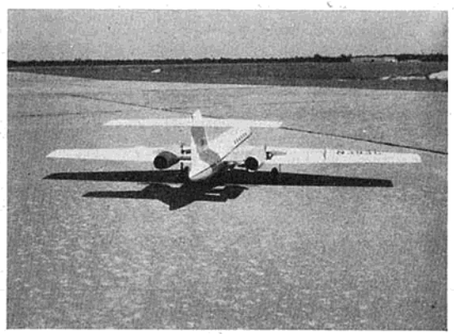
When it came to creating his personal "dream" ship, the author, an F-101 pilot, naturally chose a jet-like aircraft. A composite of the Falcon Jet and Lockheed Jet Star, the B.J. is an unusual R/C aircraft in appearance but with thoroughly proven performance.

major john oods' twin Business Jet



In keeping with its space-age design, the construction is of 80% Styrofoam, 10% desk blotter, and 10% balsa! RCM is proud to present this outstanding design effort for twin .19's and proportional.

LET me begin this article the same way that so many others have been started and say this airplane is **not** recommended for the beginner in R/C. I know that every beginner wants a 9′ multi-engined, retract gear, swept-wing Thing-a-ma-jig with flaps, working cockpit controls, lights and just a few more things that will come to mind while he is building his DREAM. Well fellows, that's all the foregoing is — a dream, and this model is definitely **not** for the beginner! I will concede that "B. J." is my dream ship but you will notice that it is neither a nine footer nor the extremely complicated model described above.

Let me digress here for a few lines and bring you up to date on just how a project of this kind got started in the first place. I started in this sport in 1952 after outgrowing model airplanes as a teenager. I got too old for it in 1945 when I was 17 years old. I again became fascinated by the prospect of building and flying a model airplane after I finished college and went to work in Geophysics for The Standard Oil Company of California in Turlock. A geologist and myself bought and built two Berkley Bootstraps and a Berkley Airtrol Transmitter, Hard Tube Receiver and Escapement. How many of you remember **that** rig?? Believe it or not, many happy hours were spent flying both of those airplanes — swapping equipment back and forth so both of our creations could float gracefully around in the wide blue sky. From there, Jack Cunningham the geologist, and I progressed through several airplanes and updated our equipment until I left the Seismic Oil Exploration crew and joined the Air Force. I continued in single channel for 10 years before I got the multi bug and upgraded to 10 channel reeds. One and a half years later I graduated to Proportional and to serious design work on my own. To be perfectly honest my early design work was mostly modifications of other modelers' ideas until I branched out on my own — and with a vengeance. My very first multi design effort was a swept wing, "T" tailed, 75% styrofoam airplane I elected to call "Styros." This airplane went through six separate models Styros; I, II, III, IV, V, VI. The last of this series, Styros VI won honorable mention in the first RCM Design Contest and although it was never published it was an above average Class III airplane, very fast wide open, yet docile and easy to land with the power back. Incidentally, I am an F101 pilot so you can see how I got started on the "T" tailed type model airplane in the first place.

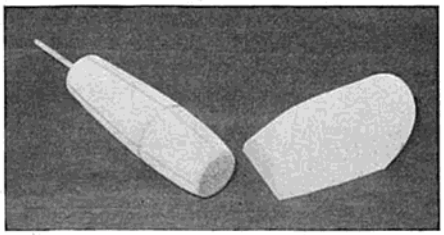
It was at this point that I let **my** personal dream ship ideas overtake me. I wanted a twin; but, at the same time, I didn't want the hazardous single engine performance associated with conventional twin engine airplanes. I had done considerable experimentation with styrofoam techniques, not only for wing and stab use, but fuselages as well. The blotter-styrofoam method of construction was originated by me in 1965 and a small article on its use was published by RCM in the June 1966 issue. It was developed on another more conventional model I designed called "Puffin II." Don't be afraid to try it — the method is tried and proven. It is about as light as normal Class III construction and much stronger. The model I envisioned was a twin engine airplane with a modern "different" look. This ruled out the ordinary scale or scale-like prop driven twins. My research drifted into the jet field but since no practical model jet engines were available I came up with a compromise; a jet-like twin using the Styros developed wing and stab airfoils and the same planform that worked so well on these airplanes. Now the detailed design work on my dream twin began.

The design settled upon was a composite of the Falcon Jet and Lockheed Jet Star, modified to accept the previously finalized moments, areas, airfoils and shape relationships. The fuselage was the only major unit from Styros that needed extensive modification because of the necessity to allow for the engine placement required of a Twin Jet and to make it resemble a Business Jet as much as possible within the confines of the design considerations already settled upon. Thus it was that "B. J." was born. I took a proven airplane, modified it in fuselage shape and engine placement and came up with a very unusual aircraft in appearance but with proven performance. Two problems cropped up because of the location of the engines; balance and fuel draw. The balance problem was solved by locating all of the radio equipment as far forward as possible and by the unusual characteristic of this wing, which allows the CG to be as much as 40% back from the leading edge of the base cord without creating any severe snap roll or tail tuck at the slower speeds. The CG can vary as much as one inch forward of the most aft location indicated on the plan. **DO NOT BALANCE BEHIND THAT POINT.** The fuel draw problem was solved by the use of a heavy rubber bladder tank with two outlet tubes, one for each engine. One unusual aspect of the tank location on this model is that as the fuel burns the CG will move slowly forward instead of rearward and increase the longitudinal stability of the model at landing time rather than decrease it. The second unusual aspect of the model will be brought out in the paragraphs on the fuselage construction. Before you read paragraph one and two and burn your issue of RCM, let me tell you the technique is not as hard as it seems at first. It is a complete departure from the stick, bamboo paper and banana oil school, but it is entirely in keeping with the age of styrofoam wing cores and the Epoxy Glue-Hobby Poxy Paint method of finishing. Another bonus here is the fact that not only does this technique allow you to build a fuselage of any conceivable shape, but do it cheaper, too! With balsa prices going up almost monthly the fact that the fuselage is 80% Styrofoam, 10% Desk Blotter and 10% Balsa should save over half the cost of building it. One more word of caution before you start: Don't attempt to modify the blotter technique. The recommended procedure took two years to develop and works very well as is.

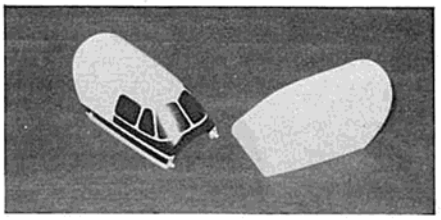
Start with the engine pods. They are made of Hobby Poxy cloth and Formula II glue. Cut two 1/8" balsa outlines the shape and size of the pods as shown on the plans. Cut a 1/8" slot one half the distance down the center of one of the pieces starting in front. Cut a slot in the other one, also one half the distance down the center, but starting from the rear. Slide the two pieces together perpendicular to one another so that they form a cross when viewed from the front and glue them together. Take a 1½" inch thick piece of beaded styrofoam and cut 4 strips wide enough to glue in each of the 4 spaces created by the balsa forms. Cut a 3/32" balsa ring for the front and rear ends with diameters indicated by the plan. Carefully sand this form to the shape of the two balsa templates glued longitudinally within the 4 styrofoam members. Keep in mind that the pods are circular in cross section at every point from front to rear. The result of this effort is the mold upon which the fiberglass engine pods are formed. I will not go into any more detail on how to construct these other than to refer you to the Pettit Hobby Poxy Easy-Does-It Balloon method for forming fiberglass parts. If you are unfamiliar with the method, a letter to Pettit will elicit a nice illustrated brochure on the procedure. Make two of these and when they are cut from the form, cut them **carefully** on the vertical separation line indicated on the plan with an X-Acto Razor Saw. Cut and finish the front and back holes and set them aside to cure thoroughly — at least 48 hours.

The engine pylon is constructed by taking a 1/4" piece of medium-hard balsa and cutting it to the shape indicated on the top view of the fuselage. Cut 2 slots in the top side of the leading edge of the pylon at the appropriate locations to accept the fuel lines and the nylon tube that will be the bearing for the single throttle bar that will simultaneously operate both throttles from one nyrod. When the throttle linkage and fuel lines are installed, sheet the top and bottom with 1/16" medium balsa and sand the leading and trailing edges round.

Cut two rings of 3/32" birch plywood according to the "P3" outlines indicated on the pod detail and cut a slot in the end of the pylon to accept it and glue in place with Franklin Titebond or Epoxy. Cut four aft pod supports and glue them in place on the top and bottom of the pylon behind each plywood ring. Cut the balsa backing for the engine mount plates "P2" and saw a 3/8" slot through the center of the resulting cylinder. Glue in place in front of "P3." Cap the front of this cylinder with a 1/8" plywood disk "P1." Cut a 3/8" slot in the aft inboard portion of the pod so it can be slipped on to the pylon and epoxied in place. Note that the tip of the pylon glues to the inside of the pod and does not stick through either pod on the outboard side. Cut a 3/8" slot just far enough into the forward pod section to allow it to slide back and meet the aft section forming the

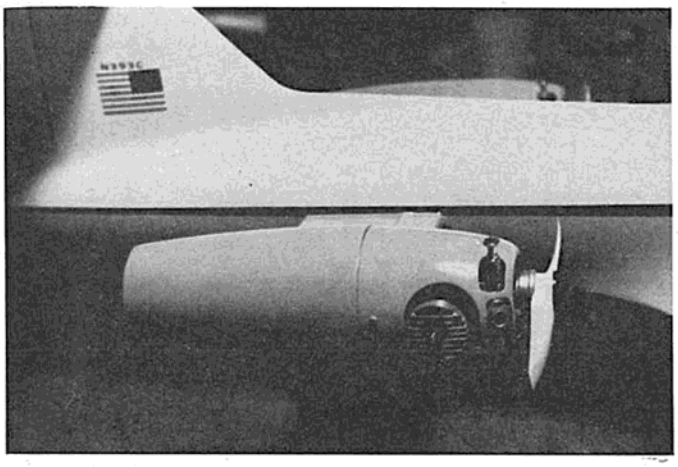


Styrofoam molds for the cabin and engine pods. No, that one on the left is not a banana popsicle.

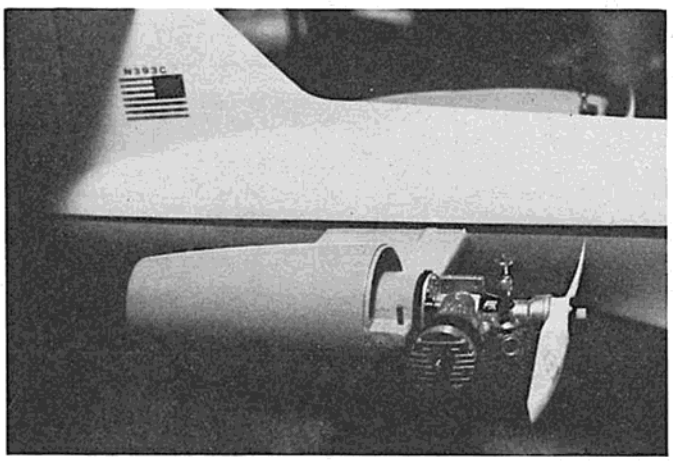


Cabin mold with completed cabin/hatch. Note pegs in front former.

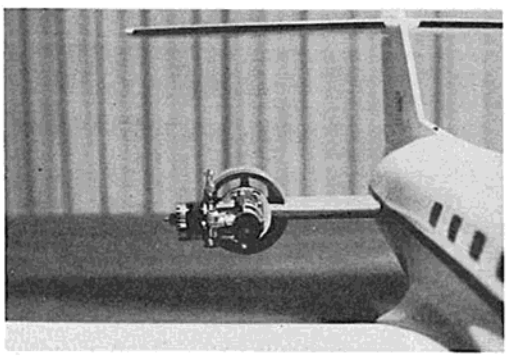
B. J.



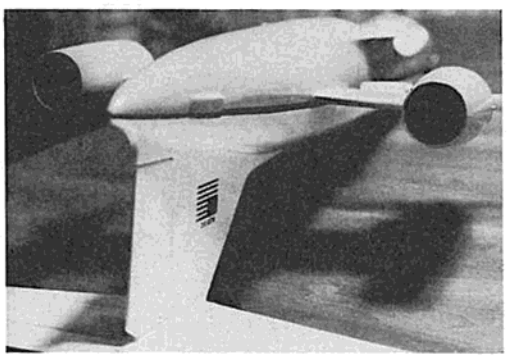
Close up of fiberglass engine pods.



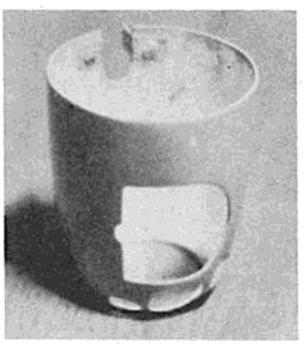
Engine pod showing engine installation.



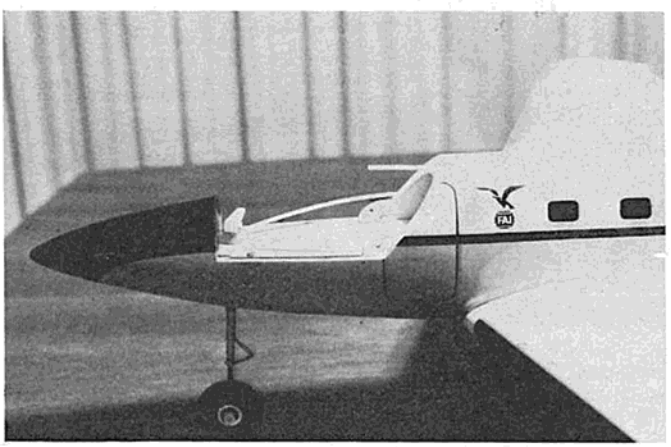
View into the front of the engine pod showing plywood aft pod support behind the engine mount.



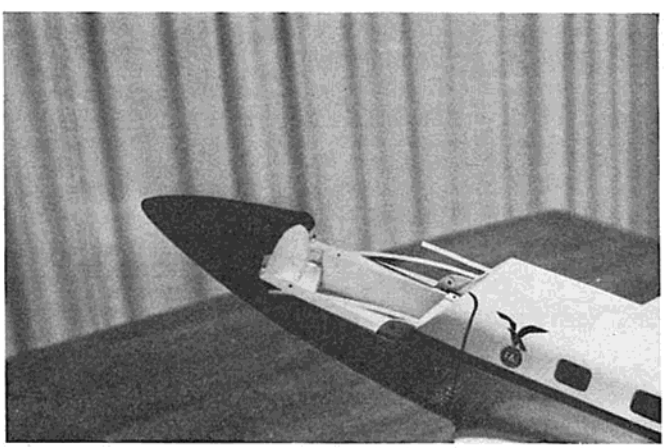
A good view of the Jet-like pipes, aft fuselage area and fillet outline.



Forward section of engine pod. Notice metal strap hold-down bracket and shape of cut out areas for engine.



Forward fuselage section with cabin/hatch removed. Notice nyrods extending out of upper fuselage bulkhead, the mount plate for the servos and the nose wheel steering arm.

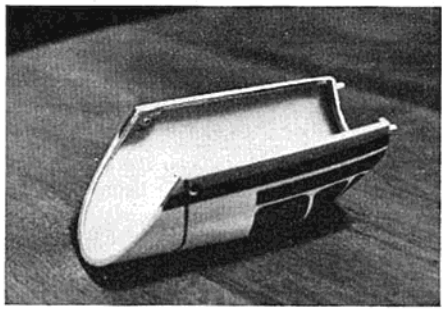


Forward fuselage section with plywood servo mount plate and nose wheel assembly removed. Receiver compartment and battery compartment shows up well here.

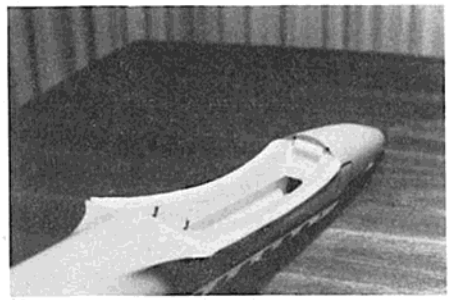
complete pod. A small 1/16" plywood ring glued to the inside of the forward and aft sections where they meet will help them retain their circular cross section. The forward section is cut out to accept the selected engine and is held in place on the plyon by a small wood screw, turned into a square of 3/32" plywood inlaid into the tip of the pylon and a 90 degree metal bracket and a 2-56 bolt and nut on the inboard side of each pod. The engines are attached to "P1" with a 1/16" aluminum plate bolted to the rear of the engine crankcases. Notice that there are four grommets separating the aluminum engine mount plates and the 1/8" plywood engine mount. These shock mount the engines and allow some engine thrust adjustments. Be sure to completely fuel proof all surfaces inside of the engine pods.

The fuselage is begun by cutting a full size piece of 1/8" soft balsa to the outline indicated on the top view. Next, cut bulkheads A, B, C, and fuselage longitudinal members F1, two F2's and F3. Glue A, B and C in place making sure they are vertical and add F1, the F2's and F3. This basic assembly should be built with the large 1/8" balsa sheet cut first pinned to a flat table or board. The bottom half of the fuselage is constructed while it is pinned down to insure proper alignment of the fuselage formers and to be sure the top of the 1/8" sheet will continue to be straight line when viewed from the side. This is important because this line is the longitudinal fuselage reference line and all of the flying surfaces are positioned utilizing it to insure perfect zero-zero alignment. Note also that the engines do not have any side or down thrust. This arrangement has been found to be ideal so please do not experiment in this area. Next cut and fit the six styrofoam blocks to fit in the spaces created by the assembly of the balsa parts. The styrofoam can be cut by hot wire or sawn, but be sure the cut angles are 90 degrees so they will fit precisely against the formers already in place. Any adhesive suitable for styrofoam can be used to glue it down, but Franklin Titebond used sparingly is recommended; sparingly to avoid weight buildup. Also, be sure the styrofoam placed against F2 and F3 is wide enough to allow it to come all the way out the fillet tip — the ends of former "C." When this is dry, cut out the wing saddle with a hot wire cutter and using the two F2 formers as a guide. Cut the wing saddle/fillet base from 1/32" plywood and glue in place against the bottom of F2. Remove from the table and shape the styrofoam using A, B, C, the longitudinal fuselage members and the fillet base as sanding guides. Start with heavy sandpaper first, grading down to fine. Be sure to sand the aft fillet contour to the shape and at the angle indicated by both the top and side views on the plan. Glue the balsa and 1/8" plywood wing hold down plates in place beneath the aft portion of the 1/32" ply fillet base. The result of all this effort should produce the whole bottom half of the fuselage including the fillets. To build the top half take the engine pod assembly and glue it in place on the top of the bottom half of the fuselage at the location indicated. Be sure this assembly is aligned perfectly or you will have the engines canted — one toward and one away from the fuselage. Next, cut bulkheads D & E. Glue E in place behind the pod assembly. Cut a large styrofoam block to fit between D & E, be sure to cut the front of the block to the angle shown on the side view. Glue it down and then glue D in place on the angled face of the foam. Sand this foam block to shape, using D & E as sanding guides. Also keep in mind the top edge of this block is a straight line and be careful not to sand it sway back. The vertical fin is built next and while it is a fairly simple job, a pointer or two will keep things straight for you. Cut the full fin outline from 3/16" medium sheet balsa and cut or saw out the lightening areas to the patterns shown. Cut out two 1/16" sheet fin sides, also to the full outline. The 1/16" sheet balsa fin sides have the grain running horizontally to increase the twist strength and provide a stronger support for the elevator. Fill the lightening holes in the rudder with 3/16" sheet styrofoam and cut the channel for the elevator nyrod along the leading edge of the 3/16" balsa fin. Glue this to the aft part of the fuselage, being careful to center it allowing for the other 1/16" fin side to be installed later. Glue the large nyrod tube in the channel and lay it in a like sized channel cut along the top of the foam block between D & E, deep enough to allow a 1/16" x 3/16" balsa strip to be inlaid over it along the top of the fuselage. To complete the fin, glue the other 1/16" fin side in place and sand the edges round. Next, add the styrofoam block forward of bulkhead "A" and the soft balsa block forward of that. Cut and glue former "AA" in place behind the styrofoam nose block and against the top of the 1/8" balsa fuselage crutch. Sand the nose section to shape. Carve out the battery hole in the foam nose all the way to the balsa tip block. Also, carve out the receiver compartment in the aft, lower nose styrofoam block between bulkheads "A" and "B" and sheet the floor and sides with 1/16" plywood. Cut the engine and rudder nyrod slots along the sides of the foam block between D & E; rudder on the left and engine on the right. Glue them in place, again deep enough to run a strip of 1/16" x 3/16" balsa over it and flush with the foam in a manner similar to the way the elevator nyrod was installed. Insert the inner nyrod tube in each of these large tubes and hook them up to the rudder horn and engine horn in any permanent manner that will not give you any later trouble because they are to be completely enclosed in the foam. Kwik Links are shown on the plan and work well for this purpose. Cut two foam blocks large enough to fill the areas on either side of the vertical fin, cut out slots in both of these large enough to allow free movement of the engine and rudder horns within the foam blocks. Glue them in shape and sand to shape. Be sure to sand a slight fillet between the fin and fuselage. You are now ready for the final fuselage construction step — the blotter covering. Start with the center skins, first cut a piece of desk blotter from the 24" x 30" white blotter that can be bought from virtually any stationery store, use green if you can't get white. Make sure that the skins are cut generously oversized. Wet them under the faucet and place on a thick section of newspaper for a few seconds to soak out the excess water. Carefully place it on the fuselage, patting and pushing it into position. DO NOT RUB. If the blotter is rubbed when wet it will roll up and degrade the final product. Use an indelible pencil and a very flexible plastic ruler to mark the cut lines on the wet blotter. In this case — down the center or spine along the top, along the edge of the fillet and vertically around the fuselage in front of and behind the fillet. Remove the blotter carefully because it tears easily while it is wet. Cut the wet blotter along the marked lines with a sharp pair of scissors. Brush white glue on the foam with a small plumbers' flux brush as thinly as possible. Coat only the area that the blotter will cover and don't let any blobs of glue come up on the surface of the blotter during a later step. Now, carefully place the blotter back on the fuselage in exactly the same position that it was when it was marked. Pat the blotter down firmly with your hand and fingers without rubbing. Make sure it conforms to each and every contour of the fuselage. If you find it necessary to trim the wet blotter after it is in place, hold the edge firmly down with a ruler and slowly cut along the edge of the ruler with a sharp **round** blade using the rounded edge, not the tip. Use a firm sawing motion. If this doesn't appeal to you it can be trimmed more easily after it has dried. Edges needing feathering or thinning can be sanded when dry, before the first coat of Epoxy II is applied. Allowing to dry **thoroughly**.

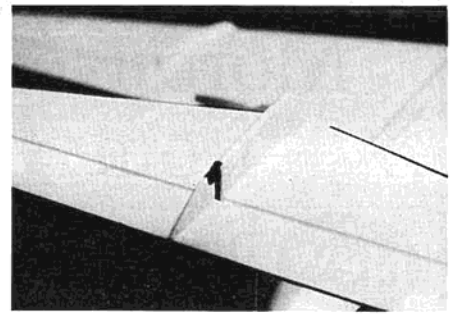
Mix some Hobby Poxy II glue and brush into the dry blotter. Use care to see that the glue does not run over the edges and restrict the butt joining of subsequent pieces of blotter. Note that each skin is placed on the fuselage and the first coat of Epoxy glue is applied and allowed to



Close-up of the underside of the cabin/hatch — note 3/32" ply reinforcement completely around the edge of the fiberglass and the maple blocks that support the countersunk 4-40 bolt hatch holddowns.



Wing saddle well detailed by this close-up of the center of the fuselage with the wing removed. Note the 4-40 bolt wing holddowns.



Close-up of the elevator horn and stab area.

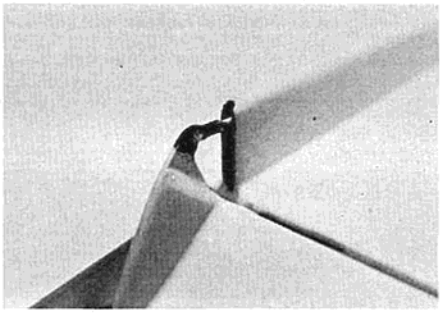
cure before the next one is applied. Do this for each of the pieces in the order indicated by the numbers on the small drawing of the fuselage side profile. The reason for doing each skin one at a time will become apparent when the #2 skin is placed on the fuselage wet. If the Epoxy was not put on #1 previously and allowed to cure, water in the blotter would wet the one already glued down and it would nearly be impossible to find the edge of the #1 skin. Convinced? Go on through the whole fuselage waiting for each one to cure before going on to the next. When you have finished the skins, sand any edges and joints needing it and lightly sand the fuzz off the surface of the epoxied blotter. Coat the fin with Epoxy II glue and sand it in the same manner as the rest of the fuselage.

ELEVATOR: Build it in the usual manner that a foam stab is built. Sheet with 1/16" balsa and Epoxy a 3/32" plywood "T" brace at the junction of the hinge line of the rudder and the under surface of the stab. Relieve the hinge line to accept the tongue of the "T" brace and cut a slot 5/16" wide forward from this brace to the apex of the leading edge of the stab. Slide the stab into place on the fin, making certain it is exactly "0" with the longitudinal axis of the fuselage and epoxy in place. Brush one coat of Epoxy II glue on the stab after it cures and sand lightly. Mix coat the entire fuselage and empanage assembly a second time and allow to cure thoroughly. Don't be stingy with this coat of glue. Sand smooth, using medium grade garnet sandpaper to start and two finer grades of garnet paper finishing up with 280 silicone carbide No Fil paper. Fill any imperfections with small amount of Formula II secondarily finishing as indicated above. Cut a piece of foam to fit between A and D and sand to the shape of the cabin. Face the front, rear and bottom with 1/16" ply and use this mold and the Hobby Poxy Easy-Does-It method to make a cabin-hatch to cover the equipment well in the forward part of the fuselage. When this section is cured completely, remove from the mold and trim. Cut 3/32" plywood reinforcement edging to fit the front back and bottom of the cabin-hatch 1/4" wide and glue in place. Recommended hold down for the hatch is similar to the standard peg and screw wing hold down used commonly on many Class III airplanes. This is shown in detail in the photos, so no further explanation will be attempted here. The elevator and rudder should now be cut out of 1/4" medium-soft balsa sanded to the airfoil shape shown on the plan and finished the same way as the fin and stab. An alternate method of finishing the wood parts is to brush two coats of Hobby Poxy Clear — not clear dope —on the wood and sand lightly after allowing each coat 24 hours to dry in a warm room. Then apply a coat of Formula II glue, finishing as previously described. This method will save 3-4 oz. of weight, but is not quite the glass smooth finish you will get with the other method. If you have already used the Hobby Poxy Easy-Does-It method and are familiar with scraping the final glue coat with a razor blade **do not** scrape the blotter covered parts with a blade because this will cause a ripple to develop. Sand only and the result will be very rewarding. The wood parts can be scraped in the manner indicated by Pettit in the EZ-Duz-It brochure, however I have found that a combination scrape and sand works the best on balsa wood.

The wing is constructed using the standard styrofoam and balsa sheet method. Just a few words about the one or two unusual aspects of the wing is in order. First, notice that this is a three piece wing. The flat center section is required so the wing will fit the flat 1/32" ply wing saddle. Join all three sections together the same way the two sections of a standard foam wing are joined. If you do not have a hot wire cutter most of the foam wing manufacturers will cut special wings on request if you send them a drawing of the wing outline and the full size cutting templates shown the plan. Be sure to inlay a sheet of 1/16" ply on top of the center section of the wing 1" from the trailing edge before sheeting the wing with balsa. This plate is part of the bolt hold-down assembly for the wing. Each of the wing fences are built from 1/8" balsa according to the outlines shown on the plan. 1/32" balsa is used to cap each side of each wing fence. The nylon tube laid inside of them is a guide for the 1/16" piano wire push rod. The aileron horns and the elevator horns are made from 1/16" phenolic material sheeted on each side by 1/16" then sanded to a standard trailing edge airfoil shape and epoxied in place. The 1/16" piano wire push rods are connected to the phenolic horns by a small brass connector, made from 1/8" brass tubing cut, flattened, drilled and soldered to the 1/16" wire. A small pin made from a paper clip is put in place and soldered on both sides of the brass tube. File the ends of the pin down after soldering in place, so it will slide easily into and out of the slot in the aft end of the wing fence as the aileron moves up and down. If you are worried about the strength of this arrangement let me say it has been used on several different airplanes without a single failure ever during the hardest landing and even a **crash** (even Volkswagen admits they aren't perfect). The connectors used on the end of the nyrods for the elevator, rudder and engine are 2-56 screws and Kwik-Links. The landing gear is placed 7" from the trailing edge of the base cord and affixed to the wing with slotted maple bearers and metal straps and screws. These can be obtained from Top Flite or you can fabricate them very easily in your shop. The nose gear installation is a bit out of the ordinary but is very strong if constructed as indicated on the plan. Be careful not to take the temper out of the 5/32" piano wire when you solder the brass sleeve over it. The scissor is made from paper clip wire and 1/16" brass tubing.

The front of the model is large enough to accept most of the proportional equipment available today. I designed it around my Logictrol II and while this equipment will fit, smaller gear like the new Bonner 4RS would be much more easily handled by the available volume in the cabin area. If the lighter equipment is used, carve the wood nose block out hollow as indicated on the fuselage nose view and pour in enough lead shot and epoxy to balance the model between 35-40% back from the leading edge of the base cord of the wing. Some additional weight and needed strength can be achieved by fiberglassing the nose section from "B" forward. If additional weight is needed, it can be added under the receiver floor. A little planning ahead here can eliminate the necessity to carve a hole in the floor to imbed the lead in the styrofoam.

The last bit of construction is the fuselage fairing beneath the wing, filling out the fuselage between "B" and "C." Cut two 3/32" ply formers with the wing in place on the wing saddle using "B" and "C" as drawing guides. Make them 1/16" undersized to allow for the blotter to be added later. Glue these bulkheads to the front and back of the wing. Cut and fit a 1/8" balsa sanding template down the center of the underside of the wing between these two bulkheads. Cut two identical foam blocks to fit either side of this strip and the contour of the wing. Glue



Close-up of the aileron horn and push-rod coupling in the fully deflected position.

these in place and sand to shape. Put the blotter over the smoothed fairings and finish the same way as the main fuselage.

The final finish is two sprayed coats of white Hobby Poxy. Sand the first coat smooth using 280 Silicone Carbide sandpaper after it has been allowed to cure completely. Spray the final coat on as thinly as you can, being careful not to get an orange peel or pocked finish. The trim is Hobby Poxy Light Blue brushed on and Gloss Black for the fuselage stripe. The De-Ice strips and the anti-glare panel in front of windshield are brushed Hobby Poxy black, but mixed with Satin Finish Hardener rather than the standard hardener. The decals used on my model are from Finishing Touch AMA sheet although any suitable decals would work just as well. The windows are cut from Sig Black sheet decal. Patterns for these are not indicated, in order to allow you to tailor your "B. J." to suit your own tastes.

One last word. The engines used on my model are OS 19 R/C's. I feel these are adequate but if you desire more power the engine pods will have to be made larger and the pylon supporting the pods will have to be extended to allow for clearance for the props used on the larger engines. In any case, I would not recommend engines larger than .29 or .30. The Styros series used a single K. B. 45 or ST 46 and they would climb nearly out of sight at a 45 degree angle so you can see the performance is there with a relatively small power plant.

Be careful on the first several flights. Let the model roll longer than you normally do and bring it in for landing faster than usual until you feel it out well. Good Luck and many happy flying sessions with your "B. J."

The excellent closeup photos accompanying this article were taken by Major J. P. Pretlow.