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**Air Accidents Investigation Branch****Aircraft Accident Report No: 1/2010 (EW/C2008/01/01)**

Registered Owner and Operator	British Airways PLC
Aircraft Type	Boeing 777-236ER
Serial No	30314
Nationality	British
Registration	G-YMMM
Place of Accident	London Heathrow Airport
Date and Time	17 January 2008 at 1242 hrs All times in this report are UTC

**Synopsis**

The Air Accidents Investigation Branch (AAIB) was notified at 1251 hrs on 17 January 2008 of an accident involving a Boeing 777-236ER aircraft registration G-YMMM at London Heathrow Airport. The investigation commenced immediately and the AAIB team consisted of:

Mr R Tydeman	Investigator-in-Charge January 2008 – October 2008
Mr R D G Carter	Investigator-in-Charge from November 2008
Mr P A Sleight	Engineering – Deputy IiC & Lead Engineer
Ms A Evans	Engineering – Chair Crashworthiness Group
Mr B D McDermid	Engineering – Chair Fuel and Fuel System Group
Mr S W Moss	Engineering – Chair Powerplant Group
Mr R Parkinson	Engineering – Chair Aircraft Group
Mr M W Ford	Flight Data Recorders – Chair Data Group
Mr A Severs	Operations – Lead Operations
Mr P E B Taylor	Operations – Chair Evacuation Group

In accordance with established international arrangements, the National Transportation Safety Board (NTSB) of the USA, representing the State of Design and Manufacture of the aircraft, appointed an Accredited Representative and was supported by a team which included additional investigators from the NTSB, the Federal Aviation Administration (FAA) and Boeing; Rolls-Royce, the engine manufacturer, also participated fully in the

investigation. The operator co-operated with the investigation and provided expertise as required. The Civil Aviation Authority (CAA) and the European Aviation Safety Agency (EASA) were kept informed of developments.

On 28 November 2008, a Boeing 777-200ER suffered an in-flight engine rollback; an investigation by the NTSB was initiated with Mr P A Sleight, from the AAIB, assigned as the UK accredited representative.

Prior to this Final Report the AAIB published an Initial Report, on 18 January 2008, a subsequent update on 23 January 2008, Special Bulletins on 18 February 2008 and 12 May 2008, and Interim Reports on 4 September 2008 and 12 March 2009.

Eighteen Safety Recommendations have been made.

Whilst on approach to London (Heathrow) from Beijing, China, at 720 feet agl, the right engine of G-YMMM ceased responding to autothrottle commands for increased power and instead the power reduced to 1.03 Engine Pressure Ratio (EPR). Seven seconds later the left engine power reduced to 1.02 EPR. This reduction led to a loss of airspeed and the aircraft touching down some 330 m short of the paved surface of Runway 27L at London Heathrow. The investigation identified that the reduction in thrust was due to restricted fuel flow to both engines.

It was determined that this restriction occurred on the right engine at its Fuel Oil Heat Exchanger (FOHE). For the left engine, the investigation concluded that the restriction most likely occurred at its FOHE. However, due to limitations in available recorded data, it was not possible totally to eliminate the possibility of a restriction elsewhere in the fuel system, although the testing and data mining activity carried out for this investigation suggested that this was very unlikely. Further, the likelihood of a separate restriction mechanism occurring within seven seconds of that for the right engine was determined to be very low.

The investigation identified the following probable causal factors that led to the fuel flow restrictions:

- 1) Accreted ice from within the fuel system<sup>1</sup> released, causing a restriction to the engine fuel flow at the face of the FOHE, on both of the engines.
- 2) Ice had formed within the fuel system, from water that occurred naturally in the fuel, whilst the aircraft operated with low fuel flows over a long period and the localised fuel temperatures were in an area described as the 'sticky range'.

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<sup>1</sup> For this report 'fuel system' refers to the aircraft and engine fuel system upstream of the FOHE.

- 3) The FOHE, although compliant with the applicable certification requirements, was shown to be susceptible to restriction when presented with soft ice in a high concentration, with a fuel temperature that is below  $-10^{\circ}\text{C}$  and a fuel flow above flight idle.
- 4) Certification requirements, with which the aircraft and engine fuel systems had to comply, did not take account of this phenomenon as the risk was unrecognised at that time.