

AF447 stalled but crew maintained nose-up attitude

French investigators have disclosed that the crew of Air France flight AF447 maintained nose-up inputs to the aircraft even after the Airbus A330 entered a stall.

The inquiry has also revealed that the pilots set engine thrust variously to go-around power and idle as they battled to rescue the jet.

In an update to the loss of the A330 over the South Atlantic two years ago the Bureau d'Enquetes et d'Analyses has detailed the last few minutes of the flight. BEA said the aircraft climbed from its cruise altitude of 35,000ft towards 38,000ft and stalled, but added that the flying pilot "maintained nose-up inputs" to the controls.

BEA confirms that the captain had left the cockpit to rest, about eight minutes before the emergency on 1 June 2009, having discussed with the relief crew possible turbulence ahead of the aircraft.

The pilots altered course slightly, about 12° to the left, and as turbulence increased they opted to reduce speed to Mach 0.8.

About 2min later the aircraft's autopilot and autothrust disengaged, and remained so for the rest of the flight. This would have put the jet into 'alternate' law, meaning it lost its angle-of-attack protection.

The aircraft began to roll to the right, and as the pilot made a nose-up left input, the A330's stall warning sounded twice - an indication that the aircraft had exceeded a critical angle-of-attack threshold.

The primary flight display on the captain's side showed a "sharp fall" in speed from 275kt to 60kt, and the aircraft's angle of attack "increased progressively" beyond 10°.

While the jet had initially been cruising at 35,000ft, investigators stated that the aircraft climbed, with a vertical speed of 7,000ft/min, heading towards 38,000ft.

The pilot made nose-down inputs as well as inputs for left and right roll. The vertical speed fell back to 700ft/min, the displayed speed "increased sharply" to 215kt, and the angle of attack reduced to 4°.

In its update the BEA said the non-flying pilot "tried several times to call the captain back".

There was another stall warning and the BEA said the stall warning sounded again. The thrust levers were positioned for take-off/go-around power but the flying pilot "maintained nose-up inputs".

Angle of attack continued to increase, it added, and the trimmable horizontal stabiliser increased from a 3° nose-up position to 13° nose-up - where it stayed for the rest of the flight.

The aircraft reached 38,000ft - its maximum altitude - with its angle of attack having increased to 16°.

AF447's captain returned to the cockpit - just 90s after the autopilot had disengaged - by which time the aircraft had started its fatal descent.

As it passed through 35,000ft the angle of attack increased to more than 40° and the A330 was descending at 10,000ft/min. Its pitch did not exceed 15°, its engine power was close to 100% of N1, and the jet oscillated with rolls of up to 40°.

"The [flying pilot] made an input on the sidestick to the left and nose-up stops, which lasted about 30s," said the BEA.

Just 20s after the captain returned to the cockpit, said the BEA, the thrust levers were set to the 'idle' position, with the engines delivering 55% of N1.

Measured angle of attack values, the BEA pointed out, are only considered valid when the measured speed is above 60kt. It said that the angle of attack, when valid, always remained above 35°.

AF447's had turned almost a three-quarter circle to the right during the emergency, and - having descended for 3min 30s - it struck the ocean surface with a ground speed of just 107kt, a nose-up pitch attitude of 16.2°, with a heading of 270°.

BEA stated that the aircraft stalled but that the inputs from the flying pilot were "mainly nose-up". It added that the engines "were operating and always responded to crew commands".

Source: Air Transport Intelligence news