

Air France Crash Probe Raises Pilot Training Questions

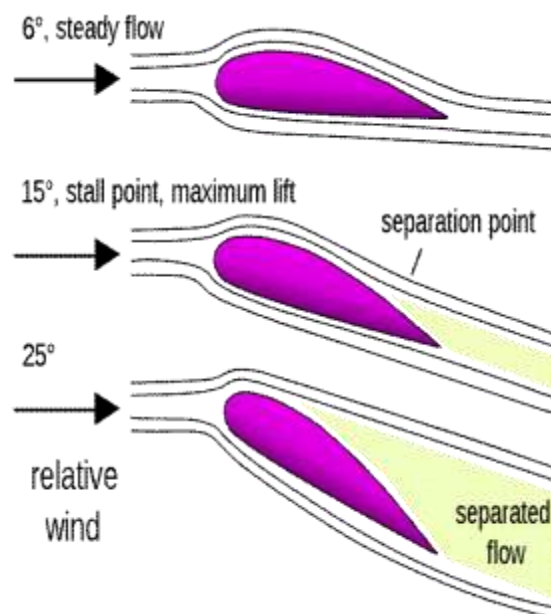
Air France Flight 447 stalled high over the Atlantic Ocean and plunged into the sea even as the pilots repeatedly tried to pull the nose up - a reaction opposite to what was needed to recover from the stall. The preliminary findings from French authorities has industry insiders questioning the pilot training needed to handle extreme confusion and the growing role of automation in the cockpit.

The Airbus A330-200 was enroute to Paris from Rio de Janeiro on June 1, 2009 when it experienced a high-altitude stall after it is thought ice blocked the plane's air speed sensor and flight instruments were therefore unreliable. French investigators have not released their final report into the crash that killed all 228 people aboard, but an initial report offers telling details about the flight's final minutes.

Most tellingly, a pilot stated, "so we've lost the speeds" approximately two hours and 10 minutes into the flight. According to authorities, the pilot then stated, "alternate law... ." Investigators have interpreted this to mean flight instruments were no longer displaying the correct airspeed, although that does not necessarily mean the plane was actually losing airspeed. "Alternate law" refers to the fly-by-wire system controlling the flight control surfaces.

The flight data recorders stopped approximately four minutes later, presumably when the airplane hit the water. The plane fell from an altitude of approximately 38,000 feet and its last recorded data points were a descent at almost 10,912 feet per minute (a typical descent is 1,000 fpm or less), a ground speed of 107 knots and a nose-up attitude of 16.2 degrees.

It is widely believed the airplane entered an aerodynamic stall, although the pilots may not have realized because of conflicting information they were seeing in the cockpit. An aerodynamic stall occurs when the smooth airflow passing over the wings separates from the wing surface, resulting in a loss of lift. It has nothing to do with the engines, which in the case of Flight 447 were operating until the plane hit the water.



Seconds before the pilot said the aircraft had "lost the speeds," the autopilot and auto-thrust systems disengaged and the pilot took control of the plane. The captain, who had been taking his regularly scheduled rest break, was back in the cockpit within 90 seconds. By that time, the pilot had made a "nose-up input" - meaning he pulled back on the control stick - and "the stall warning sounded twice in a row," according to investigators.

The recorded airspeed fell from about 275 knots to 60 knots, according to information released by French authorities. The airplane was in a stalled condition without the lift needed to maintain altitude.

In the first minute of the fall, the pilots tried repeatedly to regain control of the plane. The fly-by-wire system was operating in "alternate law" mode, allowing the pilots to exceed certain flight parameters that govern the flight controls. This includes exceeding the angle of attack protections meant to reduce the chance of entering a stall.

Once the captain was back in the cockpit, it became apparent the airspeed indicated by the instrumentation was invalid. That suggests the pitot tube, a device outside the aircraft that senses airflow and therefore airspeed, had frozen over. Pitot tubes are heated to prevent that, as a frozen tube would provide inaccurate airspeed data to the pilot and, more importantly, the fly-by-wire computer.

At this point Flight 447 was still at 35,000 feet, but the angle of attack exceeded 40 degrees (well past the normal stall angle) and the airplane was beginning its rapid fall. Over the next few minutes the pilots used various amounts of engine power and control inputs to regain control.

But according to the initial report from the Bureau d'Enquetes et d'Analyses[.pdf], the crew did not push forward on the control stick long enough to point the nose down, reduce the angle of attack on the wing and recover from the stall. This is typically how pilots are taught to recover from a stall. For an unknown reason, the Air France pilots did the opposite, holding the control stick back during most of the descent.

There are, however, some instances where pushing the controls forward is not advised. Unless more information is known about the cause of the loss of control, it is difficult to say what else was happening in the cockpit and whether the pilots were panicked or confused by the flurry of information and alarms they were receiving.

"The scene inside the cockpit certainly would have been chaotic with darkness adding to the turmoil of heavy rain and turbulence" said former airline pilot Robert Mark. He adds they would have also been facing "an array of warning lights and chimes all threatening certain death at the same moment."

Such a response is not unheard of. The pilot of a Colgan Air crash that killed 50 people on February 12, 2009, near Buffalo, New York improperly reacted to a warning that the plane had slowed too much and pulled the nose upward. And a West Caribbean Airways flight crashed in Venezuela on August 16, 2005, following a high-altitude stall. Investigators blamed the pilots for failing to recognize the plane had stalled.

That has some calling for better pilot training and more thorough instruction for dealing with unusual circumstances.

Aviation Week's Fred George points out little training time, if any, is spent covering high altitude upset recovery. And even the basic understanding of angle of attack is not always thoroughly understood.