AAIB Bulletin No: 4/94 **Ref: EW/C93/11/3** **Category: 1.1**

INCIDENT

Aircraft Type and Registration:	DC-9-32, G-PKBM	
No & Type of Engines:	2 Pratt & Whitney JT8D-9A turbofan engines	
Year of Manufacture:	1974	
Date & Time (UTC):	16 November 1993 at 1718 hrs	
Location:	Stand B4, London Heathrow Airport	
Type of Flight:	Public Transport	
Persons on Board:	Crew - 6	Passengers - 76
Injuries:	Crew - None	Passengers - 6 Minor
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	42 years	
Commander's Flying Experience:	8,350 hours (of which 3,588 were on type) Last 90 days - 219 hours Last 28 days - 77 hours	
Information Source:	AAIB Field Investigation	

Sequence of events

The aircraft had completed a scheduled flight from Leeds Bradford Airport to London Heathrow Airport. As it approached Stand B4, the left engine was shut down; when it came to a halt on the stand the parking brake was applied. As the auxiliary power unit (APU) was unserviceable, the commander had requested that ground power be available, consequently when he saw the ground engineer approaching the aircraft with the ground power connector he shut down the right engine. The engineer found that there was insufficient cable to reach the aircraft socket and stepped back to release some more. As he was doing so the right engine wound down, the generator came off line and the aircraft was left with internal battery power only. The commander immediately selected Emergency Power to 'ON'.

As the ground engineer again attempted to connect the ground power, he noticed a large amount of smoke coming from the right engine. He removed the ground power connector, dropped it in its stowage box; he then went round to the left side of the aircraft and banged on the fuselage to attract the commander's attention. When the commander opened his side window, the engineer told him that he

thought there was a fire in the right engine. By this time smoke had drifted forward and was visible from the flight deck; the commander decided to evacuate the aircraft. The Evacuation Procedure checklist was actioned and the commander made the evacuation PA announcement. Both fire extinguisher bottles were discharged into the right engine. At 1719 hrs, the first officer informed Heathrow Ground that the aircraft had a fire on Stand B4; the controller initiated the appropriate ground emergency procedures. The first officer confirmed that the Evacuation Procedure had been completed and, with the flight deck fire extinguisher, went to the cabin to assist the evacuation.

Meanwhile, when the aircraft came to a halt, the cabin staff had disarmed the escape chutes and the passengers had begun to unfasten their seat belts and collect their belongings. Being, by now, on battery power only, it was relatively dark in the cabin. When the number one cabin attendant opened the main passenger door, she heard someone on the ground shout that there was a fire and she saw some smoke. The first officer entered the cabin at about this time and it was apparent to him that the evacuation was not going ahead. He told the number one cabin attendant that the commander had ordered the evacuation. It occurred to her that this had not come out over the cabin PA loudspeakers and so she made another announcement from the forward PA station while the first officer returned to the flight deck and informed the commander who repeated the evacuation order; this time it came out on the cabin PA system.

As the jetty had started to approach the aircraft, the ground engineer signalled to the operator to stop. He then noticed that the passenger door was open and released the airstairs; however, shortly afterwards the front right service door escape chute deployed and so, realising the aircraft was being evacuated, he restowed the airstairs and went to his office to get help.

The number one cabin attendant tried to re-arm the slide on the forward passenger door. To achieve this, it was necessary to close the door; although it would not close completely, she managed to arm the slide but then found that she could not open the door. The first officer, on his return to the cabin, also tried but his efforts were unsuccessful.

A flight services manager was on board carrying out a routine check on the cabin attendants; she assisted in the evacuation and also made a PA announcement to back up that made by the number one cabin attendant.

The number two cabin attendant opened the rear bulkhead door but could not locate the tailcone release handle in the relative darkness of the tailcone area. A cabin attendant who was travelling as a passenger came to her assistance, located the handle and released the tailcone. The escape chute was deployed but, unfortunately, the detached tailcone had come to rest directly in line with the end of the chute. The non-operating cabin staff member exited first to clear it out of the path of escaping passengers.

The time scale in which this occurred was short and the front right service door, the rear door and all four over wing exits were successfully used for the evacuation which was carried out in an orderly and timely manner, with only minor injury to six of the passengers being reported. The Emergency Services attended shortly after the evacuation was completed.

Flight recorders

No relevant data was obtained from the flight recorders; power to the flight data recorder was lost when the left engine was shut down and power remained on the cockpit voice recorder after the incident which caused the recording of the event to be over written.

The right engine

Some 5 to 7 minutes after the incident fuel was observed to be draining from the right engine combustion drain and had formed a pool approximately 2 feet in diameter on the ground underneath, fuel vapour was also seen to be emerging from the engine intake. Inspection revealed that there had not been a fire, but that the white 'smoke' observed had been unburnt fuel vapour which had been formed by fuel entering the hot combustion chamber after the engine had been shut down.

There are two ways that fuel could have entered the combustion chamber; the fuel/ignition lever could have been opened momentarily, or a faulty fuel pressurising and dump (P&D) valve could have leaked. The P&D valve is designed to:

> Filter fuel before delivery to the burners
>
> Deliver fuel to the primary burners, and when they are pressurised, to deliver fuel to the secondary burners
>
> Below a pressure of 11.5 psi cutoff the fuel supply and vent the primary and secondary fuel delivery chamber (to prevent fuel reaching a hot combustion chamber after engine shutdown)

The P&D valve was tested in situ and then removed and examined by the overhaul agency, no relevant defects were found. The right-hand engine was also tested in situ without any defects becoming apparent, it was removed and despatched to an overhaul agency for further examination.

Neither the commander nor the first officer had any recollection of the right fuel/ignition lever being moved out of the closed position, even momentarily, after the engine had been shut down.

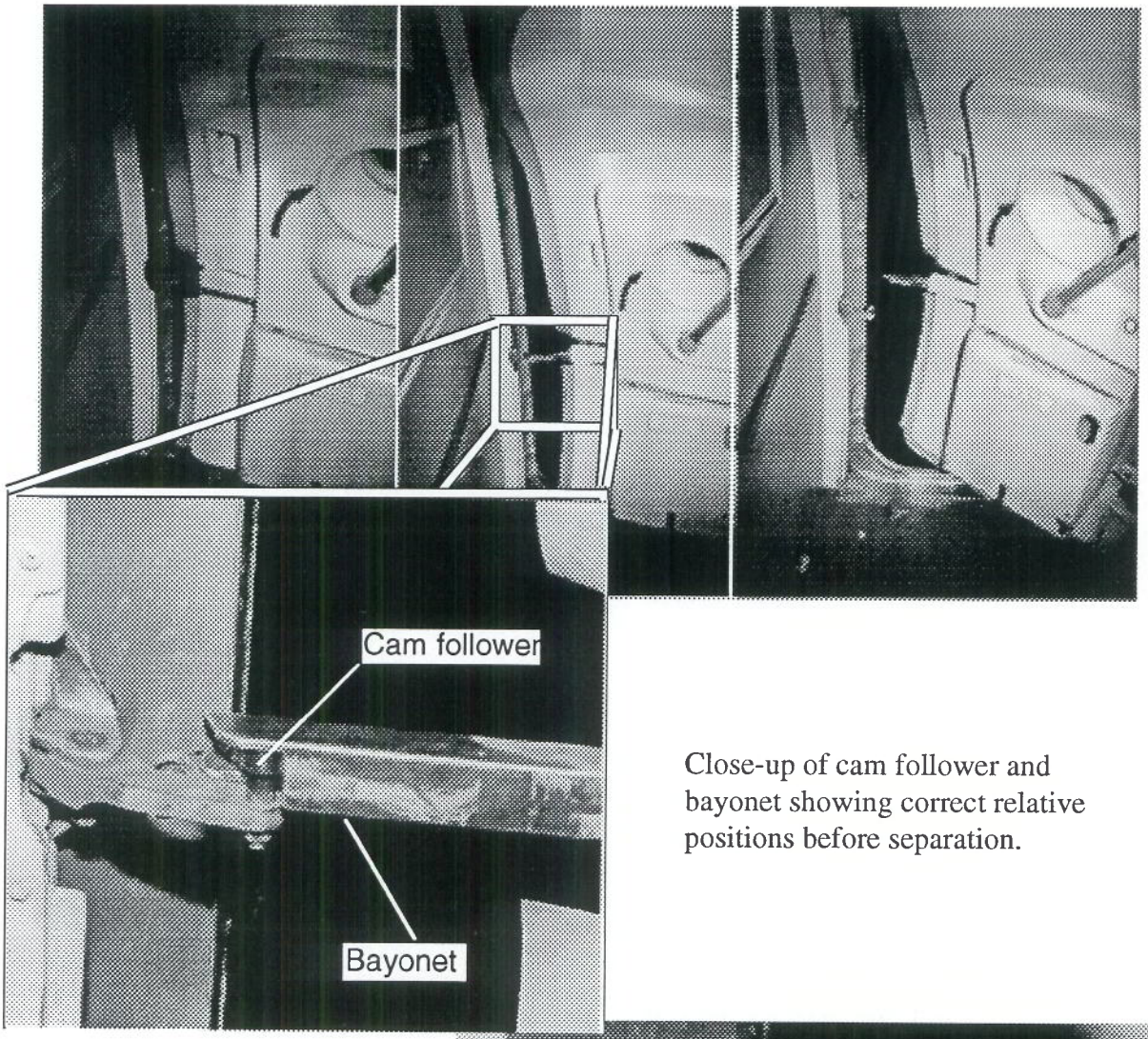
The forward passenger door

An interlock mechanism on the forward passenger door prevents its closure when the airstairs are not stowed. This would have come into operation when the ground engineer extended and then stowed the airstairs; while this was occurring the cabin attendant would not have been able to close the door to re-arm the escape chute. The company flight safety manager has recommended that engineering and ramp personnel should not operate the airstairs unless requested to do so by the aircraft crew.

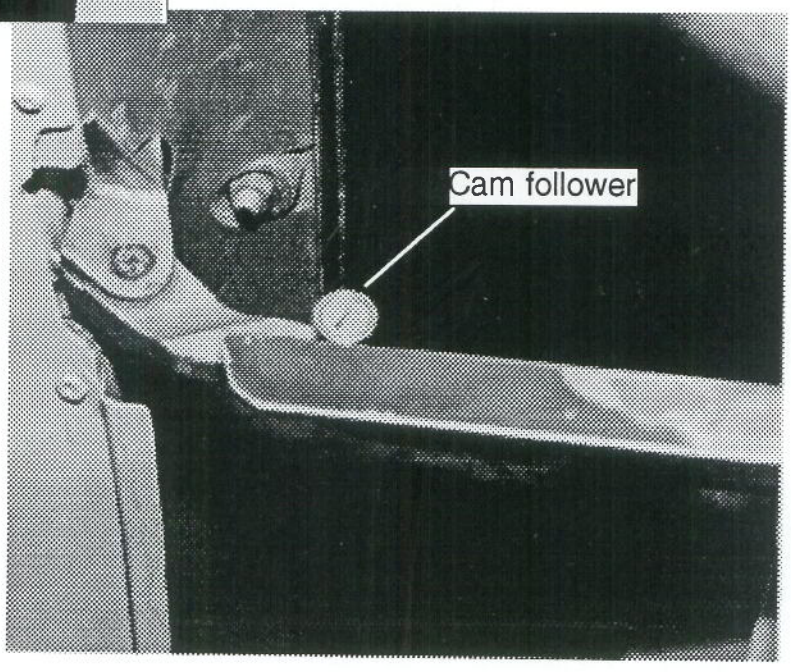
Operation of the door mechanism demonstrated that if the door were opened quickly it was possible to achieve slight overtravel at the end of the forward travel. This could result in the door bouncing back and cause the bayonet bar to end up with its blind side against the spigot, thus preventing the door opening further.

Door Opening Sequence

The passenger door is opened by rotating the inner handle clockwise. As the handle is rotated the door moves inward and forward, when the door reaches full forward travel it is then rotated and pushed outward. During this process a cam follower attached to the door jamb disengages from a guide fitted to the door (the 'bayonet').



Close-up of cam follower and bayonet showing correct relative positions before separation.



Bayonet positioned on the wrong side of the cam follower, preventing door from opening.

The PA system

The commander's first PA announcement was not heard in the cabin, however, the second was. The PA system was checked and, although the gain of the PA amplifier was found to be low, the system did function at all stations. It was also checked, on battery power, with the airstairs running; the PA functioned normally.

The telephone handset on the flight deck was not connected to the cabin PA system; this differs from the flight simulator used by the crew. The possibilty was considered that the commander had, in the heat of the moment, attempted to use the handset.

Another possibilty considered was that the commander had made a wrong selection on his audio selector panel; no reports were received that the announcement had been heard on a radio frequency.

No evidence was found to support or refute either of these possibilities, however, the company flight safety manager has recommended that the flight simulator telephone be modified to reflect the aircraft mode of operation. The training department has also been asked to advise crews of the importance of careful audio selector panel selections, particularly in emergency situations.

Rear bulkhead door emergency lighting

The rear bulkhead door exit sign was intermittent when tested after the incident and so a new unit was fitted. Cabin staff have been reminded of the requirement to carry an emergency torch when evacuating the aircraft at night.

Human factors

When the initial report was made to the commander, the ground engineer used the word "fire"; with no other evidence available to him, the commander quite correctly ordered an evacuation. There was, in fact, no fire, only unburnt fuel vapour which manifested itself as a white "smoke"; this was what the engineer actually saw and had it been reported to the commander in those terms it may not have been necessary for the evacuation to have taken place.

The personnel involved in the incident were brought together by the company flight safety manager for a group discussion; the AAIB was invited to join this forum. The discussion was on an informal basis and participants were encouraged to express their opinions about the incident itself and the interaction of the people involved; both operational and administrative matters were discussed. The group put forward suggestions for improving the response to such an incident at both operating and management

levels. It was recognised that this was a very worthwhile exercise which contributed not only to air safety but may also have helped the aircraft crew in particular, to come to terms with the psychological trauma which exists in the aftermath of any incident or accident.