Backgrounder

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Boeing's View: Above All, Safety

The aviation industry has come far in the past 100 years. Aviation history is peppered with cases of unimaginable achievement, tremendous risk and unfortunately, devastating loss. Through it all, air travel has become the safest and most-reliable mode of transportation, the result of an unrelenting pursuit of excellence and understanding.

Safety is a shared priority for airplane manufacturers, suppliers, regulators, airport authorities and operators who know firsthand the importance of the global air transportation system. The system connects people, places, ideas and opportunities in ways never before possible. It drives economies, empowers individuals, facilitates diplomacy and enables business.

At Boeing, safety is the foundation for everything we do. From design to manufacture, first flight to delivery and in-service support, Boeing engineers, pilots, production teams and technical experts collaborate to ensure the company's airplanes meet regulatory requirements and perform as designed and, most importantly, preserve public trust and confidence.

Industry track record – nearly 100 percent accident free

The overall safety record of commercial airplanes is excellent and has improved dramatically. In the early days of jet travel, fatal accidents occurred about once every 200,000 flights. Today, the global safety record is more than 10 times better. In 2011, of 23.6 million commercial flights worldwide, four involved fatalities. The industry continues to work toward a goal of zero accidents.

Flying also is the safest way to travel. In the U.S., it is 70 times safer to fly than to drive, and every year more deaths occur as a result of accidents in cars, motorcycles, trains, bicycles or as pedestrians.

All segments of the global air transportation system work together to do their part. Regulators, such as the U.S. Federal Aviation Administration (FAA), provide oversight and enact policy; airplane manufacturers design and produce airplanes that meet or exceed regulatory requirements; air carriers operate and maintain their airplanes; and airport and air traffic control authorities provide the infrastructure to keep the system running efficiently and smoothly.

Boeing's design and test philosophy

Boeing engineers design airplanes with two principles in mind: design to prevent failures, and design in protections in the unlikely event there is a failure. Above all, the goal is to ensure that no single failure will prevent safe operations and put the airplane at risk. Thorough testing validates that the design performs as intended and meets all requirements.

While the goal is to deliver flawless airplanes and services, the potential for errors exists. Boeing airplanes are designed with multiple levels of redundancy – safety nets, if you will – to ensure there are no threats to the airplane.

For example, the 787's electrical system is designed to address a number of fault scenarios. Design checks provide an additional level of confidence and ensure that system elements are separated by function and space. A robust and ready network of standby and protective systems were designed and built into the airplane.

And, on a Boeing airplane, pilots are always in command. Engineers design Boeing flight decks to provide sensory cues such as audio alarms, lighted indicators and moving and linked pilot controls such as throttles, rudder pedals and yoke to ensure the crew always knows how the airplane is responding. The 787 flight deck is designed for maximum situational awareness, with head-up displays, advanced instrumentation and airplane monitoring tools.

After the design phase, Boeing uses a "building block" approach to testing, starting with raw materials, discrete parts and subsystems, and building to larger, more complex and comprehensive assemblies and systems, up to and including the entire airplane. This approach ensures that every element of the airplane is examined and evaluated for how it performs separately and as a whole.

In context of the 787's electrical system, Boeing conducted more than 5,000 hours of laboratory testing of the battery system to demonstrate normal operations and to simulate failures, including baking the battery to induce overheating, crushing the battery and puncturing a cell with a nail to induce short circuiting. The airplane's integrated power system underwent more than 25,000 hours of laboratory testing to demonstrate the interaction of various system elements in normal operations as well as simulated failures. Once installed on the airplane, the integrated electrical system underwent more than 10,000 hours of flight and ground testing under normal operations and simulated abnormal conditions, including extreme weather, long and short durations, and low and high elevations.

Investigations drive improvement

Boeing uses proactive investigations to help prevent accidents and incidents before they occur. The company has a well-established network of resources, tools and processes to gather data on fleet performance, which allows the company to spot trends and investigate potential problems. In addition to its own sources, which include the Airplane Health Monitoring system and field-service reports, Boeing collects data from a variety of others such as suppliers and customers.

The pool of information and data is screened for safety-related concerns. Each year, Boeing receives about 2,500 continued operational safety event notices, which it reviews with the FAA. Of those, about 100 require corrective measures, which ultimately result in better, safer operations.

When safety issues arise, Boeing takes appropriate action to mitigate the risk, and communicates airplane part or procedural changes to its customers. Regulatory authorities might convert those changes into mandatory airworthiness directives (ADs). Permanent solutions to an issue may take longer to develop and implement, because changes to an airplane design must be thoroughly tested, analyzed, validated and re-certified. In these cases, interim mitigating action is used to assure fleet safety until the permanent solutions are available.

A global framework for accident investigation

According to the International Civil Aviation Organization (ICAO), a United Nations-chartered agency charged with setting international standards and regulations, the sole purpose for investigation is accident prevention.

The investigation process is triggered by two primary situations: accidents and incidents. The first relates to the operation of an airplane where fatalities or serious injuries are sustained by passengers and/or crew, or an airplane is substantially damaged, missing or inaccessible. The second involves operational conditions that affect or could affect the safety of the airplane. For example, recent cases involving 787 batteries are considered incidents.

A third type, referred to as an “event,” might or might not result in an investigation or corrective action, either by regulatory authorities, or the airplane manufacturer itself.

In any case, the goal is to understand what happened and why to drive improvements and help prevent a recurrence.

ICAO has an established investigation protocol that defines policies, process and roles and responsibilities for relevant parties involved in an investigation. There are three tiers to the responsive investigation team structure. At the top and in the lead are investigative authorities from the country where the accident or incident occurred, and who comprise the only party allowed to comment on progress, final determination and recommended resolution. Secondary parties include authorities from the country of registry, manufacture, design and operator. The third level, of which Boeing can be a part, includes regulators, manufacturers and airline carriers.

When a 787 ground incident occurred in January 2013 at Boston’s Logan International Airport, the U.S. National Transportation Safety Board (NTSB) stepped in to lead the investigation. Boeing is assisting at the invitation of the NTSB and the company’s work is directed by the NTSB investigation team. Similarly, the diversion of a 787 flight in Japan later the same month because of an in-flight battery incident means the Japanese Transport Safety Board is leading the investigation.

Finding answers

Accidents and incidents rarely are caused by a single failure or action. Rather, they usually result from a chain reaction or combination of circumstances that come together, which is why they involve complex and lengthy investigations.

Investigators identify all the factors that might have been part of a chain. Once the investigative agency has determined probable cause, it can make recommendations designed to prevent recurrence such as new training aids for pilots, new operating procedures, airplane modifications and the incorporation of new technologies.

The more we all learn, the safer the system

Boeing welcomes the opportunity to learn more and do its part to ensure the integrity of the global air transport system. The company is a member of several industry associations that provide perspective on safety policy. Most notably, Boeing is a member of the Collier-Award-winning U.S. Commercial Aviation Safety Team, whose members work together to ensure global safety efforts are effective and aligned, and several ICAO working groups focused on global air safety.

Boeing also is an active member of the Air Transport Association, International Air Transport Association, Aerospace Industries Association, American Institute of Aeronautics and Astronautics, Society of Automotive Engineering (aerospace), and the Radio Technical Commission for Aeronautics, all of which engage in aviation safety and policy dialogue.

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