Have you been looking for a docile introduction to the world of RC biplanes but didn't want to give up their heralded aerobatic abilities? Now you can have your cake and eat it, too, with this modern trigeared design.

THE FALL OF 1987 found Cliff Daley dreaming of designing a tricycle-geared RC biplane. The concept was actually the byproduct of some exciting attempts to get a tail-dragger biplane off the ground. His hope was to design a two-winger that would be as easy to handle on the ground as it was in the air.

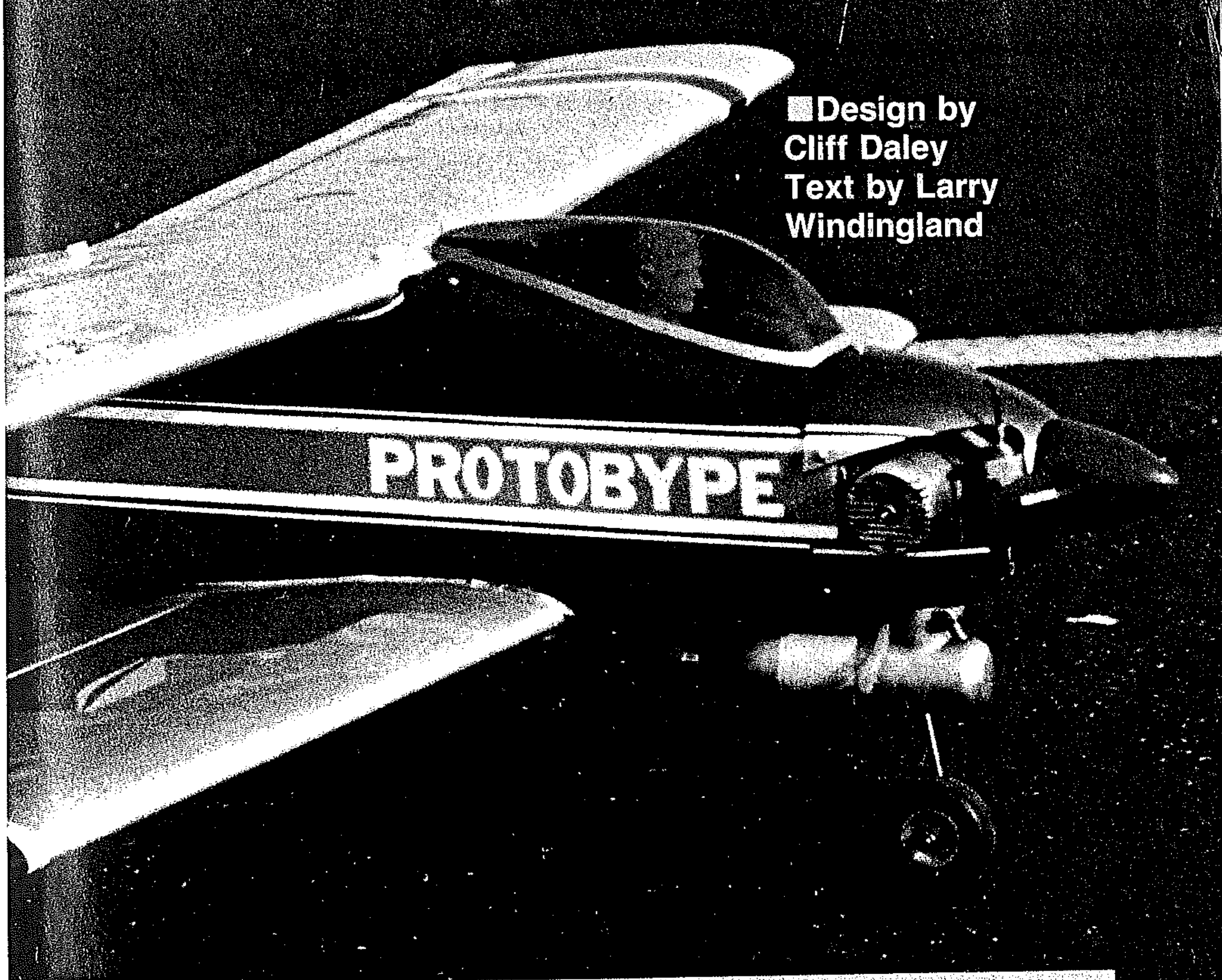
To make his eye happy, Cliff decided on a sleek, modern look; for convenience he wanted a model in either the .40- to .60-size two-cycle or the .60- to .90-size four-cycle engine range. He also wanted it to be easy to build so that it would be an appealing project for the hobbyist who works from scratch, or for the builder who's thinking about trying a scratch-built.

The original drawings were

Big Picture: Built and covered by Cliff Daley, this Protobype still looks great after many hours of flying. Above: Cliff Daley (top) and Larry Windingland had hours of fun tweaking and refining Cliff's original Protobype model design.

completed in October 1987. Cliff and I built and flight tested the initial models in late November. We decided to name the design the Protobype. The initial flights were in the early Illinois winter with the temperatures down in the low 30s. We were chilled to the bone by the time we assembled and checked out the models, but the adrenalin their flying performance generated fired us both up. We spent the winter months refining the design and drawings, and as of this writing have built and flown five Protobypes successfully.

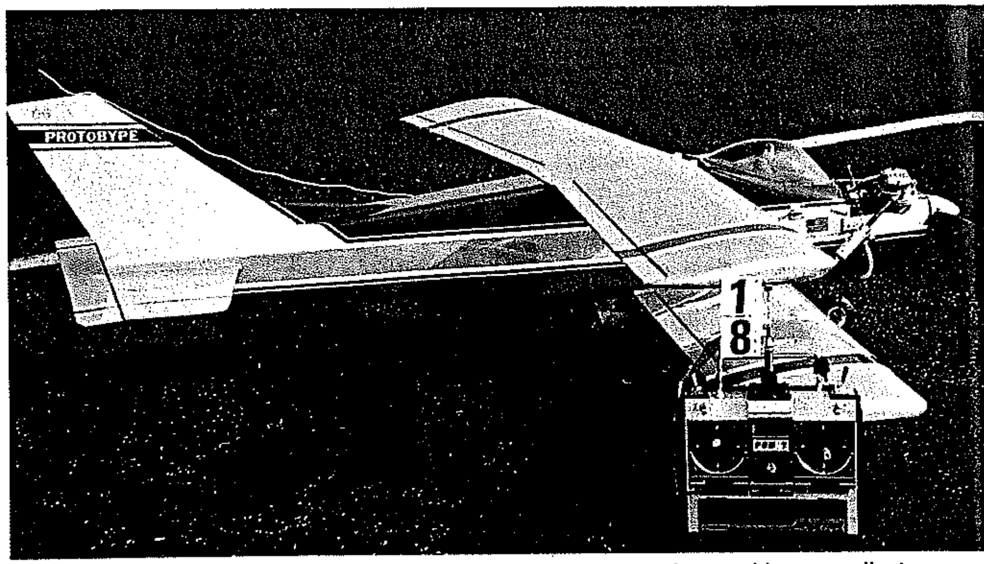
The drawing and construction techniques presented in this article represent the final version of the Protobype. They'll give you a biplane that has easy ground handling and takeoffs, solid, predictable flying habits, and a slow, gentle landing speed. Not only that, but you can really crank on the power and have a highly aerobatic airplane that still remembers its good flying habits. It has the takeoffs, landings, and slow



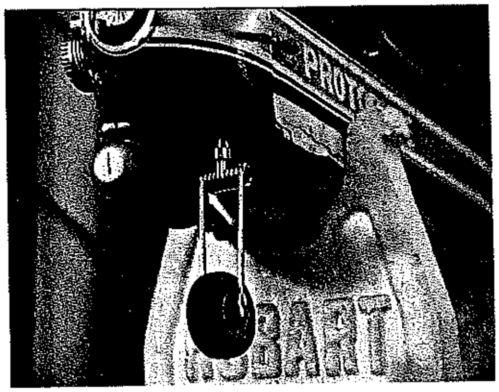
Design by Cliff Daley
Text by Larry Windingland

Protobype

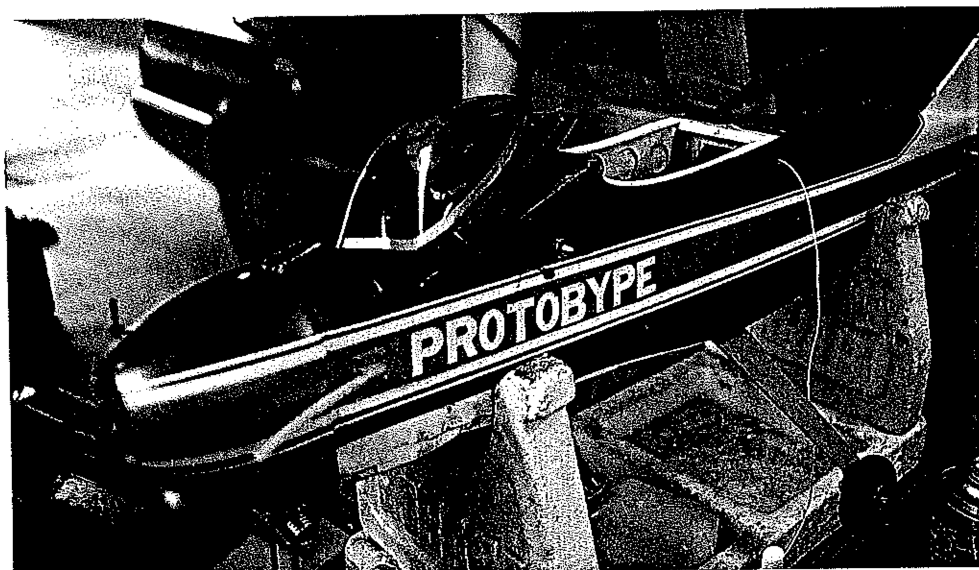
The Protobype shows off its docile handling as it slowly descends onto the asphalt runway at the Champaign Country RC Club field.



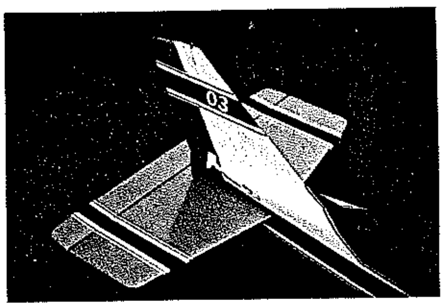
The Airtronics Spectra SP7P radio and the Enya .80 four-stroke engine provide an excellent combination of control features and power to really put the Protobype through all its paces.



The Fults nose gear assists in precise ground control, and it's very forgiving of any not-so-perfect landing you happen to make.



The hatch furnishes easy access to the fuel tank. The current version has the hatch extending up to the back of the firewall. Install the pilot and the canopy last to avoid damaging them.



Simple striping adds much detail. The rudder pushrod exits cleanly just above the stab.

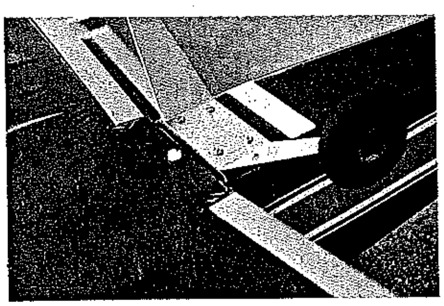
stall speed of a primary trainer, yet it can fly like an aerobatic trainer.

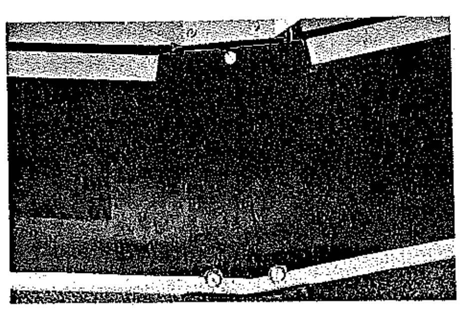
The Protobype requires no interplane or cabane struts to support the wings, which are even interchangeable. An unexpected bonus in this model's way of flying is that the rudder produces nearly pure yaw with almost no noticeable roll coupling. This characteristic makes the plane great for knife-edge flight, axial rolls, and slip practice.

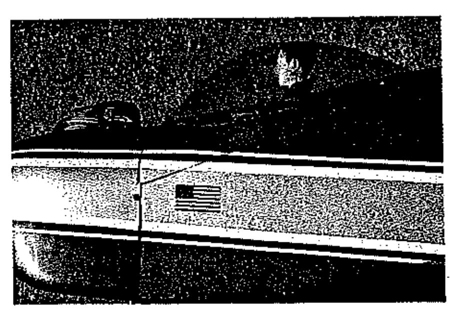
Wing panels. Begin by cutting out all 32 wing ribs, which at this stage are identical (NACA 0015 airfoil). Additional slots in the ribs for the center section spar brace should be cut later. It is recommended that the rib section shown on the plans be used as a template. We cut two ⅛-in. aluminum templates, drilled holes that could be used later for alignment on a wing jig, and placed the $\frac{3}{32}$-in. balsa rib strips between them. The rib strips were bolted together and finish shaped on a belt sander. Notches for the spars and leading edge were then cut with a fine-toothed razor saw.

The following procedure must be done four times—once for each wing panel. Remember to make two right and two left panels. It is recommended that a wing jig such as the A-Justo-Jig or the Great Planes version be used to ensure that the wing is built straight. The procedure outlined here, however, explains how to build the wing without a jig.

Secure the plan sheet to a work surface which is both flat and soft enough to push in pins, and cover it with waxed paper. Pin the ¼-in.-sq. balsa bottom spar to the plans. Place the ribs on the spar above the plans

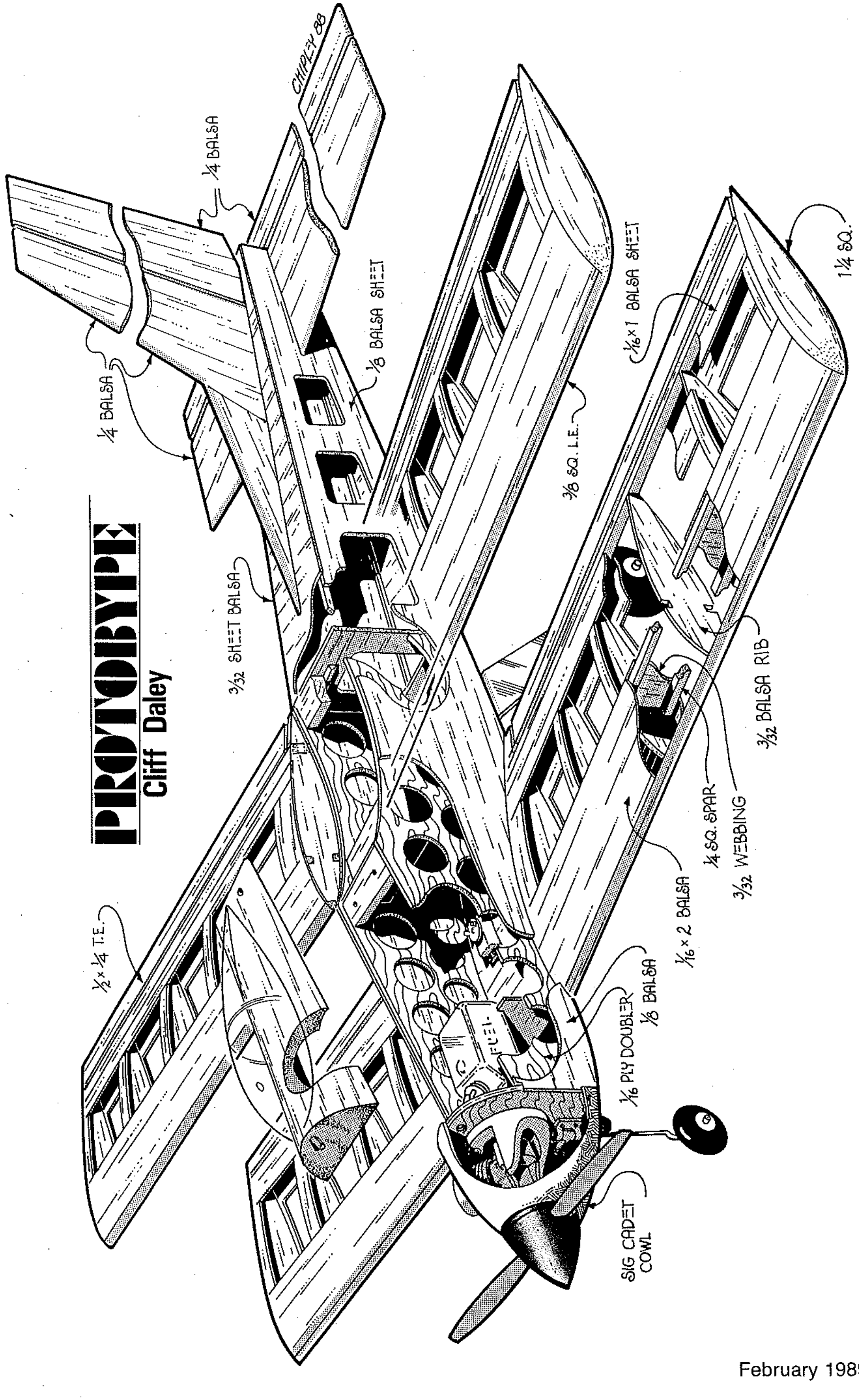


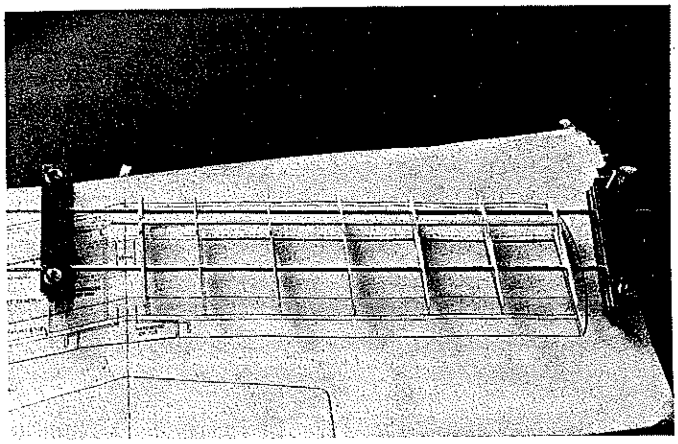


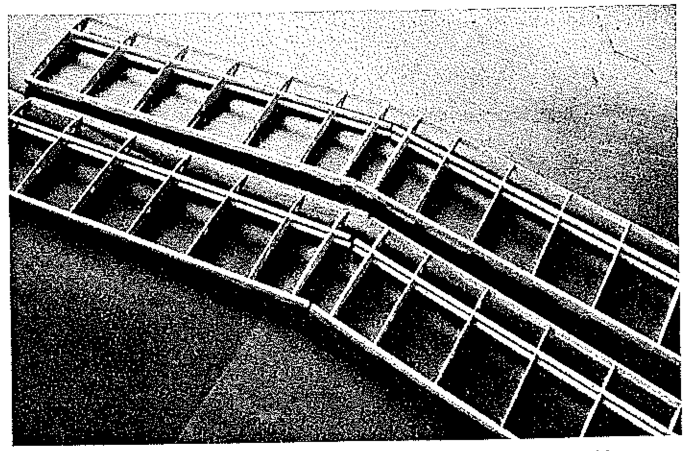


Left: The aluminum main gear is located directly behind the bottom wing. Center: Three nylon hold-down bolts in each wing give ample strength. Right: The long fiberglass cowl from T&D Fiberglass Specialties (text has part number and address) makes a nice, sleek front end.

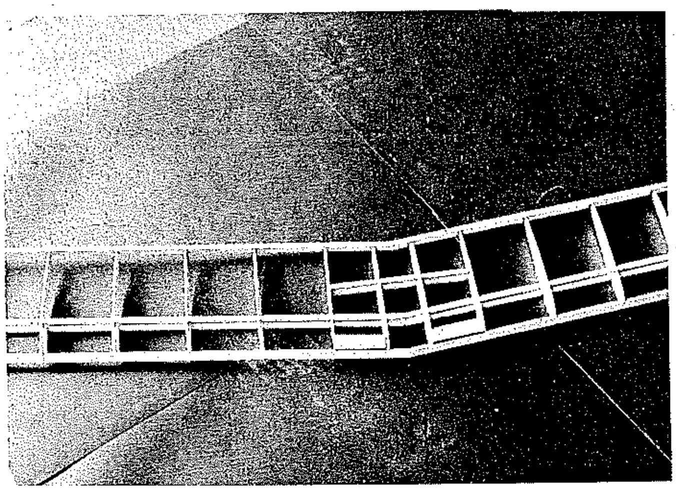
PROTOTYPE
Cliff Daley

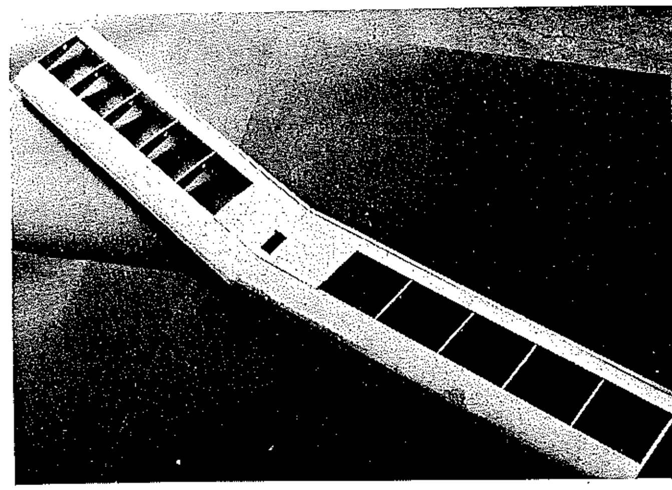




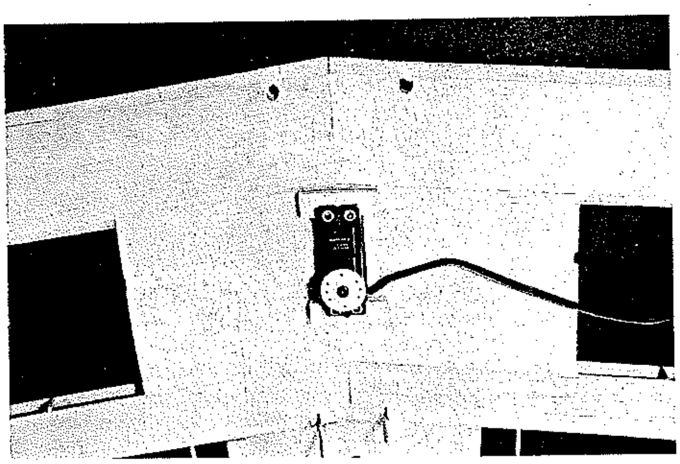


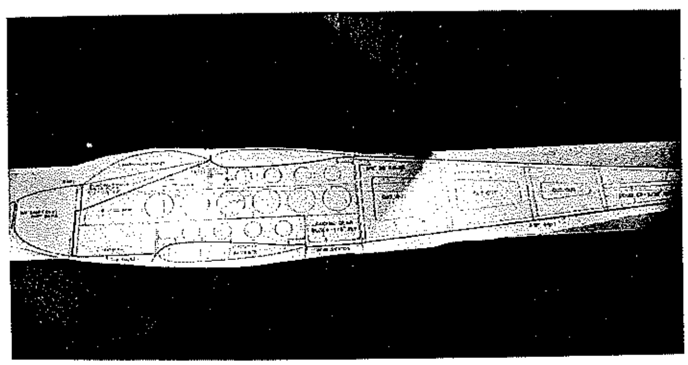
Left: Two right and two left wing panels are constructed over the plans. Using a jig simplifies alignment and gives you the confidence of knowing the wing panels will be free of warps. Right: As seen here, the four wing panels are trimmed and ready to be joined at the center.





Left: Install the center section bracing and wing hold-down fillers prior to sheeting. Right: Glue down the back edge of the leading edge sheeting first. When the glue is dry, wet the sheeting with ammonia and water, apply glue to the rib tops, and press the sheeting down into place.





Left: Small hardwood mounting blocks are used to keep the aileron servos from bottoming out inside the wing. Above: Use Scotch 77 spray to tack the balsa sides and fuselage drawing together. By cutting both sides at once, you can ensure duplicate fuselage sides.

and align. You may want to place a spacer under the rear and front of the ribs to keep them aligned.

Place the top spar in the rib slots, and glue both the top and bottom spar in place using Hot Stuff thin cyanoacrylate (CyA) adhesive. Hold the 3/8-in.-sq. leading edge in place, and glue it to each individual rib, making sure the ribs remain aligned with the plans and that the leading edge stays straight. By a similar method, glue on the 1/2 x 1/4-in. trailing edge.

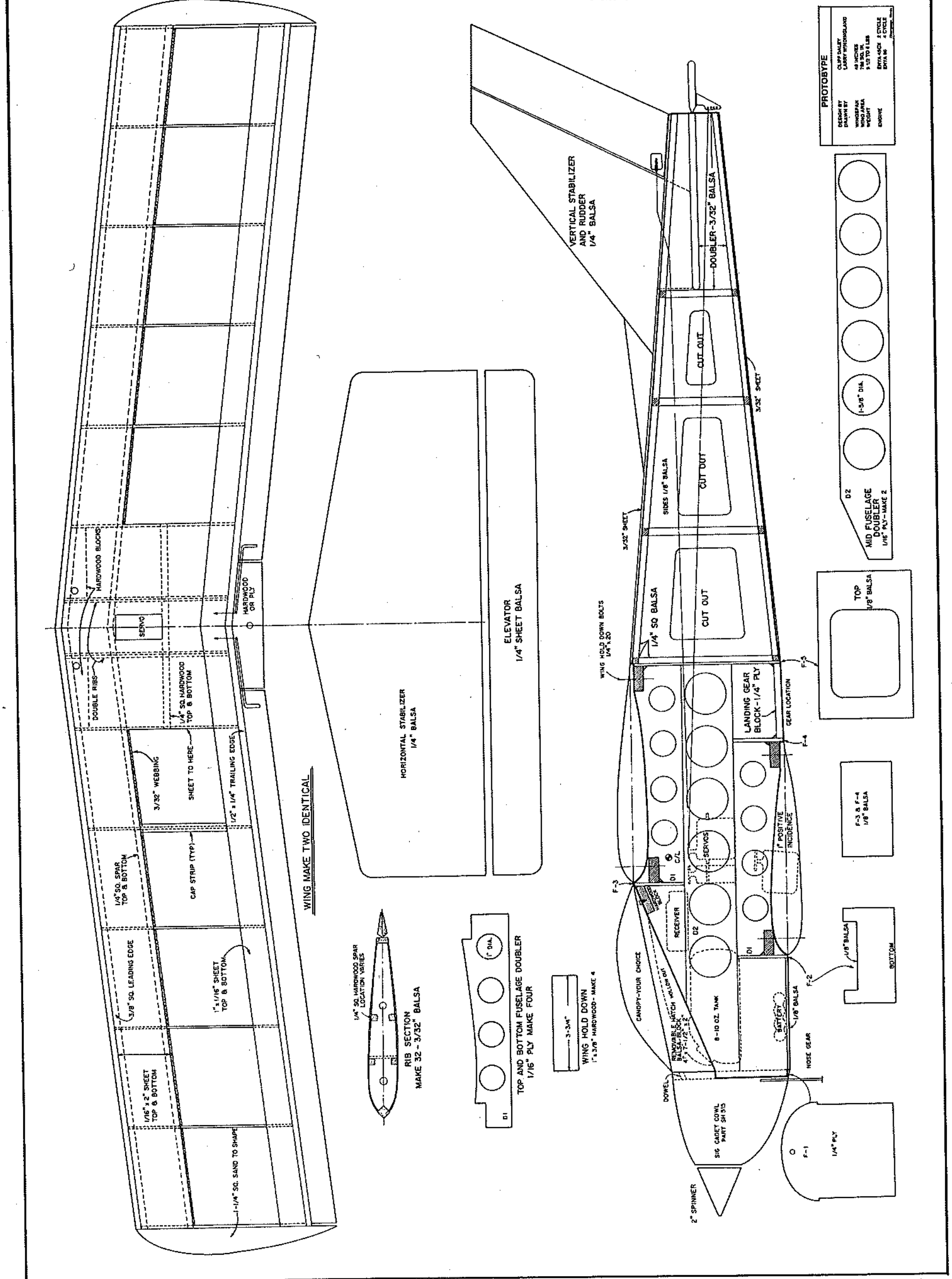
When all four wing panels are completed, trim the center sections where the two wing panels join to the proper angle. We found that cutting the wing with a fine-toothed razor saw along the centerline works great.

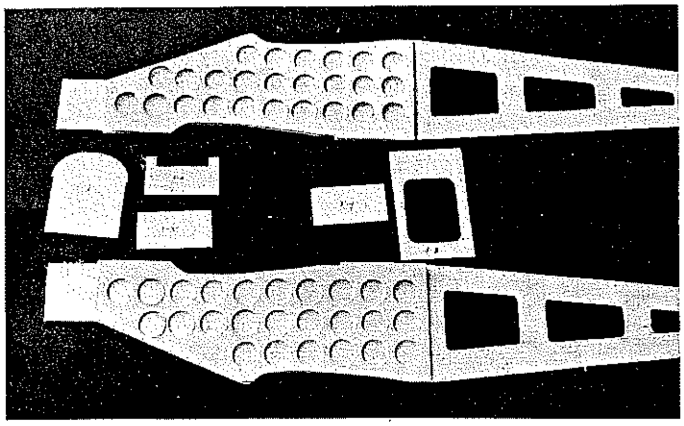
Align a right and left panel over the plans, and epoxy them together at the center joint. Align and position the 1/4-in.-sq. hardwood spar, and cut slots in the four ribs in the center of the wing assembly as shown on the plans. Glue the spar in place (both top and bottom). Note that this center brace will be used as a servo mount, so you should check for the appropriate fit of the servo in the wing prior to cutting.

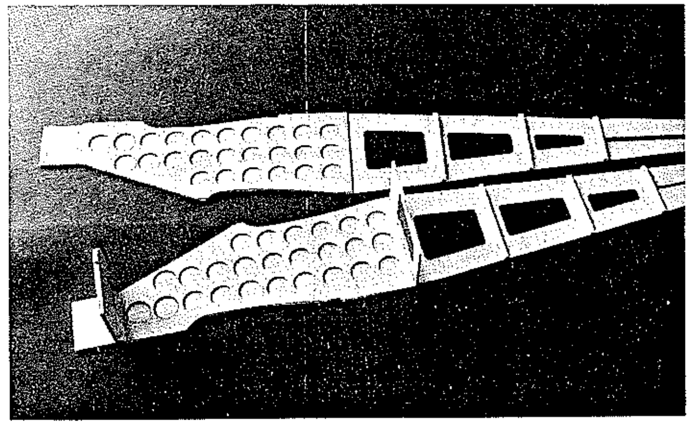
Cut and shape leading edge filler for the wing hold-down bolts. This step will prevent the hold-down bolts from crushing the leading edge sheeting.

Cut the 1/16 x 2-in. balsa leading edge sheeting to shape, and glue one edge to the wing. Wet the balsa with a little ammonia, and then curve it down over the ribs. Butt join and glue the balsa at the center. In a like manner, cut and glue 1/16 x 1-in. balsa trailing edge sheeting. Cut and glue the wing webbing as shown on the plans. Finish sheeting the center section of the wing. Mark the location of the servo so that area can be cut out later. Sand the trailing edge to taper it 3/8 in. for matching to the contour of the ribs and trailing edge sheeting.

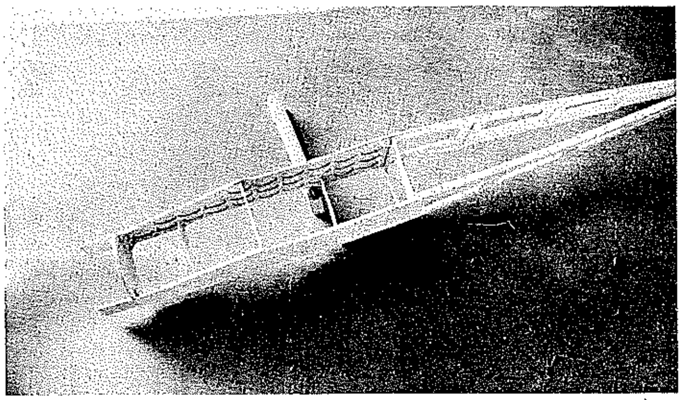
Cut and glue the cap strips (top and bot-

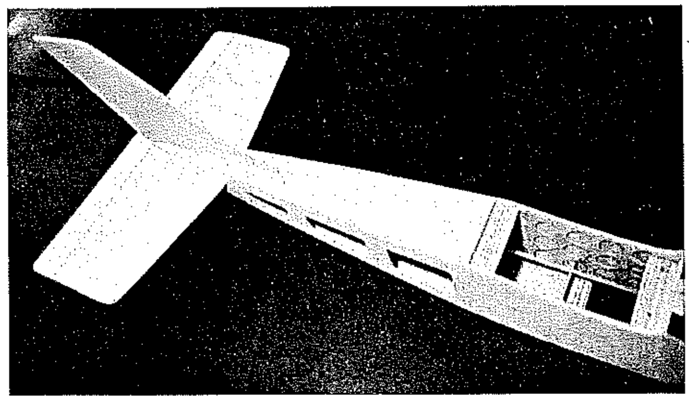

PROTOBYPE
WING MAKE TWO IDENTICAL
HARDWOOD BLOCK
SERVO
DOUBLE RIBS
HARDWOOD OR PLY
1/4" SQ. HARDWOOD TOP & BOTTOM
3/32" WEBBING
SHEET TO HERE
1/2" x 1/4" TRAILING EDGE
1/4" SQ. SPAR TOP & BOTTOM
CAP STRIP (TYP)
3/8" SQ. LEADING EDGE
1" x 1/16" SHEET TOP & BOTTOM
1/16" x 2" SHEET TOP & BOTTOM
1-1/4" SQ. SAND TO SHAPE
HORIZONTAL STABILIZER 1/4" BALSA
ELEVATOR 1/4" SHEET BALSA
VERTICAL STABILIZER AND RUDDER 1/4" BALSA
DOUBLER-3/32" BALSA
CUT OUT
CUT OUT
CUT OUT
SIDES 1/8" BALSA
3/32" SHEET
3/32" SHEET
1/4" SQ BALSA
WING HOLD DOWN BOLTS 1/4"x20
LANDING GEAR BLOCK-1/4" PLY
GEAR LOCATION
F-3
F-4
SERVOS
1° POSITIVE INCIDENCE
C/L
D1
D2
RECEIVER
CANOPY-YOUR CHOICE
8-10 OZ. TANK
BATTERY
1/8" BALSA
F-2
NOSE GEAR
DOWEL
SIG CADET COWL PART SH 515
2" SPINNER
F-1
1/4" PLY
MID FUSELAGE DOUBLER 1/16" PLY-MAKE 2
1-5/8" DIA.
TOP 1/8" BALSA
F-3 & F-4 1/8" BALSA
1/8" BALSA
BOTTOM
1/4" SQ. HARDWOOD SPAR LOCATION VARIES
RIB SECTION MAKE 32 - 3/32" BALSA
1" DIA.
TOP AND BOTTOM FUSELAGE DOUBLER 1/16" PLY MAKE FOUR
3-3/4"
WING HOLD DOWN





Left: Prepare the right and left fuselage sides, firewall, formers, and plywood doublers prior to assembling the fuselage. Right: To guarantee a square fuselage, glue the formers at 90° angles to the sides. Trim the excess material off at the front *after* the glue has set thoroughly.





Left: The rear of the fuselage is treated with ¼-in.-sq. balsa sticks prior to bringing the rear of the fuselage together. Right: Epoxy should be used to glue on both the horizontal and vertical stabilizers. Check (and correct if needed) the alignment during the epoxy's curing time.

tom). Cut, glue, and shape the wing tips. Cut out a hole in the sheeting for the servo. Cut and taper the trailing edge aileron torque rod wedges (rear wing hold-down). Recess the front edges of the ailerons to accommodate the torque rods. Install the rods (Du-Bro's strip aileron assembly #104 works well), and carefully glue them in place with epoxy.

Add a 4-in.-wide strip of fiberglass cloth to the center section of the wing. We like to use thin CyA glue on the fiberglass for a strong, fast bond. Cut and fit the aileron stock to the wing, remembering to cut the ⅜ x 1½-in. aileron stock down to a 1-in. width. Round off both corners on the front edge of the aileron to allow for its motion. Drill a hole for the torque rod, and temporarily install hinges on the aileron to ensure a proper, gapless fit. Trim the fiberglass cloth from the servo hole, and trial fit the servo and hardware to the wing. Recess the servo into the wing as deeply as possible.

Follow the same procedure for the bottom wing, and then sand the wing leading edges and wing tips to their final shape. The Protobype uses one aileron servo in each wing. A 'Y' connector is used to electrically couple the two servos together.

Fuselage. You will need four 3 x ⅛ x 42-in. (or longer) balsa sheets for the fuselage sides. Butt glue two pieces of 3 x ⅛ x 42-in. balsa together lengthwise to make each side. This glue joint will become the fuselage centerline.

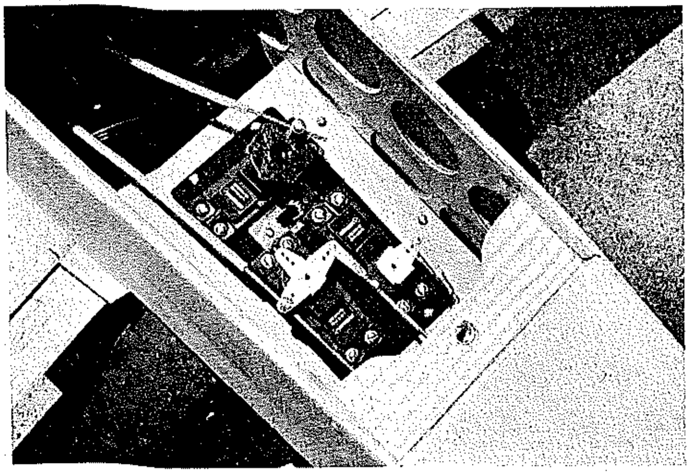
Cut the fuselage out of the plans, or trace the outline on the balsa fuselage sides. We prefer to cut the fuselage outline from the

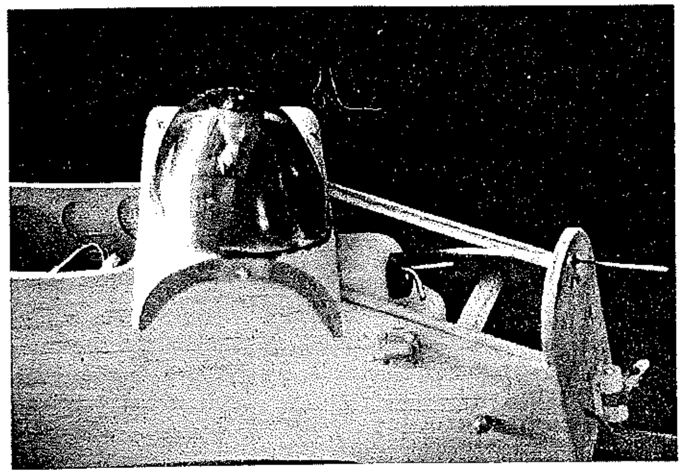
Bill of Materials

Qty	Size (inches)	Type	Purpose
2	¼ x ¼ x 36	Spruce	Wing center
2	¼ x 4 x 36	Balsa	Rudder and stab
12	¼ x ¼ x 36	Balsa	Spars and fuselage frame
1	2 x 4 x 8	Balsa	Front block
4	⅛ x 3 x 48	Balsa	Fuselage sides
6	3/32 x 4 x 36	Balsa	Ribs and fuselage top/bot.
3	¼ x 36 triangle	Balsa	Bracing
8	1/16 x 2 x 36	Balsa	Wing LE sheeting
8	1/16 x 1 x 36	Balsa	Wing TE sheeting
4	⅜ x ⅜ x 36	Balsa	Leading edge
4	¼ x ½ x 36	Balsa	Trailing edge
4	1¼ x 2 x 8	Balsa	Wing Tips
2	⅜ x 1½ x 48	Balsa	Aileron (tapered)
6	1/16 x ¼ x 36	Balsa	Cap strips
1	1/16 x 6 x 48	Lite Ply	Doublers
1	¼ x 6 x 12	Ply	Firewall and landing gear brace

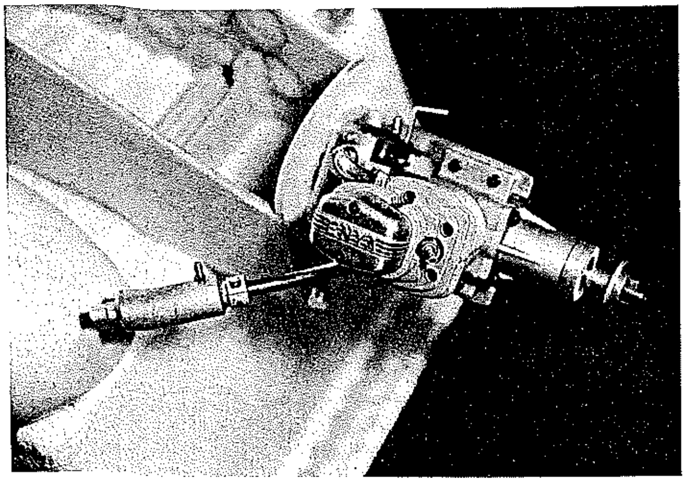
Specifications

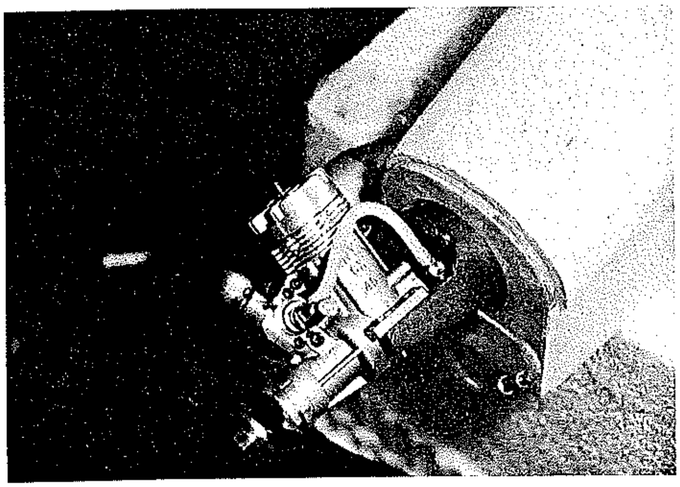
Type Aircraft	Tricycle gear biplane
Wingspan	48 in.
Wing Chord	8 in.
Total Wing Area	768 sq. in.
Location of Wing	Top and bottom of fuselage with 3 in. of neg. stagger
Type of Wing	7° Sweepback, no dihedral
Airfoil	NACA 0015 (modified)
Wing Planform	Constant chord
Fuselage Length	42 in.
Stabilizer Area	150 sq. in.
Vertical Fin Height	8 in. above fuse centerline
Vertical Fin Width	9½ in. (includes rudder)
Engine Size	.40-.60 Two-cycle .60-.90 Four-cycle
Basic Materials	Balsa and plywood
Ready to Fly Weight	5½ to 6 lb.
Wing Loading	18 oz./sq. ft.





Left: Install the pushrods and servos to take advantage of straight runs and the ability to secure the pushrod housing along the length of the fuselage. Right: The hatch is first shaped, then hollowed. Install the fuel tank, and locate the fuel filler and the remote glow plug connector.





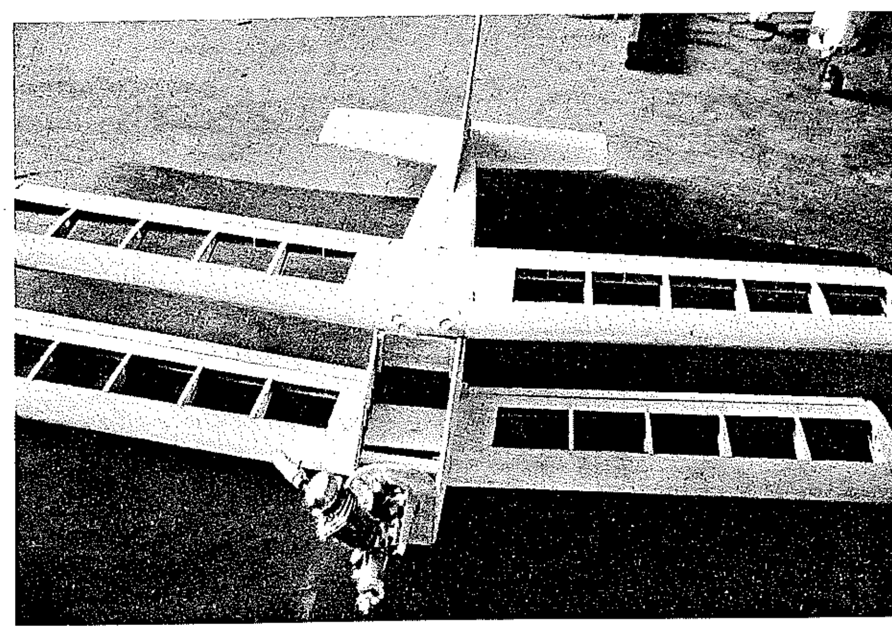
Left: The Enya .80 four-stroke fits nicely at a 45° rotation from vertical, and it really hauls this model around. It's best to use a remote glow plug connector with this engine. Right: The Enya .45CX engine with geared pump proved to be a super two-cycle powerhouse for the Protobype.

plans and use Scotch 77 spray to tack glue the two uncut fuselage sides together. The fuselage plan is tack glued to the uncut fuselage sides, and both sides are cut out together. Sand the edges of the fuselage sides to their final shape, keeping them identical. After separating the sides, mark them left and right.

Cut the fuselage doublers from a piece of 3/32-in. plywood. You can use three separate pieces for each side as shown on the plans, or a one-piece doubler can be cut from a 6-in.-wide piece of plywood. The lightening holes are easy to cut using a hole saw attached to a drill. Glue the plywood doublers to the inside of the fuselage sides as shown on the plans. Cut and glue the horizontal stabilizer doublers at the rear of the fuselage.

Cut out fuselage formers F-1, F-2, F-3, F-4, and F-5. Trial fit these formers to the fuselage. Glue the formers in place using the plans as a guide. Use epoxy on the firewall. Align the sides and formers carefully to ensure that the formers are at 90° to the fuselage sides. Check to see that everything is straight at both the front and rear of the fuselage.

Cut and glue ¼-in.-sq. balsa sticks to the inside of the fuselage sides from behind former F-5 to the rear of the the aircraft. Fit the lengthwise pieces first, then fill in the vertical sticks.



The completed wing and fuselage just prior to their final sanding and covering. The result will be an airplane with a large performance envelope that doesn't look like everyone else's model.

Bring the rear of the fuselage sides together. Taper the ¼-in.-sq. sticks so that they just disappear at the rearmost part of the fuselage. When you are satisfied they are in alignment, glue them together with CyA. Install the ¼-in.-sq. horizontal balsa crosspieces at the locations of the vertical sticks previously glued to the fuselage sides.

Cut and install the landing gear block, and secure it with ¼-in. triangle stock. Install ¼-in. triangle stock on the rear of the

Continued on page 145

Safety/Preston

Continued from page 22

Today I can go a step further by drawing to your attention a recent Federal Government decision to ban lawn darts. For those not familiar with these products, they are supplied as part of an outdoor game set, are about a foot long, weigh about a third of a pound, generally have a blunt metal tip about ¼ in. in diameter, and have plastic fins. The game that they are intended for is played on grass (hence the name), and the darts are thrown at a circular target placed on the ground about 30 ft. from the thrower.

There is rationale to suggest that, if dropped vertically from about 13 ft. or more (producing a velocity of 29 ft./sec. or more), such a product could penetrate a person's skull. These products are known to have killed three children and are believed to have caused about 650 serious injuries per year over the last 10 years.

A lawn dart travelling at 29 ft./sec. has a kinetic energy of 3.9 ft.-lb. That's a lot less than the 57 ft.-lb. figure that, when I wrote the July 1987 column, was mentioned in the "Lethal Threshold" item.

Protobype/Daley

Continued from page 31

firewall. It is recommended that the same size triangle stock also be used around the other formers for added strength.

Cut and trial fit the horizontal stabilizer in the slot at the rear of the fuselage. Align and adjust the stab until it is centered, 90° to the fuselage sides, and its tips equidistant from the front of the fuselage. When all three adjustments are right, glue the stab in place with epoxy.

Sheet the top of the fuselage with $\frac{3}{32}$-in. balsa. Cut and trial fit the vertical stabilizer. Again, alignment is critical. It must be 90° to the horizontal stab and perfectly in line with the centerline of the fuselage. Use epoxy to glue it in place.

Cut, trial fit, and temporarily hinge the elevator and rudder. Working from the bottom of the fuselage, define the pushrod exits, and install the guides for the elevator and rudder. Fasten the pushrod guides at several locations along their length. Sheet the bottom of the fuselage with $\frac{3}{32}$-balsa.

Cut, shape, and trial fit the hatch on the front of the fuselage. It is recommended that you make this structure removable; one such method is shown on the plans. This design facilitates access to the fuel tank, battery, and receiver. The hatch should be rounded to shape from F-1 to the leading edge of the top wing. The cowl fits over the firewall, so sand the hatch lightly to avoid making it undersized.

Trial fit the canopy to the top of the hatch. The canopy should be one of the last items fastened to help prevent it from being scratched or otherwise damaged.

Final Assembly. Trial fit the Enya engine to the mount, and hold the assembly up to the firewall to determine its desired location. Ensure sufficient clearance for the muffler. I found that the Enya .80 four-cycle or the Enya .45 CX with geared pump fit best at a 45° sideways mounting position (the engine is rotated 45° to the right, viewed from the rear of the model). The model requires no right thrust or downthrust. The centerline of the engine is governed by the configuration of the cowling used. The first of the prototype models used a Sig Kadet MKII cowl from Sig Manufacturing. For a four-cycle installation, it is best to use fiberglass cowl SK-1FC, available from T & D Fiberglass Specialties, 30925 Block, Garden City, MI 48135. Phone: (313) 421-6358.

Mark the firewall for placement of the holes where the blind nuts will be installed. Drill the holes and install the blind nuts. Temporarily attach the engine to the firewall, and work out the routing of the throttle and nose wheel steering pushrods. The standard nose wheel gear can be installed in an engine mount if holes are provided—or in a nose gear block mounted underneath the engine.

Trial fit the fuel tank, and decide how you will route the fuel tubing. Drill holes in the firewall for the pushrods and fuel tubing. If a remote fueler such as a Du-Bro Kwik-Fill Fuel Valve or a Robart Superfueler II or Ultra Fueler is to be used, determine its location and trial fit at this time. Also, if a remote glow plug device is to be used (highly recommended for the four-cycle Enya engine installation due to its glow plug location), now is a good time to consider the location.

Hold the cowl to the engine and determine where it must be recessed. Cut and trim the cowl for final fit, and secure it with small screws to the firewall sides. Final sand the hatch to shape.

Install the hardwood wing hold-down blocks as shown on the plans. Trial fit the top wing to the fuselage. Check incidence. The top wing is at zero (0) degrees incidence using the horizontal stabilizer as a reference (if you don't have an incidence meter, measure and set the leading and trailing edges an equal distance from the fuselage centerline). Sand the fuselage wing cradle as needed to achieve 0°. Align the wing on the fuselage so that it is centered right to left and the wing tips measure equal distances from the tips of the horizontal stabilizer.

When the wing is properly aligned on the fuselage, drill ³⁄₁₆-in. pilot holes (at the locations shown on the plans) through it and the wing hold-down blocks. Remove the wing, and drill holes in the wing for the ¼-20 nylon bolts and holes in the wing hold-down block to accept the ¼-20 blind nuts. Follow the same procedure for the bottom wing, but place this wing at one-degree positive incidence (leading edge of wing ⅛ in. higher than the trailing edge).

The main gear is aluminum and should be 3¾ to 4 in. wide at the fuselage and about 12 in. wide at the wheels. Two-inch, lightweight wheels are used for hard-surfaced runways. For grass runways, at least 2½-in. wheels are recommended. Trial fit the aluminum landing gear to the fuselage bottom just behind the trailing edge of the wing.

Check the balance point of the model, and determine the best locations for the servos, receiver, battery, switch, and charging jack. The plan shows an approximate location for these components; however, they can be repositioned to make the model balance at the point shown on the plans. When you are satisfied as to the balance, install the servos, making sure there is sufficient clearance for the wing servos.

Remove the hardware and engine. Brush epoxy or fuel-proof dope on the inside of the tank compartment and on the firewall. Sand the wings and fuselage to their final shape, and glue on the canopy. After final sanding, the Protobype will be ready to cover.

As a design alternative, you could raise the the top wing 2 in., add an extra doubler and balsa to the fuselage sides, and convert the design to a cabin model.

Covering. You can use any commercial heat-shrink material. We used MonoKote and Black Baron Metalflake on various editions of the model, and both worked great. The trim scheme is up to you. The photos show several varieties.

When the model is completed, reinstall all hardware, radio gear, and the engine. Glue in all hinges, install wing seating tape, and set the throws of the elevator, rudder, and ailerons. Aileron total throw should be ⅜ in., rudder throw should be 1½ in., and elevator throw should be set at ¾ in. Make a final check of the balance point.

Radio. The Airtronics Spectra SP7P Radio was installed in the model. This narrowband FM/PCM radio has all of the features one could desire, including servo reversing, adjustable throw volume for aileron, elevator, and rudder, and adjustable low throttle. The radio allows almost any coupling/mixing you could want and has a snap roll button. It offers both linear and exponential control action and has dual rates. Other nice features are the plug-in transmitter battery and plug-in radio frequency module. The radio features an audible alarm that sounds when voltage drops below safety margins. It also provides a fail-safe mode that can be preset or defaulted to the most recent best command. This system now has a 1991-rated receiver—ours performed flawlessly.

Engine. The Enya engines used on the Protobype are distributed in the United States by Altech Marketing, whose ads you no doubt have seen. The .45-size two-cycle is a Schnuerle-ported, chrome-liner engine with a geared fuel pump. This engine is rated at 1.3 horsepower and weighs 12.7 oz. without the muffler. It is a real performer, and we highly recommend it for two-cycle operation. The .80-size four-cycle engine claims 1.1 horsepower and weighs 20.7 oz. This is a great power-to-weight ratio for a four-cycle. Both engines perform extremely well in the Protobype models. Your local hobby shop should be able to obtain either of them for you.

Flight. The Protobype is recommended for the flier with early intermediate-level skills. Handling characteristics, determined by your adjustments of the control surface throws, can be as gentle as you like. This biplane can be docile as a trainer or as aerobatic as you are capable of handling. We're sure the Protobype will provide hours of pleasure in both building and flying. Good Flying!

Radio Technique/Myers

Continued from page 35

suspended matter, like silt and Giardia cysts, but doesn't remove dissolved material, like alcohol and salt.

I know that my domestic water is chlorinated and fluoridated, contains rust and algae from the pipes, silt from the source, and sometimes carries a lot of used detergents. The chlorine can be boiled away. The fluoride and detergents can only be removed by distillation. The filter can handle the rest.

I decided to boil off the dissolved gases and use the filter to produce water that might not injure my battery. So far, the battery hasn't blown any bubbles, and it still starts model engines, so this might be a good idea, if you have such a filter. I look at it this way—it has to be better than just plain tap water! And the idea might have some merit on the road to Alaska.

Why do we need all those RC channels? There have been some disagreements, but right now the official position is that AMA will sanction use of all 50 aircraft-only channels as of January 1, 1991. The AMA *must do that to prevent loss of our channels to nonmodeling users.* I have been receiving reports from here and there of unexplained interferences on the new channels, so if we give up half of what we've got through neglect, then subsequently encounter increasing interference on the channels we *are* using, where will we be in a few years?

If you think we can't lose them—think again! The FCC has just reassigned a 2 MHz piece from the Amateur two-meter band to Land Mobile Service, "due to underutilization." I've told you before that we are in a USE-IT-OR-LOSE-IT SITUATION!

I am unhappy that the AMA's Frequency Committee and Executive Council failed to say anything about using all 30 of the *75 MHz channels*—the surface-use-only ones—in 1991. While I understand that AMA is *not* AMYA, ROAR, etc., and therefore it doesn't "sanction" their events, the fact remains that AMA got those channels for them, and they depend on AMA to keep them. All 30 of them are, after all, listed in the 1988 *Academy of Model Aeronautics Membership Manual* (see page 10 thereof).

"Who cares?," you ask.

Sail*boat* people regularly operate more channels, simultaneously, while standing closer together, than any other hobby group except some Sail*plane* competitors. As an example, every Saturday morning, Hecksher Park pond (where I sail) supports 12 heats of 12 boats in three hours. This means that 12 RC channels are in continuous, simultaneous use all morning. That's more RC activity than you'll ever see at any airport, including Mile Square in LA.

"Why can't they share the frequencies like airplane people do?," you ask.

They do. That's why it is customary, when setting up a regatta, to require that competitors have at least two sets of interchangeable crystals or modules, to simplify race matrixing. They sail a dozen or more boats at a time, and they matrix the heats with the objective of having every skipper sail against every other skipper present. A 75-MHz switchable synthesizer would be a boon to the RC sailboat fraternity.

I hear people asking, "You can still legally swap crystals in 27 and 75 MHz radios to make matrices, can't you?"

Well, you'd better know that recently the FCC has been REFUSING TO TYPE ACCEPT new radios with interchangeable crystals. No matter how *you* read the law, that's the real world. Vendors can't import radios that aren't Type Accepted. So, it looks like any future crystal-swapping will have to be done with "bootleg" which will increase engine reliability. These mods consist of using a 72-turn needle valve from Kustom Kraftsmanship (KK) and a pressure fuel system which employs a pressure-tapped backplate, also from KK.

Wild: An appreciable power increase can be achieved by drilling the venturi to 5/32 in. This mod requires the use of a pressure fuel system. Another significant change, which requires special machining, is to modify the transfer ports to a tapered configuration. I have limited capability to perform some of these mods. Write to get details. *(J. E. Albritton's address appears at the end of this article.)*

Propellers

Stock: The Cox 5 x 3 propeller works best. This prop has actual pitch of over 4 in.

Semistock: 4¾ x 3 from Kustom Kraftsmanship.

Sorta-stock: An Albritton carbon fiber special prop for ½A is available in limited quantities. Write for details. This is the best prop known to us at the time of writing.

Nonstock: Remove ⅛ in. from the entire leading edge of a Cox 5 x 3, sand the airfoil back onto the top, and shorten it to 4¾ in.

Note: For optimal engine performance in the air, the propeller should be one that allows the engine to exceed 23,000 rpm on the ground.

Fuels

Cox racing fuel is very hard to beat, and Cox engines in particular run well on it. No other brand of fuel with under-30% nitro is recommended.

Reliability and organization

Follow the acronym KISS (Keep It Simple, Stupid). Plan what equipment you need, and use the same equipment every time you fly. Repetition is reliability.

Flying: The Taperwing is designed and built for Pylon Racing. When flying an official pylon course, the model is close in to you and turns very tight. With other kinds of flying, don't let the Taperwing get too far away, as the model's very low frontal profile makes it difficult to see at a distance.

If the nose tends to rise or dip at the completion of a turn, check the position of the transmitter stick—chances are it is not pulled straight back. For smoother and faster performance in flying the pylon course, set control throws to the minimum.

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