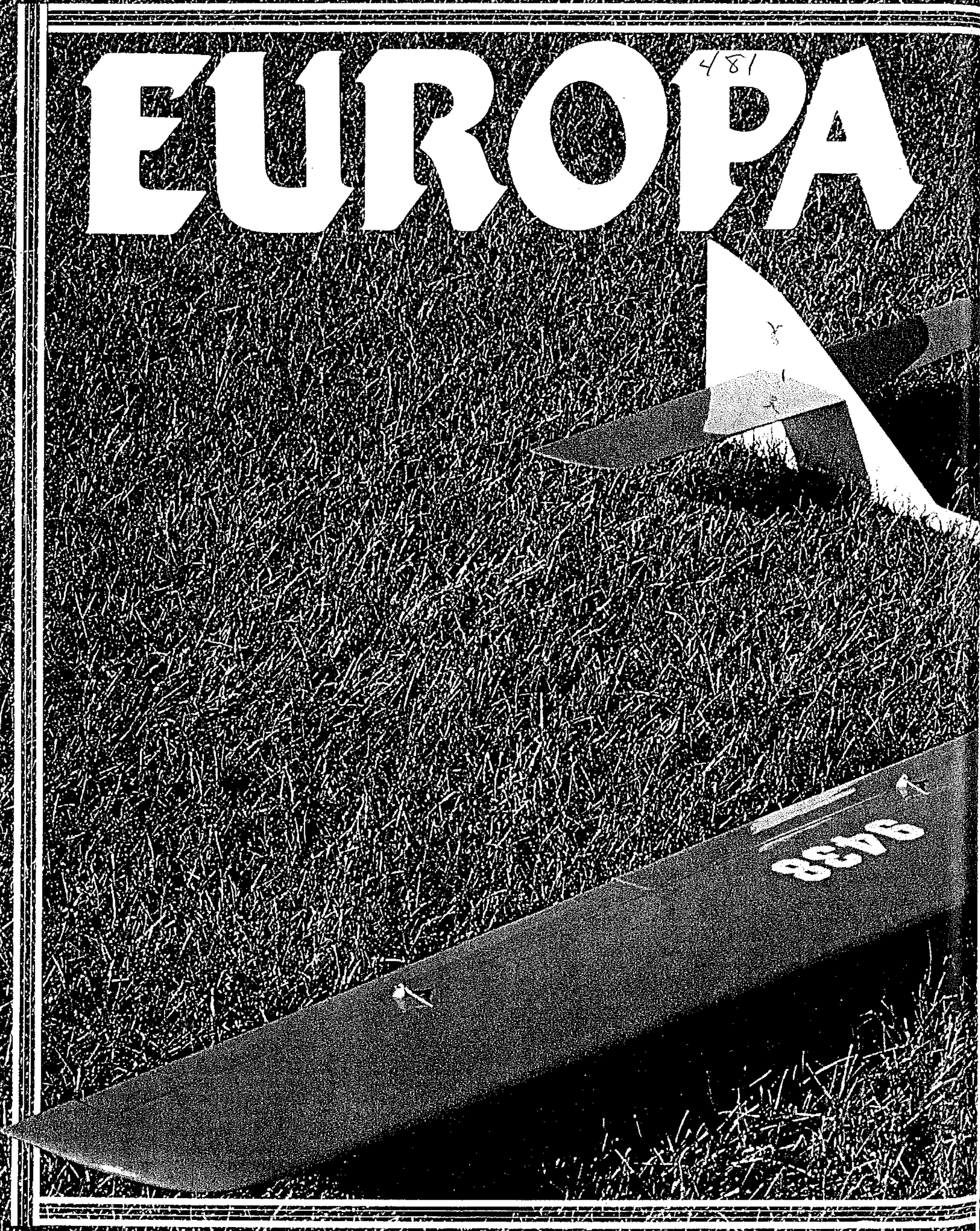
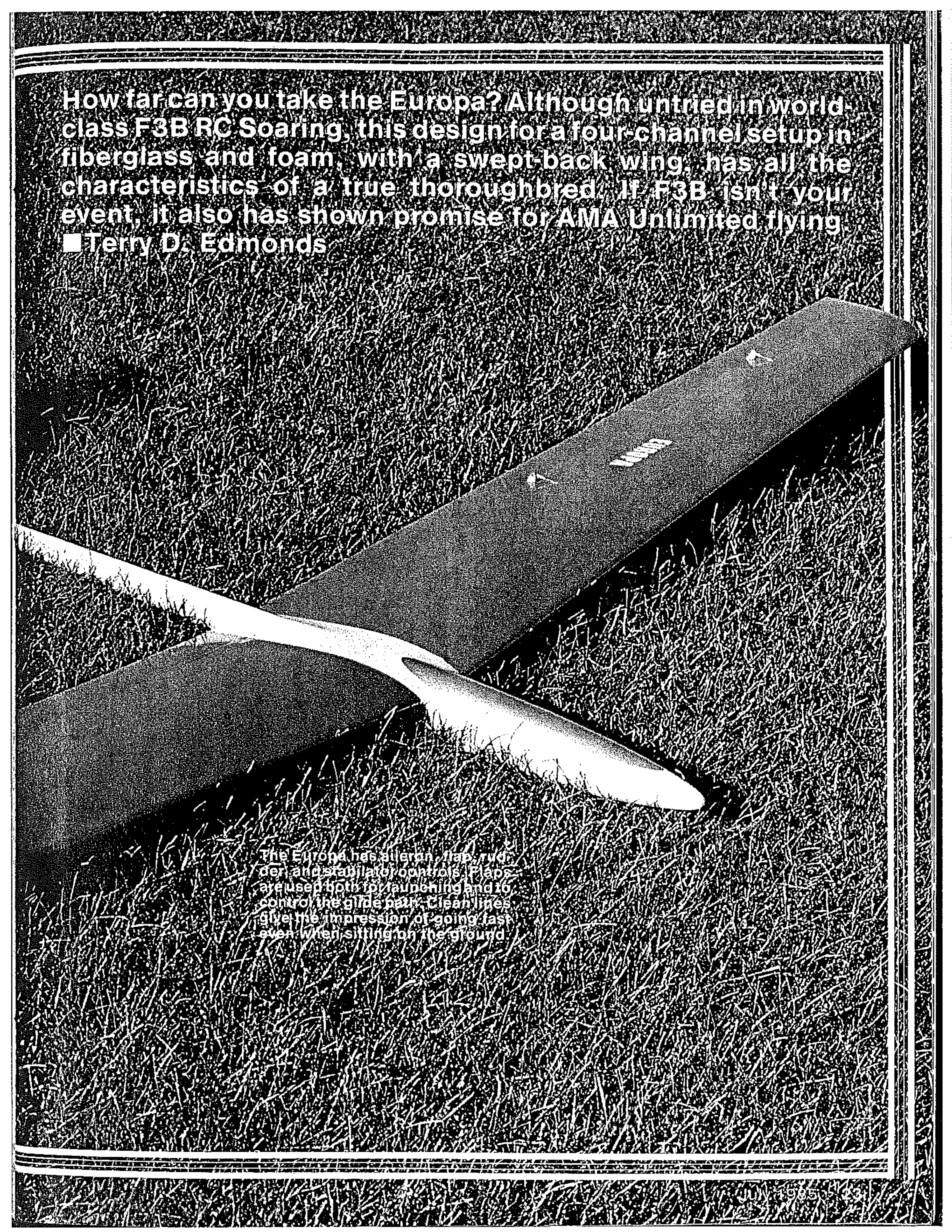
EUROPA



How far can you take the Europa? Although untried in world-class F3B RC Soaring, this design for a four-channel setup in fiberglass and foam, with a swept-back wing, has all the characteristics of a true thoroughbred. If F3B isn't your event, it also has shown promise for AMA Unlimited flying.

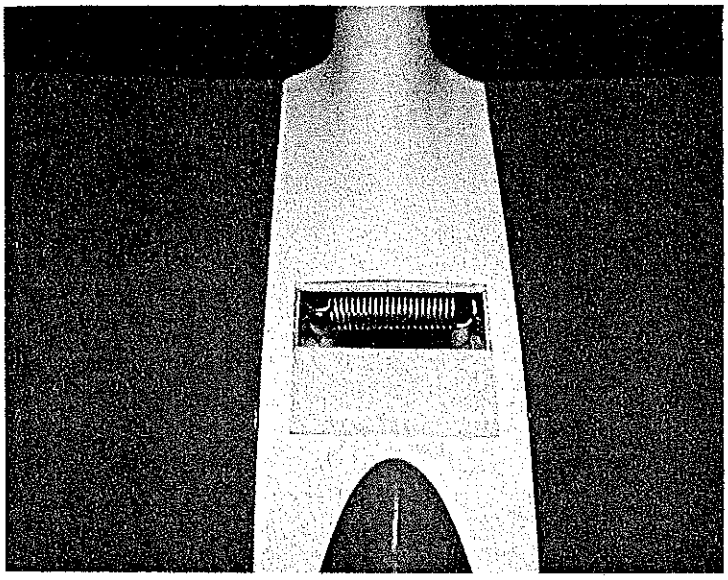
■Terry D. Edmonds

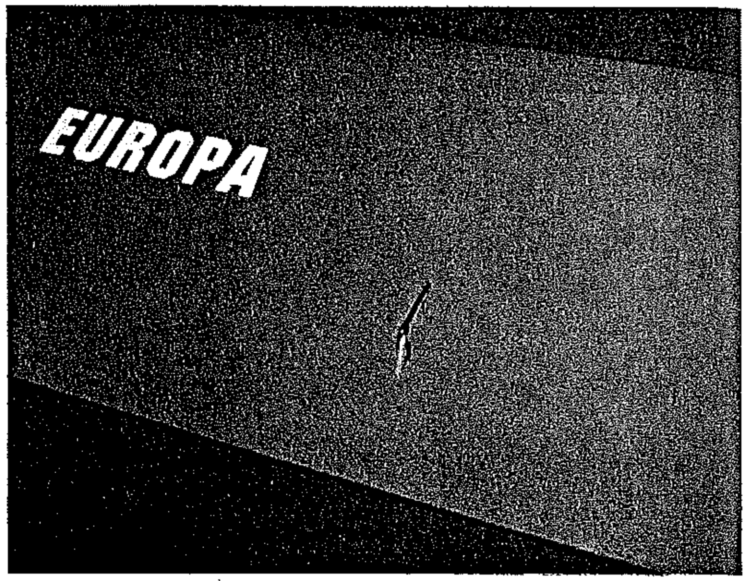


The Europa has aileron, flap, rudder and stabilator controls. Flaps are used both for launching and to control the glide path. Clean lines give the impression of going fast even when sitting on the ground.

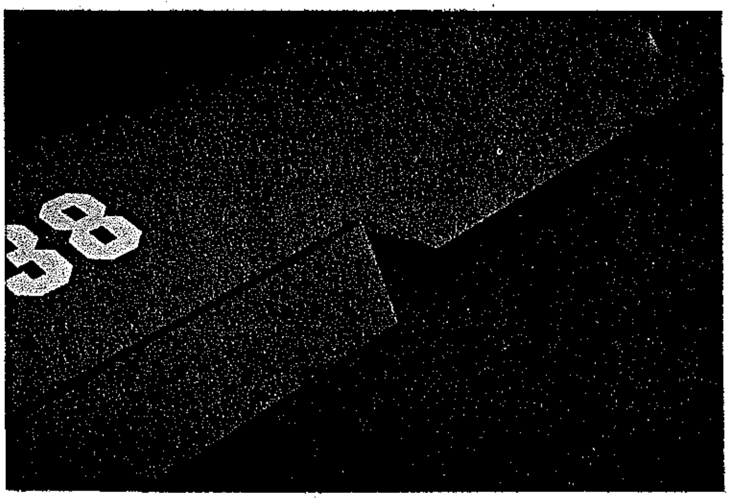
THIS SAILPLANE was conceived as a state-of-the-art design for F3B competition. It utilizes a combination of European, American, and unique features to produce a highly competitive F3B machine. Foam and fiberglass technology is used for an extremely strong structure that can handle the most powerful of winches while having a moderate empty weight. The unballasted wing loading is in the range of 11.5 oz./sq. ft. The fiberglass fuselage and foam wing cores are being made commercially available at a nominal cost to assist the average modeler in reproducing the Sailplane.

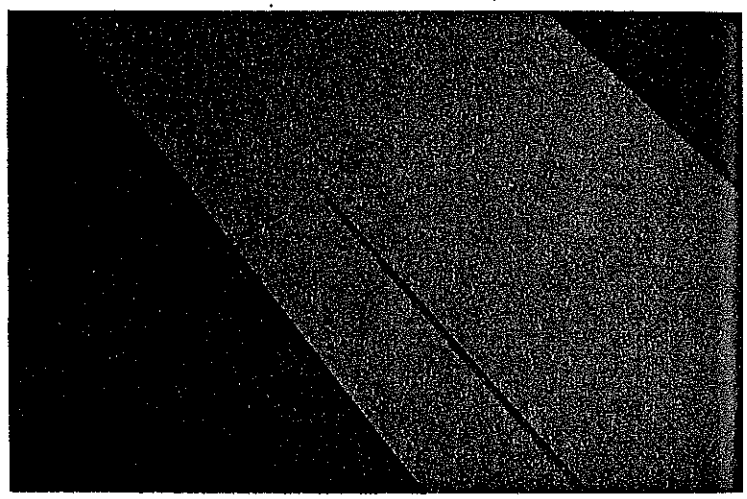
It should be stated at the onset that the author has not competed in world class F3B competition or the American team trials. However, this plane/pilot combination did place 3rd in F3B speed at the 1983 LSF International Tournament in Chicago and



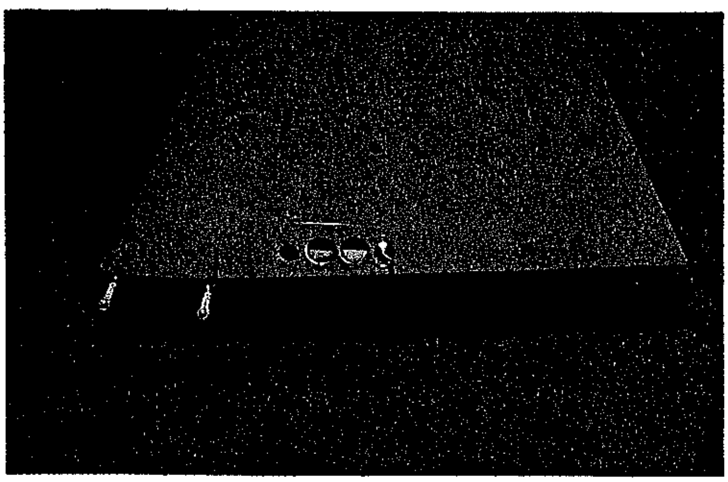


Left: A strong spring holds the wings on tightly, and the hatch makes connection and removal easy. Right: Horn base is buried in the control surface for streamlining. Simple linkage is used to minimize projecting objects. Trim adjustments are made at the servo end of the linkage.

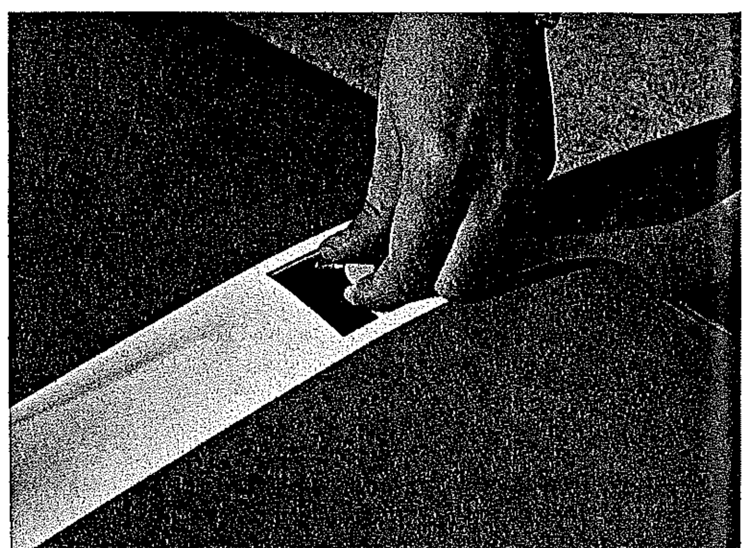




Left: MonoKote strips are ironed onto the trailing edge of the wing, on top of the flap hinge, to help seal the gap. Right: The gap in the lower aileron surface, shown here, is to allow for downward movement yet resist binding. Keep all control surface gaps to a minimum.



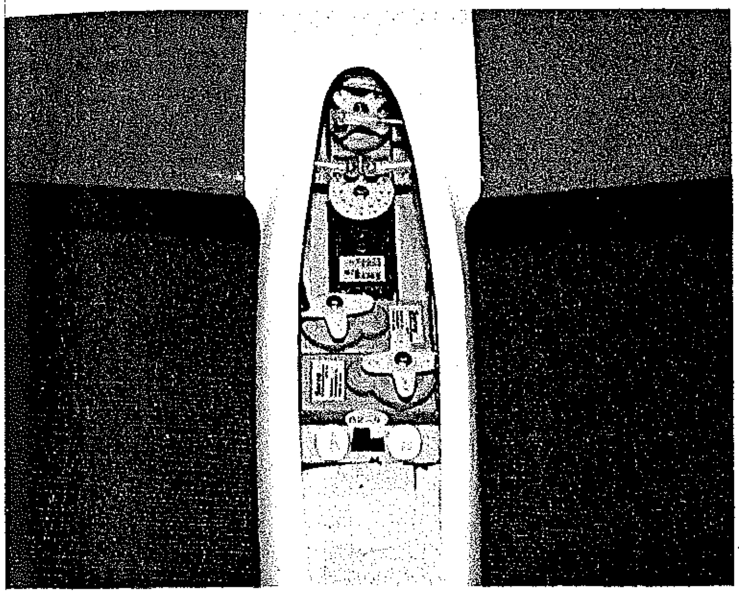
Above: The right wing root. Front cable operates the aileron, and the rear cable operates the flap. Right: Ballast slugs are inserted into the wing ballast tubes through the hatch without removing the wings, making the often-required loading changes a simple task.

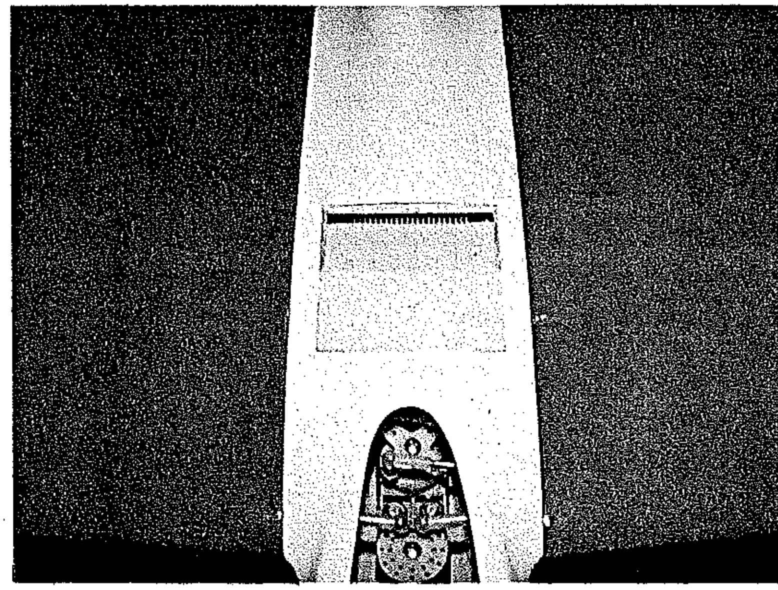


2nd in F3B at the 1984 Nationals at Reno. It is believed that the design has potential far beyond its present accomplishments.

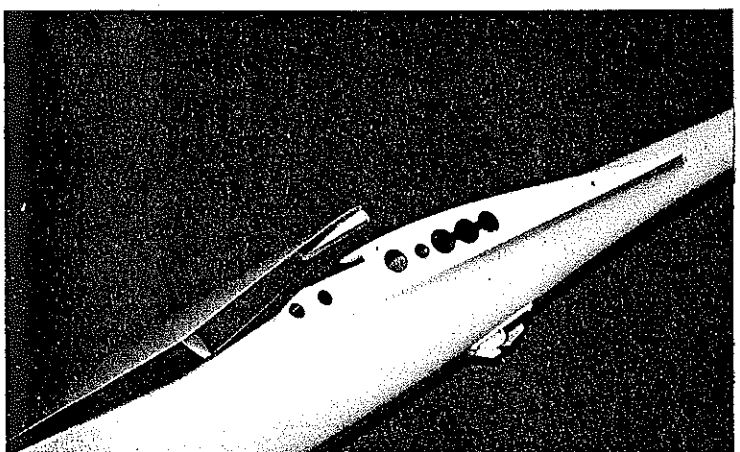
The current F3B rules emphasize the speed task. Speed is the only task one can potentially win, since the best that can be done regarding duration or distance is a tie. The Eppler 205 airfoil was chosen for the Europa with this in mind. There are quite a number of good airfoils that also could have been used. Airfoil type, while being interesting and fun to experiment with, produces a relatively small difference in overall performance. In F3B, as with most competitive Sailplane events, a consistently high launch and pilot/plane flying experience are of primary importance.

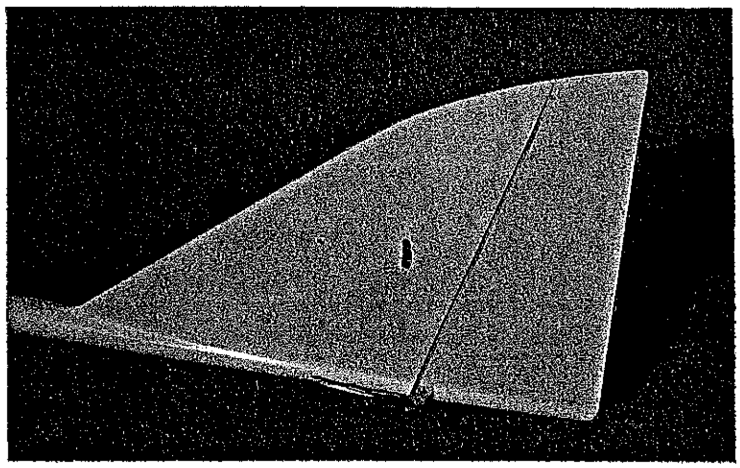
Zoom launches are executed quite well by the Europa. It has been launched on a couple of the most powerful winches in the country without folding a wing to



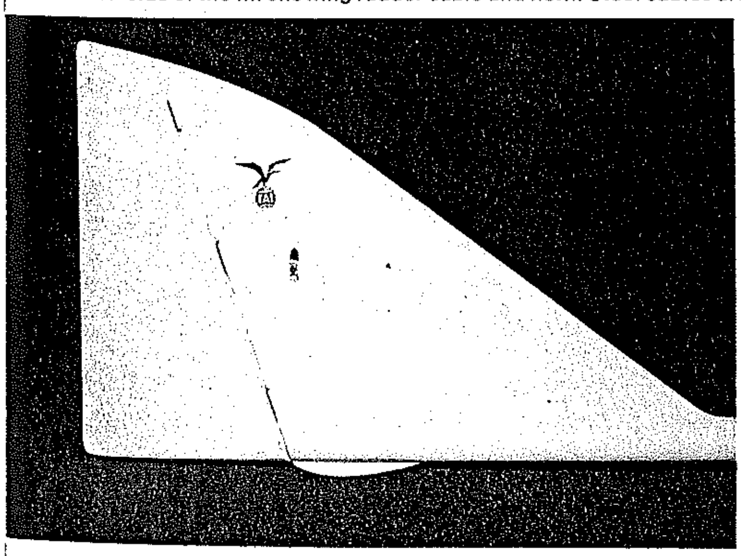


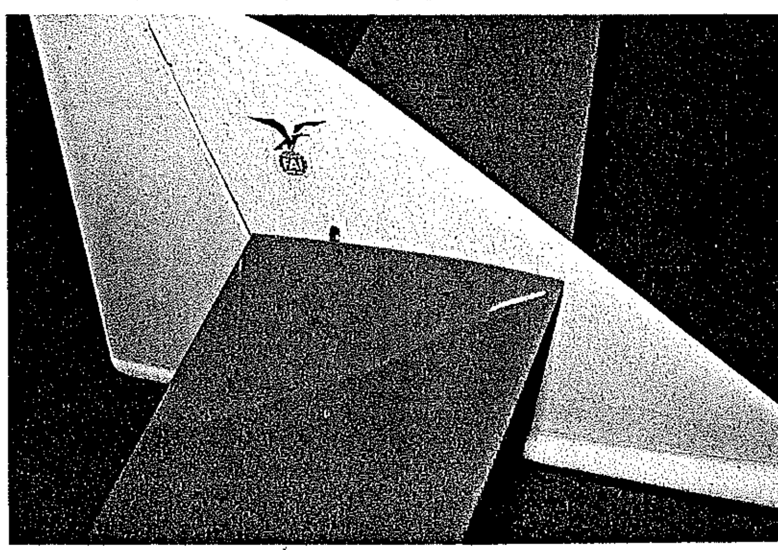
Left: A close look at the radio installation. Ball links pop on and off the flap and aileron servos for easy wing removal. Right: Stiff foam rubber is squeezed into the hatch area to keep the ballast slugs from moving around. The ballast must be snug enough for the Gs of the speed run.



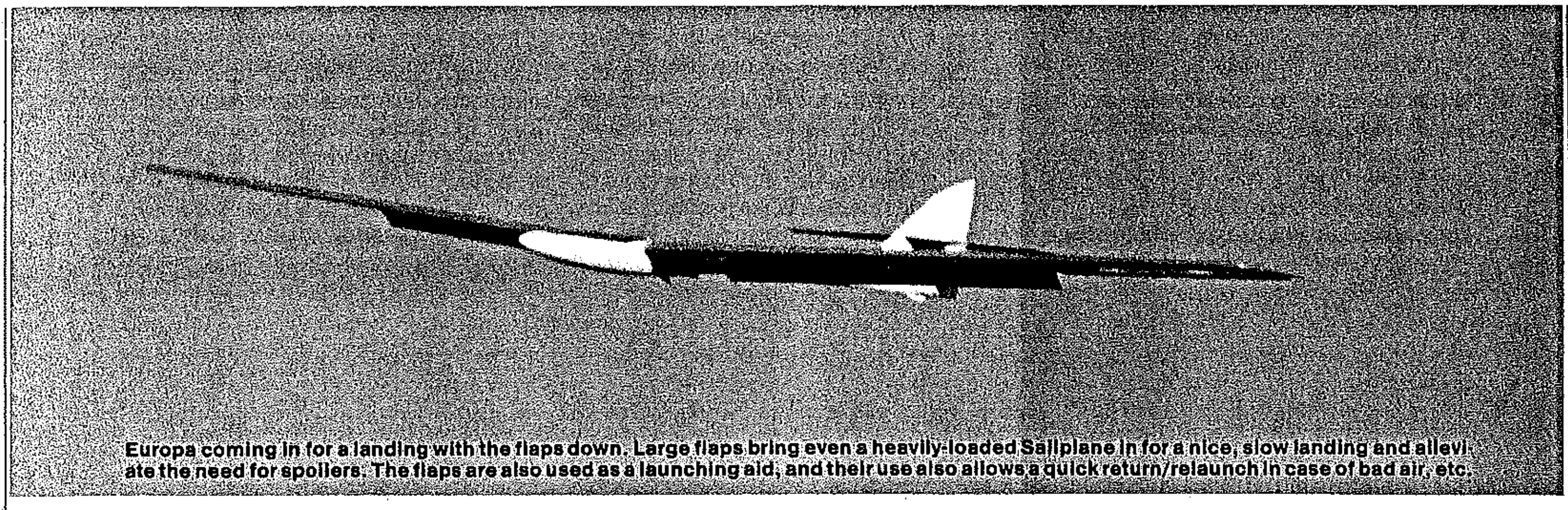


Left: A small notched block slips under the fuselage rear deck to fasten the canopy on, and a rubberband holds down the front. Right: Left side of the fin showing rudder cable and horn. Steel cables are used on all control surfaces to provide very tight control with no slop.





Left: The right side of the fin showing the position of the pinned rudder hinges and the stab drive fitting. Right: Close-up of the tail assembly. The design of the stabilator root section avoids the usual diagonal cutouts at the trailing edge to allow for the rudder swing.



Europa coming in for a landing with the flaps down. Large flaps bring even a heavily-loaded Sailplane in for a nice, slow landing and alleviate the need for spoilers. The flaps are also used as a launching aid, and their use also allows a quick return/relaunch in case of bad air, etc.

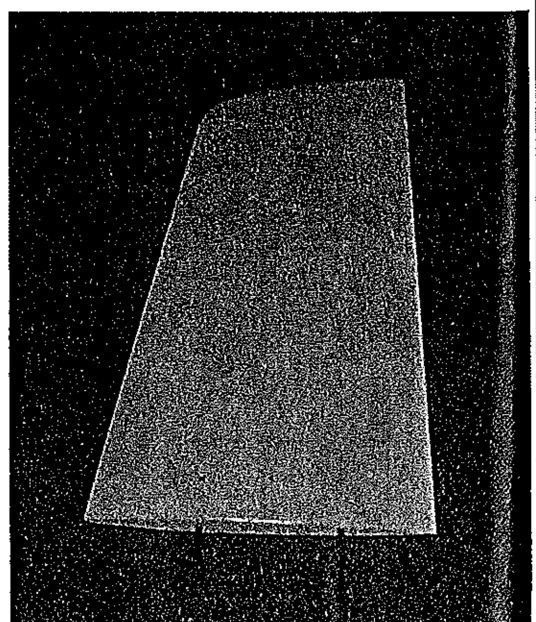
Author's daughters, Laura (holding Europa) and Alana (with the radio), on the day of the first test flight at an Eastern Iowa Soaring Society flying site. Europa utilizes state-of-the-art F3B design features. Commercially-available components greatly simplify construction.

date. This is not to say that it would not be possible to do so. It is difficult to determine the point at which a wing will break without actually breaking it.

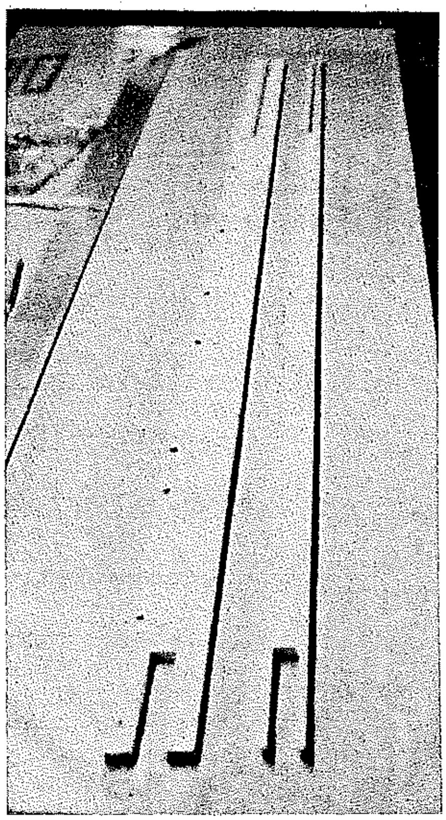
The Europa wing has a mild sweepback. Experimentation indicates the sweep yields an effective dihedral increase. The result is improved turning characteristics. Sweep also has the psychological effect of appearing to be moving faster whether it is or not.

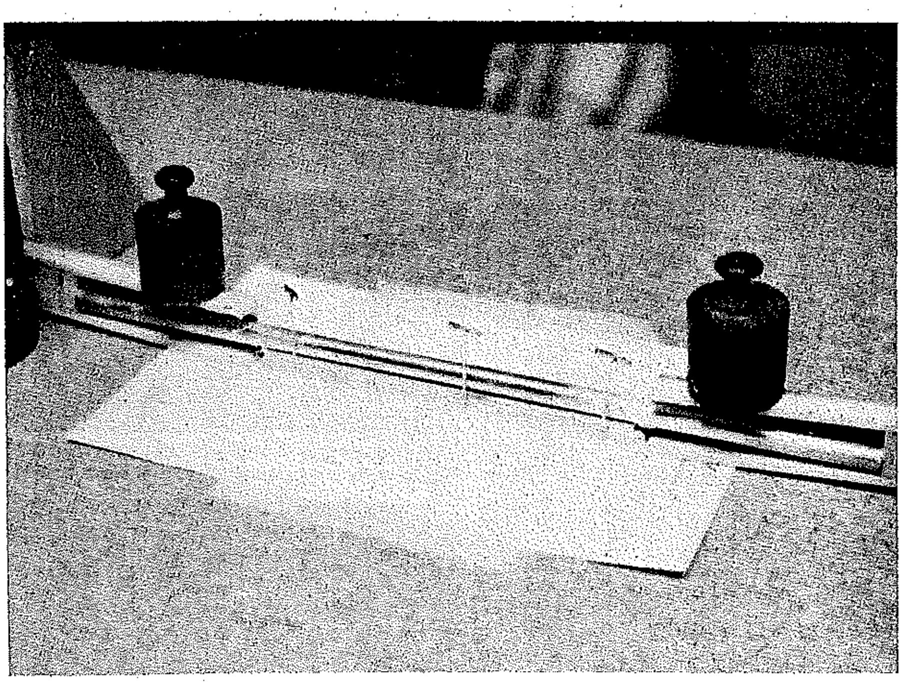
Flaps were chosen for glide path control over the author's usual preference of spoilers. This was done to achieve a combination of landing control and launching aid with one control surface. Approximately 10° of flap produces some increase in launch height. The amount of deflection depends on the pilot's launching technique and other factors such as wind speed and ballast. Full-flap deflection is also useful in an aborted attempt. The Sailplane can safely dive at a very steep angle and be landed slowly at the launching area in a much shorter time than a Sailplane without this feature, thus less working time is consumed for the relaunch.

Flaps do have some undesirable side ef-



Stabilator root section. Small black dot is the setscrew that locks the stabilator onto the fin. Made of 3/8 balsa with spruce edges.





Left: The spars are built-up external to the core. A straightedge and weights are used to ensure trueness. Above: The wing joiner tubes being fitted into the spars. Proper wing dihedral and sweep must be established on the spars for correct wing-fuselage alignment.

fects, though. Some additional drag is created at the hinge line. The amount of drag produced is the subject of considerable debate. In the Europa, I have used MonoKote seals on the gaps to minimize this effect. Also the pitch-up effect, when flaps are deflected, is severe enough that a mixer to correct the stabilizer trim is necessary. I use an electronic mixer in the transmitter, but a mechanical mixer in the plane could be used. Another difficulty in using flaps for glide path control is a pancake effect when retracting the flaps at slow speed. To overcome this, a slightly higher landing speed can be used.

Ailerons and rudder are driven by independent servos. I have an electronic coupler in my transmitter so that the ailerons and rudder can be coupled and uncoupled in flight. An alternative would be to have them coupled continuously by simply connecting both servos to the aileron channel with a Y-harness.

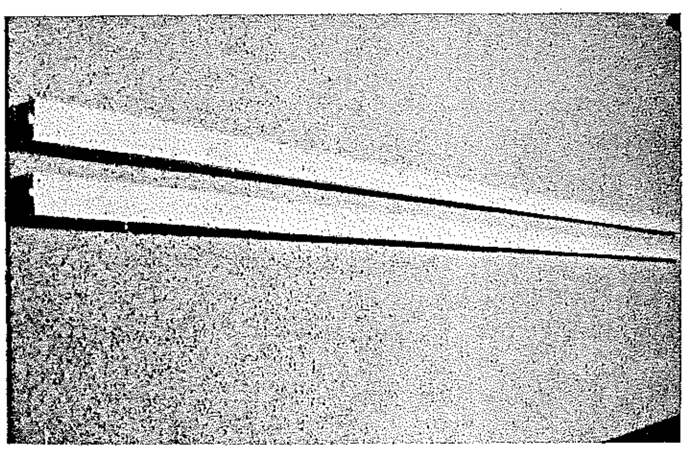
The Europa stabilator is quite thin. While it might be expected to create a pitch-sensitive condition, that has not proven to be the case in flight testing. The stabilator root section does not extend aft of the rudder hinge line. This avoids the usual diagonal cutout at the stabilator trailing edge to allow rudder swing.

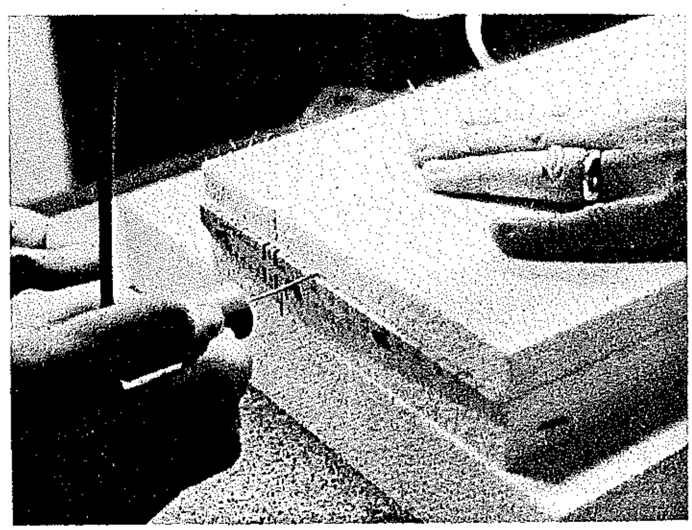
Direct-drive control cables are used on all control surfaces. This was done to discourage flutter from developing due to floppy linkages. Care must be taken in choosing cables that have a close fit to the outer tubing, or slop will appear at the 90° bend point of the cables. Flaps and ailerons are driven at about the center of their length, also to lessen the possibility of flutter.

Ballast is carried in the wing in order to keep the fuselage small. The ballast tubes can hold up to 5.6 lb. of ballast. Filling the tubes to capacity would raise the Europa wing loading to a little over the F3B limit.

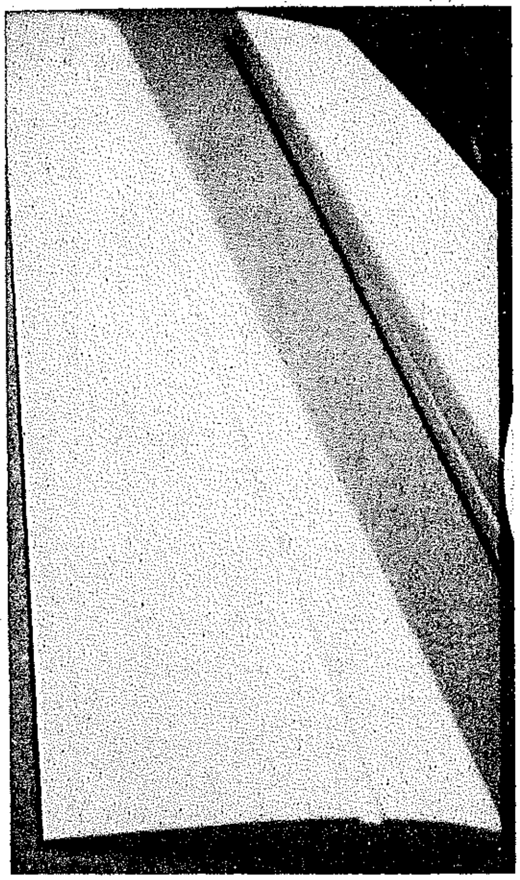
Being capable of changing ballast quickly in F3B is important, particularly if you decide to do it while on working time. To avoid having to remove the wings every time ballast is changed, an access hatch has been designed on top of the fuselage. Ballast is made up of ½ x 2-in. brass tubes filled with lead (see the Callisto '82 article, October 1982 *Model Aviation*). When using ballast, a tube is always completely filled with ballast (or ballast and dowel dummy slugs) and held in place by a stiff piece of foam squeezed into the hatch area.

It was, at first, thought that the Europa would not be a good Sailplane for AMA Unlimited duration events because of its weight. Early on it was tried in this type event and did not do particularly well. Yet some well-known fliers were using Sailplanes with wing loadings of comparable level or even higher quite successfully in





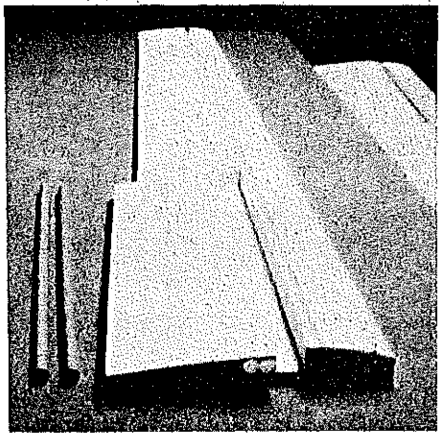
Above: Spars are solid and run the full length. Wing joiner tubes are completely installed before spars go into the wing panels. This procedure differs from usual construction methods. Right: Cutting foam wing cores with a hot wire. See the text for a source for cores.



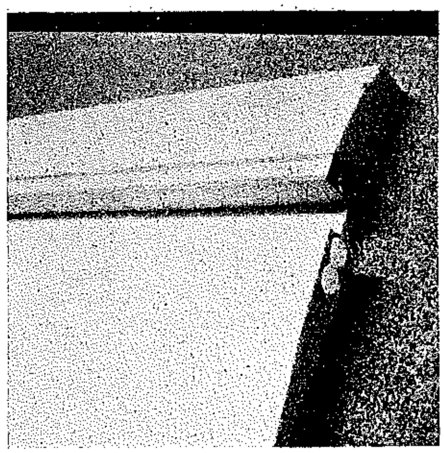
The spar notches in the core are used as a reference only. Foam between the notches will be completely removed and replaced with the spar. Photo credit: all by the author.

duration-type events. Later it was discovered that the main problem was that the plane simply required a different piloting technique than that of a lighter ship.

In windy conditions the Europa actually has an advantage over conventional duration designs. Lighter planes are having to add ballast to match the wing load-

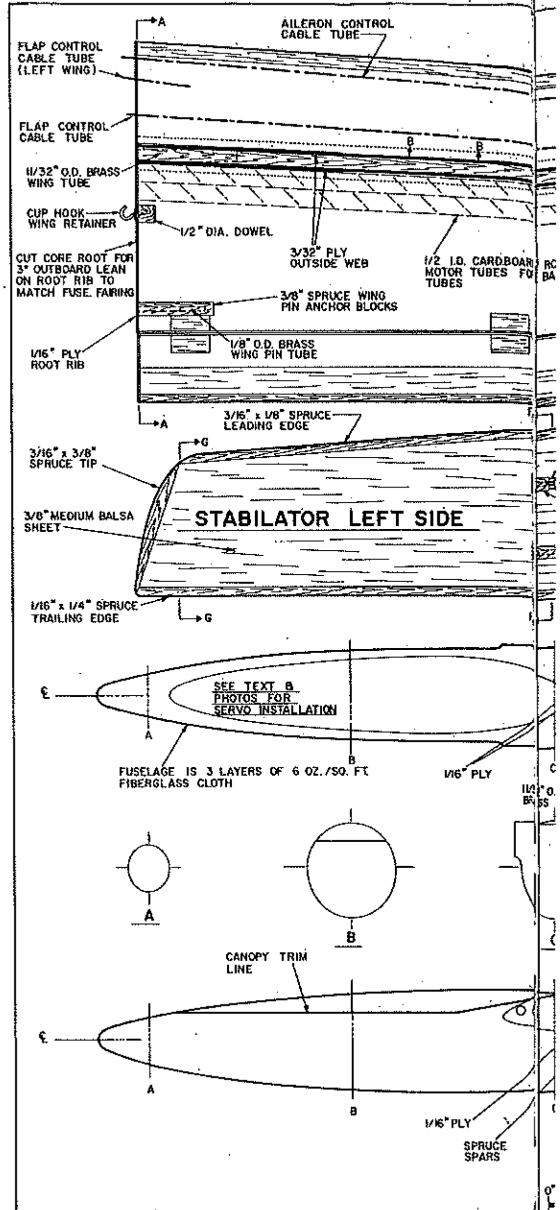


The core aft of the spar is cut into two more pieces to aid in cutting ballast tube holes.



Close-up of the ballast tube holes. These are made by using small templates with circular holes as guides for a hot wire cutter.

ings of the Europa, while the Europa has superior strength and is designed to fly at higher airspeeds. Building a lighter weight version of the Europa specifically for duration events has also been considered. That should make an interesting Sailplane

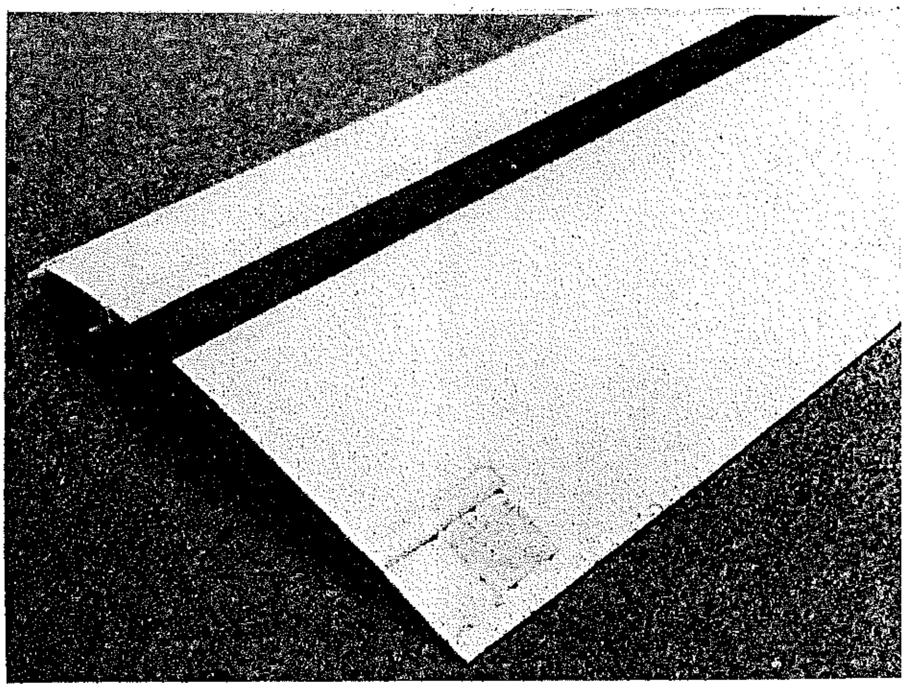


in itself.

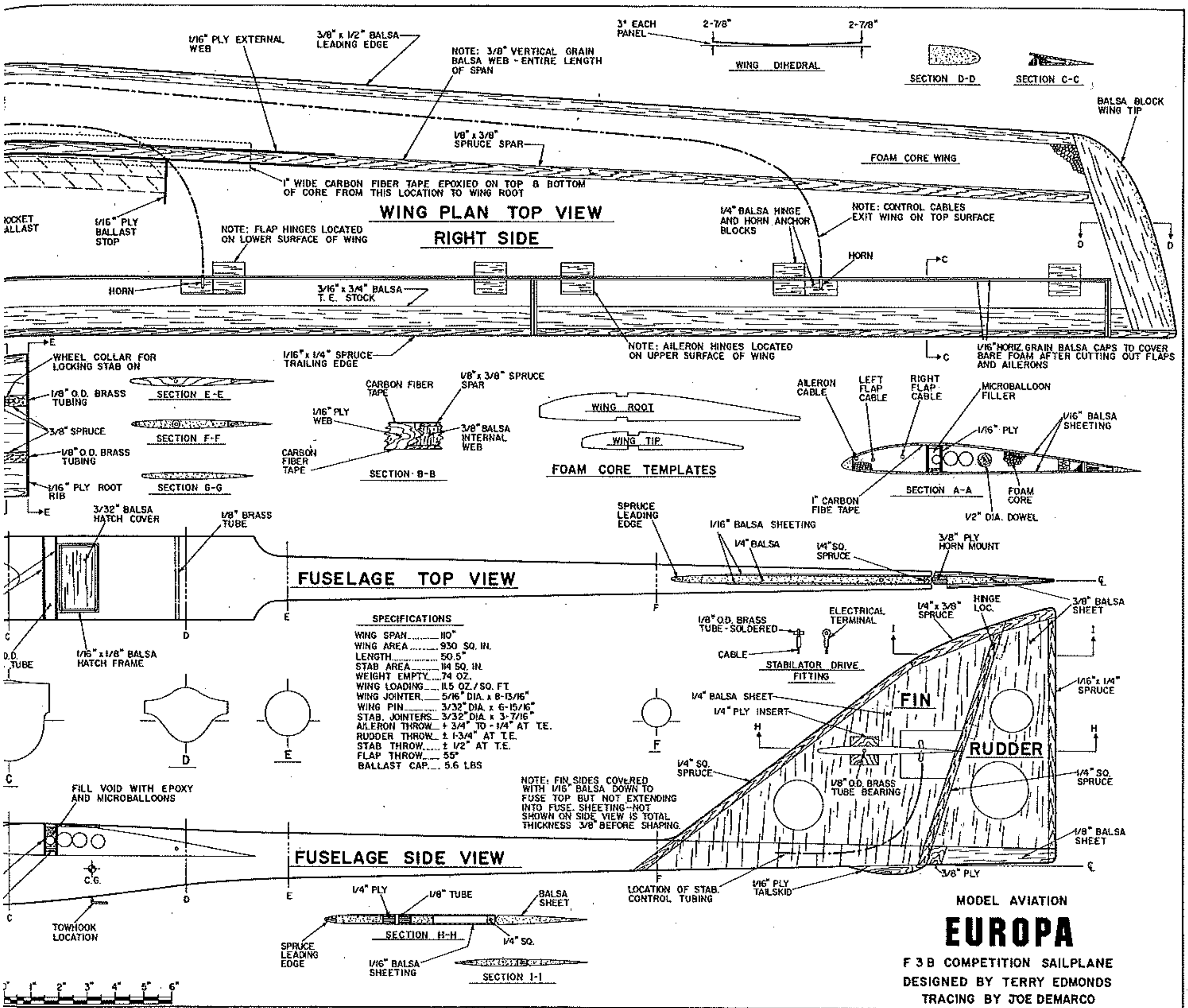
Construction. It is expected that modelers choosing to build the Europa for F3B competition have a reasonable amount of construction experience. Modelers like this usually have their own building techniques and may actually make design modifications along the way. Therefore, general building notes will be given rather than step-by-step instructions.

The fiberglass fuselage is commercially available from Viking Models, 2026 Spring Lake Dr., Martinez, CA 94553. Likewise, the foam wing cores are available from Viking or you can make core templates from the plans and cut them yourself. A standard hot wire cutter is used.

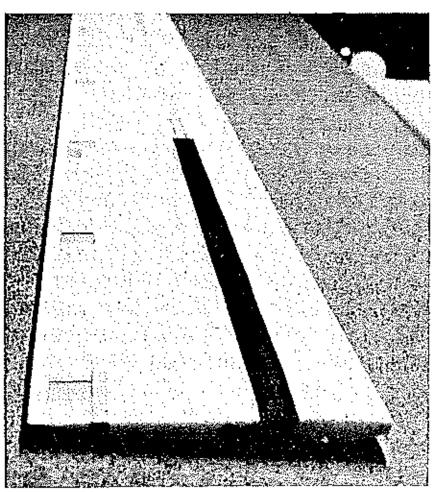
Wing. The wing spar is full length and of solid construction. It is made of spruce, plywood, balsa, and capped with carbon fiber tape after installation into the core. The carbon fiber tape can be eliminated by substituting carbon fiber spars instead of the spruce spars. However, the carbon fiber spars are sometimes difficult to obtain.



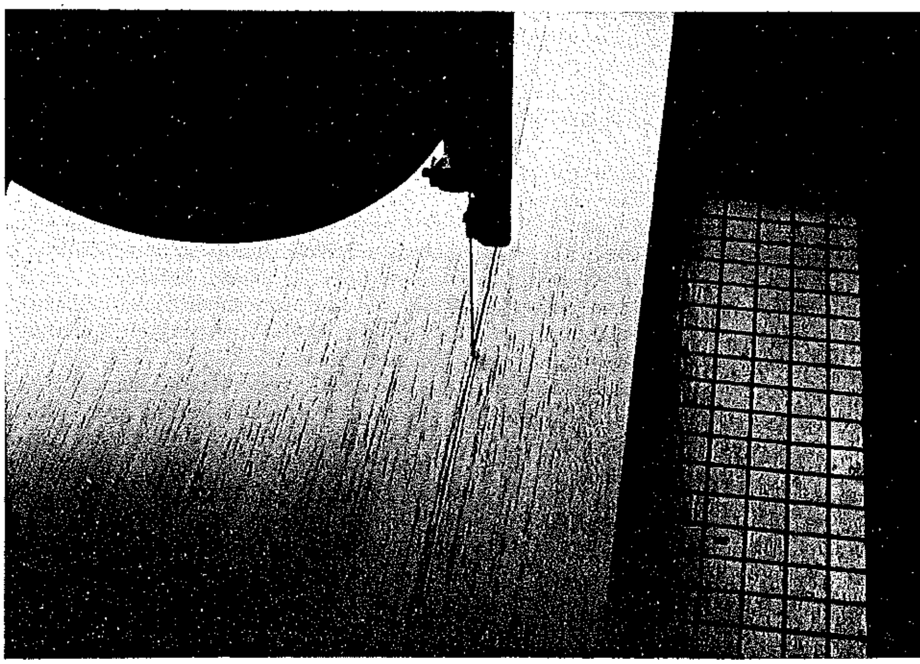
Top of the wing showing the epoxied-on carbon-fiber tape. Control cable tubing can be seen imbedded in the foam. If available, carbon-fiber spars can be used instead of spruce.



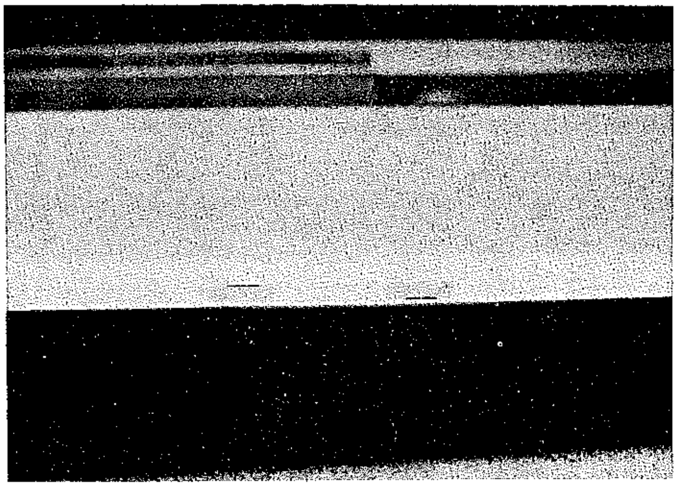
The spars are a separately constructed unit from the core. Build them completely on the building board except for the rear 3/32 ply webbing and wing tubes. Then carefully align the spars on the building

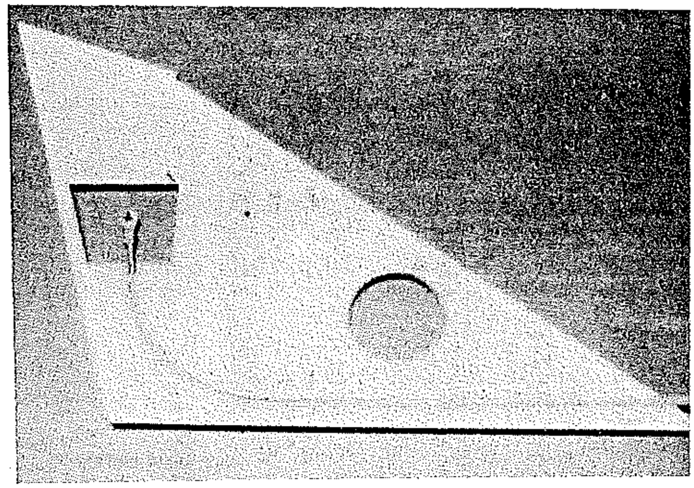


Bottom of the wing just prior to gluing on the sheeting. Chord-wise seam in the core and the ballast stop plate are visible in the pic.

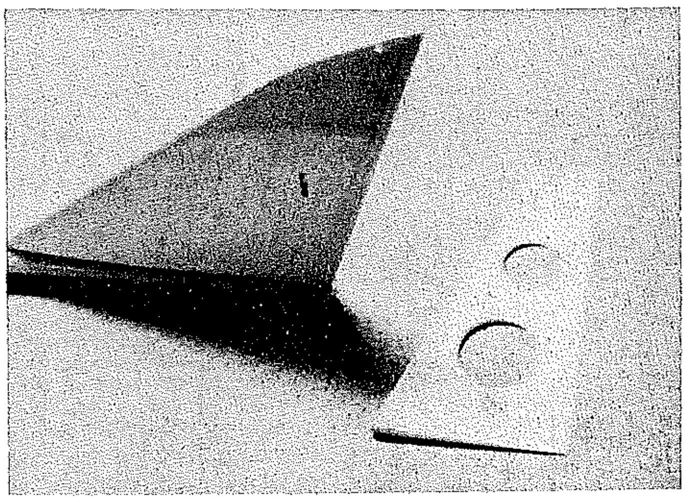


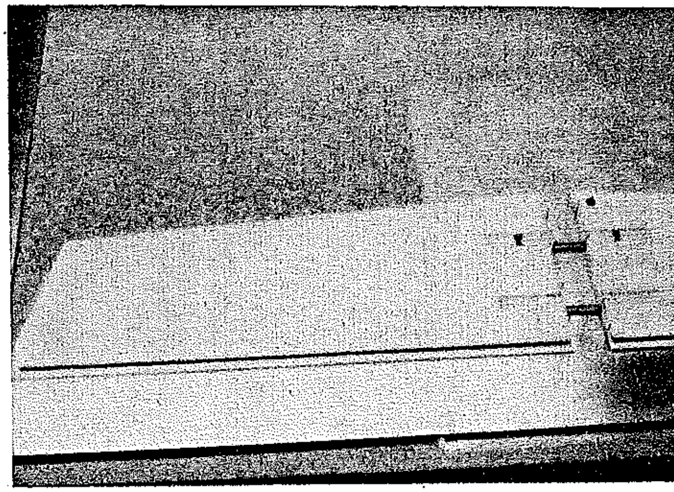
Flaps and ailerons being cut on a band saw. Core bed is underneath the wing to keep it level as it goes through. Taper the aileron leading edge to allow for downward motion.





Left: Slots for the wing hinges. Ailerons are hinged on the top surface, the flaps on the bottom surface. Pre-notching the hinge blocks will make alignment easier. Right: The fin has a $\frac{1}{4}$-in. balsa sheet core. The stabilator control cable tubing is embedded in the core.





Left: The fin and rudder after the sheeting has been applied and shaped. The rudder is made from solid sheet balsa. Right: The stabilator under construction. Joiner tubing is installed in full-length pieces to assure alignment. Later, the stab is cut into left and right halves.

board with the proper dihedral and sweepback. A single length of brass wing tubing is fit in the cavities. Some hollowing-out of the $\frac{3}{32}$ ply webbing may be necessary for proper fit of the wing tube. Install the rear webbing while filling the cavity with microballoons and epoxy. Finally, the tubing can be cut off $\frac{1}{16}$ in. beyond the end of the spars.

The core must be cut into two pieces for the spar to be installed. The spar notches in the core templates are only for reference, as the whole area between the notches is eventually cut out. This is also the time to cut out cavities for the ballast tubes. One method is to cut the core piece, aft of the spar, into two more pieces at the end of the ballast tubes, perpendicular to the trailing edge. Then the cavities can be easily cut out with a hot wire foam cutter. Small templates with tangent circles can be made for this.

The core pieces and spar are all epoxied back together at one time. Place these pieces back into the core beds and weigh them down until fully cured. Next, the carbon fiber tape can be epoxied on top and bottom of the core over the spars.

Regular pinned hinges are used on all control surfaces. This requires installing balsa anchor blocks in the foam core at the intended locations. Note: the hinges for the flaps are on the bottom surface, and the aileron hinges are on the top. Use single blocks for both wing and control surface. I also pre-notch the blocks for the hinges (making for easy hinge alignment). Anchor blocks for the horns are also installed now. Install ballast tubes, ballast stop plates, control cable tubings, and dowel hook anchors into the cores.

At this point initial fitting of the wing to the fuselage should be done. Carefully align the wing panels with the fuselage, and be sure they have equal incidence. Then glue in the rear wing pin tubes and anchor blocks.

Prepare the cores for installation of the sheeting. There will be a slightly raised portion over the carbon fiber tape, but this can be corrected when final-sanding the sheeting top surface. Glue on the sheeting, followed by the leading edge, trailing edge, and tip blocks. Make a final fit of the wing panels to the fuselage, then glue on the ply root ribs. Sand the wing to shape, and sand down the bump over the carbon fiber tape to a smooth contour.

Saw out the flaps and ailerons (a band saw is handy for this). Putting the wing panel in the lower core bed keeps it level while going through the saw. Trim the raw edges, and install the balsa caps. Note that the leading edge of the ailerons has to be tapered with a gap at the bottom of the hinge line to allow downward deflection. Hinges and horns can now be fitted, but do not glue them in until the wings have been covered. The horns have the mounting tabs cut off and are epoxied directly into a slot in the anchor blocks. Small holes should be drilled in the horn base for the epoxy to hold onto.

The stabilator is very simply made of $\frac{3}{8}$-in. balsa sheet edged with spruce strips. The hard part is sanding it to shape, but by using the ply root rib as a gauge, and a little practice, it can be shaped accurately. The jointer wire tubes should be installed in full-length pieces and later cut into left and right halves to assure alignment. Wheel collars are installed on the front wire for locking the stabilator to the fin. The rear jointer wire is bent slightly to give it some grab as is commonly done.

Fin and rudder. The fin has a $\frac{1}{4}$-in. balsa core. The core is built up with spruce edg-

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Safety/Preston

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models, as reader Col. Bill Webb found out the hard way. Bill flies at the Columbus Aero Club field, which apparently has some overhead power lines that skirt the flying area. However, Bill thinks that the RF emission from the high-voltage transmission lines caused interference to his radio, which resulted in the loss of his model as follows.

"I was flying my 'Old Reliable,' which had a high-quality three-channel radio and a good .25 glow engine, in good weather (sunny, with wind five to eight mph) and had just chopped the throttle to make my approach to land when I lost all control. The plane went into a slow, lazy left turn and flew into the power lines as if gripped by a big hand.

"I could not have lodged the plane any tighter, as you can see. (Bill included color photos which accompany this column.) We called the Ohio Power Company and they sent a truck out. The crew said "no way," the wires were main lines and had an ultra-high voltage. With the ground being damp, they could not help. I talked to other club members who, in the past, have been hit by strange glitches at the same end of the field, and they think the theory of interference was correct.

"These wires are over 2,700 feet away at the closest point, and nothing like this has ever happened to me before. I feel bad about the loss of the plane, but it is not worth a life to try and retrieve it."

In a previous Safety column, I reported the result of a modeler trying to retrieve a model caught in overhead power lines. He died. **Do not, under any circumstances, attempt such a retrieval yourself!** Call the power company and if, as in Bill's case, they will not perform the job themselves, accept the fact that you just lost a model.

One last, sobering story before I leave you for this month. A couple of weeks ago, I received a phone call from Kevin Stone, a Massachusetts modeler, who told me about an incident that occurred while he was bending a ⅛-inch music wire for a landing gear around a ⅜-inch-diameter, hardened steel mandrel. The mandrel snapped and struck Kevin in the face, which resulted in the loss of an eye. A freak accident, perhaps. However, it points out the need to consider wearing safety glasses both in the workshop and out at the flying field.

Till next month—Have a safe one!

John Preston, 12235 Tildenwood Dr., Rockville, MD 20852.

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Europoa/Edmonds

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ing pieces, ply insert, and control cable tubing. The stab drive fitting must be made up and installed now. Cut a ¼-in. slot in the top of the fuselage tail boom, and fit the fin core in position. Mark where the top of the boom lies on the fin sides. Glue on the ¹⁄₁₆ balsa fin side sheeting from the marks on up. Build up the rudder, then sand the fin and rudder to shape. Pinned hinges are used on the rudder and should be fit in with no hinge line gap.

Fuselage. Cut out an opening in the top for an access hatch. A small frame is constructed around the inside edges of the opening. A hatch cover is made out of balsa and sanded to the contour of the fuselage.

The wing rod tube in the fuselage should have been glued in when fitting the wing to the fuselage. Plywood, spruce, and microballoons/epoxy mixture are used for additional support of the wing rod tube.

The fin is now glued into the fuselage tail boom. Do this while the wing panels are installed, making certain the fin is perpendicular to the wing. It may be helpful to also have the stabilator on while doing this. Control cable tubes in the fuselage should be secured along the entire length, or at least as much as possible.

High-speed maneuvering can cause unsupported tubes to distort and interfere with control.

Finish. MonoKote is recommended for all wood surfaces and K&B paint for the fuselage. Alternately, other finishes could be considered, but weight buildup here should be avoided. F3B models tend to be relatively heavy without adding unnecessary finish weight.

Installation. If the flap and aileron cables were installed as per the plans, then the servo arrangement will have to be close to that in the photographs. Kraft KPS-24 servos were used in the prototype because they have high torque and tight centering. The aileron and flap servos are in-line, and the rudder and stabilator servos are across. The in-line servos are mounted on a plywood tray to make installation and removal easier. The other servos are on rails. Ball links are used to attach the flap and aileron linkage. The links are snapped on with the forefinger. A link is easily unsnapped by placing a small flat-blade screwdriver underneath and twisting. Aileron differential is adjusted by the take-off point on the servo wheel.

Flying. Hand toss the model a few times to check out the control sensitivity. Hook it on the winch, and build up a fairly large line tension before launching. It is recommended that you become familiar with the Europa before using the flaps to a large degree. It is very easy to use too much flap and actually decrease performance rather than increase it.

The Europa can also be successfully launched on a high-start. A word of caution here: use only a heavy-duty high-start and stretch to a minimum of 12 pounds pull, as the Europa is not a light airplane.

Speed runs should first be flown without ballast to get the feel of the ship. Slowly add ballast to find the highest speed point. Remember to keep the nose down in the turns to avoid losing momentum. Split-S turns are effective on turns one and two, but practice at altitude first.

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ations, RC flying will become "safer." For best results, *everything* should be parallel redundant, from the transmitter batteries to the servos in the plane.

Well, friends and readers, we've covered a lot of ground in this column. We started with an ultra-simple receiver no larger than your thumbnail and have progressed through a discussion of possible advantages to be obtained from grouping RC channels to concepts of a "safer" RC system with an on-board sampling computer and multiple parallel redundancy that doesn't even exist, yet. We've looked at what is, and what might be (with a tip of the hat to John Preston) and have talked a little philosophy. I hope you've enjoyed it. Keep writing.

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Toledo/Pruss

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already have set a good track record. Davey also manufactures the Sport Winch and the Pow'rzoom Winch.

Hobby Lobby. For rare Sailplanes from Germany, Hobby Lobby's line will be hard to top. Their Schulgleiter SG-38 is a kit masterpiece full of choice woods and detailed fittings that sells for $128. At ¼-scale it has a span of 102 in. and area of 1,627 sq. in. They also carry a Grunau Baby, a Reiher, and an all-fiberglass, state-of-the-art Speed Astir that spans over 12 ft. The latter is priced at $680.

Bob Martin showed another Two-Meter bird, this one called Pussycat. It has simple, straightforward construction with very attractive lines—designed for both Thermal and Slope Soaring.

M.E.N. (Model Engineering of Norwalk). Dwight Holley was the F3B World Champion in 1981, and Dwight's basically all-wood model caused many from the fiberglass school of construction to sit up and take notice. Dwight's Gobbler, available from M.E.N., did everything the glass ships did (except better). It has 114 in.