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RC-31 INSTRUCTION MANUAL

INTRODUCTION

TOP FLITE is proud to present the ANTARES, a multi task capable, Standard Class sailplane that was designed expressly to take a lot of the "mystery" out of flatwing, aileron-equipped configurations and at the same time offer you new levels of soaring capabilities There is no denying that national and international competition has made its' presence known at even the club-level of contest work The airfoil work alone has provided most of us with capabilities in a wide variety of weather conditions that just a few short years ago were unheard of Of course there is a lot more going on than just airfoil work The top U S and foreign R/C sailplane pilots long ago realized that FAI - F3B competition was extremely hard on airframes, in particularthe speed portion of the three-event format. This one aspect of the F3B competitions has spurred a great deal of work in the areas of wing construction and spar engineering This to withstand the tremend ous loads imposed on the wings during fully-ballasted launches using extremely strong winches Work in this area, particularly in Europe, has gone into the use of exotic materials and methods that, for most of us, are simply too costly and time consuming to even consider

All of this brings us to the reasons behind the design of the ANTARES The design had to be efficient We were looking for, and feel we have achieved, a tremendous glide ratio with the ANTARES by use of a combination of the top polars of the Eppler 193 "married" to the bottom plots of the Eppler 205 and adding flaps to this combina tion These flaps, as well as the rest of the controls, are driven by a single servo in the fuselage with very simple and straight-forward cable and tube connections This airfoil was designed expressly for the use of flaps and we think you will find that their use provides you with the kind of control over the airplane that you have not ex penenced before Our experience has been that these flaps provide very tall, non critical launchesoneven the weakest of launch devices, very precise speed control during flight and remarkable glide path control during the landing phase If you feel for any reason that you are paying some kind of "penalty" in the use of flaps, con sider the above If you feel that spoilers may be superior to flaps, consider that the servo required is only of use during one aspect of the total flight—landing, while the servo required for the use of these flaps provides im provement and modification of the *total* flight.

The ANTARES uses both ailerons and rudder (coupled) to provide extremely flat, precise turning capability. We discovered early on with the prototypes that we were comfortably working light I lift at much lower altitudes and distances than we would have ever done with our polyhedral ships and still making it easily back to the spot when the time came We also found that wind became much less of a factor in our thinking when making the ever present "continue to thermal or return" decision. With the reflexing capability of the flaps, returning to the spot at high speed, even from low altitudes, certainly bought us more time to work lift

You will also notice on the plans that we have shown the optional installation of four Estes BT 5 rockettube bodies, two in each wing panel on each side of the spar structure. These are used to introduce lead ballast into the airframe, thus increasing your wing loading and therefore your speed and or ability to penetrate This feature, relatively easy to do, has been incorporated into all of our prototypes and used to good advantage on more than one occasion The wing structure when built to the plans, will support this increase of weight and you will have yet another tool to work with in your flying There is more on this aspect of the design in the Ballasting section of this manual

A word about the radios that may or may not be suitable for this design In this day and age of specialization it simply is not possible to set-up a design such as the ANTARES to carry every radio system currently or historically on the market *Most* of the radios currently on the market, with the use of standard small or micro servos will fit and work with the ANTARES CHECK YOUR RADIO SYSTEM FIRST FOR SIZE AND FIT BEFORE STARTING CONSTRUCTION Secondly, radio systems which are equipped with such features as electronic RUDDER/ AILERON mixing servo reversing and, of less importance but a nicety non the less, EPA or "end point adjustment , tend to be great for this design If your radio does not have RUDDER AILERON mixing, you will have to do one of three things, 1 Obtain and install an electronic mixer such as ACE R/C's Christy Mixer", 2. mechanically (with linkage) connect the rudder to the aileron servo using a modified servo output arm or 3. learn to fly the airplane uncoupled, co-ordinating both

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the left (rudder) and right (ailerons) sticks It is important to remember that the ANTARES, like all "flat wing" configurations employs the use of coupled ailerons and rudder to eliminate unwanted adverse yaw during turns It is important to realize this now and make provisions for it such as outlined above It should be noted that if you choose option #2 above (mechanical inter connect of the ailerons and rudder), the need for a separate rudder servo is obviated and the airplane can then be flown using a three channel system All of the above is certainly not meant to scare you off but simply to inform you ahead of time, what your options and limitations are in order for you to plan ahead now instead of halfway into the project

We have launched this design using all available methods, hi-starts, normal winches and super strong winches The results have been quite uniform, with the use of flaps at about 15 degrees down, the tows are arrow straight, highly controllable and always high Dropping the flaps a little on launch certainly helps the lift situation and it also imparts a fully washed out condition to the wings, drastically lowering the possibility of the dreaded "tip stall at launch" Over the developmental period of the design, we have come up with a very good launch sequence, be sure to read the FLYING SECTION of this manual

As good as we feel the ANTARES is, there are still some fundamental requirements to get you from this stage to the winner's circle This design, as well as all others, requires careful, accurate attention to details during con struction This is almost surely the single largest factor in success or failure We have earnestly tried to give you all of the tools with this kit to provide success What remains isyourcraftsmanship and attention to detail to guarantee it The other ingredient required is a pilot A flat wing four-channel aileron and flap equipped sailplane *is a* different kind of flying — we think superior — when compared to polyhedral types Learn to fly the ANTARES in the manner it was intended, we think you will be delighted

IMPORTANT NOTE-

TOP Flite does not necessarily recommend the ANTARES as a first R/C sailplane unless you have access to and use experienced assistance in its construction and flying If you are a beginner to R/C model aircraft, consider this Flying this or any other radio controlled model aircraft is a PRIVILEGE and not a RIGHT and this privilege begins with the utmost safety considerations to others and yourself as well An R/C model airplane in inexperienced hands has the potential of doing serious personal or property damage These safety considerations start at the building board by following instructions, seeking competent help when you are confused and avoiding shortcuts These considerations have to be carried over to the flying field where safety must come first and limitations cannot be exceeded We urge you to

1. Send for and obtain your AMA (Academy of Model Aeronautics) membership which will provide insur ance for your R/C activities — DO NOT RELY ON HOMEOWNERS INSURANCE
2. Join an AMA sanctioned R/C flying club in your area where you can obtain competent, professional instruction in trimming and learning how to fly this model

Check with your favorite local hobby shop for the required AMA forms or the address where they can **be** obtained

"WARNING"!

A radio controlled model is not a "toy" Care and caution must be taken in properly building the model, as well as in the installation and use of the radio control devise It is important to follow all directions as to the construction of this kit as well as installation and use of the engine and radio gear The advice and assistance of a well experienced builder and pilot is highly recommended Don't take chances! Improper building, operation or flying of this model could result in serious bodily injury to others, yourself, or property damage.

PRE-CONSTRUCTION NOTES

The ANTARES, like other Top Flite kits employs the use of die cut wood to ease the task of construction, parts fit and identification The dies used for this kit have been rigorously checked for absolute accuracy and should provide you with excellent fit Die cut parts should be carefully removed from their sheets by first lightly sanding the *back* of each sheet of parts and then carefully removing each part Use a light garnet paper for the sanding and keep a sharp hobby knife with an X acto #11 blade or equivalent handy for assistance in removing any parts that might not have been completely cut through on the dies Parts which oppose one another and must be precisely uniform—such as fuselage sides ribs, etc — should be carefully matched after their removal from the parts sheets Matching is the process of holding the opposing pieces together with either pins, tape or spot gluing and lightly sanding the edges of the parts until they are identical A sand ing block with light garnet paper is most useful for this and other phases of construction

Your building surface should be at least large enough to accommodate the wing panels This surface should be as absolutely flat as possible and yet be able to accept pins easily We have found that a product such as Celotex fiber board works quite well for this purpose Another good surface can be found in most well stocked hardware stores, this is a 2' x 4' fiber board ceiling tile—these are quite inexpensive and can be used for several airplanes before needing replacement

As with most R/C kits that are constructed from wood, a selection of tools—most of which can be found in the average workshop—are a must to do the job correctly

Hobby knife and sharp #11 blades
Single-edge razor blades
T pins
Sanding blocks in assorted sizes
Sandpaper in various grits
Hand held hobby saw such as an X acto
Dremel tool or power drill and assorted drill bits
Straight edge, preferably metal at least 36" long
90 triangle
Soldering iron, flux (silver) and solder
Carbide cut off wheel for wire cutting
Small power jig saw, such as a Moto Saw
Razor plane
Tapes such as masking and cellophane

Our ANTARES' were constructed using a variety of common hobby adhesives including 5-minute epoxy, Cyanoacrylates, aliphatic resin (such as Titebond) and 1-hour epoxy was used to secure the main wing wire tubes in the wing roots Since all of us have our own construction techniques and favorite adhesives, stick with the ones that you are familiar with and prefer However, in certain areas there will bo callouts for certain types of adhesives and we urge you to try not to substitute since doing so could possibly cause problems structurally later on.

The last thing we should touch on before we begin actual construction is the sequence in which the ANTARES is assembled The sequence given to you in this booklet has been proven to be the most straight forward and provides the finished components in the order that you will need them to progress to the next assembly phase Try to stick with the building order presented here to avoid mistakes.

Spread the plans out on your work surface, cover them with a clear plastic material, such as the backing from a roll of Monokote or plastic food wrap and commence construction

F3B MODIFICATION SUGGESTIONS

If your sole intention is to campaign the ANTARES in all-out F3B competitions you may want to even further "beef-up" its already tough structure We have already flown the stock aircraft in such contests and came out quite well In the speed portion of the event, we have had the stock airframe loaded to an excess of 100 ounces without breaking anything However, it is realized that not everyone flies the same. some of us are harder on aircraft than others Based on our experience with the proto types, the following are some ideas that you might want to incorporate into your own bird In all[1] of this, try to remember that weight is always a factor and that we have always felt that starting out with a relatively light strong, well-built airframe and having the ability to *add* ballast to increase wing loading was superior to having a heavy airplane to begin with In F3B competition we have observed that relatively "heavy dry (unballasted) weights for the aircraft are somewhat the norm Your ANTARES is still capable of operating well at heavier dry weights but you will be giving up some of the light air capabilities

FUSELAGE You may wish to fiberglass the fuselage fin structure If so we would suggest two (2) layers of 3/4 or 1 ounce cloth The first layer should be applied 100% to the fuselage from about 4 behind the trailing edges of the F-10 fuse ribs forward to the nose This layer should be carefully sanded and cleaned off The second layer should cover the entire fuselage and fin The entire structure should be lightly sanded filled as required and either Monokoted or painted (yes, Monokote will work well with this combination, just lower the heat a little and work with it) Remember that in F3B work, anything that could possibly present parasitic drag, will Carefully fillet all joints and work toward a truly clean, drag free structure

WINGS As mentioned earlier, the stock wing structure has been subjected to some rather drastic loads (in relationship to normal thermal flying activities) and survived quite well However, it is realized that no structure is fully "bullet proof especially in extremely hiqh stress situations Therefore you may wish to further strenghten the wings Suggestions that we might offer would be such things as the addition of 5 or 6 carbon fiber reinforcing strands glued to the bottom surface of the bottom *Va" x* 3/8" spruce spars and the same treatment to the top surface of the top spars You may also consider moving the *forward* W-21 ply full-depth spar facing pieces to behind the spar structure, thus replacing the shorter W 22 piece And replace W 21 with a full length 1/16" ply facing all the way from the wing root rib to the tip Of course this means that all of the wing ribs would have to be two piece You might also consider internalizing all of the cable drive links and aileron and flap horns and closing the hinging gaps for these surfaces with Monokote. Another suggestion might be to totally replace all of the 1/16" balsa wing sheeting with medium, straight-grained 3/32" sheeting and sanding down to a true *1/16"* (a lot **of** work, but possible) Yet an other suggestion that we've heard is the possibility of totally fiberglassing the two wing panels While this might be feasible, the potential is there for a large weight gain

HORIZONTAL STABILATOR This structure is quite strong as it is However, you may wish to substitute the *1/8" x 1/4"* upright balsa 'spars with the same size in spruce You will also note that we have you making the stab root caps from 3/8" wide 3/32" ply instead of 1/4" wide material This is just in case some of you might wish to substitute the 1/16" top and bottom stab sheeting with 1/8", thus thickening the cross section of the stab to *3/8"* (we have tried this and could not discern any difference at all) Another "trick" that we have tried and found to work is the substitution of the stock .090 dia M W stab joining wires with #41 drill rod stock that is cut to the correct length This material is an absolute, play free fit to the 092 I D brass tubes in the stab halves and its use greatly minimizes the usual "rocking stab" phenomenon found on virtually all sailplanes with full-flying stabs #41 drill rod stock can be found at most industrial metal supply houses.

FIN/RUDDER You might consider totally fairing-in the hinge line of these two surfaces and maybe even going as far as to internalize the cable and horn system.

Note that in all of the above we have not shown sketches of how to do these things Frankly, there has been a great deal written in the magazines in the last few years covering everything (and more) that we have said here It is assumed that these kinds of alterations and modifications are simply not for everyone and that those individuals who might be prone to doing them tend to have a lot of prior experience and will know what it is that they want to do in the first place

FUSELAGE ASSEMBLY

The following sequence of instruction assumes that **you** addressed yourself to the questions posed in the Introduction section of this manual concerning your radio, its fit and the need to couple the ailerons with the rudder. The following assumes that electronic (via radio) coupling will be used

1 Remove die-cut fuselage parts, F-1, F 2 (ply)—do this carefully and, as mentioned earlier, use an X-acto knife to expedite this Start construction, by gluing (we used contact cement) the F-2 fuselage doublers to the F-1 fuselage sides Do this as accurately as possible, lining up slots and holes for the wing mating points and making sure these doublers are flush

with the top edges of the fuselage sides—MAKE A LEFT AND RIGHT FUSELAGE SIDE.

2. Using the 1/8" x 1/4" x 36" balsa stock supplied, glue the bottom fuselage longerons in place, starting at the front of the F-2 doubler, pinning and gluing as you work aft. Note that you will need to add an additional 6" of this longeron stock at the rear to complete to full-length bottom longeron.

3. Cut and glue the top rear 1/8" x 1/4" balsa longerons in place. Note that this longeron extends from the back of the F-9 former position to the leading edge of the fin location where it is cut on an angle to match the fin.

4. Using a sharp pencil and a straightedge, mark the locations of all fuselage formers; F-3, F-4, F-5, F-7, F-8 and F-9, including the location of the rear 1/8" x 1/4" fuselage uprights, behind former F-9—mark these locations on the right fuselage side. Holding the left fuselage side to the right, so that they are accurately matched, transfer the former locations to the left fuselage side.

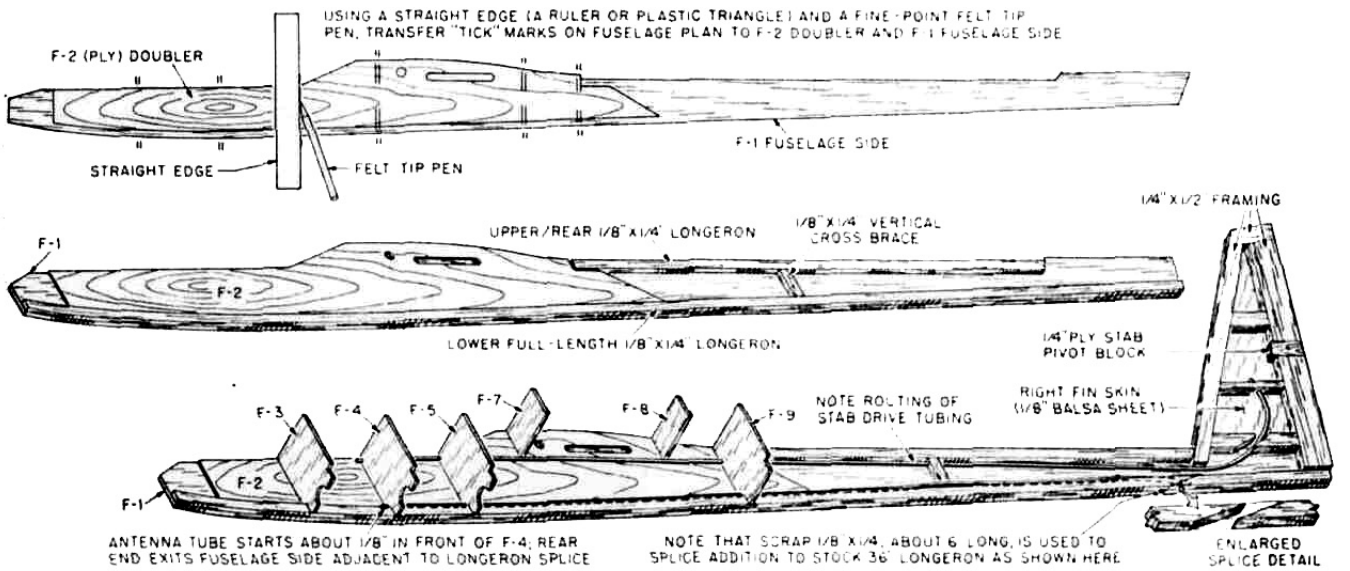
5. You will now need to drill an angled hole in the *left rear* fuselage side for the outer plastic rudder cable housing. Note its location on the plans and its distance from the rudder hinge line. Don't deviate from this location because if it is too far forward, the rudder cable may be prone to "bending" during'operation and too far aft will mean that you can't get full rudder throw. Repeat this process on the *right* fuselage side for the internal antenna tube — first check the length of your antenna to be sure that at least 1" of it will protrude from the tube at the rear. A sharpened piece of *1/8"* dia. brass tubing works very well for drilling these holes at the right angles and cleanly.

6. Pin, tape or lightly spot glue the two fuselage sides together, with their outer surfaces touching — align them to each other very carefully. Using a sanding block, sand their outer edges to match them identically. While the sides are still together, carefully match the main wing tube holes and access slots. We have purposely made the main wing tube holes a very tight fit, work carefully to open them up enough to accept a length of 11/32" O.D. brass tubing (3 pieces supplied in the kit). The main wing tube holes must line-up accurately.

7. Remove both W-1 ply wing root ribs and both F-10 fuselage root ribs carefully from their sheets. Remove the main wing tube holes from each of the ribs and access slots from the F-10 ribs—use a hobby knife to assist you. Take one of the F-10 ribs and locate the identification at the back. Drill a 1/8"dia. hole in this rib, at 90° to its surface—this rib is now your "drill guide" for the rest of the ribs. Insert one of the main wing wire tubes into the hole in the "drill guide" rib, letting one end of it extend out from the rib about 1/16". Now drill the *1/8"* dia. hole needed in the remaining F-10 and W-1's, by placing the rib onto the wing wire tube, lining up the rib to be drilled with the "drill guide" rib and drilling the hole—repeat this process until all four ribs have accurately aligned and drilled holes. Use the same procedure on the now matched fuselage sides; insert one of the main wing wire tubes into the hole in the fuselage side, slide an F-10 rib onto the tube and down *flat* against the outside of the fuselage side, position as shown on the plans and drill the *1/8"* dia. hole. Repeat this process with the other fuselage side.

8. Remove ply tailskid from its sheet. Position the tailskid in place on one of the fuselage sides, as shown on the plans. Mark its forward edge location on the bottom, rear longeron in pencil. With a single edge razor blade, remove approximately 1/32" of the thickness of the longeron, forward to the pencil mark — this becomes half of the slot that the tailskid will fit into. Repeat this process to the other fuselage side to create the 1/16" wide tailskid slot.

9. Lay the right fuselage side on your work surface in front of you with the inside facing you. "Take one of the servos that you plan to use for either the stabilizator **or** rudder and position it on the fuselage side between the F-4 and F-5 former locations. Note the position of the output arm. With a pencil, mark this location onto the inner fuselage side. Note on the plans and cross-sections that both the stab and rudder outer cable housing tubes are positioned aft, through formers F-5



and F-9 Now remove formers F-4, F-5 and F-9 from their sheets Usingarulerand pencil,line the ruler up with the mark made earlier for the servo output arm location and draw a light intersect line at the positions of F-5 and F 9 Hold F 5 in place on the fuselage side and mark the location of the intersect line onto the former Repeat this for F 9 Mark the other side of the formers for the output arm location for the rudder cable housing Sand or file a 1/8" slot on each side of these two formers, thus creating positioning and mounting locations for the rudder and stab cable housing tubes after these formers are in place (see F-5 and F 9 cross sections) Lastly, sand or file a similar slot in the lower right corner of formers F-4, F-5 and F-9 for clearance of the internal antenna tube Note on the plans, at least with the radio installation shown, that the rudder and stab tubes are in place just over the top of both the aileron and flap servo rails Check how *your* installation will fit in place and be sure everything clears

10. In this step we are going to "pre-position" both the aileron and flap servos Studying the plans you can see how the operation of these two servos affects the two control surfaces and also what the relationshipof their locations within the fuselage needs to be in relationship to the wing panels Note that the flap servo is located as far aft as possible to allow plenty of clearance for the spring wing retainerand hooks In the case of the use of a releasable or captive towhook system, such as that shown, clearance is available for getting to and tightening screws as needed Access to the flap servo is directly through the top, rear hatch, as shown The flap servo, as you can see, needs to be positioned so that its output arm is roughly centered within the slots on each side of the fuselage This assures easy, bind-free operation of the flaps and quick, non critical assembly of the airplane at the flying field Mark the locations of the required two lengths of1/32"x 3/8" ply servo rails for the flap servo onto the sides of the fuselage A trick that we have used is to now cut a short length of 1/16" x *1/4"* balsa and glue it in place on each fuselage side to later act as a gluing shelf and locator for the servo rails We have used this technique for all of the servos and it really saves time and frustration later on Next, we are going to do the same thing for the aileron servo Looking at the Top View of the fuselage plans, you can see that access to this servo is meant to be provided by the heavy fuselage canopy angle at this section You will also note that we did not provide aileron linkage holes through the fuselage sides or the ply root ribs The reason for this is simple, different radio systems and servos would not all work For this reason, these holes will have to be made by you, based on your servos and their shapes The first step for positioning the aileron servo is to develop the proper output wheel for driving the ailerons Note the drawing at the bottom of the fuselage plans This is a typical servo output wheel that is trimmed as shown. The two arms that are left arc about 3/8"apart(hole-to-hole). As you can see from the Top View shown on the left-hand side of the wing plan, the left aileron clevis attaches to one arm and the right side uses the other arm. This sim ple system of connecting the ailerons to the servo also imparts a highly desirable feature to the actual operation of them—this is called differential Simply put, differential is the unequal movement of the ailerons, in our case about 2 1 Full throw in one direction will move one aileron a total of 1/2" "up" and at the same time only moves the other aileron 1/4" "down " Almost all flat-wing, high aspect ratio aircraft (such as sailplanes) use some differential to correct adverse yaw conditions The set-up we show on the ANTARES plans works extremely well and has the virtue of simplicity Once you have made this output arm and have it in place on the aileron servo. place the servo directly onto the right fuselage side, about where it is shown on the plans Note that it must fit in place behind F-5 and high enough to position the output arm within the outline of F-10. However, it must not be so high as to interfere with the seating of the canopy Once satisfied, mark the locations of the servo rails to mount it *and* mark or roughly sketch a *1/4"* dia circle where the output arm will pick-up the aileron cable and clevis Again, we would suggest that you memorialize the locations of the aileron servo rails with the short lengths of 1/16" x 1/4" balsa for ease of installation later

Now drill a *1/4"* dia. hole directly through the fuselage side at the point marked for the aileron output arm. This then becomes your "drill guide" for the remaining fuselage side and both W-1's and F-10's As before, use a length of 11/32" tube and *1/8"* tube to first accurately locate each part to the "drill guide" fuse side, then drill the *1/4"* dia hole

11. Remove three (3) 36" lengths of the white cable housing tubes from your kit box Rough-up their outer surfaces with medium sandpaper Do this completely, we want adhesive to adhere to them Set these aside for installation shortly,

12. Next, make the fin tailpost You can see from the plans that this is made from 1/4" x *1/2"* balsa stock, laminated edge-to-edge and cut to the taper shown Now locate the shaped and drilled 1/4" ply stab pivot block Accurately note its location on the tailpost with a pencil. Take care here to be as accurate as possible—this block ultimately locates your stabilator to the fin Cut the tailpost apart to accept the pivot block and glue the block in place Allow to dry and remove from the building board.

13 Locate the die cut sheet holding the two 1/8" balsa "fin skins " Remove these from the sheet and while holding them accurately together, matching outer edges and the oblong cut outs, use a sanding block and light sandpaper to "match" their outer edges identically—we want them exactly the same Now take one of these skins and lay it directly over the plans and with a pencil mark the locations of the top and center 1/4" x 1/2" balsa horizontal braces and the lower *1/4"* sq. cross-brace and stab cable tubing support. Set aside for use in Step 14

14. You have already removed and modified formers F-4, F-5 and F-9 back in Step 9 Remove formers F-7 and F-8 from their sheet as well Formers F 5, F-7, F-8 and F-9 are all exactly the same width, 15/8 Hold them all together and use a sanding block to make sure they're all the same width Lay the *right* fuselage side over the side view of the plans and pin accurately in

place Using a triangle, glue formers F 5, F-7, F 8 and F-9 in place at 90 to the fuselage side, using the pencil marks made earlier for location (please note the "alternate F-7 location" note and the reason for it on the plans) Moving to the rear of the fuselage side, glue the previously marked (Step 13) fin skin to the top, rear section Now glue the previously assembled tailpost and stab pivot block assembly to the rear of the fuselage side and fin skin Cut, fit and glue the *1/4" x* 1/2" balsa fin leading edge in place to the fuselage side and fin skin (note that this piece terminates at the bottom edge of the top, rear fuselage 1/8" x 1/4" longeron) Cut, fit and glue the two top 1/4" x *1/2"* balsa horizontal braces whose locations were noted earlier on the fin skin Cut, fit but do not glue the 1/4" sq. brace Using the plans, note the location of the stab cable housing tube and drill an *1/8* dia hole through this brace at the point marked—now glue this brace in place Cut, fit but do not glue the bottom *1/4" x* 1/2" balsa fuselage fin brace Again using the plans, note the location of the stab tubing and the bend it takes at this point Use an X acto knife or a Dremel tool with a small router bit to carve a channel", at least *1/8"* deep into this brace to countersink and house the tubing, once satisfied, glue this last remaining brace in place, half of its width on the fin skin and the other half on the fuselage side Inspect your work carefully for good glue joints, double glue if necessary Onceallof this is sealed-up, you will not have access to it again

15. Take one of the 36", roughed-up cable housing tubes and install it (without glue yet) in place, through the slots in formers F-5 and F 9, the channel cut in the bottom fin fuselage brace and through the hole in the 1/4" sq brace on the fin skin Note that this stab drive tube is meant to fit from just inside of the rudder stab servo compartment, F 5, along the fuselage side, through the slot in F-9, all the way along the bottom edge of the top, rear longeron, through the channel cut earlier in the bottom fin fuselage brace and finally through the hole drilled in the 1/4"sq brace We used a thick CA adhesive, such as Pacer's Zap-a-Gap or Slo-Zap to now glue this tube in place along its entire length Be sure that it is firmly glued in place—we don't want it moving Using the marks made earlier, glue the short 1/8" x *1/4"* balsa upright in place between the stab tube and the bottom fuse longeron

16. Remove the right fuselage side assembly from the building board. The *left* fuselage side is now prepared for assembly to the right byfirstgluing in place the two short lengths of *1/8"* x *1/4"* balsa that is the rear upright — note the 1/8" wide channel that is left to capture the rudder cable drive tube as it curves down toward the rear, angled rudder tube exist hole, drilled earlier. Trial-fit the left fuselage side to the right side assembly Since all of the formers in place are the same width, the left fuselage side should come in firm, square contact with their left edges Once satisfied, carefully glue the left fuselage side in place against F-5, F-7, F-8 and F 9, using the location marks made earlier Take pains to be sure that the structure is truely square

17. Install another 36" length of cable housing tubing along the *left* fuselage side, from just forward of F-5, through its slot, F-9, along the fuse side. through the channel in the upright and out the angled exit hole at the rear Leave some tubing exposed at the rear for trimming (see plans) As with the stab tube, glue the rudder tube in place completely along its entire length.

18. Cut, fit and glue the *1/8" x* 1/4" balsa cross-brace in place on the fuselage bottom, just behind the towhook location, as shown Use CA adhesive to glue former F-4 in place while gently and equally bending the two fuselage sides together at the nose, when dry repeat the process while installing former F 3 Now glue the shaped hardwood noseblock in place Note that this block fits between the two fuselage sides, flush with the bottom edges of each and up against the edges of the two F-2 ply fuselage doublers Tape and/or clamp in position and allow to dry Cut, fit and glue the two lengths of 1/4" triangular stock in place behind the noseblock As you proceed through this step we strongly suggest that you continually check **for** symmetry and squareness of the assembly

19. Locate and glue the shaped balsa forward canopy mount in place against the top rear of the noseblock and the fuselage sides Sand the edges flush with the fuselage sides Carefully remove ply former F-6 from its sheet Clean up the inside edges with sandpaper. With a sanding block, bevel the two bottom edges of this former to match the fuselage sides when it's in place Note that when in place this former stands tall of the fuselage sides, this is to pick up the top *1/8"* sheet Glue F 6 in place and when dry, sand its outer edges flush with the fuselage sides

20 Using about an 8" length of one of the *1/16"* x 3" x 36" balsa sheets provided, cut and fit the canopy/hatch base Use your sanding block to bevel each end of this base to fit accurately to the forward canopy hatch block and the angled F 6 rear former Lightly tack glue this piece in place and sand its edges flush with the fuselage sides Remove canopy formers C-2, C-3, C-4 and C-5 from their sheet Sand the required bevel into the bottoms of C-2 and C-5 Carefully glue these two formers in place on the canopy base being careful to not glue them to the fuselage — their outside edges should be flush with the fuselage sides Now center and glue the C 3 and C 4 formers in place per the plans (these fit directly over F-3 and F 4 respectively). Remove the two C-1 canopy sides from their sheets. Using a flat work surface, glue and pin the y4"tnangular stock piovided to the inside top edge of the C-1 canopy sides — be sure to make a *right* and a ***left*** When dry, carefully fit these sides in place, trim as needed to get a good fit and glue them in place With the canopy assembly still tack glued to the fuselage, use your sanding block to bring the sides flush with the fuselage sides

21. With ready access to both the inside of the canopy/ hatch and the fuselage, now is the time to build the canopy hold-down system Note the views shown in the upper left corner of the fuselage plans These demonstrate how the canopy is secured to the fuselage, at the nose with a ply 'lip' that is glued to the bottom of the canopy base and fits beneath the canopy hatch block, in the middle it is held to the fuselage by two wire hooks and a rubber band and at

the rear there is a length (1/8" x 1/4" x 1-5/8") balsa glued to the back of C-5 that fits into the cut out in F-6 This system is easy to install at this stage and has worked beautifully in actual practice Cut, fit and glue the ply "lip in place, being careful not to glue it to the fuselage Cut or drill the 3/8"dia hole inthecanopy base—in the center — just behind C 4 Bend and install the two wire hooks shown, one on C-4 and the other toward the bottom of F-4 Cut, fit and glue the 1/8" *1/4" x* 1-5/8"" balsa piece to the back of C-5 (trim this piece carefully for a qood, snug fit as it is meant to keep the canopy from shifting left or right Once satisfied, use the piece of *1/8"* x 3" x 12" balsa provided to sheet (cross-grain) the top of the canopy (see side view). When dry, sand the edges flush with the sides.

22. From your packaged wood parts and hardware, locate the 11/32" O D x 2-5/16" main wing wire tube, the *1/8"* O.D. x 2-3/16" rear incidence pin tube and the maple U-block tube nest Use rough sandpaper to rough-up the outside surfaces of the brass tubes Insert the tubes into their respective holes and center them — note that each tube protrudes past the fuselage sides to pick-up the installation of F-10 later Now trial-fit the U-block onto the main wing tube inside of the fuselage, sand edges as needed for good fit and remove for gluing Cut a 1-5/8" length of 1/8" x *1/4"* balsa to fit beneath the rear incidence tube and against F 8. Using 1-hour epoxy, apply glue to each end of the U-block and fill the channel a bout one third Slide the U-block over the tube as shown on the plans—carefully wipe-off the glue that oozes onto the fuselage sides Using more epoxy, "bury' the tube in glue, rotate the tube itself to make sure there are no air bubbles. Again using epoxy, glue the 1/8" x *1/4"* balsa shelf directly under the rear incidence tube and to F-8 "Bury" this tube in adhesive as well Take a break and let the whole thing set-up — watch for runs

23. Use the remaining piece of roughed-up outer plastic tube to make the internal antenna housing Install this tube from just inside of the receiver compartment (in front of F-4), aft along the bottom right fuselage side and out through the angled hole made earlier. Note that the tube fits into the slots you made in F-4, F-5 and F-9 Glue securely in place.

24. Decision time, are you going to use a radio-actuated captive towhook system, such as the Fourmost Products shown on the plans or the fixed towhook provided in the kit While both systems work well, if you are planning contest work with your ANTARES, we highly recommend a captive system such as that shown You will note on the plans that we are releasing the towhook by radio, using a 3/4" "up" elevator signal. While at first this might sound suicidal, in actual practice this system, in conjunction with use of flaps on launch, makes for wonderfully tall "ping" launches You might take a look at the Flying section of this manual and read how we have been doing this before you decide which towhook system to use Installation of the Fourmost hook is quite simple and accurately depicted on the plans In fact, when we used this system, WP pro-slotted the ply floor, installed the mounting rails and secured the Fourmost hook in place on them and then installed the ply floor to the fuselage

If you are installing the stock, fixed towhook, start by locating the 3/32" x 2" x 17" ply forward fuselage floor. Mark a centerline down its length in pencil. Hold it in position against the bottom of fuselage with its rear edge covering half of the *1/8"* x *1/4"* cross-brace between F-5 and F-9 With a pencil, mark the outside fuselage side outlines, trim off the excess off with a saw Glue the ply floor in place on the bottom of the fuselage with the previously drawn centerline on the outside Use a 5-7/16" length of the *3/32"* x 3/8" ply stock provided and glue it in place to the inside centerofthe ply floor, between F-5 and the rear cross-brace as shown on the plans From the plans, determine the towhook location and from the outside, drill a 1/8" dia. hole through the fuselage floor and the ply doubler just installed. Epoxy the 4-40 blind nut provided into this hole from the inside — use glue liberally around the nut's base without getting any into the threads.

25. Using the remaining *1/8"* balsa sheet, finish sheeting the top of the fuselage as shown on the plans Note that one piece extends aft from the rear face of F-6 to the rear edge of F-7 This sheeting is then resumed (always cross-grain) from the forward edge of F-8 back to the rear edge of F-9 "Cap" the top of the two fuselage sides between the two edges of the sheeting with 1/8" x 1/4" balsa, aligning the outer edges with the fuselage sides The resulting rectangular opening in the fuselage top is for the access hatch.

26 As shown on the plans, the access hatch is a simple frame made from *1/8" x 1/4"* balsa, on edge, with *1/8" x 1/4"* gussets in each of the four corners We used scraps of bond paper front, back and on each side for spacing while making this frame. As shown, install two pieces of *1/8"* x 1/4" balsa as shelves on the back face of F-7 and the front face of F-8 to seat this hatch. Sheet the hatch with the last of the 1/8" balsa provided, cross-grain Lightly sand the edges flush with the frame and lightly tack glue the hatch in place for final sanding

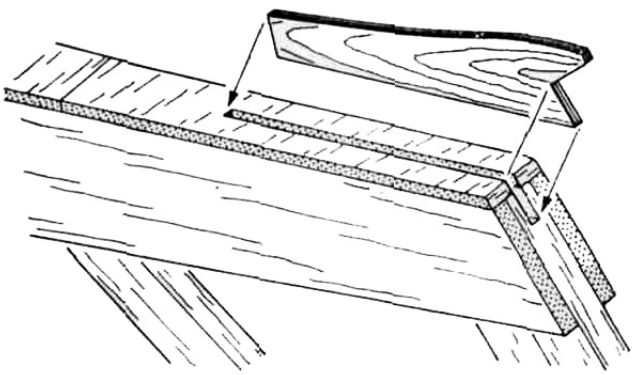
27. Trim off and sand flush any protruding rudder and antenna tubes on the right and left fuselage sides. Trial-fit the two rear fuselage sides together to be sure they will fit without any obstructions Once satisfied, we will now glue the two fuselage sides together at the rear This step is important and should be done carefully to avoid unequal bending of the fuselage sides (boloid) We would suggest that you place the fuselage directly over the top view on the plans as this supplies you with a centerline reference. Firmly secure the fuselage with heavy objects that have right angles (bricks, one on each side, are great). Use a slow drying glue such as 1-hour epoxy and apply adhesive to the inside of the fuselage sides, just ahead of the fin (see plans), aft to the tail —keep glue out of the tailskid slot Clamp the structure together. Check very carefully for squareness and alignment. Make sure that the fin structure is at 90° to the work surface and that it is aligned down the center of the fuselage when viewed from the front Let this assembly cure completely.

28. From your hardware, locate one length of 36" braided metal cable and the stab drive fitting The stab drive hole in this small fitting is slightly undersize and needs to have a #42 or 3/32"dia. drill bit run through it.

You don't want the fit between the forward stab drive wire and the fitting loose but it still should be made to pass through the fitting without binding Insert one end of the cable into the "tube" end of the fitting and solder securely (we recommend the use of Hams' STAY-BRITE silver solder and particularly their STAY-CLEAN flux for this and all other solder joints on this airplane) Clean the joint completely and insert the other end of the cable through the stab tube at the fin and push it through to the servo compartment Cut-off the excess, leaving yourself a little extra to trim later when installing thecoupler Once satisfied, usea *1/8"* dia drill bit through the rear *1/4"* ply stab pivot block hole and right fin skin Glue the *left* fin skin in place, align carefully and allow to dry

29. Cut, fit and glue the *1/8" x 1/4"* fuselage cross braces in place, top and bottom, at the aft mid point of the fuselage Cut, fit and glue the *1/4"* balsa turtle-deck in place on the top rear of the fuselage — note the bevel needed for the fin's leading edge angle Turn the fuselage over and using the *3/32" x* 3 ' x 18" balsa provided, sheet the bottom from the rear edge of the ply floor all the way back to the tailpost, keeping glue out of the tailskid slot Note that this sheeting is applied cross-grain Use a sharp razor blade to cut the tailskid slot into the bottom sheet at the tail Glue the tailskid in place Locate the shaped *1/2"* fuselage/fin fairing If needed, use your sanding block to achieve a precise fit and glue this fairing in place Use a sanding block and 120 grit sandpaper to sand the fuselage sides, top and bottom smooth Pay particular attention to the side-view contour at the top of the fuselage where the 1/8" sheet meets the *1/4"* turtledeck Sand the side and top view shapes into the fuselage all the way through the noseblock but don't start rounding any edges yet. Work around the protruding wing tubes for now Note the fin/fuselage joints are completely flush and smooth Use the 1/8" dia drill to clear-out the remaining hole needed in the *left* fin skin Trim the 1/8"O D x 7/8" brass tube used for the rear stab pivot bushing to a little more than *1/2"* long Rough-up its surface and glue it in place into the hole provided atthe rear of the fin, sand the edges flush with the fin.

CUT I/I6"SLOT IN FUSELAGE BOTTOM TO ACCEPT TAILSKID. CHECK FIT, THEN GLUE IN PLACE.



30. Temporarily install thetwo F 10's onto theirtubes and against the fuselage sides Use a soft pencil to trace their outline's onto the fuselage sides and remove the ribs Using the plans for reference start sanding the fuselage to final shape Note that at the top of the fuselage, at the F 10 location, it is only rounded *to* the outline you just drew, don't undercut it — see cross sections Use the heavier grits of sandpaper for the initial shapes, progressing to lighter grades to finish-up This fuselage and fin can be sanded to an almost ovoid shape in many of the cross sections — take yourtimeanddoa complete and thorough job, it can look really sexy when you do it right Note the suggestion of adding a couple of pieces of scrap *1/8"* balsa to each side of the tailskid and then sanding the whole thing into tho cross section of the fuselage. When finished, carefully break loose the canopy.

RUDDER

1. Construct the rudder over the plans, starting with the outside 1/4"x *1/2"* balsa frame, the three corner gussets and then the 3/32" x *1/4"* geodetic "ribs" and their two gussets Use a sanding block lightly on each side **of** this structure

2 Locate and remove the two R-1 (ply) rudder horn mounts Sandtheir edges flat andgluein place atthe bottom leading edge of the rudder—one on each side

3 Use the 1/16" x 1/2" x 36 balsa strip provided to "build-up" each side of the rudder, as shown on the exploded view on the plans.

4 Use a sanding block to bevel the leading edge of the rudder, on its centerline, to provide unobstructed movement—see cross section on plans.

5 Sand rudder to its final cross section shape with a sanding block Cut slots for hinges in the leading edge of the rudder and the trailing edge of the fin—check fit Mount rudder in place on the fin and hold with masking tape at the hinge line Sand the final fin/rudder shapes rounding all edges carefully to match — see plans Remove rudder and lunges from fin.

STABILATOR

1. Locate and remove the two required E-1's and E-2 stab parts from their die-cut sheet Start construction by using the remaining piece ofthe 1/16"x3"x 36" balsa sheet that was used for making the canopy base, to make four (4) *1/16"* duplicates, *without slots,* of both E 1 and E-2 A sharp razor and straight edge will do the job quickly—note the desired grain direction. (Note that if you wish to build a thicker stabilator, as discussed in the F3B Modification section, substitute the 1/16" stock with 1/8" sheet balsa Realize that this means a change in the size of the leading edge, spar and qeodetic material—the tips and trailing edge material could be shimmed with scrap to center them)

2 Using the 3/32" x 3/8" ply stock provided, cut two 3-1/16" lengths to serve as the stabilator "roots" (save the balance of the ply stock, it will be used for servo mounting rails) As the drawing shows, accurately mark and drill the 1/8" dia holes for the brass tubes We think this is best done with a drill press of some

kind, since the right angles are important. At this point, if you are going ahead with the *VA"* stabs, you should trim Vis" off of each side of these ribs. We would suggest that now is a good time to check and make sure that these holes are properly spaced and will fit. Locate four (4) *Va"* O.D. x TVie" brass tubes and the two W dia. x 2%" M.W. stab joining wires. Temporarily install the four tubes into the holes in the ply stab root ribs and assemble these to the fin with the joining wires. The fit should be smooth and non-binding when moved up and down at the front of the fin. All of this serves to confirm that the hole spacing is correct—if it isn't, correct as needed.

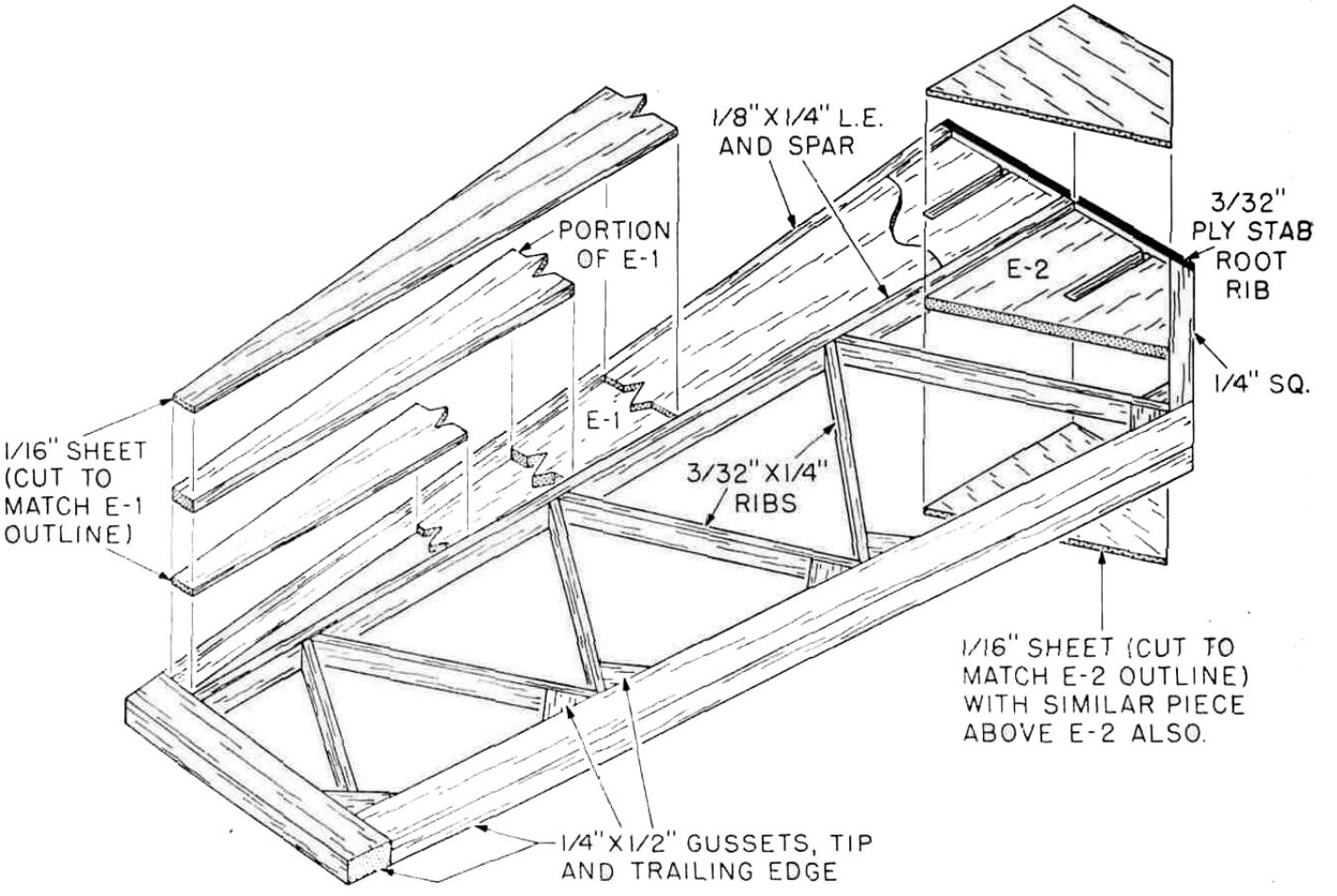
3. Next, take one of the *1/8"* O.D. stab tubes and slip the *1/8"* I.D. wheel collar over one end. As shown on the plans, mark the location of the wheel collar's set-screw hole, remove the collar and file or grind a notch into and through the wall of the tube large enough to let the set-screw pass, when tightened. Carefully clean-out any metal "flash" on the inside and outside of the tube, re-install the collar and test fit the set-screw for clearance. Once satisfied, apply a *small* amount of thick CA adhesive to the collar tube joint. This is your one and only stab-locking tube (see stab plan).

4. Cut or route-out a slot in one of the rear E-2's to accept the wheel collar—trial-fit to be sure. Leaving the tube and collar in place in the E-2 part, fit and hold two of the 1/16" balsa laminates in place with your fingers, press firmly with your fingers to create the collar's indention on the inside of each skin. "Scoop-out" balsa carefully from the indented areas, thus leaving clearance for the collar. In the bottom skin, carefully make a 1/8" hole for the set-screw.

5. Assemble the stabs directly over the plans starting with accurately locating and pinning in place the *1/8"X* 1/4" upright "spar". Assemble the rest of the stab structure as shown being careful to not get glue into the joiner tubes. Be sure to use epoxy to secure the tubes into their respective slots and that these tubes are laying *flat.*

6. When dry, remove the stabs from the plan and use your sanding block to sand them flat. Next, hold them together and "match" their outside shapes—you want them identical. Before going any further, trial-fit the stabs to the fin. You will have to trim a little of the length of the joiner wires to get the stabs to fit flush with the fin sides as we have left these a little longer for fitting purposes. What you're looking for during this trial-fit is that the two stabs sit at 90° to the fin sides and that their roots are flush with the fin sides as well. Remove the stab halves and the joiner wires. File or grind a small "flat" on one end of the rear joiner wire for the set screw to bottom-out on when in place—re-install and test-fit, including the set-screw. Once satisfied, remove all of the components from the fuselage.

7. As with the rudder, use your sanding block and 120 grit sandpaper to *carefully* bring the stabs down to the cross sections shown. Note that what you are trying to achieve here is a symmetrical airfoil. Also



note that the "entry" or leading edges are not particularly sharp, but not just "rounded" either. Approach this task with care to create the intended shapes. Final sand with light paper and set aside for covering.

BALLASTING

As we mentioned earlier in the Introduction to this manual, having the capability to incrementally increase your wing loading to match certain weather or contest conditions is of great value and simply adds additional scope to your flying abilities with the ANTARES If you have opted to build-in the four ballast tubes into the wings, you now need to develop the weights necessary to fill them As mentioned earlier, we chose to use 2' lengths of 1/2" O.D. brass tubing ("off the shelf" K&S brand), filled with poured lead These should weigh about 2.5 ounces each. Each end of these "slugs" should be carefully dressed so that they slip easily into and out of the wing's ballast tubes. Since each wing tube has a capacity of 13-3/4", then each tube can hold up to a total of six (6) slugs and therefore the total system can hold up to 24 slugs or 60 additional ounces of ballast.

IMPORTANT:

When melting and pouring lead use extreme caution. *Always* work with this material in a well ventilated area, preferably outdoors *Always* wear heat resistant gloves *Always* wear a protective mask over your mouth and nostrils to avoid fumes (such as a painter's mask). *Avoid* prolonged contact with the lead itself to your skin. *Always wear safety glasses or goggles'"*

To make these slugs you will need to obtain four (4) stock 12" lengths of K&S Engineering's *1/2"* O D. tubing, their stock #139 and about 4 pounds of lead—we use large sinkers obtained from the local tackle shop, while the tubing itself is available from your local hobby shop The lead was melted in an old iron pot over a hot plate The tubing was prepared for filling by first using thick CA adhesive to glue a small circle of 1/8" plywood over one end The tube was then securely propped-up, on the ground, sealed end down, with bricks The melted lead (about 1 pound at a time) was then poured into the open end of the tube until filled and allowed to cool on it's own —*do not* attempt to cool it with water or any other type of coolant as this will cause shrinkage of the lead within the tube. Once the tube has cooled and can be handled, knock-off the *1/8"* ply plug Repeat this process on the remaining three tubes until you have four lead filled 12" long slugs.

The slugs are now marked off in 2" increments and sawed into individual slugs We used a hacksaw for this purpose Now dress the ends of each of the slugs to remove flash. When complete, you should have 24, 2" brass-lined lead ballasting slugs *Minor* discrepancies in weight between these slugs is not important while anything over about 1/3rd of an ounce might be—check them with a scale.

Obviously, the lead slugs are loaded into the wing tubes from the wing roots but these slugs must be held in place, as close to the fuselage as possible without having the freedom to move outboard We use pre-measured and cut lengths of common *1/2"* dowel (found in most hardware and lumber supply stores) to hold the slugs in place These are sanded carefully to fit freely into the wing tubes So, in order to load, say, four lead slugs into **the** wings you will need four 11 3/4" long *1/2"* dia dowel "fillers" These fillers are inserted into the wing ballast tubes *first,* followed by four slugs This should render the slugs immobile against the fuselage F-10 ply ribs and the dowel fillers in the wing tubes In this particular instance, you have now increased the weight of the airplane by 10 ounces (plus the weight of the dowels, about .064 ounces per inch) and the wing loading accordingly.

If you are so inclined, as we were, you can now make up a carrying case of sorts that will hold all of your ballast slugs and dowel fillers We have gone as far as including in this case a chart that shows all of the possible wing loading configurations obtainable with ballast—this case goes with us to all flying sessions and contests and has proven itself to be a valuable tool in handling both conditions (weather) and tasks

Remember, all ballast must be as close to the fuselage as possible, *never* load the slugs first Also remember that all ballasting must be symmetrical, the same amount in the same location on each side of the fuselage Lastly, remember that the dowel fillers are mandatory for this ballasting system—a loose lead slug that weighs *2-1/2* ounces develops inertia quickly and can rearrange the inside of your wing—be sure that it is immobilized by the filler dowels

WING ASSEMBLY

Before starting this assembly sequence you must decide whether to build-in the ballast tube option The option is relatively easy, requiring only the four Estes #BT-5 rocket tube bodies and the holes for them in the effected wing ribs. Just make sure that when you make the required holes and insert the tubes, that they don't bend in any way—they must be straight

1. Start by removing all of the wing ribs, not the trailing-edge "riblets", from their die-cut sheets Do this carefully, use the X-acto knife if needed. We have made it a practice of stacking all of the ribs together, in the order that they are used and lightly sanding them to uniform shape with the sanding block Also be sure that the top and bottom spar notches line-up, again using the X-acto knife if needed.

2 Next we are going to prepare all of the *1/16"* wing sheeting for use Note that the top and bottom leading-edge sheeting is *1/16" x* 4" x 48", in other words, all one piece The rest of the sheeting must be "scarfed" together from the 36" and 18" lengths to produce the required 48" sheets While the diagram shows you how to do this, the Wing plan shows you exactly where to cut and join these sheets (We prefer using white glue or aliphatic resin type glues, such as Titebond for these Joints) This operation should be done carefully to produce good joints and straight edges When dry, lightly use a sanding block to smooth the joints until they cannot be felt with your fingers When complete, you should have the following pieces of wing sheeting available for assembly:

   4 pcs. 1/16" x 4" x 48" unscarfed, top and bottom leading-edge

   4 pcs. 1/16" x 4" x 48" scarfed from 36" and 18" lengths, top and bottom T.E

2 pcs 1/16" x 3" *x* 48" scarfed from 36" and 18" lengths, top center section

2 pcs. 1/16"x3"x 18"unscarfed, bottom center section

It is important to note that all of the wing sheeting pieces have clean, *straight* edges Use a metal straight edge and a razor to do this Lastly use the straight edge to accurately cut the taper into the four trailing edge sheets, *3-1/8* at the root to *3-1/2* at W 20

3. Lay the bottom trailing edge sheeting in place on the plans and with a pencil mark the aileron flap hinge line at each end of it—1 1/2" ahead of the trailing edge Use a straight edge to connect these two marks with a soft pencil Now note the location, at W 12 of the aileron/flap break line Again using a straight edge, cut this line through the sheeting from the hinge line back to the trailing edge Now accurately pin the trailing edge sheeting directly over the wing plan (your plans should be covered with clear plastic material such as the backing from a rollofMonokote)

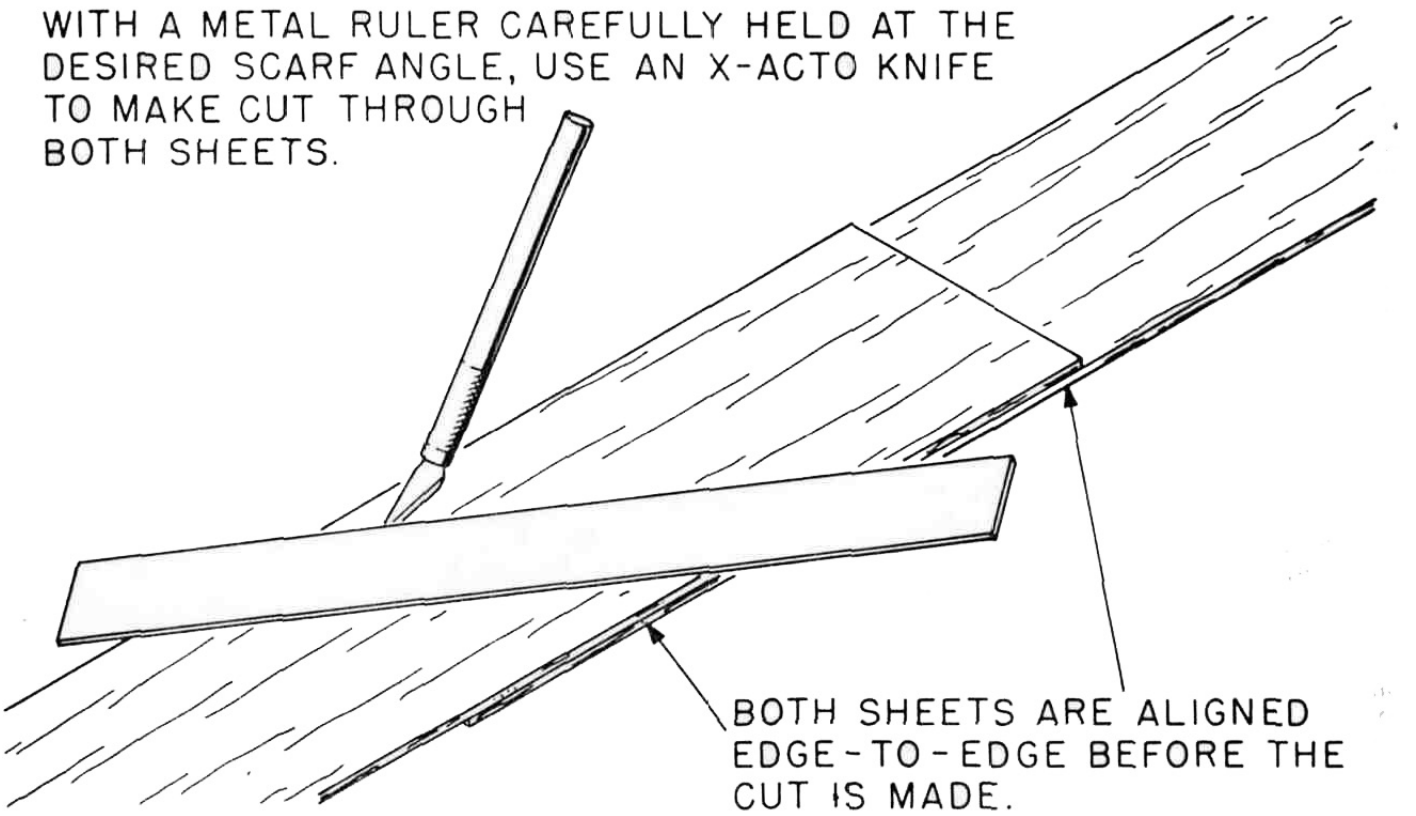
4 Now accurately position and pin in place the bottom leading edge sheeting on the plan—note that this sheet extends from the rear edge of the bottom spar, forward to the front edge of the 3/8 sq leading edge Cut, fit and glue the bottom center section sheeting in place Using the rib tick marks provided on the plan, mark the location of all ribs—W 2 through W 20 on the bottom wing sheeting Cut, fit and glue all bottom 1/16" x 1/4" cap strips in place from W 7 out to W 20 Accurately locate and glue in place the bottom 1/8" x 3/8" x 48 spruce spar Use a straight edge to make certain that it is truly straight and use pins and blocks to hold it that way.

5 Once again using your straight edge for alignment, gluethe1/4 sg x48"wing trailing edge in place along the hinge line drawn earlier The 1/4" sq leading edges for the ailerons and flaps (two pieces, one for each surface, cut from the 48 stock provided) are now glued in place to the bottom sheeting, also along the hinge line—*do not* glue these to the wing's trailing edge—spacing these two pieces from the trailing edge of the wing with scraps of common card stock.

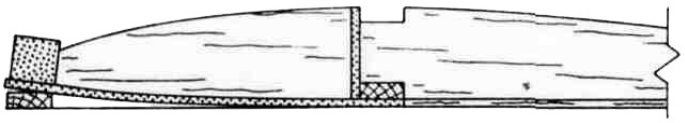
6 Using the top spars *(1/8"x3/8"x* 48"), lift and support the bottom leading edge sheeting to conform to the bottom, forward shape of the ribs Take care to accurately position this spacer" to provide uniform sheeting curvature from the root to the tip Check this curvature with the ribs you are looking for uniform contact with them from the spar forward

7. Locate and remove both W 21 's and W-22's (ply) from their sheets Note that these parts are tapered and that the wing root angle is in their root ends, therefore there is a definite way they are to be installed Use your sanding block to clean up their edges Glue the forward W 21 in place to the bottom sheeting and the leading edge of the spar, with its angled inboard end terminating at the inboard edge of the wing sheeting —be sure that W 21 is in place at 90° to the bottom sheeting to assure proper rib-end contact

8 Locate ply root rib W 1 and the 1/8" W-2A "half-rib". Hold W 1 in place against the inboard end of the wing, W 21 and the 1/4" sq trailing edge Hold W-2A in place against W 1,with its rear edge up against W-21. Use a pencil to outline the forward 1/4"dia hole drilled in W 1 for the aileron linkage onto W-2A, set aside W-1 for now Drill a *1/8* dia hole through the approxi-



NOTE HOW UPPER SPAR IS USED AS A WEDGE TO SUPPORT BOTTOM FRONT SHEETING



WITH WING FRAMEWORK PINNED TO A FLAT WORK AREA, PRESS SPAR BACK UNTIL THE SHEETING MATCHES RIB CONTOUR

mate center of the 1/4"dia pencil mark you just made on W-2A Using this rib as your guide, drill similar *1/8"* dia holes through all of the remaining ribs that hold the aileron cable tube—W 3A through W 15

9. Starting with tip rib W 20 and working inboard, glue all wing ribs in place * Use a triangle or a small block with right angles to ensure that these ribs are in place at 90° to the bottom sheeting *NOTE W-2A is installed at the same angle as the inboard end of W-21, this provides the root dihedral angle required. *Do not* install W-2B or W-3B at this time.

10. Locate and glue the 3/8" sq leading edge in place

11 Cut, glue and fit the 1/16" x *1/4"* "sheeting shelves" that fit between each rib, flush with their top edges and against the inside of the 3/8 sq leading edge These are made from the 1/16" x *1/4" x* 36 stock provided

12. Locate, remove and glue in place all of the aileron and flap "riblets" on the bottom sheeting, againstthe rear edge of the 1/4"sq stock in place Note that there are two #12's provided for each wing panel and that they are glued in place on each side of the aileron flap cut made earlier, use a piece of card stock to space them

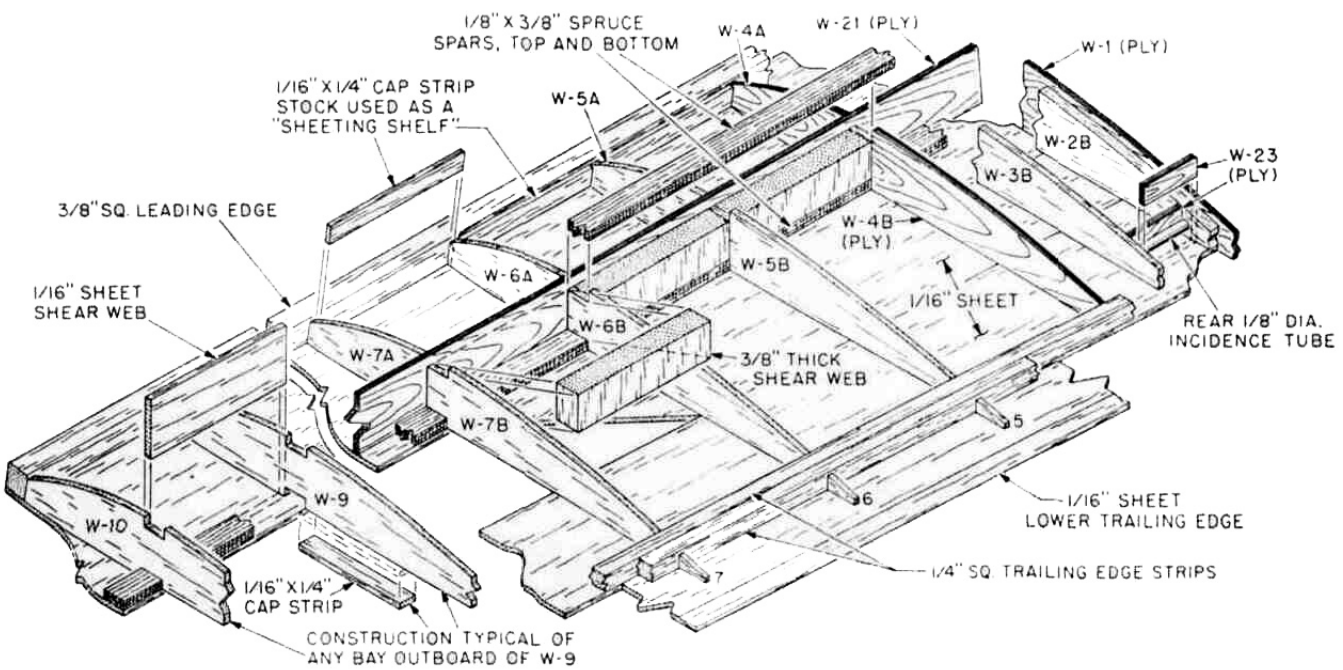
13. Remove the top spars from underneath the leading edges of the wing panels and temporarily install them into the top rib slots Align their inboard ends flush with the top inboard end of W-21 Using the spars as spacers, glue the rear ply W 22's in place to the bottom sheeting and the rear face of the bottom spar—*do not* glue to the top spdr Note that W 22 is meant to fit from the inboard edge of the bottom wing sheeting out to rib W 4B Remove the top spar and re-install it beneath the leading edge of the wing panel

14 Locate the bag containing the 3/8" x *5/8"* x 3" vertical-grain balsa shear webs These are now trimmed and accurately installed between each rib starting from W 4B out to W 20 *Note that these webs must be carefully fitted in place between each rib and the top and bottom spar locations—do not allow any gaps or bad joints, the integrity of your wing depends on these webs!*

15 Use the *1/16"* x 1" x 36 balsa strips provided to cut, fit and glue in place the horizontal grain web facing caps which are full depth, from W 9 through W 20 These are glued to the front faces of all the 3/8" vertical webs just installed—see plans and cross sections

16 In this step we want to prepare the top of the wing for sheeting This is best done with the largest, longest Sanding bloc k that you have with light sandpaper The tops of the 1/4" sq trailing edges and the *1/4"* sq. aileron and flap leading edges have to be tapered **as** shown on the plans Also, the bottom, trailing edge sheeting must be tapered as shown Take your time here to ensure accuracy We have used masking tape over the ribs, in front of and behind the *1/4"* sq. material to avoid gouging Once satisfied, cut, fit and glue the 3/32" ply aileron and flap horn mounts into the locations shown (riblet 8 and 16) These too are tapered—see cross sections

17 Locate and mark the required hole positions for the aileron and flap horns (4 40 flat head bolts) The measurement from the hinge line back to the center-line of these holes is 5/16" Drill these holes, at right angles to the work surface with either a *5/64"* dia drill bit or a #42 index bit



18. Glue rib W 3B in place Glue rib W 2B in place at the correct root angle Remove the wing panels from your building board.

19 In this step you are going to "final sand" the correct wing root angle into each panel The correct angle, as shown ontheplans is imparted to the root ribs when the tip, at W 20, is blocked up to 2" off of your work surface Take pains to firmly position each panel on the edge of your work surface before sanding this angle into the root ribs—note that the leading edge of the wing, when viewed from the top is 90 to the root. Once satisfied with the positioning of the wing panel, use a large, *flat* sanding block with heavy sandpaper to sand the root angle into each wing root

20. Glue ply wing root ribs W 1 in place to wing roots, accurately lining-up the main wing tube holes with the cavity between W 21 and W-22 The trailing edge ofthisshortenednbendsattheflaphingeline Runa 1/8" dia drill bit through the rear incidence pin tube hold in W 1 and through W 2B Locate and epoxy the *1/2"* sq maple wing hook mounting blocks in place against the inside of W 2B—note this block is positioned 9/16" behind W-22

21. Locate and get ready, the main 5/16" I D x *2-5/8"* brass main wing tubes, the 5/16 dia main wing rod, the rear *3/32"* I D x 1-3/16" incidence tubes, the *3/32"* dia x 4-5/8" MW incidence pin, W 23 s (ply, four) Also, in the small bag of wood parts locate the four pieces of 1/16" x 3/8" x 2-1/2" ply (these are spar box "fillers", see cross sections at the wing root)

    First rough-up the outside surface of all four of the brass tubes with 120 grit sandpaper Next you need to cap-off one end of each of these tubes to present epoxy from seeping inside when they're mounted. The easiest way to do this is to hold one end of the tube over a piece of bond paper and apply CA adhesive to the joint When set use a small sanding block to sand away excess, leaving just the capped end of the tubing Next, trim, fit and glue the bottom *1/16" x 3/8" x 2-1/2"* spar box "filler' in place on top of the bottom spar, between W-1 and W-4B Trim and sand the four W-23's to fit in place but do not glue yet

    We are now going to install the wing tubes, followed by using the two wing rods to fixture" their final locations Start by mixing a batch of *slow drying* epoxy (use Hobby Poxy Formula 2) Apply glue liberally to theinsidoofthespar box where the main wing tubesfit—fill itto the bottom of the hole inW 1 Insert the main wing tubes, capped end first, through W-1. Try to make sure there are no air bubbles Insert, but do not glue yet the rear incidence pin wing tubes in place, capped end first through 3/32" 1 Place the two wing panels on your work surface with the twoW-1's facing each other Prop one panel up at the tip 2", slide the two wing rods inplaceinthcir tubes in this panel Slip the other panel onto the wing rods and prop its tip up to 2 also Make sure the two W 1 root ribs are firmly in place on the work surface (use weights, if needed) and that they are parallel (Note, it is not necessary to push the two panels together tightly, just enough to "bottom out" the two rods is sufficient) Apply epoxy liberally on and about the rear incidence tubes, fittheW 23 sin place—hit them with a little CA to keep them from moving—and fill the cavity between them to the top with epoxy Note that we have not yet filled the main wing tube cavity, this will be done in due time Allow this entire assembly to cure overnight.

22 Remove the wing rods from the wing panels Slip the F 10 ribs in place over the tubes and up against the fuselage sides Use your sanding block to bring these tubes flush with the outside surface of the F-10's Do the same thing to the protruding ends of the tubes showing through W 1 Clean the edges with an X-acto blade to allow wing rod clearance Insert the wing rods into the fuselage tubes and slip the wing panels in place You may have to trim a small amount of the rod's lengths to achieve proper seating—a carbide cut-off wheel or a grinder will do the job but do not cut-off too much, we want the tubes filled with rod If any touch-up sanding is necessaryto achieves smooth, flush fit between F-10's and W-1's,do it now. Pull the panels out a little way on the rods to expose th face of F-10, apply a few "dots" of glue to the F-10's, push the panels back in place against them to allow to dry This tack glues the F-10's accurately **in** place for final sanding

23. With the panels still in place on the fuselage you must now determine the exit locations for the flap drive cables in relationship to your servo and its output arm Note on the plans that these exit locations are "staggered" to allow one servo to control both flaps. As viewed from the top, install your flap servo on its rails, directly on the centerline of the fuselage Attach the output arm to th servo with it pointing directly fore and aft along the same centerline The output arm's clevis holes, in this position, is the mark(s) that you're looking for Make a pencil mark on the tops **of** the F-10 ribs at right angles to these two holes. Remove the panels, along with the tack-glued F-10's, from the fuselage

24. Use a sharp pencil to draw the oblong slot in F-10 onto W 1 With the wing panel flat on your work surface, use a 90 triangle and pencil to pick-up the marks you just made on top of F-10 and transferthem to W-1, inside of the oblong slot With an *1/8"* drill bit, drill the flap exit holes through W-1, W-2B and W-3B, as shown on the top view of the plans Carefully make a hole in each rib, as shown on the plans, to "snake" the flap tubing out to W 8B Going back to the wing root once again, drill a small 1/32" dia guide hole, inside of the oblong slot, at the front, through W-1 and into the maple hook block Make sure this hole location is far enough behind the front of the slot to allow clearance of the wing hooks into the slot.

25 Prepare the remaining plastic tubes (2 @ 48" and 1 @ 36") for installation into the wings Rough-up their outer surfaces with sandpaper and cut the 36" piece into two 18" lengths—these are for the flaps **As** shown on the plans, 'snake" the flap tubes through 3/32" 1 andouttotheW 8B location, cutthetube leaving about one extra inch at the end (outboard) for fitting purposes later The inboard end should be flush with thefaceofW 1 Install the longeraileron tubing inthe same manner, again leaving about one extra inch **at** the outboard end Mix a batch of epoxy and carefully glue the tubing rib joints of each rib, on each side.

26. Re-position the wings back onto your work surface—your *flat* work surface Secure the panels firmly in place Using the two remaining pieces of 1/16" x *3/8" x* 2-1/2" ply spar box "fillers", trim them to fit within the spar box, above the main wing tubes Once satisfied, glue each of these in place on the bottom end of the top spars

    Mix another small batch of Formula 2 epoxy and fill-in the remaining space in the spar box above the main wing tubes Glue the top spars of each panel in place—hold this spar firmly in place, wipe-off any oozing epoxy from the spar box, weight or tape firmly in place and allow to dry.

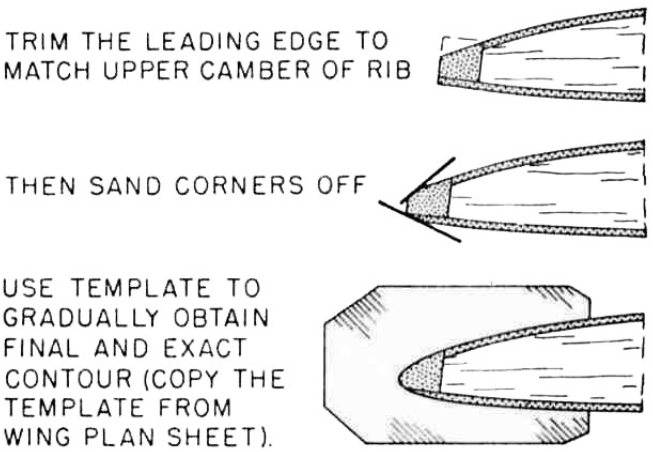
27. Once again use your sanding block—carefully—to smooth-out the top of the wing, as needed before sheeting Carefully fit and cut the top leading edge sheeting in place Note from the cross sections that the rear edge of this sheet is trimmed to fit only half way across the top spar, leaving a "shelf" for the rear sheeting Carefully glue and pin in place this sheeting, wipe-off any excess glue from the back edge.

    We have found it best to make-up the entire balance of the rear sheeting into one pre measured, cut and glued piece before applying it to the wing Once you have cut the center section sheeting (3" wide) to fit the trailing edge sheeting (4"), join them at the gluing seam with one complete length of tape (we use thin, cellophane-type) Turn this sheet over, bend the seam open, apply glue, close the seam and wipe-off excess glue and apply another complete length of tape to the joint. Place the sheet on a flat surface and place weights along the seam being glued, allow to dry.

    When the top wing sheets are dry and useable, remove the tape from the seams Use your sanding block and light sandpaper to smooth the seams. These wing "skins" can now be carefully glued in pace—pin and or weight as needed and allow to dry completely before removing from the building board.

28. Remove the wing panels from the building board. Inspect your work carefully, remove any dried adhesive that has gathered in the corners Work on the trailing edges with the sanding block, get them down to the cross sections shown From the bottom of the panels, run a 5/64"dia or #42 index drill bit through the aileron and flap horn holes and out the top sheeting. Note that these horn boltsare flat-heads and need to be counter-sunk intoitresurfaces Use a Dremel bit (45° chamfer-type) to accomplish this, see cross sections. Use a sanding block to sand all excess sheeting, leading edge and spar stock flush with W-20 at the tip in preparation for the wingtip blocks Lastly, use a pencil to mark the top and bottom "cut lines" for the ailerons and flaps at both the tips and the roots (these can be plainly seen when viewed end-on). Insert an X-acto #11 blade into the slice made earlier in the bottom sheeting, between the aileron and flap #12 "riblets" to mark the cut line location of these two surfaces on the top trailing edge sheeting

29. Without gluing them to the ends of the ailerons, glue the two shaped balsa tip blocks in place to W-20. When dry, use a hobby knife to first rough carve them down to shape and then use your sanding block to match them to the top and bottom tip profiles. Next, use a razor plane to work the leading edges down to their approximate cross section—see sections on plans Follow this with your sanding block to finish the job—avoid "waves" and "dips"—the entry should be clean, straight and consistent Carefully round the tips in the same manner, rough-carve followed by final sanding Frequently compare the two panels to make sure that they are uniform.



30 Note on the wing plans and cross sections that we recommend backing and supporting the wing sheeting with scrap 1/8" x 1/2" *x 2* balsa, underneath, at the tube exit points Working from the bottom of the wing panels, cut, fit and glue these pieces in place next to the inboard sides of W 8B and W-16, as shown Use a straight edge and d pencil to connect the outboard and inboard aileron and flap hinge line marks made earlier—this gives you a point to measure from for drilling the tube exit holes As shown on the plans and cross sections, the aileron and flap tube exit holes are drilled at 1 *1/4"* above the hinge line, at the shallow angles shown A sharpened length of *1/8"* dia. brass tubing is perfect for this operation Once the holes are drilled, Carefully route them through, from the underside of the wing panels Once in place, apply a slower-type CA adhesive to the outside and inside joints, secure with tape and allow to set Use a single-edge razor blade to slice them off flush with the wing sheeting Use a small sanding block and light sandpaper to finish the job.

31. Use a straight edge and a sharp #11 blade to cut the ailerons and flaps free from the wing panels and then part from each other Use a sanding block to smooth the trailing edges of the wing panels Using the plans and cross sections, sand the leading edge chamfers into the ailerons and flaps Sand the ends of these surfaces *lightly* to bring the sheeting flush with the root "riblets' of each

    Remove the tack-glued F-10 ply ribs from the W-1's and glue them in place on the fuselage sides.

    Perform a final inspection of your work At this point the wing panels and their control surfaces should be final sanded and ready for covering.

COVERING

The ANTARES lends itself quite well to a fully-Monokoted finish Monokote will keep the dry, unballasted weight well within reasonable bounds and this is important when working light kinds of lift Also, the hinginq method that we suggest for both the flaps and ailerons employs the use of Monokote and this means not only the extreme effectiveness of these surfaces is enhanced but colors can be chosen that match the rest of the wing We would caution you that we have never flown any of the prototypes that did not use the hinging method that we are showing you in this manual Surface effectiveness would surely suffer should you decide to hinge the ailerons and flaps with conventional nylon hinges

Before covering, we suggest that you fully assemble the airframe and perform a simple balance test This only involves trying to balance the airframe while it is suspended from the nose bottom and the rear bottom of the fuselage to see if one side is heavier than the other If, after performing this test, you find one side definitely heavier, compensate with a small amount of weight in the opposite wing panel and re-balance Repeat this process until you are satisfied This simple step, taken now, can solve a lot of problems in trim later on

Each of the individual components are now covered, fuselage, canopy, top hatch, stabilator halves, rudder, ailerons, flaps and wing panels Follow the instructions provided with each roll of Monokote Remember, to keep it simple, light and beautiful, keep it Monokote.

After covering, clear-out the hinge slots for the fin and rudder Pre flex these hinges to free up their movement We like to drill three or four small holes in each side ofthe hinges first, so that when they are epoxied in place the adhesive flows through the holes and acts as "pins" when cured Hinge the rudder to the fin

Next, hinge the ailerons and flaps to their respective wing panels As you can see from the diagram, this is done in two steps with full length 1/2" wide strips of Monokote Since the first strip applied is the inside one, you can accurately locate the position of the surface to be hinged with small pieces of light tack draftsman's tape on the bottom hinge line Now rotate the surface all the way around to the bottom surface of the wing and apply the first, inside, hinge strip Remove the tape from the bottom, hold the surface' in the full up position and apply the second hinge strip to the bottom of the hinqe line As the plans show, take care to maintain the smallest possi ble gaps between each surface (1/32" or less making sure free movement is maintained)

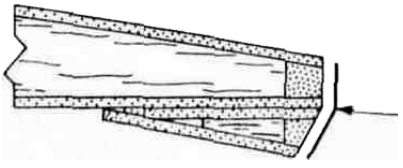
Locate and carefully clear-out all openings in the fuse lage, wings, flaps, ailerons and stabs for the various push rods, horns, antenna and tubes Use a toothpick to apply a little 5-minute epoxy to the inside of the aileron and flap horn holes Screw the 4 40 flat head bolts (4) in place from the bottom of each surface—wipe off any excess glue with acetone The nylon rudder horn is now attached with the two *#2* wood screws provided.

You may have been wondering how the stab halves could be locked in place if there is only one locking wheel collar? Sim ple First test fit the stab halves to the fin, make sure the joiner wires are the correct length to achieve a good fit to the fin Once satisfied, simply apply a tiny amount of CA adhesive to oneside of the two joiner wires (not to the "flat" side of the rear one) and insert these into the right stab half, the one without the wheel collar. Now the wheel collar can lock the stabs to the fin and you won't be losing those joiner wires'

Your kit comes with an 11" length of rubber skid material—note that this has a removable backing that protects its adhesive This material can be shaped with sandpaper, we did this at the nose to "streamline" it a little We recommend cutting away a 3/8" wide strip of the Monokote on the bottom of the fuselage where this strip will be affixed—see plans Attach the strip in place, ahead of the towhook, on the centerline We might suggest that you drill a small hole in the skid at the very nose and run a small (3/8" long, would do) wood screw through the skid and into the noseblock, this anchors it quite well and avoids "peeling".

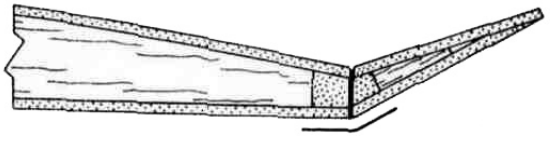
HINGE-MAKING PROCEDURE

(SHOWN IN CROSS-SECTION; NO SPECIFIC RIB)



1/2 WIDE STRIP OF SUPER MONOKOTE. FULL LENGTH OF FLAP OR AILERON

ROTATE FLAP (OR AILERON) DOWN TO A"TUCKED UNDER" POSITION TAPE SECURELY IN PLACE IRON ON A 1/2" WIDE STRIP OF SUPER MONOKOTE THAT IS FULL LENGTH OF FLAP OR AILERON.



REMOVE TAPE SWING FLAP OR AILERON UP **TO** FULL REFLEX POSITION TAPE SECURELY IRON ON 1/2" STRIP OF SUPER MONOKOTE ALONG HINGE LINE, AS SHOWN ABOVE REMOVE TAPE. DO OTHER PANEL IN SAME MANNER

RADIO INSTALLATION

Assuming that you have followed these instructions thus far, servo installation should not be a problem Use the remaining 3/32" x 3/8" ply strip material to make the six required 1-5/8" long servo rails Note that the half-round cut-outs on the bottom of the fuselage formers are there to provide passage for the radio's various leads and plugs We have consistently found that the plug and lead wires for the flap servo is to short and therefore requires an extension Start the servo installation with the flap servo.

As shown on the plans the flap servo must sit on its rails, on the centerline of the fuselage, with its output arm's clevis holes lined up with the flap tube exits in the right and left wing panel roots As previously discussed, this output arm must also be centered within the oblong slot in the fuselage sides when viewed from the side *IMPORTANT* If your radio is not equipped with a servo reversing

feature, make *doubly* sure that the flap is installed to provide the correct throw direction Some healthy damage could be done to the servo and or the airframe if it moves the wrong way' Once satisfied, route the servo lead through the fuselage and into the receiver.

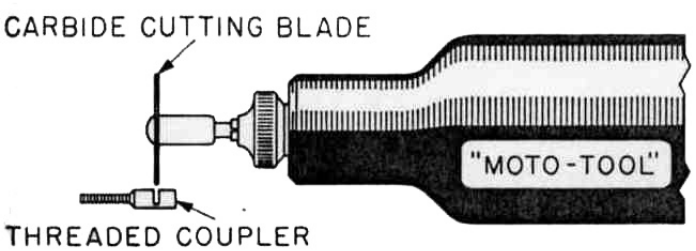
Install the stabilator and rudder servos next If additional clearance is needed for your output arms the inside of the fuselage sides at that point can be sligntly routed-out as shown on the plans. Route the leads into the receiver compartment.

The aileron servo is next Note that when viewed from the side (see plans) this servo's output arm is centered within the 1/4" holes in the fuselage and F-10's When viewed from the top, the servo is directly in place over the fuselage center line

*Note that the threaded brass cable connectors supplied with your kit each has a *5/16"* deep hole in the base for cable/connector soldering purposes It will be necessary, particularly in the flap and aileron servo areas, to cut-down the depth of these holes to achieve all of the desired movement. This is easily done with a carbide cut off wheel. Also, the carbide cut-off wheel is perfect for cutting the braided cable supplied, to length As mentioned -earlier, we use Hams' Stay-Bute solder and Stay-Clean flux for all solder connections Whenever making a cable/connector solder joint, always pre-solder the cable end first, put a little flux in the connector hole and then use the iron to "sweat" the joint. Always check for straight, permanent solder joints before installing the cable Whenever making a solder connection in or around the fuselage, protect the surrounding area with scraps of aluminium foil.

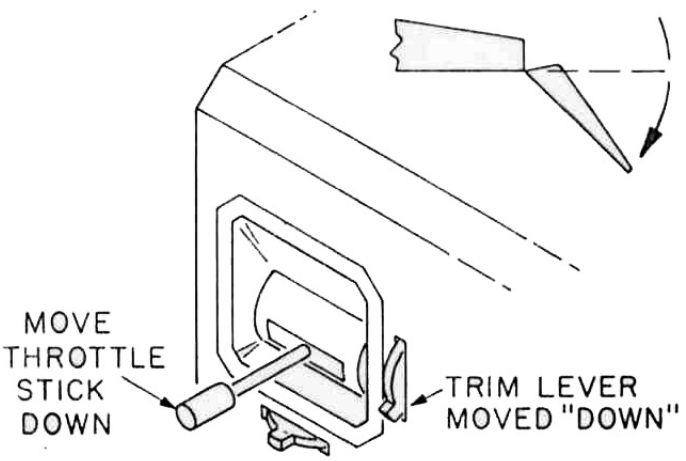
Locate the four nylon flap and aileron horns. Pre-thread them with a 4-40 bolt and then thread them in place on the 4-40 bolts on the flaps and ailerons Locate them about 1/8" below the top ofthe bolt-end as shown Assemble the wings to the fuselage with the joiner rods and spring keeper in place on the wing hook. Start by soldering a connector to one end of each of the two 48" aileron cables—these connectors, as shown, should have their hole depth cut-down to *1/8".* Now thread a nylon clevis onto each of the threaded connectors Install the other end of these cables into the wing panels, from the fuselage and connect the clevis' to their respective holes in the servo output arm Now use your radio to check the movement, left and right, of this connection Once satisfied, set the transmitter trims in neutral and make the outboard aileron cable connector joints Thread the clevis' in place and connect them to the horns Note that this connection system provides very fine adjustment

The flap drive cable is made by cutting one of the 36" lengths provided into two 18" lengths Make all the connections necessary for the flaps in the same manner you did for the ailerons Note the diagram provided that illustrates the way we set the transmitter up for the operation of flaps and reflexing them This system **has** proven to be flawless in actual operation.

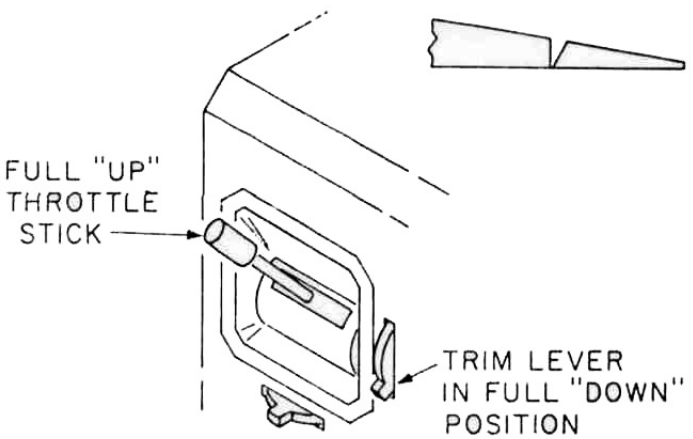


THE THREADED COUPLERS ARE SHORTENED QUICKLY AND EASILY BY USING A CARBIDE CUT-OFF BLADE IN A "MOTO-TOOL". ALWAYS WEAR SAFETY GLASSES WHEN USING CUT-OFF TOOLS.

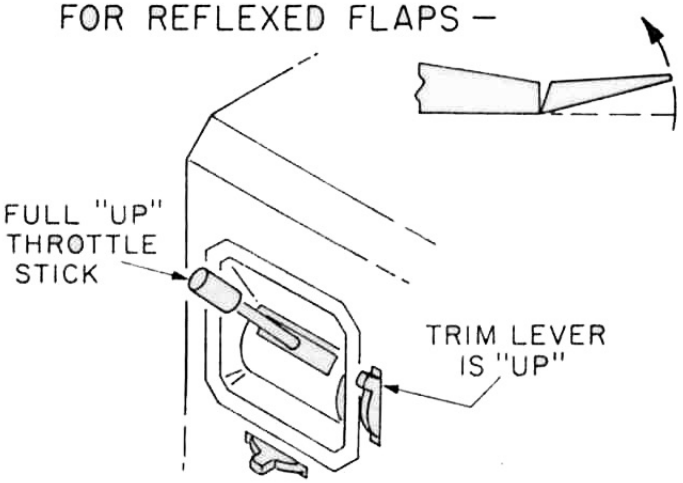
FOR "DOWN" FLAP DEPLOYMENT-



FOR "NEUTRAL" FLAPS –



FOR REFLEXED FLAPS –



The connector for the stabilator servo is next Since this cable is already in place, it's fairly easy to work with. Thread a clevis onto a connector and snap the clevis in place on the servo's output arm. Observe the distance between the rear end of the connector and the cable tube end—will the connector contact the tube during the operation of the stab? If so, trim a little length off of the end of the connector Once satisfied, use a small-tip felt marker to mark the cable for cutting Carefully cut the cable, solder the connector in place, re-thread the clevis in place and set the stab servo for neutral.

Use the remaining 36" cable for the rudder Solder a connectorto one end of the cable, thread a clevis in place and install the other end into the fuselage, at the servo compartment Connect the clevis to the rudder servo, at neutral trim Thread another clevis onto the remaining connector and attach the clevis to the center hole on the rudder horn With the rudder at neutral, use a felt marker to note the location where the cable should be cut Cut the cable, remove the clevis from the connector, solder the connector to the cable, re-thread the clevis in place and connect to the rudder horn.

Install the receiver by first threading the antenna through the tube provided and out the exit at the rear of the fuselage. We used thin foam pads to secure the receiver in place, on its side as shown on the plans Make all of the necessary servo connections The switch, as shown on the plans, is the way we installed it on all of our prototypes This method eli mi nates the need of cutting into the fuselage sides and is much "cleaner", not to mention easier.

Note on the plans that we show a SR 900 Mah battery pack installation Our experience with the prototypes, with this battery installation has been outstanding This pack takes about the same space as a normal 450-500 Mah pack, weighs just a few grams more than these packs, but has about twice the capacity' Believe us, when you are spending all day at the flying field and running four servos, it's nice to know you can rely on your power source'

Install the battery pack in the nose compartment Thread the lead and plug through F-3 to the switch Don't pack the batteries in place yet, do it after you have determined what is needed in the way of nose weight for balance.

If you are using a releasable towhook, all of the connections can now be made except for the final one to the stabilator output arm This last connection is made after the hand gliding phase and before actual launch

The radio system should now be tested Look for any "binding" or interference to the operation of the servos—correct it *now* The control surfaces are now set up for the correct amount of movement or "throw" The following is what we recommend, based on our prototypes and the way we like to fly We suggest that you at least start with these surface throws and adjust as needed after some flying experience:

AILERONS ..... 1/2" up—1/4" down (see plans)
FLAPS .....60 down—10 up (see plans)
RUDDER,
UNCOUPLED ..... 1-3/4" each direction 3-1/2" total
RUDDER, COUPLED
W/AILERONS ..... 1-1/4" each direction 2-1/2" total
STAB (MEASURED AT
LEADING EDGE) ... 3/4" up *1/4"* down *1/2"* total

PRE-FLIGHT

1. CENTER OF GRAVITY (CG)- This is a most, if not *the* most important aspect of correctly setting-up this or any other sailplane The CG shown on the plans—*3-3/16"* behind the leading edge of the wing—has proven to be ideal on our prototypes. We would caution you not to go aft of this point until such time as you are familiar with the way the airplane flies. And this is most important, do not attempt to locate the towhook further aft than the CG We made a simple device for balancing our airplanes that you might want to try It was made with two 10" dowels, 1/4" dia. These were "capped" with pencil erasers and mounted on a hardwood base which was pre-drilled for the dowels with a 3" spacing With such a device, very accurate balance can be achieved.

   Add small amounts of lead sheet or shot in front of and/or beneath the battery pack until balance is achieved and the airplane rests at level on the balancing device. Our prototypes have shown that very little lead is needed to achieve balance. The lead should be securely but not permanently installed in order to make/changes neededlater.

2. RADIO AND AIRFRAME INSPECTION: Once again, check the radio system to be sure that the surfaces move in the desired direction by radio command and that the action of the servos is smooth and bind-free. If you have installed a captive towhook system, test its operation to be absolutely sure of release on command

   Take the time to inspect the airframe and its various components Check for warps, looseness of any kind, etc...Now is the time to correct these kinds of problems, not at the flying field. Make sure your radio system's batteries are fully charged and head for the flying site.

FLYING

From time to time we have heard that this individual or that individual does not believe in hand-gliding a new sailplane. We are told that these people simply hook the airplane up to the launching system and "go for it" We would have to advise you that this is not recommended. as far as we're concerned. Let's try a few hand-glides first.

Assuming that the C G is right and that the radio is on and functioning, set all of the controls for neutral, zero flaps and all othertnms in neutral Hold the airplane at the fuselage, just beneath the wings, over your head. Run or trot into the wind until you feel the airplane getting "light" at which time throw it straight and smoothly, slightly nose down with the wings level The airplane should glide straight forward at a very flat angle. Try to remember what commands you felt that you had to give it to keep it straight, if any. Before making any (-
correctionsrepeatanotherhandglide
if they are truly necessary *Now* make any changes to the trims that you felt were needed and hand-glide once again This process should be on-going until you have achieved the long, flat, straight glide that is desired. You can now hand-launch the airplane a little harder, flattening it out at the top of its climb and get a little experience

with the flaps The first thing that you will find is that very little flap deployment is needed to produce a major reduction in airspeed Some increase in altitude will occur but it tends to be very gentle with thisdesign Full deployment of the flaps—max travel—will almost stop the plane in mid-air, flight speed will be at a walk Experimenting with this characteristic will soon demonstrate that very smooth, highly controlled and extremely slow landing approaches can be made You will also find that *suddenly* returning the flaps to neutral will result in a rapid increase of speed and loss of altitude until neutral trim cruise speed is again reached If your experience is anything like ours, you will start to think of flaps in the same sense that you would think of "throttle" on a power ship.

So far, so good You should have at least a little experi ence in the use of the flaps in their normally deployed use. Try a good, hard hand launch at neutral trim and establish normal glide speed as soon as possible Once normal cruise speed is reached, move the flap trim lever up a little to introduce some "reflex" into the flaps and watch what the airplane does carefully What should happen is a rather quick acceleration resulting in an even flatter and much faster glide As mentioned earlier, most radio systems and their servos have enough travel in just the trims to provide about 10 of reflex to the flaps Thisis about twice as much as is really needed, 5 would be plentyYou will eventually find that this reflexing capability is of tremendous value in your normal fiying It gives you the ability to leave "sink" or down air at very high speeds without sacrificing much in the way of altitude We have also used it to good advantage in contest situations by being able to work lift at rather far distances or low altitudes and still being able to make it back to the spot.

The next step is actual launch If you are using a Hi Start system you are going to want about 6-8 lbs of tension or whatever you are comfortable with on aircraft this size Turn the radio on, drop the flaps about 15° and hook the tow ring onto the hook With the wings level and the nose pointed a few degrees up, launch the ANTARES with a brisk throw. The airplane should accelerate quickly and rotate into a 60° to 70° climb As it approaches the top of its climb, return the flaps to neutral, hold a little down elevator to accelerate and as you pass over the top of the launch height, pull full up elevator This should get you off the tow instantly and climbing, at the top of the climb, flatten it out and start your flight.

Try to get familiar with the controls while you are at altitude Does the airplane turn well or do you need more or less rudder coupling Assuming all is well, use the altitude to get a little more familiar with the flaps and what they are doing at various settings Assuming that you did your homework and that the hand-glides paid-off, right about now you should be enjoying the flight How does the stab feel? Too much, too little? Try to remember these things for correction after you land.

And speaking of landing, it's about time for one. We would suggest that first landings with the ANTARES be made just as you would any other sailplane To safely slow the airplane down during these initial flights, try dropping the flaps just a little on the downwind leg. This slows it down consistently so that turning upwind to final approach it will be more than manageable As experience builds you will develop your own sequence of landing approaches

This next launch assumes that you are somewhat comfortable, in that the airplane is adequately trimmed, at least for now Use the same launch sequence as outlined earlier and start looking for lift We think that one of the outstanding characteristics of the ANTARES is the way it reads lift The airplane flies so smoothly that when lift is encountered it really tends to let you know, right away. Wings "rock", the tail "lifts", even in light lift the smoothness of the flight is interrupted with tell tale movement that is easily seen from goodly distances Interestingly, we have found that in heavy lift the deployment of the flaps is just not needed and have even gone as far as to increase the flight speed with reflex in such conditions. Just keep the airplane moving at flight speedand turning smoothly and up you go In light lift wehavefound that introducing some deployed flap is of realvalue in taking advantage of anything available In these conditions the rule is still the same, keep the airplane moving and turning smoothly When sink or down air is encountered, you should not linger in the area and the rule is get out of there quick at either hard right or left angles or punching-out further upwind at the fastest possible speed In this situation try a little reflexed flaps—it is really amazing how quickly you can get from A to B.

We sincerely hope that the ANTARES has been a rewarding project for you and that the hours spent on the building board will be nothing compared to the hours of soaring enjoyment to come Speaking of soaring enjoyment, TOP FLIGHT MODELS, INC is happy to offer you the attached information and membership declaration for the world's largest R C sailplane organization, the LEAGUE OF SILENT FLIGHT Your R/C soaring activities can take on a whole new meaning and importance by participating in the LSF's Soaring Accomplishments Program

INDEX

LEAGUE OF SILENT FLIGHT

P.O Box 647
Mundelein, Illinois 60060 USA

Hello...

You're in good company if you're curious about the LSF Many are these days. The LSF is attracting the attention and interest of R'C sailplane enthusiasts throughout the world.

The League of Silent Flight is an association of and for 'he individual sportsman It is not a club. . it is a program and participation neither conflicts with nor requires club membership However, many clubs find that group participation in the LSF can excite new interest and bring new growth.

Membership can only be earned Membership cannot be bought there are no membership dues or fees To become a member, an R C sportsman must fulfill the requirements of Level I of the LSF Soaring Accomplishments Program a 5 minute thermal flight, a 15 minute slope flight or a second **5 minute** thermal flight, and five spot landings within 3 meters (9 84 feet) of a target point

Advanced levels in the program are progressively n e challenging Level V, for example, requires a 2 hour thermal flight, an 8 hour slope flight, a 10 km (6.21 mile) goal and return flight, as well as considerable success in soaring competition

Members (sportsmen who have achieved Level I or higher) are privileged to display the distinctive LSF insignia The LSF emblem on a jacket or sail plane is a symbol of proven performance It is displayed with pride and recognized anywhere in the world

The LSF is a personal challenge, and serious sportsmen are invited to associatewith the League. The first step? Declare your intent.

To LSF Executive Board
P.O Box 647
Mundelein, Illinois 60060 USA

I. _____, (please print) will support the philosophies, concepts and criteria set forth in the Bylaws of the League of Silent Flight and give notice herewith of intention to attain Level I of the LSF Soaring Accomplishments Program, and by so doing, earn full recognition and privilege of membership

_____
(Signature)

Mailing Address. _____

_____^_____

AMA (or other FAI Affiliate) License or Membership No. _____

FCC (or other) Radio Operator's License No. _____

NOTE: ALL CORRESPONDENCE TO THE LSF MUST INCLUDE AT LEAST $1 00
IN STAMPS OR COIN FOR RETURN POSTAGE