

NATIONAL TRANSPORTATION SAFETY BOARD

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In July 1996, within hours of the first news reports that a Boeing 747 had dropped from radar screens just after takeoff from New York's Kennedy Airport, the U.S. National Transportation Safety Board had dispatched one of its Go-Teams to the site. This team, comprising some of the world's best accident investigators, immediately took charge of what would prove to be one of the largest efforts of its kind ever, as well as a major national tragedy. Coming on the heels of the ValuJet crash in May of the same year, this tragedy once again focused the world's attention on an agency so small that its entire staff can easily be accommodated on some jumbo jets.

Overview

NTSB is an independent federal agency charged with determining the probable causes of transportation accidents and promoting transportation safety through its recommendation process. Although it is among the smallest of government agencies, it has a huge job. The U.S. transportation network rivals those of other continents and is matched by those of few other nations in size and complexity. The United States has 6.4 million km (4 million mi) of roadways, 197,000 km (123,000 mi) of railroads, 40,000 km (25,000 mi) of inland waterways, and 2.24 million km (1.4 million mi) of pipeline, and U.S. airlines carried 550 million passengers in 1996. And all of these transportation sectors are growing every year.

To maintain the nation's admirable safety record, NTSB investigates accidents, conducts safety studies, evaluates the effectiveness of other government agencies' programs for preventing transportation accidents, and reviews appeals of adverse certificate and civil penalty actions involving airman and seaman licenses taken by the administrators of agencies of the U.S. Department of Transportation.

Moreover, the agency does all of this for less than 18 cents per citizen a year.

Most important, on the basis of its investigations, NTSB makes safety recommendations to federal, state, and local government agencies and to the transportation industry regarding actions that should be taken to prevent accidents. These recommendations are the focal point of the Board's efforts to improve safety in the transportation system.

The Board consists of five members nominated by the President of the United States and confirmed by the Senate to serve nonconcurrent 5-year terms. The chairman requires separate nomination and confirmation. The vice-chairman is Robert T. Francis. The other members are John A. Hammerschmidt, John Goglia, and George W. Black. The staff of about 400 is made up of civil service professionals.

Although NTSB was founded in 1967 and its current charter is the Independent Safety Board Act of 1974, its origins lie in the Air Commerce Act of 1926, legislation in which Congress charged the Commerce Department with investigating the causes of aircraft accidents. Since 1967 the Board has investigated more than 100,000 aviation accidents and incidents, as well as about 10,000 surface transportation accidents involving highways, marine and rail transport, and pipelines. NTSB also investigates accidents involving the transportation of hazardous materials and is the sole U.S. accredited representative at foreign accident investigations under provisions of the International Civil Aviation Organization (ICAO).

NTSB has no authority to regulate the transportation industry. The agency's effectiveness, therefore, depends on its reputation for timely and accurate determination of accident causation, and for issuance of realistic and feasible recommendations designed to meet the need for prompt implementation of safety improvements to prevent future

accidents. Although the missions and authorities of other federal agencies include fostering and ensuring the safety of the U.S. transportation system, the Board's independent oversight role is unique and essential in prompting compliance with the rules of those other agencies.

Go-Teams

When notified of a major aviation accident, the Board launches a Go-Team that varies in size depending on the severity of the accident and the complexity of the issues involved. The team may consist of experts in as many as 14 different specialties, each of whom, characteristically, has a strong academic background in science and engineering plus industry experience. Each NTSB expert manages a group of other industry and government specialists in collecting facts and determining the circumstances surrounding an accident.

Air traffic control specialists examine air traffic control facilities, procedures, and flight handling, including ground-to-air voice transmissions, and develop flight histories from Air Route Traffic Control Center and terminal radar facility radar records. Others examine the flight operations conducted by the carrier and the airport, as well as the flight training and experience of the crew. Weather specialists study the meteorological and environmental conditions prevailing at the time of the accident.

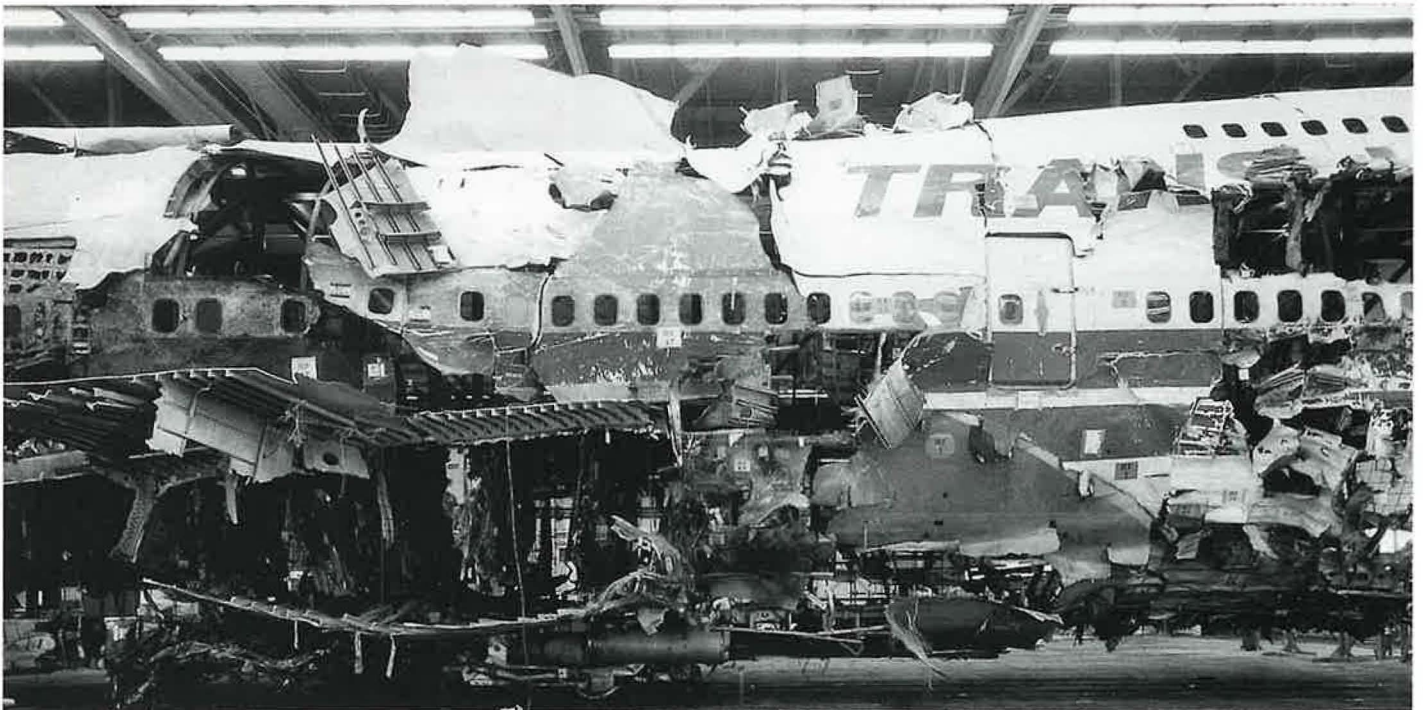
Human performance specialists review the background and performance of people associated with the accident, focusing on each individual's professional knowledge, experience, training, decisions, actions, work patterns, and physical abilities. Company policies and procedures, management relationships, equipment design, and the general work environment are also reviewed.

Power plant specialists examine the aircraft engines, while other experts study the integrity of aircraft structures and flight controls, as well as the adequacy of aircraft design and certification procedures. Systems specialists investigate the aircraft's flight controls and electrical, hydraulic, and avionics systems. Maintenance specialists study the service history and maintenance of aircraft systems, structures, and power plants.

Finally, survival factors experts investigate the survival of people involved in an accident, focusing on the causes of fatalities and injuries. These investigators also examine cabin safety and emergency procedures, crashworthiness, equipment design, emergency response effectiveness, and airport certification.

In the other transportation modes, similar teams of highly trained specialists are assembled to conduct detailed, comprehensive accident investigations. In the marine sector, for example, NTSB has a small staff of professional investigators with industry and/or U.S. Navy or U.S. Coast Guard backgrounds. These investigators include

Using wreckage recovered from the TWA flight 800 crash site, National Transportation Safety Board staff reconstructed a 94-foot section of the B-747 aircraft, including the center fuel tank area.



Air boats involved in recovery of wreckage following crash of a DC-9 into Florida Everglades in 1996.



licensed master mariners, marine engineers, and naval architects who possess a wealth of hands-on experience.

Recent Challenges

NTSB and its staff have faced major challenges in recent years. Two major aviation accidents in 1996 strained the agency's resources, both financial and human. The ValuJet crash into the Florida Everglades highlighted the issue of the transport of hazardous materials aboard airliners and proved the wisdom of recommendations issued by NTSB 8 years earlier.

The TWA flight 800 investigation proved to be the most costly in the Board's history. That tragedy was also the catalyst that prompted Congress to give the Board a new mission—acting as liaison between government agencies and family members of aviation accident victims.

Although historic in scope, the TWA wreckage recovery was not the first underwater recovery the Board has managed. It was not even the first of 1996. Earlier that year, the Board organized two underwater recovery efforts for flight recorders from crashed airplanes off the coasts of the Dominican Republic and Peru. Both sets of recorders were sent to NTSB headquarters in Washington, where they helped investigators determine quickly that both accidents were caused by operational rather than airworthiness problems.

NTSB also confronted a full slate of surface accidents, including almost two dozen railroad accidents in the first 2 months of 1996 and the spectacular collision of a freighter into a pedestrian mall in New Orleans just before Christmas of that year. And this pace was sustained in 1997, especially in August when three major aviation accidents and a major railroad accident occurred in a single week.

Safety Recommendations

The safety recommendation is truly NTSB's most important product. Since the Board began investigating accidents 30 years ago, it has issued more than 10,000 safety recommendations designed to prevent accidents, save lives, and reduce injuries. More than 82 percent of those recommendations have been implemented.

Although all the recommendations made by NTSB would, if implemented, improve safety, some have a greater potential to save lives. To identify those recommendations with the greatest impact on transportation safety, the Board implemented its Most Wanted Transportation Safety Improvements program. Recommendations selected as part of that program are the subject of more intensive follow-up activity aimed at persuading government agencies and industry to act on them as quickly as possible. The effectiveness of this approach is demonstrated by the fact that since the program began in 1990, nine Most Wanted safety issues have been removed from the list because of positive action taken by the recipients of the recommendations. In May 1997, for example, the Board removed from the list recommendations related to railroad tank cars for hazardous materials because regulations were being modified to achieve an acceptable level of safety. Recommendations regarding smoke detectors and fire extinguishers in class D cargo compartments of passenger aircraft have also been implemented.

At the same time, new areas continue to be added to the list. Examples are automatic recording devices on commercial trucks, ships, and rapid rail transit cars; procedures and training to prevent excavation-caused pipeline damage; measures to reduce the potential for explosive fuel-air mixtures in fuel tanks of transport-category aircraft; and revised requirements for testing and certifying air-

craft ice protection systems. Among the other items on the list are expanded flight data recorder parameters; positive train separation systems; administrative revocation of drivers' licenses; and highway vehicle occupant protection, including primary enforcement of state safety belt laws and education about the potential danger to small children of front-seat, passenger-side air bags.

Recent Accomplishments

Examples of transportation safety improvements resulting from NTSB recommendations abound. In aviation, a short list includes floor exit lighting, smoke detectors in lavatories, fire-blocking cabin materials, and ground-proximity warning systems for airliners; windshear detection equipment and enhanced windshear training for pilots; anticollision technology; stronger passenger seats; crew resource management training; and safety rules for commuter airlines that are in line with those for the major carriers.

In the rail sector, improvements include head shields, shelf couplers, and thermal protection on railroad tank cars, as well as nationwide Operation Lifesaver programs that have helped cut crashes at highway-rail grade crossings in half. In the highway sector, the Board's recommendations have led to age-21 drinking laws, which have saved 15,000 lives since enactment in all the states in the 1980s; mandatory seat belt use laws; and rear-seat shoulder belts in all automobiles. Personal flotation devices for children in recreational boats and emergency locating devices on marine vessels have also resulted from NTSB recommendations, as has pipeline failure detection equipment.

Other Activities

NTSB's sponsorship of public forums is a little-known element of its program to promote safe transportation practices. In late 1995, the Board and the National Aeronautics and Space Administration cosponsored a forum on fatigue in transportation. The 2-day event was attended by more than 600 transportation professionals representing 16 countries. In the spring of 1997, the Board sponsored a symposium on the effects of corporate culture on transportation safety. And subsequently, the agency hosted a public forum on air bags and child passenger protection issues.

The Board also conducts safety studies that focus public attention on major national safety issues. For example, NTSB studies prompted changes in legislation or public policy on commuter airline regulations, automobile seat belt use

National Transportation Safety Board Most Wanted Transportation Safety Improvements

"...A program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives."

Positive Train Separation

Require a railroad collision avoidance system.

Action needed by the Federal Railroad Administration and the railroad industry.

Human Fatigue in Transportation Operations

Study fatigue in the transportation industry, and update applicable regulations.

Action needed by the U.S. Department of Transportation.

Airport Runway Incursion

Provide safer control of aircraft on the ground.

Action needed by the Federal Aviation Administration.

Automatic Information Recording Devices

Require devices that will automatically record specified information.

Action needed by the United States Coast Guard and the Federal Highway Administration.

Youth Highway Crashes

Strengthen age 21, zero blood alcohol content, and licensing legislation; improve enforcement, licensing, and education programs for persons under age 21.

Action needed by the states.

Excavation Damage Prevention to Underground Facilities

Require the installation of excess flow valves in high-pressure residential natural gas distribution systems, and provide education and training related to third-party damage.

Action needed by the states, the Research and Special Programs Administration, and the American Gas Association.

Recreational Boating Safety

Strengthen legislation, enforcement, and education programs to prevent boating accidents.

Action needed by the states.

Highway Vehicle Occupant Protection

Enact primary enforcement of state seat belt laws; educate the public about transporting children in the back seat; evaluate instituting higher air bag deployment thresholds and making the back seat more child friendly.

Action needed by the states, the National Highway Traffic Safety Administration, and automobile manufacturers.

Airframe Structural Icing

Revise icing criteria and certification testing requirements. Research and develop on-board aircraft ice protection and detection systems.

Action needed by the Federal Aviation Administration.

Explosive Mixtures in Fuel Tanks on Transport Category Aircraft

Require preclusion of operation of transport category aircraft with explosive fuel-air mixture in fuel tanks.

Action needed by the Federal Aviation Administration.



Metallurgist in NTSB materials laboratory examines fragments of material under scanning electron microscope to determine origin and cause of a fracture.

and passenger-side air bag safety, air traffic control procedures, and heavy truck regulations.

As noted earlier, NTSB also serves as the U.S. accredited representative to investigations of foreign aviation accidents under an ICAO agreement. The Board becomes involved when a crash involves a U.S. air carrier or a foreign airline operating a U.S.-manufactured aircraft. The importance of this involvement is twofold. First, there are U.S. citizens aboard most international flights. Second, if there is an airworthiness problem with a particular aircraft model, it could affect millions of people flying within the United States as well. And because aeronautics is the number one U.S. export, continuing public confidence in those products is of paramount importance. In addition, NTSB laboratories are open to any foreign partner that needs the agency's facilities or assistance in reading out flight recorders. Several dozen foreign delegations typically come to Washington each year to use those laboratories.

The Board has been gratified in recent years to learn that several foreign governments—including those of Canada, Sweden, New Zealand, and The Netherlands—have modeled their transportation accident investigation agencies after NTSB. An organization of these agencies, the International Transportation Safety Association, has also been formed. Recently, several other nations have been contemplating establishing an independent accident investigation agency as well.

Laboratories

The Board's laboratories are world renowned. In the materials laboratory, highly trained specialists use sophisticated equipment to determine failure modes of metals and composites. Electronic scanning microscopes can enlarge views 200,000 times to detect the points of origin of failures that led to accidents. This method was used, for example, to detect a microscopic flaw in a titanium disk that led to the engine failure responsible for bringing down a DC-10 airliner in Sioux City, Iowa, in 1989, killing 111 people. On any given day, visitors to this laboratory can see objects as diverse as helicopter blades, broken train wheels, and broken light bulbs.

In the cockpit voice recorder laboratory, engineers listen to and decipher recordings of conversations and sounds from the cockpits of flights involved in an accident to pick up valuable clues about what was happening during the last 30 minutes of the flight. By law, the recordings themselves may not be released, but the Board prepares a transcript of the pertinent portions of the recordings for public release. Sometimes, background noises such as engine sounds, rather than the crew's conversation, provide the Board with important clues. NTSB has recommended that cockpit voice recorders be extended to 2 hours.

In the data recorder laboratory, engineers read out flight recorders, marine course recorders, railroad event recorders, and radar data. Flight recorders have evolved during the past decades from foil recorders (now illegal in this country), to digital recordings on computer tape, to new solid-state recorders. One of the many uses of the information gleaned from recorders is producing computerized, graphic re-creations of accidents that enable the Board and the public to better comprehend the sequence of events leading up to a major accident. The Board has recommended that flight data recorders on many U.S. airliners be upgraded to give investigators more information about flight controls and surfaces.

Conclusion

NTSB has investigated every major transportation accident that has occurred in the United States during the past 30 years—accidents ranging from the Exxon Valdez; to the collapse of the Sunshine Skyway Bridge; to the Challenger disaster; to the nation's worst drunk driving accident; to the worst pipeline accident in recent history, the explosion in San Juan, Puerto Rico, in November 1996 that claimed 33 lives. During this period, accident rates have been dropping, while capacity and usage have remained steady or grown, sometimes dramatically, in every mode of transportation. NTSB is a small agency with a big job—making the nation's notably safe transportation system even safer.