



ASSESSMENT OF THE RESPONSE FROM TRANSPORT CANADA TO AVIATION SAFETY RECOMMENDATION A04-04

AIRCRAFT FITTED WITH CFM56-5 SERIES JET ENGINES: CONTINUING AIRWORTHINESS

Background

On 20 October 2002, a Cathay Pacific Airways Airbus A340-300 (CPA829), B-HXN, departed Toronto/Lester B. Pearson International Airport, Ontario, at 2352 eastern standard time on a scheduled flight to Hong Kong, China, with a planned refuelling stop in Anchorage, Alaska. There were 249 passengers and 13 crew members on board. One hour and nine minutes into the flight, while cruising at flight level 350, the pilots felt an airframe vibration and observed the number 1 engine shut down spontaneously. All cockpit indications leading up to the engine power loss were apparently normal. The pilots secured the number 1 engine in accordance with the quick reference handbook, continued flight on three engines, and diverted to Vancouver International Airport, British Columbia. CPA829 landed at Vancouver at 0105 Pacific standard time without further incident.

The Transportation Safety Board of Canada (TSB) investigation revealed that an intermittent short circuit occurred in the permanent magnet alternator (PMA) when failure of the ball bearing caused the rotor to contact the stator. The PMA was then unable to generate reliable electrical power for the electronic control unit (ECU). The ECU continuously monitors the PMA, and, if the PMA no longer generates the required electrical power, the ECU will switch to other aircraft electrical power sources. The switch to other electrical sources, when it occurs, is rapid, usually with no significant change in engine performance. In this incident, the ECU became stuck in an endless loop of re-acquiring and losing PMA power due to the intermittent nature of the PMA failure. With no reliable or consistent source of electrical power, the engine eventually shut itself down. Without electrical power to the ECU, engine conditions were not transmitted to the cockpit instruments or centralized fault display system (CFDS), thus leading the pilots to assess that the engine had seized. CFM International (CFM) subsequently identified a problem with software version C.3.G, in the ECU, that prevented the switch-over to other sources of aircraft electrical power. The CFM document, entitled *CFM56-5 Fleet Highlights* (publication 00-01-7263-07), indicates that CFM has been aware of this deficiency since November 1999.

CFM issued Service Bulletin (SB) 73-0126 (published as CFM56-5C SB 73-0126, dated 13 November 2003). The SB changes the ECU software version from C.3.G to C.3.J and ensures that ECU electrical power successfully reverts to aircraft power in the event of a complete or partial PMA failure.



This SB applies only to the Airbus A340 aircraft, and, although CFM recommends implementation within six months, the actual timeframe for accomplishing this SB is at the discretion of the operator. Additionally, Airbus advises that it has launched similar initiatives to incorporate software updates on CFM56-5A and -5B engines used on its A319, A320, and A321 family of aircraft. It is anticipated that compliance for these SBs will likewise be at the discretion of the operator.

The Board concluded its investigation and released report A02P0261 on 15 December 2004.

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Given the number of aircraft affected, the known problem with PMA bearing failures, the critical function that the ECU software provides in ensuring engine reliability, and the discretionary nature of the proposed software updates, the Board is concerned that, without regulatory intervention, this known unsafe condition will remain in service well beyond the manufacturer's recommended six-month timeframe for the implementation of SB 73-0126. The Board therefore recommended that:

The Department of Transport ensure the continued airworthiness of Canadian-registered aircraft fitted with the CFM56-5 series engine by developing an appropriate safety assurance strategy to make certain that, in the event of a permanent magnet alternator failure, the electronic control unit will revert to aircraft power.

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Response to A04-04

On 11 March 2005, Transport Canada responded to Recommendation A04-04. Transport Canada stated that it confirmed, through communication with the Canadian aviation industry, "that all Canadian aircraft presently affected by CFM Service Bulletin 73-0126 will have their ECU software upgraded to version C.3.J by March 2005." The response indicated that Transport Canada was not planning on taking any further action.

On 07 October 2005, a second response was received. This response amplified Transport Canada's course of action, which includes the monitoring of Canadian operators until all the applicable CFM56-5 series service bulletins have been incorporated, and the publication, on 03 August 2005, of a Service Difficulty Alert to both Canadian operators and foreign civil aviation authorities to highlight the applicable service bulletins.

Board Assessment of Response to A04-04

Although the 11 March 2005 Transport Canada response only took into account the implementation of an SB that affects the CFM56-5C series engine fitted to the Airbus A340, the 07 October 2005 response now addresses all Canadian aircraft fitted with CFM56-5 series engines.

The actions taken by Transport Canada will substantially reduce or eliminate the safety deficiency raised in Board Recommendation A04-04.

Transport Canada's response is rated as **Fully Satisfactory**.

Next TSB Action: A04-04

As the safety deficiency highlighted in Recommendation A04-04 has been addressed, this deficiency is assigned an **Inactive** status.