

# AIB Bulletin

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No: 2/84

Ref: EW/A301

**Aircraft type and registration:** Boeing 747-B G-BDXB (multi-jet public transport aircraft)

**Year of manufacture:** 1977

**Date and time (GMT):** 11 May 1983 at 1650 hrs

**Location:** Johannesburg Airport

**Type of flight:** Public transport

**Persons on board:** Crew — 16                  Passengers — 213

**Injuries:** Crew — 2 (minor)      Passengers — 4 (serious), 13 (minor)

**Nature of damage:** No. 4 engine damaged by fire. 2 escape slides damaged during evacuation

**Commander's Licence:** Airline Transport Pilot's Licence

**Commander's Age:** 40 years

**Commander's total flying experience:** 9046 hours (of which 870 were on type)

When the crew arrived at Johannesburg Airport for a night flight to Nairobi they were aware, from contact with the incoming crew at the hotel, that there had been a problem with No. 4 engine on shut down. The engine had continued to run for some time after the start lever had been selected to 'Cut-off' and the crew were of the opinion that the high pressure fuel shut off valve (HPSOV) had failed to close and that the engine had continued to run until the fuel in the pipeline downstream of the low pressure shut off valve (LPSOV) had been used.

The HPSOV is actuated by a 28 v motor and can be motored to open and close by the operation of the start lever on the flight deck, and it can be closed by the operation of the fire switch for that engine. The rectification action taken by the ground engineers at Johannesburg had been to lubricate the electrical connections at the start lever and to carry-out a start/stop cycle on the engine. The HPSOV was then checked and found to be in the correct, closed position.

This Bulletin contains facts relating to the accidents which have been determined up to the time of issue. This information is published to inform the public and the aviation industry of the general circumstances of the accidents at the preliminary/stage and must necessarily be regarded as tentative and subject to alteration or correction if additional evidence becomes available.

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ISSN 0309 - 4278

The outgoing crew were aware of this rectification action, but they found the report made by the incoming crew in the Technical Log to be ambiguous in that it apparently referred to an indicator light for the HPSOV that was not fitted to this aircraft. They therefore decided to reassure themselves that the LPSOV was functioning correctly. The start lever was operated and a sequence of lights was observed showing the correct operation of the LPSOV. It is probable that the HPSOV ran 'Open' during this test and then failed in this position. There was no warning on the flight deck of this failure which could only be detected by a physical examination of the HPSOV inside the engine cowling. No engineer's inspection of this valve was requested by the crew. The commander decided that when he was given ATC clearance to start the engines, a normal start would be carried out on No. 4 engine followed by a normal shut down to check the functioning of the complete system. This intention was communicated to the ground engineer.

After the passengers had boarded the aircraft and the steps had been removed, the start was commenced with engine No. 4. The crew reported that as soon as the start lever was selected to 'Idle' at 22% N3 rpm, there was an instantaneous light up and the EGT increased rapidly. By the time that the N3 had risen to 25% the EGT was already at 300°C, so the flight engineer advised the commander to cut the engine. The flight engineer continued to motor the engine, but the EGT continued to rise although the commander had selected the start lever to 'Cut-off' and the LPSOV had closed. The ground engineer reported that the engine was on fire and the co-pilot confirmed that there was a visible fire around the engine. When the EGT reached 500°C the commander called for the fire switch to be operated as an alternative way of closing the HPSOV. However, this had no effect on the HPSOV but caused the high pressure air supply to the starter motor to be shut off and the engine started to run down. As the EGT continued to rise the commander decided that the fire was out of control and called for the engine fire extinguisher to be discharged and the fire drill completed.

The commander then made an announcement on the passenger address (PA) system for the 'Cabin Services Officer to report to the flight deck'. This is a company procedure for alerting the cabin crew to a potential emergency situation; on receipt of this call the cabin crew cease any passenger service and proceed to their evacuation stations and await further instructions. The commander was informed that the fire was further intensifying and so he ordered the evacuation from the left hand side of the aircraft i.e. the side away from the fire. With the commander's agreement, the co-pilot activated the evacuation alarm signal.

At this stage of the flight the evacuation slides had not yet been selected to the automatic operation position but, in fact, the cabin crew selected the slides to 'automatic' prior to opening the doors. All the doors were opened on the left hand side together with No. 2 door on the right hand side; the cabin crew member at that position had not heard the commander's instruction to open the left hand doors only. The slide at door 4 Left, just aft of the wing, failed to inflate and the slide at door 3 Left, the overwing exit, flew upwards and lodged over the top of door 4 Left rendering the slide unusable. The evacuation commenced from doors 1, 2 and 5 on the left hand side and door 2 on the right hand side. There was no passenger panic at this time, indeed it was reported that because few passengers were aware of the fire the cabin crew had some difficulty in making the passengers react quickly enough. It was also reported that the passengers were reluctant to leave their hand baggage behind. After about 20 passengers had left through the No. 5 Left door the slide suddenly deflated. There were now no serviceable slides left at the rear of the aircraft on the side away from the fire and the passengers were directed forward to the remaining exits. The fabric of the slide at door 2 Right then split, resulting in injuries to some passengers. This just left two operable slides in use so the cabin crew member at door 1 Right, on his initiative, deployed the slide at that position since he could see that the fire was away from that door.

The flight deck crew completed those parts of the evacuation drill that they felt to be relevant to this emergency situation and left the aircraft after checking that all the passengers had left. The exact evacuation time is not known but an unsubstantiated report claimed that the 213 passengers and 16 crew left the aircraft in 1 minute 50 seconds. Some passengers received minor injuries during the evacuation, but four passengers were more seriously injured when the slides at doors 2 Right and 5 Left ripped or deflated. The engine fire was extinguished by the Airport Fire Service.

No engine parameters were available from the Flight Data Recorder as it was not required to be switched on until after all the engines were started. The Cockpit Voice Recorder had been in operation but no attempt was made to isolate the equipment by the circuit breaker before electric power was restored to the aircraft after the accident, and so the recording of the engine start became erased.

The HPSOV was examined and found to be in the 'Open' position. Subsequent examination showed that the tail bearing of the actuator motor had seized due to lack of lubrication and corrosion. The actuator had been last overhauled by the operator in January 1983 and had since operated for 781 hours and 133 cycles. During the five weeks preceding the accident defective operation of this valve had been recorded on three occasions, it had once been 'deferred for further evaluation' and twice 'noted for information'. The current maintenance instructions, however, required that an intermittently defective valve be changed when the aircraft returned to London (Heathrow). Development has been proceeding with an improved valve actuator which will progressively replace those in current use.

The escape slide at door 4 Left, which failed to inflate, was examined. It was found that the raft mooring line had not been anchored correctly, this line had been ingested into the slide inflation turbo-fan causing the turbine blades to separate and damage the inflation tubes.

It could not be established why the slide at door 3 Left failed to deploy correctly; after the accident it was removed from the aircraft, repacked and then operated again. This time it performed correctly. It is possible that a tail wind may have been a contributory factor causing the over-wing ramp to balloon into the air, although it is believed that this wind was only about 6 knots.

The serious passenger injuries occurred when the fabric of two of the slides became torn and, although the reason for the tearing is not known for certain, it is believed that it was caused by sharp heeled shoes. While it is clearly desirable that passengers should be able to retain their footwear during an emergency evacuation, until improvements can be made to the tear resistance of the fabric, the operator now requires that passengers remove high-heeled shoes before using the slides.

The operator has also amended the flight crew procedures in the event of a tailpipe fire. The previous procedure called for the engine fire drill to be carried out 'if the fire continues'. The revised procedure emphasises the need to maintain the air supply to the starter motor so as to keep the engine rotating until the fuel is exhausted. The engine fire drill will not now be carried out unless there is a specific fire warning as indicated on the flight deck by the warning light or fire bell.