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## **Rapid screening test developed in response to Industry concerns over FAME in Jet**

### **FAME in Jet – why the concern?**

The continuing international governmental requirements to blend Fatty Acid Methyl Esters (FAME) with diesel fuel have resulted in the unintended side-effect of FAME potentially contaminating Jet turbine fuel. The incidents and greatest risk is in multi-fuel transport distribution facilities which has raised industry-wide concerns in both the fuels suppliers and the end users including airlines and airframe and jet engine manufacturers.

Cross contamination can occur at many points in the distribution and handling of diesel fuels into Jet fuel; from refineries, terminals, fuel blending distribution sites, fuel tank storage facilities and most importantly during the shipping of fuel and its movement through pipelines.

The bio-component in automotive diesel (FAME) is a very surface-active material which is problematic if it adheres to pipe and tank walls as the diesel passes through. FAME has the potential to be released from the walls into the following product parcel which may be jet fuel. Small amounts of diesel containing FAME remaining within distribution manifolds, tanks, vehicles or pipelines can result in traces of FAME getting into jet fuel transported through the same supply system.

### **Current Fuel Specification limits**

Current DEF STAN 91-91 and ASTM D1655 specifications for the Aviation Industry state that immeasurable levels of FAME (<5mg/kg) are acceptable. However, the Industry (including engine and aircraft manufacturers and operator airlines) are working in conjunction with the Energy Institute to evaluate the effect of FAME at higher concentrations with a move towards acceptance of 20 to 150 mg/kg limits. It is expected that this will be set at 100 mg/kg in early 2012.

The Fueling Companies Joint Inspection Group (JIG) members are working actively with other industry stakeholders to relax limits to 100 mg/kg. In addition, the Energy Institute is managing a Joint Industrial Programme (JIP) involving members seeking potential approval from the aero engine and airframe manufacturers for the use of up to 150 mg/kg of FAME in jet fuel, although this level may be slightly lower. An extensive range of lab and rig/engine tests have been applied to Jet Fuels containing FAME to ensure that there are no detrimental effects to hardware and the performance of aero engines.

For the purpose of quality assurance this has created the need for robust and fast instrumentation to detect levels of FAME in Jet contamination at the levels of critical interest.

### **Development of Rapid Screening of FAME in JET**

Following a successful collaborative effort with Shell Global Solutions to develop a novel innovative extraction-based Fourier Transform Infra Red (FTIR) analytical technique, Stanhope-Seta focused on the requirement for a rapid screening method to measure 100 mg/kg levels. The result was the development of the ground breaking FIJI - FAME in Jet Instrument, a new automated instrument that uses rapid, simple to use flow analysis technology requiring little technical expertise or training.

The development of FIJI is internationally recognized with the introduction of a new oil industry test method IP 583 – the first method for the Rapid Screening of FAME in JET (AVTUR). This was a direct result of an urgent requirement set by the UK's MOD Defence Fuels Group, and airframe and engine manufacturers for a fast, simple to use instrument for fuel release and distribution to airport hydrants for 'at wing' fueling.

Following, a request for an evaluation of the FIJI analyser using world-wide fuel sample, and in collaboration with many major oil companies and airlines, a significant additional global sample set of JET samples were measured with an enhanced chemometrics modeling system utilized inside the FIJI. This programme study has been a great success proving the robustness and sensitivity of the FIJI analyser for a increased global Jet fuel sample set.

This additional programme has been reported to the Energy Institute and will be published by the EI shortly. A presentation was given at the Oil Industry ASTM D2 committee in June and at IASH in October which was well received and supported as an advance on the challenge to measure FAME in Jet rapidly and robustly.

FIJI has played a significant part in checking low mg/kg levels of FAME in jet in the EI JIP programme and has been a pivotal analytical measurement tool to ensure fuels with FAME are blended to the correct precise level. A key advantage over current analytical FAME in Jet methods is FIJI's ability to detect all types of FAME in the range C8 to C22. FIJI has been subject to extensive development with more than 1000 tests on jet fuel samples from refineries, storage, distribution facilities, and airports globally.

Key industry stake owners include International Oil Companies, Jet Fuel Suppliers, plus a major NATO fuel logistic supplier – all of whom have participated in the sample supply and EI method development round robin studies. The model has additionally been validated against ASTM E1655 and independent studies confirmed that it is fully compliant with this standard practice.

The FIJI instrument is robust, simple to use and allows quick screening of fuels whether used in the lab, a tank storage system or pipeline terminal. The instrument will give a quick indication of possible FAME contamination that may then necessitate further investigations to maintain a safe product for delivery at wing.

FIJI is fully automatic so no specialist operator training is involved. Tests require less than 50ml of sample and typically take under 20 minutes. Results are presented in mg/kg units together with an optional traffic light system for flagging FAME contamination levels of the fuel. By comparison current analytical tests can take many hours, including shipment time to a lab with the appropriate technology, require complex equipment, and demand high analytical skill levels.

#### **The future?**

FIJI has an excellent track record in playing its part in the JIP programme and is recognised as the industry measurement tool to rapidly screen for contamination of FAME in Jet fuel throughout the Jet Fuel distribution system at all stages of critical Jet fuel transfer – pipelines, shipping and for recertification. The next step is for the EI JIP programme to report the results of its finding which is expected soon and will establish whether the proposed 100 mg/kg levels of FAME will be accepted.

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#### **Notes**

1. For further product information visit <http://www.seta-analytics.com/fame-in-jet-instrument.htm>
2. Test Method IP 583 can be obtained from the Energy Institute at [www.energyinstpubs.org.uk](http://www.energyinstpubs.org.uk)

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