JET A1 vs JP-8
Differences and Effects on Long Term Use

The question has surfaced as to what would be the long term impact to engine/component durability when vehicles/equipment and aircraft are subjected to prolonged use of JET A1 instead of JP8. To provide a baseline, a brief review of the basic compositional differences between the two fuels is provided.

JET A1 primarily differs from JP8 in that its specification ASTM D1655 does not mandate the requirement for the three additives that are specified and contained in JP8; namely, the Corrosion Inhibitor/Lubricity Enhancer, the Fuel System Icing Inhibitor, and the Static Dissipater Additive.

Corrosion Inhibitor/Lubricity Enhancer – maximum allowable dosage ranges from 9 to 24 g/m^3. Provides lubricity enhancement needed for certain aircraft fuel control components. Provides minimal level of lubricity enhancement for rotary fuel lubricated injection pumps on ground vehicles, as ten times amount allowed is needed. Provides protection against corrosion of pipeline systems.

Fuel System Icing Inhibitor – amount specified is 0.10 to 0.15 volume %. Provides freeze point protection to prevent possible ice formation in the fuel. Provided some control to reduce the proliferation of any micro-organisms in fuel tank environments, but will not sterilize these micro-organisms.

Static Dissipater Additive – amount specified is based upon meeting specified conductivity levels of 150 to 450 ps/m, amounts required typically range from 3 to 5 ppm. Provides for a reduction in the buildup of static charges being generated during movement of fuel.

[Note: Static charge generation can increase in cold and low humidity environments. With either JP8 or JET A1, any static electrical discharging that occurs within the flammability range of either fuel (i.e., from 0.6 % vol to 4.7 % vol) can initiate combustion].

Implications for long term use of JET A1 in Army Rotary Wing Aircraft

Impact of no Corrosion Inhibitor/Lubricity Enhancer - Fuel lubricity problems in aircraft fuel control systems primarily originated with Air Force aircraft. It is believed that no Army helicopter engines have ever experienced or reported any lubricity related problems with fuel control systems.

Assessment: Essentially no impact envisioned with long-term usage. Impact of no Fuel System Icing Inhibitor – Icing problems believed to be minimal as helicopters do not operate at the higher altitudes that are conducive to icing. Current Army helicopters more than likely are equipped with electrically heated fuel lines to prevent any potential freezing problems. Microbiological growth problems (i.e., infestation) may occur in warm and humid operational environmental if water is not removed by filter/separators and allowed to enter the onboard fuel tanks.

Assessment: May or may not be a problem depending upon the (1) cleanliness of fuel entering the aircraft and, (2) the climatic conditions in which the helicopter is operating (i.e., sub-freezing or warm and humid). Probability of any major impact is believed to be relatively low.

Impact of no Static Dissipater Additive – Generation of static charge buildup is dependent upon the rapid movement of the fuel through a fuel line/hose (e/g/, during rapid refueling, splash-loading, etc), and the climatic conditions favoring static charge generation that prevail at that time.

Assessment: May or may not be a problem for above reasons. Probability of major impact is however believed to be low as many Army helicopters were routinely fueled with JET-A1 during the Iraqi-Kuwait conflict with no reports/problems resulting from any static charge discharges. Implications for long term use of JET-A1 in Army Ground Vehicles and Equipment

Impact of no Corrosion Inhibitor/Lubricity Enhancer – Rotary-type fuel-lubricated distributor fuel injection pumps are very sensitive to the lubricity quality of fuel. Absence of any Lubricity Enhancer will promote wear of rotor components increasing fuel injector internal leakage when using low viscosity fuels such as JET-A1. This results in gradual power loss and enhances the potential for hot starting problems. As severity of problem increases with increasing ambient temperature, guidance has been provided to users recommending against using JET-A1 in moderate to high temperature environments. Other types of fuel injection/pump equipment such as in-line unit injectors, common rail, electronic/hydraulic types, etc. do not have this sensitivity to inadequate fuel lubricity.

Assessment: With prolonged and continuous use, can be a problem for those vehicles and equipment whose engines are equipped with rotary-type fuel-lubricated distributor fuel injection pumps such as General Motors (GM) 6.2L and 6.5 L engines. However, field and engine dynamometer testing have been conducted using the GM 6.2L engines in high temperature environments as well as laboratory engine dynamometer testing when the fuel inlet temperature to the fuel injection pump was maintained at a continuous 195° F for the duration of the 400-hour engine test. In this latter instance which involved using JET-A, performance and power loss did deteriorate significantly, but there was no catastrophic engine failure. As a matter of record, Army operations in Alaska for the past several decades have been using JET-A1 year-round in ground materiel systems as this has been the fuel provided by contractors required to furnish Arctic Grade Diesel Fuel (DFA). Probability of major impact is viewed as moderate under the above noted conditions.

Impact of no Fuel System Icing Inhibitor – Icing problems believed to be minor as Army's adopting the Single Fuel policy has resulted in greater use of JP8 which has lead to the increased filtration requirement for ground vehicles and equipment needed to provide aviation quality fuel to both ground as well as aviation materiel. This has led to a lesser potential for any water contamination being present in fuels. Microbiological growth problems (i.e., infestation) may occur in warm and humid operational environmental if water generated by condensation is not removed by filter/separators and allowed to remain as separated water in vehicle fuel tanks. Vehicles and equipment deployed in theater have seen prior JP8 service resulting in cleaner fuel tank environments that will not support microbiological growth.

Assessment: Probability of any major impact is viewed to be relatively low as Single Fuel policy of delivering aviation quality product to ground materiel systems preclude other than minor water contamination problems.

Impact of no Static Dissipater Additive – Generation of static charge buildup is dependent upon the rapid movement of the fuel through a fuel line/hose (e/g/, during rapid refueling, splash-loading, etc.), and the climatic conditions favoring static charge generation that prevail at that time.

Assessment: As mentioned above for aircraft may or may not be a problem for those reasons given above. Probability of major impact is however believed to be extremely low as large numbers of Army ground vehicles and equipment were routinely fueled with JET A1 during the Iraqi-Kuwait conflict with no reports/problems resulting from any static charge discharges.

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