



# COPA

CANADIAN OWNERS AND PILOTS ASSOCIATION

## The COPA Guide to Building a Hangar



## NOTE

*This guide contains information of a general nature only. It should not be considered as a definitive document on building a hangar. Use of this guide does not make COPA responsible for legal action taken against you. Individual circumstances involving building a hangar at a private aerodrome and the law vary greatly. Some regulations are reprinted in this Guide for your convenience. They are current as of the date of this Guide. If you are reading this Guide in electronic form, the links lead to the current version of each regulation. If you are reading a hard copy, you should refer to the current version of the regulations on Transport Canada's Canadian Aviation Regulations web site <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-433/index.html>*

## About This Guide

*In the fall of year 2010, we built a private hangar on leased land at a registered aerodrome. The process was confusing, we received conflicting advice and we made mistakes. If we were to do it again, there are things we would do differently. Our goal in writing this document is for you to benefit from our experience.*

*It was difficult to write a guide that would cover every situation. This guide was written for a person building a hangar for non-commercial use at an aerodrome or private field. We have tried to identify most concerns that may arise. You need to decide what is applicable to your particular situation.*

*Thanks to COPA members Moe Hanif, Keith Dorken, Kevin Psutka and Patrick Gilligan.*

*Happy Building,*

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## Deciding to Build

### Why Your Airplane Should Be Kept In A Hangar?

#### To Protect The Airplane From Weather

Most hangars are built primarily to protect the airplane from environmental hazards. In the daytime, the sun's radiation fades the paint and causes the external and internal non-metallic parts to become brittle. The high temperatures in the cabin can damage the electronics. At night, when the temperature drops, water vapour condenses in the engine, which can cause corrosion. In the winter, wind, snow and ice loads can damage the control surfaces and skin. Any shelter, such as covers or a simple shed roof will reduce the environmental extremes the airplane is exposed to. This reduces maintenance costs and extends the life of the airplane.



Damage to Diamond Katana wing root caused by sun exposure

#### For Winter Flying

Canadian Aviation Regulations require the critical surfaces of the airplane to be clear of frost, ice or snow before take-off. Cleaning snow and ice from the wings and horizontal stabilizer from an airplane tied-down outside can be a cold, tedious and time-consuming task. This chore is eliminated if the airplane is kept in a hangar. Your airplane will be flown more hours and more frequently through the winter. Flying on bright, cold winter days is an enjoyable experience. And a shelter eliminates the need for engine preheat.

#### To Perform Maintenance In Comfort

Even if you take your airplane to the aviation maintenance engineer's shop for maintenance, the comfort of a hangar encourages the pilot to do a better pre-flight inspection and routine maintenance.

For example, it is much easier make log entries, program a GPS and measure tire pressure in the shelter of a hangar.

## To Secure The Airplane From Animals, Interference, And Theft

Airplanes stored outside provide shelter to birds, mice and insects. Nests may interfere with flight controls, resulting in an accident. Animal urine and excrement is acidic and will damage the airplane. People are also attracted to airplanes and have easy access to your airplane at many aerodromes. Their vehicle may inadvertently collide with the airplane, loosen tie-downs, remove protective covers or flight control locks. Fuel may be siphoned from the tanks. Expensive headsets may be removed. A locked hangar allows you to carefully pre-flight the airplane at a leisurely pace the night before your flight, confident that the airplane will be in the same state in the morning.



Photo from Aircraft Owner's and Pilot's Association (AOPA) of a bird's nest built in a cowling

## Build Versus Rent

It is less expensive to rent an existing hangar than to build your own. There are many hidden expenses in building and maintaining a hangar. These costs require at least a decade to recover, and a long-term commitment to the area. Your hangar may be difficult to sell, and you may not be able to recover your costs.

Hangar space is in high demand at many airports. Vacant space is rented quickly, by word-of-mouth.

Sources of rental information include:

- The local chapter of COPA, the Experimental Aircraft Association (EAA) or the Recreational Aircraft Association (RAA).  
You are more likely to hear when a hangar becomes available if you routinely participate in your local flying community.
- The Airport Manager may know of space that is available for rent.
- Hangars for rent are often posted on bulletin boards at the airport.
- Hangars for rent may also be found in COPA's Canadian Plane Trade classified ads.

Hangar rent is less expensive than comparable warehouse space. Expect to pay upwards of \$285/month for an unheated, dirt floor T-hangar, or upwards of \$800/month for a heated hangar (prices Summer 2020). Many people think that those rents are ridiculously high. They forget that the hangar owner is also paying for interest on the hangar capital cost, property tax, land rental, an access fee, utilities and insurance.

Many people think a hangar is just a big garage that can be self-built for twenty thousand dollars in material costs. This is wrong. The cheapest manual sliding hangar door costs several thousand dollars; much more than a garage door. Hangars are specialized buildings with critical design components. When constructed on leased land or at a registered airport, it must comply with contracts and regulations. Building a hangar may require the purchase of specialized services such as engineers, surveyors and crane operators.

## Investment Property

A modest hangar, built at a popular airport where there are few hangars available, may be a worthwhile long-term investment. Risk is minimal, because rents are generally charged annually, and pre-paid in advance. Maintenance expenses are minimal compared to other real estate investments. The building may appreciate and the capital cost of the building may be depreciated. You may realize a capital gain (or loss) when the hangar is sold. Renting hangars is a complementary business for a flying club, a flight school, an air charter business or an aviation maintenance service. In most cases it will take over a decade to achieve any return on your investment. Variations in the state of the economy may affect your ability to rent space. If the hangar land is leased, terms in the contract may restrict your ability to earn income by renting the hangar space for other uses. When it comes time to sell, you will likely find that it takes a long time to find a buyer, and you may not recover your costs.

## Ownership

Your hangar may be owned by you individually, jointly by a partnership or by a corporation. In all cases, a capital gain or loss will occur when the hangar is sold. There may be benefits to incorporating a holding company to build and own the hangar. The capital required may be raised through selling shares of the company or by loans to the company. Operating and maintenance costs are paid by the company. Any profits are retained in the company. The company files a simple annual corporate tax return. When a shareholder of the company no longer wants the hangar investment, her/his shares are sold. Selling the shares is much simpler than selling the hangar.

At the end of the decision phase you will have

- Considered renting
- Defined why you are building a hangar (ie your goal)
- Defined who is going to own the hangar

## Planning Your Hangar

### Choosing The Aerodrome

Choose an aerodrome close to where to live or regularly fly. Because you are making an expensive long-term commitment, you need to be confident that the aerodrome will continue operating for a long term. Talk to other pilots, politicians, real estate agents and business people about the aerodrome. Are there other businesses at the aerodrome such as a restaurant, a flight charter service, or a maintenance facility? Ask the Airport Manager which local businesses regularly use the aerodrome. Regular use and services on-the-field help to ensure the long-term viability of the airport.

Also consider private airfields in the area. It may be easier to negotiate with one private land-owner, than an organization such as a municipality. Private airfields usually contain only one short runway, possibly with trees or other obstructions at the end. Check that the runway is long enough for your airplane to take-off with the hot summer density altitude. Check Environment Canada for the direction and magnitude of the prevailing winds, since frequent cross-wind landings may be necessary. Also consider where you will get fuel for your airplane.

Once you've chosen the aerodrome, ask for a person who will advise you. If dealing with an organization, you will need to identify a single person who will represent the organization. The organization's single point of contact must be knowledgeable in their requirements, and have the authority to make decisions on the organization's behalf. You will also find it helpful to talk to anyone who has recently built a hangar.

### Purchasing Land

In Canada, any area of land or water intended for the use of aircraft may be considered an aerodrome (Aeronautics Act). If you are considering purchasing land to build a private air strip, see [The COPA Guide to Private Aerodromes](#). Some aerodromes have land available for purchase.

When purchasing land, a lawyer should be consulted. Your purchase agreement should include the right of access to the adjacent aerodrome.

### Leasing Land

Some organizations prefer to lease land for hangar development, rather than sell the land. Leasing allows them to generate income from the asset and retain control of the land use. Land leases



typically run from ten to ninety-nine years in duration. The length of the lease should be comparable to the expected life of the building. A sixty-year lease is typical. Your contract should address what happens to the leased land in the event that you die.

The lease cost is set separately from the lease term, and may contain terms for re-negotiating the rate. A ninety-nine-year lease is considered comparable to free-hold ownership and should cost about the same as buying the land. A sixty-year lease should be set at about 75% of the free-hold ownership cost. Shorter lease periods should be set at a less expensive rate.

A mortgage for a hangar on leased land must be for the same (or lesser) term than the lease. A short-term lease will require higher mortgage payments.

Your lease contract should address:

- The terms for renewing or re-negotiating the contract.
- The rental rate.
- Additional fees such as property taxes, access fees etc.
- Utilities (electricity, water, sewage, gas, telephone, internet) that the lessor will provide to the property line
- Improvements to be erected, including any constraints on the timing, design, or appearance.

This section may force you to build something different than you wanted, the cost of which is not easily recoverable.

- Requirements for the maintenance and repair of the property, including both the building and the surrounding property (e.g. aprons, walkways, taxiways, grass-cutting, snow-plowing etc.).
- Insurance required.
- Permitted uses. Be sure it includes storage and maintenance. You may also require
- automobile parking.
- Fuel storage.
- Parts storage.
- Office and classrooms.
- Cooking and sleeping facilities (not recommended if your aerodrome is protected under Federal Jurisdiction).

## Construction Timing

In many parts of Canada, it is not feasible to build during the winter. It can be done, but there will be delays due to poor weather and quality may suffer. You may need to consider delaying construction until spring. If you are building on leased land, your contract may require construction (leasehold

improvements) to be complete within a specified time. This needs to be considered when you negotiate your lease.

## Hangar Drainage

Adequate drainage promotes the long-term health of your building by preventing mold, mildew, and rotting wood. The area around the hangar must slope away from the building so that the water drains away and does not enter the hangar. The drainage must also consider other buildings around your hangar and any existing engineered drainage such as ditches or catch-basins for the storm-water system.

## Landscaping

The land around the hangar should be graded so that it drops 10 inches in the first 8 feet (or 20 cm in 2 meters) away from the hangar (10% slope). After the initial grade, the slope may be decreased to 1.5% for grass-covered areas.

## Roof Gutters And Down-spouts

A hangar roof collects a large volume of water. Water falling off the eaves of the building is unpleasant for people standing under it and can erode the landscaping. In the winter, building run-off will freeze. Falling ice may hurt people. Icy patches on the ground are a slipping hazard. Roof gutters, installed on the eaves of the hangar, may be used to collect this run-off. Down-spouts from the gutters may be used to direct the water away from the building, or be connected into a storm-water system.

## Sub-surface Perimeter Drains

Perimeter drains consist of a perforated pipe installed in a trench below the hangar footings. The pipe is wrapped with a permeable cloth to allow the water through but keep sand out. The trench is then filled with sandy non-compacting gravel which allows the free flow of water. The drain is either connected to the storm water system or connected to a drainage ditch farther away from the hangar.

## Apron Drainage

The apron in front of the hangar should slope away from the door, so water drains away and does not enter the hangar. During the winter, water freezing under the door, can make it difficult to open the door. A slope of between 0.5% and 1.5% is standard. If you will be pushing the airplane into the hangar by hand, a shallower grade is more desirable.

## Hangar Access

### Roadways and Parking

You need a way to access your hangar with your vehicle, and a place to park your vehicle while you're flying. Check that the road access will be maintained year-round. Consider if the road access is adequate for heavy trucks and vehicles to access the building site during construction. The parking needs to be someplace close to the hangar for unloading people, baggage and items, without obstructing other aircraft or vehicles.

## Aprons and Sidewalks

It can be challenging to push an airplane into a hangar over soft wet grass. You should plan on installing some form of apron and sidewalks while building the hangar. Materials to consider include:

- patio slabs
- compacted Granular A stone
- asphalt
- concrete

## Taxiways

You may need to install a taxiway from the apron to the hangar. Whenever possible you should follow the standards found in Transport Canada's Aerodrome Standards and Recommended Practices, TP312. In summary:

Recommendations (not regulations):

- Privately owned taxiways should not connect directly to a runway. They should connect to an aerodrome taxiway or apron.
- The taxiway should be at least 15 m wide for small general aviation aircraft.
- The taxiway should slope less than 3 % for small general aviation aircraft.
- The taxiway (transverse slope) should have a crest of 1.5 - 2%.
- The taxiway centre-line should be marked with a continuous line 15 cm in width
- The taxiway should be built to the same standards as the runway to which it connects



A taxiway and apron draining to an airport storm drainage system.

## Hangar Types

There are a wide variety of types of building suitable for use as hangars. The most common found in Canada are the following:

### Glove

A glove-type building is usually custom-built for a specific aircraft type. The smaller size reduces the land rental, construction and heating costs, but is not as flexible as a rectangular building.

### Wood Framed or Post Constructed

This type of hangar is similar in construction to a simple farm building. Many local builders will be able to construct this conventional building. There is lots of extra space around the airplane for storage and maintenance. Roof trusses are usually custom pre-fabricated off-site, and must be ordered in advance.

## Arch-style Steel Building

“Quonset Huts” were originally designed by the United States Navy as an all-purpose, light-weight building that could be shipped anywhere and assembled without skilled labour. This makes them ideal for an inexpensive, self-built hangar on leased land. The steel sections come pre-punched, and are bolted together on-site. The arch is assembled in sections and connected to a foundation. Because the end walls will not support a heavy load, a bottom rolling or sliding out-rigger door must be used.

## Pre-engineered Steel-Framed Building

Pre-engineered steel-framed buildings are available in standard sizes which can be easily customized to include a hangar door. The steel frame and trusses provide a larger span with no internal supports. They can be assembled quickly, and if required, disassembled and moved. They are generally more expensive than a comparable sized wood framed building, but become cost effective for larger buildings or where a lower roof peak is required.

## T-Hangars

T-hangars are a group conjoined “T” shaped hangars in a single building. T-hangars allow several aircraft to efficiently use a larger hangar space. The efficient use of space reduces the cost per aircraft for land rental, construction and heating. T-Hangars may be left open internally, or segregated with internal walls. This type of hangar is a good choice where several people wish to share costs, or for a business investment.

## Steel-framed Fabric-Covered

Steel-framed, fabric-covered buildings have a high-strength steel framework covered by fabric membrane. These buildings can be constructed in less time than a conventional building. Although designed for permanent use, it may be moved and re-assembled if required. This is a good choice for situations where the hangar will be built on leased land.



Airplane shaped, stick-built glove-type hangar under construction in Bancroft, Ontario.



Quonset Hut Hangar in Bancroft, Ontario.

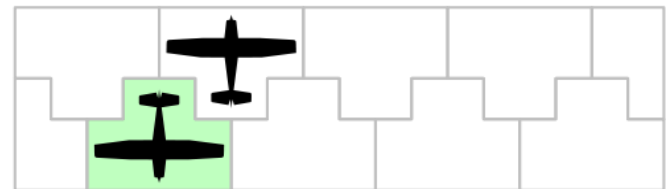
A stick-built wood-framed hangar under construction in Kincardine, Ontario.



A steel-framed, fabric covered hangar with a hydraulic swing-up door.



The steel structure of a steel-framed hangar visible from the inside.



NESTED TEE-HANGAR



STANDARD (STACKED) TEE-HANGAR

Plan view of two types of Tee-Hangars

## Sizing your hangar

### Airplane Sizes

Most hangars are sized to hold one or two airplanes. The airplane dimensions determine the required size of the hangar. Most certified general aviation aircraft have wingspans of less than fifty (50) feet, a tail height of less than eighteen (18) feet and a length of less than thirty (30) feet. Ultra Light aircraft are typically smaller. If you are planning for a specific size wingspan, add an additional five (5) feet of width for a comfortable door clearance.

Schweiss Doors for example provides a good list of airplane sizes.

<http://www.bifold.com/airplane-size-chart.php>

If you will be storing more than one airplane, a big hangar with doors for individual aircraft is better

than a small hangar with one big door. Every time you have to move an airplane in and out of a hangar, you risk “hangar rash”. A moment of inattention can result in expensive damage. Wouldn’t you rather be flying, than moving airplanes around the ramp?

## Additional Hangar Functions

There is usually lots of empty space when a single airplane is stored in a rectangular hangar. This space is typically used for storing consumables like oil, cleaning supplies, garbage and recycling, and tools like tugs, air compressors, or snow shovels.

You may need additional space if you plan on using your hangar for other functions beyond airplane storage. Other functions to consider are:

- An office area for flight planning, and maintaining records.
- An area to store seasonal parts (eg winterization kits) and spare parts (eg tires, tubes, lamps).
- A maintenance area, including tools, equipment, power and lighting suitable for a visiting aviation maintenance engineer to work.
- Amenities such as a washroom or kitchenette.
- A lounge area for guests or passengers.
- An area for building utilities, eg furnace, water tanks, meters, etc.

## Hangar Doors

Not all hangars have hangar doors. A building which protects the airplane from the elements is an improvement over leaving the airplane tied-down outside. A hangar door secures the airplane from animals, interference and theft. A hangar door may be easily installed at a later date, if it is considered in the original design of the building.

The hangar door is a critical component of the hangar design. As such, it should be selected and sized before settling on the final building design and dimensions. The building needs to be designed to support the open door span. The building opening may also required to hold the weight of the heavy door.

### Door Types

There are a wide variety of doors available. The following pictures show the basic types.



Sliding Hanging Outriggers



Hydraulic Swing-up



Bottom Rolling Multi-leaf



Roll-up



Self-built Sliding Hanging



Bi-fold



## Door Accessories

You may also wish to install some of the following useful accessories for the door:

- Electric Motor - to open and close the door
- Limit Switches - to automatically stop the motor from driving the door past the full open and full close points
- Photo-eye Sensors - to automatically stop the door from closing on an object underneath it
- Door-base safety edge - to automatically stop the door when it senses an object touching it
- Remote control - to open and close the door from the airplane or car
- Warning Lights and Horn - to alert people that the door is operating
- Emergency Backup Opener - to open or close the door during a power failure

## Utilities

### Electricity

If the hangar will have an electrically operated door, you need to consider the door motor requirements in your electrical design. Check the motors required voltage, single-phase vs 3-phase and the current load. If you will be using electric heat, you will need to increase the capacity of the electrical panel. Also, consider if you will be using electrical motors or fluorescent lights which have large starting currents.

Before building, you will need to decide on the number and locations of all the hard-wired electrical loads, such as

- door motor(s)
- receptacles
- switches
- lights
- heaters/furnaces
- fans

You may need to submit sketches of your planned electrical layout to obtain an electrical permit.

### Heat

Most heating contractors will calculate your hangar's heating requirements for free. It takes about 8000 Watts to heat a simple insulated 48 foot square hangar with a 16 foot ceiling to room temperature in the winter. If people won't be working in the hangar, you may decide to install fewer heaters. If the hangar will be frequently inhabited during the winter, you may decide to install more heaters, in order to restore the heat quickly after the door has been opened.

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## Heat Sources

Open flame heating appliances are not legal see CAR 301.09 (1) or desirable in a hangar where aviation fuel and lubricating oils will be present. Heat sources will usually be one of the following:

- Forced Air Electric or Gas - Heats air which is blown around the entire hangar space.
- Radiant Electric or Gas - Uses low intensity infrared tubes to heat surfaces in the hangar. Combustible surfaces must be kept more than 10 feet away.
- Hydronic (Hot Water Under slab) - Heats rises from the concrete slab.
- Steam Radiant
- Geothermal

When leasing land, your rental contract may prescribe a required method of heating.

## Natural Gas, Propane, Oil

Natural gas has historically been a less expensive than propane or oil. However, natural gas may not be economical if a supply line is not located near your building site. Propane and/or oil require a storage tank to be installed and regular deliveries made to the hangar. Deliveries will require an access road to the building to be maintained year-round.

## Ventilation

A forced air furnace with ducting will generally provide adequate ventilation to move heat to the floor where people are working. Since hot air rises, other heating systems will benefit from ceiling fans to help move the warm back to the hangar floor where the people and airplanes are located.

## Lights

A good rule of thumb for lighting is the equivalent of 1W fluorescent lighting per square foot of space. Depending on what you intend to do in the hangar, you may want more or less light. Lighting task areas, such as work benches, is more efficient than lighting the whole hangar space. Consider installing skylights in the ceiling or translucent panels in the walls to supplement the lighting with sunshine in the daytime.

## Solar

An airport hangar has a large plane roof and no obstructing trees. It is the ideal location for a solar collector. Solar panels may be used to make hot water or electricity. Hot water may be used for under slab heating systems. The electricity may be stored in batteries for use in the hangar. In Ontario the electricity may be used to offset your electrical use (“net-metering”) or sold under the Fee-In-Tariff program.

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## Water and Sewage

A source of water in the hangar allows you to wash the bugs and dirt off the airplane. It is also nice to have a convenient washroom following those long flights! Water supplied from the local municipality is the most desirable option. Other alternatives are drilling a well or rainwater collection into a tank.

Domestic wastewater containing body wastes or washing water must be sent to a local septic or municipal sewage system. Any floor drains inside the hangar must also be connected to the septic or sewage system. Storm water collected from the roof or foundation should be connected via drainage tubing (“Big O”) or surface channels with a 5% grade, to the airport’s storm water system.

## Insulation

Insulation keeps the hangar cool in the summer and warm during the winter. Insulation may be worthwhile, even if you’re not installing a heating system, since it will help stabilize the temperature inside the hangar. A stable temperature reduces the condensation of humidity from the air. Condensation can corrode the airframe, the engine and damage avionics.

## Fire Protection

Fixed fire protection systems are not required in small hangars used for storage only. A specialist in fire protection should be consulted if you plan on storing fuel, welding, painting or torch cutting in your hangar. As a guide, a 2500 square foot hangar with an airplane containing 50 gallons of fuel requires a 10 pound 4A60BC type ABC fire extinguisher. A fire extinguisher should be located in plain view, on a wall, near the exit and away from heat sources.

## Telephone

Telephone service to the building may not be required if you have a mobile phone and the hangar will only be used intermittently. However, in most cases it is cost effective to install the lines during construction, even if you don’t plan on using the service. Telephone service may also be used to receive internet, to send security systems alarms and to remotely activate airplane heaters.

## Security

Buildings at isolated general aviation airports are easily broken into for vandalism and theft. Damage may be covered by your hangar and airplane insurance; however, you could be without the use of your airplane for many months. Talk to your airport manager and other local pilots to find out if this occurs frequently at your location. If so, you may wish to install a security system which will alarm if someone enters the building without authorization.

## Internet

Internet service provides easy access to weather and flight planning services. If you have use of the internet through a smart phone, mobile hot spot or tablet computer, you may not need internet service in the hangar. Internet service is available in most terminal buildings. This may be an acceptable alternative if the terminal building is located near your hangar.

## Airport Impact

The construction of your hangar has the potential to adversely impact the airport by:

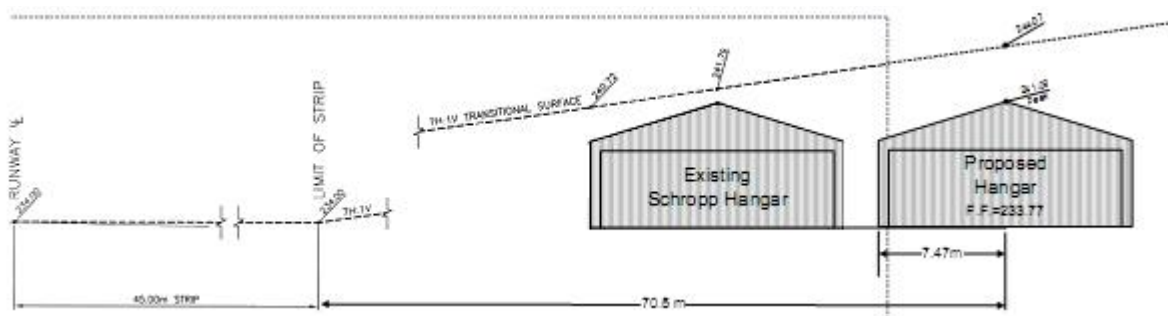
- Creating a new obstacle to aircraft movement in the air and on the ground.
- Affecting the operation of navigation aids, radar and communications.
- Obstructing the lines of sight to control towers or flight service stations.

If your airport has a Flight Service Centre, Control Tower, Weather Services, a localizer, NDB, DME, VOR, or GPS approaches, Nav Canada must confirm that your hangar will not adversely affect the airport. (Instrument flight rule procedures for your aerodrome are defined in the Canadian Air Pilot instrument procedures Part 3.) In this case you must prepare a Nav Canada “[Land Use Proposal Submission Form](#)” Along with this form you will need to submit:

- a topographic map showing the proposed location of the building
- a scaled site plan of the airport showing the proposed location of the building in relation to the runways, taxiways, roadways
- plan and profile architectural drawings of the proposed building, showing dimensions, height and elevation at grade level.

A land survey and engineering services may be required to accurately define the building’s location and prepare the documents for submission.

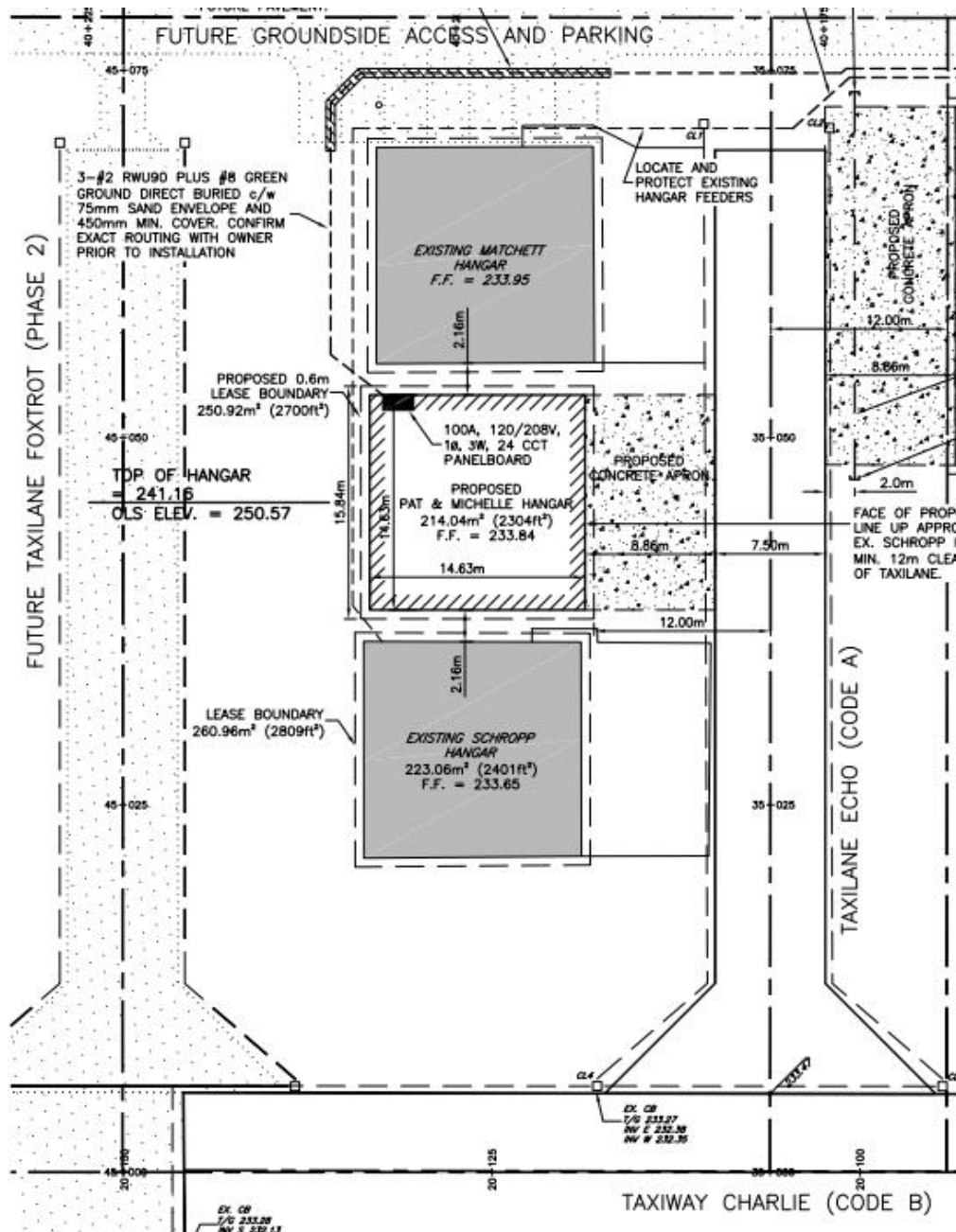
Nav Canada needs six weeks to assess the impact of the building. Emailing the documents to [landuse@navcanada.ca](mailto:landuse@navcanada.ca) will help to expedite the process.



Drawing showing the location of a new hangar relative to an existing taxi way and runway departure path (transitional surface)

## Construction Budget

Detailed planning helps you to prepare an accurate budget, so your hangar is costs no more than planned. It is a good practice to reserve 10% of the total cost on a well-defined construction plans for unexpected expenses. If your construction contains any unknowns (eg questionable drainage or uncertain excavation/fill requirements) the contingency funds should be increased.



Drawing showing taxiways, proposed hangar and apron location, elevations and buried utilities. Grading is shown on a separate diagram.

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## Planning Summary

At the end of planning you will have

- Chosen the aerodrome
- Purchased or leased land
- Planned the hangar site (taxiways, access, drainage)
- Selected the hangar location
- Selected the building type and size
- Selected the hangar door
- Planned the utilities
- Assessed the building impact on any instrument approaches
- Prepared a budget

## Building Your Hangar

### Hiring a Contractor

The same precautions are required to hire a contractor to build a hangar as would apply to build a house:

- hire someone with similar experience
- talk to their previous clients
- get written estimates or proposals including drawings and specifications
- sign a written contract
- plan to regularly inspect the work

Check that the contractor has federal insurance coverage. In Ontario, all contractors also require insurance from the Workplace Safety and Insurance Board (WSIB). If you are hiring a contractor, your contract should identify who is responsible for getting permission to build, if such permission is required.

### Building Yourself

Substantial savings can be had by building the hangar yourself. However, this requires time, skills, tools and equipment you may not have. Wouldn't you rather be flying?

### Construction Cash Flow

You should plan on paying the following expenses, which may become payable during construction:

- land lease and/or taxes

- construction insurance
- materials
- tool and equipment rental or purchase
- miscellaneous unplanned construction costs
- any expenses not covered by the contract e.g. permits, fees

If your hangar is being built by a contractor, you will be required to make progress payments as outlined in your contract. Plan on making payments:

- when you sign the contract (a deposit)
- when work commences (usually towards the materials)
- at regular stages (at set times, or construction progress milestones)
- when the work is substantially complete
- full payment 45 days following substantial completion (a builder's lien holdback)

## Permits

Since airports fall under federal jurisdiction, a provincial, municipal or county building permit will not be required if you are building on your private aerodrome or grass strip. Nevertheless, COPA always advises that you keep the township informed of your intentions, this fosters good relationships, a very important aspect of your aviation environment. Define your hangar project carefully and thoroughly and then visit the township office to share your project with them. Make sure you explain to them that since this is federal jurisdiction, you do not need a permit, that you simply want to inform them of your project. Note that you also must respect building codes and environmental bylaws, and they are allowed to inspect the construction process. Note that you remain subject to property taxes.

On the other hand, if you are building on leased land, the land owner may impose any requirements they feel are appropriate, through clauses in your lease contract, including building permits especially if the owner is the county or municipality. If you are hiring contractors, your contract should identify who is responsible for getting the permits. If you are building it yourself, you should plan on getting the necessary permits yourself. You may need permits for

- the building
- the electrical
- the plumbing/sewage
- gas heating

You may need to provide plans with your permit application and pay a fee. Most permits require the work to be inspected. Your insurer may ask for proof of inspection.

## Surveys and Reviews

If you are purchasing the land, a land survey may be required to register the title. If you are leasing the

land, a survey may be required for the building permit application to demonstrate that the planned building will not adversely impact the airport drainage and glide slopes. An “as-built” survey after construction may also be required.

Before digging, call the local utilities to locate the buried lines near your construction. You don’t want to be digging up wires, water or communication lines. Beware that previous uses of the land may result in your excavations uncovering unplanned items. Ask other people about the prior history of the land.

## Inspections

Inspections help to ensure that the hangar is safe for people, equipment and the surroundings. While building the hangar, you (or your contractor) will need to contact the Inspector and make the work available for inspection. Any deficiencies will need to be corrected before an inspection certificate will be issued.

## Building materials, equipment, tools

The materials, equipment and tools used to construct an airplane hangar are not unique. They will likely be available in your community from any construction supplier or building contractor. If you are constructing the building yourself, you may need:

- a bulldozer - to clear vegetation, remove topsoil, and grade surfaces final surfaces
- a mobile crane - to lift steel beams, roof trusses, the door
- a laser level - to set grades

## Specialized Trades

While building, you may need the services of the following specialized professionals and trades:

- Land Surveyor - to establish building reference points and grade
- Rock Blasting - to remove rock for excavation
- Backhoe or Bulldozer operator - to remove fill for building foundation
- Crane operator - to lift steel beams and trusses into place
- Electrician - to install electrical service to the building and wire the building and heating
- Plumber - to install gas, water and sewage services
- Well Driller - to drill a water well
- Civil Engineer - to inspect the building as compared to the plans



## Construction Impact on Airport Operations



A hangar under construction using a crane, mobile lift, heavy trucks and piles of gravel and fill.

Your construction needs to be carefully managed to minimize its impact on the airport operations. Things to consider include:

- heavy equipment damaging roads, taxiways and aprons and buried services
- cranes interfering with approaches
- digging causing subsidence of adjacent roads, taxiways, aprons or buildings
- isolations required to connect utilities
- potential for taxiway/runway incursions between aircraft and construction equipment
- construction debris dropped or blowing onto taxiways, runways or aprons and damaging operating aircraft.
- removal of fill/blast material.

Ensure your contractor understands airport operations. Keep a close watch for foreign object debris (FOD) on runways and taxiways. Clean-up the site on a daily basis. Regularly discuss your construction with the airport manager. A NOTAM may be required if blasting is required, a tall crane is used or a runway/taxiway is closed.

### Interior Hangar Finishes

Many people choose to leave the interior of their hangar unfinished. However there are advantages to finishing the floor and walls, and is useful if you are planning to do maintenance in the hangar.

#### Floors

A concrete floor reduces the water vapour which permeates from the ground into the hangar. This helps to protect the airplane from corrosion. A highly polished concrete floor is undesirable, as it will

be slippery when water, fuel or oil drips on it. A white floor will make it easier to find dropped items. An epoxy-based finish on the floor, resists spills and fluids from staining the concrete.

## Walls and Ceiling

It may be necessary to finish the walls and ceiling in order to make the hangar totally weather proof. An interior finish helps to protect insulation and utilities that may be installed in the walls. A white finish helps to reflect light, reducing the number of lamps required, and makes it easier to see things.

If you plan not to finish the ceiling, install netting to prevent birds from entering the hangar. Birds will build nests in the airplane cowling and tail, impairing the operation of the engine and controls. Animal droppings are caustic and will corrode surfaces.

## Building Summary

At the end of building you will have:

- Obtained the required permits, permissions, surveys, inspections and reviews
- Obtained required materials, equipment and tools
- Hired the required specialized trade and professional services
- Minimized the construction impact on airport operations
- Made payments as planned to fulfill your obligations
- Built a hangar which fulfills your requirements

## Using Your Hangar

### Regulations and Contractual Requirements

#### Standard Aerodromes Regulations

While using the aerodrome, you must comply with Canadian Air Regulations Part III Subpart 1, 301.8 and 301.09. Briefly, you may not:

- obstruct the movement area
- tow an aircraft at night without lights
- leave an aircraft on the maneuvering area at night without lights
- operate a vessel or obstruct an aerodrome which has been closed in the interest of aviation safety
- interfere with navigation markers, lights, signals etc.
- allow pet animals to wander unrestrained
- fire a gun
- smoke or display an open flame in an area, where smoking or the presence of an open flame is likely to create a fire hazard that could endanger persons or property.

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Be sure to check the Canadian Flight Supplement for any noise abatement requirements.

## **Rights of Access**

If your hangar is adjacent to a registered or certified aerodrome, the deed for your land may describe the rules or restrictions of your access.

## **Lease Contractual Obligations**

If your hangar is built on leased land, your rental contract may contain specific restrictions and requirements for the operation and maintenance of the site and hangar building.

## **Hangar Insurance**

You have spent a lot of money building your hangar and its contents. The building could be damaged or destroyed by fire, lightning, windstorms, impact etc. The hangar could be entered and vandalized. Family and friends could be hurt by ice falling off the roof or tripping hazards. You should purchase insurance to mitigate this risk.

If your hangar is located on leased land, your land lease contract may require you to purchase and provide a Certificate of Insurance. One or two million dollars coverage is appropriate. A greater value is very expensive and you should not be required to obtain more than this for a non-commercial use.

Insurance is available from both your residential and aircraft insurance broker/agent.

## **Site Maintenance**

### **Grass Cutting**

A hangar land lease may include grass cutting and weed removal from around the hangar. If not, you may need to regularly maintain the area using a lawn mower or trimmer. Growth may be prevented by installing landscaping fabric under stone or mulch.

### **Snow and Ice Removal**

A hangar land lease may include snow removal from the access road, aprons, and taxiway. In other cases, it may be cost effective for a group to share snow removal responsibilities or costs. In all cases, you should still be prepared to immediately remove slipping hazards from walkways and doorways. Keep a shovel in your hangar. For larger areas, a snow blower or snow plough may also be required.

The ice melt commonly used around homes should not be used at the hangar. Ice melting substances such as road salt, potassium chlorides, magnesium chlorides or calcium chlorides will corrode metal and concrete. Non-corrosive solids are needed for runways, taxiways, aprons and walkways. The

United States Federal Aviation Administration has approved urea, sodium formate and sodium acetate for use. Note that urea is only effective above -10 C.



Example of roof sloping away from hangar doors, if not a large overhang is required.

## Animal and Pest Removal

A hangar is like any rural building. You may need to remove things like wasp nests and raccoons from the area. Contact your municipality, county or your provincial Ministry of Natural resources for help.

## Apron Maintenance

The apron should be regularly checked for “foreign object debris” (FOD), which can be hazardous to aircraft. It is not unusual to find stones, sand, gravel, nuts, bolts, washers, rivets, and paper on the apron. Most debris may be removed with a broom. Vegetation growing through cracks in the hard surface should be killed to maintain the integrity of the apron.

## Storing your Airplane

No special storage practices are required during the Canadian spring, summer and autumn. During the winter, the temperature and humidity in the hangar will vary, causing water to condense in the engine, fuel tanks, and fuselage.

- Keep the fuel tanks full.
- Thoroughly check all fuel sumps for the presence of water

- Visually check the oil dipstick for water droplets
- When condensation is a frequent problem, keep the hangar warmer and/or install a dehumidifier.

## Humidity

Ideally, the humidity in the hangar should be maintained between 35 to 45%. This is low enough to prevent corrosion and mold from forming, but high enough to prevent shrinkage and cracking of elastomeric components. A dehumidifier will be necessary to achieve this environment during the Canadian summer. Buy an inexpensive humidity gauge and keep track of the humidity.

## Heat

Many hangars do not have any supplementary heat. However, some form of supplementary heat may be desirable in these cases.

### Below 16° C

When dressed appropriately and actively working, most people are comfortable at a temperatures as low as 16 C. This is a good target temperature if you will be working in the hangar for an extended period of time. Heat may be provided by small electric or propane space heaters at the work location, or by larger heaters or furnaces. In Ontario, industrial establishments must be heated to at least 18 C for worker health and safety.

### Below 0° C

Hangars with running water or water tanks, need to be heated greater than 0 C to prevent the water from freezing.

### Below Engine Preheat Temperature

Check your Pilot Operating Handbook to see the temperature below which your engine requires preheat. Heating may be applied through engine cylinder heaters, oil sump heaters, or by blowing hot air through the cowling.

## Storing Your Car in the Hangar

Some people store their car in the hangar while they are flying. If you do so, check that the car does not track gravel onto the apron. Loose gravel on the apron could be thrown by the propeller, damaging the airplane, hangar or bystanders. During the winter, make sure that the car is cleaned prior to putting it in the hangar. Remove all snow, ice, and the salt on the tires and bumpers. Salt will corrode the airplane, when you return it to the hangar. If you can't clean the car, don't store it in the hangar.

## Additional Hangar Equipment

The following additional equipment may be useful in the hangar:

- Portable Engine Air Heater - eg “Red Dragon”
- Tug - for moving the airplane
- Battery chargers/boosters - for the airplane
- Fire extinguisher
- Smoke detectors
- Spill kit - for fuel and lubricating oil
- First Aid Kit, Eye-wash station
- Garbage pails
- Air compressor and long air hoses
- Long extension cords
- Brooms - for dust and dirt that is tracked into the hangar
- Grass cutting equipment
- Snow removal equipment

## Usage Summary

While using your hangar you will know:

- The aerodrome regulations and contractual obligations you need to comply with
- Your responsibilities for site upkeep outside the hangar
- Understand the need for hangar insurance
- Recommended storage practices and limits for hangar temperature and humidity
- Other equipment and tools to consider purchasing for the hangar

## Renting Your Hangar

### Finding Tenants

At most airports, vacant hangar space is filled quickly. You can rent space in your hangar by:

- Putting a sign up at the local and nearby airports.
- Telling the Airport Manager that is available for rent.
- Telling people in your local flying community.
- Advertising in COPA’s Canadian Plane Trade classified ads.

To set a price for your rental, check the cost of renting other hangars at your airport. Then adjust the price considering the amenities your hangar offers. COPA’s classified ads in September 2012 listed prices between between \$285/month for an unheated, dirt floor T-hangar, to \$500/month for a heated hangar at a large certified airport.

## Insurance

If you rent or share your hangar with others, you need a “Hangar Keepers” insurance policy. This covers your risk, even if the other airplanes are insured. If a tenant’s aircraft was damaged in your hangar, they or their insurer could litigate to recover the repair or replacement costs from you. Discuss your insurance needs with your hangar insurance agent or broker.

## Tax Requirements

Rental income must be declared on your annual Canadian income tax form on line 126. The following expenses may be deducted from the rental income:

- Advertising the hangar for rent
- Insurance on the hangar and it’s contents
- Interest expenses on the mortgage or capital cost
- Legal, accounting and other professional fees required to operate or maintain the hangar
- Maintenance and repairs
- Management and administrative fees required to operate or maintain the hangar, eg: accounting services to bill tenants
- Motor vehicle expenses, where the vehicle is used to inspect the hangar
- Property Taxes
- Salaries, wages and benefits paid to employees or contractors who operate or maintain the hangar
- Hangar utilities

The following expenses are not deductible from the rental income:

- the land transfer taxes, where the hangar property is owned
- the mortgage principal
- the value of your own labour
- If you store your own aircraft in the hangar, your personal share of the hangar expenses

The Revenue Canada agency provides Form T776 to calculate your rental income. See their Guide, “Rental Income” T4036 or a tax adviser for further guidance.

## Renting Summary

Before renting you will need to:

- Know where to find tenants
- Understand the need for additional insurance
- Know how to report the rental income for taxes