Inside Air France 447

An unofficial investigative team tries to reconstruct the fatal accident.

VIDEO

Documentary Speculation

Crash of Flight 447

Written and directed by Kenny Scott. To be broadcast in the United States on the Public Broadcasting System, Oct. 26, 2010.

The camera takes us inside the cockpit of Air France (AF) Flight 447, an Airbus A330 flying from Rio de Janeiro to Paris on June 1, 2009. It is night, 35,000 ft over the Atlantic Ocean, three hours into the flight. One of the pilots calmly makes a position report to Brazil air traffic control.

A thunderstorm appears on the weather radar display. The captain illuminates the "fasten seat belt" sign for the passengers and issues a brief announcement notifying them to expect turbulence. He then plans a course deviation. So far, everything is routine. After that, nothing is. What the narrator calls "an incredible chain of events" begins.

We are not, of course, peering into the actual AF 447 cockpit on that night, but a dramatic re-creation in a flight simulation training device. The illusion of being with the pilots on that flight, which crashed into the ocean with a loss of all 228 people aboard, is intercut with analysis of the event.

No final accident report has been issued by the French Bureau d'Enquêtes et d'Analyses (BEA). The investigation has been hampered by the inability, so far, to recover the flight data recorder and the cockpit voice recorder from the accident airplane.

This program is based on the tentative findings of its own unofficial investigative team, which did not have access to the recovered parts of the A330 but was able to look at photographs of the parts. Team members included Martin Alder, a captain and training pilot for Airbus airplanes; John Cox, a former airline captain who is now chief executive officer, Safety Operating Systems, and an *AeroSafety World* contributor ("No Smoking in the Cockpit," 1/09, p. 31); John K. Williams, a weather expert; Jim Wildey, a structural engineer; and Tony Cable, a former aviation accident investigator.

A series of visual annunciations to the pilots that began with "ADVISORY CABIN VERTICAL SPEED" were transmitted automatically by the A330's datalink aircraft communications addressing and reporting system (ACARS) and recorded. A cascade of system failures followed.

The team believes that the initial failure was due to the icing of all the pitot tubes, as preliminary BEA investigative reports and speculation have suggested. Why could that have happened, since pitot tubes are heated to withstand cold and storms at altitude? They suggest that the pitot tubes fell victim to supercooled liquid water — "instant ice," as one of them says. Their search of previous incident

reports reveals 32 failed pitot tube events in A330s or A340s in the previous six years, including about one a week in the two months preceding the AF 447 accident.

Their accident scenario is based on informed speculation and may not coincide with findings of the eventual final report of the official investigating agencies.

The team speculates that the airplane entered a powerful thunderstorm that was hidden from their radar display by a nearer, smaller storm. Assuming the pitot tubes malfunctioned, there was no airspeed data for either the autopilot or the crewmembers to use. The automatic flight systems disengaged and the pilots took manual control.

"When things go very wrong, the last line of defense is the aviator," Cox says.

The pilots tried to maintain the necessary pitch and engine power to keep the airplane from stalling, the team suggests, but in the end they were defeated by the lack of critical airspeed data. "If Flight 447 speeds up or slows down by as little as 10 kt, it could suffer a … stall," the narrator says. The crew's attention may also have been distracted from the thrust settings by the many fault warnings they were receiving.

Cable finds support in the record of earlier incidents for the theory that the thrust setting selected became unsafe. The narrator says, "In 10 previous incidents of pitot probe failure, the crew fails to immediately control thrust. … In five cases, crews don't take control of thrust [until] more than 60 seconds [have elapsed]. For Flight 447, that would mean rapid deceleration and the risk of a sudden stall."

The team surmises that inhibition of lift because of airflow detachment from the wings resulted in a rapidly descending aircraft, possibly accompanied by a severe roll — "more like a fighter jet than a passenger airliner," the narrator says. "Most airline pilots have limited experience dealing with this type of event [loss of control in flight]."

Cable says, "In recent years, the single biggest cause of accidents has become loss of control. … It has raised the question about whether the situation is actually being made worse by the increasing automation, whereby crews don't get a great deal of opportunity to manually fly the aircraft."

However, the narrator adds, "Without [retrieving] the 'black' boxes and their vital data, there can be no definitive proof."

The program's production values are outstanding, using computer graphics imagery to demonstrate pitot tube icing, control surface changes, pitch and roll, and other characteristics. The simulator re-creation of the heightened workload in the cockpit when one system after another failed — accompanied by audio alerts and flashing and multi-colored visual annunicators — realistically conveys the extremely stressful flight deck environment. The simulator motion and hand-held camera movements mimic the heaving "office" the flight crew was working in once the crisis began. The pace of the cutting between shots offers a visual analogue of the increasing urgency that unfolded before the pilots.

An empathetic viewer cannot help experiencing uncomfortable moments.

— Rick Darby

REPORTS

A Status Report From NTSB

U.S. National Transportation Safety Board Annual Report to Congress: 2009 Annual Report

U.S. National Transportation Safety Board (NTSB). Report no. NTSB/SPC-10/01. July 2010. 187 pp.

The NTSB issued 138 aviation safety recommendations in 2009, the report says. Of those, as of the publication date, 42 recommendations were closed in "acceptable" status, and 22 in "unacceptable" status. Responses to the others are pending.

Issues that were added to the "Most Wanted Safety Recommendations" for Aviation in February 2010 urge the U.S. Federal Aviation Administration to "improve oversight of pilot proficiency" and "reduce accidents and incidents caused by human fatigue."

For pilot proficiency, the "issue areas" include asking the FAA to evaluate prior flight check failures for pilot applicants before hiring, and "provide training and additional oversight that considers full performance histories for flight crewmembers demonstrating pilot deficiencies." The fatigue recommendations "address fatigue [risk] management systems, which constitute a complement to, but not a substitute for, regulations to prevent fatigue."

In addition to the six major aviation accident investigation launches and 178 accident investigation launches handled by regional investigators, the board participated in 10 investigations outside the United States. The latter involved accidents in Canada, China, Italy, Jamaica, Japan, the Netherlands, Rwanda, the United Arab Emirates and Uganda. It is also a party to the investigation of Air France Flight 447.

The report listed "key challenges" the board faces in accomplishing its mission.

"In order to conduct thorough accident investigations, NTSB investigators must stay abreast of the latest technology employed in the aviation industry, such as composite materials, satellite navigation systems, flight recorders and flight control software," the report says. "Even when free training is available, travel and per diem costs can be significant. The office's challenge is to identify the available resources and manpower to obtain training in these areas. Another challenge is the difficulty in scheduling training due to the number of accidents and limited number of investigators."

The board commented on "significant outcomes and achievements." They included the following:

- "In 2009, the Office of Aviation Safety held four public hearings. To put that accomplishment in perspective, over the past 10 years, the average number of public hearings was less than one per year, and never have more than two public hearings been held in a year"; and,
- "The Office of Aviation Safety [completed] the Colgan Air accident [*ASW*, 3/10, p. 20] investigation in less than one year. It will be the first time in over 15 years that a major investigation with a public hearing has been completed in less than a year."

— Rick Darby

WEB SITES

On Ice

"Recommendations for De-Icing/Anti-Icing Aeroplanes on the Ground," <files.aea.be/Downloads/AEA_Deicing_v25_revb.pdf>

The 25th edition, dated August 2010, of "Recommendations for De-Icing/Anti-Icing Aeroplanes on the Ground" has been released by the Association of European Airlines (AEA).

The document was prepared by the AEA's Deicing/Anti-icing Working Group of airline specialists from the deicing/anti-icing field, including the following member airlines: Adria Airways, Air France, Austrian Airlines, bmi, British Airways, Finnair, KLM, Lufthansa, SAS and Virgin Atlantic.

Topics covered in detail are deicing/anti-icing methods with fluids; deicing methods with infrared technology; deicing methods with forced air; a quality assurance program; local frost prevention in cold-soaked wing areas; off-gate deicing/anti-icing procedures; and standardized training.

Editorial, technical and operational changes from the previous edition of the document appear in the introduction. A noteworthy change is that the "AEA Working Group has decided not to use two different holdover time tables for metallic and composite structures. Instead, we have added an indication to all holdover time tables that the given figures are applicable to metallic and composite surfaces." Another change is: "For holdover time purposes, treat snow pellets [and snow grains] as snow."

Application and holdover times are published in seven tables by fluid type and weather condition. A list of reference documents,

samples of quality assurance checklists and reports, and a glossary of terminology complete the recommendations document.

A sub-working group consisting of the AEA member airlines bmi, British Airways, Finnair, Lufthansa and SAS addressed training issues. The group prepared standardized training guidelines in a separate document, "AEA Training Recommendations and Background Information for De-Icing/Anti-icing Aeroplanes on the Ground," 7th edition, August 2010. The 195-page guide is available at <files.aea.be/Downloads/AEA_TrainingMan_Ed7.pdf>.

Both documents may be read online or downloaded at no cost.

— Patricia Setze

Gateways to Safety Culture

Corporate Aviation Solutions, <www.casolution.com/index.html>

Corporate Aviation Solutions says on its Web site that it provides products and services to "promote and support safety management systems [SMS] for aviation." In addition to descriptions of its products and services, the organization has posted a number of free documents.

The *SMS Template* is a 26-page guide to developing and implementing an SMS that includes "the current industry standard for a corporate flight department safety program." The guide identifies the minimum elements or processes of a corporate SMS needed to report an incident, analyze each hazard to determine the risk level, mitigate the hazard, evaluate the effect of the corrective action and document the complete process. The guide also identifies processes and plans for a more complete safety program. References, sample presentations, sample forms and reporting documents, an example of a risk matrix for determining the level of risk for a particular hazard, and more are included.

There are lists, with Internet links, of International Civil Aviation Organization (ICAO) SMS training standardization course presentations and other relevant ICAO documents and manuals in English, French and Spanish.

Transport Canada has provided James Reason's checklist for scoring a company's safety culture.

A copy of Flight Safety Foundation's (FSF's) *Approach-and-landing Risk Reduction Guide* checklist is available on the Web site. The FSF Approach-and-landing Accident Reduction (ALAR) Task Force designed the guide as part of the Foundation's *ALAR Tool Kit*. The guide is presented as a questionnaire to help pilots, dispatchers and schedulers evaluate specific operations and improve awareness of associated risks.

There is a link to a Web site, <www.safetyskills.com>, where readers can access free online safety training courses on a variety of topics, such as fire safety and slips and falls.

Last, Corporate Aviation Solutions has identified a number of U.S. Occupational Safety and Health Administration (OSHA) documents of importance to corporate aviation. The "Corporate Aviation Plans and Programs for OSHA Compliance" document addresses OSHA safety standards in the workplace. There are Internet links to free OSHA information, presentations and other resources for workplace safety and OSHA compliance on many topics, from equipment use to record keeping.

Two additional links are to free training programs and training materials. One is provided by OSHA's OSHAcademy; the other is provided by Oklahoma State University's Environmental Health and Safety Online Training.

— Patricia Setze