THE GAMGRAM

No. 70 WHEN FUEL CONTAMINATION GETS SERIOUS APR. 2019

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In past GamGrams, we have addressed many aspects of the responsibility we in this industry have to keep fuel clean and dry as well as not causing injury to the aircraft, refueling equipment, the environment and the human operators. What we have not addressed specifically is contamination and flight safety.

Bear in mind, these contamination events are not always your responsibility, but you need to know more than just what is obvious or is even technically your responsibility.

1. **Water and Dirt** - We all know that water doesn't burn and therefore is not good to put it into an engine, but it causes other problems as well. It promotes microbe growth and it has been postulated that it causes or provides a place for other contaminants to gather. One example is the interesting mechanism of condensation. As fuel in an aircraft tank cools at altitude, there are always very tiny particles of rust present that are too small for the roughly one micron refueling filters to remove. There are also dust particles entering the tank through the tank vents. These act as what we call "nucleation points," places for water to condense. The rust particles are typically smaller than a micron, while the dust that enters the wing tanks through the vents is typically larger. This "dust" often contains spores for fungi and also silica, abrasive inorganic dirt.

   This explains something many people do not understand: how fuel filtered to one micron on the refueler can plug engine filters rated 30 microns or greater. These particles, with water on them, provide a place for microbes to grow, but they also attract other contaminants. These trace contaminants can be detergents or any of a long list of other trace contaminants attracted to water.

   Overview: It is a fact that such particles have been known to cause problems for the fuel systems, the primary one being the plugging up of engine filters, which can lead to malfunction of the engine controls. Pilots can lose control of the engine and yes, this has happened.

   What we can do: Drain any and all water and dirt that we can remove out of our systems, most especially to drain filter and tank drains and sumps regularly - and by regularly we mean frequently enough to not ever build up more than a trace of water or dirt in those sump samples. In addition, change coalescer elements if they show ANY "leopard spots" on the outside cloth cover. If you see spots after one year, inspect and change elements more frequently. Of course, if there is ANY sign of microbes in your system, properly and immediately address the problem. How this should be done is a subject you should decide with the proper authority, your airline, oil company or whoever is responsible. Approved biocides are available. We must always look for ANY change in the appearance of low point fuel sump samples, but DO NOT TAKE AIRCRAFT FUEL SAMPLES YOURSELF, unless authorized by the pilot or aircraft owner (and approved by your management).

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2. **Human Error** - You may have heard that on at least three occasions, truck maintenance people put Diesel Exhaust Fluid (DEF) into the wrong tank, the tank reserved for anti-icing additive. It is critically important to make sure that additive tanks are CLEARLY labeled for FSII/Anti-Icing/Prist/DiEGME additive. An effort is being made to make these lockable for added safety. A lockable camlock cap will add this safety to most stainless steel additive tanks. We have found that a plain bicycle lock can make it much harder to put DEF into plastic DiEGME/FSII/"Prist" shipping jugs, but isolation of DEF containers from FSII containers and proper training is critical.

   In some or all of these events, the cause seems to be accidentally getting DEF from the supply room when the operator was looking for DiEGME/FSII. So isolating DEF storage is critical as well as proper training and supervision.

   How bad can it be? In at least 12 cases that we have heard of, the entire fuel system on the aircraft needed to be replaced or carefully cleaned. At least four engines have had to be replaced.

3. **Filter Separator Water Controls** - We are presently in a rush to stop using SAP type water absorbing filters on refueling vehicles (JIG Bulletin 111 and A4A notice) by 2020. An approved and proven alternative is not yet available. Many people in the industry today may have not been in the industry long enough to recall when and WHY we adopted these filters in the first place. The simple reason was that in some cases we got significant volumes of water into airliners through filter separators. Howard Gammon, who founded this company, once famously said, "A filter separator without a working water control is just a water collector." His point was that a filter separator COLLECTS water in the sump and that water must be drained or it will build up and eventually flow right into the aircraft.

   Water controls are CRITICALLY IMPORTANT. They may be float operated or electronic, but they MUST BE REGULARLY TESTED. There have been events where over 150 gallons of water were pumped onto aircraft through perfectly functional filter separators, because the water sensor didn't alert the operator and didn't stop the flow.

4. **Poorly Installed Filter Elements** - Installing the elements into a filter separator is a bit more complicated than installing monitor elements. Not only should you never touch the elements with your hands because it may disarm the elements, but a filter separator will not work unless all the elements are correctly "seated" and the correct hardware is installed. Even a missing "spider plate" (the plate used to center the closed end of the elements) MUST be installed. Why? Because the elements can work loose (especially on a vehicle bumping down the ramp) and if an element comes loose or the end cap gets loose, dirt and water will get into the aircraft. Spider plates also ensure proper element spacing. But all hardware inside a filter vessel should be removed and inspected for damage, corrosion, or failed gaskets at least every five years.

5. **Differential Pressure** - The new JIG/IATA and A4A standards require an automatic shutoff or monitor vessels if differential pressure exceeds 15 psid. We certainly have provided thousands of conversion kits to retrofit Gammon Gauges to provide this safety and we appreciate the business, but these MUST BE INSTALLED CORRECTLY AND TESTED. Be sure the control actually works. If it doesn't, it can cause engine controls to stick and be uncontrollable by the pilot. The elements may have a 175 psi burst strength, but this is a proof pressure, not an operating pressure.

So be careful of little things; they can become BIG problems and may even lead to the loss of the aircraft.