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Fuel Projects Move Forward, But Slowly

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While the EPA continues gathering data on lead emissions toward a 2017 deadline on tighter air pollution standards, development to find a 100LL continues apace, although no clear winner is in sight. Meanwhile, the FAA has initially funded a new fuels program oversight office called AIR-20 whose job is to set up certification and testing standards for candidate fuels. AIR-20's work will be funded by a combination of government funds and contributions from private industry.

AIR-20 is an outgrowth of the FAA Unleaded Avgas Transition rules committee (UAT-ARC) that completed its final report in mid-2012 with a long list of steps and requirements that any potential replacement fuel will have to meet. The UAT-ARC envisioned an 11-year maximum timeline to consider all of the potential fuel candidates, but judging by its budget estimates, most of the fuels work will be done in half that time.

How many candidate fuels are there? At this juncture, three are plainly visible: Swift LLC's Swift Fuel, General Aviation Modification Inc. 's G100UL and an additive-based fuel from ASL, the same company that developed a popular oil additive called CamGuard. Sources in the industry say the major oil companies may be developing their own fuel candidates, but none of these have been made public yet. Chevron was recently granted a patent for an aviation fuel of at least 98 octane based on an aviation alkylate and xylene blend, but that fuel doesn't appear to have entered the approval process and we don't know if Chevron plans to submit it.

Mogas could play a minor role in the fuel transition, although it won't be a candidate fuel for a formal 100LL replacement. While there's some demand for mogas, supplies of non-ethanol premium suitable for aviation use remain problematical due to the flood of ethanol looking for gasoline to blend with.

Swift Fuels has been grinding away at the 100LL replacement problem since 2008, when it initially announced a non-petroleum-based replacement that could be manufactured from biomass. Swift's Jon Ziulkowski told us that the company's research continues and that it has found two candidate organizations to fly a long-term fleet test using a Cessna 172. Swift is seeking an STC to burn Swift Fuel in Lycoming-powered Cessna 172 R and S models. But unlike GAMI, Swift doesn't plan to provide the STCs to end users, but merely use them to gather data for the required long-term fleet tests of its fuel. Moreover, Swift's STC will be predicated on an approved ASTM fuel specification.

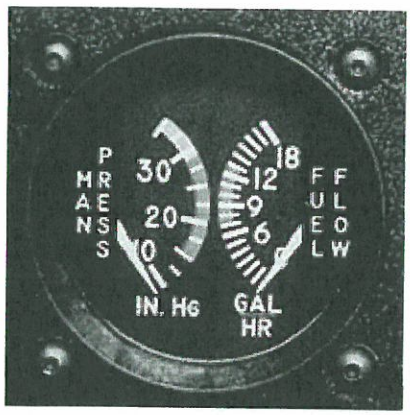
Swift Fuel is a binary chemical material consisting of mesitylene—also known a trimethylbenzene—and isopentane. The fuel is catalyzed from an acetone feedstock. While acetone can be derived from bio sources, Swift's work has concentrated on the catalytic process forward, not on producing the acetone itself. Swift's business model has been to sell the technology to manufacturers interested in producing the fuel under license, but Ziulkowski says that doesn't rule out Swift also producing fuel itself. Initial FAA tests showed that Swift Fuel has similar octane as 100LL, although with somewhat higher heat content. It's also about 10 percent heavier than avgas.

To prove the economics and volume potential, Swift is planning to construct a pilot plant in Lafayette, Indiana capable of a minimum of 10,000 gallons a month. "That facility will be in place by the end of the first quarter,"

Ziulkowski said, meeting one of the FAA's 16 requirements for avgas approval. Swift will meet with the FAA next month to determine when and how it will enter the formal UAT-ARC-prescribed approval process. As for cost, Swift maintains that its fuel will be competitive with avgas, but the final numbers remain yet to be proven.

While Swift pursues that path, GAMI has staked out a different route to an approved fuel. From day one when G100UL emerged in early 2010, GAMI sought a wide-application STC for use of its fuel, not an extended FAA approval process. Although the FAA initially strongly discouraged this approach, GAMI has persisted and the company's chief engineer, George Braly, told us that after months of testing, GAMI is close to an approved STC for Cirrus models.

A week ago, Braly told us, "We've got all of the test plans agreed to as of 10 o'clock this morning and we've got the hardest parts of those already done and the reports approved." Some testing remains to be done, says Braly, but most of that is relatively straightforward trials that aren't expected to hide any surprises. "We've got a couple of in-house tests and a 150-hour block test on the engine and that's it," Braly said.



Like Swift fuel, G100UL is a so-called high-aromatic content fuel, but it varies in chemical composition. For its base, G100UL uses the same aviation alkylate to which tetraethyl lead is added to make 100LL. However, it's blended using either mesitylene or the xylol family of aromatics. (GAMI's patents describe both, but the company hasn't necessarily settled on a final blend.) G100UL, says Braly, has a motor octane rating above the minimum spec for avgas, which is 99.6.

The FAA and some manufacturers have voiced concerns that a high-aromatic fuel like G100UL (and Swift Fuel) could cause seal or o-ring damage in aircraft fuel systems, but GAMI says it has been conducting tests for almost three years and has found no evidence of this. The FAA has accepted initial compatibility tests done by Cirrus in composite fuel tanks. In support of the large volume required to complete the block test, GAMI has commitments from a refiner and a transportation company to provide a 10,000-gallon batch. Braly said the high-volume delivery will occur during the next 60 days.

And how about cost? GAMI envisions granting non-discriminatory licenses to refiners interested in manufacturing G100UL for a price Braly believes will be between 50 cents and a dollar more than avgas, delivered. "I think the 50 cent number is consistent with what I'm seeing right now," Braly says.

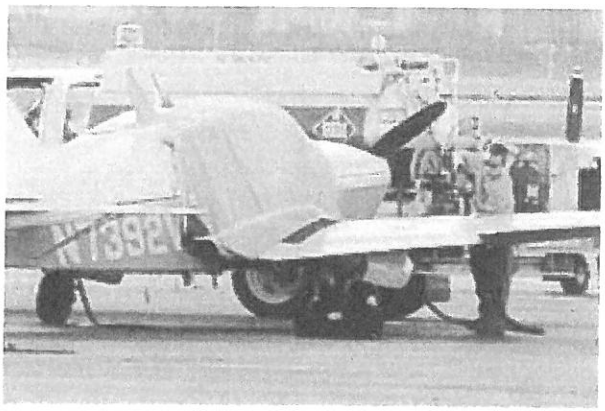
Once the Cirrus STC is approved, says Braly, GAMI will seek a wider approval for more models under an approved model list approach. The FAA has agreed to this in principle, if not in detail.

While Swift and GAMI pursue approvals for their fuels over the next two to three years, another company, ASL, is following a different path. Rather than a blended fuel, ASL chemist Ed Kollin, who developed CamGuard, is researching a drop-in, direct replacement for tetraethyl led that will yield 100-plus motor octane. So far, so good, but the problem isn't octane, it's cost.

"I've got some molecules that do the things I want them to do, it's just a matter of getting them made at a price that's reasonable. Right now, it's five times the cost of where I think it needs to be," Kollin told us. His comment goes to the core problem with TEL, other than it's toxicity: It's cheap and it provides a potent octane boost.

Aging is a problem, too. In some airplanes, avgas can remain in tanks for months if not years and thus it has to be—and is—more stable than automotive pump gas. Kollin told us his octane additive delivers excellent octane but has shown a tendency to break down when exposed to water or traces of metallic copper. Kollin says his research will continue, but he's not predicting when a fuel using his compound might be ready to enter the FAA certification process.

Another option on the table, albeit not an approved aviation fuel, is mogas. Todd Petersen of Petersen Aviation developed many of the original autogas STCs during the 1980s. He says that mogas, which was once much more in demand for aircraft than it is now, fell out of favor for two reasons. The price difference with avgas diminished and as the ethanol industry geared up to produce more volume, it became increasingly difficult to find ethanol-free gas or E0. It still is.



That said, Petersen told us he's noticed a slight uptick in the sale of mogas STCs, especially to European customers, who still have more ready access to mogas than do U.S. pilots. According to www.flyunleaded.com, a web directory of airports that sell mogas, 109 airports have it. It's not clear if this number is static or rising slightly, but since 2007, with the Energy Independence and Security Act mandating increasing ethanol blending, the production of E0 has been trending steadily downward. According to U.S. Energy Information Administration data, that trend has stabilized and actually rose slightly during the past 18 months. Still, supplies are hardly assured.

"You can still get E0," says Todd Petersen, "but it's just hard. Once in a while, I get a call from someone like on Long Island, in New York. I can't do much for them because it all has ethanol there. I sometimes worry how much longer it will be available."

The market appears to be strongly regional. Twenty five of the U.S. airports that have mogas are in Wisconsin and Minnesota.

If you happen to own an experimental or LSA with a Rotax engine, you can legally burn E10 mogas, but you'll have haul it in your own containers. No airports that we know of sell E10. Some owners find that worth the effort, but for the rest of us, it's a waiting game to see which fuel rises to the fore and there actually could be more than once choice. We just don't know yet which way the market will turn.