Fokker F28 Mark 0100, G-BXWE

AAIB Bulletin No: 8/2004	Ref: EW/G2003/10/15	Category: 1.1
INCIDENT		
Aircraft Type and Registration:	Fokker F28 Mark 0100, G-BXWE	
No & Type of Engines:	2 Rolls-Royce Tay 650-15 turbofan engines	
Year of Manufacture:	1991	
Date & Time (UTC):	29 October 2003 at 0811 hrs	
Location:	Flight Level 250 over the English Channel	
Type of Flight:	Public Transport (Passenger)	
Persons on Board:	Crew - 6	Passengers - 55
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None reported	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	34 years	
Commander's Flying Experience:	6,500 hours (of which 200 were on type)	
	Last 90 days - 120 hours	
	Last 28 days - 55 hours	
Information Source:	Aircraft Accident Report Form submitted by the commander and further enquiries by the AAIB	

History of the flight

The commander reported that when he arrived at the aircraft in the morning he was informed that the No 2 air conditioning pack was inoperative. The aircraft is cleared to fly with one pack inoperative with a maximum altitude restriction of 25,000 feet (in practice this is equivalent to Flight Level 250). The commander re-filed his flight plan for a Flight Level (FL) of 250 and departed Heathrow as normal. Upon reaching FL250 over the English Channel the flight crew's attention was drawn to a "hot smell" coming from the air conditioning vents. The commander and the first officer checked the pack duct temperature which was indicating 94°C (a normal reading would be 17°C). A few seconds later the cabin altitude started to increase. The cabin altitude climb rate exceeded the maximum indicated rate of 2,500 ft/min and the commander estimated it was between 4,000 and 6,000 ft/min. With very little time to troubleshoot he set the pressurisation control to manual and attempted to reduce the cabin altitude, but this had no effect. At this point the cabin altitude had increased to 10,000 feet so the flight crew donned their oxygen masks and initiated the emergency descent

procedure. During the descent the cabin altitude reached a maximum of 15,500 feet which resulted in automatic deployment of the passenger oxygen masks. The passenger oxygen masks in seats D, E and F in Row 2 became entangled and were unusable. The single passenger in that seat group was able to use a mask from an empty seat behind him. The aircraft levelled off at 10,000 feet and returned to Heathrow Airport.

Description of air conditioning system

The aircraft is equipped with two identical air conditioning systems referred to as pack 1 and pack 2. Each pack is capable of supporting the air conditioning and pressurisation requirements. The airflow to both packs is provided by bleed air from the engines. The hot bleed air enters the packs and is ducted to the temperature control valve (TCV) and the cooling system. The cooling system converts the hot bleed air into cold air. Variable opening of the TCV determines the amount of hot air that is mixed with cold air. The TCV can be controlled automatically via temperature selectors or manually via a hot/cold control knob.

Maintenance history

The aircraft had experienced a number of defects in both packs 1 and 2 between mid September 2003 and early November 2003. The defects included reports of: noisy packs, "hot smells", lack of flight deck temperature control, packs "surging" and "hunting", erratic pressurisation during descent, and a rapid rise in duct temperatures. A number of components were replaced during the troubleshooting including: coalescer bags, pack 1 flow control valve, pack 1 air cycle machine, pack 2 duct, pack 1 TCV, and pack 2 TCV.

On 26 October 2003 (three days prior to the incident) the flight crew shut down both air conditioning packs following a double pack 1 fault and pack 2 fault alert. The aircraft was flown unpressurised back to Heathrow for defect rectification. During the investigation a sense line on the pack 1 TCV was found to be leaking and so the TCV was replaced. The pack 2 TCV was also found to be "suspect" and replaced. During replacement, the pins in the airframe half of the electrical connector were found to be in poor condition and therefore a CFD (Carried Forward Defect) was raised for their replacement once spares became available. The intent of the CFD was for pack 2 to continue to be operated until spares were available but the wording of the CFD was ambiguous because it contained a reference to the Minimum Equipment List (MEL). The MEL permits operation with one pack inoperative and therefore the MEL reference in the CFD was interpreted as releasing the aircraft with pack 2 inoperative.

On 29 October 2003 the flight crew accepted the aircraft believing that pack 2 was inoperative. During the flight (which prompted this incident investigation), pack 1 failed. The connector defect on the pack 2 TCV was rectified and the pack tested satisfactorily. Troubleshooting of the pack 1 failure revealed that the flight deck temperature sensor ducting was adrift from its mounts. The duct was replaced and the system operated correctly when tested on the ground.

The aircraft was returned to service with both packs operational. During the next few days there were further reports of pack 1 defects. A number of additional components were replaced including relay K1816A and the flight deck air conditioning control panel. Following consultation with the aircraft manufacturer, additional wiring checks were carried out that revealed the flight deck temperature sensor was operating out of limits. The sensor was replaced and functional checks were carried out during an engine ground run. No further problems were reported following the sensor replacement.

Discussion

The operator's engineering staff carried out troubleshooting over an extended period using the Aircraft Maintenance Manual procedures. The original pack 1 pressurisation problem was probably caused by the faulty temperature sensor. Following the incident, the operator investigated the reasons behind the

ambiguous CFD entry which resulted in the aircraft's dispatch with pack 2 inoperative. The personnel involved were interviewed and instructed not to refer to the MEL in a CFD entry unless the aircraft was to be operated in accordance with the MEL.