National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: June 12, 2008

In reply refer to: A-08-46 Urgent and -47 Urgent

The Honorable Robert A. Sturgell
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

In this letter, the National Transportation Safety Board recommends that the Federal Aviation Administration (FAA) take action to address safety issues concerning a failure that results in uncontrollable engine thrust in Eclipse 500 airplanes and the lack of emergency procedures developed for that failure. Although the investigation is continuing, the information gathered thus far has raised serious concerns that warrant immediate action by the FAA.

On June 5, 2008, an Eclipse 500 airplane, N612KB, experienced a failure that resulted in an uncontrollable increase in the thrust from the two Pratt & Whitney Canada (PWC) PW610F turbofan engines to maximum power just as the airplane was landing at Chicago Midway International Airport (MDW), Chicago, Illinois.[1] After referencing the emergency procedures in the airplane's quick reference handbook (QRH), the pilots shut down one of the engines. Following the shutdown, the other engine rolled back to idle power and continued to be unresponsive to the throttle. The pilots declared an emergency and were able to land the airplane on the runway, despite one engine shutdown and the other that would not advance past idle. Visual meteorological conditions prevailed at the time of the incident. The airplane was operating on an instrument flight rules flight plan under the provisions of 14 *Code of Federal Regulations* Part 91 from Cleveland Hopkins International Airport, Cleveland, Ohio, to MDW. The two pilots and two passengers on board were not injured. The airplane was not damaged, except for two main landing gear tires that became flat as a result of the incident.

The flying pilot of the incident airplane reported that, as the airplane was crossing the runway threshold for the initial landing attempt, it encountered a 10- to 15-knot windshear and developed a high sink rate, which the pilot arrested by applying power. The flying pilot further stated that as the airplane landed at about 83 knots, he retarded the throttles to idle. About 3 seconds later, he lightly touched the brakes to slow the airplane down, but the airplane was accelerating rapidly through 100 knots. The flying pilot confirmed that the throttles were at idle, but he noted that the engines were at maximum power and that the airplane was continuing to

[1] Preliminary information about this incident, CHI08IA152, can be found on the Safety Board's website at <http://www.ntsb.gov>.

accelerate. Because the airplane was rapidly approaching the end of the runway and could not be slowed, the flying pilot decided to abort the landing.

As the airplane was climbing out from the balked landing, the pilots stated that they retracted the flaps to the takeoff position and retracted the landing gear. However, because the airspeed continued to increase through 190 knots, the flying pilot lowered the landing gear again to try to increase drag and slow the airplane. The flying pilot stated that even with the landing gear down and the flaps in the takeoff position, the airplane continued to accelerate. To remain below 200 knots, which is the maximum operating speed for the flaps and landing gear, the pilots had to maintain a shallow climb.

Both pilots noted that the Crew Alerting System (CAS) display showed "L ENG CONTROL FAIL" and "R ENG CONTROL FAIL" as the airplane climbed out following the balked landing. The pilots declared an emergency, and the MDW control tower cleared them to land on any runway. The pilots referenced the QRH Emergency Procedures section for engine control failure, which contained instructions for left engine control failures or right engine control failures, but not for both. The QRH advised that when one engine control failed, the engine should be shut down. The flying pilot stated that they shut down the right engine and began to maneuver the airplane toward the runway. He said that, shortly afterward, as they were still turning toward the runway, the stall warning activated and he noted that the left engine was now at idle and would not respond to the throttle. The flying pilot lowered the nose slightly to prevent the airplane from stalling and continued toward the runway. When he was sure that he would make the runway, the flying pilot lowered the flaps to the landing position and landed. Both pilots stated that the airplane decelerated very rapidly because the main landing gear tires were flat.[2] When the airplane stopped, the pilots and passengers exited the airplane.

The Eclipse 500 airplane does not have any mechanical linkage or cables between the throttle levers and the engines. Instead, its throttle levers are connected to potentiometers that convert the movement of the levers to an electrical signal that is transmitted to the engines' full authority digital electronic controls (FADEC) by electrical wiring. As a pilot moves the throttle levers, the potentiometers create an electrical signal that is transmitted to each engine's FADEC, which then varies the fuel flow in response to the pilot's command. Each FADEC continuously checks itself and the opposite engine's FADEC to ensure all of the components are working correctly. To ensure safe operation should a component fail, all of the electrical controls and potentiometers in the engine, throttle, and FADEC are equipped with two separate channels: one is in control, and the other stands by to become active if a component in the active channel fails. According to Eclipse and PWC, the FADEC software is programmed so that if a component in a single channel fails, the FADEC will switch to the other channel. If both channels fail, the engine control failure message for that engine will appear on the CAS display and the FADEC software will continue to control its engine by reading data from the opposite engine. If both channels fail on both engines' throttle levers, the FADEC is programmed to ignore the throttle levers' positions and maintain the requested thrust level of the last valid throttle lever position.

[2] It was not possible to determine if the tires went flat during the balked landing or during the subsequent emergency landing.

Analysis of the data from the nonvolatile memory (NVM) in the airplane's diagnostic storage unit (DSU)[3] indicated a dual-channel failure in both throttle levers occurred just before the airplane landed for the first time. Tests done on the incident airplane's throttle levers indicated that they operated appropriately throughout the normal range of travel. However, on every test when the throttle levers were pushed against the maximum power stops using a normal application of force,[4] the CAS display would show L ENG CONTROL FAIL and R ENG CONTROL FAIL messages. These faults could be cleared by cycling the electrical power to the FADEC.

Based on the pilot's recollection of the event, analysis of the NVM data in the DSU, and testing on the incident airplane's throttle levers, it is likely that the pilot advanced the throttle levers up to the maximum power stops when reacting to the windshear and arresting the sudden increase in the sink rate. This likely caused the dual-channel failures in both throttle levers. Then, because of the configuration of the FADEC software, the engines maintained the thrust level of the last valid throttle lever position. In this case, that was at—or nearly at—maximum power, so the engines remained at that high power setting.

During this incident, the fault in the right engine was cleared when the crew shut down that engine. However, because the FADEC was programmed so that the left engine would mirror the throttle position of the no-fault engine, which was positioned at idle, the power in the left engine was reduced to idle. So, after the pilots shut down the right engine in an attempt to regain engine control, it is likely that the left engine rolled back to idle immediately. Thus, the pilots were flying with one engine that was shut down and another that would not advance past idle—and they had no emergency procedures to address the situation.

The Safety Board notes that the dual-channel failure of both throttle levers occurred after the airplane had accumulated only 238 hours and 192 cycles[5] since new. The throttle levers are part of the throttle quadrant assembly. The Board is concerned about the reliability of an assembly that fails in such a short time. Moreover, when the failed throttle quadrant assembly was replaced, pushing the throttle levers on the replacement unit against the maximum power stops caused a R ENG CONTROL FAIL message to appear on the CAS display. The immediate failure of the replacement part suggests that there may be a design or quality problem in the Eclipse 500's throttle quadrant assembly.

The Safety Board is continuing to investigate the cause of the failure. Until the cause of the failure is resolved, it is imperative that failed units be identified immediately because they could result in a loss of throttle control of the engines that could lead to a loss of engine power. Therefore, the Safety Board recommends that the FAA require an immediate inspection of all Eclipse 500 airplane throttle quadrants to ensure that pushing the throttle levers against the maximum power stops will not result in an engine control failure, and the FAA should further

[3] The Eclipse 500 airplane is not equipped with a cockpit voice recorder or flight data recorder (FDR), nor is it required to be, but the DSU records many of the same airplane and engine parameters that an FDR would.

[4] Normal application of force means a force that a pilot might normally use in flight.

[5] A cycle is one complete sequence of engine startup, taxi, takeoff, climb, cruise, descent, landing, taxi, and shutdown.

require that any units that fail the inspection be replaced and that the replacement parts be similarly inspected.

The Safety Board further notes that the Eclipse 500's airplane flight manual (AFM) and QRH provide an emergency procedure for a single engine control failure but not for a dual engine control failure such as occurred in this incident. Had it not been for the resourcefulness of the pilots, the visual meteorological conditions that prevailed at the time, and the airplane's proximity to the airport, the successful completion of this flight would have been unlikely. The Board is concerned that, should another dual engine control failure occur, pilots will be without guidance and may be unable to restore control. Testing on the incident airplane showed that it is possible to regain control of the engine throttles and maintain power by cycling the electrical power to the FADECs, yet there is currently no procedure showing pilots how to do this in flight. The Safety Board concludes that it is unacceptable for there to be no emergency procedure for a control failure of both engines and no method to restore control of the engine throttles in the Eclipse 500 airplane's AFM and QRH. Therefore, the Safety Board recommends that the FAA require Eclipse to immediately develop an emergency procedure for a dual engine control failure on the Eclipse 500 airplane and incorporate the procedure into the AFM and the QRH via an airworthiness directive.

Therefore, the National Transportation Safety Board recommends to the Federal Aviation Administration:

> Require an immediate inspection of all Eclipse 500 airplane throttle quadrants to ensure that pushing the throttle levers against the maximum power stops will not result in an engine control failure, and further require that any units that fail the inspection be replaced and that the replacement parts be similarly inspected. (A-08-46) Urgent

> Require Eclipse to immediately develop an emergency procedure for a dual engine control failure on the Eclipse 500 airplane and incorporate the procedure into the airplane flight manual and quick reference handbook via an airworthiness directive. (A-08-47) Urgent

In response to the recommendations in this letter, please refer to Safety Recommendations A-08-46 and A-08-47. If you would like to submit your response electronically rather than in hardcopy, you may send it to the following e-mail address: correspondence@ntsb.gov. If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions on how to use our Tumbleweed secure mailbox procedures. To avoid confusion, please use only one method of submission (that is, do not submit both an electronic copy and a hardcopy of the same response letter).

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HERSMAN, HIGGINS, and CHEALANDER concurred in these recommendations.

[*Original Signed*]

By: Mark V. Rosenker
Chairman