



power unit (APU) were shut down, and the co-pilot advised ATC of the situation. At the time that the instruction to evacuate the aircraft was given, the emergency briefing to the passengers had just been completed. The evacuation was initiated promptly and estimates indicate that it was completed in under 60 seconds.

Prior to the request for fire cover, at 1134 hrs an inbound Boeing 747 flight crew had reported an engine shut down and Heathrow ATC had initiated a full emergency response. A full turn out of fire appliances were in position adjacent to runway 09L by 1137 hrs. When, at 1148 hrs, the call for fire cover in Bravo cul-de-sac was received, four appliances were ordered to move from their positions near the runway and attend the scene. They arrived within a minute (logged at 1149 hrs), by which time the emergency evacuation was well under way. It was ascertained from the aircraft Commander that the cause for alarm was a suspect fire in No. 1 engine, and a fire crew was deployed to cover that engine. A second crew was deployed to carry out a search of the aircraft to ensure that all passengers and crew had evacuated the aircraft.

The evacuation took place using the four main doors, the two overwing exits on the left side and the forward overwing exit on the right. All four door exit slides were deployed by the cabin crew and operated normally. The overwing exits were removed by passengers on their own initiative. These exits were placed on the cabin floor between the seat rows and do not appear to have impeded the overwing evacuation. All passengers were escorted by ground staff back into the terminal building where they were checked for injuries. Four passengers reported minor bruising but declined medical treatment; two passengers were treated for minor injuries at the Heathrow Airport Medical Centre and then discharged; and one passenger, who was in some discomfort, was transferred by ambulance to Ashford hospital where she was found to have suffered a fractured ankle. Due to a communications problem whilst the alerting procedures were being initiated, this passenger was kept waiting for about 30 minutes from the time of the accident until the arrival of the ambulance. One further passenger reported pain in her left leg which she intended having X-rayed at a later date.

Emergency services at Heathrow Airport are provided by the Airport Fire Service, the London Fire Brigade, the London Ambulance Service and the Airport Police. When an alarm is raised by Heathrow ATC, current procedures require that the Heathrow Fire Service alert the London Fire Brigade and London Ambulance Service. Civil Aviation Publication (CAP) 168 -(Licensing of Aerodromes)- requires that:-

"A vehicle suitable for use as an ambulance and manned by appropriately trained staff is required at aerodromes which are Rescue and Fire Fighting Category 4 and above, where the normal journey time for the local authority ambulance service to the aerodrome exceeds 15 minutes."

There are no ambulances manned by appropriately trained staff permanently stationed and on readiness at Heathrow Airport, as a service is provided by the London Ambulance Service. Past experience has shown that ambulances from the London Ambulance Service almost invariably reach the Airport within 15 minutes of the initiation of an alarm. The late arrival of the ambulance called to this accident was the result of a communications problem. Call out procedures and reaction times are the subject of close liaison between the Airport Authority and the London Ambulance Service and are under regular review. In consequence no formal safety recommendation has been made.

### **Engineering examination**

The air driven starter for the No. 1 engine and its associated start valve were removed from the aircraft. The start valve, which appeared undamaged and was in the closed position, was subjected to a functional check which proved to be satisfactory. The air driven starter was found to be seized and had black oily deposits within the exhaust duct and on the external casing. There was no evidence of any fire associated with the oily deposits, nor was there any evidence of fire or excessive temperatures on the adjacent airframe or systems. The air driven starter was returned to the manufacturer for investigation. Replacement units were fitted to the aircraft following which the air start motor and valve, start switch, N2 speed cut-out function and the "Start Valve Open" indicator were found to function normally.

The manufacturer's investigation of the air driven starter revealed that it was of an early design standard and not fitted with an oil contents sight glass, which made it difficult to inspect the oil level. Later units are fitted with a sight glass and also contain significantly more oil. Strip examination of the starter showed that about half of the oil contents had been lost and the oil remaining was very black. The oil and oily deposits on the casing were analysed and showed that the oil was of the correct specification. Hardness tests on the casing were normal, providing further evidence that no fire had occurred. A bearing in the turbine assembly had failed at high temperature and this had allowed the turbine to move aft, disengaging from the gearbox and making contact with the casing. The oil seal at the exhaust end of the starter was destroyed, however this was a result of the bearing failure and did not necessarily indicate a seal defect. This mode of failure is commonly seen in the event of loss of lubrication. Metallurgical examination of the bearing did not reveal any pre-existing material defects.

The starter had been fitted to the engine in September 1989. In December 1990 it was removed for investigation for oil leakage and returned to the manufacturer. No fault was found. These starters are susceptible to loss of oil contents when stored in a vertical attitude. This is not normally of concern as the units are shipped dry from the manufacturer, however there is no indication on the packaging of a recommended method of storage. The manufacturer is aware of this potential problem, and is

considering the introduction of additional packaging labels or placards. As the starter is fitted to the aircraft in a horizontal attitude, this would not account for the reported loss of oil contents.

The starter was returned to stores and was re-fitted to 'MF' in September 1991. Subsequently the starter had operated without recorded defects. It was subject to oil and chip detector inspections every 300 hours; the last inspection being recorded on 2 March 1992. The next inspection, which included an oil change, was due on the night of the accident.

The passenger evacuation drill on the flight deck requires that the engine and APU fire warning switches are overridden, pulled and rotated. These actions, which ensure that the engines and APU are shut down and their associated fire bottles discharged, were carried out prior to the evacuation order. On initial examination after the accident it was noted that the fire bottle indicator for the APU had not popped. The bottle was removed and weighed, and its weight corresponded to the discharged condition. It was concluded therefore that the indicator had failed to operate when the bottle had discharged. The two main engine bottles, and their associated indicators had operated normally.