# HEAD TO HEAD

## A pirep on G100UL

**General Aviation Modifications Inc., perhaps better known as GAMI, following the success of its GAMIjector balanced fuel injectors, has been on a 13-year crusade to get the lead out of general aviation fuel.**


GAMI G100UL unleaded aviation fuel is tested in a multiengine Beechcraft Baron C-55 in and around Ada, Oklahoma, on October 30, 2023. Photo by David Tulis.

Others have blazed this path, but none have made a drop-in 100LL avgas replacement that nearly all GA engines can operate on. The company was granted a supplemental type certificate by the FAA in September 2022. The STC can be purchased on GAMI's website for $1.50 to $1.75 per horsepower, depending on the installation.

Unleaded avgas has been an elusive formula because the tetraethyl lead in 100LL and its predecessors were key to boosting octane required to run higher-powered engines that

utilize high compression ratios. Combine that hurdle with a lack of interest among oil companies, FBOs not wanting to purchase and maintain new tankage, economics, politics, red tape, and more politics, and well, you can see why this has been back-burnered for decades. Today, avgas is the only leaded fuel used in the world and it has a big, red target on its back from environmental-activist groups and governments around the world.

Unleaded aviation fuels have been around a long time, but they're only approved for use in lower-power engines utilizing low compression ratios. The economic problem is that those engines burn only about 30 percent of the avgas sold. The other 70 percent is burned by high-powered engines found in complex singles and twins that can't use the lower-octane unleaded fuels.

GAMI broke the octane code with G100UL after about 15 months of formulaic research. The following 12-year approval process? Well, let's just say it's been a long and frustrating slog for this plucky, little company in Ada, Oklahoma. Fuel is now flowing in Ada and thanks to the donation of AOPA members Greg Herrick and Dan Shewmaker, a unique demonstration program has been initiated to continue gathering data on G100UL in real-world conditions. Herrick donated the use of his 1966 Beechcraft Baron C55, which burns G100UL in the left engine and traditional 100LL in the right. Shewmaker is offsetting the operating costs. Both Continental IO-520-C engines were freshly overhauled by Pinnacle Engines of Silverhill, Alabama, providing a clean slate from which to start this comprehensive, independent analysis.

Savvy Analysis will be provided with regular data dumps from the onboard Garmin engine analyzer. That data will be disseminated and pored over by Savvy Aviation founder and AOPA Pilot columnist Mike Busch and his team. Savvy has amassed millions of hours of historical engine data to compare with the Baron's data. Oil will be analyzed at each change and cylinders will be borescoped every 50 hours. All this extra maintenance and observation is intended to spot any trends in wear in both engines. The hope is no news is good news.

Since my family has owned a Baron D55 since 1971 when I was in diapers, AOPA called me off the bench to get my opinion on this experiment. I was happy to oblige since I hadn't been to Ada since 1999 when the company opened the country's first independent aircraft engine test facility, named after former Teledyne-Continental engineer Carl Goulet, who helped GAMI certify GAMIjector fuel nozzles after his retirement.

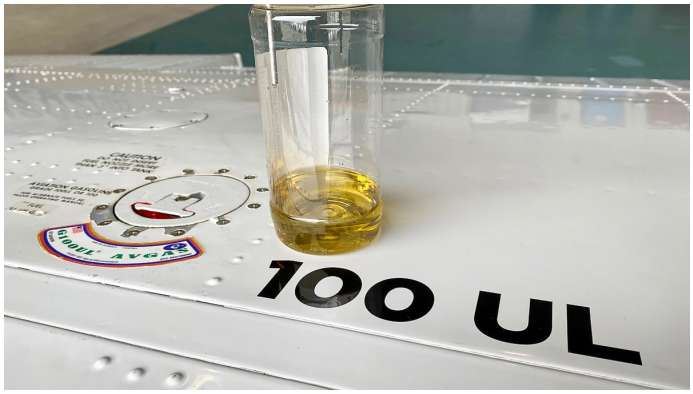
By the time I arrived in November 2023, the C55 test mule had 25 hours on the engines and had just undergone its first oil change. I immediately gravitated to the left main fuel cell, popped the cap, and gave it the smell test. G100UL definitely has a solvent smell to it. I never did well in chemistry, but GAMI president and co-founder Tim Roehl assured me that the smell was from xylenes, which are commonly found in paint thinner. Since this was unleaded fuel, I dipped a finger in it and rubbed against my thumb. Like 100LL, it evaporates quickly and leaves no residue except for dry-looking skin. Despite its lack of hazardous lead, it was recommended that I protect my hands with gloves like I now do with 100LL.

The color is officially green but that depends on ambient lighting. Flowing out of the nozzle it looks pale green, but in my fuel tester after sumping, it appeared more like a sample I hand over to my aviation medical examiner every six months. One of the biggest hurdles for GAMI was to ensure that G100UL will mix with traditional 100LL in the tanks of your airplane or in the tanks of the suppliers. GAMI co-founder and head of engineering, George Braly, likes the term fungible and it's an accurate descriptor. It's also absolutely critical for G100UL to succeed. Exhaustive testing for certification proved that G100UL and 100LL can coexist just fine. No worries for pilots mixing fuels. No new tankage for FBOs. Perhaps no more special trucks and rail cars used only for leaded fuel transport. You get the idea.

What about storage? 100LL is one of the most durable fuels on the planet. It can sit on a shelf for a decade and still meet its fuel specification. Twelve years ago, Braly set aside a few barrels of G100UL in one of his hangars and so far, occasional testing of the fuel inside is meeting the fuel's specifications.

So, what's it like to fly? Well, thankfully, you'd be hard pressed to notice anything different. In six hours of flying, I had plenty of time to look for any differences, but none could be found that couldn't fall under the category of "within the margin of error." All flights in this airplane begin with fuel topped off to 136 gallons (usable) to start with a known quantity every time. In flight, EGTs were slightly higher on the G100UL engine but not by much. Most of the time, CHTs were within 10 degrees of each other and comfortably cool across the board at all power settings.

As an early adopter of GAMIjectors in 1996, I was a skeptic when I entered the sect of lean-of-peak (LOP) operation. After all, I didn't want to be responsible for trashing two expensive engines just to save 15 percent of fuel. After lots of research, however, my two brothers and I have drunk the Kool Aid when it comes to LOP ops. We ran our IO-520s for the past eight years of their life on the lean side. And following an upgrade to IO-550 power in 2005, we've been operating them LOP in cruise nearly all their 1,300 hours.





I ran the AOPA C55 through a wide range of rich-of-peak (ROP) and LOP power settings at various altitudes with no notable differences. At 15,500 feet, 50 degrees ROP, the C55 trued 181 knots on 20 gph total with no discernible difference in engine operation between the two. Back in the thicker air of 8,500 feet, running rich of peak at 30 gph total, this old Baron with two new engines hustled out 195 KTAS. Lean of peak at 8,500 fuel flow dropped to 24 gph and speed settled at 185 KTAS. I pushed the props up a tick to 2,500 rpm and hit 200 KTAS on 32 gph ROP. And finally, I went into my Piper Twin Comanche mode where 19 inches of manifold pressure and 2,350 rpm yields 166 KTAS on 20 gph total. Throughout it all, there was no noticeable difference in engine operation from left to right.

After each flight, we carefully measured how much fuel went into each of the four tanks. The first day's flight involved a climb to 15,500 feet. In that lone, short flight, the G100UL side burned a gallon more. The Janitrol cabin heater in the nose draws out of the left main tank (one of two GAMI tanks) and that heater was running full blast against the 10-degree Fahrenheit air temperature. Subsequent flights were much longer and favored G100UL by 0.4 and 0.6 gallons less used, despite the fact that the heater was running the entire four hours, albeit not at full blast. Braly attributes this slim advantage to G100UL's one- to two-percent higher BTU rating over 100LL. Either way, a half-gallon difference after top-off is well within the margin of error to be expected in my decades of operating an identical airplane.

After all the flying, the end result is, again, no news is good news. There's no noticeable difference in operation on 100LL versus G100UL. The benefit of the doubt, however, goes to G100UL with the 0.5-gallon average savings, despite factoring in heater consumption. Cold starts and hot starts were normal. No fancy voodoo techniques required.

Part of this experience will be to see if fuel system components such as rubber fuel bladders, O-rings, and anything else that touches the fuel is adversely affected by the blend. After the lengthy certification testing, Braly isn't concerned there will be any issues. And with the lack of lead, the hope is that engines will run cleaner and last longer. Spark plug fouling by lead deposits that collect in the business end of spark plugs has long been a problem in GA. At the very least, G100UL should eliminate that.

If engines do run cleaner, oil change intervals could be lengthened since combustion blow-by isn't contaminating the oil with lead. There's also the possibility of reintroducing synthetic oils back into GA, something we haven't seen since the Mobil 1 fiasco of the 1990s. If things go really well, the possibility of extending time-between-overhauls could be on the radar. All of this will hopefully be discovered through real-world experience such as this.

So, what's the catch to G100UL? Braly mentioned one potential disadvantage is that G100UL can stain paint if it sits too long without being wiped off. We'll be watching for that. Wear gloves and keep a rag handy to promptly wipe up any splashover—got it. G100UL is also slightly heavier. Because of composition variables, G100UL weighs in at 6.15 to 6.32 pounds per gallon versus avgas at 5.8 to 6.05 pounds, according to Braly.

If future unleaded fuels become approved, this Baron is prepared to take them on as well. AOPA advocates for multiple suppliers since, from a consumer perspective, having only one fuel doesn't bode well for keeping fuel costs under control. For now, however, the lone entrant in this emerging market seems to perform as well or better than 100LL.

## Peter A. Bedell

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