National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 12, 2012

In reply refer to: A-12-47

The Honorable Michael P. Huerta
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

On February 8, 2012, American Airlines flight 837, a Boeing 767-300ER airplane, equipped with General Electric Aircraft Engines (GEAE) CF6-80C2B6 engines,[1] experienced a fire in the right engine shortly after taking off from John F. Kennedy International Airport (JFK), Jamaica, New York. The pilots reported that as the airplane was climbing through 9,000 feet, they heard a thump that was followed a few seconds later by a right engine fire warning. The pilots stated that they shut down the engine and discharged both fire bottles into the engine's nacelle before the fire warning was deactivated. The pilots stated that they declared an emergency and returned to JFK where they performed a single-engine, overweight landing without further incident. The airplane was operating on an instrument flight rules flight plan as an international passenger flight in accordance with the provisions of 14 *Code of Federal Regulations* (CFR) Part 121 from JFK to Port au Prince, Haiti. There were no injuries to the 201 passengers, 9 flight attendants, and 3 pilots on board.[2]

The NTSB's examination of the engine revealed soot on its exterior and thermal damage to the interior surface of the right thrust reverser cowl. Numerous wires and cables on the lower half of the engine showed signs of insulation that had been burned away or partially melted. When the engine was subjected to the troubleshooting procedure known as wet motoring[3] to check for fuel leaks, fuel sprayed from the front of the integrated drive generator (IDG) fuel-oil heat exchanger[4] under the spray shield and support bracket (see figure 1). Close examination of the front of the IDG fuel-oil heat exchanger revealed that the two-part support bracket and spray shield was misassembled, with the bracket having been installed over the spray shield

[1] In addition to the Boeing 767, CF6-80C2 series engines are also used on Airbus A300s and A310s, as well as Boeing 747 and MD-11 airplanes.

[2] Preliminary information about this incident, NTSB case number ENG12IA010, can be found on the National Transportation Safety Board's website at http://www.ntsb.gov/aviationquery/index.aspx.

[3] During wet motoring, an engine is run on the starter with the fuel turned on but the ignition turned off.

[4] The IDG fuel-oil heat exchanger is located on the lower right side of the engine.

(see figure 2) rather than the shield being installed over the support bracket (see figure 3) as indicated in maintenance instructions.

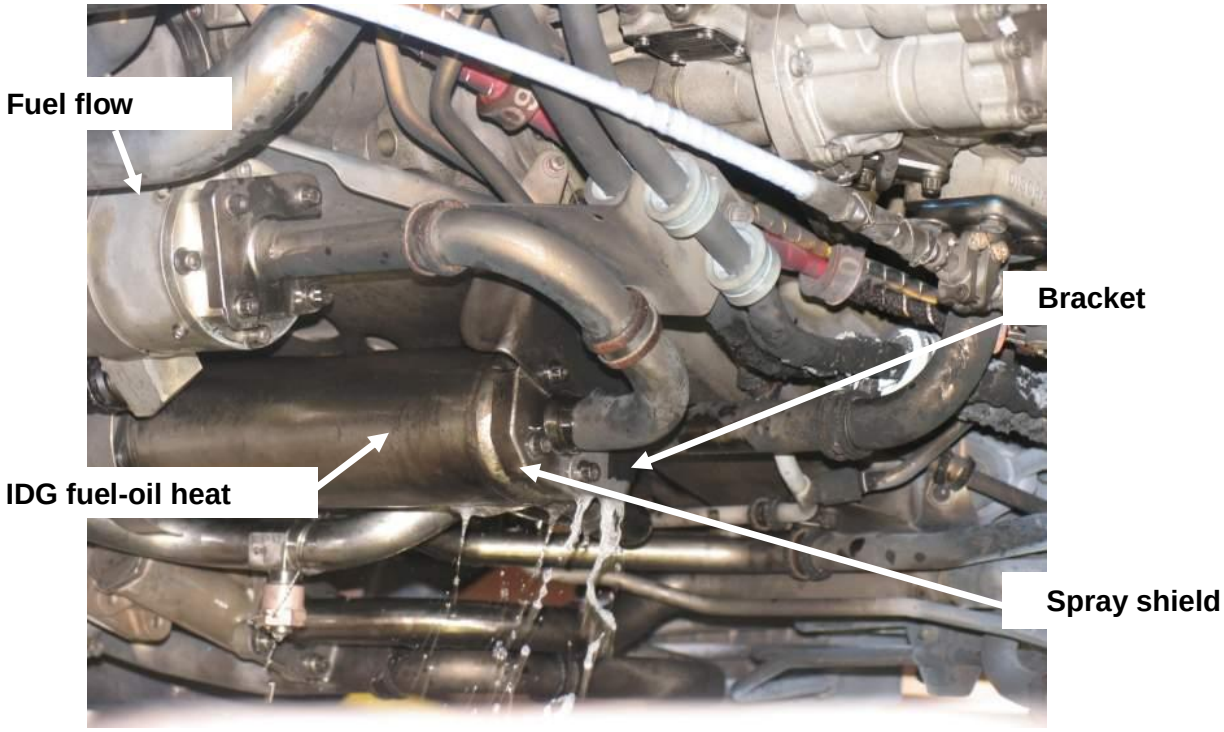

Figure 1. View of IDG fuel-oil heat exchanger showing leaking fuel when the engine was wet-motored. (GE photo)

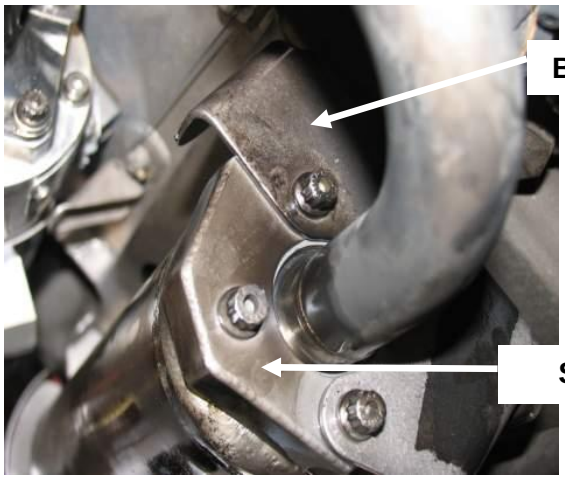

Figure 2. Close up view of the misassembled two-piece bracket and spray shield on the incident engine showing bracket installed over spray shield. (GE photo)

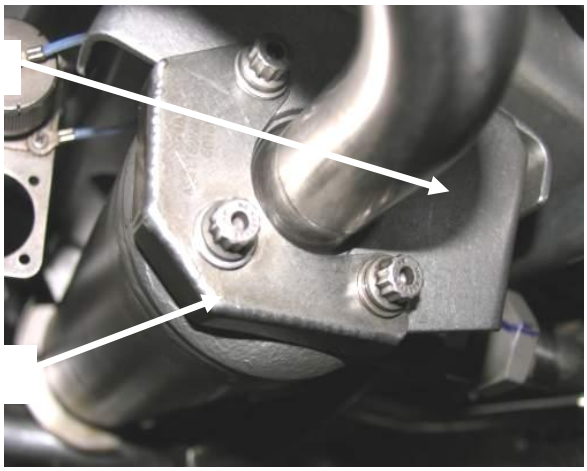

Figure 3. Close up view of correctly assembled two-piece bracket and spray shield showing the shield installed over the bracket. (GE photo)

Although the retaining bolts on the front of the IDG fuel-oil heat exchanger were at the proper torque levels, the reversed positions of the support bracket and spray shield distorted the fuel tube flange, resulting in an inadequate clamping of the seal between the fuel tube flange and the IDG fuel-oil heat exchanger body. Examination of the seal revealed that a 0.9-inch-long arc of the rubber part of the seal was missing. The inadequate clamping of the seal between the fuel tube flange and body of the IDG fuel-oil heat exchanger resulted in high pressure fuel being able to blow out part of the seal, causing the leakage.

According to maintenance records for the incident airplane, American Airlines maintenance personnel replaced the fuel flow transmitter at Miami International Airport (MIA), Miami, Florida, in the early morning of February 8, 2012. The maintenance personnel who performed this work stated that when they examined the fuel tube between the fuel flow transmitter and the IDG fuel-oil heat exchanger, it appeared that the tube was an old configuration[5] that should be replaced with a new configuration tube, in accordance with Airworthiness Directive (AD) 2000-04-14, "Airworthiness Directives; General Electric Company CF6-80C2 Series Engines," dated May 1, 2000.[6] The AD is intended to prevent improper seating of the fuel tube flange, which can lead to high pressure fuel leaks that result in engine fires. According to the maintenance instructions, replacing the fuel tube would require removing and reinstalling the support bracket and spray shield. After replacing the fuel flow transmitter and fuel tube, maintenance personnel wet-motored the engine to check for fuel leaks, and no leaks were noted. Maintenance personnel then closed the engine cowls, started the engine, and ran it at idle power for several minutes to check for leaks; no leaks were noted after the engine was shut down. The airplane was then dispatched to operate as flight 518 from MIA to JFK.[7] No problems were reported for this flight or before the airplane departed on the incident flight.

The incident involving American Airlines flight 837 was not the first of its type. On July 12, 2006, a Delta Air Lines Boeing 767-300ER, N153DL, experienced an engine fire shortly after takeoff from Rio de Janeiro, Brazil, destined for Atlanta, Georgia.[8] As the airplane climbed through 3,000 feet, the pilots received a left engine fire warning in the cockpit. The pilots shut down the left engine and discharged one fire bottle into the engine's nacelle before the fire warning was deactivated. The airplane returned to Rio de Janeiro for a single-engine, overweight landing that resulted in a hot brake warning and the deflation of six main landing gear tires.[9]

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[5] Postincident examination of the replaced fuel tube revealed that the part number was difficult to read, which prompted its replacement; the examination confirmed that the replaced fuel tube was a new configuration tube.

[6] By reference to GE Alert Service Bulletin 73-0224 (dated May 25, 1995), which introduced a newly configured fuel tube between the fuel flow transmitter and IDG fuel oil heat exchanger, AD 2000-04-14 required the installation of this tube, which featured an improved four-bolt swivel tube retaining flange.

[7] According to American Airlines, the flight time for flight 518 from MIA to JFK on February 8, 2012, was 2 hours 43 minutes.

[8] Delta Air Lines and GEAE reported this incident to the Federal Aviation Administration in accordance with the requirements of 14 CFR 21.3. However, the incident was not investigated by any aviation investigative agency.

[9] All four tires on the left main landing gear deflated, and two of the four tires on the right main landing gear deflated.

The damage observed on the Delta Air Lines engine was virtually identical to the American Airlines flight 837 engine. Soot covered the Delta engine, and many of the wires and cables on the lower half of the engine were partially burned away or had melted insulation. Thermal damage was observed on the inside of the right thrust reverser cowl. When wet-motored, the engine leaked fuel from the front flange of the IDG fuel-oil heat exchanger. Closer examination of the forward end of the IDG fuel-oil heat exchanger revealed the bracket and spray shield had been misassembled, with the spray shield being installed under—rather than over—the bracket. Examination of the seal between the fuel tube and the front of the IDG fuel-oil heat exchanger also revealed that a 0.375-inch-long section of the seal was missing.

GEAE issued Service Bulletin (SB) 73-0242, "Fuel and Control – (73-00-00) – Spray Shields and Support Bracket – Improvement," on May 17, 1996, which introduced a one-piece bracket and spray shield for the front of the IDG fuel-oil heat exchanger to replace the two-piece bracket and spray shield. The SB indicates that the purpose of the one-piece bracket and spray shield is to improve the maintainability and inspection of the IDG fuel-oil heat exchanger and fuel flow transmitter swivel flanges, as well as to eliminate the potential for misassembly. The SB was initially issued as a category 7 bulletin, meaning that GEAE recommended operators incorporate the SB at their discretion. However, following the Delta Air Lines engine fire at Rio de Janeiro, GEAE elevated the bulletin to category 3 in March 2007, meaning that GEAE recommended operators accomplish the SB at the engines' next shop visit. Although the last shop visit for the flight 837 engine was on November 9, 2009, at the American Airlines maintenance facility in Tulsa, Oklahoma (2 years after the SB was elevated to category 3), the engine did not have the one-piece bracket and spray shield installed.

The National Transportation Safety Board (NTSB) notes that, unlike an AD that mandates the accomplishment of a particular task, manufacturer SBs are only recommendations to take certain actions. Accordingly, American Airlines was under no obligation to comply with SB 73-0242, even after GEAE elevated the SB to category 3. During the NTSB's investigation, American Airlines indicated that CF6-80C2 engines on its fleet of 767s have been operating with a mix of two- and one-piece bracket and spray shields over the past 20 years. American Airlines also indicated that, until the February 8, 2012, engine fire, there was no economic reason to replace the two-piece bracket and spray shield with the one-piece bracket and spray shield and, thus, the operator had not.[10]

The NTSB is concerned that following the 2006 Delta Air Lines engine fire at Rio de Janeiro and GEAE's escalation of SB 73-0242 to category 3, the FAA did not issue an AD to require the installation of the one-piece bracket and spray shield, especially given the FAA's acknowledgement, in issuing AD 2000-04-14, that fuel leaks could lead to engine fires. Because the airplane model involved in these events is among those approved for extended operations, or ETOPS,[11] the NTSB is particularly concerned about the prospect of a twin-engine airplane

[10] In an e-mail to NTSB investigators, American Airlines' CF6-80C2 program manager stated that the company will be installing the one-piece bracket and shield on all CF6-80C2 engines repaired and overhauled at its Tulsa, Oklahoma, Maintenance and Engineering Center.

[11] According to Advisory Circular 120-42B, *Extended Operations (ETOPS and Polar Operations)*, the FAA "may authorize ETOPS with two-engine airplanes over a route that contains a point farther than 60 minutes flying time from an adequate airport at an approved one-engine inoperative cruise speed under standard conditions in still air….The FAA may also authorize ETOPS with passenger-carrying airplanes with more than two engines over a

having to operate with a single engine for as long as 3 hours if an engine fire occurred at the limits of its ETOPS range rather than shortly after takeoff. The NTSB concludes that, if the FAA had issued an AD to require installation of the one-piece bracket and spray shield on CF6-80C2 engines (as recommended in SB 73-0242) following the July 2006 Delta Air Lines engine fire at Rio de Janeiro, the engine fire on American Airlines flight 837 would not have occurred.

Therefore, the National Transportation Safety Board makes the following recommendation to the Federal Aviation Administration:

> Issue an airworthiness directive to require the incorporation of General Electric Aircraft Engines Service Bulletin 73-0242, "Fuel and Control – (73-00-00) – Spray Shields and Support Bracket – Improvement," to prevent fires on CF6-80C2 engines due to misassembly of the two-piece support bracket and spray shield on the front of the integrated drive generator fuel-oil heat exchanger. (A-12-47)

In response to the recommendation in this letter, please refer to Safety Recommendation A-12-47. We encourage you to submit updates electronically at the following e-mail address: correspondence@ntsb.gov. If a response includes attachments that exceed 5 megabytes, please e-mail us at the same address for instructions. To avoid confusion, please do not submit both an electronic copy and a hard copy of the same response.

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, ROSEKIND, and WEENER concurred in this recommendation.

Sincerely,

[Original Signed]

Deborah A.P. Hersman
Chairman

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route that contains a point farther than 180 minutes flying time from an adequate airport at an approved one-engine inoperative cruise speed under standard conditions in still air."