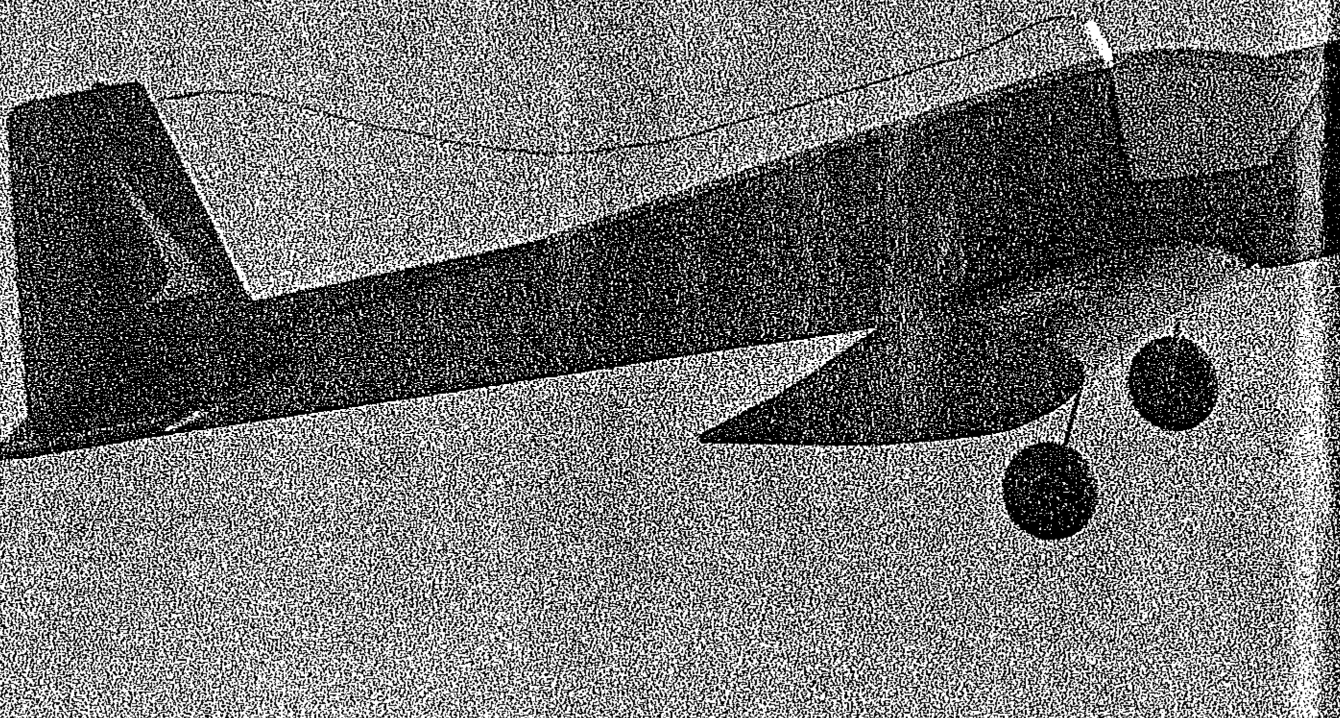
Keytwo

Easy to build and great fun in the air, this little RC sportster is an enlarged version of an original 12-year-old design. It's designed around modern .20 to .25 size two- or four-stroke engines and has a much-improved flight envelope. ■L.F. Randolph

OVER A DECADE ago I had a good deal of success with a model called Paskey that I published in *Model Builder* magazine. The airplane enjoyed some popularity, and quite a few were built and flown.

In a spectacular tour de force that's still remembered today, Eddie Williams performed a "drunk pilot" routine with one of the earlier Paskeys at a Southwestern Model Airplane Championship contest. Hidden in the pit area, Eddie wowed the audience with stalls, inside and outside loops, and upright and inverted snaps and spins—all at very low altitude. It was a heart-stopper. Though the booze-fogged, make-believe pilot got all the credit, Eddie's flying was truly magnificent.

The Paskey was built to handle the power available from the .20 to .25 engines of its day. I decided to revamp it to accommodate the increased muscle of today's engines. To duplicate the design parameters,



Big picture: Silhouette shot of Keytwo in a slow flyby heading into the sun. Above: Keytwo taxiing at the Dallas RC Club field. The airplane is capable of the normal repertoir of aerobatics, including knife-edge loops. It lands nose high, nice and slow.

of the original while using the power curve of the current O.S. .25 FSR engine, I'd need a larger airplane with somewhat heftier construction.

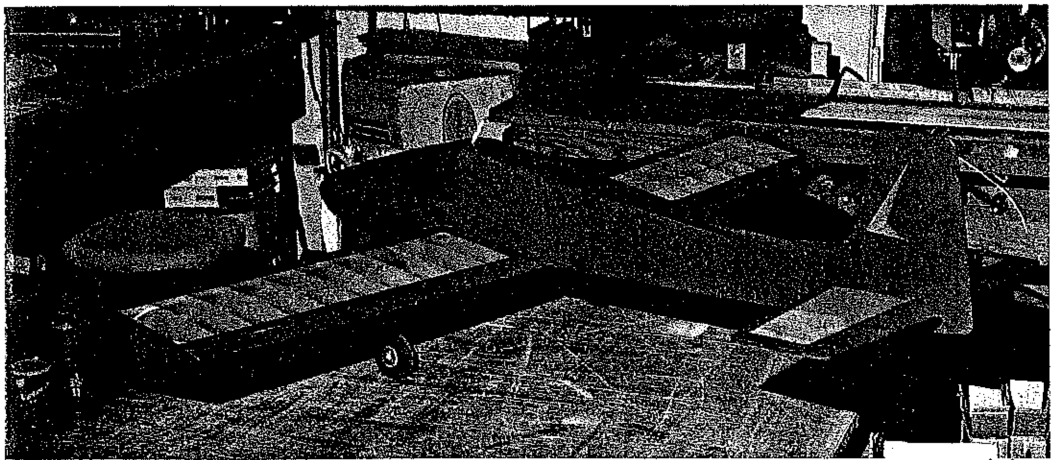
The updated model, called the Keytwo, uses the same power range of .20 to .25 engines as its predecessor. Installation of one of the new breed of two- or four-cycle .20s produces very little depreciation in performance.

Despite its greater size, the Keytwo is a cleaner airplane with a wider performance envelope than the Paskey. You'll find that it not only moves through the air with greater authority but is very stable at slower speeds.

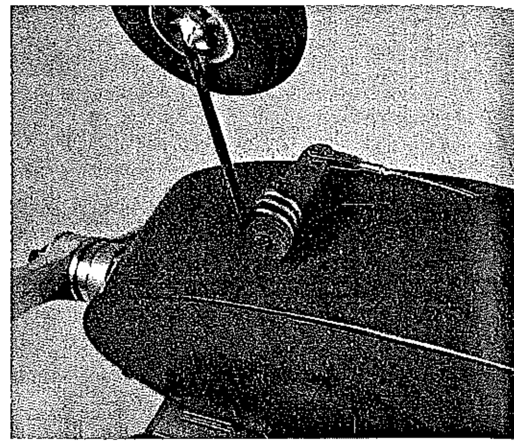
Construction

Fuselage. Edge-glue three sheets of 3/32 x 3 x 36-in. hard balsa, and cut the fuselage sides from opposite ends of this 9-in.-wide sheet. Don't forget to make both a right and a left side.

To make the forward cabin doublers, lay 3/32 sheet at the



Keytwo finished and ready to go sitting on the assembly bench in the author's workshop. The model is easy to build and should present no problems for the intermediate level modeler.



The nose gear steering arm is a piece of ⅜-in. dowel, a disc of ⅛ plywood, and two wood screws. A simple and positive system.

angle shown in the plan, and adhere with one of the slow-setting cyanoacrylate (CyA) glues.

When the glue has set, pin the fuselage sides together and cut the wing saddle into both halves at once. Cut the stabilizer slot at the tail. Add the 3⁄32-sq. longerons and the 3⁄32 x ¼-in. balsa uprights in the aft fuselage area to both sides. Note the doublers under the stab slot and the upright at the aft cabin bulkhead location. Add the 1⁄32 plywood triplers up front and at the wing mounts.

When this assembly is dry, repin the two sides together and sand them to matching outlines. The edge of the workbench works fine as a guide for the sanding block, ensuring that the edges remain square while sanding. If the wing is to be held in place with rubberbands rather than nylon bolts, drill the ¼-in. holes for the dowels at the locations shown.

Add the ⅛ x ¼-in. servo mounting rails as well as the rails for the fuel tank compartment. Glue the undrilled hardwood wing mounting blocks in place on their 1⁄32 ply triplers.

Cut the two cabin formers from ⅛-in. plywood and the firewall from ¼-in. plywood. Mark the location of the throttle cable and the nose gear steering cable on the forward bulkhead, then drill the bulkhead to fit your Nyrod. Drill the firewall for the engine mount bolts, throttle cable, and fuel and overflow lines. Epoxy the T-nuts on the back side for the mounting bolts.

Glue the two cabin bulkheads to one of the fuselage sides, using a right triangle to ensure that they're exactly perpendicular. When the glue has set, align the two fuselage sides. Once you're satisfied that everything is square, glue the bulkheads to the second side. Pull the tail halves together, and glue. Add the firewall and the fuel tank floor.

I recommend cutting the pushrod exit slots at the tail and installing the Nyrod for the throttle before beginning the top and bottom cross sheeting. It's necessary, however, to sheet the area below the fuel tank before the Nyrod to the nose gear can be installed. Complete the top and bottom cross sheeting after the tank has been mounted and the fuel lines connected. Using a sanding block with 150-grit sandpaper, round off all square edges to prepare the fuselage for covering.

Wing. Choose one of two methods for making the ribs. They may be traced from a template onto sheet balsa and cut out individually, or they may be stack sawn from 1½ x 8-in. sections of 1⁄16 balsa with a band saw. The template method uses less wood.

Select the four center ribs. Trim 1⁄16 in. from the top and bottom trailing edges to accommodate the center sheeting, then enlarge the spar notches for the ply dihedral braces. One sheet of 1⁄16 x 3-in.-wide balsa will make all four of the trailing edges; the remainder is used for the spar webs.

Cut out the four 1⁄16 plywood rib doublers (two left and two right), glue them to the ribs, and trim the bottom of the ribs to conform to the doublers. Saw out the dihedral braces from ⅛-in. plywood for installation later.

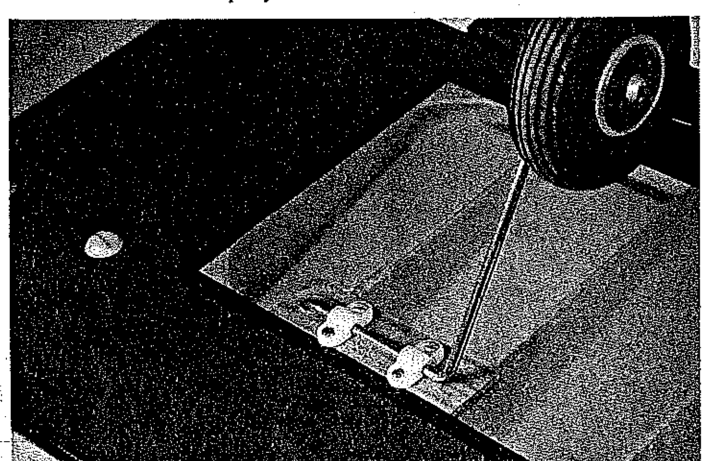
Build the wing over the plan in the conventional manner. When pinning the bottom main spars over the plan, elevate them with cross-strips of 1⁄16 sheet balsa so that the bottom surfaces of the ribs are flush with the building board. This leaves room for the 1⁄16 leading edge sheeting that will be installed later.

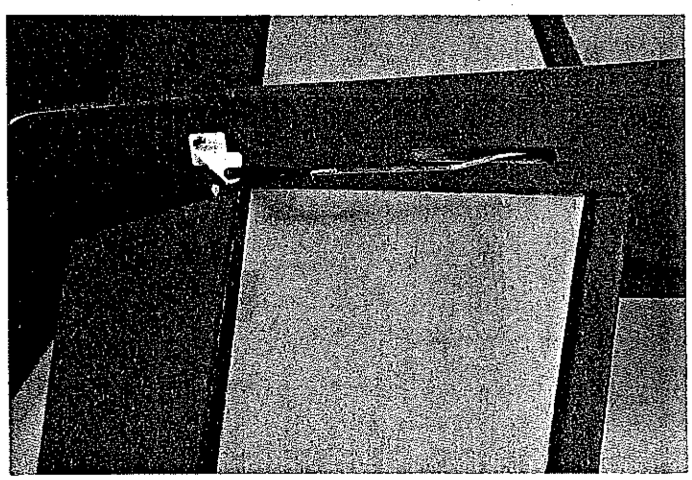
Pin the bottom trailing edge sheet in place, then glue the ribs to the main spar and trailing edge as they are assembled. Note that the ribs with the ply doublers are installed with the doublers facing on opposite sides.

Do not add the center ribs of each panel or the top trailing edge sheeting at this stage. When all the ribs are in place, add the ⅛-in.-sq. balsa trailing edge, the top main spar, and the 3⁄16-sq. leading edge.

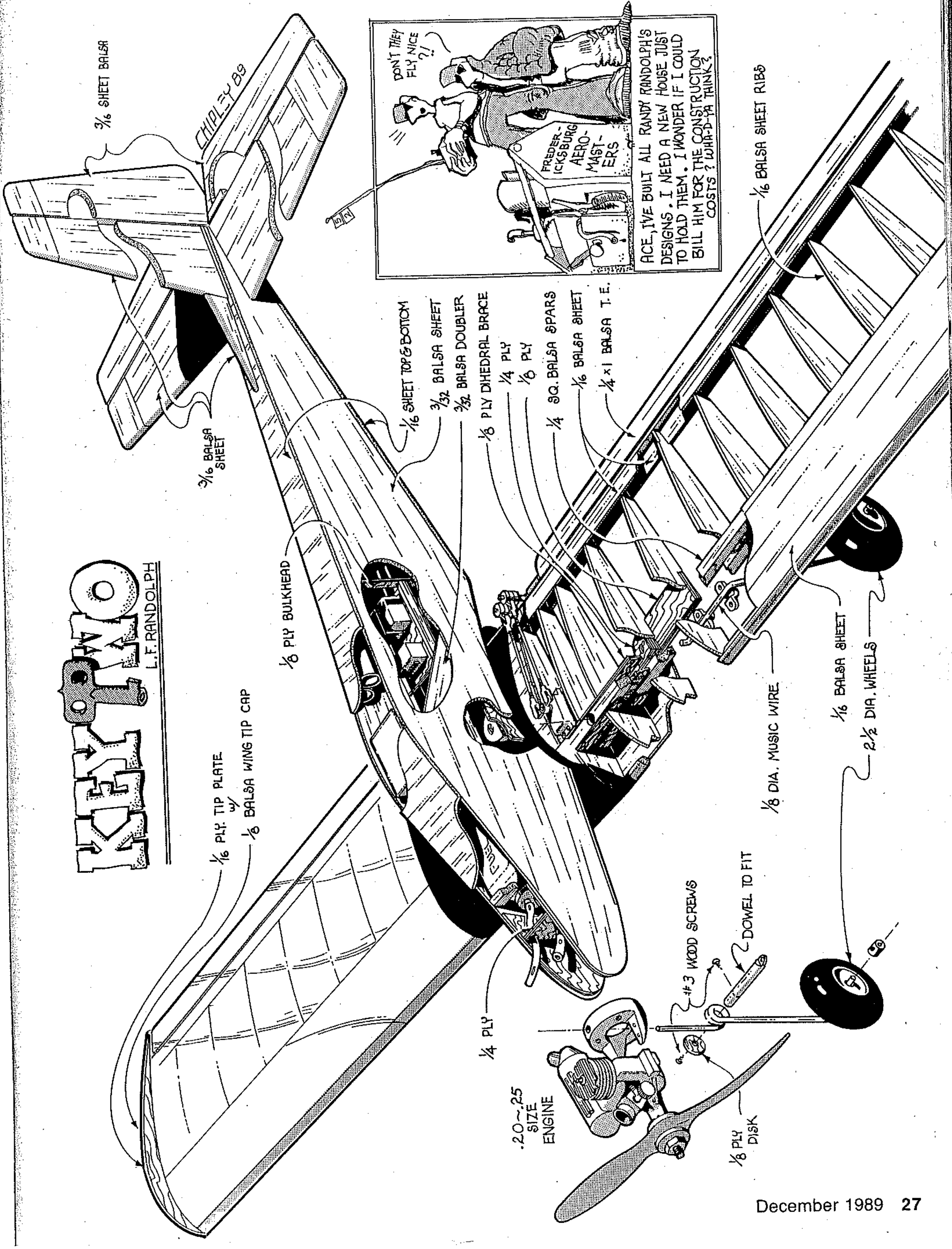
Build the other wing panel as a mirror image of the first.

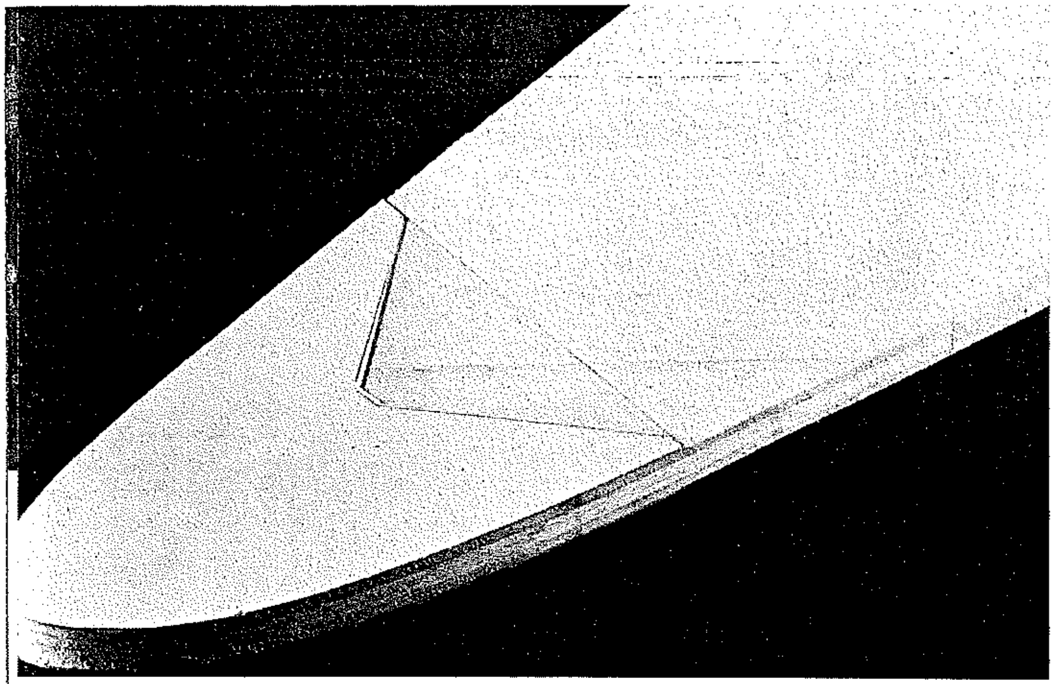
Cut the two center ribs at the spar notch, and trial fit the leading and trailing edges and the main spar of each panel, trimming as necessary so that they fit together prop-



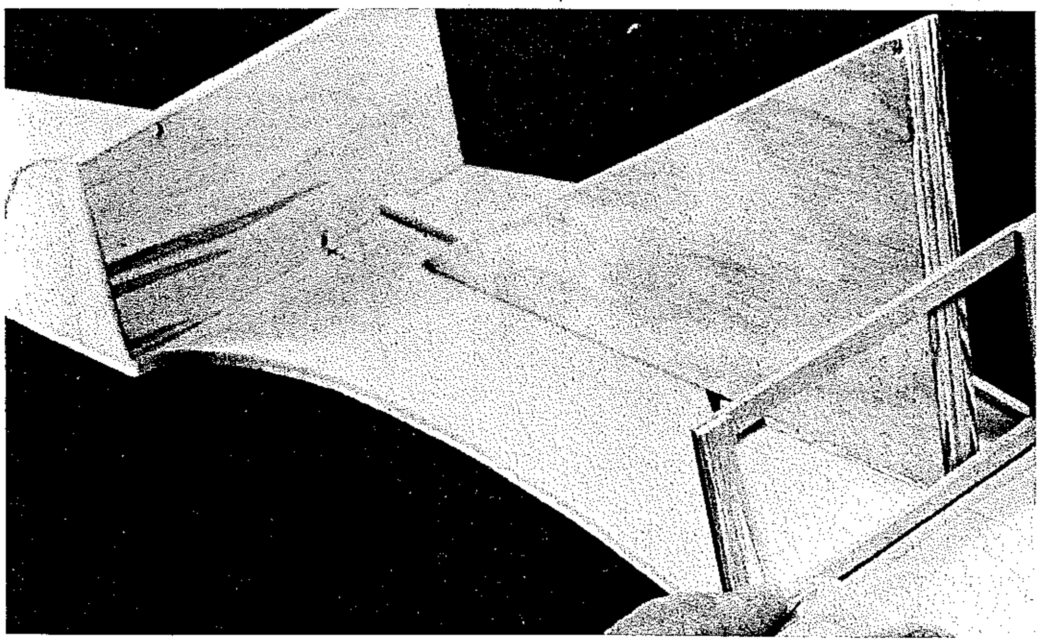


Left: Standard hardware is used to mount the simple torsion-type main gear. This type of gear can take a lot of abuse and still come back for more. Right: The pushrods exit through slits in the fuselage sides near the tail. The sheet stabilizer and rudder is quick and easy to make.


KEY TWO
L.F. RANDOLPH
CHIPLEY 89
3/16 SHEET BALSA
3/16 BALSA SHEET
1/16 SHEET TOP & BOTTOM
3/32 BALSA SHEET
3/32 BALSA DOUBLER
1/8 PLY DIHEDRAL BRACE
1/4 PLY
1/8 PLY
1/4 SQ. BALSA SPARS
1/16 BALSA SHEET
1/4 x 1 BALSA T. E.
1/16 BALSA SHEET RIBS
1/8 PLY BULKHEAD
1/16 PLY. TIP PLATE w/ 1/8 BALSA WING TIP CAP
1/4 PLY
#3 WOOD SCREWS
DOWEL TO FIT
1/8 DIA. MUSIC WIRE
1/16 BALSA SHEET
2 1/2 DIA. WHEELS
.20~.25 SIZE ENGINE
1/8 PLY DISK
DON'T THEY FLY NICE ?!
FREDER-ICKSBURG AERO-MAST-ERS
ACE, I'VE BUILT ALL RANDY RANDOLPH'S DESIGNS. I NEED A NEW HOUSE JUST TO HOLD THEM. I WONDER IF I COULD BILL HIM FOR THE CONSTRUCTION COSTS? WHA-D-YA THINK?

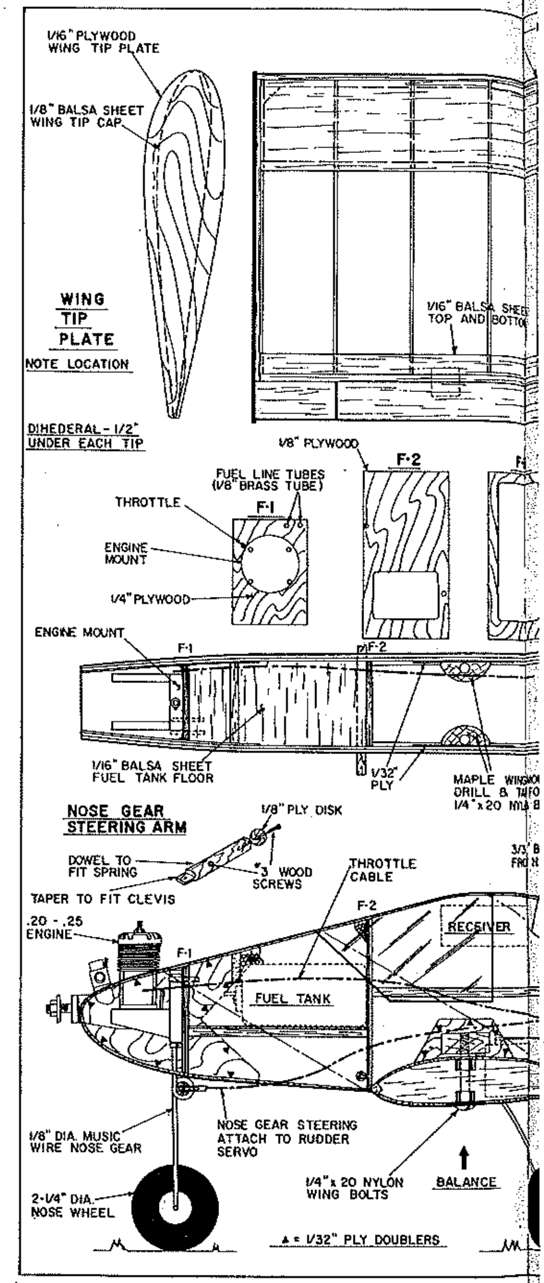


Close-up of the fuselage side showing the $\frac{3}{32}$-in. balsa diagonal grain doubler and the $\frac{1}{32}$-in. plywood triplers glued together. When the fuselage side laminations are completed, pin the two (right and left) fuselage sides together and carefully sand them to the same contour.



A right triangle is used to ensure vertical alignment of the cabin formers as they're installed. Note that the holes for the throttle and nose gear lines have been drilled in the front former.

The fuel tank is held in position with tight-fitting blocks of foam on all sides. Be sure there are no kinks in the fuel and overflow lines before gluing the top sheeting and foam in place.



erly. Bevel the main spars and leading and trailing edges to the dihedral angle, and join the two halves with the dihedral braces that were cut out previously.

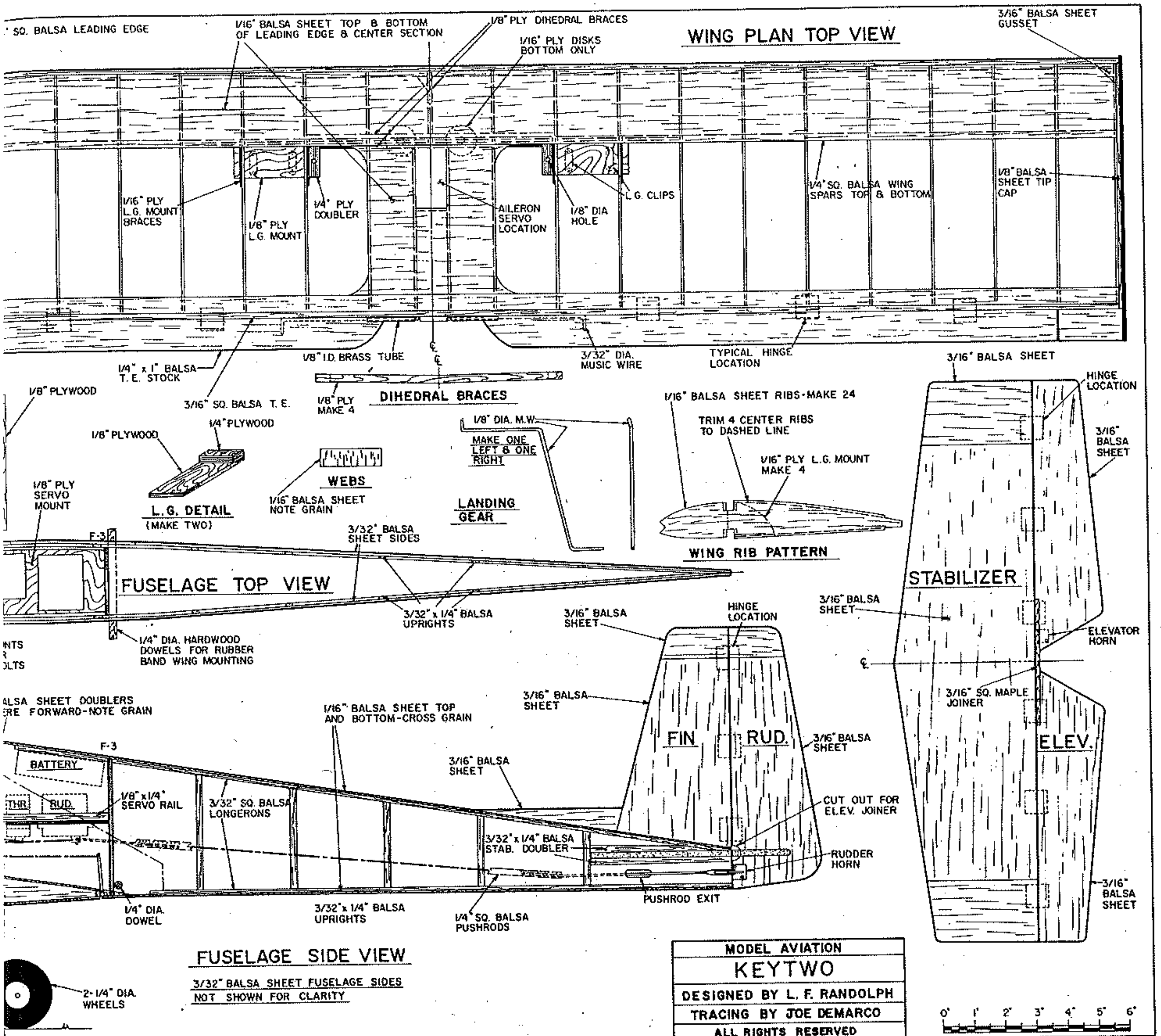
Separate the trailing edge sections of the center ribs to form the servo well, and join the leading edge pieces at the center. Add the top trailing edge sheeting.

Fit the wing into the fuselage, and mark the spars where they intersect the center of the hold-down blocks. Remove the wing from the fuselage, and drill ¼-in. holes through the spars at the marked locations. The ¼-in. drill should just fit between the ply dihedral braces without touching them.

When adding the top leading edge sheet, remember to drill from the bottom up through the top sheeting before adding the bottom sheet, and then from the top through the bottom.

Once all sheeting is complete, build up and add the ⅛-in. ply gear mounts, and then sand the completed wing. The ailerons and tip plates will be added when the airplane is

Full-Size Plans Available . . . See Page 202



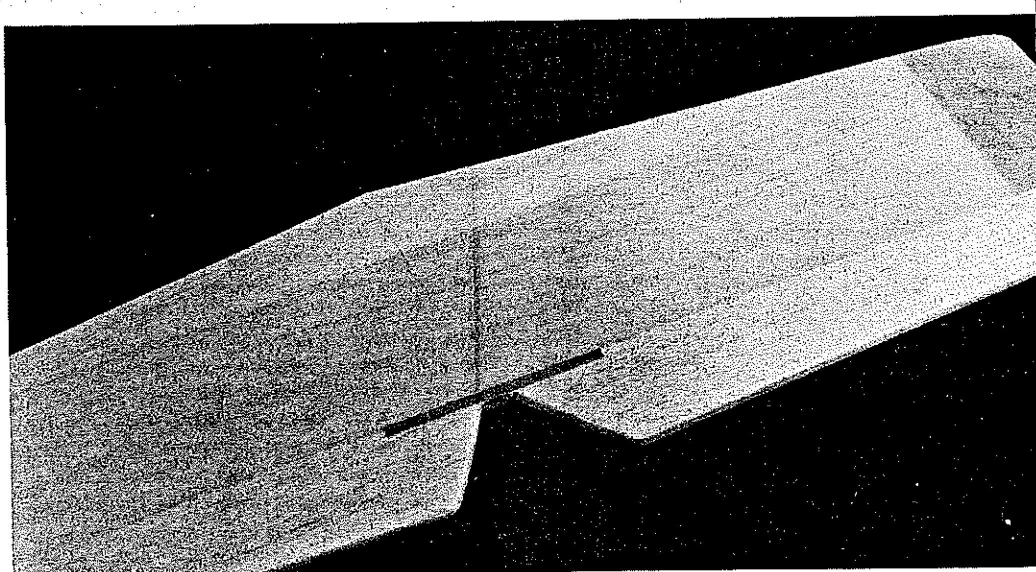
covered.

Tail surfaces. Since this is the easiest phase, it's been saved for last. Cut the fin, rudder, stabilizer, and elevator from 3/16 sheet balsa following the plan. The cross-grained end plates of the stabilizer and rudder should be edge-glued to the sheet before those parts are cut.

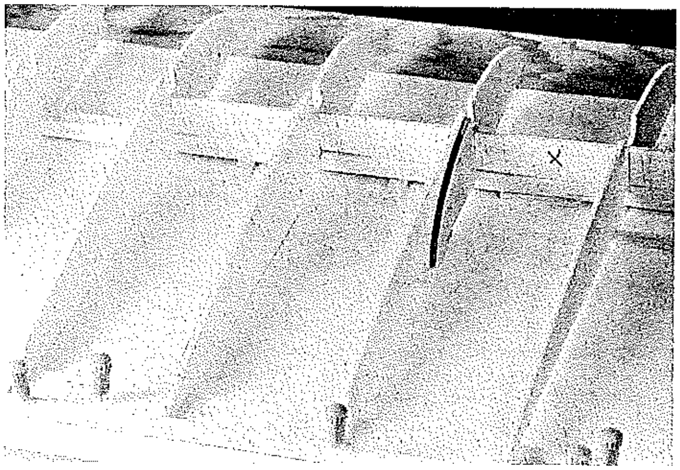
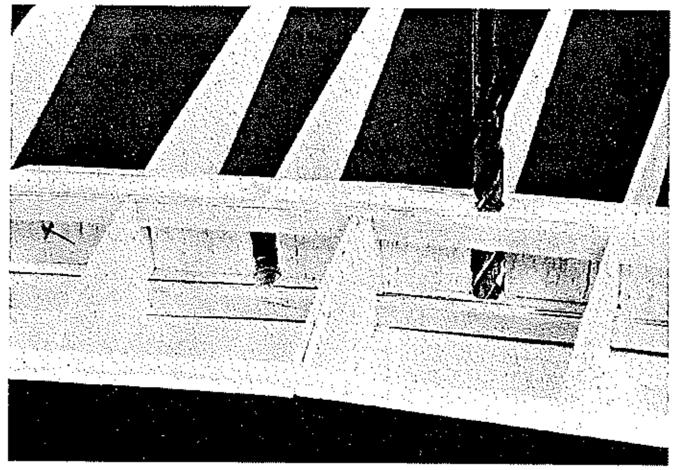
The elevator carry-through may be either 3/16 doweling or 3/16-sq. hardwood; both work equally well. Join the stabilizer-elevator and the fin-rudder with masking tape at the hinge lines, then sand all the edges smooth and round.

Finishing. Use plastic film for both covering the model and hinging the movable surfaces. Transparent Black Baron, one of the lightest films available, was used on the prototype. Follow the manufacturer's instructions with your choice of film.

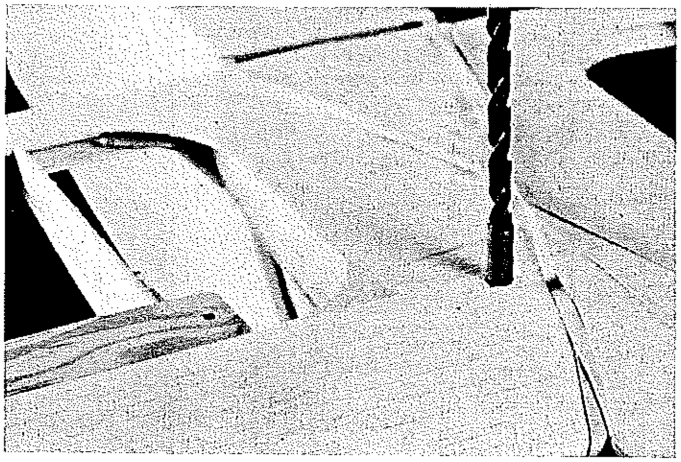
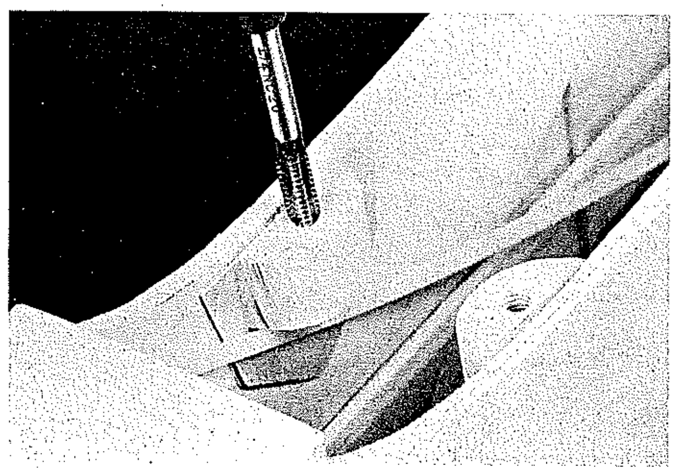
Coat the firewall and the inside of the cowl with a matching shade of epoxy paint



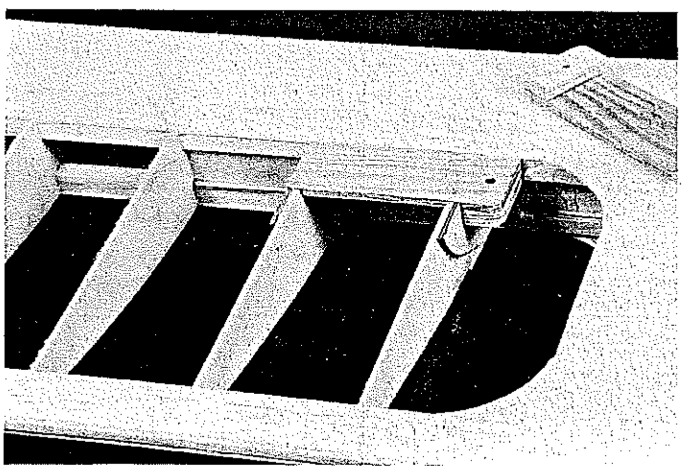
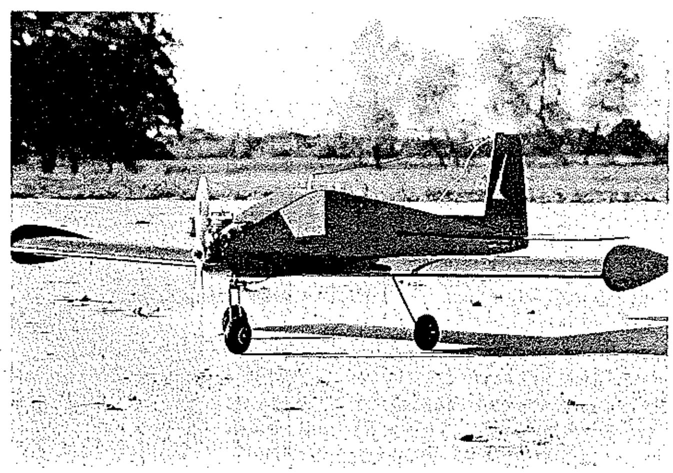
The finished stabilizer and elevator. The rudder, stabilizer, and elevator are cut from 3/16-in. sheet balsa. Glue the hardwood elevator carry-through to the leading edge of the elevator before the rudder cutout is made. The cross-grained stabilizer tips help to inhibit warping.

Left: The wing under construction showing 1/16-in shims under the bottom main spar to allow room for leading edge sheeting. The X marks shortened webs that will allow for the plywood landing gear mount supports, one of which can be seen glued to the rib. Right: Close-up of the bottom center section of the wing showing the wing mounting bolt holes being drilled. Attach the top leading edge sheeting before drilling the spars. Don't touch the dihedral braces with the drill. After the bottom sheeting is in place, the holes can be completed by drilling from the top.

Left: The wing is securely fixed in place for drilling the hardwood pads in the fuselage for the wing mounting bolts. Shim the 7/32-in. drill with ¼-in. brass tubing while drilling the pads. An alternate method of wing mounting is by installing ¼-in. hardwood dowels through the fuselage ahead of the front former and just behind the aft former—for mounting the wing with rubberbands. Right: Close-up of the hardwood wing mounting bolt pads in the fuselage being threaded with a ¼ x 20 tap. Run the tap all the way through the pads to achieve maximum strength.

Left: The landing gear mounts, one shown installed, one ready for installation. The built-up mounts are drilled before they are glued to the supporting ribs. This makes a strong and lightweight mount for the main landing gear. Right: Keytwo sitting on the ramp ready for its first flight.

to protect these areas from engine exhaust and oil.

The engine mount should be drilled for the nose gear before it's bolted to the firewall. Install the nose gear, and bend the ⅛-in. wire main gear legs. The main gear is held in place on the gear mounts with screws and formed nylon clips. The 2¼-in. wheels can be mounted with wheel collars. If the axle holes in the wheels are larger than the ⅛-in. wire, shim them with brass tubing for a smooth fit.

The steering arm through the spring of the nose gear is made from a piece of ⅜-in. hardwood dowel, a small ⅛-in. plywood disk, and two wood screws. Make the pushrods to the elevator and rudder from hard ¼-in.-sq. balsa, fitted with threaded rod which is epoxied and thread-wrapped on both ends.

Select the location of the servos and battery inside the cabin to achieve the center-of-gravity shown on the plan. Run the antenna through a piece of fuel tube, bringing it through the cabin top to the top of the rud-

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Letters to the Editor

Continued from page 12

When Ken opened his hobby shop in Burk & Company Department Store after World War II, I worked for him full-time for a year until I started college. After that I worked part-time until completing college.

Milton H. Fanning
Nashville, TN

Safety/Preston

Continued from page 22

some MonoKote repairs."

The moral of this tale is that it is wise to keep a small extinguisher in your field box. As an alternative, it may be possible to smother the fire with a towel, rag, or blanket. When the Cub Yellow engine cowling on my first RC model (powered by a Cox .09) began to turn first orange, then brown, I was able to smother the fire by wrapping a rag around the front of the model.

Have a safe month.

Keytwo/Randolph

Continued from page 30

der. When everything is in place, range check the equipment—and it's time to fly!

Flying. While it has a wide performance envelope compared to the Paskey, Keytwo is basically quite a gentle flier. Whether upright or inverted, the stall shows absolutely no tendency to snap. In fact, if the model is balanced correctly it's very difficult to *make* it snap. If snaps are your bag, move the center-of-gravity aft about ½ in. and increase the elevator throw by ⅛ in.

The roll rate with 3/16 in. of *up* and *down* movement at the trailing edge of the ailerons is about right for comfortable flying. Landings can be made nose-high and slow, with full aileron control all the way to touchdown.

I had a problem with knife-edge flight at first. The airplane persistently climbed into a half-loop, until I learned that the nose stayed up with just a little rudder. Once I'd mastered the technique, knife-edge loops were included in Keytwo's repertoire of tricks.

And what did Eddie Williams have to say about my latest re-creation? "I see you've built another Paskey," said that unsung maestro of the drunken pilot routine. "It's about time!" Play it again, Eddie?

Radio Technique/Myers

Continued from page 34

The Failsafe Flight System is small (1.5 in. sq.), light (less than one ounce), inexpensive, has very low operating current (7.0 mA), **and it works.** There is no doubt that nine-volt transistor radio batteries are expensive (about $2.50 for Duracells where I live), but they will last a long time. There is some chance that you will get careless and let them run down at some critical time. But this unit meets its claims when you follow the admonition to use fresh batteries and check servo speed during your preflight inspection.

If you are careless, you'll probably crash for some *other* reason, anyway.

Failsafe Flight System @ $39.95 list from T&D Flight Systems, P.O. Box 1782, Staten Island, NY 10314. For additional information call Alex Kronfeld at 1-718/984-9121.

Propeller Noise

Continued from page 42

cause of poor community relations. Much of the cure will depend upon education. Modelers need to understand the nature of the problem in order to properly utilize solutions. This article has introduced the propeller noise problem and provided some necessary background. Subsequent articles will explain the test results in greater detail and describe what the modeler can do to achieve better aircraft performance with less noise.

RC Soaring/Blakeslee

Continued from page 49

down, but he's hoping to arrange "manufacturer's demonstrations" during the meet. This would be flying demos, followed by show-and-tell sessions by guys like Byron Bruce (Combat Models), Marty Silberstein and Steve Peacock (Cliff Hangar Models), and Brian Laird and Paul Masura (Slope Scale Models). Other than this, I'd imagine it'll be much like the fabulously successful Richland Scale Slope Fun Fly—i.e., fly when you want as long as you have the pin. Info is available by writing Charley at SSN, 2601 E. 19th St. #29, Signal Hill, CA 90804. Better: call him at 1-213/494-3712.

1990 Soaring contests: Ray Hayes, Vice President of the LSF, wrote to remind us that now is the time to plan for next year's big contests. Specifically, Ray is talking about the every-even-year LSF Regionals and the annual NSS Soar-Ins that are put on by go-ahead clubs around the country. They're a bit expensive, but Ray is hoping to continue the tradition of awarding the beautiful LSF plaques at the LSF Regionals. They're worth winning!

Ray is also hoping that the three "super" contests (NSS Masters, LSF Nationals, and AMA Nats) can be spread around the country in 1990. All these contests were on the West Coast in '89, and Ray was afraid that guys east of Kansas are beginning to feel left out! If you'd like more info on the LSF Regionals, check with Ray at 69598 Brookhill Dr., Romeo, MI 48065; phone 1-313/752-6163. The NSS Soar-Ins have been handled by Marshall Long for the past few years (assume you're on for '90, Marshall!). Marshall's address is 824 Garden Meadow, Universal City, TX 78148.

Not to worry, East Coasters: I hear the Nats will be at Lawrenceville, IL in '90.

RC Aerobatics/Van Putte

Continued from page 51

aerodynamic center of each segment of the wing. You'll note that the root of one segment is the tip of another segment.

Figure 4 shows the geometric technique solution. Remember that the aerodynamic center of a panel is at the 25% point of the mean aerodynamic chord of the panel.

Once you've determined the aerodynamic center of each panel, you must calculate the area of each panel using Equation 2. Then, measure the distance from a convenient line to the aerodynamic centers of the panels. Figure 4 shows a convenient reference line and the distance to the respective aerodynamic centers. The distance back of this reference line that the aerodynamic center of the wing is located is determined by Equation 3.

The mean aerodynamic chord of the complete wing is calculated from the individual values as shown in Equation 4. It looks just like the equation for determining the distance to the wing aerodynamic center, doesn't it? It should, since the

BILL OF MATERIAL – KEYTWO, MA PLAN # 636

TAIL SURFACES	3/16" X 3" X 36" MEDIUM BALSA (2)
AILERONS	14" X 1" BALSA TRAILING EDGE STOCK (2)
WING RIBS	1/16" X 3" X 36" MEDIUM BALSA (2)
WING SHEETING	1/16" X 3" X 36" MEDIUM BALSA (4)
FUSELAGE SIDES & DOUBLERS	3/32" X 3" X 36" MEDIUM BALSA (4)
FUSELAGE TOP & BOTTOM	1/16" X 3" X 36" MEDIUM BALSA (2)
WING SPARS & LEADING EDGE	¼" SQUARE X 24" HARD BALSA (6)
FUSELAGE UPRIGHTS	3/32" X ¼" X 36" MEDIUM BALSA (1)
PUSHRODS	¼" SQUARE X 36" MEDIUM BALSA (1)
SERVO RAILS & TANK FLOOR BRACES	1/8" X ¼" X 36" MEDIUM BALSA (1)
FUSELAGE LONGERONS	3/32" SQUARE X 36" MEDIUM BALSA (4)
WING TRAILING EDGE	3/16" SQUARE X 24" MEDIUM BALSA (2)
WING TIP CAP	1/8" X 3" X 9" MEDIUM BALSA (1)
WING TIPS & LANDING GEAR MOUNTS	1/16" PLYWOOD 6" X 12" (1)
LANDING GEAR MOUNTS	¼" PLYWOOD SCRAPS
FUSELAGE FORMERS & SERVO MOUNT	1/8" PLYWOOD 6" X 12" (1)
WING BOLT BLOCKS	½" X ½" X 1 ¼" MAPLE (2)
WING BOLT BLOCK REINFORCEMENTS	1/32" PLYWOOD SCRAPS
NOSE GEAR STRUT	1/8" DIA. MUSIC WIRE (SIG PART)
MAIN GEAR STRUTS	1/8" DIA.X 18" LONG MUSIC WIRE (1)
WHEELS	2 ¼" DIAMETER (3)
WHEEL COLLARS	1/8" INSIDE DIAMETER (3)
ENGINE MOUNT	TO SUIT ENGINE
NOSE GEAR STEERING ARM	TO SUIT STRUT
WING BOLTS	¼" – 20 NYLON BOLTS X 2" LONG (2)
PUSHROD WIRE	1/16" DIA. X 20" LONG MUSIC WIRE (1)
CONTROL HORNS & CLEVISES	TO SUIT
FUEL TANK	TO SUIT
HINGES	TO SUIT (15)
THROTTLE PUSHROD & END FITTINGS	TO SUIT
AILERON CONTROL ARMS	3/32" DIAMETER X 12" LONG MUSIC WIRE (1)
AILERON CONTROL ARM BEARING	1/8" INSIDE DIA. X 4" LONG BRASS TUBING (1)