

A man with a beard and sunglasses, wearing a green shirt, is smiling and standing next to a blue and white airplane. The background shows a grassy field and a clear sky.

***“Team X” and the
Development of the
Garmin GFC500
Autopilot***

“Team X” and Development of the Garmin GFC500 Autopilot

By Mike Jones

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Deep inside the bowels of Garmin corporate headquarters in Olathe, Kansas lurk a small group of R&D engineers who are changing the world of avionics. The Garmin “Team X” has been tasked to make new, low-cost, high-performance avionics for both experimental and certified aircraft. In my mind, I envision a James-Bond-style lab with satellite dishes, lasers, and nubile assistants, but it’s probably a bunch of cubicles and coffee machines. Whatever it looks like, it’s the birthplace of my new Garmin GFC500 autopilot.

Running the shop is the loquacious Joe Gepner, who drives a Van RV-8 (he’s the handsome chap on the cover of this article, in front of his RV-8). He started as a software engineer at Garmin straight out of college. Like Joe, most of Team X are pilots or airplane builders themselves. “That’s why management gives us a little bit more latitude, to decide what we want to build,” Gepner said. “Ultimately, we’re making cool stuff a regular Joe-Blow pilot like me can afford and get into our airplanes.”

While twenty people work on Team X, not everybody works on the same projects. “When we did the GFC500, we had one mechanical engineer who designed the servos, one electrical engineer and two software engineers. That’s it, that’s how the system was built,” Gepner explained.

Team X stems from around 2007-8 when Garmin thought light sport aircraft were going to be the next big thing. The company already had a good partnership with Cessna so they designed the G300 system for the ill-fated Cessna Skycatcher. They also tried to sell the system to experimental owners. Unhappily, it wasn’t the right product and gently flopped.



But Garmin VP Phil Straub, looking at the bigger picture, saw that the experimental market was large and potentially profitable. He just needed a nimble group from that community, who built airplanes and knew the customers. That’s when Team X was born.

The GFC500 autopilot has an odd history, even among the many wacky Team X stories. The team was building the G3X “glass cockpit” for the experimental market but wanted a fully-integrated autopilot to ride with it. They had made some servos for the G3X system and they had a stand-by instrument in the nascent G5 digital display. They surmised that if these could be linked it might serve as a super-small, self-contained autopilot, perfect for home-builders.

“When we first started down the autopilot rabbit-hole, I found if I could minimize the lag in the system it just flew better and better,” Gepner recalls. “With more smarts in the servos, I basically got the delay down to zero. That meant the autopilot flew really good.”

Then the team needed a device to control the servos. “It was just me and another guy writing the software. We were doing the G5 and it just kept getting smarter and smarter,” Gepner related. “One Friday, both of our wives happened to be out of town for the weekend. So we came in over the weekend and just coded it up. That really was the birth of the GFC500. We had all the pieces and the GFC500 just fell out of the other end.”

The main components of the system are the G5 display, the GSA28 servos and the GMC507 control head. Surprising to most people, the G5 display is the heart — “the smart part” according to Gepner — of the system.

“It’s almost the exact opposite of what most people think,” Gepner said. “The GMC507 is an independent judge, with its own AHRS system. It watches what the G5 and servos are doing. It’s like a flight instructor, if it doesn’t like the set-up it just disengages the autopilot. But all the real brains are in the G5 and the servos.”

All three systems communicate directly with each other. “The G5 says, hey, I’d like you to fly this vertical speed, the 507 confirms it’s safe, and the pitch servo uses the algorithms and control laws inside itself to get the plane to fly that vertical speed.”

The first flight test was in a Vans RV-8. One of the team members had built one so they had him install it into his plane. That morphed into the finished experimental autopilot but management worried it might not handle larger certified planes. As proof, they installed it into a Cessna 172. It “flew like it was a 737.”

The secret sauce behind this innovation are new FAA rules for certifying avionics. According to Gepner, the FAA really has embraced the idea of using technology to improve safety. The Garmin team now is able to build avionics for certified aircraft using ‘nontraditional means of compliance’ such as the self-monitoring feature of the GMC507.

The FAA found creative ways to bring the certification bar down to where Garmin and others could get products to market at an affordable price. “If a pilot walks down the flight line at Oshkosh, all they see is technology from the ’60s and ’70s because newer certified technology simply was too expensive for private owners,” Gepner summarized. “Now you’re seeing real innovation show up in these airplanes. People are safer because of it.”

Gepner feels the success of these innovations is reinforcing the momentum for change at the FAA. “The FAA deserves all the credit there, there’s been a real shift in thinking at the FAA,” he said. “Ten years ago we never could have done this stuff at this price and now we can, and ultimately the end-customer is the one who wins.”

The success of the GFC500 also has changed Garmin’s marketing perspective. “I don’t know if Garmin appreciated how underserved that market had been,” Gepner said. “It’s really been eye-opening to see how hungry the market was for new, affordable avionics.”

It’s also changed Joe. “My passion is building stuff, whether it’s on-the-side for fun or building stuff here at work, like the years of building the servos and the AHRS and the autopilot,” Gepner said affectionately. “I can’t believe they paid me for doing that. I felt like a kid in a candy shop.”

About the Author

Mike Jones is a commercial-rated Cessna driver based in North Carolina. He’s chomping at the bit to get to Oshkosh this year: there’s a one-inch tall spacer in his avionics stack that would be the perfect spot... for something.

