Aviators IG Interesting News #11 – Vanished Into The Atlantic Ocean

#AviatorsIGFunFact: Bombardier C Series currently known as Airbus A220

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1st of June 2009, a scheduled international commercial plane, with 216 passengers and 12 crew members including 3 pilots onboard the aircraft, vanished across the Atlantic Ocean. The aircraft entered a communication dead-zone in the Atlantic Ocean with subsequent radio contact was left unanswered and was nowhere to be found until 3rd of June 2009.

The aircraft involved in this accident was an Air France Airbus A330-200, with the flight number of 447, which departed from Rio de Janeiro International Airport, Brazil to Paris-Charles de Gaulle (Paris-CDG) Airport, France. The estimated flight time leaving South America, crossing the Atlantic Ocean and landing at France takes over 11 hours, covering 9,162 km.

Figure 1: The aircraft involved in the accident

With the flight time exceeded 10 hours, a common practice by Air France was to schedule a total of 3 pilots with 1 captain (Captain Dubois) and 2 first officer (First Officer Bonin and First Officer Robert) flying the journey. This practice was to let the 3 pilots doing a shift work and have an adequate rest time so that it can minimize human error while commanding the aircraft towards its destination.

The aircraft then took-off at 22:29 (UTC) on 31st May 2009, leaving Brazil Air Traffic Area Control Centre around 01:49 (UTC), 1st of June 2009 and entered a communication dead-zone in the Atlantic Ocean. The last communication contact between the pilots and the Air Traffic Controller was that the aircraft had passed a navigation waypoint INTOL at 01:35 (UTC).and was cruising at 35,000 feet (FL 350).

At 02:01 (UTC), the captain briefed the 2nd first officer (First Officer Robert) and left the cockpit to rest. The aircraft was then being commanded by two first officer (First Officer Bonin and First Officer Robert) for the 2nd leg of the flight. Around 02:06 (UTC), the aircraft went through severe weather conditions with thunderstorms, turbulence and encountered icing condition.

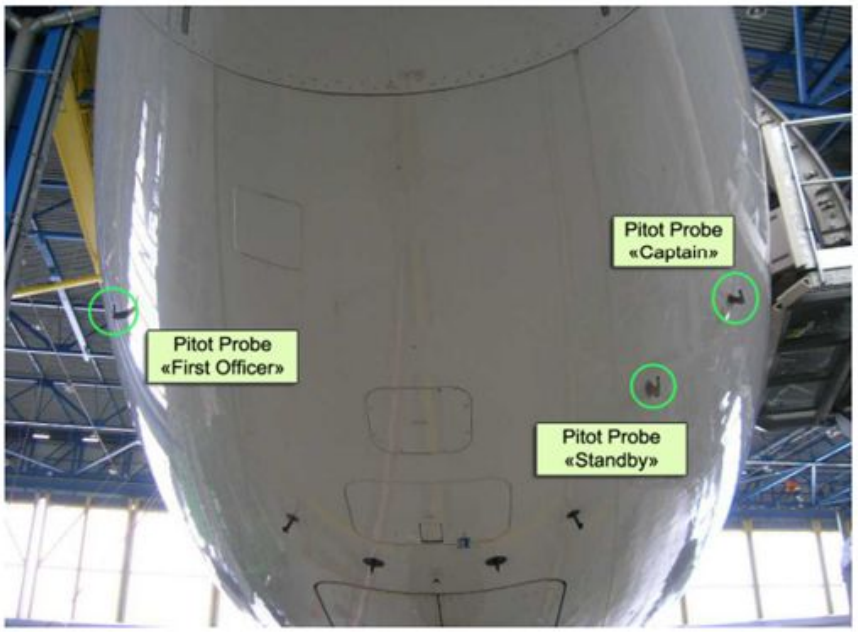

Figure 2: Air France Flight 447 – Airbus A330-200 Pitot Probe

The pilots did not know that the aircraft was experiencing icing condition, thus did not turn on the anti-icing system. The aircraft pitot tube which measures the total pressure (Static pressure and Dynamic pressure) started to accumulate ice crystals and eventually blocks the pitot tube. As the indicated airspeed is calculated by Dynamic pressure = Total pressure – Static pressure, the blocked pitot tubes will no longer providing accurate indicated airspeed information.

Due to inaccurate indicated airspeed information providing to the aircraft system, the master warning sound and automatically the autopilot disconnects. The two first officer takes over the control, with First Officer Bonin as Pilot Flying (PF) while First Officer Robert as Pilot Monitoring (PM). Suddenly, stall warning alarm was sounded, First Officer Bonin pulls the sidestick backwards and the aircraft pitch upwards.

First Officer Robert and First Officer Bonin could not figure out the reasons why the aircraft stall warning alarm was being sounded again. First Officer Robert cross-check the aircraft instruments and felt puzzled about the situation as he saw the attitude indicator was pitching up (climbing rapidly) and the indicated airspeed was decreasing rapidly.

First Officer Bonin also knew his aircraft indicated airspeed was decreasing rapidly and, in an attempt, to recover the loss of speed, he pushes the engine throttle forward to 100% thrust. The aircraft climbs to 38,000 feet but the aircraft speed was still decreasing rapidly. As both First Officer could not find a solution for their situation, First Officer Robert summoned Captain Dubois back to the cockpit.

First Officer Robert tries to recover the situation by pushing the sidestick forward, bringing back the aircraft pitch to neutral (0 degrees). However, First Officer Bonin still holds on to his sidestick, pulling back the sidestick backwards, continue to put his aircraft pitch attitude up to 40 degrees. Therefore, these two manoeuvres on the sidesticks cancel each other out. 90 seconds after the autopilot disconnects, Captain Dubois return to the cockpit.

Figure 3: Air France Flight 447 route from Brazil to France

Captain Dubois realised the aircraft stall warning alarm sounded and questioned his two First Officer about the situation. First Officer Robert response to his Captain that “We've lost all control of the aeroplane, we don’t understand anything, we’ve tried everything”, while First Officer Bonin replied: "But I’ve been at maximum nose-up for a while!"

At that instant, Captain Dubois finally understand the situation as First Officer Bonin should push the sidestick forward, giving sufficient air flow over the wings, thus will result in gaining airspeed and the aircraft will automatically recover from the stall. But instead of doing so, First Officer Bonin keeps pulling back the sidestick backwards causing the aircraft pitch upwards, resulting an aerodynamic stall.

It was all too late, the aircraft had remained stalled for more than 3 minutes, descending at a rate of 10,912 feet per minute, with the indicated airspeed decreasing from 223 knots to 107 knots and the pitch attitude at 35 degrees. The Ground Proximity Warning System (GPWS) then sounded the alarm, just as Captain Dubois shouted to First Officer Bonin: "No, No, No, don't climb!".

Air France Flight 447 crashes into the Atlantic Ocean, disintegrated at the point of impact, all 216 passengers and 12 crew members including 3 pilots onboard the aircraft died instantly. The aircraft was due to pass from communication dead-zone into Senegalese airspace at approximately 02:20 (UTC). The flight had failed to contact Senegalese air traffic control centre and subsequent attempts from Air Traffic Controller failed to reach Air France Flight 447.

Search and Rescue team from Brazil, France and Spain were deployed to locate the aircraft wreckage. Using the last known position as a reference, the Search and Rescue team finally spotted the first wreckage 3 days after the crash. 50 passengers' bodies were identified and up to 640 pieces of debris were found.

Figure 4: Air France Flight 447 vertical stabilizer recovered from the Atlantic Ocean

However, further search effort in 2009 and 2010 was deemed unsuccessful as the Search and Rescue team were unable to locate the crash area, cockpit voice recorder (CVR) and flight data recorder (FDR). A breakthrough for the team in May 2011, when they found both recorders at a depth of 3,980 metres in the Atlantic Ocean and a further of 104 passengers' bodies were recovered from the wreckage.

Bureau of Enquiry and Analysis for Civil Aviation Safety started the investigation as all the data from the CVR and FDR were downloaded. The BEA release its final report on the 5th of July 2012 and stated 6 major reasons that contributed to the crash of Air France Flight 447.

Figure 5: Air France Flight 447 FDR (Left) and CVR (Right)

The reasons were stated as follows:

1. Temporary inconsistency between the measured speeds, likely as a result of the obstruction of the pitot tubes by ice crystals, causing autopilot disconnection and reconfiguration to alternate law.
2. The crew made inappropriate control inputs that destabilized the flight path.
3. The crew failed to follow appropriate procedure for loss of displayed airspeed information.
4. The crew were late in identifying and correcting the deviation from the flight path.
5. The crew lacked understanding of the approach to stall.
6. The crew failed to recognize that the aircraft had stalled and consequently did not make inputs that would have made it possible to recover from the stall.

Photo Sources:

Figure 1 [Pawel Kierzkowski] (2007, March 28). Air France A330-203 F-GZCP lands at Paris-Charles de Gaulle Airport. – The aircraft was destroyed in Air France Flight 447. Retrieved August 09, 2018 from https://commons.wikimedia.org/wiki/File:PKIERZKOWSKI_070328_FGZCP_CDG.jpg

Figure 2 [Bureau of Enquiry and Analysis for Civil Aviation Safety] (2012, July 05). Air France Flight 447 Airbus A330-200 Pitot Probes. Retrieved August 09, 2018 from https://www.bea.aero/docspa/2009/f-cp090601.en/pdf/f-cp090601.en.pdf

Figure 3 [Mysid] (2018, April 23). Flight path of Air France Flight 447 on 31 May/1 June. Retrieved August 09, 2018 from https://commons.wikimedia.org/wiki/File:AF_447_path-notext.svg

Figure 4 [Roberto Maltchik] (2009, June 14). The frigate of Constituição arrives at the Port of Recife, transporting wreckage of the Air France Airbus A330 that was involved in an accident on 31 May 2009. Retrieved August 09, 2018 from https://commons.wikimedia.org/wiki/File:Voo_Air_France_447-2006-06-14.jpg

Figure 5[Bureau of Enquiry and Analysis for Civil Aviation Safety] (2012, July 05). Air France Flight 447 Flight Data Recorder and Cockpit Voice Recorder. Retrieved August 09, 2018 from https://www.bea.aero/docspa/2009/f-cp090601.en/pdf/f-cp090601.en.pdf

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