BIOBOR JF®

AVIATION FUEL BIOCIDE

PRODUCT DATA

Chemical Composition

Active Ingredients

2,2-(1-methyltrimethylenedioxy) bis-(4-methyl-1,3,2dioxaborinane) - *CAS# 2665-13-6* 67.6%

2,2'-oxybis (4,4,6-trimethyl-1, 3,2-dioxaborinane) - *CAS# 14697-50-8* 27.4%

(Substituted dioxaborinanes: may be expressed as CAS# 8063-89-6)

Inert Ingredients

Petroleum Naphtha 4.5%

Inerts 0.5%

Total..... 100.0%

Boron Content 7.3%

Sulfur Content .....<1ppm

Physical Properties (typical)

Density .....8.75 lb/gal

Specific Gravity 1.05

Flash Point, Tag Closed Cup .....+102˚F min

Viscosity, (CST@ 40°C) 21.31

Pour Point .....-27˚F

Appearance .....Clear Liquid

EPA Registration # 65217-1

EPA Establishment # 61897-TX-0001

CANADIAN PCP Registration # 10301

TREAT RATE

Preventative Treatment – 135 ppmW *100 ppmV	Curative Treatment – 270 ppmW *200 ppmV
1 gallon : 10,000 gallons of fuel	1 gallon : 5,000 gallons of fuel
1 ounce : 80 gallons of fuel	1 ounce : 40 gallons of fuel

By weight: **270 ppmW – Curative Treatment & Long Term Storage**
135 ppmW – Preventative Treatment - Continuous Usage

For the most accurate determination of the amount of Biobor®JF required to treat aviation fuel, ppm by weight may be used with the following treat rate calculations.

270 ppmW: Ounces of Biobor®JF required = (total weight of fuel in lbs. x 0.004)

135 ppmW: Ounces of Biobor®JF required = (total weight of fuel in lbs. x 0.002)

By volume:* **200 ppmV – Curative Treatment & Long Term Storage**
100 ppmV – Preventative Treatment - Continuous Usage

To determine the required dosage of Biobor®JF in jet fuel using ppm by volume, the ppmV dosage rates above may be used to arrive at a volumetric conversion substantially similar to the ppm by weight dose rate.

*This conversion uses a standardized jet fuel density of 6.47 lb/gal (0.775 kg/l) at 59°F (15°C), the minimum density of jet fuel per ASTM D1655, and may be used as reference when injecting or applying Biobor®JF by volume.

Metric Conversions:

To determine milliliters of Biobor®JF required to give a concentration of 270 ppmW, multiply kilograms of fuel by 0.26, and for 135 ppmW by 0.13.

Preventative Treatment – 135 ppmW *100 ppmV	Curative Treatment – 270 ppmW *200 ppmV
1 liter : 10,000 liters of fuel	1 liter : 5,000 liters of fuel
1 ml : 10 liters of fuel	1 ml : 5 liters of fuel

BENVEROY
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BIOBOR JF

AVIATION FUEL BIOCIDE

Biobor®JF is the original, industry standard microbicide used to kill and prevent microbial contamination in aviation turbine fuels. Biobor®JF provides highly effective, proven dual-phase chemistry to eliminate the growth of harmful bacteria and fungi that contaminate fuel systems, clog filters, corrode metal surfaces and cause service interruptions.

For contaminated aircraft or storage systems with microbial growth present, Biobor®JF should be used as a "curative treatment" to kill and control microorganisms in the fuel tank. Biobor®JF may also be used routinely in sterile systems as a preventative to ensure fuel quality and prevent contamination. Proactive use of a biocide prevents biomass accumulation in fuel tanks, extends fuel filter life and inhibits microbial influenced corrosion (MIC). As an added benefit, Biobor®JF has been proven to increase the lubricity properties of jet fuel, providing additional protection and reduced wear to fuel delivery components.

Biobor®JF is fully compatible with a wide variety of fuels, fuel system components and common materials. It does not affect fuel performance and is more stable, less corrosive and safer to handle than many other biocide chemistries.

Since 1965, Biobor®JF has proven highly effective and compatible by many of the world's largest refineries, militaries, airlines, and GA aircraft operators globally, and is one of only two fuel biocides approved for aviation use.

BENEFITS:

- **Highly effective biocide to kill and prevent microbial growth in aviation fuels and aircraft (bacteria & fungi)**
- **Dual Phase – partitions to both the water and fuel phases for more effective and complete protection**
- **Prevents corrosion of fuel tanks and delivery systems caused by the acidic by-products of microbial growth**
- **Safer handling and less harsh/corrosive than competitive biocides**
- **The original, most widely used biocide since 1965**

APPROVALS:

- **EPA Biocide Registration #** 65217-1
- **MILITARY SPEC** - MIL-S-53021A
- **Aviation APPROVED** - approved for aviation use globally by FAA and IATA
- **ASTM D1655 -** Listed in Table 2 - Additives for Aviation Turbine Fuels
- **OEM APPROVED** – Recommended & approved by turbine and airframe OEMs

Preventative Dosage (135 ppmW*)	Curative Dosage (270 ppmW*)
1 gal : 10,000 gal of jet fuel	1 gal : 5,000 gal of jet fuel
1 oz : 80 gal of jet fuel	1 oz : 40 gal of jet fuel
*equivalent to 100 ppmV	*equivalent to 200 ppmV

*see next page for details

Application: For existing contamination, long term storage or periodic treatment, a curative dosage should be used for effective sterilization. Drain water bottoms prior to application and keep tanks dry with proper housekeeping. Monitor fuel filters after biocide application, drain tanks & replace filters at recommended intervals. Biocide may be applied by metered injection (recommended), by splash blending during fueling or with circulation to ensure uniform blending. Aircraft maintenance manuals should be referenced for recommended dosing practices.

Storage & Handling: Containers should be kept closed to atmosphere and protected from water contamination. It is a violation of Hammonds quality standards and EPA regulations to remove Biobor®JF from its original packaging. Please refer to the Safety Data Sheet for specific safety, handling and storage information. Shelf life is 3 years from date of manufacture.

The Industry Standard in Aviation since 1965

Kills and prevents microbial growth that cause fuel contamination & corrosion

For use in all hydrocarbons including jet fuels, avgas, diesel, biodiesel, heating oils, heavy distillates and lubricants

- **MIL-S-53021A**
- **Aviation APPROVED**
- **OEM APPROVED**

Available in 8, 16, 32oz bottles. 1 gallon, 5 gallon, 55 gallon, 330 gallon containers.

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Houston | Texas | 77040
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sales@biobor.com
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IATA Journal Article - The Evaluation and Risks Associated with not using a Fuel Biocide

September 3, 2020
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Microbes are everywhere. They are in the air, ground, fuel and fuel systems. As such, the risk of biodeterioration is always present with the potential for increase, absent a fuel biocide. Rob Midgley, Global Technical and Quality Manger for Shell Aviation, recently pointed out that "somewhere around 50% or more of those aircraft" parked are showing "signs of microbial growth after two to three months of storage." He goes on to say that "you really need to have a strategy to treat the aircraft." Since there is no such thing as a sterile fuel system, biodeterioration can occur in the best maintained systems. To recognize the solution, lets briefly evaluate the problems, identify the risks and offer a practical conclusion.

Evaluating the Problems

Microbiological contamination begins the moment fuel leaves the refinery and continues to accumulate through the supply chain to its final destination. Microbes need water and food to survive and multiply. The consensus is, keep fuel dry and you reduce the chance of biodeterioration. However, that is easier said than done. Water is always present in fuel at some level and it doesn't take much to sustain life. Fuels systems are constantly breathing, bringing in more contaminants including additional microbes and water in the form of condensation. A single drop of water can sustain colonies of microbes. As condensation forms, free water accumulates exacerbating the problem of microbial contamination. Long-term storage magnifies all of the problems linked to biodeterioration.

Fuel is a food source. Microbes consume fuel, breaking down the hydrocarbons and producing corrosive acids. They also change the composition of the fuel as they metabolize it. Microbes multiply at high rates and typically live in consortia. Never found alone, different species establish symbiotic relationships beneficial to each other forming biomass environments at water-fuel interfaces (*Figure 1*) on tank walls and linings or most any place in a fuel system capable of concealing a tiny fraction of water.

Figure 1 - 30-day old untreated fuel sample

Ready sources of fuel and water are not the only problems. Aircraft fuel systems are designed for everything except easy microbiological control. While many designs incorporate water-scavenging systems and other devices to limit water, the complicated tank designs including baffles and individual tanks with transfer systems create a host of complications. Aircraft have limited access points making it

difficult or near impossible to retrieve acceptable samples for testing or to inspect the system for the presence of biodeterioration. While draining sumps does help, the automated scavenging systems that are in use during operation are of no help while aircraft are parked. Water and bioburdens can easily accumulate in places hard to reach or detect and often go unrealized until contamination reaches very high, dangerous levels.

Fuel system design and the nature of the fuel testing process attribute to inconclusive results. Sample testing is diagnostic, not representative. A reliable sample should come from a location in the tank likely to harbor microbes such as a sump drain. That being said, testing can still be inconclusive. A negative test result does not indicate the fuel is free of microbial contaminants. In contrast, a positive result makes it that much more important to act, no matter how low the level of microbial contamination. If the test indicates a positive result, the likelihood of biodeterioration is dramatically increased.

Identifying the Risks

What are the risks associated with microbial contamination and more specifically with not using a fuel biocide? *Table 1* represents the main risks linked by microorganism type. It is not difficult to see how potential problems can become both catastrophic and costly to remediate if not managed in a fundamental way. The facts are straightforward:

- Microbes are EVERYWHERE
- Water is ALWAYS present
- Microbes need WATER and FOOD
- Fuel is FOOD
- Fuel systems are NEVER sterile
- Good housekeeping ALONE is not enough
- Biocides KILL microbes
- The systematic use of **BIOCIDES WORK**

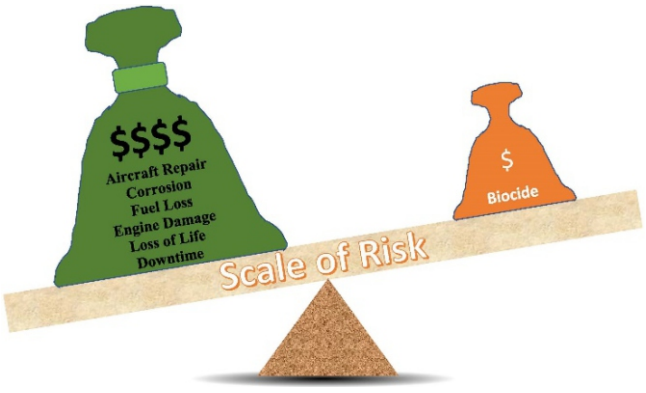
Problems	Primary Microorganism
Pipe, valve and blockage	Fungi; biopolymer bacteria
Fuel probe damage	Fungi; biopolymer bacteria
Sludge formation	Fungi; bacteria (all)
Surfactant production - coalescer/water separator malfunction and fuel/water emulsions	Fungi; aerobic bacteria
Corrosion (MIC)	Fungi; anaerobic bacteria and sulfur reducing bacteria
Downtime	ALL
Suspended solids in fuel	Fungi; bacteria (all)
Hydrocarbon breakdown	Fungi aerobic bacteria
Filter clogging	Fungi; bacteria (all)
Injector fouling	Fungi; aerobic bacteria
Increased sulfur content	Sulfur reducing bacteria
Damage to protective linings	Fungi
Loss of Life	ALL

Table 1 Problems associated with microbial growth

The risks are straightforward as well. From a risk approach, any of the problems in *Table 1* will certainly increase operational costs as well as the potential for catastrophic event. They are all a cause for concern and action.

Practical Conclusion

Compare the cost to treat the fuel with a biocide and the cost to remediate repairs associated with the problems in *Table 1*. The cost differential and the risk associated with not using a biocide are staggering. The Scale of Risk illustrates this fact. A biocide treatment costs in the $100s versus repairs ranging in the $100,000s. The risks



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associated with not using a biocide are much higher than its use. The present unprecedented long-term storage of aircraft is proving to be more than a challenge. Inactivity raises the risk of serious contamination issues, often hidden from plain sight. A proactive, preventative approach reduces the risks associated with long-term storage. Early intervention is the key. If a diagnostic test indicates any level of microbial presence, a biocide treatment is the only way to ensure the risks are reduced.

BIOBOR

AVIATION FUEL ADDITIVES

JET AIRLINERS • HELICOPTERS • BUSINESS JETS • CROP DUSTERS

BIOBOR JF

Jet Fuel Biocide

Accepted by

FAA

IATA

Biobor®JF kills and prevents **micro-organisms** (fungi, bacteria, yeasts) which cause aircraft and **fuel tank contamination**...Plus **adds lubricity** to **reduce engine wear**...**protecting vital engine parts.**

- **Prevents** microbial growth in fuel tanks
- **Prevents** clogged filters and MIC corrosion
- **Adds** lubricity
- **Dual phase:** water and fuel soluble, for a more efficient kill
- **Recommended** by airframe and turbine manufacturers around the world
- Military Spec **MIL-S-53021A**

Biobor®JF
Available in 8 oz./16 oz./32 oz.
1 gal./5 gal./55 gal./330 gal. totes

BIOBOR HUM-BUG DETECTOR KIT®

EARLY WARNING!

- **Early warning** detection of microbial infestation in fuel
- **Detects** microbial growth in all hydrocarbon fuels and oils
- **Ensures** fuel supply **quality**
- **Low cost**, easy-to-use

The HumBug Detector® Kit identifies the presence of microbial infestation in fuel tanks. Use this in conjuction with **BioborJF®** to ensure a clean and safe fuel supply.

HumBug®
Available in 12 kit cases

LubriBor CI/LI

Corrosion Inhibitor and Lubricity Improver

LubriBor® adds lubricity and **corrosion protection** to Jet Fuel and AVgas

- **Lubricates** Vital Engine Parts
- **Protects** against corrosion
- Helps **Reduce** Maintenance Costs
- **Approved** under **QPL-25017**
- **Reduces** Engine Wear

MIL-SPEC product Approved for use in commercial and military jet fuel

LubriBor®
Available in 16 oz. / 5 gallon pail
55 gallon drum

Also available from Hammonds...
Prist®–Fuel System Icing Inhibitor
Stadis 450®–Reduces electrostatic charges in jet fuel

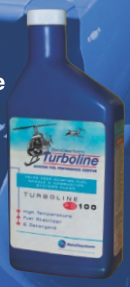
Turboline® FS100

Aviation Fuel Performance Additive

Turboline® is a **high temperature fuel stabilizer** and **detergent** for aviation fuel

- **Maintains** engine **power levels** longer
- **Less soot** and **coke** in combustor
- **Fewer** fuel nozzle **cleanings**
- **Reduces** operating **expenses**
- **Lowers** maintenance **costs**
- **Improves** aircraft **availability** and **flight safety**

Turboline®
Available in 16 oz. / 5 gallon pail
55 gallon drum



"All the Fuel...All the Time."®

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a reprint from **Aviation Maintenance Technology...**

Busting the myth that Prist eliminates bugs...

Wing tank corrosion and related fuel contamination

by Jim Street

Even for the operator who practices good housekeeping, tiny creatures with scientific names like cladosporium resinae and Pseudomonas aeruginosa, but affectionately known as "**HumBugs**," **can lurk in your jet fuel tank** and eat their way into **high maintenance bills for you** down the road.

Fortunately, there is a **simple test** to **find these hungry HumBugs**–or Hydrocarbon Utilizing Microorganisms–that can actually double in size in as little as 20 minutes and a product that can, as the Raid ads proclaim, "kill them dead."

Walter Chartrand, Vice President of Hammonds Technical Services, Inc. and Hammonds Fuel Additives, Inc., both of Houston, says the product lines of his sister companies include a **test kit** to find HumBugs and their ilk and fuel-soluble biocide **Biobor JF®**, which can **eliminate the HumBug colony** and keep it away.

It may stretch the imaginations of some to realize that there are creatures that not only can exist in the jet fuel tank of the company bird but that even thrive in tiny amounts of water and grow big and strong by actually eating the hydrocarbons and minerals in the fuel.

"Most biological contamination consists of colonies of **bacteria** or fungus which **use the fuel as a food source**," Chartrand says. "They reside at the fuel/water interface and, as they reproduce, they manufacture acidic by-products."

He says there are dozens of strains of bacteria that thrive in the hydrocarbon environment and more than 250 varieties of which fewer than a dozen are actually our friends the HumBugs.

They require **four conditions to grow** and multiply: **fuel for a food source**; **water entrained in the fuel** or introduced by rain or condensation, **warmth** and **time**. The warmer the environment, particularly in excess of 72 degrees Fahrenheit, the faster the creatures multiply and the sooner your fuel tanks will be in trouble.

Jet airplanes are particularly **favorable habitats** for the **bugs to thrive** in, Chartrand says. Even the purest fuel has water in it–it's part of the chemical makeup. The aircraft is filled with pure fuel and, at altitude, condensation forms, them turns to water when the aircraft lands.

"So you land someplace warm and humid like Fort Lauderdale and these microbes are jumping around in there having a great time," he says.

But while jet airplanes are prime incubators for the HumBugs to develop, **they can occur in all components of the fuel handling system** including **storage tanks**, **pumps**, **filters** and **delivery lines** as well as the airplane's **fuel tank**.

In fact, storage **tanks which** may **contain fuel for an extended period** are sometimes **more likely incubators** than an airplane which turns over fuel loads fairly quickly.

He says some fuel storage tanks were initially installed with the water sump drains at low point and fuel draw at a higher spot. But through improper installation or shifting and settling ground, the locations eventually become reversed. Therefore it is recommended that all jet fuel storage tanks have floating suction.

The operator shows no water in the tank because the sensor is above the water but the pump is pumping out water," he says.

Chartrand says the **Biobor JF®** product can be used for **jet and diesel fuel**. But he says the **bugs** can grow strong and healthy in aviation applications and it **important to keep them controlled**.

"An assortment of complications may be associated with microbial growth in addition to fuel degradation," Chartrand says. "Existence of **HumBugs** in storage leads to **corrosion** and **pitting** which might result in actual **penetration of tank walls**. Fiberglass tanks are also affected by delamination by the microbes' acidic waste by-products. Microbial **growth** in fuel quickly **clogs fuel filtering systems** which could result in equipment fuel starvation.

Pieces of eroded tank linings and **fungal debris** may pass through equipment fuel filters and **clog fuel lines** or **plug injector nozzles**, reducing efficiency," he adds. "Fuel quantity probe damage is also common.

"In many installations, fuel quantity measuring devices incur damage and the slime interferes with the operation of such mechanisms leading to erratic or inaccurate readings," Chartrand says. "**Sealant** and tank **top coatings** are **destroyed by the HumBug** waste products and sometimes serve as an alternative mineral food source.

"And finally," he says, "fuel injector coking results in flow capacity loss and injector surface deposits."

Chartrand says there are several ways an **operator can determine** if he is providing sustenance for HumBugs.

Slime deposits can show up on **tanks walls** or **piping** that are **slick to the touch**. They might be greenish black or brown, but they can be almost any color, he says.

Other clues include black, brown or other **colored stringy material** suspended in **tank water** bottoms; **swelling of rubber surfaces** coming in contact with fuel; sludge slime deposits on filter surfaces, and a "**rotten egg**" **smell** of sulfuric acid.

"Some microorganisms produce hydrogen sulfide while breaking down the fuel resulting in a sulphur smell," he explains. The resulting acid "tends to make holes."

To be sure you have been visited by the HumBugs, Hammonds offers **simple and inexpensive HumBug Detector Kit®**. It consists of a septum bottle containing a sterile hydrocarbon fuel/water mixture.

A sample of fuel, oil or water bottom is injected into the septum bottle and if the material being tested is pure, nothing happens. But is **problems lurk**, the **mixture turns red**, telling one and all that the dreaded HumBugs are present.

That's when **Biobor JF®** come to the **rescue**.

Biobor JF® is a special formulation of glycol borates designed for **maximum biocidal effectiveness** in hydrocarbon fuels and oils. It is authorized by FAA and **recommended by a host of airframe and engine OEMs**. It is registered with the EPA as a pesticide and **recognized by military** specification number MIL-S 53021.

It is **compatible with** a wide variety of **fuel system parts** and top coatings, sealants and elastomeric materials and does not affect fuel performance.

"When fuel tanks are opened for maintenance, a visual examination should be made to determine the presence of slime on interior surfaces and particularly in sump areas where slime proliferates," a company service bulletin advises. "Water, routinely drawn from sump areas, should also be inspected for slimy debris."

After fully inspecting the affected areas and repairing any damage that may have occurred, **Biobor JF®** can be added to the fuel at a rate of 270 parts per million for the initial shock treatment and 135 ppm as a maintenance dosage to keep the bugs away.

The higher level for "shock" treatment is approximately one gallon of **Biobor JF®** for 5,000 gallons of turbine fuel. The lower maintenance level equates to about one gallon in 10,000 gallons of fuel.

Chartrand emphasizes the need to provide a uniform level of treatment and **metered injection is strongly recommended**. Once again, Hammonds is ready and willing with a metering system.

In fact, it was the metering system that got Hammonds President and founder, Carl Hammonds involved in the aviation industry to begin with.

He says he was building metering equipment for various applications when he learned of a serious fuel tank corrosion problem in the early Douglas DC9s coming off the assembly lines. He developed an injector for adding treatments to fuel flows going into the then-new airplanes and the rest, as they say, is history.

The **Hammonds injector** can be **mounted on a fuel truck or fuel stand** to measure a **steady flow** of the additive in **exactly** the **right proportion**. They can also be free-standing on a small cart for mobility.

The additive injectors are driven by the fuel flow and **do not require external power** or other complicated installation. A simple mechanical pipe connection is all that is required.

"The efficient Hammonds fluid-powered motor **borrows** just enough **energy from the flowing product** line to do the job," Hammonds brochure states. "**No need for electricity, air or pressurized additive lines**."

The **fuel flowing** through the injector **powers pumps** that are calibrated by the operator.

"Complete, **passive operation** means they automatically operate when the rest of the system operates," the brochure states. "If it is connected to the system, it '**remembers**' **when to run**, **how much to inject** and **when to stop**. The operator has nothing to remember, nothing to adjust, nothing to forget."

Many injectors are connected both to **Biobor JF®** and Prist® lines and can be set to deliver either or both–or any other additives–to a fuel load.

Chartrand stresses the importance of a uniform flow of the product to the fuel system. He says one **Biobor JF®** user poured the solution into his wing tanks instead of injecting it and it failed to kill all the microbes in all the tanks.

"He thought the product wasn't doing its job," Chartrand says. But it turned out that the problems had developed in a center tank and a dorsal tank–both some distance from the wing tanks–and the additive was just not getting everywhere it needed to be.

Fuel contaminated with fungal growth. This infestation can occur in aircraft fuel tanks causing clogged filters and corrosion.

And he says, if the mixture is not evenly distributed, there is a danger of excessive concentrations. More than 1,000 ppm may cause the formation of solids, diminishing the product's effectiveness.

If metered injection is not available, Hammonds recommends that the operator should fill the tank half-full with fuel, then add the **Biobor JF®** to the fuel and complete the filling process to ensure proper dispersion. **Biobor JF®** should never be added to an empty tank.

The company service bulletin recommends a two-step prevention program including the addition of **Biobor JF®** and proper maintenance of the fuel handling system.

"This is a key step because the effectiveness of even the most efficient fungicide can be reduced if the fuel is allowed to retain fungal debris and high excesses of water," the bulletin states. "Proper maintenance, therefore, requires regular removal of accumulated water bottoms and drainage of sump areas in addition to property filtering to remove debris.

"Filters and screens should be inspected regularly," the bulletin advises. "Storage tanks must be included in regular cleaning and inspection schedules.

"In some instances, good housekeeping may be all that is needed to prevent fungal growth," it concludes. "However, **contamination occurs very easily** and even the best maintained systems may need the assurance of **Biobor JF®**.

"At **two cents a gallon**, it's pretty **cheap insurance** says Jim McCrosky, director of maintenance for Exxon's Houston-based Aviation Services. His fleet of four Hawker 800s were acquired eight years ago and **Biobor JF®** is added with every tankful.

"We have never had any major damage," he says. "Hawker says if you don't use an additive you have to inspect the tanks every three months."

He says Exxon's corporate fleet inspects its Hawkers every two years and "we have had some minor cleanup, but never anything major. **We put it in and it works**. There is not much to say."

McCrosky says some operators that do not use **Biobor JF®** "probably wish they had."

The Hammonds companies have acquired all rights to the

Biobor JF® product line which was developed over 40 years ago by U.S. Borax and Standard Oil of Ohio. Hammonds (also a distributor for the commonly requested Prist® additive) is busting the myth about Prist® as Chartrand says there is some confusion as to what each of the additives does and what they do not do.

"Some people think they are using Prist® so they don't need Biobor JF® ," he says. "And some think by using Biobor JF®, they don't need to use Prist®.

But they do different things.

"Prist® is designed to act as an anti-icing agent for aviation jet fuels," he says. "Scientifically known as a fungi*stat*, Prist® changes the freeze point of water droplets.

"Prist® .....won't kill the bugs."

"It works like the candy coating on M&Ms–creating a shell and encapsulating water droplets that might contain the bugs," he says. Prist® puts a barrier between any bugs and their water source but it ***won't kill the bugs***. It simply stops their continued growth.

"Biobor JF®, on the other hand, is a fungi*cide* designed as a pesticide for microbial growth," he says. "It **attacks the bugs directly** by poisoning their food source, **eliminating** the problem of **clogged filters and lines** as well as the **corrosion** that comes from their acid waste by-products."

Not all jet aircraft need Prist®, he says. Others "can't fly" without it.

If an aircraft is equipped with a fuel heater, such as most airline aircraft, Prist® is not needed. But in the warmer surroundings of the heated fuel, HumBugs have a field day because they thrive in the warmer environment.

The service bulletin says that Biobor JF® begins to act immediately but cautions the operator to allow sufficient time on large infestations for a thorough kill.

Build up of HumBug waste can harm vital engine parts

"The concern is that Biobor JF® treated fuel in a contaminated tank will begin to break up large mats of growth into smaller ones which, once dislodged, could cause filter or line plugging," the bulletin states. "It is important that treated fuel be allowed to kill an infestation completely."

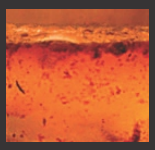
"Even still, when large, visual infestations exist, once killed, carcass remains and particulate matter which may have been trapped in large mats of microbial growth will need to be removed manually or by filtration."

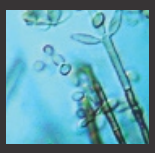
Chartrand says the dead bugs become brittle and lose their slimy characteristic. But the remains can still cause problems if the operator does not have a plan for dealing with them.

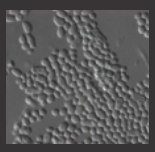
Once the treatment begins, however, what had been a serious maintenance headache now becomes a routine chore designed to keep the fleet in top operating condition and the life of the operator far less complicated.

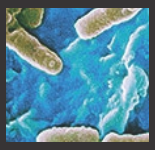
Wing Tank Corrosion and Related Fuel Contamination

Busting the myth that Prist eliminates bugs...









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