

One of the most requested topics, for us to weigh in on, is the subject of Avgas (aviation fuel) versus Mogas (automotive fuel) in light sport aircraft. This is also one of the more controversial subjects that makes it very difficult to write an article that is “definitive” on the subject. We often get questions like “what type of fuel should I be using in my light sport aircraft?” This is akin to the question, “do these pants make me look fat?” Your first instinct should be to change the subject as quickly as possible. And, god forbid, you do elect to engage, you need to recognize that the conversation is going to morph into many other unrelated topics, and nothing you say is going to be an acceptable answer. Several years ago, we did a two-hour presentation on the subject for the RV-12 fly-in in Bend Oregon. The first hour of the presentation was all the reasons that you shouldn’t use Avgas in your Rotax engine, and the second hour of the presentation was all the reasons that you shouldn’t use Mogas in your Rotax engine. (Figure: 1) Well, “that wasn’t very helpful,” was it? But it was, kind of the point. If there wasn’t a downside to a particular fuel, it would be a “no-brainer” for everyone just to select that particular type of fuel. And for the manufacturer of each engine and each airframe to recommend only one type of fuel as well. So, in reality, it is a matter of choosing the fuel for a particular mission profile that provides the least number of downsides. Or if you like, the fuel that is best suited for your mission profile. When we use the word “mission profile” we are talking about a particular set of operating circumstances. Your mission profile may change throughout the year, and as a result, the type of fuel you may want to use will also change. It is important to identify the downsides of each type of fuel in order to make a judgment about how it will impact your airframe and engine under these operating conditions. Because each fuel has its own downsides, it is important to understand what additional maintenance or operating conditions need to be performed in order to mitigate or eliminate any po-

Avgas Downsides

Tetraethyl lead
Expensive

Mogas Downsides

Alcohol and Methanol
Effect on Composite Materials
Short Useful Life
Vapor Lock
Different Formulations
Accessibility

Figure: 1 Downside of Avgas and Mogas

tential problems that may arise from each of the two very different types of fuel.

In an effort to emulate our two-hour presentation on Avgas versus Mogas, let's start off with the downsides of Avgas. On our list of downsides, we have simplified the list in to two primary reasons for not using Avgas: Tetraethyl lead, and cost.

Tetraethyl lead is the primary concern when utilizing aviation fuel. Tetraethyl lead is the additive that is added to aviation fuel which provides the anti-detonation properties (octane). This stuff forms deposits that can over time cause problems in different ways. It tends to foul spark plugs, build up deposits on the pistons and rings, and generally sludge up the oil system. Even as late as 2004 Rotax was still fighting the battle of operators using the wrong type of oil in conjunction with Avgas.

In their ongoing attempt to provide more guidance on the proper type of oil to use for each mission profile, Rotax issued service instruction SI-18-1997 R5 (now superseded). In the body of that text for the service instruction they provided a simple summary of the problem. "The lead content of currently available leaded AVGAS fuels is very high. The 100 LL AVGAS commonly available in North America contains up to 0.58 ml / litre of tetraethyl lead, more than 4 times the lead found in the leaded 80/87 AVGAS previously available. Due to this extremely high lead content, residue formation leading to operating difficulties with valve and piston ring sticking and cylinder wall glazing occurs more frequently when engines are primarily operated with leaded AVGAS fuels. Lead deposits could cause glazing of the cylinder walls."

It wasn't so much a problem exclusively with the Avgas, but rather the multitude of different oils that operators were experimenting with in conjunction with the Avgas. Well, even this updated service instruction didn't put the issue to rest, and as a result, we are currently working under service instruction-912-016R10. This latest endeavor to improve reliability and safety involved partnering with Aeroshell to develop an oil (AeroShell Oil Sport Plus 4) that is specifically designed for the Rotax 9 series engines. AeroShell says "It is designed to cope with the high shear stresses associated with integrated gearboxes and overload clutches, and has detergents that help to keep critical areas, such as pistons and cyl-



Figure: 2 AeroShell Sport Plus 4

inders, clean”. All the other oils that operators had been using for years, are now absent from the list of approved oils. And the AeroShell Sport Plus 4 oil is now the only oil recommended by Rotax for both Avgas and Mogas. It appears that Rotax is banking on standardization to prevent many of the ill-fated experiments that were ongoing in the past.

Not only that, it allows Rotax to work directly with AeroShell to make any “tweaks” that are necessary to improve performance and reliability as time goes on. And yes, we have seen that happen already. The newest formulation of Sport Plus 4 oil now comes in a red bottle instead of the previous version which was supplied in a black bottle. (Figure: 2) This oil is great at holding the tetraethyl lead in solution so that it can be extracted from the engine at oil change.

In the early days we used to take an airplane in for annual, and if the owner was using some obscure oil, we would take an oil sample in a quart jar and watch the tetraethyl lead fall out of solution and settle on the bottom of the jar literally within hours of taking oil sample. Not Good. Conducting the same test using the AeroShell oil shows no separation even after many months of sitting. One of the other methods that Rotax employs to mitigate the effects of tetraethyl lead, is to change oil on a more frequent basis. The Rotax maintenance manual gives good guidance on the oil change interval depending on the percentage of Avgas used. The premise is that changing the oil more frequently will reduce the amount of tetraethyl lead that the engine is exposed to.

Everyone agrees, that the tetraethyl lead is the downside of Avgas. And even in the conclusion of the most recent Rotax service instruction, they state, “Conclusions: - If possible, operate the listed engine types using unleaded or low-lead fuel. (AVGAS 100 LL is not considered low leaded in this context.)” This statement makes it pretty clear that Rotax favors the use of automotive fuel over 100LL.

The second item on our list of downsides for Avgas is cost. Not just the cost of fuel, but the cost of doubling up on your oil changes, and the increased maintenance costs associated with operating 100 LL. Even if you are of the mindset that cost should not play a role in the decision of which fuel to use, we must bring the total cost of operation variable into the equation. For many people, the cost of operation can be the tipping point between flying and not flying. The \$100 hamburger used to be considered a joke. Nowadays, it is more like an aspirational goal that is often dreamt about, but seldom achieved. The cost of fuel is a significant portion of the operating cost on any airplane.

The good news is, that the vast majority of light sport aircraft use engines that are literally sipping fuel compared to our big Lycoming and Continental brethren. And using automotive fuel in lieu of aviation fuel can improve the bottom line of the operating cost. But only when it makes sense. So far, in this article (Part 1), all we have talked about is the downside of Avgas. If, while reading this article you’ve come to the conclusion that “avgas should not be used on a Rotax 912 engine”, hold your horses. If you think we painted a bleak picture here, wait till we talk about the use of automotive fuel in light sport aircraft and engines.

In (Part 2), we will do just that. We will talk about all the downsides to using automotive fuel and show you some of the reasons why you may think “Automotive fuel should not be used on a Rotax 912 engine”. The good news is, it’s not the end of the world. Never fear. We will help to sort out when it would be a better idea to use one type of fuel over the other. And what to do to mitigate the negative effects of each type of fuel. And when approached appropriately, there isn’t any reason why your engine can’t reach TBO using either of these two types of fuel.