

## LICENSING AND TESTING

### GENERAL

When a builder is almost finished building his aircraft he will want to understand how he goes about registering and licensing the aircraft as an Amateur Built Experimental Aircraft. For those licensing their aircraft in the USA the FAA has a document that explains the whole process. It is Advisory Circular AC 20-27D. Get this document from your local supplier of documents, an FAA representative, or an BAA member. Persons outside the USA should contact their national aero club and appropriate government authorities.

Registering the aircraft is simple. Testing when properly done is hard work but one of the most fascinating adventures for a person to undertake. Every homebuilt aircraft is different. Therefore it is important that each builder subject his aircraft to a series of tests to assure its functional safety and airworthiness. It is absolutely mandatory that a builder seek expert advise prior to starting the test process. If you are fortunate enough to interface with a good FAA representative when obtaining your airworthiness certificate he may be of assistance beyond that obtained from others.

The builder must plan in writing what he will do based on known operational limitations. Too many homebuilts have been destroyed because their builder didn't think the test process through and then went ahead without being prepared.

During the test period an aircraft should be subjected to all anticipated operational conditions, payload distributions, airspeeds, and center of gravity limits that are to be seen during service. When the tests are complete the safety of the aircraft will be attested to in the logbook as required by FARs.

The best starting step is to procure one or more of the references shown at the back of this section. Study these documents and mentally formulate what has to be carried out to thoroughly test and evaluate the builder's particular aircraft.

This manual will not provide specific detailed instructions for testing a new KIS. It will however provide some limited guidelines for consideration when preparing a test plan based on other documents.

### GROUND PREPARATIONS AND TESTS

Prior to any flight testing a minimal series of actions and ground tests are to be performed as follows:

- a. Carry out all preparations as specified in ref (a).
- b. Weigh the aircraft as discussed in this manual section "Weight and Balance".
- c. Prepare Cockpit Procedure Cards. See separate section of this manual.
- d. Placard panel and cockpit to include IAS (red line, green arc, yellow arc, white arc), all switch/light/lever functions, fuses, flap lever positions, carburetor heat, mixture, compass correction, any instrument calibration data, "Experimental" and "Passenger Warning", etc. See Specifications" for recommended initial air speed placards.
- e. Cockpit check all instrument and control functions without starting engine. Check brakes for integrity and leaks.
- f. Gather equipment. Fresh-pack parachute, knee board, fire extinguisher, thermos, etc.
- g. Engine start and run. Follow manufacturer's instruction.

- h. Check all instruments for sense. Calibrate tachometer.
- i. Check fuel flow from carburetor line to be at least two times maximum engine requirement.
- j. Measure fuel tank capacity. Confirm no leaks. Calibrate tank gauges.

<b>Taxi Testing Suggestions</b>
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Perform slow speed taxiing tests as required to confirm aircraft steering and ground handling. Debug brake system. Fully orient pilot to the cockpit and taxi-feel of the aircraft. Confirm cockpit procedures as delineated on the cockpit procedural cards.

Proceed to fast taxi testing when applicable. Have all systems ready for flight in event of an inadvertent go-around. Pilot should wear parachute.

Use runway for all fast tests. Use a number of runs to work up to liftoff speed. Perform at least three liftoffs and runway flights, each being longer in length.

Some factors may cause pilots to refrain from extensive taxi testing. One of these is the potential formation of varnish on a new engine. Some persons may consider (hat progressive speed runs and runway lift-offs are potentially dangerous. These factors can be accessed by each pilot according to his desires.

## FLIGHT TESTING

**FLIGHT TESTING IS EXCEEDINGLY IMPORTANT AND DANGEROUS. IF YOU ARE NOT ADEQUATELY TRAINED, EQUIPPED AND PREPARED YOU MAY BE INJURED OR KILLED. HAVE A PROFESSIONAL TEST PILOT ADVISE YOU AND PREPARE YOU PRIOR TO TESTING. HAVE THAT PERSON OR OTHER COMPETENT PILOT PERFORM THE TESTS IF APPROPRIATE.**

The following paragraphs are taken from an abbreviated outline used in testing one builder's KIS. The material is not necessarily complete or correct. It is provided solely to indicate a process or technique successfully used by another builder.

Flight plan outlines are titled "A" through "J". First flight must be per "A". It may take a number of flights prior to proceeding to "B" and then "C". Other flights need not always follow in alphabetical order.

It will normally be necessary to perform a series of iterative flights to achieve the objective(s) of any single outline. For example maximum conditions such as aft CG and Vne must be approached incrementally and with great caution.

The pilot must be current and qualified to perform the testing. He must wear a parachute for all tests. The aircraft may not leave test area and may not land at fields other than those authorized.

Proceed with utmost caution. Stop testing when any abnormality is experienced. Do not test further until a problem is resolved.

### **Flight Plan "A" (Orientation/Survival)**

Pilot, chute, 8 gals fuel (near mid eg)  
Brief tower / ground.  
Climb out at 90  
Circle in pattern (stay on proper frequency).  
Check engine temps on downwind. Make decision.  
Climb to 3200 engine temps permitting.  
Stay within easy glide of home airport.  
Limit to 115 mph.  
Easy turns left and right.  
Record: Pitch/roll trim problems & relative sensitivity. All engine temps. Other comments.  
Slow to 75. Feel responses pitch and roll.  
Glide 75. Check idle.  
Descend and enter pattern.  
Downwind 100. Base 90. Approach 85.  
Land no flaps.

### **Flight Plan "B" (Initial stalls & easy flaps)**

Same loading and ideas as "A".  
Climb to 4500.  
Easy turns. Trim. Feel.  
Don't exceed 120 mph.  
Gentle straight stalls in glide.  
Deploy half flap in glide at 80 mph.  
Gentle straight stalls half flap.

### **Flight Plan "C" (Flap integrity, configuration stalls)**

Pilot, chute, 12 gals fuel.  
Climb to 6500.  
Limit to 140 mph.  
Explore half & full flaps throughout white arc.  
Work up to full 105 mph and full throttle with flaps deployed.  
Stall with full flaps.  
Gentle turning stalls.  
Slow-flight with & w/o flaps.  
Record all data.

### **Flight Plan "D" (General Handling)**

Acft Loading (Mid CG)  
Climb to 6500'  
Steep Turns  
Slips with 0, half, full flaps  
Lazy eights  
High attitude stalls  
Turning stalls with and w/o flaps  
Departure stalls

### **Flight Plan "E" (Aft CG)**

Load acft incrementally until aft-most CG condition is reached. (Ballast as required to simulate load

per wt & balance sheet. Never exceed the designer's aft CG limit.

Measure/record elevator position vs. IAS at each CG. Evaluate each plot prior to moving further aft.  
Discontinue testing if CG approaches neutral point. Evaluate handling at each CG/load condition per Plan "D". (6500' or above) Discontinue testing if adverse handling is encountered.

#### **Flight Plan "F" (Max gross wt.)**

Load per wt.& balance

Climb to 6500'. Repeat handling tests per Plan "D".

#### **Flight Plan "G" (Fwd most CG)**

Load per wt. & balance.

Perform slow flight, glide stall etc to assure adequate elevator authority. Flight Plan "U" (Red line / flutter)

Proceed with greatest care. Start dives at 12000 feet. Don't over-rev engine.

Increase speeds incrementally from dive to dive. Limit increases to 4 or 5 mph per dive. Fly aircraft to indicated red line airspeed plus 5 mph.

Pull nose above horizon and slap stick in both axis to assure no flutter tendency.

#### **Flight Plan "I" (Rain Effects)**

Evaluate rain effects on stall speed with varying flaps.

#### **Flight Plan "J" (Performance measurements)**

Measure/record ROC vs altitude.

Determine service ceiling.

Measure/record IAS vs RPM.

Determine TO distance at max gross and 1000#

Verify VOR accuracy.

#### **Flight Plan "K" (Time building and confidence)**

Carry out local flying at moderate loadings until FAA required time is achieved and builder's confidence as assured.

#### **References:**

- a. "Flight Testing Homebuilts". Tony Bengelis. SPORT AVIATION. January, February, March 1989.
- b. FAA Advisory Circular AC 90-89 "Amateur-Built Flight Testing Handbook" 9/18/89.
- c. "Is It Airworthy?" by Nathan Rambo. KITPLANES 12/85.