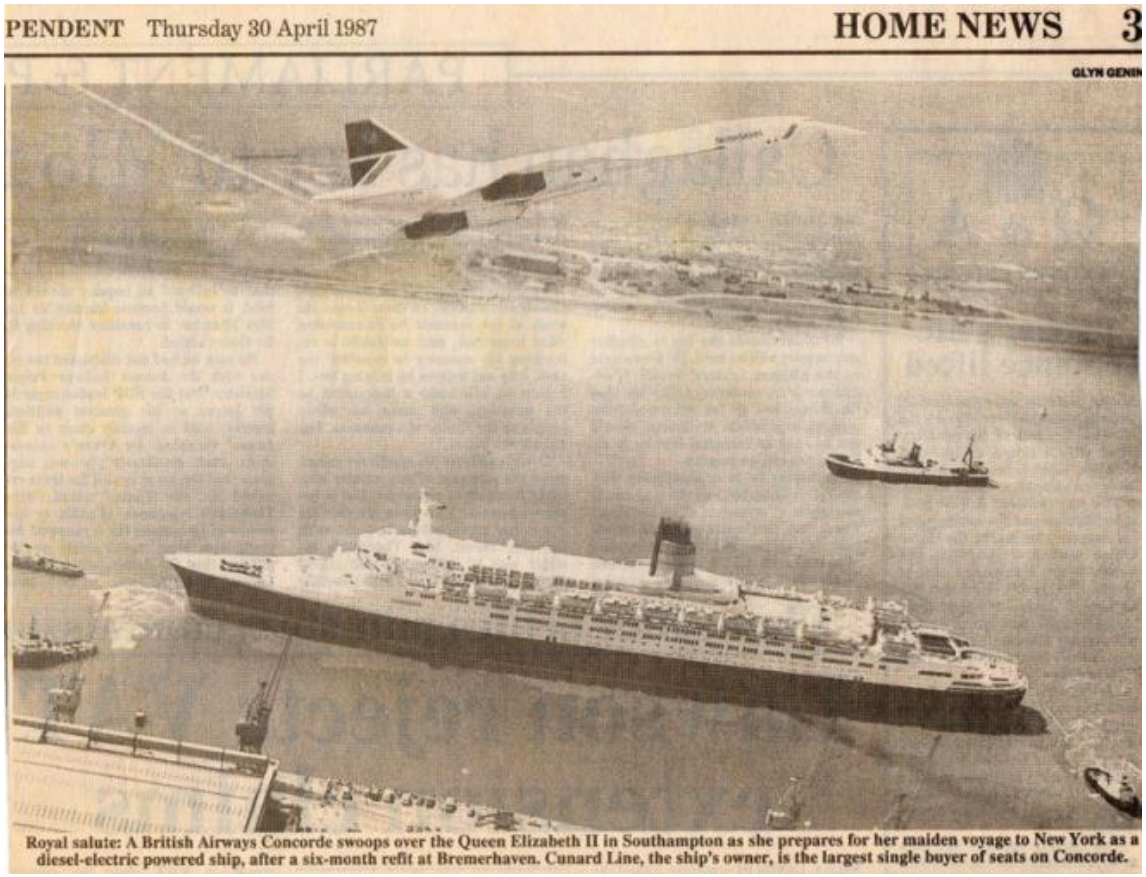
The End of the Filter Monitor

What is the future of water detection and elimination?

WHAT IS A FILTER MONITOR?

Key events in 1987



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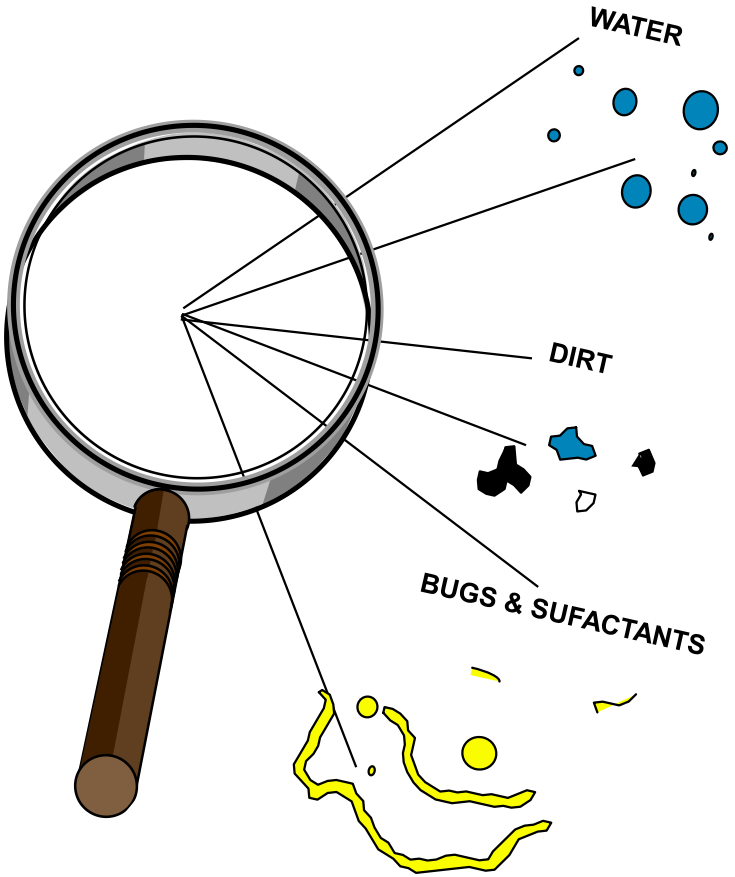
Fuel Cleanliness



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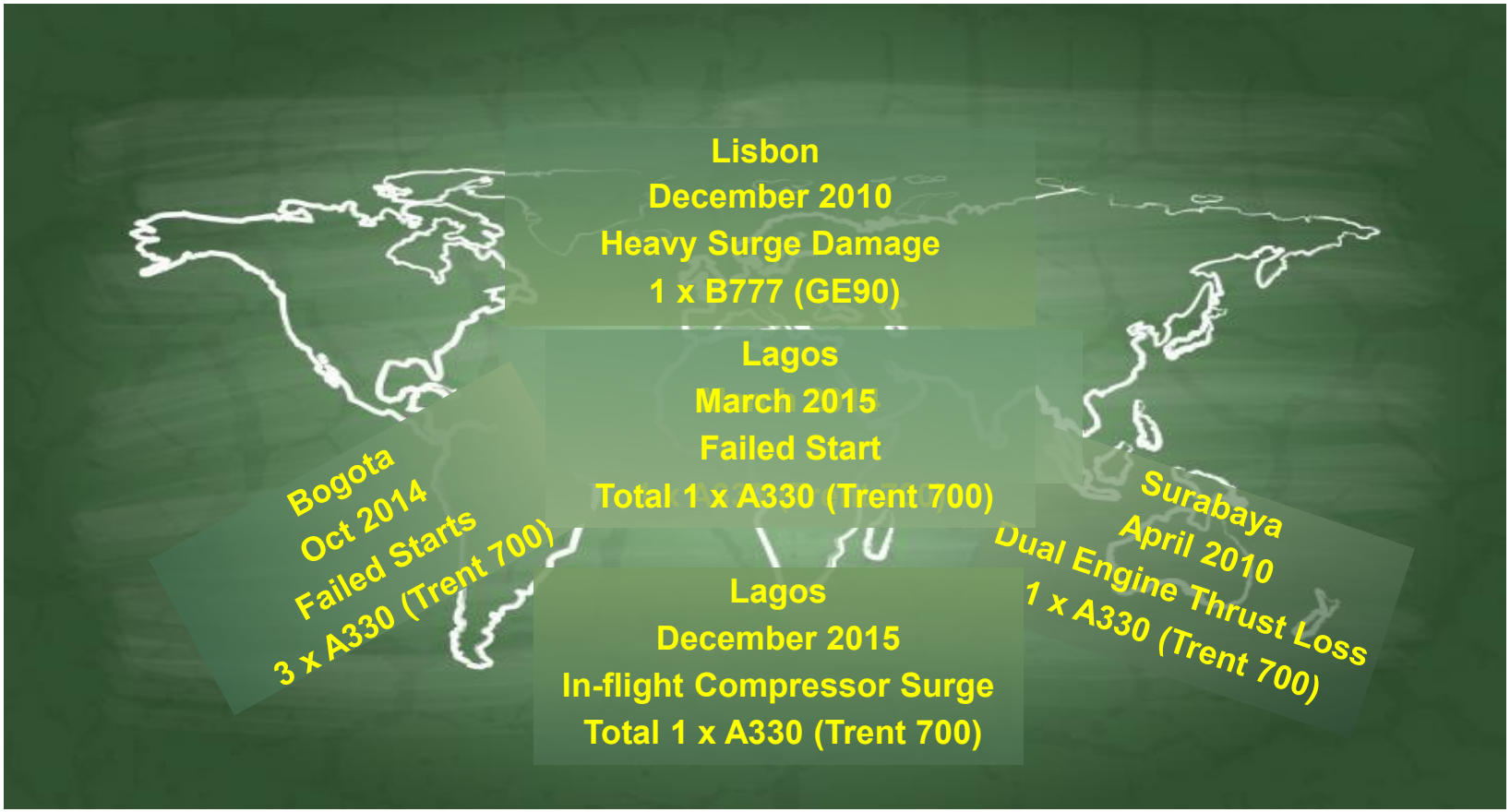
Reported SAP Incidents



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Other Reported Incidents

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Investigations – IATA SAP Special Interest Group

Broad Conclusions

- SAP found and positively identified in Engine Fuel Systems.
- Very well researched cause and effect in relation to SAP.
- Evidence suggests that issues continue to occur several flights after initial exposure.
- OEMs have concluded that flight safety cannot be assured with SAP present.
  - Challenges the OEMs ability to be tolerant of SAP.
- ***OEM conclusion is that SAP must be zero.***

Filter Testing Conclusions

- SAP has been seen to be be released by all Filter Monitors.
  - Some filters worse than others
  - Controls put in place by JIG, A4A and other users to limit SAP migration.
- ***However, it is not possible to totally eliminate SAP migration using current Filter Monitor technology.***

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Operational Challenges

- XX,000's of fuelling equipment worldwide with Filter Monitors
- No like-for-like retrofit option available for 2" systems
- Filter Water Separators (FWS) is currently the only assured technology
- Insufficient space in fuelling equipment to fit new FWS
- Other solutions (technology) need first to be robustly assessed
- Very short time scale to validate all new solutions
- Biggest challenges: on large airports with hydrant operations
- Significant MOC required by the operators

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Upgradeable equipment

Filter Monitors with no space restrictions

Estimated 15% of JIG member fleet

Cost of new FWS Vessel & pipework mods

Conversions

Estimated 5% of JIG member fleet

Cost of conversion FM -> FWS & associated hardware

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New technology or new philosophy required

Filter Monitors with space restrictions

Estimated 80% of JIG member fleet
No conversion to FWS possible with current technology

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New technology or new philosophy required

Towable Hydrant Carts

Estimated 90% of USA Airport fleets
No conversion to FWS possible with current technology

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Ongoing Actions

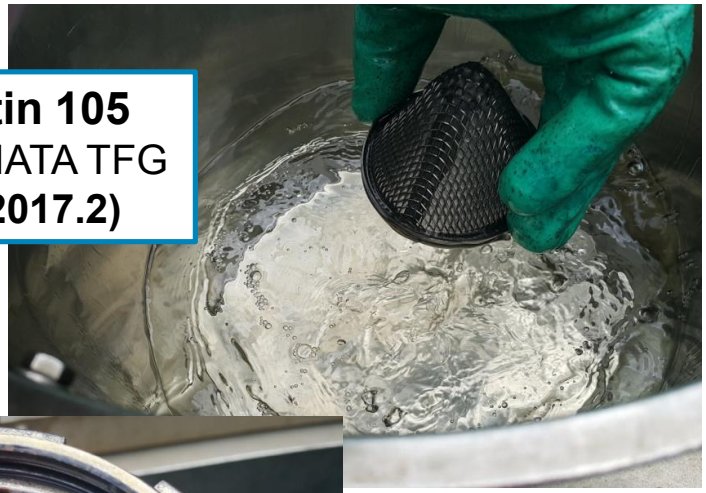
Actions to mitigate potential risk factors

- Use FWS where possible – Where not:
  - Filter Monitors to 7th ed.
  - Limit Operational dP to 15psi
  - Inspection & cleaning Hose-end strainers (100mesh)

We support implementation via

- Training of Inspectors
- Focus on inspections
- Member Surveys
- Follow Up Bulletins

JIG Bulletin 105
Endorsed by IATA TFG
and **A4A (2017.2)**



Hose-end strainer inspection/cleaning

Soon to be launched Industry Program to bring new and viable filtration technologies into service following extensive field trials

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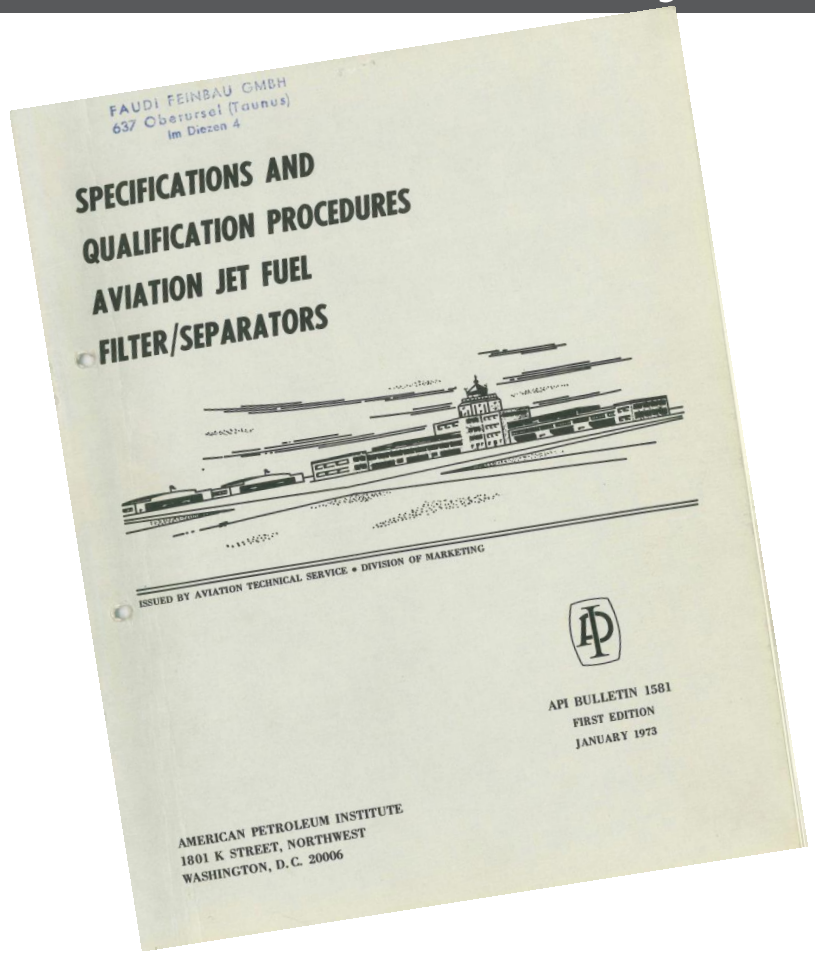
Key events in 1973



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NEXT STEPS

Possible Alternative Technologies

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Options to Retrofit - EI 1599 Dirt Defence

- Two inch diameter Dirt Defence filter
- Retrofits into Filter Monitor Vessels
- Requires another method of managing water – probably to be combined with inline water sensors.
- Three filter elements have been qualified to EI1599
- One EI1598 Water Sensor has been qualified and approved for Into-Wing applications (when used in conjunction with conventional filtration).

- Field Trial work currently being considered by the industry to assess performance envelope of EI 1599 dirt defence filters in combination with EI 1598 sensors.

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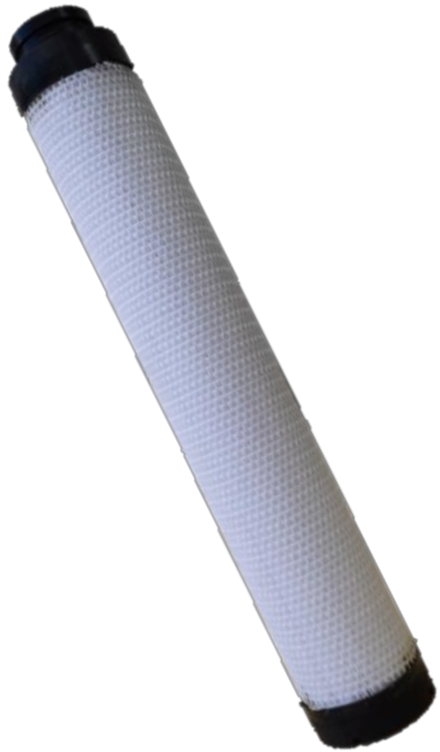
Options to Retrofit - EI 1588 Membrane Technology

- A filter membrane with fine holes and pleated media that allows fuel to pass, but not water.
- Should retrofit into Filter Monitor Vessel.
- Production Elements not yet available.



- Production elements will need to demonstrate qualification to EI 1588 standard when available.
- May need to be used in conjunction with water sensors?

- Field Trial work will need to be completed once qualification achieved.

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Options to Retrofit – Non-SAP Filter Monitor

- Similar in concept to filter monitor, but with chemically different absorbent material.
- Will retrofit into Filter Monitor Vessel.
- Production Elements not yet available.

- Production elements will needs qualification to EI 1583 standard when available.
- Will need to demonstrate no media migration.

- Field Trial work may need to be completed once qualification achieved.

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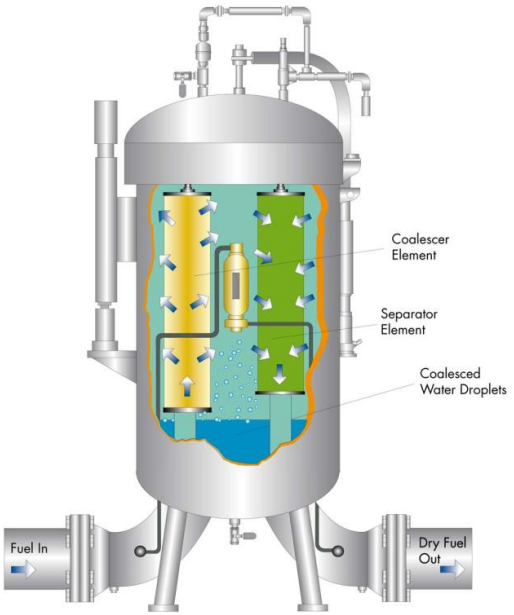
Replacement Filters – EI 1581 Filter Water Separators

- FWS remove water rather than absorb it.
- Big water droplets formed in the first element then settle under gravity within the vessel.
- This has required large elements and low fuel velocities to allow the water to settle, and leads to vessels too large to fit on many of today's vehicles.



- EI 1581 Ed 6 introduced a low water / low dirt filter option which reduces the filter size.
- EI1581 changes could help fit FWS onto existing vehicles.

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Implementation of monitor replacement technology

Development follows usual EI committee process and EI Qualification Test Witnessing Scheme

EI committee confirms technology proof of concept and develops EI specification

Filter OEM undertakes Qualification Testing to EI specification

Robustness Assessment Programme

Laboratory tests defined by EI committee (includes A4A, CAAC, CSA, IATA, JIG and filter OEMs)

One-off laboratory assessments by filter OEMs, witnessed by EI

EI oversees field conditioning of filters with rapid high fuel throughput. Conditioned filters sent to filter OEM for lab assessment

One-off prolonged exposure to multiple fuels (c1 million litres per element) using a fuel conditioning rig/test stand (not ITP)

Output from robustness assessment programme is EI committee statement that the technology is suitable for into-plane field trials (or that further EI specification or filter OEM product development is required)

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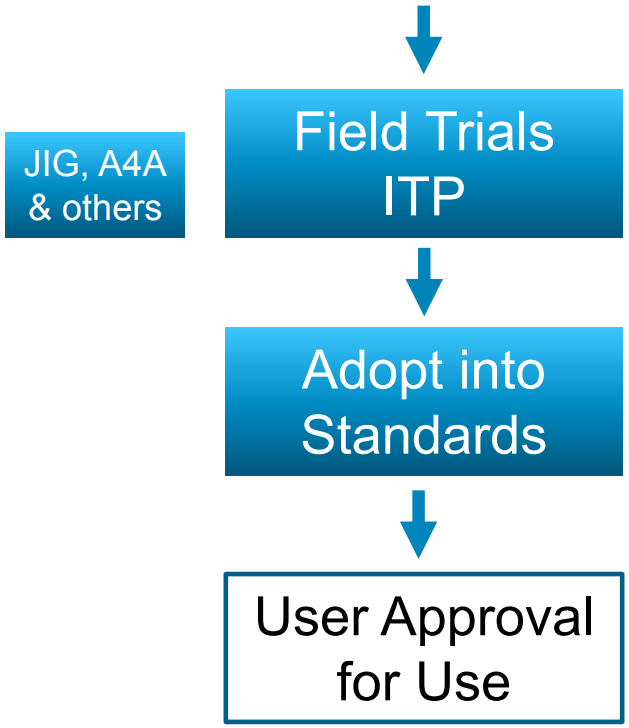
Field Trials of monitor replacement technology

Output from robustness assessment is that the technology is suitable for into-plane field trials



Objectives

- Identify conditions that limit filter operability
- Develop Operating Specifications and Procedures
- Users decide whether the equipment is acceptable for their use
- Data from Field Trials will be available to end users upon request

Key parameters

- Vibrations, Climate, operating flowrates

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WHAT IS NEXT?

Direction

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Today's SAP is Not an Option

- EI 1583 (Filter Monitor) Standard will be removed by end 2020.
- Chemically similar options will not be supported.

- Time for change is limited.
- The first time we have introduced new filtration types in 40+ years and we are on a time limit.
- Product Quality Assurance may be achieved by different means in future.
- Support is needed from **all** Aviation Fuel Stakeholders to support a safe and technically sound transition.
- Just think where would we be without all the clever Tech Folks?

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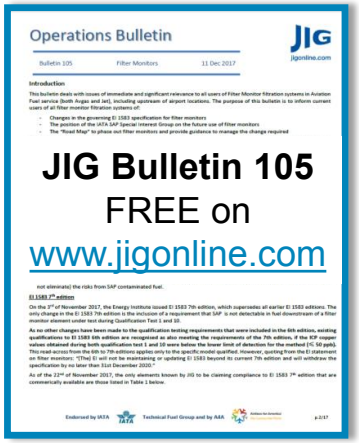
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Bulletin 105 | Filter Monitors | 11 Dec 2017

Introduction

This bulletin deals with issues of immediate and significant relevance to all users of Filter Monitor filtration systems in Aviation Fuel service (both Avgas and Jet), including upstream of airport locations. The purpose of this bulletin is to inform current users of all filter monitor filtration systems of:

- Changes in the governing EI 1583 specification for filter monitors
- The position of the IATA JAP Special Interest Group on the future use of filter monitors
- The "Road Map" to phase out filter monitors and provide guidance to manage the change required

not eliminate) the risks from SAP contaminated fuel.

EI 1583 7th edition

On the 3rd of November 2017, the Energy Institute issued EI 1583 7th edition, which supersedes all earlier EI 1583 editions. The only change in the EI 1583 7th edition is the inclusion of a requirement that SAP is not detectable in fuel downstream of a filter monitor element under test during Qualification Test 1 and 10.

As no other changes have been made to the qualification testing requirements that were included in the 6th edition, existing qualifications to EI 1583 6th edition are recognised as also meeting the requirements of the 7th edition, if the ICP copper values obtained during both qualification test 1 and 10 were below the lower limit of detection for the method (< 50 ppb). This read-across from the 6th to 7th editions applies only to the specific model qualified. However, quoting from the EI statement on filter monitors: "(The) EI will not be maintaining or updating EI 1583 beyond its current 7th edition and will withdraw the specification by no later than 31st December 2020."

As of the 22nd of November 2017, the only elements known by JIG to be claiming compliance to EI 1583 7th edition that are commercially available are those listed in Table 1 below.

Endorsed by IATA Technical Fuel Group and by A4A p.2/17

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Better decisions will be made if all parties share their knowledge, data and discuss likely outcomes

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