National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 5, 2008

In reply refer to: A-08-03

Mr. Merlin Preusse
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On July 27, 2006, Air Nostrum flight IB8174, EC-IJF,[1] a Bombardier Canadair Regional Jet (CRJ)-200, experienced a fan blade separation (or "fan blade off" [FBO])[2] event and engine fire in the No. 1 (left) engine, a GE Aviation (GE) CF34-3B1 turbofan, as the airplane was climbing through 23,000 feet after departing from Barcelona International Airport (BCN), Barcelona, Spain. The pilots reported that they heard a loud bang and experienced severe vibration, followed by a No. 1 engine fire warning. The flight crew discharged both fire bottles and declared an emergency. The fire warning continued for 9 minutes 39 seconds as the airplane returned to BCN and ended as the airplane approached the airport. An uneventful single-engine landing was made, and no injuries were reported.[3]

Postincident inspection found that a fan blade on the No. 1 engine had fractured and separated below the platform[4] in the disk attachment area. The severe loading[5] caused by the blade separation and the loss of fan blade material resulted in considerable engine mechanical

[1] Air Nostrum is a Spanish-certified regional air carrier affiliated with Iberia Airlines of Spain.

[2] The release of a fan blade in a turbofan engine results in structural loading from both the impact of the blade onto the containment ring and the subsequent instantaneous unbalance of the rotating components.

[3] The Comisión de Investigación de Accidentes e Incidentes de Aviación Civil of Spain is conducting the investigation of this incident. In accordance with the provisions of Annex 13 to the Convention on International Civil Aviation, the National Transportation Safety Board and the Transportation Safety Board of Canada are participating in the investigation representing the State of Manufacture for the engines and airframe, respectively.

[4] The platform is an integral part of the fan blade that serves as the base for the airfoil. The CF34 fan blade design includes three tangs underneath the platform that attach the blade to the fan disk. The blade is attached to the fan disk by a pin that slides through holes in each tang.

[5] The release of a fan blade in a turbofan engine results in structural loading from both the impact of the blade onto the containment ring and the subsequent instantaneous unbalance of the rotating components.

damage, including a crack in the engine accessory gearbox and failure of the low pressure turbine (LPT) case-to-turbine transition case (TTC) flange. The flange failure allowed the LPT to rotate relative to the TTC, which caused two oil lines to separate. There was extensive thermal damage to the engine accessory section, core cowl, and exhaust nozzle fairing; fire damage was also noted in the ignition zone aft of the engine fire seal, where the oil lines were separated. The primary source of the fire could not be positively identified due to thermal damage.

A second fan blade failure occurred on May 24, 2007, when an Atlantic Southeast Airlines (ASA) Bombardier CRJ-200, N933EV, experienced a contained FBO event in the No. 2 (right) engine, a GE CF34-3B1 turbofan, while in cruise flight at 23,000 feet. The pilots reported hearing a loud bang and experiencing immediate severe vibration. The pilots declared an emergency and diverted the airplane to Regional Airport, Blountville, Tennessee, where they landed without further incident. Postflight inspection revealed that a fan blade in the No. 2 engine had fractured and separated below the platform in the blade attachment area. The inspection also found that the LPT case-to-TTC flange had separated, and the LPT case had shifted aft and rotated slightly.

The investigations of both events have revealed several safety issues related to the process used to manufacture CF34-1/-3 fan blades and the engine design, and the National Transportation Safety Board has made safety recommendations to the Federal Aviation Administration addressing these issues. However, the investigations have also revealed a potential safety issue involving an airframe component. Postincident inspection of both airplanes found that the screws securing the aircraft engine throttle gearbox[6] to a bracket on the top of the affected engines were not intact. Specifically, the No. 1 engine throttle gearbox on the Air Nostrum airplane was found loose in its retention bracket. One of the three retaining screws was missing, and a second screw was in place but sheared. Although the gearbox remained in the bracket and the engine shutoff linkage was not grossly affected, it was possible to pivot the gearbox on the remaining bolt. The No. 2 engine throttle gearbox on the ASA airplane was not loose; however, one of the three retaining screws was missing, and a second screw was backed off 1/8-turn. These findings are of concern because improper alignment or continuity of the engine fuel shutoff linkage could result in the loss of engine shutdown capability.

The Safety Board notes that 14 *Code of Federal Regulations* Section 33.75, "Safety Analysis," requires that any engine or component failure will not cause the loss of engine shutdown capability. The Board is concerned that the throttle gearbox retention screws cannot withstand the extreme vibration loads that result from an FBO event and that this could result in the loss of engine fuel shutoff capability.

[6] An airframe component of the aircraft's engine shutoff mechanism, the throttle gearbox transfers the linkage position from the airframe linkage to the engine fuel control throttle arm, which controls the engine fuel shutoff valve. The same throttle linkage mechanism is used on both the CRJ-100 and CRJ-200 airplanes.

Therefore, the National Transportation Safety Board recommends that Transport Canada:

Require Bombardier to redesign the retention feature of the Canadair Regional Jet-100/-200 aircraft engine throttle gearbox to ensure that it can withstand the loads generated by a fan blade separation or similar event. (A-08-03)

The Safety Board also issued Safety Recommendations A-08-04 through -09 to the Federal Aviation Administration. In your response to the recommendation in this letter, please refer to Safety Recommendation A-08-03.

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HERSMAN, HIGGINS, and CHEALANDER concurred with this recommendation.

[*Original Signed*]

By: Mark V. Rosenker
Chairman