



Aviation Safety Investigation Report - Final

British Aerospace Plc BAe 146-100, VH-NJA

Occurrence Details

Occurrence Number:	200103696	Location:	Brisbane, Aero.
Occurrence Date:	07 August 2001	State:	QLD
Occurrence Time:	1900 hours EST	Highest Injury Level:	None
Occurrence Category:	Incident	Investigation Type:	
Occurrence Class:		Investigation Status:	
Occurrence Type:		Release Date:	04 July 2002

Aircraft Details

Aircraft Manufacturer:	British Aerospace Plc	Aircraft Model:	BAe 146-100	
Aircraft Registration:	VH-NJA	Serial Number:	E1004	
Type of Operation:	Air Transport, Domestic, High Capacity, Passenger, Scheduled			
Damage to Aircraft:	Nil			
Departure Point:	Brisbane, QLD	Departure Time:	1900 hours EST	
Destination:	Mackay, QLD			
Crew Details:	Role	Class of Licence	Hours on Type	Hours Total
	Pilot-In-Command	ATPL	7000	12000

Factual Information

Shortly after takeoff, and in accordance with standard procedure, the flight crew selected engine bleed air as the source of air for the aircraft's two airconditioning packs. Subsequently, the cabin staff reported a strong smell of fumes in the cabin. As there was also a smell of fumes entering the flight deck, the flight crew donned their oxygen masks in accordance with the non-normal procedure for suspected cabin air contamination.

The flight crew then proceeded to identify the source of the fumes using a contamination source location schedule. That procedure involved selecting different combinations of engine air and airconditioning packs. During normal operation, bleed air from engines one and two was fed to pack one, which in turn supplied conditioned air to the flight deck and cabin. Bleed air from engines three and four was fed to pack two, which normally only supplied air to the cabin. Additionally, bleed air from the Auxiliary Power Unit (APU) was used by either pack during the takeoff and landing phases or when airconditioning was required during ground operations. It was determined that with pack two selected off, the fumes dissipated. The flight was continued with only pack one supplying conditioned air to the cabin and flight deck. The two cabin staff and several passengers were affected by the fumes with symptoms of sore eyes, sore throat and headache.

On arrival of the aircraft in Brisbane, a Licensed Aircraft Maintenance Engineer (LAME) addressed the reported defect in accordance with the Civil Aviation Safety Authority airworthiness directive AD/BAe146/086 and the British Aerospace Systems Information Service Bulletin (ISB) 21-150. The ISB required certain actions to be performed whenever a cabin air quality problem was identified which was suspected of being associated with oil contamination of the air supply from the airconditioning packs. The engineer's inspection of the airconditioning system, engines and APU revealed no signs of oil contamination or oil leaks. The defect was therefore cleared and the aircraft resumed service.

The following day, the same aircraft but with a different crew was involved in a similar occurrence. A strong smell of fumes was noticed, mainly in the cabin, during the cruise. The flight crew donned oxygen masks as a precautionary measure. Symptoms of sore eyes, sore throat and headache were reported by both the crew and passengers. The pilot in command, who had been affected by fumes on previous occasions, received medical attention after landing.

Engineering inspection revealed oil contamination in the number-3 engine bleed band. The defect was deferred in accordance with the aircraft's approved Minimum Equipment List that allowed the aircraft to be flown with only the number one airconditioning pack in use. No further fumes were evident during following flights. Subsequent engineering investigation of the number-3 engine revealed that the oil leak was a result of a worn number one bearing seal. The number-3 engine was replaced and the defect was cleared.

Evidence from previous incidents of air system contamination on this type of aircraft had indicated that the fumes were associated with engine or APU oil contamination of the airconditioning system. As a result, operators have incorporated various modifications to the cabin air system, APU, and engines. They have also introduced improved maintenance practices to further address the issue. However, that action has not completely solved the problem. The air supplied to the airconditioning packs was protected from contamination by oil seals in the engines and APU. A technical defect arising in one of the seals can result in oil entering the cabin airconditioning system, with the first signal of the defect being an awareness of fumes by the members of the crew. The difficulty of identifying the origin of the contamination is exacerbated by the often-intermittent nature of the fumes events.

Analysis

Both incidents on this aircraft were initially characterised by the strong smell of fumes in the cabin. It was considered that an intermittent leak of oil in engine number three contaminated that engine's bleed air that, in turn, contaminated airconditioning pack two. The observation that the fumes dissipated after pack two was switched off supports this view.

The initial maintenance inspection of the airconditioning system, engines and APU that revealed no signs of oil contamination or oil leaks, highlighted the difficulty faced by maintenance staff in trying to trace the cause of reported fumes events. The identification of the failed oil seal and the subsequent engine change resulted from the CASA airworthiness directive requiring the operator to follow up the event with corrective maintenance action.

Safety Action

On 6 September 1999, the Australian Transport safety Bureau issued recommendation R19990052 to the Civil Aviation Safety Authority. That recommendation stated that:

"The Civil Aviation Safety Authority, in conjunction with the aircraft manufacturer, British Aerospace Plc, address deficiencies that permit the entry of fumes into the cockpit and cabin areas of BAe 146 aircraft. These deficiencies should be examined by the regulatory authority as part of its responsibilities for initial certification and continued airworthiness of the BAe 146 aircraft."

The Civil Aviation Safety Authority responded on 14 March 2000 stating:

"In the lengthy period between the incident and the release of your report, CASA has investigated this issue in considerable detail, in conjunction with the aircraft manufacturer and the major Australian operators. As a result of this work, and discussions with the certifying authority (the UK Civil Aviation Authority), CASA is satisfied that the BAe146 aircraft in service in Australia are safe for public transport. CASA technical specialists are available to brief your investigators on the scope and findings of this work.

"As your recommendation does not specify the nature of any additional deficiencies that the Bureau believes need to be addressed by CASA and the aircraft manufacturers, I am seeking details of any deficiencies that you believe have not been appropriately dealt with. It would also assist us in providing a meaningful and constructive response to your recommendations if you were to provide us with details of any incidents that have occurred since the original incident in 1997.

"In the meantime, we will continue to monitor the situation and review any information that comes to hand."

The Bureau classified the response as "Open" and has initiated further correspondence with CASA. On 12 October 2000, the Senate Rural and Regional Affairs and Transport References Committee tabled its report into Safety and Cabin Air Quality in the BAe 146 Aircraft. The Government tabled its response to the References Committee's report on 28 June 2002.