



MINI PRO

Introduction

I enjoy flying; in fact, anything that flies I enjoy. I also enjoy designing my own planes and watching them fly. There is no greater feeling to me than to see my own creation take to the air for the first time. Like most of my planes they start on a scrap of paper without any formulas being used at all. I may offend some engineers out there by saying this, but my philosophy is to throw away all those complex formulas. Just start drawing till it looks right. We all know what a plane should look like, so just let your imagination wander a bit, while still maintaining some basic aerodynamics. Some of my designs can only be described as weird, while others are just different.

I now present the Mini Pro, one of my more conservative designs, which is simple to build and does look like any airplane. The Mini Pro came about when my friend Jerry asked me to design a low wing plane to take the place of his Sig Kadet. No formulas were used in its design, just good

This simple to build .40 powered low winger was designed for the needs of the simple Sunday flier.

By John Boren

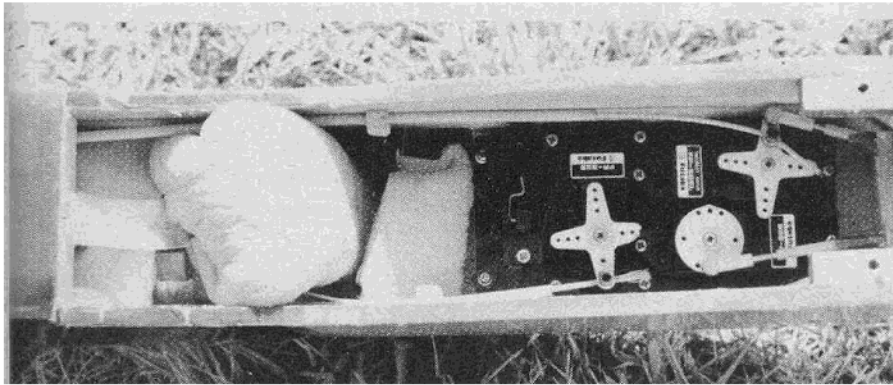


Author and Mini Pro.

common sense. The airfoil section was not plotted from an NACA number or modified from an existing wing. It was simply drawn and re-drawn till I believed it would do the job.

The job of the Mini Pro is to fit the needs from the simple Sunday flier to the competitive fun flier. It took a few minor changes to achieve these goals but the end result has been very rewarding. To date, at least ten Mini Pros have been built and flown by various club members with positive reports from all.

The prototype was designed around an O.S. .35 engine and a Futaba radio with F26 servos. The flight performance was adequate but somewhat slow for the 3½ pound plane. Needing a fun fly airplane for our monthly club contests, I decided to put a little more power up front with some added room for extra fuel. After some minor changes to the forward fuselage, a .40 size engine fit quite nicely with a little extra room to spare. Like most modelers, I would rather land the plane with the engine running, instead of dead, so I decided to make room for an 11 ounce Kraft



Typical radio installation. Receiver wrapped in foam, battery under fuel tank.

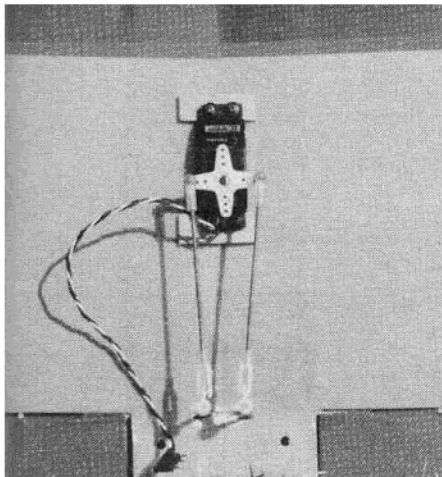
fuel tank. Of course, you may elect to use only an 8 ounce tank, but the 11 ounce tank prevents the occasional lapses of memory when we forget how long we have been up in the air.

Like my math teacher always said, you cannot add something to one side of the equation unless you add something to the other side. So I decided to increase the elevator and rudder areas a bit to take advantage of

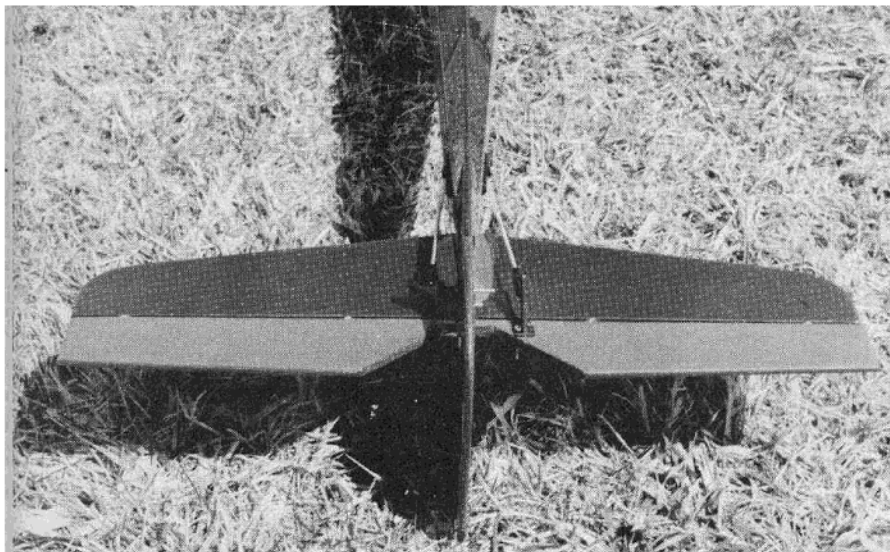
the increase in power. Also, to help take care of the extra weight of the bigger engine, I lengthened the rear fuselage and stuck everything further back. Not too scientific, but it worked. The flight performance of this new plane is more than I could have hoped for.

With a .40 engine up front and 11 ounces of fuel, the Mini Pro will do anything asked of it, and for about as long a time as your fingers can stand. Of course, the Mini Pro is not for every modeler, but if you enjoy slicing holes through the sky, going fast or slow, this airplane is for you. The slow speed flying characteristics are superb with the possible threat of a stall almost nonexistent. She simply lowers her nose and keeps on flying. If you fly in windy weather, as our club members usually do, the plane handles the wind with exceptional ease. In fact, I have flown in winds in excess of 25 miles per hour without the worry of crashing, while coming in for a landing. With control movements set at maximum there are not many planes in the sky that can turn with her, which makes her a great combat plane.

The Mini Pro is of simple but rugged construction, which helps in the event



Servo installation in wing.



Close up of tail feathers showing pushrods. Note triangle stock used to brace stab.



MINI PRO

Designed By:

John Boren

TYPE AIRCRAFT

Sport — Fun Fly

WINGSPAN

45 Inches

WING CHORD

10 Inches

TOTAL WING AREA

425 Sq. In.

WING LOCATION

Low Wing

AIRFOIL

Symmetrical

WING PLANFORM

Straight

DIHEDRAL EACH TIP

1 Inch

O.A. FUSELAGE LENGTH

42 1/4 Inches

RADIO COMPARTMENT SIZE

(L) 11" x (W) 2 1/4" x (H) 2"

STABILIZER SPAN

16 Inches

STABILIZER CHORD (incl. elev.)

4" (Avg.)

STABILIZER AREA

58 Sq. In.

STAB. AIRFOIL SECTION

Flat

STABILIZER LOCATION

Top Of Fuselage

VERTICAL FIN HEIGHT

3 3/4 Inches

VERTICAL FIN WIDTH (incl. rud.)

9 1/2 Inches

REC. ENGINE SIZE

.40

FUEL TANK SIZE

8 Oz.

LANDING GEAR

Tricycle

REC. NO. OF CHANNELS

4

CONTROL FUNCTIONS

Rud., Elev., Ail., Throt.

BASIC MATERIALS USED IN CONSTRUCTION

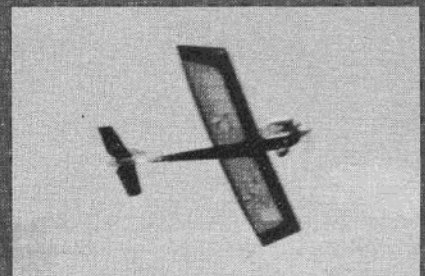
Fuselage Balsa & Ply

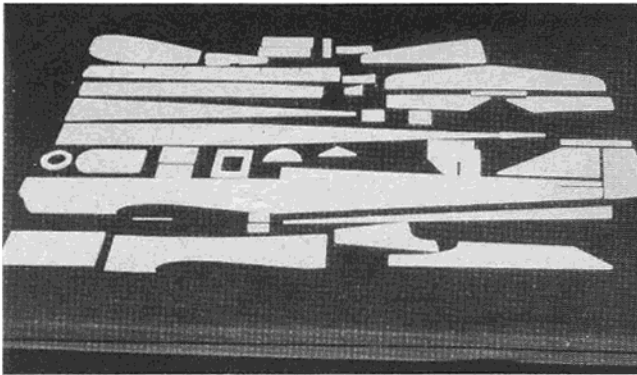
Wing Balsa, Ply & Light Ply

Empennage Balsa

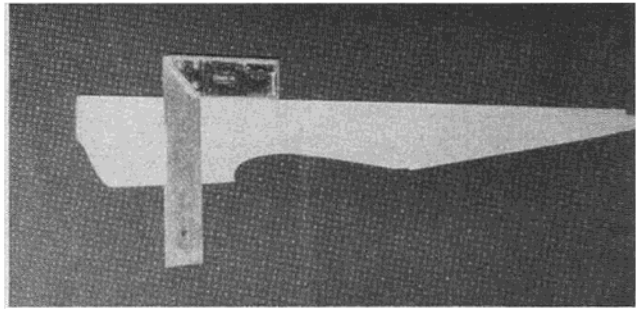
Wt. Ready To Fly 64 Oz.

Wing Loading 21.6 Oz./Sq. Ft.

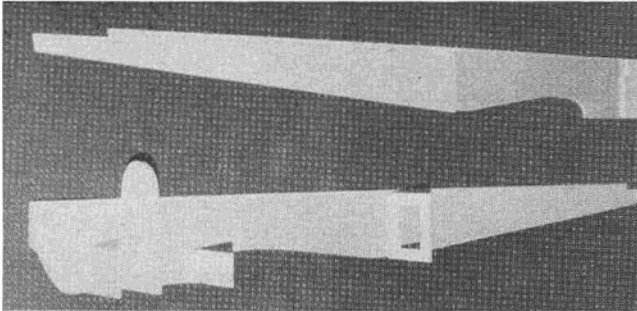




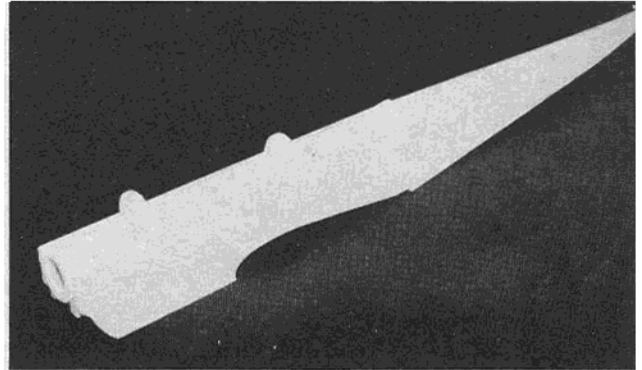
All the bits and pieces assembled in kit form.



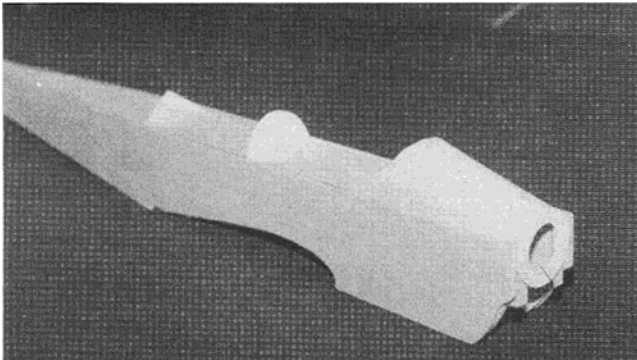
Use square to line up 1/4" balsa nose doubler.



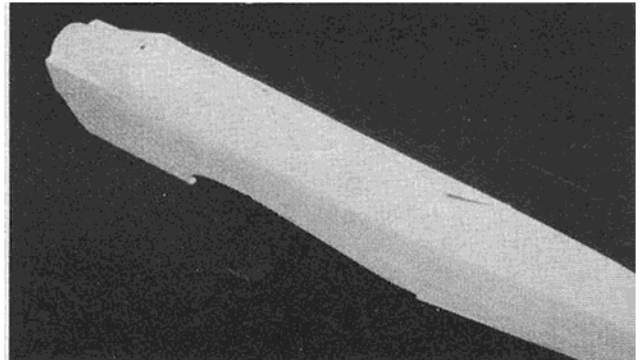
Plywood doublers and formers glued in place.



Fuselage sides with top deck and remainder of formers glued in place.



How top front sheeting should look when glued in place.



View showing front and back top sheeting in place.

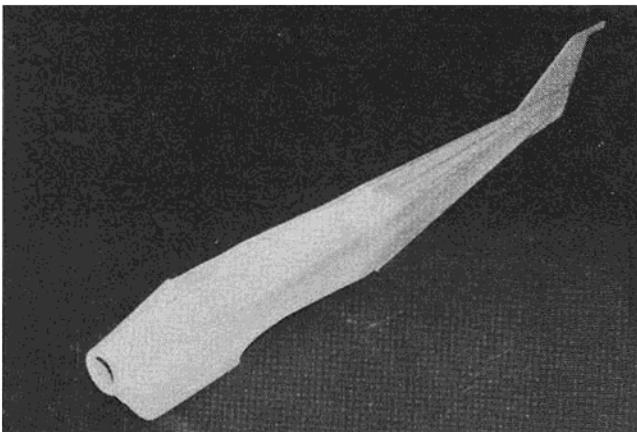
the ground decides to move in the way. We have all had that happen once or twice or maybe! Practically anyone can fly her if they have mastered a trainer and she can be framed up in about four hours. So she really fits the

needs of a lot of modelers. As with any plane you cannot start flying it till it's been built. So let's start by cutting ourselves a kit.

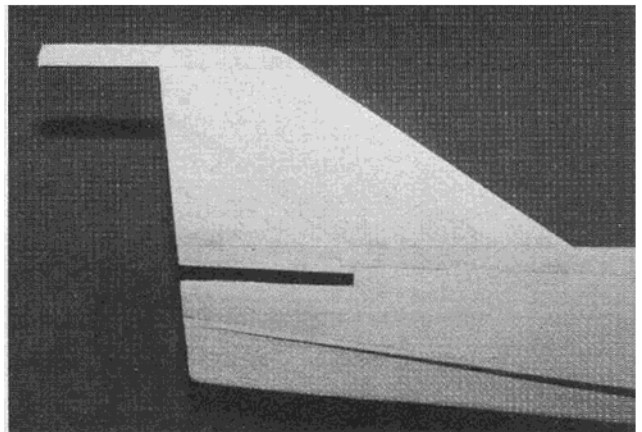
CUTTING KIT

Let's start by stacking sixteen

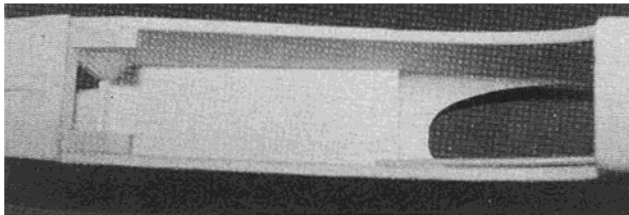
pieces of 3/32" balsa together. Trace the rib outline given on the side view of the fuselage from the plans. Cut, then sand the stack to final shape of rib. Using the 1/16" ply doubler template, cut out four pieces just like



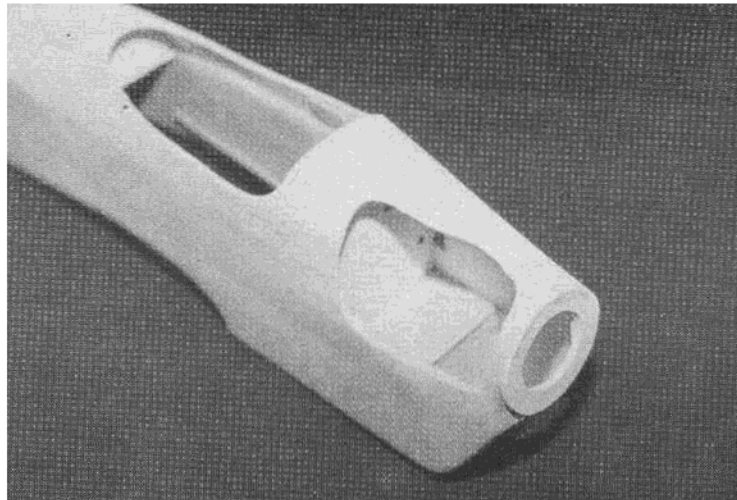
Completed fuselage sanded and ready for final assembly.



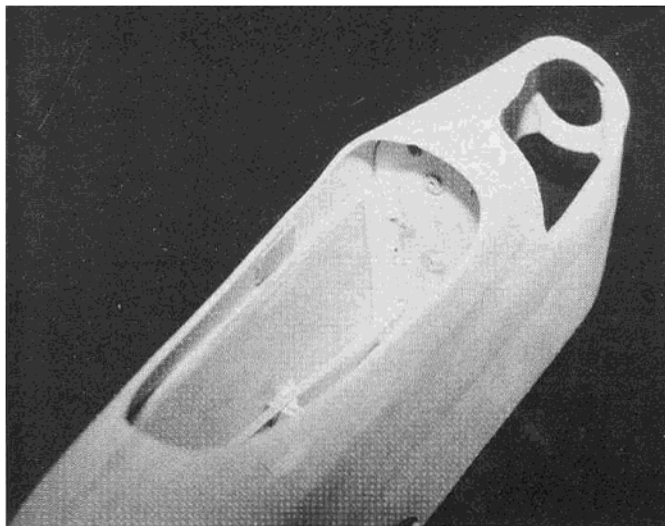
Close up view of fin and shrike placement.



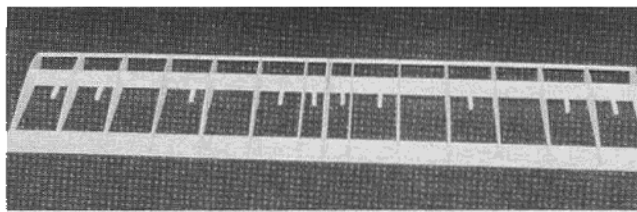
Inside view of fuselage showing wing mounting blocks.



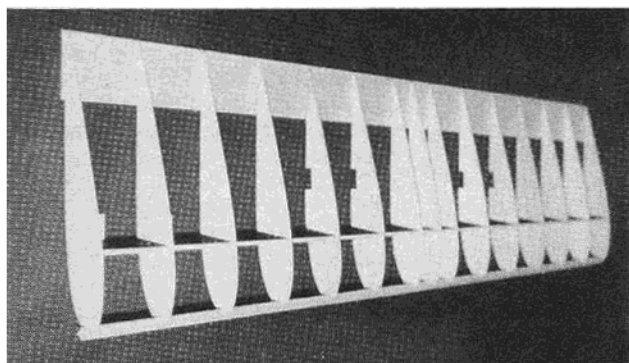
Nose section showing cut out necessary for engine. Also note optional 1/32" ply over F2.



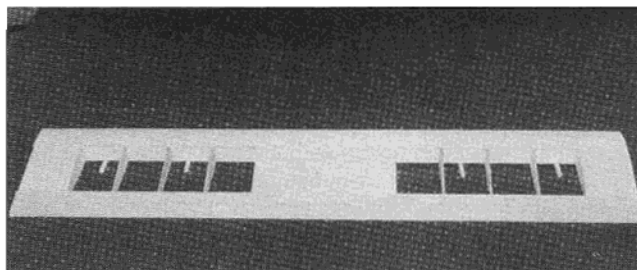
View into cockpit showing area for fuel tank.



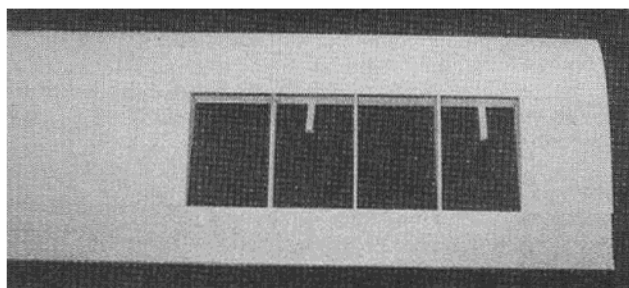
All the ribs glued in place. Note 1/4" sq. balsa under spar.



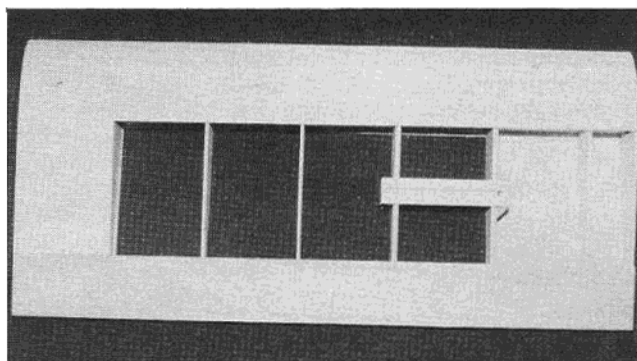
End view of wing assembly showing wing landing gear block cut-outs in appropriate ribs.



Top of wing completely sheeted. Note use of single piece of leading and trailing edge sheeting. Later sheeting cut down center.



Close up of right wing panel.



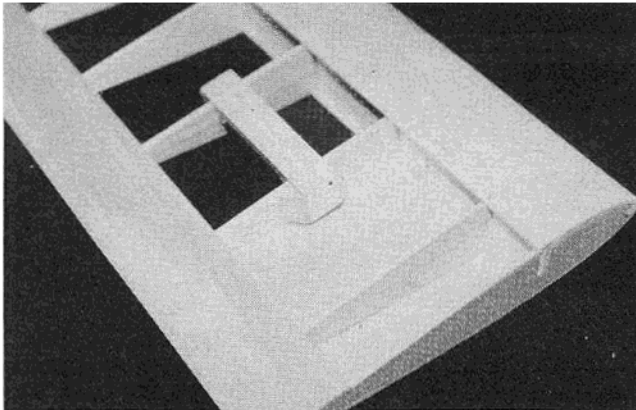
Bottom sheeting in place except center section where landing gear blocks and triangle stock must first be glued.

you did for the ribs. Cut two spars from 1/8" light ply. Pin together and cut notches for 3/32" balsa ribs. Make sure the four appropriate notches for the ply doublers are notched 1/16" wider. Next cut the dihedral brace from 1/8" light ply. Two wing mounting platforms must be cut. Cut one from 1/8" balsa and one from 1/16" ply. Cut the leading edge from 1/4" sq. balsa to length. The only parts left to be cut are

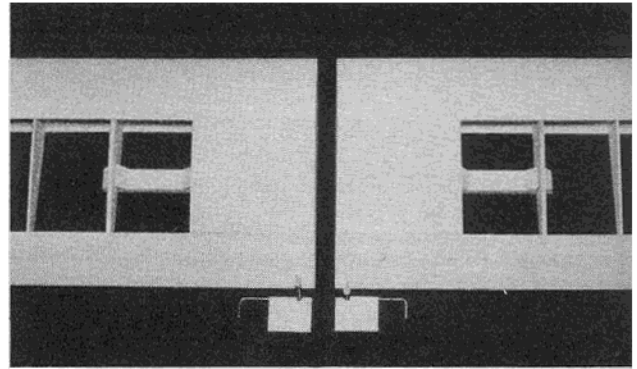
the ailerons and wingtips, which are cut from 3/16" sheet balsa. Also cut the wing tip braces from 1/8" balsa.

This is all the parts for the wing, next comes the body and tail assembly. Pin two 3/16" x 4" x 48" sheet balsa together. Trace the outline of the body on wood and cut to shape. From the leftover pieces, cut the top and bottom shrikes. Trace and cut two identical 1/32" ply fuselage doublers.

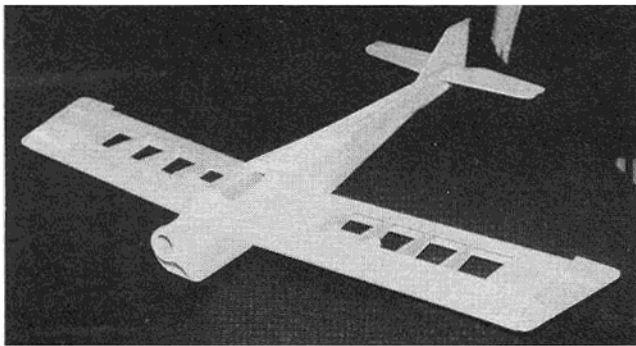
Cut two 1/4" balsa nose doublers. Make sure the doublers are cut very accurately because they are used to line up all the main formers. Cut all formers from the appropriate ply and balsa shown on plans. Make sure former F2 is cut with the grain running across the fuselage instead of vertical. This former takes a lot of abuse from rough landings and every bit of strength helps. Cut 1/4" sheet



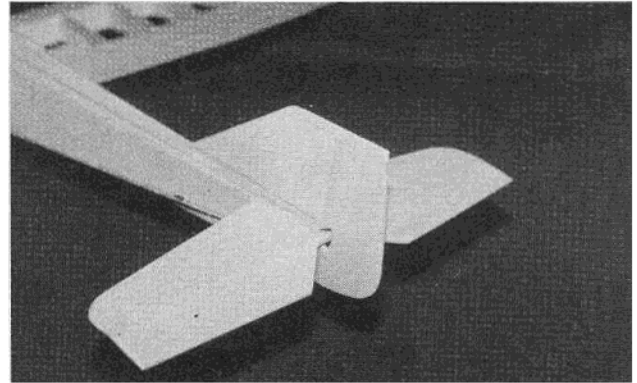
Close up of landing gear block. Note 1/8" slot behind spar needed for dihedral brace.



Center of wing showing wing mounting platform with 3/32" torque rods installed.



Completed air frame ready for covering.



Close up of tail assembly.

balsa to the approximate length for the nose. Trace and cut the top deck from 3/32" balsa. The top deck must be cut accurately for it is used to line up the entire fuselage. Cut the bottom 3/32" balsa sheet to shape. The only major parts left for the fuselage are the top sheetings which are cut from 3/32" sheet balsa. Note grain directions. Two small pieces of 1/32" ply must be cut to shape. These small pieces are used to reinforce the joint where the top two sheets come together above the fuselage sides.

The tail assembly must be cut from 3/16" balsa. This wood can be of heavier density because the Mini Pro tends to come out a bit nose heavy. Cut a piece of 3/16" x 1/4" spruce 4" long. This piece is used to connect the

elevator halves. Cut to length a piece of 3/16" x 3/8" balsa. This is glued to the top of the vertical stabilizer.

This is all the bits and pieces that must be cut for the Mini Pro except for wing sheeting, capstrips, landing gear blocks, and hardwood wing mounting blocks.

CONSTRUCTION

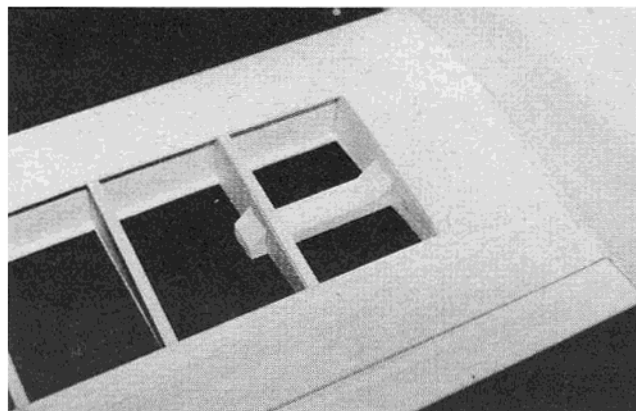
I will give step by step instruction on how to build the Mini Pro in the intent that many of you might be somewhat new to scratch building. This will hopefully clear up any questions that even a veteran might have.

Fuselage and Tail Assembly

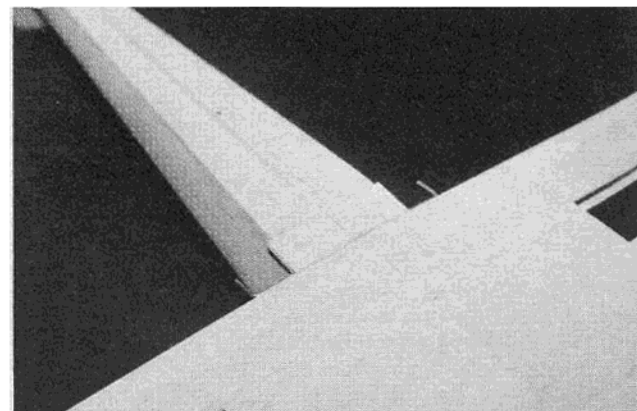
Since the fuselage is the easier of the two major components, we will

start there. Before gluing any wood you must first decide on the engine and its appropriate mount. Also, the position you want the engine to be at must be decided. I place my engines at a 45° angle. At this angle it leaves a cleaner look when viewed from the side. Once decided, drill 5/32" holes in F3 for your engine mount and install 4-40 blind nuts. Holes also must be drilled for your engine control cable, fuel lines, and nose wheel pushrod.

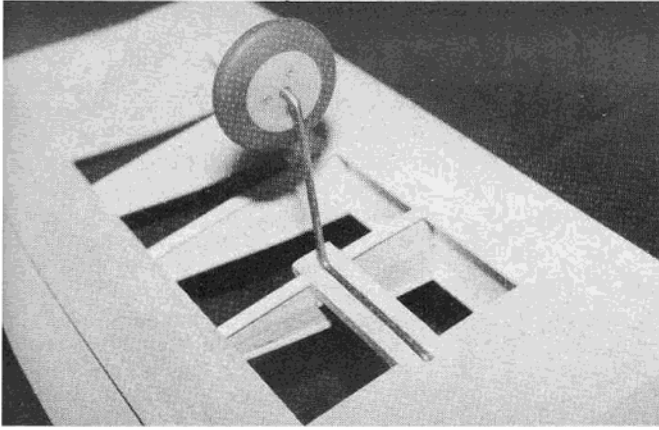
The front landing gear mount is located on its own former F2. You must drill 5/32" holes to match the mount: install 4-40 blind nuts. Also, drill for the steering pushrod. Drill a 3/16" hole in F4 (see plans for location) to accept the wing brass tube. Trial fit the 1/4" balsa nose doubler and 1/32"



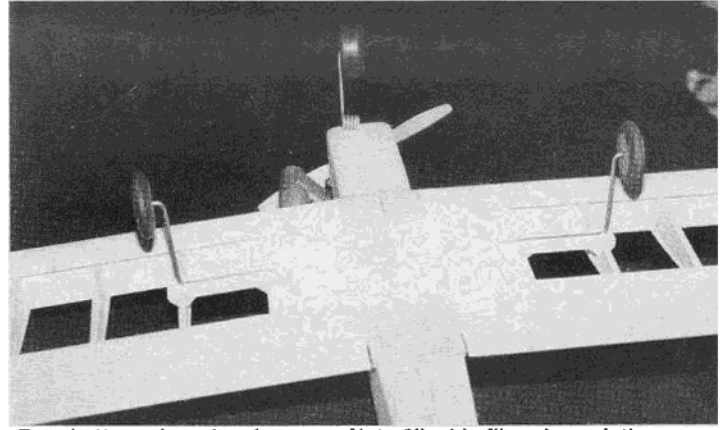
Close up of wing showing cap strips and landing gear block.



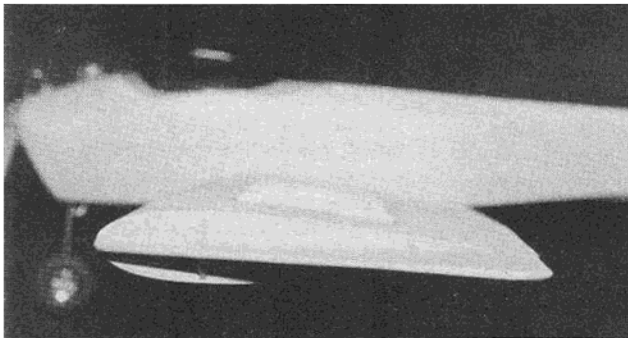
Bottom of plane showing 8-32 nylon mounting bolts.



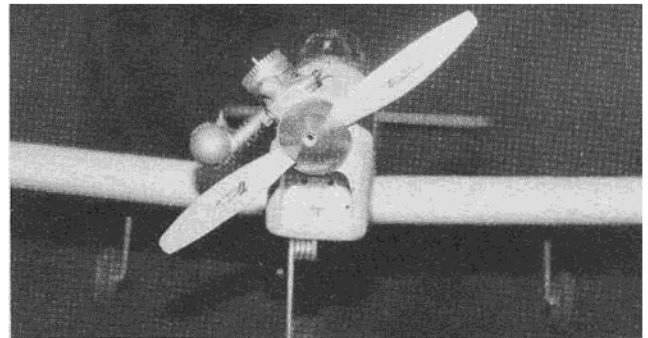
Close up of 5/32" main landing gear placement.



Rear bottom view showing gear. Note 3" wide fiberglass cloth over center section.



Close up of wing tip and its braces.



Frontal view showing engine resting in mount.

ply doubler on the 3/16" fuselage sides. Once satisfied with the fit, glue the 1/4" balsa nose doubler in place. Use a square to line up its back edge (edge where F3 will come in contact) at a 90° angle with the fuselage top. Next place F3 up against the 1/4" doubler but do not glue. Using F3 as a spacer, glue the 1/32" ply doubler in place, make sure it lines up with the wing saddle. Also, make sure a 3/32" space is left above the top edge of the doubler and the fuselage top edge. This space will be where the top deck fits. Repeat this procedure for both sides making sure to build a left and right fuselage side. You will notice that all the formers except F4 will have a built-in jig location which aids in the alignment of the fuselage. F4's location must now be measured from the plans and transferred to the fuselage sides.

Some modelers might question the

shape of the 1/32" ply doubler and why I stopped it straight before F5 instead of tapering it off past F5. Structurally the tapered doubler is superior, but it does not allow a built-in location for F5; which is one of the principle goals in the plane's design. Also I have had no fuselage failures at this location except for a total destruction of the entire airframe.

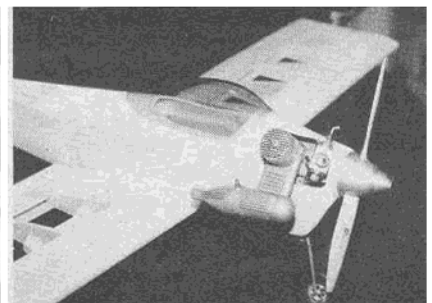
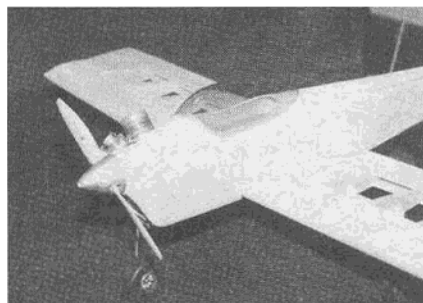
We now have left and right hand fuselage sides that must be connected. Pick one side and glue formers F2, F3, F4, and F5 in place making sure they are glued at a 90° angle to the fuselage side. Place the other fuselage side over the formers for a trial fit. Once satisfied, turn the fuselage sides upside down so F3 is hanging over the work surface. Making sure both top surfaces of the fuselage sides are laying flat, glue the second side to the formers. Once dry, turn over and fit the 3/32" balsa deck in place. It should

lay flush with the top of the fuselage sides. Glue the deck in place from F3 to F5. Next glue in place all 3/16" triangle stock and hardwood wing mounting blocks. Using the 3/32" deck as an alignment guide, bend the rear part of the fuselage sides together till they meet at the rear. Bevel cut enough wood away from the sides so when they are brought together they form a 3/16" wide edge that the rudder will butt up against. Glue the remainder of the side to the deck. Now glue the 3/32" bottom sheet in place.

You now have a box shaped fuselage, so we are now going to give it some curves. Locate the positions for formers F4A and F5A and glue in place. Locate F1 in place and glue (see section view A-A for F1 location). Install your favorite nosewheel steering cable. Glue 1/4" balsa sheet to the bottom of front fuselage. Fit 3/32" front top sheeting from F1 to F3. Glue



Plane completed and ready for covering.



BILL OF MATERIALS

Qty.	Description	Use
3	3/16" x 4" x 48" balsa	fuselage sides, top & bottom shrike fin, rudder, ailerons
1	3/16" x 3" x 48" balsa	stab, elevator, wingtips
1	1/4" x 3" x 6" balsa	front bottom sheet
1	1/4" x 4" x 12" balsa	nose doubler
1	1/8" x 2" x 18" balsa	former F4A, F5A, wingtip supports, wing mounting platform
1	1/4" sq. x 48" balsa	leading edge
4	3/32" x 3" x 48" balsa	leading edge sheet, top deck, bottom deck
3	3/32" x 3" x 36" balsa	ribs, top sheeting
2	3/32" x 2" x 48" balsa	trailing edge sheeting
2	3/32" x 1/4" x 36" balsa	cap strips
1	3/16" x 3/8" x 8" balsa	fin top
1	1/8" sq. x 12" balsa	fin support
1	3/16" x 36" triangle balsa	supports
1	3/16" x 6" x 12"	former F2, F3, F4
1	1/8" x 6" x 24" light ply	spar, F1
1	1/8" x 3" x 3" ply	former F5
1	1/16" x 6" x 12" ply	rib doublers, wing mounting platform
1	1/32" x 6" x 24" ply	fuselage doublers
1	3/16" x 1/4" x 4" spruce	connects elevator
2	3/8" x 3/4" x 4" pine	landing gear blocks
2	3/8" sq. x 1 1/4" maple	wing mounting blocks
1	3/16" x 2" brass tube	wing locating pin

HARDWARE

- 15 — Large hinges
- 1 — C.G. 5/32" nose gear mount
- 1 — .40 Kraft engine mount
- 1 — Sig 2 1/4", 5/32" nose gear
- 1 — 5/32" music wire
- 4 — Landing gear straps
- 1 — C.G. 3/32" torque rods
- 1 — 8 to 11 ounce Kraft tank
- 3 — 2 1/2" wheels
- 1 — 2" CB Spinner
- 4 — 4-40 socket head bolts and blind nuts
- 5 — Nylon clevises
- 2 — Nyrod
- 4 — Threaded rods
- 2 — Cable pushrods
- 2 — 8-32 nylon bolts
- 4 — Ball links
- 2 — EZ connectors
- 3 — 5/32" wheel collars

in place. Repeat for the other side. Fit and glue the 3/32" rear top sheeting in place. Laminate the small pieces of 1/32" ply over the inside joint where the front and rear top sheetings come together. Glue 3/16" x 1/4" x 8" balsa to the top of the fin. Glue the fin assembly to the top of top shrike. Glue the fin-shrike assembly into position making sure the fin is parallel with the rear of the fuselage. Glue 1/8" sq. balsa to the side of the shrike to reinforce the joint. Glue the bottom shrike in place. Sand down the front part of the fuselage till a smooth blend forms between the top sheeting and fuselage sides. Sand the remainder of the fuselage assembly to suit personal taste. Connect elevator halves together with the 3/16" x 1/4" x 4"

spruce stick.

At this stage you will notice that there is no room for a fuel tank. Simply cut a hole to the appropriate size in the top deck. The same holds true if more room is needed for your radio. The front top sheeting must also be cut away except the engine. This completes the fuselage and tail assembly.

Wing

The only part left is the wing. You will notice that I use a 1/8" light ply spar. Most people may think I have overdone it a bit with such a strong spar, but there is nothing worse than seeing your plane plummet to the earth because of a wing failure.

The plans for the wing are not drawn to actual cord length (see

building reference view). This will aid you in its construction. Glue 1/16" ply landing gear doublers onto four ribs and notch out ribs to accept landing gear blocks. Pin the 2" trailing edge sheeting over the plans. Place some scrap 1/4" sq. balsa over the spar locations. Place every other rib into the notches of one spar. Take spar with ribs attached and place spar directly over spar location on plans. Making sure spar lines up with plans, glue ribs to the 2" trailing edge sheeting and spar. Finish gluing the remainder of the ribs into position making sure the center rib is tilted to establish wing dihedral. Repeat the entire procedure for the other wing half. Glue 1/4" sq. balsa leading edge in place. Glue top 2" trailing edge sheeting in place. Place several weights over the trailing edge sheeting. Wet, then glue, the 3" leading edge top sheet in place. At this point you can either turn the wing over and sheet the bottom leading edge or, as I prefer, sheet the remainder of the top, then turn over and sheet the bottom leading edge.

Before sheeting the bottom center section you must first install your landing gear blocks and their triangle braces. Cut a 1/8" slot behind the wing spar to accept dihedral brace. Glue the dihedral brace in place while maintaining 2" total dihedral. Once dry, glue the remainder of the bottom sheeting in place. Sand the leading edge to shape. Add capstrips over ribs. Glue 3/16" wing tips and their braces in place. Construct the trailing edge mounting platform from 1/8" balsa and 1/16" ply. Notch platform to accept 3/32" torque rods. Drill 3/16" hole in center of wing leading edge. Place 3/16" brass tube in hole, but do not glue. Position trailing edge mounting system in place and glue. Square the wing with the fuselage. When satisfied, drill and tap for 8-32 nylon wing mounting bolts. Remove the wing from the fuselage. Glass the center section with 3" wide 2 ounce fiberglass cloth.

Covering

That takes care of the building, now comes the covering. All Mini Pro's to date have been covered with MonoKote. I will leave the choice of covering materials up to you. After covering the airframe, fuel proof the engine compartment and fuel tank locations. The plane is now ready for final assembly.

Final Assembly and Trimming

Bolt the wing to the fuselage and line the stab up with the wing. When satisfied, glue stab in place. Add 3/8" triangle stock under stab. Do not omit the triangle stock under stab. The flight performance is greatly

improved with a more rigid stab. Choose your favorite type of hinge and proceed to hinge all control surfaces. Try to maintain a small hinge gap while the glue dries. Bend 5/32" music wire for main landing gear to shape. Install main gear with nylon straps. Bolt a 5/32" Carl Goldberg nose gear mount to F₂. Install 5/32" x 2 1/4" Sig nose gear wire in place. Install engine mount and engine.

The radio installation of the Mini Pro is straightforward. I use Gold'N-Rod to hook up the elevator, rudder and cable for the engine. The nose wheel steering can be either controlled by a cable or music wire. To date all my Mini Pros have come out nose heavy so do not install the radio up front which is the usual case. Keep as much weight to the rear as possible. The plane does not seem to have a critical C.G., so just balance it close to the point shown on the plans. I would also recommend balancing the plane longitudinally as well.

As mentioned earlier, an 11 ounce Kraft tank can be fitted in the fuselage; which will let you fly a lot longer than your flying buddies will like. The only thing left is to install the canopy. I use Du-Bro canopies only because I happen to have several in my box of goodies. Use any canopy that will fit. Just cut to shape and glue in place with RC 56.

Now load up the car so we can take her to the field and break in her wings. For your first flights, set up the controls for about 1/4" aileron travel up and down, as much rudder as you can get and about 3/8" of elevator each way. After you get the feel of her you can crank in as much throw as you like; she can take it. It is only a matter of pilot's skill.

Set your engine for a low idle and line her up with the strip. With big wheels and .40 up front, grass take-offs are a breeze. After a quick acceleration you can horse her off the ground without fear of a stall or snap. If she's been built without warps, little or no corrections in the transmitter trims should be needed. Get the feel of the plane at full throttle then bring her down to about 1/4 throttle. She will maintain altitude and still be fully aerobatic with rolls and loops easily performed. Any maneuver can be done with only prolonged knife edge flight suffering from loss of altitude.

If you intend to use your Mini Pro as a fun fly airplane you will be pleased with the inverted flying performance. In fact, she flies just as well inverted as upright. The slow speed and high speed flying characteristics are very predictable. With minimum throws, a novice will have little difficulty in flying her. At maximum control movements, the sky is the limit.

I hope you will receive as much pleasure from the Mini Pro as I have. I would be happy to hear from anyone who decides to build and fly her. □

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