AWB 26-1 Issue 1, 12 September 2003 Beech turboprop aircraft - Bleed Air Warning System

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Subject

Engine bleed air warning system installation in Beech turboprop aircraft.

Effectivity

This Airworthiness Bulletin relates to the bleed air warning system installed on Beech King Air 200, 300 and 350 series aircraft. However other Beech turboprop models using similar systems may also be affected.

Purpose

The purpose of this Airworthiness Bulletin is to advise operators and maintainers that a possibility of cross connecting the left and right bleed air warning system may exist in Beech turboprop aircraft. A cross connected bleed air warning system can lead the crew to mis-identify a bleed air duct leak and isolate the wrong system.

How the bleed air warning system works

The bleed air warning system is provided to give a visual warning to the crew of a leak in the bleed air ducting behind the firewall of either engine. The bleed air ducting is designed to contain hot bleed air, which is under pressure. To protect surrounding airframe structure from radiated heat the pipes are wrapped in heat insulation lagging, which effectively prohibits visual inspection of the piping for defects, such as pinholes, and fatigue type cracks.

To monitor these pipes for leakage, a small diameter plastic ethylene vinyl acetate (EVA) tube is routed in close proximity for the entire length of each bleed air ducting. This EVA tube is connected to a normally open pressure switch located under the cabin floor. A pressure of approximately 18 psi is supplied to this EVA tube continuously from the de-ice manifold. When hot air from a ruptured bleed air pipe contacts the EVA tube, the tubing melts. Depending on which half of the system has failed, the released pressure

closes the pressure switch and illuminates the appropriate left bleed air fail (L BL AIR FAIL) or right bleed air fail (R BL AIR FAIL) annunciator in the cockpit. The warning informs the crew that there is a hot air leak somewhere in the left or right ducting, which can then be isolated from the aircraft system by appropriate checklist actions.

The EVA tubes, one for the left bleed air supply ducting and one for the right, are routed forward to the pressure switches under the cabin floor. The tubing from each side is identical. The pressure switches are mounted side by side and are identical in appearance and function.

What can go wrong

During maintenance it is possible to cross connect the pressure switches. This will lead to incorrect identification of the failed bleed air system. The crew can then be misled into shutting off the serviceable bleed air source, which leaves the leaking system still in operation affecting the surrounding aircraft structure. In this situation with the bleed air system now leaking, the crew and passengers would be put at additional risk through the loss of pressurisation.

The following incident involving a Beech B200 aircraft in Australia outlines the hazards associated with such incorrect installations: During climb through 18000' the left bleed air warning light (L BL AIR FAIL) illuminated. The left bleed air system was turned off when the aircraft was stabilised at cruise at 22000'. The cabin then slowly depressurised to 14,000 ft. Fortunately the crew detected the loss of cabin pressure and initiated a descent to return to the departure aerodrome.

A subsequent maintenance investigation found loose ducting and a hole in the right bleed air ducting. In addition, it was found that the left bleed air warning pressure switch was connected to the right air bleed system and vice versa. If this had resulted in an accident, the reason the pilot selected the wrong system off may have been impossible to determine from examining the wreckage.

Preventive measures

Maintenance manuals for Beech 200, 300 and 350 aircraft contain procedures to confirm correct operation of the warning system on the ground by simulating a break in the EVA tubing. This can be accomplished by disconnecting the tubing from the bleed air pressure source during operation of the system. When the left EVA tube is disconnected from the pressure source, the left switch should activate and illuminate the L BL AIR FAIL annunciator. Confirmation of the right system operation can subsequently be accomplished by disconnecting the right tube from the pressure source. The applicable aircraft maintenance manual procedure should be followed for testing the system.

Recommendation

Because of the potential danger associated with the incorrect detection of a failed bleed air system - operators and maintainers are advised to:

1. check for possible cross connection of the pressure switches in the aircraft in accordance with the maintenance manual.
2. be careful during maintenance so that the pressure switches are not cross connected inadvertently.

Enquiries

Enquiries regarding the content of Airworthiness Bulletins should be made via the direct link e-mail address included on the Airworthiness Bulletin web site. AirworthinessBulletin@casa.gov.au.