



European Aviation Safety Agency

Water/Ice in Fuel - Research

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Background

✈ B777 G-YMMM

Registered Owner and Operator
British Airways

PLC

Aircraft Type Boeing
777-236ER

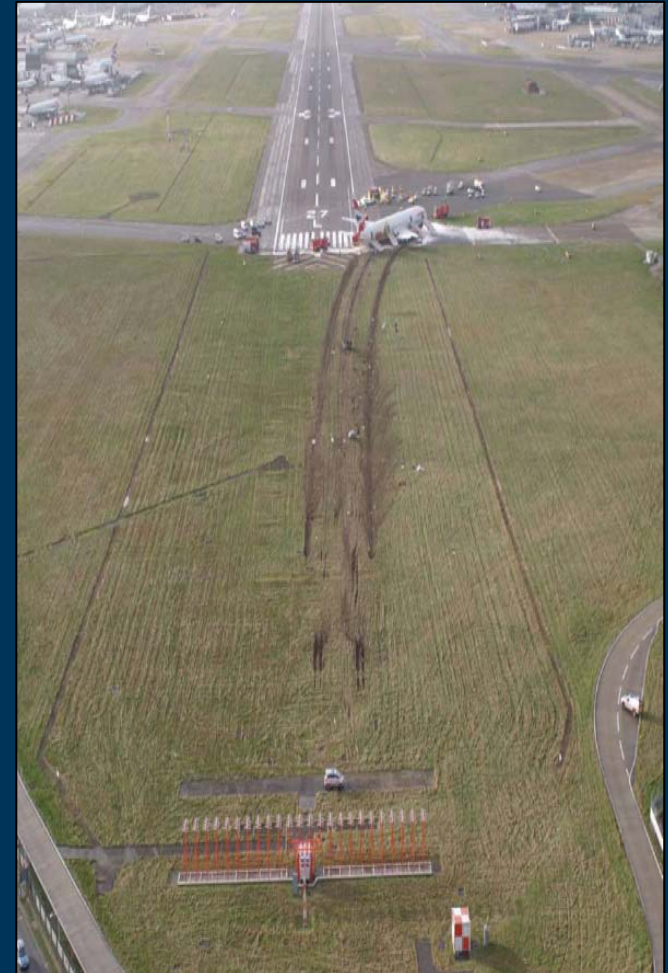
Serial No
30314

Nationality
British

Registration
G-YMMM

Place of Accident
London

Heathrow Airport





Background

→ B777 G-YMMM

- ✦ On approach, @ 720 ft : no response of RH ENG power increase and reduction to 1.03 EPR (Engine Pressure Ratio)
- ✦ 7s later, LH ENG power reduced to 1.02 EPR
 - **Loss of Airspeed**
 - **Touch down 330m short of paved runway**
- ✦ Reduction in thrust due to restricted fuel flow to both engines
 - **RH ENG : Restriction occurred on its FOHE (Fuel Oil Heat Exchanger)**
 - **LH ENG : Restriction most likely occurred at its FOHE**



Background

→ Probable Causal factors

- Accreted ice from within the fuel system released, causing a restriction to the engine fuel flow at the face of the FOHE, on both of the engines.



Figure 52

Ice collected on the face of the FOHE



Figure 53

Ice in the flexible hose located at the rear of the strut



Background

→ 3 AAIB Safety Recommendations related to water/ice in fuel research

✦ 2009-030 Review use of additives

✦ 2009-031 Conduct research on ice formation

✦ 2009-032 Conduct research on ice accumulation and release

Safety Recommendation 2009-030

It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency conduct a study into the feasibility of expanding the use of anti-ice additives in aviation turbine fuel on civil aircraft.

Safety Recommendation 2009-031

It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency jointly conduct research into ice formation in aviation turbine fuels.

Safety Recommendation 2009-032

It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency jointly conduct research into ice accumulation and subsequent release mechanisms within aircraft and engine fuel systems.



EASA Activities

→ Joint efforts with FAA

Recommendation	Leading Role	Supporting Role
UNKG-2009-030: "It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency conduct a study into the feasibility of expanding the use of anti-ice additives in aviation turbine fuel on civil aircraft".	FAA: Literature search/review in close coordination with USAF/WPAFB to summarize FSII performance at varying concentration levels. Also consult with OEMs and commercial operators of aircraft that are approved for use of FSII to review commercial operating experience and logistics issues.	EASA: Provide support as required.



EASA Activities

→ Joint efforts with FAA

Recommendation	Leading Role	Supporting Role
<p>-UNKG-2009-031: "It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency jointly conduct research into ice formation in aviation turbine fuels".</p>	<p>-EASA: <u>Literature search/review</u>: In coordination with major aviation fuel manufacturer, review data (literature) available.</p> <p>-<u>Laboratory testing</u> to be conducted on fuel samples on fuels from:</p> <ul style="list-style-type: none">-American flights-Russian flight-Chinese flight <p>-<u>Tests Analysis</u>: Water content, FAME (Fatty Acid Methyl Ester) contamination, Freezing levels. Comparison with specifications</p>	<p>-FAA: Provide input to EASA of laboratory analyses of samples from USA domestic landings (EWR, JFK, etc) of Chinese fuelings:</p> <ul style="list-style-type: none">•Fleet water concentration survey FAME contamination levels•Consult with US-based OEMs and oil companies for information on aviation fuel icing as required.



EASA Activities

✈ Joint efforts with FAA

Recommendation	Leading Role	Supporting Role
<p>-UNKG-2009-032: “It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency jointly conduct research into ice accumulation and subsequent release mechanisms within aircraft and engine fuel systems”.</p>	<p>-FAA: Scale-level testing in FAA environmental chamber to observe ice accumulation and shedding in representative aircraft fuel system components. Provide preliminary data to describe limitations of this testing and to identify any gaps in testing capability.</p>	<p>-EASA: Review preliminary data and gap identification from initial FAA testing and investigate a Call for Tender in early 2010 to conduct supplementary testing.</p>



EASA Activities

✈️ WAFCOLT - Water in Aviation Fuel under Cold Temperature Conditions

✦ Literature search/review

- With at least one major aviation fuel manufacturer, perform a survey of existing data (literature search) available on the presence and formation of ice in aviation fuel.
- definition of relevant tests, measurements and test procedures to observe the ice formation, to characterise the influence of key parameters:
 - » temperature ranges and cycles applied (rate of cooling),
 - » water content, role of contaminants (namely FAME), role of the dynamic,
 - » measure the mechanical properties of ice crystals produced (e.g. size, adherence,...).



EASA Activities

✈️ WAFCOLT - Water in Aviation Fuel under Cold Temperature Conditions

✦ Laboratory Testing

- **Shall consider parameters identified from the analysis of the existing literature or data and covering the following areas:**
 - » Water content and characterisation of water droplet (size-state);
 - » Jet fuel freezing levels
 - » Influence of the contamination by FAME (Fatty Acid Methyl Ester);
 - » Properties of ice crystals formed:
 - » Texture, shape and size of ice crystals, Adhesion to metal
 - » Crystal strength, Viscosity - stickiness



EASA Activities

✈ Ice Formation In Fuel – EASA Status

