

INCIDENT

Aircraft Type and Registration:	Boeing 767-324, G-OOBL	
No & Type of Engines:	2 General Electric CF6-80C2B7F turbofan engines	
Year of Manufacture:	1995	
Date & Time (UTC):	9 May 2008 at 1230 hrs	
Location:	Manchester Airport	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 11	Passengers - N/K
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Potable water system air compressor destroyed	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	N/K	
Commander's Flying Experience:	15,780 hours (of which 8,000 were on type) Last 90 days - 85 hours Last 28 days - 0 hours	
Information Source:	AAIB Field Investigation	

Synopsis

During pre-startup checks, a burning smell was identified in the rear of the aircraft cabin. The commander investigated and decided to disembark the passengers. During the disembarkation it was reported that the aircraft was "on fire". The commander made a MAYDAY call to ATC, switched off all aircraft power and exited the aircraft.

Examination revealed that the 'unloader check valve' (a non-return valve between the potable water tank and the potable water air compressor) had failed and this allowed moisture or liquid into the air compressor which, in turn, caused the air compressor to lock up. The thermal cut-out switch, associated with the electric motor that powered the potable water air compressor,

had cycled until it eventually became welded, or fused, in the ON position allowing a constant supply of electrical power to the compressors' motor, causing it to overheat severely.

History of the flight

During the flight crew's pre-flight checks the commander was informed by the In-Flight Supervisor (IFS) that there was a burning smell in the rear of the aircraft. He went to investigate, confirmed the smell, and decided to disembark the passengers. With three passengers still on the aircraft, an engineer ran to the cockpit from the rear of the aircraft and told the commander that the aircraft was "on fire" and to "kill" the power. The commander made a MAYDAY call to ATC, switched

off all electrical power and left the aircraft via the normal exit.

Engineering examination

Examination of the aircraft revealed that the three-phase electric motor that drives the air compressor (part number 60B50012-9), which pressurizes the aircraft's potable water tank, had severely overheated. This unit is mounted under the rear cabin floor area. The 15 amp circuit breakers for the potable water air compressor, which are located in the E&E bay, had not 'tripped'. Following replacement of the water air compressor it was found that the 'unloader check valve' (a non-return valve - part number CV99-191) was leaking and required replacing.

Potable water pressurization system

The primary pressurization for the aircraft potable water system is provided by a self-contained 0.5 horsepower, three-phase, 400 Hz, 115/120 volt ac motor driving a double-bellows reciprocating pump. This supplies clean air at pressures up to 40 psi to the water tank. The motor 'start' current is approximately 11.5 amps and the 'run' current is about 7.5 amps. A thermal protection switch is fitted inside the motor and, at 11.5 amps, will trip at about 200°F. With no current it will trip at about 600°F. Once the thermal protection has 'tripped', it will automatically reset after approximately 1.5 seconds.

The operation of the air compressor is controlled by a pressure switch connected to the compressed air input line to the potable water tank. When the water tank air pressure reaches approximately 40 psig, the switch shuts off the electrical power to the compressor. When the tank pressure falls to below approximately 30 psig (gauge), the switch allows power to the compressor. The 'unloader check valve' is fitted between the compressor and the water tank to maintain the air pressure in the

tank. It also prevents water from the tank going to the compressor. The unloader check valve is maintained on an 'on-condition' basis (that is, to replace the valve only after it has failed). A secondary water tank pressurization system is provided by the engine air bleeds, APU or ground support equipment.

Examination of the potable water air compressor

A strip examination was carried out on the potable water air compressor. Externally, the electric motor casing showed evidence of having experienced a high degree of overheating. The coating of protective paint had discoloured to a dark colour consistent with exposure to a temperature of at least 125°C. It was observed that the internal core of the motor had been exposed to significant heat which had removed the rotor from its core. Examination of the current-sensing overheat switch revealed that one of the three sets (three-phase switch) of electrical contact points had become welded, or fused, together.

Other information

The potable water air compressor (part number 60B50012-9) is fitted to Boeing 777, 767 and 737NG aircraft. The unloader check valve (part number CV99-191) is fitted to Boeing 767, 747-400 and 737NG aircraft. Unloader check valve part number CV99-191 was superseded by part number CV99-237 on the aircraft production line and subsequently on an attrition basis. On Boeing 777 aircraft, however, this check valve has been superseded by another part number (CV020T3E*3 in SB 777-38-0032) and, on B777 aircraft from production line position 586, the potable water pressurisation system has been replaced by a water pump.

The manufacturer of the air compressor (part number 60B50012-9) stated that they had seen in excess of

200 units where the electric motors had failed due to overheat as the result of moisture ingress into the compressor bellows.

The aircraft manufacturer stated that three flight diversions had resulted from smoke/fumes in the cabin generated by the electric motor of this potable water air compressor.

Service Bulletins and Service Letters

In February 2007, the aircraft manufacturer issued Service Letters (SLs) informing operators of a preferred unloader check valve used in the potable water system water pressurization line for Boeing 777, 767, 747-400 and 737NG aircraft. The SLs also informed operators of the elimination of the unloader check valve on B777 aircraft.

Following problems with the original unloader check valve, the manufacturer revised B747-400, B767, and B777 potable water system designs to specify installation of check valve, part number CV99-191, in place of the original valve. The replacement check valve was installed on all new production aircraft.

Some B767 and B777 aircraft operators reported problems with the potable water system air compressor (part number 60B50012-9). Examination showed that the compressor bellows had been contaminated with water. The aircraft manufacturer performed tests on a B777 aircraft with the unloader check valve removed, to determine whether water could be forced into the compressor during the potable water tank refill operation. These tests showed that water could leak into the compressor bellows. Further investigation revealed that the unloader check valve poppet could deteriorate, causing the check valve to remain in the open position.

The manufacturer revised the B777 aircraft potable water system design to specify installation of unloader check valve part number CV99-237. On B767 aircraft, this check valve was an option. On B747-400 aircraft, this check valve was added as a preferred option.

However, following a number of in-service failures of the later unloader check valve, part number CV99-237 on the B777 aircraft the manufacturer went back to installation of the earlier valve, part number CV99-191. On B767 aircraft, check valve part number CV99-237 was removed as an option and, on B747-400 aircraft, part number CV99-191 was added as the preferred option.

Revisions for B777 aircraft

As noted above, following service difficulties reported by operators, on B777 aircraft from production line position 586 the potable pressurization system was replaced with a pump system. This change eliminated the unloader check valve. On aircraft delivered prior to production line position 586, Service Bulletin 777-38-0032 provided instructions to replace the unloader check valve and made a number of other improvements. These included reducing the system operating pressure range to 30-40 psig and changing the compressor circuit breaker from 7.5 to 5 amps.

These changes have, so far, only been introduced for the B777 aircraft. The following Safety Recommendation is therefore made for the 767 aircraft:

Safety Recommendation 2009-090

It is recommended that the Federal Aviation Administration (FAA) review the continued airworthiness of the potable water air compressor system fitted to Boeing 767 aircraft, to ensure that the compressor's electric motor does not overheat, causing the generation of acrid fumes and creating a fire hazard.