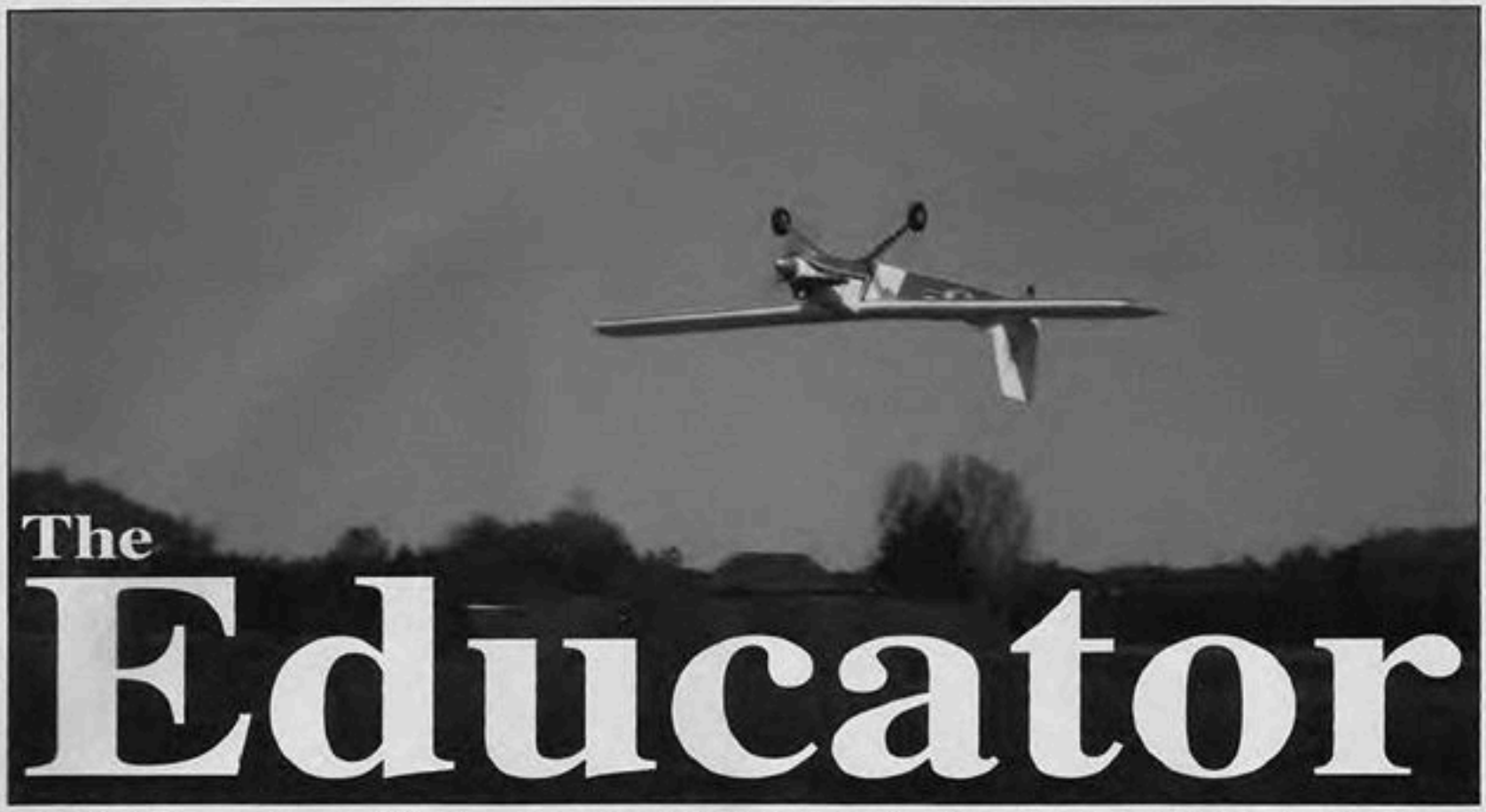


The Educator

By Justin A. Cork

What's in a name, everything, it identifies a person, a location, or an item. It is for this reason that I took into consideration a name that would be appropriate for this model, the "Educator." Meaning, that by the time the modeler with limited experience has built and flown this model he will have a good basic education on the subject matter. After having built numerous training and sport models, I felt that they all had some characteristics that were missing. The Educator as presented is the final refinement of numerous models I have built in this series. I believe that it is important that the potential builder of the model understand why I have designed the aircraft in the manner I have, in order that he may come to his own conclusion.

Most sport trainer designs that I have seen are a cosmetic rearrangement of another design. What I mean by that is, the wing section is symmetrical, tail section is flat, and incidences are set at 0°. The engine is also set at 0° down and right thrust. This is a good starting point for a pattern model but hardly satisfactory for a sport trainer. Much better is the set-up often used by the scale modeler, a semi-symmetrical wing section, wing incidence at 2° negative, and tail plane set at about 1-1/2° positive. Where this arrangement really shows up is in the landing approach where inexperienced fliers have the most problems. The wing at 2° gives additional lift at low speeds and the tail plane at positive incidence keeps the tail plane flying, making for a low speed landing approach. The former set-up would stall and snap roll under similar circumstances. I also believe some engine right thrust should be used as models have a tendency to swing left on take-off, particularly taildraggers. Add a small amount of down thrust just for assurance that the thrust is in the right direction.

The first decision that has to be made is, what engine do you intend on using, not with regard to make but to weight. You can look at the ads in this magazine and see engine requirements for a model as follows: "requires: 2-stroke .40-.46 or 4-stroke .60-.70 engine with a model weight of 5.25-6.0 lbs., a wing loading of 23 oz./sq. ft., and a wing area of 566 sq. in." Now look in the Towers Catalog and the weight of an O.S. 40 FP ABC without muffler is 8.75 oz. and that of an FS-70 Surpass is 20.1 oz., approximately 9 oz. difference. I say "no way Jose." This is obviously an extreme example but I make it to prove a point that it is necessary to take engine weight into consideration when selecting and building a model if one expects the balance to come anywhere close to where it should be.

For the "Educator" I have selected and used two engines, the Fox 40 BBRC and Fox 45 BBRC, as typical of the type of engines one would use. From Clarence Lee's articles in this magazine the weight with muffler and spinner is 12.2 oz. and 16.9 oz respectively. This required moving the fire wall forward 1" if the .40 size engine is used instead of the .45. Which engine do I prefer? If one has limited experience I would use the .40 as it will give you a lighter wing loading and has more than adequate power. The .45 if you want to get into pattern and scale for your next plane. This is a good model to familiarize yourself with the engine and break it in. One thing for sure is follow the fuel instructions of the manufacturer and use castor oil. I had all sorts of problems and did not know what they were until I phoned the factory and they advised.

THE EDUCATOR

Designed by:
Justin A. Cork
TYPE AIRCRAFT
Sport Trainer
WINGSPAN
64 Inches
WING CHORD
10-1/4 Inches
TOTAL WING AREA
650 Sq. In.
WING LOCATION
Shoulder Wing
AIRFOIL
Semi-Symmetrical
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
1-1/4 Inches
OVERALL FUSELAGE LENGTH
47-1/2 Inches
RADIO COMPARTMENT SIZE
(L) 10" x (W) 3" x (H) 3"
STABILIZER SPAN
20-3/4 Inches
STABILIZER CHORD (inc. elev.)
6-1/2 Inches (Avg.)
STABILIZER AREA
134 Sq. In.
STAB AIRFOIL SECTION
Semi-Symmetrical
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
10 Inches
VERTICAL FIN WIDTH (inc. rud.)
7-1/2 Inches (Avg.)
REC. ENGINE SIZE
.40-.45 2-stroke
FUEL TANK SIZE
8-10 Oz.
LANDING GEAR
Conventional, Fixed
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.

BASIC MATERIALS USED IN CONSTRUCTION

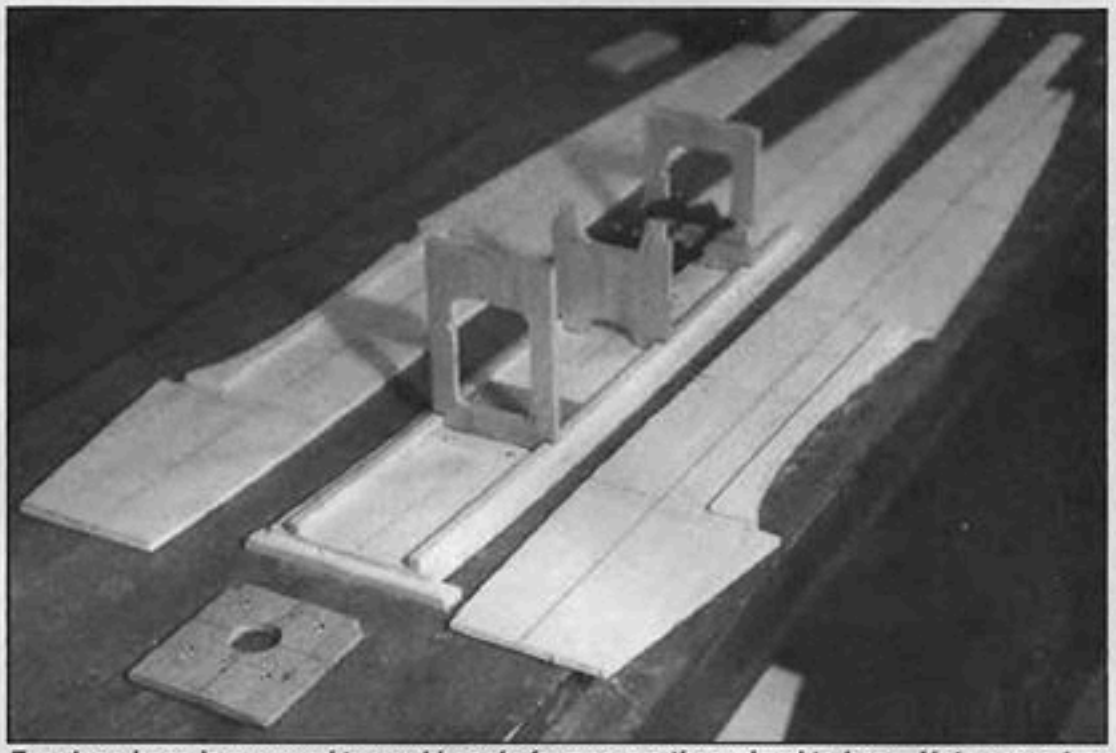
Fuselage	Balsa and Ply
Wing	Balsa
Empennage	Balsa
Wt. Ready To Fly	88-96 Oz. (5-1/2- 6 Lbs.)
Wing Loading	19-21 Oz./Sq. Ft.

CONSTRUCTION

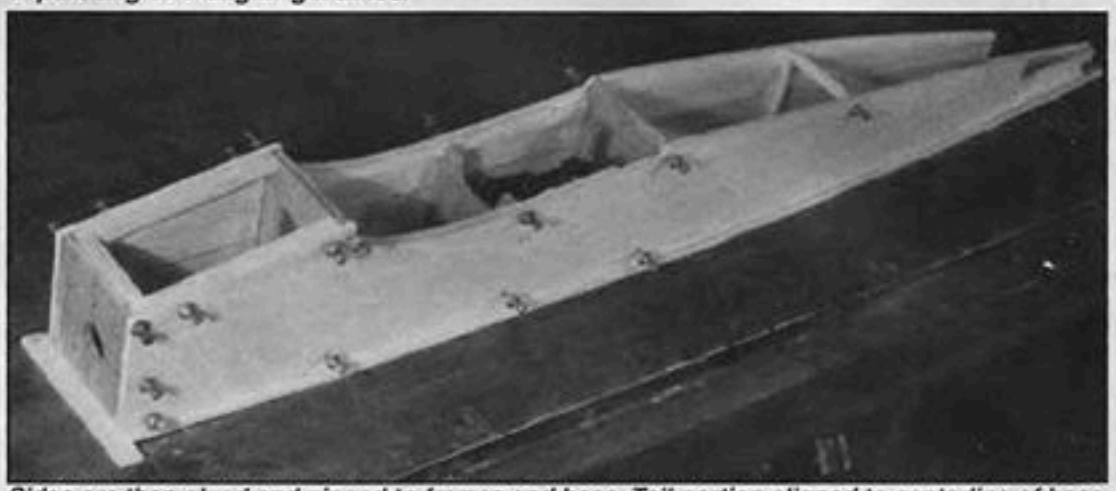
Fuselage:

Some of the features of the fuselage design are: Note that the bottom is flat and straight back. This is a base line reference and assists in aligning all components of the model. Screw the base to a flat building board in front of F2 and place a 3/8" block under F1 so that the base flares into the cowling if you decide to use one. Mark a centerline down the base and make sure it is accurate as all fuselage formers and sides are aligned to this centerline. Cut the bottom and sides from 3/16" x 4" x 36" balsa, add wing saddle to sides. It will be necessary to splice an extension at the tail end. Make sure the bottom of the sides are straight and flat.

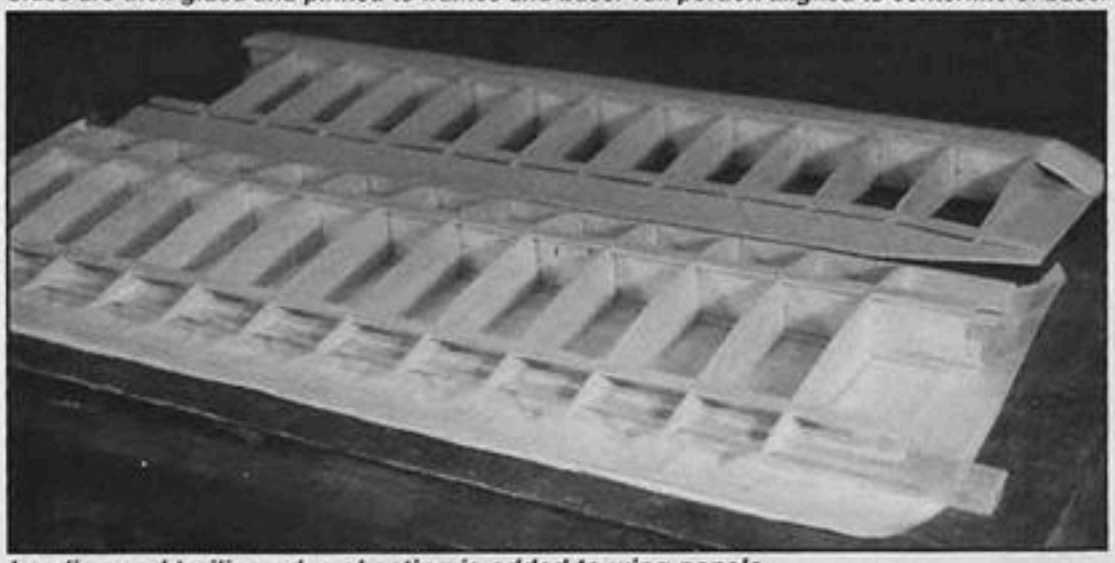
Fuselage formers are made by laminating two pieces of 1/8" lite ply or door skins 22" long by 3-1/8" wide. Doing this will assure that they will be flat. Trim to exactly



Fuselage base is screwed to workbench, frames are then glued to base. Note servo tray separating and aligning frames.

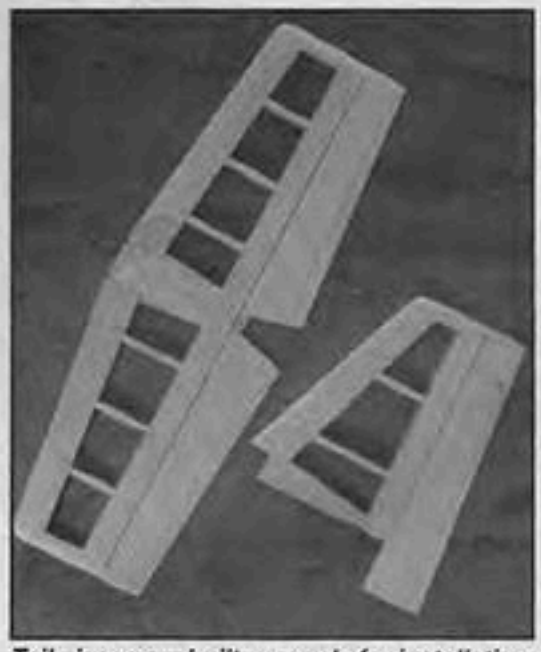


Sides are then glued and pinned to frames and base. Tail portion aligned to centerline of base.



Leading and trailing edge sheeting is added to wing panels.

Assembled wing panels are ready for joining. Dihedral braces are not required but good glue joints are, as well fiberglassing of center section is a must!



Tail pieces are built-up ready for installation.

3" wide and mark centerline. When you cut out the formers make sure that they are absolutely square with sides. Wing hold-down former F2A is not glued to F2 until assembly with wing and fuselage. Assemble servo tray to formers F3 and F4 before gluing to base.

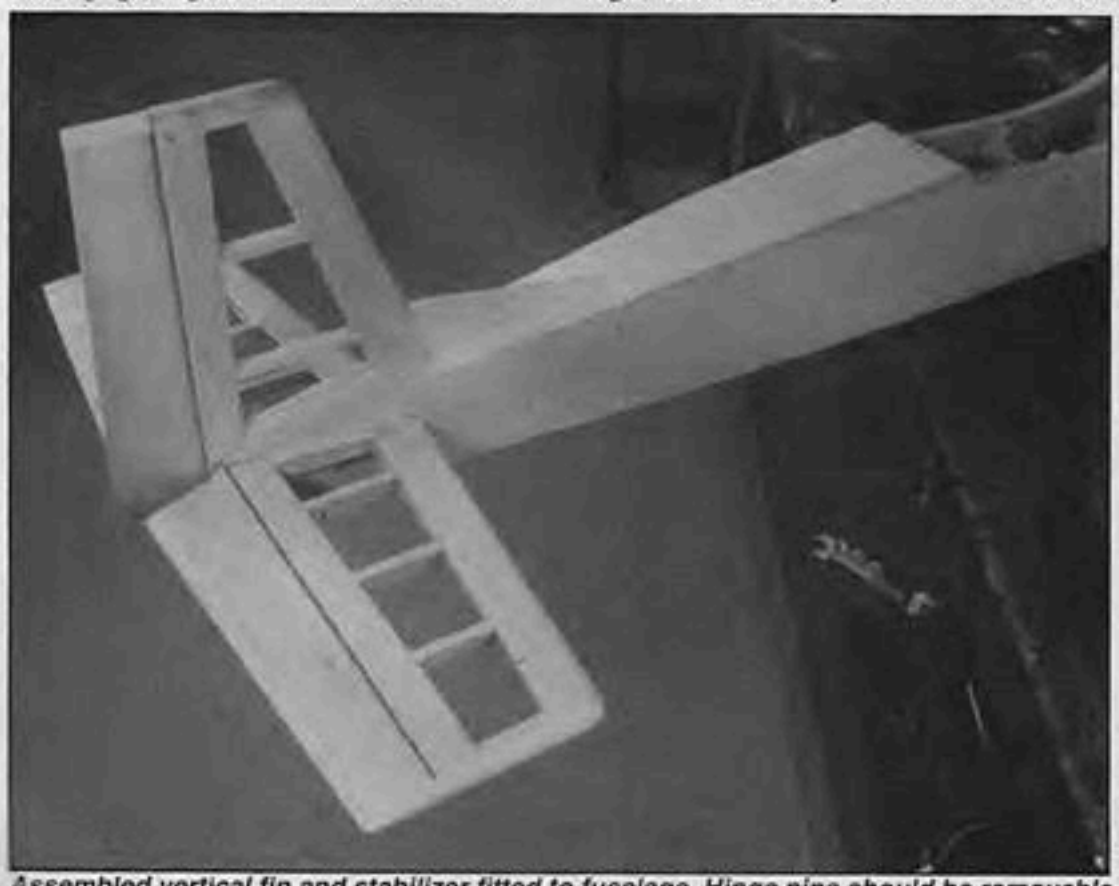
The formers are now glued to base using centerlines for alignment, use gussets if necessary and make sure that they are square with base. Don't forget to add the landing gear gusset. The sides are now glued to formers and when dry the sides are pulled in and glued, making sure that both are in alignment with centerline. Add former F5. You should now have a fuselage that is true. Make a cut-out for the rudder control rod and finish as per plans.

An engine cowling makes the model more attractive but is not a necessity. It is not too difficult to construct if the engine is used as a fixture. Mount the engine to the fire wall and remove the carburetor. Using a hole saw, cut a 1" diameter hole in a 1/2" x 3" x 3" block, then glue on a 1/32" x 1" i.d. x 2-3/8" o.d. plywood sheet. This will fit neatly over the propeller hub of the engine. Now add a 1/16" spacer between the spinner backplate, and the nose ring. The bottom and sides are then fitted, glued, and shaped.

Tail Group:

I prefer a symmetrical section for the vertical fin and horizontal stabilizer, as it is much stronger and less likely to warp. This can be difficult to construct when compared to a flat section. I have combined the two methods as shown on plans. If you prefer the standard flat section do so, I doubt that it will make any difference in the flying characteristics.

I have shown the elevator pushrod going directly to the elevator horn inside the fuselage. This is a very neat installation but requires removal of hinge pins for access to the pushrod clevis. If you do not like this method, route the pushrod out to the left elevator.



Assembled vertical fin and stabilizer fitted to fuselage. Hinge pins should be removable for access to elevator control horn.

Wing:

Wing design and construction is somewhat different than usual particularly when a thick airfoil is used and strip ailerons are not practical, nor desirable. A wing rib alignment jig has to be made from 1-1/4" x 1/4" x 36" trailing edge stock glued to 1" x 3/8" x 36" stock for the trailing edge of the ribs. The wing ribs interlock with a rib alignment and spar gusset. This assures that the ribs are evenly spaced and vertical. It makes for a very strong leading edge "D" section. It is very important that the top and bottom of the gusset is straight and the depth the same as the ribs. Wing rib spacing is even in order that right and left wing panels can be made from the same plan. Cut 24 ribs from 3/32" balsa and modify as shown on plans. Cut two root ribs from 3/16" balsa as it is necessary to have a good glue joint with the sheeting where the two wing panels join.

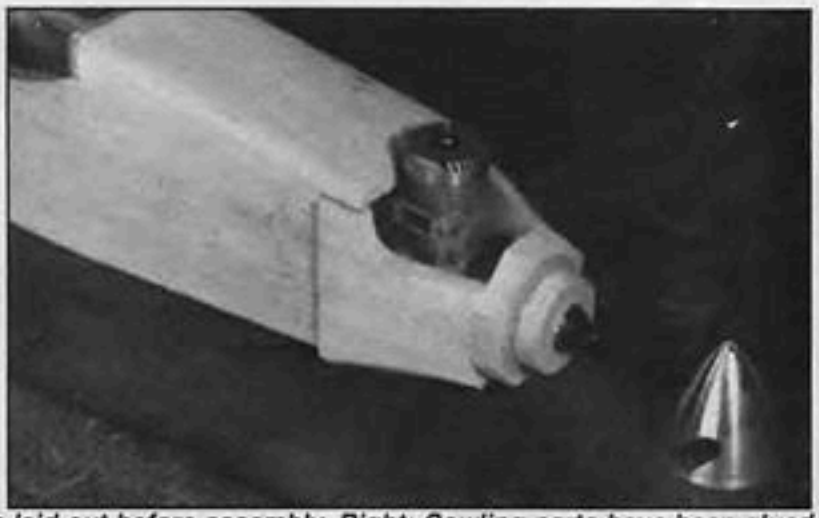
Cut four front spars 1/8" x 1/2" and four 1/8" x 3/16" medium hard balsa with a 36" ruler or a Windsor balsa stripper. I am of the opinion all balsa sticks should be cut from sheet stock because you can be assured of even quality and weight at less cost. Pin down the front spar, add gusset and ribs. Place rear alignment fixture under wax paper, add rear spars and glue assembly. Add top spar and leading edge capstrip. Now place the alignment fixture under the trailing edge. Place a 1/16" x 1-1/2" balsa sheet under the trailing edge, 3/8" from rear spar, and glue. If you want to make sure the trailing edge is straight, add trailing edge strip. Now you can remove wing from plan and finish wing. **Note:** The two 3/16" center ribs are not glued in place until the wing panels are joined with the proper dihedral (see plans). After joining the wing panels with epoxy, be sure to glass the center section with 6 oz. glass cloth, 5"-6" wide and epoxy or resin.

Assembly:

This is an item that is not often mentioned but is very important if you want the aircraft to fly properly without a lot of trim adjustments. The feature of this design is that the straight back flat bottom makes it easy. Place the fuselage on a flat table and add wing. It is likely one wing will be higher than the other. Remove material from the higher wing saddle until both wingtips are at the same height. I also like to add 1/32" ply to the wing saddle in order to make a perfect fit. Now drill and tap for wing hold-down bolts. Leading edge dowels are fitted to F2A and glued to former F2.

The stabilizer is now glued to fuselage making sure that right and left sides are the same height. Glue the vertical fin in place, 90° to the stabilizer. I am inclined to offset the vertical fin about 1/32" to the left to make sure that I am on the correct side of neutral.

At this time you should also do a balance



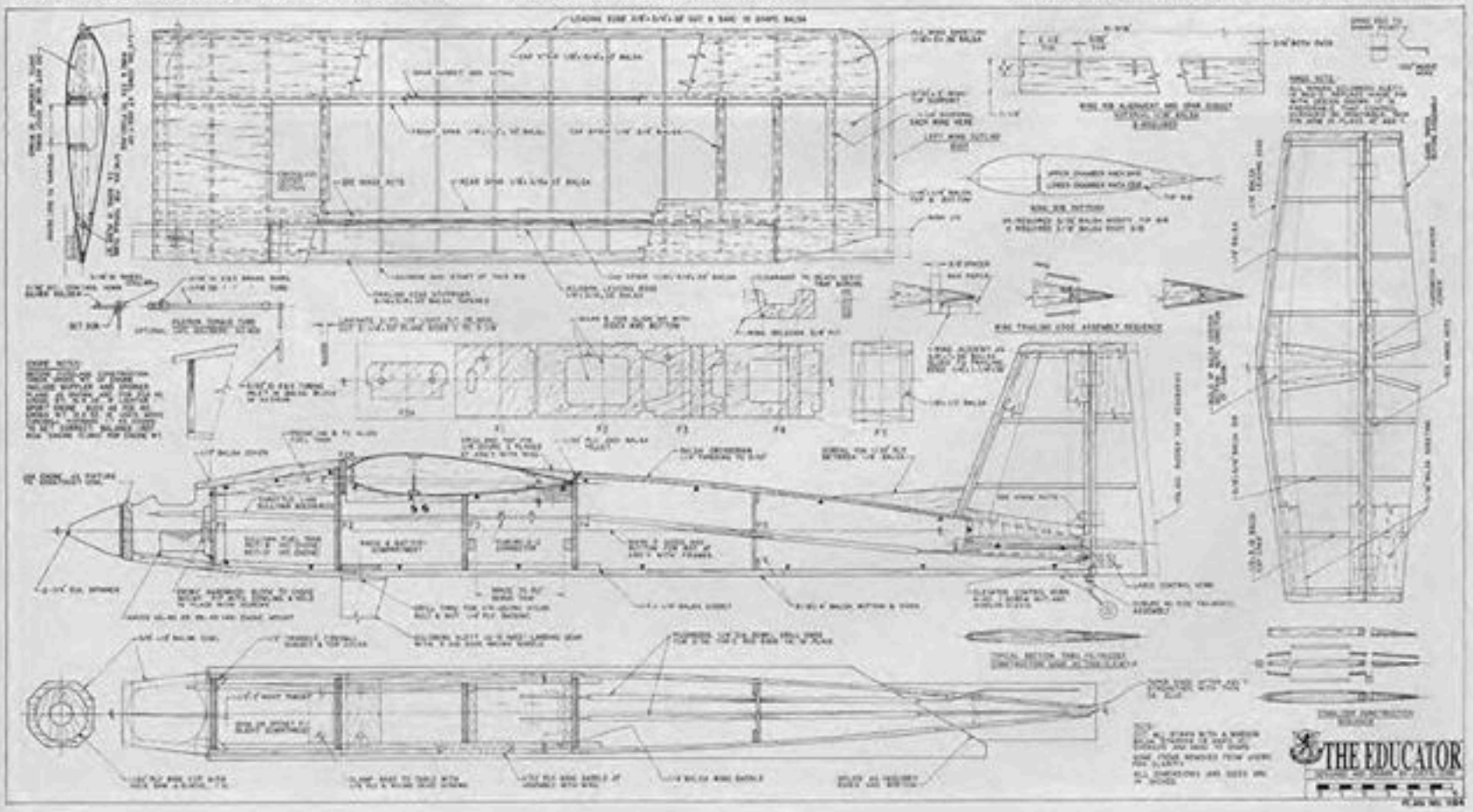
Left: Assembly sequence of engine cowling. Fitted parts are shown laid out before assembly. Right: Cowling parts have been glued and assembled.

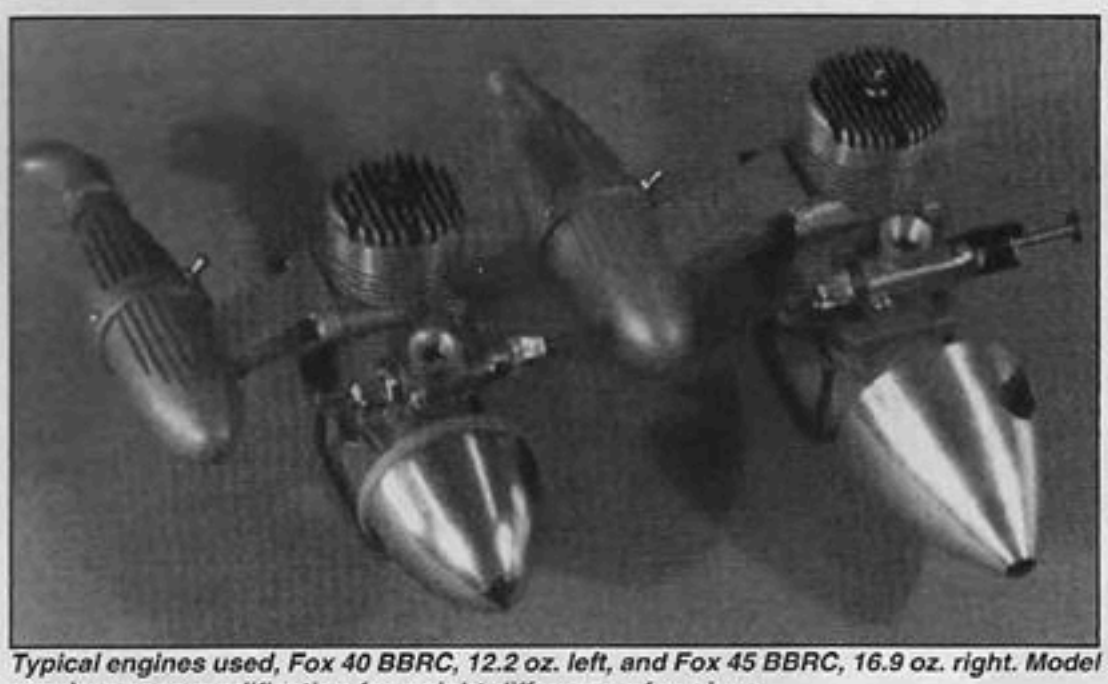
Left: Shape cowling with spinner in place, then fit cowling to carburetor and muffler. Right: Balance uncovered model with all components in place to be assured Center of Gravity is in right location. Model should be a little nose heavy to compensate for covering.

test. The wings should be balanced spanwise. Place pins at leading and trailing edges along centerline and invert the wing. You will probably find one wing is heavier than the other. Add weight until wings are horizontal, then glue in place. Now balance the model with all components in place, at 25%-30% behind leading edge of wing (2-1/2" to 3"). Take into consideration that the model should be a little nose heavy as covering will add weight to the tail. If you have any doubt leave gluing fire wall and engine assembly to fuselage, moving it forward or backwards until you get the balance where you want it. If these items are done it will be unlikely that you will have any serious trim problems as long as you also make sure that there are no warps in the flying surfaces.

Finishing:

This is a subject over which you can be sure to get a lot of controversy, what is good in one instance is not in another and everyone has different ideas. I will just add a few personal thoughts. Most instructions on coverings state that they should be added to the bare wood. This will no doubt be satisfactory but I find some surface preparation





Typical engines used, Fox 40 BBRC, 12.2 oz. left, and Fox 45 BBRC, 16.9 oz. right. Model requires nose modification for weight difference of engines.

will give better results. I like to add a thinned finishing epoxy to the balsa. The thinned epoxy should flow from the brush not drip. Add epoxy thinner or acetone to epoxy until right consistency is achieved. Brush epoxy on a section of balsa, then with a 2" to 3" plastic squeegee scrap all the epoxy off to another section. Then with a cloth wipe off any excess epoxy to make sure there are no high spots. When dry, sand with fine sandpaper.

The advantages of this wood preparation are: Strengthens the wood by binding the wood grains together, prevents wood grain from showing through the plastic film, seals the wood from moisture and fuel, and is much easier to remove balsa dust before covering. Film glue adheres better to this surface, as well as removal if recovering, and there is less likelihood of film bubbling with age as epoxy acts as a seal between film and balsa. This is not new and is called "epoxy saturation" in plywood boat building. Its main purpose in this instance is to prevent dry rot. This is just a suggestion for the modeler to consider. From here on cover and finish as you see fit.

Flying:

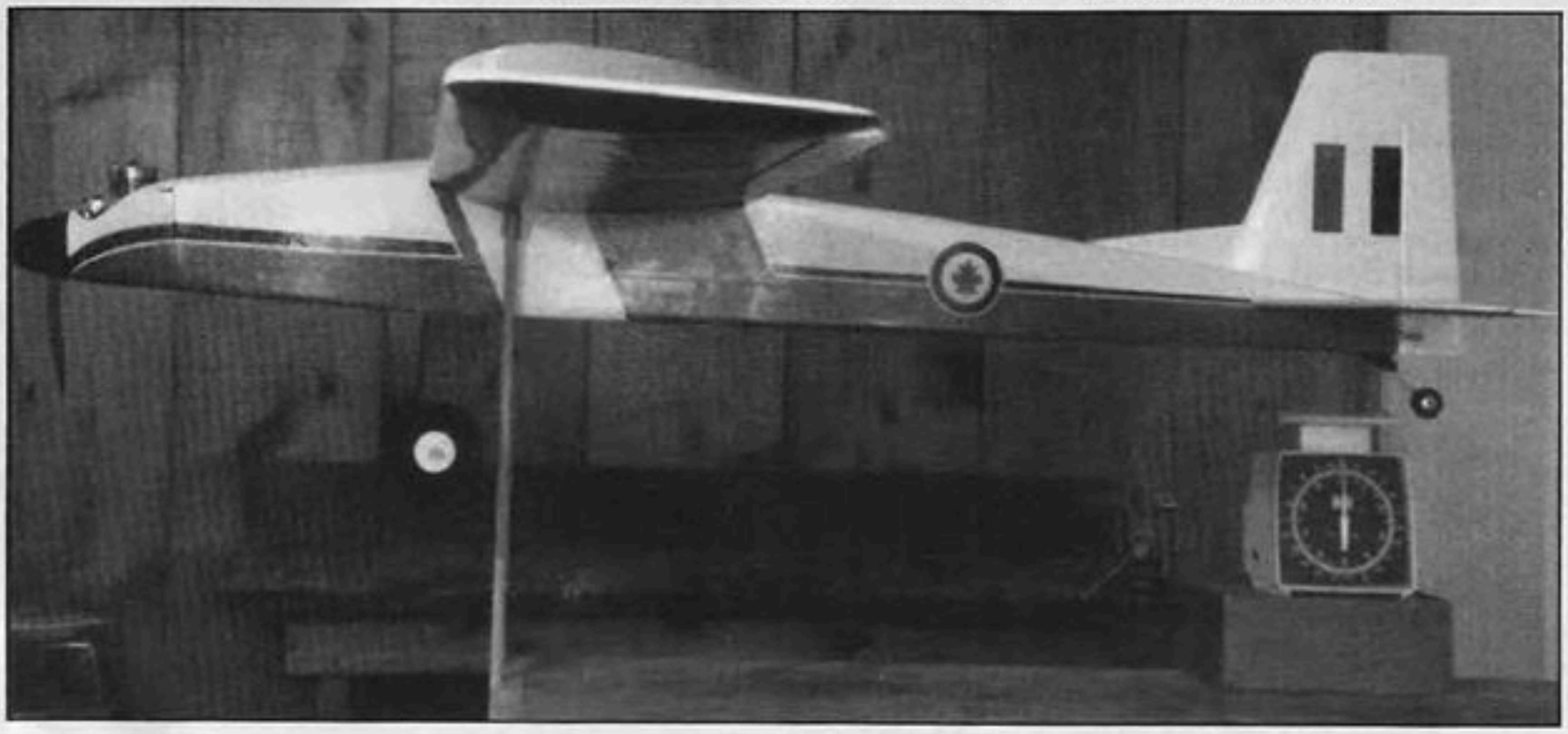
The control surfaces and balance should be properly set before attempting to fly. If the modeler is inexperienced he is likely to overcontrol the model and get into trouble. Set the ailerons at approximately 5/16" up and down and elevator at 3/8". For aerobatics use 3/8" and 1/2" respectively and use the large rudder. The model will roll and do all basic aerobatic maneuvers. If you get into difficulty and don't have any qualified pilot to help you, just remember to throttle back immediately and take your hands off the controls. The inherent stability of this model will, in most situations, return the aircraft to a normal flight path if properly trimmed.

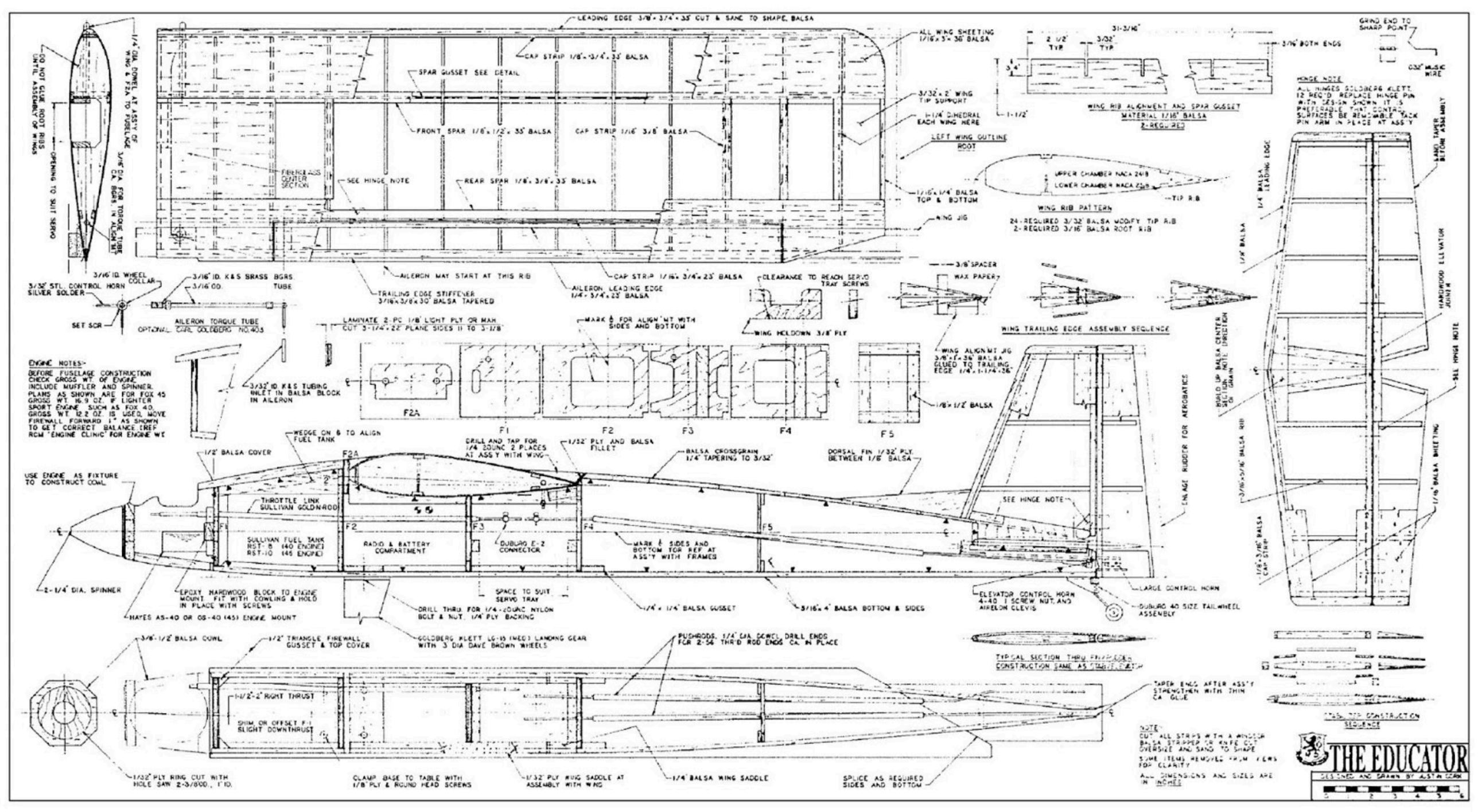
Practicing take-offs and landings is what this model is designed to do. On take-off keep the tail on the ground with full-up elevator, ease the throttle forward slowly. When full power is achieved, release elevator and the tail will come up, then add in a little up elevator along with some right rudder until desired altitude is achieved.

View of radio compartment, showing ample room.

Landing is best accomplished by throttling back to idle and letting the aircraft settle down to its glide path; if too low, control height with throttle — if too high, do another circuit. Flare with a small amount of up elevator just before touchdown. The rest you will have to learn on your own.

Forget about "happy landings," safe landings are more important.




LEADING EDGE 3/8" x 3/4" x 35" CUT & SAND TO SHAPE, BALSA
CAP STRIP 1/8" x 3/4" x 35" BALSA
SPAR GUSSET SEE DETAIL
FRONT SPAR 1/8" x 1/2" x 35" BALSA
CAP STRIP 1/16" x 3/8" BALSA
REAR SPAR 1/8" x 3/8" x 35" BALSA
FIBERGLASS CENTER SECTION
SEE HINGE NOTE
ALL WING SHEETING 1/16" x 3" x 36" BALSA
3/32" x 2" WING TIP SUPPORT
1-1/4" DIHEDRAL EACH WING HERE
LEFT WING OUTLINE
ROOT
1/16" x 1/4" BALSA TOP & BOTTOM
WING JIG
AILERON MAY START AT THIS RIB
TRAILING EDGE STIFFENER 3/16" x 3/8" x 30" BALSA TAPERED
AILERON LEADING EDGE 1/4" x 3/4" x 23" BALSA
CAP STRIP 1/16" x 3/4" x 23" BALSA
1/4 DIA DOWEL AT ASS'Y OF WING & FZA TO FUSELAGE
3/16 DIA FOR TORQUE TUBE BGRS. IN ALIGNMENT
DO NOT GLUE ROOT RIBS UNTIL ASSEMBLY OF WINGS
OPENING TO SUIT SERVO
3/16 I.D. WHEEL COLLAR
3/32" STL. CONTROL HORN SILVER SOLDER
SET SCR
3/16" I.D. K&S BRASS BGRS. TUBE
3/16 O.D.
AILERON TORQUE TUBE
OPTIONAL CARL GOLDBERG NO. 405
3/32" I.D. K&S TUBING INLET IN BALSA BLOCK IN AILERON
LAMINATE 2 PC 1/8" LIGHT PLY OR MAH CUT 3-1/4" x 22" PLANE SIDES 11 TO 3-1/8"
MARK ℄ FOR ALIGN'MT WITH SIDES AND BOTTOM
CLEARANCE TO REACH SERVO TRAY SCREWS
WING HOLDOWN 3/8" PLY
3/8" SPACER
WAX PAPER
WING ALIGNMT JIG 3/8" x 4" x 36" BALSA GLUED TO TRAILING EDGE 1/4" x 3-1/4" x 36"
1/8" x 1/2" BALSA
F2A
F1
F2
F3
F4
F5
WING RIB ALIGNMENT AND SPAR GUSSET
MATERIAL 1/16" BALSA
2 REQUIRED
2 1/2" TYP
3/32" TYP
31-3/16"
3/16" BOTH ENDS
1-1/2"
WING RIB PATTERN
UPPER CHAMBER NACA 2418
LOWER CHAMBER NACA 2418
TIP R/B
24 REQUIRED 3/32" BALSA MODIFY TIP R/B
2 REQUIRED 3/16" BALSA ROOT R/B
WING TRAILING EDGE ASSEMBLY SEQUENCE
GRIND END TO SHARP POINT
.032" MUSIC WIRE
HINGE NOTE
ALL HINGES GOLDBERG KLETT. 12 REQ'D. REPLACE HINGE PIN WITH DESIGN SHOWN. IT IS PREFERABLE THAT CONTROL SURFACES BE REMOVABLE. TACK PIN ARM IN PLACE AT ASS'Y
LAND TAPER BEFORE ASSEMBLY
1/4" BALSA LEADING EDGE
1/4" BALSA
HARDWOOD ELEVATOR JOINER
SEE HINGE NOTE
1/16" BALSA SHEETING
3/16" x 3/16" BALSA CAP STRIP
BUILD UP BALSA CENTER SECTION. NOTE DIRECTION OF GRAIN
ENLARGE RUDDER FOR AEROBATICS
ENGINE NOTES:
BEFORE FUSELAGE CONSTRUCTION CHECK GROSS WT. OF ENGINE INCLUDE MUFFLER AND SPINNER. PLANS AS SHOWN ARE FOR FOX 45 GROSS WT. 16.9 OZ. IF LIGHTER SPORT ENGINE SUCH AS FOX 40 GROSS WT. 12.2 OZ. IS USED, MOVE FIREWALL FORWARD 1" AS SHOWN TO GET CORRECT BALANCE (REF. FROM "ENGINE CLINIC" FOR ENGINE WT.
USE ENGINE AS FIXTURE TO CONSTRUCT COWL
WEDGE ON ℄ TO ALIGN FUEL TANK
1/2" BALSA COVER
DRILL AND TAP FOR 1/4-20UNC 2 PLACES AT ASS'Y WITH WING
1/32" PLY AND BALSA FILLET
BALSA CROSSGRAIN 1/4" TAPERING TO 3/32"
DORSAL FIN 1/32" PLY BETWEEN 1/8" BALSA
THROTTLE LINK SULLIVAN GOLD-N-ROD
SULLIVAN FUEL TANK RST-8 (40 ENGINE) RST-10 (45 ENGINE)
RADIO & BATTERY COMPARTMENT
DUBURO E-Z CONNECTOR
MARK ℄ SIDES AND BOTTOM FOR REF AT ASS'Y WITH FRAMES
SEE HINGE NOTE
2-1/4" DIA. SPINNER
EPOXY HARDWOOD BLOCK TO ENGINE MOUNT. FIT WITH COWLING & HOLD IN PLACE WITH SCREWS
HAYES AS-40 OR OS-40 (45) ENGINE MOUNT
SPACE TO SUIT SERVO TRAY
DRILL THRU FOR 1/4-20UNC NYLON BOLT & NUT. 1/4" PLY BACKING
1/4" x 1/4" BALSA GUSSET
3/16" x 4" BALSA BOTTOM & SIDES
ELEVATOR CONTROL HORN 4-40 1 SCREW NUT, AND AIRFOIL CLEVIS
LARGE CONTROL HORN
DUBURO 40 SIZE TAILWHEEL ASSEMBLY
3/8-1/2" BALSA COWL
1/2" TRIANGLE FIREWALL GUSSET & TOP COVER
1-1/2°-2° RIGHT THRUST
SHIM OR OFFSET F-1 SLIGHT DOWNTHRUST
1/32" PLY RING CUT WITH HOLE SAW 2-3/8OD., 1" ID.
CLAMP BASE TO TABLE WITH 1/8" PLY & ROUND HEAD SCREWS
1/32" PLY WING SADDLE AT ASSEMBLY WITH WING
1/4" BALSA WING SADDLE
SPLICE AS REQUIRED SIDES AND BOTTOM
GOLDBERG KLETT LG-15 (NEW) LANDING GEAR WITH 3" DIA DAVE BROWN WHEELS
PUSHRODS, 1/4" DIA. DOWEL, DRILL ENDS FOR 2-56 THR'D ROD ENDS CA. IN PLACE
TAPER ENDS AFTER ASS'Y STRENGTHEN WITH THIN CA GLUE
TYPICAL SECTION THRU FIN/RUDDER CONSTRUCTION SAME AS STABILIZER
FIN/RUDDER CONSTRUCTION SEQUENCE
NOTE:
CUT ALL STRIPS WITH A WINDSOR BALSA STRIPPER OR KNIFE CUT OVERSIZE AND SAND TO SHAPE
SOME ITEMS REMOVED FROM VIEWS FOR CLARITY
ALL DIMENSIONS AND SIZES ARE IN INCHES
THE EDUCATOR
DESIGNED AND DRAWN BY AUSTIN CORK
0 1 2 3 4 5 6