Swissair 111

BY 'BOOMER' BOMBARDI

Sensors could have made a difference.

More than 10 years have passed since Swissair Flight 111, a McDonnell Douglas MD-11, crashed into Peggy's Cove, Nova Scotia, Canada, on Sept. 2, 1998, with the loss of all 239 aboard. The aircraft crashed due to loss of control caused by a hidden on-board fire. The flight crew had a delayed indication of the fire, and had no means of reaching or extinguishing it. A divert to Halifax was attempted but was unsuccessful because of the delay caused by the lack of timely information about the intensity of the fire.

It is an undisputed fact that the crew of Swissair 111 did not know the seriousness of the on-board fire. The flight crew of Swissair 111 did nothing wrong. Given the same circumstances and lack of vital information, my actions would have been the same as theirs. However, I maintain that if the Swissair pilots had better knowledge of the nature and intensity of the fire, and had initiated an earlier and more aggressive divert to Halifax, there would have been time to safely land the aircraft.

While this possibility has been discussed, this theory was never tested, until now. To attempt to document alternate scenarios, and put this speculation to rest, I was able to obtain the use of an MD-11 simulator to evaluate several diversion scenarios.

Some may ask, "Why use Swissair 111 as an example? There have been other smoke/fire/fumes (SFF) accidents and fatalities." My point is that an aircrew needs to know the nature and seriousness of any emergency in order to take the proper actions to deal with it. Even though corrective measures were taken in other SFF accidents, the issue of being able to identify, extinguish and monitor a hidden fire has not been resolved. Swissair 111 is the most recent example and, hence, is used in this article.

The known accident sequence began at 0110:38 local time, when the first officer mentioned an unusual odor in the cockpit. At this point the aircraft was approximately 95 nm (176 km) from Halifax. About 21 minutes later, at 0131:18, the aircraft struck the water.

It cannot be assumed that all 21 minutes would have been available for flying the airplane. The Canadian accident investigation report states that there was no response to an air traffic control radio message to Flight 111 at 0125:16, and the voice and data recorders stopped working at 0125:41. Conditions inside the cockpit and the status of the aircraft control systems in the final minutes of the flight are not known, but the aircraft may or may not have been flyable.

While the time from the first scent of the fire to the crash was 21 minutes, unknown is how much additional time the crew would have had to fly their diversion if the aircraft had been equipped with better fire sensors and warning systems, and the crew had earlier indications of the problem.

Nearly five minutes after the first scent, at 0115:10, the crew selected Halifax as the diversion target. Halifax was a Swissair-designated intermediate alternate airport, approved for MD-11 operations. At this point the aircraft was 60 nm (111 km) from Halifax. From 0115:10, Swissair 111 had approximately 16 minutes before loss of control and impact with the water.

We flew a number of simulator profiles, and for each test case, the aircraft gross weight was 501,800 lb (227,616 kg) with 112,200 lb (50,894 kg) of fuel aboard, altitude was Flight Level (FL) 330, heading was 058 degrees, and airspeed was Mach 0.82. In each case a maximum effort diversion was initiated to land as soon as possible.

Test Case No. 1

The aircraft was 95 nm from Halifax, no winds. This was the position of the aircraft when the first indication of a problem surfaced. The aircraft's configuration for the diversion was engines at idle, speed brakes out, airspeed at the maximum allowed and fuel was being dumped.

The result: The aircraft landed at normal speed on Runway 05 at Halifax approximately 16 minutes later.

Test Case No. 2

In the second simulation we were closer to the field, using the actual accident scenario in which the crew asks at 0115:36 for a diversion to Halifax

when they were 60 nm away. We flew the simulator in a more aggressive descent — engines at idle, speed brakes out, gear down, fuel dumping, speeds at times exceeding maximum limits.

The result: The aircraft landed at normal speed 10 minutes, 15 seconds later. The accident aircraft struck the water approximately 15 minutes and 42 seconds after the start of the diversion at 0115:36.

Test Case No. 3

In the third simulation, starting from the same location as in Case No. 2, we added tail winds. We used a tail wind of 60 kt from FL 330 to FL 200, 30 kt from FL 200 to 6,000 ft, 10 kt from there to touchdown.

The result: The aircraft landed approximately 9 minutes, 47 seconds later, speed 169 kt. Once again, from 0115:36, Swisssair 111 struck the water approximately 15 minutes and 42 seconds later.

Test Cases No. 4 and No. 5

We flew two additional simulations with less aggressive descents, the first included delayed landing gear extension, no fuel dumping and adhering to maximum speed limits, and the second further delaying landing gear extension until the last minute to help slow down. The result of both of these scenarios is that landing was 9 minutes, 19 seconds after the beginning of the diversion.

Conclusion

These simulator data indicate that if the crew had known the seriousness of the fire and had started an aggressive diversion to Halifax, they should have been able to safely land the aircraft. The diversion could have been initiated either from 95 nm or 60 nm from Halifax.

With the results of the simulator data in hand, I met with representatives of the U.S. Federal Aviation Administrations (FAA) Fire Safety Team, from the William J. Hughes Technical Center. We discussed sensor technology as it would apply to identifying/monitoring SFF events in hidden areas of aircraft. Sensor technology has rapidly advanced since the crash of Swissair 111. The consensus of the representatives of the Fire Safety Team was that there are a variety of sensors that could be used to monitor inaccessible areas of the aircraft. However, research and testing would be needed to optimize the type and location of the sensors to ensure a timely response.

Admittedly, the unknown effect of the fire on the crew and on critical aircraft systems makes it impossible to say for certain whether sensors alone could have enabled the crew to land the aircraft. It is clear, however, that sensors and an effective extinguishing system or a means of accessing and extinguishing the fire surely would have enabled the crew to land safely.

There were several comments/recommendations pertaining to identifying, monitoring and extinguishing hidden fires in the Transportation Safety Board of Canada (TSB) report on Swissair 111.[1] The FAA was urged to conduct a comprehensive research project to examine the feasibility of systems to identify, monitor and extinguish inaccessible aircraft fires.

Data from the simulator testing clearly indicate that SFF sensors could have made the difference with Swissair 111. The time has come to be proactive instead of reactive when it comes to inaccessible aircraft fires. I can think of 239 reasons why the FAA should move forward with this research. I can't think of one reason not to.

Capt. H.G. "Boomer" Bombardi first became involved with the issue of smoke/fire/fumes (SFF) in aircraft while flying C-141 aircraft for the U.S. Air Force. Flying for a major U.S. airline, Bombardi worked on several SFF projects, eventually joining Air Line Pilots Association, International's Air Safety Committee's In-Flight Fire Project.

The FAA technical center is evaluating wireless smoke detectors (top) and flow-through air analyzers (bottom) in the cargo compartments of a Boeing 727 freighter.

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Note

1. TSB Canada Report no. A98H0003.