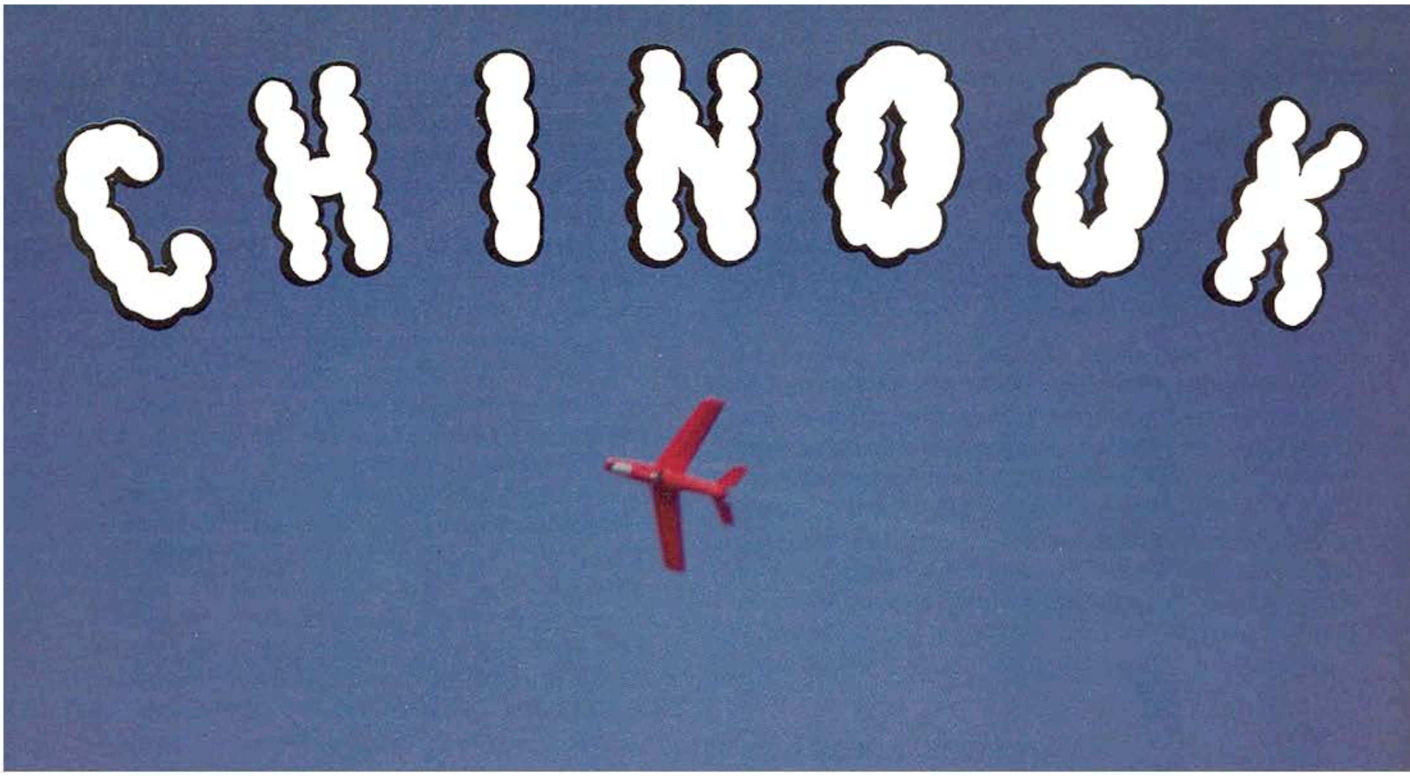
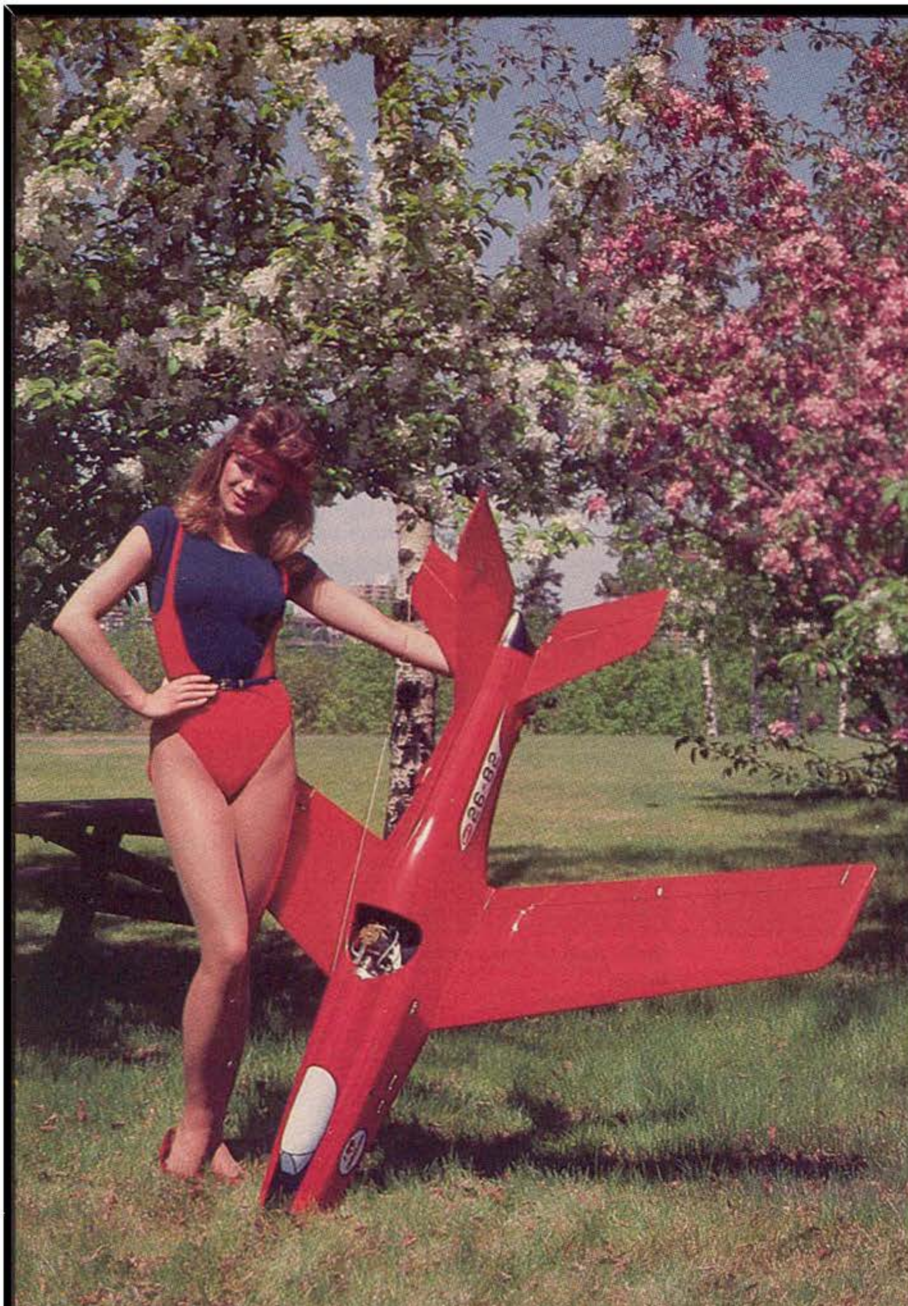
# CHINOOK



CHINOOK — definition — "a warm, moist wind blowing from the sea to land in winter and spring on the northern Pacific Coast." The start of the chinook season in Alberta signals the end of a long, usually harsh and sometimes depressing and boring winter. In many ways my involvement in fan jets is comparable to the effect of a "chinook" on my modeling activities. I have been building models of one sort or another for as long as I can remember, with my first R/C project (a Goldberg Senior Falcon) being completed in 1967. Since that time, I have tried sport planes, pattern planes, sailplanes, seaplanes and Stand-off Scale. All were thoroughly enjoyable, but somehow in the last few years I felt that I had slipped into a rut. Then in 1981 I built a Byron Originals Mig 15 powered by an OPS .65 R.E. engine. My modeling world changed overnight! What fascination! What frustration! What thrills! A Byron A-4 Skyhawk was next, powered by the same engine. More excitement! There is something about the noise a fan jet makes as it goes by



| "CHINOOK" | |
|---|---|
| **Designed By:** | Bill Gillespie |
| **TYPE AIRCRAFT** | Sport Fan Jet |
| **WINGSPAN** | 73 Inches |
| **WING CHORD** | 11½" Avg. |
| **TOTAL WING AREA** | 840 Sq. In. |
| **WING LOCATION** | Low Wing |
| **AIRFOIL** | Symmetrical |
| **WING PLANFORM** | Swept Double Taper |
| **DIHEDRAL EACH TIP** | Zero on top of wing |
| **O.A. FUSELAGE LENGTH** | 62½ Inches |
| **RADIO COMPARTMENT SIZE** | (L) 9" X (W) 2" X (H) 2" |
| **STABILIZER SPAN** | 27 Inches |
| **STABILIZER CHORD (incl. elev.)** | 7½" Avg. |
| **STABILIZER AREA** | 170 Sq. In. |
| **STAB AIRFOIL SECTION** | Symmetrical |
| **STABILIZER LOCATION** | Mid-Fuselage |
| **VERTICAL FIN HEIGHT** | 11 Inches |
| **VERTICAL FIN WIDTH (incl. rud.)** | 10" Avg. |
| **REC. ENGINE SIZE** | .65 to .81 Cu. In. |
| **FUEL TANK SIZE** | 16 Oz. |
| **LANDING GEAR** | Tricycle (fixed) |
| **REC. NO. OF CHANNELS** | 6 |
| **CONTROL FUNCTIONS** | Elev., Throt., Ail., Nosewheel, Flaps, In-Flight Fuel Mixture Adjuster |
| **BASIC MATERIALS USED IN CONSTRUCTION** | |
| Fuselage | Balsa & Ply |
| Wing | Balsa & Foam |
| Empennage | Balsa |
| **Wt. Ready To Fly (Dry)** | **176-192 Oz.** |
| **Wing Loading** | **30.2-33.0 Oz./Sq. Ft** |

from a long diving approach that simply cannot be described! I know that it sometimes makes the hairs on the back of my neck stand up, and my mouth gets so dry I couldn't spit if I tried! (This guy must be a weirdo, you say — well, try it for yourself and see what I mean!)

While the Mig 15 and Skyhawk are both superb models, I like doing my own thing, and so I decided to design a "sport" fan jet, a non-scale model about the size of a large .60 class pattern plane. The primary design objectives were as follows: Operation from grass fields; construction by conventional methods and materials; relatively low wing loading; fixed tricycle landing gear; upright engine installation; air intake above the wing (to avoid sucking dirt, grass and debris into the fan); utilize Byron Originals fan unit and tuned pipe.

After several false starts, the basic

**By Bill Gillespie**

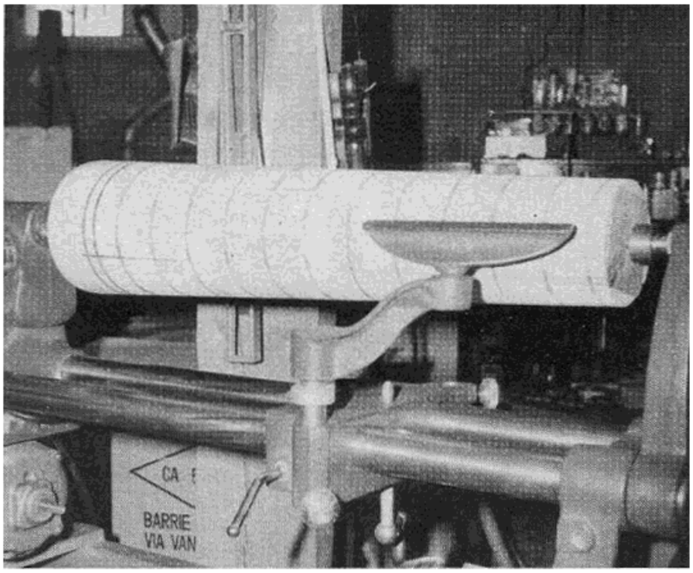
ABOUT THE AUTHOR

**Bill Gillespie is a professional Civil Engineer. He graduated in 1950 from the University of Alberta with a B.Sc. Degree in Civil Engineering. He is a member of the Canadian Society for Civil Engineering and a member of the Institute of Traffic Engineering.**

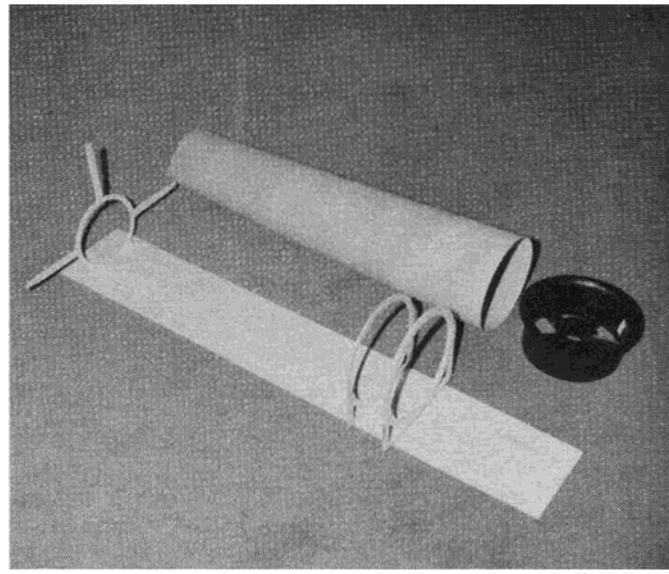
**Bill is 57 years old and is married, with four children. Bill built his first model at age 5 years and has been at it ever since. His first R/C project (a Goldberg Senior Falcon) was built in 1967. The Chinook fan jet is his 28th R/C project.**

**Bill is a member of the following organizations: the Model Aeronautics Association of Canada; the League of Silent Flight (presently working on Level IV); the Northwest Soaring Society; the Edmonton Radio Control Society; and the St. Albert Aero Model Society.**

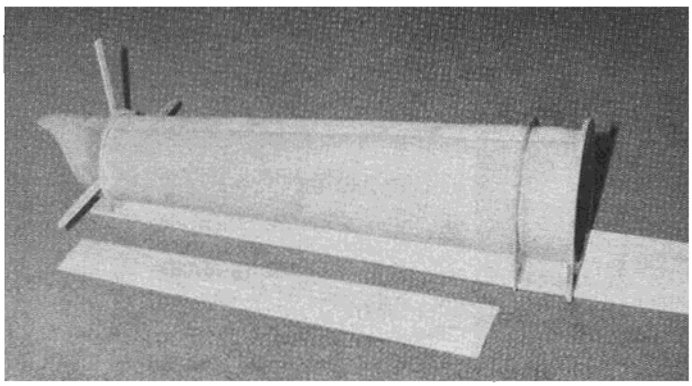
**The Chinook is a non-scale sport fan jet in a .60 pattern size.**



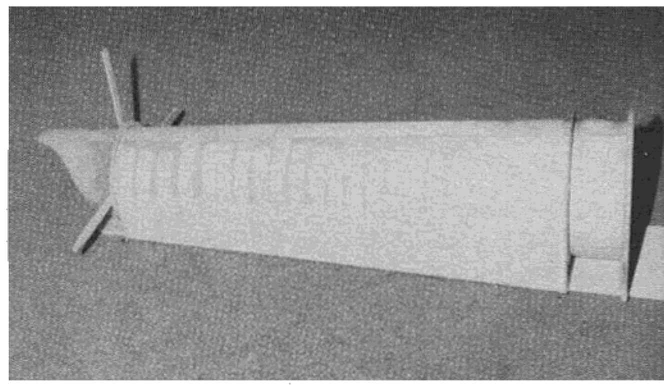

*If available, tail pipe form can be turned on a lathe, however, not necessary.*



*Byron originals fan unit, ply fan shroud, ply formers and rear bottom plate are utilized to form tail pipe.*



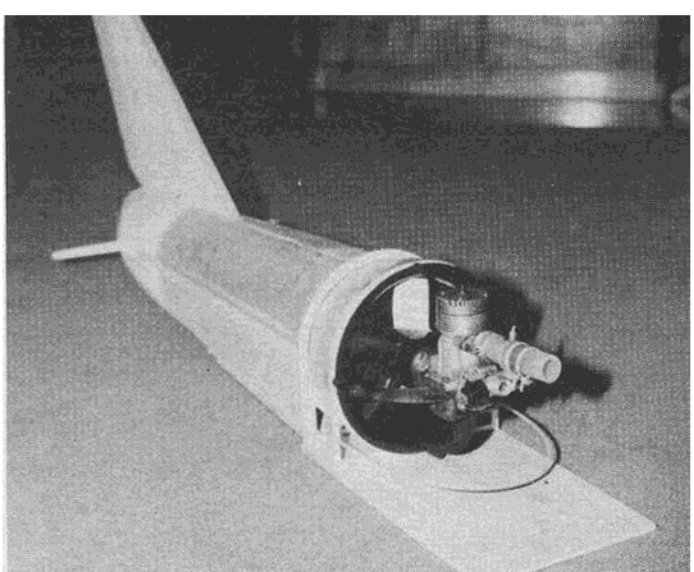
*3/16" balsa sides to fit between E & F formers of tail pipe.*



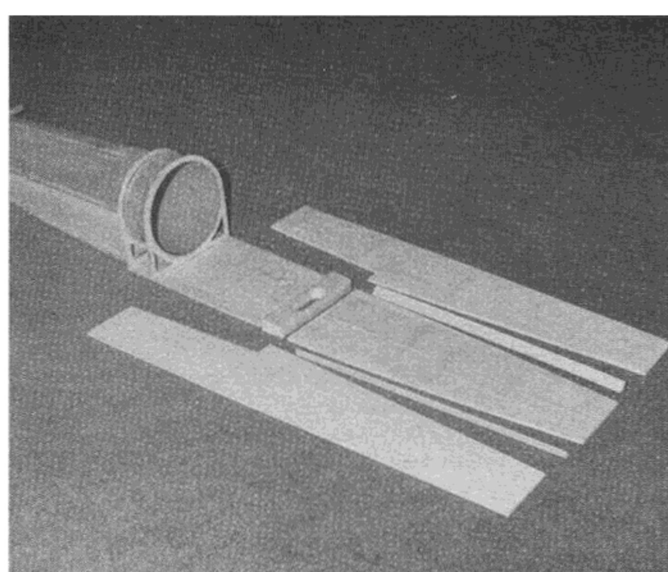
*Sides held in place on tail pipe with masking tape while epoxy cures.*

concept for the "Chinook" was finalized. I wish that I could say that the design was based on complex space age aerodynamic formulas augmented by extensive wind tunnel testing by NASA — but that was not the case. Instead, I used two principles that have proven invaluable over the years "KISS" — meaning "keep it simple, stupid," and "ILAR" — meaning "it looks about right."

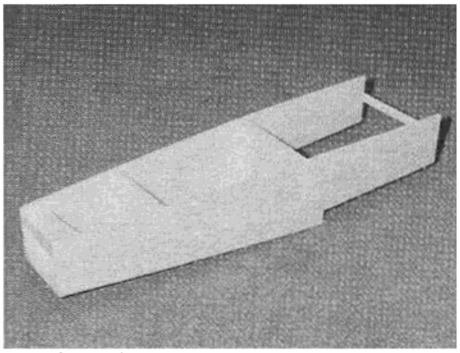
The need to keep the proper relationship between the tail pipe length, the engine and fan location, the Center of Gravity and the Center of Lift resulted in a swept wing design. The fin and stabilizers were also swept in order to provide a good tail moment. (Besides which, the swept tail matches the wing.) Flaps were included in order to enhance short landing



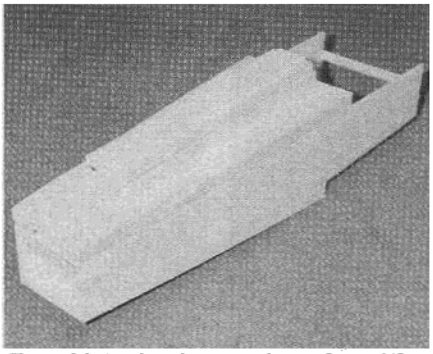
*Mount fan shroud and engine for final check on fit.*



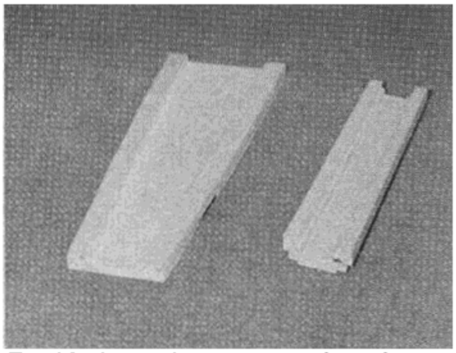
*Front fuselage parts ready to assemble.*



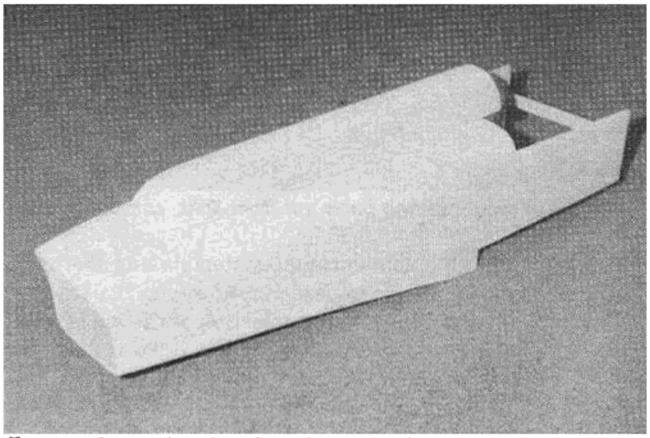
*Front fuselage parts assembled using temporary 1/4" balsa formers.*



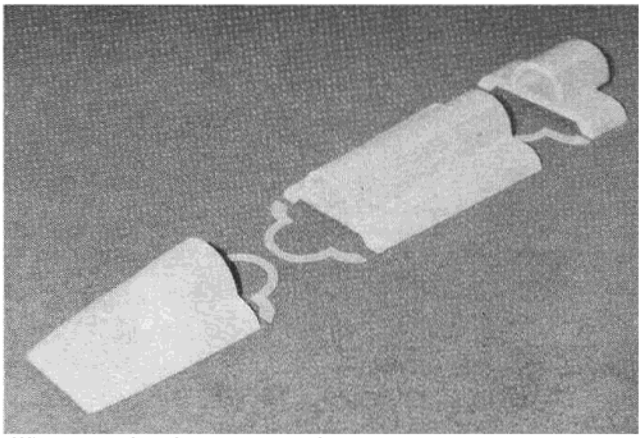
*Top of front fuselage made up from 1/2" balsa blocks.*



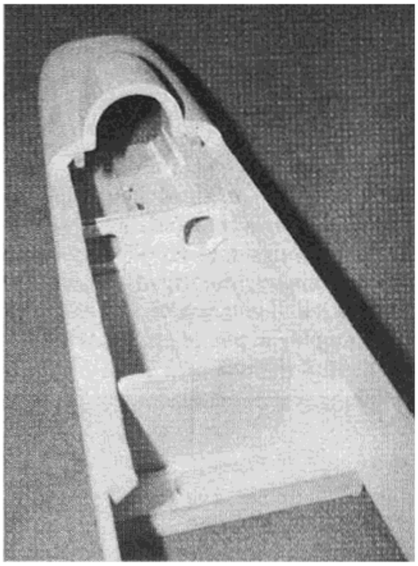
*Top blocks ready to carve and sand to shape.*



*Front end completed and ready to attach.*



*When completed, separate and add ply formers.*



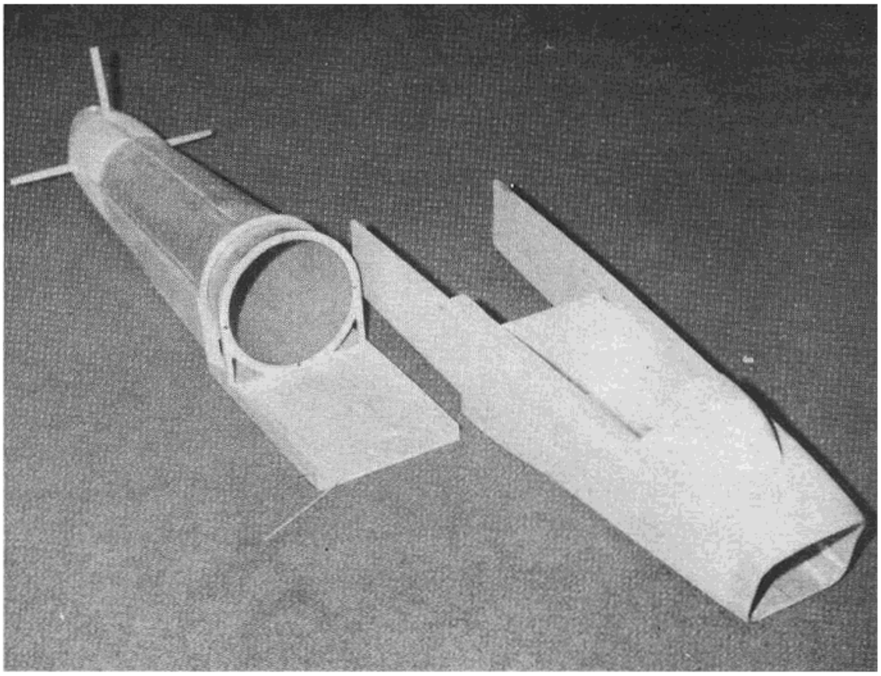
*Front end should now look like this.*

capabilities.

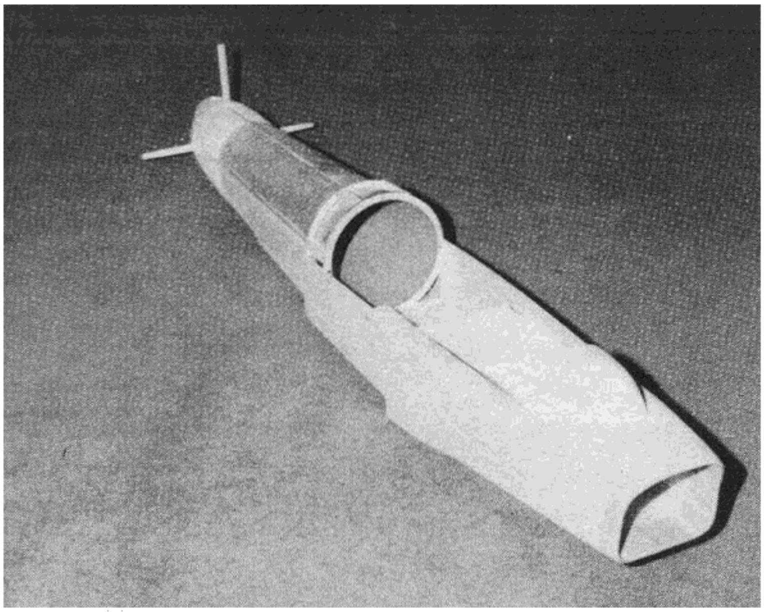
In any event, the basic design features must be all right, as the model flew well on its initial flights, with only modest C.G. and trim changes. Its performance was very good using the OPS .65 ABC engine, with no problems getting off our local grass fields (providing that the grass was reasonably well-cut). It is a completely honest airplane, grooves well, does lovely axial rolls (like most an jets) and has no vices, providing that proper flying speed is maintained.

It has recently been equipped with the Rossi .81 Fan engine — superb performance — but the rate of fuel consumption is awesome!

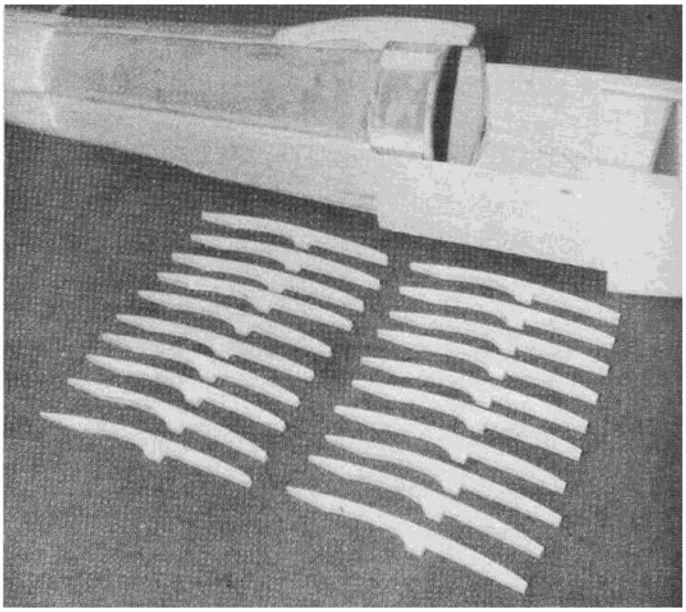
I have had a great deal of pleasure with the Chinook, and I feel that it is an ideal first project for anyone considering getting into fan jets. A word of caution, however, it is **not** an undertaking for the beginner to radio control, and the pilot must be able to handle a typical .60 class pattern plane.



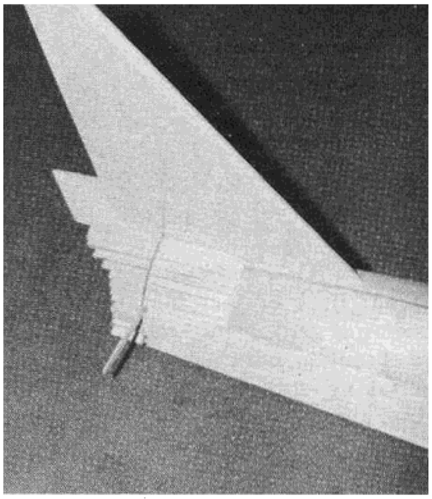
*Ready to mate front and rear sections.*



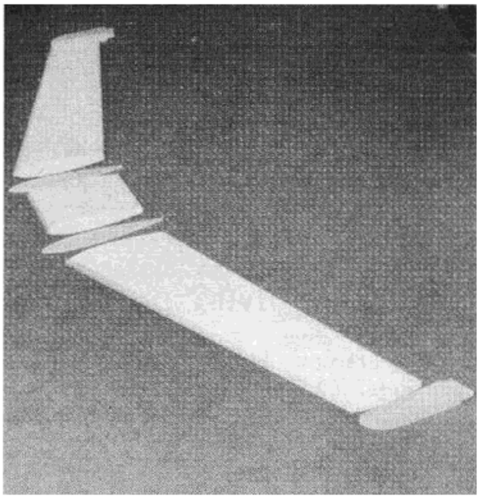
*Fuselage sections epoxied together.*



*Tail and fan mount fairing parts cut from light, soft balsa.*



*Glue in place, sand and fill to final shape.*



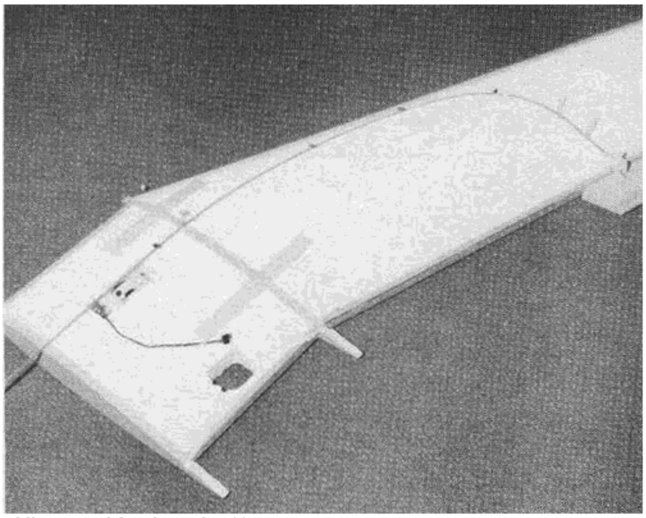
*Wing cores cut and ready to assemble.*

I hope that some of you out there will give the Chinook a try, as I know that it will open up a whole new chapter of R/C for you.

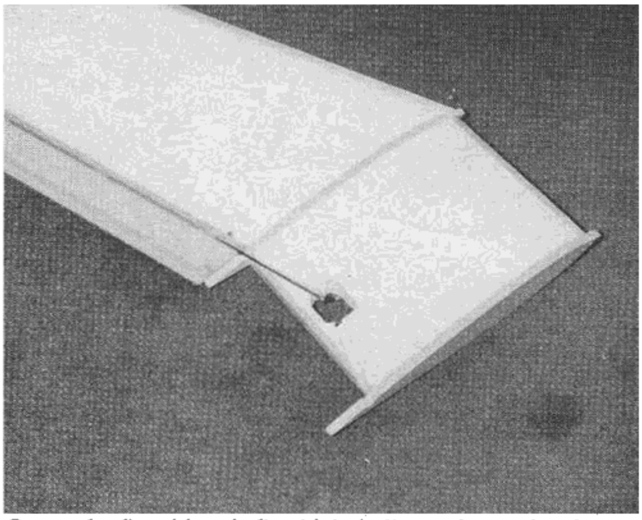
**CONSTRUCTION**

The model is constructed using conventional materials and methods. It is imperative, however, to use great care in the selection of the balsa wood used, as weight is a critical factor in the success of any fan jet. If, for example, suitably light wood is not available for the tail surfaces and flaps and ailerons, then consideration should be given to built-up or foam core construction.

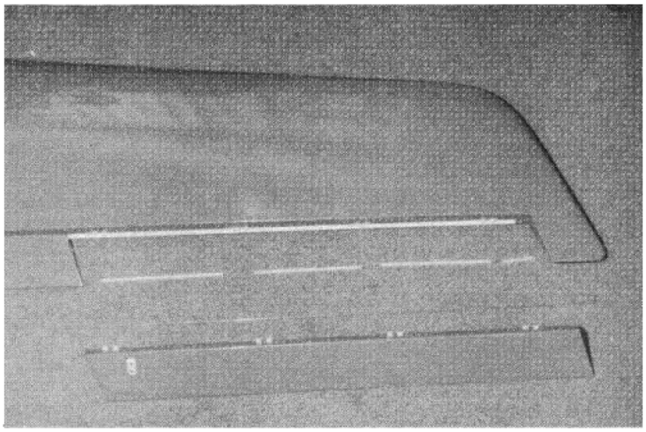
Care must also be taken in finishing the plane. Remember, it is a **sport** plane, and does not require a three pound paint finish! So, please, try and minimize weight in every way possible. The original now flies at about twelve and one half pounds. It is at least a pound and a half overweight due to repairs, modifications, and a repaint job. If you can keep the weight to about eleven pounds you will have a real winner!



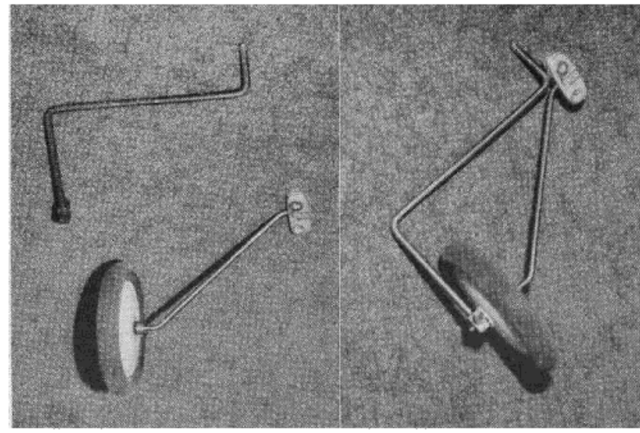
*Aileron cables installed in bottom of wing prior to wing sheeting.*



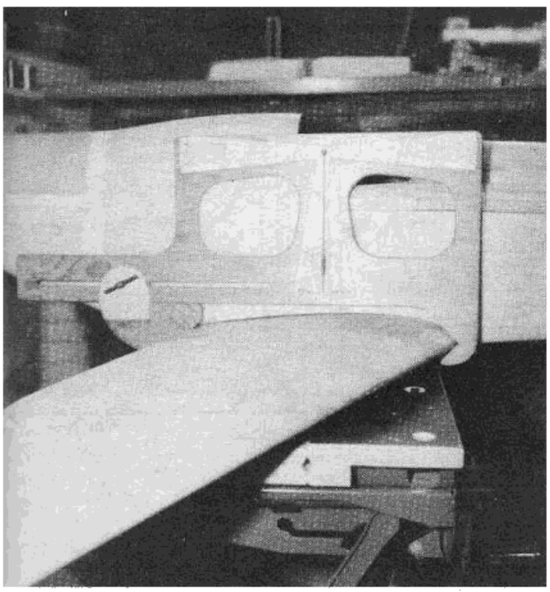
*Groove for flap drive shaft cut into bottom prior to sheeting.*



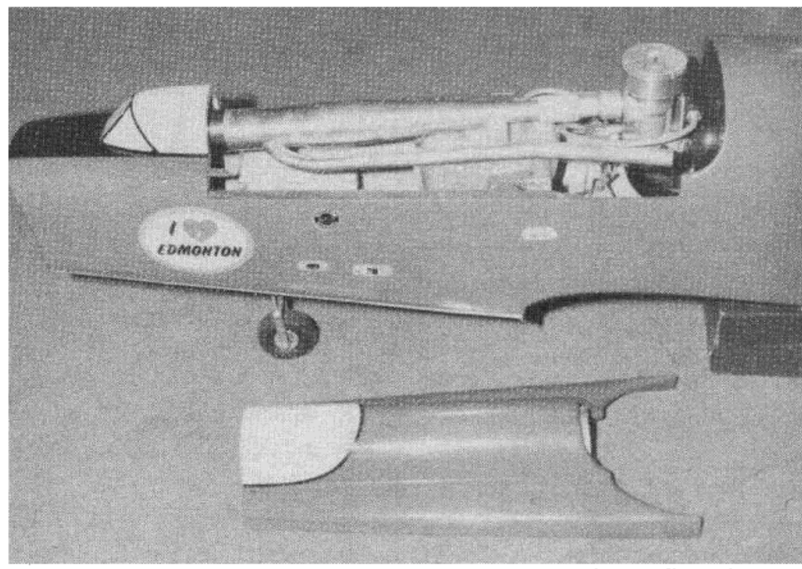
***Simple and effective control surface hinging.***



***Main landing gear made from two pieces. Proved to be very effective on rough terrain.***



***Wing should set at one degree of positive incidence.***



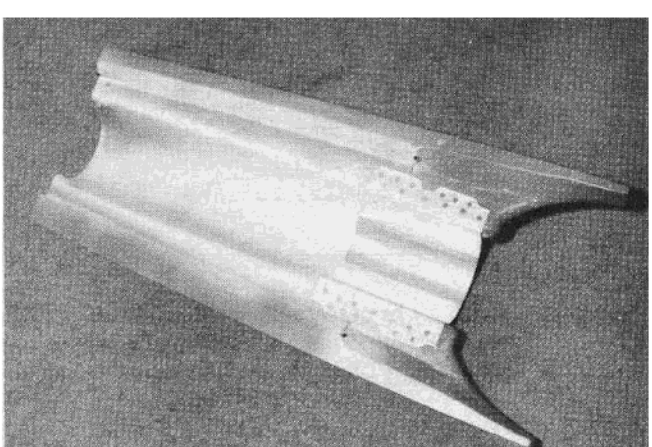

***Byron pipe coupled to a Rossi .81 hauls this bird around in excellent shape.***

Although there is enough detail on the plans, augmented by the accompanying photo sequence, for a relatively experienced modeler to build the Chinook without any further advice from me, I have included a detailed description of the construction steps for the tail pipe assembly, and the wing mounting.

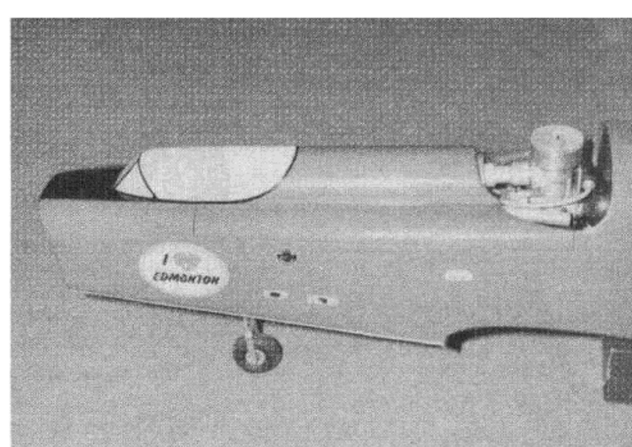
General comments are included for the balance of the construction.

**Fuselage:**

The key element of the fuselage is the rolled 1/32" ply tail pipe, which also serves as a major structural component of the fan mount and the tail group. The tail pipe can be made on a form turned on a lathe or the fan shroud, and plywood Formers D, E, and G, along with the rear bottom plate can be utilized to form the tail pipe. If you intend to make only one tail pipe, then the lathe turned form is probably not worth the effort involved.



***Aluminum heat shield on underside of hatch in manifold area.***




***Hatch held in place with four bolts into blind nuts on top side of fuselage sides.***

The following sequence of construction is recommended:

Cut out ply formers and 1/4" balsa doublers.

Cut out 1/32" tail pipe — see template Sheet 2. The length of the template is oversize to allow for final trimming.

Join together two 3" wide 1/4" balsa sheets and cut slots for formers. **Do not** trim to fuselage outline at this stage.

Mount fan shroud and 8-32 wide flange blind nuts in Former D. Be sure that the shroud is oriented so that the engine mount will be upright. It may be necessary to trim the flanges of the blind nuts to clear the fan shroud.

Trim inside of Former G so that the inside diameter of the tail pipe is 4⅝".

Wrap masking tape around the back edge of the fan shroud to a depth of not less than 1/32". (The tape will later be removed and will provide the proper clearance between the tail pipe and the shroud.)

Mount formers D and G onto the bottom plate with 5-minute epoxy. Note that the formers are not at right angles to the bottom plate — see template on plan Sheet 1.

Roll the tail pipe into a tube and insert from the rear through Former G until it butts up against the back of Former D.

Using masking tape, gently snug the tail pipe down around the taped section of the fan shroud.

Make a foam plug (1" to 2" thick) that can be inserted in the tail pipe to hold it snugly inside Former G.

Mark the tail pipe for a smooth butt fit against Former D.

Remove the tail pipe, trim to markings. Repeat the preceding three steps until you are satisfied with the fit. Note that you may have to notch the tail pipe to clear the blind nuts.

**To Page 42**

**From Page 46**

level flight. One or two throttle notches below this will give you the proper setting for a typical landing approach. Power can be cut just before touch down. Remember it is better to land a little "hot" than to fall out of the sky!

Starting a fan engine can sometimes be a real pain. I have found that the following procedure will get an engine start almost every time.

(a) Remove the glow plug, and prime the cylinder directly with one or two healthy squirts of fuel.

(b) Turn the fan by hand, while holding a finger over the engine intake, until fuel is observed at the carb inlet.

(c) Hold a Kleenex tissue over the glow plug hole, and with the starter, give the engine a good spin to drive out all excess fuel from the engine.

(d) Replace the glow plug, connect it to your glow plug battery, and energize. Set the throttle to about one quarter open.

(e) Engage the starter (Byron starter drive) with the fan. Manually turn the starter **backwards** until engine compression is felt.

(f) Take a deep breath, get a firm grip on the plane, (usually the fin or the stab will provide a hand hold) and activate the starter while firmly pushing it against the fan. I'll bet you a blown glow plug that it will start on the first try!

(g) It is highly recommended that you always have a helper to hold things down during the engine starting and run up procedure.

(h) Change the glow plug after every six flights. Better to change than wait for it to go out in the air.

(i) I have found that a quality set of industrial ear protectors are a must for starting and running up a fan engine.

Experience has shown that a good support for the model is a must for transportation, and handling on the field. Such a support can easily be made from either a suitably sized, strong cardboard box or from 2" foam sheets. I prefer the foam, as it is fuelproof.

If any problems are encountered during the construction or flying of the Chinook, please feel free to contact me at 9316 — 85 Street, Edmonton, Alberta, Canada, T6C 3C8, or by phone at (403) 466-6713. (No collect calls please.)

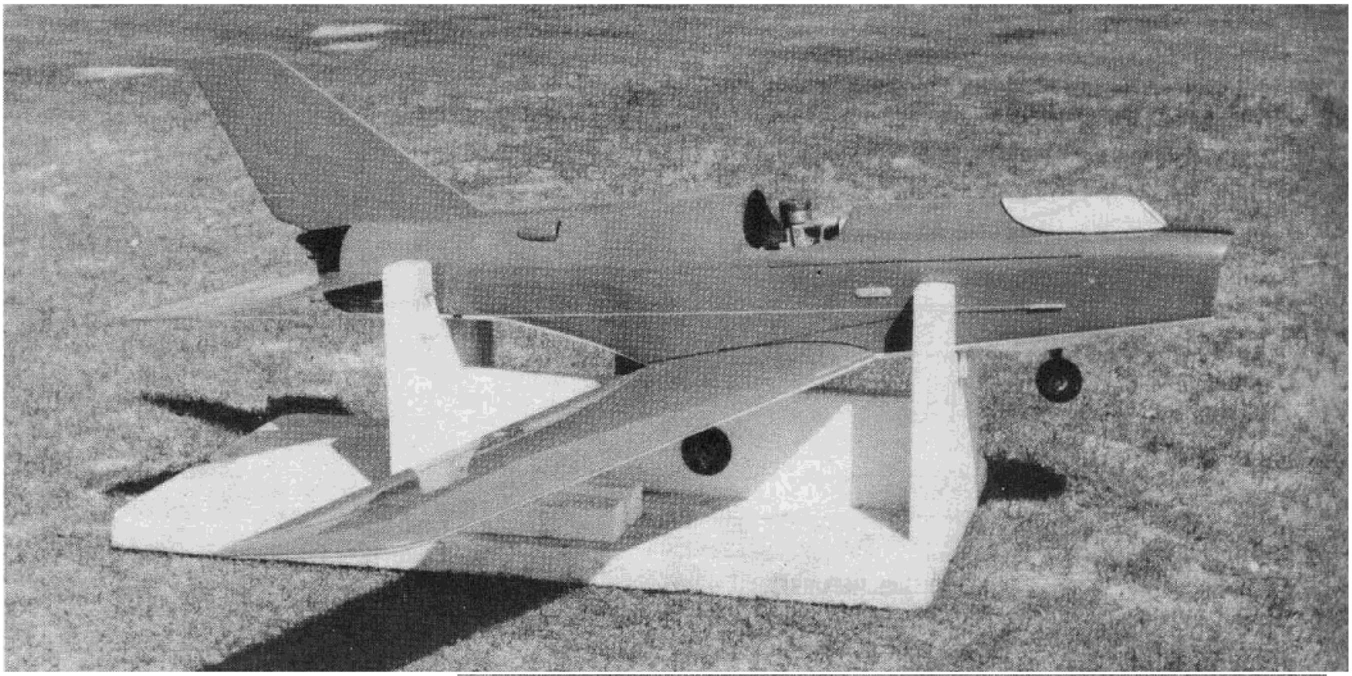
I will be looking forward to hearing from you even if you don't have any problems.

**Postscript**

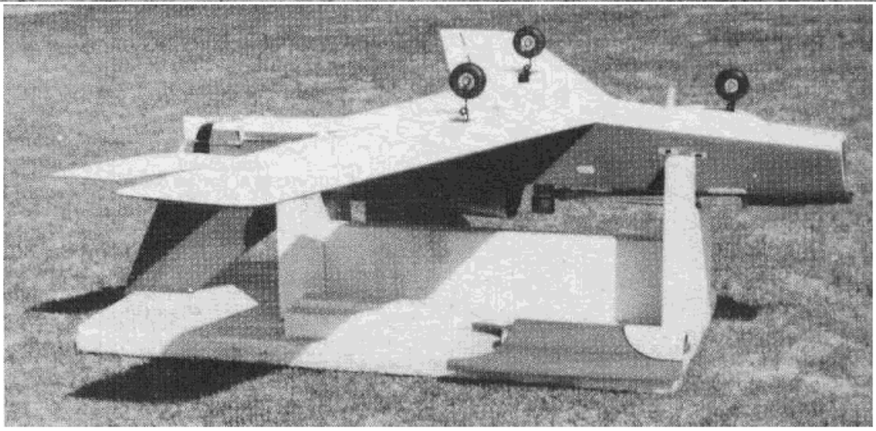
The Byron Originals fan unit and tuned pipe are superbly engineered, and will produce truly awesome thrust when combined with engines like the OPS .65 and Rossi .81. Byron Originals also produces a long shaft starter drive unit that is a must for this type of fan jet model. All necessary components are available from the Byron Originals factory, or in Western Canada, from B & P Transport Ltd., Box 6, Bawlf, Alberta, Canada TOB 0J0.

□

**From RCModeler Oct. 1984**



*Author's stand made from 2" foam sheets epoxied and doweled together. It also fits his MIG 15 and A-4 Skyhawk.*



Measure the outside diameter of the tail pipe at Former D. This measurement will be the inside diameter of the 1/4" balsa doubler.

Fabricate the 1/4" balsa doubler and epoxy to the back of Former D. (Do not plug the blind nuts with epoxy, and do not epoxy to tail pipe at this time.)

Measure the outside diameter of the tail pipe at the location of Former E. This measurement will be the inside diameter of Former E and the 1/4" balsa doubler. Fabricate the doubler and epoxy to the front of Former E. It is better to have the fit around the tail pipe a little loose for ease of construction and alignment.

Extract tail pipe and epoxy Former E into place on the bottom plate using the template provided.

Insert tail pipe again and check fit in Former E. Trim former as required, and repeat until you are satisfied with the fit.

Install the 1/4" balsa tail pipe support onto the bottom plate between Formers E and G. Check with a straightedge to insure a good fit against the bottom of the tail pipe.

Using Epoxy II (45 min.), apply a fairly liberal coat to the inside of the 1/4" doubler on Former D; the inside of Former E and its 1/4" doubler; the inside of Former G; the top of the 1/4" tail pipe support, and the overlap area of the tail pipe joint.

Insert the tail pipe from the rear, and butt it firmly against the back of Former D. Note the location of the tail pipe overlap joint — see X Section F-F, Sheet 1.

Insert foam plug at Former G.

Using masking tape, gently snug the tail pipe down around the taped section of the fan shroud.

Using masking tape, wrap the balance of the tail pipe as required to hold the joint straight. Note — it may be necessary to insert several additional foam plugs inside the tail pipe between Formers E and G in order to hold the overlap joint closed. This may be done by temporarily removing the fan shroud and inserting the plugs from the front. Be sure to replace the fan shroud though, as the fit of the tail pipe at the taped section of the shroud is critical. Allow the epoxy to completely set. Things should now look like Photo No. 4.

Using a small set square held on the bottom plate, and against the tail pipe, mark a line on the bottom plate, on each side. Mark another line, parallel to the first, and 3/16" inside of the first. Trim the bottom plate to the inside lines.

Cut and trim to fit two 3/16" balsa sides between Formers E and G. (See X Section F-F Sheet 1. Note that the top of the side falls on the centerline of the tail pipe.)

Using Epoxy II and masking tape attach sides to the tail pipe assembly.

The elevator control cable should be installed as part of the preceding step.

Before proceeding any further, mount the fan shroud and engine to check for final fit.

Trim tail end of tail pipe to approximate final outline.

Using Epoxy II (45 min.), thoroughly fuelproof the Formers D and E and the inside of the tail pipe. This is best done by hand (use rubber gloves) rubbing the epoxy firmly into the wood. When completely set, sand lightly and apply a second coat. **Make sure** that you have done this step properly, because the Byron tuned pipe exhausts directly into the fan, and the inside of the tail pipe is therefore subjected to a fuel and oil bath each time the engine is run.

The last step in mounting the fan shroud can be done at any time. Clean and lightly sand the inside of the tail pipe in the area of the fan shroud. Coat the outside of the fan shroud with a layer of grease. (I use Lubriplate.) Apply a bead of GE Silicone Seal rubber around the outside of the rear portion of the fan shroud. Wet your finger with saliva and taper the bead so it will fit into the tail pipe. Mount the shroud, and allow the silicone to cure. The shroud can be removed at any time, and the silicone provides a perfect rubber cushion between the shroud and the tail pipe. *(**Congratulations** You have now completed the only tricky part of constructing the Chinook. The rest is just like any other plane you have built.)*

Fabricate the front fuselage sides, bottom plate, and plate joiner block.

Using your favorite adhesive, assemble the front fuselage section. Note that temporary 1/4" balsa formers are used at this stage to align the sides.

Block up, using layers of 1/2" balsa, the top portion of the front fuselage.

Carve to shape.

When you are satisfied with the shape of the top, separate with a razor saw on X Section, lines B-B and C-C. Cut out plywood top formers.

Add plywood formers, remove surplus balsa in tuned pipe area, and glue front top section in place. Add nosewheel mount and remove temporary balsa formers from front.

The front fuselage section is now ready to be joined to the tail pipe assembly. Using Epoxy II (45 min.), join the two sections together.

The tail and fan mount fairings are made from very light, soft balsa. Block in roughly, carve and sand to shape and fill cracks with filler.

Add wing saddle structure. Do not install plywood wing dowel plate at this time.

Complete top hatch.

**Tail Assembly:**

Nothing unusual here, except maybe the elevator drive mechanism, but it is quite simple as detailed on the plans. Please note that if you **cannot** obtain soft, **light** balsa, you should consider a built-up structure or foam core, with 1/16" balsa sheeting.

The rudder is fixed, and is used as a manual trim tab. (See notes in **Flying** section.)

**Wing:**

The wing is composed of two outer panels joined to a center section, and sheeted with 1/16" balsa. The center section is fiberglassed in the usual manner. The flaps and ailerons are balsa, shaped and hinged as per the plan details.

Install the aileron control cables in the **bottom** of the wing prior to sheeting. I cut the groove for the cable in the foam with a suitably shaped piece of #14 copper wire attached to my soldering iron.

Cut grooves for the flap drive shafts in the **bottom** of the wing prior to sheeting. Please note that the brass sleeve bearings for the flap drive shafts are not epoxied in place until final assembly. The flaps, ailerons, and elevators use a hinging system that I have found to be simple and very effective, as follows: (1) Du-Bro heavy duty hinges. (2) Continuous 0.047" piano wire hinge. (3) 1/2A clear fuel tubing threaded onto the .047" wire to act as a gap sealer.

Please note that the flaps **must** be installed first when final assembly takes place.

The main landing gear is made up of a 3/16" diameter steel torque strut coupled to a 5/32" diameter steel axle by a mild steel junction block. Please do not panic --- it is quite simple to make, and is very effective in absorbing the abuse of a rough grass field. The wheels are 3¾" Williams Bros., chosen for their narrow tread and small rolling resistance through grass. (Remember the skinny wheels on the Ford Model T? Those wheels could roll through most anything!)

I would like to cover the alignment of the wing and the wing dowels in a little more detail. The following procedure will virtually guarantee a nice fitting wing:

Fabricate the 1/4" balsa leading edge of the center section, along with the 4 MM ply wing dowel plate. (See detail Sheet 1.) Make both slightly oversize. Clamp together in approximate alignment, and mark and drill the 5/16" diameter wing dowel hole through both pieces. A drill press is best in order that the holes are perfectly perpendicular to the wood surfaces.

Install the leading edge and wing dowels.

Complete the wing sheeting and center section fiberglass.

Mark and drill oversized dowel holes into the bottom plate joiner block.

Carefully shape the wing saddle to provide one degree of positive incidence. The incidence gauge in the photo is one that I concocted many years ago, and it has proven to be an invaluable tool in getting my models set up properly. (If you would like to construct one of these, refer to Dick Phillips' column "Big Is Beautiful" in the July 1983 issue of RCM. Dick has added a nice refinement — a ball bearing pivot for the needle.) The top edge of the fuselage side in front of the fan mount can be used as a zero degree reference.

When you are satisfied that the incidence angle is correct, grease the wing dowels (fuelproof first), and slip the 3/16" ply dowel plate onto the dowels.

Invert the fuselage, coat the 3/16" ply dowel plate (joiner block side) with Epoxy II (45 min.) and put the wing in place on the wing saddle. Check wing tip alignment and seat the dowel plate against the joiner block.

When the epoxy has set, mark and drill 1/8" diameter alignment holes for the wing bolts. (Watch the angle of the drill!)

Remove the wing, and drill 1/4" diameter (or 17/64" if you prefer a looser fit) wing bolt holes.

Drill and tap wing bolt plate for 1/4" diameter wing bolts.

Very carefully mark a line 1/16" parallel to the edge of the wing saddle, and remove this material.

Spot glue a couple of 1/8" x 1/8" shims to the wing saddle in line with the wing bolt holes.

Carefully sand these shims until the wing is once more at one degree positive incidence and properly aligned with the fuselage.

After the wing and fuselage have been completely finished, wrap the wing with strips of backing film from EconoKote in line with each side of the wing saddle.

Grease the wing dowels and center section leading edge.

With the fuselage inverted, apply a good thick layer of GE Silicone Seal rubber to the wing saddle, the wing dowel plate (leave some clearance around the holes), and the trailing edge area of the wing saddle.

Carefully install the wing, and tighten the wing bolts.

Let cure for 24 to 48 hours, and remove the wing and plastic film.

With a new razor blade, trim the surplus rubber along the edge of the wing saddle.

You now have a fuelproof, perfectly aligned wing assembly. This procedure can be used on any type of model. It is especially effective for seaplanes as the wing saddle is also waterproof.

With the landing gear installed, adjust the nose gear strut length so that the wing is at least one degree positive to the ground.

**Finishing and Covering:**

Use your favorite materials and methods, but **keep it light.** The wings and tail surfaces of the original were covered with EconoKote, and the fuselage was painted with Hobbypoxy paint.

**Engine Installation And Operation:**

The key to the successful operation of any fan jet is to be able to achieve "rock solid" dependable engine runs. An engine failure will typically occur at the worst time and place (Murphy's Law) — resulting in an off-field landing, with who knows how much damage to the aircraft. (Ask me — I know!) I have found that two factors are all important, and they are as follows:

(a) **Tuned pipe length** — Start with an overly long length and trim the manifold by 1/4" at a time, taking tachometer readings each time until you feel that you are getting close to the maximum rpms. **Do not** try to extract every last rpm, as the shorter the pipe gets, the more critical and unreliable it becomes. I have found that at our local altitude of about 2,400 feet, the OPS .65 (using Sig FAI fuel) will turn a comfortable 18,000 rpm with a manifold length of 6.8 mm. (end of manifold to exhaust flange on engine). This provides ample thrust for take-off, and more than enough for the usual sport flight maneuvers.

(b) **Fuel flow** — The fuel system must be capable of providing an adequate and reliable fuel flow under any combination of throttle settings and fuel tank levels. I have found that fan engines have a nasty habit of going lean after take-off, regardless of what type of fuel system was used. This characteristic can be resolved by adding a simple servo actuated in flight mixture control. Details of such a device for the OPS .65 are shown in Sheet 2. (If you use the Rossi .81 you are laughing, as it comes with a built-in mixture control.) A slide type auxiliary transmitter channel should be used. The mixture can then be easily adjusted as required during flight. Another nice feature of such a control is that you can fine tune the needle valve without getting your fingers anywhere near that ever-loving fan. I cannot over-emphasize the importance of the in-flight mixture control for the safety of your airplane! The use of a Perry oscillating pump will provide a uniform fuel flow regardless of fuel level. Even though not called for in the pump instructions, it may be used in conjunction with manifold pressure to the tank in the event that you need additional fuel flow for full bore operation of the Rossi .81. Fuel flow, high speed needle valve setting, and in-flight mixture control throw should be such that you can go from slightly lean to breaking into a 4-cycle at full throttle within the range of the transmitter auxiliary channel. Idle rpm can be in the 4000 range, as little thrust is developed at this rpm. The low speed needle valve should always be adjusted with a low tank fuel level.

In order to get a tachometer reading on the fan, it will be necessary to paint **one** blade of the fan with white epoxy paint. (Be sure to do this before the fan is balanced.) As most tachometers are calibrated to read two blades, it is necessary to double the reading to get the rpm of the fan (or re-calibrate your tachometer if it is adjustable).

The Byron pipe was used on the Rossi .81. The end of the exhaust outlet may have to be bent slightly to clear the engine mount and throttle linkage. The exhaust goes directly into the fan and down the tail pipe. (So does all the gook! --- super fuelproofing the tail pipe and engine area is a **must**!) The Byron folks have told me that this system can add up to a quarter pound of thrust! Be sure to install the fuel dam and drain pipe (see details on plans) in order to control and eliminate excess fuel and exhaust residue in the engine compartment.

It is advisable to add an aluminum heat shield to the underside of the hatch cover in the vicinity of the manifold --- things get **hot** here!

The hatch is held in place with four bolts screwing into blind nuts on the top of the fuselage sides.

Speaking about tuned pipes and their installations, I encountered an annoying problem in my early efforts in setting up and operating tuned pipe engines. Due to vibration, or perhaps a slight flex in the engine mount, the end of the tuned pipe would creep towards the engine and vibrate against the end of the manifold, resulting in damage to each. No amount of tightening of the coupler clamps seemed to help. The problem was resolved by fitting aluminum sleeves over the manifold and the end of the tuned pipe. Each sleeve acts as a shoulder for the respective end of the coupler to bear against. The coupler itself prevents contact between the pipe and the manifold. See Tuned Pipe details on Sheet 1. The sleeves are seated with a thin film of GE Silicone rubber.

**Flying, Engine Starting And Field Handling:**

Flying the Chinook is a very thrilling and satisfying experience. However, certain basic guidelines must be followed:

(a) Make sure that the Center of Gravity is as shown on the plans, or perhaps 1/2" further forward for the initial flights.

(b) Limit your first flights to about three or four minutes until you get an indication of fuel consumption, especially if you are using the Rossi .81. Fan jet engines use fuel at a much faster rate than propeller planes, and the last thing you want is to run out of fuel before your first landing! Also, keep in mind that you can burn up a lot of fuel taxiing out to the runway. If possible, it is best to start the engine right at the take-off point, to conserve as much fuel as possible for flying.

(c) **Never** attempt a flight if you are not sure of a reliable engine run --- **Never!**

(d) Do not attempt a take-off from grass at less than 17,500 to 18,000 rpms.

(e) Do not fly in a calm, as take-off and landing ground speeds may be excessive (unless you have long runways).

(f) Do not attempt a take-off in strong cross winds, as with a fixed rudder, the model has a tendency to weather cock into the wind when the nosewheel becomes "light."

(g) When landing, make sure that adequate flying speed is held right to touch down. When the flaps are deployed, make a steeper descent than normal. All landing approaches are made under partial throttle. It is wise to establish the throttle setting (at a safe altitude) that will just maintain