident victims. He stated that such an effort would require government, industry and private organizations like the American Red Cross to work together, with the support of the Congress. On September 5, Chairman Hall returned to express support for the Aviation Disaster Family Assistance Act of 1996 (H.R. 3923), adding that the crash of TWA 800 had shown that something needed to be done to better coordinate services for family members of victims of air disasters. Historically, this matter has been the sole responsibility of the airlines but, in view of recent accident experience, that arrangement was not satisfactory. Chairman Hall noted that, while care must be taken not to dilute the investigative function of the Board, assigning the NTSB a lead role would ensure a coordinated, unified approach to providing information and services to victims' families.

On June 25, Chairman Hall met with the same subcommittee to review the issues raised by the crash of ValuJet flight 592 in Florida. Noting that the industry had made great strides in preventing accidents through the systematic elimination of hazards and the use of technology to overcome human failures, the Chairman questioned whether sufficient progress had been made in eliminating a management mindset or culture that allows unsafe practices to exist at airlines, or go undetected by the FAA. He explained that the flight 592 investigation would examine: the adequacy of federal requirements for air carriers and shippers in the handling of hazardous materials, and federal standards for airliner fire safety, with particular emphasis on cargo compartments not protected by smoke/fire detection and extinguishing systems. The investigation also would thoroughly examine the FAA's ability to assure that airlines comply with federal safety regulations, particularly those carriers that outsource much of their training and maintenance. The Chairman indicated that an area of special focus would be the FAA's initial certification of new entrant carriers and the oversight of those airlines during start-up and periods of rapid growth.

On June 27, Robert Chipkevich, Chief of the Pipeline/Hazardous Materials Division, testified before the House Commerce Committee's Subcommittee on Energy and Power regarding the prevention of excavation damage to the nation's pipeline infrastructure. Mr. Chipkevich reported that the adoption by some states of "one-call" systems to notify buried facilities operators of planned excavations was producing beneficial

results. Operators, alerted in advance, were able to mark the locations of their facilities, thereby reducing the chances of excavation damage, especially to gas pipelines. Mr. Chipkevich noted, however, that the NTSB, concerned by a rash of excavation-caused pipeline accidents in 1993-4, believed that more needed to be done to motivate the states to uniformly develop their excavation damage prevention programs to realize the full potential of the “one-call” notification system.

Barry Sweedler, Director of the Office of Safety Recommendations, testified August 1 before the House Committee on Transportation and Infrastructure’s Subcommittee on Aviation regarding the use of child safety restraint systems on airliners. Mr. Sweedler discussed the NTSB’s investigative experience that led to recommendations that the FAA require infants and small children aboard aircraft be restrained in a manner appropriate to their size, and develop standards for forward-facing, integrated child safety seats. Commenting on the response to these recommendations, Mr. Sweedler stated that the Board believed that protection for children should not be a “safety option,” and would support legislation to require the use of child restraint systems on airliners.

Finally, Chairman Hall met on December 19 with the House Appropriations Committee’s Subcommittee on Transportation and Related Agencies to discuss the dangers of air bags to infants and small children. The Chairman noted that this issue was brought to the forefront in 1994, shortly after the Board initiated a safety study to evaluate child restraint systems. While air bags are a proven safety device for most properly restrained adults in severe frontal crashes, the study indicated that passenger-side air bags, as currently designed, are not acceptable as a protective device for children. Chairman Hall stated that the Board supported reducing the speed and force of air bag deployments, evaluation of increased thresholds for deployments, technological solutions such as on/off switches for cars already on the road, and expedited development of intelligent air bag systems. The Chairman also called for a highly visible, multimedia campaign to ensure the public is alerted to the dangers air bags posed to children.

NTSB & STATE/LOCAL GOVERNMENTS

NTSB Members and staff, in 1996, continued a program of meetings with state/local legislators and officials to discuss transportation safety issues and promote implementation of Board recommendations for safety improvements. In visits to 13 states, the discussions generally focused on highway safety measures, with an emphasis on enacting standard enforcement of mandatory seat belt use laws and zero alcohol tolerance for young drivers. Other important issues included administrative license revocation, graduated licensing (phased-in licenses for teenagers) and recreational boating safety.

On January 9, Chairman Hall met with the Governor and Lt. Governor of Hawaii to discuss safety in the air tour industry. The meeting followed publication of an NTSB Special Investigation report on the air tour industry prompted, in part, by two sightseeing helicopter accidents in Hawaii in which six people were killed. The Chairman also discussed Board recommendations on zero alcohol tolerance and graduated licensing.

On February 12-13, Chairman Hall addressed the Georgia Senate on zero tolerance and primary enforcement of mandatory seat belt use laws. Chairman Hall also met with the Governor, the Speaker of the General Assembly and other legislators.

On February 26, in conjunction with Virginia Congressman Frank Wolf, the Board conducted a workshop for state and local officials on school bus safety. Chairman Hall briefed the Virginia officials on the NTSB's investigation of the fatal collision in Fox River Grove, IL, between a commuter train and a school bus, and discussed the Board's recommendations for improving school bus and grade crossing safety. Other workshops were held in Arkansas, California, Illinois, Massachusetts and Maryland.

On March 4, Member Goglia spoke to the Joint Transportation Committee of the Connecticut legislature. In addition to testifying on graduated licensing, Member Goglia stressed the problem of railroad/highway grade crossing accidents and reviewed the Fox River Grove accident.

In other meetings on vehicle/highway safety issues Member Black spoke to the Colorado Senate Transportation Committee on March 7; Chairman Hall met with Senate and House Judiciary Committee members in South Carolina on March 16-17; and Member Goglia met with the

NTSB & STATE/LOCAL GOVERNMENTS

Texas House Jurisprudence Committee on April 10. NTSB staff members also pursued these issues in visits to seven other states.

On September 13, Chairman Hall addressed the National Association of Governors' Highway Safety Representatives, in Nashville, regarding the Board's proposal for funding of state drunk driving countermeasures.

Additionally, during the year, NTSB representatives briefed the National Conference of State Legislatures, the annual Lifesavers Conference, the National Association of Boating Law Administrators, the Southern Legislative Conference and other state-level organizations regarding both highway and marine safety recommendations. The Board also worked with the National Administrative License Revocation Coalition, the National Recreational Boating Safety Coalition, and the Air Bag Safety Campaign on promoting safety improvements.

SAFETY RECOMMENDATIONS

The NTSB issued 382 recommendations in 1996 to improve safety in the five modes that make up the nation's transportation system: aviation, highway, marine, railroad and pipeline/hazardous materials. The recommendations are the important final product of approximately 2,400 accident investigations conducted annually by the Board. The overall acceptance rate for all recommendations issued through the end of 1996 was 82.1 percent.

Typically, it takes 1,080 days for a safety recommendation to be implemented. For "urgent" recommendations, the time is much shorter -- 270 days on average. For recommendations issued and implemented from January 1, 1990, through December 31, 1996, the average time to implementation was 505 days. For recommendations to DOT agencies during that period, the average implementation time was 595 days. Historically, the recommendation acceptance rate at DOT has ranged from 87.8 percent at the Federal Highway Administration (FHWA) to 72.0 percent at the U.S. Coast Guard.

Status Of Safety Recommendations December 31, 1996

Favorable Action

Closed - Exceeds Recommended Action	15
Closed - Acceptable Action	5659
Closed - Acceptable Alternate Action	910
Open - Acceptable Response	714
Open - Acceptable Alternate Response	31
<hr/> Total	<hr/> 7329

Unacceptable Action

Closed - Unacceptable Action	1463
Open - Unacceptable Response	141
<hr/> Total	<hr/> 1604

Pending, Superseded Action

Open - Awaiting Response or Response Received	549
Superseded, reconsidered or no longer applicable	812
<hr/> Total	<hr/> 1361

“MOST WANTED” SAFETY RECOMMENDATIONS

Since the NTSB was established, it has issued about 10,300 safety recommendations to prevent accidents, save lives, and reduce injuries. While all these recommendations are designed to improve safety and help prevent accidents, some have a greater potential to save lives. In order to identify and increase the public's awareness of those recommendations with the greatest impact on transportation safety, the Board adopted the “Most Wanted” Safety Recommendations Program in 1990. Recommendations selected as part of the program receive more intensive follow-up activity to persuade government agencies and industry to act on them as quickly as possible.

To be considered for the “Most Wanted” list, a recommendation must have a national impact on transportation safety, concern a safety issue of high visibility, or be of great interest to the public. Also considered are: the extent to which a safety problem exposes the public to risk; the loss of life and property incurred and the potential for future losses; and previous action taken by the recommendation recipient(s). Strong regard is given to recommendations that have not been acted upon for an inordinately long period of time.

In 1996, three issues were added to the “Most Wanted” list, which is updated on an annual basis. In aviation, the Board added recommendations for an FAA-maintained system of pilot performance records for airlines to use in evaluating applicants for commercial pilot positions. In the railroad mode, the Board also elevated to priority status recommendations dealing with improvements in rail car design to enhance passenger protection. Also added to the list were recommendations for better highway vehicle occupant protection through strengthened enforcement of seat belt laws and the proper use of child restraint seats.

The Board also renewed its call for improved flight data recorders in commercial aircraft, first issued after the crash of USAir flight 427 near Aliquippa, PA, in September 1994. The aircraft involved in this accident was a B-737, the workhorse of the civilian aviation fleet. At that time, the Board noted that the absence of a modernized recorder with expanded capabilities to measure flight control inputs and control surface movements severely hampered the accident investigation.

SAFETY RECOMMENDATIONS

Two issues were dropped from the “Most Wanted” list in 1996 because of positive actions taken by the regulatory agencies and industry in response to NTSB recommendations. These involved: (1) improving commuter airline safety through adherence to the more stringent pilot training, maintenance and operating regulations followed by the major air carriers; and (2) the industry-wide adoption of uniform collection, processing and testing of toxicological specimens.

At year's end, the "Most Wanted" safety improvements being sought by the NTSB included recommendations in 18 areas regarding:

- Recreational Boating Safety
- Administrative Revocation of Driver's Licenses
- Airport Runway Incursions
- Positive Train Separation
- Requirements for Mode C Intruder Conflict Alerts in FAA Aviation Terminal Radar Control Areas
- Fishing Vessel Safety
- Youth Highway Crashes
- Flight Data Recorder Expanded Parameter Recording
- Installation of Pipeline Excess Flow Valves
- Railroad Hazardous Materials Tank Cars
- Human Fatigue in Transportation Operations
- School Bus Safety
- Small Passenger Vessel Safety
- Wake Turbulence
- Heavy Commercial Truck Safety
- Pilot Background Checks
- Safety of Passengers in Railroad Cars
- Highway Vehicle Occupant Protection

AVIATION SAFETY

The Department of Transportation Act, signed into law in 1966, and Independent Safety Board Act of 1974 placed the responsibility for investigating and determining the probable cause(s) of all civil aviation accidents with the NTSB. Recent legislation also has authorized the Board to investigate accidents involving public use (government) aircraft, except those operated by the armed forces and intelligence agencies.



Flushing, NY. On landing at LaGuardia airport, MD-88 struck approach lights fixed on piers in Flushing Bay.

In practice, the Board sometimes delegates general aviation accidents to the FAA for investigation – primarily those involving agricultural, experimental or home-built aircraft. However, although it may delegate the actual investigative fact-finding to another agency, the Board is the only entity that may make an official determination of probable cause.

The Board is also charged with carrying out studies, special investigations, and assessments on aviation-related issues. In 1996, these included a study of air traffic control equipment outages and a special investigation into a series of Robinson (R22) helicopter accidents.

Because of the international nature of the air transportation industry and the leading role of the U.S. in the development of aviation technologies, the Board's investigation of domestic accidents and participation in foreign investigations is essential to the enhancement of aviation safety on a worldwide basis. The Board fulfills U.S. obligations with regard to foreign accident investigations, established by treaty under the auspices of the International Civil Aviation Organization (ICAO), by sending accredited representatives to participate in investigations in cases where U.S. interests are involved. These typically concern accidents involving U.S. airlines in foreign territories or U.S.-manufactured aircraft or major components (e.g., engines) operated/utilized by foreign carriers. U.S. manufacturers and operators rely heavily on the Board to facilitate their access to foreign accident investigations. The safety issues that arise in these investigations often have wide-reaching implications for the aviation industry.

Foreign governments often request the assistance of NTSB analysts and laboratory specialists in their investigations. The Board's major aviation accident reports, safety recommendations, and accident statistics are disseminated worldwide and have a direct influence on the safety policies of foreign aviation authorities and airlines.

Another important aspect of the NTSB's mandate is to investigate the approximately 2,000 general aviation accidents that occur annually. In addition, the NTSB will investigate aviation incidents that are less complex and may involve only property damage as they often provide information that may be helpful in preventing accidents.

The NTSB serves as the nation's primary repository of aviation accident statistics and other related data, but its approach goes beyond the collection of data and a narrow determination of probable cause. Typically, NTSB investigators examine all factors surrounding an accident or series of accidents, thereby ensuring that the regulatory agencies and the industry are provided with a thorough and objective analysis of actual as well as potential deficiencies in the transportation system. Only then can solutions be proposed to correct deficiencies that may have caused the accident.

AVIATION SAFETY



East Moriches, NY. TWA Flight 800 wreckage was strewn over a wide area, about 8 miles off shore, at a depth of 120 feet. Many federal, state and local agencies participated in the recovery effort.



*Calverton, NY. Recovered TWA
Flight 800 wreckage.*



Calverton, NY. TWA Flight 800 wreckage is examined, catalogued and set out on the hangar floor.

OFFICE OF AVIATION SAFETY

The Office of Aviation Safety has the primary responsibility for investigating aviation accidents and incidents, and proposing probable causes for Board approval. Working with other NTSB units, the office also formulates aviation safety recommendations.

The staff is located in Washington, DC, and in 10 regional and field offices in major metropolitan areas throughout the United States. The office is composed of six divisions: Major Investigations, Field Operations and General Aviation, Operational Factors, Human Performance, Aviation Engineering, and Survival Factors.

When the Board is notified of a major aviation accident, it launches a “Go Team,” which varies in size depending on the severity of the accident and the complexity of the issues involved. The team, accompanied by a Board member, may consist of experts in as many as 14 different specialties. Each expert manages a group of other specialists from government agencies and industry in establishing a factual record and determining the conditions and circumstances surrounding the accident.

The participation of these other (non-NTSB) parties multiplies the Board’s resources and fosters a greater likelihood of general agreement over the findings of the investigation. It also allows first-hand access to information so that timely corrective actions may be taken by the appropriate parties.

A public hearing may be convened, or depositions taken, to collect additional factual information and review progress of the investigation to date. After an investigation is completed, a detailed narrative report is prepared that analyzes the investigative record and identifies the probable cause(s) of the accident.

A major investigation usually takes from eight months to more than a year to complete. Safety recommendations resulting from major investigations generally are included in the final accident report although, in the interest of safety, they may be issued at any time during the course of an investigation if deemed necessary by the Board.

The Major Investigations Division provides the Investigator-In-Charge (IIC) for an accident and coordinates the preparation of the Board’s aviation accident reports. The NTSB group chairmen, under the direction of the IIC, coordinate the efforts of the other expert participants in accident investigations provided by industry and other government agencies.

Operational factors experts in three disciplines (air traffic control, carrier operations, and weather) support major investigations with intensive work in their specialties. Aviation engineering experts provide strong technical skills in four areas: powerplants, structures, systems, and maintenance. Human performance specialists review the background and performance of persons associated with an accident. Survival factors experts investigate circumstances that affect the survival of persons involved in accidents, including the causes of injuries and fatalities.

The Office of Aviation Safety manages the NTSB's international aviation affairs program, providing leadership of U.S. teams supporting investigations of accidents in foreign territories conducted under ICAO rules by aviation authorities of other nations. The office also maintains liaison and coordinates international aviation activities with the U.S. Interagency Group on International Aviation, with other governments, and ICAO.

MAJOR AVIATION INVESTIGATIONS IN 1996

Among the major domestic and foreign aviation accident investigations initiated in 1996 were the following significant cases:

Asuncion, Paraguay - DC-8 Cargo Aircraft Crash

On February 4, a Colombian cargo aircraft (DC-8-F55) operated by Lineas Aereas del Caribe crashed into a suburban neighborhood shortly after departure from Silvio Pettirossi International Airport in Paraguay. All three crew members, a passenger, and 19 people on the ground were killed. The aircraft was destroyed by impact forces and post-accident fire.

In accordance with Annex 13 of the Convention on International Civil Aviation (Chicago Convention), administered by ICAO, the NTSB provided an accredited U.S. representative to assist in the Paraguayan investigation of the accident. Also assisting as technical advisors were representatives of Douglas Aircraft and the Pratt & Whitney company. As a part of the investigation, the aircraft recorders were read out at the NTSB laboratories in Washington, DC. Paraguayan civil aviation authorities concluded that the crew lost control of the aircraft after deliberately slowing the engines with the intention of conducting a training exercise for the co-pilot.

Puerto Plata, Dominican Republic - Charter B-757 Crash

On February 6, a B-757-200, registered to the Turkish air carrier Birgenair, crashed about five miles offshore after takeoff from General Luperon International Airport in the Dominican Republic. The aircraft was leased to Alas Nacionales, a Dominican Republic company, and was operating as a passenger charter flight to Frankfurt, Germany. The aircraft was destroyed by impact forces, and 176 passengers and 13 crew members were fatally injured.

Under the provisions of Annex 13, the investigation was under the jurisdiction of Dominican Republic aviation officials with the U.S., as the country of aircraft manufacture, an accredited participant. An agreement was reached among the various countries and corporate entities with an interest in the accident on the sharing of the estimated \$1.4 million cost of retrieving the submerged flight data and cockpit voice recorders, and portions of the wreckage. The NTSB contracted with the U.S. Navy Supervisor of Salvage and Diving for the recovery effort.

The Dominican Republic authorities' investigation report cited as the probable cause of the accident the failure of the flightcrew to recognize a "stick-shaker" warning of an aerodynamic stall, and to accomplish the procedures necessary to avoid a loss of control. The report also indicated that, before the "stick-shaker" activated, there was confusion among the crew regarding erroneous airspeed indications, the proper thrust setting and pitch attitude, and an overspeed warning advisory.

The investigation raised concerns that prompted the NTSB to issue, on May 31, a number of recommendations to the FAA, applicable to B-757/767 aircraft, regarding the lack of a "caution" alert to warn pilots of erroneous airspeed indications, the adequacy of procedures pilots are to follow in the event of erroneous airspeed indications, and the need for pilots to receive training on the effects of a blocked pitot tube on airspeed indications.

Houston, TX - DC-9 Wheels Up Landing

On February 19, Continental flight 1943, a DC-9-32 with 82 passengers and 5 crewmembers aboard, landed with wheels up at Houston Intercontinental Airport. The aircraft slid about 7,000 feet before coming to rest in grass 140 feet to the left of the runway. The cabin began to fill with smoke and the captain ordered an evacuation. No fatalities or serious injuries occurred; minor injuries to 12 passengers were reported. Damage to the aircraft fuselage was substantial. The investigation focused on flightcrew adherence to standard operating procedures, checklist design, flightcrew training, and FAA surveillance of the carrier.

Straits of Florida - Cuban Military Shootdown Of Two Cessnas

On February 24, two U.S.-registered Cessna 337 aircraft operated by “Brothers to the Rescue,” a group supporting refugees fleeing Cuba via water, were shot down by Cuban military fighters over international waters. Four persons aboard the Cessnas were killed. The U.S. protested to the United Nations Security Council (UNSC), which asked ICAO to investigate. The NTSB led the U.S. interagency effort to support the fact-finding mission undertaken by ICAO, coordinating interviews and meetings, and the provision of radar data, voice recordings and other materials to the investigators. ICAO’s investigative report, which was forwarded to the UNSC, confirmed that Cuba shot down the aircraft in international airspace, and did not comply with international standards for interception of aircraft.

Arequipa, Peru - B-737 Crash On Approach

On February 29, a B-737-222, operated by the Peruvian carrier Faucett, crashed while on approach to Rodriguez Ballon Airport in Peru. The flight earlier had left Lima International Airport carrying 117 passengers and 6 crew. All were fatally injured. The flightcrew gave no indication of any problems to the control tower before the aircraft impacted near the top of a ridge about two miles from the runway. An NTSB investigator led a U.S. team to Peru to assist with the investigation. The Peruvian authorities have characterized the accident as “controlled flight into terrain.”

Dubrovnik, Croatia - Crash of Secretary Brown’s Aircraft

On April 3, a U.S. Air Force CT-43A (B-737-200), carrying Secretary of Commerce Ronald Brown, other government officials, and a delegation of business executives, crashed on a mountainside while on approach to Cilipi Airport in Croatia. All 35 people aboard the aircraft were killed. The NTSB provided technical assistance to the Air Force investigation in the areas of flight control systems, structures and aircraft performance. As part of the investigation, the flight control system, including the rudder system, was examined in detail and certain components were shipped back to the U.S. for extensive tests and analysis. The Board advised the Department of Defense (DOD) to equip military transports with cockpit voice and flight data recorders similar to those required on civilian transport aircraft.



Dubrovnik, Croatia. Wreckage of Secretary Brown's aircraft.

Cheyenne, WY - Transcontinental Flight "Record" Attempt

On April 11, a Cessna 177B collided with terrain after a loss of control following takeoff from Cheyenne Airport. The pilot-in-command, along with a 7-year-old pilot trainee, and the trainee's father were fatally injured. The aircraft, which took off into deteriorating weather conditions (including turbulence, gusty winds, and an advancing thunderstorm and associated precipitation), was continuing on the second leg of a transcontinental flight "record" attempt by the youngest "pilot" to date (the pilot trainee). Witnesses described the aircraft's climb rate and speed as slow and they observed it enter a roll and descent consistent with an aerodynamic stall. The aircraft's gross weight was calculated to be 84 pounds over the maximum limit at time of impact. Safety issues in the investigation include fatigue, the effects of media attention and itinerary pressure, and aeronautical decision making.

Florida Everglades - ValuJet DC-9 Crash

On May 11, ValuJet flight 592, a DC-9-32, crashed into the Everglades shortly after takeoff from Miami International Airport en route to Atlanta. About 5 minutes into the flight, the crew had decided to return to Miami after reporting smoke in the cabin to air traffic controllers. All 105 passengers and 5 crew members aboard were killed and the aircraft was destroyed in the high-impact crash.

The NTSB, in conjunction with local authorities, launched a month-long operation to retrieve the wreckage for examination. An extensive effort also was mounted to recover and identify the victims. Initial examination of the wreckage indicated an extremely intense fire in the aircraft, hot enough to melt seat railings and floor beams. It also was revealed that a substantial number of chemical oxygen generators, packed in cardboard boxes, had been loaded into the forward cargo compartment of the aircraft. At least some of the generators were not empty, as indicated on the shipping documents, and none were equipped with safety caps.

On May 31, while the investigation was continuing, the Board issued six urgent recommendations to the FAA and DOT's Research and Special Programs Administration (RSPA).

The FAA was asked to immediately evaluate air carrier practices and training relating to accepting baggage and freight shipments (including company materials) and for identifying undeclared or unauthorized hazardous materials that are offered for transport; and, based on the evaluation, revise the practices and training accordingly.

The FAA and RSPA were asked to:

- Prohibit the transportation of chemical oxygen generators as cargo on board any passenger or cargo aircraft when the generators have passed expiration dates and the chemical core has not been depleted;
- Prohibit the transportation of oxidizers and oxidizing materials (e.g. nitric acid) in cargo compartments that do not have fire or smoke detection systems.

A public hearing chaired by Board Member John Goglia was held November 19-23 in Miami. Participating in the hearing were representatives of the FAA, RSPA, Douglas Aircraft, ValuJet Airlines, SabreTech, Inc., Pratt & Whitney, and Scott Aviation. Issues examined

included employee training and the carriage of hazardous materials aboard aircraft, outsourcing of maintenance by air carriers, FAA oversight of start-up airlines, and cockpit crew emergency equipment and training.

Boston, MA - B-767 Emergency Landing

On May 28, a B-767-300ER, operated by Martinair and registered in the Netherlands, made an emergency landing at Boston's Logan International Airport after experiencing intermittent electrical power disruptions. The flight was en route from Amsterdam to Orlando, FL, with 201 people on board, when all four primary electronic flight instrument displays went blank and the navigation system failed, prompting the crew to declare an emergency.

On touchdown at Logan, several of the systems that assist the wheel brakes in stopping the airplane, such as the anti-skid system, thrust reversers, and ground spoilers, were inoperative, and the engines remained in flight idle and did not reduce thrust to the normal ground idle setting. The rollout on landing was much longer than expected but, with heavy manual wheel braking, the crew managed to stop the aircraft about 1,500 feet from the end of the runway. All eight main landing gear tires deflated as a result of the heavy braking, and the aircraft sustained minor damage from a brake fire that was quickly extinguished by airport firefighters.

The NTSB investigation revealed that the flightcrew's ability to stop the aircraft was hindered because a portion of the air/ground logic circuitry was prevented from changing from "air" to "ground" mode on touchdown. Disruptions of power during the flight are the focus of the ongoing investigation.

On November 14, the NTSB recommended that FAA require Boeing to modify the crew alerting system on B-757/767 aircraft to include a "caution" alert to notify pilots when a malfunction in the air/ground logic circuitry has occurred that will render certain braking systems inoperative on touchdown. The alert should also specify which systems will not function properly on landing. It also was recommended that Boeing modify its 757/767 Operations Manual to include detailed emergency procedures and the necessary data for flightcrews to execute a landing when certain braking systems will be inoperative. The Board also asked FAA to review the design of transport-category airplanes other than the B-757/767 to determine if similar modifications are necessary.



Fukuoka, Japan. Attempt to abort takeoff resulted in DC-10 overrunning the runway and catching fire.

Fukuoka, Japan - DC-10 Rejected Takeoff Accident

On June 13, a DC-10-30, operated by the Indonesian airline Garuda, aborted a takeoff from Fukuoka International Airport, overran the departure end of the runway, and hit the concrete side of an elevated public road. The aircraft was destroyed in the ensuing fire; there were three fatalities and 18 serious injuries reported among the 275 passengers and crew. An NTSB-led U.S. team assisted in the investigation. Initial information indicated that the aircraft had rotated and just become airborne as the pilot attempted to abort the takeoff. There also was preliminary evidence of a possible turbine blade failure and an overheated engine.

Pensacola, FL - MD-88 Uncontained Engine Failure

On July 6, a Delta Air Lines MD-88 aircraft, carrying 142 passengers and five crew, experienced an uncontained failure of the left engine front compressor hub (fan hub) during takeoff from Pensacola Regional Airport. Two passengers were killed and another was seriously injured when fragments of the engine penetrated the aft

fuselage. Although the investigation is ongoing, the NTSB, on July 29, issued urgent recommendations based on metallurgical examinations that revealed production flaws in the JT8D-200 series engine fan hub that are not readily detected during inspections.



Pensacola, Florida. Failed engine on an MD-88 aircraft.

East Moriches, NY - TWA Flight 800

On July 17, TWA flight 800, a B-747-131 on a regularly scheduled flight to Paris, France, crashed into the Atlantic Ocean off the coast of Long Island, NY, shortly after takeoff from John F. Kennedy International Airport. Conversations between the pilots and air traffic controllers had indicated a routine flight until the time of the accident. First reports from witnesses described an explosion followed by debris descending into the ocean. All 230 people on board the aircraft were killed. The wreckage was strewn over a wide area, about eight miles off the coast, at a depth of 120 feet.

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The NTSB launched what has become the most extensive and costly investigation in its history. A parallel criminal investigation was initiated by the Federal Bureau of Investigation (FBI), looking for evidence of an act of terrorism or sabotage to the aircraft or the possibility of an accidental missile firing by U.S. armed forces. With the assistance of U.S. Navy, Coast Guard, National Oceanographic and Atmospheric Administration, and state, county, and city police and fire units, search efforts initially focused on victim recovery and identifying and mapping the debris fields. NTSB investigators also examined air traffic control information from Kennedy Airport and other sites, and reviewed crew histories and service and maintenance records for the aircraft and engines. The FBI conducted numerous interviews both in the U.S. and abroad.

The cockpit voice recorder (CVR) and flight data recorder (FDR) were recovered by U.S. Navy divers on July 24. Readout at NTSB laboratories revealed that both recorders had stopped operating abruptly at about the same time. The FDR showed normal operation of the airplane's recorded systems and engines before the data ended.

U.S. Navy vessels, some equipped with laser scanning devices that provided high resolution imagery of the ocean floor, began the main salvage operations on July 26. Recovered wreckage was brought to a former aircraft manufacturing facility in Calverton, NY, where each piece was meticulously examined, tagged, catalogued, and set out on the floor of the main hangar. Work began immediately on reassembling portions of the fuselage and the cabin interior. The aircraft's four engines, which were recovered between August 10-16, were disassembled and closely examined with no significant findings.

Fuel system components (fuel quantity probes and pumps) recovered from the ocean were tested at the National Aeronautics and Space Administration's Marshall Spaceflight Center in Huntsville, AL, also without significant findings. The search continued for the remaining fuel system components, including a scavenge pump from the center tank, that are still missing. To assist in recovery of the wreckage, the NTSB contracted with a private company to supplement the Navy's work with special side-scanning sonar equipment.

On November 2, after about 4,000 dives, the Navy ceased diving operations. The following day, NTSB-contracted trawling operations began on the ocean floor in the debris fields. These are ongoing at the end of 1996 and will continue as long as wreckage is being recovered.

With about 95 percent of the aircraft recovered, work continues at the Calverton hangar, with investigators examining, documenting and reconstructing portions of the wreckage. Other projects were underway elsewhere – from testing Jet A fuel at the California Institute of Technology to an extensive series of tests at Boeing facilities –all under NTSB supervision. NTSB personnel also began re-interviewing witnesses and others involved in some way with TWA 800, including ground service crews at Kennedy Airport.

Close examination of the wreckage focused attention on the aircraft's center wing fuel tank, which was nearly empty when the airplane left Kennedy Airport. Investigators determined that the fuel/air vapor in the center tank exploded and that this led to the structural breakup of the airplane. However, the ignition source that touched off the explosive fuel/air mixture in the center tank has not been discovered.

At the close of the year, investigators were still considering three theories as explanations for the TWA 800 tragedy – a bomb, a missile, or a mechanical failure. No physical evidence of a bomb or missile has been found to date and investigators are exploring several possible mechanical ignition sources for the explosion.

On December 13, the Board issued a series of recommendations suggesting near and longer term changes aimed at making center wing fuel tank explosions, a rare event, even less likely to occur. The Board recommended that the FAA:

- Require the development of and implementation of design and or operational changes that will preclude the operation of transport-category airplanes with explosive fuel/air mixtures in the fuel tanks.
 - (a) Significant consideration should be given to the development of airplane design modifications, such as nitrogen-inerting systems and the addition of insulation between heat-generating equipment and fuel tanks. Appropriate modifications should apply to newly certified airplanes and where feasible, to existing airplanes.
 - (b) Pending implementation of design modifications, require modifications in operational procedures to reduce the potential for explosive fuel/air mixtures in the fuel tanks of transport-category aircraft. In the B-747, consideration should be given to refueling the center wing fuel tank (CWT) before flight whenever possible from cooler ground fuel tanks, proper monitoring and management of the CWT

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fuel temperature, and maintaining an appropriate minimum fuel quantity in the CWT.

- Require that the B-747 flight Handbooks of TWA and other operators of B-747s and other aircraft in which fuel tank temperature cannot be determined by flightcrews be immediately revised to reflect the increases in CWT fuel temperatures found by flight tests, including operational procedures to reduce the potential for exceeding CWT temperature limitations.
- Require modification of the CWT of B-747 airplanes and the fuel tanks of other airplanes that are located near heat sources to incorporate temperature probes and cockpit fuel tank temperature displays to permit determination of the fuel tank temperatures.

The Board made these recommendations on the premise that, despite the industry's best efforts, there can never be complete certainty that all possible sources of ignition have been eliminated, and that these measures would be worthwhile safety precautions even though the precise ignition source for the TWA 800 explosion was not known.



Newburgh, NY. DC-10 In-Flight Fire.

Newburgh, NY - DC-10 In-Flight Fire

On September 5, a DC-10-10F operated by Federal Express made an emergency landing at Newburgh, NY, following the crew's detection of an in-flight fire. The three crew members and two employee passengers managed to evacuate the aircraft using the forward emergency exits and cockpit emergency ropes, and sustained only minor injuries. The aircraft was destroyed by the fire. A focus of the NTSB investigation is the possibility that the aircraft was carrying undeclared hazardous materials.

Ouagadougou Region, Africa - B-747 In Heavy Turbulence

On September 5, an Air France B-747-400 proceeding from Johannesburg to Paris encountered heavy thunderstorms, hail and severe turbulence for 5-6 minutes. For a time, the turbulence was of an intensity never experienced before by the flightcrew. The aircraft was safely diverted to a landing in Marseilles but 24 persons were injured and one passenger later died of multiple medical complications. There was considerable damage in the aft cabin – ceiling panels torn loose and support rods bent or buckled, video monitors detached, stowage bins deformed. Initial information indicated that unseatbelted passengers were thrown against the ceiling during the turbulence. The French investigation, with NTSB participation, focused on operational issues, the aircraft's weather radar and the design, testing and certification of cabin interiors.

Lima, Peru - B-757 Crash In Ocean

On October 2, a B-757-200, operated by Aeroperu, crashed into the Pacific Ocean about 30 miles off the coast of Lima, Peru. The flightcrew declared an emergency immediately after takeoff because of erroneous airspeed and altitude indications and was attempting to return to Lima when the accident occurred. All 70 people aboard were killed and the aircraft was destroyed. In the investigation initiated by Peruvian authorities, which the NTSB joined, interviews with Aeroperu maintenance personnel revealed that, while the aircraft was on the ground in Lima, masking tape had been applied to the static ports before the aircraft was cleaned and polished. Static ports provide critical sensor information to the primary and backup flight instruments. Recovery of a portion of the wreckage confirmed that three static ports on the left side of the fuselage remained obstructed by masking tape.

On November 15, with the investigation still underway, the Board recommended that the FAA immediately review and amend all aircraft maintenance manuals to require operators to use only standardized, highly

conspicuous covers with warning flags in any situation in which static ports would need to be covered.

Flushing, NY - Delta MD-88 Landing Accident

On October 19, a Delta Air Lines MD-88 from Atlanta was substantially damaged on landing at LaGuardia Airport. The aircraft was descending over water when the right wing struck two sets of approach lights fixed on piers in Flushing Bay. The main landing gear then hit the approach end of the runway, which was built on a steel/concrete pier extending out into the bay. The landing gear was sheared off and the airplane slid about 2,700 feet down the runway before coming to a stop. None of the 63 people on board were hurt, although three passengers sustained minor injuries during the aircraft evacuation.

Issues in the NTSB investigation included crew performance and duties, stabilized approach criteria, weather conditions, and LaGuardia Airport operations and runway lighting.

Manta, Ecuador - B-707 Cargo Aircraft Crash

On October 22, a B-707-323C cargo flight to Miami, operated by Millon Air Inc., crashed after takeoff from Eloy Alfaro Airport in Ecuador. The aircraft was destroyed; four people on board and 30 on the ground were killed. About 50 serious injuries also were reported. Investigation of this accident is under the jurisdiction of Ecuadorian aviation authorities, with the participation of a U.S. team led by an NTSB accredited representative.

Quincy, IL - Commuter Runway Collision

On November 19, a United Express Beechcraft 1900C operated by Great Lakes Aviation, Ltd., completing its landing roll at Quincy Municipal Airport, collided with a private aircraft, a Beechcraft King Air A90, that was taking off on an intersecting runway. All 10 passengers and two crew aboard the commuter flight and the two occupants of the King Air were killed in the collision and ensuing fire. Initial reports indicated that some on the Beechcraft 1900C survived the initial impact but that would-be rescuers were not able to open the exit door of the aircraft in time to save them. The NTSB immediately launched an investigation looking at a number of safety issues including Beech 1900C certification standards and compliance with

requirements on door jamming, the certification of small airports used by scheduled commuter airlines, aircraft rescue and fire fighting protection, and the importance during flight training of emphasizing careful scanning for traffic (“see and avoid”).

Narrows, VA - DC-8 Loss of Control

On December 22, a DC-8-63, operated by ABX Air Inc. (Airborne Express), impacted mountainous terrain near Narrows, VA, while on a post-modification test flight. The DC-8 had received a major overhaul and modifications of the cockpit, avionics and aircraft systems, installation of a cargo handling system, and engine modifications to meet (Stage III) noise level reduction requirements. Initial readout of the cockpit voice recorder indicated that the crew was testing the stall characteristics of the aircraft when control was lost. Three flightcrew members and three maintenance technicians on board were fatally injured; the aircraft was destroyed by the impact and fire. The NTSB investigation focused on guidelines and limitations for conducting functional test flights, stall recovery procedures and stall warning systems, and the FAA’s surveillance of air carrier test flight programs.

OTHER INVESTIGATIONS

Aliquippa, PA - USAir Flight 427

Work continued in 1996 on the complex issues surrounding the crash of USAir flight 427 on September 8, 1994, near Aliquippa, PA – the longest running accident investigation in the history of the NTSB. The aircraft, a B-737-300 on a regularly scheduled flight from Chicago to Pittsburgh, was destroyed by impact forces and fire. All 132 people on board were killed.

Progress in the investigation has been hampered by the absence of an upgraded flight data recorder with the capability to measure adequately flight control inputs and control surface movements. This prompted the Board to add recommendations for a requirement for improved flight data recorders in commercial aircraft to its list of “Most Wanted” safety improvements.

In the past year, investigative activities have been concentrated in the areas of aircraft systems and performance, human performance, and

sound spectrum analysis. As simulator and kinematic studies of data from the aircraft's flight data recorder indicate that a significant deflection of the rudder most closely matches the data, a major focus of the investigation has been uncovering what may have caused the rudder to move. Issues being studied to determine the source of the rudder deflection include pilot actions and inputs, hydraulic fluid contamination, yaw damper failure, dual hydraulic failure, standby rudder actuator, rudder power control unit failure, structural failure, and electrical short circuits.

Areas that are no longer being actively pursued in the investigation include criminal intent (bomb), engine reverser deployment, slat/flap extension, spoiler extension, cargo, service or entry door opening in flight, cargo shifting, electromagnetic interference, engine mount/pylon failure, floor beam failure, and bird strikes. These areas can be re-opened at any time, however, if new information indicates that further investigation is required.

Due to the importance of this investigation, the NTSB formed an advisory group of industry and government experts to review the work accomplished in the investigation to ensure that all issues are being fully addressed and to propose any additional efforts that they believe are needed to ensure a complete investigation.

On October 14, the Board issued a series of 14 safety recommendations concerning operational and design changes to the B-737 rudder system, and pilot training in the recognition of and recovery from unusual attitudes and upset maneuvers. Work on this investigation will continue into 1997.

Buga, Colombia - B-757 Hits Mountain

The NTSB, on October 16, issued a series of recommendations to the FAA stemming from the Board's participation in the investigation of the crash of an American Airlines B-757-223 near Buga, Colombia on December 20, 1995. The aircraft, on a regularly scheduled flight from Miami to Cali, Colombia, struck trees and then crashed into a mountainside while descending into the Cali area. All but four of the 163 passengers and crew on board were killed. The accident was investigated by Colombian civil aviation authorities, with a U.S team, led by NTSB specialists, providing operational and technical assistance. Additionally, the flight data and cockpit voice recorders were read out at the Board's facilities in Washington.

Based on the investigation, the Board made 17 recommendations to the FAA dealing with:

- Requirements for automatic retraction of aircraft speedbrakes;
- Evaluation of air carriers' terrain avoidance procedures (maximum escape/climb performance);
- Development of mandatory CFIT training programs, including simulator exercises;
- Requirements for enhanced ground proximity warning equipment;
- Modifications to Flight Management Systems (FMS) on FMS-equipped aircraft;
- Visual presentation of angle of attack information to pilots; and,
- International naming conventions for Standard Terminal Arrival Routes.

Significant Aviation Accident Investigations Initiated In 1996

Accident Date	Location	Carrier/ Aircraft Type	Fatalities
1/7/96	Nashville, TN	ValuJet/DC-9	0
2/4/96	Asuncion, Paraguay	Lineas Aereas DC-8	23
2/6/96	Puerto Plata, Dom. Rep.	Birgenair/B-757	189
2/19/96	Houston, TX	Continental/DC-9	0
2/24/96	Florida Straits	BTR/Cessna 337 (2)	4
2/29/96	Arequipa, Peru	Faucett/B-737	123
4/3/96	Dubrovnik, Croatia	USAF/CT-43A	35
4/11/96	Cheyenne, WY	Private/Cessna 177B	3
5/11/96	Florida Everglades	ValuJet/DC-9	110
5/28/96	Boston, MA	Martinair/B-767	0
6/13/96	Fukuoka, Japan	Garuda/DC-10	3
7/6/96	Pensacola, FL	Delta/MD-88	2
7/17/96	East Moriches, NY	TWA/B-747	230
9/5/96	Newburgh, NY	FedEx/DC-10	0
9/5/96	Ouagadougou Region, Africa	Air France/B-747	1
10/2/96	Lima, Peru	Aeroperu/B-757	70
10/19/96	Flushing, NY	Delta/MD-88	0
10/22/96	Manta, Ecuador	Millon Air/B-707	34
11/19/96	Quincy, IL	United Express/Beechcraft 1900C, Private/King Air A90	14
12/22/96	Narrows, VA	ABX Air/DC-8	6

MAJOR AVIATION REPORTS ADOPTED IN 1996

Major aviation reports adopted by the NTSB in 1996 included the following significant cases:

Roselawn, IN - ATR-72 In Icing Conditions

On July 9, after a comprehensive investigation, the NTSB adopted a final report on the crash of an ATR-72-212 commuter aircraft, October 31, 1994, south of Roselawn, IN. The aircraft, operated by Simmons Airlines doing business as American Eagle flight 4184, on a regularly scheduled passenger flight from Indianapolis to Chicago's O'Hare airport, crashed during a rapid descent after an uncommanded roll excursion. The flight was in a holding pattern and was descending to a newly assigned altitude when the initial roll excursion occurred. The aircraft was destroyed by impact forces; the four crew members and 64 passengers sustained fatal injuries.

Investigation of the accident included a series of inflight tests of icing on the ATR-72, conducted with the assistance of a U.S. Air Force tanker aircraft. The Board concluded that the aircraft's loss of control was due to a sudden and unexpected movement of an aileron that occurred after a ridge of ice accumulated behind the wing de-icing mechanism ("boot"). The report cited the aircraft manufacturer's failure to completely disclose to operators adequate information concerning previously known effects of freezing precipitation on the ATR-72's stability and control characteristics, autopilot, and operational procedures. This information was not incorporated in the ATR-72 flight and operating manuals and crew training programs.

The Board also pointed to inadequate oversight of ATR-42 and ATR-72 aircraft by the French aviation regulatory agency and the failure to take necessary corrective action to ensure continued airworthiness of the aircraft in icing conditions. The report noted that the French authorities failed to provide the FAA with timely airworthiness information developed from previous ATR accidents and incidents in icing conditions.

Contributing to the Roselawn accident, the Board determined, was the FAA's failure to adequately oversee the continued airworthiness of ATR-42 and ATR-72 aircraft and to update aircraft icing certification requirements, which were based on meteorological and technical research dating back to the 1940s and 1950s.

In accordance with Annex 13, French aviation authorities were provided a copy of the draft final report for review and comment. The French response strongly disagreed with the Board's conclusions that cited failures of the airplane manufacturer and French aviation authorities as causal to the accident, adding that the pilots should have been cited as causal. These comments were appended to the final published report. Subsequently, the French Director General of Civil Aviation submitted a petition for reconsideration which asked the Board to revise its conclusions and the probable cause. The Board is evaluating this petition for reconsideration.

The NTSB issued a series of 26 safety recommendations, mostly to the FAA, including some aimed at improving weather information collection and transmission to flightcrews, dispatchers and air traffic controllers. Other recommendations called on the FAA to revise aircraft icing certification criteria and testing, based on up-to-date weather research, and require safe performance of aircraft in freezing drizzle, freezing rain, and mixed water and ice crystal conditions. If an aircraft manufacturer cannot demonstrate safe operation under icing certification requirements, operational limits should be imposed to prohibit flying in those conditions, the Board said. The Board also recommended that the FAA review the way it monitors and verifies certification of aircraft by foreign countries.

The NTSB recommended that American Eagle: require dispatchers to inform flightcrews of pertinent en route weather conditions so crews can use the information in preflight and in-flight decisions; encourage captains to observe the "sterile cockpit" environment when an airplane is holding, regardless of altitude, in icing conditions that have the potential to demand significant flightcrew attention; and, eliminate conflicts in guidance and procedures in flight and operations manuals and other published materials.

The Board also recommended that NOAA develop methods to produce weather forecasts that define specific locations of atmospheric icing conditions (including freezing drizzle and freezing rain), and short range forecasts that identify icing conditions for a specific geographic area with a valid time of two hours or less.

Atlanta, GA - DC-9 Uncontained Engine Failure/Fire

On July 30, the NTSB adopted a report urging the FAA to tighten rules governing aircraft repair stations, both in the U.S. and abroad.



Atlanta, GA. DC-9 Uncontained engine failure/fire.

The recommendations stemmed from the investigation of an accident on June 8, 1995, involving a ValuJet DC-9-32 aircraft at Hartsfield Atlanta International Airport. The aircraft was on takeoff roll, with 62 people on board, when the right engine failed. Fragments from the failed engine penetrated the fuselage and severed the main fuel line, igniting a fire that rapidly engulfed the cabin area. Takeoff was rejected and the aircraft was stopped on the runway and evacuated. A flight attendant was seriously injured; six others received minor injuries. The aircraft was destroyed.

The Board determined that the probable cause of the accident was the failure of a Turkish aviation maintenance company to properly inspect a 7th stage high compressor disk on the engine, thereby allowing a detectable crack to grow to a length at which the disk ruptured under normal operating conditions. ValuJet bought the engine from the Turk Hava Yollari repair station in 1994 and put it into service on the DC-9.

Contributing to the failure to detect the cracked disk, the Board reported, was the repair station's lack of an adequate recordkeeping system and the failure to use "process sheets" to document, step-by-step, overhaul and inspection procedures.

The Board, consequently, urged the FAA to review the licenses and operations specifications of all repair stations to make sure that the extent of their authority to repair and overhaul aircraft parts is clearly stated. The Board also called for more stringent recordkeeping responsibilities for all FAA-approved repair stations and for the same requirements be applied to domestic and foreign firms.

The Board also dealt with a number of other shortcomings uncovered during the investigation. Report recommendations called for: upgrading within two years of the sound quality of cockpit voice recorders; refurbishing the interiors of older aircraft with materials that meet current flammability standards when the cabins are overhauled or the airplanes are transferred from one carrier to another; and, retrofitting transport aircraft built before November 1990 with public address systems capable of operating on independent power sources. Additional recommendations focused on flight attendant training, uniforms, and access to cockpits in emergency situations.

East Granby, CT - MD-83 Collision With Trees On Final Approach

The NTSB determined, November 13, that the failure of the flightcrew to maintain the required minimum descent altitude until runway visual references were in sight was the probable cause of an American Airlines MD-83 collision with trees while on final approach to Bradley International Airport, East Granby, CT. The accident occurred on November 12, 1995, as flight 1572 was making an instrument landing during a rain storm. After hitting the trees, the aircraft, carrying 78 passengers and crew, also struck an instrument landing system antenna as it came down short of the runway on grassy, even terrain. One passenger sustained minor injuries; damage to the airplane and airport equipment amounted to over \$9 million.

The Board found that contributing factors to the accident were the failure of the approach controller to furnish the flightcrew with a current altimeter setting and the crew's failure to request one, at a time when weather advisories were reporting rapidly falling air pressure.

The Board proposed that the FAA evaluate Terminal Instrument Procedures (TERPS) design criteria for non-precision approaches to consider the incorporation of a constant rate or constant angle of descent to minimum descent altitude in lieu of step-down criteria. Also recommended were precipitous terrain adjustments for the approach to Bradley Airport flown by flight 1572.

The Board also suggested that for all aircraft executing non-precision approaches at all airports, during periods in which the official weather report includes the remarks “pressure falling rapidly,” controllers be required to issue, as frequently as practicable, altimeter setting changes to flightcrews in addition to the altimeter setting issued on initial contact.

The Board also examined the operator’s emergency evacuation procedures and recommended that FAA develop a uniform policy on shoe removal during aircraft evacuations, and require that all MD-80 and DC-9 operators immediately inspect floor level exits to ensure that evacuation slides are properly rigged.

Carrollton, GA - EMB-120RT Loss of Propeller Blade

On November 26, the NTSB reported that the loss of a propeller blade led to the crash of an EMB-120RT commuter aircraft, on August 21, 1995, about 30 minutes after departing Atlanta Hartsfield International Airport.

The aircraft, operated by Atlantic Southeast Airlines on a regularly scheduled flight to Gulfport, MS, and carrying 26 passengers and a crew of three, initially attempted to return to Atlanta but was vectored toward the West Georgia Regional Airport at Carrollton when it was unable to maintain altitude. Crash forces and fire destroyed the aircraft. The captain and four passengers were fatally injured; three other passengers died of injuries in the following 30 days. The other two crew members and 11 passengers were seriously injured, and the remaining eight passengers received minor injuries.

The Board determined that an in-flight fatigue fracture and separation of a propeller blade resulted in distortion of the left engine nacelle, causing excessive drag, loss of wing lift, and reduced directional control of the airplane. The fracture was caused by a fatigue crack from multiple corrosion pits that were not discovered by the propeller manufacturer, Hamilton Standard, due to inadequate inspection and repair procedures. Contributing to the accident, the Board found, was the failure by the manufacturer and the FAA to require recurrent on-wing ultrasonic inspections for the affected propellers. Contributing to the severity of the crash was the overcast cloud ceiling at the accident site.

The Board made a number of recommendations to the FAA which would require Hamilton Standard to review the adequacy of its tools, training and procedures for performing propeller blade repairs, and ensure that those repairs are being performed properly. It also was recommended that Hamilton Standard consider long-term, atmospheric-induced corrosion

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effects and amend the component maintenance manual inspection procedure to reflect an appropriate interval that will allow detection of any corrosion within the taper bore. Additionally, the Board suggested that the company be required to review its policies regarding internal communications and documentation of engineering decisions, as well as communications with the FAA on these decisions.

JFK International Airport, NY - B-747 Runway Departure

On December 20, 1995, Tower Air flight 41, a B-747-136, veered off the runway at John F. Kennedy International Airport during an attempted takeoff. The flight was a regularly scheduled operation from New York to Miami with 468 persons on board. One flight attendant was seriously injured; 24 passengers sustained minor injuries. The aircraft was heavily damaged.

The Board determined that the probable cause of the accident was the captain's failure to reject the takeoff in a timely manner when excessive nosewheel steering tiller inputs resulted in a loss of directional control on a slippery runway. The final report, adopted on December 2, also cited inadequate B-747 slippery runway operating procedures developed by Tower Air and the Boeing Company, and inadequate fidelity of B-747 flight training simulators for slippery runway operations as contributing factors. The Board also found that the captain's reapplication of forward thrust before the airplane departed the runway contributed to the severity of the runway excursion and damage to the aircraft.

The Board issued recommendations to the FAA regarding modification of operating procedures to further caution flightcrews against the use of the tiller during slippery runway operations, and appropriate limitations on tiller use during these operations. The FAA also was urged to require that Boeing develop operationally useful criteria for making a rapid and accurate decision to reject a takeoff under slippery runway conditions, and that these be reflected in flight, operating, and training manuals. Additionally, the FAA was asked to evaluate B-747 simulator ground handling models to ensure that they accurately replicate slippery runway handling characteristics of the aircraft.

Nashville, TN - DC-9 Ground Spoiler Activation In Flight

On January 7, 1996, a DC-9-32, operated by ValuJet Airlines, touched down hard in the approach light area short of runway 2R at

Nashville International Airport. The aircraft sustained substantial damage to the tail section, nosegear, aft fuselage and both engines when it hit the ground. A flight attendant and four passengers reported minor injuries. The flightcrew had encountered several aircraft system anomalies shortly after takeoff from Atlanta with 88 passengers on board.

The NTSB determined, on December 11, that the probable cause of the accident was the flightcrew's improper actions (failing to contact system operations/dispatch, failing to use all available aircraft and company manuals, and prematurely resetting the ground control relay circuit breakers) in response to an in-flight abnormality, which resulted in the inadvertent activation of the ground spoilers during the final approach to landing and the airplane's subsequent increased descent rate and excessively hard ground impact in the runway approach light area.

Cited as contributing factors were ValuJet's failure to incorporate cold weather nosegear servicing procedures in its operations and maintenance manuals, the incomplete procedural guidance contained in the ValuJet quick reference handbook, and the flightcrew's inadequate knowledge and understanding of aircraft systems. The Board also found that FAA oversight of ValuJet's procedures and operations had been inadequate.

The Board recommended that ValuJet develop immediately a more extensive and accurate winter operations manual, with corresponding adjustments to maintenance procedures, to reflect the aircraft manufacturer's cold weather servicing procedures. Because no airline is exempt from encountering a range of weather extremes, the FAA was asked to broaden the recommendation to require that all airlines review their maintenance manuals and adjust procedures as necessary to accord with manufacturer specifications.

The FAA also was urged to require ValuJet to revise its crew resource management (CRM) training to clearly reflect modern integrated (flightcrew, cabin crew, company) CRM practices and to combine academic/classroom training with integrated, practical crew simulations. In addition, the FAA was asked to reevaluate ValuJet's flight operations training manual and syllabus, and require that these documents be revised to include more detailed descriptions of DC-9 systems.

Major Aviation Reports Adopted In 1996

Report Number	Date Adopted	Accident Location	Carrier/Aircraft Type	Fatalities
AAR-96-01	7/9/96	Roselawn, IN	Simmons/American Eagle/ATR-72	68
AAR-96-03	7/30/96	Atlanta, GA	ValuJet/DC-9	0
AAR-96-05	11/13/96	East Granby, CT	American/MD-83	0
AAR-96-06	11/26/96	Carrollton, GA	Atlantic Southeast/EMB-120RT	8
AAR-96-04	12/2/96	New York, NY	Tower Air/B-747	0
AAR-96-07	12/11/96	Nashville, TN	ValuJet/DC-9	0

SPECIAL INVESTIGATION REPORTS

Air Traffic Control Equipment Outages (NTSB/SIR-96/01)

In the latter part of 1995, the NTSB conducted an investigation into a series of computer and related equipment outages and disruptions experienced in the FAA's en route air traffic control (ATC) system. The investigation focused on problems at the five air route traffic control centers (ARTCCs) with the oldest controller display computer systems (New York, Washington, Cleveland, Chicago, Fort Worth) that had raised public concern. At issue was the FAA's ability to operate the ATC system safely with the current, aging equipment until the next generation of equipment became available. A team of investigators conducted interviews and research at the five ARTCCs and at one terminal approach control facility. Because of limitations on time and resources, the Board did not attempt to analyze FAA management of past ATC modernization programs, or scheduling and financial matters pertaining to current modernization projects.

Among the issues raised in the investigation were:

- The increasing frequency of outages involving the aging IBM 9020E display channel complex equipment;
- Other recent outages involving power systems and communications equipment;

- Lack of controller proficiency with the direct access radar channel/Standalone mode of the backup computer system;
- The increased likelihood that some ARTCC computer systems will be operated with compromised redundancy, which increases the risk of outages; and,
- The adverse effect of the retirement of highly skilled airways facilities technicians on the FAA's ability to maintain and repair many ATC systems.

After examining these issues, the Board concluded that, overall, the U.S. ATC system is safe. In a report adopted on January 23, the Board noted that, in the vast majority of recent computer outages, controllers were able to provide safe aircraft separation using a backup system similar to the primary system. "On those rare occasions that computer capabilities were degraded further," the report stated, "controllers were able to reroute planes and prevent aircraft departures.In the extremely rare situation in which all electrical power is cut off to an ATC facility, and radar and radio contact with airplanes is lost, the system in which adjacent facilities handle traffic has worked successfully."

Nonetheless, the Board did find that IBM 9020E outages are becoming more frequent and that the situation is exacerbated by the lack of qualified maintenance technicians and spare parts. It noted that any degradation of radar and communications capability increases the complexity of the tasks facing both controllers and flightcrews, and reduces the margin of safety afforded by the primary system. The Board also expressed concern with the tendency to operate ATC computer systems with less than full redundancy, which leaves the system more vulnerable to an outage.

The Board reported that air traffic controllers needed greater proficiency in operating emergency backup systems and urged the FAA to upgrade training programs. The Board also recommended that FAA develop incentives to retain adequate numbers of maintenance/repair personnel at ATC facilities.

While concern over computer outages prompted the ARTCC investigation, the Board found problems with ATC communications and facility power generation that are equally troubling. These matters present significant safety concerns because they can result in a loss of radio contact with the aircraft. FAA has initiated a program to improve ARTCC electrical power systems, which should reduce the instances of power failure once installation is complete. A new voice switching and control system also has been developed that will provide several important features

to enhance communications. Additionally, the Board recommended that FAA identify and rectify safety deficiencies such as frequency failures, interference problems, and inadequate radio coverage that are not addressed by current improvement programs.

Robinson Helicopter Company R22 Loss Of Main Rotor Control Accidents (NTSB/SIR-96/03)

On April 2, the NTSB issued a report on an investigation into a series of accidents involving Robinson Helicopter Company R22 aircraft. Between 1981 and 1994, the R22 experienced fatal accidents involving loss of control, including loss of main rotor control, at rates much greater than other helicopters.

There were at least 31 R22 accidents (domestic and foreign) that involved a loss of main rotor control, in which the rotor blades struck the fuselage or tailboom, causing in-flight breakups that resulted in fatalities. The investigations of these accidents did not identify any precipitating mechanical failures or material defects in the aircraft, which generally appeared to have been operating at normal main rotor revolutions per minute within the approved flight envelope, and with no indications that weather may have been a factor. This led the Board to undertake a study of these accidents as a group in an attempt to find common factors and develop appropriate remedial measures.

The Board found that the loss of main rotor control in many of the accidents “most likely stems from a large, abrupt pilot control input to a helicopter that is highly responsive to cyclic control inputs.” The cyclic on the two-seat utility helicopter controls the tilt of the main rotor system and directs the course of flight.

As R22s are used extensively for training, and the aircraft is likely to be more responsive to cyclic control inputs than other helicopters used in training or by low-time pilots, the Board suggested that special training requirements for both student pilots and flight instructors are needed. “Flight instructors probably do not have sufficient time to react to R22 students’ large, abrupt flight control inputs,” the Board said, “therefore, they must guard the cyclic closely to prevent such inputs.”

During the investigation, the FAA implemented several operational changes, primarily to ensure that pilots of the R22 and flight instructors were better trained and more proficient and that flights in R22s in certain adverse weather conditions were restricted. The Board recommended that FAA make these measures permanent

and consider similar measures in certifying future lightweight, highly responsive helicopters. The FAA also was urged to require manufacturers to provide data on the response of helicopters to flight control inputs to be used as part of the certification process, and require operational limitations or other measures for those helicopters that are highly responsive.

Based on examination of FAA records, the Board recommended that the agency review the process by which FAA certification offices and management resolve and bring to closure safety recommendations presented in internal documents, including special certification reviews, and take appropriate action to ensure that each recommendation is properly reviewed and that the disposition of each recommendation is properly documented.

The Board also called on FAA and NASA to undertake more research into lightweight helicopter behavior, continuing development of a simulator model that would be a national resource tool for the study of flight control systems and main rotor blade dynamics.

BIRD STRIKES

On January 11, the NTSB hosted a briefing for the aviation industry and various government agencies on the hazards of bird strikes. The Board has had a longstanding interest in this issue and over the past 20 years has issued wide-ranging recommendations aimed at preventing accidents caused by the ingestion of birds into aircraft turbine engines.

However, the continuing nature of the problem was demonstrated by the September 22, 1995, crash of a U.S. Air Force E-3B AWACS aircraft after takeoff from Elmendorf Air Force Base in Alaska. The airplane was destroyed and all 24 people on board were killed. The Air Force investigation determined that a flock of Canada geese had flown in front of the airplane as it became airborne and were ingested into two engines, causing them to lose power. Investigators found the remains of nearly three dozen birds on the runway after the accident and thousands of geese residing on the airport grounds.

During the briefing, it was reported that U.S. air carriers continue to experience bird strike incidents at the rate of approximately 2,500 per year and that, in addition to the safety risk this poses, the cost in damages to civilian aircraft in 1994 was estimated at over \$100 million. It also was

noted that the bird population is increasing in size and weight, and that many birds no longer migrate and have begun to take up residence on and around many U.S. airports. Takeoff and initial climb were identified as the phases of flight during which bird hazards pose the greatest threat, and discussions focused on steps that could be taken to reduce the risk of bird strikes at these times.

On July 8, drawing on information presented at the briefing, the Board issued a new set of bird strike recommendations to the FAA. The Board urged that the Aeronautical Information Manual be modified to advise pilots not to take off in the presence of a known bird hazard in the runway environment, rather than just having them review “engine out” procedures prior to the takeoff. It was also recommended that a set of “scare tactics” be developed that can be requested by pilots, controllers and/or airport personnel to disperse birds near runways. Other recommendations related to briefing controllers annually on guidelines for disseminating bird hazard information to pilots; including the location of bird hazards on automatic terminal information system recordings; and improving the reporting of bird strike incidents to the FAA.

GENERAL AVIATION INVESTIGATIONS IN 1996

In 1996, the NTSB’s regional and field offices initiated 2,002 general aviation accident investigations and completed 2,802 investigations. Although these investigations generally do not have the high visibility of those involving major air carriers, they are an important source of transportation safety information. In addition, the NTSB regional offices investigated 55 aviation incidents in 1996. Incidents are broadly defined as occurrences not serious enough to be considered accidents, but incident investigations often can lead to significant safety improvements.

A general aviation accident is handled in a manner similar to a major investigation but, because the investigation typically is much smaller in scope, it often is conducted by a single regional investigator who, working with representatives from other parties, gathers the pertinent information. Analysts located at Board headquarters review the standardized accident forms and narrative reports prepared by regional investigators for the public record. Computer “brief” reports containing relevant facts, findings and probable causes are prepared for all regional investigations and summary narrative reports are prepared

for selected cases. The data from all investigations are maintained to identify trends, assess program effectiveness and provide statistical support for NTSB safety recommendations and studies.

The regional air safety investigators accomplish scores of site specific corrections during the course of their investigations that have a direct impact on preventing future accidents. Recommendations generated from regional investigations generally account for about 25% of the total recommendations issued. During 1966, the regional staff also was called upon to assist in several major accident investigations, including ValuJet flight 592 (Florida) and TWA flight 800.

**Table 1. Accidents, Fatalities, and Rates, 1996 Preliminary Statistics
U.S. Aviation**

	Accidents		Fatalities		Flight Hours	Departures	Accidents per 100,000 Flight Hours		Accidents per 100,000 Departures	
	All	Fatal	Total	Aboard			All	Fatal	All	Fatal
U.S. Air carriers operating under 14 CFR 121										
Scheduled	32	3	342	342	12,900,000	8,185,000	0.248	0.023	0.391	0.037
Nonscheduled	6	2	38	8	783,000	369,000	0.766	0.255	1.626	0.006
U.S. Air carriers operating under 14 CFR 135										
Scheduled	11	1	14	12	2,474,000	3,171,000	0.455	0.040	0.347	0.032
Nonscheduled	87	27	59	59	1,902,000	n/a	4.57	1.42	n/a	n/a
U.S. General aviation	1,907	358	631	614	23,650,000	n/a	8.06	1.51	n/a	n/a
U.S. Civil aviation	2,040	390	1,070	1,035						
Other accidents in the U.S.										
Foreign registered aircraft	15	1	1	1						
Unregistered aircraft	8	4	4	3						
U.S. registered aircraft operated abroad by foreign air carriers	2	2	81	81						

Notes All data are preliminary.

Hours and departures are compiled and estimated by the Federal Aviation Administration.

n/a - not available

Accidents and fatalities in the categories do not necessarily sum to the figures in U.S. civil aviation because of collisions involving aircraft in different categories.

**Table 2. Accidents and Accident Rates by NTSB Classification, 1982-1996
for U.S. Air Carriers Operating Under 14 CFR 121**

Year	Accidents				Aircraft Hours Flown (millions)	Accidents per Million Hours Flown			
	Major	Serious	Injury	Damage		Major	Serious	Injury	Damage
1982	3	4	6	5	7.040	0.426	0.568	0.852	0.710
1983	4	2	9	8	7.299	0.548	0.274	1.233	1.096
1984	2	2	7	5	8.165	0.245	0.245	0.857	0.612
1985	8	2	5	6	8.710	0.918	0.230	0.574	0.689
1986	4	0	14	6	9.976	0.401	0.000	1.403	0.601
1987	5	1	12	16	10.645	0.470	0.094	1.127	1.503
1988	4	2	13	10	11.141	0.359	0.180	1.167	0.898
1989	8	4	6	10	11.275	0.710	0.355	0.532	0.887
1990	4	3	10	7	12.150	0.329	0.247	0.823	0.576
1991	5	2	10	9	11.781	0.424	0.170	0.849	0.764
1992	3	3	10	2	12.360	0.243	0.243	0.809	0.162
1993	1	2	12	8	12.706	0.079	0.157	0.944	0.630
1994	4	0	12	7	13.124	0.305	0.000	0.914	0.533
1995	3	2	14	17	13.510	0.222	0.148	1.036	1.258
1996	6	0	18	14	13.963	0.430	0.000	1.289	1.003

Definitions of NTSB Classifications

Major - an accident in which any of three conditions is met:

- a Part 121 aircraft was destroyed, or*
- there were multiple fatalities, or*
- there was one fatality and a Part 121 aircraft was substantially damaged.*

Serious - an accident in which at least one of two conditions is met:

- there was one fatality without substantial damage to a Part 121 aircraft, or*
- there was at least one serious injury and a Part 121 aircraft was substantially damaged.*

Injury - a nonfatal accident with at least one serious injury and without substantial damage to a Part 121 aircraft.

Damage - an accident in which no person was killed or seriously injured, but in which any aircraft was substantially damaged.

Table 3. Passenger Injuries and Injury Rates, 1982 through 1996, for U.S. Air Carriers Operating Under 14 CFR 121

Year	Passenger Fatalities	Passenger Serious Injuries	Total Passengers Enplanements (millions)	Million Passenger Enplanements per Passenger Fatality
1982	210	17	299	1.4
1983	8	8	325	40.6
1984	1	6	352	352.0
1985	486	20	390	0.8
1986	4	23	427	106.8
1987	213	39	458	2.2
1988	255	44	466	1.8
1989	259	55	468	1.8
1990	8	23	483	60.4
1991	40	19	468	11.7
1992	26	14	494	19.0
1993	0	7	505	No Fatalities
1994	228	16	545	2.4
1995	152	15	561	3.7
1996	319	16	590	1.8

Notes *Injuries exclude flight crew and cabin crew.*

**Table 4. Number and Rate of Destroyed Aircraft,
1982 through 1996 for U.S. Air Carriers
Operating Under 14 CFR 121**

Year	Hull Losses	Aircraft Hours Flown (millions)	Hull Losses per Million Aircraft Hours Flown
1982	3	7.040	0.426
1983	2	7.299	0.274
1984	2	8.165	0.245
1985	8	8.710	0.918
1986	2	9.976	0.200
1987	5	10.645	0.470
1988	3	11.141	0.269
1989	7	11.275	0.621
1990	3	12.150	0.247
1991	5	11.781	0.424
1992	3	12.360	0.243
1993	1	12.706	0.079
1994	3	13.124	0.229
1995	3	13.510	0.222
1996	4	13.963	0.286

Table 5. Accidents, Fatalities, and Rates, 1982 through 1996, for U.S. Air Carriers Operating Under 14 CFR 121, Scheduled and Nonscheduled Service (Airlines)

Year				Aboard	Flight Hours	Miles Flown	Departures	Accidents per 100,000 Flight Hours		Accidents per 100,000 Miles Flown		Accidents per 100,000 Departures	
	All	Fatal	Total					All	Fatal	All	Fatal	All	Fatal
1982	18	5	235	223	7,040,325	2,938,513,000	5,351,133	0.241	0.057	0.0058	0.0014	0.318	0.075
1983	23	4	15	14	7,298,799	3,069,318,000	5,444,374	0.315	0.055	0.0075	0.0013	0.422	0.073
1984	16	1	4	4	8,165,124	3,428,063,000	5,898,852	0.196	0.012	0.0047	0.0003	0.271	0.017
1985	21	7	526	525	8,709,894	3,631,017,000	6,306,759	0.241	0.080	0.0058	0.0019	0.333	0.111
1986	24	3	8	7	9,976,104	4,017,626,000	7,202,027	0.231	0.020	0.0057	0.0005	0.319	0.028
1987	34	5	232	230	10,645,192	4,360,521,000	7,601,373	0.310	0.038	0.0076	0.0009	0.434	0.053
1988	29	3	285	274	11,140,548	4,503,426,000	7,716,061	0.251	0.018	0.0062	0.0004	0.363	0.026
1989	28	11	278	276	11,274,543	4,605,083,000	7,645,494	0.248	0.098	0.0061	0.0024	0.366	0.144
1990	24	6	39	12	12,150,116	4,947,832,000	8,092,306	0.198	0.049	0.0049	0.0012	0.297	0.074
1991	26	4	62	49	11,780,610	4,824,824,000	7,814,875	0.221	0.034	0.0054	0.0008	0.333	0.051
1992	18	4	33	31	12,359,715	5,054,916,000	7,880,707	0.146	0.032	0.0036	0.0008	0.228	0.051
1993	23	1	1	0	12,706,206	5,249,469,000	8,074,393	0.181	0.008	0.0044	0.0002	0.285	0.012
1994	23	4	239	237	13,122,221	5,478,118,000	8,242,903	0.168	0.030	0.0040	0.0007	0.267	0.049
1995	36	3	168	162	13,513,219	5,648,512,000	8,451,606	0.266	0.022	0.0064	0.0005	0.426	0.035
1996	38	5	380	350	13,683,00	5,761,935,000	8,554,000	0.278	0.037	0.0066	0.0009	0.444	0.058

Notes **1996 data are preliminary.**

Hours, miles, and departures are compiled by the Federal Aviation Administration.

The 62 total fatalities in 1991 includes the 12 persons killed aboard a Skywest commuter aircraft and the 22 persons killed aboard the USAir airliner when the two aircraft collided.

The following suicide/sabotage cases are included in "Accidents" and "Fatalities" but are excluded from accident rates in this table.

Year	Location	Operator	Fatalities	
			Total	Aboard
1982	Honolulu, HI	Pan American	1	1
1986	Near Athens, Greece	Trans World	4	4
1987	San Luis Obispo, CA	Pacific Southwest	43	43
1988	Lockerbie, Scotland	Pan American	270	259
1994	Memphis, TN	Federal Express	0	0

**Table 6. Accidents, Fatalities, and Rates, 1982 through 1996,
for U.S. Air Carriers Operating Under 14 CFR 121, Scheduled Service (Airlines)**

Year				Aboard	Flight Hours	Miles Flown	Departures	Accidents per 100,000 Flight Hours		Accidents per 100,000 Miles Flown		Accidents per 100,000 Departures	
	All	Fatal	Total					All	Fatal	All	Fatal	All	Fatal
1982	16	4	234	222	6,697,770	2,806,885,000	5,162,346	0.224	0.045	0.0053	0.0011	0.291	0.058
1983	22	4	15	14	6,914,969	2,920,909,000	5,235,262	0.318	0.058	0.0075	0.0014	0.420	0.076
1984	13	1	4	4	7,736,037	3,258,910,000	5,666,076	0.168	0.013	0.0040	0.0003	0.229	0.018
1985	17	4	197	196	8,265,332	3,452,753,000	6,068,893	0.206	0.048	0.0049	0.0012	0.280	0.066
1986	21	2	5	4	9,495,158	3,829,129,000	6,928,103	0.211	0.011	0.0052	0.0003	0.289	0.014
1987	32	4	231	229	10,115,407	4,125,874,000	7,293,025	0.306	0.030	0.0075	0.0007	0.425	0.041
1988	28	3	285	274	10,521,052	4,260,785,000	7,347,575	0.257	0.019	0.0063	0.0005	0.367	0.027
1989	24	8	131	130	10,597,922	4,337,234,000	7,267,341	0.226	0.075	0.0055	0.0018	0.330	0.110
1990	22	6	39	12	11,524,726	4,689,287,000	7,795,761	0.191	0.052	0.0047	0.0013	0.282	0.077
1991	25	4	62	49	11,139,166	4,558,537,000	7,503,873	0.224	0.036	0.0055	0.0009	0.333	0.053
1992	16	4	33	31	11,732,026	4,782,825,000	7,515,373	0.136	0.034	0.0033	0.0008	0.213	0.053
1993	22	1	1	0	11,981,347	4,936,067,000	7,721,975	0.184	0.008	0.0045	0.0002	0.285	0.013
1994	19	4	239	237	12,292,356	5,112,633,000	7,824,802	0.146	0.033	0.0035	0.0008	0.230	0.051
1995	34	2	166	160	12,770,405	5,326,266,000	8,102,491	0.266	0.016	0.0064	0.0004	0.420	0.025
1996	32	3	342	342	12,900,000	5,419,380,000	8,185,000	0.248	0.023	0.0059	0.0006	0.391	0.037

Notes 1996 data are preliminary.

Hours, miles, and departures are compiled by the Federal Aviation Administration.

The 62 total fatalities in 1991 includes the 12 persons killed aboard a Skywest commuter aircraft and the 22 persons killed aboard the USAir airliner when the two aircraft collided.

The following suicide/sabotage cases are included in "Accidents" and "Fatalities" but are excluded from accident rates in this table.

Year	Location	Operator	Fatalities	
			Total	Aboard
1982	Honolulu, HI	Pan American	1	1
1986	Near Athens, Greece	Trans World	4	4
1987	San Luis Obispo, CA	Pacific Southwest	43	43
1988	Lockerbie, Scotland	Pan American	270	259
1994	Memphis, TN	Federal Express	0	0

**Table 7. Accidents, Fatalities, and Rates, 1982 through 1996,
for U.S. Air Carriers Operating Under 14 CFR 121, Nonscheduled Service (Airlines)**

Year	All	Fatal	Total	Aboard	Flight Hours	Miles Flown	Departures	Accidents per 100,000 Flight Hours		Accidents per 100,000 Miles Flown		Accidents per 100,000 Departures	
								All	Fatal	All	Fatal	All	Fatal
1982	2	1	1	1	342,555	131,628,000	188,787	0.584	0.292	0.0152	0.0076	1.059	0.008
1983	1	0	0	0	383,830	148,409,000	209,112	0.261	0.00	0.0067	0.00	0.478	0.00
1984	3	0	0	0	429,087	169,153,000	232,776	0.699	0.00	0.0177	0.00	1.289	0.00
1985	4	3	329	329	444,562	178,264,000	237,866	0.900	0.675	0.0224	0.0168	1.682	0.017
1986	3	1	3	3	480,946	188,497,000	273,924	0.624	0.208	0.0159	0.0053	1.095	0.005
1987	2	1	1	1	529,785	234,647,000	308,348	0.378	0.189	0.0085	0.0043	0.649	0.004
1988	1	0	0	0	619,496	242,641,000	368,486	0.161	0.00	0.0041	0.00	0.271	0.00
1989	4	3	147	146	676,621	267,849,000	378,153	0.591	0.443	0.0149	0.0112	1.058	0.011
1990	2	0	0	0	625,390	258,545,000	296,545	0.320	0.00	0.0077	0.00	0.674	0.00
1991	1	0	0	0	641,444	266,287,000	311,002	0.156	0.00	0.0038	0.00	0.322	0.00
1992	2	0	0	0	627,689	272,091,000	365,334	0.319	0.00	0.0074	0.00	0.547	0.00
1993	1	0	0	0	724,859	313,402,000	352,418	0.138	0.00	0.0032	0.00	0.284	0.00
1994	4	0	0	0	829,865	365,485,000	418,101	0.482	0.00	0.0109	0.00	0.957	0.00
1995	2	1	2	2	742,814	322,246,000	349,115	0.269	0.135	0.0062	0.0031	0.573	0.003
1996	6	2	38	8	783,000	342,555,000	369,000	0.766	0.255	0.0175	0.0058	1.626	0.006

Notes 1996 data are preliminary.

Hours, miles, and departures are compiled by the Federal Aviation Administration

**Table 8. Accidents, Fatalities, and Rates, 1982 through 1996,
for U.S. Air Carriers Operating Under 14 CFR 135, Scheduled Service (Commuter Air Carriers)**

Year	All	Fatal	Total	Aboard	Flight Hours	Miles Flown	Departures	Accidents per 100,000 Flight Hours		Accidents per 100,000 Miles Flown		Accidents per 100,000 Departures	
								All	Fatal	All	Fatal	All	Fatal
1982	26	5	14	14	1,299,748	222,355,000	2,026,691	2.000	0.385	0.1169	0.0225	1.283	0.247
1983	17	2	11	10	1,510,908	253,572,000	2,328,430	1.125	0.132	0.0670	0.0079	0.730	0.086
1984	22	7	48	46	1,745,762	291,460,000	2,676,590	1.260	0.401	0.0755	0.0240	0.822	0.262
1985	21	7	37	36	1,737,106	300,817,000	2,561,463	1.209	0.403	0.0698	0.0233	0.820	0.273
1986	15	2	4	4	1,724,586	307,393,000	2,798,811	0.870	0.116	0.0488	0.0065	0.536	0.071
1987	33	10	59	57	1,946,349	350,879,000	2,809,918	1.695	0.514	0.0940	0.0285	1.174	0.356
1988	19	2	21	21	2,092,689	380,237,000	2,909,005	0.908	0.096	0.0500	0.0053	0.653	0.069
1989	19	5	31	31	2,240,555	393,619,000	2,818,520	0.848	0.223	0.0483	0.0127	0.674	0.177
1990	16	4	7	5	2,341,760	450,133,000	3,160,089	0.683	0.171	0.0355	0.0089	0.506	0.127
1991	22	8	99	77	2,291,693	433,900,000	2,820,440	0.960	0.349	0.0507	0.0184	0.780	0.284
1992	23	7	21	21	2,363,745	508,242,000	3,114,932	0.931	0.296	0.0433	0.0138	0.706	0.225
1993	16	4	24	23	2,641,268	554,963,000	3,601,902	0.606	0.151	0.0288	0.0072	0.444	0.111
1994	10	3	25	25	2,787,904	594,716,000	3,850,372	0.359	0.108	0.0168	0.0050	0.260	0.078
1995	11	2	9	9	2,478,872	565,577,000	3,216,900	0.444	0.081	0.0194	0.0035	0.342	0.062
1996	11	1	14	12	2,474,000	608,814,000	3,171,000	0.445	0.040	0.0181	0.0016	0.347	0.032

Notes 1996 data are preliminary.

Hours, miles, and departures are compiled by the Federal Aviation Administration.

The following attempted suicide case is included in "Accidents" and "Fatalities" but are excluded from accident rates in this table.

Year	Location	Operator	Fatalities	
			Total	Aboard
1992	Lexington, KY	Mesaba Airlines	0	0

**Table 9. Accidents, Fatalities, and Rates,
1982 through 1996, for U.S. Air Carriers Operating Under
14 CFR 135, Nonscheduled Service (On-demand Air Taxis)**

Year	Accidents		Fatalities		Flight Hours	Accidents per 100,000 Flight Hours	
	All	Fatal	Total	Aboard		All	Fatal
1982	132	31	72	72	3,008,000	4.39	1.03
1983	141	27	62	57	2,378,000	5.93	1.14
1984	146	23	52	52	2,843,000	5.14	0.81
1985	154	35	76	75	2,570,000	5.99	1.36
1986	117	31	65	61	2,690,000	4.35	1.15
1987	96	30	65	63	2,657,000	3.61	1.13
1988	101	28	59	55	2,632,000	3.84	1.06
1989	110	25	83	81	3,020,000	3.64	0.83
1990	106	28	50	48	2,249,000	4.71	1.24
1991	87	27	70	66	2,241,000	3.88	1.20
69	76	24	68	65	2,009,000	3.78	1.19
1993	69	19	42	42	1,809,000	3.81	1.05
1994	85	26	63	62	1,993,000	4.26	1.30
1995	75	24	52	52	1,910,000	3.93	1.26
1996	87	27	59	59	1,902,000	4.57	1.42

Notes 1996 data are preliminary.

Hours are estimated by the Federal Aviation Administration (FAA).

Table 10. Accidents, Fatalities, and Rates, 1982 through 1996, U.S. General Aviation

Year	Accidents		Fatalities		Flight Hours	Accidents per 100,000 Flight Hours	
	All	Fatal	Total	Aboard		All	Fatal
1982	3,233	591	1,187	1,170	29,640,000	10.90	1.99
1983	3,078	556	1,069	1,062	28,673,000	10.73	1.94
1984	3,017	545	1,042	1,021	29,099,000	10.36	1.87
1985	2,739	498	955	944	28,322,000	9.66	1.75
1986	2,582	474	967	878	27,073,000	9.54	1.75
1987	2,495	447	838	823	26,972,000	9.25	1.65
1988	2,385	460	800	792	27,446,000	8.69	1.68
1989	2,232	431	768	765	27,920,000	7.98	1.53
1990	2,215	442	766	761	28,510,000	7.77	1.55
1991	2,175	432	786	772	27,226,000	7.98	1.58
1992	2,073	446	857	855	23,792,000	8.71	1.87
1993	2,039	398	736	732	22,531,000	9.05	1.76
1994	1,994	404	730	723	21,873,000	9.11	1.84
1995	2,054	411	733	726	23,538,000	8.72	1.74
1996	1,907	358	631	614	23,650,000	8.06	1.51

Notes 1996 data are preliminary.

Hours are estimated by the Federal Aviation Administration.

Suicide/sabotage cases included in "Accidents" and "Fatalities" but exclude from accident rates in this table are: 1982 (3 acc., 0 fatal acc.); 1983 (1, 0); 1984 (3, 2); 1985 (3, 2); 1987 (1, 1); 1988 (1, 0); 1989 (5, 4); 1990 (1, 0); 1991 (3, 2); 1992 (1, 1); 1993 (1, 1); 1994 (2, 2); 1995 (2, 1)

Effective in April, 1995 the NTSB is required by law to investigate all public use accidents. The effect upon the number of general aviation accidents is an increase of approximately 1 1/2 percent.

ASSISTANCE TO FAMILIES

The Aviation Disaster Family Assistance Act of 1996 (PL 104-264), passed by the Congress and signed by the President on October 9, conferred major new responsibilities on the NTSB for aiding the families of victims of aircraft accidents on U.S. territory. This new law closely followed a Presidential Executive Memorandum (dated September 9) which designated the Board as the coordinator of federal services for families of victims of major transportation disasters.

These actions were taken in response to inadequacies in the treatment accorded to families of victims in the wake of a number of major crashes. The intent was to marshal the resources of the federal government and other organizations in support of the efforts of the airlines and local authorities, which traditionally has the responsibility of meeting the needs of aviation disaster victims and their families.

Under the new legislation, the airlines retain primary responsibility for notification and caring for the families of accident victims. Similarly, local authorities maintain the same jurisdiction they had prior to the act in areas such as emergency response, victim recovery, site security, medical examiner operations, and site cleanup.

The law gives the NTSB primary federal responsibility for facilitating the recovery and identification of fatally-injured airline passengers. In addition, to the extent practicable, the Board is to provide victims' families with factual information on the accident investigation before it is released to the media, including updates on victim recovery and identification, and the disposition of personal effects.

The Board also has primary responsibility to coordinate and integrate the efforts of other federal and private organizations in such areas as crisis counseling, forensic services, communicating with foreign governments, and translation services. Memoranda of Understanding are being prepared that will specify the responsibilities of these organizations.

It is planned that, under NTSB direction, the American Red Cross will provide crisis counseling to the families. The Department of Health and Human Services (DHHS) will be responsible for assisting the local medical examiner in the identification and return of remains to the families. Upon request of the medical examiner, the Board will ask DHHS to provide a National Disaster Mortuary Team composed of

forensic pathologists, finger print experts, and other medical/technical personnel. DHHS can also provide a fully equipped mobile mortuary to expand the local medical examiner's capabilities.

The DOD also will support victim identification efforts by providing military resources, such as personnel from the Armed Forces Institute of Pathology and the use of military facilities. If there are any foreign passengers or crew involved, the Department of State (DOS) will assist the airline in officially notifying the victim's government and helping the affected families travel to the U.S. DOS also will provide translation services to facilitate communication with all the parties. The NTSB also can call on the Federal Emergency Management Agency to augment the Board's public information efforts with additional staff and any communications equipment that may be needed. If the cause of an accident is due to a criminal act, the Department of Justice (DOJ) will provide information to the families on assistance available under the Victims of Crime Act of 1984.

The legislation requires that, within six months, the airlines submit emergency response plans for family affairs to DOT and the NTSB for joint review. These plans will include procedures for publicizing a reliable toll-free number and providing adequate staff to handle calls from family members, assurances of consultations with family members regarding the disposition of victim remains and personal effects, and assurances that the air carrier will assist family members in traveling to an accident site and providing for their "physical care" while at that location.

Another provision calls on the Secretary of Transportation to establish a task force composed of family members of air accident victims and representatives of government, private relief agencies, and air carrier employees to develop a model plan to assist the airlines in responding to accidents. Issues the task force is to address include improving the timeliness of casualty notifications to families, ensuring that attorneys and representatives of media organizations do not intrude on the privacy of family members, and ensuring that family members of accident victims who are non-citizens receive "appropriate assistance."

NTSB Chairman Hall has said that the Board will move quickly to implement the new legislation, and establish a staff of NTSB family assistance specialists. The aim, as the Chairman noted is to build an infrastructure that, in cooperation with the carriers and local authorities, will provide more timely and effective assistance to the families of air disaster victims. At the same time, Chairman Hall stressed that care would be taken to ensure that the Board's new family assistance duties do not hamper or interfere with its primary function of accident investigation.

ASSISTANCE TO FAMILIES

On November 19, the Board mobilized its family assistance plan for the first time since passage of the legislation. Several family assistance staff members were dispatched to Quincy, IL, following the runway collision between a United Express flight and a private aircraft that killed all 14 persons on the two airplanes.

SURFACE TRANSPORTATION SAFETY

The NTSB investigates selected surface transportation accidents and incidents. The Board's Office of Surface Transportation Safety manages these investigations when multi-disciplinary "Go-Teams" are dispatched to an accident site, while smaller-scale accidents are usually investigated by one person or a partial team from one of the Board's seven regional surface transportation offices.

The Surface Transportation office contains five investigative divisions: Highway, Marine, Railroad, Pipeline and Hazardous Materials, and Human Factors. These divisions provide the IICs for the teams that conduct the investigations and also coordinate the preparation of the Board's comprehensive surface transportation accident reports.

When the Board is notified of an accident, the team that is launched varies in size depending on the severity and complexity of the event. As with aviation accidents investigated by the NTSB, the teams consist of experts in various technical specialties, including vehicle factors, hazardous materials analysis, operational and environmental factors, systems design and support, human performance, and survival factors. Each expert manages a team of specialists from industry and other government entities in collecting the facts and determining the circumstances surrounding the accident.

A hearing may be conducted (or depositions taken) to gather additional information in connection with an investigation. After the investigation is concluded, a detailed narrative report that analyzes the investigation record and identifies the probable cause(s) of the accident is prepared. A major surface accident investigation often takes from nine months to a year to complete.

Safety recommendations resulting from the investigations are generally included in the final report, although they may be issued at any time during the course of an investigation if warranted by events. The Surface Transportation office also is responsible for follow-up with safety recommendation recipients, once an agency or organization has responded to particular recommendations.

HIGHWAY DIVISION

Each year, highway traffic crashes cost the nation about 40,000 lives, more than five million injuries, and \$137 billion in medical costs, lost productivity, and property damage. About 4,600 vehicles annually are involved in accidents at railroad grade crossings that kill about 500 persons and injure more than 1,800.

The NTSB is charged with investigating highway accidents, including railroad grade crossing accidents, that it selects in cooperation with the state authorities. The Board seeks to concentrate its limited highway investigation resources on accidents that have a significant impact on the public's confidence in highway safety, that generate high public interest, or that concern technical safety issues that cause or contribute to accidents and injuries on a national scale. In-depth investigations, therefore, tend to focus on accidents involving multiple fatalities and/or substantial property damage. Under current highway accident selection criteria, the Board generally will investigate:

- Crashes involving a passenger bus with fatalities or serious injuries on the bus;
- Crashes involving a school bus with a fatality or serious injury on the school bus;
- Grade crossing accidents involving a hazardous materials carrier, school bus, passenger bus or van, or emergency vehicles;
- Highway bridge collapses or closures;
- Highway crashes with five or more fatalities; and
- Highway crashes involving a heavy truck resulting in three or more fatalities.

Investigative areas selected by the Board for special emphasis include:

- Intrastate trucks not subject to federal/state oversight;
- Passive grade crossings;
- School bus passenger protection;

- Air bag induced injuries; and
- Motor coach oversight.

HIGHWAY INVESTIGATIONS IN 1996

The NTSB investigated 71 highway accidents in 1996 and completed one safety study with the Office of Research and Engineering. Issues involved in the investigations ranged from truck maintenance and inspection to railroad/highway signal interaction. Among the investigations initiated in 1996 are the following significant cases:



Plymouth Meeting, PA. Concrete-mixer truck collided with passenger sedan at state highway exit.

Plymouth Meeting, PA - Loss of Braking Control

On April 25, a truck delivering concrete to customers in the Philadelphia metropolitan area collided with a passenger sedan at a “T” intersection on exiting from a state highway. The four-axle truck with a

HIGHWAY DIVISION

concrete mixer body, unable to stop as it left the exit ramp, struck the automobile on the passenger side, overrode it, and dragged it across the intersection before the truck came to rest on its right side. The driver of the car was fatally injured; the truck driver sustained minor injuries.

The NTSB investigation focused on the maintenance and inspection practices of the company operating the truck and the adequacy of federal and state guidelines for conducting truck airbrake system inspections. Investigators are seeking to uncover any deficiencies in the accident truck's dual air brake system that might also be found in similarly equipped trucks nationwide.

Cosmopolis, WA - Transit Bus Fatality

On November 26, near Cosmopolis, WA, a utility truck hit and fatally injured a 10-year-old child who ran from behind a transit bus that had transported him from school to his residence. The transit bus had stopped and had activated its headlights and four-way flashers. The driver of the utility truck, coming around a curve from the opposite direction, slowed down but began to resume speed when the flashers on the bus were deactivated and the bus started to move away from the stop. As the truck accelerated, the child ran out from behind the transit bus and was struck.

A major issue in this investigation is whether children riding transit buses to and from school are afforded an equivalent level of safety as those children who ride school buses. In addition, investigators are looking into whether there is a mechanism in place to document the extent to which transit buses are being used nationwide to transport children to and from school.

HIGHWAY REPORTS ADOPTED IN 1996

Sycamore, SC - Grade Crossing Accident

On March 11, the NTSB adopted a report on an Amtrak passenger train that derailed near Sycamore, SC after colliding with a truck at a grade crossing. The Amtrak Silver Star, carrying 279 passengers from New York to Tampa, on May 2, 1995, struck a "lowbed" tractor-semitrailer that had been lodged for about 35 minutes on the high-vertical-profile (hump) passive grade crossing. The two

locomotive units and 14 cars of the 16-car train derailed. Thirty-three persons sustained minor injuries. The combined damage to the train and truck exceeded \$1 million.

NTSB investigators found that the truck, as configured, could not safely travel over the crossing because of the crossing's substandard geometric characteristics. Also, as is often the case, the driver in this accident was untrained in grade crossing safety and emergency notification procedures, and, therefore, was unprepared to react appropriately to the situation. The Board concluded that had the driver taken appropriate action and notified authorities shortly after becoming lodged at the crossing, this accident probably would not have occurred. In addition, had emergency notification information been posted at the accident crossing, the truck driver may have used it to notify the railroad, thereby avoiding the accident.

As a result of the investigation, the NTSB issued 15 recommendations to DOT, the trucking company and various industry organizations. The Board recommended that DOT encourage and coordinate efforts between the railroad industry and state and local highway officials to identify substandard grade crossing profiles and take appropriate action to eliminate them. DOT also was asked to encourage states to post warning notices at hump crossings where high profiles present potential hazards for highway vehicles and where such hazardous profiles cannot be corrected in a timely manner.

The Board called on Class I railroads and railroad systems to implement, without delay, a 24-hour toll-free emergency notification telephone system for use by the public in reporting grade crossing emergencies, and to have information on the system posted at grade crossings. Similar recommendations were made to the American Public Transit Association (APTA) and the American Short Line Railroad Association.

Recommendations to the American Association of Motor Vehicle Administrators suggested that commercial driver manuals be revised to include specific information on grade crossing safety and emergency notification procedures, and that truck drivers be tested on their knowledge of these matters. The American Trucking Associations, Inc., was asked to advise its members of the circumstances of the Sycamore accident, and highlight grade crossing hazards and emergency notification in training programs.

The firm operating the truck was urged to establish a contingency plan that addresses on-the-road emergencies and provides drivers with guidance in dealing with potentially hazardous situations such as having a vehicle stall or become lodged on a grade crossing.



Fox River Grove, IL - Seven students died when a commuter train hit school bus at a grade crossing.

Fox River Grove, IL - School Bus/Commuter Train Collision

On October 25, 1995, a regional express commuter train struck the rear left side of a stopped school bus at a railroad/highway grade crossing in Fox River Grove, IL. The collision occurred after the school bus had crossed the railroad tracks and stopped for a red traffic signal, with the rear portion of the bus extending about three feet into the path of the train. Seven of the 35 passengers on the school bus were killed, 24 sustained serious injuries. The school bus driver received minor injuries; there were no injuries aboard the commuter train.

As part of the NTSB's investigative process, a public hearing was held, January 16-19, in Crystal Lake, IL, to further explore safety issues that had been raised in the investigation. The final investigation report, adopted by the Board on October 29, stated that the probable cause of the collision was that the bus driver had positioned the school bus so that it encroached upon the railroad tracks because of: the failure of the Illinois Department of Transportation (IDOT) to recognize the short queuing area for vehicles on the road crossing the tracks and to take corrective action; IDOT's failure to recognize the insufficient time of the green signal indication for vehicles at that point on the road; and the school district's failure to identify route hazards for its drivers with alternative instructions for such situations.

Contributing to the accident, the Board found, was the failure of IDOT and its contractors, the Illinois Commerce Commission, and the railroads "... to have a communication system that ensures understanding of the integration and working relationship of the railroad and highway signal systems."

As a result of the investigation, the Board issued a series of 29 recommendations to a variety of public and private organizations. The U.S. DOT was asked to develop a comprehensive railroad/highway grade crossing safety inspection program to be conducted jointly by railroads and public entities. U.S. DOT also was urged to develop a mandatory training program in the design and operation of railroad grade crossings, that includes the interaction between rail and highway signal systems, for representatives of the railroads, public entities, and others who design and maintain grade crossing signal systems.

Other recommendations dealt with the development of methods to delineate grade crossing areas to give motorists visual reference points to ascertain whether they may be encroaching on the travel path of a train, and the dissemination of this information to drivers nationwide.

Illinois authorities were requested to provide bus drivers with practical training on vehicle positioning on the road, especially at grade crossings. IDOT was asked to review and modify the highway design for all grade crossings in the state to ensure vehicles have adequate space and time to clear the crossing before the arrival of a train. Another recommendation to IDOT called for training staff and contractors involved in the design, inspection and maintenance of highway signals at grade crossings to ensure that they understand the integration and working relationship of the railroad and highway signal systems.

The school district was asked to implement a program to identify school bus route hazards and to routinely monitor and evaluate all regular and substitute school bus drivers. A similar recommendation was one of several made to the National Association of State Directors of Pupil Transportation Services. Various other transportation, engineering, and public works associations were advised to inform their members of the circumstances of this accident and the importance of exchanging information regarding railroad/highway grade crossings.

Major Highway Investigations In 1996

Accident Date	Location	Accident Type	Fatalities
4/25/96	Plymouth Meeting, PA	Truck/Car Collision	1
11/26/96	Cosmopolis, WA	Transit Bus	1

Major Highway Reports Adopted In 1996

Report Number	Date Adopted	Location	Accident Type	Fatalities
HAR-96/01	3/11/96	Sycamore, SC	Grade Crossing Collision	0
HAR-96/02	10/25/96	Fox River Grove, IL	School Bus/Train Collision	7

MARINE DIVISION

The NTSB is authorized to investigate marine accidents involving U.S. vessels anywhere in the world and foreign vessels in U. S. territorial waters. In past years, the Board has conducted marine accident investigations as far away as the Persian Gulf and the South China Sea.

The marine accident investigation function is performed entirely from NTSB headquarters; there are no regional marine offices or marine personnel assigned to any of the Board's modal field offices. To carry out its marine safety program, the Board maintains a small staff of professional investigators with industry and/or U.S. Navy or Coast Guard experience. These investigators include licensed master mariners, marine engineers, and naval architects who possess a wealth of hands-on maritime experience.

During an average year, about 4,000 accidents involving commercial vessels and more than 6,500 accidents involving recreational boats occur in the United States. Given these large numbers, the Board targets for investigations those accidents that appear to involve the most significant safety issues. Under current marine accident selection criteria, the Board generally will investigate accidents involving:

- The loss of six or more lives;
- The loss of a self-propelled vessel of over 100 gross tons or damage to any vessel exceeding \$500,000;
- Serious hazardous materials threats to life, property and the environment;
- Coast Guard safety functions (e.g., vessel traffic services, search and rescue operations, vessel inspections, aid to navigation positioning/lighting); or
- A public or non-public vessel collision or other accident with one or more fatalities or \$75,000 or more in property damage.

Investigative areas selected by the Board for special emphasis include:

- Large passenger vessels, including ocean cruise ships and excursion vessels, ferries and harbor excursion boats;
- Small passenger vessels carrying more than six passengers;

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- Bridge resource management;
- Tank ships and tank barges;
- Fatigue and hours of service on all vessels;
- Commercial fishing vessels;
- Collisions and groundings involving oceangoing vessels; and
- Inland tow vessel rammings.

The Board does have the option of requesting that the Coast Guard investigate an accident without NTSB participation. In such cases, the Coast Guard will send the accident file to the Board when the investigation is completed. If the Board does decide to investigate a marine accident, then it must coordinate with the Coast Guard on whether the investigation will be conducted jointly under Coast Guard rules or independently under NTSB rules.

As in the other transportation modes, the Board also undertakes studies involving specific marine safety issues, which typically result in the issuance of recommendations to federal and state agencies, and the maritime industry.

MARINE INVESTIGATIONS IN 1996

In 1996, the Marine Division launched teams of investigators on six accidents; one investigation was conducted jointly with the U.S. Coast Guard. Marine investigators also were part of the NTSB team that responded to the crash of TWA flight 800 off East Moriches, NY, in July. Among the investigations initiated in 1996 were the following significant cases:

Point Judith, RI - Tank Barge Fire/Oil Spill

On January 19, the U.S. tugboat SCANDIA suffered an engine room fire while towing an unmanned tank barge, the NORTH CAPE, about 4.5 miles off Point Judith, RI. There were no deaths or injuries among the six crew members who were forced to abandon the tug amid 15-foot seas and winds of 45 knots. The crew, however, was

unsuccessful in their efforts to release the anchor of the barge, which ran aground and spilled over 800,000 gallons of home heating oil. Reports described this as the largest pollution incident in Rhode Island history.

The safety issues identified during the investigation include fire fighting training and fire safety precautions aboard uninspected towing vessels, the effectiveness of the Coast Guard's search and rescue, the effectiveness of barge retrieval/anchoring systems, and the operating company's vessel maintenance programs.

Lynn Canal, AK - Cruise Ship Fire

On July 27, a fire started in the main laundry room of the Panamanian cruise ship UNIVERSE EXPLORER while en route from Juneau to Glacier Bay, AK, with 733 passengers and 274 crew members on board. The fire generated dense smoke and heat that spread to the deck where the crew accommodations were located. Crew members attempting to escape the fire had difficulty finding their way to safety. Five crewmembers perished; another 67 crewmen and two passengers were injured.

Interest in this case was heightened because the vessel is used most of the year as a floating university campus. The NTSB investigation is focused on the adequacy of fire prevention, detection and suppression capability, and procedures for escape, rescue and evacuation on board UNIVERSE EXPLORER, as well as other cruise ships of the same vintage.

Since 1979, the Board has investigated 24 major accidents involving foreign passenger vessels operating from U.S. ports. These accidents resulted in 11 deaths, 198 injuries and \$144 million in property damage. In May 1992, largely due to the Board's recommendations for improved fire safety standards on passenger ships, the International Maritime Organization (IMO) adopted a series of amendments to the Safety Of Life At Sea Convention (1974). These fire safety amendments called for improvements to be phased in over a 16-year period, starting in October 1994. The Board's investigation of the UNIVERSE EXPLORER fire will look into the adequacy of these amendments to see if additional measures are necessary.



Portland, ME. Tank ship carrying heating oil collides with pier of bridge.
PHOTO BY BILL JEWELL

Portland, ME - Tank Ship Rams Bridge

On September 27, the 560-foot-long Liberian tank ship JULIE N, carrying a cargo of heating oil, collided with a pier of the Portland Bridge. At the time, the vessel was proceeding to a terminal and was under the direction of a state-licensed docking master. The collision resulted in a large hole in the port bow above the water line and a 30-foot long hole in the hull beneath the water line from which both fuel and cargo spilled. Despite vigorous containment and cleanup measures, a considerable area of the harbor was affected by the spill.

The major safety issues identified in the ensuing investigation include the adequacy of risk analysis for Portland harbor, and current marine requirements for post-accident drug and alcohol testing.

Marina del Rey, CA - Charter Yacht Fire

On December 7, a fire broke out on the charter yacht SUNDOWNER after departure from Marina del Rey, with 63

passengers aboard, for a corporate Christmas party dinner cruise. The fire spread rapidly to the fiberglass covered third deck and, within 5-6 minutes, engulfed nearly the entire vessel above the first deck. The passengers abandoned the vessel, jumping into the water without flotation devices because they were not told where the gear was stowed. There were no fatalities but six passengers were reported hospitalized with second and third degree burns.

In their investigation, NTSB investigators are examining: fire safety on smaller passenger vessels; crew training for emergencies; and, the adequacy of present practices concerning post-accident alcohol testing.

New Orleans, LA - Ship Strikes Riverside Mall

On December 14, the Liberian bulk carrier BRIGHT FIELD was navigating outbound in the lower Mississippi River, when an apparent problem with a lubricating oil pump started a sequence of events that led to a temporary loss of propulsion power and maneuvering control. The ship, which had a harbor pilot on board, veered to the left descending bank and struck a wharf adjacent to a shopping mall, a parking garage, and a hotel. There were no injuries among the people at the mall, but a number of people on a casino boat moored next to the complex were seriously injured when they jumped overboard, thinking that the BRIGHT FIELD was about to collide with their vessel.

The major issues under examination in this accident investigation are: pilotage and communications; the adequacy of the ship's main engine and automation systems; and the adequacy of port risk assessment, including the current status of contingency planning for the Port of New Orleans.

MARINE REPORTS ADOPTED IN 1996

Seward, AK - Fishing Vessel Fire

A fatal fire aboard a fishing vessel in Alaska prompted the NTSB to issue a series of recommendations aimed at improving fire safety on about 250 domestic fishing and fish processing ships that operate in and around U.S. waters.

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On May 27, 1995, the U.S. fish processing vessel ALASKA SPIRIT caught fire and burned while moored alongside a dock at the Marine Industrial Center in Seward, AK. The ship's captain died in the fire; damage to the vessel was estimated at \$3 million. The ship, which usually carried a crew of 48, was in port for maintenance, repairs, and preparations for the next fishing voyage. Eight crew members stayed on board to accomplish the work.



Seward, AK. Fatal fire aboard Alaskan fishing vessel.

At a public meeting, the NTSB determined that the probable cause of the fire was the failure of the operator, the Fishing Company of Alaska, Inc., to address inadequate safety conditions and practices aboard the vessel. Contributing to the severity of the damage and loss of life, the Board found, was the lack of fire safety standards for commercial fishing vessels.

In a report adopted on June 11, the Board urged the U.S. Coast Guard to work with the National Fire Protection Association to develop national fire safety standards for commercial fishing vessels, including structural fire protection standards and fire detection and suppression systems in ships' accommodation areas, and to incorporate these standards in regulations. The Board also recommended that the Coast Guard promptly seek a change in law to require the phasing-in of fire safety regulations, currently applicable only to new vessels, by all existing fishing industry ships that carry more than 16 persons.

The Board reported that the likely fire ignition source was an electrical cooking pot in a crew member's room that had been locked and unattended for several days. Investigators also found that a sprinkler system would probably have extinguished the fire in its early stages, impeded the spread of the fire, and possibly prevented the loss of life. To correct these and other problems uncovered aboard the ALASKA SPIRIT, the Board recommended that the fishing company:

- Develop written guidance for vessel masters to review and document the fire safety condition of all crew rooms when the occupants disembark from the vessel and the rooms will be unoccupied;
- Install smoke detectors in the accommodation spaces on all vessels, regardless of whether heat detectors are installed;
- Install automatic fire suppression systems in all accommodation spaces that are constructed of combustible materials;
- Direct ship masters to check all fire stations on their vessels to ensure that fire hose thread couplers are compatible with vessel fire hydrants, and to replace all incompatible equipment; and
- Develop fire contingency plans that improve the training and readiness of vessel personnel and equipment to respond to a fire emergency.

Shelter Island, AK - Fatal Motorboat Capsizing

On August 21, 1994, a disabled 18-foot QUESTAR motorboat, with the vessel's owner and a passenger aboard, capsized while being towed by the Coast Guard auxiliary vessel PUPPET south of Shelter Island, near Juneau, AK. The QUESTAR's owner was trapped inside the vessel's cabin and drowned; the passenger was uninjured.

In a summary report adopted on November 26, the NTSB found that the probable cause of the QUESTAR's capsizing was the flooding of the vessel due to improper towing procedures by the Coast Guard auxiliary operator of the PUPPET. Contributing to the accident was the failure of the PUPPET's operator to assess the risk properly before deciding to tow the vessel in hazardous sea conditions. Contributing to the loss of life, the Board decided, was the failure of the PUPPET's operator to remove the people on board the QUESTAR before towing the vessel.

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As a result of the investigation, the Board issued a series of recommendations to the Coast Guard dealing with improving search and rescue operations, particularly with auxiliary units. Other recommendations dealt with publicizing the lessons learned from this investigation and incorporating them into training programs for auxiliary personnel.

INTEGRATED BRIDGE SYSTEMS

On March 6-7, the NTSB convened a forum of top experts on ship control technology to examine recent advances in navigation and communications and how these might impact on the safety of maritime operations. Discussion at the forum, in Vienna, VA, focused on integrated bridge systems in which advanced navigation systems are joined with automated sub-systems in a single unit that enables navigation watch officers to monitor and control all essential ship functions. Forum topics included:

- Design standards for ship integrated bridge systems;
- Industry and government oversight of manufacturers, installers and operators of integrated bridge systems;
- Training and certification of mariners responsible for operating integrated bridge systems; and
- Impact of new technology on safety, crew workload and watch keeping.

Participating in the forum were representatives of shipping companies, manufacturers of navigation equipment, members of classification societies, U.S. Coast Guard, IMO, Electromechanical Commission, National Marine Electronics Association, Radio Technical Commission for Maritime Services, and maritime training institutions.

Major Marine Investigations In 1996

Accident Date	Location	Vessel	Accident Type	Fatalities
1/19/96	Point Judith, RI	SCANDIA/NORTH CAPE	Tank Barge Fire	0
7/27/96	Glacier Bay, AK	UNIVERSE EXPLORER	Cruise Ship Fire	5
9/27/96	Portland, ME	JULIE N	Ship/Bridge Collision	0
12/7/96	Marina del Rey, CA	SUNDOWNER	Charter Yacht Fire	0
12/14/96	New Orleans, LA	BRIGHT FIELD	Ship/Mall Collision	0

Major Marine Reports Adopted In 1996

Report Number	Date Adopted	Location	Vessel	Accident Type	Fatalities
MAR-96/01	6/11/96	Seward, AK	ALASKA SPIRIT	Fishing Vessel Fire	1
MAR-96/01/ SUM	11/26/96	Shelter Island, AK	QUESTAR/ PUPPET	Motorboat Cap- sizing	1

RAILROAD DIVISION

Since 1967, the primary responsibility for railroad accident investigation has been assigned by Congress to the NTSB. As in the other surface modes, the Board performs in-depth analyses of selected rail accidents, determines the probable cause(s), and issues recommendations to effect changes to prevent similar accidents.

The Board also conducts studies of significant railroad safety issues, often based on a set of accident investigations specifically undertaken as the basis for the study. In other cases, the studies may be based on an analysis of regulations, railroad safety programs and procedures, audit reviews of management and operational practices, or other research. In addition, the Board investigates selected accidents involving specific life-saving issues.



Sycamore, SC. Passenger train derailment after collision with truck at a grade crossing.

Because of limited resources, the Board is able to investigate only a fraction of the approximately 2,000 accidents and incidents that are reported each year to the FRA. It, therefore, attempts to focus its efforts in areas where it can have a significant safety impact. Under current railroad accident selection criteria, the Board generally will

investigate:

- Collisions or derailments involving passenger, rail transit, or commuter trains;
- Collisions between trains that result in an employee fatality, serious injury to two or more employees, or damages of \$500,000 or more to railroad and/or non-railroad property;
- Accidents involving a passenger fatality; or
- Rail/highway grade crossing accidents involving 5 or more fatalities, release of hazardous materials release, or a failure of crossing protection equipment.

Investigative areas selected by the Board for special emphasis include:

- Train collisions;
- Rail transit;
- Human performance failures;
- FRA track safety standards;
- FRA power brake regulations; and
- Oversight of short line railroads and tourist/scenic railways.

RAILROAD INVESTIGATIONS IN 1996

The Railroad Division initiated 4 major and 55 field investigations in 1996, and provided major support in the investigation of the school bus/commuter train collision in Fox River Grove, IL, and the grade crossing accident in Sycamore, SC. Railroad investigations in 1996 included the following significant cases:

Secaucus, NJ - Commuter Trains Collide

On February 9, during the morning rush-hour, an eastbound New Jersey Transit (NJT) commuter train ran a stop signal at a track intersection near Secaucus, NJ, and collided nearly head-on with a westbound NJT

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train. The two trains were carrying about 400 passengers. The engineers on both trains and one passenger were killed in the collision; there were more than 150 minor-to-serious injuries. Damages were estimated at over \$3 million.

The major safety issues in this investigation are the medical condition of the engineer of the eastbound train, the adequacy of medical standards for locomotive engineers, and the NJT train crew's response to the accident. Board investigators also are looking at the crashworthiness of the trains and the response effort of emergency personnel.

Silver Spring, MD - Amtrak/Commuter Train Crash

On February 16, a Maryland Rail Commuter (MARC) train, heading eastward, collided with a westbound Amtrak passenger train near Silver Spring, MD. The MARC train, en route to Washington, DC, and traveling under CSX Transportation, Inc., (CSXT) operation and control on CSXT tracks, did not stop for a red signal at Georgetown Junction, where the crash occurred. The Chicago-bound Amtrak train had been routed onto the same track as the MARC train, after departing Washington's Union Station, in order to pass a stopped freight train. The Amtrak train had started to cross back to its original track when the crash occurred. The fuel tank of the Amtrak train's lead locomotive ruptured on impact and the diesel fuel ignited. All three operating crew members on the MARC train and eight passengers were killed in the derailment and fire. Eleven MARC train passengers and 15 of the 182 passengers and crew aboard the Amtrak train were injured. Estimated damages exceeded \$7.5 million.

On March 12, the Board issued urgent recommendations to the Maryland Mass Transit Administration (MTA) regarding the installation of removable windows or kick panels for emergency exits in passageway doors, interior quick-release mechanisms for exit doors, and reflective signage at emergency exits that provide easily understood instructions.

As part of the on-going investigation, the Board held a public hearing in Rockville, MD, on June 26. Testimony on a wide variety of rail safety issues was taken from witnesses to the accident and officials from the FRA, CSXT, Maryland MTA, rail employees unions and other interested parties.

The investigation is focused on the performance and responsibility of the MARC train crew, the oversight of CSXT signal system modifications, federal oversight of commuter rail



Silver Spring, MD. Amtrak/Commuter Train Crash.

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operations, the lack of positive train control separation systems, and the adequacy of passenger car safety standards and emergency preparedness. In addition, Board investigators are examining the use of the reverser during an emergency brake application, the effectiveness of the computer-aided train dispatching recordkeeping, the crashworthiness of locomotive fuel tanks, and the contents of the CSXT and MARC operating agreement.

Secaucus, NJ - Derailment on Bridge

On November 23, an eastbound Amtrak train derailed while crossing Portal Bridge, a swing bridge spanning the Hackensack River in Secaucus, NJ. When the train derailed it sideswiped an Amtrak train crossing the bridge in the opposite direction on an adjacent track. All 12 cars of the first train derailed, with the two locomotives and 4 cars coming to rest at the bottom of an embankment at the east end of the bridge. The other train sustained damage but was able to stop, intact and on the rails, some distance west of the bridge. No fatalities resulted from the accident, but 43 passengers were reported injured. Estimated cost of damaged train, track, signal equipment, and site cleanup exceeded \$3.6 million.

There are two primary safety issues in this investigation: Amtrak management of oversight of the inspection, maintenance, and repair of the miter rail assemblies on Portal Bridge; and the adequacy of Amtrak's emergency notification procedures. The Board also is examining the effectiveness of Amtrak locomotive event recorders in capturing critical operational data.

RAILROAD REPORTS ADOPTED IN 1996

Brooklyn, NY - Subway Train Collision

On March 19, the NTSB adopted a final report on the collision of two trains on an elevated portion of the New York subway system near the Ninth Avenue station in Brooklyn. The accident occurred on February 9, 1995, when a northbound subway train went past a stop signal, accelerated around a blind curve, and was unable to avoid hitting the rear of a stopped 10-car train. The accident resulted in 15 minor injuries and damage estimated at \$1.5 million.

The Board determined that the probable cause of the collision was the inadequate oversight and compliance program of New York City Transit (NYCT) to ensure that train operators comply with published operating rules. Contributing to the accident was a design modification to the “key-by” feature of the automatic stop arm that enabled the train operator to pass a stop signal contrary to the published operating rules that require stopping at a red signal unless permission to pass is granted by Rapid Transit Operations.

In its recommendations, the Board called on NYCT to revise the Operating Employee Evaluation Checklist to effectively determine compliance with operating rules and instructions, and include, at a minimum, unannounced speed and signal tests and radio communications procedures. The Board also urged that certain signals be upgraded and the automatic “key-by” feature at those signals be deactivated. Also suggested was that NYCT include overspeed protection and positive train separation in the modernization of its signal system.



Brooklyn, NY. Subway Train Collision.

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Batavia, NY - Amtrak Derailment

On July 11, the NTSB adopted a report that highlighted a condition known as “flattened rail head,” a depression in the top section of a rail, as the main factor in an Amtrak derailment, near Batavia, NY. The accident occurred on August 3, 1994, as the Amtrak Lake Shore Limited was en route to Chicago from New York. Fourteen cars of the 18-car consist derailed; 108 passengers and 10 crew members were injured.

The Board determined that the probable cause of the derailment was the fact that federal and industry guidelines do not address flattened rail head conditions, due to an insufficient understanding of the risk that flattened rail poses to train operations.

Field tests and simulations confirmed that the flattened rail head at the initial point of derailment had allowed the train wheels to lose contact with the track, beginning a sequence of events that led to the accident. Investigators also found that, before the accident, track inspections were being carried out as prescribed by the FRA and that the flattened rail condition at the derailment site had been detected before the accident occurred. However, the condition was not corrected because, under existing guidelines, it did not meet the definition of a rail defect and the track geometry did not meet defect specifications.

The investigation prompted the NTSB to make several recommendations to the FRA, urging it to alert track inspectors to the problem and take corrective action. The Board also suggested that FRA, in conjunction with the industry, conduct research and develop a data base to assess the risks posed by flattened rail heads. Based on that research, the Board recommended that FRA issue appropriate guidelines for inspectors to use in identifying rail head that may be hazardous to train operations and regulations to ensure remedial measures are taken.

Brooklyn, NY - Subway Trains Collide on Bridge

The NTSB reported, September 4, that the probable cause of a rear-end collision of two subway trains on the Williamsburg Bridge in New York was the failure of the operator of the second (“J”) train to comply with a stop indication because he was asleep, and the failure of the train to stop in time because of inadequate braking distance between signals. Contributing to the accident, which occurred on June 5, 1995, were NYCT’s inadequate measures for ensuring employee

compliance with proper radio procedures. The “J” train operator was fatally injured in the crash and 69 people reportedly were treated for injuries at area hospitals. Damages were estimated at over \$2.3 million.



New York, NY. Two subway trains collide on the Williamsburg Bridge.

In connection with the investigation, the Board held a public hearing, November 29-30, 1995, in Manhattan, at which 12 witnesses testified.

Overall, the Board determined that the design of the NYCT signal system did not provide sufficient safeguards against accidents caused by operator error. It found that had the operator of the forward (“M”) train, or one of the operators ahead of him, radioed the command center to report being stopped at red signals, as they were required to do, and had the command center relayed this information to the operator of the following “J” train, the accident might have been avoided.

The Board also concluded, after extensive investigation, that the most plausible explanation for the behavior of the “J” train operator is that he was falling or had fallen asleep. Post-accident testing showed, however, that had the operator complied with the last signal, given the train’s speed, there would not have been sufficient time to stop.

The Board recommended that NYCT educate train operators and other employees involved in safety-sensitive positions about the hazards of

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performing their duties while fatigued. Related recommendations were sent to the FTA and the APTA. Other recommendations dealt with ensuring that operators adhere to rules requiring that they immediately contact the command center when their trains stop at a red automatic signal. In addition, NYCT was urged to identify areas in the subway system that have insufficient braking distance for trains traveling at maximum attainable speed, and implement changes to prevent rear-end collisions caused by operator error.

Gaithersburg, MD - Metrorail Trains Collide

On January 6, 1996, a Washington Metropolitan Area Transit Authority (WMATA) subway train failed to stop as it entered the above-ground Shady Grove station, near Gaithersburg, MD, the final station on the Red Line segment of the Metrorail system. The four-car train, operating in a snowfall, ran by the station platform and continued into the Metrorail yard north of the station, where it struck a standing, unoccupied subway train. The train operator was fatally injured; property damage was estimated at about \$2.5 million. Train operators on the line had not been allowed to switch to a manual mode of operation despite reports of station overruns because of slippery tracks.



Gaithersburg, MD. Snowy conditions hampered rescue workers at scene of collision of two Metrorail trains.

In a report adopted on October 29, the NTSB determined that the probable cause of the accident was the WMATA management's failure:

- To fully understand and address the design features and limitations of the automatic train control system before establishing automatic train operation as the standard operating mode at all times and in all weather conditions;
- To permit Operations Control Center controllers and supervisors to use their own experience, knowledge and judgment to make decisions involving the safety of Metrorail operations; and
- To effectively promulgate and enforce a prohibition against placing standby trains at terminal stations on the same track as incoming trains.

The Board concluded that WMATA's decision to completely and suddenly replace its policy of intermittent manual train operation with an essentially untested policy of full-time automatic train operation was "a hasty decision based on insufficient information." In its report, the Board acknowledged statistics indicating that most transportation accidents are attributable to human error, and noted that the NTSB itself has been at the forefront of efforts to promote the use of automated systems in all transportation modes to avoid absolute reliance on operating personnel to ensure safe operations. The Board further acknowledged that, since the opening of the Metrorail system, most accidents have been caused by human operators rather than by automated systems. Nevertheless, the Board stated that total faith in technology, no matter how advanced and sophisticated that technology may be, is inappropriate and that technology should instead be approached with a high degree of informed caution. The Board's conclusion was that WMATA management did not display that caution; instead, it encouraged among Metrorail employees a degree of confidence in the automated system that was wholly unjustified given the system's built-in limitations.

The Board issued a series of 20 recommendations to the WMATA designed to remedy the deficiencies that had been uncovered. In addition, the Board recommended that the FTA, in cooperation with the APTA, develop guidelines for monitoring/recording devices that capture critical performance and event data for rapid rail transit cars and urge transit agencies to install these devices on new and rehabilitated cars. The Board, addressing actions taken by fire and rescue units, also recommended that emergency response plans and procedures for Metrorail accidents be reviewed and modified, stressing the need to quickly establish direct communications links with the Metrorail Operations Control Center.

Cajon Junction, CA - Runaway Freight Train

On February 1, 1996, an Atchison, Topeka and Santa Fe (ATSF) freight train experienced a loss of braking power and derailed while descending a mountain pass near Cajon Junction, CA. All but the last four cars of the four-locomotive/49-car train left the tracks while negotiating a curve on Cajon Pass and came to rest in a 400-500 foot pileup of cars. Five rail cars in the pileup were tankers containing hazardous materials. In addition, two underground pipelines, which transported petroleum products, were near the derailment site. A fire ignited after the derailment, and the center of the pileup and the surrounding area were engulfed in flames. The conductor and brakeman on the train were killed; the engineer suffered serious injuries. Estimated damages approached \$10 million.

The NTSB reported on December 11 that the probable cause of the derailment was an undetermined restriction or blockage that prevented the train crew from maintaining adequate braking force, and also the lack of adequate FRA and industry (specifically the ATSF Railway Company) regulations, policies, and procedures regarding the consistent utilization of two-way end-of-train devices as a redundant braking system to protect trains from catastrophic brake system failure.

NTSB investigators found that the train line blockage, probably between the fifth and ninth cars, resulted in responsive brakes only on the locomotive units and possibly the first eight cars, which prevented the engineer from slowing or stopping the train.

NTSB recommendations regarding two-way end-of-train devices previously had been issued after an ATSF accident at Cajon Pass, in December 1994, and an earlier runaway train collision on another line in Helena, MT, in 1989. However, at the time of the second Cajon Pass accident, no regulations or comprehensive industry guidelines were in effect for the implementation of two-way end-of-train devices or any other methodology to provide the capability to initiate emergency brake application from either end of a train. The Board's report stated that had the train "been equipped with a fully functioning two-way end-of-train device, the engineer could have applied the brakes from the rear of the train and the derailment may have been avoided." The report also noted that the FRA did issue an emergency order after the second Cajon Pass accident responding to the Board's earlier recommendations.

The Board issued new recommendations relating to inspections of end-of-car hose arrangements, the periodic testing and placement of train event recorders, and emergency contacts with pipeline operators

that have transmission pipelines on or adjoining railroad company property. Other recommendations dealt with assessing the effects of mechanical and/or fire and heat damage to tank cars involved in accidents and developing guidelines and obtaining information that will assist in the handling and movement of those cars.



Cajon Junction,CA. Tank cars burning after freight train derailed while descending mountain pass.



Cajon Junction,CA. Charred and twisted wreckage after freight train derailment and fire.

**Special Investigation Report - Steam Locomotive
Firebox Explosion (NTSB/SIR-96/05)**

On November 15, the NTSB adopted a Special Investigation Report on a firebox explosion aboard a Gettysburg Railroad steam locomotive near Gardners, PA. The locomotive was pulling a six-car passenger train with 310 passengers and crew when the accident occurred. The engineer and two firemen received serious burn injuries. The Board initiated the investigation because of concerns that the circumstances of the accident “are not unique but reflect an ongoing attrition of specialized knowledge and skills within the tourist steam excursion industry.”

The Board determined that the probable cause of the explosion was the failure of the operating company to ensure that the locomotive boiler and its appurtenances were properly maintained and that the crew was properly trained. Specifically, it was found that the explosion resulted from crownsheet failure caused by having too little water in the boiler. Investigators learned that the low water level was not due to a single event or condition. Rather, it was the cumulative result of a number of steam locomotive boiler maintenance and operational factors stemming from a lack of training, knowledge and application.

As a result of the investigation the Board issued safety recommendations to the FRA, the National Board of Boiler and Pressure Vessel Inspectors, and the Tourist Railway Association, Inc.

Major Railroad Investigations In 1996

Accident Date	Location	Carrier	Accident Type	Fatalities
2/1/96	Cajon Junction, CA	ATSF	Derailment	2
2/9/96	Secaucus, NJ	NJ Transit	Collision	3
2/16/96	Silver Spring, MD	Amtrak/ MARC	Collision	11
11/23/96	Secaucus, NJ	Amtrak	Derailment	0

Major Railroad Reports Adopted In 1996

Report Number	Date Adopted	Location	Carrier	Accident Type	Fatalities
RAR-96/01	3/19/96	Brooklyn, NY	NYCT	Collision	0
RAR-96/02	7/11/96	Batavia, NY	Amtrak	Derailment	0
RAR-96/03	9/4/96	Brooklyn, NY	NYCT	Collision	1
RAR-96/04	10/29/96	Gaithersburg, MD	WMATA	Collision	1
SIR-96/05	11/15/96	Gardners, PA	Gettysburg Rail Line	Explosion	0
RAR-96/05	12/11/96	Cajon Junction, CA	ATSF	Derailment	2

PIPELINE/HAZARDOUS MATERIALS DIVISION

More than 1.6 million miles of natural gas pipelines provide service to more than 50 million customers in the U.S. In addition, there are more than 240,000 miles of gathering and petroleum product pipelines traversing the country to provide essential fuels to major cities. The regulation and inspection of most of these pipelines, and the investigation of accidents for enforcement purposes, are shared by DOT's Research and Special Programs Administration (RSPA), Office of Pipeline Safety (OPS), and various state agencies. While pipeline safety on interstate facilities is the sole responsibility of the OPS, because of the enormous size of the pipeline system, OPS inspectors share this responsibility through a variety of arrangements with state officials.

About 500,000 shipments of hazardous materials enter into the U.S. transportation system daily. Responsibility for the regulation, inspection and enforcement of regulations regarding the transportation of these hazardous materials shipments is shared among the DOT's RSPA and modal administrations, as well as the states. The responsibility for investigating hazardous materials transportation accidents is similarly diversified. RSPA is responsible for issuing hazardous materials regulations, and for inspecting shippers and manufacturers of shipping containers that are of a multi-modal nature.

The NTSB investigates pipeline and hazardous materials accidents on a selective basis, focusing on those events involving significant threats to public safety and major disruptions within communities, or those that provide an opportunity to address industry-wide safety issues and issues related to emerging technologies. Under current criteria, the NTSB generally will investigate pipeline accidents involving:

- One or more fatalities or multiple severe injuries;
- Property damage exceeding \$1 million;
- Extensive release of highly volatile liquids; or
- Significant damage to the environment.

Investigative areas selected by the Board for special emphasis include:

- Accidents where consequences could have been reduced by

PIPELINE/HAZARDOUS MATERIALS DIVISION

- the use of an excess flow valve;
- Failure of the aging pipeline infrastructure;
- Accidents involving human performance issues;
- Accidents involving recognition or response delays;
- Environmental damages resulting from the release of more than 8,000 barrels of product and/or result in an actual threat to water supplies, migration into closed/confined areas and have the potential to explode, or effect environmentally sensitive spaces and populated areas; and
- Excavation damage caused accidents.

Under current hazardous materials criteria, the NTSB will investigate:

- Accidents involving fatalities or serious injuries by the release of hazardous materials; and
- Major evacuations of the public or major disruptions to a community's normal functioning due to the threats caused by a release of hazardous materials.

Hazardous materials special emphasis areas include:

- Non-collision container failures;
- Failure of containers under accident conditions in which the containers reasonably should have been expected to survive;
- Cargo or transfer operations;
- Unusual or unexpected behavior of hazardous materials;
- Misidentified or non-identified hazardous materials; and
- Emergency response difficulties because of the unexpected behavior of hazardous materials involved in an accident or the lack of adequate information about cargo or containers involved in an accident.

In the conduct of investigations, the NTSB works to identify and document the hazardous characteristics of materials transported, the threats posed to public safety when those materials are released into the environment, and the consequences of unintentional releases of those

PIPELINE/HAZARDOUS MATERIALS DIVISION

materials during transportation. It also includes evaluating the level of packaging protection required during transportation relative to the seriousness of the hazards posed. Further, there is the evaluation of the construction, inspection, testing, and maintenance of hazardous materials packaging and its performance in the transportation environment.

PIPELINE/HAZARDOUS MATERIALS INVESTIGATIONS IN 1996

In 1996, the Pipeline and Hazardous Materials Division initiated 13 investigations. The division also provided major support to seven investigations in the other transportation modes, including: the freight train derailment near Cajon Junction, CA, in February; ValuJet DC-9 crash in Florida in May, which involved the transport of chemical oxygen generators; the TWA 800 explosion and crash off East Moriches, NY, in July; and the fire aboard a FedEx DC-10 aircraft which made an emergency landing at Newburgh, NY, in September.

Among the investigations initiated in 1996 were the following significant cases:

Sweetwater, TN - Railroad Tank Car Failure

On February 7, a tank car containing carbon disulfide, a flammable and poisonous material, separated in two as the train containing the tank car began to move. About 8,000 gallons of the carbon disulfide was released, necessitating the evacuation of about 300 people. Five people reportedly sought medical attention for exposure to the chemical vapors. Preliminary information is that the tank car failure occurred at a point where structural modifications had been made that were not in accordance with approved designs. Metallurgical examination at the NTSB's materials laboratory also showed evidence of brittle failure of the tank's steel shell.

The safety issues addressed in this investigation include repair procedures and modifications to railroad tank cars, the adequacy and strength of steels used for the construction of tank cars, and the operational practices of railroads in transporting hazardous materials.

Selkirk, NY - Tank Car Explosion And Fire

Safety issues similar to those under examination in the Sweetwater, TN, case are also being investigated in a Selkirk, NY, accident. On March 6, a railroad tank car containing over 30,000 gallons of liquefied propane dramatically failed shortly after being moved through switching operations at a Conrail yard in Selkirk. The propane was released and ignited to create a large fireball. The tank car shell fractured into two pieces, with one section propelled by the force of the explosion a distance of about a ¼ mile. There were no fatalities or injuries but there was substantial damage to cars on adjacent tracks and to the rail yard. Investigators found that the origin of the tank car fracture was next to a weld overlay repair that had been done previously to increase the thickness of the tank wall, which had been affected by corrosion. Examination in the NTSB laboratory also indicated evidence of overstress and brittle failure of the steel tank shell.

Gramercy, LA - Gasoline Pipeline Rupture

On May 23, a 20-inch diameter pipeline, operated by the Marathon Pipe Line Company, ruptured near Gramercy, LA, releasing almost 500,000 gallons of unleaded gasoline within a marshland downstream of the company's refinery. The escaping gasoline quickly flowed over the marshland right-of-way and spilled into the Blind River, contaminating the waterway and causing extensive environmental damage.

Among the issues investigators are addressing in the accident are the prompt identification of abnormal operating conditions, rapid shutdown of failed pipelines, employee training, and excavation damage protection.

Fork Shoals, SC - Oil Spill Into River

On June 26, a 36-inch pipeline, owned and operated by Colonial Pipe Line Company, ruptured near Fork Shoals, SC, and released almost one million gallons of No. 2 fuel oil into the Reedy River. This failure occurred at a site that had a long history of erosion and associated problems such as corrosion.

The NTSB is investigating a number of safety issues, including company processes for the safe operation of compromised pipelines, adequacy of employee training for recognition of and response to abnormal and emergency situations, work-rest schedules for pipeline controllers, and the effectiveness of electronic systems for diagnosis and control of abnormal and emergency situations on pipelines.

San Juan, Puerto Rico - Propane Gas Explosion

On November 21, a gas-fueled explosion heavily damaged several commercial buildings in San Juan's Rio Piedras business district, causing 33 fatalities and more than 60 injuries. On several occasions before the accident, San Juan Gas Company workers had been sent to Rio Piedras in response to reports of suspected propane gas leaks but were unable to find and correct the reported problems. They were called out again on the morning of the accident but failed to find a gas leak before the explosion occurred.

Safety issues raised by this investigation include pipeline operator response to gas leak complaints, pipeline company employee qualifications and training, operator oversight by parent company and by federal and local regulatory bodies, and excavation damage prevention programs.



San Juan, PR. Investigators documenting scene of gas explosion that killed 33 people.



San Juan, PR. Investigators at scene of gas explosion.

PIPELINE/HAZARDOUS MATERIALS REPORTS ADOPTED IN 1996

Special Investigation Report - Evaluation Of Accident Data And Federal Oversight of Petroleum Product Pipelines (NTSB/SIR-96/02)

Within a 15-month period, the Colonial Pipeline Company experienced the rupture of two petroleum product pipelines, which resulted in large releases of diesel fuel that affected major water supplies. In both accidents, in Fountain Inn, SC, and Reston, VA, the ruptured section of pipeline had been mechanically damaged during previous excavation work.

With the growing concern about the environmental consequences of pipeline discharges and because the two Colonial accidents seemed to raise safety issues applicable to the entire national pipeline system, the NTSB conducted a review of RSPA efforts to implement Board

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recommendations that apply to petroleum product pipelines. In particular, the Board examined recommendations that address the prevention of excavation damage, the control of corrosion damage, the inspection and testing of pipelines, and methods to more rapidly detect and shut down failed sections of pipeline. The Board also analyzed petroleum pipeline accident data compiled by RSPA to assess accident trends and causes, identify safety problems, and compare the performance of individual pipeline companies. In a report adopted on January 23, the Board concluded that:

- Although RSPA has taken regulatory action and undertaken other initiatives to minimize excavation damage, RSPA has failed to take effective and timely action to address corrosion control, inspection and testing of pipelines, and methods to limit the release of product from failed pipelines;
- RSPA's failure to fully implement the NTSB's original 1978 safety recommendations to evaluate and analyze its accident data reporting needs has hampered RSPA's oversight of pipeline safety;
- Although RSPA's data on hazardous liquid pipeline accidents can be analyzed to determine some general trends and conclusions, the data on hazardous liquid pipelines, as they are currently collected and reported, are not sufficient for RSPA to perform an effective accident trend analysis or to properly evaluate operator performance; and
- With the deficiencies of the current accident data base for hazardous liquid pipelines, RSPA will find it exceedingly difficult to fully implement an effective risk management program.

Consequently, the Board recommended that RSPA:

- Develop within one year and implement within two years a comprehensive plan for the collection and use of gas and hazardous liquid pipeline accident data that details the type and extent of data to be collected, to provide the RSPA with the capability to perform methodologically sound accident trend analyses and evaluations of pipeline operator performance using normalized accident data.

The Board also reiterated three earlier recommendations to the RSPA that concerned inspection criteria employed by operators and expediting requirements for installing automatic or remote-operated valves to provide for rapid shutdown of failed pipeline segments.

Allentown, PA - Natural Gas Explosion

The investigation into a fatal natural gas explosion at a retirement complex in Allentown, PA, prompted the NTSB to call on the governors of all states and the mayor of the District of Columbia to require installation of excess flow valves on new and renewed gas distribution service lines, including lines supplying schools, churches and other places of public assembly.

The Board's recommendations were contained in the final report on the Gross Towers retirement complex explosion, adopted on February 26. The accident occurred on June 9, 1994, when a 2-inch steel gas service line, that had been exposed during an excavation, separated at a compression coupling near the eight-story building. The escaping gas flowed underground into the building foundation and migrated up to the other floors. The explosion killed one person, injured 66 others, and caused more than \$5 million in property damage.

The Board determined that the probable cause of the explosion and fire was the failure of the excavation company to ensure compliance with Occupational Safety and Health Administration and its own excavation requirements through project oversight. A contributing factor was the company's failure to notify the gas company that the line had been damaged and was unsupported. Contributing to the severity of the accident was the absence of a gas detector, which could have alerted the fire department and residents promptly when escaping gas entered the building.

The absence of an excess flow valve or similar device that could have stopped the flow of gas once the service line was ruptured also was highlighted as a contributing factor to the severity of the accident. The Board's report stated that, had such a device been in place, "the consequences of the accident could have been substantially reduced; the likely result would have been no deaths or injuries." The report noted that Board recommendations on excess flow valves dated back over 20 years, and that the issue had been on the list of "Most Wanted" transportation safety recommendations since its inception. The Board concluded that the federal regulators had failed to effectively assess the benefits of excess flow valves and promote their use.

Consequently, in addition to the recommendations to the state governors, the Board recommended that RSPA require gas-distribution operators to notify all customers of the availability of excess flow valves, and that the Department of Housing and Urban Development require the installation of excess flow valves in new and renewed gas services to buildings that the Department has approved for federal rent subsidies.

**Special Investigation Report - Evaluation Of Pipeline Failures
During Flooding And Of Spill Response Actions, San Jacinto River
Near Houston, TX. (NTSB/SIR-96/04)**

In mid-October 1994, major flooding occurred in the San Jacinto River flood plain near Houston, TX, forcing over 14,000 people to evacuate their homes and causing 20 deaths. Due to the flooding, eight pipelines ruptured and 29 others were undermined both at river crossings and new channels created in the flood plain. About 1.5 million gallons of petroleum and petroleum products were released into the river. On repeated occasions, the released products caught fire, reportedly resulting in injuries (mostly minor) to over 500 people. The spill response costs were in excess of \$7 million and property damage was estimated at \$16 million.

These events starkly illustrated the threats to public safety and the environment posed by petroleum transportation by pipeline and prompted an NTSB Special Investigation focused on: the adequacy of federal and industry standards on designing pipelines in flood plains; the preparedness of pipeline operators to respond to threats to their pipelines from flooding and to minimize the potential for product releases; and, more broadly, the ability of authorities across the U.S. to minimize the consequences of petroleum releases.

The Board's investigation report, adopted on September 6, noted that the design bases of most of the pipelines ruptured or undermined during the flood did not include study of the flood plain to identify potential threats; rather, operators used only general design criteria applicable at the time the pipelines were installed. The Board concluded that standards are needed for the design of pipelines that cross flood plains and streambeds, and for periodic re-evaluations of the designs in light of changes that occur over time. Recommendations to this effect were made to the American Petroleum Institute, the Association of Oil Pipe Lines, and the Interstate Natural Gas Association of America.

A recommendation to the RSPA addressed the need for operators to develop plans for responding to substantial threats of pipeline failure and product discharge, and requirements for rapid detection and shutdown of failed pipe segments. Other recommendations, issues to the National Response Team, dealt with improving communications, coordination of planning and operational activities, and conducting "after-action" critiques.

Major Pipeline/Hazardous Materials Investigations In 1996

Accident Date	Location	Accident Type	Fatalities
2/7/96	Sweetwater, TN	Tank Car Failure	0
3/6/96	Selkirk, NY	Tank Car Explosion	0
5/23/96	Gramercy, LA	Gas Line Rupture	0
6/26/96	Fork Shoals, SC	Oil Line Rupture	0
11/21/96	San Juan, PR	Gas Explosion	33

Pipeline/Hazardous Materials Reports Adopted In 1996

Report Number	Date Adopted	Location	Accident Type	Fatalities
SIR-96/02	1/23/96	Fountain Inn, SC/Reston, VA	Pipeline Failures	0
PAR-96/01	2/26/96	Allentown, PA	Gas Explosion	1
SIR-96/04	9/6/96	Houston, TX	Multiple Pipeline Failures	0

RESEARCH & ENGINEERING

The Office of Research and Engineering provides laboratory and technical support for NTSB investigations and conducts studies that examine safety issues in all transportation modes.

Laboratory specialists in this office analyze voice recordings from aircraft, ship, train, and supporting systems communications. The office also provides electronic engineering support for all accident investigation modes in examining communication and control systems, including digital and analog formats.

Laboratory staff also extract, format and analyze data from digital aircraft flight recorders and recorders installed in locomotives, large ships, and some highway vehicles. Advanced computer technology is used to examine the performance characteristics of vehicles in accidents, including animated three-dimensional vehicular performance studies and complex analytical studies of vehicle dynamics and operation.

Materials specialists provide engineering support for all transportation modes in areas such as fracture, deformation and failure analysis, chemical composition and strength of materials, design, fabrication and testing of components, friction, rolling contact and wear, impact and crash reconstruction, instrument and system component inspection, and fire and explosion effects.

The Research and Engineering office also provides computer and data processing support for all NTSB units, and manages the aviation accident data base. The office publishes reviews of aviation accidents and statistical surveys and analyses of accident data on an annual basis. The office also is responsible for management of the NTSB World Wide Web site.

SAFETY STUDIES

Safety studies are performed to evaluate and stimulate improvements in government and industry safety programs, and advance technological change in the transportation system. The studies typically involve the exploration of policy issues, program coverage

and management effectiveness. Board studies of major transportation issues also are conducted by analyzing accident statistics and data derived from past accidents or special investigations, and studying transportation systems or subsystems to uncover safety problems. Comprehensive reports containing recommendations for corrective action are prepared for public release.

In selecting subjects for safety studies, the Board identifies existing or potential safety problems or issues of national significance. Close consideration is given to matters that have the potential for reducing accident losses, improving the safety effectiveness of other government agencies and to attaining implementation of previous board recommendations. The adequacy of program resources committed by government entities, the timeliness of studies with regard to transportation agency program planning and implementation, and the potential impact on regulatory or other safety programs are also considered.

Safety Study - The Performance and Use Of Child Restraint Systems, Seatbelts, And Air Bags For Children In Passenger Vehicles (NTSB/SS-96/01).

On September 17, the NTSB adopted a major safety study containing new recommendations for improving the performance and use of vehicle occupant safety systems for children – air bags, seat belts, and child restraint systems.

The study was initiated in response to a growing number of inquiries from the public regarding the safety of small children in passenger vehicles. The Board analyzed data from 120 accidents involving at least one vehicle in which there was a child passenger under age 11, and in which at least one occupant was transported to a hospital.

The Board concluded that:

- Children in the back seats of vehicles (especially if properly restrained) are less likely to sustain injury than those seated in front seats;
- Passenger-side air bags, as currently designed, are not acceptable as a protective device for children positioned in front of them, and can kill or critically injure them in accidents that would have been survivable had the air bag not deployed;

RESEARCH & ENGINEERING

- Air bags are designed in accordance with National Highway Traffic Safety Administration (NHTSA) requirements to protect unbelted rather than belted vehicle occupants, even though the air bags are promoted as supplemental restraint systems and the majority of motor vehicle occupants now use seatbelts; and
- NHTSA's air bag performance certification testing is not representative of actual accident environments.

Drawing on the study, the Board called on state authorities to disseminate educational materials emphasizing the importance of transporting children in the back seats of passenger vehicles, and urged that mandatory state child restraint use laws be expanded to cover children up to 8 years old.

The Board also recommended that NHTSA immediately revise performance requirements for passenger-side air bags based on testing procedures that reflect actual accident circumstances, including the effects of pre-impact braking, out-of-position child occupants (belted and unbelted), properly positioned belted child occupants, and cases where the seat track is in the forward-most position.

NHTSA also was urged to establish a timetable to implement intelligent air bag technology that will moderate or prevent air bag deployment, if full deployment poses a hazard to a vehicle occupant.

Noting that there will be nearly 22 million vehicles with passenger-side air bags on the road by the end of 1996, with an additional 13 million added each subsequent year, the Board recommended that technical solutions being developed for air bags in cars in the future – increasing deployment thresholds, depowering the passenger-side air bag, installing weight sensors, or deactivating the passenger-side air bag for families who choose to do so – also be considered for vehicles now on the road.

With regard to seatbelts/child restraint systems, the Board determined that more than two-thirds of the children in the accidents investigated were not in an appropriate restraint for their age, height and weight. Many, for example, had changed directly from child restraint systems to seatbelts, rather than using booster seats as an interim measure. Over half of the children who used child restraint systems were improperly restrained, as were about one-quarter of the children who used seatbelts. Further, the Board found that securing a child restraint system properly in a vehicle is complicated by incompatibilities related to the design of current passenger vehicles, seatbelts and the restraint systems.

Consequently, the Board issued recommendations to NHTSA and the automobile and child restraint manufacturers calling for new design standards that would simplify placement of a child in a restraint system, provide for secure and uniform installation of child restraints, require adjustable upper anchorages at all outboard rear seating positions and the installation of center rear lap/shoulder belts in all newly manufactured vehicles. The Board also suggested that the automobile manufacturers develop programs to reduce the misuse of child restraint systems that include elements such as training for dealership personnel in the proper use of restraint systems and promotional events to provide parents with such information.

Prior to completion of the safety study, the Board, on November 2, 1995, issued a number of urgent recommendations to NHTSA, the automobile and restraint manufacturers, the National Association of Broadcasters and the Advertising Council calling for a nationwide media and mail campaign to alert the public to the dangers of placing a rear-facing child safety seat or an unrestrained child in the front seat of a vehicle equipped with a passenger-side air bag. The Board also urgently recommended that highly visible warning labels be installed in passenger vehicles.

As a result of the safety study, the Board reiterated a recommendation that state governments enact legislation to provide for primary enforcement of mandatory safety belt laws, and consider enforcement provisions such as fines and/or the imposition of driver license penalty points.

ADMINISTRATIVE LAW JUDGES

Since 1967, the NTSB has served as the “court of appeal” for airmen, mechanics or mariners whenever a certificate action is taken by the FAA or the Coast Guard.

Under 49 U.S.C. section 1133 and 49 C.F.R. Part 821, the Board’s administrative law judges hear, consider and issue initial decisions on appeals of FAA certificate actions taken under 49 U.S.C. sections 44106, 44709 and 44710 and civil penalty actions involving pilots, engineers, mechanics and repairmen pursuant to U.S.C. sections 46301, *et seq.* Also covered are petitions for airmen whose applications for certification have been denied by the FAA pursuant to 49 U.S.C. section 44703. The judges’ decisions in these cases may be appealed to the five-member NTSB by either the airman or the FAA.

Under the Equal Access to Justice Act of 1980, as amended (“EAJA”), the NTSB’s judges also review and decide applications for attorneys fees and expenses from airmen against the FAA in cases brought pursuant to 49 U.S.C. sections 44709 (certificate actions) and 49 U.S.C. sections 46301(d) (civil penalty cases).

The Board’s review on appeal of its administrative law judges’ decisions is based on the record of the proceeding, which includes hearing testimony (transcript), exhibits and the judge’s decision, as well as appeal briefs submitted by the parties.

The final decision of the full board is subject to judicial review by the U.S. Court of Appeals. The right of appeal to the U.S. Court of Appeals is granted to the airman and, to a limited extent, the FAA. Upon review of the Board’s decision, the U.S. Courts of Appeals have the power to affirm, modify or set aside that decision in whole or in part – or, if need is found, to order further proceedings by the Board. The judgment and decree of the Court of Appeals is subject to review by the U.S. Supreme Court.

Marine certificate actions are heard first by the Coast Guard’s administrative law judges, and may be appealed to the Commandant of the Coast Guard. The ruling of the Commandant may then be appealed directly to the full five-member Board, which follows the same appellate process as it does in considering the initial decisions of its law judges in aviation cases. In 1996, one marine appeal was filed with the NTSB, and the Board closed two marine cases.

ADMINISTRATIVE LAW JUDGES

There were 494 aviation certificate appeals filed with the Board's Office of Administrative Law Judges in 1996; 173 of these cases were from emergency orders. The Board's judges held 152 hearings and closed 479 cases in 1996.

During 1996, 91 of the judges' decisions were appealed to the full five-member Board for review. The Board decided 81 appeals, reversing the judges' decisions in 6 cases. Fifteen of the Board's decisions were appealed to the U.S. Courts of Appeals, which rendered 14 decisions in 1996, affirming the Board in 11 of these. (Two of the remaining cases were dismissed and one was remanded to the Board.)

There were 19 EAJA applications filed with the Board's administrative law judges in 1996, and 18 cases were decided by the judges. In 1996, eight of the judges' EAJA decisions were appealed to the full Board, which issued rulings in 10 EAJA cases.

Investigations, Reports & Recommendations At A Glance

	1996	1995	1994	1993
Total Accident Investigations	2345	2394	2341	2434
Aviation	2134	2188	2106	2158
Hazardous Materials	2	5	12	8
Highway	71	100	98	165
Marine	6	13	10	11
Pipeline	11	3	6	5
Railroad	59	85	56	63
Foreign Aviation Investigations	62	58	53	59
Hearings/Forums/Briefings	5	4	3	2
Major Accident Reports Adopted	16	20	21	25
Aviation	6	7	10	13
Hazardous Materials	0	1	1	0
Highway	2	3	4	2
Marine	2	4	4	3
Pipeline	1	1	0	2
Railroad	5	4	2	5
Recommendations Issued	382	349	324	310
Aviation	183	151	226	171
Highway	59	50	17	34
Marine	19	62	52	49
Pipeline	30	48	18	29
Intermodal	11	2	8	4
Safety Studies/Special Investigative Reports	6	2	2	3
Aviation Certificate Appeal Cases Closed	479	492	497	669
Seamen Certificate Appeal Cases closed	2	4	4	8
Aviation Equal Access to Justice Cases Closed	18	20	32	45

NTSB WEB SITE

The National Transportation Safety Board has established a World Wide Web home page to provide the public with direct access to accident reports, news releases and other important safety information.

The NTSB web site can be accessed at:

<http://www.nts.gov>

Some NTSB home page features:

- The Board's history and mission, regional and field office locations, board Member profiles;
- News releases;
- Speeches and Congressional testimony by Board Members;
- The NTSB's "Most Wanted" list of safety improvements;
- Summaries of aviation accident investigations; (e.g., accident reports, safety studies).

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