12. Discuss the organizational structure of OSHA, and describe the functions of its nine directorate offices.
13. Discuss the organizational structure of the EPA, and describe the functions of its 13 major offices.

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CHAPTER THREE

THE NATIONAL TRANSPORTATION SAFETY BOARD

LEARNING OBJECTIVES

After completing this chapter, you should be able to

- Explain the International Accident Investigation process
- Discuss ICAO's role in international accidents
- Describe the purpose of the National Transportation Safety Board (NTSB) and

- List the types of aviation accidents investigated by the NTSB.
- Explain the steps involved in investigating a major commercial aviation accident.
- Discuss the composition, function, and working of the go-team, the party system, and the board of inquiry as they relate to accident investigation.
- Summarize the responsibilities of the FAA during an investigation.
- Discuss the NTSB most wanted aviation safety improvements.

INTERNATIONAL ACCIDENT INVESTIGATION

OVERVIEW

As introduced in Chapters 1 and 2, ICAO has played a major part in international aviation matters since its establishment in 1944. Commercial aviation safety has truly become a worldwide concern in the modern era of jet airline transportation, and the ICAO Chicago Convention provides for international cooperation in accident investigations in two documents: Article 26 of the Convention and in its Annex 13 entitled "*Aircraft Accident and Incident Investigation.*" This section will set forth ICAO's role in this process and explain how the aircraft accident investigation process is handled on a worldwide basis.

ICAO'S ROLE

As stated, the international process for aircraft accident investigation is set forth in Annex 13 of the Chicago Convention. This document provides the following principles:

- The ultimate objective of accident investigation is prevention.
- Responsibility for an investigation belongs to the member state in which the accident or incident occurred (State of Occurrence).
- All ICAO States that may be involved must be promptly notified of the accident or incident occurrence.
- Other member States may participate in an investigation based upon their relationship to the accident such as the State of:
  - Registry
  - Operator
  - Design and Manufacture
- States of Registry, Operator, Design and Manufacture are entitled to appoint an *accredited representative* of that State to take part in the investigation.
- Experts and advisors may also be appointed to assist accredited representatives. The investigation may call on the best

- The investigation process includes the gathering, recording, and analysis of all relevant information; the determination of the causes of the accident; formulating appropriate safety recommendations and completion of the final report.

REGIONAL AND NATIONAL AUTHORITIES

The following are the primary international authorities empowered to investigate aircraft accidents in their state or region:

- Australia—Australian Transport Safety Bureau
- Canada—Transportation Safety Board of Canada (BST/TSB)
- France—Bureau d'Enquêtes et d'Analyses (BEA) pour la Sécurité de l'Aviation civile
- Mexico—Secretariat of Communications and Transportation (SCT)
- Russia (Commonwealth of Independent States, Former USSR area)—Interstate Aviation Committee (MAK)
- United Kingdom—Air Accidents Investigation Branch (AAIB) of the UK Department for Transport
- United States—National Transportation Safety Board (NTSB)

RECENT INTERNATIONAL INVESTIGATION

AIR FRANCE FLIGHT 447. On June 1, 2009, an Airbus A330-200 aircraft en route from Rio de Janeiro to Paris—Charles de Gaulle Airport crashed in the Atlantic Ocean causing 228 fatalities. This has been described as the worst accident in French aviation history by the BEA, which is currently investigating the accident under Annex 13 of the ICAO Convention. The NTSB has assigned an "accredited representative" to assist the BEA in this investigation. Additional information on this accident will be provided later in Chapter 5 of this book.

Aviation safety remains a top priority of ICAO and its member States. The recent 37th Assembly of ICAO, which concluded in Montreal in October 2010, strongly endorsed the sharing of safety information, and the United States offered its leadership and support by signing a precedent-setting agreement with ICAO, the European Union and the International Air Transport Association (IATA) to facilitate such sharing using modern Safety Management Systems (SMS) concepts. The NTSB organization and accident investigation process will be explored next.

NATIONAL TRANSPORTATION SAFETY BOARD

The *National Transportation Safety Board (NTSB)* is an independent agency of the U.S. government that determines the probable cause of transportation accidents and promotes transportation safety through the recommendation process. The

agencies' transportation safety programs, and reviews appeals of adverse actions by the U.S. Department of Transportation (DOT) involving pilot and mariner certificates and licenses.

To help prevent accidents, the NTSB develops and issues safety recommendations to other government agencies, industry, and organizations that are in a position to improve transportation safety. These recommendations are always based on the NTSB's investigations and studies and are the focal point of its efforts to improve safety in U.S. transportation systems.

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 Aviation Safety. In 1967, Congress consolidated all transportation agencies into a new Department of Transportation and established the National Transportation Safety Board as an independent agency within the department.

NTSB MISSION. Every 3 years, the Board issues its Strategic Plan. In its plan for fiscal years 2010 through 2015, the NTSB states its mission is to promote transportation safety by

- Maintaining its congressionally mandated independence and objectivity;
- Conducting objective, precise accident investigations and safety audits;
- Performing fair and objective airman and mariner certification appeals;
- Advocating and promoting safety recommendations;
- Assisting victims of transportation accidents and their families through Transportation Disaster Assistance (TDA).

In creating the NTSB, Congress envisioned that a single agency could develop a higher level of safety than the individual modal agencies working separately. Unlike the Bureau of Safety, the NTSB was to make its recommendations for safety reforms publicly. In summary, the NTSB's mission is to determine the "probable cause" of transportation accidents and to formulate safety recommendations to improve transportation safety.

With the passage of the *Independent Safety Board Act of 1974*, Congress made the NTSB completely independent outside the DOT, because "no Federal agency can properly perform such investigatory functions unless it is totally separate and independent from any other . . . agency of the United States." Because the DOT is charged with both the regulation and the promotion of transportation in the United States, and accidents may suggest deficiencies in the system, the NTSB's independence is necessary for objective oversight.

It is important to note that the NTSB has no authority to regulate, fund, or be directly involved in the operation of any mode of transportation. Therefore, it has the ability to oversee the transportation system, conduct investigations, make recommendations from a totally objective viewpoint, and make recommendations for [illegible]. Its effectiveness depends on an ability to make timely

and accurate determinations of the cause of accidents, along with comprehensive and well-considered safety recommendations.

The most visible portion of the NTSB involves major accident investigations. Under its accident selection criteria, the NTSB's investigative response depends primarily on

- 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 database so that trends can be identified and projected

NTSB investigations include the participation of modal agencies and other parties (such as manufacturers, operators, and employee unions). Within the transportation network, each government organization has been established to fulfill a unique role. Each modal agency investigates accidents to varying degrees of depth and with different objectives. As the only federal agency whose sole purpose is promoting transportation safety, the NTSB conducts detailed, open, and thorough accident investigations that often uncover significant systemwide problems that need to be corrected to prevent future similar accidents.

Under the Independent Safety Board Act of 1974, the NTSB investigates hundreds of accidents annually, including

- All accidents involving 49 Code of Federal Regulations (CFR) Parts 121 and 135 air carriers
- Accidents involving public (i.e., government) aircraft (except military accidents);
- Foreign aircraft accidents involving U.S. airlines and/or U.S.-manufactured transport aircraft or major components
- Accidents involving air traffic control, training, midair collisions, newly certified aircraft/engines, and in-flight fire or breakup
- General aviation accidents, some of which are delegated to the Federal Aviation Administration (FAA) for fact finding (it is important to note, however, that probable-cause determinations are never delegated)

In addition, based on the agency's mandate under Annex 13 to the Chicago Convention and related international agreements, the NTSB participates to a greater or lesser degree in the investigation of commercial aviation accidents throughout the world. The NTSB enjoys a worldwide reputation. The major share of the NTSB's air safety recommendations are directed to the FAA. These recommendations have resulted in a wide range of safety improvements in areas such as pilot training, aircraft maintenance and design, air traffic control procedures, and survival equipment requirements. The NTSB is also empowered to conduct special studies of transportation problems. A special study allows the NTSB to

break away from the mold of the single accident investigation to examine a safety problem from a broader perspective. In the past, for example, the NTSB has conducted special studies in weather, crashworthiness, in-flight collisions, and commuter airlines. In over 40 years of operation, the NTSB has issued nearly 13,000 safety recommendations.

NTSB ORGANIZATION

As provided on its Web site, there are three levels to the NTSB organization chart which is provided in Fig. 3-1. Current updates of this organization are*

- Top Level: Five board members, each nominated by the U.S. President and confirmed by the Senate to serve 5-year terms. A Chairman and a Vice Chairman are designated from these five board members. NTSB board members establish policy on transportation safety issues and on NTSB goals, objectives, and operations. Board members review and approve major accident reports, safety recommendations, and decide appeals of FAA certificate actions. Individual NTSB board members often serve as spokesman for major accident investigation ("Go Teams"), preside over public hearings, make major speeches, and testify before Congressional Committees.
- Second Level: The following offices report to the Chairman of the NTSB:
  - The Office of the Chief Financial Officer
  - The Office of the General Counsel
  - The Office of the Managing Director
  - The Office of Communications
  - The Office of Equal Employment Opportunity (EEO)

  The Office of the Managing Director supports the NTSB mission by providing overall leadership for the management of the Board. The office coordinates the activities of the entire NTSB staff, supervises eight offices at the next level, and develops plans to achieve NTSB program objectives.
- Third Level: The following offices report to the NTSB Managing Director:
  - The Office of Research and Engineering
  - The Office of Railroad, Pipeline, and Hazardous Materials Investigations
  - The Office of Aviation Safety (further described later in this chapter)
  - The Office of Highway Safety
  - The Office of Marine Safety
  - The Office of the Chief Information Officer
  - The Office of Administration
  - The Office of Administrative Law Judges

The Office of Aviation Safety has the responsibility for investigating aviation accidents and incidents, and for proposing probable causes for the Board's

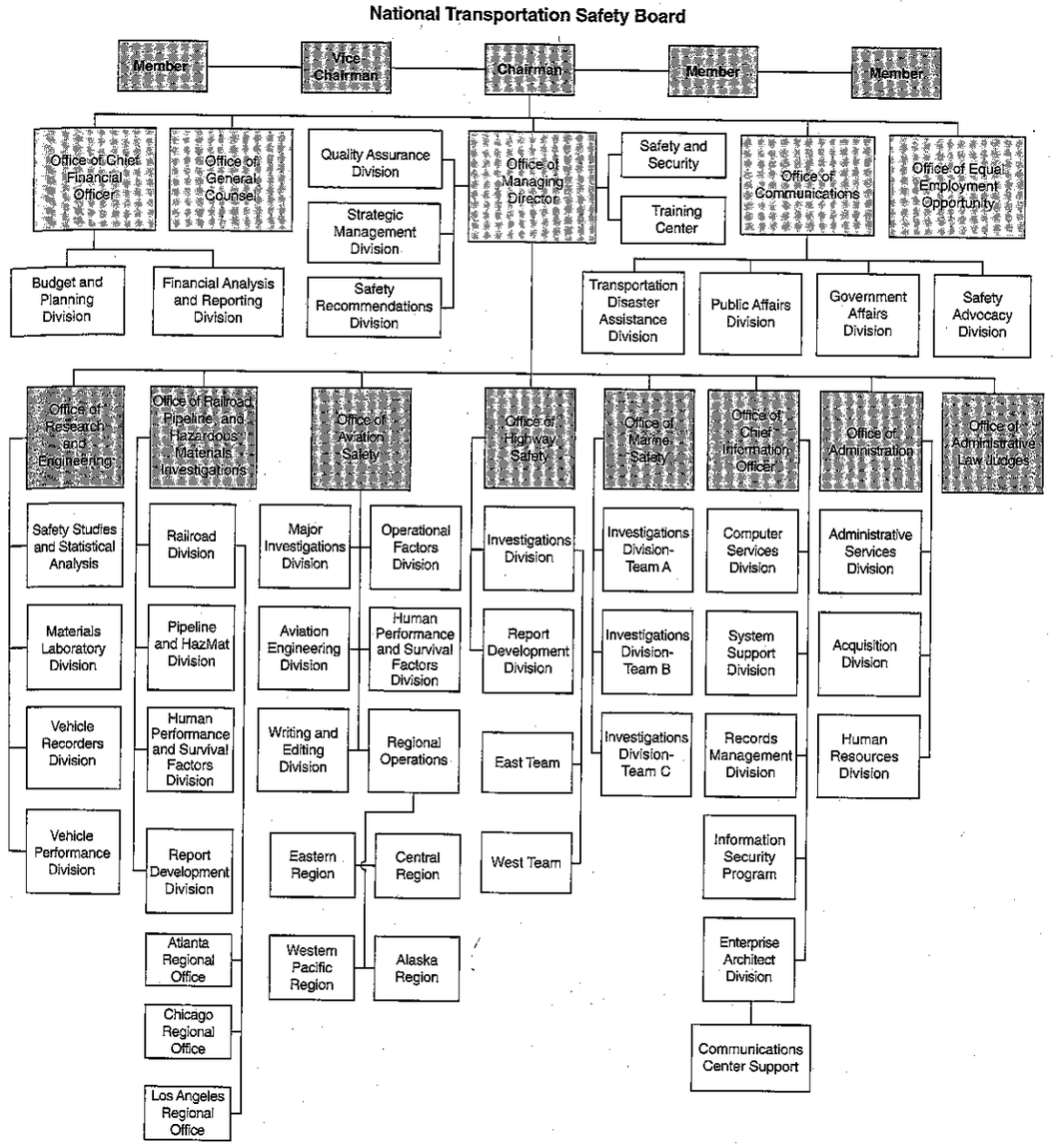

FIGURE 3-1 National Transportation Safety Board organizational chart, Nov 2010. (*Source: www.ntsb.gov*)

approval. With only 80 accident investigators among a total staff of about 120 people, the office handles more than 1,600 aviation accidents and incidents annually. The office also works, in conjunction with the other offices, to formulate recommendations to prevent the recurrence of similar accidents and incidents and to otherwise improve aviation safety. Most of the field investigations are led by a regional investigator from one of the four offices located in these regions across the country:

- Eastern Region
- Central Region
- Western Region
- Alaska Region

Additionally, there are five working divisions within the NTSB Office of Aviation Safety as follows:

- Major Investigation Division
- Operational Factors Division
- Human Performance and Survival Factors Division
- Aviation Engineering Division
- Writing and Editing Division

By necessity, much of the NTSB's work deals with the inanimate—aircraft structures, railroad tracks, pipelines, operating rules and procedures, and so forth. However, there is one unit of the NTSB, called the *Office of Administrative Law Judges,* that most often deals directly with the individual. Basically, the role of the Office of the Administrative Law Judge is to act as an initial appeals court for persons who might have had licenses or certificates suspended, revoked, or modified by the FAA or the Department of Transportation. The license holders range from pilots and aircraft mechanics to merchant seamen and flight dispatchers. But the authority of the law judge also extends beyond the individual to include the hearing appeals that might involve the loss or suspension of operating certificates issued for individual aircraft models or to airline firms.

The law judges function as trial judges, administering oaths, receiving evidence, ruling on motions, issuing subpoenas, and regulating the course of the hearing. Many hearings are held outside the Washington, D.C., area. Pursuant to authority in the Equal Access to Justice Act of 1980, the judges also review applications from airmen who prevail over the FAA in appeals brought under Section 609 of the Federal Aviation Act of 1958. The review of the applications for attorney fees and expenses for the most part is a determination of whether an award will be granted

assigned to the application might set the matter for informal conference or an evidentiary hearing when necessary for full and fair resolution of the issues arising from the application.

The law judge's initial decisions and orders are appealable to the full NTSB. Either party to the proceeding, the airman or the FAA, may appeal the judge's decision to the NTSB. After the NTSB has issued its opinion and order, either party may petition the NTSB for reconsideration. If a petition for reconsideration is not filed, then the NTSB's order becomes final if not appealed to the U.S. Court of Appeals. Only the airman or seaman can take an appeal to the U.S. Court of Appeals. The FAA and the U.S. Coast Guard, in the case of seamen, do not have the right of appeal to the court. On review, the court has the power to affirm, modify, or set aside the full NTSB's opinion and order, in whole or in part, and if need is found, to order further proceedings by the NTSB.

ACCIDENT INVESTIGATION PROCESS

When a major commercial aviation accident occurs, an NTSB go-team, led by an *investigator-in-charge (IIC),* is dispatched from the agency's Washington, D.C., headquarters to the accident site, usually within a couple of hours of notification of the event. The IIC, a senior air safety investigator with the NTSB's Office of Aviation Safety (OAS), organizes, conducts, and manages the field phase of the investigation, regardless of whether a board member is also present on the scene. This activity includes investigating the factual circumstances of the crash (on site and afterward), preparing final reports for submission to the board members, initiating safety recommendations to prevent future accidents, and participating in foreign accident investigations. The IIC has the responsibility and authority to supervise and coordinate all resources and activities of the field investigators. The NTSB go-team may form as many as 10 investigative groups. Specialist "working group" teams may be formed around subject matter areas, such as power plants, systems, structures, operations, air traffic control, human factors, weather, and survivability. Cockpit voice recorder and flight data recorder groups are formed at the NTSB laboratory in Washington. All NTSB staff assigned to a particular investigation are under the direction of the IIC.

PARTY PROCESS

Increasingly, the NTSB has no choice but to conduct its investigations in the glare of intense media attention and public scrutiny. As commercial air travel has become routine for millions of passengers, major accidents have come to be viewed as nothing short of national catastrophes. At the same time, an NTSB statement of cause may be nothing short of catastrophic for the airline, aircraft manufacturer, or other entity that may be deemed responsible for a mishap. A very real, albeit unintended,

consequence of the NTSB's safety investigation is the assignment of fault or blame for the accident by both the courts and the media. Hundreds of millions of dollars in liability payments, as well as the international competitiveness of some of the most influential U.S. corporations, rest on the NTSB's conclusions about the cause of a major accident. This was not the system that was intended by those who supported the creation of an independent investigative authority more than 40 years ago, but it is the environment in which the investigative work of the agency is performed today.

The NTSB relies on teamwork to resolve accidents, naming "parties" to participate in the investigation that include manufacturers, operators, and, by law, the FAA. The *party system* enables the NTSB to leverage its limited resources and personnel by bringing into an investigation the technical expertise of the companies, entities (such as the pilots' union), and individuals who were involved in the accident or who might be able to provide specialized knowledge to assist in determining the probable cause. Except for the FAA, party status is a privilege, not a right. The IIC has the discretion to designate the parties that are allowed to participate in an investigation, and each party representative must work under the direction of the IIC or senior NTSB investigators at all times. No members of the news media, lawyers, or insurance personnel are permitted to participate in any phase of the investigation. Claimants or litigants (victims or family members) are also specifically prohibited from serving as party members.

The specialists that any party assigns to an investigation must be employees of the party and must possess expertise to assist the NTSB in its investigation. Providing the safety board with technical assistance gives parties many opportunities to learn what happened and to formulate theories as to the cause of the accident. Party representatives are not permitted to relay information to corporate headquarters without the consent of the IIC, and then only when necessary for accident prevention purposes. Information is not to be used for litigation preparation or for public relations. Sanctions for failing to abide by the NTSB party rules and procedures include the dismissal of individuals or even the party from the investigation team. Party representatives must sign a party pledge, a written statement agreeing to abide by the NTSB rules governing the party process.

The first 2 days following an accident are critical because the evidence is fresh and undisturbed. After people start going through the wreckage, the clues begin to disappear. An airspeed indicator's needle might be moved, or a fuel line might drain. Subtle clues are lost that could reveal possible causes of the accident. Consequently, crash sites are protected from the untrained until the go-team arrives on the scene.

THE GO-TEAM

On 24-hour alert, *go-team* personnel possess a wide range of accident investigation skills. For aviation accidents, a go-team roster could include one of the five members of the NTSB, an air traffic control specialist, a meteorologist, a human-performance expert, an expert trained in witness interrogation, an engine specialist, as well as experts in hydraulics, electrical systems, and maintenance

expertise is applicable to each mode. Human-factors experts fall into this category, as do the NTSB's metallurgists, meteorologists, and hazardous-materials experts.

Go-team duty is rotated. Immediately after one team has been dispatched, a new list is posted. Like firefighters, go-team members spend many hours doing office work and working on special studies until the inevitable call comes. The FAA usually gets the first word of an accident, then the director of the NTSB's regional or field office. This office notifies the go-team, the board member on duty, the NTSB chair, and the public affairs division. The team is normally on its way within 2 hours. Until it arrives, an investigator from the nearest NTSB field office secures the crash site with the help of local authorities. Representatives from the aircraft manufacturer, the airline, the engine manufacturer, and the FAA also arrive. If the accident is major, a member of the NTSB accompanies the team. The investigator-in-charge calls a meeting and assigns each of these individuals to a section of the go-team.

ACCIDENT SITE

The length of time a go-team remains on the accident site varies with need, but generally a team completes its work in 10 to 14 days. However, accident investigations often can require off-site engineering studies or laboratory tests that might extend the fact-finding stage. In cases of crew fatalities, a local coroner usually performs autopsies on the flightcrew to determine at the outset whether pilot incapacitation might have been a factor. An autopsy can also reveal who was sitting where in the cockpit and who was flying the aircraft.

After the preliminary steps are completed, the detailed work begins. The go-team is organized into groups of experts, each of which focuses on specific aspects of the investigation. Each group, headed by a group chairperson, concentrates on a specific portion of the investigation. Coordination is effected among group chairpersons to ensure investigative coverage in areas where more than one group may have a responsibility. Using their combined knowledge of flying in general and of this aircraft in particular, they compare what they know with what they find in the wreckage. Simple cameras are an important tool of the trade. Before the team members touch any of the wreckage, they take pictures from various angles and distances and make verbal notes into tape recorders.

Operational factors experts in three disciplines (air traffic control, operations, and weather) support major investigations with intensive work in their specialties. Air traffic control (ATC) specialists examine ATC facilities, procedures, and flight handling, including ground-to-air voice transmissions, and develop flight histories from Air Route Traffic Control Center (ARTCC) and terminal facility radar records. Other specialists examine factors involved in the flight operations of the carrier and the airport and in the flight training and experience of the flightcrew. Weather specialists examine meteorological and environmental conditions that may have caused or contributed to an accident.

Human-performance specialists examine the background and performance of persons associated with the circumstances surrounding an accident, including the person's knowledge, experience, training, physical abilities, decisions, actions, and

work habits. Also examined are company policies and procedures, management relationships, equipment design and ergonomics, and the work environment.

Aviation engineering experts in four areas provide strong technical investigative skills. Power plant specialists examine the airworthiness of aircraft engines, while structures experts examine the integrity of aircraft structures and flight controls as well as the adequacy of design and certification. Systems specialists examine the airworthiness of aircraft flight controls and electrical, hydraulic, and avionic systems. And maintenance specialists examine the service history and maintenance of aircraft systems, structures, and power plants.

Survival-factors experts investigate factors that affect the survival of persons involved in accidents, including the causes of injuries and fatalities. These investigators also examine cabin safety and emergency procedures, crashworthiness, equipment design, emergency responsiveness, and airport certification.

LABORATORY

While the investigators work on site, the NTSB's materials laboratory in Washington, D.C., performs detailed analyses on items found at the site. One of the finest of its kind in the world, the laboratory is designed to support investigators in the field. For example, the laboratory has the capability to "read out" aircraft cockpit voice recorders (CVRs) and decipher flight data recorders (FDRs), which provide investigators with such key factors as airspeed, altitude, vertical acceleration, and elapsed time. These two *black boxes* provide investigators with a profile of an aircraft during the often crucial last minutes of flight.

Metallurgy is another of the laboratory's critical skills. NTSB metallurgists perform postaccident analysis of wreckage parts. The laboratory is capable of determining whether failures resulted from inadequate design strength, excessive loading, or deterioration in static strength through fatigue or corrosion.

The investigation of the American Airlines DC-10 that lost its left engine after takeoff from Chicago's O'Hare Airport in May 1979 probably could not have been concluded without the help of the materials lab. Preliminary investigations led metallurgists to focus on the aft bulkhead of the left engine pylon—the vertical member of the wing from which the engine is suspended. They found the overstressed area where the engine broke off. As suspected, a trail of fatigue marks also was found leading up to the overstressed area. But the real mystery turned up when the metallurgists followed the fatigue marks to their point of origin, only to discover another overstressed area, and nothing else. The first overstress had caused the fatigue, and the fatigue had caused the final break. But what had caused the initial overstress?

The metallurgists and specialists reviewed the aircraft's maintenance records and found that when removing the engines, a maintenance crew had used a forklift to help lower the entire engine-pylon assembly. Although the crew didn't realize it at the time, the method was causing hidden damage at the points where the engine and pylon were fastened to the wing. As a result of the findings, the engine removal

ACCIDENT REPORT PREPARATION

Following completion of the on-scene phase of the investigation (which may last for several days or weeks), each NTSB group chair (the senior investigator overseeing a specific area of the investigation) completes a factual report on his or her area of responsibility. The reports are likely to include proposed safety recommendations to correct deficiencies and prevent future similar accidents. All factual material is placed in the public docket that is open and available for public review. Thereafter, the investigators involved in the case begin an often lengthy period of further fact gathering, usually involving one or more public hearings, and final analysis of the factual information collected.

There is no time limit on NTSB investigative activity. Safety board procedures have a target date for completion of the final accident report within 1 year of the date of the accident, but major commercial aviation accident investigations have taken as little as 4 months and as much as more than 4 years.

A key milestone in the report preparation process is the group chairs' preparation of analytical reports in their respective areas of expertise. The parties may contribute to the analytical reports through their continued contact with the NTSB group chairs and the IIC, but parties are not allowed to review, edit, or comment on the analytical reports themselves. The parties also contribute to the safety board's analytical process through written submissions, which are sometimes extensive and become part of the public docket.

PUBLIC HEARING

Following an accident, the NTSB might decide to hold a public hearing to collect added information and to discuss at a public forum the issues involved in an accident. Every effort is made to hold the hearing promptly and close to the accident site.

A hearing involves NTSB investigators, other parties to the investigation, and expert witnesses called to testify. At each hearing, a *board of inquiry* is established that is made up of senior safety board staff, chaired by the presiding NTSB member. The Board of Inquiry is assisted by a technical panel. Some of the NTSB investigators who have participated in the investigation serve on the technical panel. Depending on the topics to be addressed at the hearing, the panel often includes specialists in the areas of aircraft performance, power plants, systems, structures, operations, air traffic control, weather, survival factors, and human factors. Those involved in reading out the cockpit voice recorder and flight data recorder and in reviewing witness and maintenance records also might participate in the hearing.

Parties to the hearing are designated by the NTSB member who is the presiding officer of the hearing. They include those persons, government agencies, companies, and associations whose participation in the hearing is deemed necessary in the public interest and whose special knowledge will contribute to the development of pertinent evidence. Typically, they include the FAA, operator, airframe

manufacturer, engine manufacturer, pilots' union, and any other organization that can assist the safety board in completing its record of the investigation. Except for the FAA, party status is a privilege, not a right. Parties are asked to appoint a single spokesperson for the hearing.

Expert witnesses are called to testify under oath about selected topics to assist the safety board in its investigation. The testimony is intended to expand the public record and to demonstrate to the public that a complete, open, and objective investigation is being conducted. The witnesses who are called to testify are selected because of their ability to provide the best available information on the issues related to the accident.

News media, family members, lawyers, and insurance personnel are not parties to the investigation and are not permitted to participate in the public hearings.

Following the hearing, investigators will gather additional needed information and conduct further tests identified as necessary during the hearing. After the investigation is complete and all parties have had an opportunity to review the factual record, from both the hearing and other investigative activities, a technical review meeting of all parties is convened. That meeting is held to ensure that no errors exist in the investigation and that there is agreement that all that is necessary has been done.

On rare occasions, the hearing may be reopened when significant new additional information becomes available or follow-up investigation reveals additional issues that call for an airing in a public forum such as a hearing.

FINAL ACCIDENT REPORT

With the completion of the fact-finding phase, the accident investigation process enters its final stage—analysis of the factual findings. The analysis is conducted at the NTSB's Washington, D.C., headquarters. The final accident report includes a list of factual findings concerning the accident, analysis of those findings, recommendations to prevent a repetition of the accident, and a probable-cause statement.

The IIC and the NTSB senior staff create a final draft report, called the *notation draft,* for presentation to the board members. This draft includes safety recommendations and a finding of probable cause. Following a period for review of the draft report, a public meeting of the board members is held in Washington. The NTSB staff will present and comment on the draft report; party representatives are permitted to attend but may not make any kind of presentation or comment. At this meeting, the board members may vote to adopt this draft, in its entirety, as the final accident report; may require further investigation or revisions; or may adopt the final accident report with changes that are discussed during the meeting.

Safety recommendations resulting from major investigations generally are included in the final accident report; however, in the interest of safety, they may be issued at any time during the course of an investigation if the NTSB deems it necessary.

Technically, NTSB investigations are never closed. Parties to the investigation may petition the board to reconsider and modify the findings and/or probable-cause statement if the findings are believed to be erroneous or if the party discovers new evidence. Petitions from nonparties will not be considered.

SAFETY RECOMMENDATIONS

The *safety recommendation* made to the FAA is the NTSB's end product. Nothing takes a higher priority, and nothing is more carefully evaluated. In effect, the recommendation is vital to the NTSB's basic role of accident prevention because it is the lever used to bring changes and improvements in safety to the nation's transportation system. Close to 80 percent of the recommendations made to the FAA are acted upon favorably. With human lives involved, timeliness also is an essential part of the recommendation process. As a result, the NTSB issues a safety recommendation as soon as a problem is identified without necessarily waiting until an investigation is completed and the probable cause of an accident determined. In its mandate to the NTSB, Congress clearly emphasized the importance of the safety recommendation, saying the NTSB shall "advocate meaningful responses to reduce the likelihood of recurrence of transportation accidents." Each recommendation issued by the NTSB designates the person, or the party, expected to take action, describes the action that the NTSB expects, and clearly states the safety need to be satisfied.

Recommendations are based on findings of the investigation and may address deficiencies that do not pertain directly to what is ultimately determined to be the cause of the accident. For example, in the course of its investigation of the crash landing of a DC-10 in Sioux City, Iowa, in 1989, the NTSB issued recommendations on four separate occasions before issuing its final report. In the TWA Flight 800 investigation in 1996, once it was determined that an explosion in the center fuel tank caused the breakup of the aircraft, the NTSB issued urgent safety recommendations aimed at eliminating explosive fuel/air vapors in airliner fuel tanks.

Occasionally, a single crash investigation can have major ramifications on the entire commercial aviation industry. Such was the case of Colgan Air Flight 3407, a commuter airline accident which occurred on February 12, 2009 near Buffalo, New York. From an NTSB point of view, this accident investigation was extraordinary in its sweeping scope, number of recommendations, and speed of delivery to the public. The issues presented and explored during the public hearing and investigation were the following:

- Effect of icing on aircraft performance
- Cold weather operations
- The "sterile cockpit" (inappropriate discussions between the pilots)

- Flight crew experience and training
- Fatigue management
- Stall recovery

The final NTSB report was issued with unprecedented speed less than 1 year after the accident and the Board makes 28 safety recommendations in this significant document. These recommendations cover a wide range of safety issues that were factors in this accident, especially pilot training and fatigue. As stated in Chapter 1, this single accident has had a profound effect on commercial aviation safety which will be addressed in detail in appropriate sections throughout this book.

INVESTIGATING A GENERAL-AVIATION ACCIDENT

The investigation of general-aviation accidents is a simpler process requiring fewer staff members per accident. Inasmuch as the NTSB investigates many general-aviation accidents per year, abbreviated investigations are generally necessary, given the agency's limited staff and budgetary resources. Most general-aviation accident investigations are conducted by one of the NTSB's regional or field offices. In a *field investigation,* at least one investigator goes to the crash site; a *limited investigation* is carried out by correspondence or telephone. Some, but by no means all, general-aviation accidents generate safety recommendations approved by the NTSB members.

FAMILY ASSISTANCE AND THE TRANSPORTATION DISASTER ASSISTANCE OFFICE

Following the enactment of the *Aviation Disaster Family Assistance Act of 1996,* the President designated the NTSB as the lead federal agency for the coordination of federal government assets at the scene of a major aviation accident and as the liaison between the airline and the families. The role of the NTSB includes integrating the resources of the federal government and other organizations to support the efforts of state and local governments and the airlines to aid aviation disaster victims and their families. The NTSB's Transportation Disaster Assistance Office assists in making federal resources available to local authorities and the airlines, for example, to aid in rescue and salvage operations and to coordinate the provision of family counseling, victim identification, and forensic services. The safety board has sought to maintain a distinct separation between family assistance activities and the NTSB's technical investigative staff.

FAA RESPONSIBILITIES DURING AN INVESTIGATION

Accident investigation is largely the responsibility of each FAA Flight Standards District Office (FSDO), which maintains a preaccident plan that is tailored to that office's specific requirements (e.g., geographic location, climate, staffing, and

resources). The FAA works very closely with the NTSB, and the formal agreement between agencies can be found in *FAA Order 8020.11C* dated 2/2/2010, entitled, *Aircraft Accident and Incident Notification, Investigation, and Reporting.* FAA accident investigation responsibilities include the following:

Ensuring that

- All facts and circumstances leading to the accident are recorded and evaluated.
- Actions are taken to prevent similar accidents in the future.

Determining whether:

- Performance of FAA facilities or functions was a factor.
- Performance of non-FAA owned and operated air traffic control (ATC) facilities or a navigational aid was a factor.
- Airworthiness of FAA-certified aircraft was a factor.
- Competency of FAA-certified airmen, air agencies, commercial operators, or air carriers was involved.
- Federal Aviation Regulations were adequate.
- Airport certification safety standards or operations were involved.
- Airport security standards or operations were involved.
- Airman medical qualifications were involved.
- There was a violation of Federal Aviation Regulations.

The FAA conducts investigations and submits factual reports of the investigations to the NTSB on accidents delegated to the FAA by the NTSB. This delegation of certain NTSB accident investigation responsibilities is exercised under Section 304(a)(1) of the Independent Safety Board Act of 1974.

The FAA's principal investigator at an accident is called the *investigator-in-charge.* This individual directs and controls all FAA participation in the accident until the investigation is complete. Included is the authority to procure and use the services of all needed FAA personnel, facilities, equipment, and records.

The FAA investigator-in-charge is under the control and direction of the NTSB investigator-in-charge in an NTSB-conducted investigation. When accident investigations are delegated to the FAA by the NTSB, the FAA investigator-in-charge becomes an authorized representative of the NTSB. All the investigative authority prescribed in the applicable NTSB regulations falls to this person. All other FAA personal report to the investigator-in-charge and are responsible to that person for all reports they have prepared or received during the investigation.

NTSB ACCIDENT DATABASES

The NTSB aviation accident database and synopses, which go back as far as 1962, are available online at http://www.ntsb.gov. These databases contain information on civil aviation accidents and selected incidents that occur within the shores of the

United States, within its territories, and in international waters. Within a few days of an accident a preliminary report is normally available online. This is followed by a factual preliminary report that gets replaced with a final report outlining probable cause, when the investigation is completed. Complete information may not be available for cases under revision or where the NTSB did not have primary responsibility for investigating an accident. A summary of information available on this site includes

- Interactive search capability for the NTSB database that is updated daily. Search information is possible by
  Day, month, and year since 1962
  City and state in which the accident occurred
  Severity—incident, accident, fatal, nonfatal
  Aircraft category (airplane, helicopter, etc.)
  Type of assembly—amateur or commercial
  Aircraft make, model, and registration
  Operation (Part 121, Part 135, etc.)
  Name of airline
  NTSB accident number
  Word strings
- Monthly listing of accidents sorted by date that is updated daily.
- List of investigations nearing completion.
- Complete downloadable data sets for each year beginning from 1982 and updated monthly in Microsoft Access 2000 MDB format.
- Complete description of Government Information Locator System (GILS) accident databases, including definition of *accident* and *incident*.
- Complete FAA incident database information about incidents, including those not investigated by NTSB.
- Lists of data, information products, and other sources of information about aviation accidents, including publications, dockets, and press releases.

NTSB MOST WANTED AVIATION SAFETY IMPROVEMENTS

Since the NTSB lacks regulatory authority over the FAA and aviation industry, one of its most important functions is to strongly recommend and advocate appropriate FAA actions that will improve aviation safety. The Board satisfies this mandate by publishing and frequently updating its "Most Wanted List" of aviation safety improvements. A current NTSB "Most Wanted List" can be found on its Web site at www.ntsb.gov

As of this writing, there are seven aviation issues on this list, and NTSB "color codes" FAA action in three categories:

Red = Unacceptable response

Yellow = Acceptable response, proceeding slowly

Green = Acceptable response, proceeding in a timely manner

Below is the current NTSB most wanted list, and the reader is encouraged to check the most current NTSB Web site for updates and emerging information on the latest safety issues.

NTSB SEVEN MOST WANTED LIST ITEMS (JUNE 2011)

1. Improve Oversight of Pilot Proficiency

   Status: Red

   Action needed by FAA:
   - Evaluate prior flight check failures for pilot applicants before hiring
   - Provide training and additional oversight that considers full performance histories for flight crewmembers demonstrating performance deficiencies

2. Require (Cockpit) Image Recorders

   Status: Red

   Action needed by FAA:
   - Install crash-protected image recorders in cockpits to give investigators more information to solve complex accidents

3. Improve the Safety of (Helicopter) Emergency Medical Services (EMS) Flights

   Status: Red

   Action needed by FAA:
   - Conduct all flights with medical personnel on board in accordance with stricter commuter aircraft regulations
   - Develop and implement flight risk evaluation programs for EMS operators
   - Require formalized dispatch and flight-following procedures including up-to-date weather information
   - Install terrain awareness and warning systems (TAWS) on aircraft used for EMS operations

4. Improve Runway Safety (Runway Incursions)

   Status: Yellow

   Action needed by FAA:
   - Give immediate warnings of probable collisions/incursions directly to flight crews in the cockpit

- Require specific air traffic control (ATC) clearance for each runway crossing
- Require operators to install cockpit moving map displays or an automatic system that alerts pilots when a takeoff is attempted on a taxiway or a runway other than the one intended
- Require a landing distance assessment with an adequate safety margin for every landing

5. Reduce Dangers to Aircraft Flying in Icing Conditions

   Status: Red

   Action needed by FAA:
   - Use current research on freezing rain and large water droplets to revise the way aircraft are designed and approved for flight in icing conditions
   - Apply revised icing requirements to currently certified aircraft
   - Require that airplanes with pneumatic deice boots activate the boots as soon as the airplane enters icing conditions

6. Improve Crew Resource Management (CRM)

   Status: Yellow

   Action needed by FAA:
   - Require commuter and on-demand air taxi flight crews to receive crew resource management training

7. Reduce Accidents and Incidents Caused by Human Fatigue in the Aviation Industry

   Status: Red

   Action needed by FAA:
   - Set working hour limits for flight crews, aviation mechanics, and air traffic controllers based on fatigue research, circadian rhythms, and sleep and rest requirements
   - Develop a fatigue awareness and countermeasures training program for controllers and those who schedule them for duty
   - Develop guidance for operators to establish fatigue management systems, including a methodology that will continually assess the effectiveness of these systems.

KEY TERMS

ICAO Annex 13—Aircraft Accident and Incident Investigation

Accredited Representative

National Transportation Safety Board (NTSB)

Independent Safety Board Act of 1974

NTSB Board Members

Office of the Managing Director

Office of Administrative Law Judges

Investigator-in-charge

Go-team

Party system

Probable cause

Black boxes

Board of Inquiry

Final accident report

Safety recommendations

Notation draft

Field investigation

Aviation Disaster Family Assistance Act of 1996

Transportation Disaster Assistance Office

FAA Order 8020.11C, Aircraft Accident and Incident Notification, Investigation, and Reporting

NTSB Most Wanted List

REVIEW QUESTIONS

1. Discuss the role of ICAO and NTSB in international aviation accident investigations. What is an accredited representative?
2. What are the primary responsibilities of the National Transportation Safety Board (NTSB)? How did passage of the Independent Safety Board Act of 1974 affect the NTSB? Describe the types of accidents investigated by the NTSB. Describe the organizational structure of the NTSB.
3. Explain the role of the investigator-in-charge (IIC) and the go-team. What is the so-called party system that enables the NTSB to leverage its limited resources? Identify the steps taken in a major accident investigation. What types of activities are performed at the NTSB's laboratory in Washington, D.C.? When are safety recommendations made?
4. What is the purpose of a public hearing? Are hearings ever reopened? What information is included in the final accident report? Distinguish between a field investigation and a limited investigation of a general-aviation accident.
5. What is the role of the NTSB under the Aviation Disaster Family Assistance Act of 1996? What is the Transportation Disaster Assistance Office?
6. Describe the responsibilities of the FAA during a major accident investigation. Describe some of the functions of the NTSB besides accident investigation.
7. What is the purpose of the NTSB Most Wanted List?

REFERENCES

ICAO—Chicago Convention Article 26/Annex 13.
NTSB Strategic Plan FY2010 - FY 2015.
Testimony of Honorable Deborah A.P. Hersman, Chairman NTSB, before the Aviation Subcommittee, Committee on Commerce, Science and Transportation, U.S. Senate—Hearing on Aviation Safety: One year after the crash of (Colgan) Flight 3407, February 25, 2010.

WEB REFERENCES

http://www.icao.int
http://www.ntsb.gov