

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 777-200, V8-BLF
No & Type of Engines:	2 Rolls Royce Trent 892-17 turbofan engines
Year of Manufacture:	2000 (Serial no: 30869)
Date & Time (UTC):	27 December 2012 at 1140 hrs
Location:	Over Broxbourne, Hertfordshire
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 12 Passengers - 256
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to right engine thrust reverser assembly
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	56 years
Commander's Flying Experience:	17,052 hours (of which 1,539 were on type) Last 90 days - 152 hours Last 28 days - 51 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional enquiries by the AAIB

Synopsis

Whilst climbing through FL150 after takeoff from Heathrow Airport, the crew noticed a loud rumbling noise together with a small amount of vibration and observed an Exhaust Gas Temperature (EGT) exceedance on the right engine. Having performed all the appropriate drills, it appeared that all engine parameters were normal but the crew nevertheless decided to return to Heathrow.

Following an uneventful overweight landing, inspection showed that a large amount of the right engine inboard thrust reverser inner wall structure was missing and the engine nozzle was damaged. This was the fifteenth similar occurrence known to the manufacturer and a number of inspections and modifications were already in place to try to mitigate inner wall damage and

potential parts liberation. The aircraft manufacturer has advised that replacement of the thrust reverser inner wall will be required, and may be mandated, for all affected aircraft.

History of the flight

The aircraft had taken off from Runway 27L at Heathrow, destined for Dubai. During the climb at about FL150, the crew noticed a loud rumbling noise, a small amount of vibration and an EGT exceedance on the right engine. All memory and Emergency Checklist items were carried out and a review of the engine parameters showed both engines were within the normal range. Nevertheless, the commander decided to return to Heathrow as a precaution and a normal two-engined

approach and landing was carried out on Runway 27L. An emergency services Local Standby was initiated at the airport due to the overweight landing.

Upon examination, it was found that the right engine inboard thrust reverser half was missing a large amount of material from its inner wall and consequently, the exhaust nozzle had been damaged and was loosely attached (Figure 1). A considerable amount of the missing composite structure was recovered later that day from a property in Broxbourne, Hertfordshire. All parts, including the damaged reverser half, were despatched to the aircraft manufacturer for further examination.

Thrust reverser break-up history

This incident represented the fifteenth similar occurrence of Boeing 777 Trent engine thrust reverser break-up known to the manufacturer (the design and manufacture of the reverser is the responsibility of the airframe manufacturer). Approximately half of the events involved fracture and liberation of a portion of the reverser inner wall which can also result in consequential damage to the exhaust nozzle.

In June 2010, a similar incident to a British-operated Boeing 777-236, registration G-YMMP, prompted an AAIB Field Investigation which was reported in the AAIB Bulletin 10/2011. At that time it appeared that this was the tenth known event and various Service Bulletins (SB) which had been issued by the manufacturer were described, culminating in SB 777-78-0071 which was issued in late 2009. It is apparent that attention had been focussed on the effectiveness of the insulation blanket in protecting the composite structure from heat and the SB introduced a new thermal protection system. The modification had not been approved by EASA at the time of the incident



Figure 1

Right engine thrust reverser showing material missing from inner wall and dislodged exhaust nozzle

to G-YMMP. However, at the time of the incident to V8-BLF, it is understood that more than 60% of the affected fleet had been modified. Additionally, more than 50% of the fleet have incorporated an associated engine manufacturer's modification to a bleed vent.

The AAIB was also made aware of another case of inner wall collapse on a similar aircraft in the Far East on 7 January 2013, although this is not an AAIB investigation and no details are known.

Engineering investigation

V8-BLF was fitted with the later standard of insulation and was up-to-date with the various required inspections. However, it was found that one of the

four compression rods which carry the hoop stresses in the inner wall was not correctly engaging the receptor cups when the thrust reverser was closed (Figure 2). Because of this, the end of the compression rod had damaged the insulation blanket in that area, although no evidence of associated heat distress was found, as well as wear to the hanger brackets (Figure 3). The manufacturer reports that the cause for the misalignment and subsequent incorrect engagement has not been determined, but that investigation continues.



Figure 2

Receptor cup showing witness mark where compression rod has not engaged (Boeing picture)

Whilst an additional inspection has been required to inspect for evidence of disconnection or wear in the compression rods, the manufacturer has devised a programme of thrust reverser inner wall replacement for reversers, because existing non-destructive test techniques may not reliably detect previous thermal damage. They further advise that the Federal Aviation Administration may mandate inner wall replacement on all Rolls-Royce powered Boeing 777 aircraft.



Figure 3

No.1 compression rod and worn hanger plates (Boeing picture)