SLICK

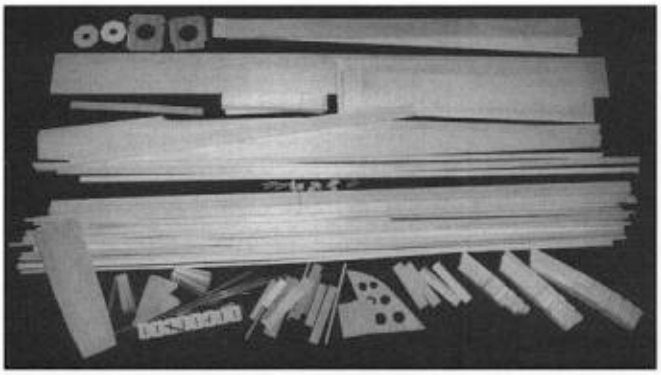
MOTOR GLIDER

At Last, A High Performance Motor Glider For Modelers On A Budget.

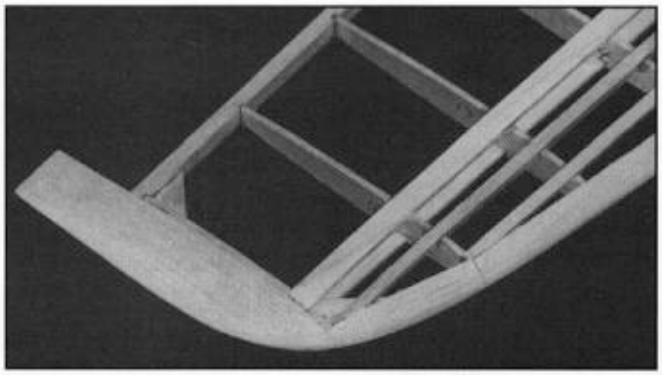
By: Theodore E. Davey

The Slick has been designed for those modelers who want the performance of aileron controlled expensive composite construction models, but are reluctant to spend the extra money for that type of kit. The design is based on my experience with the S3021 airfoil in two kits that I had in production, the Vengence and the Skimmer. The Slick offers improved performance through the use of ailerons and a full flying stabilizer which contribute to its smooth, predictable high performance and a tremendous speed range. The design features a fuselage large enough to easily accommodate up to 14-cells as well as a bottom hatch for easy pack removal.

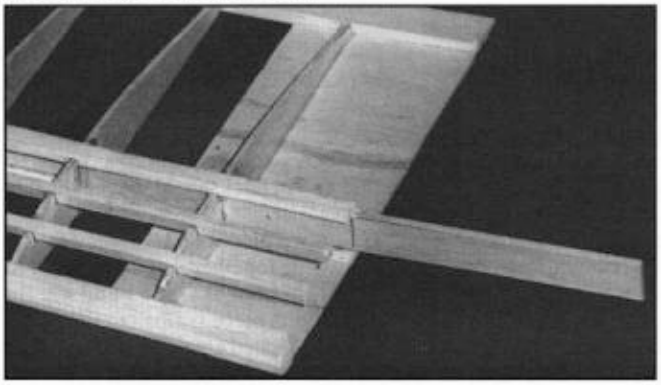
The Slick can be flown with any



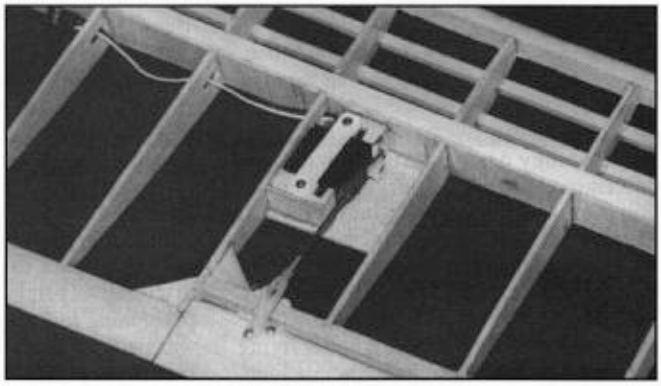
All required parts in "kit" form.



Completed wingtip.



Wing center with dihedral brace in position.

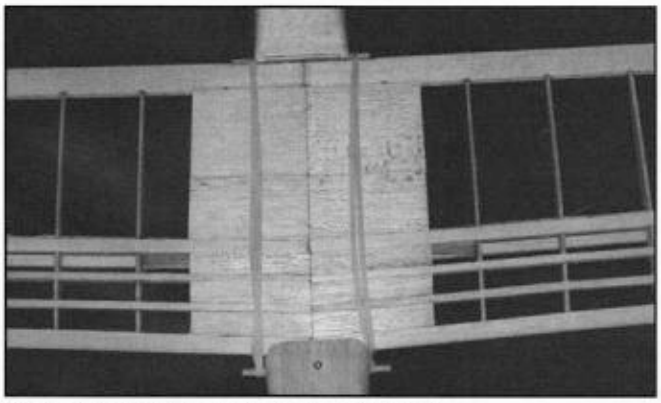


Aileron servo mounted in wing.

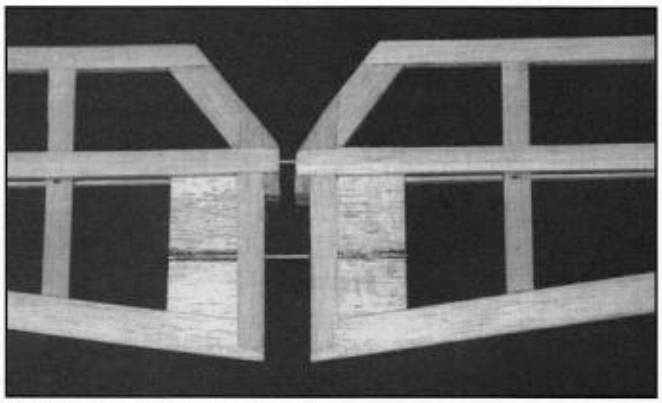
05/075/15 size motor as well as larger motors for spectacular 10-cell competitive performance. The required controls are aileron, elevator, and motor with optional rudder. If you have a programmable 6-channel radio, you can also use the ailerons as aileron/flaps for approach control. Gear reduction has not been shown on the plans because the generally higher speed of direct drive is usually more desirable with models that utilize ailerons. However, there are some in-line gear reduced motors on the market that would readily fit into the nose if this is your choice.

The easiest way to build the Slick is to spread out the plans and walk through the construction while reading these instructions, so that you become familiar with the design. Then, using the templates, cut the formers and ribs and then the fuselage sides by first making a tracing over the plans for a template. Then gather all of the other parts required that are listed in the parts list. The required lengths of the sticks is given as are all of the other required dimensions for the small parts. All of the hardware listed is of the usual modeling type and should not present any problems. If you don't have any 5/32" wood, you can easily sand down some 3/16"with a sanding board as none of the pieces are large. The 5/32" size is used, instead of 1/8", because it is not only easier to slit for the hinges, but is also a little stronger and can better stand up to the rigors of the high speeds that this design is capable of.

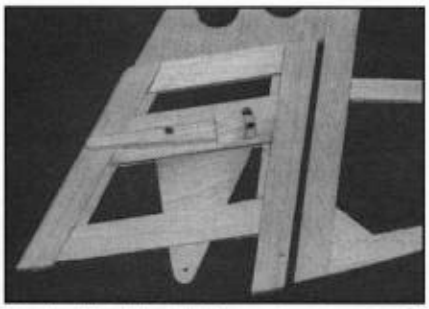
All of the prototypes have been built with cyanoacrylate adhesives, using both



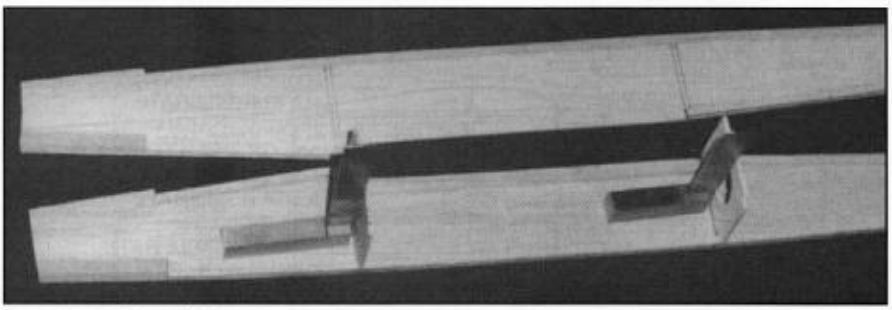
Completed wing center section on fuselage.



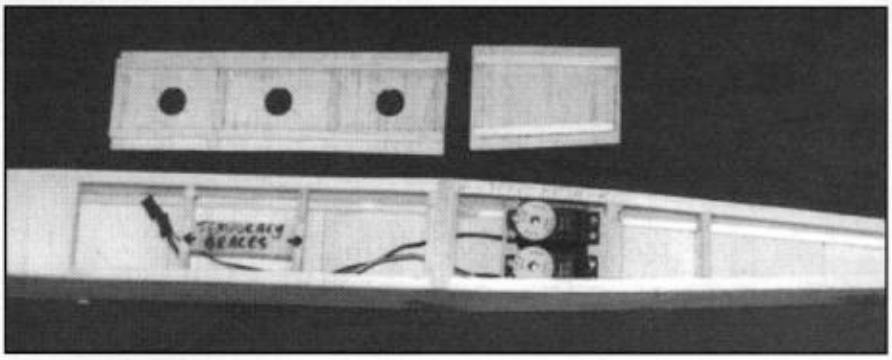
Stabilizer center section detail.



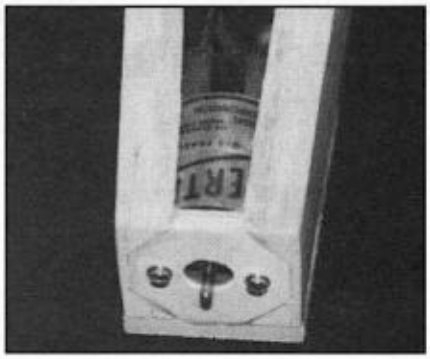
Vertical fin with stabilizer control horn detail.



Fuselage sides with formers.



Fuselage bottom with hatches.



Fuselage nose with motor.

the thin and thick viscosities with an accelerator. If you are not familiar with these types of glue, experiment with them in a ventilated area on some scrap wood of the type you will use in assembly. This will not only give you an opportunity to see how they perform, it also will help determine if you are allergic to them. If you prefer other types of glues, you will have a very small weight increase and it will simply take you a little longer to build the model because of the longer drying time. Regardless of your choice, it will be easier to assemble a stronger, better flying model if you take the time to double glue, or preglue each joint that has a butted end. This pregluing seals the wood and allows the second coat to actually glue the pieces together more securely.

CONSTRUCTION

Wing:

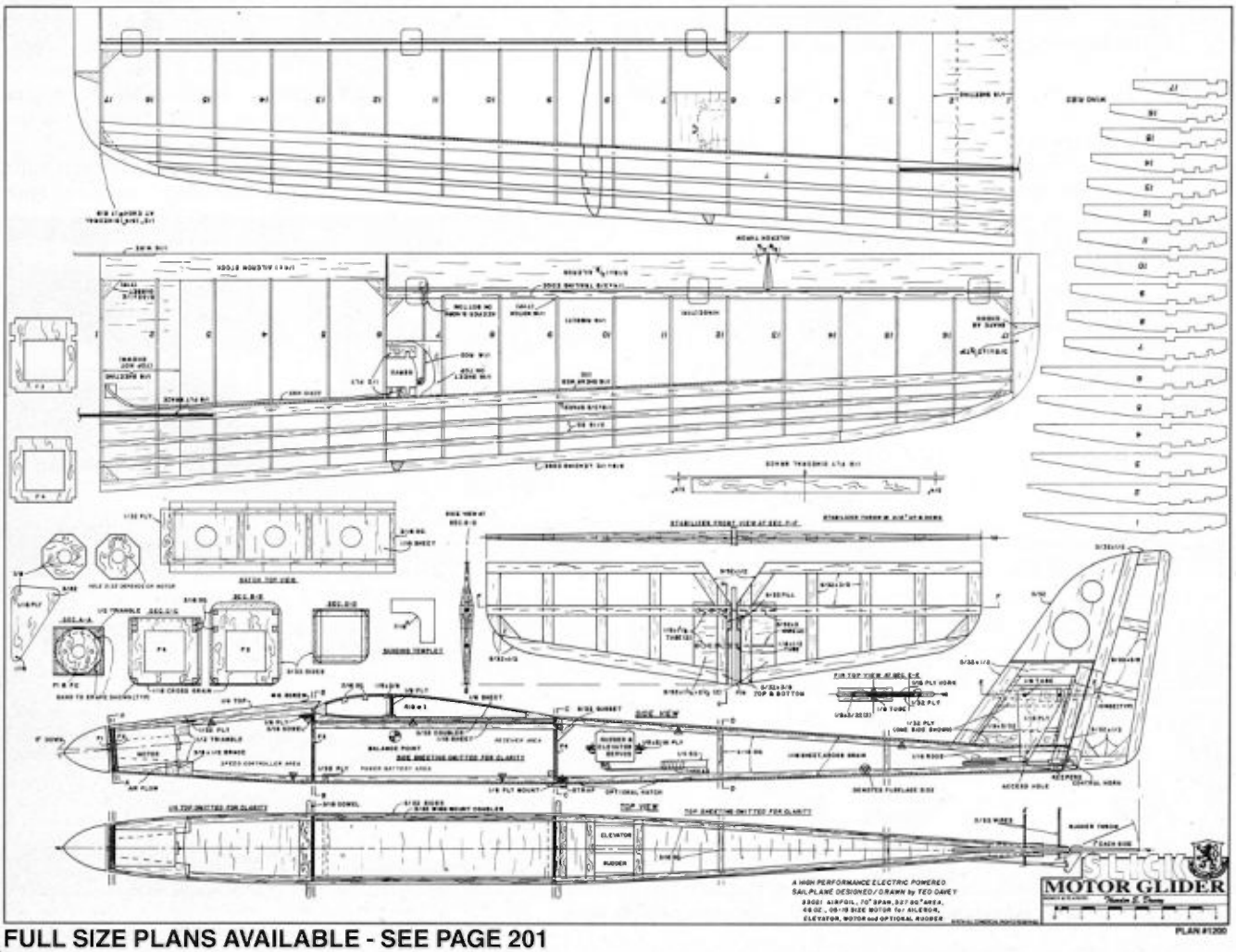
The wing is built first because you will need it when constructing the fuselage to be certain the spacing between formers F3 and F4 is accurate. The wing is flat bottomed from the spar to the rear edge; consequently, assembly will go quickly. The 1/8" x 3/8" spars and the shear webs are used, along with the larger than normal 3/16" square turbulator spars, to give maximum strength to a relatively light wing. Before you start positioning and gluing, cover the plans with wax paper or the clear plastic sheet left over from your last model covering job. Carefully fit all of the parts, then glue everything in place, so that the wing will be as strong as it should be.

(1) Pin one 1/8" x 3/8" spar in place over one wing panel on the plan, either pinning through it or by straddling it with enough pins to keep it in place.

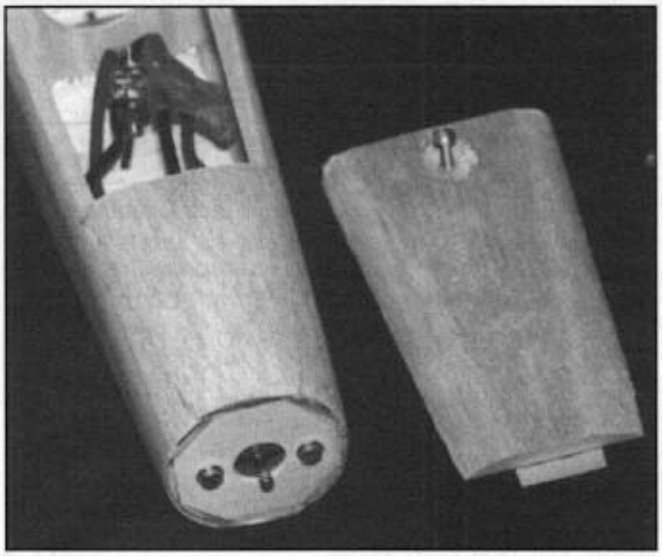
(2) Mark the position of the ribs onto both the 1/4" x 3/8" and the 1/4" x 1" trailing edges and cut in grooves 1/16" wide and 1/16" deep for the wing ribs. You may find that an old hacksaw blade makes this operation easier.

(3) Cut two pieces of 1/16" sheet to 3" long, butt glue together and then glue it to the rear of the spar at ribs #1 and #2. Be certain that this piece is flush to the board and do not use much glue. Cut another sheet and glue it to the front of the spar.

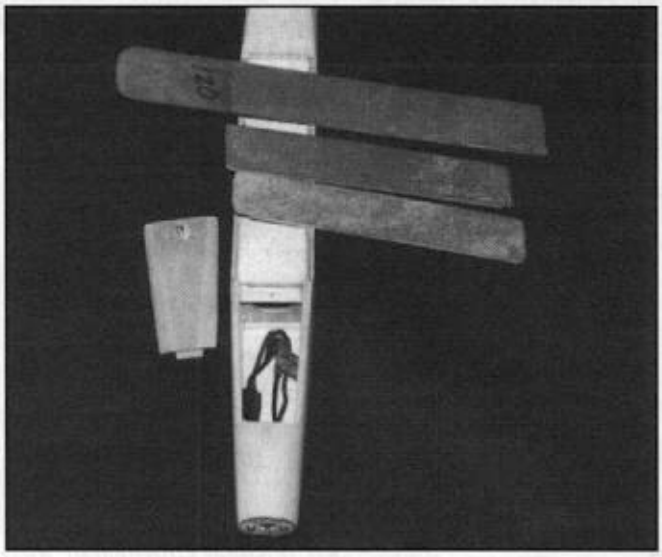
(4) Position, and pin in place, the two different trailing edge pieces. Check the fit of the ribs, and when you are satisfied, glue all of them in place except rib #1. For the



FULL SIZE PLANS AVAILABLE - SEE PAGE 201



Finished fuselage nose with hatch detail.



Partially finished fuselage with sanding blocks.

moment, use as little glue as possible so that you won't have to sand off the excess once the wing is taken off of the board.

(5) Position in place the 3/8" x 1/2" leading edge, shimming it up in several places with some scrap. Cut this piece at ribs #14 and #16 as shown, making a smooth perpendicular cut. Glue in place the longest piece. Sand a butting angle into the piece that fits between ribs #14 and #16 then glue in place. Repeat the same procedure for the piece between ribs #16 and #17.

(6) Glue in place the top spar and the two 3/16" square turbulators. Note the small taper out at the tips and bend the spars down accordingly. Fit the shear webs and glue in place.

(7) Remove this wing panel from the board and repeat steps one through six for the other wing half.

(8) Carefully preform the wingtips and glue in place as shown. Using a sanding board with 80 or 100 grit, carefully sand the wing to blend in the ribs with the leading and trailing edge. Shape the leading edge as shown on the plans, working carefully to obtain the proper shape. Shape the tips, including some of the spar and leading edge material, to obtain a smooth taper. Hold the panel near the edge of the bench when shaping the leading edge and it will be easier to form the proper airfoil. Then turn the wing around and hold the aileron in place against the 1/4" x 3/8" trailing edge while sanding both pieces to shape for a smooth fit.

(9) Sand the sheeting and spars at the #1 rib of one wing panel to get a flush edge and pin it to the board. Shim up the other wing panel 1" and sand the spars, leading edge, and trailing edge to properly butt against the first panel. Cut the slot in both #1 ribs for the dihedral brace and glue them together.

Slick Parts List

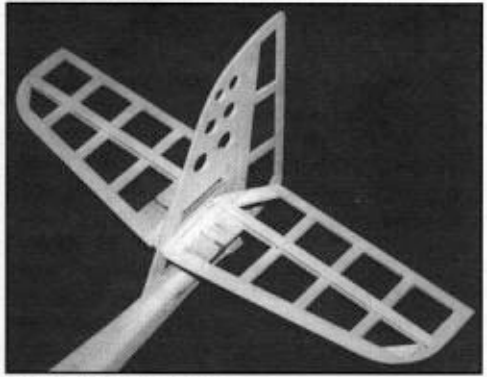
All sizes in inches

1 — 1/16 x 3 x 30 wing center sheeting
2 — 1/16 x 3 x 24 Fuselage sheeting
2 — 3/32 x 3 x 36 Fuselage sides
1 — 1/4 x 3 x 8 Fuselage canopy/nose
2 — 1/16 x 3 x 36 Wing ribs
2 — 1/8 x 1-5/8 x 1-5/8 Lite ply, F1 & F2 formers
1 — 1/8 x 2-7/16 x 2-3/4 Lite ply, F3 former
1 — 1/8 x 2-7/16 x 2-1/2 Lite ply, F4 former
2 — 5/32 x 1-1/4 x 2 Stabilizer center
8 — 3/16 x 3/16 x 36 Fuselage & wing
2 — 3/8 x 1/2 x 36 Wing leading edge
4 — 1/8 x 3/8 x 36 Wing spars
3 — 5/32 x 3/8 x 36 Stabilizer & rudder
2 — 5/32 x 1/2 x 36 Stabilizer, rudder, & gussets
2 — 1/4 x 3/8 x 24 Wing trailing edge
2 — 5/16 x 1-3/8 x 24 Ailerons
2 — 1/4 x 1 Aileron stock for trailing edge
20 — 1/16 x 3/4 x 2-1/8 Shear webs
2 — 1 x 3/4 x 5-1/2 Wingtips
1 — 1/8 x 5/8 x 8-1/2 Ply wing dihedral brace
1 — 5/32 x 3 x 5 Rudder
2 — 1/32 x 2 x 3 Ply stabilizer control horns
2 — 1/32 x 1/2 x 2 Ply hatch latches
2 — 3/32 x 3/8 x 9 Fuselage wing doublers
2 — 1/32 x 3/4 x 3 Ply, fin
2 — 1/32 x 1/2 x 3 Ply, fin
1 — 1/8 x 3/32 x 5 Fin
3 — 1/8 x 5/16 x 2-1/2 Ply, servo & hatch mount
1 — 1/8 x 1/2 x 2-1/2 Ply, canopy mount
4 — 1/2 x 3 Triangle stock for motor mount
2 — 3/16 x 3-1/2 Dowel, wing mount
1 — 1/8 x 1/2 Brass tube, fin
2 — 1/8 x 1-1/4 Brass tube, stabilizer
1 — 1/16 x 4 Wing wire
2 — 3/32 x 3 Stabilizer wire
8 — Hinges
3 — Small control horns
4 — Small keepers
11 — Sheet metal screws, #2
1 — #6 x 3/4 Sheet metal screw, canopy
1 — Nylon landing gear strap, hatch
4 — 1/16 x 12 threaded rod
2 — 1/4 x 1/4 x 12 Pushrod
Plus material for mounting servos in wing.

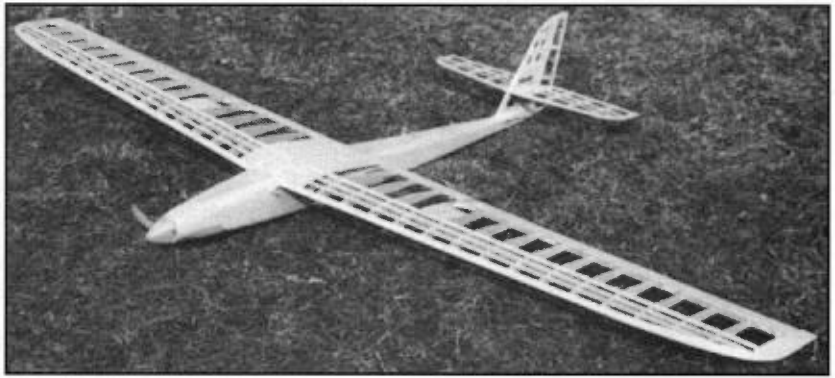
NAME
SLICK
Designed by:
Ted E. Davey
TYPE AIRCRAFT
Motor Glider
WINGSPAN
70 Inches
WING CHORD
7-1/2 Inches (Avg.)
TOTAL WING AREA
527 Sq. In.
WING LOCATION
Top of Fuselage
AIRFOIL
S3021
WING PLANFORM
Tapered Leading Edge
DIHEDRAL, EACH TIP
1/2 Inch
OVERALL FUSELAGE LENGTH
40 Inches
RADIO COMPARTMENT SIZE
(L) 12" x (W) 2" x (H) 2"
STABILIZER SPAN
8-1/2 Inches
STABILIZER CHORD (inc. elev.)
4 Inches (Avg.)
STABILIZER AREA
73 Sq. In.
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid Vertical Fin
VERTICAL FIN HEIGHT
8 Inches
VERTICAL FIN WIDTH (inc. rud.)
5-1/4 Inches (Avg.)
REC. MOTOR SIZE
05/075/15
BATTERY SIZE
7-10 Cells
LANDING GEAR
NA
REC. NO. OF CHANNELS
4-6
CONTROL FUNCTIONS
Elev., Throt., Ail., Opt. Rud., Flaperons
C.G. (from L.E.)
3 Inches
STABILIZER THROWS
3/8" Up — 3/8" Down
AILERON THROWS
3/8" Up — 3/8" Down
RUDDER THROWS
1" Left – 1" Right
SIDETHRUST
0°
DOWNTHRUST
5°

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage ..... Balsa & Ply
Wing ..... Balsa & Ply
Empennage ..... Balsa & Ply
Wt. Ready To Fly ..... 46-50 Oz.
(2 Lbs.14 Oz. - 3 Lbs. 2 Oz.)
Wing Loading .... 12.5-13.5 Oz./Sq. Ft.



Finished tail feathers.



Completed model airframe.

Cut the slots for the same brace in the #2 ribs and test fit the dihedral brace.

(10) While maintaining the 1" dihedral, fit it all together. When you are satisfied, glue the wings together on the bottom sheeting, brace and spars. Take the time to test fit very carefully to prevent gluing in any tip wash-in or wash-out. Next, fit and glue the ribs and top spars in place. Again, use just enough glue to obtain good joint strength. If need be, you can add more later.

(11) Once the glue is dry, remove the wing from the board. Cut the gussets from 5/32" x 1/2" material, and glue in place as shown. Cut away enough wood on the trailing edge to fit, and glue in place the 1/16" wire protector.

(12) Mount the servos in the wing next to rib #6. The prototypes are flying with both Hitec HS 80 and Airtronics 94501 servos. Both are relatively small and fit in the wing easily. The mounts are made from 1/2" ply, cut out to accommodate the servos as shown, and then glued in place. A small strap of thin, 1/4" wide plastic holds the servos in place with two small sheet metal type screws mounted into the plywood. Cut

holes in each rib to run the wiring back to the center section and then out the bottom through another hole, and into the fuselage.

(13) Cut to fit and add in the top 1/16" sheeting behind the main spars and between the 3/16" sq. turbulators. Finish sanding the wing and spread some thin glue on the leading edge to protect the wood from the wing mounting rubber bands. Carefully cut the slots into the ailerons and the 1/4" x 3/8" trailing edge for the hinges. Work very carefully here so that the aileron is flush with the wing top when mounted with the hinges. Do not glue them in place at this time. Go over the entire wing and add in a little more glue where you feel more strength is required.

Stabilizer, Fin, And Rudder:

The stabilizer is made up from 5/32" x 3/8" or 1/2" wide wood with a little bit of 5/32" sheeting in the center. It's a little more work than a conventional stabilizer/elevator as it is tapered and has a diamond airfoil, but this design offers excellent performance. The fin/rudder combination is also of 5/32" wood and is a little different because of the large plywood control horn buried in the middle of the fin. This horn can be made of either 1/16" ply or two pieces of 1/32" ply crossed-grain and glued together. All of the prototypes use two pieces of 1/32" because it's a little stronger and less prone to warping. Drill the three holes into the horn using 1/8", 3/32", and 1/16" drill bits.

(1) Cover the stabilizer plans to protect them as you did the wing, then cut the 5/32" x 3/8", and the 1/2", and pin in place. Cut the 5/32" x 1-1/4" x 2-1/2" pieces to shape to fit into the angle shown and glue in place. Cut, fit, and glue in place the 5/32" fill pieces as shown, being careful to use as little glue as possible. On one side, cut and fit into place the 1/8" brass tubing into the 5/32" sheet. Cut and fit in place the 3/32" wire pieces into the other sheet. Insert the wire into the tubing and check the fit very carefully. They must not only be parallel to each other, they must also be parallel to the building board. Very carefully glue the pieces into the wood, keeping in mind that the wire rods have to slide in and out of the tubes once they go through the fin. The two stabilizer pieces will stay together if one of the wires is bent slightly forward about 1/2" from the tip.

(2) Glue the 5/32" x 3/8" strips to the top as shown at section F. Glue more of the same size to the front and rear of the first piece in the center. Turn the stabilizer over and repeat this step.

(3) Using a sanding board, sand in the front to back and the center to tip tapers as shown. Sand in the rounded leading edge and carefully finish sand everything with a piece of 220 sandpaper.

(4) Cut to fit, and pin to the board the three 5/32" x 1/2" pieces that form the front, top, and rear of the fin. Note that the rear piece extends to the bottom of the fuselage. Cut the two pairs of 3/32" ply to shape as shown. Very carefully drill the front hole and cut the rear slot into the top pieces. Glue one top and one bottom to the front and rear

5/32" frame over the plans. Glue the front and rear 1/8" x 3/32" balsa to the ply and the 5/32" balsa. Glue in place the other two 3/32" ply pieces, being careful to properly align the top ones so that when the 1/8" x 1/2" brass tube is glued in place, it will be perfectly perpendicular to the fin surface. If a mistake is made here, the result will be a stabilizer that will not be perpendicular to the fuselage or parallel to the wing.

(5) Form the rudder over the plans as shown. Again, glue very lightly when you butt the pieces or you will have to do a lot of sanding. Remember, some coverings adhere differently to the glue on the wood, instead of the wood itself when the heat of the iron is applied, and you could end up with a strange finish if too much glue is left on the wood.

(6) Cut the hinge slots into both pieces and temporarily mount the hinges. Finish sand the assembly on a flat surface and round off the leading edge. Then, sand the taper shown on the top view into the rudder with a sanding board. Finish sand with the 220 grit paper and set it aside.

Fuselage:

The sides that you have precut, along with the formers as shown, are large enough to accommodate any of the 05/075/15 size motors available. There are also some in-line gear reduced motors now marketed by Graupner and Pica/Robbe that will fit without additional work. The fuselage as shown, is large enough for 14-cell packs if the servos are mounted behind former F-4. Even if you have no plans to use the larger packs, it is a good idea to put the servos there because you will then have much more room available to mount the rest of the equipment.

The Slick features a canopy hatch to facilitate access to both the motor and the speed controller, as well as a bottom hatch for quick removal of the power pack. There is no structural integrity loss, because cross-grained sheeting has been added under the wing mount to keep the fuselage stiff. You may also find it convenient to make a smaller hatch under the servos in the event you want to service one of them. One of the prototypes has such a hatch that is held in place by the ironed-on covering. If need be, the covering can be slit and the hatch opened.

Prior to starting construction of the fuselage, glue F1 and F2 together with the grain of one rotated 90° from the second one. Then, carefully sand in the taper shown on all sides for a proper fit when the nose is pulled together. The sanding template required to obtain the round fuselage shape can be made from light cardboard, such as a business card.

(1) Pin one precut side to the board and pin and glue the 3/16" sq. stringers to it as shown. Be certain that the longer stringers butt the side edges. Glue in place formers F3 and F4, using a square to obtain the required 90° angles. Glue in place the two 1/2" triangle pieces and the gusset behind F4.

(2) Pin down the other side, and pin and glue in place the 3/16" sq. stringers, 1/2" triangles, and the gusset.

(3) Stand the first side on the two formers and butt the other side to it at the formers' positions. Rubber band or tape the assembly together and check the fit very carefully. Pull the tail sections together to be certain that the alignment will be accurate and that you will not be building in a crooked tail. When you are satisfied, glue the formers to the second side.

(4) Build the hatch from 1/16" sheet and 3/16" sticks. Since the top of the fuselage is still open, you can check the hatch fit to be certain that it is correct. Position, and glue in place, the 1/32" ply hatch latch as shown while you still have access from the top. Hold the hatch in position with masking tape and cross-grain plank the area under the wing mount. The sides will not bulge out now while the nose and tail areas are completed. An alternate method would be to tack glue in place temporary braces.

(5) Sand the taper into the 3/16" stringers as shown in the top view. Keep in mind that the rear of the fin goes all the way down to the bottom of the fuselage. It is a little more difficult to mount the fin this way, but it is a lot stronger than simply gluing it on top.

(6) Put a scrap piece of 5/32" material in place where the rudder will go, pull the two sides together and clamp in place. Cut, fit, and glue in place the top and bottom 3/16" sq. crosspieces on both sides of F4 and to the rear of F4.

(7) Fit and glue in place the 1/8" x 5/16" ply crosspieces for the hatch screw mount and both servo mounts, using your servos to

properly space the mounts. Sheet the fuselage top with cross-grain 1/16" balsa.

(8) Preglue all sides of the F1/F2 former and let dry. Position this double former in place in the nose and pull in the fuselage sides to meet the former. Clamp, rubber band, or tape the sides into this position and very carefully check your fit to be sure that there is no side thrust and that there is 5° of down thrust. Once you are satisfied, seep in enough thin glue to hold the formers in place.

(9) Once the glue has set, remove the clamps, etc., and check the fit. If the alignment is not perfect, now is the time to cut it apart and repeat step #8 above. If you are satisfied, butt sand the nose with 80 grit paper. Fit and glue in place the 1/8" canopy plywood mounting plate.

(10) Glue in place the 1/4" thick top nose/canopy plate. Temporarily, insert a sheet of plastic behind the 1/32" ply hatch latch plate, so the top will not be glued back further than required. Drill through the 1/8" ply plate with a 1/16" bit from the bottom so that the sheet metal mounting screw will be centered. Screw in the screw from the top to hold the hatch in place.

(11) Sheet the bottom of the nose area with cross-grained 1/16" balsa as shown. Fit and glue in place the 3/32" doublers in the wing mount area and trim to fit the wing cutouts already formed in the sides.

(12) Fabricate the two servo pushrods from hard 1/4" square balsa. Use the threaded end for the clevis at the control horns and a shorter piece for "Z" bends at the servos. Cut the slot in the fuselage side for the rudder pushrod. Hook up both the stabilizer and the rudder. Temporarily plug in the servos and check for centering and the proper throws. The stabilizer should move as far as possible and the rudder 1" each way.

(13) If you prefer to use an antenna tube, now is the time to install it. Drill the holes for the two 3/16" wing hold-down dowels, but do not glue them in place. Sheet the bottom of the fuselage with 1/16" sheet cross-grain. If you prefer to use a servo hatch, it must be constructed at this time.

(14) Sand the fuselage to the shape shown on the section views. Use the template for most of the fuselage except where

Continued on page 190

Slick Motor Glider

Continued from page 109

the nose is tapered to fit the spinner. Do most of the rough shaping with a sanding block with 60 grit paper and the final shaping with 120 grit.

(15) Cut the canopy block as shown and glue on the small 1/32" ply latch plate which keeps it in position at the front end. Temporarily mount the motor with the two screws, fit in the small support underneath it, and glue in place.

Final Assembly And Finishing:

(1) Place the fuselage on a flat surface and secure it so it will not move. Mount the stabilizer to the fin and then position the fin into the fuselage rear to check the fit. Place a flat ruler across the wing saddle and align the fin/stabilizer assembly so the stabilizer is perfectly parallel to the wing saddle. Assuming that you have the fin perpendicular to the stabilizer, glue the fin in place. Remove the stabilizer and run an extra bead of glue at the fin fuselage joint to form a fillet. You may also want to form a more pronounced fillet with wood filler.

(2) Final sand the whole model using 220 grit paper and then 320. Take the time to look carefully and even use some filler if required to be certain that the finish will be as nice as you want it to be. Position the ailerons in place with the hinges and finish the controls. The throw should be 3/8" in both directions.

(3) Cover everything with your choice of material. The prototypes were covered with Coverite's 21st Century and Hobby Lobby's Oracover. Cut through the covering material on the rudder and the ailerons and glue the hinges in place. Cut the slots into the wing and fin and assemble the parts, keeping the air gap to an absolute minimum.

Equipment Installation And Flying:

(1) Keep in mind the balance point when installing the equipment. The receiver, its batteries, the controller, and the power pack can all be mounted with Velcro-type material. The material will adhere better to the balsa if you first spread a thin layer of glue on the wood to form a hard skin. You can also glue some 1/32" ply to hold the Velcro and to hold the switches as well.

(2) I strongly suggest that you use some kind of motor control, either an electronic throttle or an on-off type. Flying is much more enjoyable, and certainly a lot safer, if the speed can be controlled. Simply turning on the motor and letting the model fly until the batteries run down, heats up the batteries and the motor which can cause premature wear, failure, or both.

(3) Prior to powered flight, check that the servos are operating in the proper direction and try some test glides. Test by throwing it straight out, not up, and do not throw it too hard so it won't balloon and stall. Reposition the equipment as required to get a long flat glide.

(4) To obtain optimum results from your motor, be certain that the battery pack is fully charged before you fly. Many chargers advertise a 15-minute charge cycle and, in fact, have a 15-minute timer. In reality, you will find that a discharged pack is rarely fully charged in 15-minutes, particularly one that is rated at 1500 mAh or more. The easiest way to be assured of a peak charge is to use a Peak Detection Charger which automatically fully charges the pack and then shuts off. If one is not available, monitor the voltage charge rate with a digital meter, and stop the charge when the voltage peaks and starts to drop. At that point, the pack is fully charged and will give you the best performance.

(5) If you are a newcomer to aileron controlled flying, it might be a good idea to get some experienced help for the first flights. Having someone else do the launching will give you a little more time to react. Either way, be certain to launch it straight out as was done with the test glides. When in doubt, a good rule of thumb is to launch it at the horizon. When the time has come, launch the Slick under full power directly into the wind. Let it continue to climb straight out at a shallow angle with very easy turns until it reaches a few hundred feet of altitude. At that point, try some mild aerobatics and different speeds until you feel out the controls.

(6) When you set up for the landing, don't let it slow down too much and lift the nose or it might stall, drop a wingtip and drop in. The Slick likes to fly, so keep it moving until you flare it for the landing, just as it is ready to touch down. Good luck with your new bird, I am sure that you will like it!