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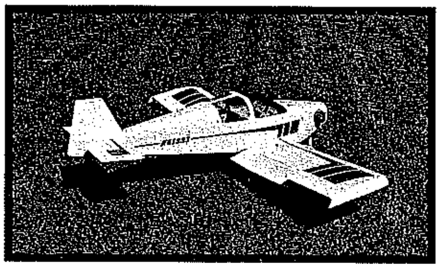
PART TWO

Snipe

Last month we previewed the full-scale Snipe. Now let's build the model.

■ **James Gilgenbach**



LAST MONTH, I explained the steps required to design a full-scale home-built aircraft. I also gave the reasons why I believe a ¼-scale RC model of that design should be built and tested. This month the design, construction, and testing of the model will be discussed.

MATERIAL AND HARDWARE SELECTION

My goal was to pick good quality, readily available products that would allow simulation of the assembly processes I would use in building the full-scale aircraft.

For the model aircraft substructure, I chose to use plywood—aircraft quality and Lite Ply—and balsa. In such critical areas as wing spars, landing gear, and wing folding joints, I used aluminum and/or 4130N steel, depending on strength requirements.

For skinning the aircraft, I used .010-inch-thick ABS plastic. This should give a good indication of what I will encounter when skinning the full-scale aircraft with .016- to .040-inch-thick aluminum sheet.

I needed to use adhesives that could bond plywood, balsa, Styrofoam, fiberglass, steel, aluminum, and ABS plastic. Satellite City was able to meet these requirements with UFO Thin and UFO Thick adhesives, plus Hot Shot and Kick-It accelerators.

Where instant bonding was necessary, UFO Thin worked well. UFO Thick allows repositioning of parts before the adhesive sets. This was especially important during the skinning process. One feature I appreciate about UFO is that it doesn't give off the irritating gas that some CyA glues do.

Du-Bro Products has a complete line of quality hardware items, including scale wheels, hinges, control horns, pushrods, wheel collars, blind nuts, etc. I used Du-Bro hardware wherever possible. The pushrod/clevis assemblies with coil spring locks were used for all control surfaces to ensure safe, reliable connections.

ENGINE SELECTION

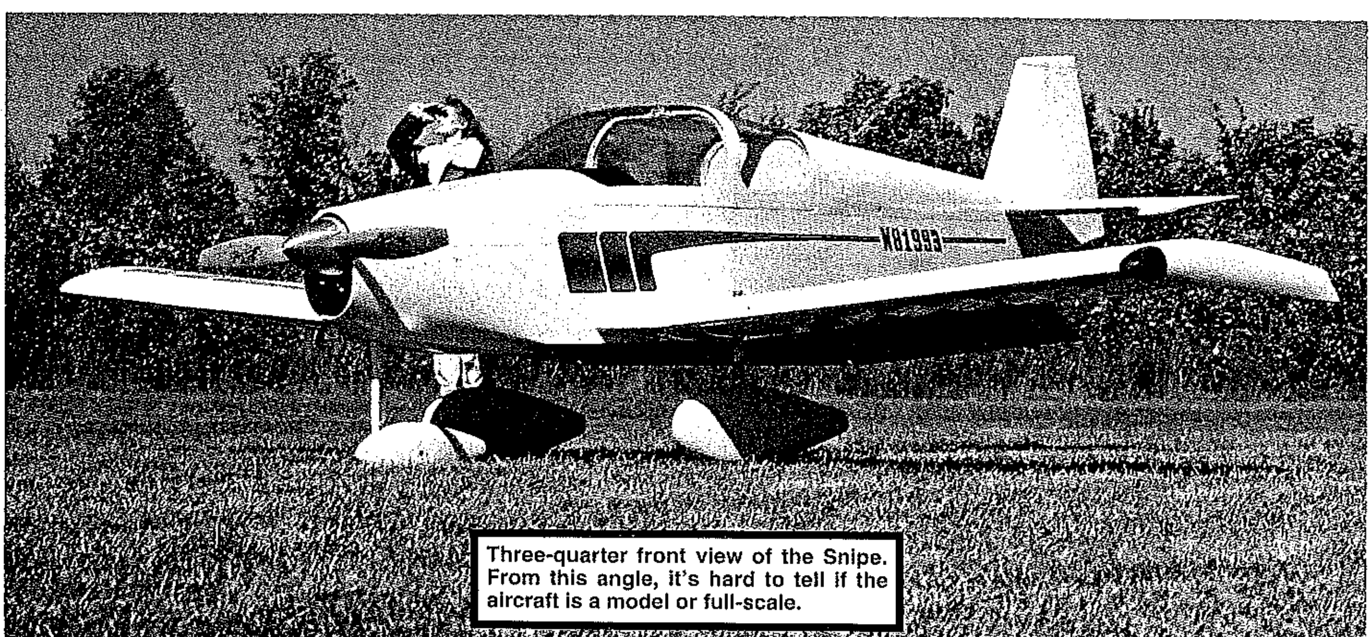
Many different engine types and sizes were considered before I made my final selection. The objective was the ability to swing an 18 x 10 prop at approximately 7,000 rpm. I didn't want to use gasoline for fuel, because of its relatively dangerous handling characteristics, so I considered only methanol-burning engines.

There are several multicylinder engines that could have done the job, but their initial cost is prohibitive.

Of the single-cylinder methanol-burning engines available, the OPS 30 Maxi (from Shamrock Competition Imports, Inc.) offers the best value. It's a powerful engine that has good starting, idling, and transition throttling characteristics.

Other appealing features are the muffler location's flexibility and the engine's light weight. This is *not* a converted leaf-blower engine. It was specifically designed to power model aircraft in the 15- to 22-pound range.

Although it is a ringed engine, the manufacturer still recommends breaking it in for about an hour. This is no problem for me—I always run engines for quite a while to familiarize myself with them and to ensure that everything is functioning properly before taking to the air.



Three-quarter front view of the Snipe. From this angle, it's hard to tell if the aircraft is a model or full-scale.

straight, with no tendency to snap roll or drop a wing tip.
3) At slow ground speeds, it is difficult to turn the model without a steerable nose wheel or individual main gear brakes.
4) The ABS skin does not vibrate excessively, regardless of engine rpm.
5) Theoretically, the model should fly well at 34 pounds, but I have yet to test this theory.
6) Elevator trim changes are not required when the flaps are activated.
7) Landings were docile with 20° to 40° of flaps. Forty degrees of flap quickly slows the plane and greatly increases the rate of descent.
8) No control flutter was encountered.
9) The aircraft will not spin with the CG at less than 20%, even with full control travel.

CONCLUSIONS

This project would not have been successful without the help and encouragement of many individuals and organizations. I strongly recommend that modelers patronize the manufacturers and distributors mentioned in this article. Further, I wish to thank my flight assistants—Gus Rebensburg, Jerry Reichow, and Duncan Stewart—for their time and effort.

Based on my test results, I am now confident that it is feasible to develop a full-scale Snipe. As I am detail-designing the big Snipe, I will continue to use the ¼-scale model to test different features and building techniques. I can't wait to get started bending tin!

By the summer of 1998, I'll let you know how the full-scale aircraft flies. This leads to a final question:

If I build a full-scale model of the prototype ¼-scale aircraft, which one can I enter in a sanctioned AMA scale contest? ✈

RC Slope Soaring/Byers

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required by the servo. In fact, a typical microservo will extend and retract the landing gear as well as open the landing gear doors.

Gene has also designed an over-center system into the retractable landing gear so that in landing, no force is transmitted to the servo that might strip the servo's gears. This over-center system also works in the retracted mode so that the wheel's inertia cannot throw the gear out and open. The ruggedness of this retract system is surprising. Gene has even tested his gear design by doing push-ups on them.

To install the gear, a builder custom-fits it in the fuselage between two bulkheads. This installation method serves two purposes. First, the bulkhead mounting provides a very rugged attachment to the inside of the fuselage so that the gear cannot be broken loose from landing impact. And the mounting system lets the builder adjust the depth of wheel extension through the fuselage.

Now if you are a meticulous scale builder and want the best retractable gear that money can buy, the Cope retract is probably worth considering. Gene offers the retract in two sizes. He has a ¼-scale version, which is currently priced at $125. Cope also offers a supersize ⅓-scale retract that will handle the *really big birds.* He tells me that sometime in the not-too-distant future he will be offering a ⅕-scale model too.

Cope Retracts can be contacted at 3203½ Main St., Union Gap, WA 98903. The telephone number is (509) 457-9017.

One of the many modelers and friends who contacted me during the month, Mr. Darrel Johnson, of Mesa, Arizona, suggested that I discuss how I balance my models. Well, to be perfectly honest, I sometimes just mount the model atop my left and right index fingers and do a quick and dirty. Other times, however, my procedure is a bit more exacting, and I use a balance stand.

The balance stand is a simple device that can be built in just a few minutes with the aid of good old Hot Stuff or a similar product. The stand is built from ¼-inch plywood or other plywood of approximately that size. The drawing outlines the construction and shows the supporting fillets that keep the stand from breaking when a large load is applied. The drawing also details the round edge on the stand upon which the model is placed.

The reason I use the stand is quite obvious; I want to obtain a balance point on the model as accurately as possible. With the stand, this is much easier to do. Using only your fingers to balance the model turns the procedure into somewhat of a juggling act. However, you can place the model on the stand and make weight

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The aircraft should be taxied to familiarize yourself with its ground-handling characteristics.

After running the engine, cycling the radio, and taxiing, check all linkage connectors, nuts, and bolts for tightness. If you find loose components, don't just retighten them—determine why they loosened, and take corrective action, such as gluing or using Loctite on them.

PREFLIGHT

Once I became familiar with the operating characteristics of the aircraft and was confident that everything was functioning properly, I was ready to take that long, lonely drive to the flying field. With any new model, I recommend the following:

Don't go to the flying field on a day when it will be crowded.

Don't take a lot of friends. Arrange to have just two helpers—an experienced model builder/pilot and a good camcorder operator. Videotape your entire flying session, including preflight.

If the weather is adverse, cancel and wait for another day.

Conduct a preflight inspection: Check all linkages and connectors; inspect control surfaces for direction of travel and amount of throw; run the engine at different attitudes; and range-check the radio.

FLIGHT PLAN

I developed a flight plan so that I would know exactly what I intended to do and so that I would have contingencies if something went wrong. My flight plan had these steps:

1) Take off to the northwest, into the wind. The flying field I went to has approximately ⅛ mile of grass in this direction. If the engine died on takeoff, I could land into the wind without attempting a turn.
2) At approximately 200 feet altitude and 200 yards distance, perform a 180° right-hand turn.
3) Climb to 300 feet, and fly 400 yards to the southeast.
4) Perform a left-hand procedure turn.
5) Fly 400 yards to the northwest, trim the controls, and perform a right-hand procedure turn.
6) Fly 400 yards to the southeast.
7) Repeat steps 4 through 6 several more times, trying both high and low rates on the elevator and ailerons, verbally noting the control response to the helper and video camera.
8) Test the flight characteristics of the aircraft with the flaps down.
9) Enter a right-hand landing pattern and land the aircraft with flaps down, if possible.

After the first flight, I inspected all linkages, nuts, bolts, and connectors—nothing had fallen off.

My prototype proved to be quite stable, but was too responsive, even with the controls on low rate. It was interesting that activating the flaps produced no pitching tendency. With 25° of flaps and the engine at idle, the landing was relatively slow, considering that the fueled aircraft weighed 25 pounds.

On the second flight, I explored the aircraft's aerobatic characteristics. To my surprise, it performed very much like a pattern ship. A landing without flaps was disastrous, however, as the model caught a wing tip, damaging the left wing and nose gear.

After the second flight, I checked the model, cleaned it, folded the wings, packed up, and went home to review the videotape. The video recording proved invaluable for this project. I guess that's why they have flight recorders on airliners.

The video showed that on the second landing I flared too soon and too much, causing the right wing to drop slightly. I then overcorrected and the model's left wing hit the ground. After further analysis, the causes were obvious: I still had too much elevator and aileron throw with the CG at 28%, and my flying skills were rusty.

On subsequent days, I checked out the stall and spin characteristics at different weights and CG locations.

TEST RESULTS

1) The model flies well with the CG at 25%.
2) With the drooped wing tips, the stall is

the epoxy sets, you will have a lot more trouble removing it, and you may have to sand it off.

Removing UFO from ABS plastic is tricky: Put a small amount of Zap Z-7 Debonder onto a clean rag and lightly wipe over the UFO. If you rub too hard or too long, the Z-7 will cut into the plastic.

If you dull the surface with Z-7, you can bring back the shine with Turtle Wax white automotive polishing compound.

Sooner or later, you will scratch the ABS skin. When this occurs, the scratches can be removed by sanding with 1200-grit wet-or-dry sandpaper, then rubbing with polishing compound. When sanding or rubbing the skin, don't push too hard or the skin may crack where it is attached to the structure.

The plastic can be shrunk using a heat gun, but it is also very easy to melt, and it will shrink with enough force to warp the substructure. I don't recommend heat-shrinking.

To minimize wrinkling in sunlight, the plastic should be preheated before installation.

K&B thinner cuts into ABS plastic, so K&B epoxy sticks well to it, especially when thinned. Conversely, don't use K&B thinner for cleanup—use denatured alcohol.

All the miscellaneous parts were painted with K&B primer, then K&B Super Poxy. These parts were made of plywood, balsa, spruce, steel, aluminum, brass, epoxy, fiberglass resin, and ABS plastic. I've never found a paint that sands and holds up better than K&B. It worked equally well over all these materials.

In order to save weight and time, I chose not to paint the entire aircraft. However, I did sand and polish the skin where it had blemishes and scratches.

I used the Jumbo Stripe Kit from Eagle Products to trim the model. The decals are easy to install, are durable, and look good. Eagle Products offers several different color schemes so you can individualize the aircraft. Personally, I like the fluorescent pink/blue/purple combination.

TESTING—AT HOME

Before taking a new model to the flying field, several things should always be done.

First, check the center of gravity (CG). It should be between 23% and 27% of the wing chord. My first few flights were flown with the CG at 28%, but I would recommend adding weight to the nose, if necessary, to get the CG to 25% of the wing chord.

The engine should be test run in the aircraft and set up at different attitudes—e.g., nose up, nose down, inverted, and upright—to check run consistency.

The radio equipment should be actively cycled for one hour, then recharged and cycled again for an hour. This test will also reveal any control surface/linkage hang-ups.

The radio must be range-checked, both with the engine running and with it stopped. Don't forget to tie down the plane.

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2) Glue the framework to several Styrofoam blocks.
3) Cut and sand the Styrofoam to shape.
4) Cover the assembly with a layer of six-oz. fiberglass cloth. I used Hobbypoxy Formula 2 to bond and fill the cloth.
5) After the epoxy is hard—wait at least a day—trim off the excess fiberglass, sand the rough edges and high points, and apply a heavy coat of Hobbypoxy mixed 50/50 with microballoons.
6) Wait at least a day, then rough sand the outer surface to shape.
7) Split the cowl and hollow out the Styrofoam, but leave a 3/8-in.-thick Styrofoam wall inside each half.
8) Sand the Styrofoam wall smooth, and apply one layer of six-oz. fiberglass inside each half.
9) Wait another day, then trim and sand the excess fiberglass. Add the hinges and hold-down latches (hinges with T-pins).
10) Reassemble the two halves, and finish sanding them. The cowl halves are exceptionally rigid. To assure a good fit, I attached the cowl to the fuselage and match-sanded them. Remember to compensate for the .010-in.-thick ABS fuselage skin.

The wheel pants can be made by forming a Styrofoam plug, covering it with two layers of six-oz. fiberglass, coating the fiberglass with the 50/50 epoxy/microballoon mix, sanding to shape, and hollowing out the Styrofoam.

SKINNING, PAINT, AND TRIM

Sand the contour of the stabilizer smooth. Remove all dust and loose particles.

Cut out the .010-in. ABS plastic skin slightly larger than the area to be covered. Cut the skin to wrap around the leading edge, and allow enough stock to overlap the leading edge of the control surface at the stabilizer's trailing edge.

Place the skin onto a hot (approximately 100°F), flat surface, and tape down one end. I used my wife's glass-topped dining room table with a space heater on the underside of the glass. This is necessary so the skin will be tight at normal room temperature.

Run a bead of UFO Thick on the trailing edge and all the ribs up to the leading edge on the top side of the horizontal stabilizer. Starting with the top gives you a better chance to spot any misalignment of the skin, so the best part of the skinning job is visible. You can start on either side of the vertical stabilizer.

Press the trailing edge onto the skin, leaving 1/4-in. overhang. Roll the stabilizer on the skin, toward the leading edge, while pulling the stabilizer toward yourself to keep the skin taut. (Remember, you taped the opposite edge to the glass table.) Hold pressure on the assembly for about a minute as the UFO sets.

Remove the assembly from the table, and apply UFO Thick to the leading edge top, front, and bottom.

Tape the skin to the table again, and roll the skin around the leading edge, making sure the skin is tight. Hold pressure on the assembly for about one minute.

Remove the assembly from the table. The skin should now be glued tightly around the leading edge.

Now apply UFO Thick to the ribs and trailing edge on the remaining side.

Tape the edge of the skin to the table, and roll the stabilizer onto the skin. Hold pressure on the assembly for about one minute.

Remove the structure from the table, and trim the edges with a sharp knife and sanding block. When the structure cools, it should be stiff, with a tight skin. The exposed rib sides can be covered with ABS plastic and paint, or a commercially available heat-shrinkable plastic covering may be used.

The skin is folded at the trailing edges of the elevator and rudder, which yields good-looking, straight trailing edges. Folding ABS plastic can present a problem, however, so the following technique should be used:

1) Build and sand the control surface. Remove loose particles.
2) Cut the ABS skin slightly larger than required.
3) Lay a thin (.025-in.) steel straightedge onto the skin at the fold line, and weight or clamp it down at each end.
4) With a hard pencil, draw the trailing edge fold line. Push down hard on the pencil so that the plastic is scored but not scratched.
5) Fold the skin over the straightedge, creating a 180° bend.
6) Remove the straightedge, and fold the skin flat. The fold line should now be straight.
7) Tape the top side of the skin to the heated glass table.
8) Apply UFO Thick to the top side of the control surface substructure.
9) Position the substructure onto the skin. Press and roll it to attach it to the skin. Hold pressure on the assembly for about one minute.
10) Remove the assembly from the table, and apply UFO Thick to the opposite side of the substructure.
11) Repeat operation 9 on the opposite side.
12) Trim off the excess skin.

On the rudder, I rolled the skin halfway around the leading edge from each side. On the elevator, I covered the leading edge separately.

The wing panels were subsequently skinned, using the same procedure as on the horizontal stabilizer. The ailerons and flaps were skinned using the same procedure as on the elevator.

The fuselage sides were skinned first, then the turtledeck, and finally the bottom, using basically the same techniques—placing the skin on a warm work table, applying UFO Thick to the structure, and pressing and rolling the structure on the skin.

Through trial and error, I've learned several interesting things when working with .010 ABS plastic.

If you accidentally spill epoxy on the plastic, denatured alcohol will remove the epoxy without damaging the plastic. Once

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but modelers have a material available to them that is as strong, yet less expensive: music wire, a truly amazing steel. Most model aircraft use this gear type because it is simple and durable.

WING

My model's wing is made to simulate the folding feature of the full-scale aircraft. From a practical standpoint, however, a normal model would only need removable wing panels, so that is what I've shown on the plans.

On the prototype model, I used #6 tapered pins to hold the wing sections together. This feature required some difficult machining, so the plans show a hex-head cap screw with a nylon-insert locknut.

The most unusual feature of the wing design is the use of .025-in.-thick x .75-in.-wide 4130N steel for wing spar caps.

The wing is designed to handle +9.0G and –4.5G ultimate loads—the loads at which structural failure occurs. A full-scale aircraft would not exceed loads of +6.0G or –3.0G under normal aerobatic conditions. With a model and haphazard flying techniques, it is possible to attain much higher loads. Therefore, prudence must be exercised when flying this model.

Wing construction is simplified through the use of a wing fixture and notched front and rear spar webs. The building sequence is as follows:

1) Make the wing fixture using miscellaneous pieces of lumber you have around your workshop. Make all spars and ribs.
2) Cut all 14 steel spar caps (six long, eight short) to length, radius the ends, drill all the mounting and lightening holes, deburr, and sand them.
3) Cut out the $\frac{1}{16}$ x $\frac{3}{4}$ plywood and $\frac{1}{16}$ x $\frac{3}{4}$ balsa spar caps, and glue them to the steel caps of the outer wing panels only, using UFO Thick.
4) Cut out and notch the plywood spar webs. Make sure these webs fit snugly into the wing fixture.
5) Using UFO Thick, glue the bottom outer front wing spar caps to the wing webs.
6) Clamp one of the outer wing panel front spar assemblies to the fixture, and position the rear spar web, with the ribs, into the fixture.
7) Align all ribs, and glue them to the spar webs. Note: Do not glue the top front spar cap yet.
8) Glue the leading edge to the front of the ribs.
9) Glue the rear plywood spar caps to the ribs and rear spar web, and remove the assembly from the fixture.
10) Screw the bottom outer main spar caps to the wing web block.
11) Repeat operations 6 through 10 on the other outer wing panel.
12) Glue the $\frac{1}{16}$ x $\frac{3}{4}$ plywood and balsa spar caps to the center wing steel spar cap.
13) Glue the plywood front spar web to the center bottom front spar cap assembly.
14) Clamp this assembly to the fixture, and position the rear spar web with the ribs into the fixture.
15) Align the ribs vertically using a square, and glue them to the spar webs. Do not glue the two end ribs at this time.
16) Glue the top front spar cap to the ribs and spar web.
17) Glue the leading edge and the two rear plywood spar caps to the ribs and rear spar web. Remove the assembly from the fixture.
18) Screw the spar caps to the wing web block.
19) Glue the four wing-locating dowels in place on the outer wing panels.
20) Assemble the outer wing panels to the center wing panel, and adjust the dihedral angles by sliding the top wing spar caps on the outer panels.
21) Clamp the two end ribs of the center wing section to the two end ribs of the outer wing sections with .020-in.-thick shims between the ribs. The shims are the thickness of two pieces of .010 ABS plastic.
22) Glue the top outer wing spar caps and center section outer ribs in place.
23) Screw the top outer wing spar caps to the wing web blocks.
24) Shape and sand the leading edges of the three wing panels to match.

The ailerons and flaps can be built over the plans on a flat surface. The interconnecting flap swivel tubes should be aligned and glued with the swivel joint installed while the flap sections are aligned on the wing in retracted position.

Note that all control surfaces use music wire through the hinges for easy assembly/disassembly.

My model's wing tips are made of balsa and plywood, and are bolted to the outer wing rib with two 6-32 socket-head cap screws. They could also be glued in place, but I intend to try several different wing tip types to determine which give the best stall characteristics.

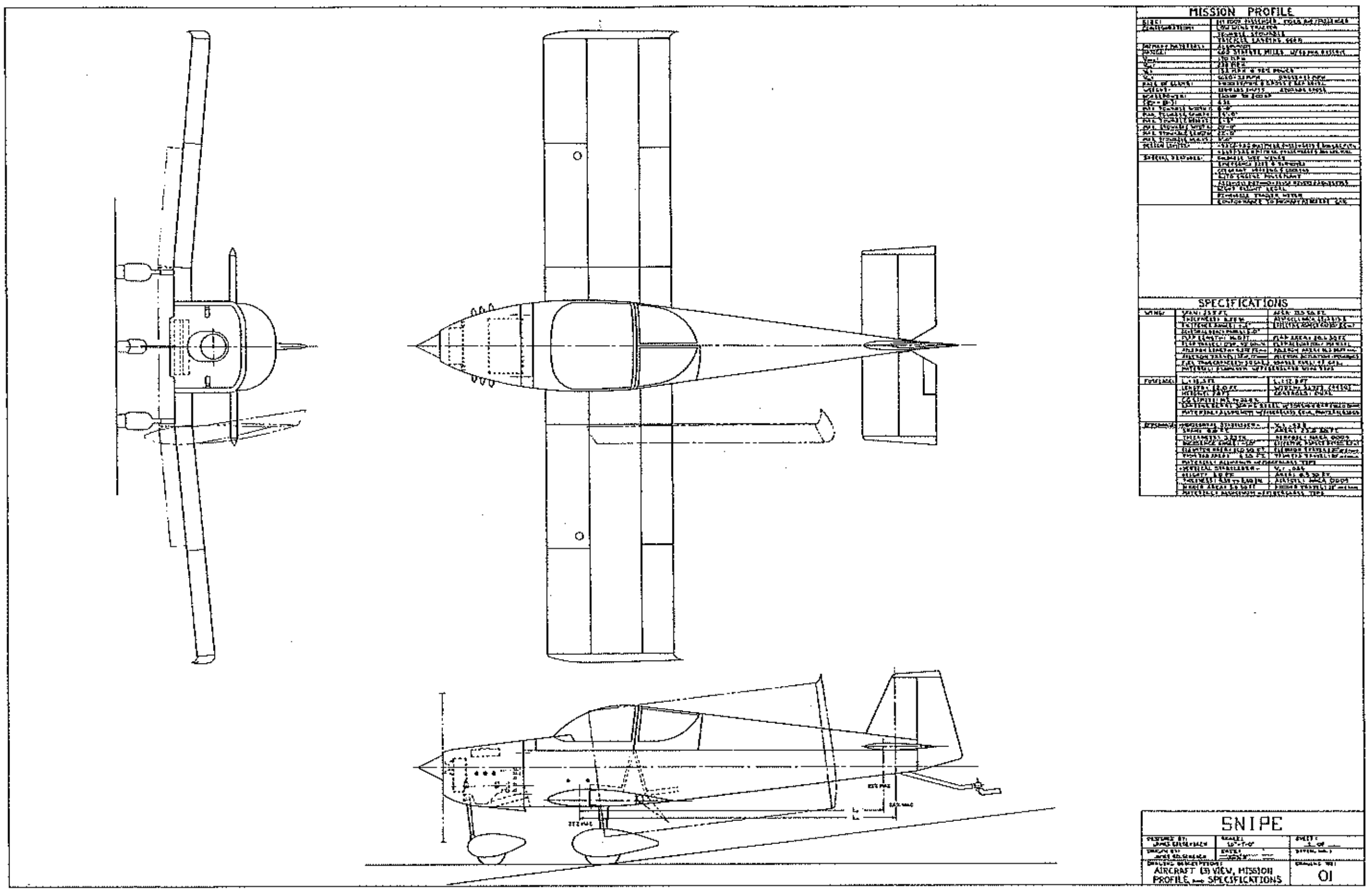
CANOPY

The canopy was made by heating and stretching .040-in. Plexiglas over a plug as follows:

1) Make the plug from wood, and coat it with epoxy.
2) Sand the epoxy smooth. The texture of this surface will transfer directly to the inside of the canopy when formed.
3) Attach handles to two sides of the Plexiglas sheet.
4) Heat the sheet and the plug in an oven until the Plexiglas starts to sag.
5) Remove both from the oven, and stretch the Plexiglas over the plug. I repeated this process several times to get the final shape.
6) Make the canopy frame.
7) Trim and attach the canopy to the frame, using UFO and #1 flat-head wood screws.

COWL AND WHEEL PANTS

Make the cowl in the following sequence:
1) Cut out the plywood cowl framework.



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separate article, so I will not detail their use here. However, several rules of thumb should be followed concerning alignment:

- First, *never* check an alignment or dimension only once. Check it over several times, preferably in several different ways.
- Second, don't get so engrossed in the details that you forget the basics (example: making two left wings).
- Third, eyeball all alignments. If they look wrong, they probably are.
- Fourth, add temporary braces to structures that are flimsy until the structures are covered or skinned.

The fuselage is the main structure from which all alignments are set. The top longerons should be used as the starting point for alignments. Wing dihedral and incidence, as well as horizontal stabilizer incidence and parallelism, should be set in reference to these longerons.

LANDING GEAR

I debated whether to present the details of my scale landing gear in this article and on my drawings; the full-scale gear will use torsion bars and hydraulic shock absorbers. My intent was to minimize the weight of the full-scale gear, yet still provide good shock-absorbing qualities.

Many different approaches can be taken to meet these criteria. If you want to learn more, the book *Landing Gear Design for Light Aircraft* by L. Pazmany is an excellent source.

I concluded that my gear is far too complex for anyone who just wants a good-flying, less-than-exact-scale model. It took me several hundred hours to design and machine the parts on a milling/drilling machine and a metal lathe. I went through this exercise only because I needed to develop the knowledge to build the full-scale aircraft.

The gear I recommend for the model is referred to as Wittman-type gear because Steve Wittman originally developed it for full-scale aircraft. These aircraft use expensive, high-alloy steel for the gear legs,

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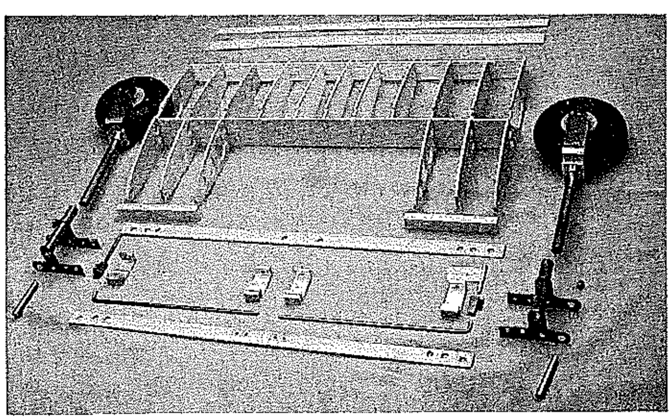
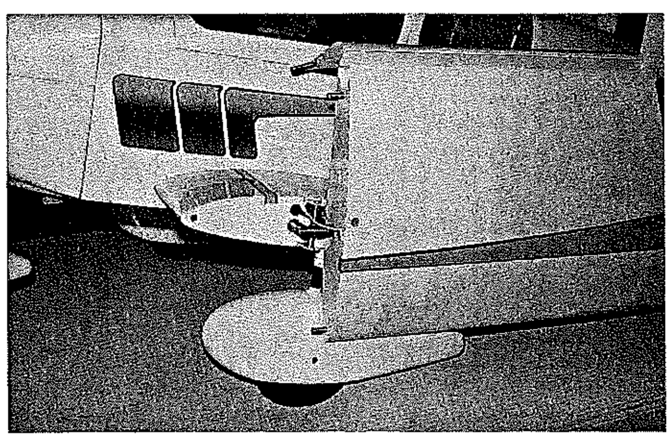
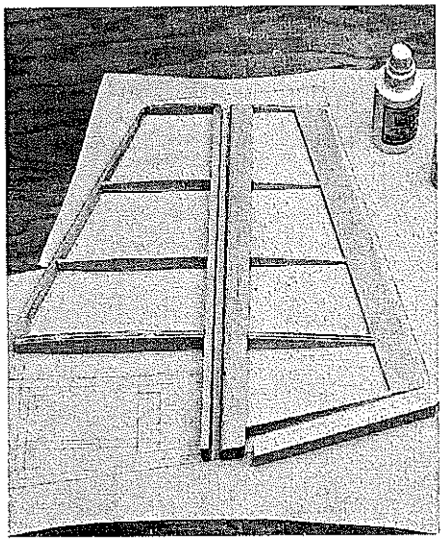


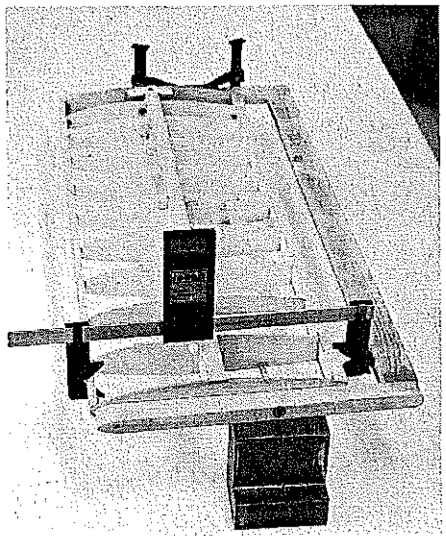
The original landing gear was somewhat complex, as it was intended to simulate the full-scale gear. A much-simplified Wittman-type gear design made from ¼-inch-diameter music wire is shown on the plans.



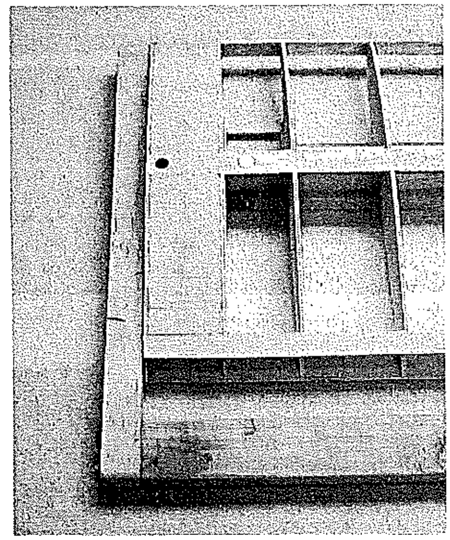
A swivel joint was machined to allow the prototype's wings to fold. Wing pins are #6 tapered. This complex feature is not shown on the plans—removable panels have been substituted.



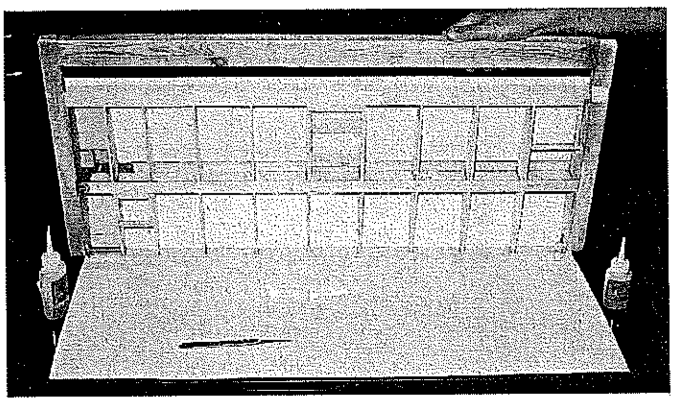
Vertical stabilizer and rudder are built directly over the plans. Rudder post features a full-length music wire pin.



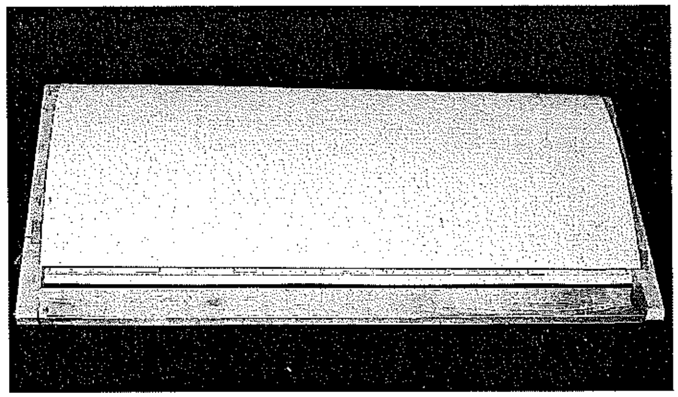
A simple fixture holds the wing in place during the skinning operation. The skin gives the wing much of its rigidity.



Root ribs were stiffened with 1/16-in. balsa sheeting. Spar caps are .025 4130N steel laminated between 1/16 ply and 1/16 balsa.



The wing skin is attached to the leading edge with contact cement to prevent cracking over a period of time. UFO adheres the skin to the balance of the structure.



Completed skin looks beautiful. The fixture eliminates wing twist and skin misalignment. Wings have one degree of washout built in.

producing a good-flying aircraft, and I have found several tools that are invaluable for establishing that alignment. They are as follows:

1) Steel squaring blocks (at least three required)
2) 12-in. combination square/level
3) 6-in. machinist's scale
4) 72-in. straightedge/scale
5) 16-in. x 24-in. carpenter's square
6) Incidence meter
7) Wing and horizontal stabilizer airfoil templates (1/8-in. plywood coated with UFO Thin)
8) Flat work table (2 ft. x 5 ft. minimum)
9) C-clamps
10) T-pins
11) Masking tape
12) Alignment/building fixtures and gauges.

Explaining how and where to use these tools could consume enough pages for a

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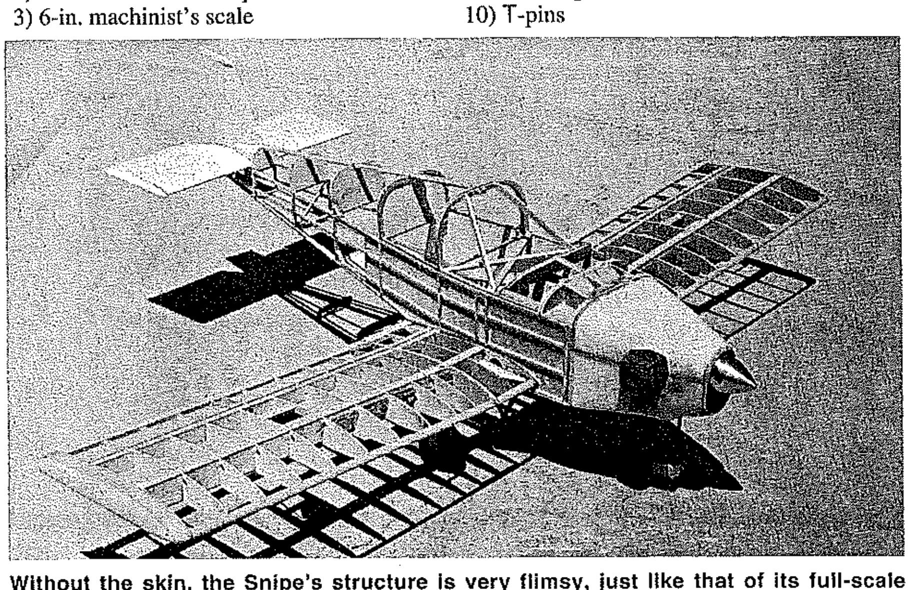
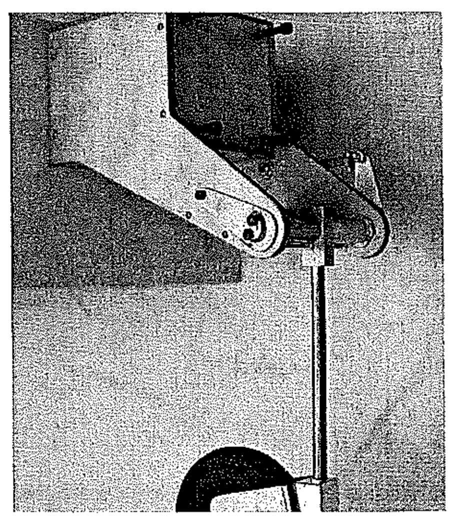


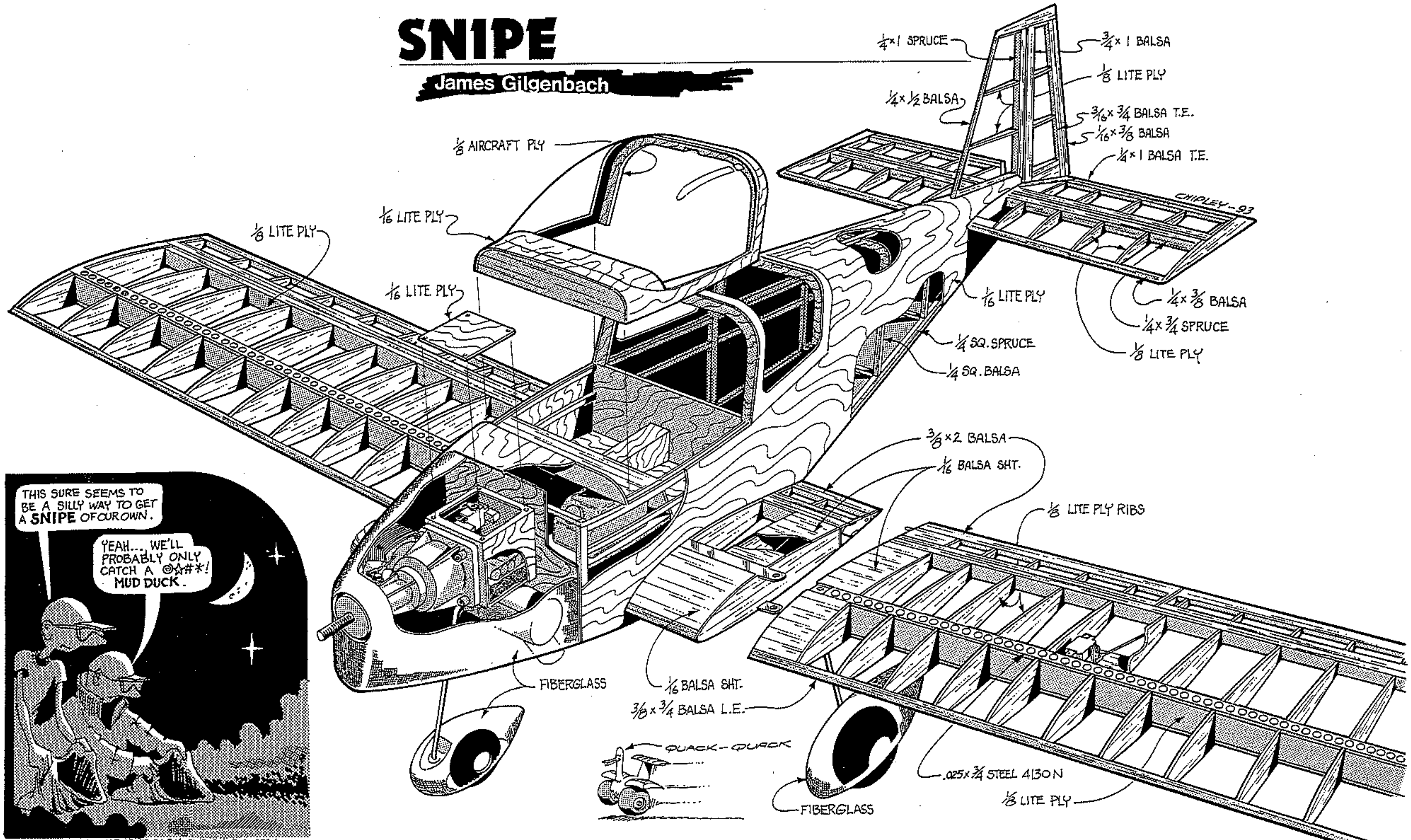
Without the skin, the Snipe's structure is very flimsy, just like that of its full-scale brothers. The text contains complete skinning instructions.

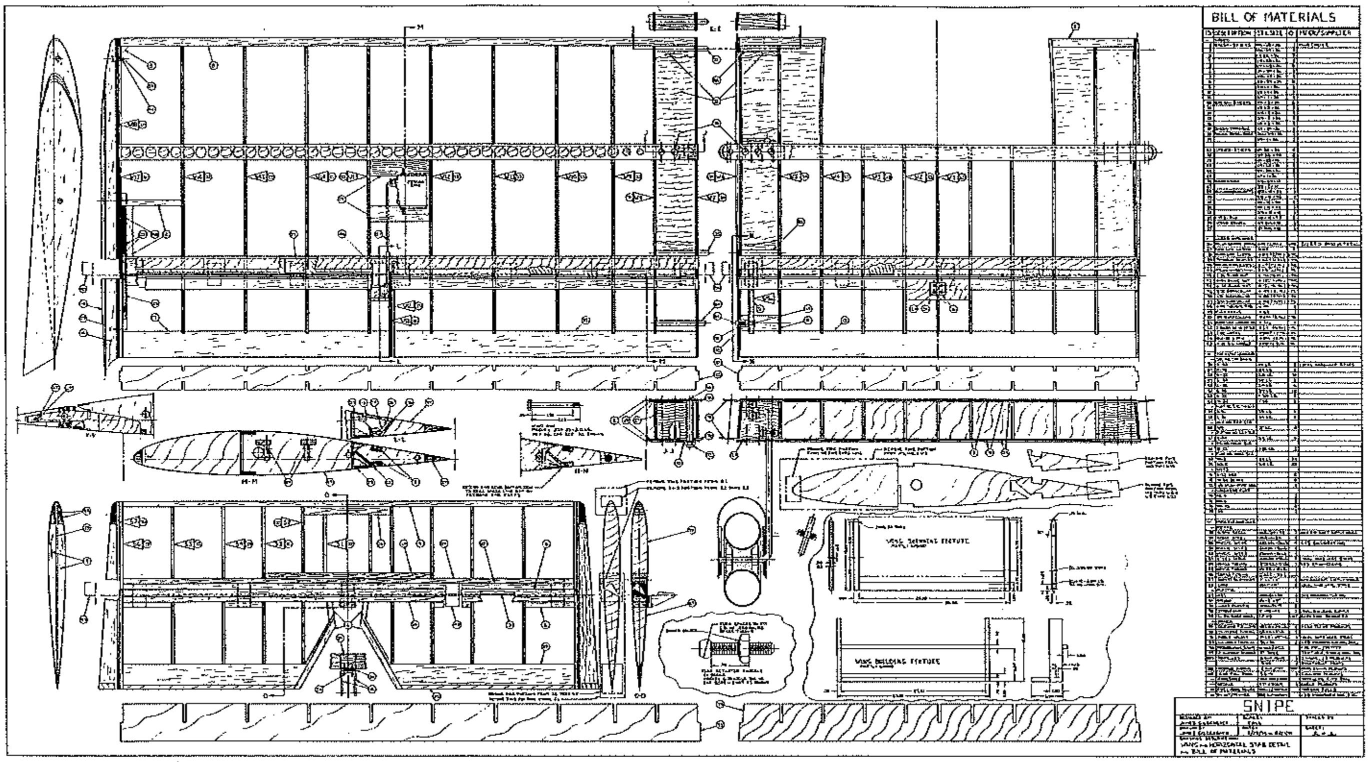


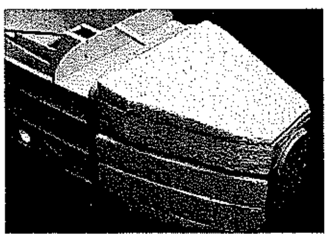
The original torsion bar nosewheel allowed the nose to dip too much on high-grass fields. The plans show fixed gear.

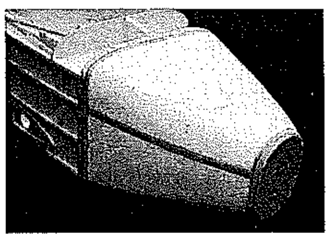
SNIPE

James Gilgenbach

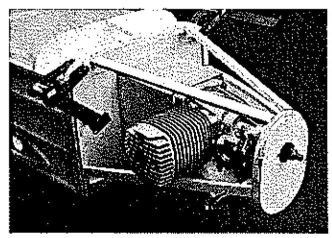


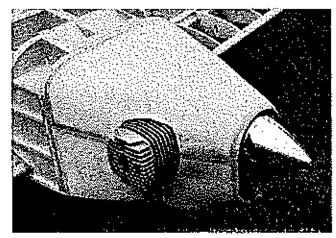






Styrofoam was glued to the cowl frame and sanded to shape. The cowl assembly was then removed from the fuselage and fiberglassed with six-ounce cloth and Hobbypoxy Formula 2.





A ¼ x ½ balsa frame was used to locate the cowl to the engine. The OPS 30 Maxi runs very cool—a streamlined cowl could have been added around the cylinder and head.

empennage fairing.

12) Make and fit the cowl and canopy.

13) Skin the remaining parts of the model.

14) Install the rest of the radio components, and balance the model.

15) Paint the accessories, and add the trim.

EMPENNAGE

In order to determine the best skinning process, I started by making the empennage. If I messed up while skinning, replacement of a vertical or horizontal stabilizer substructure would not be as traumatic as a wing substructure replacement.

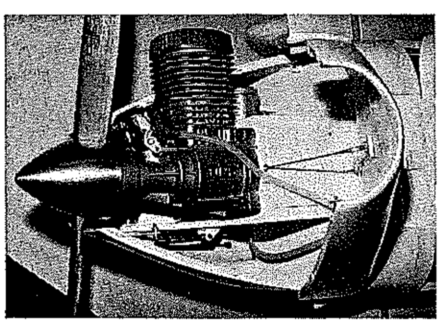
The substructure of the empennage is made of balsa and Lite Ply, so assembly can be done using a variety of accepted techniques. I chose to drill holes through all the ribs and use music wire rods for alignment.

Although my elevator has a separate trim tab, the model does not need it for normal RC flying. The empennage assembly is attached to the fuselage with two 6-32 bolts and two 2-56 bolts, and can be removed for storage and maintenance.

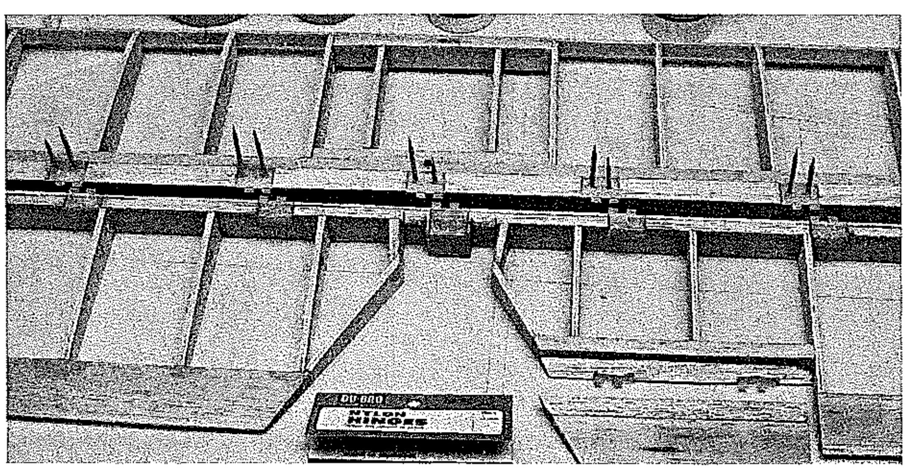
The tips of the rudder and elevator have lead added to balance these control surfaces. They were then covered with white Super MonoKote and glued to the control surfaces with UFO.

FUSELAGE

The fuselage is built upside down on the plans, with the top cowling and turtledeck added later. Overall alignment is critical for

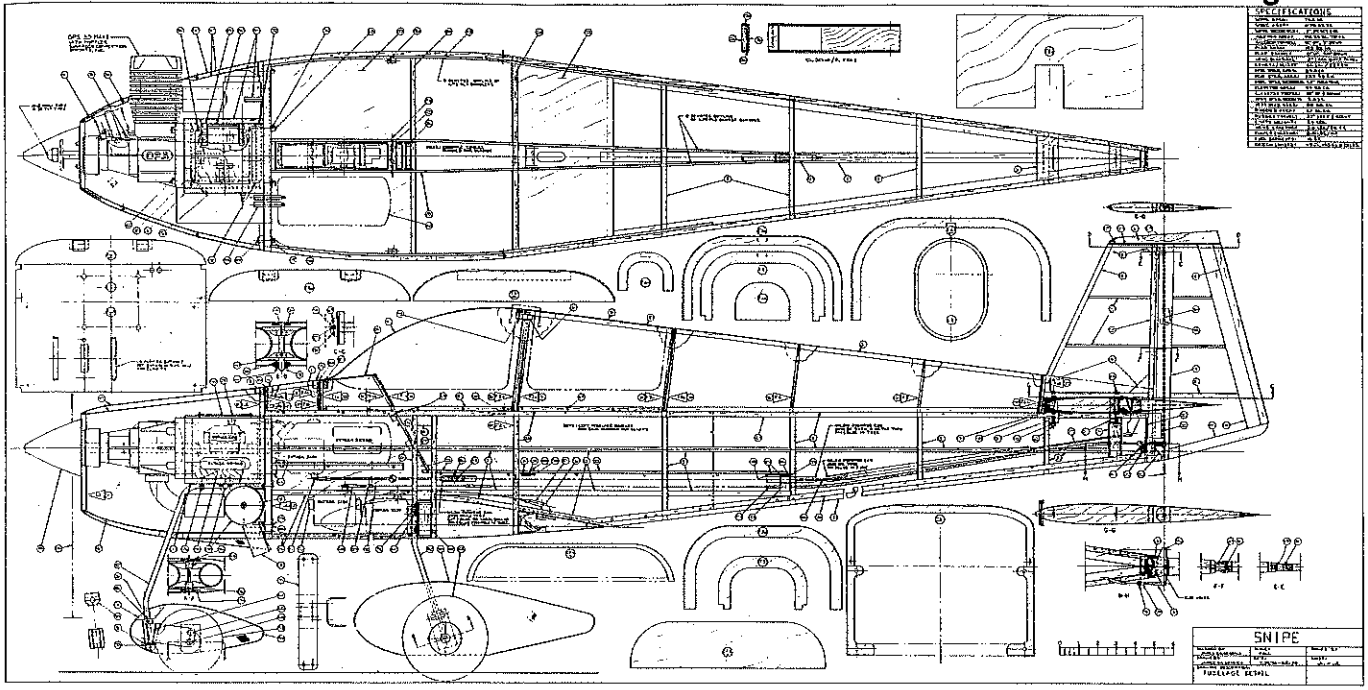


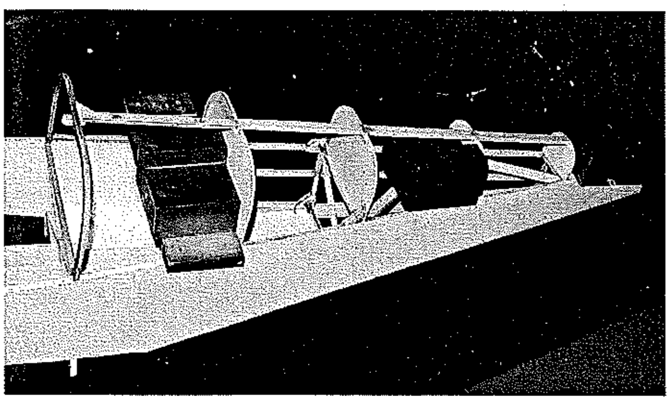
The OPS 30 Maxi was an excellent choice to power the Snipe. It pulls the model through every maneuver without effort.



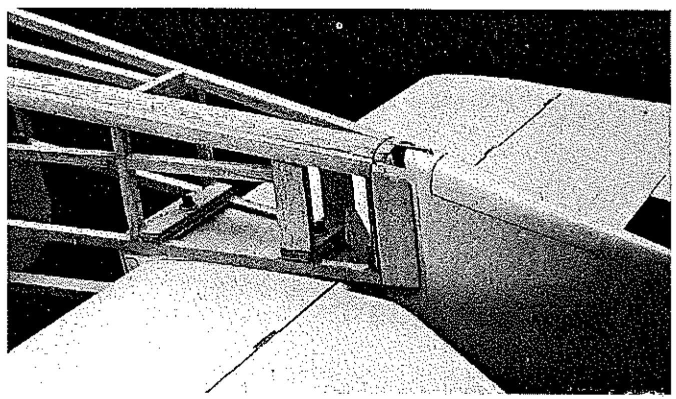
Toothpick pins were added to the elevator hinges due to their location beneath the model's skin. Trim tab on the prototype is not necessary for normal flying.

Full Size Plans Available–See Page 184





Steel weights hold the bottom of the fuselage side skin in place until the UFO Thick sets up. Fuselage longerons are used to key the alignment of all surfaces.



Two 6-32 bolts and two 2-56 bolts attach the removable empennage to the fuselage. All control surfaces use music wire hinge pins for easy assembly/disassembly.

8) Charger: FBC-6B4

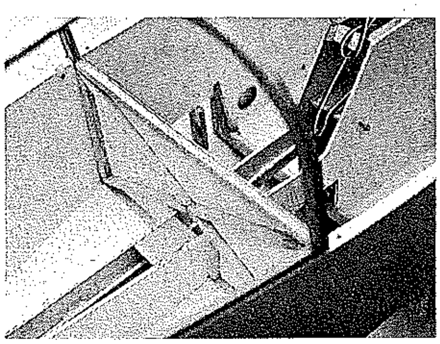
The programmable transmitter allows fine-tuning of all flight controls without the need to modify mechanical linkages. This feature saved me at least 20 hours of trial-and-error testing.

I also like the built-in timer, which can be used to monitor how long the radio has been discharging. The servos are tight, thus eliminating control drift and the need to constantly change trim.

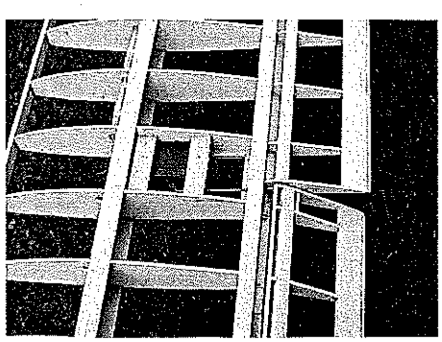
MODEL CONSTRUCTION SEQUENCE

The basic steps to build the model are as follows:

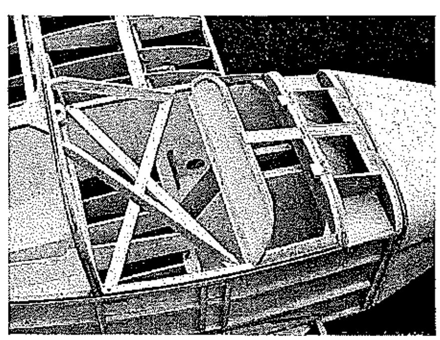
1) Build and skin the horizontal and vertical stabilizers, elevator, and rudder.
2) Build the fuselage, including the console, without the turtledeck and top. Build the engine/nosewheel mount.
3) Make the landing gear parts and the steel spar caps.
4) Build the center wing section.
5) Build the outer wing sections—leave the top spar cap loose.
6) Assemble the wing sections, and adjust the dihedral.
7) Make and install the flaps and ailerons.
8) Fit the wing and the horizontal and vertical stabilizers to the fuselage.
9) Install the engine, muffler, and nose gear.
10) Install the aileron servos, and make the hatches.
11) Skin the fuselage interior. Make and install the turtledeck, front fuselage top, and



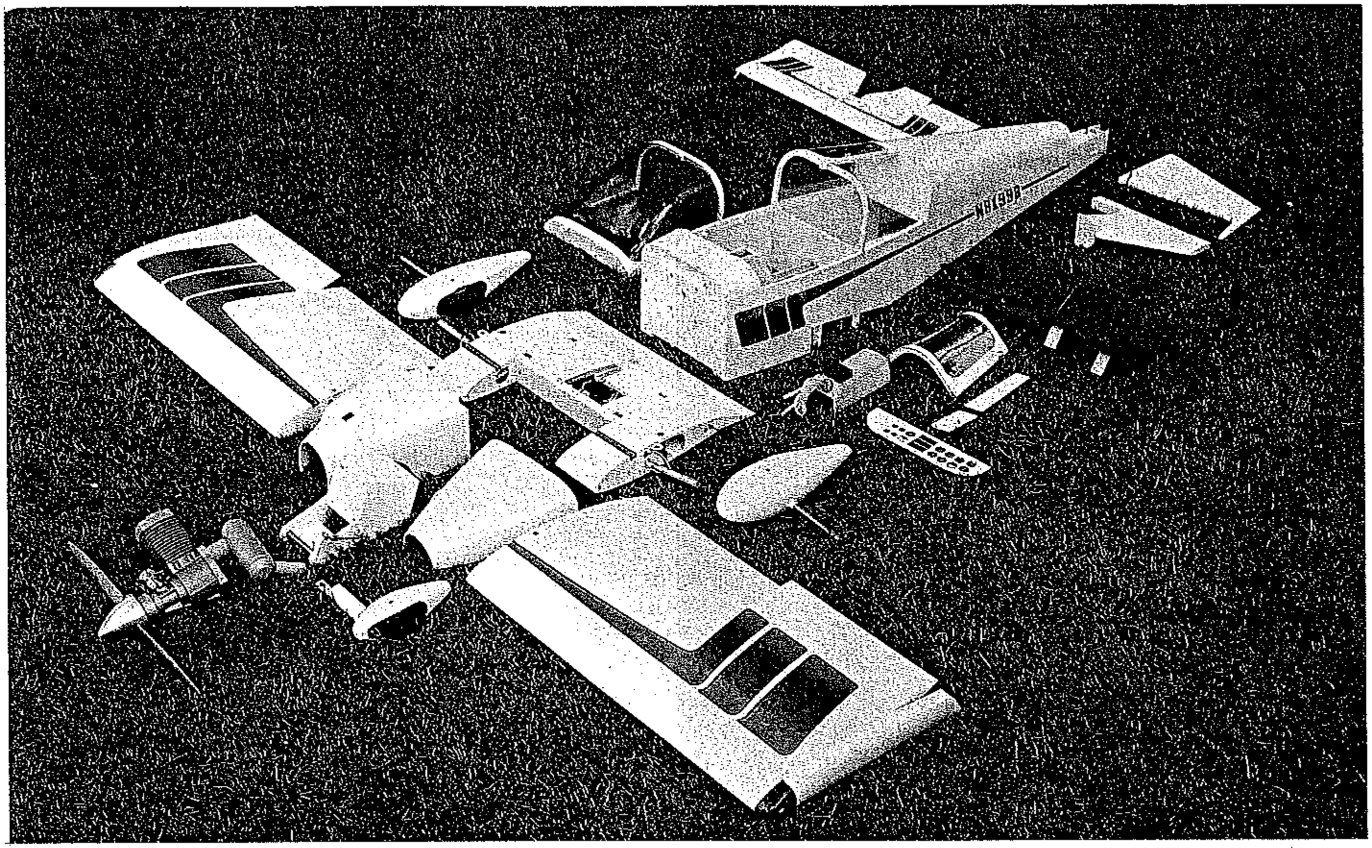
A bulkhead stiffens the center section of the fuselage. Empennage control rods and cables run through the center console.



A Futaba S148 servo is mounted in each wing section to actuate the ailerons. Most of the wing ribs are 1/8 Lite Ply.



The canopy frame has temporary cross braces added until the Plexiglas canopy is glued and screwed in place.



This is not a crash—components are shown prior to assembly. The model can be readily stripped down as necessary for shipping or storage. Model's skin is .010 ABS plastic.

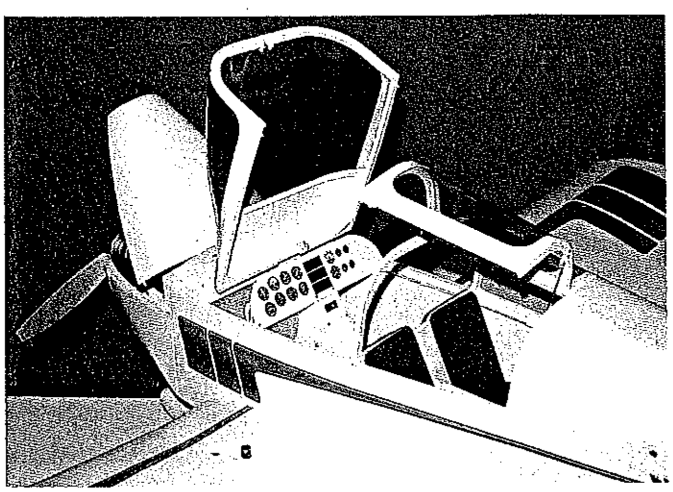
I selected Cool Power Tartan/Bully fuel, which is specifically blended for this engine size and type. I have had excellent results with Cool Power in the past, and this application was no exception. Another benefit from using Cool Power, as opposed to the factory-recommended 5% castor oil and 95% methanol, is the added rust/corrosion protection.

I wanted a lightweight three-inch-diameter aluminum spinner that would fit the OPS 30 Maxi and look good. The Tru-Turn TT-300B proved to be an excellent selection.

I modified the TT-300B by cutting the slots to fit an 18 x 10 prop (Tru-Turn has a big scale spinner available that doesn't require this); drilling the backplate for the engine drive pins; drilling and tapping the prop washer, prop, and backplate for two 6-32 bolts; and drilling and tapping the OPS 30 Maxi prop nut for a 10-32 spinner bolt.

These modifications lock the prop to the engine in a fashion similar to that used on full-scale aircraft. Both Zinger wood props and Dynathrust composite props performed well. With these props, the OPS 30 Maxi turned the following rpm:

Zinger		Dynathrust	
18 x 6:	8,100 rpm	18 x 8:	7,400 rpm
18 x 8:	7,500 rpm	18 x 10:	6,700 rpm
18 x 10:	6,800 rpm		
18 x 8/14:	6,200 rpm		
20 x 8:	5,800 rpm		



The cowl, canopy, and hatch open just as they will on the full-scale aircraft, allowing access to all instruments.

RADIO SELECTION

The Futaba 7UAP radio control system offers all the options required to handle the ¼-scale Snipe. These options include the following:

1) Ailerons: separate S148 servos for each aileron.
   a) Y connector: AEC 4
   b) Extensions: AEC 11
2) Elevator: S134 ¼-scale servo
3) Rudder: S134 ¼-scale servo
4) Flaps: S134 ¼-scale servo
5) Throttle: S148 servo
6) Elevator trim tab: S148 servo
7) Airborne battery pack: NR-4LB (1,000 mAh)

Snipe

Type: ¼-scale test model

Wingspan: 76 inches

Recommended motor size and type: OPS 30 Maxi

Number of RC channels recommended: Six

Expected flying weight: 25 pounds

Type of construction: Built-up

Type of covering finish recommended: ABS plastic skin; K&B Super Poxy