

BAe 146-300, EI-CLG

AAIB Bulletin No: 1/2000 **Ref: EW/G99/08/42** **Category: 1.1**

Aircraft Type and Registration: BAe 146-300, EI-CLG

No & Type of Engines: 4 Lycoming ALF 502R turbofan engines

Year of Manufacture: 1989

Date & Time (UTC): 31 August 1999 at 0838 hrs

Location: Daventry

Type of Flight: Public Transport

Persons on Board: Crew - 3 - Passengers - 72

Injuries: Crew - None - Passengers - None

Nature of Damage: Failure of No 1 electrical generator

Commander's Licence: Airline Transport Pilot's Licence

Commander's Age: 37 years

Commander's Flying Experience: 5,875 hours (of which 2,100 were on type)

Last 90 days - 160 hours

Last 28 days - 55 hours

Information Source: Aircraft Accident Report Form submitted by the pilot and investigation by AAIB, manufacturer and operator

The aircraft was on a scheduled service from London Stansted Airport to Dublin and was climbing to FL220. On passing FL190 the Autopilot tripped out, warning flags appeared on the commander's ADI (Attitude Direction Indicator) and, at the same time, a 'GEN OFF LINE' caption illuminated for the No 1 electrical generator and the caption 'ELECT' appeared on the Master Warning panel. The commander took manual control of the aircraft and he and the first officer felt a change of pressure in their ears. They checked the Pressurisation panel on the flight deck and saw the cabin pressure indicator showing a rate of descent of some 1,800 to 2,000 feet/min. The crew switched the Pressurisation controller to MANUAL mode and selected the cabin air discharge valves to fully shut.

As a precaution the crew donned oxygen masks and requested descent to FL100. They were then further cleared down to FL80 and confirmed to ATC that they would like to declare an emergency and that they had electrical and pressurisation problems. After evaluation of the situation at FL80 they requested a downgrade of the Emergency and a diversion to Manchester so that the No 1

electrical generator could be examined. During the descent the commander instructed the first officer to start the APU. The landing at Manchester was normal and there was no injury to crew or passengers.

The No 1 generator was removed at Manchester and later examination showed that it had tripped off-line due to a high temperature in the oil supply to the CSD (Constant-Speed Drive). The Pressurisation controller was found to be serviceable but was removed and later sent for a full examination, which showed no defects.

System description

In the BAe 146 electrical system, AC power is normally supplied through two separate busbars, (AC BUS 1 and AC BUS 2), powered respectively by the Nos 1 and No 2 electrical generators. The AC BUS 1 normally supplies the essential services on the ESS AC BUS (including the commander's ADI and the Pressurisation controller). In the event of failure of supply to either AC BUS 1 or AC BUS 2, the Bus-Tie Contactor (BTC) should close automatically and the remaining generator will power both busbars. In addition, the Pressurisation controller has a backup DC supply from the Emergency/Battery busbar, so crew training does not include pressurisation problems coincident with electrical problems.

The normal mode of operation of the pressurisation system is automatic (AUTO), with the Pressure controller continually adjusting the two cabin air discharge valves to maintain the selected cabin altitude. If the crew select MANUAL control, these valves will remain at the position selected on the rotary knob on the Pressurisation control panel and their position is shown on two indicators.

Analysis

The only system defect identified following the incident was the failed No 1 electrical generator, with no defect in the BTC or the Pressurisation controller. Failure of the No 1 generator would result in an interruption of AC electrical power in the period taken for the No 2 generator to assume the load on AC BUS 1 through the BTC. This would result in a transient electrical interruption in, for instance, the autopilot, the commander's ADI and the Pressurisation controller.

The aircraft manufacturer comments that the occurrence of a pressure surge in this incident suggests that the No. 1 generator momentarily supplied power outside normal limits before its protection circuits 'tripped' and allowed the transfer to the No 2 generator. There could, therefore, be a period of up to 5 seconds during which power supply had not transferred but supply from the No 1 generator was inadequate for proper control of the discharge valves.

The crew's rapid reaction to the transient pressure fluctuation was premature, in not allowing the Pressurisation controller to restore the selected cabin altitude in automatic mode. However, their reaction in these circumstances is understandable as the behaviour of the Pressurisation system was unexpected and the effect of the pressure change compelling .