



EUROPEAN AVIATION SAFETY AGENCY  
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE  
EUROPÄISCHE AGENTUR FÜR FLUGSICHERHEIT

# *Water/Ice in Fuel research Activities*

*R. Deletain*

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# Water/Ice in Fuel

## ➤ B777 G-YMMM

<b>Registered Owner and Operator</b>	<b>British Airways</b>
<b>Aircraft Type Boeing</b>	<b>777-236ER</b>
<b>Serial No</b>	<b>30314</b>
<b>Nationality</b>	<b>British</b>
<b>Registration</b>	<b>G-YMMM</b>
<b>Place of Accident</b>	<b>London Heathrow Airport</b>
<b>Date and Time</b>	<b>17 January 2008 at 1242 hrs</b>



# Water/Ice in Fuel

- Dual engine loss of power within 7s
- 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



# Water/Ice in Fuel

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

➤ 2009-030 Review use of additives

### **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.

➤ 2009-031 Conduct research on ice formation

### **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.

➤ 2009-032 Conduct research on ice accumulation and release

### **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.

- “FUAD” (fuel anti-ice additives for civil aviation)
    - Literature review
    - Data collection on use of anti-ice additives
    - Major driver investigation :
      - airworthiness aspects: additives performance, engine / aircraft fuel system impact, material compatibility, maintenance impacts,...
      - distribution : transport, storage, quality control and refuelling procedures,...
      - deployment and economical factors: potential demand, changes to existing infrastructures, analyse cost-breakdown (production, delivery)
- ➡ Feasibility analysis for commercial transport operations

- Call for Tender EASA.E.2.2011.NP.04 “FUAD” (fuel anti-ice additives for civil aviation) - sent on 28.10.2011
- 2 offers received
- Cranfield University selected
- Kick-Off: 01/02/2012
- Interim reports received 04/2012 – 07/2012
- Contact with aviation industry initiated – comments to be captured:
  - Fuel/refuelling companies
  - Airport facilities
  - Airlines.
- Draft report received in February 2013



- Call for Tender EASA.2010.OP.08  
“WAFCOLT” (water in aviation fuel under cold temperature conditions) - sent in May2010
- Objective:
  - Identify and review the existing data/reports concerning the presence of water and ice in aviation jet fuel
  - Define tests and test procedures in order to:
    - Characterise the formation of ice crystals and the influence of key parameters including water concentration, fuel temperature range and cooling rate, presence of contaminants such as Fatty Acid Methyl Ester (FAME)
    - Characterise the type and related mechanical properties of ice crystals in fuel
  - Collect a set of aviation fuel Jet A-1 and A samples representative of the different manufacturing standards existing worldwide
  - Perform the retained set of tests and analyse the results to derive recommendations for preventive actions as to ice formation in jet fuel.



## 2009-031 Conduct research on ice formation

- 4 offers received
- Airbus & Cranfield University selected
- Kick-Off: 17/01/2011
- Final report delivery date: Issue 2 of final reprot delivered on 10/05/2013 – will be made available by 29th May.



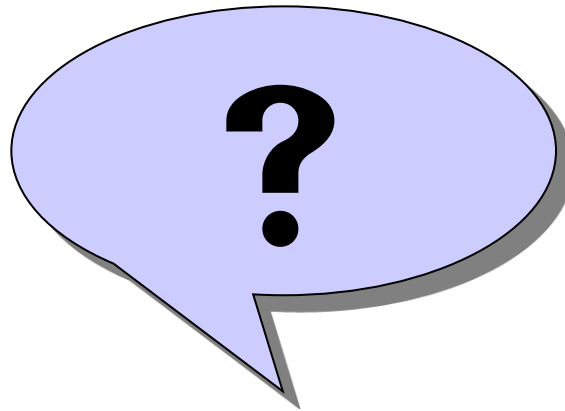
- Call for Tender EASA.2012.OP.14 “ICAR” (ice accretion and release in fuel systems) – 10/09/2012
- Investigate accumulation and shedding of ice in a representative turbine engine aircraft fuel system through tests.
- Scope:
  - Use of a fuel supply system test rig representative of large turbine engine aircraft (geometry, configuration of fuel pipes, fuel pumps, valves, filters and fuel/oil heat exchangers).
  - Operating conditions: shall reproduce the different flight conditions in cold atmosphere
  - Fuel flow and ice content: different scenarios for fuel supply to the engines and the injection of different types of ice crystals (e.g. soft and hard) or water shall be evaluated

- Deadline 29/10/2012
- Opening Session 08/11/2012
- Completion of tender Evaluation November 2012
- Signature of contract Decembre 2012
- Duration 12 months
- Interim report (litterature review, historical document review and industrial standard evolution) by end of May.

# Seminar–Water/Ice in aviation fuel



- Date: 29th May 2013
- Place: Institution of Mechanical Engineers, London
- Presentations from:
  - AAIB
  - Airbus
  - Cranfield University
  - EASA
  - FAA-TC
  - Rolls Royce



Thank You For Your Attention