**DRAFT 2**

**The Story of a Beaver C-FFHB Model**

# CONTENTS

## Introduction:

This is the story of a model of DeHavilland Beaver Mk.1, Serial #1, C-FFHB. The very first Beaver, was built in 1947, and then used as a prototype and for flight testing. It was then later sold and served as a bush plane until 1980. The aircraft is currently on display at the Canadian Aviation and Space Museum.

The model is: 18% scale with 103” wingspan, weighing 33 lbs.; built from a kit by MR Aerodesign; powered by an OS Max 120AX two-stroke glow engine; controlled with Futaba servos and a Spektrum receiver; fitted with a BCM muffler, Glennis wheels, a pilot by Warbirds Pilots; and finished with graphics by Cal-Grafx, and painted with Klass Kote.

The construction is traditional, with laser cut ply forming the main structure, sheeted with 3/32” balsa, then covered with fiberglass cloth and resin.


1 **The Completed Model**

## Why a Beaver?

I love Beavers!! My first attempt at a “serious” scale model was a Beaver from the eight-foot span Unionville kit. Since I was starting scale competition at the Novice level, it served its purpose by getting me into scale competition and gaining experience. As I moved up to more competitive levels, it became apparent that this original Beaver model would not generate the static points necessary to remain competitive. However, that original Beaver model is still part of my fleet, and I still enjoy flying it.

Another aspect is the Beaver is that it was built in my hometown of Toronto. I have always thought that the DeHavilland Canada facility created some great aircraft.

The more that I researched this project, the more involved and interested in Beavers that I became. There are great stories out there about Beavers. They always feature largely in any aviation documentary about bush planes or float planes.

## Why a Kit??

When I started out, I had expected to design the whole model from scratch. I did a survey of the kits and ARFs on the market to form some ideas of size and power requirements. While doing that, I found that most available Beaver models are not very accurate. During this search, I happened upon the MR Aerodesign Beaver (www.mraerodesign.securicom.ca). It was about the right size for me, it has very accurate outline, and it had some other very well thought out design features. The scale landing gear immediately caught my eye. So … I bought the kit to save myself a lot of design effort, and a lot of fabrication effort in making the cowls and landing gear.

## Finding a Beaver to Model:

The next step was finding a specific Beaver to model. For competition, the model has to be of a specific aircraft, not a generic type.

Although most Beavers look very similar, there are small differences between them due to aftermarket modifications. For example: The Beaver Mk I was originally built with the circular porthole window in the aft cabin. On many Beavers, this has been replaced with one or two windows to provide better visibility for passengers in the rear seat.

Another popular modification is the “Alaska Door” which provides a huge cargo entry behind the normal doors. A number of Beavers also have wing modifications which include leading edge droops and wing fences. There are even a few Beavers which have had the engine moved forward about 4” to provide better balance with heavy cargo. And of course there are small fins mounted on the stabilizer or sub-fins on the fuselage fitted to float equipped Beavers.

All this means that you should pick the aircraft to model before you cut wood!

It is very helpful to have an aircraft near home to visit several times during the build, or at least to visit your selected aircraft and take a few dozen – or hundred – photos of all the details, also keeping in mind the photos that you need for your “Documentation Package”

My selection process involved finding a “pretty” Beaver on wheels, as almost all scale competition takes place from runways. Yes - I know some scale rules allow the use of dollies for water aircraft, but that was a complication that I wished to avoid.

There are several great resources for finding Beavers. The best is the website called Beavertails (www.dhc-2.com ) which has photos of most of the Beavers ever built, plus some technical resources.

The Yahoo chat room for Beavers (http://groups.yahoo.com/group/DHC-2Beaver/ ) is a great place to visit. The site has lots of interesting Beaver stories and also some technical information if you search the

archives, plus an associated photo album section with more Beaver pictures – including some models. A search of this website also will help identify some key places to visit and watch Beavers. For Example: Campbell River, Seattle, Ketchikan, Vancouver and Nanaimo harbours, and Tofino in BC; Kenora, Dryden, Red Lake and Sioux Lookout in Ontario; and Selkirk, Gimli and St. Andrews in Manitoba.

More recently there is a Facebook page "DHC-2 DeHavilland Beaver" devoted to Beavers, and many photos on Pinterest.

There are several Beavers in Museums across Canada and the USA, as well as New Zealand and the Netherlands, and other countries. Beaver #454 at Robins Air Force Base Museum near Macon Georgia was neat one to visit as the aircraft was in a quiet corner, and I could walk right up to it and measure things like corrugations, door handles and rivet sizes.

Scale Model Research (www.bobsairdoc.com/ ) has photo packs of Beavers available for those who cannot get up-close and personal with one. MR Aerodesign also has a CD full of Beaver photos.

The Beaver that I chose to model is C-FFHB, the very first Beaver, and also the one in the Canadian Aviation Museum in Ottawa. I used the Norcanair livery.

I visited the museum to look at and photograph the aircraft, and to make a prearranged visit to their archives. They have some photos of this craft through its history, as well as all the log books and maintenance records and other information. I found enough information to document C-FFHB on wheels in the Norcanair colours, and have enough supplementary information to document the details.

While at the museum, I discovered that they have modified the aircraft. They changed the call letters from C-FFHB to CF-FHB to match the markings when the aircraft was built. They also changed the cowl to the original one with the small lower scoop. So what is on display is an aircraft that accurately represents neither the original as-built aircraft, nor the aircraft as flown by Norcanair!

## Documentation:

In addition to the websites, museums, and visits to full scale aircraft, there are a number of good references on Beavers.

In my library are:

- The Beaver Bushplane at home in Ontario by Henry and Linda Feisen: ISBN 0-9686597-0-5.
- The Immortal Beaver by Sean Rossiter: ISBN1-55054-519-1.
- DeHavilland in Canada by Fred W. Hotson: ISBN0-921022-10-7.

These books do not necessarily provide a lot of scale detail, but they do provide some interesting background on the aircraft.

Of more value for finding scale details, dimensions, and information are:

- Beaver DHC-2 Flight Manual
- Beaver Repair Manual
- DHC-2 Beaver Illustrated Spare Parts Catalogue
- The FAA Type Certificate - AIRCRAFT SPECIFICATION NO. A-806

The Illustrated Spare Parts Manual has cutaways and exploded views, plus all the layout dimensions of the fuselage bulkheads and wing ribs for accurate rivet placement. There are also many sketches of all the parts and aircraft system, letting you dig up all kinds of details.

The Repair Manual has details of all the sheet metal panels and metal thicknesses for setting the panel lines accurately

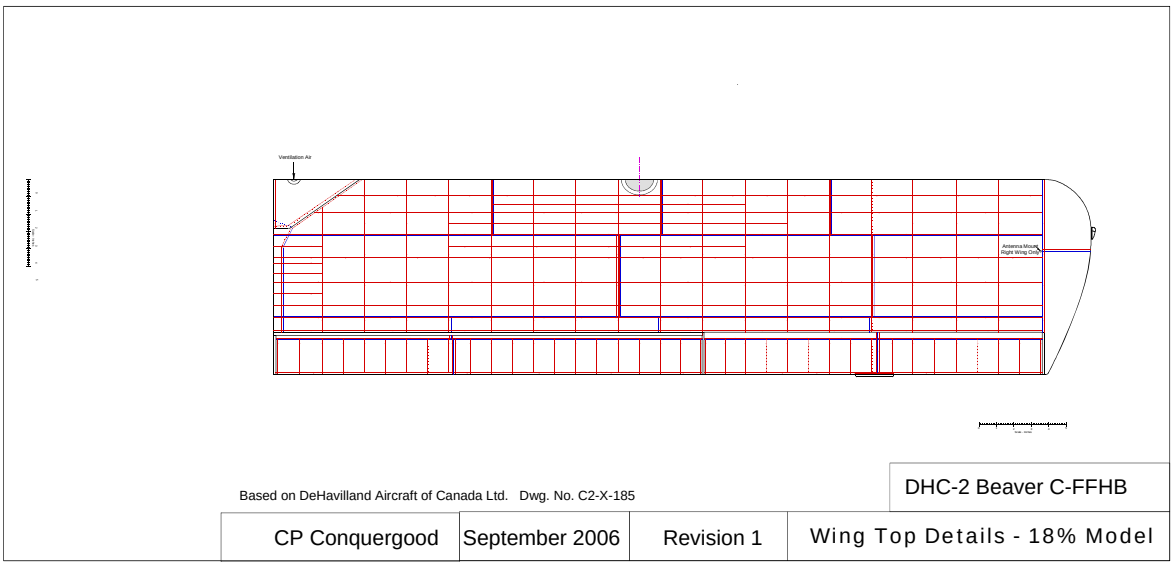
These references are available on the web - for a fee.

### *Three-View Drawings:*

Accurate three-view drawings of the Beaver are hard to find, particularly ones with panel line and other details. Bob Banka has one at Scale Model Research. (http://www.bobsairdoc.com/ ) I believe that the original source was Aeromodeller magazine in October 1949.

To supplement all the information, and to ensure accurate placement of details, I have ended up making my own three-view drawings using CAD software.

A sample of the wing drawing is attached. Panel lines are blue, Rivet lines are red. Sorry – but this work is not yet finished or available for sharing at this time.




**2 Wing Top Drawing With Panel and Rivet Lines**

For the “ultimate” Beaver model – have a look at http://www.mhm-scale-aircraft.com/menue03.php?search=DHC-2

## Engine Selection:

The next step for me was developing a power system. My main objective was to have everything enclosed in the cowl. A secondary objective was to have a four-stroke. The sound of a four-stroke in a scale model is hard to beat. Note that a full scale 9 cylinder radial running at the rated 2300 RPM has 5175 firings a minute. A model four-stroke running at about 10,350 RPM has the same.

My research and scaling determined that I wanted to have about 3 HP (as rated by the engine manufacturers) to achieve realistic scale performance with an expected weight in the 25 to 30 pound range. I quickly determined that most model radials of four-strokes would not fit in the cowl. I ended up with an OS AX 120, which is a compact engine, which fits nicely in the cowl, and leaves room for a dummy radial. Bison Custom Muffler made me a special version of their standard muffler for the AX 120 which puts the model exhaust at the correct scale position and size.

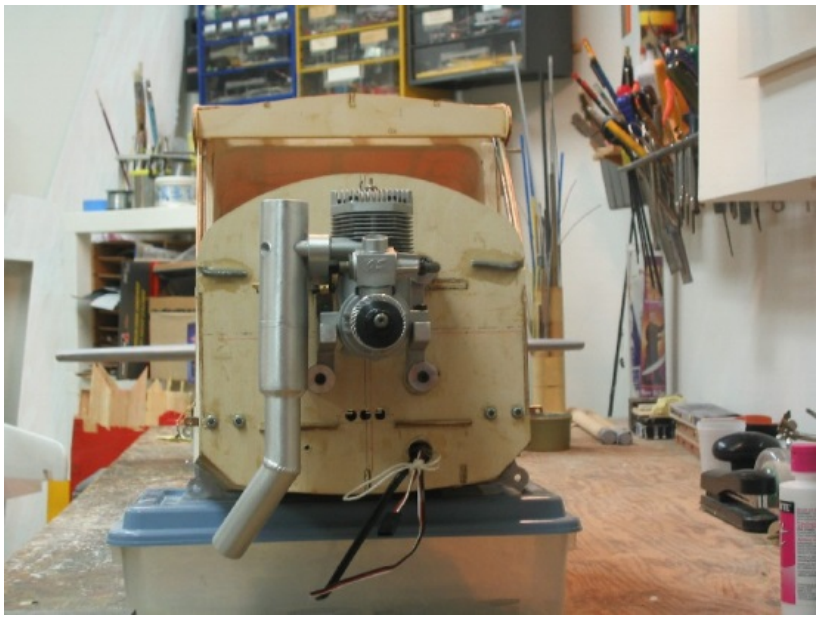
To complicate life a bit, I have chosen to install an instrument panel and pilot seating in the front of the cockpit. This means that I could not mount the fuel tank just behind the engine as we normally do. The tank is mounted in the center of the cabin just behind the centre of balance. I have bench tested this system, and it seems to work ok. Actually, on the test stand, the AX 120 seemed to draw fuel well with the remote tank even with normal exhaust pressure and a simulated steep angle of climb.

## Engine Installation:

Here are some photos of the engine installation:

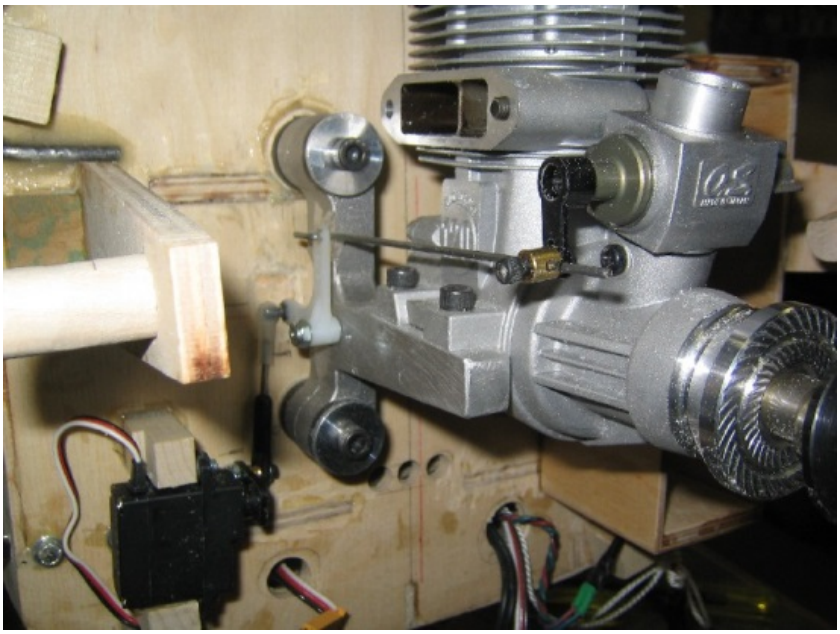
You will note that I have relocated the throttle servo to the firewall. I did this to make the throttle linkage simpler, accessible and maintainable.

Since the engine is buried behind the dummy engine, a shaft extension was necessary.

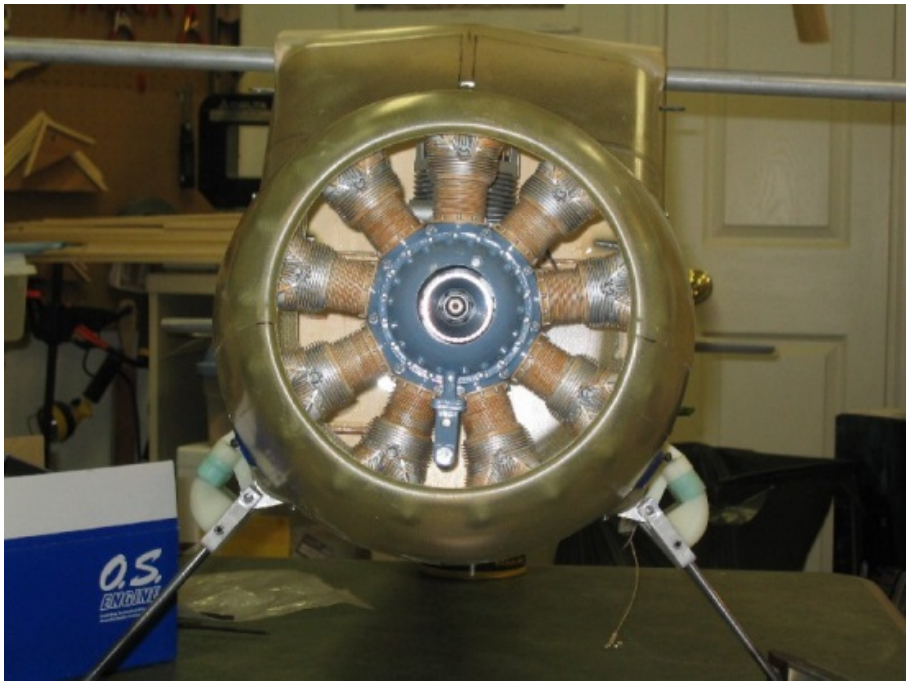


**3 Engine on Firewall**

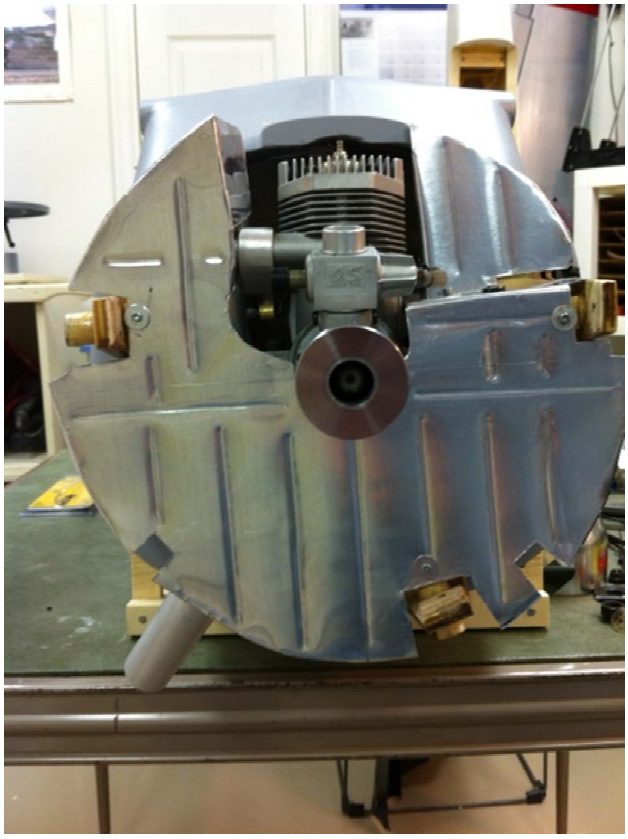

**5 Muffler**



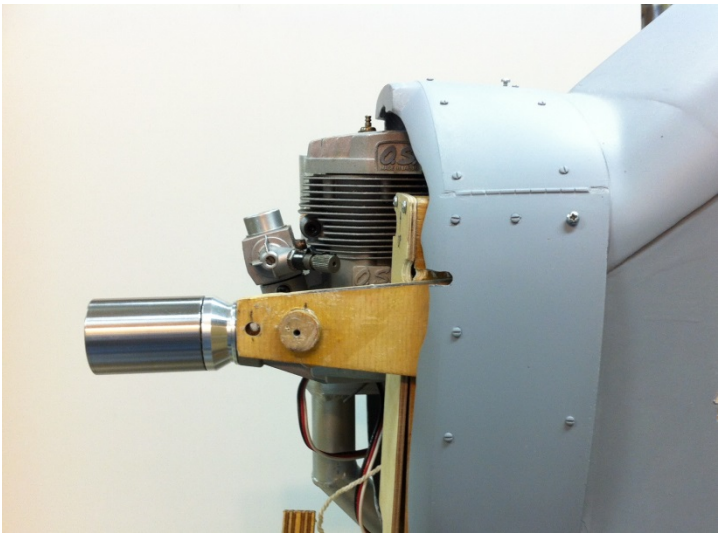
**4 Throttle Servo Location**



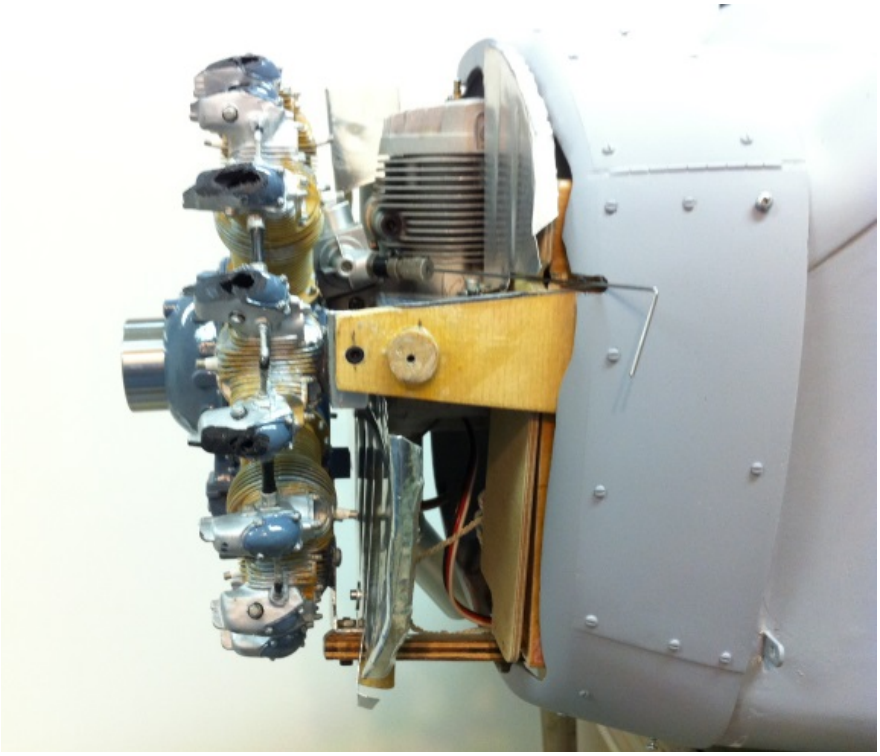

**7 Dummy Radial Fitting**



**6 Cooling Baffle**



**8 Engine Shaft Extension**



9 **Mounting of Dummy Engine and Baffle**

***Dummy Radial Engine:***

The dummy engine is a 1/6 scale Wasp from Williams Brothers. There is still some detailing to add to it in these photos. There are lots of articles on detailing dummy engines, so I will not elaborate here.

### *Engine Baffling:*

With the engine buried deep in the cowl, cooling was an issue. A baffle was installed behind the dummy engine to direct the airflow over the cylinder and down to the bottom exit just ahead of the fire wall.

Initial engine test runs were made without the cowl and baffle. Later tests were made with the engine fully coweled. Telemetry data indicates that the engine runs 20 to 30º F cooler when fully coweled and baffled.

## Wing Detailing:

### *Wing Hinges:*

One of the few things that I did not care for in the kit were the hinges for the flaps and ailerons. The hinge point is in the right scale position relative to the wing, but the parts do not look very scale like.

I made my own hinge parts from 0.040” and 0.060” aluminum sheet. They are bolted to the ribs in the wing, aileron and flap. The hinge pin is a #2-56 bolt, set in a nylon bushing to avoid metal-to-metal contact.

**10 Aileron Hinge Parts**

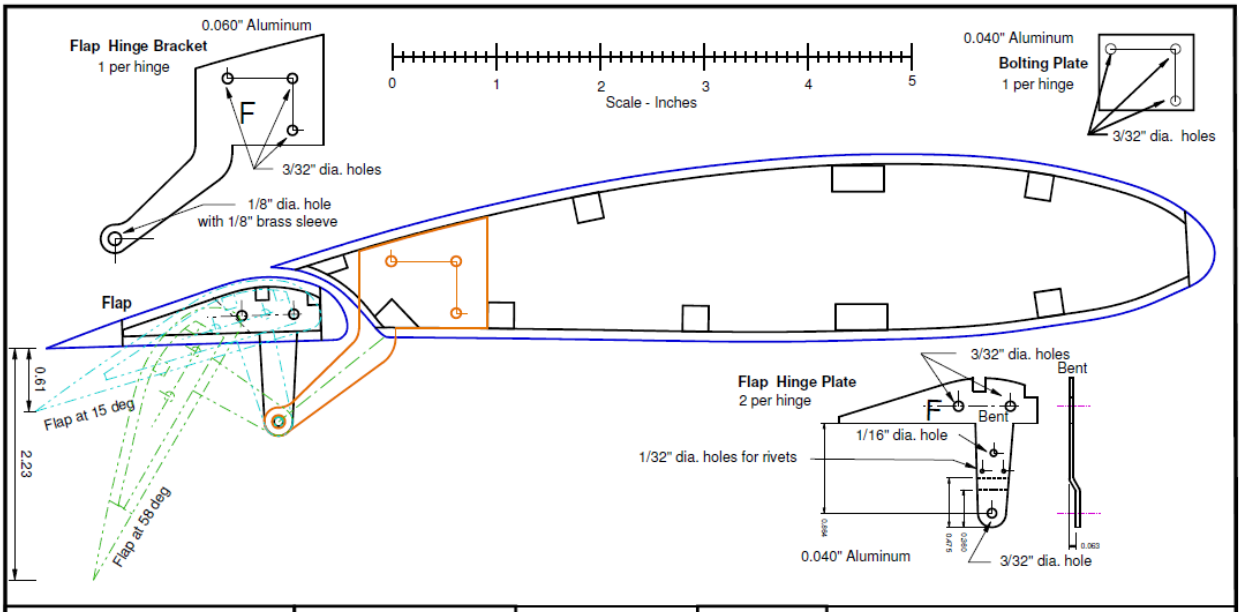
**11 Aileron Hinge Fitting**

These two pictures show the finished hinges on a prototype piece of wing.

**13 Completed Aileron Hinge**

**12 Side View of Completed Aileron Hinge**

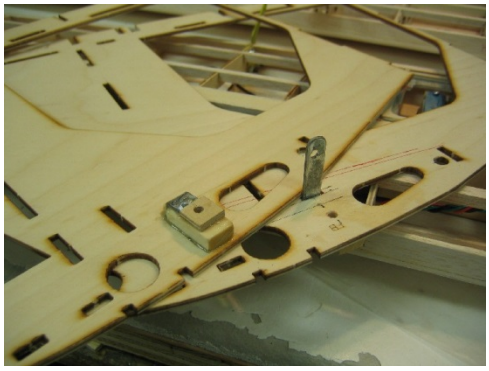
Here is a drawing of the flap hinges, and the components that were used.




**14 Flap Hinge Design**

***Wing Mounting:***

Another small change in the kit. The wing mounting uses a tube, which is a strong and simple system. Most wing tube mounting systems use bolts through the fuselage side into the wing root to lock the wing in place. The problem I had was, that with the finished interior, the “locking" bolts were not accessible. Instead, I built a metal tab that extends from the fuselage side into the wing root, and have a #4-40 bolt that comes up from the bottom of the wing, through the tab and into a blind nut to lock the wing in place. The bolt head is recessed into a stub of ¼” tube.



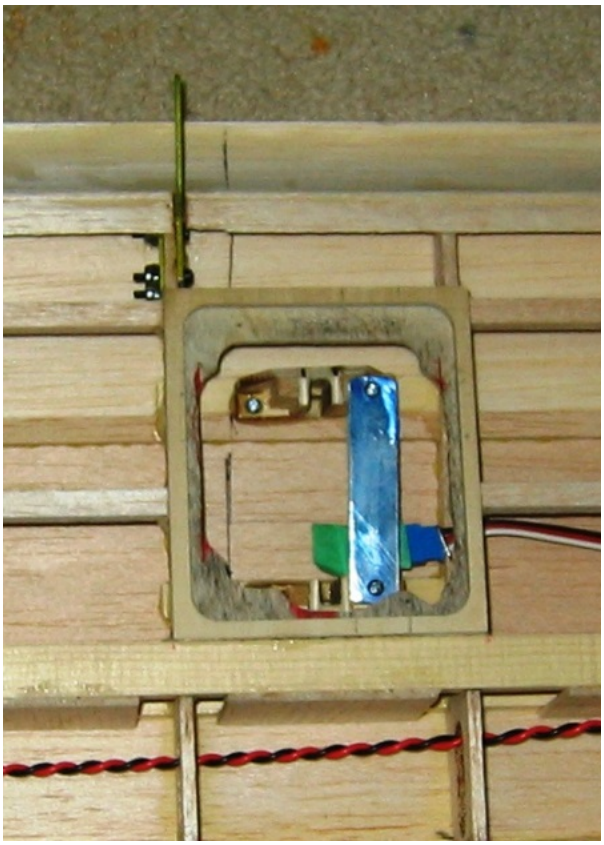
**15 Tab on Fuselage Side**

**16 Matching Bolt Location on the Wing**

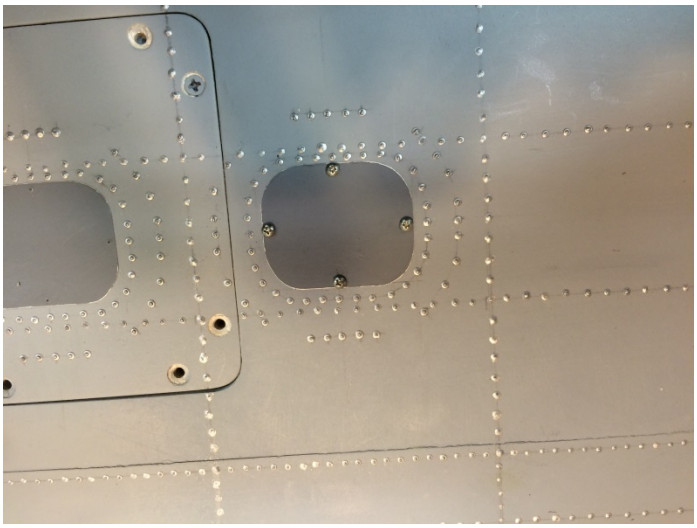
***Wing Hatches:***

The access hatches for the flap and aileron servos were purchased from J&B Access Panels and mounted flush with the skin.

The simulated maintenance access hatches were created using automotive aluminum foil tape. The tape was first burnished to remove any surface coatings, primed, then cut and trimmed to size with the help of the CAD drawings. The hold down screws are #1 screws.



**17 Flap Servo Access Hatch**



**18 Simulated Maintenance Access Hatch**

***Wing Panel Lines:***

With the wings assembled and wrapped in fibreglass it was time for details to be added. The majority of the wing panels on the Beaver are overlapped, making a ridge on the surface. The panel lines and reinforcing plates were done with the conventional technique of masking tape and spray primer.

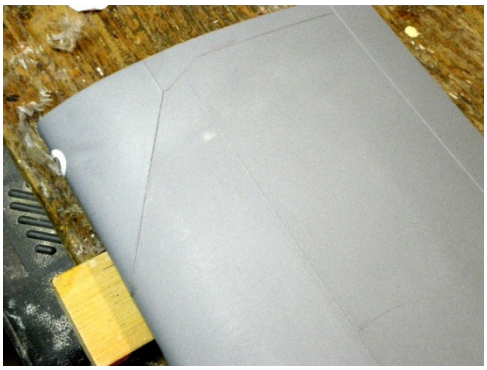
Two layers of tape were used to get the thickness right and sprayed with three coats of automotive spot filler and primer in a layer tapered towards the tape followed by a light sanding on the edge of the tape before removing it.

There are a few butt joints in the panels, mostly on the aileron and flaps. These were simulated by painting over a piece of 1/64” drafting tape and then sanding down to the tape before removing it.

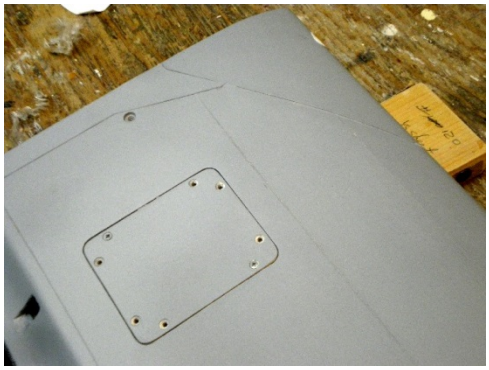
For the wing root cuff and fairing extra thickness of primer was used, needing four layers of tape.

After the panel lines were in place, simulated reinforcing plates were added to the bottom of the wing. These were scaled form the prototype photographs, fabricated from 0.005” styrene sheet, and glued in place with vinyl canopy glue. (Refer to the photo in the riveting section.)

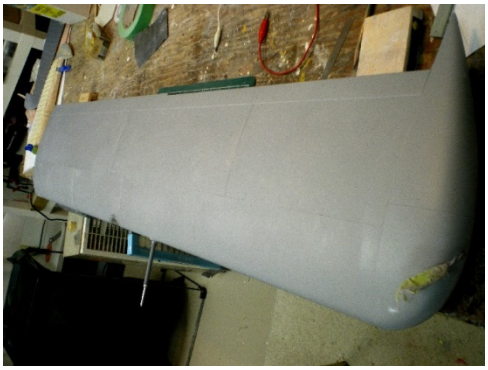
All set now for the rivets!



**20 Top Wing Root Cuff and Fairing**

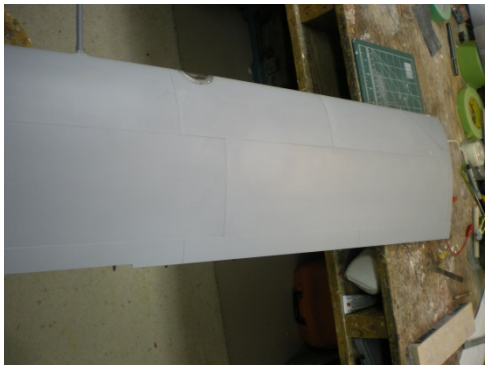


**19 Bottom Wing Root Cuff and Fairing**

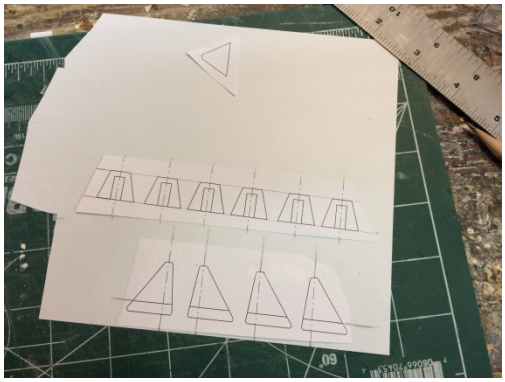


**21 Wing Top Panel Lines**

**22 Wing Bottom Panel Lines**



**24 Wing Top Panel Lines**



**23 Wing Reinforcing Plates**

***Control Surface Corrugations:***

The full scale Beaver has corrugated aluminum on both sides of the rudder, both surfaces of the elevator and on the bottom of the flaps and ailerons. They are all the same: corrugations at 3” centres, about 3/8” high, 3/8” wide at the bottom, tapered to about 1/8” at the top, and rounded. On the model this worked out to a spacing of 0.540” and a height of 0.068”.

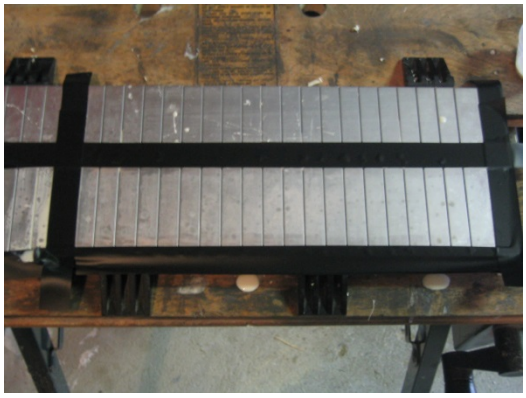
Trying to replicate these caused a lot of head scratching. These would obviously be very fine feature, but they needed to be about the right spacing to look good, and of course parallel to each other. Trying to glue on individual bits to simulate the ridges seemed too daunting, and too prone to inaccuracy. I tried scribing ridges into thin aluminum manually, but got inconsistent results. A friend suggested building a machine to make the crimps, probably the same way that they make the full scale ones, but I had neither the knowledge nor the tools to make such a device.

My solution was to mould them. I obtained a piece of ¼” aluminum plate and a machinist friend cut shallow slots into it at the right shape and spacing. He was able to shape his cutting tool so that the slots

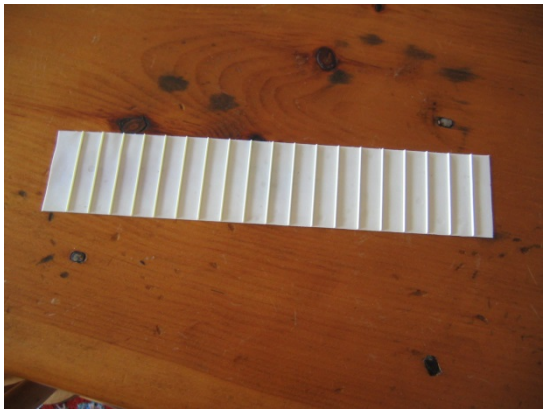
had the correct profile. It was then a theoretically simple matter to cast thin sheets of material to replicate the aluminum sheeting on the full scale Beaver. I said theoretically because it actually took a fair number of rejects before I got the technique to work properly.

In the end I was casting the sheets with polyurethane casting resin. I embedded a sheet of ¾ oz. glass fibre into each one as it set, to give the part a little strength. The finished sheets were cut to shape and glued to the model with 30 minute epoxy.

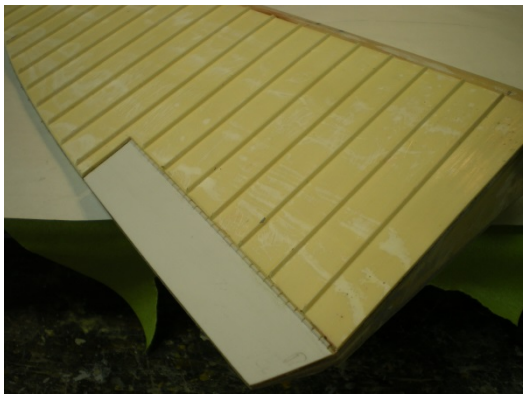
In the photos below, you can see the mould, taped off to make an aileron skin, then a sample piece of finished skin. The next photo shows the skin attached to the rudder before priming. The trim tab hinge is a piece of styrene tube notched with a hobby saw.



**26 Corrugation Mould**



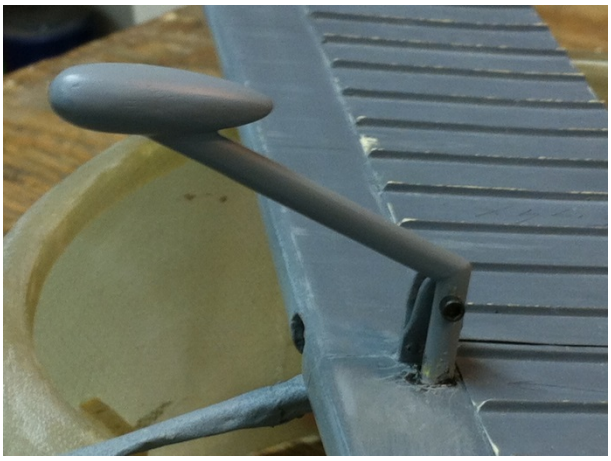
**25 Corrugation Panel**



**27 Installed Corrugation**

***Aileron Mass Balance:***

The aileron mass balance which is the last step on the wing build before the rivets. The support is a



**28 Aileron Mass Balance**

**29 Aileron Mass Balance and Corrugations**

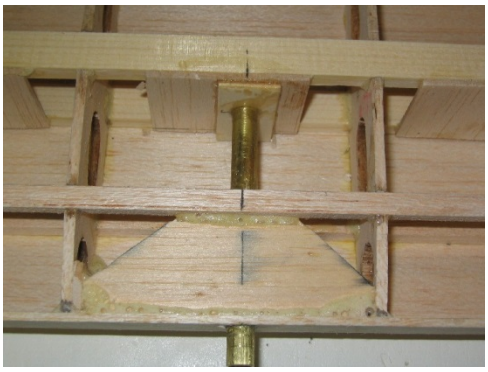
slightly flattened 5/32” brass tube, and the weight was carved from a piece of 5/16” dowel.

***Pitot Tube:***

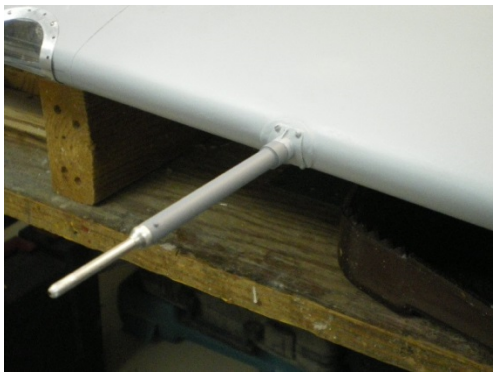
The Pitot is ¼” dia. brass tube, inset into a 9/32” tube in the wing. It is removable, and held in place with a rare earth magnet, holding a steel rod inset into the removable part.

The front tip was made from aluminum tubes inset into the ¼” tube. The bracket on the wing was made from styrene sheet and tube.

It is interesting to note that most Beavers have a fin on the front of the Pitot, but not C-FFHB



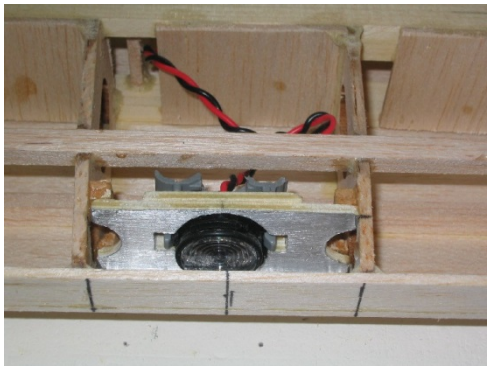
**30 Pitot Tube Mount in Wing**



**31 Pitot Tube**

***Landing Light:***

The landing light was mounted on an aluminum foil covered bracket set into the leading edge of the wing. After covering, the hole was cut out. The cut-out was covered with a piece of clear 0.010” butadiene, and the mounting ring was made from 0.010” aluminum sheet, held in place by #0 screws.



**33 Landing Light Mount**

**32 Landing Light**

# MAKING RIVETS:

Since this is my first model with a lot of rivet detail, I have experimented with a variety of techniques and materials. One can question whether of making rivets for this scale a model is worth the effort. They scale size is only about 1 mm diameter.

I put rivets on my test wing panel, and found that they do not show much after a couple of layers of paint. But they do show! My conclusion is that they add a surface texture to the model which aids the realism content.

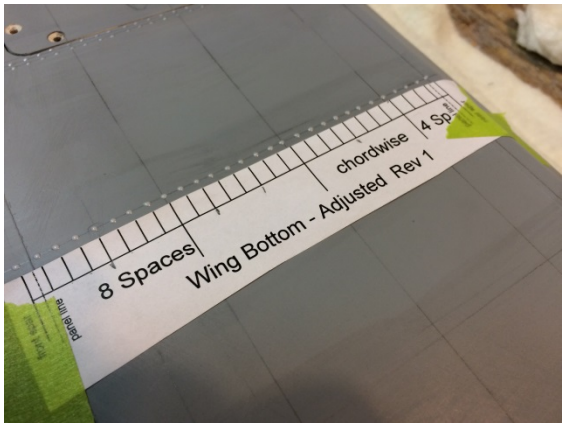
A common way to simulate rivets is to use glue dots, which is the approach that I used. The trick is to get the right tools and glue mixture. I found a hypodermic hard to control. Instead I used a small bottle with a hypodermic type nozzle, 22 Ga. about 1” long. I got these online from a small parts store.

If you want bigger rivets, larger nozzles are available.

The glue is a mixture of 10 parts Weldbond or Titebond, 1 part aluminum acrylic craft paint and about 1 part water. This combination gave a glue dot of the right size. The aluminum paint provides two functions. It makes the glue dots visible, and if the rivet is exposed when scuffing the surface for weathering, it has the right colour.

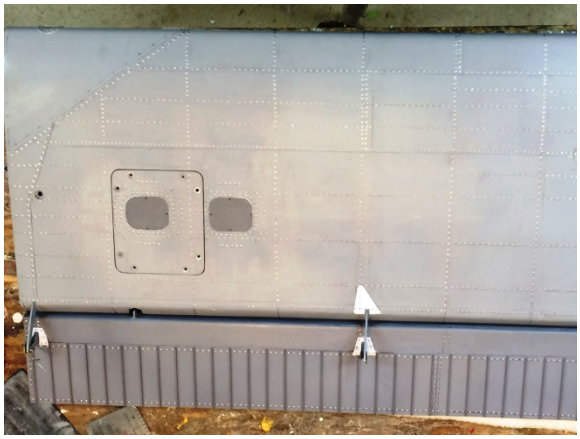
I also experimented with the perforated tapes that are on the market for making rivet dots. These worked well, and made consistent rivets. But when I added up the cost of the tapes for doing the whole model, I found the cost to be prohibitive since the tapes can only be used one time.

So I ended up placing the dots by hand. I drew lines on the skin using a soft pencil, and made guide templates to get the spacing right. With a little practice I could lay down the rows of rivets quite quickly and fairly uniformly. They are not perfect, but since they are small, and partially buried in paint, the resulting overall effect is good.

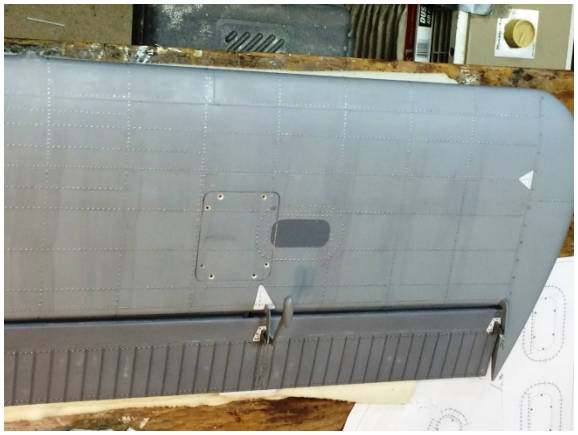



**35 Wing Rivet Template**


**34 Rivet Applicator Tool**



**36 Finished Rivets - Wing Bottom Root End**



**37 Finished Rivets - Wing Bottom Tip End**

## Lighting:

Working lights add a lot to a scale model. It has always been a challenge to get them bright enough to show up in daylight. The new high-brightness LED technology is now making it possible to have very bright lights, with low power consumption.

I built my own LED lighting system. It is not hard. The main technical task is sizing a resistor for the LED circuit so that they do not burn out.

These high brightness LED's are available at many electronic component sources. A couple of sources on-line are www.superbrightled.com and http://www.lightingforaeromodellers.co.uk/ . Alternatively, there are now a variety of lighting systems commonly available on the market with pre-sized resistors and wiring harnesses, which are simpler to use.

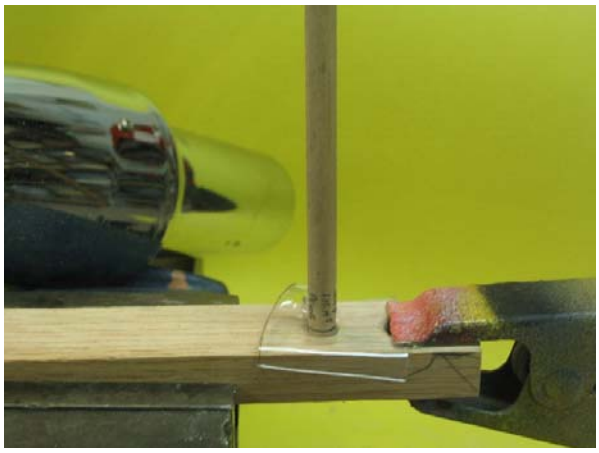
The more difficult challenge is making a light fixture that is scale like.

In my Beaver, I installed a three-light navigation light system, and a landing light.

The lenses for the wingtip Navigation lights were made using a simple heat forming jig. A hole of the correct size is drilled in a block of wood, a pieces of 0.030" clear plastic is clamped in place, heated with a heat gun until soft, then driven into the hole with a piece of rounded dowel. The lenses were then coloured with transparent paint, and trimmed to size. An LED is glued into the lens.

The wingtip housing is made in three parts. The lens as described above, a flat base plate made from aluminum or styrene, and a cover piece. The cover was carved to shape, and then I made a mould and cast several covers. The finished assembly is shown painted blue at the top of the photo.

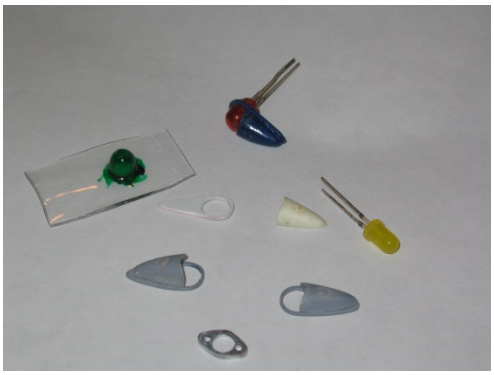
The tail Navigation light uses a two part design. The LED diameter is very close to the required scale size, so an LED was glued into the aluminum holder shown at the bottom of the photo and screwed to the tail cone. The holder was made from 0.040" aluminum sheet.



**41 Making the Navigation Lamp Lens**

**40 Navigation Lamp Lenses**


**38 Painting the Navigation Lamp Lens**



**39 Navigation Lamp Components**

**42 Finished Tail Light**

## Control Throws:

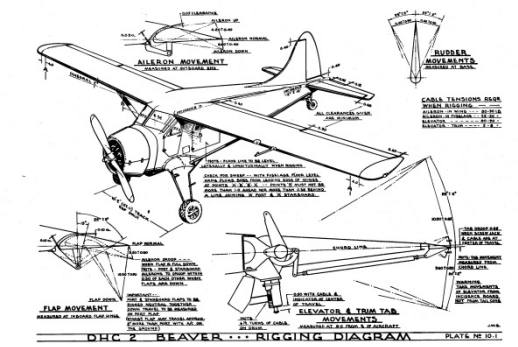
The Control throws were not included on the kit plans. I have been a believer that a good starting point for control throws should be the throws used on the full size aircraft.

At first, these were hard to find, but with enough rooting around …. I found them. Actually I got some good help from the Beaver Chat room on Yahoo, in the form of a Rigging Diagram used by the British military. This helped to make sense of the information that I found in the FAA Type Certificate and the STC for a Beaver modification.

Here is the data.

| | |
|---|---|
| Ailerons Up | 18 º |
| Ailerons Down | 11 º |
| Aileron Droop with full flap | 15 º |
| Elevator Up | 28 º |
| Elevator Down | 20 º |
| Rudder Right | 25 º |
| Rudder left | 25 º |
| Flap Setting at inboard hinge -- 0 - Cruise | 0 º |
| Flap Setting at inboard hinge -- 15 - Climb | 15 º |
| Flap Setting at inboard hinge -- 35 - Take Off | 35 º |
| Flap Setting at inboard hinge -- 50 - Landing | 50 º |
| Flap Setting at inboard hinge -- 58 - Full | 58 º |
| Ailerons Up at tip | 4.20 in. |
| Ailerons Down at tip | 2.50 in. |
| Aileron Droop at tip with full flap | 3.50 in. |
| Elevator Up at 8" from aircraft CL | 10.90 in. |
| Elevator Down at 8" from aircraft CL | 7.60 in. |
| Rudder Right at bottom | 11.40 in. |
| Rudder left at bottom | 11.40 in. |
| Flap Setting TE at inboard hinge -- 0 - Cruise | 0.00 in. |
| Flap Setting TE at inboard hinge -- 15 - Climb | 3.50 in. |
| Flap Setting TE at inboard hinge -- 58 - Full | 12.30 in. |

Note that for a Mark III Turbo Beaver, down elevator is 23 degrees.



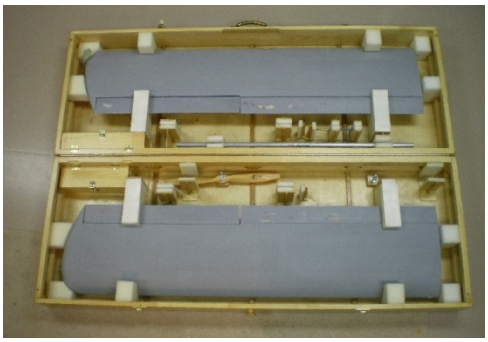

**43 Beaver Rigging Diagram**

## Wing Box:

I took some time out during the detailing to build a wing box to store and transport the model parts. I was starting to get some issues with hangar rash!

The box is modelled after the ones used by the Precision Aerobatics guys. Mine will hold the two wings, wing tube, struts, scale prop, spare props, and some spare parts. The box is a pine frame with 1/8” birch ply sheet. The birch ply comes in 5 foot square pieces, so I only needed one, whereas I would have needed two 4 x 8 sheets to cover the 52” length.

The foam cushioning is high density upholstery foam. The foam cuts nicely with an electric carving knife, or a hot wire, but I mostly used my band saw. It is hard to tell from the pictures, but the wings are mounted with the leading edge lower than the trailing edge, to provide clearance for the hinges, while minimizing the box depth.



**45 Wing Box Contents**

**44 Wing Box - Ready to Travel**

## Fuselage Detailing:

### *Seats:*

Into the interior now…

The front seats used several techniques. The seat frame was vacuum formed using 0.040" sheet styrene. This was my first time attempting vacuum forming. It was not as difficult as I expected. I built a small forming box and connected it to my shop vacuum. The tricky part was waiting long enough for the styrene to soften in the oven.

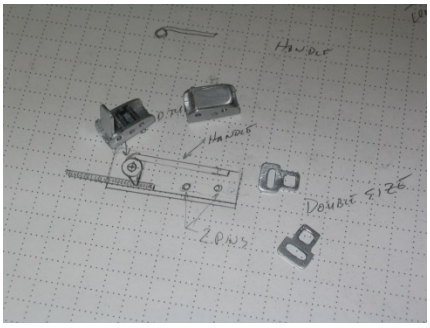
The seat cushions are carved from balsa blocks. The pedestal is a block of balsa sheeted with aluminum glued to the balsa. The seat belts are a piece of shoelace. The working seat belt buckles were fabricated from aluminum sheet. The control column is fabricated in brass, with details discovered in the "Illustrated Parts Manual".

**47 Mould and Parts for Seats**

**46 Seat Frame**

**49 Finished Seat**

**48 Interior Looking Aft**




**50 Seat Belt Buckle Components**

***Cabin Interior:***

I chose to install cockpit detail, which meant moving the fuel tank to the center of the fuselage. I then decided to hide the fuel tank and radio system inside simulated cargo. While building the cargo, I discovered that I could run 1/64" and 1/32" plywood through my inkjet printer, and make stencils on the cargo.

**52 Cargo Box to Cover Receiver**

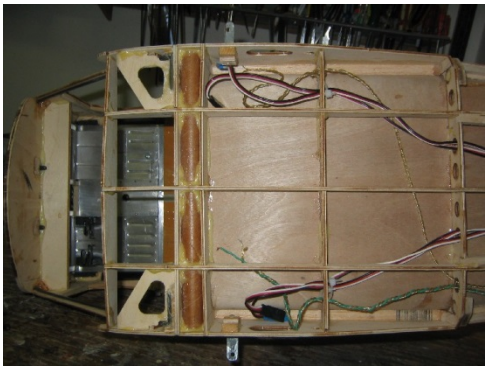

**51 Cargo Box to Cover Servos**


**53 Cargo Box to Cover Fuel Tank**

**54 Interior and Floor**

Having gone that far, I figured that I had to put some sort of lining on the inside of the cabin, so I sheeted the inside of the cabin with 1/64” ply. I did this before sheeting the exterior of the fuselage, and before installing the firewall. To fit it in smoothly, I had to do some trimming on a couple of the bulkheads. This step also meant that I had to install some of the wiring early.

**56 Cabin Lining**



**55 Fuselage Wiring Before Skinning**

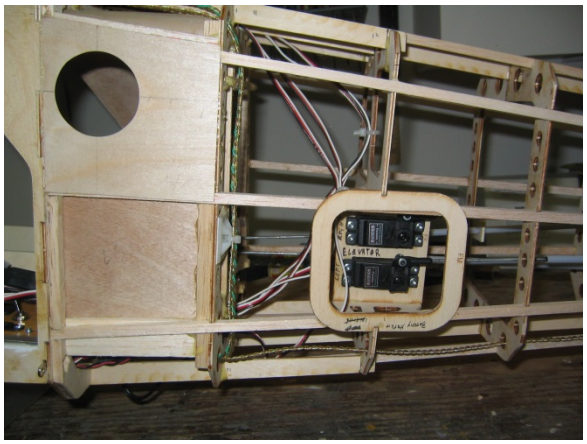
***Instrument Panel:***

A moulded resin instrument panel was an option for the kit. It was detailed by gluing on instruments, painting knobs and switches, and adding coloured pins for the engine control levers. The bottom of the cockpit area was covered in 0.010” aluminum sheet to simulate the unpainted cockpit floor. The engine fuel lines were run under the raised center section of the cockpit floor.

**57 Instrument Panel**

### *Fuselage Porthole Window:*

The location for the porthole window was not shown on the plans, so careful measurements from the three-view drawing and photographs were required to locate them. A sheet of 1/16" ply was laid on the fuselage with a cut-out for the window, and raised to allow for the sheeting thickness on the rest of the fuselage. The glazing fit on the inner side of the plywood after painting. An internal frame holds the glazing in place. The frame was initially fabricated from bit of wood and plastic, then moulded and cast in resin.



**58 - Fuselage Porthole Window and Battery Hatch**

**59 - Finished Porthole - from the inside.**

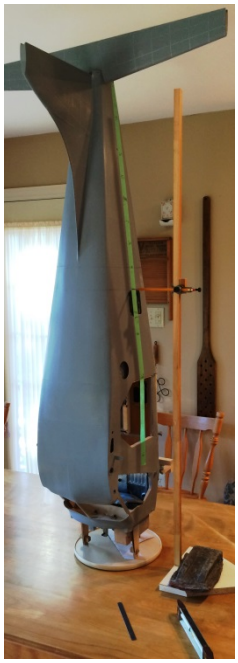
### *Battery Hatch:*

The Battery Hatch is used to access two of the servos. The hatch is held in position by two magnets. The hinges are hardware store brass hinges, but without hinge pins so that the hatch can easily be removed, and so that paint would not bind the hinge. The wing nuts were fabricated by soldering a #2 washer onto the head of a #2 screw, and then grinding off the part that did not look like a wing nut.

**60 - Finished Battery Hatch**

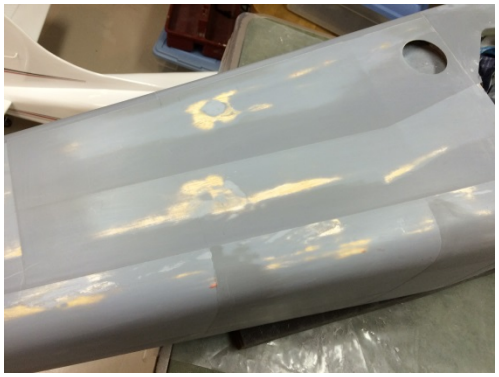
### *Fuselage Panel Lines:*

The techniques used for the panel lines on the fuselage were the same as used on the wing. The main challenge was marking the vertical lines for the panel liens and rivets at the bulkheads. The bulkhead locations were identified by data in the “Illustrated Parts Manual”. I mounted the fuselage vertically on my kitchen table (not enough head room in the shop) and used a trammel to mark the lines by rotating the fuselage.



**62 Trammelling the Fuselage**

**61 Masking for Panel Lines**

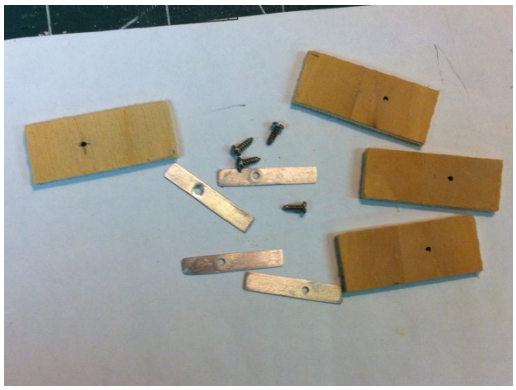


**63 Fuselage Panel Lines**

### *Cowl Detailing:*

The cowls were detailed by adding small screws. Number 1 screws were a close match for the Dzuz fasteners on the prototype. Number 2 screws are used to mount the cowl. A hinge was simulated on the rear cowl by gluing on a small rod of styrene, and notching it with a fine saw. Simulated Cowl latches were made from aluminum sheet, and mounted on a block of plywood in a cut-out in the cowl.

**65 Cowl Details**



**64 Cowl latch Components**

### *Reinforcing Plates and Repair Patches:*

A number of reinforcing plates, maintenance access hatches and repair patches were added to the fuselage after the panel lines. The techniques used on the wing were also used here – thin styrene sheet, aluminum foil tape and small screws.

**67 Fuselage Plates and Patches – Right Side**

**66 Fuselage Plates and Patches - Left Side**

### *Doors, Door Hinges, Handles and Latches:*

Each of the doors open. Cast resin scale hinges were provided in the kit, and can be seen in the phots above. The door handles on each of the doors of the prototype are different. The latch mechanism and door handles were fabricated with bits of brass and brass tube. A piece of 3/32" square tubing transfers the door handle rotation through the door to the latch mechanism.

The doors are 1/8" light ply, with a ¼" balsa frame on the inside to enclose the latch mechanism and window glazing. A rabat was routed around the inside edges of the door and the window openings to reduce the apparent thickness. The 0.030" butadiene windows are set into the rabat. The inside of the front door is skinned with 0.010" aluminum, while the inner skin on the rear doors is 1/64" plywood.

**70 Door Handle**

**69 Door Latch**

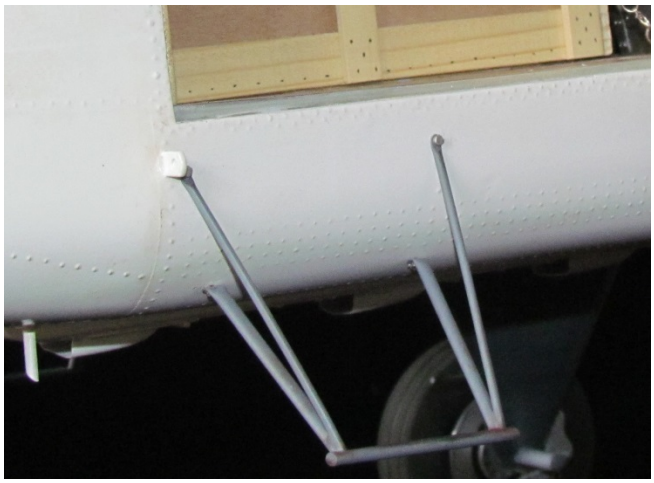
**71 Finished Door**

**68 Door Edge**

**72 Door Handle**

***Passenger Door Step:***

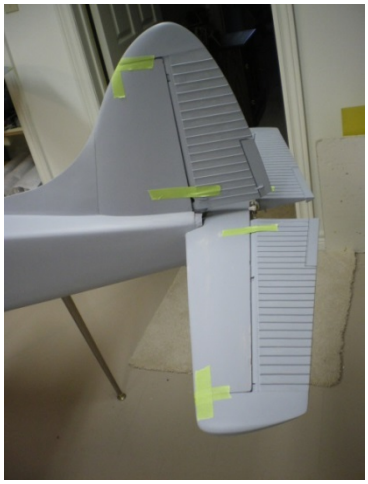
The passenger door steps again took a lot of careful measurements from the documentation. The steps were fabricated from brass tube soldered together in a jig. Some of the tubes were partially flattened in a vice to create the oval cross-section. They are mounted to the fuselage with brass #1 lag bolts screwed into ¼" dowel set into the fuselage.



**73 Passenger Door Step**

***Tail Surface Corrugations:***

The tail surface corrugations were made using the same technique as for the aileron and flap corrugations.



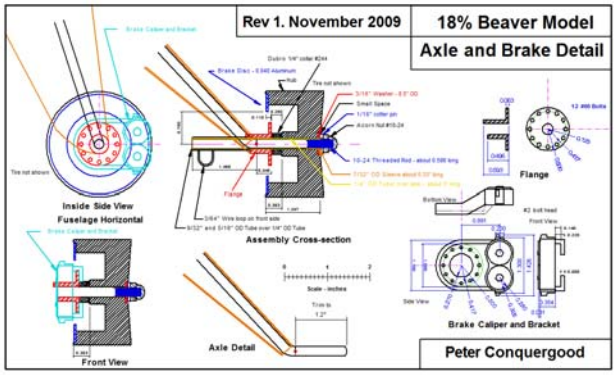
**74 Rudder Corrugations**

**75 Elevator Corrugations**

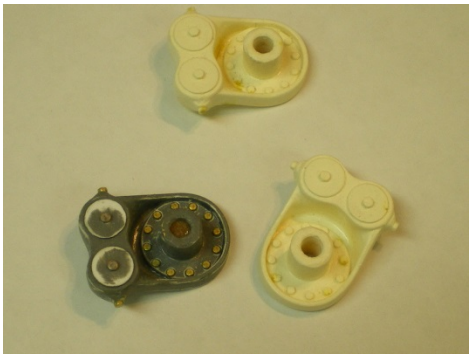
***Landing Gear and Brake detail:***

The landing gear has been modified to include the stub axle on the inside of the landing gear, and the ski attachment loop. The axle was modified to have a threaded end so that a more scale like acorn nut could be used to retain the wheel. This was done by shortening the end of the original 7/32" OD landing gear wire, then sliding a ¼" diameter brass tube over it. The tube was slotted about ½ its length so that it extended to the inside. The inside part of the tube was reinforced over the slot by larger tubing soldered into place. A short length of threaded rod was soldered into the outer end of the ¼" tube.

The wheels and hubs are from Glennis (www.glennis.com ). The brake disc is from 0.040" aluminum sheet.




**79 Wheel and Axle Design**



**78 Brake Parts**

**77 Mould for Brake Parts**

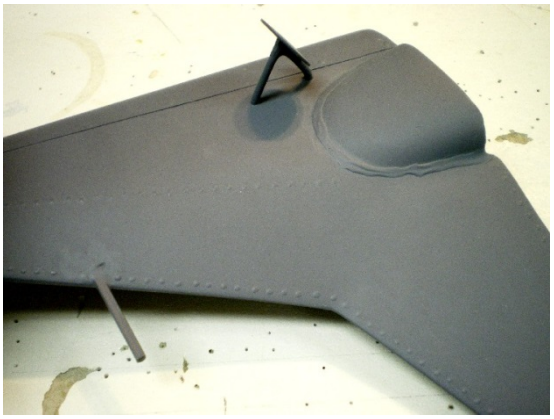
**76 Internals of Landing Gear**

The brake calliper assembly on the Beaver sits mostly inside the hub. First, a prototype assembly was made from sheet styrene and brass screws. Then a mould was made and the final parts were cast using a polyurethane casting compound. The cast parts are lighter and stronger than the prototype.

Internally the landing gear fairing supplied in the kit contains an aluminum hinge plate and formed piano wire struts. These connect through a hinge pin to ¼" aluminum plates built into the fuselage, and to a rubber shock absorber system as used on the prototype. Externally the landing gear fairing was fitted

with one disc step, and one step bar. The disc step was fabricated from a hardware store picture hanger. Note that most Beavers have two disc steps. C-FFHB was different. Panel line and rivets were added, as was a simulated weld bead.

The hydraulic hose was made from a combination of 1/16” music wire, 3/32” brass tube, 1/8” aluminum tube, insulation from 16 gauge wire, #2 x ¼” brass lag bolts and #1-72 brass nuts.



**81 Landing Gear Detail**

**80 Axle Detail**

**83 Finished Brake Detail**

**82 Landing Gear Assembly**

### *Antennae and Other Small Components:*

A number of small components are found on the prototype. Some of these were scaled from photographs, and some measured on the prototype.

The trim tab rods on the rudder and elevators were made from rod, wire, and small ball joints, and are mounted on tabs made from 0.010” aluminum.

There are two attachment plates on the bottom, used when floats are fitted. These were made from 0.010” aluminum.

On the bottom of the fuselage is a raised section which allows access to the fuel drains and other fittings. This was fabricated form balsa and styrene sheet. The vent louvres were made using a heat forming jig, as was used for the navigation lights.

A number of small drain pipes are found on the fuselage. These were made from brass tube.

The steps at the rear cabin doors were assembled form brass tube, some of which were flattened to give a streamline shape. Soldering them all together required that a special jig be made.

The removable tail cone has some unusual fastener retainers. These were made from 0.010” aluminum, and held in place with 1/32” aluminum rivets.

There are four antennae, two radio, one ELT and one trailing wire long wave antenna. The trailing wire antenna runs form an insulator on the fuselage top, to a hook on the fin, then to a clip on the wing tip.

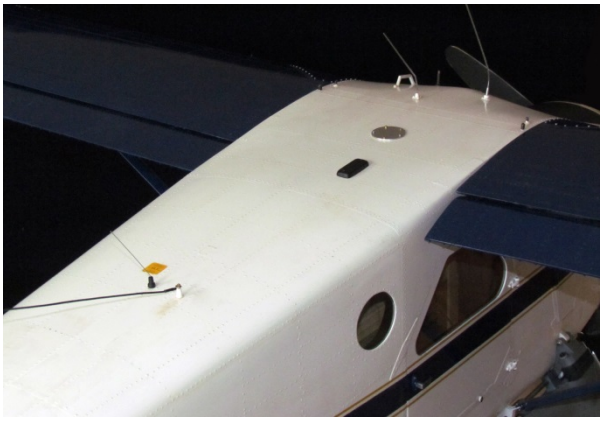
The EFT antenna mount and insulator were turned from a brass rod. The insulator has a #0 rod screws into the top for fastening the trailing antenna. The mounts for the two radio antennae were fabricated from brass tubing. The radio antennae are 0.047” music wire and are removable, being retained by magnets inside the structure.

An access step of the front right of the fuselage, and a handle on the top were built from brass tubing and sheet.

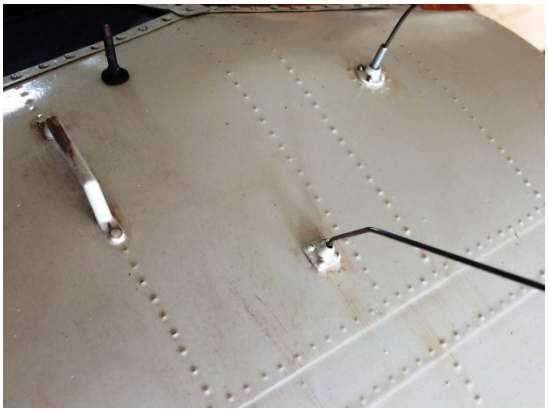
The last items to be installed before clear coating were small unpainted screws which retain the wing tips, wing root cuff and fin fairing. These are very small eyeglass screws. I was able to order a box of 1000 online for $4. They were screwed into 3/64” holes. I am expecting the paint to hold them in place.


**85 Rudder Trim Tab Actuator**

**84 Clips on the Bottom**

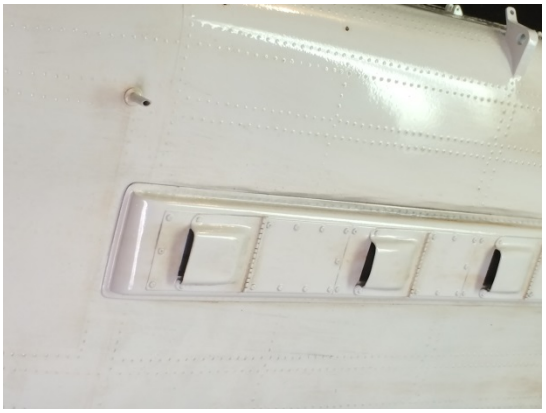


**87 Fuelage Top - ELT and Antennae Mounts,**



**86 Radio Antennae and Handle**

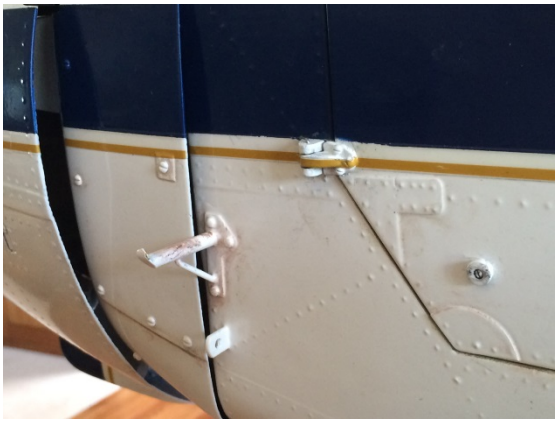

**88 ELT and Insulator**



**90 Fuselage Bottom Fuel Tank Drains and Access**

**91 Tail Cone Fastener Retainers**

**89 Fuselage Step and Handle**



**92 Fuselage Step**

**93 Small Screws on Wing Cuff**

## Scale Propeller:

The scale prop was assembled from a cast resin kit of a Hamilton Standard constant speed propeller from Scale Specialties (scalespecialties.com ). It was painted with Alclad II paint as used by plastic modellers to obtain the polished aluminum look.

**94 Scale Propeller**

## Colour and Painting:

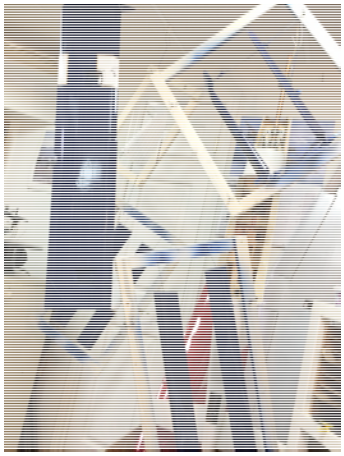
The model was painted with Klass Kote 2-part epoxy white paint. The blue was custom mixed by Klass Kote to match the prototype paint. I had taken a number of paint chips from my local store with me when I visited the prototype in the museum. I had one that was a perfect match for the blue, and used that to match the model paint. The blue trim on the fuselage cowl and fin were painted over the white. The wing also had a base coat of white. A special jig was used to hold the wings and fuselage during painting so that they could be rotated, allowing all sided to be painted in one go. The dowel in the 2x4 was sized to fit into the wing tube.

A number of 1” x 2” wooden frames were built to hold the smaller parts during painting. The parts were held on the frames with wire. The photo shows them hanging in the shop while the paint cured.

**95 Fuselage in the Painting Jig**

**98 Masking Tape Used to Mark the Location of the Blue Stripe**

**97 The Final Masking**



**96 Painted Parts Hanging to Cure**

### *Graphics:*

The Norcanair graphic on the fuselage, and the compass graphic on the fin were created by Cal-Graphx using photographs of the prototype markings.

The fine yellow stripes were also prepared by Cal-Graphx. I figured that it would be too challenging to mask the yellow stripes and paint them, and have them come out looking uniform and equally spaced from the blue. The yellow stripes were created by Cal-Graphx were 0.080” wide and colour matched to the prototype. Each of the stripes had a clear strip 0.091” wide on one side. This was the spacing to the blue trim. It was an easy task to lay down the yellow stripes by running the edge of the clear on the edge of the blue. The vinyl stripe material was flexible enough, and the adhesive strong enough to allow the trim to fold around small parts and in tight corners. E.G. over the door hinges.

The white call-sign lettering was obtained from my local sign shop.

The yellow ELT label was a decal created on my computer.

**99 Yellow Trim Application**


**100 Graphics Applied**

### *Weathering:*

Weathering can add a lot of character and depth to a model, but it is easily overdone. The model should look the same as the photos in your documentation. Yet I was modelling an aircraft with years of experience, and based on photos of it in service, not in the museum. I tried to make it look used, but not abused. I applied small amounts of weathering in nooks and crannies, and a few oil and exhaust stains on the underside.

The visible part of the shiny aluminum exhaust pipe was treated to give it a dirty, heated, stained look.

**101 Weathering on the Cowl Latch**

### *Clear Coat*

After all the graphics, details and weathering were complete, the entire model was given a coat of clear coat. The coat was a 50-50 mix of gloss and satin, which resulted in a bit of gloss, but not as shine as fresh paint.

## The Finished Project


**102 The Finished Project**

# Table of Figures