SPORTPLANE BUILDER

Tony Bingelis

AFTER THAT FIRST TEST FLIGHT

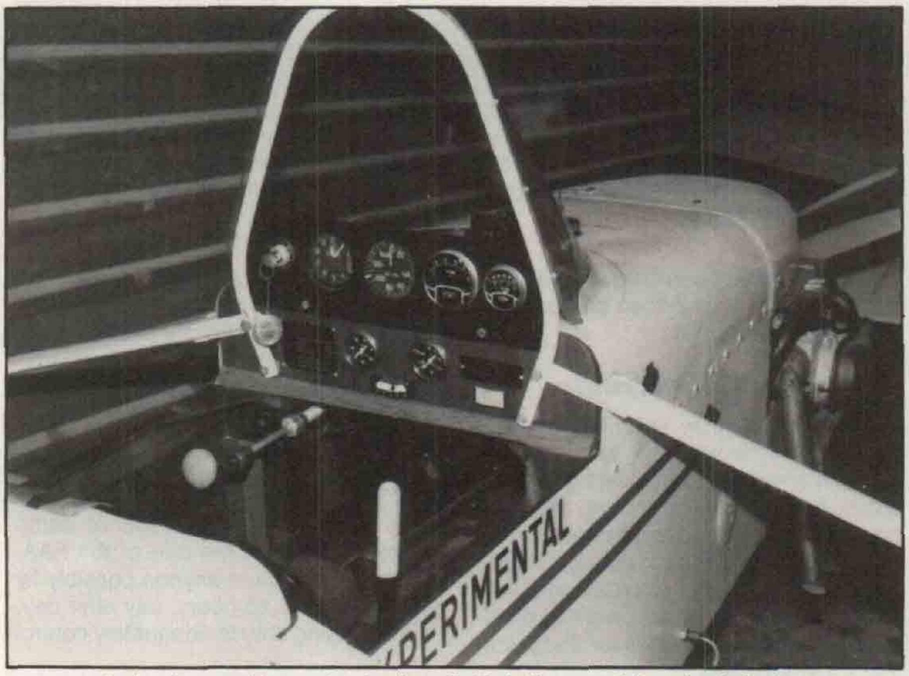
'Tis an oft told tale.

"The young (or not so young) builder, encouraged and aided by his wife and his friends, finally, after many years of devoted labors of love, has completed a beautiful gleaming aircraft for all to behold. The young (or not so young) guy and his wife and his friends are understandably beside themselves with pride and joy. And so, finally, it came time to free this beautiful bird of its earthly shackles - but not before the ritual of the traditional ceremonial first test flight was performed. And that day, too, arrived, and the epic test flight was as thrilling as it was successful. Then, as the golden rays of the setting sun shone on the new gleaming aerial steed, the builder and his wife and his friends were satisfied with what had been accomplished, and they were happy."

This is a tale that I never tire of reading in its various forms and renditions. Somehow though, I fully expect one day to find the ending reading, ". . . and they lived happily ever after."

Most detailed stories about newly completed aircraft never seem to get beyond a glowing description of that epic first test flight. And yet, there is so much more to the tale. For example, wouldn't it be interesting to learn what really happened during the 25 hour test period. The appropriate ending would then read something like this, ". . . and so the FAA, in its infinite wisdom, released that fledging aircraft from its mandated confinement to a restricted flight area, and bestowed on the newly proven bird its certificate of ultimate freedom."

I think most of you who are interested in amateur built aircraft know that when a newly certificated aircraft is granted its Airworthiness Certificate, it is also issued a list of Operating Limitations among which is one that restricts it to an assigned flight test area until it has accumulated 25 flight hours (40 hours for non-standard propeller/engine installations) of additional testing. NOTE:



A simple panel for a simple aircraft. Only the mandatory basic instruments are installed here, but even these few should be calibrated.

In the past, the number of mandatory hours imposed appeared to vary from region to region and from one FAA inspector to another. However, lately I have detected a greater uniformity.

After this mandatory period of flying has been satisfactorily completed in the assigned test area, the owner (builder) may apply to the FAA for an amended Operating Limitations. But before the requested amended limitations can be issued, the FAA inspector will review the applicant's flight log to determine whether corrective actions have been taken on specific problems encountered during the testing - and that the aircraft condition for safe operation has been established (attained).

Just what does this mean? Well, based on current experiences, you would not ordinarily anticipate another inspection of the aircraft. However, you should be prepared for the FAA inspector to:

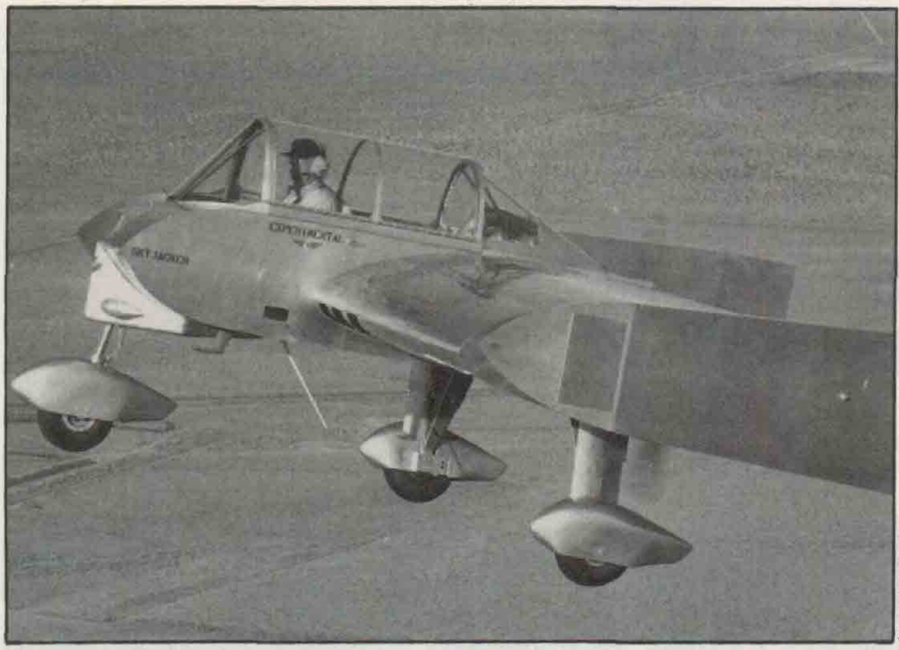
1. Review your Aircraft Log Book and any other aircraft records he might ask for. He will probably look for, and expect to find, brief entries recording the flights made during the mandatory test period.

2. Examine the entries to see what maneuvers were performed and look for evidence of unsafe conditions and uncontrollable characteristics.

NOTE: If you had requested, initially, that the aircraft be approved for aerobatics, he will now check to see what aerobatic maneuvers you had successfully performed and will generally include approval for the successfully demonstrated maneuvers in your amended Operating Limitations.

3. Review the entries for descriptions of mechanical and structural difficulties, if any, that have not been corrected.

However, it should be understood that each FAA inspector has considerable latitude over what he will approve or disapprove on an individual basis. So



Ralph W. Sawyer

Testing a radical design or an unusually configured aircraft requires higher pilot skills and a carefully planned flight test program. It also entails a far greater risk to the pilot than testing a plans, or kit-built airplane that has an established track record of performance and reliability.

you should have been sure of what was expected of you, and then complied to the best of your ability.

What Test Program?

This may surprise you. There is no mandatory checklist of tests to be made, maneuvers to be flown or procedures to be followed during that 25 hours of flight in an assigned test area. You simply do what you want and make a few entries in your Aircraft Log Book for those flights. If all you want to do is to just fly around in circles for 25 hours, that's just fine, too.

This revelation might be hard to swallow but it is, generally speaking, true.

The FAA is primarily concerned with the safety of the public and is, therefore, most interested in learning that your airplane is controllable, and that it is in a safe condition to fly. They are not particularly interested in the scientific niceties of your aircraft's design nor in its exotic aerodynamics.

O. K., if that is so, how come they let us do what we want during the test period, and don't require us to comply with a strict and detailed flight test format? Well, why should they? Just think about it for a moment.

Up to the present time, there must be over 200 individual design types of amateur built aircraft ranging from the lightest of the light airport hoppers to the most sophisticated 300 mile per hour retractables. How can a general test program be mandated that would be fair and equally effective for every kind of aircraft? And then there is the matter of pilot proficiency. What kind of a flight test program could the average pilot complete? Average pilot? Pilot skills range from the newly certificated types to old timers holding fistfuls of ratings. One pilot may be doing good during most of his flight time keeping his airplane right side up while another would rather not.

The current rules, therefore, as general as they are, are really good. I believe them to be the result of some clever thinking on the part of the FAA. After all, how could anyone possibly fly an airplane for 25 hours, day after day, without being able to adequately control it and without subjecting it to a variety of maneuvers, operational checks and observations. Even those few who profess an individual indifference to "Hollywood type" test programs will, nevertheless, find that they have been accomplishing more testing than they had realized.

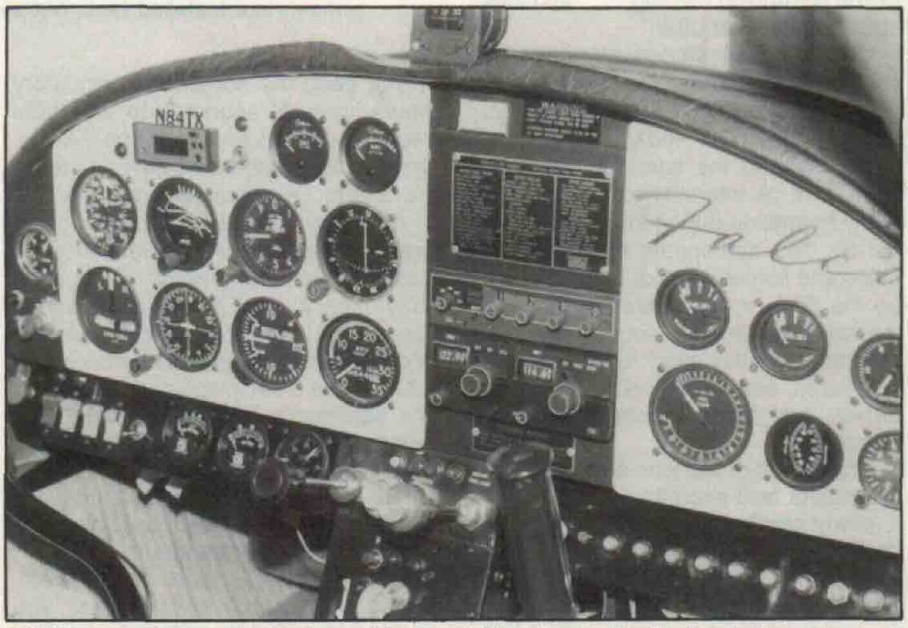
In short, some kind of a test program - preplanned or otherwise - is going to take place during those 25 hours of flying in an assigned test area regardless. Let's look at it this way:

Passive Flight Testing

There will be numerous take-offs and landings, right? In the process, a lot will be learned about the power settings and the aircraft's controllability at various speeds and attitudes. Naturally, while all this is going on, the brakes will be used and amply tested. Trying to establish the proper approach speed will lead to some power off approaches while others will require adding power just to get to the runway. There might even be a go-around or two, giving you ample opportunity to learn if the airplane will fly with full power and full flaps . . . and for how long. These activities may also require the use of carburetor heat (will the engine continue to run?).

Anyone flying a complex homebuilt will not be able to avoid the use of propeller and mixture controls, as well as the flaps and retraction system. Trying different starting procedures for a hot fuel injected engine can be a testing procedure in itself.

Then there is the business of fuel management, fuel consumption and



This is a nicely instrumented panel but until that airspeed indicator, tachometer, and other instruments are calibrated, the test flight figures may be nothing but lies. Also, uncalibrated instruments increase the risk of exceeding engine design limitations as well as risking inflicting structural damage to the aircraft.

Anyone flying a newly built complex homebuilt cannot avoid learning the proper use and effectiveness of his engine, propeller, mixture control, as well as the flaps and retraction system . . . that's testing, too. Isn't it?

range. Surely the airplane will have to be refueled a few times in 25 hours. How will the test pilot know when to do it? How much it will take, and how much will run out of his vent lines if he fills the tanks too full? How much of his fuel is useable? When he runs a tank dry, will he learn how to switch tanks quickly and restart the engine - or gain even more valuable test data by making a forced landing, power off?

All of these "routine" flight activities, when combined with the earlier ground operational checks performed before the first test flight, and the stalls, turns and maneuvers tried during the original test flight, just naturally include most of the major test elements performed in any good flight test program. All you have to do is record some of these observations in your Aircraft Log Book and you will be doing your duty as a test pilot.

Another thing - everything we have mentioned can be done even if your instruments are merely operational and not calibrated. For example, your aircraft will take off when the airspeed needle reaches a certain point on the airspeed indicator dial no matter whether it is calibrated or not . . . and do it every time. Naturally, you will not know the exact speed. Your airspeed indicator might be reading 100 knots on the approach when your true speed could be 80 knots or even 110. You won't know until you calibrate your airspeed indicator and pitot-static system. But, now we are getting into some real flight testing specifics, aren't we?

The Conservative First-Time Test Pilot

I know of homebuilt owners who have been flying their airplanes for two or even three years and still have not explored some important flight and operational limits. These include testing for flutter and verifying the aircraft's design red line (Vne) speed. This may be because they don't care to push the airplane too far and are content to operate at speeds well below those advertised for the design. In other words, if the aircraft reportedly has a 200 mph never exceed speed, they see nothing wrong with testing it only to 175 mph, marking the dial accordingly, and confining their flying to within those limits. The same logic is used for establishing other flight limitations such as the maneuvering speed, maximum G loads and testing for flutter at the lower, safer speeds.

I see nothing wrong with such a conservative approach. It is your airplane and so long as you operate it within the limits for which it has been tested, you'll be O. K. I would be far more concerned with the individual who habitually exceeds the weight and other limits established by the aircraft's designer.

Elements Of A Complete Testing Program

In order to obtain the maximum benefit from your flight tests you should record the instrument readings, your reactions and the aircraft's behavior. To do this, I would recommend using a knee board as used by some flight instructors. Better than that, though, use a small pocket recorder and tell it everything. Read off the instrument indications, temperature, altitude, time and weather conditions during each flight. Describe the maneuvers and speeds used, etc. Then, later, at your leisure, you can study and analyze the results of each flight.

Calibrate all of your instruments and pitot/static system . . . and don't forget your tachometer. Do this at the very start of your flight test program. This is very important if you want to relate the performance of your aircraft and engine to other aircraft, and learn how close your aircraft's flight performance is to that published for the design.

Run some performance checks at low altitude and at economy cruising speed, maximum continuous rpm speed, and at some intermediate speed that you like to fly. Do this by flying between two measured points 5 miles apart (10 miles apart would be more accurate). Check the time in both directions. Everyone will be asking you how fast it is, so it would be nice to know.

To determine what kind of climb rates your aircraft can produce, use a stop watch, not your rate of climb instrument. Simply fly the aircraft holding a steady indicated airspeed (using full throttle or the recommended continuous climb power for the engine) and check the time taken to climb through each 500 ft. or 1000 ft. level. How do those figures

Although simple airplanes like the Volksplane have low cruise speed, they too, none the less, must be flight tested for possible flutter . . . cautiously.

Wearing a parachute is highly recommended, especially when exploring for higher load limits and for flutter. However, what good is a parachute if you cannot open or jetison your canopy in an emergency. A sliding canopy lends itself to airborne bailout but what about that large flip-over bubble canopy?

compare with the rate of climb instrument? Do this at several different climb speeds.

Since the initial flight test probably lasted less than 45 minutes, it is unlikely that very many stalls were performed. Try every kind of stall you can think of, including accelerated stalls and stalls with and without flaps (if installed).

The figure you see on the airspeed indicator when the stall occurs will be inaccurate and will most likely indicate that you are stalling at a speed much slower than you know is possible for your aircraft - so don't use that figure in figuring what your approach speed should be. Instead, rely on the designer's figures until you determine from flight experience the approach speed you prefer.

A good thing to determine is the service ceiling. This is usually considered to be the altitude at which the rate of climb drops to 100 fpm.

Another good thing to know is your minimum sink rate. This is essential information to have in the event you have an engine failure and are faced with a potential forced landing. It is well known that many homebuilts have a fairly high sink rate making them poor gliders. You should realize, however, that the speed at which the minimum rate of sink is obtained may well be different when the propeller is stopped and is not windmilling. Some brave souls may be so bold as to shut the engine down and stop the prop . . . all in the interest of precise knowledge. That's not for me, and I don't recommend it to anyone. You can get a very good idea of the gliding distance with a throttled back engine. In the event of an engine out situation, you should realize that your expected gliding distance may well be reduced even more. But what about overshooting? By the way, have you tried slipping your airplane to lose altitude? How does it do? And there is much more you can learn about your airplane. Ever hear of stability tests? Structural flight testing? Best climb angle? Center of gravity limits? And how about using steep turns to impose G loads?

Keep It Simple But Thorough

As you can see, testing a new airplane can be a fairly simple matter or it can proliferate into a complex series of calculations and flights that cannot possibly be completed in a mere 25 hours of flying.

Plan a simple but thorough flight test checklist for the type of airplane you have. A Volksplane, for instance, does not have the weight, speed, instrumentation or complexity of a Falco, nor does it need to be tested to the same degree.

If you wish to contact the author for additional information, please write to Tony Bingelis, 8509 Greenflint Lane, Austin, TX 78759.

EAA Membership Honor Roll

This month we continue our recognition of persons who have qualified for the EAA Membership Honor Roll. When you receive your new or renewal EAA Membership Card, the reverse side of the attached form will contain an application with which you can sign up a new member. Fill in your new member's name, enclose a check or money order and return to EAA Headquarters and you will be recognized on this page in SPORT AVIATION — and there is no limit to how many times you may be so honored here.

Introduce your friends to the wonderful world of EAA . . . and be recognized for your effort. The following list contains names received through February 10.

TOM LUTHER
DeSoto, TX

JOYCE L. EHRENBERG
Menasha, WI

WALTER BEVAN
Brunswick, GA

JACK G. COUTTS
Carp, Ont., Canada

JAMES E. VEECH
Louisville, KY

WILLIAM P. LAMBING
Wichita, KS

F. C. TERPENNING
Eyota, MN

VICTOR CHRISTY
Pittsville, WI

JOHN E. CANNON
Milwaukee, WI

EDMUND TELICZAN
Baldwin, MI

BENNETT M. STUTSMAN
Lansing, MI

JAMES C. PIERCE
Tallahassee, FL

JOHN BURTON
Oshkosh, WI

ROBERT E. KEEFER
Sacramento, CA

TRICIA NORVELLE
Jacksonville, FL

DAVID J. VON LINSOWE
Mt. Morris, MI

BERNARD A. RASCH
Benton City, WA

TERRI M. ROSS
Wausau, WI

DR. STANLEY MOHLER
Dayton, OH

ROBERT M. WHITE
Phoenix, AZ

RICHARD P. JAMES
Fennimore, WI

ALDO J. GIANNERINI
Lockport, IL

LINWOOD ROBERTS
Durham, NC

PHILIP M. SAVIDES
Oshkosh, WI

KEN HAUGEN
Anoka, MN

ROBERT L. WILLETT
Brookfield, WI

ROGER GODBOUT
Sherbrooke, Que., Canada

RAPHAEL M. SCHLEINKOFER
Bensalem, PA

JOHN S. MOFFITT
San Jose, CA

ROBERT S. NORTH
Arlington, VA

MARCUS VINICIUS TABACNIK
Sao Paulo, Brazil

C. R. HIGGINSON
Nashua, NH

JOSEPH B. RIZZICO, JR.
Clearwater, FL

PAUL A. BELL
Woodbridge, VA

RALPH L. BRUNER
West Sunbury, PA

THOMAS C. PAYNE
Leesburg, VA

EARL DURBIN
Morris, IL

PETER M. REKITZKE
Oak Lawn, IL

RICHARD MARESH
Fullerton, CA

FABIO SIMONI, JR.
Belo Horizonte, Brazil

(Continued on Page 35)