



RAAP 10

Test Flying Amateur Built Aircraft

Recreational Aviation Advisory Publication (RAAP) – 10-2018
For other RAAPs see www.raaus.com.au
July 2018

Factsheet – Test Flying Amateur Built Aircraft

Committed to providing timely information

RAAus is committed to providing timely information to its members and potential member's about the types of aircraft operated. RAAus has created this RAAP to inform and answer frequently asked questions related to amateur-built RAAus aircraft (registered 19-).

RAAus encourages and fosters experimental aircraft design and construction, which is the basis of what the RAAus 19- amateur-built category is all about.

Maintenance and airworthiness

The most important point to understand is the continual airworthiness of an amateur-built aircraft is the responsibility of the registration holder. That is you, the person who owns, operates and flies the aircraft.

It is critical you understand this particularly if you did not build the aircraft, but have subsequently purchased an amateur built aircraft, whether a kit built, plans built, partially completed or already flying.

Additionally, RAAus members understanding of maintenance and operation of aircraft is varied and may be the result of loose interpretations, hangar talk and urban myths.

An experimental amateur-built aircraft is not required to comply or meet any known design standards. The current regulations allow a person to construct an aircraft for their own education and recreation. This means that a builder can use materials that do not need to comply with any known legislation nor be tested to any standard.

Materials used

Building an amateur-built aircraft can result in the use of materials and processes not normally considered by mainstream aircraft designers and engineers. In purchasing an amateur-built aircraft, the prospective buyer needs to remember Buyer Beware. These aircraft are commonly referred to as Experimental meaning the aircraft builder is doing exactly that, experimenting.

In regards to the purchase of a scratch or kit built aircraft, areas that members should take into consideration are materials used.

- Is the material used in construction of the airframe of a known standard such as 4130 chrome-moly or has the builder used mild steel?
- Are bolts commercial material (purchased from a local hardware store) or is the bolt of a known grade such as aviation type AN hardware?
- Does the aircraft have a logbook and does it list any modifications or changes? It is a requirement that a logbook for maintenance activities is kept.
- Did the owner-operator complete the RAAus L1 online assessment? This is a requirement to be eligible to maintain their own aircraft.

Further areas to consider - The engine and propeller combination

- Have the appropriate maintenance practices been carried out – annual inspections, service bulletins, etc.?
- On what basis were the maintenance requirements determined? If the aircraft uses an automotive conversion, what regular maintenance schedule is used for oil and filters, spark plug changes, Time Between Overhaul (TBO) requirements, propeller maintenance (torqueing of propeller bolts, etc.)

What factors should I consider when planning to test fly the aircraft I have built?

The key point here is planning. After potentially spending years building an aircraft, the final requirements include not just the first test flight, but a complete regime of flight testing. After spending all that time building, the last thing you may want is to let another pilot complete the first test flight, however, you may not have the required currency and recency or experience on the type to be best qualified to complete the first flight.

Here are a number of important factors to consider when making this critical decision and planning your actions:

- Am I the right pilot to complete the initial test flying
- Am I current enough as the pilot
- Will I be ready on the day to complete the first flight
- How much experience (current and recent) do I have on this new aircraft type
- Should I have a more experienced or current pilot on the type test fly the aircraft
- Is the location I am planning for the test flight suitable
- What possible aircraft rigging or operational issues should I consider
- What could this new aircraft do which I may not expect
- What sort of emergencies should I consider and plan for
- What are the emergency out landing options
- What emergency plan have I created
- What emergency services are available
- Who is available to provide ground crew and back up
- What time of year is best for my flight testing
- Has someone else reviewed my building work
- How am I planning to complete the initial flights
- What am I trying to achieve from the test flight/s
- Post flight assessment and actions list

Am I the right pilot to test fly the aircraft I have built?

Often, as a result of the builder spending all their spare time and energy on building the aircraft, regular flying has not been completed and flying skills significantly degrade as a result.

Considerations such as recency (how often and how many hours have been recently flown by the builder), currency (how regular are those hours and in what type of aircraft) and familiarity with emergency procedures and the specific aircraft being tested should be thought about.

If the builder has the majority of their experience on one or two types of aircraft and the new aircraft is different, there will be additional factors to consider.

The new aircraft may not be set up correctly, for rigging and weight and balance, which may affect how the aircraft behaves at various airspeeds and fuel combinations. It may fly with one wing low, out of balance or with lighter or heavier control inputs and control column feedback than the builder is used to.

If the builder is not current, doesn't have recency or experience on the new aircraft, or is too emotionally invested in the build, consider asking an experienced pilot to complete the first 5-10 hours of flight testing.

Am I current enough as the pilot?

Use this risk assessment tool to help you decide who should complete the first 5-10 flight test hours. As the builder do you have the detachment from all the hours of work spent building the aircraft to act appropriately in the event of an emergency or make difficult decisions about your safety as opposed to the safety of the aircraft?

Members are encouraged to read FAA Advisory Circular AC90-898 available at this link as Section 4.0 has specific detail regarding assessing pilot suitability. https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_90-89B.pdf

This extract is a guide to the type of consideration should be given to selecting the appropriate test pilot.

“Suggested Test Pilot Flight Time Requirements. Each test pilot must assess if his or her level of competency is adequate, or if additional flight training is necessary. If you determine you are not qualified to flight test an unproven aircraft, you must find someone who is qualified. The following suggested number of flight hours is only an indication of pilot skill, not an indicator of pilot competence.

Par 1-3 Page 9(1) One hundred hours solo time before flight testing a kit plane or an aircraft built from a time-proven set of plans.

(2) Two hundred hours solo time before flight testing a unique design or high-performance aircraft.

(3) A minimum of 50 recent takeoffs and landings in a tailwheel aircraft) if the test aircraft is tailwheel equipped.”

Am I ready on the day to complete the first flight?

Using the IMSAFE checklist will ensure you are ready to fly.

I LLNESS	Do I have an illness that I need to take into consideration, or any symptoms of an illness?
M EDICATION	Have I been taking prescription or over-the-counter drugs?
S TRESS	Am I under psychological pressure about work, worried about financial matters, health problems, or family?
A LCOHOL	Have I been drinking in the last 8 hours? 24 hours?
F ATIGUE	Am I tired or not adequately rested?
E ATING	Have I eaten enough of the right foods to keep me nourished during my entire flight? When was my last meal?

Consider only having key support personnel present for the initial test flight to reduce distractions and pressure to perform.

How much experience (current and recent) do I have on this new aircraft type?

Use the risk assessment tool provided above to determine what minimum experience the test pilot should hold.

- Do you really have the skills in this aircraft to manage the first flight
- Are you familiar with the cockpit layout and switches
- When was the last time you really practiced a forced landing
- When did you last practice an emergency in the circuit
- When did you last practice gliding to a nominated landing area

- Have you considered unexpected emergencies like an in-flight cockpit fire, smoke in the cabin, etc?
- Have you practiced emergency protocols
- Have you drilled the correct responses in case of a fuel fire, oil fire, electrical fire and smoke in the cockpit or other unusual emergency.
- What if the engine doesn't fully stop, but only provides partial power
- What if the trim becomes stuck in one position
- What if the flaps fail to reposition

Should I have a more experienced or current pilot on the type test fly the aircraft?

If you don't have the appropriate experience, who should you approach to complete the initial test flying? Is there a highly experienced CFI, Instructor or fellow aircraft type builder you can contact?

Use the same risk assessment tool to ensure your possible test pilot meets the minimum criteria.

Is the location I am planning for the test flight suitable?

- Is this just a convenient airport, airstrip or landing area to your home
- Are the runways long enough, or wide enough
- What is the surrounding terrain like
- Are there open paddocks or is it in a built up area with houses or factories
- What is the prevailing wind at this time of year
- Is there a runway which suits this prevailing wind, to reduce crosswind component
- What out landing options are there from every possible runway direction you plan to use
- Is there a runway you won't use due to lack of length or width, poor out landing options or other issues
- What ambient temperature should I fly in (how hot is too hot, or cold is too cold?)
- What time of day should I fly to avoid additional traffic levels
- Are there Regular Public Transport flights
- Are there gliding, parachuting or flight training operations at the same time

What possible aircraft rigging or operational issues should I consider?

While you may have had independent inspections, have you confirmed the accuracy of the rigging for the aircraft?

- Do the ailerons, elevator and rudder have the minimum or maximum deflections?
- Is the washout correct?
- Is the propeller confirmed to produce the required RPM for flight?
- Is the engine going to produce full power?

What could this new aircraft do which I may not expect?

The builder should consider how this aircraft will handle differently to previous aircraft flown. If the aircraft is built from a kit there should be information on websites and forums from other builders, but what if this is a first of type?

- Will this aircraft glide as well as my previous aircraft
- Will it glide better?
- Am I sure I have sufficient airflow over the elevator if the engine stops?

- How much stick force will I need to hold a specific attitude if the trim jams or breaks?
- Can I fly only on trim and power?
- Can I use secondary effects of primary controls to manage the aircraft in an emergency?

What sort of emergencies should I consider and plan for?

There are a huge number of new systems which will be working for the first time during the test flight. Thinking about these systems and more should trigger consideration of possible emergencies.

- Fuel lines, pumps, filters
- Oil lines, filters and pumps
- Air ducting for cooling
- Hydraulics for cooling or brakes
- Wiring and switches, engine monitoring gauges, warning lights and avionics
- Windows and windscreens
- Major control systems
- Rigging wires
- The nuts and bolts holding everything together.

NOTE The EAA has developed a Flight Advisor Program which offers builders/pilots assistance in performing a self-evaluation of the flight-test program and/or selection of the test pilot. To obtain additional information, see the following EAA Web page: www.eaa.org/flightadvisors

What are the emergency out landing options?

What sort of out landing options are nearby and have you practiced and planned for the best outcomes in other aircraft before your test flight? What sort of paddocks are nearby and what areas should you avoid?

- Paddock condition – fallow, ploughed, stock grazing, stubble
- Nearby houses or residences
- Power lines
- Noise sensitive areas
- Landing on the aerodrome itself (off the runway) – ditches, lights, gable markers

What emergency plan have I created?

- Do I need to advise local police, fire brigade and ambulance, or SES for the first flight/s?
- Have I created an emergency contact list for ground personnel to contact, including Australian Transport Safety Bureau, RAAus or other organisations?
- Have I thought about how first responders will get to the aircraft in the event of an emergency (through the aerodrome fence or by a gate, do they have a key?).
- If the aerodrome is operated by the local council is there an aerodrome reporting officer you can talk to and advise of your flight?
- If it is privately owned, do you need to contact the owner and discuss your flight?

What emergency services are available?

- How far from the closest town are emergency services and what help can they provide?

- Is there a town fire brigade or do you need someone on the ground with a vehicle and fire extinguisher? Don't forget if it goes wrong, it will be you or someone you know needing this assistance, and a speedy response may be critical.

Who is available to provide ground crew and back up?

Do you have a reliable friend/s who will sit at the aerodrome and provide radio support, emergency response, a contact point in the event of an emergency or just ensure you aren't getting too tired, stressed or overloaded?

What time of year is best for my flight testing?

Just because the aircraft is ready in the middle of summer doesn't mean this is the best time to start test flying. Should you delay for a month, choose a different location or make different decisions to suit the time of year?

Has someone else reviewed my building work?

Before I fly, has someone with practical knowledge on the aircraft assessed the build and provided input to ensure a fresh set of eyes has reviewed the aircraft?

Have I completed the weight and balance, had my calculations checked by an independent person and ensured the aircraft will stay within controllable parameters throughout flights with differing fuel, pilot and passenger loads?

Once you have considered all the options and planned the flight tests, you are ready to fly the aircraft.

How am I planning to complete the initial flight?

The planning should break up the initial flight testing into basic phases:

- Ground exercises
- Taxi
- High speed taxi
- Controllability checks
- Initial flight behaviours
- Flight testing for performances – Pilot Operating Handbook (POH) figures

These phases are intended to ensure the aircraft is controllable through basic phases of flight prior to committing to flight. Once the aircraft has completed basic upper air assessment, the test pilot is expected to fly basic flight tests to determine aircraft performance figures such as stall speed in various configurations, best climb rate and glide speeds, endurance and other fuel parameters. This information should be recorded into a POH for future pilots to reference prior to flight.

What am I trying to achieve from the test flight/s?

Often part of the reason why a test flight does not go to plan is because there is no plan! Consider what you are trying to achieve from the first, second, third and subsequent test flights.

First flight – short flight

- Checking controllability
- Engine parameters

- Assess rigging
- Trim and make small adjustments

Second flight – longer flight

- Remaining overhead the airfield
- Ensuring engine parameters are within tolerances
- More deliberate manoeuvres, turns, basic stall (at an appropriate height)

Third flight – once all the bugs have been ironed out, while remaining overhead the airfield

- Start recording basic parameters as outlined in the FAA test flying information to create the beginnings of the Pilot Operating Handbook

Subsequent flights – remaining in gliding distance of the airfield

- Expand the manoeuvres and performances of the aircraft to determine best rate and angle of climb and descent
- More involved stall assessments with different configurations
- Flights at different airspeeds to confirm handling
- Flights at different weights to confirm controllability throughout the range

Post flight assessment and actions list

Once the initial flight test is completed, conduct a thorough post-flight inspection of the aircraft to assess for:

- Fluid leaks
- Security of fasteners
- Heat or cooling issues
- Evidence of any exhaust burning
- Integrity of fairings
- Spats
- Routing of hoses and lines
- Internal cockpit issues or other considerations

Ideally, this will involve another person, to provide a “fresh set of eyes”

When adjusting trim or making control deflections, use a systemic process, make only one adjustment or change followed by subsequent flight assessment to ensure the change has addressed the root cause.

For example, an adjustment may be made to an elevator deflection when in fact the root cause is one of weight and balance, or a correction may be made to rudder trim when the issue is incorrect engine offset or nose spat drag.

Create a list of identified corrections, deficiencies, adjustments and problems to amend to ensure nothing is overlooked prior to completing the rest of the flight test regime.

Safe flight

The RAAus team