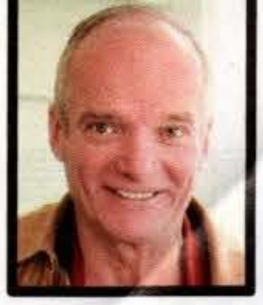

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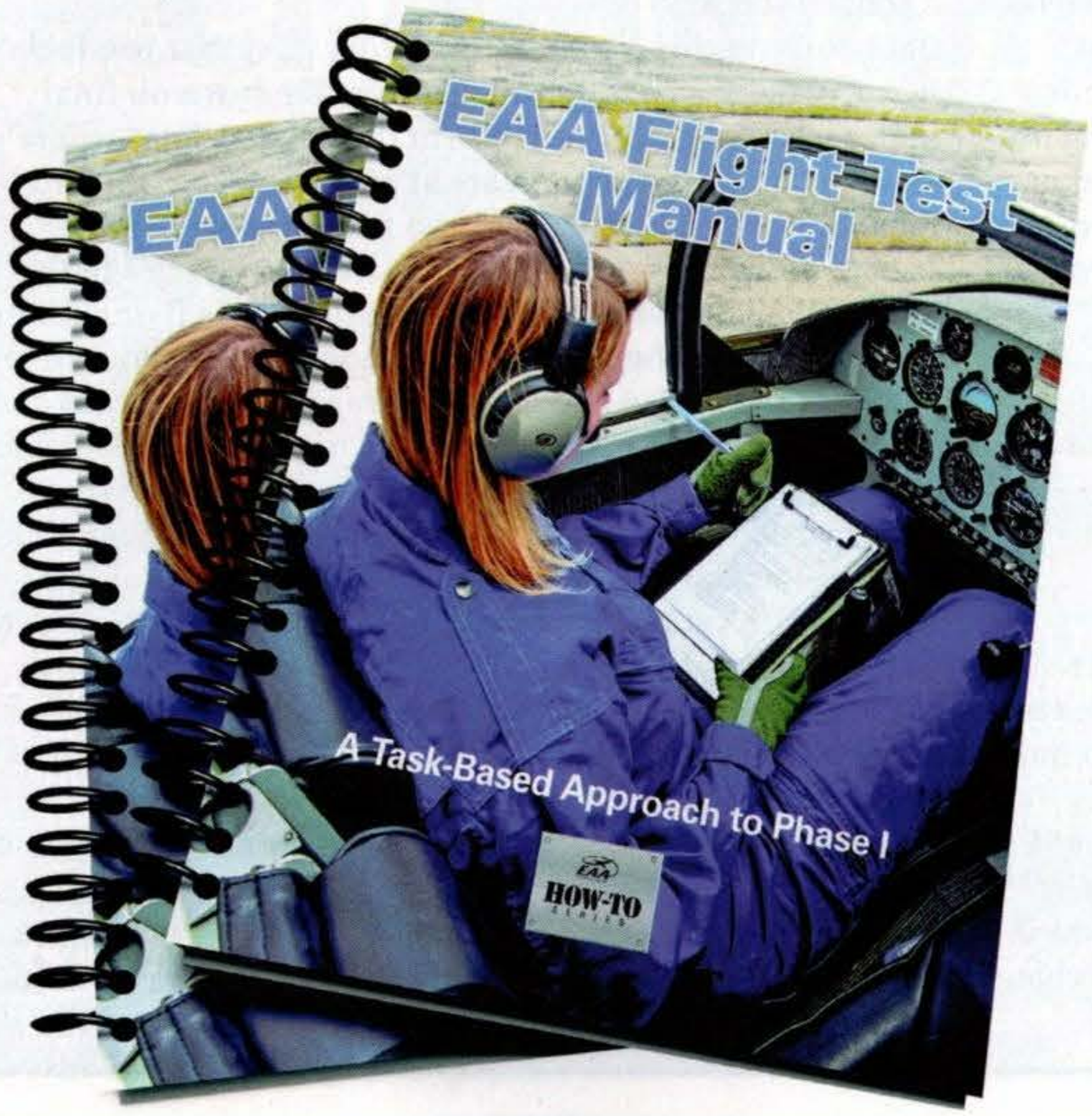
COMMENTARY / FLIGHT TEST



EAA's New *Flight Test Manual* Is Here

A task-based approach to Phase I

BY CHARLIE PRECOURT

GREAT NEWS! EAA has just released its new *EAA Flight Test Manual* (*FTM*) for amateur-built aircraft following considerable work by a great team of EAA staff and volunteers from the homebuilt council and safety committee. The *FTM* is envisioned to take the next step in our Phase I flight test initiative that began with the Additional Pilot Program (APP). Recall that the NTSB's 2011 report on amateur-built aircraft pointed out a concerning level of accidents in Phase I testing, so we worked with the FAA to establish the APP. For more, find the FAA's Advisory Circular 90-116 at www.EAA.org/extras.

Per the FAA, "The APP was developed to improve safety by enhancing Builder/Owner Pilot skills and mit gate risks associated with Phase I flight testing of aircraft built from commercially produced kits through the use of a qualified additional pilot. ... The APP is an optional program which provides another pathway to conducting Phase I. ... The traditional option for a pilot to test their aircraft solo during Phase I is not ... affecte by this AC, and remains an option."

The APP has been in use for several years now an has not recorded a single fatality or significant accident, which is a great testament to the way the program was established. However, the original inte was also to change Phase I to a task-based program a opposed to the traditional 25- or 40-hour flight-time based program (40 hours for aircraft without a certified engine/propeller combination). Surveys showed that most amateur-built aircraft projects did not make productive use of those hours, so a more appropriate task-based approach was devised using experience from the professional flight-test community. The result is the EAA *FTM*, which we will use t propose further safety-enhancing changes to the FAA's Phase I requirements. These changes would result in Phase I being complete once all of the test maneuvers on the flight cards in the *FTM* are executed in flight. Whether that requires more or less than the current 25- or 40-hour minimum is irrelevant — what matters is the manual enables the builde to acquire useful data to create their pilot's operating handbook (POH) and truly understand their aircraft' capabilities and limitations.

The manual is composed of three parts — aircraft preparation, flight testing, and the POH. The flight-testi section involves 18 flight test cards ranging from fuel flow, engine run, and taxi tests to first flight, stall testing and stability tests. Throughout the testing, the idea is to establish a set of expected outcomes before each test flight to compare your aircraft's results against. This wi enable you to stop and investigate when your results di fer from those achieved by others with the same type/ model aircraft.

An excellent example of this approach to testing happened to me when I was flight-testing the first F-15E for the Air Force. The objective of the E mode was to expand the F-15C/D model's mission to carry ing air-to-ground weapons (in addition to its air-to-air missiles). As a result, the airframe gross weight was increased from 68,000 pounds to 81,000 pounds, the airframe was beefed up to withstand 9*g* versus the original 7.33*g* limit, and it had a brand-new glass cockpit and uprated engines. So the flight test program was designed to do essentially all of th testing outlined in the *EAA Flight Test Manual,* and then some.

Surveys showed that most amateur-built aircraft projects did not make productive use of those hours, so a more appropriate task-based approach was devised using experience from the professional flight-test community. The result is the EAA *FTM*.

We were performing the test cards for the aircraft's accelerated stall tests (similar to Test Card 12 in EAA's *FTM*) when we ran into a surprise. While I was performing a relatively high-*g* maneuver approaching full aft stick, the aircraft abruptly rolled and departed controlled flight. The aircraft began multiple aileron/barrel rolls, and I immediately broke the stall in the pitch axis while using rudder and aileron to stop the roll. A "departure from controlled flight" is experienced whenever an aircraft begins uncommanded movement in any axis. In this case, I had control of the pitch axis (pulling *g*) but lost control of the roll axis (high rate of uncommanded roll). Because this was an unexpected outcome, and because it was not a behavior seen in the F-15C/D models, we terminated the testing to investigate.

After analyzing the data recordings of the test maneuvers, we discovered that the changes to the E model gross weight and structures resulted in a center of gravity that was not typical of the C and D model F-15, which in turn caused this characteristic. When maneuvering near full aft stick, airflow to the E model horizontal tail was being blanked by the wing. Once we had a handle on these differences, we could make adjustments to safely complete the test program. With many GA aircraft, we know that there can be large shifts in yaw as you approach the stall. If you ignore the ball in a stall in a Bonanza V35 you can see as much as 60 degrees angle of bank at stall. But if you keep the ball centered, the stall is a nice level nonevent *g*-break. Some experimental aircraft have very little stall warning — as little as 1-2 knots — and some will have a wing drop regardless of how well you keep the ball centered. The point is, for this test series you should collect information from others about what to expect from this type of aircraft and then compare that to your own results. If there is an unexpected difference, stop and investigate. Be ready for the surprises; unload to reduce angle of attack.

An excerpt from the EAA *FTM* for accelerated stall testing (Card 12) provides the guidance necessary to protect from similar risks as I experienced in the F-15E:

"Perform your wings-level stall tests first. ... You should have a detailed description of the expected behavior in an accelerated stall available (either from the kit manufacturer or through design analysis) prior to beginning the test. The objective is to verify that the behavior of your aircraft matches the expected behavior. ...

"Make separate test flights to evaluate the airplane's performance at different weights and CG locations. Start with lighter gross weight and forward CG locations. Never exceed the maximum gross weight or the fore or aft CG limits. ...

"... For each stall, test fly the aircraft at a safe altitude (8,000 feet AGL or as appropriate for aircraft type, in smooth air), trim the airplane to 1.5 times the predicted stall speed, and set the flaps as required for the test (this should be slower than V_{FE}).

"Apply carburetor heat if required, pull the power to idle, and establish a coordinated turn in a 30-degree bank; ensure the slip/skid ball is centered. Reduce speed to 10 knots or mph above the straight-and-level stall speed for that flap setting, then decelerate at 1 knot or 1 mph per second; you may need to descend gently to maintain this rate.

"As the airplane slows, make sure it requires an increasingly greater stick or yoke pull force. If the force lightens or changes to a push force, abort the test. This may indicate an aft CG location or insufficient elevator authority. Either of these may cause the nose to pitch up at stall.

"As the airplane slows, normal control inputs should maintain the 30-degree bank attitude and nose position. When you feel the prestall buffet, note the speed, roll level, and recover to straight-and-level flight."

By describing the maneuvers in the *FTM* in this manner and discussing what to look for when you run through the *FTM* test cards, you can readily prepare for each test flight in the Phase I plan. You'll also learn what to expect of your aircraft throughout the flight envelope. Let us know how the *FTM* works for you. We are striving to make task-based Phase I a reality for amateur-built aircraft in the very near future.

Fly safe! EAA

Charlie Precourt, EAA 150237, is a former NASA chief astronaut, space shuttle commander, and Air Force test pilot. He built a VariEze, owns a Piper JetPROP, and is a member of the EAA board of directors.

A U.S. Air Force F-15E popping flares during a flight over Afghanistan.

PHOTOGRAPHY BY **STAFF SGT. AARON ALLMON**