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SERVICE INFORMATION LETTER

Background and Current Situation Regarding Possible Fatty Acid Methyl Ester (FAME) Contamination in Aviation Turbine Fuel

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Publication Number D200906000007

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Transmittal Information

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Summary

This is the INITIAL release.

Revision History

This service information letter has had no revision(s) as shown in Table 1.

Table 1. Revision History

Revision Number	Revision Date
0	16 Apr 2010

1. General Information

A. Effectivity

(1) This service information letter is applicable to TPE/TSE331 All Models, ALF502 All Models, LF507 All Models, AS907, T76, T800 All Models, ATF3, F124, F125, TFE731 All Models, T53 All Models, T55 All Models, T5508D, AL5512, and LTS/LTP101 All Models.

B. Reason

(1) To notify Honeywell operators of the background and current situation regarding possible FAME contamination in aviation turbine fuel.

C. Background

(1) Jet fuel has been successfully transported in multi-product pipelines for many years. Quality assurance procedures for handling interfaces between products, together with laboratory testing requirements, are well established and quality incidents are rare. However, recent changes to diesel fuel requirements are raising questions regarding possible aviation fuel contamination. Either by government mandate or customer demand, road fuel suppliers in Europe are now required to make sure that a target percentage of their total road fuel sales are biofuels. To help achieve these targets, FAME is being blended into conventional diesel at refineries to create a biodiesel fuel. The biodiesel fuel is then transported via multi-product pipeline systems or other means (ship, barge, road, and rail transportation), which also carry aviation turbine fuel.

(2) Field trials and recent operational experience have demonstrated that trace levels of FAME from biodiesel can contaminate batches of aviation turbine fuel. The biocomponent in biodiesel FAME is a surface active material. This means that, in theory, it can adhere to pipe and tank walls as the biodiesel passes through, and then release from the walls in the following product, which may be jet fuel. Also, small amounts of biodiesel remaining within distribution manifolds, tanks, pipes, and vehicles can result in traces of FAME getting into jet fuel transported through the same components. At high enough concentrations, FAME could impact the thermal stability and freeze point of the jet fuel.

(3) The aviation fuel community, which includes aircraft and engine manufacturers as well as petroleum producers, has formally approved the use of aviation jet fuel containing less than 5 parts per million (ppm) (5 mg/kg) of FAME. This limit is currently included in the Joint Inspection Group (JIG) Product Quality Bulletin 15 (the bulletin is available at www.jointinspectiongroup.org) and the UK Defense Standardization (DEF STAN) 91-91 jet fuel specification, and will be incorporated into the American Society for Testing and Materials (ASTM) D1655 jet fuel specification. However, due to the planned increase in FAME concentrations in diesel fuel, as well as the assessment that the operating procedures outlined in JIG Bulletin 15 are neither operationally practical nor sustainable in the longer term, JIG has requested the maximum allowable limit be increased to 100 ppm (100 mg/kg).

(4) The aviation fuel industry Energy Institute (EI) has established a Joint Industry Project (JIP) on FAME to conduct a complete evaluation (details in Energy Institute Publication

EI-JIP08-004) to determine if operation with up to 100 ppm (100 mg/kg) of FAME is acceptable. Jet fuel with up to 400 ppm (400 mg/kg) FAME is being analyzed to provide margin in the analysis. Specification and fit-for-purpose testing has been completed on a variety of fuel blends containing the most common FAMEs and a cocktail of all four FAMEs at concentrations up to 400 ppm (400 mg/kg). Table 2 shows variants of FAME commonly added to diesel fuel that are being evaluated:

Table 2. Variants of FAME

Abbreviation	Variant (Location)
RME	Rapeseed methyl ester (Europe)
SME	Soybean methyl ester (U.S.A., South America)
POME	Palm oil methyl ester (Malaysia, Indonesia, Thailand)
TME	Tallow methyl ester (U.K., Australia)

(5) Specification and fit-for-purpose property data, already generated by the EI JIP, show that even at the 400 ppm (400 mg/kg) level, there were no significant effects of FAME contamination on fuel properties and that short-term operation with up to 30 ppm (30 mg/kg) of FAME does not pose a risk to safety of flight. However, additional evaluation is required to ensure there is no adverse impact of FAME-contaminated jet fuel on gas turbine engines.

(6) Material compatibility tests, along with component and engine tests, are planned to make sure there is no adverse effect of 100 ppm (100 mg/kg) FAME contamination in jet fuel on engine or auxiliary power unit (APU) operation or durability.

(7) Field tests to measure FAME contamination levels are being developed by the EI JIG, but are not yet commercially available. Several gas chromatograph-mass spectroscopy (GC-MS) laboratory methods are currently being used to check for FAME contamination in jet fuel samples taken at fuel storage locations upstream of airports that are at risk of FAME contamination.

D. Needed Actions

(1) Concerns have been raised by operators regarding the possibility of fuel supply disruption at airports should FAME levels exceed the very stringent less than 5 ppm (5 mg/kg) continuous use limitation. Experience over the last year has demonstrated that this is a real risk and could result in a major disruption of operations.

(2) The Federal Aviation Administration (FAA) Special Airworthiness Bulletin (SAIB) (NE-09-25R1, Special Airworthiness Bulletin: Jet Fuel Containing FAME, dated 19 August 2009) has indicated that operation with jet fuel containing more than 5 ppm (5 mg/kg) of FAME would not be in compliance with the aircraft and engine operating limitations, unless approved service information is issued with revised limitations to accommodate FAME levels greater than 5 ppm (5 mg/kg). The SAIB also indicates that the FAA determined that the performance properties of aviation turbine fuel are not impacted with up to 30 ppm (30 mg/kg) of FAME under restricted, short-term usage. The FAA approved data for use by aircraft and engine manufacturers for issuance of service information to permit operation with aviation turbine fuel containing 5 to 30

ppm (5 to 30 mg/kg) FAME under restricted, short-term usage. The SAIB provides operating procedures and limitations for those aircraft and engines for which service information has not been issued, which are similar to those provided herein.

(3) Based on the best information available, Honeywell Aerospace, in conjunction with the other engine original equipment manufacturers (OEMs) and the FAA, has defined an “emergency clearance” procedure as defined in Paragraph 1.D.(4) to meet operator needs.

(4) Emergency clearance procedure:

(a) Jet fuel fully compliant with fuel specifications, defined in the latest release of DEF STAN 91-91 or ASTM D1655, except for the presence of FAME at or above 5 ppm (5 mg/kg) up to 30 ppm (30 mg/kg), may be used within the limitations defined in Table 3 during an emergency.

(b) Definition of an emergency: An unexpected and unforeseen situation that requires urgent and prompt action, in this case being the situation where FAME-contaminated fuel has been introduced into that part of the airport distribution system where it cannot be quickly segregated or isolated for remediation without halting airport fueling operations. This may include the situation where aircraft has been loaded with contaminated fuel.

(c) Additional notes to Table 3:

1 FAME levels defined in Table 3 must be based on actual measured levels, wherever possible. Estimations of FAME levels based on, for instance, aircraft tank draining and filling with known fuel quantities (dilution calculations), must be recorded and measured values obtained as soon as practical (refer to the follow-on actions in Table 3), but within 3 days. Dilution calculation:

$$PPM_N = [(V_L \times PPM_L) + (V_R \times PPM_R)] / (V_R + V_L)$$

Where:

PPM_N = FAME concentration (ppmv) in tank after fueling (parts per million by volume).
V_L = volume (gallons) of contaminated fuel loaded.
PPM_L = FAME concentration (parts per million by volume) of contaminated fuel loaded.
V_R = volume (gallons) of fuel in aircraft fuel tank prior to fueling.
PPM_R = FAME concentration (ppmv) of fuel in tank prior to fueling.

2 Limitations in Table 3 must be implemented as soon as operators become aware that FAME levels have exceeded the 5 ppm (5 mg/kg) limit. However, limitations on the number of refuels or amount of fuel for a particular aircraft shall be counted from the point when the aircraft was first loaded with fuel known to be contaminated (i.e., above the 5 ppm (5 mg/kg) limit).

3 Reporting of fuel analysis is required to be completed within 3 days, and samples must be taken from both the aircraft and ground fuel supply. However, if fuel sampling and analysis logistics are such that this cannot be achieved, the allowances described in Paragraph 1.D.(4)(c)3a and Paragraph 1.D.(4)(c)3b will be made:

a The requirement for samples from contaminated aircraft fuel tanks will be waived if onboard FAME concentrations can be reliably calculated from tank contents, fueling volume, and FAME concentration data. The dilution calculation is provided in Paragraph 1.D.(4)(c)1.

b If the 3 day turnaround cannot be achieved, then new timescales must be agreed with OEMs on a case-by-case basis. Also, this waiver is dependent on positive assurance that fuel at the affected airport is below 5 ppm (5 mg/kg) FAME in the intervening period.

4 Consult with the aircraft manufacturer to determine if more stringent requirements exist.

5 The limitations and requirements defined in Table 3 are limited to one emergency event at one airport only. Allowance to pick up FAME-contaminated fuel again in subsequent contamination events will be by agreement with the relevant OEMs.

Table 3. Emergency Clearance Procedure for Aviation Jet Fuel Contaminated with FAME

FAME Level	**Immediate Action**			**Follow-on Actions Prior to Further Aircraft Operation (Refer to Emergency Clearance Procedure Text)**
	Aircraft En Route or Engines Run on the Ground	**Aircraft on Ground Fueled (Engines Not Yet Run)**	**Aircraft Waiting to be Fueled**	
Less than 5 ppm (5 mg/kg)	None.	None.	None.	None.

Table 3. Emergency Clearance Procedure for Aviation Jet Fuel Contaminated with FAME (Cont)

FAME Level	Immediate Action			Follow-on Actions Prior to Further Aircraft Operation (Refer to Emergency Clearance Procedure Text)
	Aircraft En Route or Engines Run on the Ground	**Aircraft on Ground Fueled (Engines Not Yet Run)**	**Aircraft Waiting to be Fueled**	
5 to 30 ppm (5 to 30 mg/kg)	None. Two refuels or 1,000 gallons (3785.4 liters) maximum, whichever is greater.	Allow dispatch. Two refuels or 1,000 gallons (3785.4 liters) maximum, whichever is greater.	Take action to make sure fuel supply is below 30 ppm (30 mg/kg), but preferably below 5 ppm (5 mg/kg) prior to fueling aircraft. Fuel aircraft and allow dispatch. Two refuels or 1,000 gallons (3785.4 liters) maximum, whichever is greater.	1) Owner/Operator report event to Honeywell Customer & Product Support per Paragraph 1.D.(4). No maintenance actions required before next flight. 2) Owner/Operator record event in engine log book. 3) A fuel sample must be taken by the fuel provider or fuel supplier at the originating airport. a) Sample is to be sent for full fuel specification analysis, FAME content, and fuel thermal stability breakpoint. b) Report analysis results to Honeywell within 3 days. 4) A 4 ounce (0.12 liter) fuel sample must be taken by Owner/Operator from the aircraft fuel tanks. a) Sample is to be sent for FAME content analysis. b) Report analysis results to Honeywell within 3 days. 5) At next fueling ensure that supplied fuel contains less than 5 ppm (5 mg/kg) FAME.

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Table 3. Emergency Clearance Procedure for Aviation Jet Fuel Contaminated with FAME (Cont)

FAME Level	Immediate Action			Follow-on Actions Prior to Further Aircraft Operation (Refer to Emergency Clearance Procedure Text)
	Aircraft En Route or Engines Run on the Ground	**Aircraft on Ground Fueled (Engines Not Yet Run)**	**Aircraft Waiting to be Fueled**	
Greater than 30 ppm (30 mg/kg)	Aircraft En Route – Contact airframe manufacturer for aircraft disposition. Engines Ground Run – Do not allow dispatch prior to completing maintenance actions.	Do not start engines or allow aircraft to dispatch. Take action to make sure fuel in aircraft tanks is below 30 ppm (30 mg/kg) FAME, but preferably below 5 ppm (5 mg/kg), then apply requirements as defined for 5 to 30 ppm (5 to 30 mg/kg).	Do not fuel aircraft. Take action to make sure fuel supply to aircraft is below 30 ppm (30 mg/kg) FAME, but preferably below 5 ppm (5 mg/kg) before fueling operations recommence, then apply requirements as defined for 5 to 30 ppm (5 to 30 mg/kg).	For aircraft engines exposed to greater than 30 ppm (30 mg/kg) FAME, aircraft must not be flown prior to engine and aircraft OEM agreement on maintenance and return to service actions. Same fuel sampling and reporting requirements as for 5 to 30 ppm (5 to 30 mg/kg) (above) except aircraft sample must be 1 gallon (3.8 liters) and be sent for full fuel specification analysis, FAME content. Note fuel sampling and reporting of analysis will be essential before return to service can be defined. Refer to 5 to 30 ppm (5 to 30 mg/kg) requirements and limitations.

E. References

(1) JIG Bulletin 15, “Transport of Biodiesel in Multiproduct Pipelines”, dated November 2007.

(2) JIG Bulletin 16, “UK FAME Related Jet Fuel Product Quality Incident on 14th May 2008 – Briefing Note”, dated June 2008.

(3) JIG Bulletin 20, “Potential Contamination of Jet Fuel with Biodiesel – Industry Update”, dated October 2008.

(4) JIG Bulletin 21, “Risk of Contamination of Aviation Kerosene (Jet Fuel) with Biodiesel”, dated November 2008.

(5) U.K. Ministry of Defence Standard 91-91, “Turbine Fuel, Aviation Kerosine Type, Jet A-1”, reprinted August 2008.

(6) Energy Institute Publication EI-JIP08-004.

(7) NE-09-25R1, Special Airworthiness Bulletin: Jet Fuel Containing FAME, dated 19 August 2009.

(8) ASTM D1655, “Standard Specification for Aviation Turbine Fuels”.

F. Honeywell Actions

(1) Honeywell will provide return to service actions for engines that have either of the following:

(a) Exceeded > two refuels with 5 to 30 ppm (5 to 30 mg/kg) fuel.

OR

(b) Been refueled with 30 ppm (30 mg/kg) or greater fuel.

G. Summary

(1) Environmental regulations are requiring higher levels of FAME in diesel fuel. It has been shown that FAME may contaminate aviation turbine fuels during transportation. Therefore, the allowable FAME level and the effects of FAME on gas turbine operation must be evaluated. The current allowed level of FAME in aviation jet fuel is 5 ppm (5 mg/kg). The JIG is requesting approval of FAME levels up to 100 ppm (100 mg/kg). The U.K. Energy Institute has formed a JIP to evaluate and approve the requested level of 100 ppm (100 mg/kg). Honeywell understands the need to evaluate and approve a realistic FAME contamination limit for jet fuels and fully supports the evaluation program. This approval is not expected before the 4th quarter 2010.

(2) The engine OEMs have jointly defined an “emergency clearance” procedure that allows up to two refuels of jet fuel contaminated with up to 30 ppm (30 mg/kg) of FAME to meet operator needs. Operators should contact their representative airframe manufacturers for aircraft dispatch disposition. No immediate action is required unless a contamination event occurs.

(3) EI JIP sponsored testing will continue to evaluate if higher (100 ppm (100 mg/kg)) continuous use limits for FAME contamination can be established. On successful completion of the EI JIP FAME evaluation program, assuming no negative results, the industry will be in a position to approve up to 100 ppm (100 mg/kg) of FAME in jet fuel.

H. Action

(1) Honeywell recommends that operators:

(a) Contact their fuel suppliers to make sure that fuel being delivered meets all relevant fuel specification requirements. In particular, seek assurance that procedures are in place to limit FAME below the current 5 ppm (5 mg/kg) specification limit, and that should an excursion above this level occur, it will be identified and the operators and authorities informed immediately.

(b) Arrange contingency plans with their fuel suppliers to make sure that, should a contamination event occur, emergency FAME levels will not be exceeded. Also, make sure that procedures are in place to make sure fuel supplies that comply with continuous use requirements can be reinstated within required timescales given the number of uplifts limitation.

(c) Make sure that guidance is available in operations manuals informing flight crews of the appropriate action to be taken in the event of FAME contamination of any fuel that has been uplifted.

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(d) Consult the latest applicable airworthiness (FAA, Civil Aviation Authority (CAA), European Aviation Safety Agency (EASA)), and JIG documents issued that cover this subject area.

(2) Quality control procedures relating to FAME contamination can be found in JIG Bulletin 15, “Transport of Biodiesel in Multiproduct Pipelines”, dated November 2007, and Bulletin 21, “Risk of Contamination of Aviation Kerosene (Jet Fuel) with Biodiesel”, dated November 2008. Additional background information is available in JIG Bulletin 16, “UK FAME Related Jet Fuel Product Quality Incident on 14th May 2008 – Briefing Note”, dated June 2008, and Bulletin 20, “Potential Contamination of Jet Fuel with Biodiesel – Industry Update”, dated October 2008.

(3) If there are any questions regarding this service information letter, contact:

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I. Definitions

(1) Fuel supplier: Entities that distribute fuel through the fuel supply chain.

(2) Fuel provider: Entities that dispense fuel into aircraft at the last step of the supply chain.