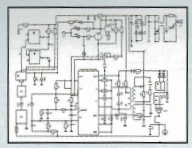
REWIRING A 340A

by Gerd Mickle, TTCF Member



In 2008 we bought our Cessna 340A, a known ice 1980 model. Although it had Garmin GNS navcoms, new Garmin transponders, and a nice new interior, it was otherwise totally stock: original engines, props, stock intercoolers, and 950 hours on the airframe.

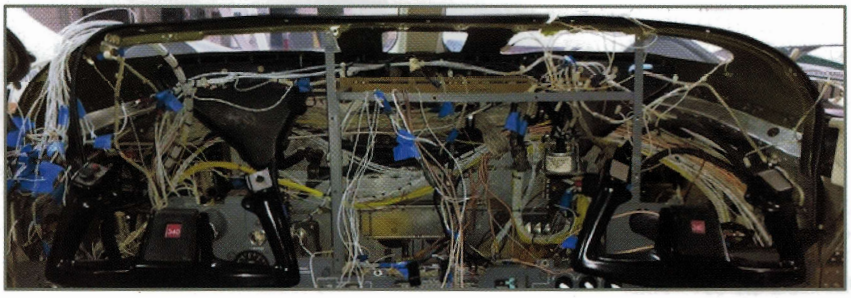
Coming from a Garmin 1000 Mooney, we were not crazy about going back to steam gauges, so we went to an avionics shop with a drawing of our desired new panel layout. That was our introduction into the world of avionics certification. We could have put in a G500, but most all of the old instruments would have had to stay in the plane due to certification limitations. That was not appealing to us and so we postponed the project and flew the plane on steam guages to Puerto Rico, Panama, Alaska, Greenland, Iceland, Poland, Germany, and anywhere between. And it flew just fine.

Over time we changed the stock propellers to MT composite props and a few years later upgraded to RAM VII engines with new cases and Continental cylinders. With these two modifications, the plane changed from an ever-overheating hog to a fantastic performer. As much as we like the low-level run along the Florida Keys to Key West, we also like to go on long trips, so the versatility of a pressurized piston twin is hard to beat (see the excellent January 2014 article from Kevin Ware about that).

But on April 26, 2018, after ten years of preparation, the wait was over. On that day Garmin announced the certification of the GFC 600 autopilot for the C340A, the missing link. We could now replace all the avionics in our 340.

It was another seven months until our avionics shop, Sebastian Communication in Merrit Island, FL, could fit us into their schedule, but it was worth the wait. Carl Campbell has decades of experience in the avionics business and Jim, one of their technicians, has extensive experience working on the wiring of the Space Shuttles, so I was optimistic they could tackle the 340 with ease.

From Dark Ages to Digital



Five months later, the plane was 90 lbs lighter (with a useful load of 1,898 lbs.) and better than almost any comparable airplane that can be bought today fresh from the factory. Except for a few minor issues, everything worked right off the bat. We were not surprised, as we had seen the amount of testing Jim put into the project in the weeks before.

I am a software engineer and have a degree in mechanical engineering, so I knew exactly what I wanted and was heavily involved in the panel design. The shop knew how to make it happen. One reason we chose Sebastian Avionics was because it was close by, and we could check in every week, monitor progress, and make all those little decisions which inevitably come up.

Our level of involvement both before and during the project was likely higher than with the average owner, but Sebastian worked with us, and the result was an airplane that conformed to our every wish and, again, was better than just about anything we could buy new today. Although well-prepared, we learned a few things along the way which we want to share.

Autopilot architecture

The wiring necessary for the old autopilot system is just mind-boggling. There were five subsystems: The indicator/control panel, the autopilot computer, the altitude hold box, the airspeed switch, the GPSS converter, and connections to the diode box and the switch panel. In addition to that, a bundle of wires ran from the autopilot computer to each of the servos (three in the tail and one in the right wing).

The autopilot computer alone was connected to 82 wires. Some of the wires went from the tail, through the back and front pressure bulkheads, up to the junction box in the nose compartment, and from there back to the indicator/

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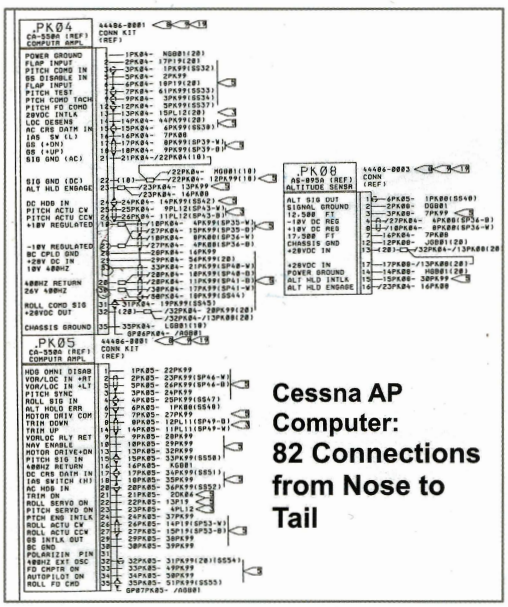
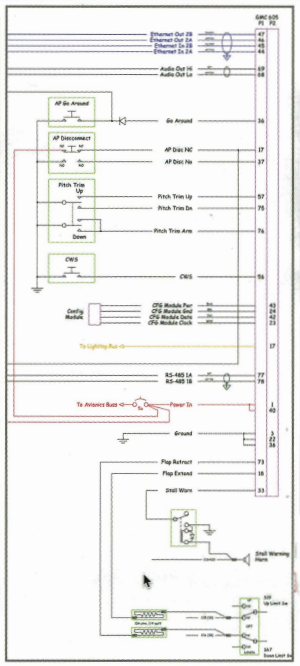
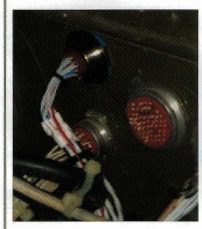
One Example



Cessna AP Computer: 82 Connections from Nose to Tail





Complete Garmin AP: Only Four Connections out of the Panel Area

control panel. Now add the wiring of the other four subsystems to it. To us, it seemed like a miracle how a system that complicated could ever work flawlessly.

The GFC 600 is just one box, the one you see in the panel. Seven short wires go to several switches (AP disconnect, CWS, trim), two to the flap switches, and one to the stall warning system. One high speed data bus connects to the G500, and an audio connection runs to the audio panel close by. Only four wires leave the vicinity of the panel area. They run to the first servo and then from that servo to the next and so on. That's it.

One subsystem and 25 connections total, versus five subsystems and 100+ wires crisscrossing the whole airframe. Progress!

System architecture - better redundancy

As we learned from experience, even two-screen G1000 systems often do not have a lot of redundancy. If you lose the air data computer, for example, you not only lose the indications on your PFD, but you also lose the mode C output of the transponder. Or if you lose the AHRS, you are on your backup attitude indicator.

Our expectation for the two panel G500 TXi installation was somewhat similar. If we lose one component of one screen, we can still look at the other side. But the system architecture delivers a whole lot more redundancy than that. A two-screen G500 TXi system consists of independent systems. There are two independent AHRS units and two air data computers. If we lose the AHRS from the pilot side system, the data will simply be provided by the AHRS from the copilot system. You will get an annunciation, but otherwise everything will still work as before. Same with air data.

Provided you still have power (and with the low power draw of modern avionics, battery power alone lasts longer), it takes a lot more components to fail until you finally end up with the emergency backup EFIS as your only option.

Stormscope wiring, then and now

Although in our old setup the stormscope was already connected to the GNS 530, even here there were substantial improvements to be made. The old connection had a thick bundle of wires routed from the stormscope location in the tail cone to the GNS 530 in the panel. With the connection to the GTN 750, this was reduced to one shielded cable containing three wires.

Dimming in the seventies versus dimming today

Every Twin Cessna pilot is familiar with the sliding dimmers in the electrical panel. But that is only the tip of the iceberg. The wires go from the circuit breaker panel and the master day/night switch to the dimmers via a 15-

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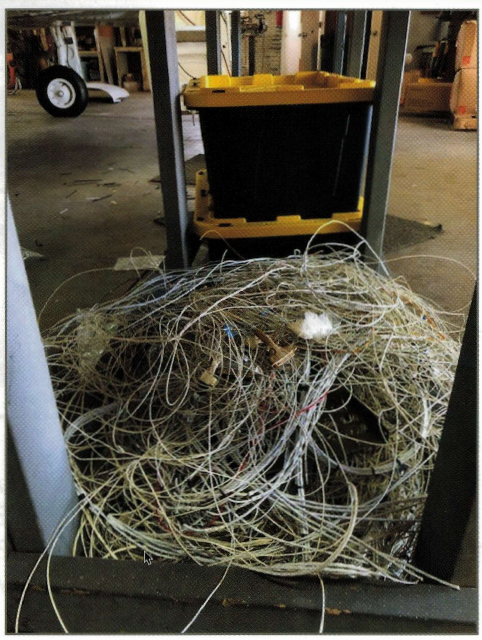
Massive Amount of Old Wiring Removed



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The Result – 86+ lbs. less and a lot to learn

- 86 lbs. lighter for an Empty Weight of 4,496 lbs. and a Useful Load of 1,894 lbs.
- Payload with Full Fuel (218 gal.) grew from 500 lbs. to 586 lbs. (17%)

pin dimmer control connector. From there, via an 18-pin connector, a bunch of nine wires is routed through the front pressure bulkhead to the nose compartment. There, the wires go to another connector, connecting to a transistor assembly with a huge heat sink. From there, the nine wires go all the way back through the same 18-pin connectors mentioned above until they are back at the 15-pin dimmer connector. From there the wires go to the lighting subsystems which are to be dimmed. Whew!

Today, all you need are five digital dimmers connected to that single 15-pin dimmer control connector. Everything else can be taken out of the plane completely. Fewer wires, less current draw, less heat, less risk of any short - and less weight.

A modern panel needs modern warning lights

The VIVISUN lights and lighted push-button switches from Applied Avionics are a good option that provide redundancy and modernize the look of the panel. Instead of one incandescent lightbulb per indicator, several LED lights are lighting up every single switch and warning light. They are made to order, so it takes a few weeks' lead time to work with these.

You always get hit from where you least expect it: Aerospace Logic

Aerospace Logic offers nice fuel level gauges to get rid of the archaic original fuel gauges. They are FAA certified for replacement of the original factory fuel gauges and, as such, available to work with the 0-1 V output of the Cessna pennycap fuel signal conditioner boxes. Take out, plug in, put in, recalibrate, done. That's what we thought anyway.

Every signal conditioner box provides two outputs (r0 r-) and the voltage between the lines is 0-1 V. However, the Aerospace Logic displays only provide a common airframe ground and one input line per tank. That doesn't work! With some back and forth support from the company, we had to abandon the idea to replace the factory fuel gauges for now. We are now working on a way to use CiES fuel senders which will hopefully allow us to get rid of the last Cessna factory gauge standing.

Once we get rid of the fuel signal conditioner boxes, almost all the hard-to-get and hard-to-maintain electronics will be completely replaced by more modern, easily-serviceable, and readily-available components. As long as we can still get Avgas and airframe parts, we are looking at the fifth decade of service from these fantastic airframes.

Modern avionics allowed us to upgrade our Twin Cessna beyond what our wildest dreams were when we bought our 340A ten years ago!