

UNDERTAKER

Here is an airplane designed to help you put away your racing opponent for good (or at least until he builds an Undertaker of his own). This machine, like an Indy Formula One, is designed for all-out racing. The lines are clean and all drag producing items have been cut to a minimum. From the 1/2A Foremost engine mount and laminar flow wing (64,A012) to the triangular fuselage and enclosed linkages, this aircraft is built to race. It won't disappoint you.

The birth of the Undertaker resulted from a sudden desire to compete and the creative thinking of the racing team's chief design engineer, Mike Edmonds. In my 27 years of modeling, I have been a Saturday flier with brief periods of combat and pattern competition. Several months ago, members of the Mid State RC Club (Louisiana) started 1/2A racing, and the bug bit me too. All I could think about for several days was racing. Having previously worked on original designs, I decided to try again. Two weeks later, Mike had two prototypes put together, one ready to fly and the other ready for me to paint. I supplied the engine mounts, fuel tanks, and built the tail surfaces (Mike is the faster builder).

Thursday, after work, was the day chosen for the trim flights. As the Undertaker accelerated out of the launch, it was immediately apparent that I had a very fast, tail heavy aircraft with too much control deflection. After 15 seconds of attempted control, I rolled inverted and applied down elevator. The engine finally quit after three quick outside loops and I sighed with relief as the aircraft slid softly onto the grass.

A quick trip to the shop shifted the C.G. 1/4" forward and cut down all control throws. The next flights were pure joy with arrow straight flight and very sharp high speed turns. Power off glides are deceptively fast because of the large speed differential between powered and gliding flight. A little care must be taken to slow down for landing until the flier is familiar with the Undertaker's characteristics.

After our trim flights, we took the Undertaker to the club field the following Saturday. The pylons had



Author's daughter Amy (7) likes to show off dad's airplane.

Bill Of Materials

- | | |
|--|---|
| 1 — 1/8 x 3/16 x 36 Balsa — Wing Trailing Edge | 1 — Foremost 1/2A Racing Entire Mount |
| 2 — 1/8 x 4 x 36 Balsa — Fuselage Sides | 1 — 1 oz. Sullivan Round Fuel Tank |
| 1 — 1/8 x 3 x 36 Balsa — Fuselage Bottom | 7 — Small Polypropylene Hinges |
| 1 — 1/4 x 3 x 3 Balsa — Fuselage Bulkhead | 3 — 4-40 Socket Head Bolts & Blind Nuts for Engine Mount |
| 2 — 1/16 x 3 x 36 Balsa — Wing Sheeting | 1 — Ace High Performance Needle Valve TD .049-.051 |
| 3 — 1/16 x 4 x 36 Balsa — Wing Ribs, Sheeting, Empennage, Cap Strips | 1 — 2-56 Screw & Nut for Hatch Retainer |
| 2 — 3/16 x 3/8 x 36 Balsa — Wing Leading Edge, Turtle Decking | 1 — Goldberg Small Control Horn for Elevator |
| 1 — 1/8 x 1/4 x 36 Balsa — Wing Front Strip | 1 — Set 1/16" Music Wire and Brass Tubing for Aileron Linkage |
| 1 — 1/8 x 1 x 36 Balsa — Wing Spar | 1/2 Roll Monokote for Wings |
| 1 — 1/8 x 1 x 10 Balsa — Wing Tips | Finishing Materials for Fuselage & Empennage |
| 1 — 3/8 x 36 Balsa Triangle Stock — Fuselage Stiffeners | Small Two-Channel Radio |
| 1 — 2 x 2 x 4 Balsa — Canopy | Tornado 5/4 Prop |
| 1 — 1/8 x 2 x 2 Plywood — Firewall | Cox TD .049-.051 |
| 1 — 1/64 x 6 x 30 Plywood — Empennage, Fuselage Doublers | |

Built around Foremost's 1/2A engine mount, this pylon racer was designed to help you do away with your competition
By Milton R. Sanders and Mike Edmonds

UNDERTAKER

Designed By:

Mike Edmonds & Milt Sanders

TYPE AIRCRAFT

1/2A Pylon

WINGSPAN

31 1/2 Inches

WING CHORD

6 1/2" Avg.

TOTAL WING AREA

202.3 Sq. In.

WING LOCATION

Mid-Fuselage

AIRFOIL

Symmetrical

WING PLANFORM

Double Taper

DIHEDRAL EACH TIP

3/8" (flat across top)

O.A. FUSELAGE LENGTH

27 Inches

RADIO COMPARTMENT SIZE

(L)9" x (W)2" x (H)2"

STABILIZER SPAN

10 Inches

STABILIZER CHORD (incl. elev.)

3 1/8" (Avg.)

STABILIZER AREA

31.25 Sq. In.

STAB. AIRFOIL SECTION

Flat

STABILIZER LOCATION

Top of Fuselage

VERTICAL FIN HEIGHT

3 1/4 Inches

VERTICAL FIN WIDTH

2 3/4" (Avg.)

REC. ENGINE SIZE

Cox TD .049-.051

FUEL TANK SIZE

1 Oz. round

LANDING GEAR

None

REC. NO. OF CHANNELS

2

CONTROL FUNCTIONS

Aileron & Elevator

BASIC MATERIALS USED IN CONSTRUCTION

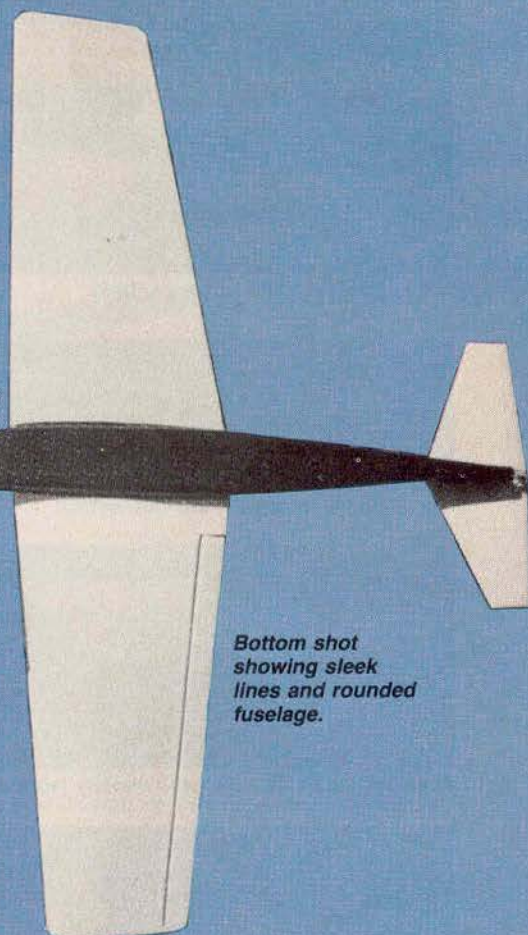
Fuselage	Balsa & Ply
Wing	Balsa
Empennage	Balsa & Ply
Wt. Ready To Fly	18.5 Oz.
Wing Loading	14.2 Oz./Sq. Ft.

just been set up and a few guys were waiting for more to show up to race. Mike and I answered a few questions and noted some smiles from the guys for our original design, but did not get a great deal of interest. Never having flown around the pylons before, I flew one practice flight, characterized by extremely wide turns and comfortable altitudes. The guys were not impressed by my flying and decided to have some fun teaching me what racing was all about.

They got out their planes and fueled

up before I could get in another practice. We opened a few eyes that day by taking three firsts, a second, and a zero. The second came when the canopy came off and slowed us down. The zero happened when a friendly competitor knocked us into the ground with a mid-air during launch, but our well-built aircraft showed no damage. With my turns getting tighter and altitudes lower, we gained some respect and felt we had a good showing for the first time out. Our second contest, racing against very fast competition, gave us six outright wins and a 1/2-second finish behind a plane disqualified for three pylon cuts.

The Undertaker takes a little more time to build than a standard GLH or Quickie, but the time and effort spent can give you a real competitive edge. Mike designed the fuselage dimensions to fit the minimum rules and squeezed the radio in later, putting priority into the aerodynamics. The racing engine mount fits nicely into the fuselage.



Bottom shot showing sleek lines and rounded fuselage.

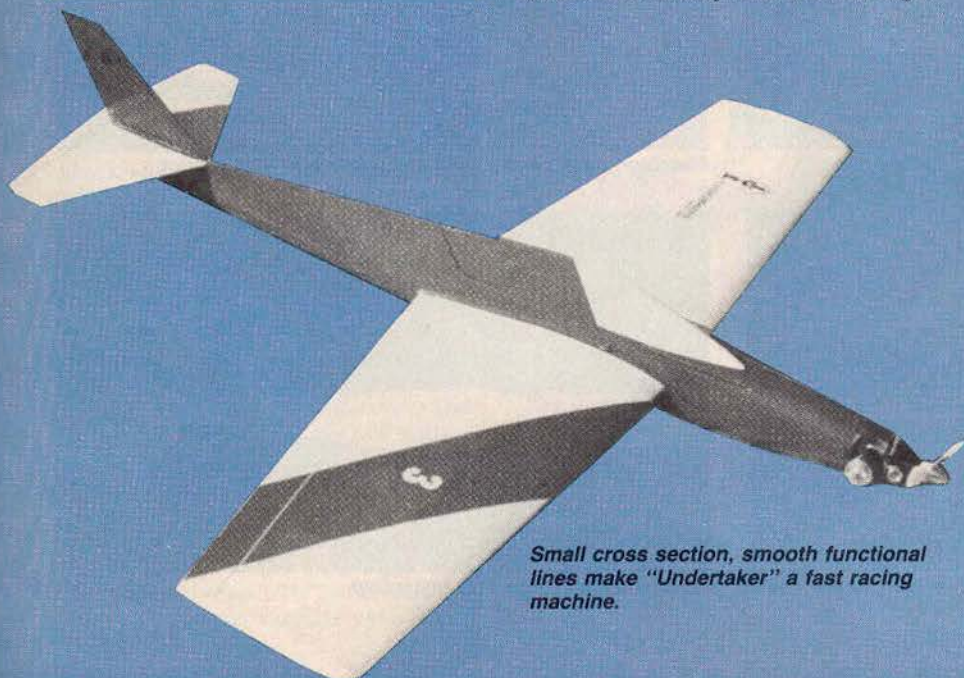
The triangular fuselage meets the width and depth requirements but keeps the surface area and cross section at a minimum for drag considerations. The canopy has a sharp leading edge similar to the Convair F-102 and F-106 jet fighters. The laminar wing has a low drag "bucket" at small angles of attack. This allows higher speed on the straights and comparable, if not better, turns with other aircraft. The wing is also double tapered for better penetration, stability, and flying qualities. The flying surfaces have relatively sharp leading and trailing edges to decrease drag in high speed flight. Mike and I are highly pleased with the design and have built five of them in a month and a half (not for necessity, but pleasure and a desire to win). I think you will be pleased with yours too.

Construction

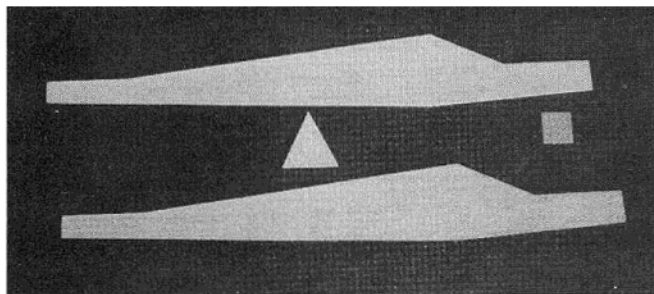
Wing:

Cut out the ribs using the plan as a guide. Take time when making the main spar as this is a major alignment piece. Begin building the wing in the inverted position by gluing the ribs to the spar and upper trailing edge planking. Next attach the leading and trailing edge balsa taking care to ensure a straight wing.

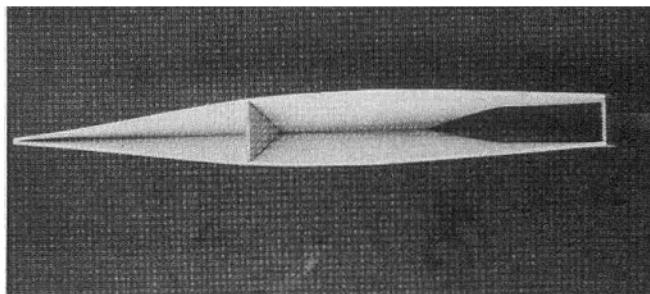
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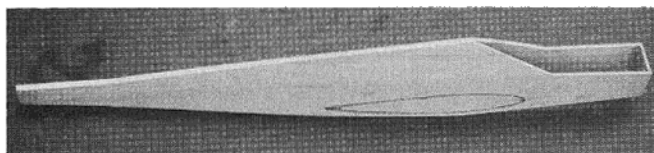
Small cross section, smooth functional lines make "Undertaker" a fast racing machine.



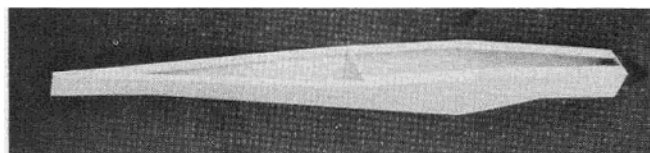
Basic fuselage parts — very simple.



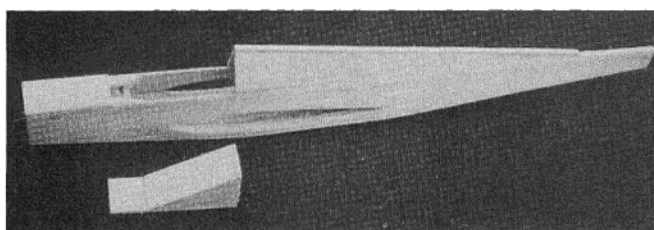
For proper shape, fuselage has to go together in this order.



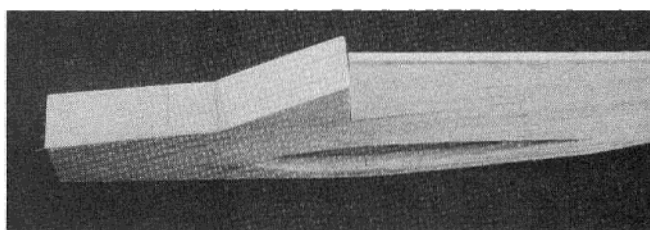
Top view showing wing cut-out outline.



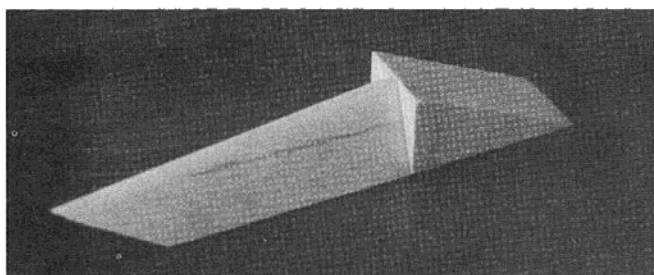
Load bearing structure added to fuselage.



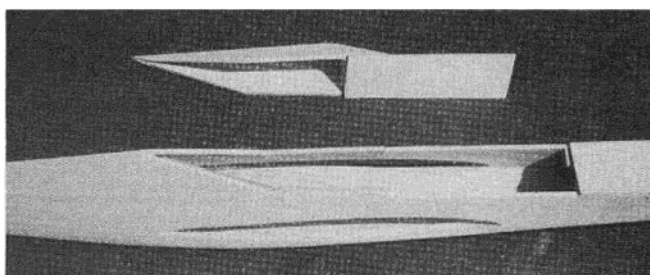
Fuselage ready for hatch and canopy fabrication.



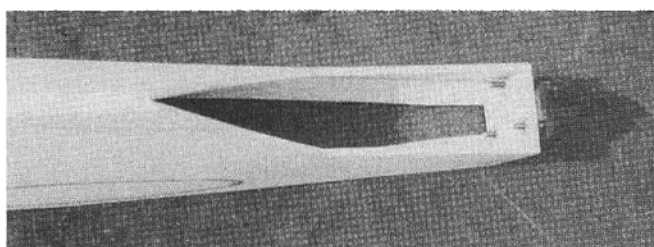
Canopy blocks in place ready to carve.



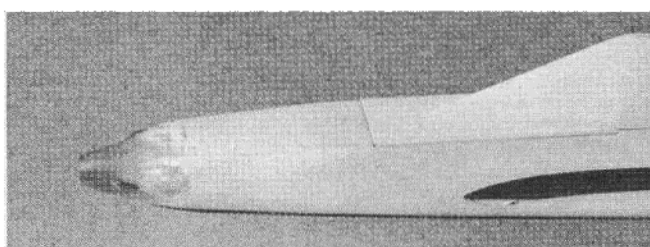
Canopy glued to rear hatch turtleneck, ready for carving.



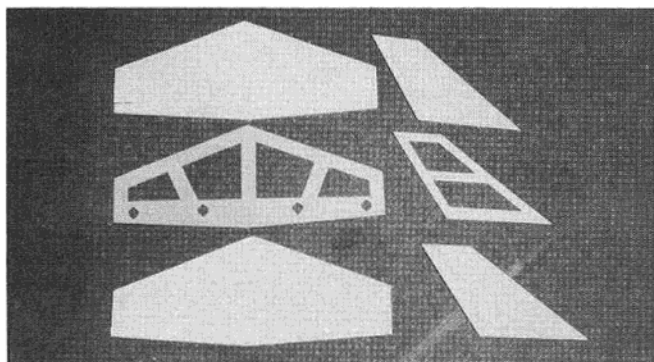
Hatch completed, note plywood doublers used as a lip around hatch cut-out.



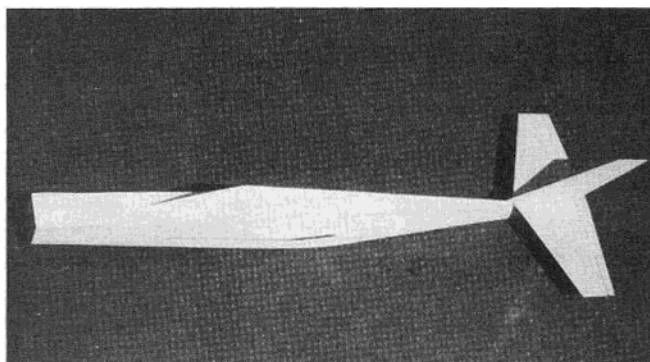
Fourmost 1/2A mount bolted into place.



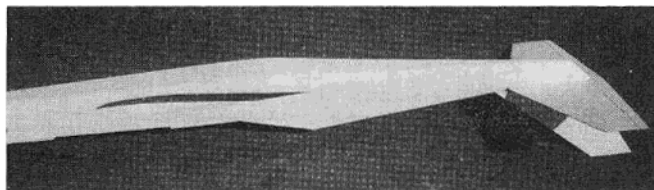
Fuselage nose sanded and shaped into engine mount.



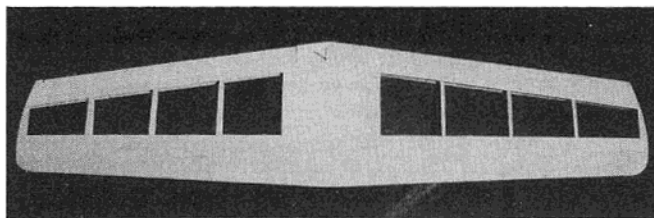
Empennage parts ready for assembly. The Klett hinges were cut off to match the slots shown in the stabilizer.



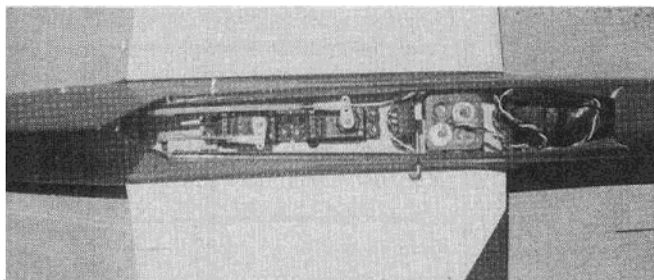
Completed fuselage with tail group.



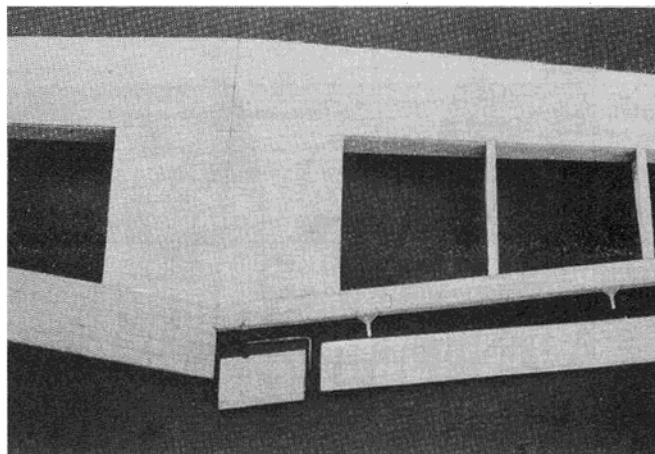
Bottom view of completed fuselage/tail.



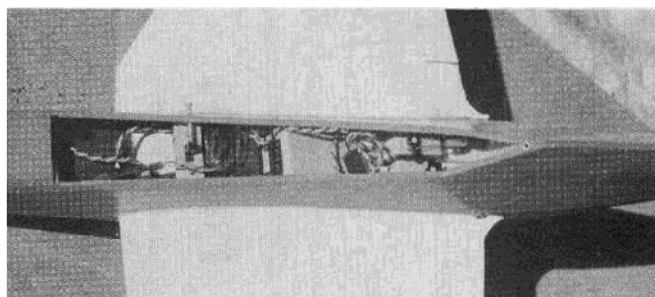
Completed wing structure ready for covering. Easy to build, yet light and strong.



Plenty of room for tandem servo installation: Futaba S-20's, Heath 3 channel, Motorola batteries.



Aileron, linkage, hinge, and trailing edge detail.



KPS-18 servos side-by-side with KPR-7L receiver and Motorola batteries --- all in the wing.

I use Hot Stuff on everything but the firewall and some of the wing sheeting as this cuts assembly time and provides a very light, but strong, airframe. The basic wing structure is now complete and the remainder adds strength and planform.

Carve and sand the leading edge to a triangular section and plank the top forward surface of the wing with a single sheet of 1/16" balsa. Taper the trailing edge and add the bottom trailing edge planking, followed by the top center section planking. Plank the bottom leading edge and center section of the wing. A single piece of 1/16" balsa can be used for the leading edge planking if it is soft enough. Hot Stuff it at the spar, apply Titebond along the ribs, and Hot Stuff the planking at the leading edge, making a strong, fail-safe wing. Cap strip the ribs, then finish sanding the trailing edges. Add the wing tips and sand everything to the proper contours. Fill the ends of the trailing edges with scrap balsa before sanding.

Cut out the right aileron, then cut out the right inboard trailing edge (the piece left from the aileron to the center line). Face the aileron with a 1/8" sq. balsa insert for hinging. Install the aileron linkage as shown on the plans, then glue the trailing edge back on permanently. Fill the openings in the trailing edge and aileron with scrap 1/16" balsa. Fill the inboard aileron section with hard

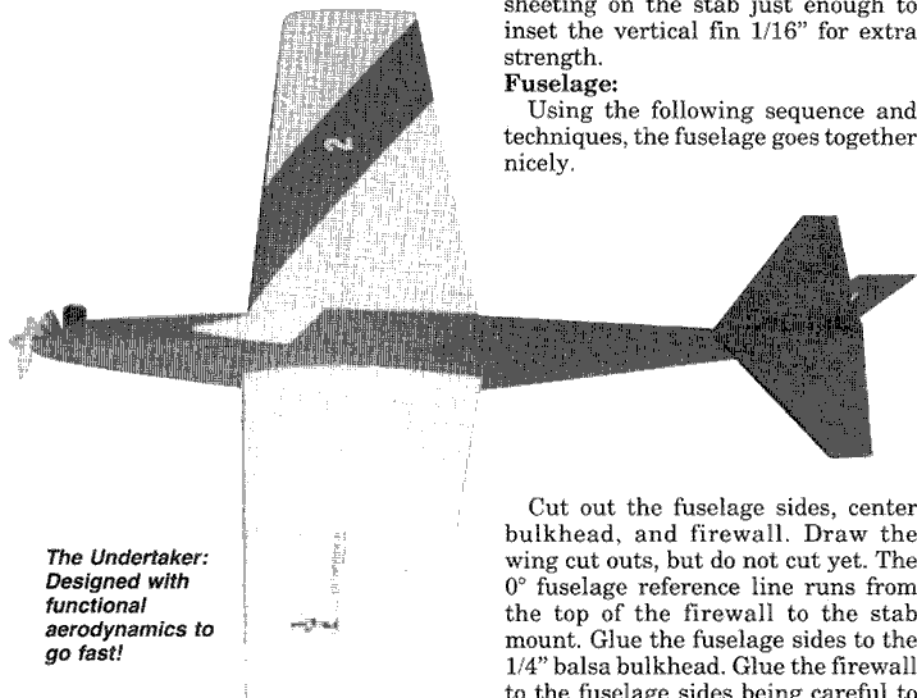
balsa or spruce as a suitable mount for the torque rod in the aileron. Install small hinges and glue with Hot Stuff. Reinforce the forward hinge attachment with baking soda and Hot Stuff. Finish sand the entire wing and cover with MonoKote or your favorite finish.

Tail Surfaces:

Cut out the basic outlines from 1/64" ply. Hot Stuff the 1/16" balsa over the plywood and sand to sharp edges. The plywood helps keep the edges even and straight without chipping. Cut off and hinge the elevator after the stab is sanded to shape. Cut through the top sheeting on the stab just enough to inset the vertical fin 1/16" for extra strength.

Fuselage:

Using the following sequence and techniques, the fuselage goes together nicely.



*The Undertaker:
Designed with
functional
aerodynamics to
go fast!*

Cut out the fuselage sides, center bulkhead, and firewall. Draw the wing cut outs, but do not cut yet. The 0° fuselage reference line runs from the top of the firewall to the stab mount. Glue the fuselage sides to the 1/4" balsa bulkhead. Glue the firewall to the fuselage sides being careful to maintain alignment (no side thrust, 0° - 0° wing and tail).

Use epoxy on the firewall. When dry, glue the sides together at the tail.

Next glue the top of the fuselage turtle deck together. Add the 3/8" triangular stock from the firewall bottom to the center bulkhead, using two pieces on each side because of the bend in the fuselage. Carve and sand the entire bottom smooth and flat, then add the 1/8" balsa bottom. I used medium soft balsa and did it in one piece for strength, grain lengthwise.

Install the motor mount with 4-40 socket head screws and blind mounting nuts. Make the wing cut outs and temporarily fit the wing. Carve and sand the bottom corners of the fuselage to minimum width (2 1/4") and blend the fuselage smoothly with the motor mount. Add the fuel tank and plumbing at this time. Bring both the fuel feed and vent lines through the middle of the firewall. Grind away enough of the motor mount so the brass tubing will clear the engine. The fuel feed should supply the engine from the right or bottom side.

When you install the engine, reverse the needle valve assembly so the needle valve sticks up and won't break on every landing. Add the 3/8" triangular stock behind the firewall at the top. Don't forget to use epoxy at the firewall. Install the nose planking back to the hatch line. Remove balsa from the fuselage sides in the canopy area as outlined on the plans to prepare the surface for the solid balsa canopy. Sand the turtle deck glue joint flat and glue the 1/4" x 1/4" balsa along the top. Carve and sand to shape. Fit the 3/32" hatch along the top.

Form the solid canopy from a balsa block or Hot Stuff three pieces of 1/2" balsa. Glue the canopy to the turtle deck but not the hatch yet. Now cut the turtle deck along the hatch cut-out lines as shown on the plans. Finish shaping the canopy and glue the canopy and turtle deck portion of the hatch to the 3/32" front hatch. Add bracing as necessary to strengthen the hatch. Install the hatch hold-downs, a lip in the front and a screw, a snap, or velcro in the back. Carve and sand the forward fuselage to contour with the motor mount. A little care here will make a super slick looking nose. Sand entire fuselage. Add 1/64" ply doublers on inside fuselage through the wing area. Let them stick above the hatch cut out 1/16" as a lip to seal the hatch behind the canopy.

Assembly:

Align and install the tail surfaces. Add small fillets between the fuselage and stab for further strength. Fit and align the wing in the fuselage. You will need to cut a small hole in the side of the fuselage to slip the aileron linkage into it. Save the piece you cut

out and glue it in later. Mark the wing position and pull the wing back out. Now is the time to cut out the servo and battery holes in the wing while you can easily get at it. Cutting those holes after wing installation is possible but much harder. I filled and painted the fuselage and tail surfaces before gluing in the wing. That way I didn't have to mask the wing, and the primer was much easier to sand. Install, align, and glue in the wing, adding wing fillets as desired. Make your final finishing touches, numbers, and racing stripe.

Radio:

We used two KPS-18's a KPR-7L miniature Kraft receiver, and a Motorola 175 mah battery on the first airplane. The batteries are small and light (1 oz. total), but at \$5.00 each, a little expensive. The KPS-18's can be installed side by side, but larger servos which we used in the other airplanes (Futaba S-20, Cannon Super Mini, and Kraft KPS-12) must be installed in tandem. Fit the servos through holes cut into the wing sheeting, but leave the spar, leading and trailing edges intact. Other receivers we have used include a Cannon Super Mini, and a Heath 3 channel. The Heath was removed from the plastic case, taped, and padded in foam. Standard linkages and fitting will fit with a little care. A piece of inner Gold-N-Rod makes a nice antenna guide to the rear of the fuselage. Kraft has a short 18" antenna which only protrudes slightly from the rear for a clean installation.

Preflight:

Adjust the engine and check the C.G. Adjust so it's between 1/4" to 1/2" in front of the main spar. Any C.G. aft of that point will give you a big handful of airplane. I suggest a forward C.G. to make the plane more docile until you get used to a hot racer. Check and adjust control movements for the following: elevator $\pm 3/32$ "; aileron $\pm 5/32$ ". Too much control movement will really give you a wild ride and will make you think you have a bad airplane. I speak from experience — 3 1/2 outside loops before the engine shut off. Trim all controls to neutral with the transmitter trim also at neutral. Check servos for accurate centering from both directions. I had an inaccurate one on aileron and rocked back and forth the entire flight. Charge the batteries and head for the field.

Flying:

The Undertaker accelerates smoothly from a two-handed launch (one hand on the fuselage, the other on a wingtip). An overhead launch will get you out of the pits faster but requires practice. For practicing by myself, I can launch it easily

underhanded by grabbing the fuselage behind the wing and tossing it into the air. A small amount of right aileron may be needed to counteract torque. Roll is fast and smooth, and pitch control is very responsive. Have your assistant standing by to adjust the trim for you because you won't want to take your eyes off the model or fingers off the sticks if the plane is very much out of trim.

When trimmed, the Undertaker is very stable and penetrates well. Rolling wings level out of a hard turn, I can take my hand off the transmitter and the Undertaker flies arrow straight until I have to turn for the next pylon. I have also flown in 15-20 knot winds with no problems. The tight turn around No. 1 pylon will water your eyes since the plane hardly slows at all. The speed coming out of #3 will be a joy also as you pass anyone close in front of you. Our TD .051 is turning 19,000 with a Tornado 5/4 nylon prop on standard Cox Glow Power fuel, and 20,000 with K & B 1000. We haven't had time to experiment with a lot of different fuels yet, but I'm sure we can do better as the competition edges a little closer.

We had one problem with the TD needle valve backing out, so we switched to an Ace High Performance TD 049-051 needle valve, which solved the problem and also allowed us to set the needle valve more precisely. Our best prop seems to be the Tornado 5/4, but we are still looking.

We like our airplane's performance and handling qualities. With five of them we are having a ball, especially with the competition going bananas trying to keep up with us. Happy flying and turn left, fast! □

**From
RCModeler
Mar. 1983**