

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 737-33V, G-THOO	
No & Type of Engines:	2 CFM56-3C1 turbofan engines	
Year of Manufacture:	1998	
Date & Time (UTC):	11 February 2012 at 1445 hrs	
Location:	London Gatwick Airport	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 6	Passengers - 140
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damage to right ram air duct turbofan and surrounding pipes	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	35 years	
Commander's Flying Experience:	8,813 hours (of which 3,184 were on type) Last 90 days - 81 hours Last 28 days - 21 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

During the climb the flight crew noted the sudden onset of airframe vibration. There were no abnormal engine or system indications but a smell of burning was reported in the cabin. The commander declared a MAYDAY and initiated a diversion back to London Gatwick Airport where an uneventful landing was carried out. The source of the vibration and burning smell was subsequently identified to be a failed bearing assembly in the right air conditioning pack turbofan.

History of the flight

After departure from London Gatwick Airport, while climbing through FL200, the flight crew became aware of the sudden onset of airframe vibration and

an accompanying "whining" noise. The engine indications were stable and all systems appeared to be operating normally. Cabin crew reported that the vibration and noise were noticeable throughout the aircraft, particularly so in the mid-cabin area and that the passengers were becoming alarmed.

On first contact with Brest ATC the aircraft was cleared to climb to FL330 but the co-pilot requested a level-off at FL290 due to a "slight technical problem". The air traffic controller approved the level-off and cleared the aircraft to proceed on its planned route.

After levelling off at FL290 the flight crew were

unable to identify the source of the vibration and the commander made the decision to return to Gatwick. The co-pilot declared a PAN with Brest ATC, advising of a “technical problem with one of our engines”. After a further exchange with ATC the aircraft was cleared to turn right to waypoint DIKRO. The flight crew discussed the situation, and approximately 2½ minutes after the initial PAN declaration, the co-pilot declared a MAYDAY. The flight crew declined further instruction to route to waypoint DIKRO, and instead initiated a direct route back to Gatwick. The controller then coordinated the aircraft’s descent and subsequent handover to London control.

Cabin crew at the rear of the aircraft subsequently reported a smell similar to that of burning rubber. The flight crew briefed the senior cabin crew member to prepare for a precautionary landing.

Upon selection of FLAP 1 at approximately 6,000 ft the vibration and noise ceased. An uneventful landing was made at Gatwick. After vacating the runway the Airport Fire Services carried out an external inspection of the aircraft and reported no evidence of any external problems. While this inspection was ongoing, cabin crew at the rear of the aircraft reported that the burning smell in the cabin had become stronger.

Whilst the commander was making a PA call to place the cabin crew on standby should an evacuation become necessary, the right PACK TRIP OFF light illuminated. The flight crew turned the right air conditioning pack switch off and consulted the QRH. The intensity of burning smell in the cabin reduced and the flight crew therefore concluded that it had been associated with the right air conditioning pack overheat. The aircraft taxied to the terminal where the passengers disembarked normally. A subsequent

internal inspection of the aircraft by the Fire Services revealed nothing unusual.

Aircraft examination

Inspection of the aircraft by the operator’s engineers determined that the bearing assembly on the turbofan shaft within the right air conditioning pack had failed. There was evidence the impeller blade tips had rubbed against the turbofan casing. The turbofan had detached from its mounts and the turbine air duct was split. The operator sent the turbofan and turbofan valve to a repair facility for strip examination.

Aircraft information

Relevant defects

On the day prior to the incident a defect was raised in the technical log because the right ram air inlet door was indicating fully open throughout the flight. The B737 Dispatch Deviations Guide (DDG) permits continued operation if the ram air inlet door is locked open for the flight. The associated maintenance actions also require the electrical connector to the ram air actuator to be disconnected and the electrical supply isolated. This was accomplished on 11 February and the aircraft operated two further sectors in this configuration prior to the incident flight. The defect recurred after the incident and was finally resolved in late April 2012 after extensive troubleshooting.

Air conditioning pack turbofan servicing

A turbofan oil service is required every 2A Check (250 hours) and this was last carried out during a maintenance input approximately one month prior to the incident. The turbofan had last been overhauled on October 2007.

Discussion

Air conditioning pack turbofan failure

In normal conditions the turbofan operates only during ground operation or in slow flight with the flaps extended. However, the sustained vibration during the incident flight suggests that the turbofan was operating during high speed flight. The aircraft manufacturer initially considered that this condition could arise if the electrical connector on the ram air actuator had remained connected when the ram air inlet door was locked open. As the connector had been isolated in accordance with the DDG, other potential anomalies with electrical relays and switches in the ram air system which could have accounted for this condition, were also considered. However due to the various maintenance interventions associated with the troubleshooting of the ram air door defect, it was not possible to determine the precise reason for this.

The cause of the airframe vibration was identified as the imbalance in the turbofan shaft resulting from failure of the bearing assembly. The associated burning smell was attributed to the turbofan impeller blades rubbing on the casing as a result of the imbalance. In this condition the turbofan was unable to provide adequate cooling for the right air conditioning pack, resulting in an overheat condition and the illumination of the right PACK TRIP OFF light.

The workshop examination concluded that it was likely that the turbofan bearing had run dry of oil as a result of oil leakage at the seals. However there was limited detail in the strip examination report and the operator considered that it was not possible to verify this. Nor was it possible to ascertain whether operation during high speed flight contributed to, or accelerated, the failure of the turbofan bearing assembly.

Air traffic control aspects

A review of the radio telephony recordings revealed that the first part of the transmission in which the co-pilot declared the PAN was blocked (most likely by a transmission from another aircraft). The controller was therefore initially unaware that a PAN had been declared. Taking into account the airspace and traffic density she planned to route the aircraft via waypoint DIKRO before handover to London control, but did not communicate this intention to the flight crew. Believing that the controller was not facilitating their request for an immediate return to Gatwick, the flight crew upgraded the PAN to a MAYDAY, in order to take responsibility for their own routing.

As a result of this incident Brest ATC Safety Department conducted a review to determine whether they could make any improvements to the way they handle emergency flights.