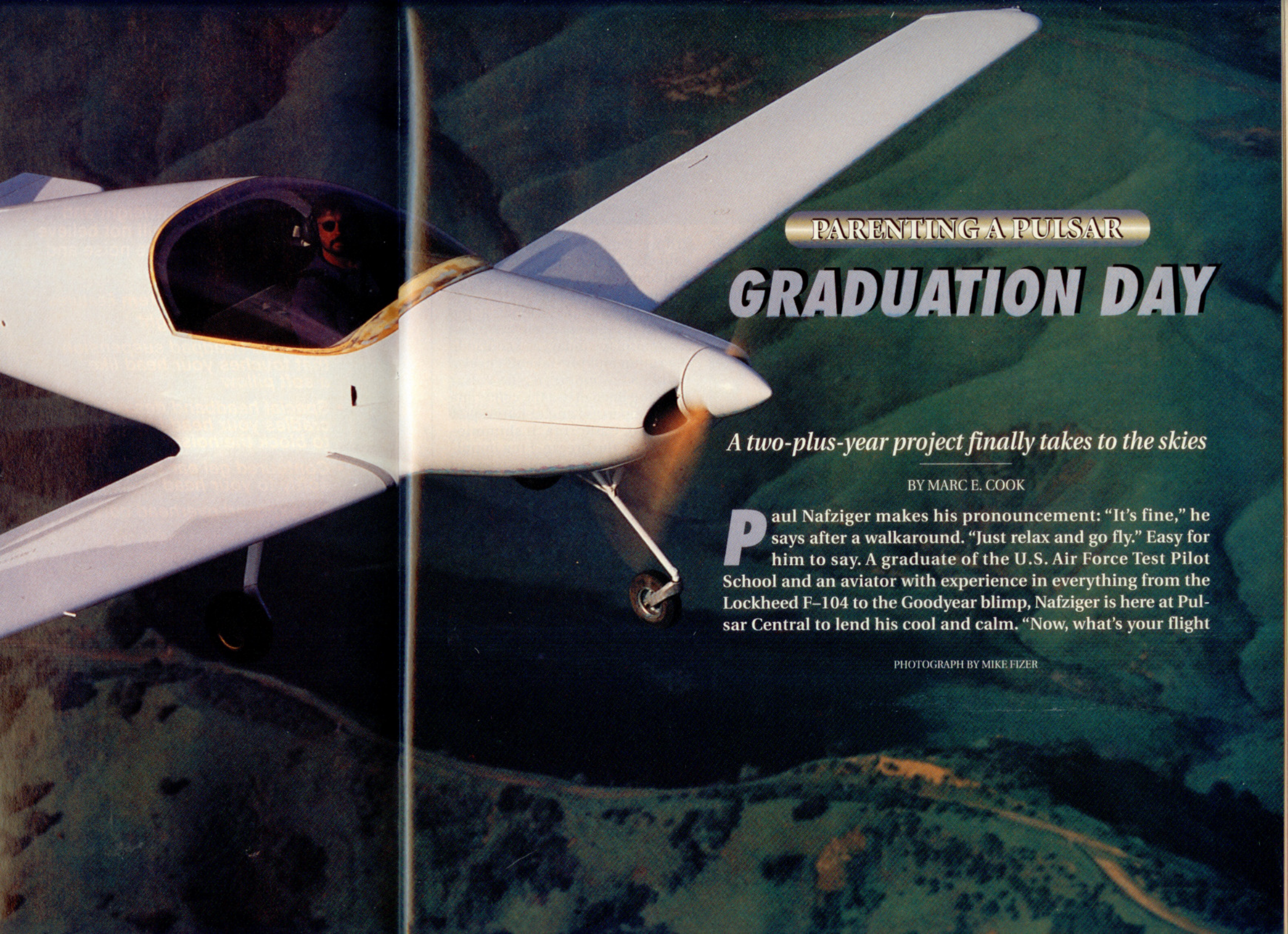


PARENTING A PULSAR

GRADUATION DAY

A two-plus-year project finally takes to the skies

BY MARC E. COOK

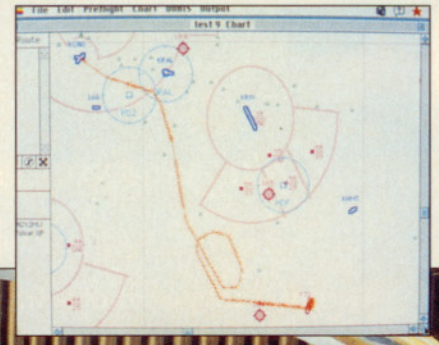
Paul Nafziger makes his pronouncement: "It's fine," he says after a walkaround. "Just relax and go fly." Easy for him to say. A graduate of the U.S. Air Force Test Pilot School and an aviator with experience in everything from the Lockheed F–104 to the Goodyear blimp, Nafziger is here at Pulsar Central to lend his cool and calm. "Now, what's your flight

PHOTOGRAPH BY MIKE FIZER

On the morning of the first flight: one each Pulsar and pilot, fired up and ready to fly.

test plan?" he asks for the umpteenth time. I'm starting to get the drift: Know the plan intimately, so that no matter what, you'll be able to fly it. Good advice, I would soon find out.

Our flight-test crew, already larger than is generally considered appropriate, begins to show some emotion as I step into the rented parachute and attempt to put the first-flight plan into nonvolatile memory. My wife, Martha, is busy acting as events coordinator, with help from my in-laws, Jim and Jackie Johnson. Nafziger and his wife, Gloria, help ease tension among the group. I'm too far gone to be helped. Conflicting schedules have spared my own mother from having to witness this event.



Logging flight data in a laptop computer helped during the flight-test phase. MentorPlus's program shows the path of one test flight leg.

Soon the group assembles at the edge of the runway (there will be no chase airplane today) as I conclude the runup and pre-takeoff checks. Within a few moments, the Pulsar and I are lined up on the centerline at the departure end of Runway 21 in Chino, California. It shimmies slightly in the breeze. I tug impulsively on the parachute straps to check their tightness and try to get comfortable on the unpadded seat bulkheads.

After a brief wait on the runway, I hear the Chino Tower controller say, "Experimental Two-One-Two-Mike-Juliet, Runway Two-One, cleared for takeoff." I acknowledge and set about my task. Rising to a familiar pitch, the Rotax pulls the airplane down the runway with alacrity. At about 60 mph, I ease back slightly on the center stick and let the airplane break ground. For the first time.

I no sooner catch my breath than I realize not everything is going according to plan—which was to climb over the airport to a safe altitude and begin the small number of tasks on the 30-minute-long

first flight. Immediately I notice that a left rolling tendency discovered during runway hops, and ostensibly remedied, has returned with a vengeance. The airspeed indicator shows 80 mph and no more, even with the nose on the horizon and full power in. I glance at the panel-mounted GPS to find a 100-knot groundspeed. Correcting for wind, I realize I have blown right through my self-imposed 100-mph maximum speed for the first flight. As if that's not enough, one of the cylinder-head temperatures rises rapidly to the maximum of 300 degrees Fahrenheit.

Three strikes. Time to go home.

I call the tower and say something to the effect of, "I'd like to land now." Immediately the controller asks if there are any serious problems. I reply in the negative. "Just a cylinder running too hot," I tell him. He clears me to land on any runway I want. A hot, high approach concludes with a long but reasonably soft landing.

Out of habit, I click the flight-timer switch on the electronic tachometer. It reads, ":12." Twelve minutes. Two tenths. Probably only half of that in flight. Could have fooled me.

Back at the hangar, Nafziger is all smiles. "Great job; you did exactly what you needed to do." I feel differently—dejected and defeated is more like it. The flight has been a failure, too many things gone wrong, too little time in the air. I imagine that the flight-test duration of 40 hours will stretch into eternity.

Nafziger tries once more. "Cheer up," he says. "You flew the airplane, and it's back on the ground safe. This is what it's all about."

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Flight testing a homebuilt is not something to be taken lightly. Accident statistics continue to reveal that builder/pilots face substantial risk in the first few hours of flight. The reasons are many. Each homebuilt is more than an unproven airplane. Thanks to the vagaries of homebuilding and constant improvements from the factory, it's rare that any two homebuilts of a given model are identical. Unlike production test pilots, who have some chance that the flight-test item will conform to some loose set of specifications, the homebuilder-cum-test pilot has no such assurance.

These factors in mind, I thought long and hard about who would perform the first flight of my Pulsar. After careful consideration, I decided it would be me. Frankly, were this a faster, more complex homebuilt, I would not likely have come to the same conclusion. Something on the order of the Glasair III or a Lancair IV deserves the talents of a good test

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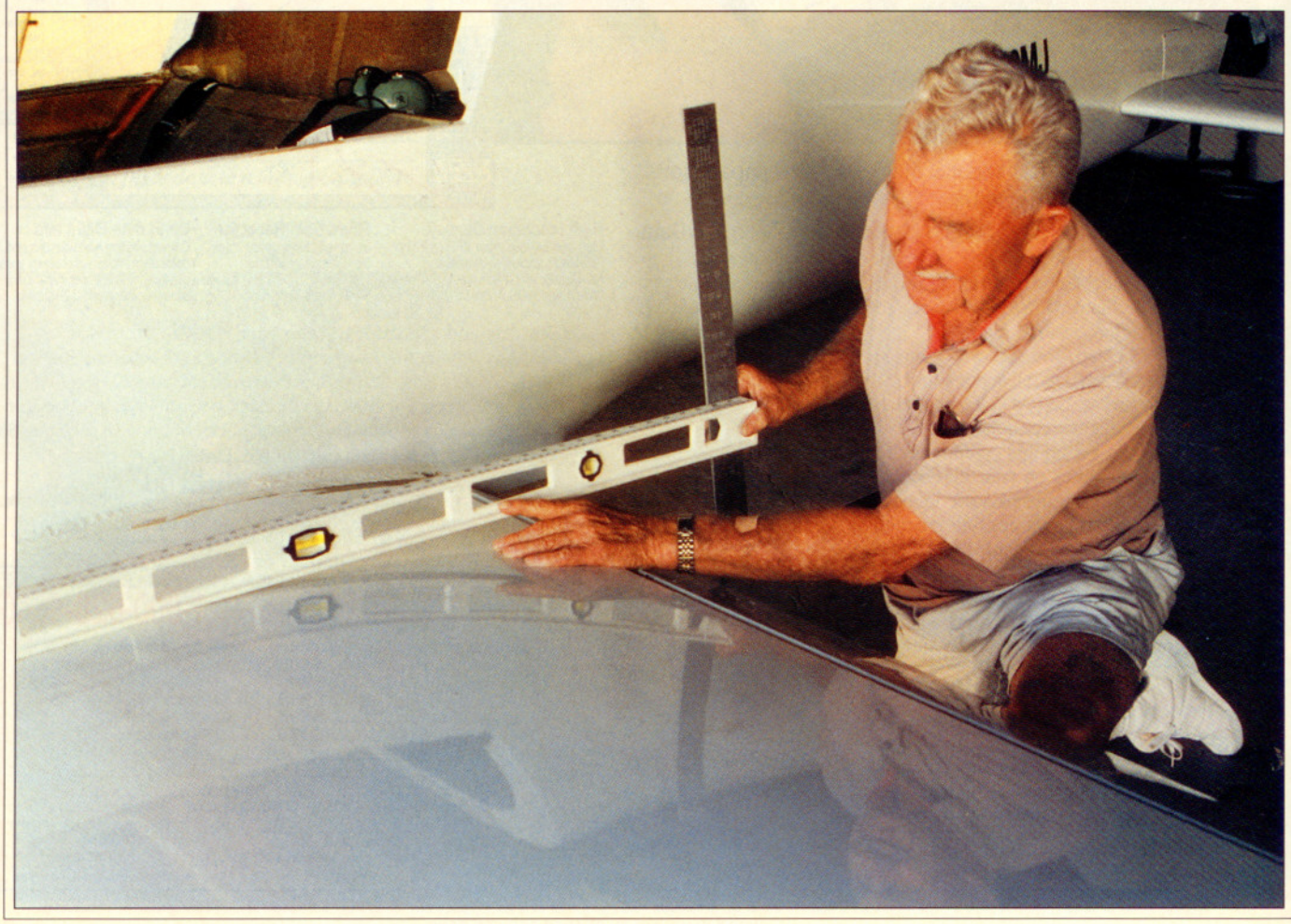

Jim Johnson takes a wing measurement. Discovering a malconstructed flap helped cure the Pulsar's left-turning tendency.

pilot who also has significant time in similar makes and models.

In the months preceding the anticipated first flight of N212MJ, I stopped in on the Aero Designs crew and made several flights in the factory demonstrator Pulsar XP. These were helpful in myriad ways, not the least of which was to get my enthusiasm to fever pitch for the inaugural flight. Performing several landings, power-off approaches, and unusual attitudes in the factory airplane gave me useful insight into what I might expect from my Pulsar. These familiarization flights should be considered essential for the builder who intends to make the first flight.

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As any flight-test pilot will tell you, first flight marks the beginning of the *real* work in a new airplane. In those 12 minutes, I found more than a handful of items that would need correction in the coming weeks. The airspeed system would be simple—ultimately, after testing each part of the pitot-static system in order, we discovered the indicator itself to be bad. Flushing the cooling system in the Pulsar's Rotax 912 engine cured the high cylinder temperature.

The rolling tendency then grasped our focus. After fielding possibilities with the Aero Designs staff, Jim and I decided to measure the twist in the wings. As is true with most aircraft, the Pulsar's airfoil has a greater angle of attack at the root than at the tip. This twist ensures that the wing root stalls first, preserving roll control and fending off a rapid wing drop.

Our initial measurements on the airplane did not encourage us. It appeared that the right wing had less twist than the left, which would allow it to produce more lift and create the rolling tendency. In the week after first flight, we experienced an emotional roller coaster as we attempted to determine the precise cause of the rolling and construct a fix. Finally, we caved in and pulled the wings for a measurement of twist, amid a great sense of foreboding. If, in fact, one wing had too much twist (or the other had insufficient twist), the only solution would be to remove the lower skin and literally twist the whole assembly into the correct shape. I envisioned months of extra work and resumption of the tedious

finishing process. (Adding to the confusion is the fact that I had received the earliest sets of quick-build wings, and the documentation for them lagged slightly. Having handled the wings for months, I assumed that the wing twist was built in, even without the bottom skin in place. Not necessarily, it turns out.)

Perched on two carefully leveled sawhorses, the suspect wing proved to be just off specification, but well within the limits set by Aero Designs. We found the wing to be 1/16-inch shy of the correct amount of twist. Unsure about the real cause, we placed the other wing on the jig and discovered it to be right on spec. Quickly following the great relief that flowed over us was the realization that something else must be wrong.

During a day in the hangar, taking measurements of the newly reinstalled wings from virtually every angle finally gave us a culprit. Inadvertently, the right flap was built with too much twist at the outboard edge, creating something akin to aileron deflection. We removed the rivets from the ends and leading edge of the folded-metal flap and, a few days later, reconstructed the flap with the outboard trailing edge almost 1/4-inch higher than before. To further help our cause, a small trim tab that I constructed for the right aileron removed some of the stick needed to fly straight and level.

Exactly one week after the first flight, Mike Juliet took off again. The flight was an unqualified success. Our flap changes eliminated 90 percent of the rolling motion, and the engine temps were all in line. On that 45-minute flight I finally had the chance to sit back and relax—just a little—and enjoy the ride.

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Airplanes are emotions, it could be argued. In 40 hours of flying spread over two months, I had the opportunity to experience virtually the whole spectrum. In the first handful of flights, my objective was simply to make sure that the engine would continue to run and that the airplane was basically controllable. They were pleasurable but basically tense test sessions.

The 80-horsepower Rotax ran flawlessly, and the handling characteristics of my airplane were very close to those of the factory's.

Quickly following the relief that flowed over us was the realization that something else must be wrong.

Though light to the touch, the Pulsar flew with good stability and excellent manners.

As part of the rolling tendency problem, I expected the stall characteristics of the airplane to be, ah, unique. Fortunately, I was wrong. Admittedly, the first few stalls in the series had my heart beating hard and my palms plenty sweaty. At first, the Pulsar wanted to drop the left wing vigorously, although it would then roll only 45 degrees or so from straight and level. Jim and I tweaked the flap positions and altered each wing's angle of incidence. Finally, we got the airplane to behave reasonably well with one person aboard; ballasted to simulate two-up travel, the Pulsar stalls straight ahead. Ultimately, I decided that there's only so much you can do about lateral balance in an airplane that weighs 550 pounds empty and is expected to carry a 190-pound pilot sitting entirely to the left of the aircraft's centerline.

Other parts of flight test included data gathering, and this can be the real boring part of the plan. Essentially, you are expected to gather climb and cruise numbers at different altitudes. This means, simply, climbing to the test altitude, flying at a precise heading and altitude, and reading both the airspeed indicator and the GPS. Opposite-direction speed runs disclose any airspeed-indicator errors. To bolster my handwritten notes, I used MentorPlus' FliteMap program to capture many of the flights on my laptop computer. This freed me from constantly having to plot groundspeed and heading.

For data acquisition, I at least had help from good test gear. In addition to a set of Mitchell electric engine gauges, the Pulsar carried an Electronics International single-point EGT and a DPS electronic tach. I almost didn't get the multi-talented LCD tach, since the company decided to suspend production of the $300 device about the time I was ready for it. Thankfully, company founder Bob Johnson resumed making the instrument in time for my flight tests. Good thing, too, since the 2.25-inch tach is superbly accurate and possesses several useful features. It has LED limit lights (green for normal limits, yellow for caution, and red for the maximum limit), a nonvolatile hourmeter (set to run at engine speeds in excess of 1,400 rpm), and a resettable flight timer. What's more, it connects directly to the

Rotax's integral electric tachometer drive circuits.

Kudos also to the Bendix/King KLX 135 GPS/com. It saves precious panel space, acting as both a high-quality com radio and an accurate, easily used GPS. Having the spot-on groundspeed numbers at hand made calibrating my Pulsar's airspeed indicator simplicity itself. (A moving-map version of the 135 will be available later this summer. Expect a more detailed report soon.)

Near the end of the second month, I had completed all the items on the flight-test card—airwork, climb and cruise tests, center of gravity limits verification, and engine cooling and durability trials. I also had time to mock up a canopy seal (it gets cold in there without a heater on an overcast day) and to install an intercom and a baggage shelf. Yet, I knew I was dealing in the margins, making small changes and flying to see if they did any good (or harm). I tracked down small leaks, electrical gremlins (remarkably few of them, actually), and proved the airplane to be an excellent climber (1,600 feet per minute at light weight, 1,000 fpm ballasted to maximum gross) and faster than the factory's claims. At optimum altitude and power, this Pulsar will do 128 knots true, with a fixed-pitch prop and no wheelpants.

We hastily unload the truck's contents and, in the hour before sunset, go flying. Just for the fun of it.

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On the last day of flight test, Jim drives with me to Chino to clean out the hangar. Later that afternoon, I land the Pulsar at my Long Beach base and taxi to the hangar in which much of the airplane construction had taken place. It feels suddenly odd, that what had been a project of creation would suddenly now be a flying, useful airplane.

Jim and I hastily unload the truck's contents and, in the hour before sunset, go flying. Just for the fun of it. □