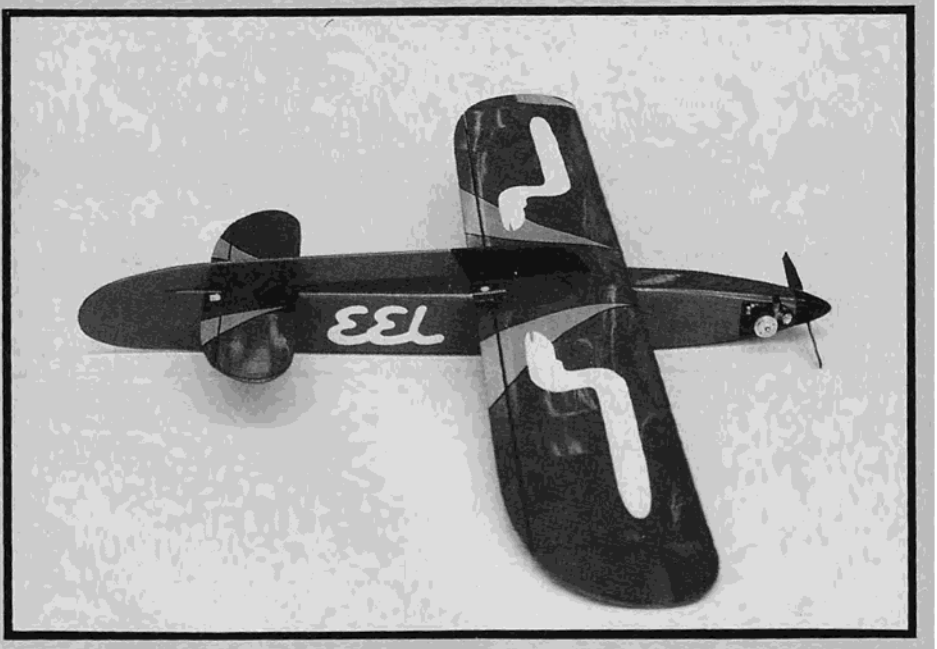
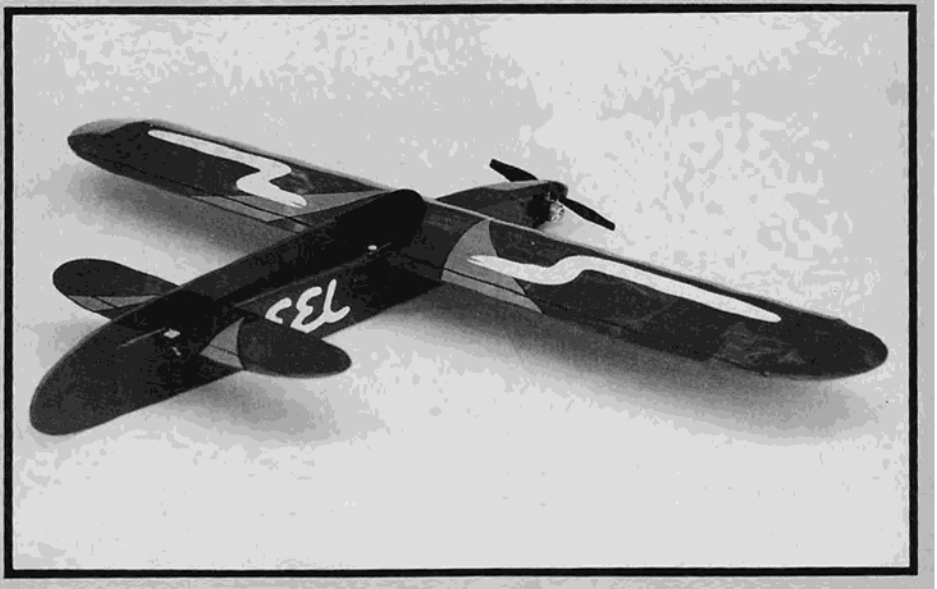
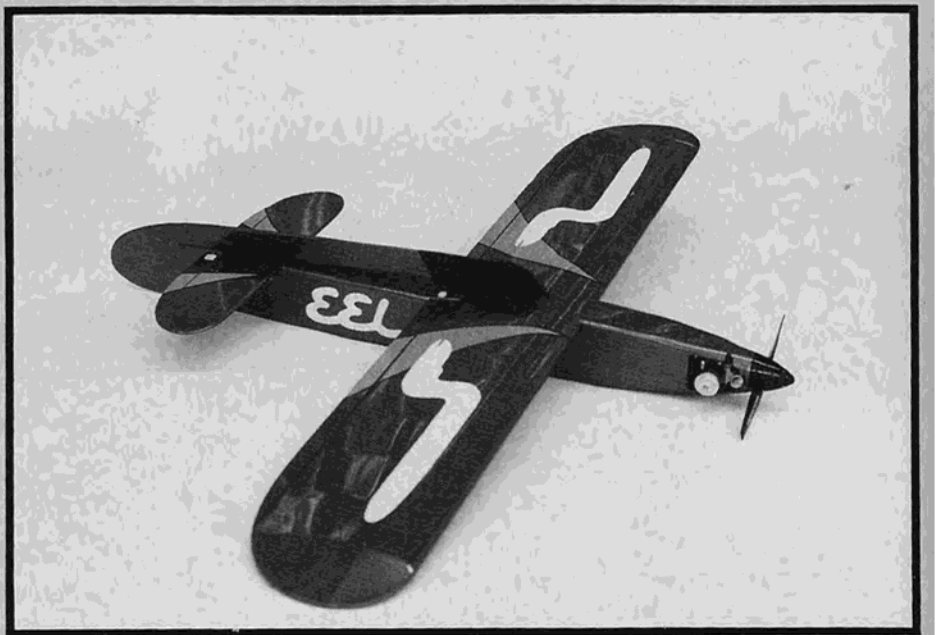
EEL

A FLYING FISH? . . . WELL, CLOSE BUT NOT QUITE.

By Bruce Tharpe

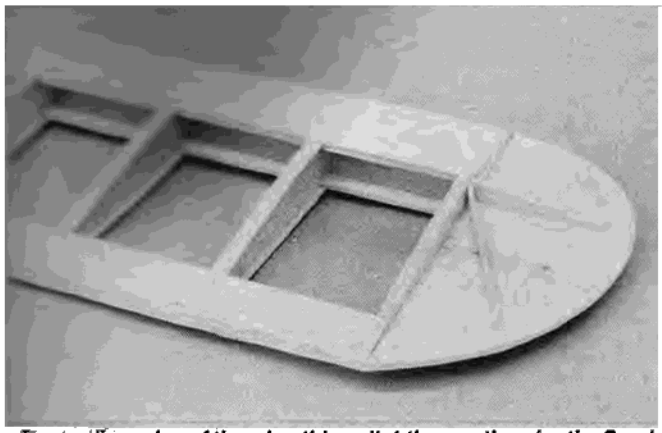




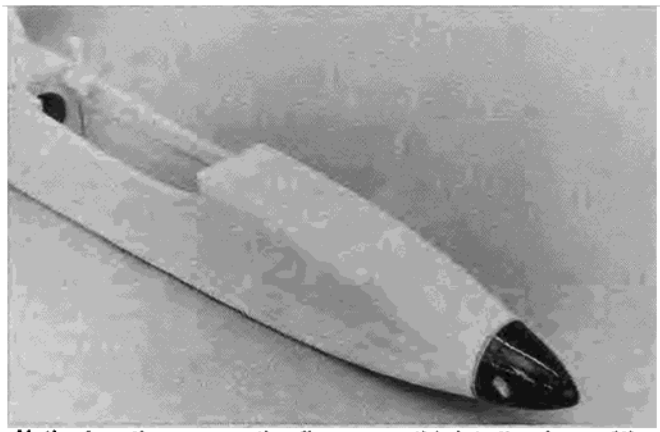


EEL
Designed By:
Bruce Tharpe
TYPE AIRCRAFT
Sport
WINGSPAN
40 Inches
WING CHORD
6¼ Inches
TOTAL WING AREA
240 Sq. In.
WING LOCATION
Shoulder Wing
AIRFOIL
Symmetrical
WING PLANFORM
Constant Chord w/Ellip. Tips
DIHEDRAL, EACH TIP
0
OVERALL FUSELAGE LENGTH
24½ Inches
RADIO COMPARTMENT SIZE
(L) 6¼" x (W) 1¾" x (H) 2"
STABILIZER SPAN
14 Inches
STABILIZER CHORD (incl. elev.)
3½ Inches
STABILIZER AREA
44 Sq. Inches
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
NA
VERTICAL FIN WIDTH (incl. rud.)
NA
ENGINE SIZE
.049-.10
FUEL TANK SIZE
2 Oz.
LANDING GEAR
NA
REC. NO. OF CHANNELS
2 or 3
CONTROL FUNCTIONS
Elev., Throt., Ail.,
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa — Spruce
Empennage	Balsa
Wt. Ready To Fly	26 Ozs. (1 Lb. 10 Ozs.)
Wing Loading	15.6 Oz./Sq. Ft.



The trailing edge of the wing thins slightly near the wingtip. Sand the aileron to match.



Notice how the nose section flows smoothly into the shape of the spinner. Protect the spinner with masking tape while sanding.

The similarities between fish and aircraft are obvious. Both require streamlining to move efficiently through their respective "fluids." Both require stabilizing surfaces and the ability to change direction in three dimensions. In support of this comparison, aeronautical texts quite often include a drawing of a fish when first broaching the subject of airfoils or drag reduction.

So the next logical question for philosophical and aeronautical free thinkers everywhere has to be: "How come airplanes don't look like fish?" Okay, so maybe that **isn't** the logical question, but it was a subject that I pondered during at least one point in my life. Think about it — plenty of planes have been named after fish, but they don't really look like their namesakes. Douglas was pretty heavy into fish, and came the closest with their Skyray, which does resemble the manta ray after which it was named. However, they blundered badly with their dolphin, which had no snout, and their Skyshark which lacked teeth. Curtiss tried putting shark teeth on P-40's, but forgot the gills. The Minnow pylon racer was painted the wrong color, and the Barracuda home-built has the wrong fin shape. Neither the Fairey Swordfish or the Martin Marlin have a point.

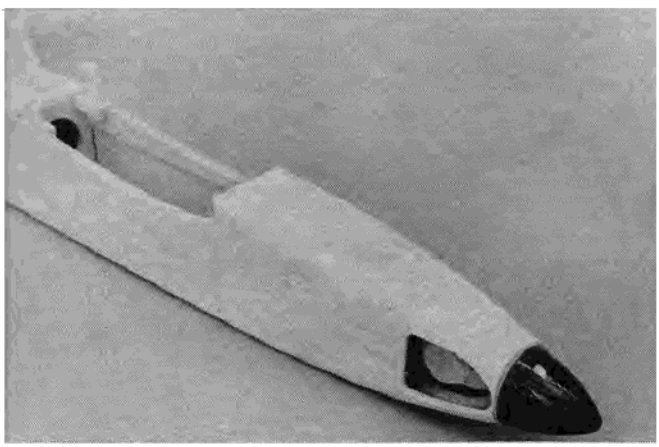
You might be thinking that I don't have a point either. Well, maybe not, but it was that kind of thinking that made me decide one day to design a model that really looked like a fish. Since the obvious quite often escapes me (just ask my flying buddies), I didn't think about a common flying fish until well into this project. Ah, too easy anyway. Why, you ask, did I choose the eel? The idea sprang from another self imposed, philosophical debate, during which I asked myself: "Does a vertical stabilizer have to extend above or below the fuselage to work?" Reasoning that **any** side area on an airplane aft of the C.G., be it fuselage or fin, contributes positively to directional stability, it seemed possible to design a model without a traditional vertical stabilizer. The idea was to simply extend the fuselage and fin aft, rather than up. The resulting doodles and sketches looked like an eel, and the rest is aeromodeling history. (Thank goodness.)

Does it really look like an eel? Not exactly, but with the right kind of flexible imagination, I think one can certainly see more than a passing resemblance (can't one?). Not surprisingly, all of my flying buddies concluded that my new plane definitely looked more like a dogfish than an eel. Now, I really don't know exactly what a dogfish looks like, but I didn't like the connotation. Oh well, that's what "buddies" are for!

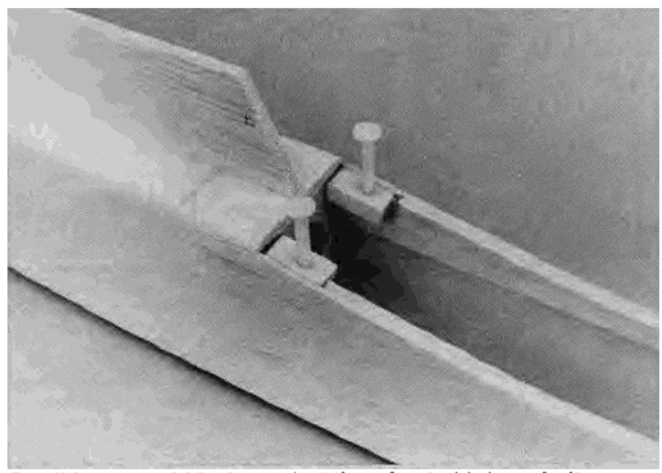
CONSTRUCTION PRELIMS

The Eel is a pretty simple design, and most modelers who feel capable of flying the airplane are almost certainly capable of building the airplane. Like any good construction article must do, you are hereby implored to use only the lightest wood and components in the model. The beauty of scratch-building is the fact that **you** get to pick the wood.

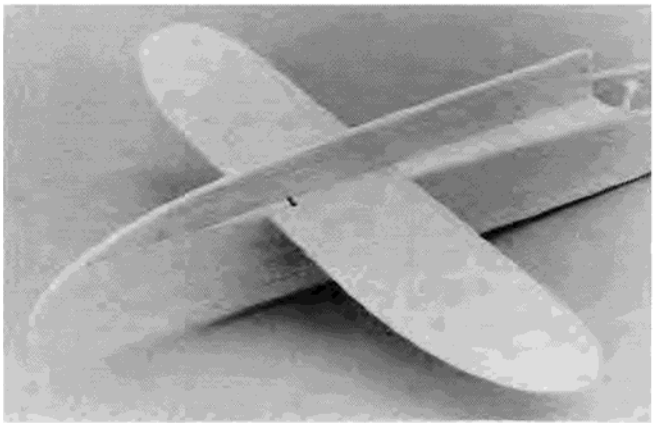
You also need to make a few decisions before starting, like what engine and radio to use. Engine-wise, I think it would be tough to beat the Cox T.D. .09 used in the prototype. It's cheap, powerful, and lightweight. At a total weight of 26 ozs., a stock Cox .09 provided outstanding vertical performance. However, if you fly where noise is a problem, you may want to go with an O.S. .10 with a muffler. Some modelers



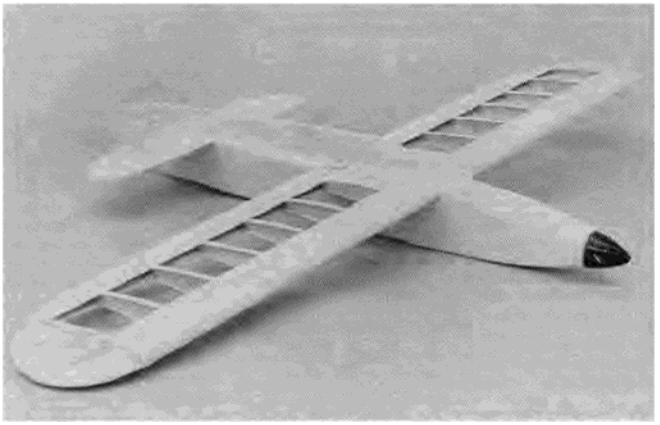
The engine cut-out reveals the previously mounted Cox .09 crankcase. The cut-out must be large enough to remove the engine and the mount. Protect the engine area with several coats of dope.



Small basswood blocks accept the wing hold-down bolts.



Ultra simple tail surfaces. Note the small gap in the top fuselage sheeting which provides clearance for the elevator joiner wire.



Bare bones model, ready for covering. A good sanding effort here will pay off with a smooth covering job.

may insist on throttle control, but remember: you'll be adding complexity and the weight of a servo to the model (assuming you can find room for the servo!). The prototype Eel used Futaba S-33 micro servos and a 250 mAh battery pack, and there wasn't much room left in the radio compartment. You'll definitely need small radio equipment.

Some builders may insist on adding landing gear, especially if they must fly from hard surfaces. The Eel was designed without landing gear to make it lighter, faster, simpler, sleeker, and less expensive. Eels generally like water, but I recommend sticking to soft grass for a landing area without wheels.

Wing:

The wing construction technique was borrowed — well, stolen — from a Joe Bridi kit that I built years ago. The basic procedure is laid out on the plans, so only a few extra comments are needed. After the top sheeting and capstrips are in place, the wing is flipped over and pinned to the building board upside down, this time using 1/16" shims under the leading and trailing edges (extra capstrip material works nicely). If your building board is straight, your wing will be straight.

Notice that the two outermost wing ribs (W-2's) are shaved away slightly on the bottom. This gives the wing a tiny bit of washout, and serves to thin the trailing edge at the tip. The 1/8" balsa wingtips should match the thickness of the trailing edge at the W-2 ribs.

The ailerons are made by cutting 1/4" off the trailing edge of standard 1/4" x 1" trailing edge stock. This results in thicker, stiffer ailerons that blend into the airfoil. After cutting the curve in each aileron, you can sand their bottom surfaces to match the thinning trailing edge at the wingtip.

Fuselage:

Start the fuselage by cutting the sides from 3/32" balsa and adding the 1/8" sq. balsa longerons and 3/8" triangle stock in the nose area. Join the two sides to F-2 and F-3, making sure that the sides are square with the formers. When dry, add F-1 and join the sides at the rear.

Positioning the spinner ring can be a real pain; but if you use a Cox engine, you can cheat like I did. Simply remove the cylinder, piston, and needle valve assembly; cover up the holes with some tape; then bolt the remaining "engine" in place on the model. Now you can slap a spinner on the engine and use it to line up your plywood spinner ring. Go ahead and leave the engine in there — you'll get it back later!

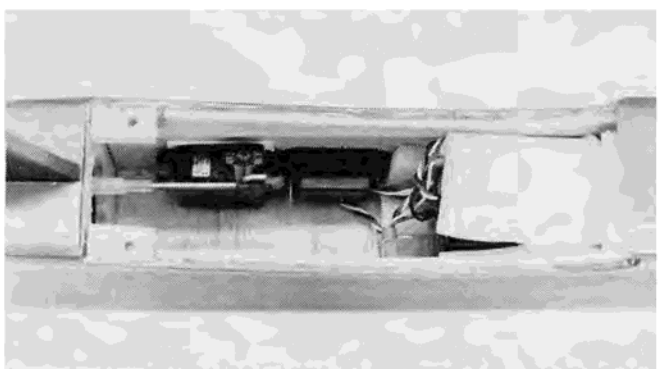
The cross-grain top, bottom, and nose sheeting can now be added. Be sure to leave a spot open in the top sheeting for the stabilizer. Round off all the corners, paying particular attention to blending the nose area into the spinner contour.

After mounting the wing to the fuselage, temporarily tack glue the canopy to the wing and the fin pieces to the fuselage. Sanding these parts together while installed on the model insures that they'll line up later when glued on permanently.

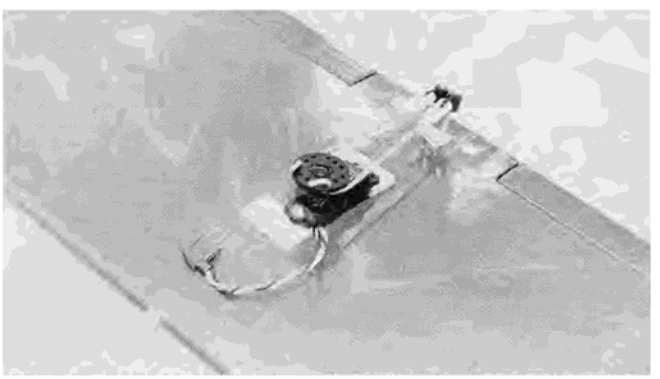
Finishing, Radio Installation, and Pre-Flight:

I like to cover all the major pieces first, then assemble with CA glue. Of course, the covering material must be carefully removed at the glue joints. One tip that I can pass along for the Eel is to leave a short (1/16") flap of excess material hanging from the aft end of both fuselage sides. After the fin assembly is glued in place, this excess material can be ironed down to the fin, completely hiding the glue joint. Incidentally, I hinged the control surfaces with half-size Sig Easy Hinges and covered my model with eel-like charcoal MonoKote.

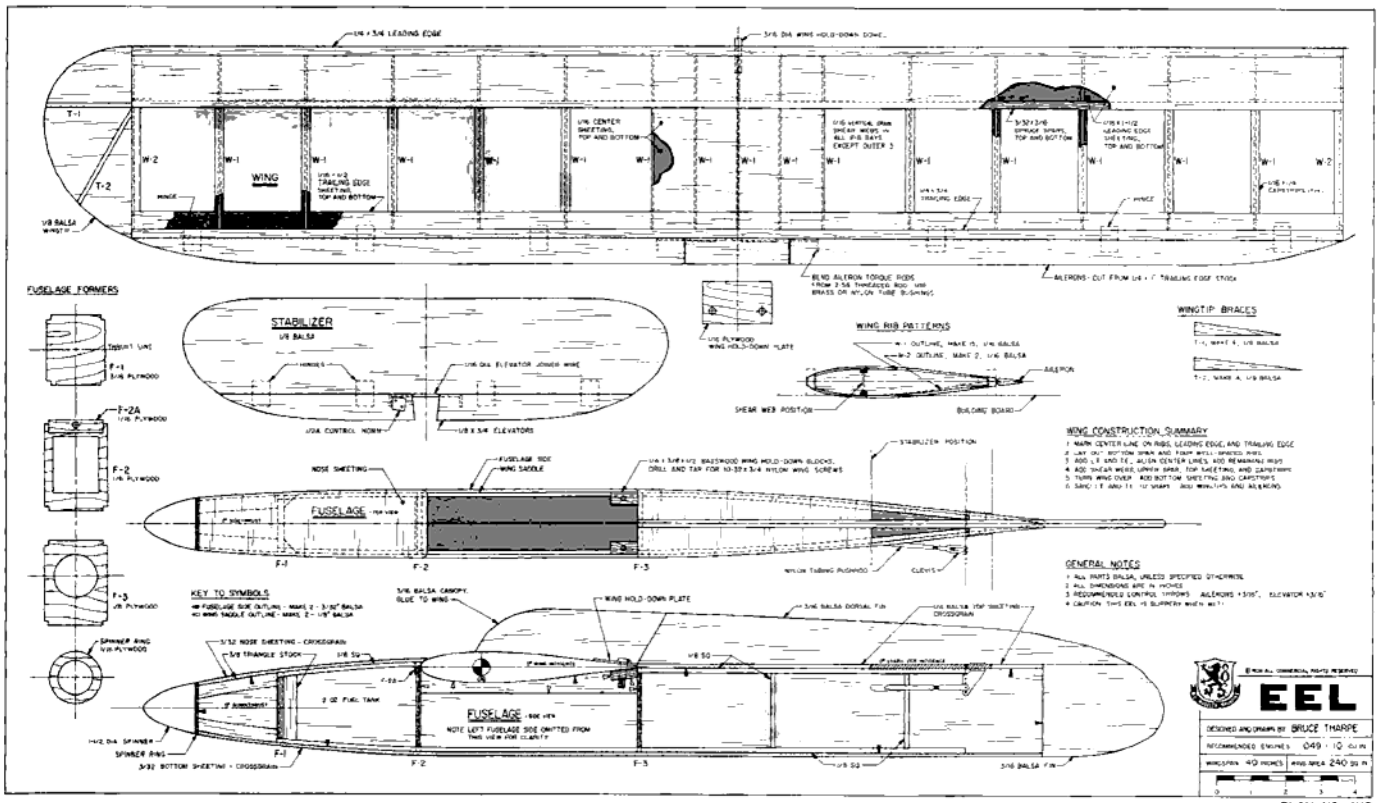
The radio compartment in the Eel is tight! The receiver and battery in the prototype were wrapped individually in foam rubber and stacked on top of each other just behind F-2. The elevator servo was mounted with servo tape to the left side of the model, and the aileron servo was mounted just to the right of the center wing rib. Staggering the servos this way prevents the separate linkages from interfering with each other. Don't bother with an extension cord for the aileron servo; simply plug the servo lead directly into the receiver when assembling the model at the field. Try to mount the switch so that you can't turn it off accidentally during a hand launch. The antenna is always a problem on small



Radio installation in the fuselage. Servo tape works fine on small models, and was used on the elevator servo shown here. The elevator is hooked to the servo with a nylon tubing pushrod.



The aileron servo and the torque rods have been offset from center to avoid interfering with the elevator pushrod in the fuselage. The aileron servo wire can be plugged directly into the receiver when the model is assembled for flight.



models — all you can do is run it to the back of the model and let the rest dangle behind. Don't be tempted to wrap up the excess inside the model!

Be certain that your Eel balances at the point shown on the plan. There isn't much room for error on a model this size, so add weight if necessary to balance correctly. The recommended control throws for the ailerons and elevator are shown on the plan.

Flying:

Time for some fun! I admit to being a tad nervous before the big test flight, but once this fish got airborne, all I could say was, "Holy mackerel!" (Sorry.) The Eel is fast, smooth, and neutrally stable in pitch and roll — it goes where you point it. Directionally, the Eel is very stable, with no evidence of fishtailing (sorry again, but I had to throw that in there). When the engine quits, the Eel will glide in for a smooth landing from any reasonable altitude or attitude, and slows down without floundering (I can't stop!).

Get someone else to hand launch your model the first few times. Later, when you're used to the model, you'll easily be able to launch it yourself. Launch the Eel fast and level and you should have no problem. Like any small model, it's wise to keep it in fairly close just so you can see it easier. The 2 oz. tank doesn't last too long with a .09 or .10, but the action is fast and furious! Towards the end of the run, keep the model relatively high so that you have some time to plan your glide path.

If this is your first small, aerobatic model, you're in for a treat. You only have two channels to play with, but most maneuvers are simply combinations of loops and rolls anyway. The Eel won't snap or spin without a rudder, but that hardly reduces the amount of satisfaction derived from the sheer simplicity of the model.

One last note: Be sure to clean the model well after each flight. There's nothing worse than trying to launch a slippery **Eel**!

List of Materials

2 — 1/16" x 1/4" x 36" Balsa — Capstrips
2 — 1/16" x 1/2" x 36" Balsa — T.E. Sheeting
3 — 1/16" x 3" x 36" Balsa — L.E. & Center Sheeting, Shear Webs, Ribs
2 — 3/32" x 3/16" x 36" Spruce — Wing Spars
3 — 3/32" x 3" 36" Balsa — Fuselage Sides, Nose and Bottom Sheeting
3 — 1/8" sq. x 36" Balsa — Fuselage Stiffeners
1 — 1/8" x 3" x 36" Balsa — Stabilizer, Elevators, Top Sheeting, Wingtips, Wingtip Braces, Wing Saddles
1 — 3/16" x 3" x 36" Balsa — Canopy, Dorsal Fin, Fin
1 — 3/16" dia. x 1" Dowel — Wing Hold-Down Dowel
1 — 3/8" Triangle x 36" Balsa — Corner Braces
2 — 1/4" x 3/4" x 36" Balsa — Leading Edge, Trailing Edge
1 — 1/4" x 1" x 36" Balsa T.E. — Ailerons (Cut to 3/4" wide)
1 — Scrap 1/16" Plywood — Spinner Ring, F-2D, Wing Hold-Down Plate
1 — Scrap 1/8" Plywood — F-2, F-3 (Lite-Ply okay)
1 — Scrap 3/16" Plywood — F-1
1 — Scrap 1/4" Basswood — Wing Hold-Down Blocks
1 — Scrap 1/16" Music Wire — Elevator Joiner
2 — 10-32 x 3/4" — Nylon Wing Bolts

Miscellaneous:

Engine, Engine Mount, Propeller, 1½" dia. Spinner, 2 oz. Fuel Tank, Small Fuel Line, Mini Strip Aileron Torque Rods, 1/2A Control Horn, Elevator Pushrod (of your choice), Hinges, One Roll of Covering Material, Radio with Mini Servos and Small Receiver Battery. □