That's right, I am now officially:

Mr. Lucky 16!

On September 3, 2010, I became the 16th person to fly a high-performance, high-compression, turbonormalized Cirrus SR22 on G100UL fuel. As every BeechTalker should already know, G100UL is a new unleaded aviation fuel that is/has been developed by General Aviation Modifications, Inc. (GAMI) in Ada, Oklahoma.

I was in the Dallas area over the holiday weekend and was able to steal away on Friday to head up to the mecca for Bonanza upgrades--Ada. Ada is the home of Tornado Alley Turbo (TAT) and GAMI (very closely related companies) that supply our much beloved GAMIjectors and turbonormalizing systems for the A36 and soon-to-be Barons (more on this in the near future).

Because my A36 is not (currently) turbonormalized, I opted to leave the checkbook and credit cards at home for this visit.

George Braly, fellow BeechTalker and part of TAT, GAMI, and Advanced Pilot Seminars (APS), was kind enough to let me hang out for most of the day and learn a lot about all things GAMI and TAT related. One of those "things" was learning about G100UL. I'm going to try to share what I know about it, but forgive me if I miss some details--there was a firehose of information and I tried to pick up as much as I could, but invariably I missed stuff.

As George and I walked the several hangars as Ada, I gawked at the Bonanzas and Barons in various stages of upgrades. I even got to see the GAMI B36TN with its TKS, etc. What a plane. However, one plane stood out from the rest--the silver Cirrus SR22 in the corner. I know the plane well as I have followed its various flights and details here on BeechTalk--N223TN.

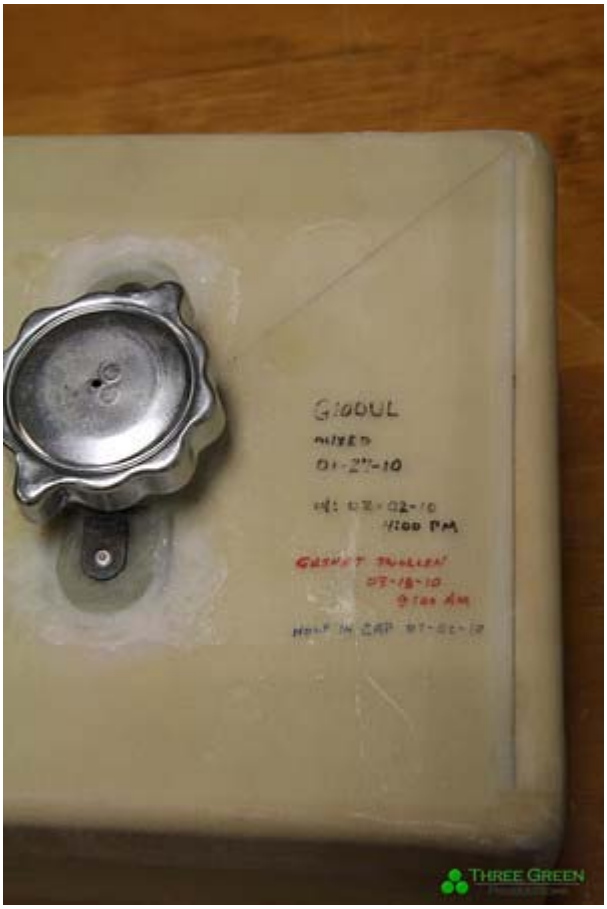
This particular Cirrus is unlike the many others currently flying in that is has a big black sticker with white lettering that says, "EXPERIMENTAL". That sticker, I guess, makes it faster than others....or, perhaps, it is the G100UL fuel that's been in its right tank since the beginning of 2010 and the Density Controller (named "World Peace") stuck in its panel.


AVGAS MIN GRADE 100LL OR 100
46 U.S. GALS. (174 LITERS)
TOTAL USABLE CAPACITY
30 U.S. GALS. (113 LITERS) USABLE TO TAB
G100UL WHEN IN EXPERIMENTAL
THREE GREEN
PRODUCTIONS


AVOID
CONTINUOUS
OPERATION WITH
THE FUEL FLOW SET
BETWEEN 18GPH AND 30 GPH WITH
THE MP ABOVE 26" HG
NORMAL HIGH POWER CRUISE
2500RPM 29.0-29.5" MP AT 16 TO 17.6GPH
TURBO CONTROL
MIXTURE CONTROL
FASTEN SEATBELTS • NO SMOKING
FIRE EXTINGUISHER FORWARD LEFT OF PILOT SEAT
THREE GREEN
PRODUCTIONS

As we walked up to the plane, George pulled both of the fuel caps and let me smell the difference and inspect the condition of the caps (much like looking at a wine cork, now that I think about it)--one cap was for the 100LL tank and the other cap was for the G100UL tank. As best I could tell there was a slight difference in smell, but the cap conditions were the same. There didn't seem to be any signs of deterioration of the gaskets or any evidence of the fuel attacking the fuel cell. We later sumped both tanks, and other than the color difference (100LL being blue and G100UL being clear), there were no pieces of tank floating in the G100UL sample.

George took me to one of many rooms around the GAMI/TAT compound and showed me a couple test containers that were made to test the effects of long term exposure of G100UL on various bladder materials. These containers and bladders have held the same sample of G100UL since the beginning of January 2010, with no signs of degradation. As you can see from the cap, it looks clean and intact.


G100UL
MIXED
01-27-10
THREE GREEN


G100UL
MIXED
01-27-10
GASKET SWOLLEN
07-18-10
HOLE IN CAP
470-300
THREE GREEN
PRODUCTIONS

After we toured the rest of the compound and looked at all things TAT/GAMI related (and after some good Mexican food), George asked if I wanted to go fly it. Well, HECK yea!! No chicken enchilada is going to keep this guy down. With my 2.3 hours in Cirrusseses, I jumped in the left seat while George went to go get another headset.


TN
EXPERIMENTAL
CIRRUS
THREE GREEN
PRODUCTIONS


N500AB
THREE GREEN
PRODUCTIONS

We started the cold SR22TN on the right tank (G100UL) and, wouldn't you know it, it fired right up. The SR22TN has an IO-550, like my Bonanza, and I didn't see any difference in the ease or difficulty of starting the engine on G100UL. As I understand it, another alternative fuel has shown signs of making cold starts difficult, but I didn't see any problem with the G100UL.

We taxied out on the G100UL and did a full power runup on the runway to make sure everything was fine. According to George, because we are flying an experimental aircraft with an experimental fuel, this was simply being cautious--it would not be necessary once the fuel was approved.

With release of the brakes, we were heading down the runway and lifting off. Climbing out, I felt no hesitations or stumbles--just climbing like a TN IO-550 heading for 10,000 ft.

We set up for cruise on the G100UL as we would normally do--set that newfangled Cirrus combined throttle/prop control and started pulling the mixture back to cruise setting (about 17 gph, if I recall correctly). At that time, George started showing me the difference in performance between the G100UL and the 100LL in the left tank. As he normalized the EGT display and switched tanks (which takes about 10 seconds to get from the tank to the engine), you could see the EGTs change indicating the reduced energy density available from 100LL.

Here is a video of us making the switch (sorry for some camera shake--it was a bumpy day). It was filmed in 1080p, so be sure to view in the highest resolution you can handle on your end, and be sure to view in full screen mode:

http://www.youtube.com/watch?v=-TN2T1Nrhjc

Because of this reduced energy density with 100LL, we would have to increase fuel flow using 100LL to get the same performance as G100UL. From what I could see, G100UL provided about 3% more energy density than 100LL. According to George, this means that we can get about 3% reduced fuel flow at the same airspeed and about 3% extended range using G100UL. When I put this in context with my flight from Michigan to Texas two days earlier (850NM), that would mean I would have about 25NM of increased range. Personally, that doesn't sound all that significant; however, I think the take-away point from this is that it isn't going in the opposite direction and reducing our range! The weight of G100UL is slightly more than 100LL, which amounts to about 10 lbs more per tank.


AVIDYNE
RPM
MANIFOLD PRESSURE
% POWER
OIL TEMP
OIL PRESS
2680 RPM
33.6 In-Hg
112 %
207 °F
40 PSI
TIT/EGT Normalized
Absolute
Normalize
Lean Assist
Emerg. Checklist
TIT(°F)
EGT(°F)
CHT(°F)
Electrical
M.BUS 28.2 V
E.BUS 28.6 V
ALT1 24 A
ALT2 7 A
BATT Chrg 2 A
DENSITY ALT 10500 FT
OAT 54 °F
OAT Units
Fuel
FLOW 39.0 GPH
USED 5.5 Gal
REM 39.0 Gal
TIME 00:59 h:m
ECON 4.2 NMPG
Map TAWS Chart Trip Nrst Chklst Aux Engine
THREE GREEN PRODUCTIONS


AVIDYNE
RPM
MANIFOLD PRESSURE
% POWER
OIL TEMP
OIL PRESS
2530 RPM
30.5 In-Hg
100 %
194 °F
40 PSI
Looking for 1st Peak
Absolute
Normalize
Lean Assist
Emerg. Checklist
TIT(°F)
EGT(°F)
CHT(°F)
Electrical
M.BUS 28.2 V
E.BUS 28.6 V
ALT1 25 A
ALT2 6 A
BATT Chrg 1 A
DENSITY ALT 11100 FT
OAT 53 °F
OAT Units
Fuel
FLOW 20.3 GPH
USED 11.5 Gal
REM 33.0 Gal
TIME 01:37 h:m
ECON 8.6 NMPG
Map TAWS Chart Trip Nrst Chklst Aux Engine
Hdg Bug 012°
Alt Bug 10000 FT
VSI Bug 70 FPM
Baro Set 30.22
Hdg Sync
THREE GREEN PRODUCTIONS


AVIDYNE
RPM
MANIFOLD PRESSURE
% POWER
OIL TEMP
OIL PRESS
2520 RPM
30.5 In-Hg
81 %
197 °F
40 PSI
TIT/EGT Normalized
Absolute
Normalize
Lean Assist
Emerg. Checklist
TIT(°F)
EGT(°F)
CHT(°F)
Electrical
M.BUS 28.2 V
E.BUS 28.6 V
ALT1 28 A
ALT2 6 A
BATT Chrg 1 A
DENSITY ALT 11000 FT
OAT 52 °F
Fuel
FLOW 16.5 GPH
USED 12.5 Gal
REM 32.0 Gal
TIME 01:56 h:m
ECON 10.2 NMPG
Initial Fuel
Map TAWS Chart Trip Nrst Chklst Aux Engine
Hdg Bug 012°
Alt Bug 10000 FT
Baro Set 30.22"
THREE GREEN PRODUCTIONS


AVIDYNE
FLIGHT DIRECTOR
AP OFF FD ON
AP ON
MANEUVERING SPEED: Vo 133 KIAS
HDG
ALT
AP
10000 FT
Power
Nav GPS1
Bearing OFF
Aux OFF
Range View
Hdg Bug 012°
Alt Bug 10000 FT
Vsl Bug 0 FPM
Baro Set 30.22"
TAS 181 KTS
GS 168 KTS
OAT 11°C
FF 16.4 GPH
Tach 2520 RPM
MAP 30.5 in-Hg
Oil 197 °F
Oil 40 PSI
Absolute
Normalize
Lean Assist
Emerg. Checklist
Map TAWS Chart
N223TN
THREE GREEN PRODUCTIONS

George also demonstrated the new Density Controller, nicknamed World Peace. George told the story about how the name came about--in a nutshell, when the guys in the shop were installing the panel mounted controls, they asked George what he wanted to call it so they could printed the panel labels. He said, "I don't know. I just know that it's better than beer in a can." George had to leave to go take a call and when he returned all the guys in the shop were laughing under their breathes and trying to look away. When George noticed the label, he called the guys overs and asked who came up with it. They said that they all had a vote and the only thing they could think of that was better than beer in a can would be World Peace. Like the label, the name stuck!

In essence, the Density Controller monitors the manifold pressure, fuel flow, outside air temperature, and other parameters to intelligently control the manifold pressure and fuel flow to account for outside temperature and pressure (IIRC). The net effect is that, depending on conditions, the Density Controller can adjust the engine operating conditions to safely extract more power out of the engine by, again safely, increasing MP and fuel flow to allow the engine to run over 100%. The Density Controller has various fail safe features that also help the pilot and engine perform together, such as carefully controlling the fuel flow, especially at altitude, to prevent a flooding condition when a pilot reduces power significantly and later rapidly advances the throttle. I admit that I didn't pick up all the nuances of the Density Controller--probably because I was most interested in the fuel and its performance.

As we made our way back to Ada, I kept commenting to George that what was most impressive about G100UL fuel in a high-performance, high-compression, turbonormalized aircraft was that it was seamless. No change in pilot operations. No change to the aircraft fuel system. No reduction in performance (in fact, an slight increase). Just fly it.

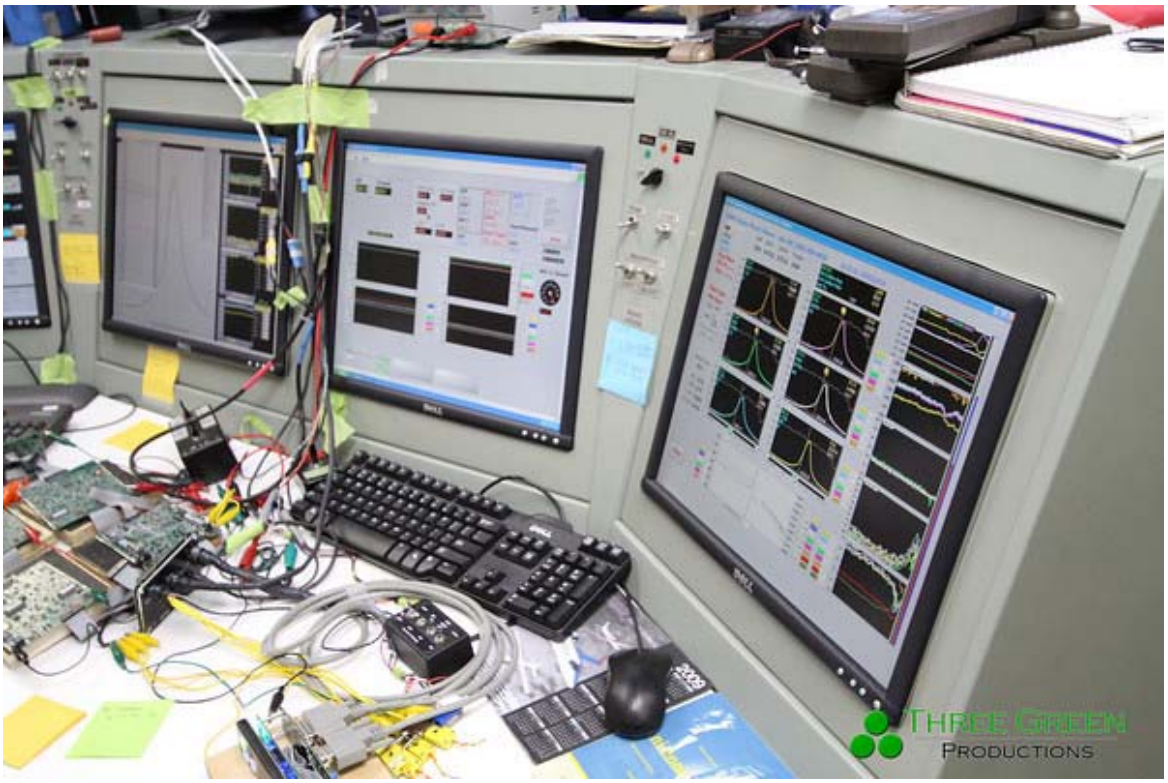
Once back at Ada I got to watch George, James, and James test a variation of G100UL in the test cell (TAT/GAMI's engine test stand). This variation of G100UL was being used to test various composition limits relative to 100LL and min-spec 100LL.

The test cell is an impressive setup. They have an TN IO-550 that has been in the cell for close to 1200 hours (IIRC) without any cylinder work, etc.


GAMI's
'Carl Goulet'
Memorial
ENGINE TEST FACILITY
Engineering For The Future
Of General Aviation
THREE GREEN
PRODUCTIONS


BUSKEE
THREE GREEN
PRODUCTIONS


OFF
PUMP
START
MAGNETOS
LEFT
RIGHT
RIGHT ENGINE
STOP
DELL
THREE GREEN
PRODUCTIONS


THREE GREEN
PRODUCTIONS

As they warmed up the engine, they started putting the engine and test fuel through its paces--doing things that we all try to avoid. Namely, they were setting up the engine to achieve detonation! They then throw a couple valves from the control room and within 10 seconds 100LL and then 100LL min-spec is run through the engine in similar conditions to gauge performance. The test fuel apparently performed well and, in fact, better than 100LL min-spec.

That day I spent several hours looking at test bladders, sticking my nose into fuel cells, inspecting gaskets, flying a G100UL powered aircraft up to 10,000 ft, and watching the testing of outer-boundary fuel combinations, and I came away from it all with a new respect for G100UL. Although the red tape appears to be slowing progress, from what I saw, I would have no reservations converting G100UL into noise using my Bonanza A36!

Those guys work hard to make a fuel replacement so simple.