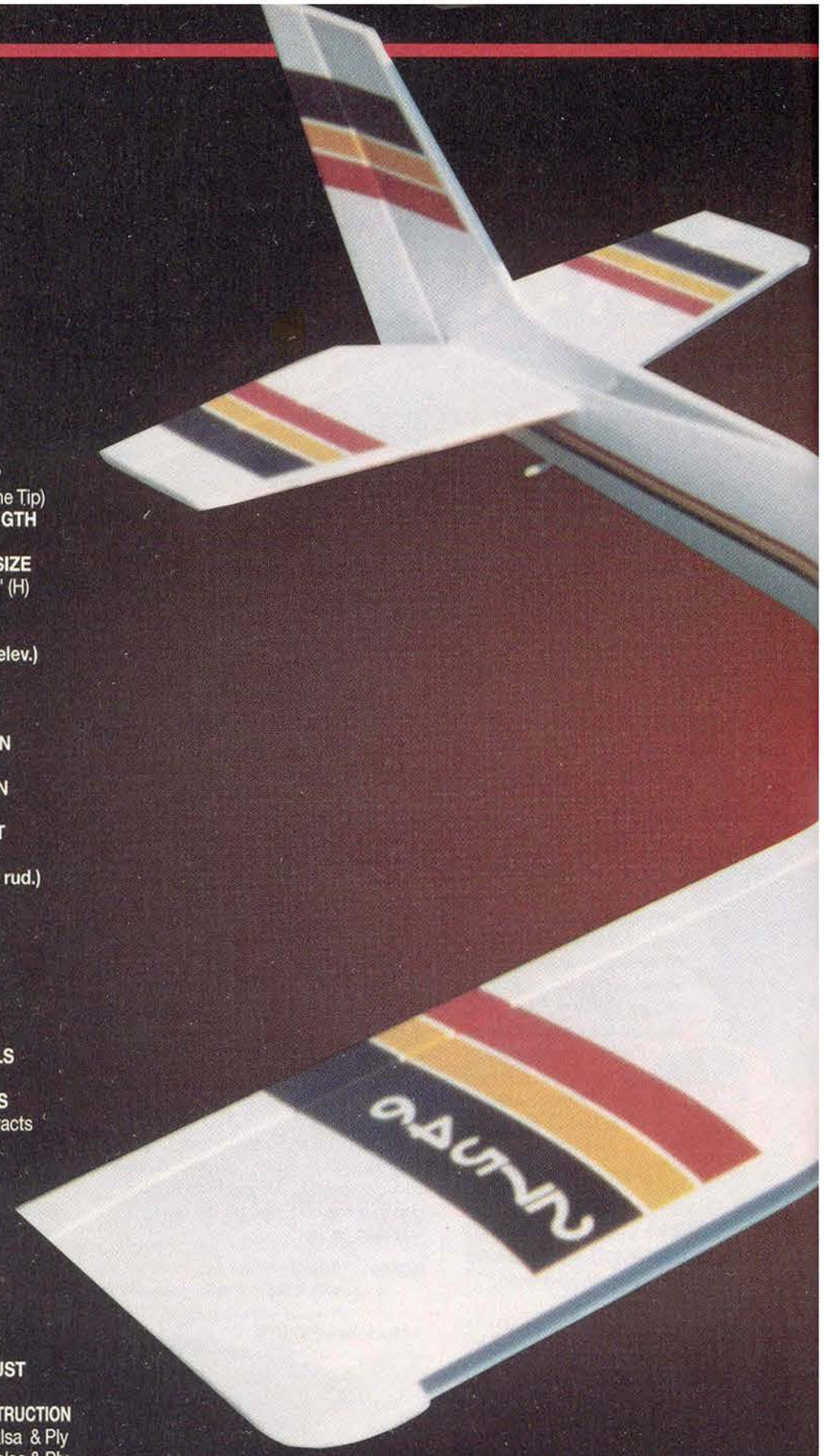
LITE TIGER 60
Designed by:
Don Sobbe
TYPE AIRCRAFT
Sport/Pattern
WINGSPAN
58-1/8 Inches
WING CHORD
12-1/2 Inches
TOTAL WING AREA
726.5 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
Symmetrical
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
29/32" Each Tip (1-13/16" One Tip)
OVERALL FUSELAGE LENGTH
60-3/4 Inches
RADIO COMPARTMENT SIZE
12-1/2" (L) x 3" (W) x 2-1/2" (H)
STABILIZER SPAN
22 Inches
STABILIZER CHORD (inc. elev.)
8-1/2 Inches
STABILIZER AREA
187 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
10 Inches
VERTICAL FIN WIDTH (inc. rud.)
8-1/4 Inches (Avg.)
REC. ENGINE SIZE
.60 2-Stroke
FUEL TANK SIZE
12 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4-5
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail., Retracts
C.G. (from L.E.)
4-5/8 Inches
ELEVATOR THROWS
5/8" Up — 5/8" Down
AILERON THROWS
5/8" Up — 3/8" Down
RUDDER THROWS
3/4" Left — 3/4" Right
SIDETHRUST
2° Right
DOWNTHRUST/UPTHRUST
3° Downthrust

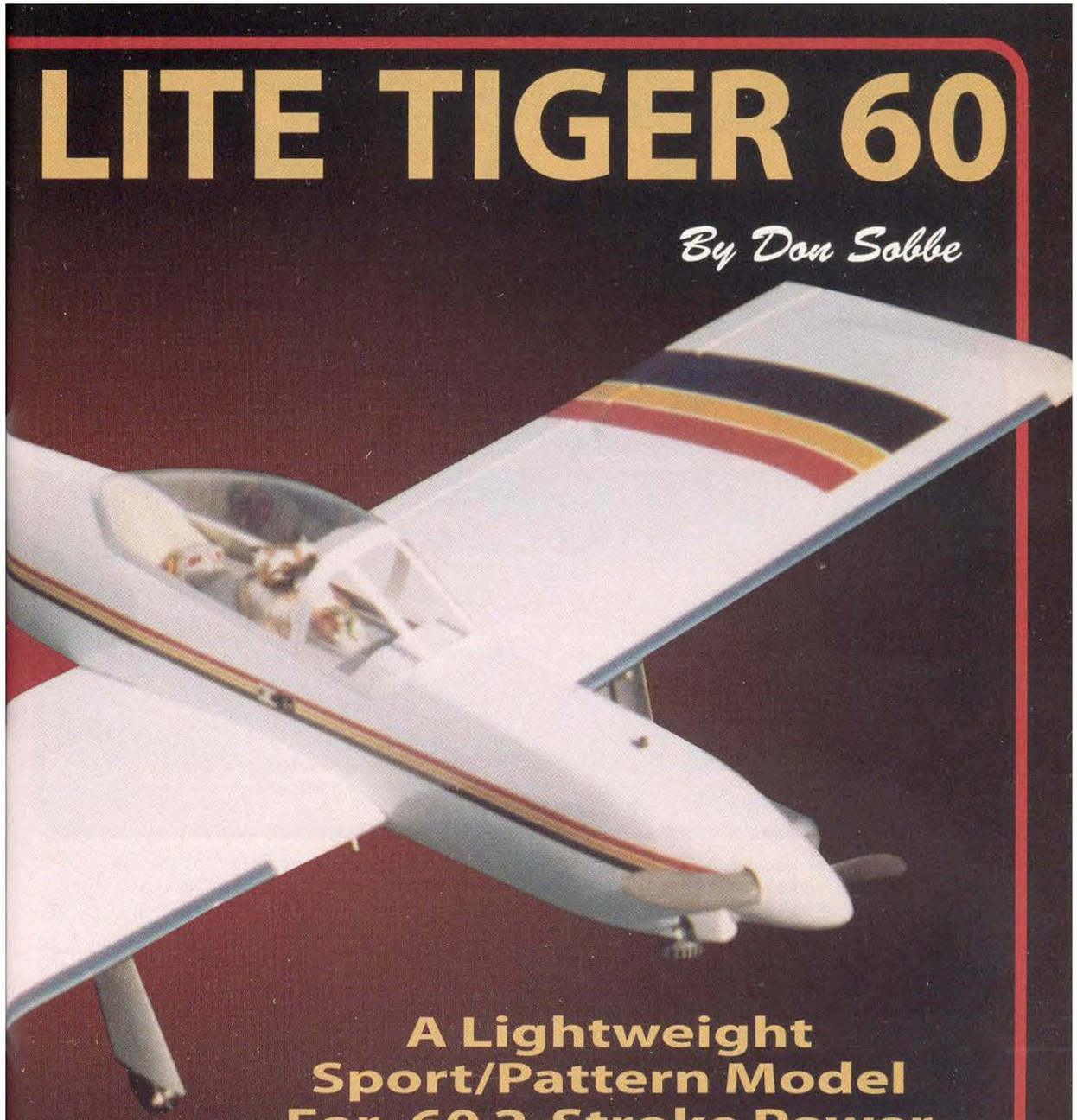
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa & Ply
Empennage	Balsa
Wt. Ready To Fly	112 Oz. (7 Lbs.)
Wing Loading	22.3 Oz./Sq. Ft.



LITE TIGER 60

By Don Sobbe



A Lightweight Sport/Pattern Model For .60 2-Stroke Power

"Semi-Monocoque Fuselage Construction" (Nov. 1993 *RCM*) illustrated a light, strong construction method for fuselages that are comprised of simple curved sections. Since that article was published I've had requests from readers for a model that utilizes this construction method. In choosing a subject, I decided to use a well known sport model rather than a scale or original design; as it would better illustrate the adaptability of semi-monocoque construction. I've always thought the Goldberg Tiger 60 has very nice lines in spite of its slab sides and square corners. So, it didn't take too much effort to convince myself that here was a swan trapped inside of a square duck!

Semi-monocoque construction saves about a pound of weight versus the Tiger 60's conventional bulkhead construction. This weight savings yields a significant increase in both vertical and aerobatic flight

ABOVE: Author holding the second prototype.
LEFT: Note the redesigned stabilizer and narrow aft fuselage. The curvature built into the semi-monocoque fuselage makes this structure torsionally stiff.

Prototype ready for take-off. White pegs under wings are the hinges for the inner gear doors, which were removed for the first flights. Note how well the engine is hidden in the partial cowling.

performance. The retract-equipped model in the photos weighs 7 lbs. 1 oz. and it has a heavy cast aluminum engine mount! An additional 6 oz. could be saved by using a fixed landing gear. With a little forethought a model in the 6 lb. range is very possible.

The Lite Tiger 60 maintains the fuselage profile of the Tiger 60, but has a more rounded cross section. It also includes some minor design changes based upon what others have done to improve the model's aerobatic performance. I shortened the fuselage about 2", reshaped the stabilizer, enlarged the elevators, reduced the wingspan, dihedral and rib spacing, repositioned the spars and got rid of the nose gear in favor of a lighter and simpler conventional landing gear. Because of the new cross section I was able to reduce the fuselage width without compromising interior space. Oh, did I mention the inverted engine? Well, why have a cylinder head sticking out of the nose when there is all that room underneath to tuck it in out of sight? Don't be afraid to mount your engine inverted, either. Properly adjusted, modern 2-stroke engines start just as easily inverted as upright.

Construction Notes:

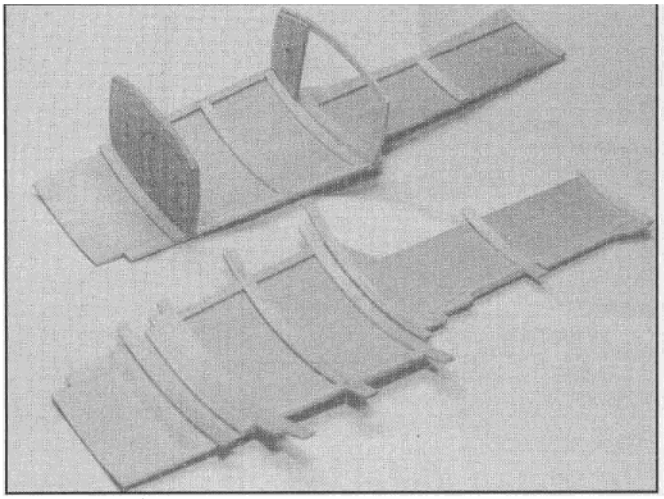
Since some of the construction requires accurately cut parts, the builder should be proficient at scratch-building. So, the following text mainly covers unusual parts fabrication and assembly sequences. With the exception of the dorsal fin, fin and rudder, no other parts can be made from the fuselage side or top views on the plan. This is because some shapes in these views are distorted by their curvature. They are for reference only.

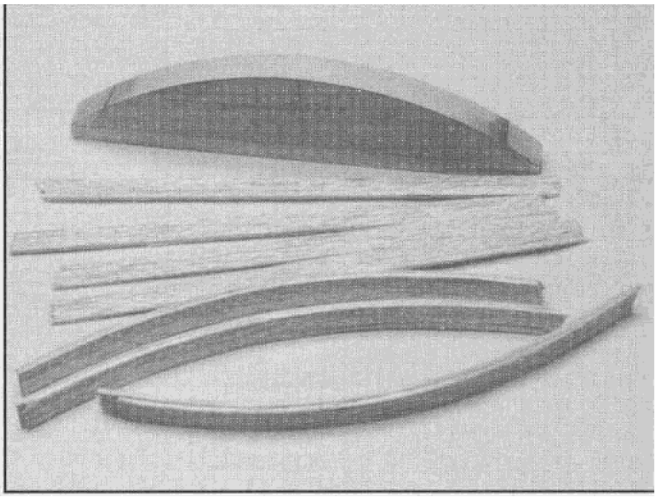
Medium grade balsa is used throughout the model. **Do not** use a light grade or "**soft**" balsa for the fuselage sides. Nor should hard balsa be used for the sides. It is heavy and too brittle. Also, do not attempt to install the landing gear in the fuselage. It is not stressed for that type of loading. If you are not familiar with semi-monocoque structures I recommend you read "Semi-Monocoque Fuselage Construction" mentioned above.

This entire model can be built using thin CA and gap-filling CA+. Epoxy is used only to join the wings, reinforce the stabilizer joint, and fuelproof the tank compartment.

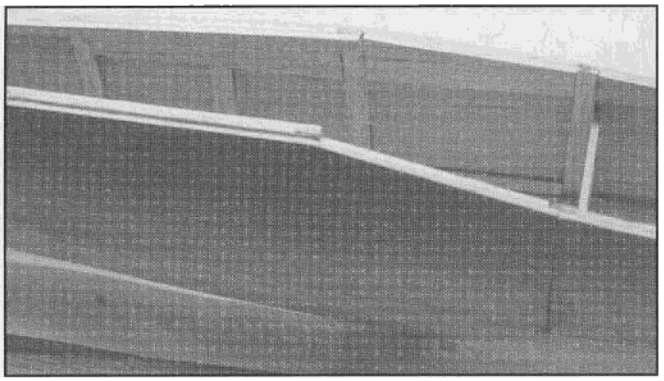
Fuselage:

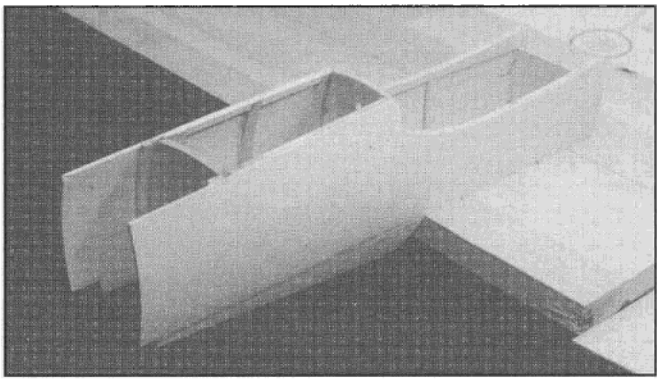
Fuselage construction is somewhat unusual as it is built from sub-assemblies consisting of forward and rear curved sections. Start by making F-1, F-2, F-2A, F-3T, the cockpit deck, and the four fuselage sides from the patterns on the plan. These parts should be cut accurately, as they must match at key points in order for the fuselage to assemble straight, easily, and quickly. All of the bulkhead radii are 5-7/8". It is easier and more accurate to lay out these parts with a compass, rather than trace them from the plan. Align and glue F-2A to one side of F-2. Glue scrap 1/16" balsa to the rest of that side





LEFT, Photo #1: False bulkheads create a simple curve in the fuselage sides. On-the-spot alterations are easy with this type of construction. Several additional false bulkheads have been added to the closest fuselage side to correct an error in positioning F-1 on the prototype. F-1 and F-2 have been fitted, but not glued, on the other fuselage side and the false bulkheads have been trimmed flush with the filler strips. RIGHT, Photo #2: The bending jig, wood strips and some finished laminated false bulkheads made from them.





LEFT, Photo #3: The vertical line on the side is the joint between the forward and rear fuselage sides. Just above it is F-3T. The wing saddle filler strips have been trimmed flush with the fuselage edges. The longerons, which are raised slightly above the fuselage edges, will be faired flush later in construction. RIGHT, Photo #4: The forward fuselage parts are assembled inverted on the cockpit deck, which has been pinned to a flat building board. Because of the curved sides, this assembly will become torsionally stiff when glued together.

to make the thickness of F-2 constant.

Use straight grain "**medium**" grade 1/8" sheet balsa for the fuselage sides. All four sides can be cut from two 1/8" x 4" x 48" sheets using the splice lines shown on the patterns. The forward fuselage sides can extend to any convenient length ahead of F-1, as shown in Photo #1. This is to provide a curved extension upon which to build the cowling. Also, note that the false bulkhead positions that locate F-1 are different for each side. After cutting the four sides, check that both the forward and rear side sets are identical and that their edges are square, as shown in Figure 1A. Also check that the corners of F-1 and F-2 meet at the edges of the forward fuselage sides when these bulkheads are in position and the fuselage sides are bent around them, as shown in Figure 1B. Last, check that the top edges of the forward fuselage sides that contact the cockpit deck are straight and 90° to their rear edges, and that the stabilizer slots in the rear fuselage sides are 90° to their forward edges, as shown in Figure 2. Since the cockpit deck will be the only flat, straight surface on the assembled fuselage, it will be used as the reference for all incidence and relative measurements. So, it is important that these edge relationships are accurate.

Make the bending jig shown on the plan. Its radius is 4-7/8". Cut fifty-four 1/16" x 3/8" x 6-1/4" balsa strips to make up the 27 curved laminated strips that are false bulkheads for the fuselage. This is definitely a job that goes quickly with CA+. Apply CA+ to one strip. Align and lightly press another strip into contact with the first one. Quickly press the two strips around the jig, using the palms of your hands to apply pressure over the full length of both strips. Hold them for about 15 seconds and then release them. They will spring back slightly and should look like the false bulkheads in Photo #2. Inspect each assembly. Any gaps in the assembled strips, broken or cracked wood indicates a weak spot. Throw that assembly out and try again. With a little practice, you'll find that this part of construction goes very quickly.

Photo #1 shows the false bulkheads glued in place on the forward fuselage sides. Use a pencil to lightly mark the location of each bulkhead on the sides. Using CA+, glue each false bulkhead in place by bending the fuselage side around the false bulkhead. Don't bend the bulkhead to meet the side, as this will deform the desired curve. Note that each false bulkhead has a considerable overhang. This is necessary to assure that the radius continues to the edges of the fuselage sides. Use F-1 and F-2 as spacers to position the false bulkheads that contact them, as shown in Photo #1. However, don't glue F-1 or F-2 in yet. Note that the false bulkheads marked **J** on the plan are glued to the forward fuselage sides "only" and overhang the back edges by 1/8" to form a step that will mate with the rear fuselage sides; later in construction. As you add false bulkheads the fuselage sides may twist. This is normal and will be taken care of when the filler strips are added and the fuselage assembled.

Photo #3 shows the filler strips and a longeron in an assembled rear

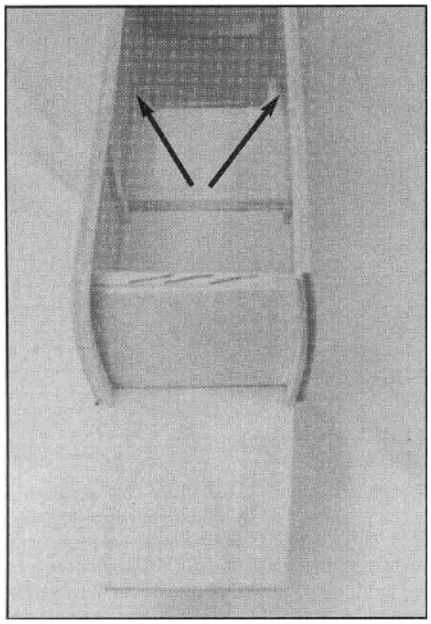
fuselage section. Figure 3 shows a section through these parts. Note that they are stepped out about 1/16" over the edges of the fuselage sides. This is so they can be faired down later on to mate with the top and bottom sheeting. All of the filler strips are to be positioned in this way except the filler strips in the wing saddle, which can be trimmed flush with the wing saddle edges. It is a good idea to pin the edge of each fuselage side that is being worked on to a flat surface while adding the filler strips and longerons. This will prevent the sides from bowing. After adding all of the filler strips, trim the false bulkheads flush with them.

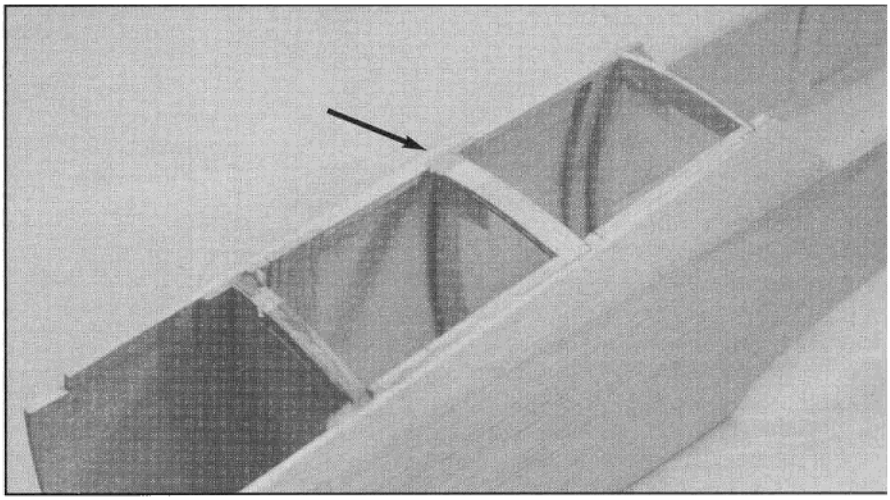
Trial-fit F-1, F-2 and F-3T with the forward fuselage sides, as shown in Photo #4. Hold the parts together with rubber bands or pins. Trial-fit the cockpit deck. Trim and bevel the edges of the cockpit deck that contact the inside of the fuselage sides, false bulkheads, and F-2 for a good fit, as shown in Photo #5. Then, pin the cockpit deck to a "flat" surface. Position the assembled forward fuselage on the cockpit deck. Check that the corners of F-1 and F-2 are flush with the edges of the sides, as shown in Figure 1B, that the sides are straight longitudinally and parallel to each other. Do this carefully. Once these parts are glued together the assembly will become rigid. When everything is correctly aligned, run CA into the joints between the bulkheads, cockpit deck, and the fuselage sides. Note that F-3T is a temporary bulkhead and should not be glued in.

Cut square notches into the false bulkheads on the fuselage sides to accept the false bulkheads that lay across the forward fuselage top and bottom, as shown on the plan. If cutting the notches is too difficult there, the top and bottom false bulkheads can be located near the side false bulkheads by cutting notches into the softer filler strips as shown in Photo #6. The false bulkheads should be glued flush with the fuselage edges, as shown in Figure 4. Cover these bulkheads with masking tape and use #80 grit sanding bar to trim the filler strips and fuselage edges flush with the false bulkheads, as shown. Glue the bottom 1/8" sheet to the forward fuselage. Fuelproof the inside of the fuel tank compartment before adding the top sheet. Be sure that the top sheet overhangs F-1 so that the cowl sheeting can be bonded to it. Trim the back edge of the top sheet flush with the fuselage sides, as shown in the side view on the plan. Glue a 1/8" balsa sheet over these edges to form the instrument panel.

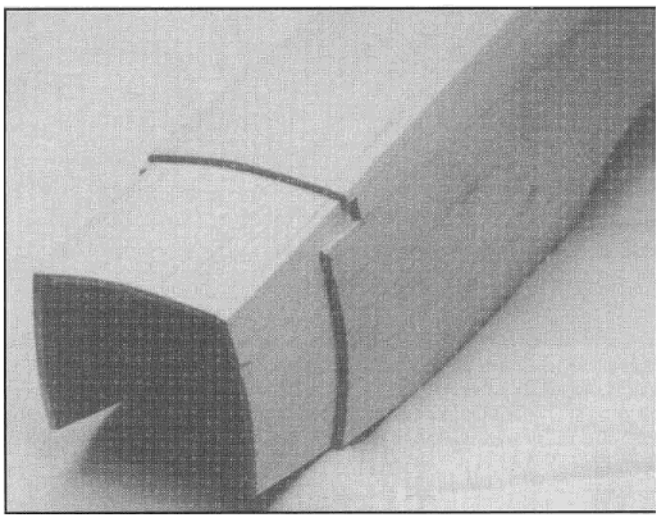
Photo #7 shows the cowl under construction. Build out the cowl by laminating 1/8" sheet balsa to form a 1/4" thick cowl, as shown. Add more layers to the inside of the cowl front where it will curve in towards the spinner, as shown in Photo #8 and the plan. Then, trim and sand it to shape. This type of cowling is essentially an inverted box that provides very easy engine installation and access. At the same time it appears to be a full cowling when viewed in an upright position.

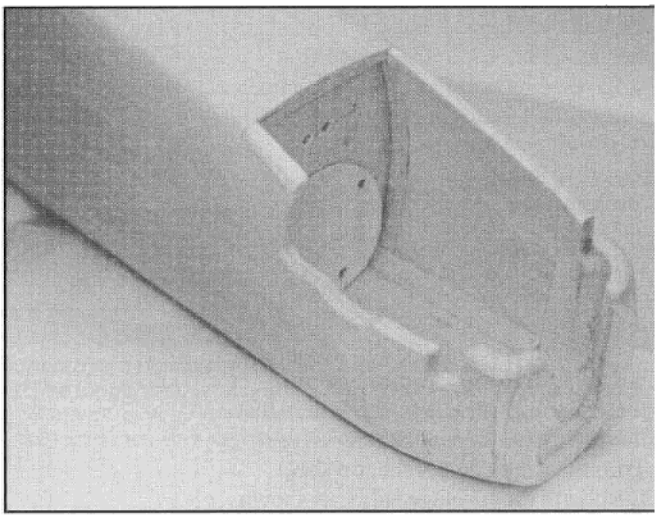
Figure 5 shows the stabilizer doubler assembly. These lite ply doublers prevent the fuselage from cracking at the leading edge of the stabilizer. Make sure they are in place before assembling the sides. Tape the rear fuselage sides into the notches in the forward fuselage. Be sure that F-3T is in place. Hold the rear edges of the rear fuselage sides together with a clamp. Taper the longerons so that the back





LEFT, Photo #5: The arrows indicate where the cockpit deck needs to be fitted with the false bulkheads and F-2. The tapered end of the cockpit deck in the foreground will mate with the rear fuselage sides. ABOVE, Photo #6: A false bulkhead being fitted across the top of the forward fuselage (arrow). Masking tape protects the tops of the bulkheads while the fuselage edges are faired flush with them.





LEFT, Photo #7: The cowling is being built out here. Notice that its curvature is automatically built in. RIGHT, Photo #8: Here you can see the additional laminations added to the front of the cowl so that it can be shaped to meet the spinner. The sides have been trimmed to allow clearance for the needle valves and exhaust header. Engine installation and access are very easy.

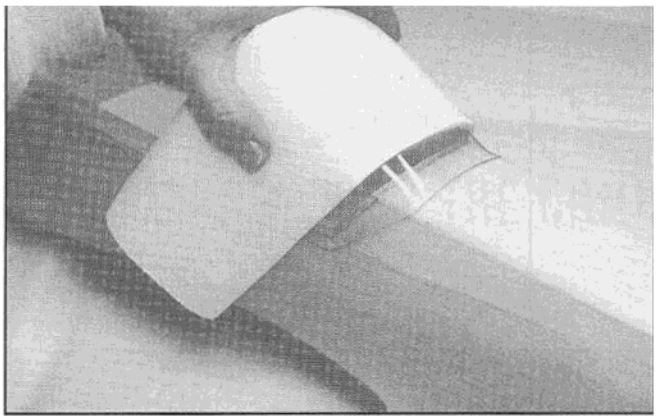
edges of the fuselage are 3/8" thick when joined. If the cockpit deck interferes with aligning the rear fuselage sides, trim its tapered edges to clear them. Adjust the sides so they are centered with the forward fuselage sides, as shown in Figure 6A. Lay strips of wood across the cockpit deck and in the stabilizer slot, as shown in Figure 6B. Adjust the back edges of the rear fuselage sides so that the two wood strips are parallel and the back edges of the sides are perpendicular to the cockpit deck, as shown. This adjustment will square the stabilizer slot with the cockpit deck and wing saddle. Also, check that the stabilizer slot incidence is 0° "parallel" with the cockpit deck. If necessary, the incidence of the stabilizer slot can be adjusted by carefully sanding the mating edges of the forward and rear fuselage sides. When everything is correctly set, run CA into the joints. Tie the tapered portion of the cockpit deck to the rear fuselage sides with 1/8" x1/4" balsa strips, as shown on the plan.

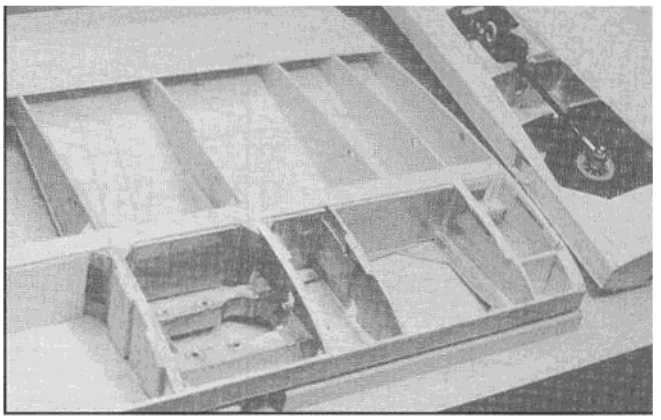
Install the cockpit back on the cockpit deck between the rear fuselage sides, as shown on the plan. As with the forward fuselage sides, cut notches into the filler strips to accept the false bulkheads that lay across the rear fuselage top and bottom, as shown on the plan and Figure 4. Check to be sure that the sides remain straight when adding the top and bottom false bulkheads. Cover these bulkheads with masking tape. Use a #80 grit sanding bar to trim the filler strips, longerons, and fuselage edges flush with the false bulkheads, as shown in Figure 4. Take care to sand the edges straight along their entire length. Make up your pushrods and cut their exits before adding the bottom sheeting. The fuselage becomes very narrow under the stabilizer. 1/16" piano wire pushrods running through NyRod conduits install easily in these tight spaces. I also recommend using a Y pushrod for the elevators. Remove F-3T. Install the lite ply wing saddle doublers. Bend them around the joint between the forward and rear fuselage sides. Add the bottom sheeting, but omit the last 6" under the stabilizer slot. Also, omit the top sheeting. These parts will be added later.

Empennage:

The tail feathers are built directly on the plan. You can use 3/8" x 1/2" balsa as shown, but I prefer to laminate lengths of 3/16" x 1/2" balsa. Laminating eliminates bowing and warping common in heavier wood parts.

Position the completed stabilizer in

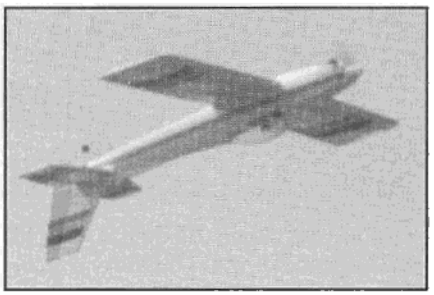




LEFT, Photo #9: The paper towel protects the canopy while it is heat formed around the fuselage. See text. RIGHT, Photo #10: The retractable landing gear in the author's prototype. Note the use of triangle stock to reinforce joints. Always a good idea in highly stressed areas. The wheel wells have been painted. The openings will be covered by large inner and outer gear doors.

the stabilizer slot in the fuselage. Again, lay a flat wood strip across the cockpit deck and adjust the stabilizer so that it is parallel to this strip and square with the fuselage centerline. Then, run CA into the joints. Taper the back portion of the top sheet that lays over the stabilizer, as shown on the plan, and glue the top sheet in place. Turn the fuselage upside down. Use a narrow stick to run a small amount of epoxy into the interior joint between the fuselage and stabilizer. If necessary, trim away the longerons to gain access. Glue in the remaining bottom sheeting. Finish shaping and sanding the fuselage.

Cut a notch in the trailing edge of the stabilizer so that the rudder post on the fin will butt against the rear fuselage. Trim the bottom edge of the fin, as necessary, so it contacts the top sheet evenly. Glue it in place with CA+.



Stable and predictable. No surprises here.

Then, add the dorsal fin.

Wing:

The wing plan shows the bottom views of the wing panels. The wing can be built with a fixed or retractable landing gear, depending upon which lite ply rib doublers are used. A fixed gear installation is shown on one wing panel, a retractable gear installation on the other. Note that the front of rib #3 is moved outboard on the retract installation to create the wheel well. You can also substitute 1/8" x 1/2" spruce spars if you don't want to use the 3/8" x 1/2" balsa spars shown on the plan. If so, reduce the depth of the spar slots in the ribs accordingly. The ailerons are of semi-monocoque construction. They are stiff and very light.

Start by trimming one long edge of a trailing edge sheet "straight." Pin it in position flat on the plan with the straightened edge over the trailing edge line. Glue a 1/8" x 1/4" rear spar in position on the trailing edge sheet. Be certain that this spar is located accurately, straight, and is parallel to the trailing edge. Glue the ribs to this assembly, making sure they are perpendicular to the trailing edge. Glue the top rear spar into the slots in the

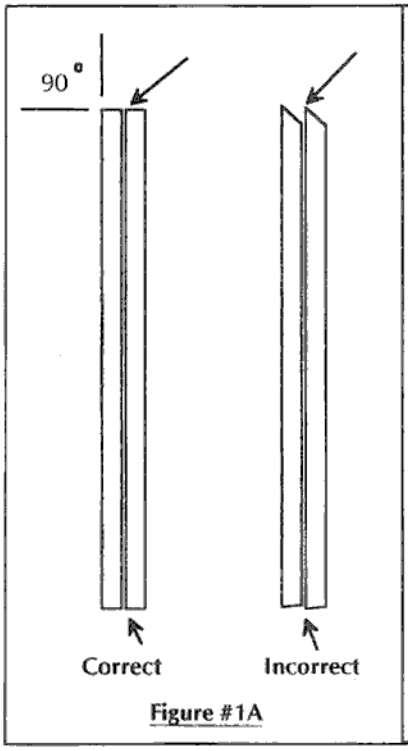


Figure #1A

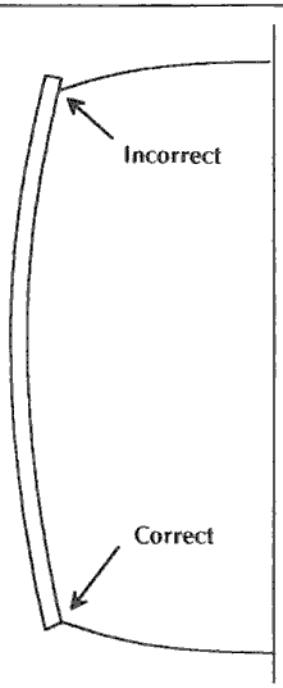


Figure #1B

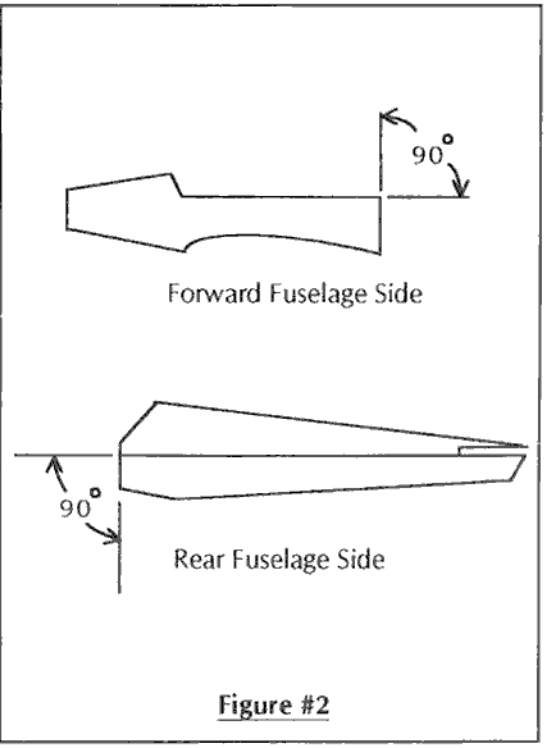


Figure #2

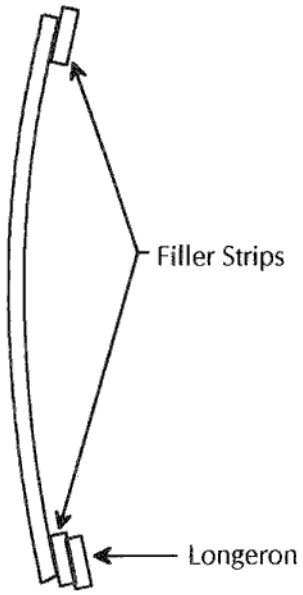


Figure #3

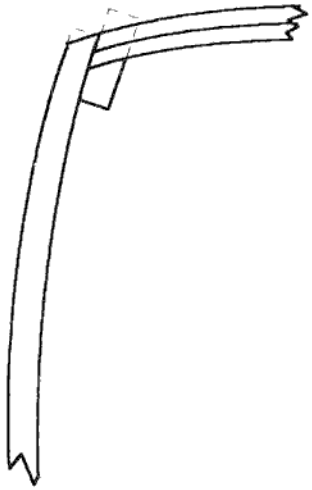


Figure #4

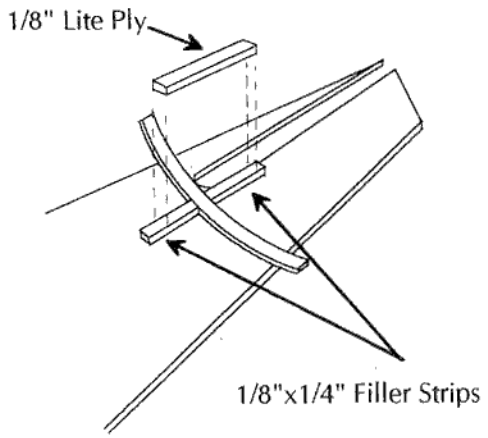


Figure #5

ribs. Add the partial rib for the inside end of the aileron, the shear webs and all filler pieces for the bolt, dowel support, and hinges. Bevel the remaining trailing edge sheet, as shown on the plan, and glue it in position with CA+.

Pin one bottom front spar flat on the plan and slip the assembled ribs over it. Block up the trailing edge of the wing panel with a length of 1/2" balsa. Adjust the trailing edge so it is parallel with the front spar. Insert the top front spar into the slots in the ribs. Align the spars and ribs and glue them together.

Position the lite ply rib doublers for the landing gear of your choice by slipping them between the spars and rotating them into an upright position against the ribs. Glue the 1/8" x 5/8" leading edge to the fronts of the ribs and bevel its upper edge flush with the tops of the ribs. Install all of the shear webs. Add the leading edge sheeting and center section sheeting. Turn the wing panel over, pin it down and recheck its alignment. Install or fit any linkages. Then, add the leading edge sheeting and center section sheeting.

Taper the end of the 3/16" sheet wingtip so it fits snugly between the trailing edge sheets and the leading edge, as shown on the plan. It's a good idea to cut the wingtip about 1/4" longer than shown to allow for fitting. Glue the wingtip to the trailing edge sheeting, the end rib, and the leading edge. Then, bend the ends of the trailing edge sheets into contact with the edge of the wingtip, as shown in Section AA on the plan, and bond them with CA. Add 1/16" capstrips to the top and bottom of the wingtip and to the ribs. Glue the leading edge cap and wingtip braces in place. Sand the

Figure #6A

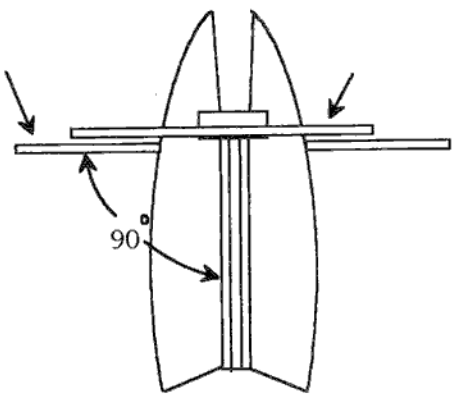


Figure #6B

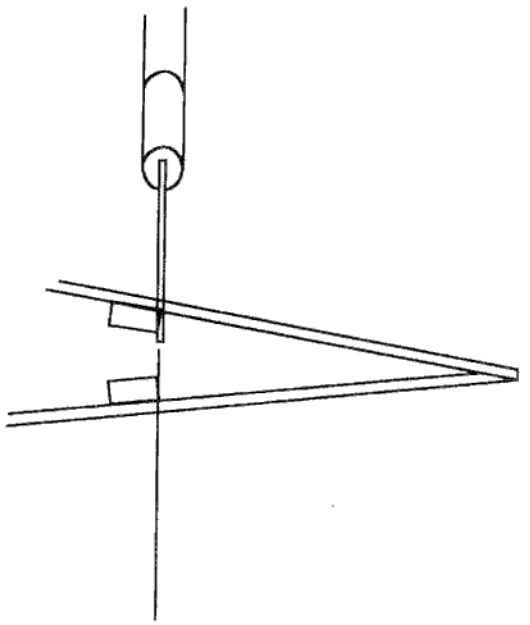


Figure #7

leading edge cap and wingtip to their finished shapes.

Measure in 1-3/4" from the trailing edge "on both sides" of the wing panel and lightly mark the cut lines for the aileron. Use a straightedge to guide the cut through the trailing edge sheeting, rear spars, wingtip, and ribs with a **sharp** X-Acto knife, as shown in Figure 7. Cut through one side and then the other. Remove the aileron. Use a sanding block to true up any wavy edges on the wing. Then, cap the aileron opening in the wing with 1/16" sheeting. Measure the distance between this aileron cap and the wing trailing edge, and subtract 1/4". Measure and mark that distance forward from the trailing edge, on the aileron. Again, use a straightedge to guide the cut through both sides of the aileron. Pin the aileron to a flat surface. Use a long sanding bar to finish the cut edges flat. Cap the leading edge of the aileron with 1/4" balsa and shape the V in the leading edge, as shown on the plan. Repeat the above instructions to build the opposite wing panel.

Cut the balsa from between the forward spars and ribs #1. Use a screwdriver to punch out the balsa between the spars in ribs #2. Apply epoxy to the dihedral brace and ribs #1. Assemble them. Block up one wing panel 1-13/16" at rib #10, as shown on the plan, to set the dihedral. Use epoxy or CA to bond fiberglass cloth to the center section.

Install the wing hold-down dowel in the leading edge. Sand the wing saddle to fit the wing and set its incidence at 0°, parallel to the cockpit deck. Glue a hardwood wing hold-down block between the fuselage sides "across" the back of the wing saddle, as shown on the plan. Center the wing on the fuselage. Install the hold-down bolts.

Canopy:

Install the cockpit sides, as shown on the plan. Roughly fit a Sig 15" Military Style Canopy over the cockpit opening. A heat gun is used to mold the forward and rear edges of the canopy around the top of the fuselage. Cover the forward portion of the canopy with a folded paper towel to protect it from the heat gun, as shown in Photo #9. Apply heat evenly to the exposed portion of the canopy while firmly pressing it into contact with the fuselage. Remove the heat gun when the canopy just begins to soften. Continue to apply pressure until the canopy cools. Repeat this procedure to form the rear portion of the canopy. Then, trim it to its final shape.

Finish:

The Lite Tiger 60 in the photos was finished with Goldberg UltraCote iron-on covering. After covering, the engine compartment and wing saddle areas were sealed with K&B epoxy primer and paint.

Equipment Installation:

If you use a nylon engine mount you can balance the finished model with radio equipment placement in the fuselage. The locations shown on the plan have worked well on the prototypes. The C.G. shown on the plan provides a good balance between tracking and control sensitively. It can be shifted about 1/4" either way to suit your preferences. I also recommend that you laterally balance the assembled model to optimize trim for aerobatics.

Measure the initial control throws from the trailing edges, at the tips of the surfaces.

Ailerons 5/8" up, 3/8" down
Elevators 5/8" up and down
Rudder 3/4" left and right

Flying:

There are no surprises here. Like its ancestor, the Lite Tiger 60 is very easy to fly. Even snap rolls and spins are stable, predictable, and leisurely. If you have flown the Goldberg Tiger 60, you may notice that the Lite Tiger 60's controls have more authority and vertical performance is better. With a reasonably strong engine and a slightly rearward C.G., the Lite Tiger 60 can perform any pattern and most free style maneuvers. One word of caution, though:

It's just good sense to carefully inspect a model that experiences very high G's, a minor collision with the earth, an off-field hard landing or a nose-over. Conventionally-built fuselages contain many frames, doublers, stringers, and trusses that share these imposed loads. But, these structures also add weight that hurts performance. The outer skin and longerons of a semi-monocoque fuselage "alone" carry the bulk of these loads, just like a fiberglass fuselage. So, it is even more important to carefully inspect it for cracks or other damage after a mishap. That way, the next flight won't become the last flight. I think you'll agree, that's a small price to repeal the law of gravity.

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