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AEE 342: Aerodynamics

Homework 3 Problem 3: Essay

As time has progressed, humanities innovative and technological spirit has progressed with it. This progression, no matter how revolutionary, always comes with consequence. One of the best examples of modern day innovation is airplanes. Taking it a step further, one of the most interesting examples of consequence comes from Air France flight 447 that took off Rio de Janeiro, Brazil on June 1st 2009. This Air France flight that was headed back to Paris, France crashed in the Atlantic Ocean sometime around 2:14 coordinated universal time. The fact of how it crashed is very interesting and has led to flight mandates that are implemented today.

Approximately 1 hour and 36 minutes into the flight, pilot Marc Dubois and co-pilots Pierre-Cedric Bonin and David Robert had reached the outer portion of a tropical storm system they had not decided to route around. The captain, Dubois, gives the less experienced co-pilot, Bonin, the left-hand seat (main seat) as he went to rest. This is when complications began. The tropical storm had spawned heavy thunderstorm clouds within their path. This storm had caused ice to form on the plane, and more importantly the Pitot tube designed to measure the flow speed of the air. As the ice built up, obscuring the Pitot tubes accuracy, disguised readings of pressure difference and airspeed were distributed to the pilots. This caused instruments in the cockpit to produce improper readings, which resulted in the planes computer disabling the auto-pilot in favor of manual controls. Turning the plane to the left, decreasing its speed from Mach .82 to the turbulence penetration speed of Mach .82, the plane began to roll due to turbulence. Co-pilot Bonin, who was at the controls at the time, adjusted the stick repeatedly in order to steady the plane, eventually increasing the planes angle of attack causing the plane to ascend at a dangerous rate despite hearing the blaring “stall” warning from the systems computer. The co-pilot Robert believed that the plane was flying level, or even descending, not realizing Bonins mistake of pulling up on the controls. The pilots were also flying under “alternate law”, a command which imposes more human control (more room for Bonin to make his mistakes). Once their ascension brought them to their maximum altitude the Pitot tube began to function normally, leaving all error to the pilots from that point on. With the nose at an angle of attack of 18 degrees, engines at full power, Air France flight 447 began to drop out of the sky due to stall. Fumbling to regain control of the plane, the pilots attempted to adjust the nose to no avail as they were descending too rapidly. The plane then crashed into the Atlantic Ocean at 10 degrees of pitch.

In the resulting search of the crash, it took a full 2 years for the planes black box to be found on the sea bed despite reaching the conclusion that it had crashed only 6 hours after contact was lost. Once recovered and analyzed it was discovered how the planes Pitot tubes had iced, resulting in the manual engagement of the plane controls to an inexperienced co-pilot who proceeded to stall it before his colleagues could figure out what was wrong. A Brazilian Air Force aircraft from the archipelago, US Navy P-3 Orion aircraft, and French recon aircraft all participated in the search to find Air France 447. The ensuing investigation was labeled criminal, a standard procedure involving the loss of life. A French judge eventually ruled the case as preliminary manslaughter against Air France and Airbus. In terms of a technical investigation, the French government was tasked with the goal of enhancing the safety of future flights. This meant implementing mandates for advising aircraft instruments and their warnings (the stall warning). It also included paying closer attention to the weather and other airborne vehicles in the vicinity, explicitly defining who is in charge when co-pilots are in the cockpit without the captain, and understanding normal and alternate law when in flight and how the airplane may respond to given situations such as a frozen Pitot tube. Finally the French government stressed practicing hand-flying the airplane during all stages of flight. It does however; bring up the question of the reliability of instruments, something that requires undivided attention in such a field as avionics.

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