SALT LAKE CITY DEPARTMENT OF AIRPORTS

GENERAL AVIATION NEWS

VOL. 15 ISSUE 3 MARCH 2007

WINTER GA CONSTRUCTION

SLCIA- Runways 17/35, 14/32, and taxiway R will be resurfaced this summer. Specific schedules of affected areas will be detailed in subsequent newsletters.

Airport II- Construction of the nested T-hangars east of row E on the new ramp nears completion. Availability for occupation is estimated about April 1st. Anyone desiring occupancy in the new hangars in April may contact Johnathan Liddle at 801-575-2894 for additional information.

Air Center of Salt Lake's new 8,000 square foot hangar under construction is progressing on schedule. It will be used to hangar transient and tenant aircraft. Completion is forecast for April 2007.

GA AIRCRAFT FUEL SYSTEMS 101

By Jim Cavanagh in AOPA Pilot Magazine

More than just about anything, pilots fear a sudden silence coming from up front. To go from a solid, throaty rummmmmm to a whishy wind noise is the granddaddy of all discomfort factors. It also doesn't score any points with your passengers.

Thank goodness this doesn't happen often. Our little engines are simple, tried and true. I think that the only thing more dependable than an aircraft reciprocating engine is a tape measure. Redundant ignition and fairly loose tolerances combined with simple gravity fuel feed or redundant, dissimilar fuel pumps (engine driven and electric) are the mainstays of these mills. All of the other stuff… EGTs, CHTs, fuel flow gauges and monitors-are extras. The engine is the thing, and the thing is nearly always there for us.

The one thing that would cause an engine to quit abruptly in every case is an interruption of fuel. Sure, other things could cause an engine to quit, but you would have to have two bad mags at the same time, or throw a rod, punch a hole in the case and seize the engine, and these are rare, rare, and rare.

Yup, fuel is the thing we need to keep an eye on, and the list of times that would cause a fuel problem is, thankfully, short, including fuel starvation, carburetor ice, improper fuel, and fuel exhaustion.

Basically, carburetors pump the fuel through a jet that sprays the fuel, atomizing it so that induction air will carry it to the cylinder through large intake tubes. An injected engine meters the fuel and pumps it to injector nozzles in the cylinder head, and this atomization occurs during the intake cycle of the combustion process. The latter is more precise and is used on higher powered engines.

Fuel starvation occurs when there is fuel on board, but it doesn't make it to the engine. This can occur for three reasons-mechanical blockages, caused either by a bend or kink in a line or incorrect plumbing, blockage by contamination, selector switches improperly selected, and inadequate venting.

These are some of the ways fuel to an engine can be disrupted. Not knowing your plane's system or having a labeling error, a plumbing error or a blockage are the four main reasons for disruption of fuel in a gravity-fed airplane. In a low –wing airplane, you can add the failure of both fuel pumps (a highly unlikely possibility). Of the first four, the one that you would expect to find the most is a blockage due to material in the line.

When we sump our tanks, we are looking for two things: water and contaminants. Contaminants can be anything, from dirt to bugs or parts of the lining of the fuel bladder to a glob of wet wing tank sealant. All of these things are rare, since all fuel is filtered multiple times, but storage tanks get old, bladders get old, and things happen.

The designers of the systems allow for a certain amount of this. Sumps are placed at the lowest points in the tanks, including multiple sumps if the tanks up two bays. They are also placed at lower points in the system, like the belly, header tanks and a gascolator on a strainer drain in the engine compartment. In the nineties, Cessna came out with service bulletins to install additional drains in select models. Screens are installed at the fuel port that stop large particles from entering the supply lines, and the orifices in the sump drains are large enough to allow smaller particles to be removed with the sumped fuel. And still, things happen.

When a system is opened for service to allow access to something, the lines need to be plugged to prevent contamination from getting into the line. Most fuel lines are 3/8 to ½-inch aluminum, with blue anodized aluminum fittings aft of the firewall and steel components in the engine compartment. There are bends and angles for routing the lines, and the aluminum tubing is relatively easy to crush or ding with tools when working on other items. A good annual inspector will have the fuel lines inspected to see if there is any reduction in dimension. This would be a likely place for a blockage to occur.

In gravity feed system, it is possible to have a blockage in either of the two lines coming down from the wings or in the main line to the engine after the fuel selector. While the former is bad, the latter is worse, blocking the availability of fuel from both wings.

With an injected engine, fuel can be blocked at the pump or the injector itself. Some mechanics like to clean injectors at annuals because of suspected varnish or evaporative buildup, but in these

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HOTLINES

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very pages, we're told that the number one contaminant in a fuel injector is shop rag lint! So, "if it isn't broke, don't fix it"!

Proper venting is hugely important in a fuel system. If the fuel leaving a tank cannot be replaced with air, it causes a vacuum which can become so great that it overcomes gravity and/or a fuel pump.

Probably the number-one blockage gremlin is carburetor ice that is caused by the cooling mechanics of vaporization. Converting liquid gas to a vapor reduces the temperature in the carburetor by around 30 degrees Fahrenheit. At around 55 to 65 degrees OAT, if there is sufficient humidity, ice will occur. Not may occur, will occur! Sometimes it is transient, but sometimes it will build up on the throat and butterfly and significantly reduce fuel flow. It is more prevalent on carbureted Continental engines, since Lycoming induction tubes run through the oil sump and are heated by conduction to well over the icing threshold. Owners experience more icing with automobile fuel than avgas because of the volatility of the fuel.

There are instances where airplanes get topped off with improper fuel like jet fuel in recip engines or avgas in turboprops. Mogas has been used to top off airplanes requiring 100 octane fuels. If a mis-fueling can happen, it sometimes will. It is the pilot's responsibility to check not only the fuel levels and drain the sumps after fueling but, also to verify the type of fuel on board.

Be careful not to use auto fuel when you really shouldn't. Not all planes like auto fuel. It's not that it won't burn in an engine, which it will, but because of plumbing, induction system or myriad other idiosyncrasies, it just won't work well.

The culprit with mogas in most instances is vapor lock, which occurs when fuel in a line boils due to heat, creating a pressurized bubble. Vapor lock is insidious. Usually, at low power settings, there is enough fuel for combustion. When you advance the throttle, there is a normal power surge as fuel in the carburetor bowl is used and then a sudden loss of power when the bowl isn't refilled… and another uncomfortable moment ensues.

Vapor lock is more common in fuel-injected engines than in gravity-fed carbureted systems but isn't as much of a surprise with an injected system… because the engine won't run long enough to start the takeoff roll. Injected engines will sometimes start, then immediately shut down, start again, and shut down again until the engine compartment cools or the vapor bubble is removed from the line.

Airplanes using firewall mounted pumps to pull gas from the tanks are more prone to vapor lock than designs with pumps pushing from the tank end.

When you run out of fuel, the engine quits. Everybody knows this, but somehow some pilots don't actually realize it. Just the fear of running out of fuel when the gauges get down to a quarter tank is uncomfortable. But even knowing this, fuel exhaustion is still a major cause of accidents.

Avoiding fuel exhaustion is as basic as one, two, and three. You have multiple tools to help: fuel gauges, which, by the way, according to FARs only have to be accurate when they read empty, a trip fuel log, the POH Fuel Use Tables and a fuel-flow indicator, a clock, and the ever-more-popular fuel totalizers.

Estimate fuel burn on start, run-up, taxi and takeoff to altitude, and compute the total so you know where you are. Everyone knows this simple math but people get diverted; winds change, and any sort of onboard anomaly, like a leaky sump or a siphoning cap can make all of this figuring worthless.

The most important money you can spend on your airplane is a fuel totalizer. Electronics International, JPI, DMA and Shadin are some of the companies that offer these units. They will tell you how much fuel you are burning at the time, how much you have burned on a trip, or how much you have burned since you filled up, as long as you remember to reset it.

The little transducers they use, vanes that are spun by fuel flow, are calibrated per installation, but they only represent what they can sense. If they aren't reset with the correct amount of fuel, if there is a leak, or if someone steals fuel out of the airplane late at night, they will not be representative of the actual fuel on board.

Cessna engineers have been refining the fuel systems on their airplane for almost 60 years. Some of the new models have about 19 sumps. But they can't plan for everything. For all of their effort, things are going to happen that will somehow cause a fuel problem, someway for someone. The best we can hope to do is to follow aircraft manuals, perform every bit of maintenance and service required, and fly responsibly. We, as pilots, have to fly expecting the worst and enjoying the best.

HELPFUL POINTS OF CONTACT

For GA operational, facilities maintenance, aviation, newsletter, airfield and SLC Title 16 questions call: Steve Jackson, General Aviation Manager, 647-5532 or e-mail at steve.jackson@slcgov.com.
For hangar lease and repair questions call: Johnathan Liddle, Properties Management Specialist, at 575-2894 or e-mail at johnathan.liddle@slcgov.com.
For aviation security questions call: Connie Proctor at 575-2401.
For gate access problems call: Airport Control Center at 575-2401.
For emergencies call: at SLCIA, 575-2405
at TVY or U42, 911 then 575-2405
For common General Aviation information call the GA Hotline: 575-2443

UPCOMING EVENTS

Dave and Ryan Coats' AIR CENTER at Salt Lake Airport II (U42) has resumed its monthly fly-in/drive-in breakfast. They are held at the AIR CENTER 9:00 AM - noon on the last Sunday of each month.

Happy St. Patrick's Day!