ABS Flies in the Unleaded Fuel Baron

by Thomas P. Turner

I was privileged to take a 50-minute flight in AOPA's C55 Baron during its G100UL unleaded aviation gasoline demonstration, with AOPA's Dave Hirschman at the controls. GAMI's George Braly had first asked me if I'd like a demonstration flight in December and it came together as AOPA neared the end of its trials in late February.

Using a leased 1966 C55 Baron, AOPA began demonstration flights in October out of GAMI's Ada, Oklahoma, base (GAMI's private tank is the only place to get G100UL currently). The goal is to "get some actual experience with 100 octane unleaded fuel in the kinds of airplanes and engines our members own and fly," according to AOPA President Mark Baker. The AOPA demonstration calls for 150 flight hours running GAMI unleaded fuel in the left engine and 100LL in the right. Baron N202MD (TE-148) is equipped with two IO-520 engines freshly overhauled by Pinnacle Aircraft Engines and monitored using a Garmin Engine Information System (EIS) linked to a G500TXi Primary Flight Display/Multifunction Display (PFD/MFD) and a smaller, dedicated Garmin engine display mounted ahead of the power quadrant.

AOPA Pilot Editor-at-Large Dave Hirschman is flying the bulk of the 150-hour demonstration. Dave flew the Baron to Wichita from Ada for my noontime flight, throttling back and maneuvering on his way to put another hour into the test log (**Photo 1**). We did the standard safety briefing before the flight — Dave would fly the airplane while I worked the radios and navigated to the local practice area—and spent some time talking about AOPA's goals. "This is not a scientifically valid test," Dave told me, "with a sample size of [just] one [engine] and only 150 hours of flight." Instead, "this is a demonstration" to "put to rest the performance questions. Science aside," he continued, this demonstration "gives decision-makers time in the plane" so G100UL is "no longer theoretical, it's real." Dave briefed that he's seen "a shade less fuel consumption on the GAMI side. GAMI claims it burns half a gallon less per hour," he said, "but that's not been my experience." Dave reports that "if you match the fuel flows" of both engines the G100UL engine EGTs run "a little hotter" and CHTs are "a little cooler."

Walk-around

The G100UL Supplemental Type Certificate (STC) is airframe- and engine- serial number specific. This means a Baron requires *three*

G100UL STCs: one for the 95-C55 airframe (indicating compatibility with the Baron's fuel bladders, hoses, valves, and other Beech components) and two engine STCs, one for each IO-520C by engine serial number (for demonstrated compatibility with engine components and operation). I didn't ask, but presumably N202MD has STCs for each engine. To clearly identify fuels input for the demonstration, however, the left wing's two fuel ports have the STC placard (**Photo 2**), while the right fuel ports do not have the placard and "100LL" is stenciled prominently nearby (**Photo 3**).

Dave performed the walk-around and sampled the fuel tanks, pointing out the dark yellow "native" color of G100UL fuel (**Photo 4**). When commercially available, G100UL will have blue dye added to give the fuel a green tint to distinguish it from a mis-fueling with jet fuel. G100UL may be mixed in any proportion with 100LL for operation during the transition from leaded fuels, and when mixed the result will be a shade of blue-green depending on the ratio.

To the skies

Start-up, takeoff, and climb in the spotlessly blue, pleasantly warm February sky was Baron normal. Dave climbed to 6,500 feet and set up what he told me is his usual time-building power setting: about 22.5 inches manifold pressure and 2300 RPM. Interpolating the *Pilot's Operating Handbook* tells us this is about 60 percent power, but it would be a bit more if richer than the "book" 25°F rich of peak EGT (ROP), and somewhat less on the lean side of peak (LOP). Dave offered me the engine controls and we tried it both ways.

First, using the EIS Lean Find in ROP mode (referencing the first cylinder to reach its peak EGT), I set power for 50°F ROP on both engines. Fuel flow was 14.0 gallons per hour on the GAMI side, 14.6 on 100LL, consistent with GAMI's claim. The G100UL engine had slightly cooler EGTs, counter to what GAMI suggests, and slightly warmer CHTs as well (**Photo 5**). Next, I set the engines at about 15°F LOP. This resulted in 11.5 gph on the GAMI side and 11.7 gph with 100LL. The hottest EGT was 24°F cooler using G100UL and the hottest CHT was 13°F hotter (**Photo 6**). As a final test Dave suggested matching the fuel

Photo 1: AOPA's Dave Hirschman

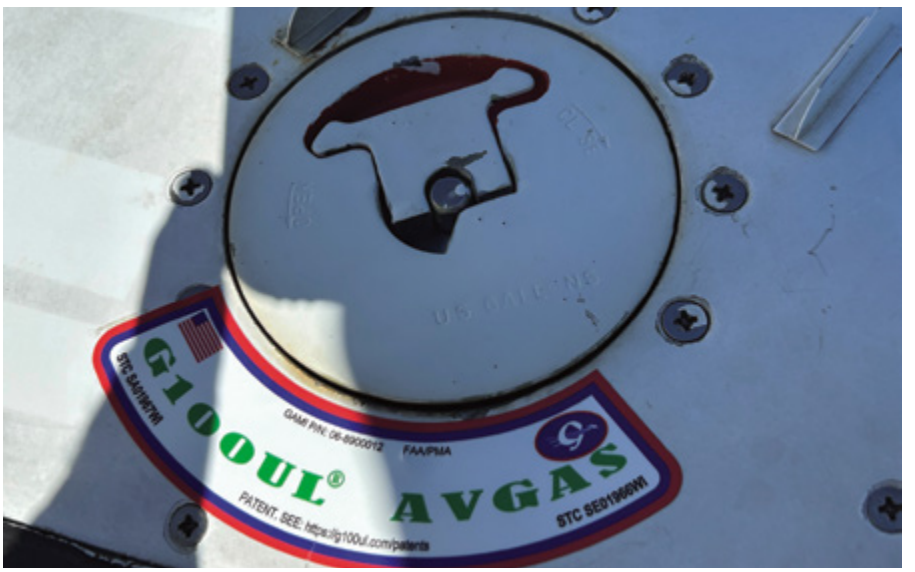

Photo 2: G100LL placards are on the two fuel ports on the left wing.

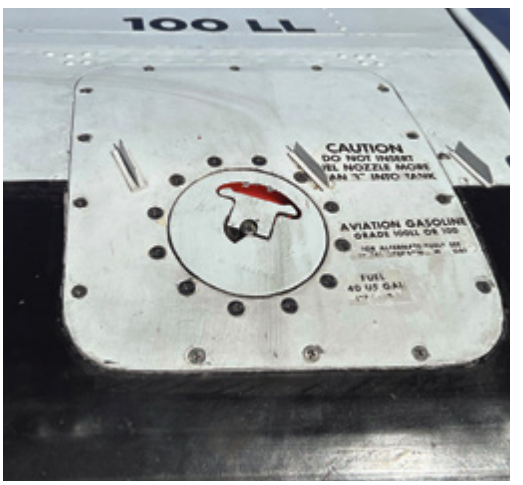

Photo 3: The right wing omits the STC placards and is clearly labeled 100LL for the demonstration.

Photo 4: G100UL's "native" color is dark yellow. When commercially available blue dye will be added to make the fuel green, distinguishing it from jet fuel.

Photo 5: Engine data at about 50°F rich of peak. G100UL on the left engine, 100LL on the right

Photo 6: About 15°F lean of peak. G100UL on the left engine, 100LL on the right

Photo 7: Matched fuel flow. G100UL on the left, 100LL on the right

flows. The GAMI engine had a cooler highest EGT, 1393°F compared to 1417°F on 100LL, and a hotter highest CHT, 316°F versus 306°F compared to leaded avgas (**Photo 7**).

Before you start making any judgements about the difference between GAMI's predictions and real observations consider this: Whether rich of peak, lean of peak, or with fuel flows matched, engine performance was well within the range of two separate engines attached to the same airframe when both are run on 100LL—a nonevent, which is exactly the outcome GAMI is looking for. As Dave said, this is a demonstration, not a scientific evaluation. To confirm the difference between 100LL and G100UL fuel flows and temperatures you would have to run one of the engines first on 100LL, then run that same engine on G100UL under the same conditions. Only then would you eliminate the variables of one engine versus the other and get a true comparison (see "Baron Pilot: Fraternal Twins," in the September 2017 *ABS Magazine*).

The C55 Baron gives AOPA a unique opportunity to do just that. Since Barons of that vintage have independently selectable auxiliary fuel tanks, they could fill the main with one fuel and the aux tank on that same side with the other fuel. Level off in cruise, set power, lean the mixture, and record data, then switch to the other fuel type on that same engine and repeat the experiment. It's still an unscientific sample size of one in a short-duration trial (as a function of engine longevity), but it would probably confirm the theoretical predictions. Knowing that Dave is probably in his last day of reaching 150 hours as I write this (he needed about seven more when he left Wichita), I've suggested trying this before he takes the Baron back to AOPA in Maryland.

To market

Dave made it clear that by conducting this operational demonstration of G100UL in the Baron, AOPA is not specifically advocating for GAMI's product over any other. If the opportunity presents itself AOPA may conduct similar demonstrations of other unleaded 100 octane aviation fuels as they earn FAA approval. AOPA supports all efforts to ensure we have a smooth transition from leaded fuels to a commercially available unleaded avgas.

G100UL is the only unleaded 100 octane option with FAA approval to date. That my short flight in AOPA's Baron showed engine performance indistinguishable from "normal" tells me GAMI has met its performance goal. ABS members reading this have probably seen reports of the legal challenge to FBOs selling 100LL in California, and the pressure on FBOs to switch to G100UL in the short term since it is an "available" unleaded fuel. GAMI recently reported an agreement with Vitrol Aviation for manufacture and distribution of G100UL and said the product will be available for purchase at multiple West Coast locations "by this summer." When you receive this magazine, summer will be only two months away, so the future of unleaded avgas will unfold rapidly if GAMI and its partner can make the leap from development to deployment.

Thank you, Dave, for the demonstration, and thanks George Braly for making it happen.