THE GAMGRAM

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With any new technology, even those of us who consider ourselves “experts” have to learn new skills to work with and troubleshoot new equipment. The "tried and true" older technologies do work well, so the advantage of new technology has to be to add more functions, better safety, greater efficiency, better record keeping or a combination of these elements.

In our opinion, the logical way for future refueling vehicles to work is to have all new technology centralized, not in separate meter, chassis, fuel quality and additive system (if present) controls. We encourage control manufacturers to directly connect to our Digital Gammon Gauge and Viper Additive Injector to eliminate the complexity of adding separate controls.

Electronic Flow Controls

1. **Engine Management System (EMS)** - Patented (in USA) by Rampmaster for use in diesel powered refueler (tank type) trucks. Basically, an expansion of the computer control on modern diesel engines, adding in refueling control.

   The result of the Rampmaster design is a much more fuel efficient refueler with fewer parts than a conventional refueler. (No control valves, reference regulators and gauges, or venturis). Calibration is simple. Fueling is done with better fuel economy, less pollution and longer life for the engine and pump parts. It provides the fast refueling rates at accurate pressures. The engine only runs as fast as is needed to generate the desired flow/pressure. Deadman function is by a simple air operated butterfly valve, an air operated butterfly bypass valve and a PTO interface. The result surprises even experienced fueling experts. It can be used with or without hose end regulators but is limited to pump-type tank vehicles.

   Setting up the EMS is simpler and may result in some improvement in fueling time on smaller tanks that accept fuel more slowly. A pressure transducer (and PLC) does a better job than a venturi when the flow rate is restricted. At this time, Rampmaster is the only US supplier of this design. We are told that the German manufacturer Kunz manufactures a similar design.

2. **Digital Electronic Pressure and Flow Control** – CarterEaton designs are available for both refuelers and hydrant carts using inline control valves plus bypass valves on tank-type refuelers and pit couplers on hydrant carts. This design is similar to a conventional system, but controls the valves electrically instead of using compressed air/hydraulic controls. The system is more accurate in pressure control and flow rate control than a conventional system and easier to calibrate. A transducer is more accurate at lower flow rates than a venturi so fueling times may be improved particularly when filling smaller auxiliary aircraft tanks.

   Note, different traditional control systems work differently and some brands match or come close to matching the digital system flow times, even when flow is restricted.

Additive Injection Control and Monitoring

Modern additive injection systems mostly work with electronics, either simple or complex. The simplest designs have a visual flow indicator that the human operator needs to monitor to be sure the additive is flowing. The more complex injectors use a microprocessor to monitor additive concentration and should self-adjust, keep records and stop fuel flow if there is a problem. Of course we manufacture the most common injector, the Viper, and can provide the electronics or these can be provided as part of the meter or truck control system.

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You may think that additive injection is only for anti-icing additive for small aircraft and helicopters, but that may not be true in the future. We are impressed with a new additive, Aquarius, which eliminates all water concerns by breaking the water into submicroscopic (nano) particles (up to the additive's stated capacity) and encaging them so they are consumed together with the fuel. In 7 years of testing, Aquarius has undergone and passed all tests it has been subjected to, including a flight test. These particles are tiny, smaller than a mold spore and have no negative effect on the aircraft.

This additive is expected to provide protection from corrosion, micro-organisms, attack on tank linings as well as ice formation in tanks and in engine controls and issues with tank drain lines freezing. It must be injected proportionally as the aircraft is fueled to preserve the additive's capacity. 250 ppm of Aquarius can neutralize up to about 240/250 ppm of water. *It is reportedly non-toxic, unlike anti-icing additive.*

Electronic Sensing of Fuel Quality

Both Faudi Filters and ParkerVelcon have developed laser devices to help detect contaminants in jet fuel to meet the EI 1598 standard. These devices use light scattering/obstruction technology to determine the difference between water and dirt. They do not, as of this printing, determine the exact dirt or water content, but do give a graduated response and detect trend changes and may (should) provide slug sensing.

Constant sensing just downstream of the final filter is a valuable real-time supplement to periodic testing. Consult the manufacturer and your own QC experts for more details. This technology is not inexpensive.

There are also density sensing devices than can detect different fuel grades or significant mixture of fuels as well as fuel weight for the pilot's use. Also not inexpensive.

Particle Counting

Particle counting provides a relatively inexpensive (compared to some electronic sensors) periodic test in place of the traditional 0.8 micron "Millipore"TM or "MiniMonitor"TM membrane test to ASTM D2276. Particle counting cannot detect the smallest dirt or water particles (under 4-5 microns) or tell the difference between dirt and water without a cosolvent such as “Resolver”. Because particulate is usually present in both small and large particles, in most cases the 4-5 micron limit should not allow particulate to go undetected. These devices do not meet ASTM D2276 or D3240 but are good for trend analysis and are under ballot at ASTM at this writing. This technology has been widely used in many applications, including lubricating oils. It is presently a periodic test.

Differential Pressure and Filter Condition Monitoring

Monitoring corrected pressure drop across the final filters may become common in the future. Using our Digital Gammon Gauge removes the need to “condition” the readings from transducers. (spikes and waves cause errors, see GamGram #26). We feel the real value of DP monitoring is in bulk transfers, to detect gross dirt upon change in custody.

Conclusion

So do you need any of these things today? The old saying is that "If it isn't broken, don't fix it" - but we see technology becoming important in the future. Constant monitoring is simply better than periodic checks. But cost is always a prime concern as well. Technology is not cheap.

One day perhaps quality control will involve computer monitoring of the function of every part of our fuel systems. But it is important that we keep every vigilant, computers cannot think. Looking for any change and understanding the possible ramafications is the job of the QC expert. As we always say, quality control is there to find little problems before they become big ones and looking for changes is the key to quality control and safety, no matter how seemingly insignificant.
In our opinion, electronics should help, not replace fuel handling professionals.