

INCIDENT

Aircraft Type and Registration:	Boeing 747-400, 9M-MPL	
No & Type of Engines:	4 Pratt and Whitney 4056 turbofan engines	
Year of Manufacture:	1998	
Date & Time (UTC):	18 May 2006 at 0425 hrs	
Location:	Over the Thames Estuary, England	
Type of Flight:	Public Transport (Passenger)	
Persons on Board:	Crew - 20	Passengers - 348
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	47 years	
Commander's Flying Experience:	13,493 hours (of which 2,804 were on type) Last 90 days - 72 hours Last 28 days - 38 hours	
Information Source:	AAIB Field Investigation	

Synopsis

A passenger saw what appeared to be small flames coming from between the No 1 engine exhaust shroud and its pylon; the flight crew were informed. The engine indications were normal; nevertheless, the commander decided to shut the engine down. The 'flames' continued until the aircraft was slowed for an approach. The aircraft landed uneventfully. Investigation revealed that a rubber seal had torn, and that when agitated by the air flow it gave the appearance of flames. There had been eleven previous events reported on similar aircraft.

History of the flight

The aircraft departed Kuala Lumpur on a scheduled flight to London (Heathrow), with a flight crew of two captains and two co-pilots. One captain and co-pilot

operated the aircraft for its takeoff, climb and the early part of the cruise; this captain was designated as the commander for the flight. The other captain and co-pilot flew the cruise portion of the flight until a little more than one hour from landing when the original crew resumed control of the aircraft.

The flight was uneventful until shortly before the aircraft commenced its descent towards London. A passenger observed what appeared to be orange flames between the No 1 engine exhaust shroud and its pylon. The passenger pointed this out to one of the cabin crew, who immediately informed the flight crew via the interphone. The 'cruise' co-pilot was sent to the rear of the passenger cabin to look at the engine through a window. He also

saw what appeared to be flames, and went back to the flight deck to report this. Having discussed the situation, the 'cruise' co-pilot returned to the rear of the passenger cabin and remained there, in interphone communication with the flight crew, for the remainder of the flight. The 'cruise' captain also went to the passenger cabin to assess the situation, before returning to the flight deck where he confirmed the co-pilot's report.

The flight crew and the 'cruise' captain evaluated all of the available information, including the engine indications, which were normal. As the aircraft descended, they shut down the No 1 engine, and pulled the fire handle (in order to shut off the fuel and hydraulic connections to the engine and isolate it electrically). As there were no flight deck indications of an engine fire, they did not discharge the fire extinguisher bottles.

After the engine had been shut down, the 'cruise' co-pilot reported that the 'flames' appeared to remain, and when the aircraft decelerated from 290 kt to 250 kt, they appeared to increase slightly.

The flight crew informed ATC that they had a problem and that there was a "ONE FOOT FLAME" from the No 1 engine. They requested a priority landing with the fire service placed on standby. The controller explained that the flight crew would need to declare an emergency in order to be given priority; the flight crew declared a 'PAN' and the aircraft was then radar vectored for a priority landing. When Flap 5 was selected, the 'flames' appeared to extinguish. The commander completed an uneventful automatic approach and landing, and the aircraft was inspected by the airport fire service before taxiing to the terminal buildings.

Communications

Radio communications between the flight crew and ATC were analysed. Although the flight crew did inform ATC of the aircraft's problem, they did not use the stipulated phraseology¹; nonetheless, the communication was clearly understood by ATC. Later, the flight crew did not inform ATC when the 'fire' had ceased, nor that the No 1 engine had been shut down. Given the benign nature of the problem, and the fact that the landing was uneventful, there was no detrimental outcome of these omissions.

Recorded data

The aircraft was fitted with a Cockpit Voice Recorder (CVR) and a Flight Data Recorder (FDR). The CVR recorded the last two hours of cockpit audio. However, despite timely requests to isolate power from the CVR, the useful recordings were overwritten by the time that the AAIB attended the aircraft. The FDR recorded over 53 hours of data.

The aircraft took off at 1557 hrs on 17 May 2006 and landed at Heathrow at 0442 hrs on 18 May 2006. At 0417 hrs, the aircraft commenced its descent from FL360. The autothrottle was in VNAV mode and the thrust levers were retarded to facilitate the descent. The parameters for the No 1 engine indicate that it was shutdown at 0429 hrs with the aircraft at a pressure altitude of approximately 10,000 ft.

There were no indications of an engine fire, engine overheat or any other engine abnormality.

Footnote

¹ CAP 413, the *Radiotelephony Manual*, gives the correct phraseology for declaration of urgency ('PAN') or emergency ('MAYDAY')

Engineering examination

Initial examination of the rear lower pylon area did not reveal any evidence of burning or of fluid leaks. The area, both externally and internally, showed evidence of a dark 'sooting' type of staining that was dry and of a long-term nature. There was no evidence of hydraulic fluid loss from the aircraft reservoirs nor a fuel loss or fuel tank imbalance. The aircraft's hydraulic and fuel systems were 'powered up' and no fluid leaks were observed. The No 1 engine was 'motored' with the fuel selected off and on and no fluid leaks were observed. All the pylon panels, including the upper wing panel, and the engine cowls, including the 'C' duct, were opened and no evidence of any fluid leaks was seen.

A telephone call from the aircraft manufacturer's Safety Services Department informed the AAIB of

a number of previous incidents of reported airborne fire in the area of the lower rear pylon and the engine tail pipe. In each case extensive examination on the ground found no evidence of a fire having taken place but that the inboard 'sacrificial' bulb seal between the lower rear area of the pylon and the tail pipe had torn/failed. These bulb seals, part number 313T3371-21, are circular in cross-section, hollow, approximately 1.25 inches in diameter, 14 inches long, and made from flame-orange-coloured, high temperature, silicon rubber. Examination of the aircraft involved in this incident showed that the bulb seal on the inboard side of the No 1 lower rear pylon (Figure 1) had torn/failed along its fore/aft axis allowing the outer section to protrude into the air stream around the pylon.

Following replacement of the engine cowls and pylon panels the aircraft was taken to an isolated area of the

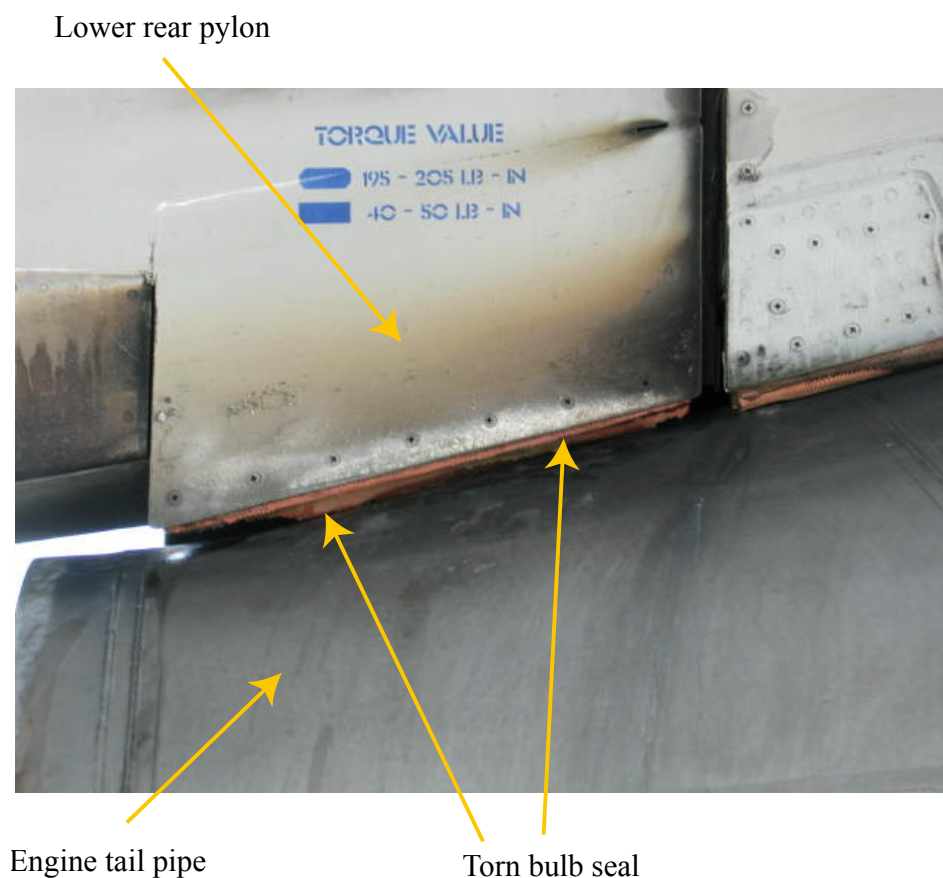


Figure 1

airport where low and high engine power runs were carried out. During these engine runs no fluid leaks were noted and all flight deck indications were normal. An observer was placed in the seat in the cabin from where the 'cruise' co-pilot observed the flames during the aircraft's descent and he noted that during the full power run the torn bulb seal 'flapped' in the airflow in a way that could very easily be mistaken for a flame. This 'flapping' bulb seal was also seen by ground observers.

The torn bulb seal was changed and the aircraft returned to service with no further problems reported regarding airborne fires in the areas of the pylon tail pipe interface.

Previous history

In January 2002 the aircraft manufacturer issued 747-400-FTD (Fleet Team Digest)-54-02001, revised April 2006, alerting Boeing 747-400 operators with PW 4000 series engines to the possibility of torn/

damaged pylon tailpipe bulb seals being mistaken by passengers and flight crew members for flames as it fluttered in the air stream.

The FTD article advised operators of Boeing's efforts to find a suitable replacement for the orange/red seal that would be less likely to be mistaken for a flame. In March 2006, Boeing advised operators that a suitable 'brown' coloured replacement part for the orange/red seal had been identified, although production and retrofit incorporation had not yet been scheduled. Boeing recommended that operators inspect the affected area on a periodic basis and replace damaged seals.

In the light of the aircraft manufacturer's continuing review of this issue, together with the provision of an alternative 'brown' coloured seal, the AAIB does not see the need for any recommendation.