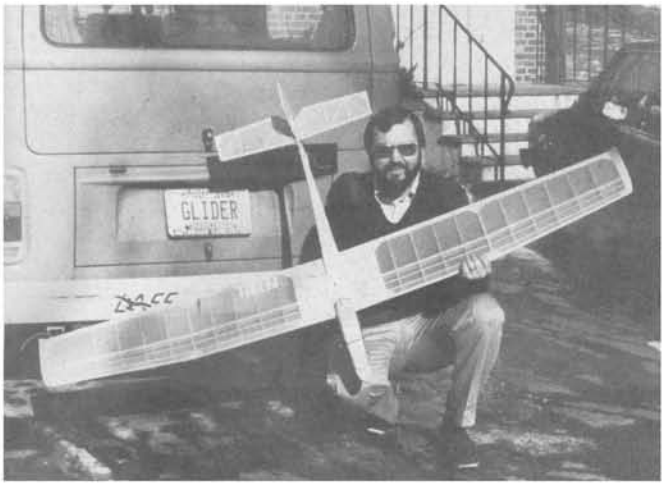


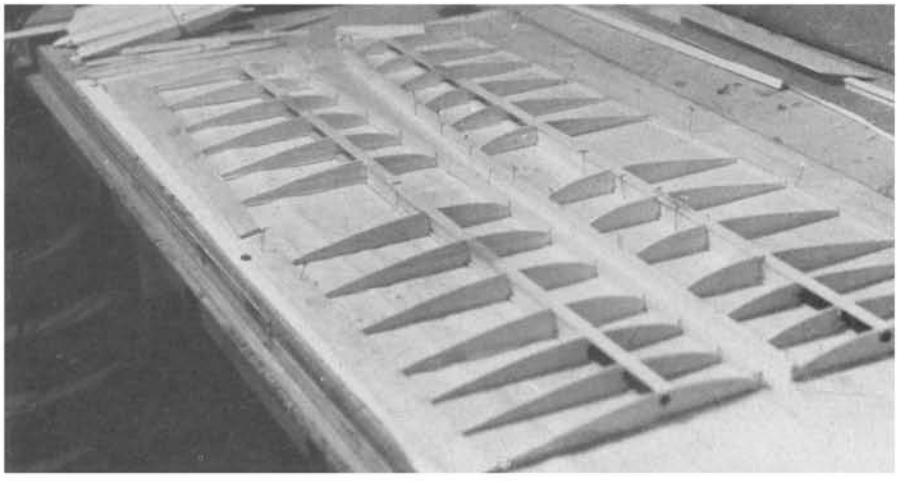
PHOTOS BY AUTHOR

Left, "Petrel" designer Jim Ealy; right, his son Jimmy about to launch the Petrel on a hi-start. Design follows current trend toward lower aspect ratios, as Dave Thornburg points out in his Sailplane Design article in the February MB. Plans show optional spoiler installation.

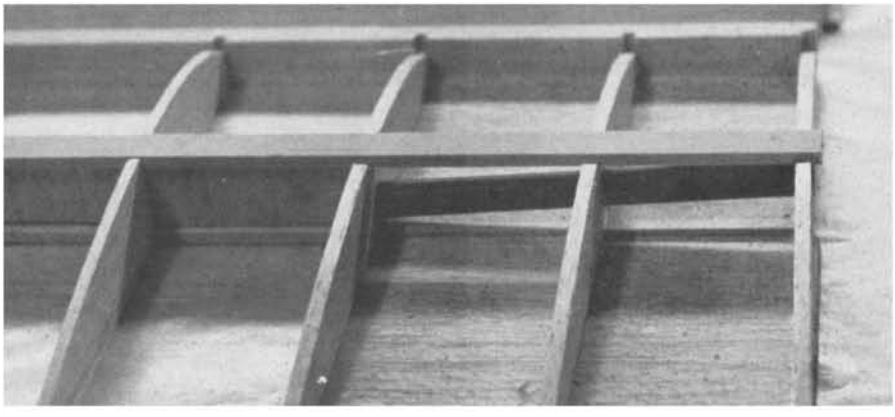
PETREL

By JIM EALY . . . An excellent 2-meter design for competition or sport flying. Plans also show how to make 100-inch wings.

• The Petrel, as in "Storm Petrel", is a member of the group of various small birds that inhabit the shores of most oceans. These small aggressive birds are extremely maneuverable and can penetrate easily in stormy weather, but can relax and soar with the best in calm, light air. The model, like the bird, appears to have all of the above natural talents in the hands of a beginner, and can keep the expert from becoming overly complacent. If you are on the contest trail, as well as being a Sunday flier, it will bring home hardware and help you look like one of the experts. I wish to thank one of my favorite experts, Don Climeson, for encouraging me to make detailed drawings and for showing me and others just how well the Petrel could fly. He gave me the enthusiasm to start the long process of making the drawings, as well as getting homemade kits to the interested fliers . . . an undertaking not recommended for the sound of mind!



Basic wing layout. Note that the ribs are not yet notched for the turbulator spars or spoilers, as the author prefers to do this after the wings are assembled.



Closeup of the fiberglass wing rod tube in the wing root. Space between tube and spars is filled in with 3/16 balsa. At 1/4-inch diameter, an aluminum wing rod is plenty strong.

The Petrel was designed for my son to compete in the two-meter LSF contests. While it was being built, he was at hockey camp. He returned the day before the contest, test flew it for three short flights at dusk, entered it the following day, and did quite well! Maybe the advantage of youth (ten years old) and the fact that he is working on LSF Level Four makes some difference. The plane has been flown by several others of greater skill than either of us, and it has made an instant, positive impression. However, the reason for this article is that several "novice" club members have been handed the transmitter, and most of them felt that they could fly it better than their own ship. Those of us who were watching agreed. Also, the ease of construction and the several variations that can be made during the building appeals to both novice and expert alike.

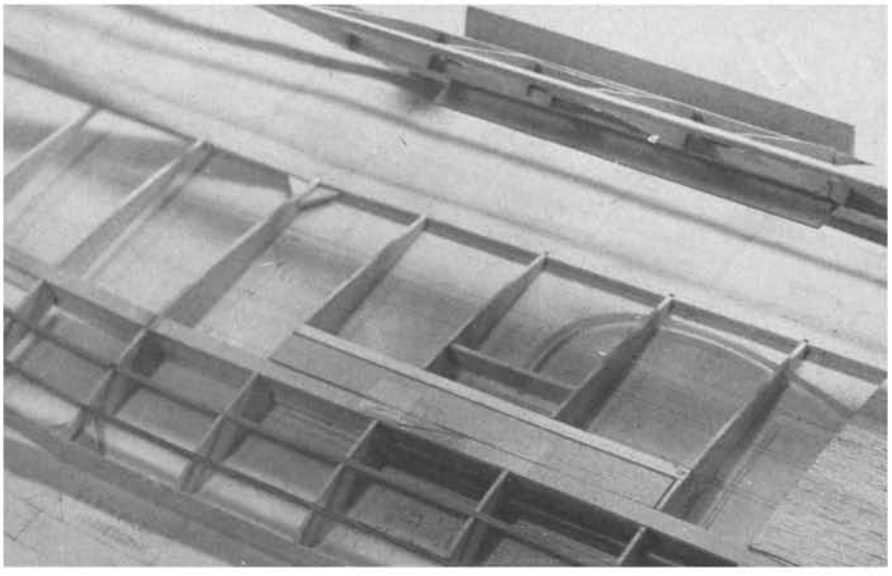
I teach at THE HILL SCHOOL, an all-male college preparatory school, which has the good fortune to have about fifteen acres of open athletic fields (mowed several times a week), several large basketball courts (for indoor flying) and a pond that can be used for power and sailboats. This lends itself to a good, active model club. As if this were not enough, we also have a very complete metal shop and wood shop. Several students in the past have built .40-size glow engines from scratch, and a possible full-size glider is being talked about for the wood shop under the guidance of the EAA School Flight Program. THE HILL SCHOOL enrolls young men in grades eight through

twelve; some become club members, with little or no model experience, and a few have placed at the Nationals. The club needed an easy-to-build, strong and stable ship to teach the novice members how to fly, and the Petrel was the answer.

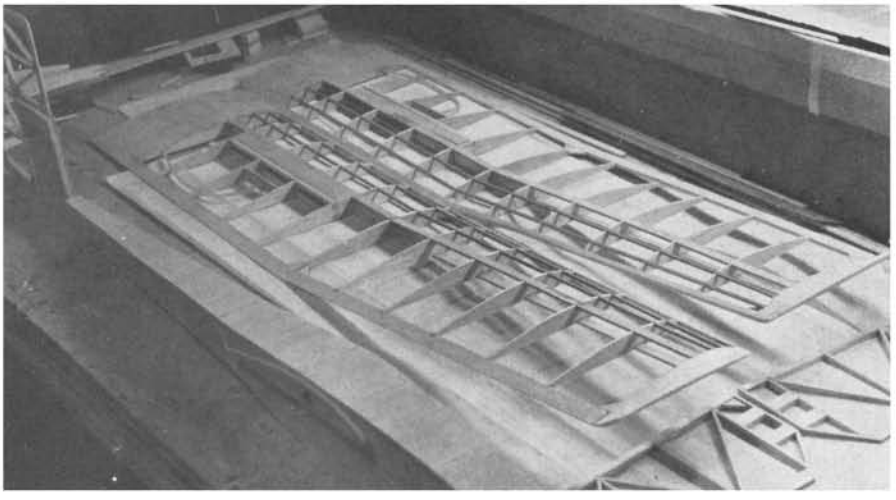
The design parameters have been selected with regard to the published advice of true experts and winners, and from my own experience and conviction. Most of these convictions are the result of my years of building and designing, but mostly result from the frustration with designs that, with a little more thought, could have been so much easier and logical. This would have made it easier for the young person to be successful and to continue with the hobby. Too many designs are for the well-advanced expert (who rolls his own anyway), or so simple that the beginner will know that when he takes it to the field, everyone else will know he is a rank beginner. We were all beginners, but we tried not to be that obvious about it.

The design parameters are listed as follows, and include a reason for that parameter. Two-meter wing span: a new challenge and a relatively untried class. A wide nine-inch chord for the inboard panel and a reasonable taper to a seven-inch tip chord: lots of squares (650 sq. in.). The airfoil is a compromise: a thin 9.8% at 31% of the chord but with turbulator spars. The turbulator spars are optional, but they will guarantee extra height on launch and guarantee a true airfoil at high speeds, when coverings deform, thus increasing efficiency . . . the name of the game! Notched trailing and leading edges: ten-fold increase in structural and torsional strength. This small procedure takes about five minutes, and is well worth the time. The spars are a bit much and so is the webbing, but 1/8 x 1/4 spars and 3/32 webbing instead of that shown on the plan will only earn a decrease of 7/8 oz. This decrease in wing loading versus strength at a wing loading of 5.0 to 5.2 oz./sq. ft. is an academic argument and not a practical one . . . Besides, some of our friends need a ship that will break winch lines without folding the wings to gain a relaunch! Ballast tubes in the wings are also optional, and can be made from plastic, brass, or aluminum; however, use brass filled with lead, and not aluminum! Depending upon the tubing size you select, you can add about 2 to 2-1/2 pounds to the ship's weight.

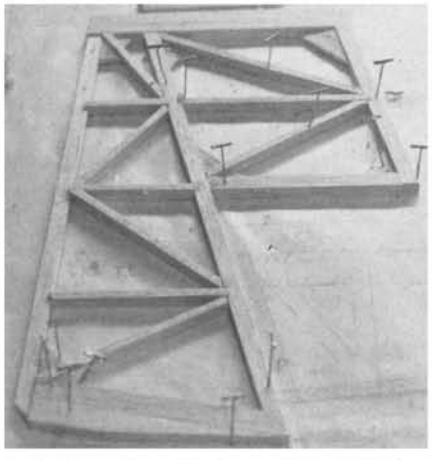
We do some slope flying here on the East Coast, but only when we are forced to by heavy rain. Built as per plans and ballasted to the hilt, the Petrel can be dived and pulled out without concern on your part and without much flex in the wings. The flying stab provides ease of trimming and change of in-flight incidence angle, as well as having the positive effect of no hinge line drag. The balanced rudder is very efficient and sturdy; a few of us are still surprised by strange and sudden gusts of wind that seem to cause our ships to invert on landing. This fin and rudder won't

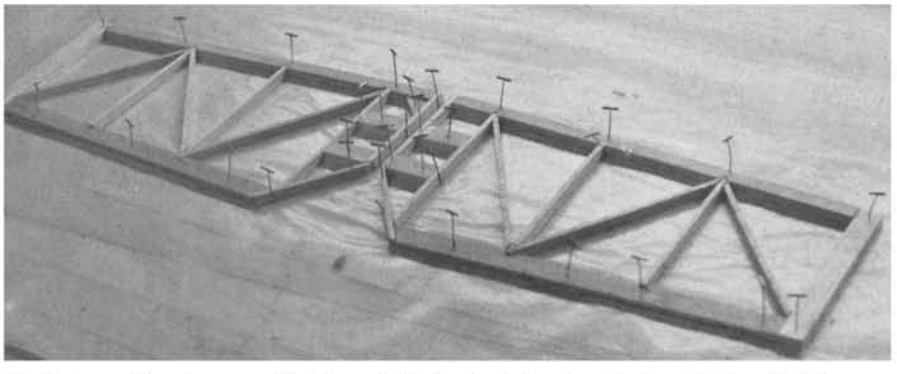


Spoiler details. Rear view of wing at top of photo shows top and bottom spoilers open. Also, note the optional ballast tubes just in front of the main spar. Lots of options on this model!

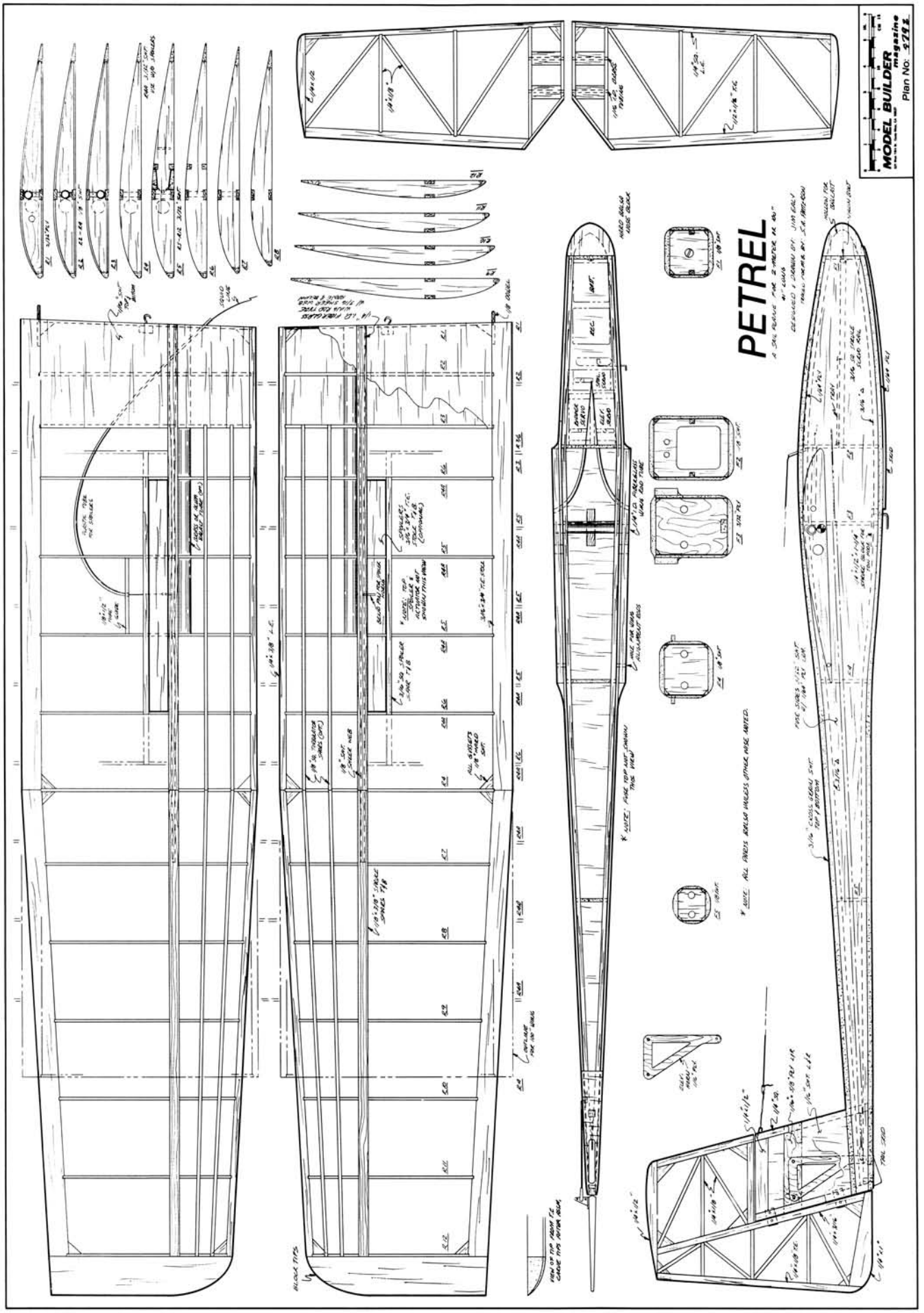


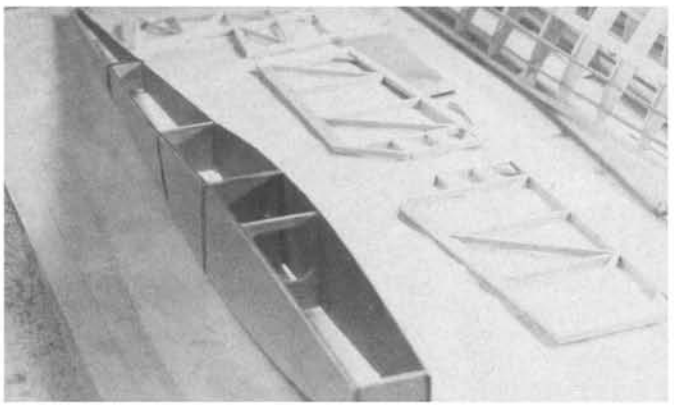
The entire airplane, ready for sanding and finishing.



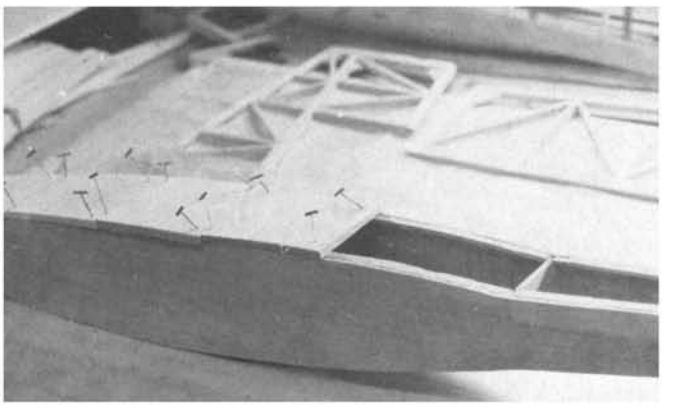


Both the rudder and stab can be completely assembled before taking them up off the board. Rudder is designed not to break if the ship flips over in an overzealous attempt to hit the spot. Extensive use of notching provides extra strength.


MODEL BUILDER
Plan No: 1212
PETREL



Fuselage structure without top and bottom sheeting. With full-length 1/64 ply side doublers, that fuselage should never break!



Use of thick top and bottom sheeting and triangular stock in corners permits well-rounded edges on finished model.

crunch.

The fuselage is reasonably wide and deep to allow us to put all of the necessary equipment in place and have it look neat, particularly those of us blessed with short, fat fingers. The nose block is hollowed with a Dremel tool, and a cut-off 1/4-inch nylon bolt will allow easy access to change the ballast towards the mad, mad, mad 45%. The width of the fuselage, the wing tips, wing root fairing, and the length of the fuselage allow us to make use of standard 36-in. sheet and strips. The full-length 1/64 ply doubler makes the fuselage much stronger than you will believe. The really neat thing about the Petrel is the fact that you can build 100-inch wings for it by simply adding more No. 4a ribs and using 48-inch stock instead of the 36. Now you are saying, "Ealy, you finally went too far!" NO! The two-meter version has moments almost at the maximums, but the model is still very responsive. All who have seen it fly agree to that fact. After attaching the 100-inch wings, we are now near, but not beyond, the minimum moments for the wing span, chord, etc. One might guess that it would now be too sensitive, but in truth, the increased lateral mass slows down the yaw rate . . . again, a smooth and responsive 100-incher. With the wing loading decreased by the increased area of 850 sqs., you now have another winner!

"To spoiler or not to spoiler, that is the question." I need them to get landing points, but my son doesn't, so it is your option again. I personally believe that spoilers on just the bottom are more efficient airfoilwise, but I use them on top and bottom. With top and bottom spoilers, the Petrel will almost stop in midair. You can bring it in for 100-point landings everytime, unless someone is already there and the nose of your plane is too high off the ground for the 100-point section to reach, because you are on top of his ship. Go ahead and laugh, this happened to a person who was eager to win.

CONSTRUCTION

1) Read all directions first, before doing any building. (Alright, go ahead without reading, Murphy loves you!) Separate all strip wood, sheeting, and hardware into neat piles that will become the wings, fuselage, fin, stab, and rudder.

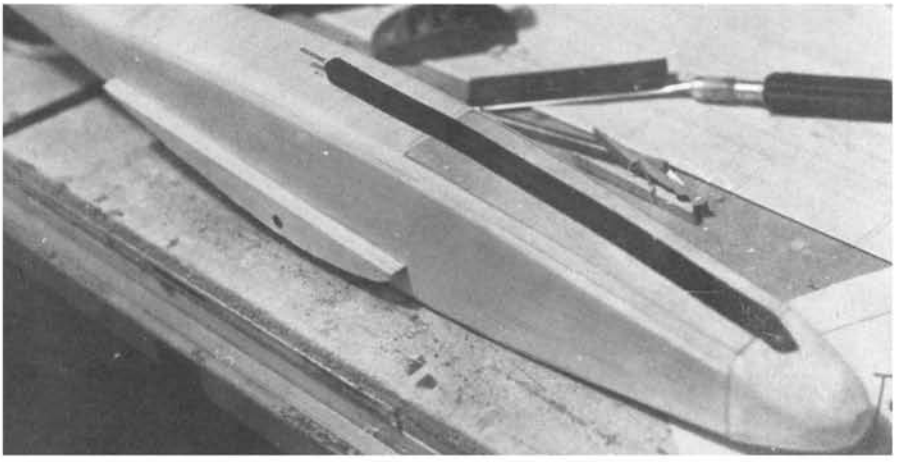
2) Cut out all ribs and notch them for the spars. Pin the l.e. and t.e. to the plans and mark and notch them 1/8 inch deep for the ribs with three hacksaw blades. If you plan to use ballast tubes, sand one end of the tube very sharp and use it to cut holes in each rib. Insert the tube into the holes after step No. 7 and attach with epoxy or cynoacrylate adhesive.

3) Pin l.e, t.e. and bottom spoiler to plans (be sure to cover the plans with plastic wrap first!). Cut and glue bottom sheeting in place and glue all ribs in place except the dihedral ribs.

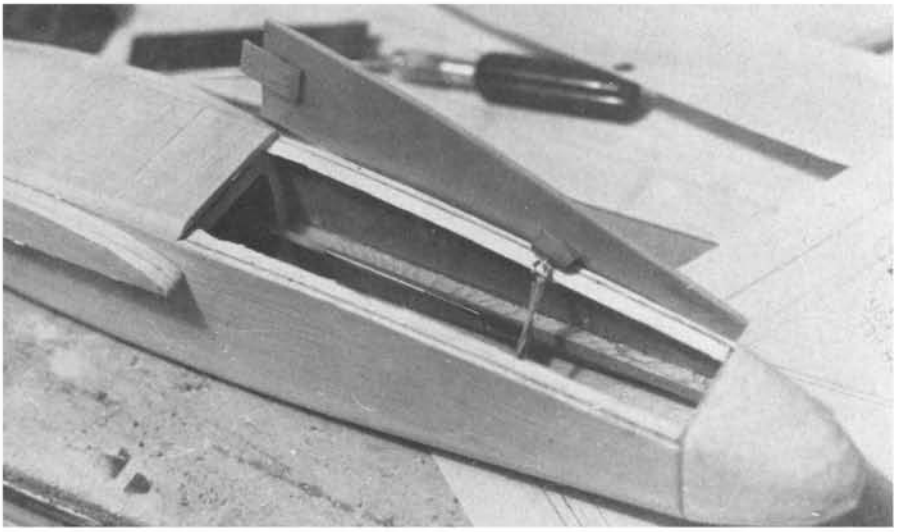
4) Place the fiberglass wing rod tube (cut to exact length) in place. DO NOT GLUE. Cut and place 3/16 webbing between tubing and spars and tack glue only. Cut and glue the 1/8 webbing between the appropriate ribs and glue top spar in place. This is to be done with inboard and outboard panels.

5) Notch top and/or bottom of ribs to accept spoiler blades and spoiler spars,

Continued on page 93



Bottom view of fuselage showing skid, towhook, and 1/64 ply bottom doubler. Rubber skid keeps ground slide to a minimum, which helps when making spot landings.



Radio hatch has 1/64 ply doubler on the inside. Former F2 is notched on top to accept the tongue on the rear of the hatch. Nose block is hollowed out to serve as a ballast box.

Petrel . . . . . *Continued from page 45*

and glue spars in place. Install spoiler blade with tape to insure proper fit. Install spoiler cable tubes, epoxying the tube and tube support in place. Make and install bent-pin spoiler horn onto blade, cover with your favorite covering at the appropriate time, and attach with Scotch brand sealing tape.

6) Remove wing panels from plans and sand the outboard edge of the inboard panels vertical, both wings. Prop the wing tip up two to three inches. (Two inches will result in flights of constant turn with neutral rudder after turn has been initiated. Three inches will result in a turn being manitained only with constantly applied rudder.) After you have selected the height, sand the inboard edge of the outboard panel vertical, both wings. Epoxy dihedral rib, l.e., t.e., and spars together. Add epoxy to webbing around the dihedral ribs and add gussets.

7) Insert wing rod into tubes, prop up wings at dihedral joint 1-1/2 inches, and pin root rib to table, keeping rod level. Epoxy tube and webbing to spars, spreading epoxy onto ribs. Add gussets and hardwood blocks for screw eyes. Insert screw eyes later.

8) Add top sheeting, turbulator spars, and glue wing tip blocks in place. Locate and drill 1/8-inch hole in root rib and trailing edge to accept the 1/8-inch dowel alignment rod. Epoxy or Hot Stuff in place.

9) Sand all surfaces and l.e. to shape. If you wish, you may sand lower edge of ribs and l.e. upward to approach a "Phillips" type entry. Sand l.e. very sharp at root and gradually decrease it to a blunt edge at tip; this will eliminate the need for wash-out and the induced drag associated with it. If you wish to have wash-out, raise t.e. at tip 3/16 of an inch when you cover it, by warping it with a heat gun.

STABILIZER

1) Cut and pin l.e., t.e., and tip to plans. Mark locations of ribs, remove and notch l.e. and t.e. with the hacksaw blades. Repin l.e. and t.e., shim up t.e. with 1/16 scrap, and cut and glue all ribs and gussets. Glue the blocks for stab rod tubes in place. DO NOT DRILL HOLES AT THIS TIME. Sand the stab to a symmetrical shape. After the fin is complete, use the 3/32 and 1/16 wire rods to mark the placement of the stabilizer support tubes, then drill and insert brass or aluminium tubes in place, holding them with Hot Stuff.

FUSELAGE

1) Cut the 3/32 balsa sides and the 1/64 ply doublers for the sides, hatch, and skid. Attach the sides to the doublers with Southern R/C Products "Sorghum" or any spray adhesive. MAKE A LEFT AND RIGHT. Those of you who are skeptical about the strength may spread a thin layer of epoxy between the pieces in the forward section.

2) Epoxy fin post and former F1 in place and clamp with rubber bands. Epoxy formers F2, F3, F4, and F5 in place. They must be square and vertical. Sight down the fuselage and adjust for a smooth and symmetrical shape. Be sure all formers are at the specified locations.

3) Epoxy the spruce servo rails in place and the 1/4 x 1/2 spruce block to former F3 for the towhook. Sheet the bottom with 3/16 balsa, cross-grain. Add 1/4-inch triangular strips for gussets and glue the 1/64 ply skid doubler to outside of fuselage bottom.

4) Route out a cavity in the center of the nose block and epoxy it to former F1. Precisely and very carefully locate and line up the wing fairing and drill holes through the fuselage sides for the fiberglass wing rod tube, the screw eyes, spoiler tubes, and the dowel alignment rods. Harden the screw eye's hole and the alignment rod's hole with Hot Stuff. Add spoiler tubes to fuselage and epoxy fairing in place.

5) Glue fin l.e. and 1/4 x 1/2 top of fin together and epoxy to fuselage, shimming if necessary. Be sure that it is vertical with respect to the wing rod. Add the 1/2-inch x 3/32 I.D. brass tube to stab bellcrank and mark hole in the 1/16 ply bellcrank supports. Cut slot for rear alignment tube to move up and down 1/2 inch and epoxy in place. Sheet fin with 1/16 sheet.

6) Insert pushrod tubes, locate and cut exit hole in the side for the rudder pushrod. Locate and cut hole in the fin l.e. for the stab pushrod tube, and epoxy in place.

7) Add triangular strips to the top of fuselage, add 3/16 cross-grain sheeting up to former F2. Cut, but do not glue, cross-grained sheeting for the hatch. Place ply hatch doubler on fuselage over waxed paper, glue hatch sheeting to doubler and hold in place with rubber bands until dry. Remove and add the spruce block for the hold-down screw eye. Slot the top of former F2 to accept a 1/16 ply tongue glued to hatch cover. The tongue will slip into slot, and the rubber band attached to the fuselage bottom and the hatch screw eye will hold the hatch in place quite well. Drill hole for antenna exit and sand entire fuselage and fin to the shape indicated by the cross-sections on plan at the formers.

RUDDER

1) Pin l.e. and t.e. to plans, shimming up t.e. with 1/16 scrap. Cut rudder post and top and bottom pieces and glue as per plans. Cut and glue all ribs and gussets, and sand to shape. Slot rudder and fin post for hinges. Insert hinges and drill a 1/16 hole through post and hinge. After the fin and rudder are covered, reinsert hinges and push round toothpick into hole. Cut off toothpick and sand flush. Hot Stuff in place.

ASSEMBLY AND FLYING

Attach wings with rubber band through screw eyes. If necessary, sand root fairing to match the wing. Insert pushrods and install radio as per manufacturer's instructions. Epoxy and screw front edge of skid in place; drill hole for tail skid, making sure the posts clear the stab horn, and epoxy in place. Add towhook and balance as per plan, or to your desire. The plane will fly best as shown on the plan, but I am sure that some of you will be able to come up with improvements. I would be most pleased to hear replies. "May the wind be at your back" (except on launch!!). Ribs, hardware, and formers can be purchased from me at Box 120, Pottstown, PA 19464, for $19.95. Good luck and find lift. •