100LL Fuel Future?

As a member of the Board of Directors of the American Navion Society, I have been asked to gather information on the future of aviation gasoline or AVGAS. Decades ago the automotive industry faced this issue and dealt with it using some of the same methods that we may have to resort to using now. Do you remember the early 70's when leaded gas became unavailable for cars? Remember the "pinging" we often heard from our cars under certain high load low RPM operating conditions. That pinging is caused by premature ignition known as detonation due to poor quality gasoline. Detonation in a piston engine is an uncontrolled explosion that results in excessive heat that can burn a hole in the piston. The automotive industry initially tackled the problem by lowering engine compression ratios and altering ignition timing. While these changes did help our cars run on poor quality gasoline they also resulted in a noticeable decrease in power.

We are now facing the end of 100LL AVGAS. The EPA is expected to regulate 100LL out of existence by banning the use of lead in aviation fuels. Currently the aviation community enjoys an exemption from the EPA for lead content in our fuels that allows the continued production and use of 100LL AVGAS. The EPA has recently stated that no timeline has been set for the removal of tetraethyl lead from AVGAS, but it is expected the exemption will likely end in the not too distant future. Aviation Consumer quoted Johnny Doo, Vice President for engineering at Continental Motors as estimating that 100LL will only be around until 2015 or perhaps 2017. The future of 100LL fuel appears to be certain. It is not if we will have it available but how much longer we are able to get the fuel and what replacement fuels will be available. 100VLL (very low lead) AVGAS has been approved and is very likely already entering the fuel distribution system. We are not expected to notice any difference in performance with this gasoline, but 100VLL is considered a temporary measure.

Removing the tetraethyl lead additive completely from 100LL avgas results in a 94 octane fuel referred to as 94UL. Some experts think we can get by using 94UL with little difficulty while other sources disagree. AOPA magazine, AVWEB, Aviation Consumer, and others report that Continental Motors is running and flying modern engines using 94UL, but FADEC is reported to be involved in the process. FADEC or Fully Automated Digital Engine Control works much like the electronic fuel injection in your automobile and is available on the IO550 series of Continental engines. FADEC can adjust the engine's ignition timing and fuel mixture to avoid allowing detonation to take place. The FADEC option increases engine price by around $10,000. The folks at Lycoming Engines do not believe that 94UL is a reasonable option for engines designed to use 100 octane fuels and push for continued development of 100 octane replacement fuels.

Engines designed to run on 80 octane gasoline, the E-185, E-225, and GO-435 will run fine on 94UL AVGAS. Navion owners who still fly with these engines may be able to continue flying with whatever replacement fuel is developed. Currently Navion aircraft

with these engines designed to run on 80 octane fuels are required to burn 100LL because there is no STC for burning MOGAS (automotive gasoline) in the Navion.

Many of us have upgraded our Navions to Continental Motors IO470, IO520, and IO550 engines which require 100 octane gasolines. There are also a few Navion aircraft flying with Lycoming engines that require 100 octane fuels. These more powerful engines will not run well on 94UL without modification.

One approach may include modification of engines by changing the pistons to lower the compression ratio closer to the 7:1 of 80 octane engines. Lower compression ratio will mean less power and poorer fuel economy from our engines. Lowering compression ratio on the IO470H engine from 8.6:1 down to the 7:1 ratio compatible with 80 octane gasoline will decrease horsepower from 260 to 225 horsepower. I expect that the same modification to the IO520B series engines will result in around 246 horsepower. These changes will result is increased fuel consumption for the same amount of power. I am not excited about getting the proverbial "less for more". Changing the pistons also will result in unexpected expense unless your engine is in need of at least a "top overhaul".

Some of the companies working on the fuel problem are Continental Motors, GAMI, and Swift Enterprises. General Aviation Modification Inc (GAMI) is working on a fuel that they hope to be acceptable as a direct replacement for 100LL. The fuel is reported to be 100 octane but without the lead component. The GAMI fuel is referred to as G100UL and according to AVWEB the fuel is being tested in a Cirrus SR22 and an STC has been applied for to allow for wider fleet testing. Like the product it is intended to replace G100UL is made entirely from petroleum products.

Another approach to replacing 100LL AVGAS is SwiftFuel under development by Swift Enterprises Inc. along with the laboratories at Perdue University. While ethanol based "renewable resource fuels" are made by fermenting food into alcohol, Swift Fuel or 100SF is made by fermenting cellulose which is not suitable as food for humans into acetone to make fuel. According to a recent article in AVWEB the fuel has higher energy content, 15% more, than current 100LL AVGAS and the SwiftFuel web site reports 104 octane. If those numbers are correct and the product can be produced in sufficient quantity and quality at a reasonable price this option may become available.

Some sources try to make the problem seem smaller and state that 75 to 85% of general aviation aircraft engines do not require 100 octane fuels and can easily use 94UL fuel, but Aviation Consumer reports that at least 60% and other sources report as much as 80% of the aviation fuel used in this country is consumed in aircraft engines that require 100 octane fuels.

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The folks still flying Navions with “80 octane” engines may think that this issue will not affect them, but they will likely be required to use whatever fuel is finally developed for the rest of the fleet. While some organizations are pushing for a dual fuel solution, I have not read about any plan to return to producing and distributing a separate fuel for use in the lower compression “80 octane” engines. Since most airports do not carry MOGAS, it anticipated that most fixed base operators would not endure the added expense of handling a separate aviation fuel for such a small portion of fuel sales.

Recently the FAA announced the formation of an FAA/Industry committee – known as the Unleaded Avgas Transition Aviation Rulemaking Committee {ARC} – to advise the administrator how to tackle this problem. Certainly a solution to this fuel problem is essential for the future of general aviation. Alternative fuels have been studied for many years and a suitable unleaded 100 octane AVGAS has yet to be approved. The fuel replacement project is anticipated to be a 10 year process; 2 years to identify the fuel and/or other products required to maintain engine performance, and 8 years to implement. This timeline gives nearly all engines a maintenance cycle within the implementation period. We are well into the first year, if not beyond.

AOPA has become involved in the process of finding a replacement for 100LL AVGAS as well as the EAA and others. For more information visit the Clean 100 Octane Coalition at www.100octaneformyplane.com which contains links to other web sites and suggestions for how you can become involved in the process of keeping high quality fuel available for our Navions.

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