



# STARTLE Effect

Beginning on p. 14, Mark Lacagnina delves into the causes of the crash of Air France Flight 447 (AF447) in June 2009 as laid out by the final report of France's Bureau d'Enquêtes et d'Analyses (BEA). Next month, we will take a closer look at some of the BEA's recommendations.

To anyone who has followed the investigation and read the interim reports, the final report did not contain any real surprises, but it did, among other things, shine a spotlight on training needs, situational awareness, crew resource management and the "startle effect," which, coincidentally, appears in two stories in this month's issue.

The first and most significant story involves AF447, the Rio de Janeiro to Paris nonstop flight that crashed into the Atlantic Ocean, killing all 228 people on board. As Mark details in his story on the BEA's final report, ice crystals blocked the aircraft's pitot probes, resulting in the production of unreliable airspeed information. The Airbus A330-200's electronic flight control system, reacting as it was designed to do, rejected the air data, disengaged the autopilot and autothrottle and reverted to a lower control law.

When the autopilot disengaged, the pilot flying (PF) "made rapid and

high-amplitude roll control inputs," according to the English translation of the BEA's final report on the accident. "He also made a nose-up input that increased the aeroplane's pitch attitude up to 11 degrees in 10 seconds," the report said.

Investigators surmised that "the excessive nature of the PF's inputs can be explained by the startle effect and the emotional shock at the autopilot disconnection." Of course, the PF's initial, startled reaction was not the sole problem, but it did play a "major role in the destabilization of the flight path," the BEA report said.

Two years later, on an A340 flight from Caracas to Paris, a strong wind gust caused airspeed to increase momentarily to 0.87 Mach (p. 58). The pilots said that they were surprised when the master warning light illuminated and the aural overspeed warning sounded. The pilot not flying (PNF) manually disengaged the autopilot and "a pitch-up input on the PNF's sidestick going as far as three-quarters to the stop was recorded for six seconds," the BEA's report said. "This input was accompanied by an input to bank to the right then left. The PNF stated that he did not remember these inputs."

The report said that the control inputs likely were reflexive actions that resulted from the "startle effect" produced by the

overspeed warning. "Sometimes this effect sparks primal instinctive reaction, instant and inadequate motor responses," the report said. "These basic reflexes may prove to be incorrect and difficult to correct under time pressure and may affect the pilot's decision-making ability."

In recommending that the European Aviation Safety Agency review the requirements for initial, recurrent and type rating training for pilots "in order to develop and maintain a capacity to manage crew resources when faced with the surprise generated by an unexpected situation," the BEA authors of the AF447 final report said: "Initial and recurrent training as delivered today do not promote and test the capacity to react to the unexpected. Indeed, the exercises are repetitive and well known to crews, and do not enable skills in resource management to be tested outside of this context."

Stay tuned for more on the BEA's recommendations next month.

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