

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 747-436, G-BNLV
No & Type of Engines:	4 Rolls-Royce RB211-524G2-T-19 turbofan engines
Year of Manufacture:	1992 (Serial no: 25427)
Date & Time (UTC):	22 August 2013 at 2045 hrs
Location:	London Heathrow Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 17 Passengers - 257
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to APU and starter motor
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	57 years
Commander's Flying Experience:	25,000 hours (of which 10,000 were on type) Last 90 days - 240 hours Last 28 days - 80 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

Shortly after the APU was started on the ground, the APU starter motor suffered a catastrophic failure causing it to shear from its gearbox mounting flange. The failure allowed hot oil to be released; the oil ignited and caused a fire in the APU bay. The flight crew shut down the APU, discharged the fire extinguisher bottle and ordered a precautionary passenger disembarkation.

History of the flight

The aircraft was parked on stand at London Heathrow Airport and the APU had been running for about 5 minutes when the flight crew received an APU fire warning on the EICAS¹ display. The crew carried out the 'APU Fire' checklist actions which involved shutting down the APU and discharging the fire extinguisher bottle into the APU bay. A 'Precautionary Rapid Disembarkation' announcement was made and the passengers vacated the aircraft via the jetty to the terminal. The Airport Rescue and Fire Fighting Service were called to the aircraft and although there was no indication of fire at the rear of the aircraft, they sprayed water into the APU exhaust as a precautionary measure.

Footnote

¹ Engine Indication and Crew Alerting System.

Examination of the aircraft

When the APU bay doors were opened the APU starter motor was hanging from the starter feeder cables because its gearbox mating flange had sheared. Some internal parts of the starter motor, including the sprag clutch, had separated and were found on the APU bay doors. There was damage to the APU oil filter cluster mounts, some charring to instrument lines and blistered paint.

The starter motor and APU were removed for strip examination. The damage to the APU was found to have been caused by a catastrophic failure of the starter motor. The start contactor was examined and although an internal component had broken, the contactor was determined to have been fully functional and not a cause of the starter motor failure. A strip examination of the starter motor revealed that the shear neck between the motor and the sprag clutch had failed; in the operator's experience it would normally be the shear neck on the driveshaft that would fail. However, due to excessive internal damage the cause of the starter motor failure could not be determined, although this shear neck failure would be consistent with a seizure of the sprag clutch.

Operator's assessment of the cause

The operator determined that the starter motor had not disengaged after the start cycle, and this caused the catastrophic failure of the clutch housing and flange mount. The failure allowed hot oil to be released from the starter; the oil ignited and caused a fire. The cause of the starter motor's failure to disengage could not be determined. The start contactor was determined to have operated normally, but had been the cause of previous starter motor failures, therefore, as a safety precaution, the operator decided to embody the Boeing Start Contactor Service Bulletins applicable to all Boeing fleets. This is an optional modification which replaces the start contactors with a new design.