COPA

CANADIAN OWNERS AND PILOTS ASSOCIATION

COPA Guide to Amateur Builts

Contents

Introduction

Welcome to the wonderful world of building and flying your own aircraft, referred to as Amateur-Built aircraft!

Even though the word *amateur* these days has come to mean "not very professional" it was originally a compliment. The word *amateur* comes from the Latin word *amore*, which means to do something for *love*. In other words, people who are amateurs do things for the "love of it" and not just "for money" as the mere professionals do. Love is definitely a higher calling than money!

Many Canadians have built and flown their own amateur-built aircraft. Why? Because amateur-built aircraft:

- Can be cheaper to buy and fly than an equivalent certified aircraft
- Can often offer more performance than a certified aircraft
- Are more easily customized to your individual needs than a certified aircraft
- Offer more aircraft type choices than are currently available in certified aircraft (There are currently about 30 certified light aircraft in production and over 700 amateur-built plans and kits available)
- Offer the chance to get to know almost everything about one's individual aircraft – since you built it!
- Give the chance to learn and practice new skills
- Offer the opportunity to do your own maintenance
- Offer the chance to own a truly unique aircraft and not just another factory-produced aircraft

Of course, amateur-built aircraft are not new in Canada. In the early pioneering days of aviation all aircraft were "amateur-built" since there were no professional builders and no certified aircraft.

The first airplane to fly in Canada, the Aerial Experiment Association Silver Dart, was an amateur-built aircraft built in the USA and first flown there on December 6th, 1908. It was brought to Canada and had its first Canadian flight on February 23rd 1909, piloted by JAD McCurdy. This was its eighth flight since construction and took place on the frozen surface of Bras D'Or Lake near Baddeck on Cape Breton Island. It was the first flight of an airplane in the British Commonwealth.

Amateur-built aircraft had no legal status in Canada until Keith Hopkinson approached the Department of Transport in the mid-1950s. He wanted to build an amateur-built aircraft and wanted DoT to change the rules to allow it. Based on the growing success of amateur-builts in the USA, the DoT agreed to work with him to develop the rules to allow aircraft to be constructed by amateurs for "educational and recreational purposes".

Hopkinson's highly modified Stits SA-3A Playboy took to the air in October 1955 with the registration of CF-IGK (it was later changed to CF-RAD) – Canada's first registered amateur-built aircraft! CF-RAD is now in a place of honour in the Canada Aviation Museum.

Originally all amateur-built aircraft were built from plans or were original designs of the builder, with the builder given the job of finding all the raw materials and specialized parts, such as the engine and instruments, to complete the aircraft. Then plans suppliers started offering some of the harder-to-find or harder-to-make parts, like canopies and cowlings. Before long whole aircraft kits were available – all the parts you needed were in one box at one price. By the 1980's most amateur-built aircraft were constructed from manufacturer-produced kits.

The popularity of kits stemmed from the way it simplified the work of building – builders no longer had to find or make parts. Many kits today are "quick-build" kits with much of the hard work already taken care of for the builder. Kits help cut down the skills required, and the time involved and have made amateur-building accessible to more people. This all adds up to more aircraft flying more quickly and fewer abandoned projects.

In 2013 there were 4068 amateur-built aircraft registered in Canada, accounting for 11% of all Canadian registered aircraft. Of the non-certified aircraft, they are second in popularity only to ultralights. (6984 are BULA & AULA)

Scope of This Guide

This COPA Guide is designed to give you the background information that you will need to get involved in amateur-built aircraft, whether you are planning to design your own plane, build from plans, build a kit or buy a used amateur-built aircraft. This Guide will cover some of the pitfalls, regulations and choices available. It is designed to get you started!

This COPA Guide is **not** designed to tell you how to do the actual building of an amateur-built aircraft. That is a big subject and it is best covered in specialized (and much thicker) publications than this one! This COPA Guide does include a References section which will list some of those books that are the best source of knowledge on the "how to"s.

NOTE

While this guide does discuss the rules for building and flying an amateur-built aircraft, it is not legislative. Ensure that you read and understand the current CARs regarding amateur-built aircraft before commencing construction or buying an amateur-built aircraft.

Reviewing The Rules – CAR STD 507 Appendix C

The rules governing Canadian amateur-built aircraft have changed significantly since they were first approved in 1955. At that time amateur-builts were "aeroplanes only", were limited to two seats, 1200 lbs and were officially called "ultra-light aeroplanes".

- Today, Canadian Amateur-builts are no longer limited by passenger seats and weight. (2009 article)
- Fixed wing aeroplanes (no longer limited by passenger seats or weight)
- Helicopters (no longer limited by passenger seats or weight)
- Gliders (no longer limited by passenger seats or weight)
- Powered gliders (no longer limited by passenger seats or weight)
- Balloons (no longer limited by passenger seats or weight)
- Airships (no longer limited by passenger seats or weight)
- Gyroplanes (no longer limited by passenger seats or weight)
- Gyrogliders (no longer limited by passenger seats or weight)

The term "ultra-light aeroplane" now refers to a completely different category of aircraft.

While Transport Canada officially calls this category "amateur-built aircraft", many people also refer to them as "home-built aircraft".

On April 23rd, 2002 the current rules came into being as an exemption to the CARs and replaced the previous rules, Airworthiness Manual Chapter 549, known as CAR Standard 507 Appendix C.

In April 2009, Specific reference to aircraft weight or occupancy limits and in the case of lighter than air aircraft, buoyancy or cubic capacity limits were simply removed from the existing exemption Section 549.01 of the CARs and Chapter 549 of the Airworthiness Manual. Although this new amendment is not available on TC's website as of the writing of this article, the referenced document can be found at:

http://www.tc.gc.ca/civilaviation/regserv/affairs/exemptions/docs/en/1963.htm and is in effect until appropriate provision of the CARs come into effect. (Special C of A Amateur-built, New Rules).

The new rules introduced some substantial changes, which will be discussed in the next few sections of this COPA Guide. A copy of the complete text of the exemption is attached at the end of this guide. TC also originally issued a series of Airworthiness Manual Advisories (AMAs) as advice and information for amateur-builders as part of Airworthiness Manual Chapter 549.

Canadian versus US Amateur-Built Rules

The rules for amateur-built aircraft in the US are generally similar to the Canadian rules, but there are some differences.

- US amateur-built aircraft are only legally required to have one inspection by the FAA before first flight – Canadian amateur-built aircraft must be inspected prior to closing any areas that can't be inspected after close-up, such as ailerons or wings, prior to covering the structure and prior to first flight.

- The original builder or an A&P mechanic are the only people who can maintain a US amateur-built aircraft. The owner, regardless of whether they built the aircraft or not, can maintain a Canadian amateur-built aircraft.

Ensure that the kit, plans or completed foreign amateur-built you are considering will meet the Canadian requirements!

The 51% Rule

Canadian amateur-builts must comply with the “major portion rule”. This will be defined in CAR 507 Appendix “C” (currently exemption from Section 549.01):

"amateur-built aircraft" means an aircraft, the major portion of which is constructed or assembled individually as a unique project, either from raw materials or from a kit;

"major portion" means more than 50% of the total number of items assembled during the project;

This so-called Major Portion (at least 51%) rule has become rather misunderstood since the introduction of the new rules through the exemption that replaced AWM Chapter 549.

The old AWM Chapter 549 simply required that amateurs build the major portion of the amateur-built aircraft. The “major portion” was interpreted to mean “more than half” or 51%. Any portion that you paid a professional to do was deducted from the “major portion”, except for parts you were not expected to build such as engines, wheels, brakes and instruments, which were not included in the “major portion”.

If the kit did not allow the builder to complete the major portion of the aircraft, then it did not qualify to be built as an amateur-built aircraft in Canada.

Under the new rules none of that has changed. The “Major Portion (at least 51%)” is still there. The only difference is that CAR 507 Appendix “C” allows for professional assistance in building that remaining “major portion”. The new CAR defines:

“builder” means the individual or group of individuals who constructs or assembles an amateur-built aircraft, or who oversees the construction by other persons, of an amateur-built aircraft.

That means that you can have professional assistance complete the whole aircraft’s construction, as long as you actually oversee the construction. You still have to be there in person for the MD-RA inspections as the builder.

All aircraft, whether built from plans or a kit, are still required to meet the Major Portion rule. This can only be demonstrated in two ways:

- Confirm that the kit is on the joint FAA/TC *Listing Of Amateur-Built Aircraft Kits*, in which case it is considered to meet the rule or
- Have MD-RA complete a Major Portion determination for the project (there is a fee of $395 plus tax, for this service)

This means that any aircraft that is not on the list must have a Major Portion determination – no exceptions. Even if an identical kit has previously been assessed, if it is not on the list then your kit will also have to be assessed as each project is unique. Complaints about this problem should be directed to the kit manufacturer as it is up to them to request a Major Portion (at least 51%) determination of the kit. Once that is done and the kit is on the list, builders will no longer have to pay for Major Portion (at least 51%) determinations on each kit.

Mass Production Of Aircraft

Questions have been asked about the exact meaning of paragraph 13 in CAR 507 Appendix "C" which says:

> *(13) The aircraft shall not be constructed under a mass production system.*

TC has issued Maintenance Policy Letter 13 to clarify the exact interpretation of this policy.

Basically, TC will not accept multiple amateur-built aircraft being produced by one person or a company on an assembly line. As long as each aircraft has a separate builder then it should be acceptable for several aircraft to be produced in the same place and time, however.

Selecting A Design

Finding the right aircraft design, plans or kit is probably the most difficult part of the process! It is readily apparent from reading the classified ads that many builders have made poor choices for themselves. The ads are obvious – amateur-built aircraft offered for sale with very low times on them, some as little as one or two hours! Some of these aircraft are being sold by people who just like to build more than fly, but the majority, are being sold by people who completed the aircraft and then quickly discovered one of the following:

- Even though the aircraft was well within their building skills it was too high-performance for their flying skills. In other words they scared themselves!

- The aircraft had some unanticipated flaw in it that greatly disappointed them, such as:
  - Insufficient useful load. This usually means that the empty weight crept up during construction and what was supposed to carry two people will only carry one.
  - Unpleasant or unexpected handling characteristics.
  - Inability to achieve expected or advertised cruise speed.

- The aircraft just didn't meet their needs when it was done. It could be because they started building a two-seater for themselves and their spouse to fly together and during the building process added two kids and have no seats for them.

- They didn't appreciate the costs that would be involved in operating the aircraft.

All of these problems can be avoided. There are entire books on the subject. Highly recommended is *Choosing Your Homebuilt – The One You'll Finish and Fly* By former COPA Director Ken Armstrong.

Another good reference for picking a design is KitPlanes magazine which runs a series of three issues annually (December, January and February) that lists all the plans and kits available. EAA also has some good information. This COPA Guide section will just cover some of the basic considerations.

It can be argued that there are two ways to choose a design that will suit you – The "Scientific Method" and the "Emotional Method". Both work equally well, depending on the person involved.

The Scientific Method usually involves starting with a list of "design criteria". This is a list of what the completed aircraft will be able to do and considers such factors as:

- Number of seats
- Useful load
- Full fuel payload
- Cruise speed
- Runway requirements
- Rate of climb
- Range
- Endurance
- STOL capabilities
- Aerobatic capabilities
- IFR suitability

This method will also consider some other "non aircraft performance" criteria as well:

- Total cost to complete, including:
  - Airframe kit
  - Engine
  - Paint and fabric
  - Instruments
  - Avionics
  - Tools and special equipment (engine stands, etc)

- Forecast annual operating cost - you can calculate this using the *COPA Guide to Estimating Aircraft Operating Costs*
- Is the insurance you need available for you on this type of aircraft?
- Construction space required versus construction space available - single car garage, two car garage or hangar
- Available assistance from other builders, kit completion centres, kit manufacturer, aircraft tye club, AME, etc.
- Base of operations for the completed aircraft
- Hangarage required for completed aircraft

Based on all these criteria, the available designs are assessed to see which ones fit and which ones don't. With a "short list" made up, each remaining design can then be assessed more carefully to find the optimal solution. Given perfect information the best choice can be made this way. The problem is that information is rarely perfect!

The "Emotional Method" is much simpler. This is the method most often used when buying planes and cars, too. This method simply says build the plane that you find appealing! If this didn't work then GM would never sell Corvettes, as they don't stand up to the "Scientific Method"!!

Most people don't give a lot of credence to the "Emotional Method", but there is one strong factor in its favour – very few pilots appreciate building, owning and flying the scientifically best aircraft for them if they don't like the aircraft. It may be the right aircraft for them, but it just doesn't grab their imagination! We don't usually choose spouses using a scientific method!

Of course, in reality, most potential builders do a combination of the two methods – they analyze the basics, create a short list of aircraft that will fit the bill for their needs and then pick the one that most appeals to them. The ultimate test is whether you are happy with the choice when it is done – how you get to that point is ultimately immaterial!

Fly Before You Buy!

When looking at potential aircraft to build, one "hard and fast" rule has been learned over time – ***Fly Before You Buy***.

Reading factory brochures and websites is fine to start with, as is listening to factory demo pilots and salespeople. But, of course, they are keen to tell you about the virtues of the design and will probably gloss over the drawbacks. Some designers are very careful to publish performance figures that have been carefully flight tested and verified by actual builders. They want to make sure that builders are not disappointed when they make their first flight.

Many other designers publish “other performance figures”, however. These can be flight test results with a lightly loaded aircraft, “design goals”, wishful thinking or just “sales figures” (in other words – numbers published with the sole purpose of generating sales).

How do you determine whether the performance that the factory claims is achievable? You could ask a builder who has completed his or her plane and is flying it. Experience has shown that almost all builders are very enthusiastic about their planes. After years of building they are reluctant to admit that they made a poor choice, so even those that are not pleased with the results are not likely to give you an honest indication of flight performance. Experience has shown that many builders will exaggerate numbers like cruise speeds when asked. Besides, they might be hoping to sell you the completed aircraft!

What to do? As the title of this section says, “Fly Before You Buy”. Seeing is believing! Make sure you find an example flying either at the factory or in private hands and get a flight in it. Be prepared to travel to get a flight and be prepared to pay for the flight expenses.

Before actual flight, work out the weights available for useful load and payload based on the actual empty weight of that individual aircraft. Don’t count on “factory estimated empty weights” but see what a real aircraft actually weighs and therefore how much useful load it has.

When in the air make sure you get a chance to fly the aircraft and feel how the controls respond, how the aircraft handles, how it takes off and lands. Note the best achievable cruise speed, rate of climb, runway length used and other parameters.

What do you do if there is no example to fly? The factory just sold its only demonstrator, all the private owners you have found either haven’t finished building or their aircraft are unserviceable. Keep trying. If a chance to fly an example seems to constantly elude you then consider that perhaps the designer would rather you bought one without flying it first. Ask yourself why that might be! If you can’t fly – then don’t buy. Find a more “available” aircraft type instead.

Perhaps the best source of unbiased information comes from ex-owners, people who built one, flew it for a while and then sold it. These people may be ready to give you a complete assessment of the aircraft, including why they sold it! They can be hard to track down, but the Civil Aircraft Register includes details on each aircraft’s history and that includes past owners!

Construction Times

One area to be skeptical about is “manufacturer-claimed build-times”. These are the claims that “a builder can complete this kit in 300 hours”. As with any manufacturer’s claims, some of these are accurate, but many are not. Manufacturers naturally want you to think that the kit can be built in the

shortest time possible. Some of them will actually count the person-hours for one person to build a prototype kit, while others just estimate. Of course, the number of hours that it takes a factory worker, working fulltime, with all the tools and parts handy, who has built ten examples before, will not be a typical result that a first-time builder can expect. For many builders the problem is not that it takes any particular number of hours to build the aircraft – just that they were counting on it requiring what the manufacturer said.

If you are not absolutely certain that first-time builders, working in their own shops, remote from the factory, working part-time, have completed the kit in the factory-specified time then the next best thing is to take the manufacturer's estimated construction time and triple it. That means that if the manufacturer says the kit will take 100 hours expect it to take 300 hours and if they estimate 5000 hours then count on 15,000 hours. Keep in mind that is actual building time, not time spent ordering parts, sweeping up or re-reading the construction manual.

In many ways the best approach is to ignore those estimated build-times and just accept that the plane will be done when it is completed, no matter how long it takes.

Options – Design Your Own Versus Plans Versus Kits Versus Buying Used

One of the great advantages of the amateur-built category is that you have lots of options! You can, not only build many different categories of aircraft, like gliders, airplanes and balloons, but you can also get the aircraft that you want in several different ways. Here are some of the different ways of getting an amateur-built aircraft:

- Design your own original aircraft and then build it from raw materials
- Buy a set of plans for an existing design and then build it from raw materials
- Buy a set of plans and then build the aircraft from a combination of factory-supplied components and raw materials
- Buy a complete kit
- Buy a partial kit or subcomponent kits (i.e. tail kit, wings kit) to construct the aircraft one component at a time
- Buy a partly completed project that the current builder is selling
- Buy a completed aircraft that is already flying
- Buy a completed aircraft that has already flown for some time but now needs rebuilding or restoring
- Import a completed aircraft that has flown at least 100 hours from another country. More on this option can be found under Importing an Amateur-Built

All these options hopefully mean that there is an option that will suit your requirements and budget. In general, the more complete the option (kit versus plans and raw materials) the greater the cost. You can almost always trade doing extra labour for saving money and vice versa.

Aeroplanes

Aeroplanes, or "airplanes" as most people outside TC call them, are obviously the most popular type of amateur-built aircraft to construct and fly. In January 2014, 4,069 A-B airplanes in Canada and including a wide variety of aircraft, from fixed wing airplanes, helicopters, gliders, gyroplanes to balloons, airships and even one ornithopter. Amateur-builts made up 17% of the aircraft added to the private fleet in 2013.

Airplanes may be powered by any type of two-stroke, four-stroke, diesel or rotary piston engine, turboprop, turbojet or turbofan engine. Only solid or liquid fuel rocket engines are not permitted in this category.

Within the Canadian amateur-built category airplanes, propeller-driven aircraft must meet a minimum horsepower calculation, while the builder is left to determine the suitability of jet engines for the aircraft. There is a minimum rate of climb test to be passed of 1180 feet in 3 minutes from sea level (393 fpm). These requirements are all designed to increase the safety of the design.

If the wing loading of an airplane is over 13.3 lb/sq ft without flaps or 20.4 lb/sq ft with flaps the aircraft will be considered "high performance" and will require a type rating. This is not a difficult problem but getting a type rating must be factored into the requirements before test flying begins!

Gliders

Amateur-built gliders have enjoyed steady popularity over the years and currently 81 are registered and account for 1.99% of Canadian amateur-built aircraft. They are not required to meet the rate of climb or minimum useful load calculations. They must meet the same wing loading limitations as airplanes if they are to avoid being classed as "high performance".

Powered Gliders

"Powered Glider" is the TC term for what many people call a "self-launching sailplane" or "Motor Glider". The requirements for these aircraft are very similar to powered aircraft. There is also a limitation that the value M/b^2 (mass to span^2) shall not be greater than 0.615 lb/sq ft.Powered gliders have to meet a test flight climb requirement of 984 feet in 4 minutes (246 fpm) along with the same minimum useful load, wing loading and minimum rated horsepower as airplanes.

Helicopters

The new CAR 507 rules have liberalized which helicopter designs can be built in Canada. Under the old AWM 549 rules only designs that had been evaluated by TC were accepted. Under the new rules any helicopter can be built that meets the category requirements. Helicopters must meet the same minimum useful load requirements as airplanes, although they have no stated minimum horsepower or rate of climb requirements. Those are left up to the builder to ensure they are adequate for safe operation.

It is worth noting that in 2006 liability insurance for helicopter student pilots was hard to get in Canada, except through helicopter schools. This means that building your own amateur-built helicopter and then learning to fly on it may not be an option – you may have to attend a certified helicopter school to complete your *Private Pilot – Helicopter* licence with the high costs that go with that. The high training costs are one factor in the low numbers of amateur-built helicopters in Canada. January 2020 there was 121 and account for 2.97% of Canadian amateur-builts. In-flight hull insurance for amateur-built helicopters is also hard to get, especially for low time helicopter pilots and this should be considered before buying one of these aircraft. You may have to be comfortable flying without that coverage.

Gyroplanes

Gyroplanes are the second most popular amateur-built types after airplanes, currently at 183 accounting for 4.49% of Canadian amateur-builts. Like helicopters, gyroplanes must meet the same minimum useful load requirements as airplanes, although they have no stated minimum horsepower or rate of climb requirements. Those are left up to the builder to ensure they are adequate for safe operation. Also, like amateur-built helicopters, gyroplanes have had insurance problems in Canada recently. For the last few years liability insurance has not been available for student gyroplane pilots. This problem has been solved and liability insurance to a maximum of $100,000 has been available for student pilots on gyroplanes through the COPA VIP Silver and Bronze Plans.

Instructors cannot currently get liability insurance for teaching, although pilots who have their *Pilot Permit – Gyroplane* can get liability insurance. No in-flight hull insurance is available for gyroplanes at all in Canada right now. Liability insurance is not available for instructors or students in the USA either at present and as a result there are only a few schools operating there (liability insurance is not a legal requirement in the USA, unlike in Canada). All of these factors should be considered before buying a gyroplane.

Gyrogliders

Gyrogliders are an interesting category of aircraft permitted under the amateur-built rules in Canada because there are currently none registered. Historically gyrogliders were often used as developmental prototypes for gyroplanes and helicopters and in this role were often towed behind a car. During the 1920s and 1930s many were constructed and towed like kites. The most famous and most mass-produced gyroglider was the *Focke-Achgelis FA-230 Bachstelege* (Sandpiper) which was a single seat gyroglider towed like a kite behind surfaced U-boats during World War Two as an observation platform!

If a Canadian were to build a gyroglider, minimum useful load, rate of climb and horsepower would not be applicable to a gyroglider.

Balloons

Amateur-built balloons have never reached large-scale popularity in Canada, but there are several designs available from the US. Currently there are only 18 amateur-built balloons in Canada. T he Canadian rules only allow for hot air or non-flammable gas as buoyancy agents, so hydrogen is ruled out for obvious reasons.

Airships

Airships are quite rare in Canada and amateur-built airships are even rarer, currently numbering only five. As with balloons only hot air or non-flammable gas may be used for buoyancy. No engine power requirements are specified, leaving that up to the builder's judgement.

Some Warnings About Designs

There are more than 700 kits and plans for amateur-built aircraft available. Some are excellent aircraft and some are not. Strangely enough there are many poor designs that have lots of examples that have been flying over many years, so looking at numbers flying or the longevity of the design is no guarantee of a good design. As mentioned above in Fly Before You Buy, the only way to be sure whether a design will meet your requirements is to fly one yourself before you build it.

As mentioned in Selecting A Design there are several common reasons why designs can be a disappointment, although the aircraft can be flown safely. Other designs that have difficult handling characteristics can rack up a high number of accidents. Checking the accident history can be a useful exercise, as it will tell you much about the weaknesses of a design or of the pilot training requirements before flying it!

Fixed Pitch Helicopters

Another area to be concerned about is flagrantly unsafe concepts in amateur-built designs. One of these is the “fixed pitch helicopter”. In recent years several of these have appeared, usually aimed at the US ultralight market, because there is no design evaluation involved in that category. Fixed pitch helicopters have no collective pitch control and rely on increasing engine rpm to climb. Two-stroke engines usually power them. The key problem is that a fixed pitch helicopter cannot auto-rotate, so when the engine fails it just crashes, usually killing the pilot.

CAR 507 Appendix “C” contains this requirement:

Prior to issuance of a flight authority, an amateur-built aircraft shall be inspected in accordance with a schedule acceptable to the Minister:

a) for workmanship and general serviceability;
b) to detect apparent and obvious unsafe features; and
c) *to provide reasonable confidence of safe operation*.

Aircraft with inherent design flaws such as “fixed pitch helicopters” will not pass these criteria and thus will not be permitted to fly in Canada. Save your money and do your homework – avoid designs with fundamental safety flaws in them. If you have any doubt contact MD-RA to find out whether a particular design would be acceptable in Canada.

Pressurized Turbine?

You have your heart set on a really hot airplane – something turbine powered and pressurized? There

are some extra considerations there beyond the obvious requirement for a specific type rating (since it is probably “high performance”).

The most important factor to consider is that all Canadian pressurized and turbine aircraft, not in commercial or flight training use, that are used to carry passengers are required to operate under CAR 604 Private Operator Passenger Transportation. This means that you will need a Private Operating Certificate (POC). The relevant requirements are contained in CAR 604.

The POC program requires you to write and follow a Safety Management System for the operation of the aircraft, have a custom-designed maintenance program that complies with CAR 625 Appendix D (you cannot just adopt CAR 625 Appendix B & C as you can with other private aircraft) and meet minimum training and insurance benchmarks plus several other requirements.

Private Operator link at Transport Canada
http://www.tc.gc.ca/eng/civilaviation/standards/commerce-business.htm

This is not to say “don’t buy a turbine pressurized aircraft”, just be aware that there are some extra requirements and costs involved.

Please note that to fall under the requirements of CAR 604 the aircraft must be both turbine powered (jet or turboprop) and pressurized. Aircraft that are pressurized and piston powered (stock Lancair IV-P for instance) are not captured by this rule, nor are turbine, non-pressurized aircraft (Rotorway Jet Exec helicopter).

It is also worth noting that you can modify an aircraft into requiring an operating certificate under CAR 604 by converting the engine to turbine power. For example, if you own a piston powered Lancair IV-P and you convert it to a Walter turbine-engine turboprop, then you suddenly will need a POC under CAR 604 before you carry any passengers in the aircraft.

The POC program requires you to write and follow a Safety Management System for the operation of the aircraft, have a custom-designed maintenance program that complies with CAR 625 Appendix D (you cannot just adopt CAR 625 Appendix B & C as you can with other private aircraft) and meet minimum training and insurance benchmarks plus several other requirements.

MD-RA’s Role

Between the start of organized amateur-building in Canada in 1955 and the mid 1990s, TC Maintenance and Manufacturing Inspectors were responsible for inspecting amateur-built aircraft. This system worked well for decades, but as TC priorities shifted in the 1980s and 90s and budgets were cut, it became hard for TC to provide inspectors to inspect amateur-built aircraft in a timely manner.

Some builders waited many months for inspections, their aircraft grounded in the meantime. The solution was for the industry to take over inspections.

After a test period, the Minister Delegate – Recreational Aircraft (MD-RA) was set up in the mid 1990s. The current program is based on volunteer inspectors, located around Canada, all trained to a common standard and inspecting aircraft for a fee. The fees are paid to MD-RA to cover administration costs. As volunteers, inspectors receive no pay, except mileage charges to get to the place of inspection. MD-RA has been an advantage for amateur-builders in Canada. Under MD-RA administration inspections now happen more quickly and delays are not common!

Mandate of Minister Delegate - Recreational Aviation (MD-RA)

MD-RA is a Transport Canada external delegation of authority program. MD-RA is responsible for amateur-built aircraft only. MD-RA inspectors perform inspections on aircraft under construction and, upon completion, issue the initial Special Certificate of Airworthiness and a restricted flight authority. Once the aircraft is complete and flying, the files are transferred to the Transport Canada Civil Aviation.

The MD-RA fees for their services are listed at this link FEE SCHEDULE Travel costs for the inspectors ($0.55/km) are not included in the schedule and are payable to the inspector at the time of the inspection. Consult their website for more information on inspection requirements www.md-ra.com.

As can be seen, the total inspection requirement for a typical kit-built aircraft (not requiring a 51% determination) could be expected to add about $2000 to the cost of an amateur-built aircraft, including the fee for the *Special Certificate of Airworthiness $250.00*, plus any applicable mileage charges. Mileage charges can be quite low if you live near an MD-RA inspector, but if you live in a more remote part of the country, they could be quite substantial. These costs have to be considered and budgeted for in the building process.

Because MD-RA act as the Minister of Transport's delegates the regulatory requirement to report your amateur-built project to the Minister is satisfied with MD-RA registration. There is no need to contact TC as well as required in CAR 507 Appendix C:

A person who intends to construct an amateur-built aircraft shall, before starting construction:

a) inform the Minister of the intention to construct the aircraft;
b) identify himself or herself as the builder of the aircraft;
c) show that the aircraft design meets the requirements of this standard; and
d) *confirm that the major portion of the aircraft will be constructed individually, as a unique project.*

Full details about MD – RA services are available on their website at www.md-ra.com or through their office at:

MD-RA Inspection Service
2469 Aviation Lane
L ONDON, ONTARIO
N5V 3Z9
519-457-2909
877-419-2111 (in Canada only)
519-457-0980 fax
877-800-6362 toll free fax
email md-ra@md-ra.com

Construction Outside Canada

CAR 507 Appendix "C" does allow the construction of an amateur-built aircraft outside Canada under certain circumstances.

The rules say you can build an aircraft outside of Canada if:

- the builder is a Canadian citizen living abroad and intending to resume permanent residence in Canada, who provides advanced notice of the intention to construct the aircraft outside Canada and

- the builder makes arrangements to have the aircraft inspected during construction, and after final assembly, by:

    - an employee (aviation safety inspector, airworthiness inspector) of the foreign civil aviation authority (FCAA) of the State in which the amateur-built aircraft is being constructed, who is authorized by the FCAA to conduct inspections of amateur-built aircraft;
    - a representative of the FCAA of the State in which the amateur-built aircraft is being constructed, who has been delegated authority by the FCAA to conduct inspections of amateur-built aircraft, and is authorized by the FCAA to conduct inspections of amateur-built aircraft;
    - a representative of a recreational aviation organization of the State in which the amateur-built aircraft is being constructed, the organization having been delegated authority by the FCAA to conduct inspections of amateur-built aircraft; or
    - any other person acceptable to the Minister.

- the builder shows that the aircraft design meets the requirements of these standards.

Note: Although CAR 649.01 section (6) .2 specifies ‘’the builder makes arrangements to have the aircraft inspected during construction, and after final assembly, **by a person acceptable to the Minister**; MD-RA Services no longer use or accept foreign officials for A-B aircraft inspection.

Where some builders have run into trouble is when they are Canadian residents (in other words: that they are legally living in Canada and not a foreign county) and try to build an aircraft outside the country – for instance at a US or European completion facility. The rule is very clear: the builder must be a Canadian citizen living abroad. A Canadian resident does not have the option of building outside the country.

Why do Some Aircraft Not Get Finished?

This is an important issue and much has been written on it over the past decade or so. In the days when most aircraft were built from plans it was estimated that about 80% did not ever get finished. Much of that has changed with kits, but depending on the kit, the number “not completed” by the original builder is still in the range or 20-50%.

What are the most common reasons why amateur-builts are started and not finished? Here are some of them:

- **Lack of Spouse Support** – this is probably the number one reason – if your spouse is opposed to the existence of the aircraft then it is unlikely to get finished.

- **Divorce Forced Sale** – related to the issue above - when things get really bad you may have to sell the project to pay for the divorce.

- **Ran Out Of Money** – a common problem. Projects always cost more than you think they will.

- **Insufficient Time** – projects always take more time than you think they will and most people over-estimate the time that they can dedicate to building. Anyone employed full time and who has a family with children will be hard pressed to find more than 300 hours a year to work on an aircraft. This means that an aircraft that will take 5000 hours to build will take 17 years to complete!

- **Loss of Motivation** – This is more common than most people think. Building aircraft can be hard work and very time consuming. Often the frustrations of parts that don’t fit, suppliers going out of business or other factors add up to just giving up, temporarily or permanently. Lack of family support often plays a big role here.

- **Insufficient Skills** – Some aircraft projects require you to learn new skills, like welding, composites and woodwork. Some people find that they do not have the skills and are not able to learn the skills to complete the project. Of course, under the new rules you can hire someone to do the work for you, but that may lead to runaway costs!

- **Insufficient Space** – It can be impossible to build some aircraft in a single car garage. This may mean building in a hangar at a distant airport, which means that you have a long drive to get there, which means that you don't go very often.

- **Job Change Or Move** – Sometimes, a job transfer or even a new career path entirely can mean that you don't have the same amount of time or space to complete your amateur-built aircraft, especially if you move from a house with a garage to an apartment.

- **Loss Of Medical** - When we undertake a project like building our own aircraft, we tend to keep the image of us flying it in our minds to keep us motivated to complete the project. That can all change quite drastically if we are no longer medically qualified to hold a pilot's license.

- **Change in Lifestyle** - In some cases, we may experience a change in our own health or circumstances which, though not medically disqualifying, may incur a higher financial demand on us. That means less money (and probably less time) to complete our project.

So what is the cure for each of these? Some advanced planning is needed to ensure that each of these traps is avoided. Don't even think about building your own aircraft without spouse and family support. If they aren't on your side in this issue then consider another way to get the plane that you want, such as buying a used amateur-built instead.

There are some advantages to unfinished projects – many builders find that they are able to buy up incomplete or abandoned projects from other builders and finish them. Someone else's defeat can be your victory!

In some cases, incomplete projects cannot be finished, due to the lack of available parts or other factors. Some of these projects can still be worthwhile purchases anyway, for use as spare parts and raw materials to complete a different project.

Documentation

Like everything in aviation there is a requirement for paperwork for amateur-built aircraft. The good news is that the paperwork requirements are not too onerous, in keeping with the fact that most people build amateur-built aircraft for fun. Not to say that the paperwork is necessarily fun, but it isn't too difficult.

In building and registering an amateur-built aircraft here is a list of some of the paperwork to expect:

- Letter of Intent
- Inspections
  - 51% determination (if required)
  - Sub-assembly inspection (if required)
  - Pre-cover inspection
  - Final inspection
  - Supplementary (re-visit) Inspection (if required)
- Journey logbook requirements
  - Magnetic Compass calibration
  - Maintenance schedule statement
  - Airworthiness statement
- Application for C of R
- Application for Special C of A
- Weight and Balance Report
- Fuel Flow Report
- Dataplate report or photo

MD-RA has many helpful resources to help builders through the paperwork process on their website www.md-ra.com, including forms for the C of R, Special C of A, Letter of Intent and a very useful final inspection checklist.

One of the advantages amateur-built aircraft have is that they do not need to have a *Technical Record*. As authorized in CAR 605.92 all aircraft records can be kept in a Journey Logbook alone – that simplifies record keeping!

Weight And Balance

Doing the aircraft weight and balance and then completing the calculations and forms seems to give many builders trouble. It can be a bit daunting for the first-time builder who doesn't have aircraft maintenance experience. Your MD-RA inspector will want to see a complete weight and balance report during the final inspection of the aircraft prior to first flight.

Fortunately, there is a great reference book that walks you through the whole process in great detail, with lots of diagrams and examples. The FAA publication *AC 43.13-1B Acceptable Methods, Techniques and Practices, Aircraft Inspection and Repair* has an entire chapter on the weight and balance (Chapter 10) and is the standard reference on the subject. The good news is that you can download the entire book for free in Adobe Acrobat format files from the FAA website.

Many amateur-built aircraft clubs have the equipment, including scales and the expertise to help you with your weight and balance, too. Weight and balance shouldn't be a problem with that kind of assistance available!

Airworthiness Directives (ADs)

Airworthiness Directives do not apply to Amateur-built aircraft since these aircraft are not certified. However, this does not mean that individual components of an amateur-built aircraft are exempt from AD's. An AD might be issued against the engine that is installed on some amateur-built aircraft, or a propeller, or the exhaust system and/or cabin heater for instance. The owner would be well advised to understand the AD and its implications

Design Changes

Many builders of amateur-built aircraft incorporate changes in the aircraft they are building, whether the aircraft is being built from kits or plans. One of the great advantages of the amateur-built category is that this is allowed. It is up to builder to decide whether the changes are warranted and how they will be carried out.

Both the CARs and the courts have been clear that when the aircraft is completed it is the builder who is responsible for the airworthiness of the aircraft, not the original designer or the manufacturer of the kit from which it was constructed. This is a good thing as it allows the builder to make changes, but it carries with it the responsibility to do a good job in making changes to a design. Ensure you know what you are doing as you will be solely and legally responsible for the outcome!

If you are not confident in your abilities as a designer, then get professional help from the original designer or an aeronautical engineer. Otherwise don't make the changes to the design, especially when they involve changes to the structure.

Installing Parts

Installing parts on your plane is a subject that confuses a lot of people. What parts are you allowed to install and what paperwork is required for which parts?

Amateur-built aircraft are authorized in CAR 571.07 to have non-certified parts installed. It is recommended that aviation quality parts be installed, but it is not required. The decision is left to the owner as to the choice of parts. No certification document is required for new parts installed on these aircraft. A used part that has undergone maintenance will need a document releasing that work. The release can, of course, be signed by the owner of the aircraft.

Signing the Maintenance Release

Who can sign the maintenance release when work is done on an amateur-built aircraft? The answer to this question is found in CAR 571.11 (2) (b) *Persons Who May Sign a Maintenance Release*. It says: "in the case of maintenance performed on an aircraft that is operated under a special certificate of airworthiness in the amateur-built classification, the person is an owner of the aircraft;" An AME can also sign the release.

This is pretty clear in the case of an aircraft that is owned by an individual, but what about an aircraft that is in the name of a company? Who can sign then? Can a company even own an amateur-built?

The Civil Aircraft Register has several hundred amateur-builts that are registered to companies. It is not clear from the CARs when the owner is a company whether the owner of the company is authorized to sign on behalf of the company. Then there is the case where the company has many owners or is publicly held through shares. A check with TC on this issue indicates that they have never addressed it formally, that they accept the signature of the company owner without detailed investigation. This looks to be a non-issue at this point in time, although it could become a complication in the future.

Parts Warrantees

It can be a great feeling to have all the parts for your aircraft assembled in one place before you start to build. It can reduce delays while you try to locate a source for the parts you need. There is one drawback to this method that should be considered – sometimes warrantees expire on parts while they are sitting on the shelf! This especially applies to avionics, instruments and engines – these are some of the most expensive items installed on amateur-built aircraft. Engines, especially, are often one of the last items to be installed on the aircraft and they typically come with warrantees that specify a number of flight hours (250 hours is typical) and a time period (usually six months or a year), whichever comes first.

Some components are warranted for a period of time from the date you install them, but many are warranted from the time you buy them! It is important to know which is the case when you buy your parts. It may save a lot of problems if you leave buying engines, instruments and avionics until you are ready to install them, but check with your suppliers to find out about warrantees. Another advantage to waiting until you need key components is that technology changes. Because aircraft often take longer than expected to build, buying your engine, instruments and avionics early may mean that that new technology may become available later on. This can make the item that you have sitting on the shelf more of a liability than an asset!

Registration & Markings

Amateur-built aircraft are registered in the same manner that certified aircraft are. They carry a *Certificate of Registration* (C of R) and require nationality and registration marks. Amateur-built aircraft are registered in the C-F and C-G series. A C of R currently costs $110 from TC. For an additional $140 you can choose your marks from those that are available. To check the availability of marks, use the Canadian Civil Aircraft Register search function and look for your ideal registration call letters. If they are free then you can reserve them.

The actual aircraft specifications for nationality and registration markings are contained in CAR 202 and CAR Standard 222. The standards are very complex and bear reading through before you paint the markings on or order them from the sign-shop in vinyl. Just some of the highlights of the registration rules include:

- Marks are now optional under the wings or under the cabin on rotorcraft.
- Amateur-builts are required to have markings on the fuselage or tail that are 11.8” high if possible. They can have marks as small as 3” high if the structure doesn’t allow them to be 11.8” high, but they have to be as close to 11.8” high as possible, if space allows.
- If you do put marks under the wings then they have to be at least 19.68” high.
- Lettering has to be of equal height, Roman style capital letters, a contrasting colour and without ornamentation (no serifs).
- Letters can be angled back or forward up to 35 degrees
- Letters cannot be arranged vertically down a tail or other surface (they have to run parallel to the longitudinal axis)
- Pay attention to the hyphen length, it should be 2/3rds of the high of the lettering

…And many, many more rules!

The rules for markings are very complex, so read them carefully before you apply your markings!

Insurance

Insurance is generally available for flying amateur-built aircraft, with some restrictions.

The COPA VIP Bronze Plan insurance provides Public Liability and Property Damage Coverage (Third Party Liability), Passenger Liability Insurance and Non Owned In-Motion Hull coverage for pilots who borrow or rent aircraft. Any COPA member who is qualified to fly the aircraft can purchase coverage under this group plan. Coverage can be purchased immediately online at VIP Bronze. For more information, have a look at the COPA VIP Aviation Insurance or call 1-855-VIP-COPA.

The COPA VIP Silver Plan provides Public Liability and Property Damage Coverage (Third Party Liability), Passenger Liability Insurance and Not-In-Motion Hull coverage for certified aircraft. Any COPA member who owns an aircraft can purchase coverage under this group plan. Any COPA member who owns an aircraft can purchase coverage under this group plan. Up to 4 pilots may be added to your VIP Silver Policy at no additional charge as long as they are COPA Members. Coverage can be purchased immediately online at VIP Silver. For more information, have a look at the COPA VIP Aviation Insurance or call 1-855-VIP-COPA.

For amateur-builders who want to apply for complete coverage, including in-motion hull coverage, COPA has the Gold Plan. Coverage is not automatic, as the underwriter will assess such items as pilot experience, time on type, age, accident record, currency, aircraft performance and several more factors in determining whether they can provide coverage and at what price. Consult the COPA VIP Gold Insurance Plan form for a *Request for Quote* or call 1-855-VIP-COPA.

Many high-performance homebuilts cannot get in-motion hull coverage at the present time. Accident records have shown that many of these aircraft can be demanding to fly and high hull values combined with high losses have caused many underwriters to say “no” to covering these types of aircraft. If you really want to fly a high performance home-built you may have no choice but to do it without in-motion hull coverage.

One of the realities of the insurance market is that it changes in time. One COPA member requested a quote on a high performance amateur-built that he was thinking of building. The quote came back – the coverage was available and the cost was reasonable. The builder took five years to build the aircraft but when it was ready to fly the insurance market had changed. The aircraft type had developed a reputation as demanding to fly and in-flight hull coverage was no longer available. Builders of amateur-builts need to be ready for this possibility and be willing to fly without in-flight hull coverage, even if it was available when construction was commenced. COPA’s VIP Silver Plan is still available to provide Public Liability and Property Damage Coverage (Third Party Liability), Passenger Liability Insurance and Not-In-Motion Hull coverage.

Rotorcraft are currently working with some severe insurance restrictions in Canada. There are currently no underwriters willing to provide:

- Any insurance at all for gyroplane instructors to teach students, although solo insurance is available since January 1st, 2005.
- Only limited availability of insurance for student helicopter pilots to fly solo, except under the auspices of a certified helicopter school.
- Only limited availability of insurance for helicopter pilots on amateur builts.

Insurance is available for helicopter schools to teach helicopter students, but is only available in some cases for pilots be able to earn their licence on their own amateur-built helicopter. If a pilot cannot get insurance for training this will greatly increase the cost of obtaining the *Private Pilot Licence – Helicopter* required to fly your amateur-built helicopter. Make sure that you investigate the costs before you commit to building a helicopter.

There has been no gyroplane instruction or training legally possible in Canada for a number of years, due to the lack of the minimum legally required insurance for student pilots and instructors. This has now changed and since January 1st 2005, COPA's insurance program started offering $100,000 third party liability insurance for student gyroplane pilots.

Work-in-Progress Insurance

Work-in-Progress Insurance is something to consider when you start building an amateur-built aircraft. Almost all homeowner's insurance policies specifically exclude covering losses to aircraft and aircraft parts. That means that if your home burns down and your partially completed aircraft goes with it, you will have no coverage for the aircraft. The same holds true for break-ins; aircraft parts that are stolen will not be covered.

Work-in-Progress Insurance covers your project while it is under construction. Have a look at the COPA VIP Insurance for more information on this fairly inexpensive coverage.

Taxes (At Registration And Importation)

Taxes are a reality in Canada and are mostly unavoidable. The best you can usually do is to avoid having to pay the same tax twice.

If you import an aircraft, aircraft kit or any aircraft parts you will have to pay PST (if applicable in your province of residence) and GST or HST (if you live in BC, ON, NB, NS or NL) at the border. It is important to keep receipts for those taxes paid! There are no duties or other tariffs to pay, just tax.

If you buy your aircraft, aircraft kit or aircraft parts in Canada you will pay the GST/HST and PST (where applicable) on the aircraft components as you buy them. When you register the aircraft with Transport Canada most provinces (except Alberta) will send you a letter demanding the PST or HST on the aircraft. If you have already paid the PST on the aircraft kit or individual parts as you imported them, or purchased them in Canada, then you will be able to show that the PST or HST was already paid on the aircraft. If you can't show receipts to prove that, then you will have to pay PST or HST all over again on the completed aircraft – so keep those receipts! If you haven't paid the PST on the parts then you will have to pay it when you get the province's letter.

One COPA member recently discovered a problem with constructing an aircraft outside the country. He built an aircraft in the USA while living temporarily there. CAR 507 Appendix "C" does allow this, but rather than build it as a Canadian amateur-built aircraft he registered the aircraft in the USA to a US company and applied "N" numbers to the aircraft. When he came to bring it home to Canada, Canada Customs charged him the taxes (PST and GST) on the appraised value of the aircraft. This appraised value greatly exceeded the value of the parts in the aircraft, which is what he would have been able to pay taxes on if he had registered it as a Canadian aircraft and then flown it home from the USA. Essentially he was importing a completed American aircraft and was taxed accordingly. The fact that he was paying extra taxes, above the parts value, on his own labour was not a relevant issue to Canada Customs. The other problem he faced was that the US aircraft he had built was not registerable in Canada until it had flown 100 hours on its US Special Airworthiness Certificate, as explained in CAR 507 Appendix "C".

Taxes are unavoidable, so plan to have the money available when you are presented with the bill.

Flight Requirements

Before a new amateur-built aircraft can be flown it needs to meet a few requirements. These are:

- A *Certificate of Registration* ($110 from TC)
- A *Special Certificate of Airworthiness – Amateur-Built Aircraft* (supplied by MD-RA at the time of final inspection)
- A final inspection (from MD-RA at a cost of $875 (plus HST) including the Special C of A

- Third Party Liability Insurance (as required by CAR 606.02). The minimum amount required is $100,000 for aircraft with gross weights under 2300 lbs and $500,000 for aircraft between 2301-5000 lbs)
- Weight and balance report
- Journey Logbook
- In addition, the pilot who will fly the aircraft requires:
- A pilot licence or permit for the type of aircraft flown
- A medical certificate
- A radiotelephone operator's certificate (if radios will be used)
- 100 hours in the same category of aircraft (for flying a new amateur-built in the first five hours of flight)
- A type rating if the aircraft is classified as "high performance"

Test Flying

When the aircraft is finally completed, has had its final inspection, is insured for flight and the paperwork is complete then the inevitable next step is the first test flight. This is obviously a big step in the life of the project. The US NTSB statistics show that about half of all amateur-built accidents happen in the first five hours of an aircraft's life. This indicates that many owners are not managing the risks in those first flight hours very well. There are a number of issues worth discussing here.

One of the key issues is "Who is going to fly the aircraft?" Commonly it is the owner and builder who flies the first flight and the first few hours. CAR 507 Appendix D requires that the person flying the first five hours must have 100 hours in the same category of aircraft. In the CARs "category" of aircraft means:

"when used in reference to flight crew licensing, the classification of aircraft as an aeroplane, a balloon, a glider, a gyroplane, a helicopter or an ultra-light aeroplane"

This means if the aircraft is an "aeroplane" that the person doing the test flying must have 100 hours on "aeroplanes". While that rule is a start in the right direction, that may or may not be enough

experience, or the right kind of experience, to ensure that the aircraft and the pilot make it though the first few hours unscathed. It is definitely a good idea for the pilot to have time on the actual aircraft type. This would mean a minimum of a dual checkout on the type and, especially for higher performance types, some significant amount of time on type.

One of the "rules of thumb" that has proven very useful over the years is to only have “one new item on any test flight”. If you have a new aircraft, then that is the new item. Do not also add a new pilot to the type, new location or other new factors. On each flight make sure only one thing is changed (other than needed flight safety items) for each subsequent test flight. As can be seen the best person to make the first few flights may not be the builder of the aircraft. The builder is often at a disadvantage because of:

- A lack of time on type
- A lack of flying currency, due to the time and costs involved in building the aircraft
- The emotional investment in the aircraft that can cause them to make poor decisions about when to fly or how to handle emergencies.

Obviously, the builder will get to decide who will fly the aircraft. If the builder decides to do the test flying himself or herself then they have to make sure that the odds are stacked in their favour. This means that:

- The builder needs to be current for flying
- The builder needs to be checked out on type
- The aircraft needs to be airworthy and ready to fly
- The location needs to be optimal (runway length, obstacles, rescue services, etc)
- The weather needs to be ideal (clear and calm, early morning or evening is best)

Keep in mind that the best person to test fly the aircraft may be someone other than the builder of the aircraft.

Some words on “crow-hops” must be mentioned. The term “crow-hop” refers to runs down the runway where the aircraft is allowed to take off and then the throttle is reduced and the aircraft landed again. Many builders think that crow-hops are a good idea, but the accident statistics show that they account for about half the crashes in the first few hours of flight. The reasons are pretty obvious:

- Most pilots discover that crow-hops are a new maneuver to them – pilots just do not train for taking off and then immediately landing again. Flying a new aircraft on a new maneuver is too many new things at once.

- Many pilots run out of runway while doing crow-hops and run off the end, ground loop while panic braking or decide to complete a circuit when they are not psychologically prepared to do so.

The record is clear – crow-hops are a risky maneuver. It is far wiser to make sure that you have adequate space for the first flight and then do a normal take-off. If the aircraft has problems do not be afraid to abort the take-off, but do not intentionally plan to make it a two-foot flight.
First test flights can attract a lot of spectators. This can be a problem for a number of reasons:

- They can be a distraction from doing a proper walk-around and other required pre-flight procedures

- They can cause a subtle pressure to actually fly the aircraft even though it may not be 100% airworthy or the winds and weather may not be suitable for that first flight

First flights are best done with a minimum crew consisting of a few trusted people who can, in an emergency:

- Put out any fires
- Rescue the pilot
- Call 911
- Keep other curious bystanders away from the aircraft

Lastly, it should be mentioned that first flights need to be planned. Test flights require a written checklist of items to be tested and confirmed as operating correctly or in need of rectification. The first flight should typically consist of:

- Inspection of paperwork to ensure it is complete and the aircraft is ready to fly

- Careful inspection of the aircraft itself

- Start-up, observing such items as oil pressure and cooling parameters

- Pre-take-off checks to confirm everything is working well

- A normal take-off

- A short flight to test the items detailed on the checklist, including such things as
    - Operation of landing gear
    - Brakes
    - Flaps
    - Flight controls
    - Trim
    - Radios and other avionics fitted
    - Stall speed and characteristics
    - Engine parameters, especially cooling
    - Unusual flight characteristics
- A landing followed by a careful post-flight inspection looking for things such as oil leaks.
- A recording of test flying observations and snags to be fixed prior to next flight

First flights can be a time of elation or a time of annoyance that the aircraft needs some adjustments prior to more flying. Sometimes they go very smoothly and other times they do not. Either way the builder needs to be ready for the emotions involved in a first flight. It is normal to feel elated, relief, disappointment or even sad that the building process is done. It is more common than many people suspect that the builder does not feel the elation that they expect to feel after the first flight. Sometimes it takes a few flights to get comfortable with a newly created aircraft.

No matter what the outcome, the first flight is the beginning of a process of "adjusting and more test flying" that hopefully should result in the aircraft getting better with each flight and the builder more comfortable with his or her creation.

Ken Beanlands has written an excellent article describing the test flying process on his Christavia. It is well worth reading to get a flavor for the process!

Initial Operating Restrictions

All amateur-built aircraft come with a Special C of A that includes initial operating restrictions. These are spelled out in CAR 507 Appendix D. The newly-constructed amateur-built will have restrictions as follows:

- A specific base of operations will be designated and will be the only place from which the aircraft may be flown

- The aircraft shall not be flown more than 25 nautical miles from the base designated except with written authorization of the TC Regional Manager Maintenance and Manufacturing
- The aircraft shall not be flown over any built-up area, or open-air assembly of persons
- Carriage of persons other than for dual instruction is prohibited
- Aerobatic flight is prohibited
- Day VFR flight only
- During the first 5 hours of flight, the aircraft can only be flown only by pilots who have acquired not less than 100 hours of pilot-in-command on the same category of aircraft.

This Special C of A restrictions can be modified only once the aircraft have accumulated the following flight times:

- Powered fixed-wing aircraft, helicopters and powered gyroplanes - shall be the number of hours required to rectify all design and/or construction errors plus an additional 25 hours during which the aircraft has required only the maintenance, repair, and inspection associated with normal aircraft operations.
- Fixed-wing gliders - 10 hours.
- Unpowered gyroplanes (gyrogliders) - 100 flights including 20 flights in which the towline is released at a height of not less than 30 metres (100 feet) above the surface.
- Balloons - 10 hours, including 10 flights

Final Operating Restrictions

Once the conditions mentioned above have been met the operating restrictions on the aircraft can be amended as mentioned in CAR 507 Appendix D. Normally this means that aircraft are left with just two restrictions:

- VFR flight only
- Aerobatics prohibited

It is possible to have both those restrictions removed as well, as discussed in the following sections.

IFR Amateur-Builts

Amateur-built aircraft can have the VFR-only restriction removed if they are equipped for IFR flight. The requirement is simple – however confusion with Civil Aviation Safety Inspectors- Airworthiness regarding the use of Non-Tradition equipment (electronic display equipment) has created long delays and refusal. This situation was clarified by Transport Canada in the form of a Staff Instruction document SI 500-024. Amateur-builts have to be equipped as described in CAR 605.18. This CAR specifies the equipment required for any aircraft to be operated IFR. It says:

Power-driven Aircraft - IFR

605.18 No person shall conduct a take-off in a power-driven aircraft for the purpose of IFR flight unless it is equipped with

(a) when it is operated by day, the equipment required pursuant to paragraphs 605.16(1)(a) to (h);

(b) when it is operated by night, the equipment required pursuant to paragraphs 605.16(1)(a) to (k);

(c) an attitude indicator;

(d) a vertical speed indicator;

(e) an outside air temperature gauge;

(f) a means of preventing malfunction caused by icing for each airspeed indicating system;

(g) a power failure warning device or vacuum indicator that shows the power available to gyroscopic instruments from each power source;

(h) an alternative source of static pressure for the altimeter, airspeed indicator and vertical speed indicator;

(i) sufficient radiocommunication equipment to permit the pilot to conduct two-way communications on the appropriate frequency; and

(j) sufficient radio navigation equipment to permit the pilot, in the event of the failure at any stage of the flight of any item of that equipment, including any associated flight instrument display,

(i) to proceed to the destination aerodrome or proceed to another aerodrome that is suitable for landing, and

(ii) where the aircraft is operated in IMC, to complete an instrument approach and, if necessary, conduct a missed approach procedure.

Amateur-builts do not have to have any certified equipment or instruments, but they have to meet the CAR.

Aerobatic Amateur-Builts

The “aerobatics prohibited” restriction can also be removed from the Special C of A of an amateur-built aircraft. There are two ways of doing this.

If the aircraft is on the list specified in CAR 507 Appendix D then it is already approved for aerobatics and will be eligible to have its restriction lifted with no further documentation required. The aircraft on the CAR 507 Appendix D list are:

- Pitts Special aircraft models S-1, S-1C, S-1 D, S-2E;
- Steen Skybolt;
- Cuby Acro Trainer;
- Zenair CH 150;
- Acro Zenith CH 180; and
- Christen Eagle II

Each of these aircraft has specified limitations for aerobatics in CAR 507 Appendix D.
Other aircraft can have their aerobatic restriction removed if they have a qualified pilot investigate, demonstrate and document the individual aerobatic maneuvers to be specified by TC on the modified Special C of A.

A qualified pilot to conduct this evaluation is a pilot with one of the following qualifications:

- A current Aerobatic Flight Demonstration Certificate issued by Transport Canada
- A Designated Airworthiness Representative (Flight Test)
- The holder of a current Statement of Aerobatic Competency issued by the FAA
- Current aerobatic instructors and members of recognized aerobatic organizations

- Current and former military pilots with recognized training in aerobatics

Following the evaluation TC will amend the Special C of A to permit the specified aerobatic maneuvers to be permitted. The complete procedure to accomplish this is detailed in AMA 549.101A.

Maintaining Your Amateur-Built

Amateur-built aircraft are maintained in much the same way that certified aircraft are. They both have regular maintenance according to a maintenance schedule. The main difference is that CAR 571.11 allows the maintenance of amateur-built to be signed for by the owner of the aircraft.

Unlike the case of Owner Maintenance category aircraft there is no need for the owner to be a pilot. Unlike in the USA there is no requirement for owners who are not the builder of the aircraft to have the aircraft maintained by an A&P mechanic (AME). The current owner is permitted to sign for all work done. There is no need to use certified aircraft parts either.

Like any aircraft, amateur-builts aircraft need a maintenance schedule. If you don't want to have a special maintenance schedule approved by TC then you can use the ready-made and pre-approved maintenance schedule found in CAR 625 Appendix B. Appendix B contains the requirements for an annual inspection. Appendix B is supplemented by the information in CAR 625 Appendix C. Appendix C contains all the items that are "out of phase" with the annual inspection. In other words they may need taking care of at other times of the year. The two appendices together make a complete checklist for everything you need to remember in maintaining your aircraft.

The annual inspection must be completed at intervals not exceeding 12 months or else the aircraft is grounded until the inspection is signed off. This means that if the annual was performed on July 12th last year it must be performed by July 12th this year or else the aircraft cannot be flown after July 12th until the annual is completed. As mentioned, Appendix C contains the "out of phase items". This appendix was written more with certified aircraft in mind, even though it applies to amateur-builts, so some explanation is in order. Keep in mind that the "manufacturer of the aircraft" in the case of an amateur-built is the builder, not the kit manufacturer. Here are some of the important highlights that affect amateur-builts:

- Rotorcraft Dynamic Components - At the intervals recommended by the aircraft manufacturer, inspect, overhaul or test:
    - the drive shafts or similar systems
    - the main rotor transmission gearboxes
    - the main rotors and hubs
    - the tail rotor.

- Except for aircraft that are operated under a special certificate of airworthiness in the owner-maintenance or amateur-built classification, all variable pitch propellers shall be overhauled at the following intervals:
    - (a) Where the manufacturer has made recommendations regarding the air time between overhauls, overhaul at the interval recommended or every ten years, whichever comes first;
    - (b) Where the manufacturer has not made any recommendations regarding TBO, the propeller(s) shall be overhauled at the following intervals:
    - (i) in the case of propellers installed on turbine engines: 2,000 hours air time or ten years, whichever comes first;
    - (ii) in the case of double acting propellers installed on piston engines: 2,000 hours air time or ten years, whichever comes first, or;
    - (iii) in the case of single acting propellers installed on piston engines: 1,500 hours air time or ten years, whichever comes first.
    - Information Note: The ten year overhaul intervals mentioned in (a) and (b), start either from its initial date of installation following manufacture, from its last five year corrosion inspection or its last overhaul, whichever occurred last.
- Fixed Pitch and Ground Adjustable Propellers
    - *(a)* Fixed pitch wooden propellers shall be checked for tightness after the first 25 hours of air time following their installation and at each subsequent inspection.
    - *(b)* At intervals of not more than 5 years, the propeller shall be removed from the aircraft and inspected for corrosion or other defects over its entire surface, including the hub faces and the mounting hole bores. While the propeller is removed, it shall also be checked for correct dimensions. However, if defects which require repairs beyond those recommended as field repairs by the propeller manufacturer are found, the propeller shall be repaired by an organization approved for the overhaul of propellers.

Information Note:
The dimensional check requirement does not include a check on blade twist. The dimensional check refers to changes in blade dimension resulting from repairs, particularly cropping of the tips. It is intended to ensure that the blade diameter remains within service limits.

- Engines

Information Note:
No hard time, including calendar time, between overhauls need be observed in the case of small aircraft reciprocating engines in non-commercial private operation.

- Tachometers - The accuracy of mechanical drag cup type tachometers, for fixed wing propeller driven aircraft, shall be checked on site annually, and be accurate to within the tolerances established by the aircraft manufacturer or, where no tolerance has been specified by the aircraft manufacturer, to within +\- 4% of engine RPM at mid-point of the cruise range.

- Non-stabilized Magnetic Direction Indicators (MDIs) - Non-stabilized magnetic direction indicators (wet compasses) shall be calibrated, and a dated correction card installed for each indicator, at intervals not exceeding 12 months;

- Survival and Emergency Equipment - Survival and emergency equipment shall be overhauled at the intervals recommended by the manufacturer.

- Emergency Locator Transmitters (ELTs) - Except where powered by water activated batteries, the ELT shall be checked at intervals not exceeding 12 months, in accordance with Appendix G of Chapter 571 of the *Airworthiness Manual*.
    - ELTs powered by water-activated batteries shall be performance-tested at intervals not exceeding 5 years.
    - ELT batteries shall be replaced at the interval recommended by the ELT manufacturer.

Note: Testing ELTs may require equipment beyond that found in the workshops of most amateur-builders – outside help may be required

- ELT 406 - The existing regulation CAR 605.38 that permits older ELTs (TSO C91), newer ELTs (TSO C91a) or the newest ones broadcasting on 121.5 MHz and 406 MHz (and some also on 243 MHz) (TSO C126) remains in place until such time as Transport Canada issues a revised regulation. There is no date set for the revised regulation but there will be a transition period permitted regardless of whether or not we are exempt from equipping with a TSO C126 ELT.
- Altimetry Devices - Altimeters and other Altimetry devices installed in aircraft operating under Instrument Flight Rules, or under visual flight rules in Class B Airspace shall be calibrated at

intervals not exceeding 24 months, to the standard outlined in Appendix B of Chapter 571 of the *Airworthiness Manual*.

Note: Testing altimeters may require equipment beyond that found in the workshops of most amateur-builders – outside help may be required

Information Note:
For the purpose of this section, the term "other altimetry devices" includes any air data computer, or other barometric device, providing a flight crew station, or an auto pilot, or automatic pressure altitude reporting system with altitude data derived from static pressure.

- Air Traffic Control (ATC) Transponders - ATC Transponders, including any associated altitude sensing reporting mechanisms, where installed, shall be tested every 24 months, in accordance with Appendix F of Chapter 571 of the *Airworthiness Manual*.

Note: Testing transponders may require equipment beyond that found in the workshops of most amateur-builders – outside help may be required

All work signed off by the owner of an amateur-built aircraft shall include the statement required in CAR 571.10:

"The described maintenance has been performed in accordance with the applicable airworthiness requirements."

Most builders have little trouble maintaining amateur-built aircraft because they built the aircraft and know it intimately. If you buy a used amateur-built you have the choice of learning the skills needed to maintain and repair the aircraft or else using outside help. There are many sources of help that the new owner can make use of. These include:

- AMEs
- AMOs (TC Approved Maintenance Organizations)
- Other amateur-builders
- Commercial welders and other specialists

Being able to do your own maintenance is one of the most fun and rewarding parts of owning an amateur-built aircraft, whether you built it yourself or bought it used.

Repairs and Modifications to Amateur-Builts

Repairs or modifications to an amateur-built aircraft are required to conform to CAR 571.06 Repairs and Modifications which says that "All other modifications and repairs shall be performed in accordance with "acceptable" data."

The same CAR defines "acceptable data" as:

"(a) drawings and methods recommended by the manufacturer of the aircraft, component, or appliance;

(b) Transport Canada advisory documents; and,

(c) advisory documents issued by foreign airworthiness authorities with whom Canada has entered into airworthiness agreements or memoranda of understanding such as current issues of Advisory Circular 43.13-1 and -2 issued by the FAA, Civil Aviation Information Publications (CAIPs) issued by the Civil Aviation Authority (CAA) of the United Kingdom, or Advisory Circular, Joint (ACJs) issued by the Joint Aviation Authority (JAA)."

You should note that the builder is the "manufacturer of the aircraft" and therefore you can design your own data – it just has to be documented. This could simply be a leaflet that describes what was done and illustrates it with photographs of the work as it was assembled.

These requirements are also reflected in CAR 507 Appendix C by the following statements in the information notes following paragraph 71 – at the end of the document:

(ix) Repairs and modifications to amateur-built aircraft must conform to technical data acceptable to the Minister; sources of acceptable data include, but are not limited to:

- *a) drawings and methods recommended by the manufacturer of the aircraft kit, component, or appliance;*
- *b) Transport Canada advisory documents;*
- *c) FAA Advisory Circular 43.13-1 and -2, UK CAA Civil Aircraft Inspection Procedures (CAIP), JAA Advisory Circulars, (ACJ) and publications issued by recognized authorities on the subject matter concerned.*

(x) Owners may devise their own data, which need not be approved, but must be subject to an appropriate level of review or analysis, or be shown to comply with recognized industry standards, or commonly accepted practice.

(xi) Changes that affect the structural strength, performance, power plant operation, or flight characteristics of an amateur-built aircraft must be reported to the Minister before further flight of the aircraft; such changes may require re-evaluation to confirm that the aircraft continues to comply with the applicable standards.

(xii) The Minister is the final authority for determining the acceptability of data.

The last note is worth paying attention to – ultimately the Minister of Transport, in the person of his delegated inspectors, has the last word as to whether the data you have presented is acceptable.

Handheld Fire Extinguishers

Most pilots know that all powered aircraft except ultralights need fire extinguishers. That requirement is outlined in CAR 602.60 but that CAR is pretty general in nature. It just requires "a hand-held fire extinguisher in the cockpit that is

- of a type suitable for extinguishing the fires that are likely to occur,
- designed to minimize the hazard of toxic gas concentrations, and
- readily available in flight to each flight crew member"

That CAR doesn't tell you what standard the fire extinguisher has to meet, if any and doesn't refer to anywhere else in the CARS to look for a standard for fire extinguishers.

As is common in the CARS there is a standard, but it is well hidden and not cross-referenced from the regulation.

The standard for fire extinguishers is hidden away in CAR 551.400. This CAR indicates that it is the standard for "Hand-Held Fire Extinguishers required by CAR 602.60, 604.41, 704.83 and 705.93." and includes this information note:

"As required by CAR Part VI and VII requirements, hand-held fire extinguishers shall contain a type and quantity of extinguishing agent suitable for the kinds of fires likely to occur in the compartment where the extinguisher is intended to be used. For crew and passenger compartments, hand-held fire extinguishers shall be designed to minimize the hazard of toxic gas concentrations."
It then lists the acceptable standards that hand held fire extinguishers must comply with. These are any of:

- TSO C19b,
- approved by Underwriters Laboratories of Canada, bearing ULC approval label; approved by the British Civil Aviation Authority (BCAA) for aircraft use;
- approved by the Federal Aviation Administration (FAA) for aircraft use, including extinguishers approved to TSO-C19b "Portable water-solution type fire-extinguishers";

- approved by Underwriters Laboratories Inc. (U.L.), Factory Mutual Research Corporation to specification U.L. 1093 (construction and operation), and to specification U.L. 711 (rating and testing);
- approved by U.S. Coastguard under title 46 of the U.S. Code of Federal Regulations, for use in aircraft;
- approved for aircraft use by the airworthiness authority of any country, whose standards are accepted by the Minister.

The CAR then gives information on the installation: “The installation of hand-held fire extinguishers shall be such that when properly secured in its mounting:
(1) the extinguisher will remain secure when subjected to the ultimate inertia loads established by the aircraft basis of certification, but not less than the following ultimate load factors:

Load Factors	Aeroplanes	Rotorcraft
Forward	9.0	4.0
Sideward	1.5	2.0
Upward	2.0	1.5
Downward	4.5	4.0

(2) the extinguisher will have a "quick release" function to enable easy removal from its mount.

The standard then finished with requirements for Identification and Markings:

(1) The hand-held fire extinguisher shall be identified and marked with the applicable specifications as determined by the approving authority per paragraph (b).

(2) A stowage compartment or stowage container that contains a hand-held fire extinguisher shall be clearly marked as to its contents.”
So as long as your installed handheld fire extinguisher meets one of those stated standards and is mounted as described then it will meet the CAR requirements.

Licenses to Fly Amateur-Builts

All amateur-builts require a pilot licence and medical certificate to fly in Canada. Amateur-builts are not considered a separate category of aircraft for licensing and so the qualifications to fly them are the same as if they were a certified aircraft. This means that to fly a:

- Amateur-built airplane you need an airplane licence:
  - *Private Pilot Licence – Aeroplanes*
  - *Commercial Pilot Licence – Aeroplanes*
  - *Airline Transport Pilot Licence – Aeroplanes*
  - If the amateur-built aircraft is single-engined and is non-high performance then it can be flown with a *Pilot Permit – Recreational Aeroplanes*, provided that only one passenger is carried.
  - If the amateur-built aircraft is 1200 lbs or less and has a stall speed (V_{SO}) of 39 knots of less then the minimum licence is a *Pilot Permit - Ultralight Aeroplanes* (although this licence does not allow the carriage of passengers unless you have added the *passenger carrying rating*)
  - Note – all amateur-built aeroplanes that are considered "high performance" require a type-rating to fly. See "Type ratings" below.

- Amateur-built helicopter you will need a helicopter licence:
  - *Private Pilot Licence – Helicopters*
  - *Commercial Pilot Licence – Helicopters*
  - *Airline Transport Pilot Licence – Helicopters*

- Amateur-built gyroplane or gyroglider you will need a:
  - *Pilot Permit – Gyroplanes*

- Amateur-built glider you will need a:
  - *Pilot Licence – Gliders*

- Amateur-built powered glider you will need a:
  - *Pilot Licence – Gliders*

- Amateur-built balloon you will need a:
  - *Pilot Licence – Balloons*

- Amateur-built airship you will need a:
  - *Pilot Licence – Balloons*, with a type endorsement for each airship type

Type Ratings

What if the aircraft you are looking at is classified as a "high performance aircraft"? This happens when an amateur-built aircraft has:

- A wing loading over 13.3 lb/sq ft with no flaps or
- A wing loading over 20.4 lb/sq ft with flaps or
- A V_{NE} of over 250 knots or
- A V_{SO} of more than 80 knots

As explained in CAR 421.40 if your aircraft is "high performance" then it is not a showstopper, you will just need a type rating. The requirements for the rating are fairly straightforward:

High Performance Aeroplane
(i) Knowledge
An applicant for an individual aircraft type rating for a high performance aeroplane shall have completed ground training on the aeroplane type.
(ii) Experience
An applicant shall have completed flight training and have acquired a minimum of 200 hours pilot flight time on aeroplanes.
(iii) Skill
Within the 12 months preceding the date of application for the rating, an applicant shall have successfully completed a qualifying flight under the supervision of a Transport Canada Inspector or a qualified person qualified in accordance with CAR 425.21(7)(a)

If the type of aircraft is a single seater with no two-seat trainer available, then TC will accept training on a similar type of aircraft. In that case talk to your local TC Licencing Inspector first to ensure the suitability of the aircraft you are considering.

Canadian Amateur-Builts In The USA

Canadian amateur-built aircraft are allowed to fly in the USA. The current procedure to do this is very simple. All you need to do is print out the FAA Authorization, sign it, comply with the restrictions on it and carry it with you while in the USA. That is all there is to it!

Selling Your Amateur-Built

Selling an amateur-built aircraft is no different from selling any other aircraft. You advertise it to find a buyer, exchange a Bill of Sale for a cheque and the new owner flies the aircraft away. Forms for selling any aircraft can be found in The COPA Guide to Buying an Aircraft. The one question that has been asked by sellers of amateur-builts is "what can be done about the potential liability of selling an aircraft that I built?" Currently in Canada there is no aircraft construction insurance available for amateur-builders, so your best protection maybe a combination of careful construction and maintenance on the aircraft to be sold, disclosing all potential problems with the aircraft and perhaps having the new owner sign a waiver as a condition of the sale.

Buying a Used Amateur-Built

Buying a used amateur-built aircraft is no different than buying any other type of aircraft. The COPA Guide to Buying an Aircraft provides a lot of useful information on the subject and includes *Offer to Purchase* and *Bill of Sale* forms along with sample partnership agreements and many other resources.

Importing an Amateur-Built

Importing an amateur-built aircraft was not possible until CAR 507 Appendix C came into effect in 2002. COPA's action on this issue was instrumental in changing the rules so that amateur-builts can now be imported from many other countries. To import an amateur-built from another country you have two ways of doing it (three in the case of lighter aircraft, under 1200 lbs, as explained below).

The aircraft can be imported:

- If it is not complete and is in the "pre-cover stage" then it can be imported and finished in Canada. For most aircraft that means wing, fuselage and tail skins are not installed, so that it can have its MD-RA pre-cover inspection done. It needs no permission to bring into Canada at this stage, just import it (via trailer!) and then register it as a project with MD-RA, finish it and have MD-RA do the pre-cover inspection, when you are ready;

- If it is finished and flying and has 100 hours total time on the airframe then it can be imported as allowed in CAR 507 Appendix C, with only an inspection of the finished aircraft when it comes into the country. Transport Canada, Aircraft Maintenance & Manufacturing Staff Instruction, MSI 2008-11-26 section 2.3 Delegation of Authority (b) In consideration of the fact that an imported amateur-built aircraft is considered to be a new Canadian amateur aircraft project, it is within the delegation of authority of the MD-RAs to conduct the inspection and issue the original Canadian special certificate of airworthiness – amateur-built.

NOTE: *If the aircraft is past the point in construction where the fabric and wing skins are installed and does not yet have 100 hrs flying time on it then it can't be imported as an amateur-built without taking it back to the pre-close up stage.*

- In the case of an aircraft that has a stall speed of 39 knots (45 mph) or less and a gross weight under 1200 lbs, it can be imported at any stage at all and registered as a basic ultralight in Canada with a C-I registration. The main drawbacks to this category over the amateur-built category are that basic ultralights cannot carry passengers and you must wear a helmet when flying it. Consult the *COPA Guide to Ultralights* for more information on this subject.

NOTE: Basic ultralights can fly with two pilots on board or with a student and instructor, so if your planned passenger is a pilot (with privileges on the aircraft) then that will not be a problem.

Join a Club

One of the best ways to learn about building your own aircraft and find support and encouragement is to join a club and mix with others who are further along the pathway. In Canada the following organizations are great sources of aircraft building knowledge.

- **COPA Flights** – the local chapters of COPA usually include many amateur-builders and ultra-lighters. Some COPA Flights are dedicated to building and flying your own plane. The COPA website lists well over 200 local COPA Flights right across Canada.

- **RAA Chapters** – the 49 local chapters of the Recreational Aircraft Association are a great resource to the amateur-builder. Their website lists chapters across Canada.

- **EAA Chapters in Canada** – The US Experimental Aircraft association has chapters in Canada that are also a great resource for the aircraft builder. Their website has a searchable database of local chapters in Canada.

Aircraft Type Clubs

Aircraft type clubs can provide a wealth of information on specific aircraft types and variants. There are literally hundreds of these clubs around the world providing services to many, if not most, aircraft types that have been produced in any significant numbers. Many amateur-built aircraft designs have their own type clubs.

Type clubs vary a lot in the services they offer and how they work. Some are simply volunteer clubs run by one enthusiast, using a free web service to provide a website. These often have minimal publications or services. On the other end of the scale some of the largest types clubs have a fulltime staff and offer a full range of services.

Here are services that some type clubs offer:

- A magazine to pass type-related information, news and events
- A website, often with type-specific buyers checklists
- Technical question support from aircraft type experts
- Buyers guides
- Conventions and fly-ins
- Type specific classified ads (often on-line)
- Background and aircraft type historical information
- Maintenance tips publications
- Operating tips information
- Maintenance and aircraft systems courses
- Aircraft type conversion training programs
- Type specific insurance (often available in the USA only!)
- Formation flying training
- Scholarships
- Many other possible services

In some cases, with highly popular aircraft designs you may find that there are competing type clubs that both offer services for the same aircraft type or types. In those cases you have the choice of clubs, or you can join them all!

COPA supports aircraft type clubs – they serve a great need in the aviation world, providing type-specific technical information and support that is not provided by anyone else. Consider joining and supporting the club for the type of aircraft that you buy – most of them are well worthwhile. What if you check and discover that there is no type club for your aircraft type? Well then, consider starting one. With free web services on which to post a website it can be done for no cost. If nothing else you will meet many more fans of the aircraft type you own!

Amateur-Builts Versus Ultralights

Many lighter amateur-built airplane designs can also be built and registered as ultralights. If the aircraft is under 1200 lbs gross weight and has a Landing Configuration Stall Speed (V_{SO}) of 39 knots or less then it can be built as a basic ultralight aeroplane (BULA) instead of amateur-built. There are pros and cons to this approach:

Pros:

- BULAs do not to be inspected by any outside agency, thus saving money on inspections
- BULAs do not have any maintenance standards
- BULAs do not have any design standards
- BULAs do not have to carry some equipment that amateur-builts do, like:
  - ELTs
  - Operating checklist or placards
  - Aeronautical charts and publications
  - Fire extinguisher
  - Timepiece
  - Flashlight
  - First aid kit
- BULAs do not have to meet VFR instrument and equipment requirements
- BULAs can be used commercially for flight training and hang glider towing
- BULAs have simplified paperwork requirements – C of R only required, no Special C of A or logbooks required
- BULAs can be purchased new and completely assembled – no 51% rule
- BULAs do not need to comply with Destination Fuel requirements (destination plus 30 minutes worth of fuel)
- BULAs are not required to carry survival equipment
- BULAs do not need to file an *Annual Airworthiness Information Report*

Cons:

- BULAs cannot carry passengers (however two pilots can fly together, provided they both have licences that would let them fly the aircraft. Also a student and instructor can fly together)
- You need to wear a helmet in a BULA
- BULAs have restrictions on airspace – they cannot be flown in controlled terminal airspace. Since February 15, 2010 exemption from 602.29(1)(c), for operation in Class E airspace, BULA shall be equipped with a portable or fixed altimeter and for cross country flight in Class E airspace, the BUAL shall be equipped with a portable or fixed magnetic compass or GPS receiver.

Another alternative is that some kit aircraft under 1232 lbs and with a V_{SO} of 39 knots or less can be built as an advanced ultralight aircraft (AULA), if the kit manufacturer has declared that the aircraft complies with the LAMAC publication *Design Standards for Advanced Ultralight Aeroplanes.*

As in the case of the BULAs there are pros and cons in comparison to amateur-builts:

Pros:

- AULAs do not need to be inspected by an outside agency, unless the factory requires it (some do and there is usually a fee if they do)
- AULAs have simple maintenance standards (they must follow the factory approved standard)
- AULAs do not require logbooks, just maintenance records
- AULAs do not have to carry some equipment that amateur-builts do, like:
  - ELTs
  - Operating checklist or placards
  - Aeronautical charts and publications
  - Fire extinguisher
  - Timepiece
  - Flashlight
  - First aid kit
- AULAs can be used commercially for flight training and hang glider towing
- AULAs have simplified paperwork requirements – C of R only required, no Special C of A or logbooks required
- AULAs can be purchased new and completely assembled – no 51% rule
- AULAs do not need to comply with Destination Fuel requirements (destination plus 30 minutes worth of fuel)
- AULAs are not required to carry survival equipment
- AULAs do not need to file an *Annual Airworthiness Information Report*

Cons:

- Modifications require written authority from the kit manufacturer – if they go out of business then no further modifications are allowed
- AULAs must be built from a kit or sold completed, no building from plans allowed
- Manufacturers may issue “Mandatory Actions” similar to ADs for certified aircraft.

For more information on ultralights see The COPA Guide to Ultralights.

Building An Ultralight Kit As An Amateur-Built

Most aircraft kits that fit the ultralight category can also be built as amateur-built aircraft. Since the amateur-built rules allow bigger and heavier aircraft than the ultralight category, any kit that would qualify as an ultralight will fit the basic amateur-built definition. Some of these kits will also require a 51% determination, if they have not been assessed at the factory request before. See the section on 51% determination for more information.

Many Canadian kit manufacturers produce different versions of their kits for the ultralight and amateur-built markets. These ones are easy to assess; they will usually require no changes to be built as amateur-builts. Other manufacturers produce their aircraft strictly for the Canadian ultralight category. These may need some serious changes to fit them into the amateur-built category. The Canadian amateur-built rules and construction practices differ from normal ultralight construction methods and so there will probably be a requirement that some of the materials be changed to fit the aircraft into the amateur-built category.

Some common examples of possible changes required could be:

- Amateur-builts require a fuel indication system, whereas many ultralights do not have one
- Amateur-builts must usually have a minimum of 1/8” 7X7 cable for rudder controls, whereas many ultralights use smaller cables.
- Changes will be needed to accommodate required items such as fire extinguishers and ELTs
- The fuel system will require a gascolater filter system
- The engine intake manifold system will require a carb heat system
- There may a need to change bolt sizes and uses as well as nut safety devices, especially in hinge areas and controls
- Many other possible changes

MD-RA can provide more information on these and other requirements as they apply to specific kit designs. It would also be very useful to contact someone who has built a specific ultralight kit as an amateur-built to ask them what changes were required, if any.

Can Certified Aircraft Become Amateur-Builts?

This question is often asked when an aircraft owner has a certified aircraft that they want to rebuild, restore or modify and this can’t be done within the certified category using STCs and LSTCs for the design. The short answer is “yes”, if you can meet the 51% determination rules during a tear-down and re-build of the aircraft. There are amateur-built aircraft flying in Canada that have been constructed

from certified parts in whole or in part. The builder will have to construct or supervise the construction of the major portion of the aircraft for the aircraft to qualify as an amateur-built.

For more information on how this might apply to a specific aircraft project contact MD-RA.

Can Existing Ultralights Become Amateur-Builts?

This is another common question – can I convert my already flying ultralight to an amateur-built? Some ultralight owners want to do this to allow their BULA to carry a passenger. The answer is that it is possible. The aircraft will have to be dismantled to the point where it is prior to the point of a "pre-cover" inspection. That means all wing and fuselage skins will have to be removed for inspection. In the case of Dacron envelopes this may not be difficult – in the case of metal skins it may be very hard. In the case of composite aircraft, it may be impossible.

After the pre-cover inspection the aircraft will then need to be completed in complete compliance with the amateur-built standards, including the required instruments and equipment and subjected to the final inspection, just like any other amateur-built. In most cases the cost and effort will not be worth it, but if you are going to totally dismantle an ultralight airplane for a complete restoration then it may be possible.

Contact MD-RA for more information on the requirements.

Appendix A - References For Building

There are literally hundreds of excellent publications, videos and references for building your own aircraft. This is a very short list of just a few of the more useful publications and websites.

- **The Standard Aircraft Handbook**, published by Tab Aero Books, edited by Larry Reithmaier ISBN 0-8306-8634-7. An excellent pocket reference that outlines how to select and use aircraft hardware, materials and techniques. It is widely available from outlets such as Chapters in Canada.

- **The FAA publication AC 43.13-1B Acceptable Methods, Techniques and Practices, Aircraft Inspection and Repair** - has an entire chapter on weight and balance (Chapter 10) and is the standard reference on the subject. It also gives complete information on all accepted practices for all aircraft. An invaluable reference to have! The good news is that you can download the entire book for free in Adobe Acrobat format from the FAA website. It is also widely available for sale in a paper version. One such source of the paper version is Aircraft Spruce and Specialty.

- **Tony Bingelis' fabulous series of books**. His works cover everything the plans and kit builder needs to consider, all in a very straightforward and entertaining style. Each book is profusely illustrated with the author's own drawings and published by the EAA Aviation Foundation. They are widely available from suppliers such as Aircraft Spruce and Specialty . The four volumes are:

- **The Sport Plane Builder**

- **Sportplane Construction Techniques**

- **Firewall Forward**

- **Tony Bingelis On Engines**

- EAA's *AeroCrafter* – a listing of all the available designs and lots of useful building information and articles.

- **EAA Canadian Council's Info-To-Go Builder's Handbook Amateur-Built Aircraft** is a great reference that covers most of the rules and procedures that Canadians need to know to build an amateur-built aircraft. The best part is that the book is available on paper at no charge from:

Rem Walker, 2348 Garnet Street, Regina SK S4T 3A2
Phone 306-352-6442 Fax 306-565-0694 (no e-mail)

- **The Aircraft Spruce and Specialty Company Catalogue**. Not only does this company offer just about every piece of hardware and other materials for the aircraft builder but also the catalogue itself is an excellent reference of what is available and how to use it effectively. The catalogue can be ordered on paper from 1-877-4-Spruce or downloaded from their website www.aircraftspruce.com.

- **The Wicks Aircraft Supply Catalogue**. A great reference with clear illustrations showing all the hardware you can imagine – many hard-to-find items are illustrated. You can order this reference from them at 1-800-221-9425 or at www.wicksaircraft.com

- **The MD-RA website** www.md-ra.com - outlines the procedures and fees for getting your aircraft inspected in Canada.

- **KitPlanes Magazine** is an excellent reference and their website www.kitplanes.com offers many free resources for the aircraft builder.

- **Airworthiness Manual Advisories** - TC originally issued the Airworthiness Manual Advisories (AMAs) as advice and information for amateur-builders as part of Airworthiness Manual Chapter 549. Recently TC has decided to re-issue these as Advisory Circulars. They are a great resource and contain a lot of useful experience and knowledge. They are recommended reading! The new Advisory Circulars can be found on the TC website.

Diary of an Amateur Test Pilot

by Ken Beanlands

Editor's Note: *This great article by Calgary amateur-builder Ken Beanlands really gives good insight into the process of test flying your own plane*

In 1989, I embarked on a project I estimated would take 5 years to complete, the building of a Christavia MK 1 airplane from scratch. Just shy of 15 years later, it finally flew. Over the 15 year period, the plane was moved from it's original home in St. John's, Newfoundland to Calgary in 1995, then to a new house in 2001 and finally to a hanger at Glen Bishell's airstrip just east of Carstairs.

Although 15 years seems like a long time, there were fairly large stretches of inactivity while I worked on other projects around the house not to mention the time it took to build up a shop that matched my father's in Newfoundland where the Christavia was hatched. I also started building at a very early time in my work career, merely out of university 6 months, which introduced delays while I saved up for materials and tools. The total number of hours to build was near 3000, although I could now do it in half the time with the tools and experience I now have. By far, the greatest amount of time was around the changes I made to the original design.

I have had a great deal of help in this project. First, by my parents in Newfoundland who let me use their shop and tools to start construction. I've also had a great deal of help and advice from numerous members of both the RAA Calgary chapter and the Calgary Ultralight Flying Club. Most recently, Glen

Bishell and Mike Sweere have been a tremendous help in the final assembly and first flights of the plane. Of course, the greatest source of assistance has been from my wife. Renee has helped out on numerous occasions, covered half the plane, listened to me gripe and complain about parts that didn't fit or corners that I painted myself into, and has been totally supportive of this entire endeavor (she's even supporting the idea of a Bearhawk...). Without her support, the plane would never have flown.

Despite being heavier than I had hoped (empty is at 1114 lbs, gross at 1650 lbs) and a little nose heavy, the plane seems to be exactly what I was looking for. I decided to pull together the notes I had made and share them with you.

July 5, 2004

Well, after 14 years and 10 months of building, C-GREN (AKA Chrissy) finally took to the air this afternoon for a quick 10 minute flight around the patch. The flight was cut short by an oil temperature that was dangerously close to the redline. The temp had stabilized at about 220 during the taxi testing just prior, but in the air, it hit about 240, just below the redline. Also, the oil pressure started dropping to the minimum
at this temp. I suspect the culprit is a prop with too coarse a pitch and too small an air duct to the oil cooler (currently 2"). I can also seal up the seal around the oil cooler a bit better to help this.

On the plus side, the CHT's were perfect at 300 F, right in the middle of the 240-400 F operational range. The old T&B gyro I was using is not up to the task so it'll be removed in favor of a simple skid indicator. The red flag was on before I took to the air, and the breaker popped in flight. No biggie there, I only installed it to use the ball anyway.

Other than a little heavy on the left wing, easy to fix with the adjustable for end in the rear strut, she flew great. Even with a very coarse prop, I was seeing 600-700 fpm at about 65 mph indicated and at a gross weight of 1524 lbs.

I had started with taxi tests doing about 12 runs varying from walking speed up to about 40 mph with the tail high. The only problem noted there was that the bottoms of the rudder pedals were too far forward and I kept dragging on the brakes. A 10 minute fix added two 3/4" blocks to the bottom of the pedals, and everything was good.

The take-off was done by letting the speed come up to about 35 and pushing the tail up to level. She flew off at about 45 and started to climb at about 50 mph. Climb was good and for a moment I had a feeling of pure elation and then absolute dread at what I was doing! What makes me think that I can build and fly a plane!! I shook it off by telling myself that I was flying the Citabria. When the voltmeter dropped to zero, I immediately realized that the gyro breaker had popped and remembered that the voltmeter was tied to it. I tried to cycle it, then left it off having figured out the problem.

I had planned on climbing to 3000' AGL and trying a couple of stalls, but the oil temperature was really concerning me and I was worried at what a continued full power climb would do. So, I decided to try a couple of stalls at 2000' to try and establish some sort of approach and landing speed. I could not get it to break at all and she was still climbing at 30 mph indicated. I'm very pleased with the stall characteristics.

I flew the approach at 65 and had to forward slip a little to compensate for the light, left crosswind. The landing was a little long and included a flare that was a little high and maybe a bit hot, but resulted in only a little bounce. The bungee gear really absorbed the energy and helped it really stay planted.

My wife, Renee, caught the whole thing on video tape including a few little sobs on take-off and landing. Unfortunately, it will be a week or so before I can fly again as we leave for Arlington in the morning.

July 18, 2004

Well, the whole thing was put on hold for 6 days while we went to Arlington. This was good as I got a chance to consult with several "experts" I know and came up with a plan of attack.

I put together an order on Monday and had the parts on Tuesday evening. I went out to the airport on Wednesday and started hauling things apart.

The first step was to remove the faulty T&B gyro and replace it with a blanking plate. Since I only really installed the thing to use the ball, I got a lightweight slip indicator that screws into the bottom of an existing 3-1/8" instrument, in my case the ASI. In the process, I dropped 2 lbs from the plane...good.

Then I tackled the rudder pedals. I have a pair of stamped aluminum pedals off a Traumahawk (I believe) which I attached to the existing 1/2" tube framed rudder pedals. The new pedals have a 1" relief at the heels that has solved the problem nicely and only added 6 ozs

The third challenge was to replace the current oil cooler shroud and duct with a better one. The original was an old carb heat air box that I modified. The seal around the bottom wasn't that great (3/8" gap at either end) and it was fed by a 2" hose coming from the nose bowl. This was replaced with a 3" hose from the right, rear baffle. I built a whole new shroud from 0.032" aluminum and in the process saved another 1 lb over the original installation.

I finally finished everything yesterday evening. The winds were only 4 kts, but unfortunately were 90 degrees to the runway!

This morning, I went back out. The winds were pretty much down the pipe at 5-10 kts so I pulled out the plane and fired it up for a quick check of the firewall forward changes. Just before shutting down, I

heard a homebuilt call in on downwind. Fellow chapter members Ralph Inkster and Calvin Thorne dropped in to check on my progress in Ralph's Caviler, an all wood, low-wing trike (currently for sale). Shortly after, my wife, Renee showed up. We gabbed for over an hour while I waited to see what the winds would do. Finally, with no more excuses, I decided to go for another flight.

I arranged with Ralph to fly chase while Calvin took a few digital pictures for posterity. Since he was quite a bit faster, I took off first. This time, the oil temperature settled nicely at 220F indicated (which I've determined is about 210F really) despite the 31C temps! The cylinder head temperature on #4 and #2 jugs (right ahead of the 3" hole I cut in the baffles) actually DROPPED and never came above 200F.

By the time I was on downwind, Calvin had caught up with me. The first thing I was able to determine is that the ASI is off by about 13 kts. He was showing 90 kts and I was indicating 77. This was also confirmed by GPS. I was doing 93 kts on one heading and 73 kts on the reciprocal while indicating 70 kts. I'll have to fiddle with the pitot and static lines to solve this one I think.

Another thing that became apparent is that the trim is mostly ineffective. I'm pretty certain that gap seals will solve the problem. Finally, I determined that the left wing low problem I was experiencing before is actually a need for a rudder trim tab, not a wing twist. After 10-15 minutes of formation flying, Ralph broke off and headed home. We had a great deal of static between the radio transmission between the two planes when they were in close proximity, but once he got over 1/2 mile away, it cleared up nicely. Talking to other aircraft in the area also indicated that I was transmitting and receiving clearly at least 25 NM to Beiseker.

I was able to get one nice, crisp stall at just under 30 mph indicated, which is probably closer to 40 mph CAS. I think the fact that I'm at the forward point in the CG envelope is making it hard to fully stall.

One other thing I noted was that full throttle cruise yields only 2500 RPM and 2350 on the ground. I'm going on the assumption that I should have almost redline RPM at full throttle. I'm also slightly over-square (about 2" worth) which I'd like to fix. I'm thinking that I should go to a 53" pitch rather than the current 57".

The main performance concern I have right now is that the acceleration on take-off is lower than I'm happy with. The Citabria at gross was certainly off quicker from the same field than I'm getting solo. However, the plane is still climbing at 600-700 FPM despite the coarse pitch at relatively high density altitudes. I'm certain that the prop fix will solve this. Anyway, 40 minutes later I was back on the ground after another very successful flight.

July 23, 2004

After waiting since Sunday, the boomers finally left us alone last evening. Temperatures were cooler

than they had been at about 20 C. I arrived at the airfield later than I had planned at 7:30 PM and started in on the gap seals for the trim. Then I refueled, preflighted the plane and pushed her out. Mike was out mowing the property but he was the only one around so I told him my intentions and he said he'd keep an eye out for me.

The engine caught on the second or third blade as normal and settled into it's normal idle, rough by Lycoming standards, but quite normal. After the oil temp gauge showed about 120F, I did a run-up. After consulting with the engine manual, I'm now quite comfortable with the 175-200 RPM mag drop at 1800 RPM. The manual allows for 250 as long as the difference between the drops is less than 50 RPM.

A quick check of the sock showed that the winds were still flat calm so I taxied to the north end of the field to take advantage of the down-hill run. The take-off was fairly normal although it seemed a bit shorter despite the lack of wind, probably due to the fact that I'm getting used to the plane and the cooler temps. Climb was steady at about 600 fpm with a gross of about 1525 lbs.

The mission for this flight was to start the break-in of the engine. The manual makes no mention of the break-in procedures, so I used the advice that I gleaned from the experts at Arlington and plan to run it at full power for about 5 hours. This would be the first hour.

The air was perfectly still and I didn't hear a single radio call all evening. It was hazy with visibility down to about 4-5 miles. The first thing I noticed was that the trim was now MUCH more effective with the gap seals in place.

The controls, left to their own devices, are currently uncoordinated requiring a bit of left aileron and right rudder to straighten up. This will be fixed before the next flight with a fixed rudder trim and adjustments of the strut fork-ends.

Then I played with the cruise speeds. The ASI is still registering low despite my attempts to straighten the pitot tube a little. I think I'll try flaring the end a little to compensate. However, according to the GPS, the winds were less than 2 kts and the full throttle cruise at 2500 RPM and 6000' is 96 kts! That's 110 mph! Not bad at all.

After about 45 minutes, I decided it was time to land. The first approach was way too high and hot. I aborted. The second approach was better, but I still touched down a little hot, and about 2/3 up the runway. Fortunately, I landed uphill and had more than enough time to stop. I think that the combination of an 800 rpm static idle (right at the minimum RPM range specified in the manual) and the coarse, 57" prop is actually giving me a 0 to positive thrust condition on final rather than the negative thrust normally experienced when I pull the power back to idle on the Citabria. I'll have to adjust my circuit and approach accordingly until I get the prop pitch changed next week to 54".

After shutdown, I noticed that I have a small leak developing at the T-fitting in the bottom of the tank that splits off my sight gauge. I have a spare so that will be first on my list tonight. I checked the oil and noticed that I consumed about 1/2 liter over that 1 hour, which is not unusual for a new engine. I also need to clean off the port bungee as the full power, full rich setting is blowing back a little carbon. I plan to cover them with a vinyl covers as seen on the J-3.

I've also noticed that the stick is a little too far forward to be comfortable, so I plan to bend it back a bit to a more comfortable position. So, it looks like tonight will be a maintenance night rather than a flying night. At any rate, testing is progressing well. If I can get all the snags fixed tonight, I'll be flying again tomorrow morning.

You can Tuna Fish, but can you tune a plane?

The last time we met, Chrissy my newly completed Christavia MK 1, had just completed its third flight, accumulating 1.9 hours. So far, no serious problems have been encountered although a number of small issues are being addressed.

The hope had been to finish the 25 hour test flight phase by the time the Calgary Ultralight Flying Club left on their infamous annual Air Adventure Tour. With only a couple of days left before we leave on vacation and only a week after that before the Tour, this target is no longer achievable. However, I'm having so much fun flying the plane, I'm not that disappointed about not flying the Tour, although I do plan to provide ground support.

July 24, 2004

This morning was flight number 4 for Chrissy. Prior to the flight, I changed the wing twist by 2.5 turns on each side to take out the right wing low trim. I also replaced one of the AN fittings under the tank to remove a slow fuel drip I was getting. While filling the tank, I took measurements at 2.5 gallon intervals to calibrate a dipstick.

I had also noticed that the stick was not comfortably positioned, so I swapped in a strait stick in place of the original stick that's offset forward by about 3"-4". The strait stick just clears the front of the seat.

Finally, I lengthened the turnbuckle on the left rudder cable to help with the left pull. However, I won't add a trim tab until the break-in is finished and I can run at part power again to figure out what's needed in cruise.

The weather was clear with visibility about 8-10 miles in haze. Winds were straight down the pipe at 8-10 kts out of the south. Just as I was ready to taxi out to the runway, a Cherokee showed up. This is an unusual event at Bishell's as there are seldom drop-in visitors. After a check of the sock and final, I taxied to position and took off.

The first thing I noted was the fact that the plane now flew hands off (but not feet off, it still requires a little right rudder) and was far more comfortable with the new stick position.

I decided to lean out the mixture for the full-power flight as I had accumulated a lot of carbon on the left bungee the previous flight. However, shortly after take-off, I noticed the oil temp climbing so I richened the mixture which dropped the temps to normal.

This morning, I took closer notice of the GPS altitude and noticed that it was consistently out by 300-350 feet from about 3500' AGL up to 6500' MSL despite the fact that the GPS and altimeter were only out by 9' on the ground. The Altimeter is showing low, which means the static pressure is too high. This is confirmed by the airspeed being low since the difference between static and dynamic pressure is too low. I'm going to try putting a small O-ring on the static tube ahead of the static ports.

After an hour, I decided that it was time to land. The approach and landing were a lot better as I ignored the altimeter and flew the circuit using the GPS altitude settings. I had far better results than the Thursday night flight as I'm sure I was flying that one 300' high, requiring a quick dump of a lot of altitude on short final.

Oil consumption is still around 1/2 liter per hour. I plan to do another 2-3 hours at full power to assist the break-in before continuing the test flying. I'm starting to get a little more confident in my abilities and the airplanes abilities, but I'm really looking forward to the lower prop pitch.

July 25, 2004

Well, there's now 4.0 hrs air time on the Christavia. The engine seems to be running smoother at idle and I may adjust the idle down to 750 rpm from the current 850. Before, I was having trouble getting it to stay lit below 850, but it seems to be idling much better now. The idle range from the manual is 750-950 RPM.

I slipped an O-ring over the static tube today ahead of the static ports. The ASI seems to be within 5 kts now (still reading low) and the altimeter is within about 150-200'. I may try installing a small washer using a little silicone to hold it in place. I'm certainly on the right track though! Full power cruise is about 96-97 kts and the 75% cruise is closer to 85 kts. The prop will be going in on Wednesday for a re-pitch but I won't get to try it until the 16th due to our vacation in Newfoundland.

August 18, 2004

I finally received the newly re-pitched prop and installed it. The new static RPM has leveled off at 2550 rpm and the full power cruise RPM is about 2680. I went for a short, 30 minute test hop that confirmed that the idle RPM is too high (higher now that the prop is flatter). After landing, I noticed that the O-

ring I had installed on the static mast had snapped so I replaced it with a thicker rubber grommet. Climb performance is marginally better with about 700 fpm solo. Not quite what I had hoped, but that is at 4000' MSL. We're now sitting at 4.5 hours.

August 25, 2004

The planned Air Adventure tour was finally cancelled due to poor weather. This left a perfect opportunity to head to Carstairs and work on the plane. Also, with the Air Adventure Tour cancelled, I decided to fill the 100 gal slip tank that was to be used for the Tour, with 100 LL. This means that I no longer need to fool around with plastic jugs and I can ground the plane while refueling.

It took about an hour, but I finally got the idle set down to about 650 RPM. After buttoning up everything, I decided to take her up for a spin; after all, now that we had officially cancelled the Tour, the weather was looking much better!

After 10 minutes of cruising around, I decided to try a few stop and goes (with a back track). The combination of low idle RPM, flatter pitch and a little more experience on the plane finally helped bring it all together for some respectable landings. I learned that an approach speed of 70 mph was required to produce an acceptable landing, anything less resulted in crunching the tail wheel in first. This isn't surprising considering that the Citabria requires the same approach speed. The elevator trim is still not producing enough back stick pressure for my liking on approach. 1.1 hours resulted in a total time of 5.6.

August 26, 2004

Stu Simpson had mentioned that he would likely head to Red Deer, and possibly St. Albert on Thursday as the weather was forecasted to be good. Since that put them directly through my 25 NM tethered area, I asked Stu if he'd give me a shout before leaving and I'd meet up with them. I'd finally get my chance to fly with the Dragonflies! Stu said that they should be near Airdrie (extreme southern end of my region) at about 9 AM following the power lines. I showed up there about 9:05 just as they were coming into view. I formed up with Stu with his "Jolly Green Giant", a Bushmaster II in camo colors, and with Carl Forman in his Mini-Max "Phoenix". A few minutes later, Bob Kirkby joined the formation in his Starduster Too.

I was delighted to find that Chrissy seems to like the slow flight regime quit well as I cruised along at 60-70 mph with the throttle back to 1900 RPM. The trim was my only complaint at this speed. Stu took a few beautiful, in-air shots of the formation. I tooled along with them, for about 30-40 minutes before the tether started to draw tight forcing me to return to Carstairs. It certainly was tempting to just fly on with them. Oh well, that should be soon enough.

The interesting thing is that this flight was 1.8 hours long, with more than half of it at or below 2000 rpm in cruise. The second half was in the circuit. Total fuel burn was 7 gallons! That's only 4 gph. After refueling, I went up for another 1.1 hours cruising at 2300 the whole time. This yielded a 6 gph fuel burn. Total time is now 8.5 hours.

August 27, 2004

I came up with a possible solution to the elevator trim problem. I looked over the Wag Aero Wagabond plans they show a spring between the upper elevator horn and the fuselage structure to help relieve back stick pressure. I can't see why this shouldn't work on Chrissy. I had an assortment of springs and took them along to the hanger. Since getting in at the tail is pretty much impossible without cutting fabric, I decided to pull the belly pan and see if I could attach it somewhere on the control stick end. There was a perfect location between the lower front stick control attachment and the front lip of the torque tube to install the spring. An hour after I started, I had eliminated nearly all the effects of gravity on the elevator. It would hold any position I put the elevator in.

Two hours of cruising and circuits confirmed that I had licked the trim problem! I'm really starting to get comfortable with the plane and I have a lot more confidence in its reliability. Total hours are now at 10.5.

August 28, 2004

This morning I decided to attempt the dreaded climb test that all Amateur-Built planes are required to do; the results of which are submitted with your final paperwork to Transport Canada. To bring the plane to the 1650 lb gross weight, I filled the fuel tanks and added two 5 gallon cans of water, one on the rear seat and one in the cargo area. This resulted in a CG right about at the mid-point with me in front. I actually performed 3 climb tests and averaged them out. Transport Canada requires a measured 3 minute climb that starts as soon as the climb stabilizes after take-off. On a standard day at sea level the requirement is 1280' in 3 minutes. However, they do account for elevation and temperature differences which, using the graph provided showed that my requirement at 3500' and 60 F is about 700' in 3 minutes or about 230 fpm. I gained an average of 1480' in 3 minutes easily exceeding the requirements.

Having a full tank, I continued cruising around for about 2 hours before an approaching cell shut me down. After it passed, I popped up for another hour of circuits and some stall speed testing. The power off stall is coming in at about 40 mph IAS and power on is 35 IAS. As the fuel burned off, the CG continued to progress rearward with no ill effects. Another cell shut me down, but not before hearing Glen Bishell and Bjorn landing in Hanna. They were on their way back from picking up a new Cessna 120. I was quite impressed that my little handheld Yaesu radio was transmitting and receiving over 100 miles!

After the third cell passed, I headed up again. I started heading west of the field until I heard Glen calling from Three Hills. I made my way east toward Three Hills hoping to meet up with them. Thinking that I had missed them, I started heading home only to be buzzed by the 120 half way back. It's quite a neat machine with a fast cruise on a small engine (120 mph on 90 hp).

By the end of the day, I had another 3.5 hours racked up with the only persistent snag being the ASI indicating about 8 mph slow. The total time is now 14.0 hours.

August 29/30, 2004

I was a little late getting to the airfield on Sunday night and only had enough light to get in 0.6 hours. The 30th was a beautiful evening for flying with no wind and a beautiful sunset and moonrise! I took the opportunity to do some speed runs to get a closer idea of what the cruise speeds would be. I ran from 1900 all the way up to 2680 in 100 RPM increments (using the digital tach) Speeds ranged from 70 to 112 mph TAS. Then I tried the slow-flight, holding it nicely at about 50 mph IAS (about 60 mph TAS).

I also noted the differences between IAS and the speed I was getting on the GPS. At higher speeds, they were out by about 8 mph dropping to about 4 mph at 60 mph with the indicated speed being slower than GPS in still air. At 50 mph the error increased to 10 mph, probably due to the high angle of attack of the pitot tube. I was at a loss to explain why I was still reading so much lower than I should.

Then it dawned on me...The GPS is reading TRUE airspeed in still air and the ASI is giving INDICATED airspeed with no correction for pressure altitude! I ran some quick calculations to convert TAS to IAS and VOILA...the ASI is dead on! I guess I've had too much flying at or near sea level where the errors are not as pronounced. The total time is now 16 hours.

Conclusion

Although the flight testing is continuing, the remainder will likely be limited to getting some fuel flow numbers and burning off the remaining 9 hours. In general, I'm quite happy with the machine, but I'm already making up a list of minor changes. I'm looking at replacing the 600x6 tires with 700's or 800's to help with ground clearance and touchdown attitude, not to mention flight-line attitude. I've also purchased a new set of bungees, a little stiffer than the current ones, to replace the carbon caked ones currently in use. I also bought a J-3 cover to protect them. Over the winter, I've planned some minor changes to the secondary structure (door frames, window frames, floors, etc) in an effort to reduce the weight. I hope to have the hours flown off by the Labor Day weekend so I can attend a couple of the fall fly-ins. I look forward to more flights as a Dragonfly!

Appendix B – Regulations for Amateur-built Aircraft

CAR STD 507 Appendix C

On April 23rd, 2002 Transport Canada introduced the new rules for amateur-built aircraft under an exemption. The new rules totally replace Airworthiness Manual Chapter 549, which is now no longer in use, even though it can still be found in the CARs online. The new rules are known as CAR Standard 507 Appendix C.

507 Appendix C introduces some significant changes over AWM 549, including the authority to get professional help with building an amateur-built aircraft and the ability to import a completed amateur-built aircraft from outside Canada under some circumstances.

On April 2, 2009 Transport Canada produced a revised exemption removing the weight and passengers seat limitations.

Here is the complete text of the exemption. If you are interested in building or owning an amateur-built aircraft it is important to be familiar with the contents of this CAR. It can also be found on line at http://www.tc.gc.ca/civilaviation/regserv/affairs/exemptions/docs/en/1963.htm

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EXEMPTION FROM SECTION 549.01 OF THE *CANADIAN AVIATION REGULATIONS* AND CHAPTER 549 of THE *AIRWORTHINESS MANUAL – AIRWORTHINESS STANDARDS - AMATEUR-BUILT AIRCRAFT*

EXEMPTION FROM SECTION 549.01 OF THE *CANADIAN AVIATION REGULATIONS* AND CHAPTER 549 OF THE *AIRWORTHINESS MANUAL – AIRWORTHINESS STANDARDS - AMATEUR-BUILT AIRCRAFT*

Pursuant to subsection 5.9(2) of the *Aeronautics Act*, and after taking into account that the exemption is in the public interest and is not likely to affect aviation safety, I hereby exempt **persons who apply for a special certificate of airworthiness in the amateur-built classification** from the requirements of section 549.01 of the *Canadian Aviation Regulations* (CARs) and Chapter 549 of the *Airworthiness Manual - Airworthiness Standards - Amateur-built Aircraft*, subject to the requirements set out in Appendix A of this exemption.

Section 549.01 of the **CARs** stipulates that a person who intends to construct an aircraft and obtain, under paragraph 507.03(b), a special certificate of airworthiness in the amateur-built classification in respect of the aircraft must

a. before starting construction,

i. inform the Minister of the intention to construct the aircraft,
ii. show that the aircraft design meets the standards specified in Chapter 549 of the *Airworthiness Manual*, and
iii. show that the major portion of the aircraft will be constructed from raw material and assembled on a non-commercial, non-production basis for educational or recreational purposes; and

b. during construction and again before the first flight, make the aircraft available to the Minister for inspection.

Chapter 549 of the ***Airworthiness Manual - Airworthiness Standards - Amateur-built Aircraft*** sets out the design and construction standards, which an applicant shall meet to satisfy the Minister that the aircraft is amateur-built, and the requirements for inspections, equipment and instruments, and operating information necessary to obtain a Special Certificate of Airworthiness - Amateur-built.

Purpose

The purpose of this exemption is to permit **persons who apply for a special certificate of airworthiness in the amateur-built classification**:

- to contract for professional assistance in the construction or assembly of parts of the aircraft, provided the work is subject to the builder's overall control;
- to import, register and operate in Canada foreign-built amateur-aircraft, subject to a Transport Canada inspection of the aircraft; and
- to not have to comply with the maximum permissible take-off mass (weight) and the maximum number of passenger seats requirements.

Application

This exemption applies to **persons who apply for a special certificate of airworthiness in the amateur-built classification**.

Condition

This exemption is subject to the following condition:

Persons who apply for a special certificate of airworthiness in the amateur-built classification shall comply with the requirements of **Appendix A** to this exemption.

Validity

This exemption is **in effect** until the earliest of the following:

a. the date on which an amendment to the appropriate provisions of the *Canadian Aviation Regulations* comes into effect;
b. the date on which the condition set out in this exemption is breached; or
c. the date on which this exemption is cancelled in writing by the Minister where he or she is of the opinion that it is no longer in the public interest, or is likely to affect aviation safety.

CANCELLATION

The exemption from section 549.01 of the Canadian Aviation Regulations and Chapter 549 of the Airworthiness Manual - Airworthiness Standards - Amateur-built aircraft, issued to persons who apply for a special certificate of airworthiness in the amateur-built classification, on August 30, 2006 at Ottawa, Ontario by the Director General Civil Aviation on behalf of the Minister of Transport, is hereby canceled because it is the opinion of the Minister that it is no longer in the public interest or is likely to affect aviation safety.

Dated at Ottawa, Ontario, Canada, this *2nd* day of *April*, 2009,
on behalf of the **Minister of Transport, Infrastructure and Communities.**

Original copy signed by

Merlin Preuss
Director General
Civil Aviation

Appendix C Standards of Design and Construction for Amateur-Built Aircraft

PART I - Procedures

Interpretation

(1) In this appendix:

"amateur-built aircraft" means an aircraft, the major portion of which is constructed or assembled individually as a unique project, either from raw materials or from a kit;
"major portion" means more than 50% of the total number of items constructed or assembled during the project;
"builder" means the individual or group of individuals who constructs or assembles an amateur-built aircraft, or who oversees the construction or assembly by other persons, of an amateur-built aircraft.

Information note*:*
In this appendix, measurements and formulae are presented in SI (metric) units, with the equivalent imperial data in parenthesis.

Inspection requirements

(2) A person who intends to construct an amateur-built aircraft shall, before starting construction:

a. inform the Minister of the intention to construct the aircraft;
b. identify himself or herself as the builder of the aircraft;
c. show that the aircraft design meets the requirements of this standard; and
d. confirm that the major portion of the aircraft will be constructed or assembled individually, as a unique project.

(3) Prior to issuance of a flight authority, an amateur-built aircraft shall be inspected in accordance with a schedule acceptable to the Minister:

a. to verify the workmanship and general serviceability;
b. to detect apparent and obvious unsafe features; and
c. to provide reasonable confidence of safe operation.

(4) The builder of an amateur-built aircraft shall make the aircraft available to the Minister for inspection:

a. during construction, for inspection of enclosed areas that will not be accessible after final assembly; and

b. when the aircraft is fully assembled and equipped, but before the first flight, at the site of the planned test flight.

Information note:
Prefabricated parts that were fully enclosed by the parts (kit) manufacturer at the time of delivery, need not be subject to the internal inspection required by (4)(a).

(5) Except as provided in (6) or (7) an amateur-built aircraft must be assembled in Canada.

Construction outside of Canada

(6) A Special Certificate of Airworthiness — Amateur-built may be issued in respect of an amateur-built aircraft constructed outside Canada where:

a. the builder is a Canadian citizen living abroad and intending to resume permanent residence in Canada, who provides advanced notice of the intention to construct the aircraft outside Canada;
b. the builder makes arrangements to have the aircraft inspected during construction, and after final assembly, by a person acceptable to the Minister; and
c. the builder shows that the aircraft design meets the requirements of these standards.

Information notes:
(i) The Director, Standards, or a person designated by the Director, will make an official request, on behalf of the builder, for inspection of the amateur-built aircraft, and will provide the necessary inspection and observation reports forms to the person who will perform the inspection.

(ii) All documents pertaining to inspections shall be returned to the office of the Director, Standards, or the person designated by the Director, upon completion of each inspection.

Importation of foreign-built amateur aircraft

(7) A Special C of A — Amateur-built may be issued in respect of an amateur-built aircraft constructed outside Canada, where:

a. the aircraft was constructed in accordance with standards of the State of construction, and the Minister finds them to be equivalent to these standards;
b. the aircraft was issued a permanent flight authority pursuant to the regulations of the State of construction, and has subsequently completed not less than 100 hours air time; and
c. the aircraft undergoes a complete inspection for compliance with these standards.

PART II - Construction Standards

General

(8) The builder shall be responsible for ensuring that the materials and methods of construction of the aircraft are adequate for the purpose.

(9) The methods of construction and assembly, and the workmanship employed, shall be appropriate to the aircraft design and shall conform to accepted aviation standard practices.

(10) Materials shall be appropriate to the aircraft design and should conform to aviation quality specifications.

(11) The builder shall personally construct or assemble, or personally oversee the construction or assembly, of the major portion of the aircraft.

(12) The aircraft shall be constructed as a unique and individual project.

(13) The aircraft shall not be constructed under a mass production system.

Information note:
For the purpose of compliance with these standards, "mass production" means the simultaneous construction, by the same builder, of more than one amateur-built aeroplane, glider, rotorcraft, manned free balloon or airship, of the same type and model.

(14) Mass produced parts such as engine(s), propeller(s), rotor blades and precision hub components, accessories, wheels and brakes, standard aircraft hardware, heat treated or welded assemblies and components from other aircraft may be used, provided the major portion of the entire assembly is constructed or assembled individually.

(15) The builder may contract for professional assistance in the construction or assembly of parts of the aircraft, provided the work is subject to the builder's overall control.

Information note:
Any materials may be used in the construction of an amateur-built aircraft, provided they are adequate for the purpose. It is recommended that established aircraft quality material and components be used, especially in fabricating primary structure parts, such as wing spars, critical attachment fittings, and

fuselage structural members. Non-aircraft materials, or materials whose identity cannot be established, should only be used after careful evaluation by the builder.

PART III - Design Standards

General

(16) All amateur-built aircraft shall comply with the design standards of this Part, in addition to the standards contained in Part IV, V or VI of this appendix, as appropriate.

(17) Every amateur-built aircraft is unique, whether it is an individual design, constructed from plans, or assembled from a kit.

(18) The builder is responsible for evaluating and accepting the original aircraft design, and any changes incorporated into the design during construction, to ensure that they are adequate, appropriate, and in conformity with these standards.

(19) The inspections of the aircraft during construction and before first flight do not constitute, and are not to be construed as, evaluations or acceptance of the aircraft design.

Powerplant

(20) The builder is responsible for evaluating and accepting the powerplant chosen to ensure that it is adequate and appropriate to the overall design.

(21) The powerplant may employ propeller, fan, or reaction jet propulsion, but not solid or liquid fuelled rockets.

(22) Propeller driven aircraft may incorporate conventional 2 or 4 cycle piston engines, rotary (e.g., Wankel) engines, gas turbines, other internal combustion engines or battery powered electrical motors.

(23) Jet propelled aircraft may incorporate turbojet or turbofan engines.

(24) Each enclosed engine compartment shall be isolated from the remainder of the aircraft by a firewall, which shall be made of fireproof material.

(25) Engines equipped with carburettors shall have means to minimise the likelihood of carburettor icing, unless this can be shown to be unnecessary, either by actual test or by documentation from the kit manufacturer, engine manufacturer or aircraft designer.

Information notes:
(i) Builders are urged to be particularly aware of the risks associated with used engines, propellers and accessories whose history cannot be verified or that may have been involved in accidents or have undergone unapproved repairs or modifications.

(ii) Amateur-built aircraft are not required to comply with the noise standards of Chapter 516 of the Airworthiness Manual. However, builders are reminded that aircraft noise is a sensitive environmental issue, and every effort should be made to reduce noise emissions.

Equipment and Instruments

(26) Unless otherwise indicated in an applicable part of this appendix, amateur-built aircraft shall have the following minimum equipment and instruments:

a. a safety belt for each seat, including shoulder harness for each pilot seat and each front seat adjacent to a pilot seat, securely anchored so that the loads are transmitted to the primary structure;

Information note:
Builders are cautioned against the use of automotive-type safety belts; it may not be possible to release some kinds of automotive belts if the aircraft is inverted

b. a portable fire extinguisher;
c. an airspeed indicator;
d. an altimeter;
e. a magnetic compass;
f. a tachometer for each engine;
g. an oil pressure indicator for each engine that uses a pressure lubricating system;
h. a temperature indicator for each engine (displaying the temperature of the cylinder heads, lubricating oil, coolant or exhaust gas, as applicable to the type of engine);
i. a fuel quantity indicating system for each main fuel tank;
j. a gascolator located at the lowest point in the fuel system; and
k. a manifold pressure indicator for each supercharged engine, and for each engine equipped with a variable pitch propeller.

Placards

(27) Unless otherwise required in the applicable section, each amateur-built aircraft shall display the following placard:

a. one containing the following statement readily legible from each passenger station, or displayed on the side of the fuselage:

YOU FLY IN THIS AIRCRAFT AT YOUR OWN RISK.

THIS AIRCRAFT DOES NOT COMPLY WITH INTERNATIONALLY

RECOGNIZED STANDARDS.

VOUS VOLEZ À BORD DE CET AÉRONEF À VOS PROPRES RISQUES.

CET AÉRONEF N'EST PAS CONFORME AUX

NORMES RECONNUES À L'ÉCHELLE INTERNATIONALE.

b. if the placard required by 27(a) is displayed on the side of the fuselage, it shall be in a position that is readily legible to persons entering the aircraft, in letters at least 10 mm (3/8 in.) high and of a color contrasting with the background;
c. in any area of an aircraft designated for the carriage of passengers, other than an area beside the pilot, a placard showing the maximum permissible load for that compartment or area:

MAXIMUM PASSENGER AND/OR BAGGAGE LOAD: .....KG (LB)

or

CHARGE MAXIMALE, PASSAGERS/BAGAGES: .....KG (LB)

Aircraft Identification Plate

(28) In accordance with the requirements of CAR 201.01, a fireproof plate that identifies the aircraft shall be attached to a non-removable part of the structure in a prominent location:

a. in the case of an aircraft other than a balloon, to the structure of the aircraft in a place where it is visible to a person on the ground or to a person at the main entrance or rearmost entrance door;
b. in the case of a balloon, to the lower or upper girdle of the envelope in a place where it is readily visible prior to inflation.

(29) The aircraft identification plate shall include the following information:

a. the name of the builder;
b. the aircraft model designation;
c. the aircraft serial number

PART IV - Design Standards - Fixed-Wing Aircraft

General

(30) This part contains design standards additional to those outlined in Part III, which are applicable to:

a. aeroplanes;
b. gliders; and
c. powered gliders.

Seats

(31) For the purpose of determining the maximum empty mass, only one aircraft seat shall be designated as a pilot's seat.

(32) All seats other than the pilot's seat, shall be designated as passenger seats.

Maximum Empty Mass

(33) To ensure that an adequate minimum useful load, including fuel, can be carried within the maximum permissible take-off mass authorised for the aircraft, the maximum empty mass (weight) MEmax (WEmax) of an aeroplane or a powered glider should not be greater than that determined by the following equation:

$$M_{Emax} = M_{TOmax} - (80 + 80\sqrt{a} + 0.3P) \text{ (kg)}$$
$$((W_{Emax}) = (W_{TOmax}) - (175 + 175\sqrt{a} + 0.5P) \text{ (lb))}$$

where:

M_{TOmax} (W_{TOmax}) = maximum permissible take-off mass (weight) selected by the application in kg (lb);
a = the number of passenger seats; and
P = the rated power of all engine(s) in kW (BHP).

Minimum Rated Engine Power

(34) The minimum permissible rated engine power of propeller driven aeroplanes and powered gliders shall be determined by the following equation:

$$P_{min} = 0.0263M + \frac{CV\sqrt{M3}}{b} \text{ (kW)}$$

$$(P_{min} = 0.016W + \frac{CV\sqrt{W3}}{b} \text{ (BHP))}$$

where

P_{min} = total rated power of all engines in kW (BHP);
^{b} = wing span in metres (ft);
M(W) = declared maximum TO mass (weight) in kg (lb);
C = 0.01339 (0.018 where foot, pound, second units are used) for monoplanes (including tandem and canard wings);
or
C = 0.01711 (0.023 where foot, pound, second units are used) for biplanes or triplanes.

(35) The minimum permissible rated engine power of jet propelled aeroplanes shall be determined by the builder, who shall ensure that the engine power is adequate and appropriate for the aircraft design.

Rate of Climb

(36) In standard sea-level atmospheric conditions at the maximum approved weight, the aircraft shall demonstrate the following climb performance:

a. aeroplanes: 360 m (1180 ft) in 3 minutes.
b. powered gliders: 300 m (984 ft) in 4 minutes.

Information note*:*
Tests conducted in other than standard sea-level atmospheric conditions shall be corrected for the difference in atmospheric conditions by means acceptable to the Minister.

Wing Loading

(37) Wing loading is given by the equation:

$$M/S \text{ (kg/m}^2\text{)} \quad (W/S \text{ (lb/ft}^2\text{))}$$

where:

M (W) = the maximum permissible take-off mass (weight); and
S = the total wing area.

Information note*:*
The total wing area is taken as the total planform area of all wings (including canard wings) that provide positive lift in the landing configuration (obtained by extending the wing leading and trailing edges through nacelles and fuselage to the aircraft centre line) and includes the areas of ailerons, wing strakes, and flaps in the retracted position.

(38) Amateur-built aeroplanes without flaps, having a wing-loading exceeding 65 kg/m^2 (13.3 lb/ft^2), or with flaps, having a wing loading exceeding 100 kg/m^2 (20.4 lb/ft^2), are classified as high performance aeroplanes.

Information note*:*
CAR 401 requires pilots of high performance aeroplanes to hold a licence with a rating for the specific aircraft type. Pilots should consult STD 421 for the applicable type ratings standards.

Equipment and Instruments

(39) In addition to the equipment and instruments required by section 26 of Part III, aerobatic aeroplanes shall be equipped with a peak recording accelerometer.

(40) Gliders need only have the items required by subsections 26(a), (c), (d), and (e) of Part III installed.

Placards

(41) In addition to the placards specified in section 27 of Part III, the following placards shall be displayed in the cockpit or cabin in full view of the pilot:

a. where the aircraft flight authority contains the restriction "aerobatic manoeuvres prohibited:"

AEROBATIC MANOEUVRES PROHIBITED

or

ACROBATIES AÉRIENNES INTERDITES

b. where the aircraft flight authority does not contain the restriction "aerobatic manoeuvres prohibited:"

THE FOLLOWING AEROBATIC MANOEUVRES

AND COMBINATIONS THEREOF,

MAY BE PERFORMED IN THIS AIRCRAFT:

1 - .....

2 - .....

3 - .....

or

LES MANOEUVRES D'ACROBATIES AÉRIENNES SUIVANTES

ET TOUTE COMBINAISON DE CELLES-CI PEUVENT ÊTRE

EXÉCUTÉES AU MOYEN DE CET AÉRONEF :

1 - .....

2 - .....

3 - .....

c. for high performance aeroplanes:

THIS AEROPLANE IS A HIGH PERFORMANCE AEROPLANE.

OPERATION REQUIRES A TYPE RATED PILOT LICENCE.

or

CET AVION EST UN AVION À HAUTES PERFORMANCES.

SON UTILISATION REQUIERT UNE LICENCE DE PILOTE

COMPORTANT UNE QUALIFICATION DE TYPE.

PART V - Design Standards - Rotary-Wing Aircraft

General

(42) This part contains standards of airworthiness for:

a. helicopters;
b. gyroplanes; and
c. gyrogliders.

Number of Seats

(43) For the purpose of determining the maximum empty mass, only one aircraft seat shall be designated as a pilot's seat.

(44) All seats other than the pilot's seat, shall be designated as passenger seats.

Maximum Empty Mass

(45) To ensure that an adequate minimum useful load, including fuel, can be carried within the maximum permissible take-off mass authorised for the aircraft, the maximum empty mass (weight) MEmax (WEmax) of a helicopter or a gyroplane should not be greater than that determined by the following equation:

$$M_{Emax} = M_{TOmax} - (80 + 80\sqrt{a} + 0.3P) \text{ (kg)}$$
$$((W_{Emax}) = (W_{TOmax}) - (175 + 175\sqrt{a} + 0.5P) \text{ (lb))}$$

where:

M_{TOmax} (W_{TOmax}) = maximum permissible take-off mass (weight) selected by the applicant in kg (lb);
a = number of passenger seats; and
P = rated power of engine(s) in kW (BHP).

Minimum Rated Engine Power

(46) It is the responsibility of the builder to evaluate the chosen powerplant to ensure that the minimum rated engine power is adequate and appropriate for the aircraft type.

Performance: Rate of Climb

(47) It is the responsibility of the builder to ensure that the rate of climb is adequate.

Equipment and Instruments

(48) In addition to the equipment and instruments specified in section 26 of Part III, a helicopter or gyroplane shall have a main rotor tachometer with rotor speed limits clearly identified.

(49) A gyroglider need only have the equipment and instruments specified in section 26 (a) and (c) of Part III.

Placards

(50) In addition to the placards required by section 27 of Part III, rotorcraft shall have a placard stating any ballast required, as obtained from the aircraft weight and balance report.

PART VI - Design Standards - Lighter-Than-Air Aircraft

General

(51) This part contains standards of airworthiness for manned free balloons and airships.

Lifting media

(52) The aircraft buoyancy shall be provided by heated air or captive non-flammable gas.

Number of Occupants

(53) Balloon: the number of occupants shall be established by the applicant so that pilot's operation of the balloon is not adversely affected during flight.

Power Plant (Airships)

(54) It is the responsibility of the builder to evaluate the chosen powerplant to ensure that the minimum rated engine power is adequate and appropriate.

Equipment and Instruments

(55) In lieu of the equipment and instruments required by section 26 of Part III, all lighter-than-air aircraft are required to have the following:

a. an altimeter;
b. a rate of climb indicator; and

c. for each occupant of a balloon that is not located in a basket or gondola, an appropriate means of restraint, securely anchored to the primary structure.

(56) Hot-air balloons: in addition to the equipment and instruments required by section 55 of this Part, hot-air balloons shall have the following:

a. a fuel quantity gauge for each fuel tank;
b. an envelope temperature indicator;
c. unless found unnecessary by the Minister, shielding to protect the occupants and balloon parts from exposure to the burner flame.

(57) Captive gas balloons: in addition to the equipment and instruments required by section 55 of this Part, captive gas balloons shall have a compass.

(58) Airships: in addition to the equipment and instruments required by section 55 of this Part, airships shall have the applicable powerplant equipment and instruments required by section 26 of Part III.

Placards

(59) In lieu of the placard specified in subsection 27(c) of Part III, lighter-than-air aircraft shall display the following placard in a conspicuous position, readily visible to persons boarding the aircraft, showing the number of occupants allowed:

MAXIMUM NUMBER OF OCCUPANTS: ……..

or

NOMBRE MAXIMUM D'OCCUPANTS: ……..

(60) Hot air balloons: in addition to the placard specified in subsection 27(a) of Part III, hot air balloons shall display the maximum operational temperature permitted for the envelope on a placard attached to the envelope, in full view of the pilot, as follows:

MAXIMUM OPERATIONAL ENVELOPE
TEMPERATURE: ……..°C (……..°F)

or

TEMPÉRATURE OPÉRATIONNELLE MAXIMALE
DE L'ENVELOPPE: ……. °C (…….°F)

PART VII - Continuing Airworthiness

(61) Except where specifically stated to the contrary, amateur-built aircraft are subject to the same operating and maintenance regulations as type certified aircraft. Some of the applicable regulations, and their practical effects, are summarized in the following information notes.

Information notes:
(i) The details of all maintenance and elementary work performed on an amateur-built aircraft must be entered in the aircraft's technical record.
(ii) All maintenance activities require a maintenance release.
(iii) The owner of an amateur-built aircraft may sign the release for the maintenance of his or her own aircraft.
(iv) Elementary work does not require a maintenance release; however, it must be recorded in the aircraft technical record, together with the signature of the person who performed the work.
(v) The maintenance schedule requirements detailed in STD 625 Appendix B are approved by the Minister for use with amateur-built aircraft, at intervals not exceeding 12 months. STD 625 specifies that Appendix B must be supplemented by the applicable requirements of STD 625 Appendix C, for out of phase tasks and equipment maintenance requirements.
(vi) All entries in respect of the technical records for the airframe, engine and propeller for an amateur-built aircraft may be kept in the journey log, provided the requirements with respect to technical records are met.
(vii) A weight and balance report is required for each aircraft configuration.
(viii) Amateur-built aircraft are not required to comply with airworthiness directives; however, operators are strongly encouraged to review applicable airworthiness directives to determine if they wish to comply voluntarily, in order to enhance the safety of the aircraft.
(ix) Repairs and modifications to amateur-built aircraft must conform to technical data acceptable to the Minister; sources of acceptable data include, but are not limited to:

- *drawings and methods recommended by the manufacturer of the aircraft kit, component, or appliance;*
- *Transport Canada advisory documents;*
- *FAA Advisory Circular 43.13-1 and -2, UK CAA Civil Aircraft Inspection Procedures (CAIP), JAA Advisory Circulars, (ACJ) and publications issued by recognized authorities on the subject matter concerned.*

(x) Owners may devise their own data, which need not be approved, but must be subject to an appropriate level of review or analysis, or be shown to comply with recognized industry standards, or commonly accepted practice.
(xi) Changes that affect the structural strength, performance, power plant operation, or flight characteristics of an amateur built aircraft must be reported to the Minister before further flight of the aircraft; such changes may require re-evaluation to confirm that the aircraft continues to comply with the applicable standards.
(xii) The Minister is the final authority for determining the acceptability of data.

Maintenance and Manufacturing Policy Letter 13

1. Purpose

1.1 The purpose of this letter is to define Transport Canada's interpretation of the phrase "mass production", as found in paragraph (13) of Part II of Appendix A of the Ministerial Exemption that implements the revised standards governing the design and construction of amateur-built aircraft.

2. Background

2.1 On 23 April 2002, a ministerial exemption, signed by the Director General, Civil Aviation, implemented the revised standards governing the design and construction of amateur-built aircraft, as approved by the members of the CARAC Part V Maintenance and Manufacturing Technical Committee.

2.2 Amongst other things, the exemption allows persons who apply for a special certificate of airworthiness in the amateur-built classification to contract for professional assistance in the construction or assembly of parts of the aircraft, provided the work is subject to the builder's overall control. The intent of this provision in the revised standard is to allow a builder to seek assistance with the construction of those parts of the aircraft where the builder does not feel competent.

2.3 Paragraph (12) of Part II of Appendix A of the ministerial exemption states that "the aircraft shall be constructed as a unique and individual project".

2.4 Paragraph (13) states that "the aircraft shall not be constructed under a mass production system".

3. Policy Statement

3.1 For the purpose of compliance with the standards governing the design and construction of amateur-built aircraft as implemented by the ministerial exemption, Transport Canada interprets the phrase "mass production" to mean: the simultaneous construction, by the same builder, of more than one of the same type and model of amateur-built aeroplane, glider, rotorcraft, manned free balloon or airship. Aircraft constructed under a mass production system would not be considered to comply with the requirements and therefore would not be eligible for a flight authority.

3.2 The definition of the phrase "mass production" will be added to the standards governing the design and construction of amateur-built aircraft.

4. Effective date

4.1 This policy comes into effect immediately.

5. Expiry

5.1 This policy expires upon the publication of revised standards governing the design and construction of amateur-built aircraft.

6. Contact

6.1 The responsible division indicated below may be contacted for information regarding this MPL:

Policy Development AARPC

D.B. Sherritt
Director
Maintenance and Manufacturing