



LISA TURNER
COMMENTARY / AIRWORTHY

Top 5 Trouble Areas on a New Homebuilt

Checklists for flying safely during Phase I flight testing

BY LISA TURNER

I OPENED THE DOOR to the flight school office and walked up to Ellen, who was poring over a flight manual at her desk. She looked up.

"Hey!" Ellen said. "I hear you completed testing on your Pulsar. How do you like it?"

"I love it," I said. "It's the sports car of the sky. Thirty-six miles per gallon! I couldn't be happier. I've got 46 hours on it now."

"You mean gallons per hour," Ellen said. "What can I sell you today?"

"Four gallons per hour," I said. "Only aviation people understand gph. Everyone understands mpg. How about a flight review?"

"Sure," Ellen said. "In your Pulsar? I'd love to get a ride. And you have an IFR panel, right? We can get in some under-the-hood time."

"Sounds like a plan."

The next morning I taxied up to the flight school, and Ellen eased herself into the small cockpit. We took off into a cloudless blue sky. Even though my confidence in the Pulsar was solid, as a low-time pilot I was feeling nervous. I liked Ellen a lot as an instructor, and I wanted to please her.

"Very nice, very smooth, and quiet," Ellen said into the intercom.

"Yes!" I replied, some of my nerves easing.

We did a full repertoire of maneuvers, including a stall, slow flight, and emergency drills. The hour was up.

"That went fast!" I said.

"Let's do a little hood time," Ellen said. "I won't charge extra."

As I was listening to Ellen's instructions, the engine skipped a beat and began to sputter. I quickly switched the auxiliary fuel pump on and changed fuel tanks from left to right. The faltering Rotax 912 came back to life immediately. The left tank indicated 6 gallons remaining and the right tank indicated a full 10.

"Whoa," Ellen said. "We better go back now."

I took the hood off and turned back to the airport, making my calls and landing without incident on Runway 33.

I apologized to Ellen, upset that she had to encounter a problem in my new homebuilt.

"You better get that checked out," Ellen said. "It didn't sound good. Come by the office later. I will sign off your review."

I taxied back to the hangar, worried and perplexed.



STAYING OUT OF TROUBLE

When you complete your new homebuilt, you may feel that your work is over, and it's time to fly with abandon. This euphoria is completely understandable. Building an airplane yourself gives you a feeling of mastery that extends to piloting the aircraft. But the logical part of your brain knows the aircraft is still very new, and there will be bugs, adjustments, and some surprises in the first weeks and months of flying.

Whether you are in the middle of your build, at the end, or already flying, take note of the following items that plague many new flyers. I've assembled the top five things I've seen as a designated airworthiness representative and as an EAA technical counselor that can ground pilots away from home, stop an engine in flight, or send the airplane into the ditch.

Many homebuilders are not high-time pilots. Any trouble with operation can doubly confound the inexperienced pilot. Of course, there are more than five areas that produce problems, especially on complex and high-performance homebuilts, but these basics will get you started.



Fuel Filter

Fuel systems. Problems here will stop your engine in the middle of a flight. You might be able to restart and/or switch tanks, but either way it is a serious problem.

- Smells. You should not be able to smell auto or aviation gas inside your airplane. If you open the canopy and smell gas after the airplane has been sitting, investigate. Some builders use the less expensive automotive fuel hoses and find they emit a gasoline odor while not registering on a fumes meter. Follow the kit manufacturer's advice on hoses.

- Leaks. Look at hoses, connections, fuel tank end plates, the quick drain, gascolator, fuel pump, and everything else connected to the fuel system. Look for blue stains if you use 100LL aviation fuel in your aircraft.
- Filters and screens. Plan on filters and screens clogging up early with everything from fiberglass bits to metal shavings. No matter how hard you try to clean everything up during the build, some debris will remain and must be flushed out with regular filter and screen changes. If you run mogas in your aircraft, use a screen or filter when filling your gas can and when filling your tanks.
- Use the grade of fuel recommended by your engine manufacturer. Realize autogas begins to collect moisture and degrade as soon as it leaves the station. Using a premium grade and making sure there is no ethanol in the fuel can offset but not delay this degradation. A 2017 Rotax article on fuels advises not to use any non-premium mogas with more than 5 percent alcohol, nor any fuel that is older than three weeks since coming out of the pump. (For more fuel-related advice from Rotax, go to www.EAA.org/extras.)



Hardware and component installation. Problems in this category include something on your airplane falling off or controls that don't work. This is another flight-interrupting scenario you do not want to experience.

- Control cables, turnbuckles, and safetying. Start at one end and follow the cables, making sure you look at everything.

- Look for missing nuts and bolts and for loose hardware. Missing? Yes, I have seen it.

- Torque Seal. If you did not use Torque Seal, a paste available in many bright colors, start now. Torque Seal provides a convenient visual method for identification of vibration loosening in nuts, bolts, fasteners, and assemblies. I really don't think you can overuse it. Don't confuse this with thread locker, a colored chemical used to help hold threads tight according to the manufacturers' specifications.



- Check the security of things bolted to your aircraft. Check jam nuts and look for cotter keys where indicated. You might find some missing or loose.

- Remember that bolts designed to rotate should have a castellated nut and cotter pin. I see many instances where the builder doesn't really understand the difference. Always refer to the plans to make sure you have castellated nuts and fiber nuts in the right places. Except for rod end bearings (where the joint is built in), look at what the nut is capturing; if it rotates, you should have a castellated nut with a cotter key on it to allow for the rotation.



- Check the cowling and the engine compartment for rubbing hoses and clearances on exhaust components.

Brakes, nose wheels, and tail wheels. Not being able to stop the aircraft on the ground or steer it can result in damage to property and persons.

- Brakes mushy? Did you get all of the air out of the hydraulic fluid? You might need to take another go at it in the first five or 10 hours as things settle in.
- Brake pad wear. The first 10 hours on a homebuilt are brutal on brake pads. Most homebuilts with nose wheels use a free casting system where judicious application of power and brake steer the aircraft. Differential braking and steering mechanisms on tail wheels can also contribute to brake pad wear. New homebuilders will use a lot of brake as they are learning. Check pads often. Consider leaving wheelpants off for the first 50 hours so you won't be tempted not to check the pads.
- Nose wheels and tail wheels. Recheck the systems if you get any shimmy or binding. It may take some time for these to appear as the hardware is settling in after your build. Any shimmy should be addressed immediately, as it will only get worse and can lead you right off the runway or break a gear leg or strut on landing.

Electrical system. Problems in the electrical system, such as active cables coming loose, can start a fire.

- Double-check your connections at the starter, the relay, and the battery. Are they tight and clean?
- Check clearances on the electrical harnesses to make sure they are secured, verify the entrance and exits from the firewall and other bulkheads are secure and grommets, and ensure there aren't any loose wires or attachments. Check to make sure wiring is properly bundled and away from high heat areas in the engine compartment.

Documentation. Mistakes here, such as on weight and balance or not finishing your Phase I flight testing, can cause serious safety issues such as not being able to control the aircraft when fully loaded.

- The airworthiness certificate and the operating limitations should be in the aircraft — not in a file somewhere — along with the certificate of registration and weight-and-balance analysis. The airworthiness certificate needs to be visible to passengers.
- Did the manufacturer send you any service bulletins or advisories? If so, did you comply?



Airworthiness Certificate

- Do you have any equipment on the aircraft, such as engine components, that have airworthiness directives or service bulletins issued for them? “It’s experimental” is not the right answer on this question. Safety always wins.
- Have you completed your flight-test program? Did you remember to sign the aircraft out of Phase I? Do you have documentation on the testing that you did?

This is a short list, and there is more to look at to make sure you are safe in the early hours of your homebuilt’s life. Make it a practice to conduct an inspection after every flight during the first few weeks and months of flying. Follow the manufacturer’s advice on maintenance intervals and inspection areas. It’s also always a good idea to ask other people to look over your new aircraft. They will see what you missed.

LESSON LEARNED

I pulled the Pulsar into the hangar, upset about the fuel flow problem. “Fuel,” I said aloud to myself. I got out my notebook and checklists. “Look in tanks. Check sumps. Check connections, hoses, and filters.” Everything looked fine until I got to the fuel filters. I had fitted three clear glass and metal filters to the fuel system for the Pulsar. One on the exit for each tank and one after the auxiliary pump. These filters turned out to be a blessing and a curse, as the fine mesh was catching all the junk, and I didn’t realize how fast they could clog.

The left tank filter had fiberglass particulate in it that had formed a little dust ball in the outlet end. I shook my head and turned the little plugged-up screen around in my hand.

I changed all three filters for good measure and headed out for testing. I flew for an hour, switching tanks numerous times, watching flow and pressure, and all was well. When I got back, I taxied up to the flight school. I saw Ellen getting ready to fly with a student. I rolled back the canopy and waved.

“Problem solved?” Ellen asked.

“Yes,” I replied. “Clogged fuel filter. I should have checked it earlier.”

Ellen smiled. “Lesson learned.” *EAA*

Lisa Turner, EAA 509911, is a manufacturing engineer, A&P, technical counselor, advisor, and former DAR. She built and flew a Pulsar XP and Kolb Mark III, and is currently restoring a Waco UPF-7 with her husband. Lisa is a member of the EAA Homebuilt Aircraft Council and Women in Aviation International.