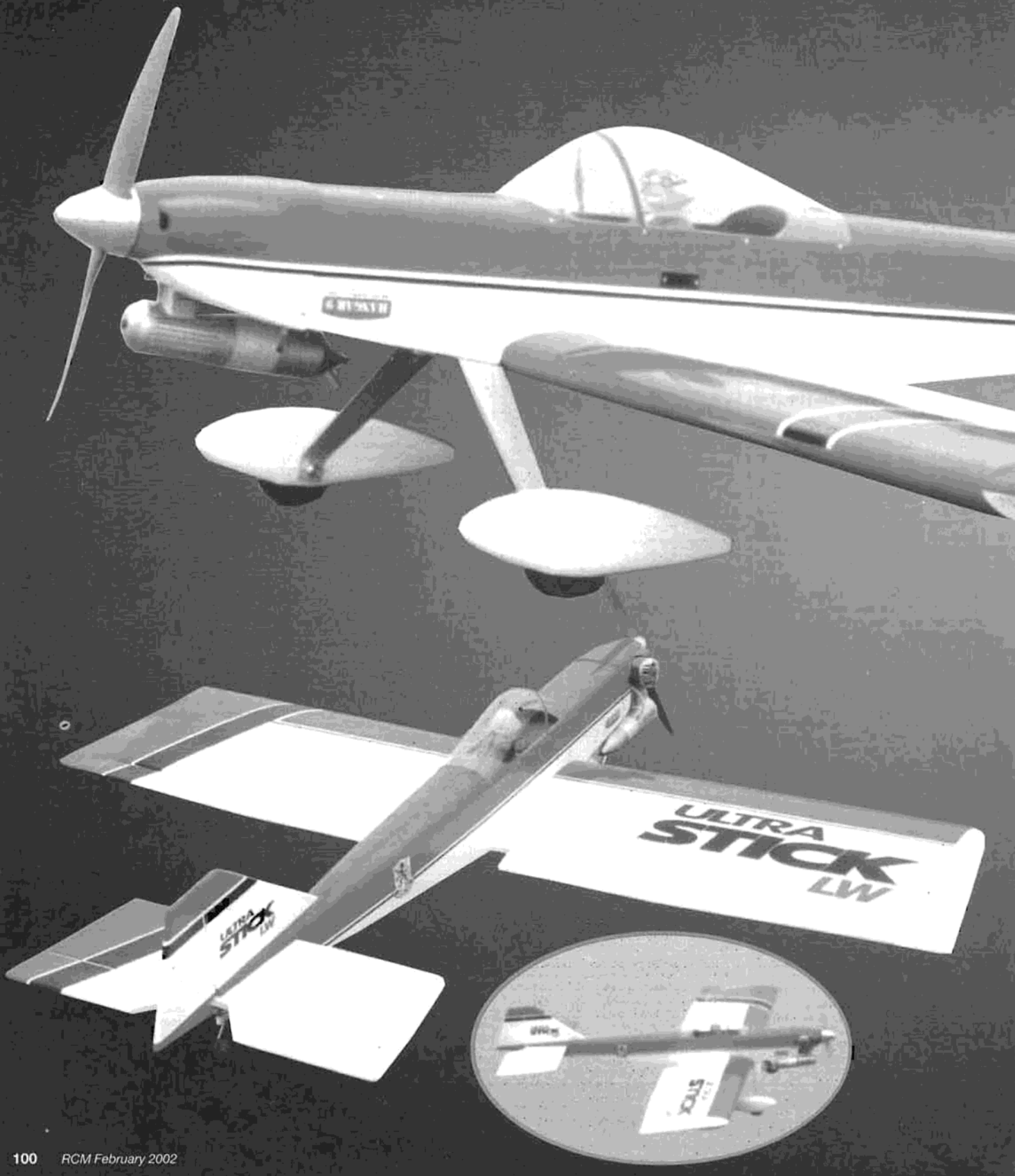


ULTRA

A Modified Hangar 9 Ultra Stick



STICK LW

By Jim Feldmann



ULTRA STICK LW

Designed by:
Jim Feldmann

TYPE AIRCRAFT

Sport/Fun Fly

WINGSPAN

76 Inches

WING CHORD

16-3/4 Inches (Avg.)

TOTAL WING AREA

1214 Sq. In.

WING LOCATION

Low Wing

AIRFOIL

Symmetrical

WING PLANFORM

Slight Taper

DIHEDRAL, EACH TIP

1 Inch

OVERALL FUSELAGE LENGTH

66-1/4 Inches

RADIO COMPARTMENT SIZE

14" (L) x 4" (W) x 3-1/2" (H)

STABILIZER SPAN

28-3/4 Inches

STABILIZER CHORD (inc. elev.)

11-1/4 Inches

STABILIZER AREA

302 Sq. In.

STAB AIRFOIL SECTION

Flat

STABILIZER LOCATION

Mid-Fuselage

VERTICAL FIN HEIGHT

8 Inches

VERTICAL FIN WIDTH (inc. rud.)

8-3/4 Inches (Avg.)

REC. ENGINE SIZE

1.08-1.60 2-Stroke/1.20-1.80 4-Stroke

FUEL TANK SIZE

18 Oz.

LANDING GEAR

Taildragger

REC. NO. OF CHANNELS

4 to 8

CONTROL FUNCTIONS

Rud., Elev., Throt., Ail., Flaps, Crow

C.G. (from L.E.)

4-3/4 Inches

ELEVATOR THROWS

3/4" to 1-1/4" Up — 3/4" to 1-1/4" Down

AILERON THROWS

3/4" to 1-1/4" Up — 3/4" to 1-1/4" Down

RUDER THROWS

1-3/4" to 3" Left — 1-3/4" to 3" Right

SIDETHRUST

2° Right

DOWNTHRUST/UPTHRUST

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage Balsa & Ply

Wing Balsa, Ply, & Hardwood

Empennage Balsa

Wt. Ready To Fly ... 225 Oz. (14 Lbs. 1 Oz.)

Wing Loading 26.7 Oz./Sq. Ft.

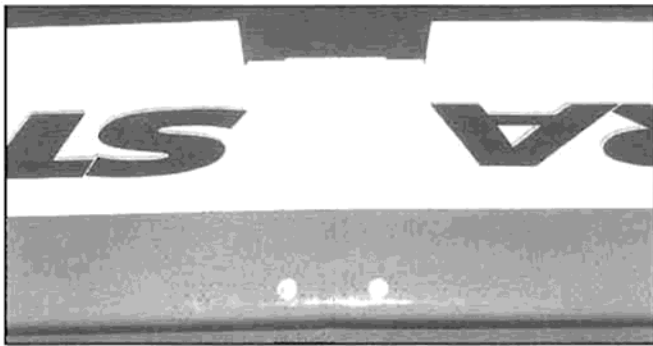
The Hangar 9 Ultra Stick is a terrific airplane. It has all of the virtues of the traditional Stick design, the smoothness and great visibility of a 1.20 size, and the added flexibility of control surfaces designed to take advantage of the mixing capabilities of a modern computer radio. The people who fly them generally have nothing but good things to say about them.

Appearance-wise, a Stick is a Stick, and while some people like their looks, I personally find them ... well, kind of unfinished. I have also found that a low wing airplane generally flies a bit smoother than a shoulder wing, and that's how the Ultra Stick LW came about.

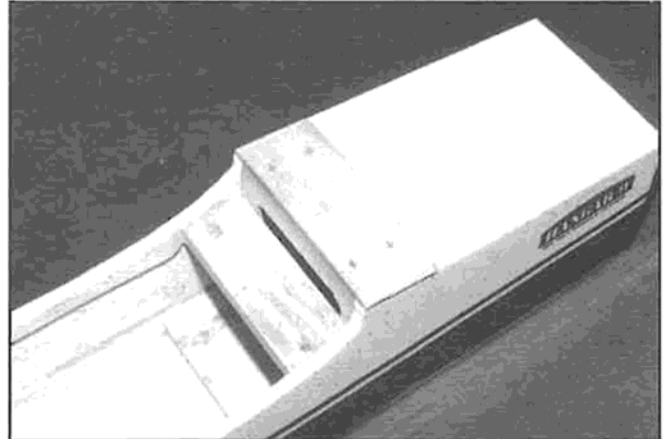
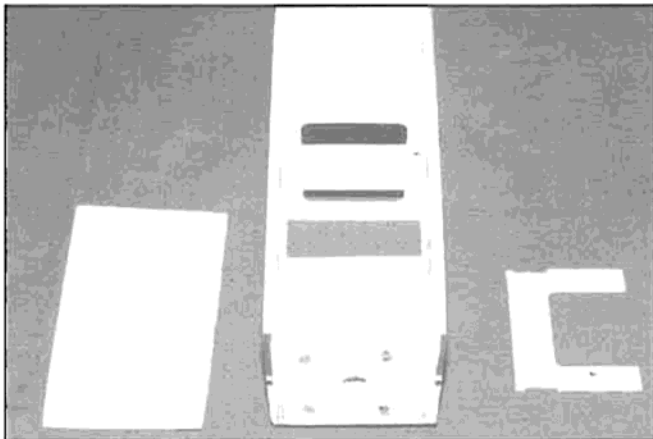
Converting a shoulder wing Stick to a low wing is fairly simple. Turn the fuselage upside down, attach the vertical fin to the top of the horizontal stab and add new landing gear mounts. The result is

a Stick that is more neutral in roll and doesn't drop its tail on the landing approach. Nevertheless, it still looks like a Stick. I built the rounded top decks and added a custom cowl, canopy, and wheel pants, strictly for appearance sake. These items add some weight but the Ultra Stick wing is so big that the wing loading is hardly affected. Use an engine at the top of the range like the O.S. 1.60 FX or Saito 1.80 and vertical performance will still be unlimited. (The cowl, canopy, and wheel pants are available from Stan's FiberTech, 2575 Jackson, Riverside, CA 92503. Phone 909-352-4758.)

The Ultra Stick LW uses the same radio set-ups and is capable of the same maneuvers as the unmodified Ultra Stick. The LW flies a little better, looks a lot better, the conversion is easy to do, and nobody else at the field will have one. (At least until they fly yours.)



LEFT: Modified wing-bolt holes and hold-down plate are shown in this view of the bottom of the finished wing. **RIGHT:** The bottom of the vertical fin needs trimming to fit in its new position on top of the horizontal stabilizer.



LEFT: The front portion of the kit fuselage bottom (which will be the top) is removed for access to the tank compartment and the back of the firewall. **RIGHT:** A section of the kit fuselage top (which will be the bottom) is removed and replaced by a new main landing gear mount. A similar mount is installed for the new tail wheel assembly.

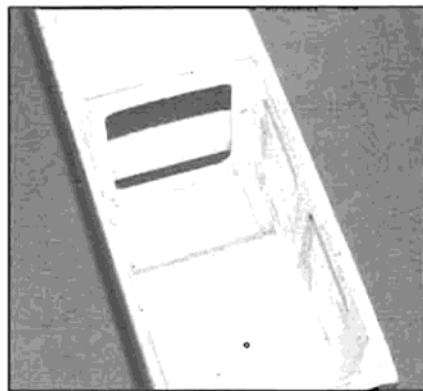
Power Plant Choices

Engine/Muffler:

- The engine size range for the LW is the same as for the Ultra Stick.
- Any single cylinder 4-stroke with its stock muffler will fit fine.
- 2-stroke glow engines will need a stock or stock type muffler such as a Bisson Sport or a J'Tec 3000 series. A Pitts style muffler would require too much of the cowl to be cut away for clearance.
- Gasoline engines generally will not fit inside the cowl.

Propeller:

- The LW has about 1/2" more ground

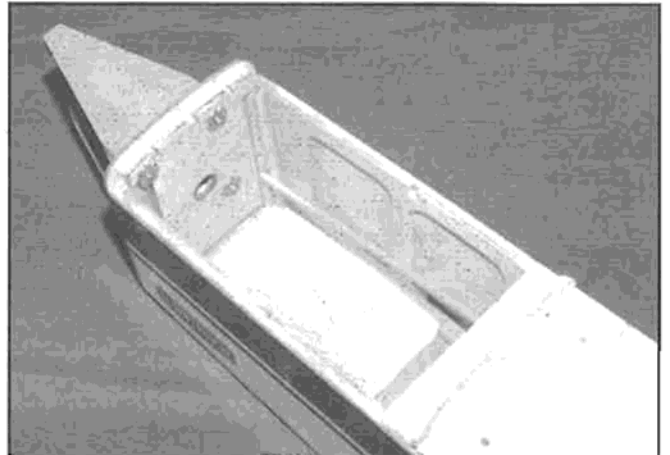
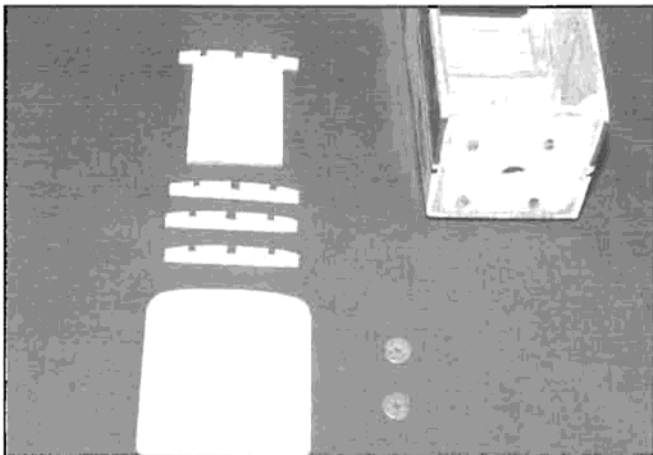


Here is a view of the new main gear mount from inside the tank compartment.

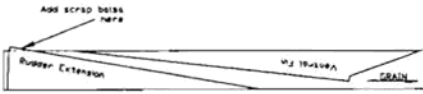
clearance than the Ultra Stick, so you can use up to a 17" diameter prop. Use a 6 or 8 pitch. The LW is aerodynamically cleaner than the Ultra Stick and will go faster on the same prop. Pitches over 8 dramatically increase the chance of control surface flutter.

CONSTRUCTION

The first thing to do with any ARF kit is to tighten up the covering. I have found that tightening UltraCote with a heat gun is a temporary solution at best. I recommend using a covering iron and a sock to iron down the covering. This



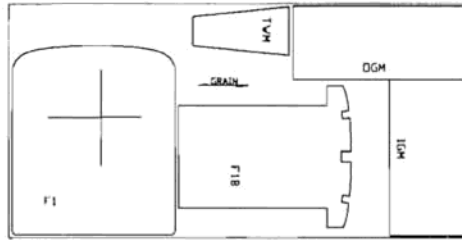
LEFT: New parts raise and strengthen the kit firewall. Note the triangle stock reinforcements already in place behind the firewall. The fender-washers are used to give the engine a couple of degrees of right thrust. **RIGHT:** The modified firewall with the kit engine mount in place.



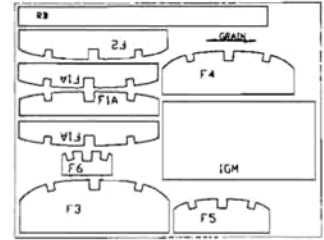
TEMPLATE:
(Glue this to a 1/2' x 1' x 11'
piece of Medium Balsa with 3M-77)



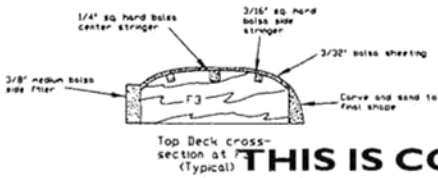
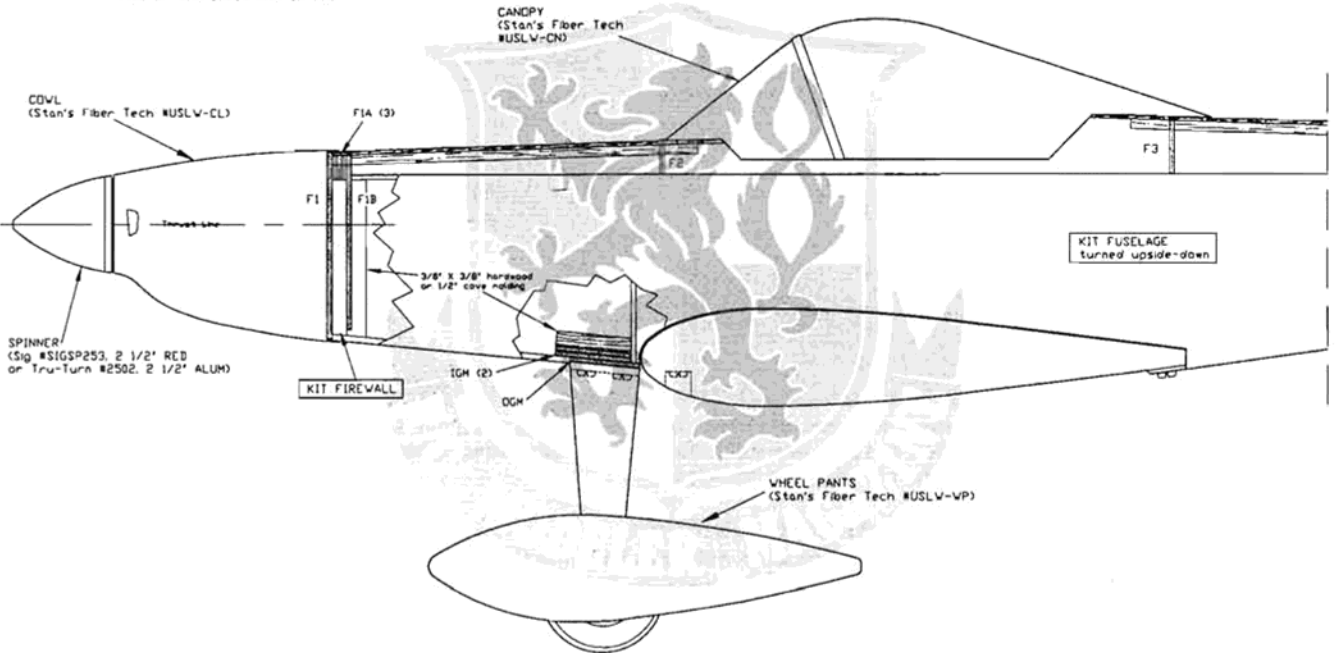
TEMPLATE for LW stickers.
(Glue this to the back of UltraCoat
Plus or trim sheet with 3M-77.)



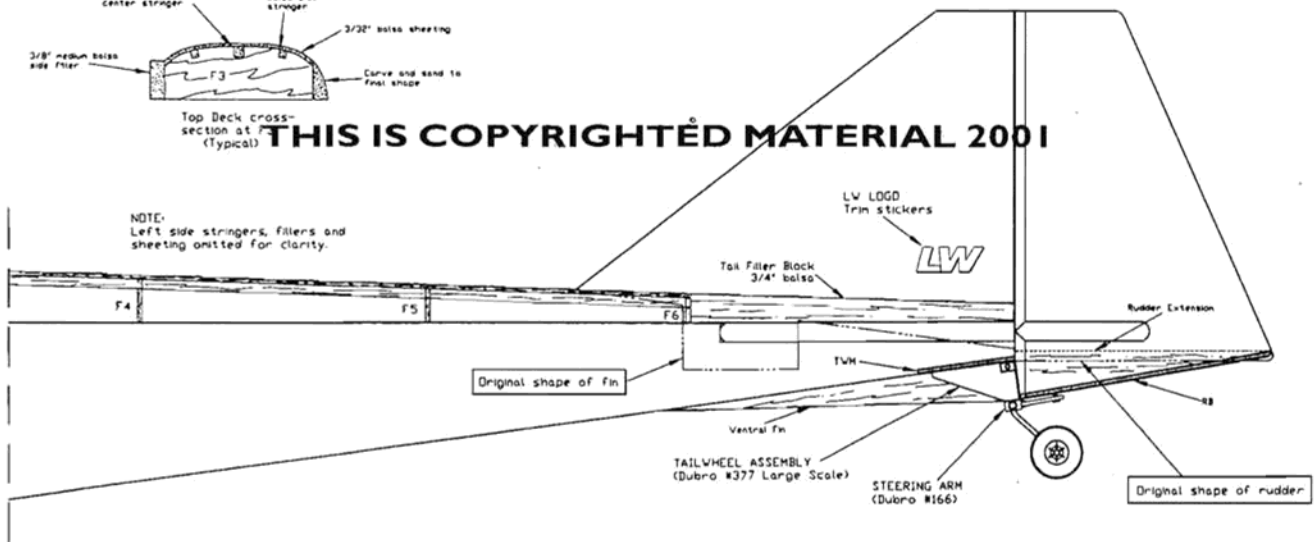
TEMPLATE
(Glue this to a 1/8'x6'x12' sheet
of Birch Plywood with 3M-77)



TEMPLATE
(Glue this to a 1/8'x6'x8' sheet of Birch
or Poplar (Lite) Plywood with 3M-77.)



NOTE:
Left side stringers, fillers and
sheeting omitted for clarity.

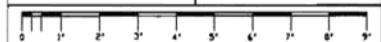


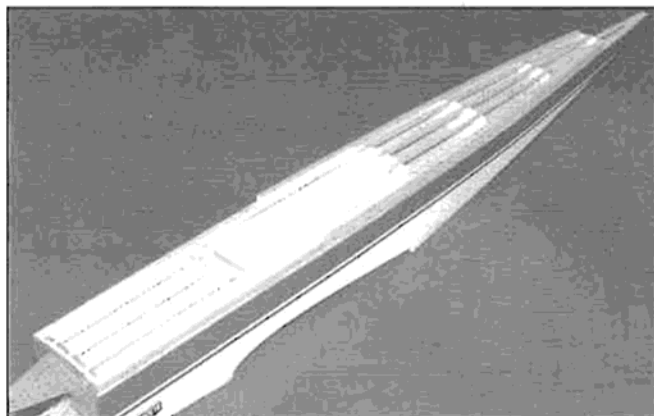
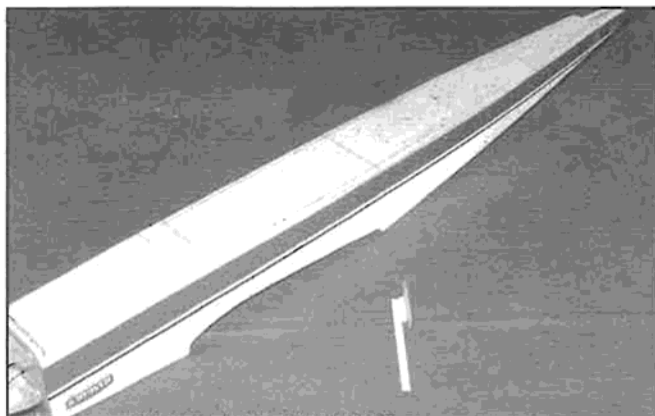
NOTE:
All incidences are 0-0 except
2 degrees right thrust.



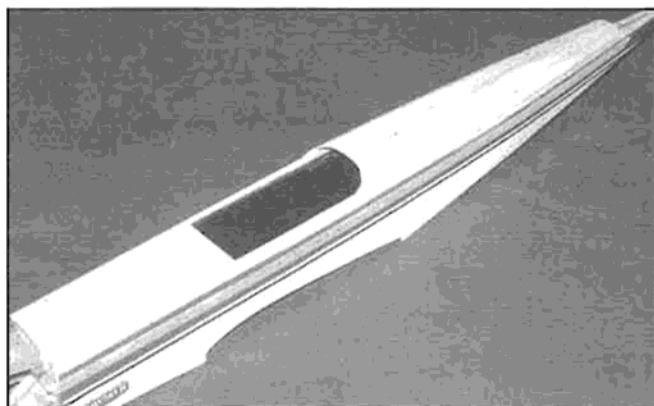
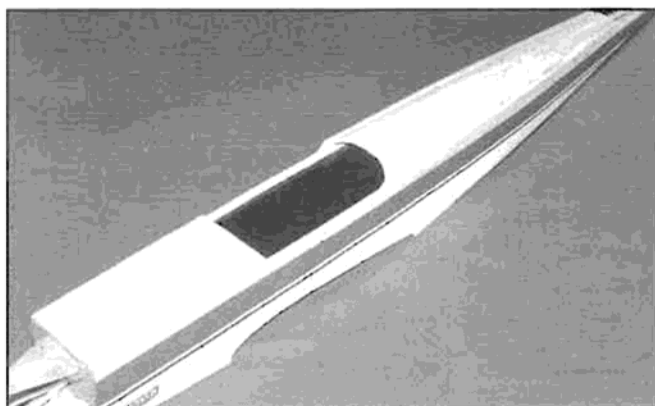
ULTRA STICK LW
A modified Hanger 9 Ultra Stick

Designed By: **JIM FELDMANN** Plans By: **JIM FELDMANN**





LEFT: After reinstalling the front portion of the fuselage top, the position of the deck formers and side fillers is marked. Note the tool used to draw a smooth line 3/8" from the edge of the fuselage top. **RIGHT:** Here the formers, stringers, and side fillers have been installed. The cockpit floor will be covered with UltraCote before the sheeting is added.



LEFT: Sheeting is installed between the side fillers. Sheeting these sections is relatively easy because there are no sharp radii or compound curves to worry about. **RIGHT:** The side fillers are then planed and sanded to blend the sheeting with the fuselage sides. Note the masking tape in position to protect the existing covering.

method seems to be a lot more resistant to future bubbles and wrinkles.

The second step is to cut the templates from the plans and glue them to the raw wood with 3M-77 or rubber cement. Use a band saw to cut out the new wood parts, smooth the edges with sandpaper and make sure the stringers will fit in the notches. Then peel off the paper and write the part number on each part.

Before we assemble anything, a few modifications need to be made to the kit parts.

Modifying The Wings

The kit is set up to have the flap and aileron servo wires exit from the bottom of the wing. We want them to exit from the top of the wing instead. Find the precut servo wire exit holes in the bottom center sheeting of each wing. **Do not cut away the covering over these holes.** Instead, cut a similar hole in the **top** of each wing, but center it 5-1/2" in front of the trailing edge of the wing. (For some reason, the kit exit holes don't line up with the servo wire holes in the wing

ribs. This measurement will make them line up properly.)

We need to change the front wing mounting bolt holes so that the bolts go in from the bottom instead of the top. Trim the covering away from the large hole on the top and the smaller hole on the bottom of each wing. Put a wing bolt through the bottom hole with the head against the bottom of the wing and draw a line around the head of the bolt. Remove the bolt and cut away the balsa inside the line. There is a thick piece of plywood under the balsa. You want the bolt to seat against the bottom side of this plywood. When you're done, the holes in the bottom of the wings should look just like the holes in the top of the wings.

Assembling The Wings

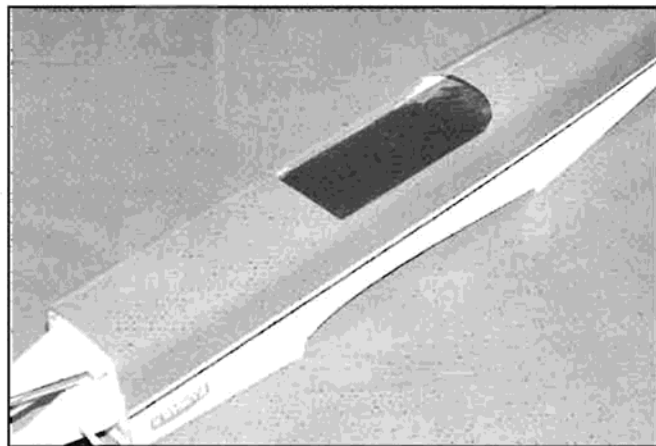
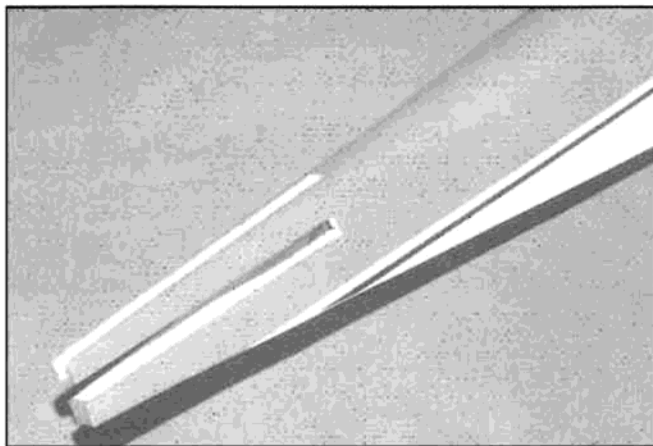
Complete Section 1 of the kit instructions. You can build either the Conventional Wing or the Quad Flap Wing.

Skip to Section 3 of the kit instructions. (I've always found it easier to do the servo installation and set-up before joining the wings.) Make sure that you use the servo wire exit holes that you cut in the **top** of the wing. You

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LEFT: Tail filler blocks are installed and sanded to match the fuselage shape before the new fuselage top is covered. **RIGHT:** Cover the top with matching UltraCote and the fuselage is ready for final assembly.

might also want to complete Section 15 now.

Now back to Section 2. Don't worry about the amount of dihedral; just let the angle of the root ribs determine that. (More is better in this case.) Use lots of epoxy on that wing joiner! Put the center joint trim tape on the **bottom** of the wing instead of the top.

Check the fit of the wing in the wing saddle before you go on to Section 4 of the kit instructions. Put the wing in the saddle **upside down**. Since the airfoil is symmetrical, this will not change the wing incidence, but because of manufacturing variations you may need to trim the saddle a little bit to make the wing sit flat. Mount the wing in accordance with Section 4, but with the wing upside down in the saddle. Put the wing bolt hold-down plate on the **bottom** of the wing.

That completes the wing. Not much to it was there.

Modifying The Tail Surfaces

We will use the horizontal stabilizer and elevator just as they come, but the vertical fin and rudder will mount differently and will need some modification.

Measure up along the trailing edge of the vertical fin 3/4" from the bottom and make a mark. Draw a line perpendicular to the trailing edge from the mark forward. Cut off the area of the fin that is below the line and save the cut-off pieces for later use.

Cut off the bottom 1/4" of the rudder. Strip off about 1/4" or so of the covering above the cut edge on both sides of the rudder and put a strip of masking tape 1/4" above that to protect the remaining covering.

Glue the 1/2" medium-hard balsa Rudder Extension to the bottom of the rudder and glue the 1/8" lite ply Rudder Bottom (RB) to the bottom of the extension.

Sand all of the joints smooth and

round off the edges of the Rudder Bottom to match the shape of the fuselage bottom, then cover the exposed wood with white UltraCote.

Modifying The Fuselage

Remove the red covering from the bottom (now the top) of the fuselage and down 1/2" on the sides. (To keep it simple, from here on, we'll refer to the red part of the fuselage as the top and the white part as the bottom. Left and right are designated as if you were standing **behind** the airplane.)

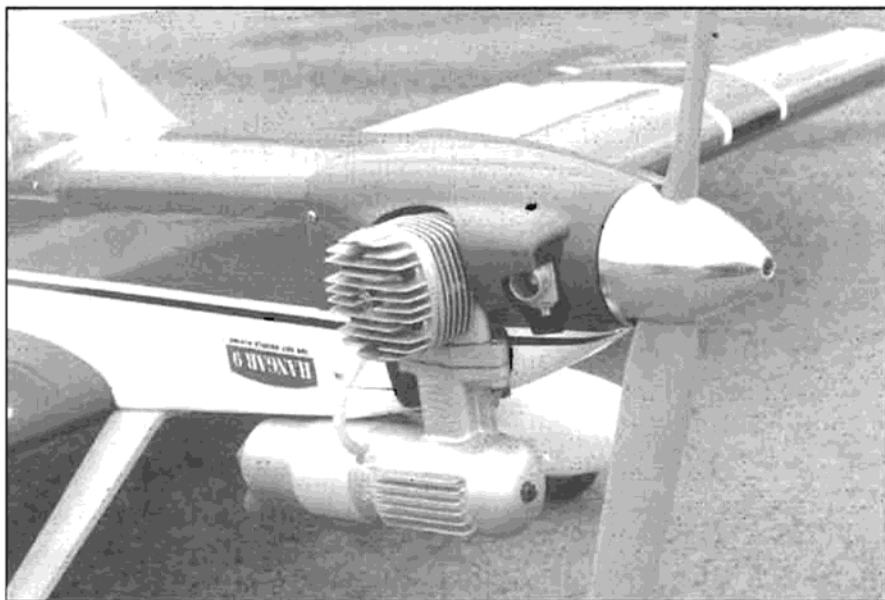
Carefully remove the front 7-3/4" of the plywood fuselage top. (**Save that piece!** You'll need to put it back later.)

Remove the tank support former that is between the firewall and the front of the wing saddle. (You can throw that away.) Some early Ultra Stick kits didn't have any triangle stock reinforcement behind the firewall, if yours doesn't you should add some 3/8" sq. hardwood stock or 1/2" cove molding down both sides. (This was a notorious weak point on the early Ultra Sticks.)

We need to build new landing gear mounts. Turn the fuselage over and remove the rear 1-3/4" of the balsa front fuselage bottom. (You can discard this piece.)

The Outer Gear Mount (OGM) goes on the outside of the fuselage to replace the balsa piece you cut out. Note: This piece is intended to extend 1/8" behind the front wing saddle former to act as a mini-fairing. Smooth the edges of the fuselage sides and the former and fit OGM in place. When you are happy with the fit, glue it on with epoxy.

There is an Inner Gear Mount (IGM) cut from aircraft plywood and another one cut from lite ply. Laminate them together. (CA is fine for this.) When the glue has set, fit this assembly inside the fuselage up against the former at the



The O.S. 1.60 FX and its factory muffler are a tight fit. A 4-stroke engine would probably need smaller holes in the cowl.

BILL OF MATERIALS

Wood

- 1 — 1/8" x 6" x 12" Birch (aircraft Plywood (firewall, landing gear mounts))
- 1 — 1/8" x 6" x 8" Poplar (lite) Plywood (formers, rudder bottom)
- 1 — 3/8" x 3/8" x 12" Hardwood (corner reinforcements) (can use 1/2" Cove Molding)
- 1 — 3/32" x 2" x 24" Medium-hard balsa (front sheeting)
- 2 — 3/32" x 3" x 30" Medium balsa (rear sheeting)
- 2 — 3/16" x 3/16" x 30" Hard balsa (side stringers)
- 1 — 1/4" x 1/4" x 30" Hard balsa (center stringers)
- 1 — 3/8" x 3/4" x 30" Medium-soft balsa (front side fillers)
- 2 — 3/8" x 1-1/4" x 30" Medium-soft balsa (rear side fillers)
- 1 — 1/2" x 1" x 11" Medium-hard balsa (ventral fin, rudder extension)
- 1 — 3/4" x 2" x 18" Medium-soft balsa (stab fillers)

Hardware

- 13 — 4-40 x 1/2" Button head screws — Du-Bro #527 (Cowl, canopy, rudder steering arm)

- 2 — 3/4" Fender-washers (Right thrust)
- 4 — 1/4"-20 Nylon bolts (Main landing gear)

Accessories

- 1 — Canopy — Stan's FiberTech #USLW-CN
- 1 — Cowl — Stan's FiberTech #USLW-CL
- 1 pair — Wheel Pants — Stan's FiberTech #USLW-WP
- 1 pair — Wheel Pant Mounts — Sig #SH-727 (5/32")
- 1 roll — Covering — UltraCote #866 True Red
- 1 roll — Covering — UltraCote #870 White
- 1 — Pilot — 1/5 scale
- 1 — Spinner — 2-1/2" — Sig #SIGSP253 (Red) or Tru-Turn #2502 (Alum)
- 1 — Tail wheel assembly — Du-Bro #377 (Large Scale)
- 1 — Tail wheel steering arm — Du-Bro #166

Miscellaneous

- Small piece of 1/8" balsa sheet (fuselage side doublers)
- 1 — Extra hinge (CA type or hinge-point type)

Moving to the back of the fuselage, we need to install a stronger tail wheel mount and relocate the pushrod exit holes. Remove and discard the rear 2-1/2" of the balsa rear fuselage bottom. Glue a 1/8" scrap balsa doubler on the inside of the fuselage sides over the factory-cut exit holes. **Do not** cut the covering away from the factory holes.

Cut new pushrod exits the same distance from the rear of the fuselage as the factory holes but 5/8"-3/4" below the stabilizer saddle on the **left** side of the fuselage (for the rudder pushrod) and 1-1/8" to 1-1/4" below the stab saddle on the **right** side of the fuselage (for the elevator pushrod). Use a long 1/8" or 3/16" bit to drill through the former that is just in front of the pushrod exits.

Fit the Tail Wheel Mount (TWM) to the rear of the fuselage, and glue it in place with epoxy.

Round the edges of the OGM and the TWM to match the shape of the fuselage bottom and sand the glue joints smooth, then cover the exposed wood with white UltraCote.

We need to reposition the engine to fit the cowl and top deck. This requires a new, taller firewall. First, laminate the three F1As together to make a single piece 3/8" thick.

If you added triangle stock to the back of the firewall, check to make sure that F1B will fit between your triangles and, if needed, trim it until it will.

Smooth the top of the kit firewall and glue the F1A assembly in place.

Using 30-minute epoxy, glue F1 to the front of the firewall. **Note:** The top of F1 extends 3/32" above the top of the F1A assembly.

When that epoxy has set, glue F1B to the back of the F1A assembly and the kit firewall.

Note: The engine mount supplied with the kit will work fine for engines

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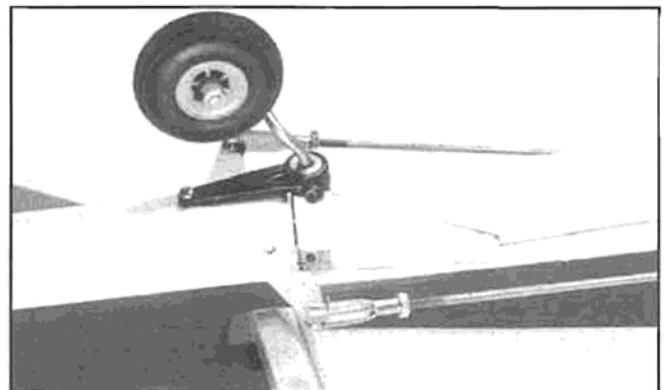
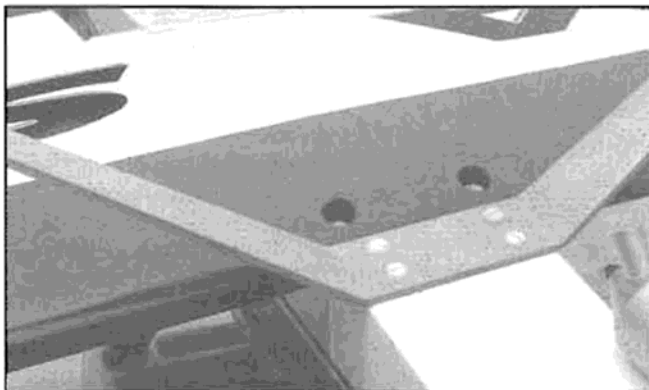
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rear of the tank compartment. The lity ply side goes against the OGM. When you are happy with the fit, glue the IGM assembly in place with epoxy.

Add a piece of 3/8" square hardwood or 1/2" cove molding to the top of the IGM assembly along each fuselage side.

I recommend 1/4-20 nylon bolts threaded into the wood to attach the gear, but the kit hardware will work fine in you prefer to use it. The landing gear should be installed with the tapered side toward the front so that the gear won't be too far forward. Mark, drill and tap the holes, and test-fit the gear.



LEFT: A view of the completed main gear and wing bolt installation. **RIGHT:** The rear of the Ultra Stick fuselage is so thin below the stabilizer that the tail wheel mounting and steering system needs to be unique. The final configuration shown here has proven to be very strong and reliable.

with a crankcase width up to 1-7/8". If your engine is wider than 1-7/8" use a J'Tec aluminum beam mount. The engine can be mounted upright, sideways, or inverted; it's your choice.

Note: The Hangar 9 Ultra Stick does not have side thrust built into the firewall. The Ultra Stick LW version flies better with some right thrust, so 2° is included in the design and the cowl is built for it. The engine mount is installed 3/16" off center on the firewall so that the spinner will wind up centered in the cowl. To create the right thrust, a standard 3/4" o.d. fender-washer must be installed between the firewall and the engine mount on both of the **left** side engine mount bolts.

Locate the engine mount holes using the thrust centerline shown on the plans. Drill the holes in the firewall and install the blind nuts.

Temporarily install your engine mount and engine. Position the engine on the mount so that the back of the spinner is 5-3/4" from the firewall. Locate and drill your fuel line and throttle pushrod holes in the firewall. If you wish to fuelproof the inside of the tank compartment, now is the time to do it.

Assemble the tank and attach the fuel lines as shown in Section 11 of the kit instructions, but use three fuel lines: carburetor, muffler, and fill/empty.

Install the throttle pushrod, surround the tank with foam, and install it as high as possible in the tank compartment. You can remove the engine now, but leave the fuel lines hanging out of the firewall; you won't be able to get to the tank to install them later.

Locate the plywood piece you removed from the top of the tank compartment. Trim it to fit behind F1B and glue it back in place. Since Hangar 9 instructs you to install the tank through the rear of the tank compartment, the tank could theoretically be removed that way if it were ever necessary to do so, but I suspect you would have to cut a hatch in the bottom of the tank compartment. Rather than go to the trouble of building a hatch now though, I would wait and only do that if the need arises.

Measure 8" back from the rear of F1B and draw a line across the top of the fuselage. Also measure 3/4", 7-1/2", 15", and 22-1/2" forward from the front of the stabilizer saddle and draw lines across the top of the fuselage. Now draw lines 3/8" in from the edge along both sides of the fuselage from F1B to F6. (I made a tool for doing this by

gluing a pencil and a spacer to a stick of scrap ply so that the pencil point was parallel to the stick and 3/8" away. Running the stick along the fuselage sides causes the pencil to make a mark the right distance from the edge. There should be a picture of the tool included in this article.)

Glue formers F2 through F6 in place, on the lines. (If you are using a heavy engine, you should cut big lightening holes in the kit fuselage top sheet between formers F3, F4, F5, and F6. You won't need that piece for strength any longer.)

Glue the 1/4" square balsa center stringer and the 3/16" square side stringers in place from the firewall to F2. Let the stringers extend a half-inch or so beyond F2.

Glue the center stringer and side stringers between F3 and F6 with about 1" extending beyond F3.

Sand the top of the stringers lightly to remove any glue lumps or slight misfits but be careful not to change the shape of the formers.

Cut and glue the 3/8" x 3/4" x 15" front side fillers in place, then add the 3/8" x 1-1/4" x 30" rear side fillers. The rear fillers butt against the back of the front fillers and extend to the back of F6.

If you are planning to apply covering material to the cockpit floor, now is the time to do it.

Now comes the most intimidating part of the project (at least for me), sheeting the top decks.

Start with the front deck. Cut two 2" x 10-1/2" pieces of medium-hard 3/32" balsa sheeting. One edge of each sheet will be glued to a side filler block. Bevel that edge for a good glue joint, then mark and trim each piece so that it will only cover half of the center stringer.

Now glue one sheet to its side filler, let the glue set, wet the sheet on the outside, add glue to the formers and stringers where it will touch, roll the sheet down and hold it until the glue sets.

Do the same on the other side. Check first to make sure that there is no interference between the two sheets at the center.

The rear deck sheeting is done the same way, using two 3" x 25" sheets of medium grade 3/32" balsa sheet, except that you will have to carefully fit each sheet to the curve of the side filler before sanding the bevel.

Okay! It's all easy from here!

After all of the sheeting is in place, you can clean up the cockpit opening.

This is not critical, so you can do it any way that pleases you. I simply cut the side fillers down to 3/8" high between the front and rear sheeting and then sand off the sheeting at a 45° angle, as viewed from the side. If you want to put a dash panel in place, cut another F2 but without the stringer notches and glue it under the front sheeting.

Protect the remaining covering on the fuselage by running a strip of 1" masking tape along each fuselage side about 1/2" below the cut edge.

Now, using a plane and a coarse sanding stick, carve and sand the side fillers to the shape shown on the plans. Start by cutting them down to match the angle of the sheeting where it meets the fillers. Then knock off the corners at a 45° angle. Finally, you can round them off. Don't be afraid to take a lot of material off the side fillers. Most people don't sand them enough.

Fill the gaps under the side fillers with your favorite spot filler. I prefer to use Spackle, with a coat of thin CA to harden the surface after the final sanding.

Cut two 8-1/2" x 7/8" x 3/4" tail filler blocks and rough taper them with a band saw.

Using the pieces you cut off the bottom of the fin and rudder as spacers under and between the blocks, fit the tail filler blocks in place and glue them to the back of F6.

When the glue has set, remove the spacers and sand the filler blocks to match the shape of the rear deck.

Do the final sanding on the entire top of the fuselage and cover it with True Red UltraCote. Overlap the original covering by 1/4" to 1/2".

Finish the inside of the cockpit and add a 1/5 scale pilot.

Trim the canopy to fit and attach it using your favorite method. I prefer to use small screws and trim tape so that I can remove it later if necessary. The screws will hold fine in the balsa if you harden the threads with thin CA.

Install your engine and fit the cowl around it. The cowl slips over the front of the fuselage and is attached with four or five small screws into the edges of the firewall. Position the cowl so that there is 1/16" clearance behind the spinner. Be sure that the top of the cowl doesn't hit the front of the engine mount. Once you are satisfied with the fit, paint the cowl with Jet White and True Red LusterKote. (You may want to wait until the wheel pants are ready so you can paint them at the same time.)

That completes the fuselage modifications. Looks a lot different doesn't it?

Installing The Wheel Pants

Let's jump ahead and do the wheel pants so that we can start on the painting.

Install the axles in the main landing gear.

Drill a 5/32" hole on the inboard side of each wheel pant, centered above the wheel opening and 1/2" to 5/8" up from the bottom edge of the pant. **Be sure to make a right and a left!**

Slide each pant on its axle, check that it is perpendicular to the axle when looking from the front and from the bottom, then make a mark where the axle hits the wooden pad on the outboard side of the pant.

Remove the pant and drill a 5/32" hole through the outboard wooden pad, but **not through the fiberglass**. This provides a hidden support for the outboard side of the pant. (You may have to shorten the axle a little to allow the pant to fit against the landing gear strut on the inside.)

Install Sig #SH727 Wheel Pant Mounts, following the directions on the package.

Now you can prepare and paint the cowl and wheel pants.

Assembly

Let's go back to Section 5 of the instruction manual and install the horizontal stabilizer. You will have to remove covering from both top and bottom of the stab, and of course, you won't be able to glue it on by setting it flat on a table, but the alignment steps are the same.

Go to Section 6 and install the vertical fin. **Do not** cut open the slot in the bottom of the fuselage. Fit the fin in position between the tail fairings. Mark and then cut away the covering on the fin that will be inside the fairings and the covering on the top of the fuselage that will be under the front of the fin. Attaching the rudder to the fin (without glue) will make it easier to align the rear of the fin as you glue it in place.

Skip Section 7. The tail wheel assembly that comes with the kit is too short to keep the rudder tip off the ground. (And don't glue the rudder hinges in yet!)

Install the elevators as shown in Section 8. Before you install the rudder, you will need to cut a large hole in its leading edge to clear the elevator joiner. Make sure the elevator will reach full travel regardless of rudder position. Once you are satisfied with the clearance, cover the raw wood with a coat of white paint.

We need to add a hinge at the very bottom of the rudder to carry the load

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of the control horn. (I used a CA hinge cut in half lengthwise to fit the narrow space available.) Carefully cut the necessary hinge slots, and then install the rudder and glue the hinges in place.

The rudder control horn is installed on the **left** side of the rudder about halfway between the bottom of the horizontal stab and the bottom of the rudder.

Install the elevator control horn as in Section 9 of the instructions, but put the horn on the **bottom** of the right elevator.

The tail wheel requirements of the Ultra Stick Low Wing are unusual because of the very slim rear fuselage of the original Ultra Stick. I tried several styles of tail wheel mount and the following set-up was the strongest and easiest to install.

Use a Du-Bro #377 tail wheel assembly. Bend the wire strut back about 45° at a point 1/4" above the bottom of the straight section. Slip a Du-Bro #166 steering arm onto the strut, insert the strut into the plastic bracket and then install the provided wheel collar at the top of the strut. Snug the steering arm up against the bottom of the bracket. **Note:** The strut must not extend beyond the top surface of the bracket.

Position the bracket on the TWM so that the center of the strut, **at the steering arm**, is aligned with the rudder hinge line. Trim the leading edge of the rudder if necessary. This will prevent binding as the rudder reaches the ends of its travel. When you are happy with its position, drill holes and mount the tail wheel bracket with the provided screws.

Turn the steering arm so that it extends over the bottom of the rudder and install a 4-40 x 1/2" screw through the last hole in the steering arm and into the rudder bottom. Install the tail wheel, align it with the rudder and tighten the set-screw in the steering arm. **Note:** I do not recommend filing a flat in the strut for the set-screw. This would weaken the strut at a critical point and eventually the strut would break.

We've already fitted the main landing gear (Section 10). Mount the main gear strut on the fuselage (with the straight side to the rear). After the

paint on the wheel pants has dried, slide the pants on the axles with a wheel collar on both sides of the wheel. Snug up the wheel pant mount, center the wheel in the cutout and tighten both wheel collars.

Set the fuselage on a table and block up the tail so that the black stripe on the fuselage side is level with the tabletop. Adjust the pants so that they are also level and then tighten the set-screws in the wheel pants' mounts.

We've already completed the tank installation (Section 11) and the engine installation (Section 12) so we can skip those.

Install the radio per Section 14 (and Section 15 if you haven't already completed the aileron and flap linkages). To minimize the possibility of flutter, always connect the pushrod to the outer hole of the control horn. If you need more travel, use a longer servo arm.

Assemble and install the pushrods as in Section 16. The hardware in the Ultra Stick kit is good quality and I used it for the LW as well.

Nevertheless, if you have a favorite brand or style of control linkage, feel free to substitute it.

The control throws given in Section 17 and the C.G. called out in Section 20 are just about right for the LW. I'd recommend that you use the low rate settings until you get used to the Ultra Stick LW's flying characteristics. Again, to minimize the possibility of flutter, and to increase control effectiveness, you should seal all hinge gaps. Here's an example of how to do this: Disconnect an aileron pushrod and bend the aileron as far up as it will go. Then install tape or a strip of covering material along the bottom (open) side of the joint, pushing it down into the gap as far as the hinge line and then adhering it to the trailing edge of the wing and the leading edge of the aileron. Flex the aileron to make sure it still moves freely and then reattach the pushrod.

All of the programming options given in Sections 18 and 19 can be used on the LW, and in some cases they work even better on the LW than on the original Stick. The only change I had to make was to mix in more down elevator with lowered flaps and in the crow configuration.

That's it! You are now the proud flier of the best looking Ultra Stick around. Have fun and try to always land on the wheels.

