

EMC²



This design was engineered to take advantage of the FAI rules using two metres and five kilos as maximum size and weight limits.

Your model will weigh close to the limit using current equipment. Do not expect to get it under ten lbs.

Included are weights we have recorded, in grams, to provide a guideline for acceptable weights.

We have not used any cored wing or extremely soft wood as the wing size simply can produce a very high G load!

The placement shown for radio and servos was chosen because the model balanced well using a 1.2 four cycle engine. The new two cycle engines will tend to be lighter but the servo locations can remain the same.

BASIC KIT: Fuselage, cowling, canopy and floor, firewall, wing tube assy, wing panels, horizontal stabilizer cores and rudder core

Your instruction manual has templates, scale drawings and sketches to guide you in constructing and finishing the model.

Wood stocklist: 1/16"x4"x42"A GRAIN, 6-8 lb sheeting. 24 pieces (includes a couple of extras). 1/4"x4"x42" A GRAIN 6 lb sheet for edging. 2 pieces.

Lite plywood, 1/8"x24"x12", 1 piece. Spruce 1/8"x3/8"x36". 2 pieces
1/2" birch dowel. 1 piece

Hardware is up to you but low profile retracts are suggested.

The following tools, equipment and supplies are recommended to make construction easier and possibly, more accurate.

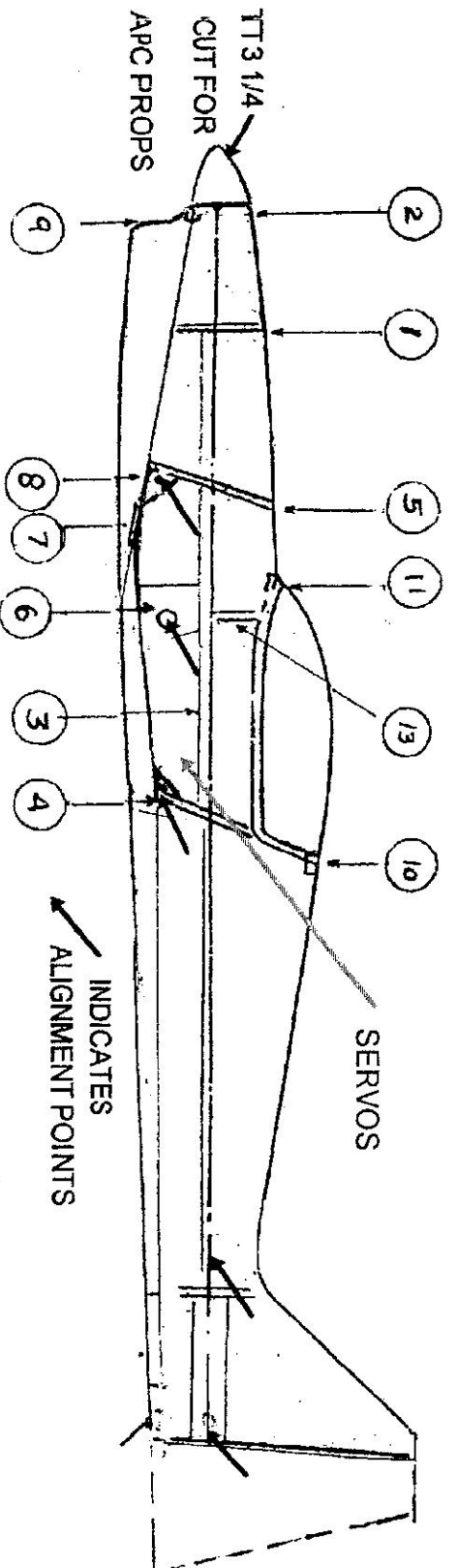
One inch thick, particle board at least 20"x40", four pieces. (Used for wing layup and as a building and alignment board.)

A band saw, a jig saw and a fine toothed hobby saw are desirable but you can make do with hand knives and small saws.

Gram scales, either beam type or electronic type are very helpful in wood selection etc. but should be capable of weighing up to 20 ozs.

8 ozs of laminating epoxy, some medium thick CA, an ounce of clear silicon rubber such as GE SILICONE 11, and a squeeze bottle of white or yellow glue.

Vacuum bagging the surfaces is great, if you know how to do it without crushing the foam around cutouts. Properly done it can be stronger.

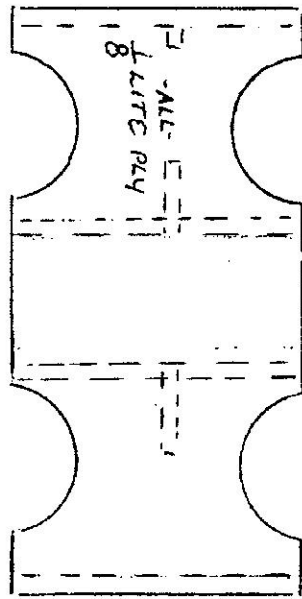


ASSEMBLE IN THE FOLLOWING ORDER

NOTE: GLASS FUSELAGES CAN BE DAMAGED BY HEAT AND CONSTANT PRESSURE. STORE UPRIGHT

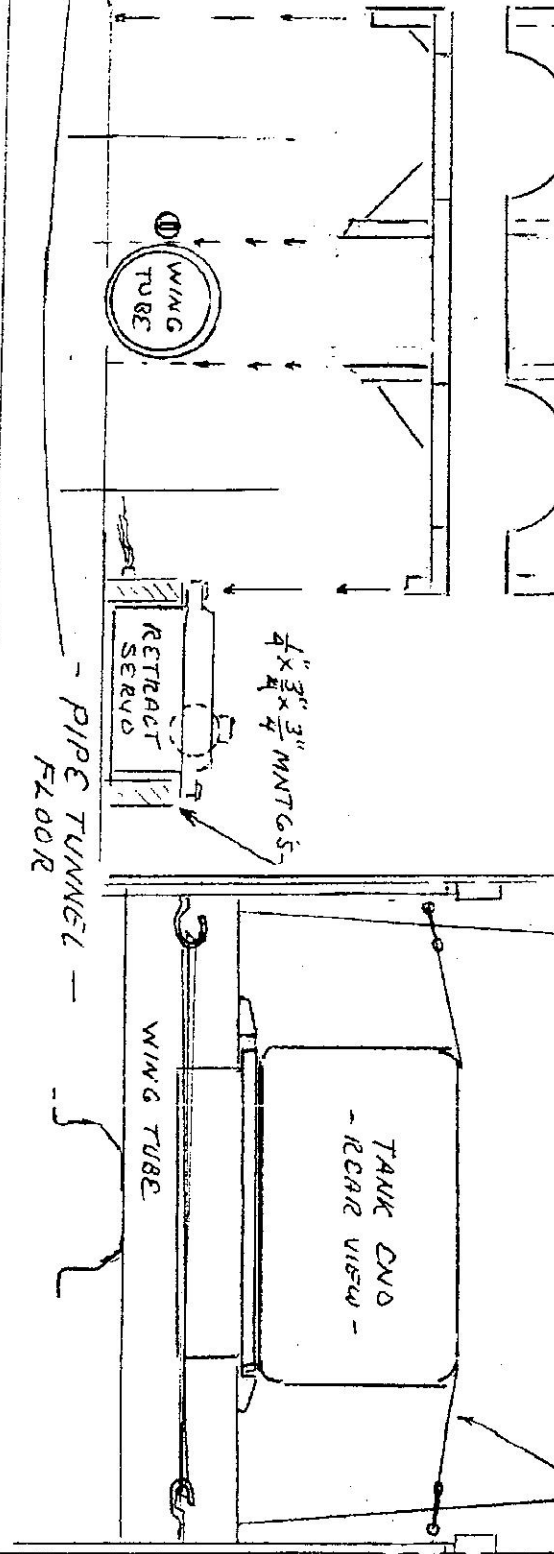
- 1 FIREWALL- USE TEMPLATE- 1/8" PLY-EPOXY
- 2 NOSE RING SUPPORT-USE TEMPLATE-EPOXY
- 3 LONGERON-1/8"X3/8"X24" FIRM BALSA-SILICONE RUBBER
- 4 CANOPY BLKHD-TEMPLATE-BALSAPLY-SILICONE RUBBER
- 5 FORWARD BLKHD-TEMPLATE-BALSAPLY-SILICONE RUBBER
- 6 WINGTUBE & SIDE SUPPORT-4"X4" BALSAPLY-EPOXY
- 7 COWL MOUNT-TEMPLATE-1/8" LITEPLY-EPOXY
- 8 ANTI ROTATION PLATES-1/8" LITEPLY-EPOXY
- 9 COWL MOUNT-TEMPLATE- 1/8"HARDPLY- EPOXY
- 10 CANOPY MOUNTING-SEE DETAIL
- 11 CANOPY MOUNTING-SEE DETAIL
- 12 SERVOS
- 13 TANK ATTACHMENT & SIDE SUPPORT-TEMPLATE-EPOXY & SILICONE RUBBER SEE DETAIL

EMC2 FUSELAGE ASSEMBLY

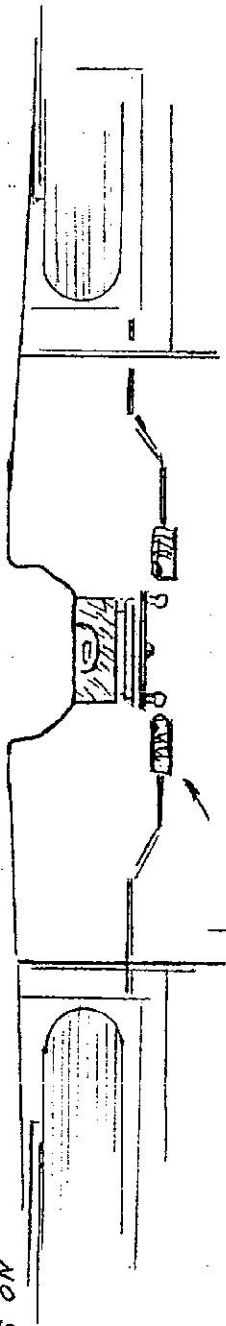


LITEPLYWOOD FLOOR IS SHAPED TO FIT TANK
ATTACH FLOOR TO TANK WITH RUBBER BANDS
THE TANK ASSEMBLY DROPS OVER THE WING TUBE

A QUICK DISCONNECT BAND HOLDS TANK



THE SERVO IS A LOW PROFILE TYPE
LINKAGE IS SPRING LOADED TYPE



NO SCALE

EMC2 FUEL TANK AND RETRACT SERVO

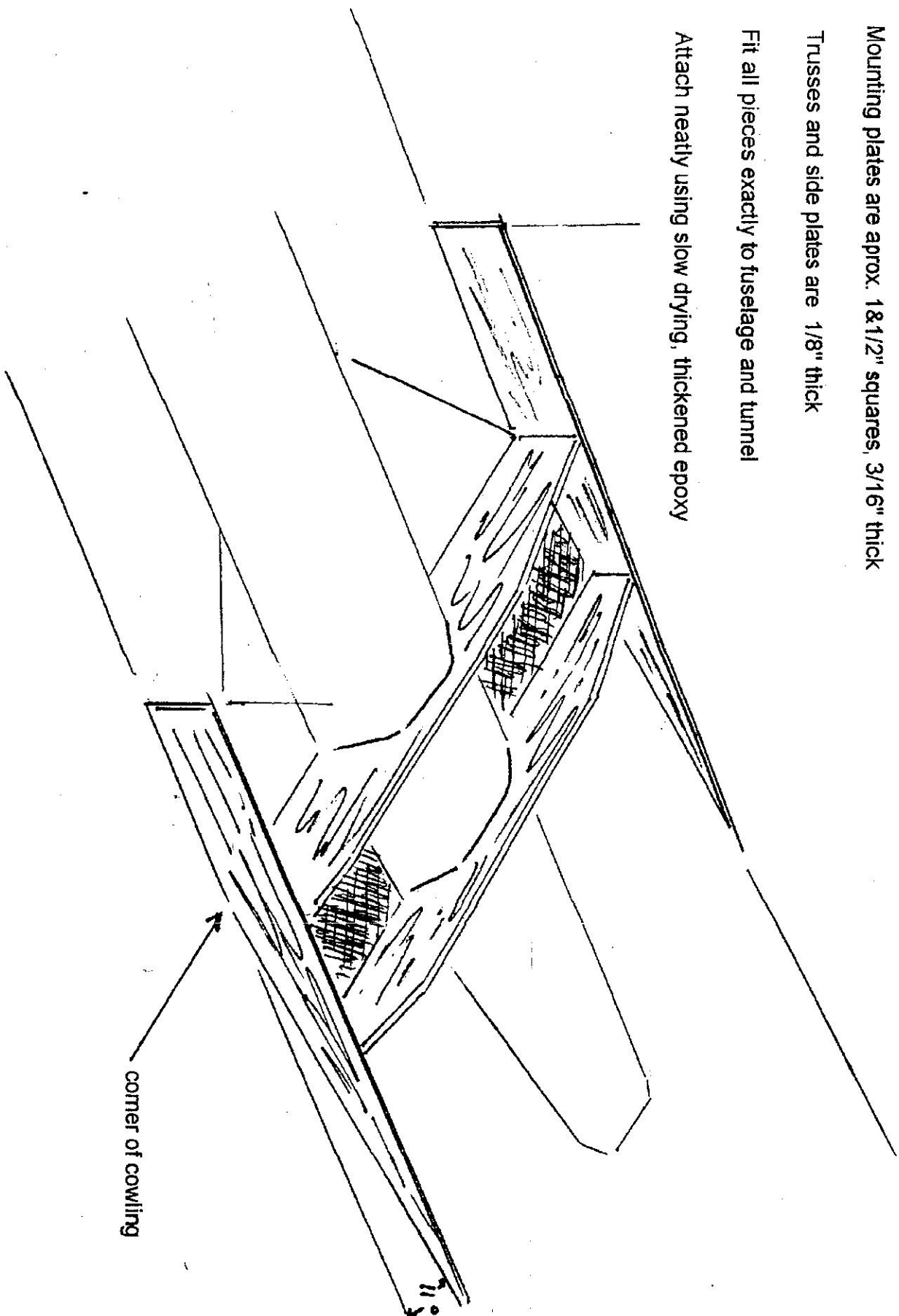
All parts are light ply or composite plates

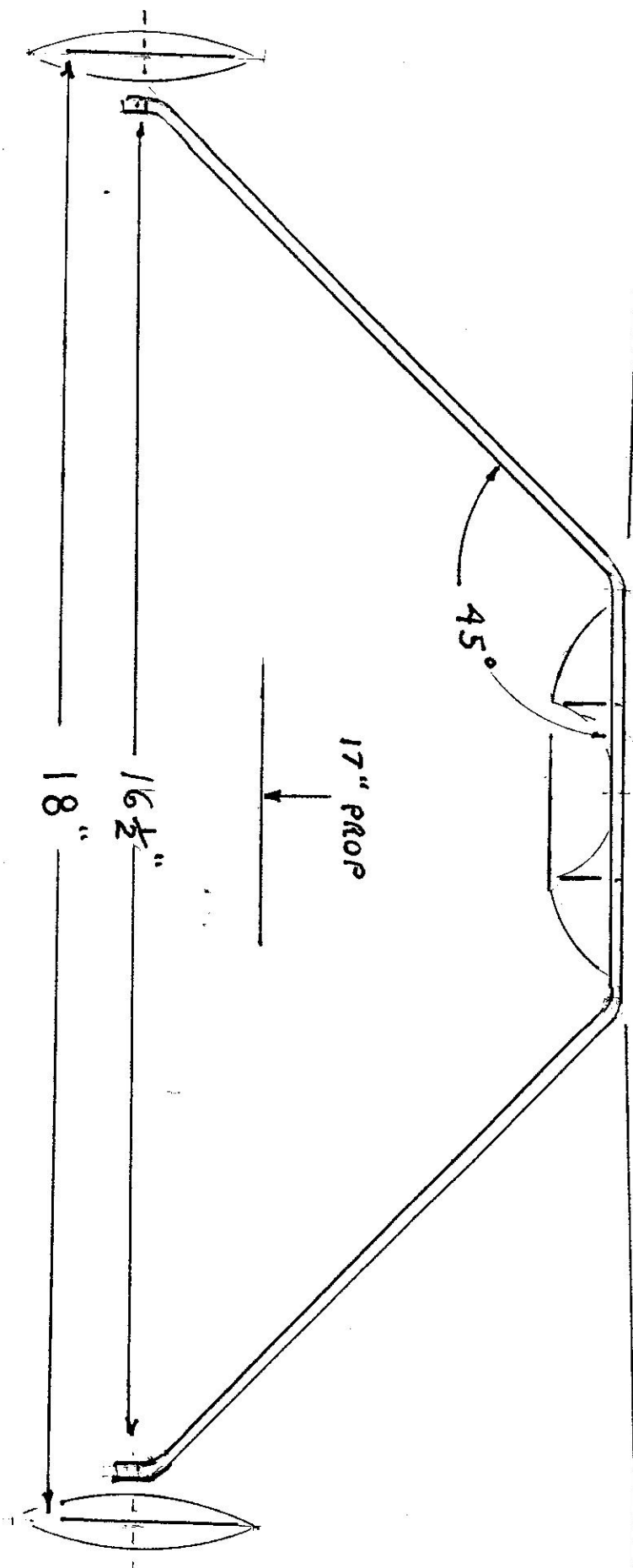
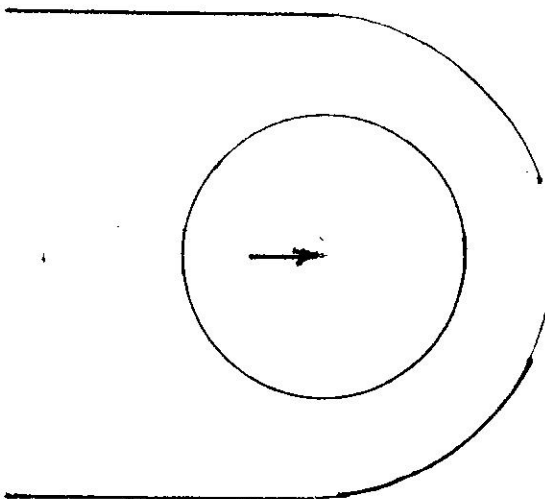
Mounting plates are aprox. $1\frac{1}{2}$ " squares, $\frac{3}{16}$ " thick

Trusses and side plates are $\frac{1}{8}$ " thick

Fit all pieces exactly to fuselage and tunnel

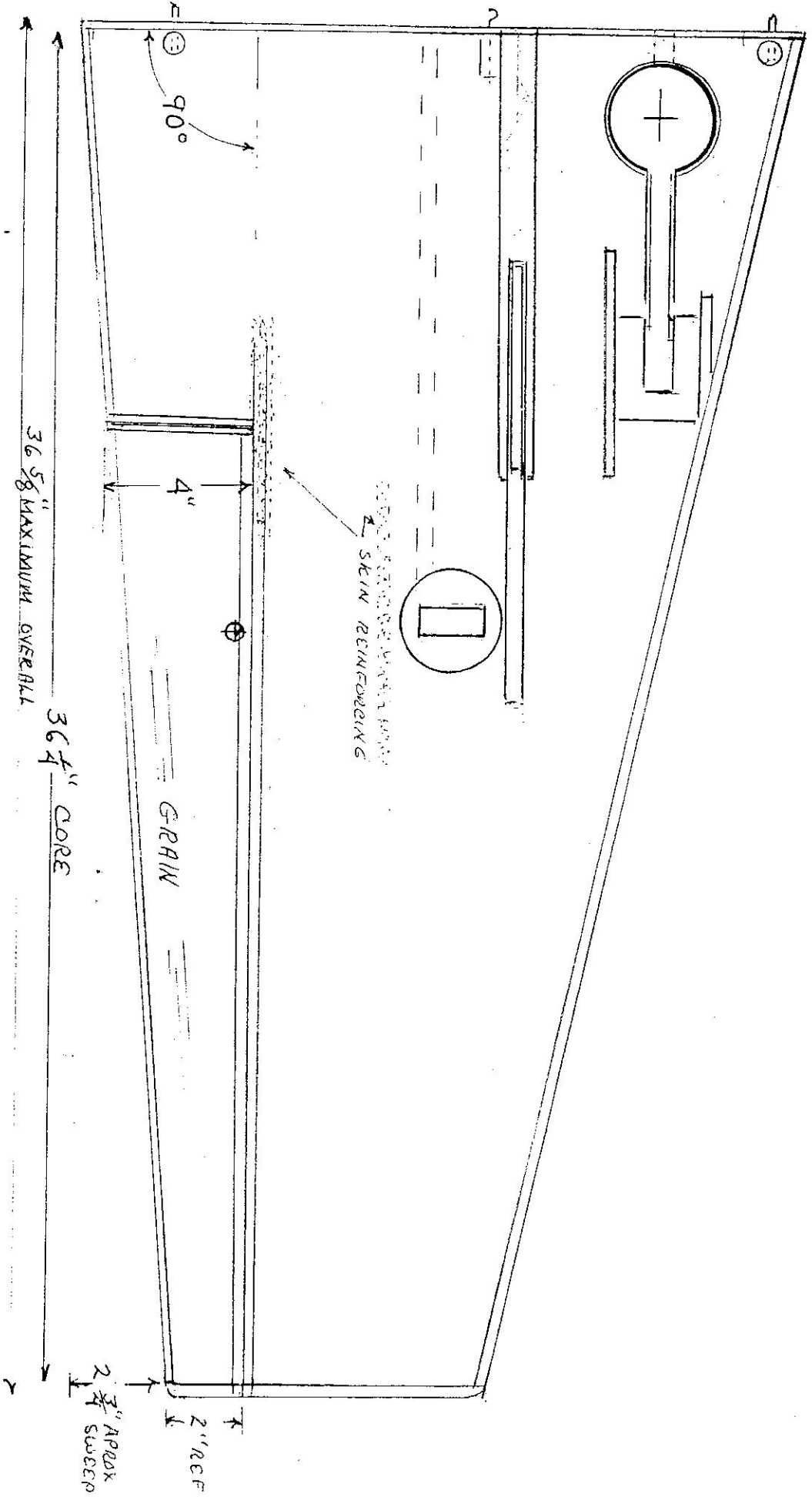
Attach neatly using slow drying, thickened epoxy





EMC 2

"BULLETS" ARE ALUMINUM OR HARDWOOD
ROUND AND POLISH ONE END



EMC2 WING ASSEMBLY

SHEETING WHEN READY TO ATTACH WILL WEIGH APPROX. 7 OZS. (200GMS.) ALL EDGING IS "A" GRAIN, MED LIGHT.

TIP WOOD IS HARD BALSA, AS ARE AILERON END FACINGS. EPOXY USED IS THIN LAMINATING EPOXY.

WHITE GLUE MAY BE USED ON LEADING EDGE AND TIP.

SKIN REINFORCING MAY BE 2 OZ CLOTH OR CARBON FIBRE ATTACHED TO UNDERSIDE OF SKIN WHERE SHOWN.

PLACE WING PANELS IN FOAM SHUCKS, BOTTOM SIDE UP, USING A MINIMUM AMOUNT OF EPOXY, INSTALL TUBES LEAVING 1/4" EXPOSED.

ADD SPAR FILLER BALSA AND SPRUCE SURFACE SPAR, RETRACT PLATE AND SUPPORTS USING EPOXY.

SLIP JOINING TUBE IN PLACE AND INSURE PANELS ARE SQUARE WHILE DRYING.

WHEN DRY, ADD TOP BALSA AND SPRUCE SURFACE SPAR.

SQUARE AND JOIN SHEETING; SEVEN PIECES FOR EACH WING PANEL, 38" LONG, CUT DIAGONALLY, LEAVING 1/4" ALL AROUND EXCEPT FOR TRAILING EDGE. SQUARE WOOD ON TRAILING EDGE AT ASSEMBLY.

BLOCK SAND & DUST CLEAN. ATTACH USING EPOXY. A TOTAL OF APPROX. 80 GMS WILL BE USED IF IT IS SCRAPPED ON USING A NOTCHED PLASTIC SCRAPER.

SQUARE CAREFULLY AFTER WEIGHTS ARE IN PLACE

LAY UP ONE PANEL AT A TIME TO MINIMIZE COMPOUNDED ERRORS. IF STACKING PANELS, LAY SECOND PANEL LEFT OF PREVIOUS PANEL AND USE TWO BOARDS BETWEEN EACH PANEL TO ALLOW REQUIRED SHIMMING AT WING TIPS. OTHERWISE ONE TIP MAY CURVE UP SLIGHTLY. PROPERLY SHIMMED, EACH BOARD DIRECTLY UNDER EACH PANEL WILL BE EXACTLY FLAT.

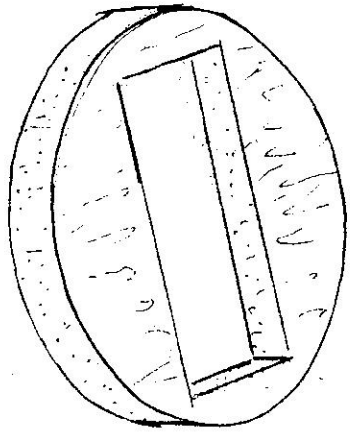
WHEN DRY, TRIM, ALLOWING FOR INSET ROOT RIB, EDGE, MATCH AND ADD ROOT PLYWOOD RIB USING EPOXY.

CUT OUT AILERON STARTING 10 1/2" FROM ROOT AND FACE EDGES WITH 1/4" BALSA. USE EPOXY AND RE-ALIGN ANY CURVE IN AILERON WHEN ATTACHING FACE. ADD SERVO SETUP PER DRAWING

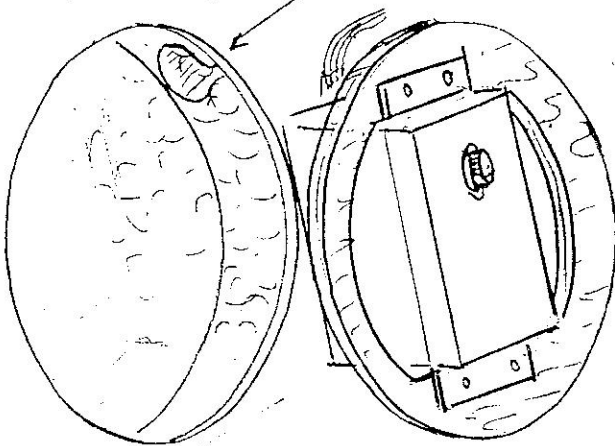
LINE RETRACT WHEEL HOLE WITH 6 OZ CLOTH AROUND SIDES ONLY. LINE GEAR LEG SLOTS WITH 1/8" BALSA.

ADD AILERON HARD POINT FOR THE HORN AND INSTALL END GRAIN BALSA PLUGS FOR "BULLET" SUPPORTS AT ENDS OF ROOT RIB.

EACH PANEL ASSEMBLY SHOULD WEIGH 14 OZS. (APPROXIMATELY)

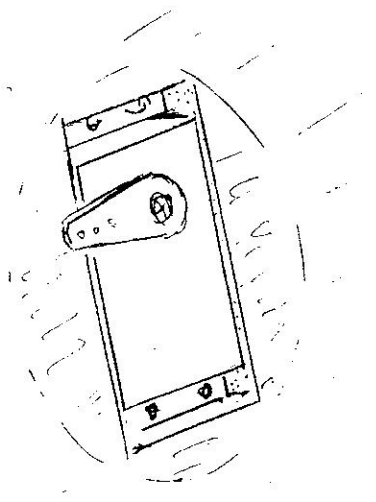


SOFT BALSA FILLER
TIGHT FIT TO CLEAR THE SERVO
WHEN ALIGNED WITH THE PLYWOOD



1/8" PLYWOOD RING MOUNT
MOUNT THE SERVO AND FIT THE FILLER BLOCK
SLIDE THE SERVO AND RING INTO THE WELL
ALIGN AND SPOT GLUE INTO DESIRED POSITION
INSTALL FILLER USING EPOXY AROUND BOTTOM
AND OUTER EDGE

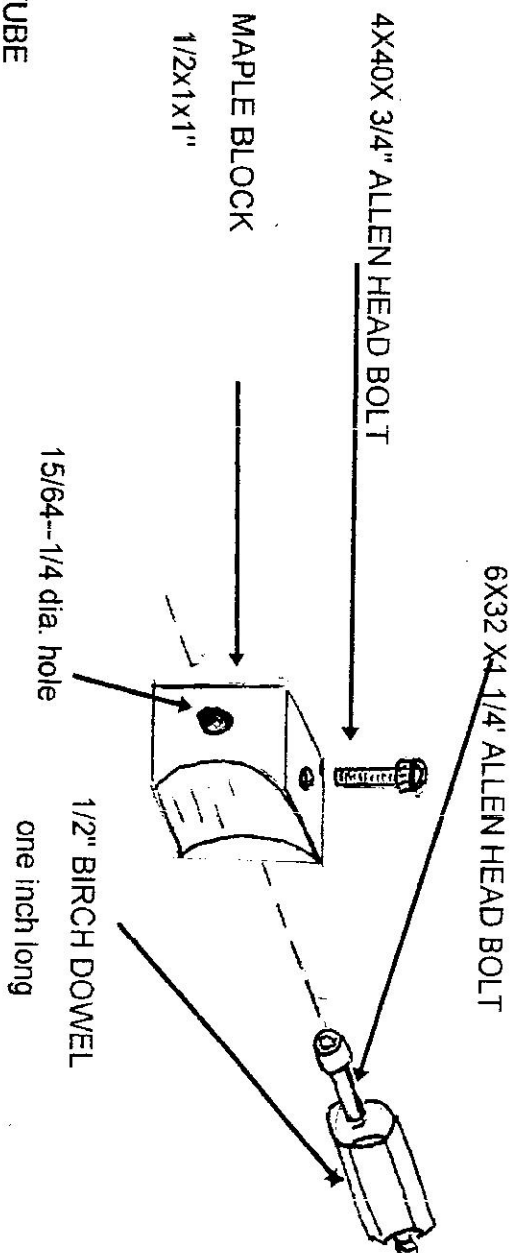
SERVO WELL IS 2 1/2" DIA.
THE RING SHOULD FIT SNUGLY



REMOVE SERVO AND BLOCK SAND
MAKE CERTAIN THE GLUE JOINT IS COMPLETE
EACH ASSEMBLY WEIGHS APPROX. 1/4 OZ. (7 GMS).

EMC2 AILERON SERVO MOUNTING

NO SCALE



ASSEMBLY

DOWEL IS EPOXIED TO WING TUBE

BLOCK IS EPOXIED TO CENTER TUBE, AGAINST FUSELAGE

THE 6X32 BOLT IS THREADED INTO THE DOWEL AND IS ADJUSTABLE

THE 4X40 BOLT CAPTURES THE HEAD OF THE 6X32 BOLT

HOLD WING FIRMLY SEATED AGAINST FUSELAGE AND ADJUST LENGTH OF 6X32 BOLT

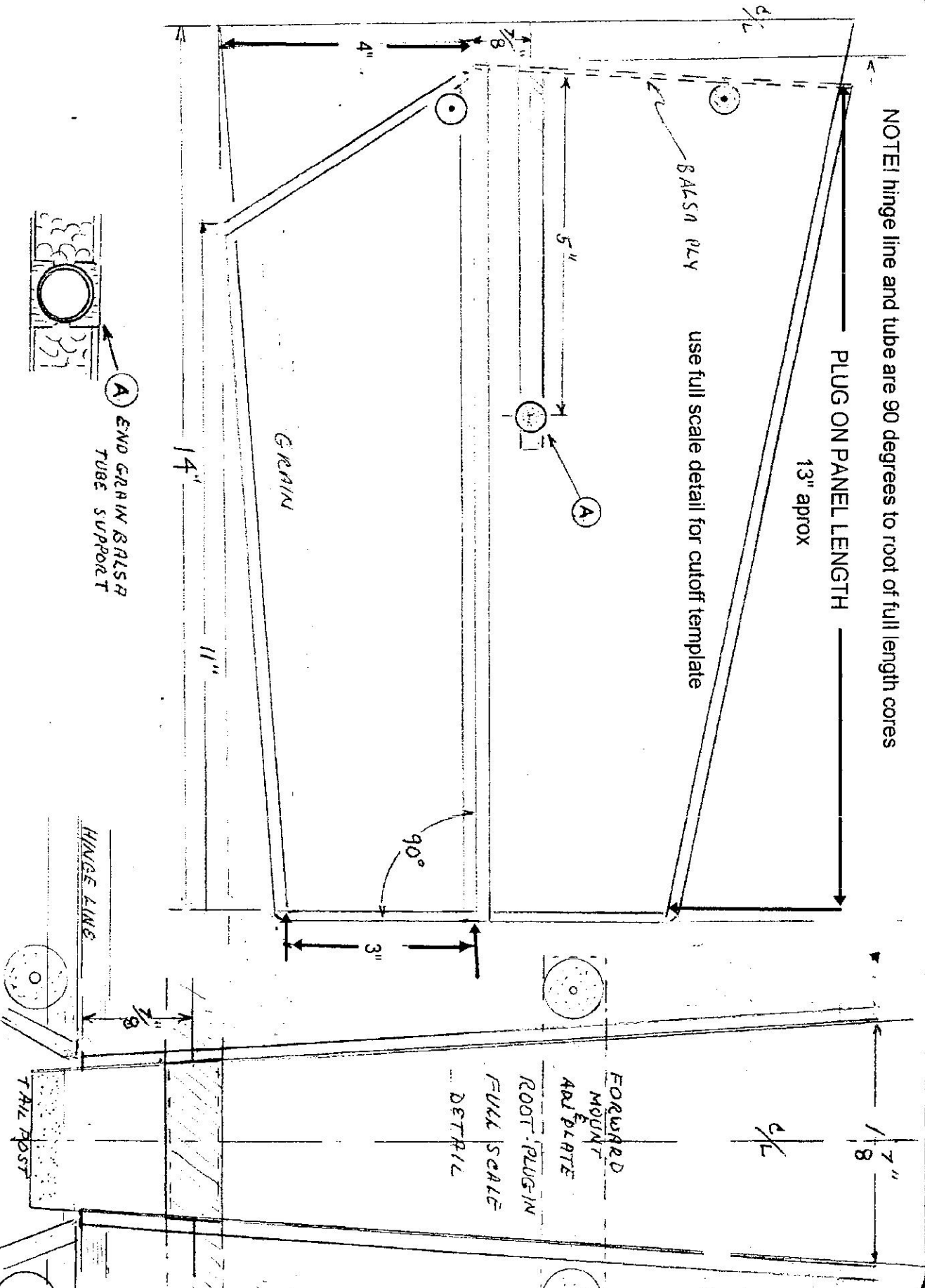
CORRECTLY ADJUSTED, THE 4X40 BOLT WILL CAPTURE THE 6X32 BOLT, BEHIND THE HEAD.

THE BOLTS MUST FIT SNUGLY INTO THE TAPPED THREADS, INSPECT REGULARLY

THREE TURNS OF THE 4/40 BOLT WILL LOCK OR UNLOCK THE WING PANEL

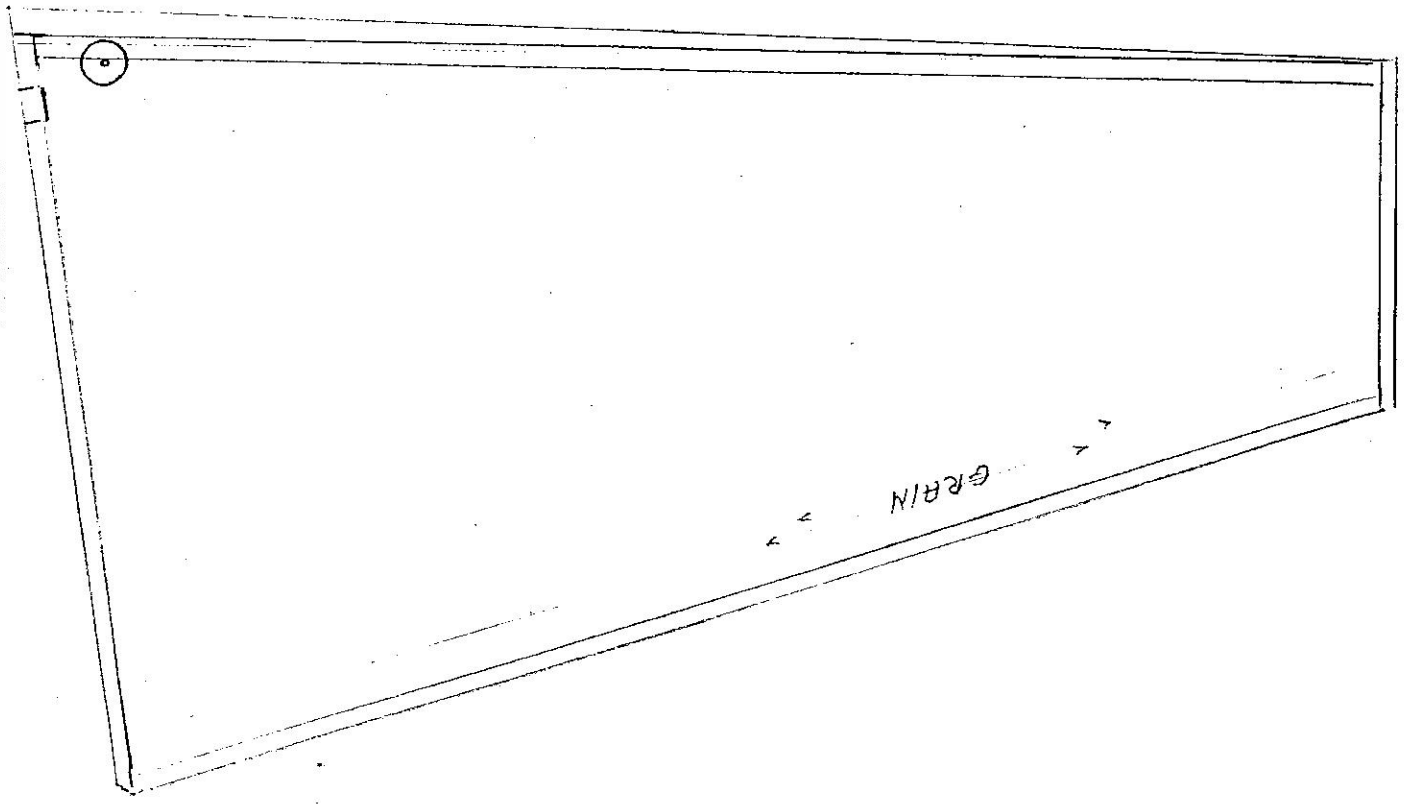
WING CAPTURE BOLT ASSY

NOTE! hinge line and tube are 90 degrees to root of full length cores



EMC2 HORIZONTAL STABILIZER ASSY

1/8" SCALE



EMC2 RUDDER ASSEMBLY

1/2 SCALE

THE HORIZONTAL STABILIZER MAY BE BUILT AS A PLUG ON TYPE OR A SLIDE THRU ONE PIECE TYPE. THE WEIGHT IS ALMOST THE SAME. THE PLANS SHOW THE PLUG ON TYPE USING A SINGLE MOUNTING PLATE TO LOCK AND ADJUST IF NECESSARY.

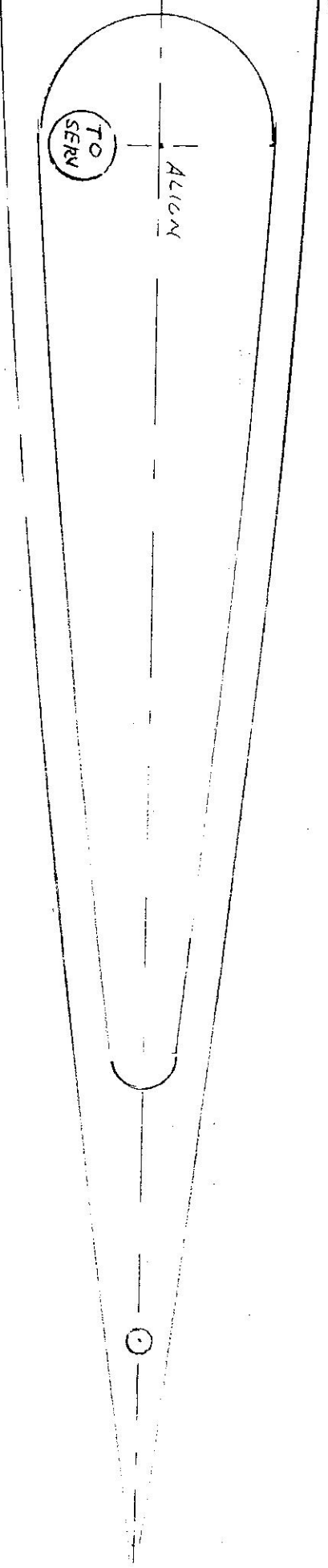
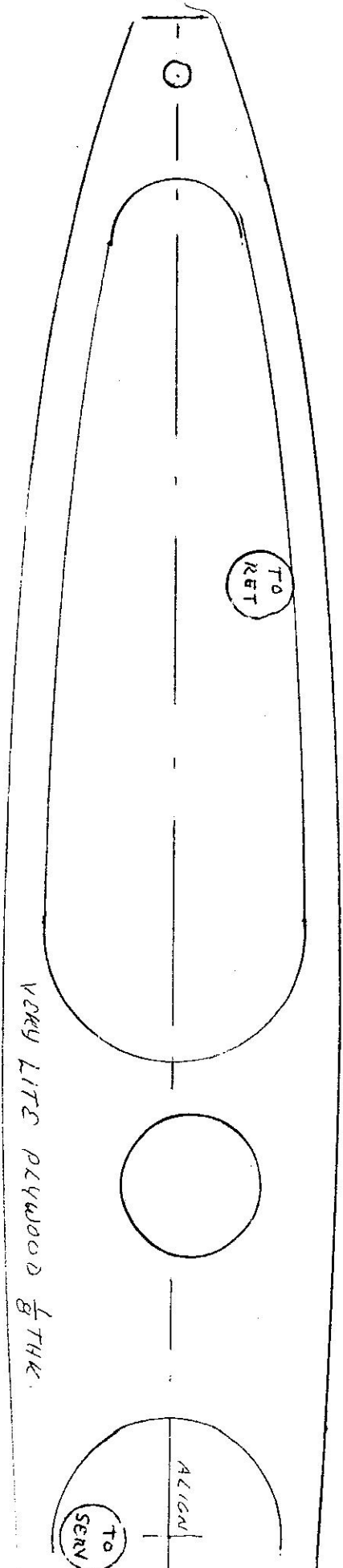
THE WOOD USED CAN BE THE LIGHTEST OF BALSA AS LONG AS IT IS NOT PUNK WOOD

FOLLOW THE SHEETING TECHNIQUES OUTLINED FOR WING CONSTRUCTION. WITH EACH HALF SANDED AND SQUARED, EITHER JOIN THE HALVES OR MAKE A JIG AND BORE THE JOINER TUBE HOLES.
CUT ROOT PER TEMPLATE AND INSTALL TUBE (AS DONE ON WING). LEAVE 1/4" OF TUBE EXPOSED.

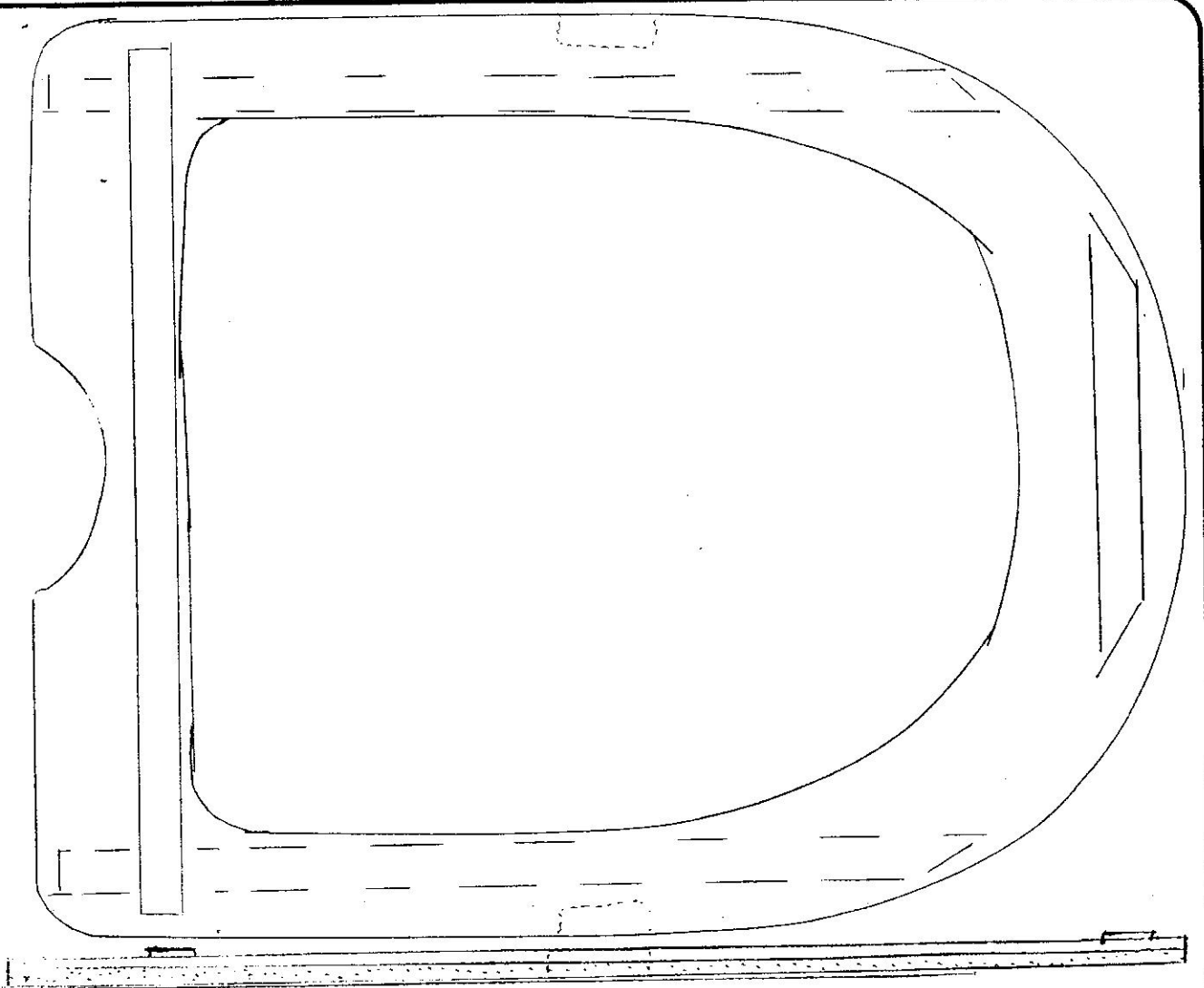
EDGE WOOD WITH 1/4" MEDIUM BALSA AND THEN CUT OUT ELEVATORS AND EDGE. USE PLY BALSA FOR ROOT RIB WITH VERTICAL GRAIN AGAINST FOAM INSTALL END GRAIN TUBE SUPPORTS AND BIRCH DOWELS.
THE COMPLETED ASSEMBLY SHOULD WEIGH UNDER 5 OZS. TOTAL (135 GMS)

RUDDER

SHEET WITH LIGHT 1/16", TRIM AND EDGE WITH MEDIUM 1/4" ON T.E, TOP AND BOTTOM EDGES. USE A DOUBLED PIECE OF LIGHT 1/4" ON THE L.E.
BLOCK SAND TO SHAPE THEN TRIM L.E. AS SHOWN TO 1/4" AT TOP.
SAND IN BEVEL TO ALLOW ABOUT 40 DEGREES THROW EACH WAY.
NOTE THE COMPOUND CURVE IN THE LEADING EDGE SIDES. DO NOT CHANGE.
ADD BIRCH DOWELS AS SHOWN
FINISHED WEIGHT SHOULD BE JUST OVER 1 OZ.
(35-40 GMS)



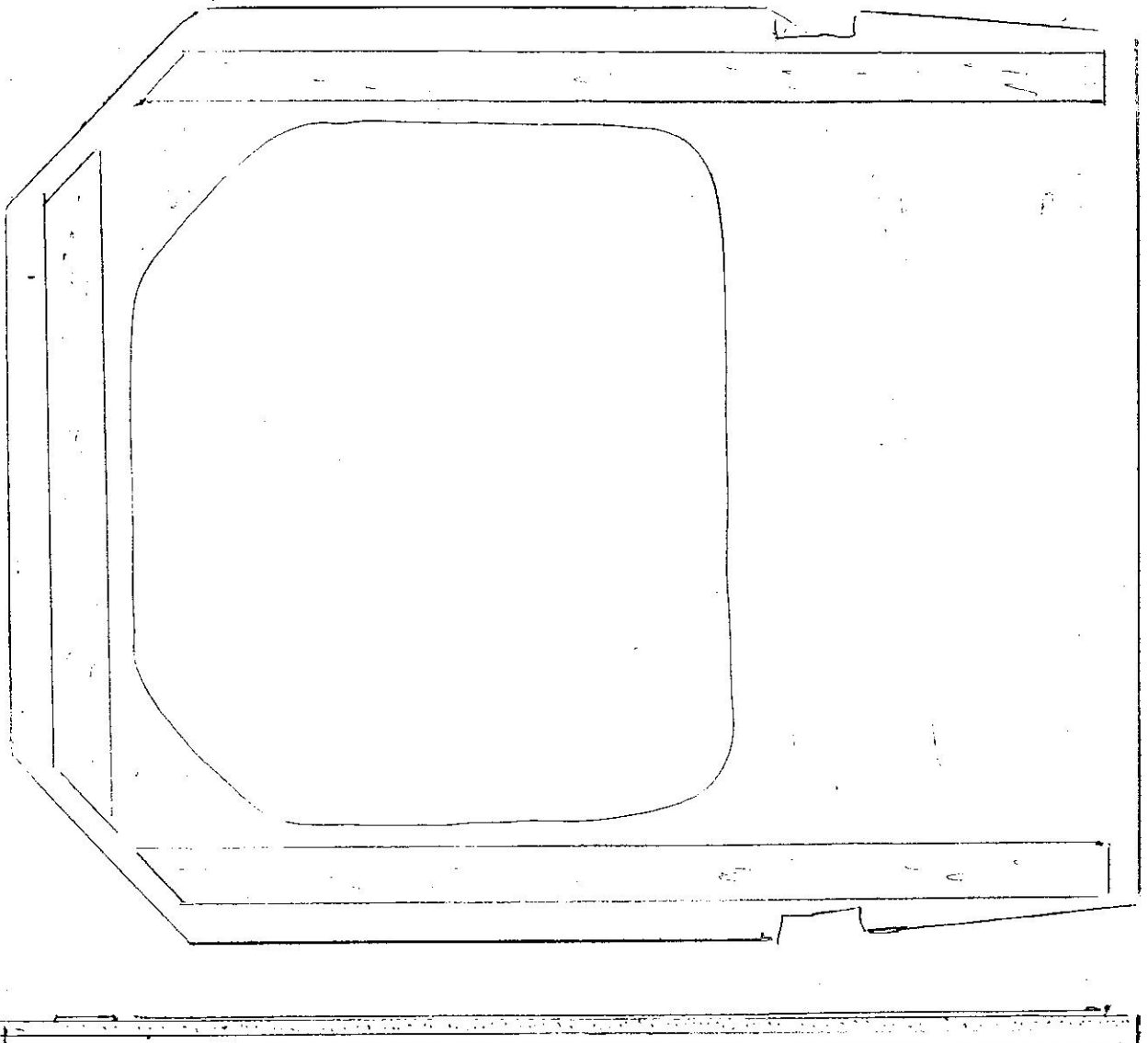
EMC2. ROOT RIB (FOAM CORE SIZE)



MAKE FROM SCRAP 1/16" SHEETING
 ONE PLY IS VERTICAL, ONE HORIZONTAL
 JOIN WITH THICK C.A.
 ADD 1/64" PLYWOOD STRIPS AS SHOWN
 SAND AND TRIM FOR A LOOSE SLIP FIT
 FIT AROUND LONGERON IS NOT IMPORTANT
 RUN BEAD OF SILICON ALONG SIDES
 EPOXY UPPER EDGE TO HEADREST RETURN
 ANTI ROTATION PLATES ATTACH WITH EPOXY
 ASSEMBLY WEIGHS 9 GRAMS

FULL SCALE

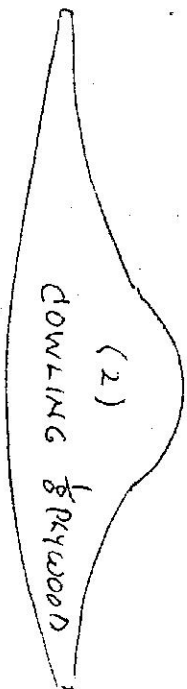
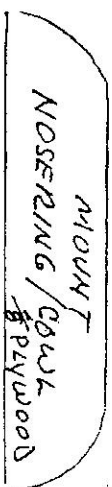
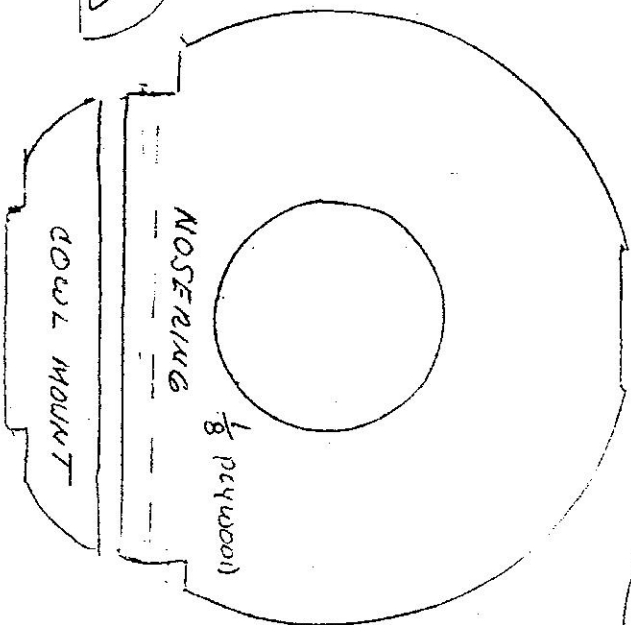
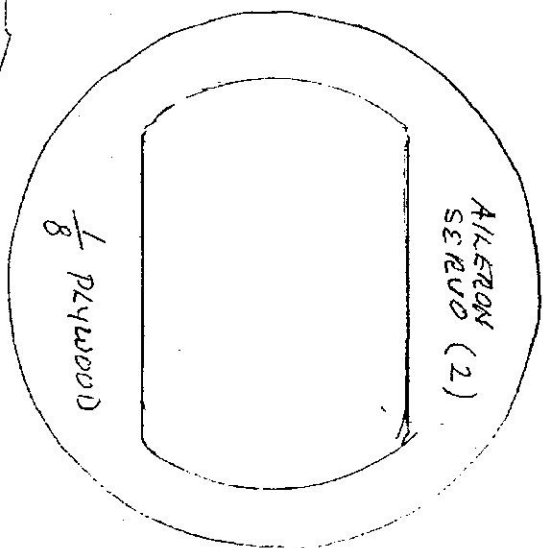
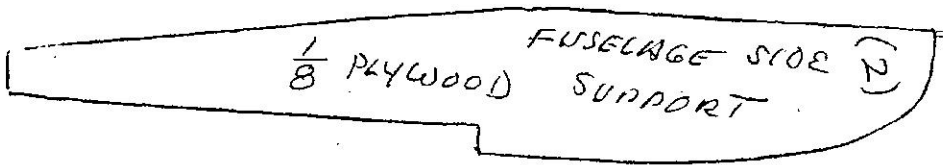
EMC2 FORWARD BULKHEAD



MAKE FROM SCRAP 1/16" SHEETING
 ONE PLY IS VERTICAL, ONE HORIZONTAL
 JOIN WITH THICK C.A.
 ADD 1/64" PLYWOOD STRIPS AS SHOWN
 SAND AND TRIM FOR A LOOSE SLIP FIT
 FIT AROUND LONGERON IS NOT IMPORTANT
 RUN BEAD OF SILICON ALONG SIDES
 EPOXY UPPER EDGE TO HEADREST RETURN
 ANTI ROTATION PLATES ATTACH WITH EPOXY
 ASSEMBLY WEIGHS 7 GRAMS

FULL SCALE 1-1

EMC2 CANOPY BULKHEAD



EMC2 TEMPLATES

THE WING TUBE CENTER IS MARKED ON THE FUSELAGE. CUT ONE SIDE TO FIT CENTER TUBE, THE OTHER SIDE SHOULD BE SLIGHTLY OVERSIZE TO ALLOW EXACT ALIGNMENT OF PANELS. CENTER TUBE IS CUT TO EXACTLY 5 1/4".

WITH WINGS ASSEMBLED ON TUBE AND POSITIONED AGAINST FUSELAGE, THE DISTANCE FROM EACH TIP TO THE C/L FOR THE STABILIZER SHOULD BE THE SAME. ALSO, THE DISTANCE FROM THE TIPS TO THE VERTICAL FIN TIP SHOULD BE MATCHED.

THE SIDES OF THE FUSELAGE AND THE C/L OF THE FIN ARE PARALLEL. YOUR FIT UP SHOULD BE WITHIN 1/16" ERROR..

SPOT GLUE CENTER WING TUBE AND RECHECK ALIGNMENT. SAND ROOT RIBS OR BUILD UP AS REQUIRED WITH SCRAP BALSA. THE WING SHOULD FIT SNUGLY AND EASILY AGAINST THE FUSELAGE WITH THE ROOT RIBS ALIGNED WITH C/L SPOTS FRONT AND REAR. FINISH YOUR GLUING

NEXT, INSTALL BULLETS IN WING ROOT RIB, SQUARE AND CENTER ON RIB MARK FUSELAGE AND DRILL TO MATCH THEIR POSITIONS

ADD DOWEL IN ROOT RIBS TO ATTACH JOINING HOOKS.

MARK AND CUT HOLE IN FUSELAGE FOR ACCESS AND RUBBER BAND THE WINGS INTO POSITION. EACH PANEL SHOULD FIT FUSELAGE AND RESIST ANY FORE-AFT MOVEMENT.

NOW THE STABILIZER CAN BE ALIGNED TO THE FUSELAGE. MARK WITH A PEN ONTO FUSELAGE AND CUT MOUNTING HOLE FOR TUBE AND A SLOT UNDER THE STABILIZER TO MATCH UP WITH THE MOUNTING DOWELS. THE MOUNTING PAD IS 1/4"x5/8" X3" PLYWOOD AND #4X1" SOCKET HEAD SCREWS ARE USED TO ATTACH THE PANELS.

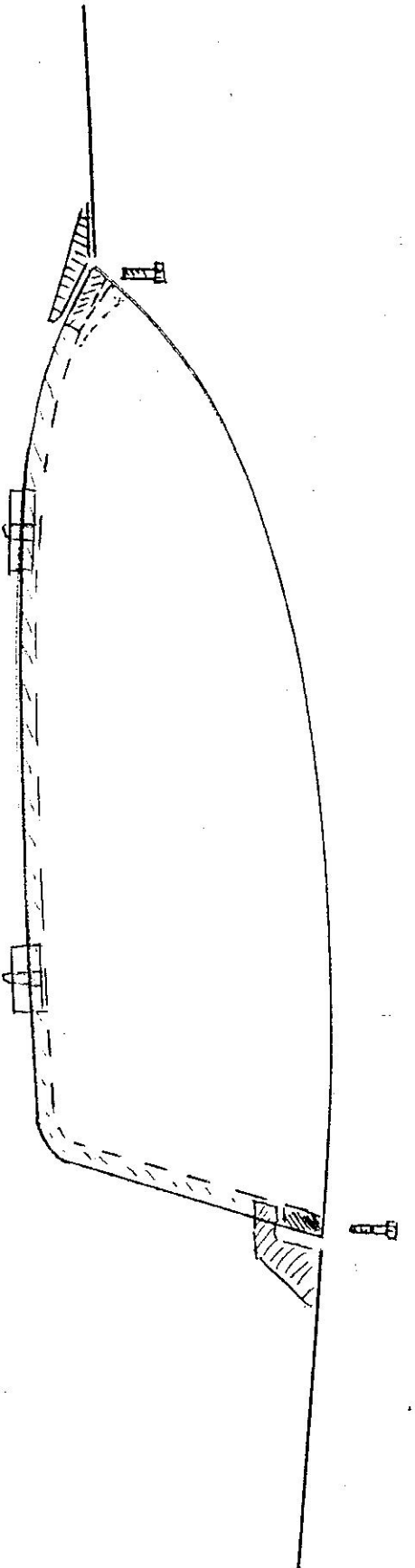
THE HATCH ALLOWS YOU TO SOLIDLY GLUE IN THE STABILIZER PIECES WHEN ALIGNMENT TO THE WING IS COMPLETED.

YOUR ENGINE MOUNT IS YOUR CHOICE BUT IT SHOULD CANCEL MOST VIBRATION.

ADD YOUR FAVORITE HARDWARE FOR FUELING, ETC. AND ADD RX & BATT MOUNTS AFTER MODEL IS FINISHED. THE PIPE (IF USED) SHOULD CLEAR THE BOTTOM OF THE TROUGH BY 3/8" TO PREVENT HEAT DAMAGE.

PAINT SHOULD BE **MINIMUM** REQUIRED FOR A SMOOTH FINISH. ONLY A TINY AMOUNT OF PRIMER SHOULD BE REQUIRED FOR MODERN FINISHES. I AIRBRUSH EPOXY PRIMER TO CHECK FOR ANY CORRECTIONS NEEDED. YOU SHOULD ONLY NEED A FEW OUNCES OF FINISH BUT IT IS EASY TO ADD 1/2 LB THROUGH OVER PAINTING!

I ALSO USE ULTRACOAT OR MONOKOTE ON ALL WOOD SURFACES. BE CERTAIN YOU DO NOT MELT ANY FOAM WITH EXCESSIVE HEAT OR RUBBING.



TRIM CANOPY FLOOR TO FIT FUSELAGE. THE FLOOR, WHEN PUSHED DOWN AND HELD AT THE TWO MOUNTING POINTS, SHOULD BE SLIGHTLY BELOW THE HEADREST AND SHORT OF THE COWL BY APPROX. 1/16".

THE CANOPY WILL FILL THE REMAINING SPACE.

EPOXY MAPLE PIECES TO ALLOW A 4X40 BOLT TO PASS VERTICALLY THROUGH THE FLANGE.

THE BOLT SHOULD BE COUNTERSUNK INTO THE BLOCKS AS SHOWN AND THE MOUNTING PAD (MAPLE OR A BLIND NUT), MATCH DRILLED AND TAPPED.

THE CANOPY IS TRIMMED TO THE UPPER FLANGE AND THEN TRIMMED TO FIT THE FLOOR WITH THE FLOOR ATTACHED.

SCUFF SAND THE FLOOR FLANGE AND THE INNER EDGE OF THE CANOPY TO PROVIDE A SOLID GLUEING SURFACE.

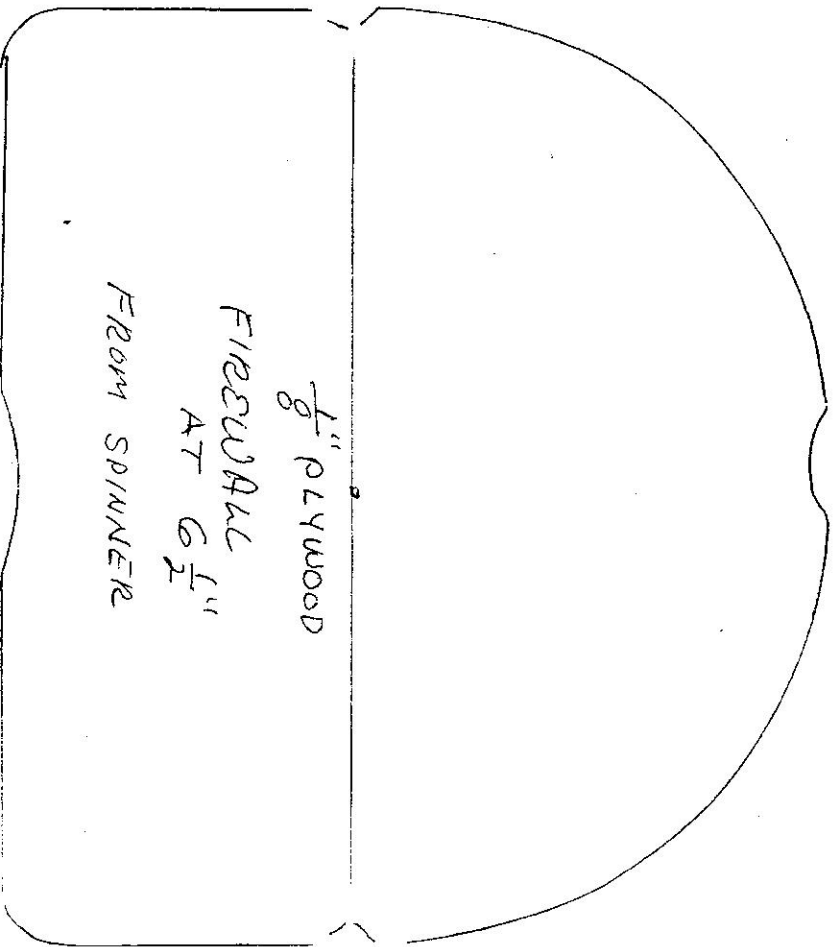
ANY COCKPIT DETAIL SHOULD BE DONE USING LIGHTWEIGHT MATERIALS. THE FRONT OF THE FLOOR CAN BE RADUSED UPWARD WITH A LITTLE EPOXY/WOOD BUILDUP IF DESIRED. THIS SIMPLIFIES THE FRONT MOUNTING LOCATION.

MASK OFF AND SCOTCH BRITE (SCUFF) THE PLASTIC CANOPY FOR THE TRIM DETAIL.

YOUR FINISHED CANOPY SHOULD WEIGH APPROX. 5 OZS..

EMC2 CANOPY DETAIL

WING TIP
 $\frac{1}{4}$ " HARD Balsa



EMC₂

SETUP AND TRIMMING HINTS

The CG is at the wing tube. Start your trim flights using this setting.

1. Trim for hands off at normal cruise speed
2. Try a vertical line check, up at power, down at zero power
3. If the model pulls a lot to the canopy in both vertical lines, it needs a rearward cg shift or a retrim in the stabilizer or both.
4. When both are about right, the stabilizer will appear to be at "0" and the elevators will appear to be "down" a very small amount.
5. If the model is sluggish in response to the "down" elevator inputs, increase down throw about 10% or reduce expo on down. **DO NOT BIND OR BOTTOM OUT SERVO MOVEMENTS**
6. Set maximum full throttle roll in horizontal flight to about one roll per second. Or faster.
7. Adjust expo or dual rate for less as preferred.
8. Set rudder for maximum throw without hitting elevators.
9. NOW try knife edge flight at normal cruising speed. Add or subtract elevator mix with rudder if desired.
10. Maximum rudder will cause a slight down pitch as well as a slow roll couple.

MODEL CHARACTERISTICS

No prop offset is used. The straight line trim must be done using rudder or elevator corrections. If everything is correct, no offsets are needed.

Very little or no rudder is used in rolling and knife edge except for four point rolls (extended rolls).

A tailheavy arrangement will cause rudder to induce a pitch to belly in any attitude.
Stall turns are done by first hovering, then applying full rudder and pulling power to an idle in a combined movement. This is quite a change from models having very long tail moments.

Failure to hold some power while starting the yaw, will result in tailsides or flops.

Snap's may be done at very low power settings. Properly adjusted, a roll which shows some mild pitching is the result. Failure to use enough elevator will cause the snap to start slow, go off line and lose heading.

The model should roll positively in a vertical climb, even at very low airspeeds.