



As the plane sped down the runway at Puerto Plata in the Dominican Republic, the captain noticed a problem. The Boeing 757 was accelerating but his airspeed indicator was doing nothing. "Is yours working?" he asked the co-pilot as the plane passed the point of no return – the captain could not brake and expect to have enough runway to stop. The only option is to keep accelerating and get into the air.

"Yes sir", the co-pilot replied a few seconds before the 7575 parted company with the runway. As the aircraft climbed, the captain noticed that his airspeed indicator suddenly started working again. Maybe it was just an intermittent fault, never to be seen again. As the plane climbed, the entire auto-pilot was activated – a system that used the suspect airspeed indicator as one of its sources of data.

Twenty seconds later, as the plane reached an altitude of 1km, warning signs flashed up in the cockpit. And the captain realised that his airspeed indicator was acting strangely. It was not the only one. "There is something crazy here. Two hundred [knots] only is mine and decreasing, sir," the co-pilot announced.

"Both of them are wrong," the captain exclaimed. "What can we do?"

As alarms went off in the cockpit, the captain's airspeed indicator showed the plane had reached a speed of 350 knots. The autopilot reacted, pointing the 757 up at an angle of close to 20 degrees and reducing engine thrust.

But that simply made the pilot's control stick shake from side-to-side, making a loud rattling noise. This was the warning sign of an imminent stall, the symptom of flying too slow and at too high an angle.

The stall warning was not in error. Within seconds, BirgenAir flight 301 was falling, its autopilot fighting against the human pilots' attempts to regain control. At a point where the aircraft needed full power to climb, the autopilot inexplicably cut power.

Automated warnings to pull up were in vain as the autopilot was disconnected too late. At an angle of 80 degrees, the 757 powered into the ocean 20km northeast of Puerto Plata, disintegrating on impact.

What brought down flight 301 on 6 February 1996? A damaged sensor was the root cause.

Investigators thought the pitot tube, which measures differences in air pressure, had become blocked. The aircraft had stood for days while it was being repaired, providing an opportunity for local insects to possibly build a nest in the tube. However, the tubes were never recovered from the ocean and this remains just a plausible hypothesis.

The effect of a blocked pitot tube or failed sensor on the autopilot was not anticipated by the system's designers, a situation compounded by warnings from other systems that the pilots were not trained to

understand. Another computer on board was able to determine that the airspeed indicators were not working properly but the warnings flashed up seemed to have little to do with the problem.

The aircraft operations manual, at the time, did not say that the warnings "MACH/SPD TRIM" and "RUDDER RATIO" appeared together when the plane's other sensors found a discrepancy of more than 10 knots from each other. Not realising their true meaning, the cockpit crew pondered over the meaning of these cryptic messages as the 757 headed towards its final destination.

Ultimately, the investigation into the accident blamed the pilot for the crash. Although the crew had been misled by the system, the investigators considered that the pilot made decisions that reduced the chance of the aircraft recovering from what was, initially, a minor problem. The co-pilot's speed indicator seemed to be working and the pilot's was malfunctioning, but the pilot still switched the autopilot on that was controlled by his own airspeed indicator. The flight crew realised too late what had happened.

However, there were systemic issues in the design of the autopilot software and the user interfaces employed by the control systems in the plane that exacerbated the flight crew's confusion. In fact, researchers have come across many situations where poor user-interface design has caused problems for pilots, although luckily many have realised the problem before it became fatal.