



# ZAGI-THL

*A Thermal / Hand Launch Glider*

<b>Wing Span</b>	<b>48"</b>
<b>Wing Area</b>	<b>486 sq/in</b>
<b>Airfoil</b>	<b>Zagi 07-1.5</b>
<b>Weight</b>	<b>14-16 oz</b>
<b>Loading</b>	<b>4 oz/sq.ft</b>
<b>Radio</b>	<b>mixing required</b>

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PO Box 2089 Belfair, WA 98528

***Tools and materials needed:***

Optional: a second roll of contrasting color poly tape

80 to 150 grit sandpaper

Sanding block

X-Acto knife or Dermal

3M Super 77 or 87 Spray Adhesive

Longnose pliers

These instructions are updated with each new production run. Any mods or changes to the kit are included with each run. 3M Super 77 Spray Adhesive (#77) is the recommended adhesive for the assembly of the Zagi-THL. Since the new Zagi-THL is all EPP the #77 will not damage the foam. Shoe Goo, Goop, Gorilla or any of the other glue, goo or goop adhesives can be used with a weight penalty.

**Wing Panels** The wing panels are die-cut for micro servos (The Hitec HS-81). The die-cut electronics bays will accept a receiver and a flat four or five cell 270 mAh battery pack. The electronics bays will accommodate almost any receiver size. The die-cut servo bays can be glued back in place and recut if different size servos are preferred. Just push them out and spray them with the #77 and replace them. Balsa or foam shims can also be used to assure a snug fit. The wing is thick enough for the radio installation within the original contours of the airfoil. Radio gear should not protrude above the contour of the wing. The Zagi-THL balances at 7 1/2 inches back from the nose. This means that most of the outboard portion of the wing panels are behind center of gravity (CG). Adding weight behind CG means that more weight will be needed in the nose to achieve balance. So you pay a weight penalty twice or even more for adding the extra weight behind the CG. The battery bay is a good place to stow nose weight if it is necessary to achieve balance. An alternative to adding weight to balance the THL is use of a 5 cell battery. The 5 cell, 6v battery increases the efficiency of the servos and provides some necessary nose weight. The battery bay is already die-cut to fit the 5 cell battery. Trick R/C does not currently have the 5 cell battery pack available but we are working on it. For the first flight, the recommended CG is 7 1/2 inches back from the nose. Conditions and pilot skill level will ultimately determine where to balance the ZAGI-THL.

**The ZAGI-THL is not a combat or bungee launch airplane. The design objectives were to make a rugged low cost, light weight wing for thermal and hand launch. The performance envelope includes hand launch, high start, and slope soaring.**

### **Mods**

The challenge of making any modifications on flying wings is the trade-off between the advantage and the penalty. Structural modifications made to the airframe should be made with caution. Since most mods involve adding weight, and more than likely behind the CG, mods should be avoided. If care is taken in the building process, the weight will be right on the manufacturers listed weight range. Mods made to save weight are the best approach to building. Having said that, Here's a few mods that will work in a positive way.

One way to save weight is to use as little of the adhesives and tapes as possible. Instead of thinking a little more tape or glue will make the airplane better, think how little of each is required to make it as strong as it needs to be. Epoxy makes a heavy and brittle wing joint and spar adhesive. The #77 adhesive will make a more than adequate bond. Remember, you're only bonding foam. The foam will usually fail before the bond will.

Saving weight on the elevons will reduce the need for nose weight. Some balsa elevons are heavier than others. Elevon weight can be reduced by shaping. If the elevons seem heavy replace the elevons supplied with the kit with extra light weight contest grade balsa. Winglets made of meat tray styrofoam are lighter than the stock material although not nearly as strong.

Covering materials like Ora Cover or Ultra Kote are heavier than tape. The lighter materials like Solar Film are light but not as strong as tape. Heat shrink materials can distort the geometry of the wing. Designs can be made with the color tape by alternating colors in a variety of patterns without adding weight.



The wing core is shipped between the top and bottom beds. The beds are used as construction jigs so do not discard them.



There are three parts to each wing panel. The top of the wing can be identified by its greater curvature. The right wing is the wing that would be on your right if you were in the cockpit. The right and left panels can be identified by the color mark at the root (the big end of the wing panel,) red on the right.

**DO NOT REMOVE ANY PRE-CUT PARTS AT THIS TIME!**



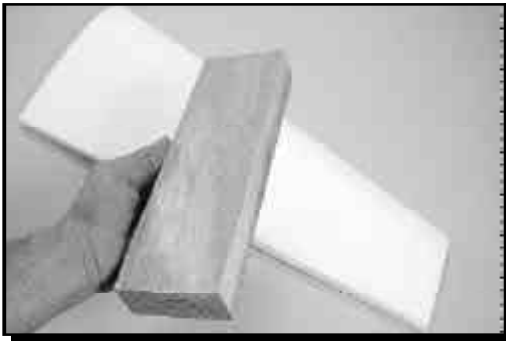
There are three important pre-cut features on the wing panels. The electronics bay, the spar channel and the servo bays are pre-cut. The servo bays are hard to see on the wing cores. An easy way to find them is to examine the top and bottom beds to locate the cut-outs.



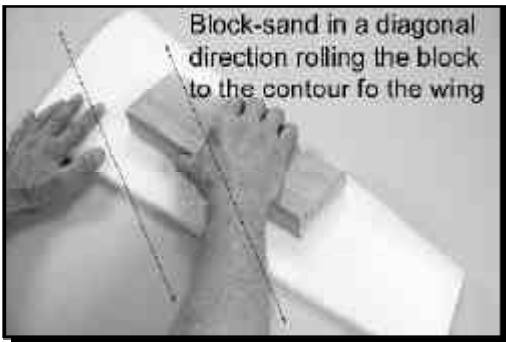
This picture is for identification. Do not remove the parts at this time.



The two carbon fiber spar channels extend the full length of both wings panels only on the bottom sides.

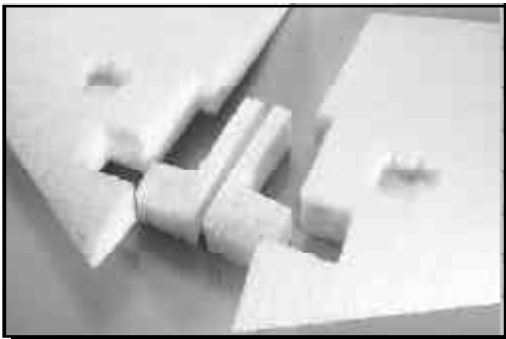


Make a sanding block by gluing #80 or 100 grit sandpaper to a flat scrap of wood. A 2 X 4 scrap works great. The #77 works well for making sanding blocks. Spray a light to medium coat of #77 on the back side of the sandpaper and the wood block. (light to medium is 2 to 3 quick even passes at 12 inches) Let the #77 dry to a tacky touch (tacky touch is when touched it is tacky but does not come off on your finger.) When the #77 is tacky, join the sandpaper with the block.

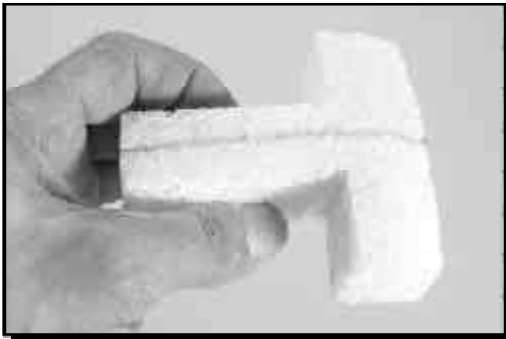


Block-sand in a diagonal direction rolling the block to the contour fo the wing

Put the right wing panels top side up in the bottom beds on a flat surface. Block-sand the panels in a diagonal direction to avoid making flat spots. Roll the block to follow the contour of the wing surface. Take about 50% of the shine off of the foam. Put the wing panels in the top beds and sand the bottom of the wing. Be very careful when sanding the leading edge (LE). Do not flatten or sharpen the leading edge. Block-sand gently while rolling the block around the leading edge.



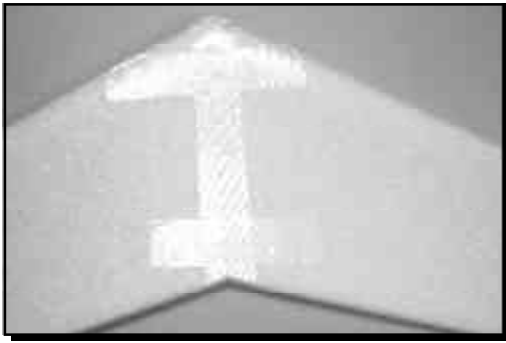
Remove the electronic bay cutouts. Be careful to remove the parts in one piece without damage. Trim the parts and the walls to remove the attachment tabs. Do no disgard these parts.



Use #77 to glue the electronics bay cutouts together. Put the part aside and let the glue set.



Locate the servo bay. The shape of the cutout indicates the orientation of the servo. Push the die-cut servo-shaped cookie partially through to the bottom of the wing. Use a razor knives or a sharp kitchen knife to cut the cookie flush with the bottom of the wing. Low pressure, long slicing cutting motions will keep the foam from deforming. Another trimming method is to mark the perimeter of the cookie with a pencil. Remove the cookie, make the cut and replace the cookie. Once the servo is fitted flush with the top wing surface, glue the servo bay floor into the wing with #77.



Tape the top beds together with fiber filament tape. Then tape the bottom beds together. Lay the bottom beds on a flat surface.



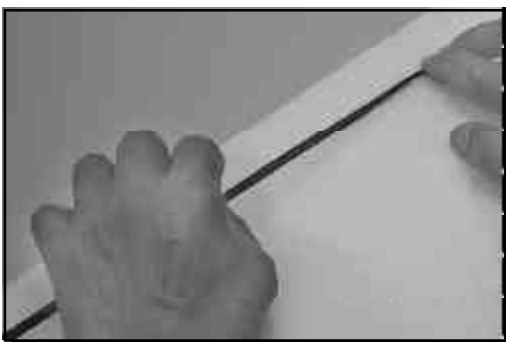
Join the wing panels together using the top beds as a jig. Make a slurry with the #77 by spraying about a 30 second half power close-up blast directly into the spray can cap or a small cup. (Do not use a styrofoam cup) Mix the slurry for a few minutes to evaporate some of the thinner. Spread the thickened slurry on the wing roots with a popsicle stick. Let the adhesive dry to the touch. Align the electronics bay walls and join the wing panels together. Put two pieces of fiber tape on the top to hold the wing panels together.



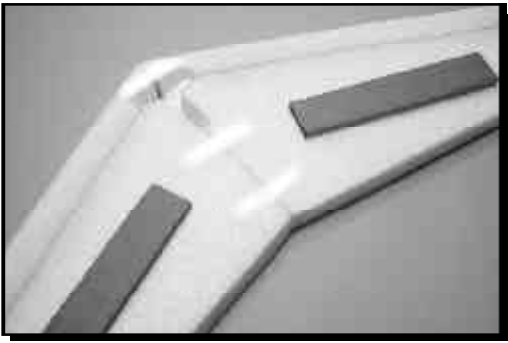
Glue the carbon fiber spars in the bottom side of the wing. Lay the top beds on a flat surface. Put the wing panels in the top bed bottom side up. Hold the spray head 2 inches from the spar slot. Spray one long puddle of spray adhesive the length of the two spar slots.



Use a credit card or similar size piece of plastic as a squeegee to trowel the adhesive into the spar slot. Work the adhesive deep into the slots. Scrape off any adhesive remaining outside the slots.



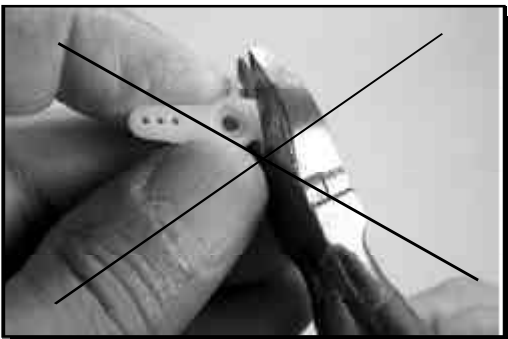
Lay two flat carbon spars on a piece of newspaper and spray them with #77. Starting a half inch from the battery bay, push the spars into the channel. Use popsicle stick as a probe to push the spars to the bottom of the channel



Make sure that the entire spar is below the wing surface. Add more adhesive over the spars if they appear dry. Align the wing in the top beds and place weights on the wing. Leave the wing in the top beds for several hours. Overnight is best.



The servos must be zeroed with the correct control arm before installation. The Zagi THL servo bay was designed to fit Hitec HS-81 micro servos. The servo bay may be expanded or shimmed to fit different size servos. Find the “+” shaped control arm with four tabs in the parts bag supplied with the servos.



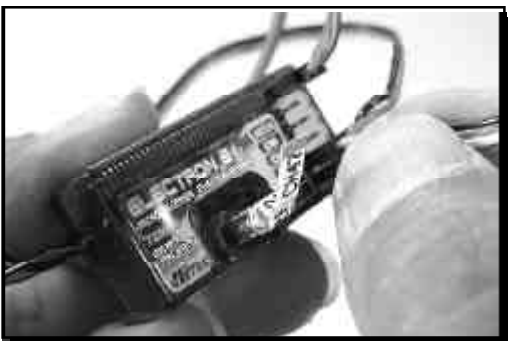
Cut off two of the short and one of the long tabs from the control arm leaving only one tab.



Replace the round servo control arm with the modified arm. Avoid stressing the gears by holding the control arm to limit travel when removing and replacing the screw. Do not over-tighten the screw. Snug is tight enough. To maximize servo life, avoid moving the servo control arm with the radio off.

**DO NOT INSTALL THE SERVOS AT THIS TIME.**

The servos must be centered with the radio powered up before they can be installed.



The receiver plugs have mechanical anti-reverse protection to prevent reversing the polarity into the receiver. The plugs can still be plugged in wrong if pushed hard enough. They will only work when the yellow wire is opposite the numbers. Plug the right and left servos into the receiver. Check to see that the switch is off. Plug the switch into the battery slot of the receiver. Plug the battery into the other side of the switch. Notice that the switch and battery wires only have a red and black wire. Plug the switch wire to match the colors of the servo wires



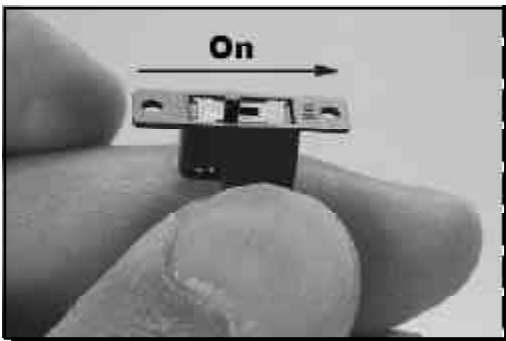
The following steps are for the radio setup. The Hitec Neon-SS system that comes with the THL Combo has a mixing switch on the face of the transmitter (TX). Make sure that the switch is in the on position. Center the trim levers in the middle of the slide.



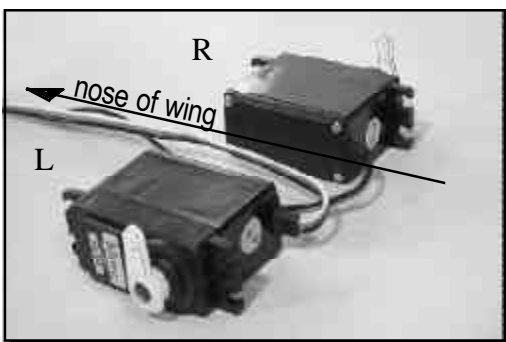
The trim levers are located on all transmitters to the side and below the control stick. Some trim controls are electronic and others are mechanical. Trim levers are provided to adjust the zero position of the servos. Center the trim levers to the zero position. For details on electronic zero centering, refer to radio owner's manual. Computer radios have settings for elevon mixing. Check the radio manual for flying wing, elevon or delta-wing mix setting. V-tail settings will not work. Set the transmitter for elevons and determine the appropriate receiver slot for the controls.



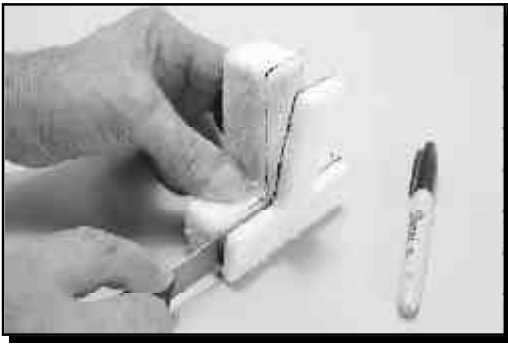
Power up the transmitter. Always turn the transmitter switch to the on position before powering up the receiver. Check the battery condition indicator on the transmitter to make sure that the battery is charged.



Power up the receiver



Position the servos the way they will be in the wings, with the control arms facing outboard. With the transmitter and receiver powered up, the control arms should be 90 degrees to the servo case in the hands-off neutral stick position. If they are not, remove the control arm and replace it at 90 degrees to the servo case. Do not use the trim levers to make the adjustments to align the control arms. When the elevon control stick on the TX is pulled back (the opposite direction to antenna) the servo control arms should both move forward. When the stick is moved to the right, the right servo control arm should move forward and the left servo control arm moves back.



Make an electronics bay floor using the previously joined "T" shaped electronics bay cutout. Measure and make a line around the entire perimeter 1/4" from the bottom side. The bottom side is the flat side. Cut along the mark to make the electronics bay floor. Do not discard the leftover part.



Place the wing top side up in the bottom beds. Apply #77 to the edges of the 1/4" cutoff piece of the electronics bay floor. Push the part into the bottom of the electronics bay to make the floor.



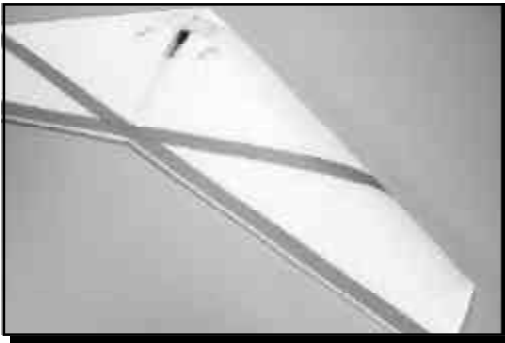
Place the "T" shaped top side (rounded side) up. Cut off the top of the "T".



Make a battery cover with the top of the "T" shaped part. Place the part top side (rounded side) up. Position the battery laying flat in front of the part and make a mark at the height of the battery on all four sides. Make a receiver bay lid with the other part the same way. Cut the parts at the line. Do not discard the remaining parts. The rounded cutoff pieces are the battery and receiver covers. fit the battery in the battery bay.

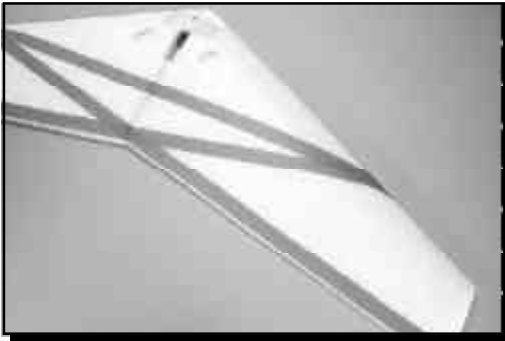


Place the battery in the battery bay. The THL requires 1 oz. of nose weight to achieve balance. One oz. fishing weights are available. A stack of five U.S. quarters weighs 1 oz. Place the quarters or lead next to the battery. Fit the battery cover to blend with the original contour of the wing. Make shims from scrap foam to level the seat for the battery cover. Do not glue the battery cover in place. The covering tape will hold it in place. A razor cut on three sides of the cover will provide access to make the battery and nose weight servicable if more or less nose weight is required or the battery needs to be changed.



***The fiber tape will not appear as dark as pictured here. Darker tape was used in these pictures to enhance contrast visibility.***

Mask-off the battery wire and radio connector before spraying. Tape the wire to the receiver bay floor with masking tape or cut a piece of cardboard to size to cover the wire and plug. Lay the wing top side up in the bottom beds. Spray a light coat of #77 on the entire top side of the wing. Let the adhesive dry to a tacky coat before taping. Apply a strip of fiber tape along the trailing edge (TE) in a straight line to the opposite leading edge on both sides of the wing. Extend the fiber tape an inch at the ends around the LE and the wing tip.



Apply a piece of fiber filament tape straight across center section of the wing. Extend the fiber tape an inch at the ends around the LE.

Place the wing in the top beds and repeat the same procedures on the bottom side of the wing.



Spray a light coat of #77 on the top surfaces of the wing including the areas covered with fiber tape. Make sure to spray the tips and trailing edges. Spray 2 inches of the bottom of the wing at the trailing edge (TE). Let the adhesive dry tacky.

Apply the first strip of color tape so that half of the width of the tape extends beyond the TE.

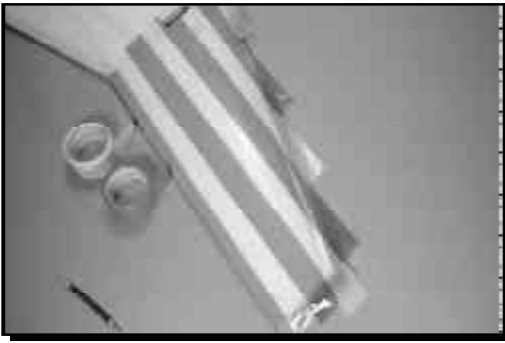


*Covering the top and bottom of the wing in contrasting colors makes the plane much easier to fly. Use the darker color on the bottom surface. An optional roll of color tape will be required.*

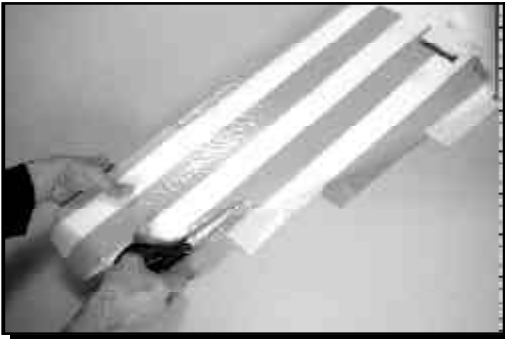
The first strip of tape is wrapped around the TE from top to the bottom, being careful to follow the shape.



Apply strips of tape working forward from the TE. Overlap each strip of tape a quarter of an inch. Pull the desired length of tape off of the roll. Extend the tape two inches beyond the tips. View the tape directly over the wing for a better aim. Touch the tape down at the wing tip. Chase the tape with a very gentle touch toward the center. Cut the tape two inches beyond the center line of the wing.



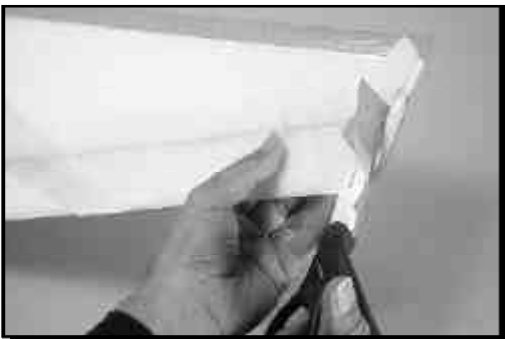
Continue overlapping the strips of tape until the entire top right wing panel is covered. Pictured here is an alternated pattern of orange and yellow.



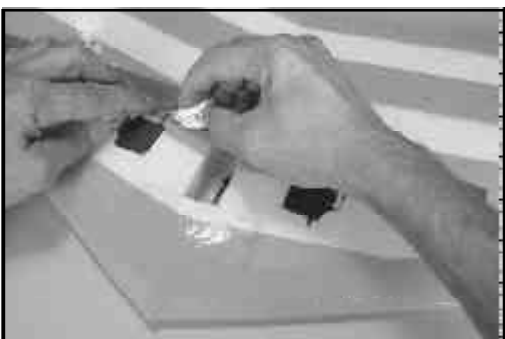
Trim the tape that extends beyond the LE.



Trim and fold the tape around the wing tip.



Fold the tape around the tip and cut it to the contour of the bottom surface. Spray a light coat of #77 on the bottom surface of the wing. Place the wing in the top beds bottom side up. Cover the wing with color tape working from the TE to the LE. The final strip of tape is wrapped around the LE from top to the bottom, being careful to follow the shape.



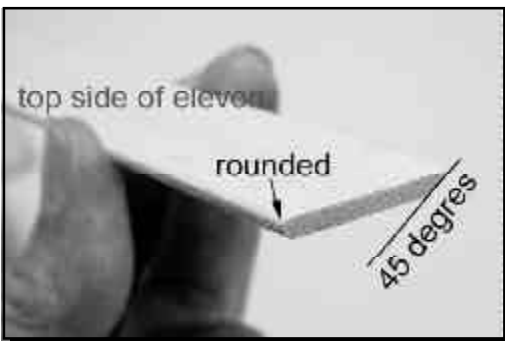
Cut an "X" pattern in the tape covering the servo and receiver bays. Fold the tape into the servo and receiver bays. Push the servos in place. Make a small slice in the tape that prevents entry. Align a straight-edge with the servo wires.



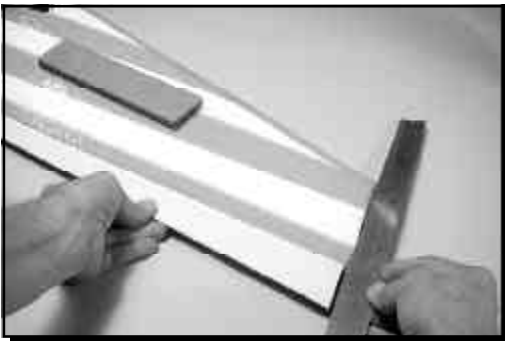
Use small pieces of masking tape to hold the elevon in position against the TE temporarily. The wide end of the elevon goes outboard. Hold a straight-edge against the wing tip. Make a mark to match the wing tip.



Hold a straight-edge parallel to the center line of the wing. Make a mark on the elevon. Trim both ends of both the elevons on the line to match.



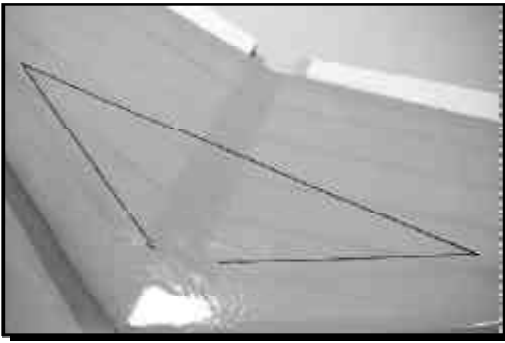
Sand a 45 degree angle into the LE of the elevon (the LE is the edge of the elevon that makes contact with the wing). Sand the elevons and smooth all the surfaces. Round the TE of the elevon. Spray the elevons with any spray enamel. Apply a light coat of paint and immediately wipe it with a cloth before it soaks in and dries. [Do not do a "paint job". Paint is too heavy] Let the paint dry. For rough duty, the elevons may be covered with color tape. There is a weight penalty for tape or a paint job and the wing will need more nose weight



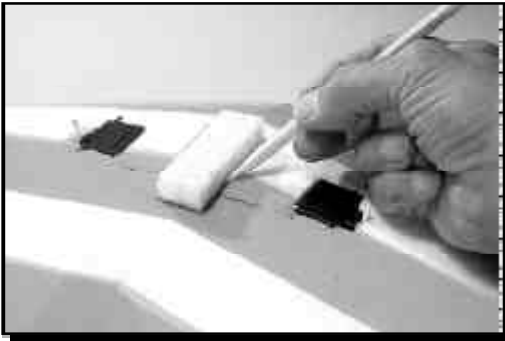
Place the wing in the bottom beds, top side up. Put weights on the wing. Position the elevon on the trailing edge of the wing. The wide end of the elevon goes outboard. Align a straightedge with the wing tip. Leave a 1/8" space between the end of the elevon and the straight edge for clearance from the winglet. Make a placement reference mark on the TE at both ends of the elevons on both sides.



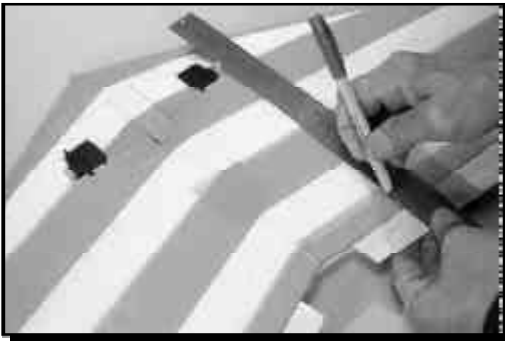
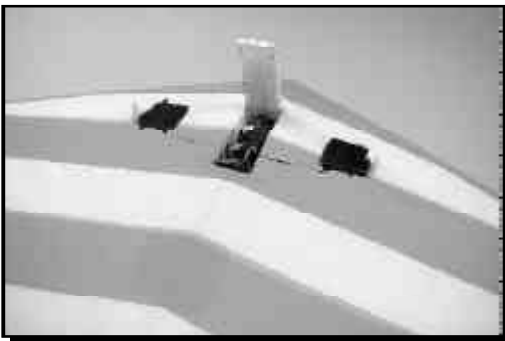
Peel the paper backing from the 1" x 3 mil vinyl hinge tape. Apply the hinge tape to the TE so that half of the width extends beyond the TE. Align the elevon with the placement reference marks. Hold the elevon at about a 22 degree down angle and slide the elevon along the TE up to the hinge tape.



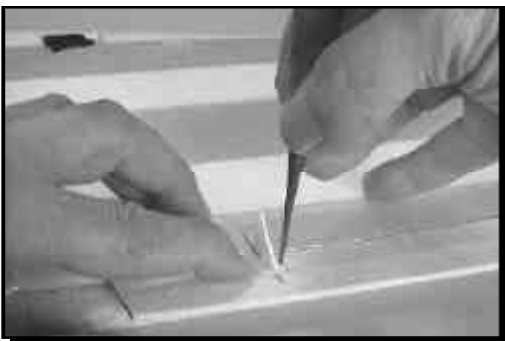
Drill a hole in the front corner of the receiver bay floor. Push the wire through leaving two inches of antenna wire in the electronics bay for positioning. Using a straight edge as a guide, make a 1/4" deep cut in the wing surface for an antenna wire channel. Cut the antenna channel 1/2" from the carbon spar down to the cross piece of fiber tape applied on page 10. Continue the cut above the fiber tape to 1/2" from the opposite carbon spar. Continue cutting the channel 1/2" from the carbon spar to the length of the antenna wire. Push the antenna wire into the channel with a flat blade screwdriver. Cover the channel with color tape.



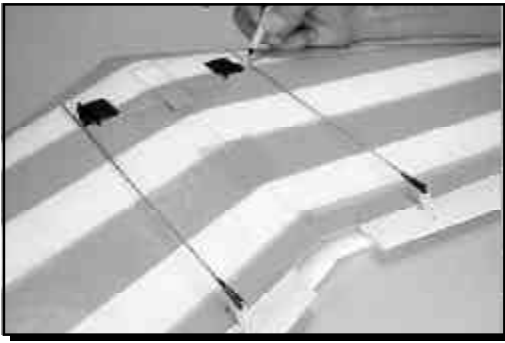
Install the receiver and switch assembly. Review the Radio operating instructions for the appropriate servo assignments and mixer settings. The servo wires may be stowed under the receiver bay cookie



Make a line from the outboard side of the servo control arm to the elevon. The line should be parallel to the center line.



Align the control horn to the line on the elevon. Use a punch or any pointed tool to mark the position of the holes in the control horn foot. Drill two holes big enough for the 2 x 56 self tapping machine screws. Thread the machine screws through the elevon into the nylon locking pad. Snug the screws to make a slight impression in the balsa wood. Do not over tighten!

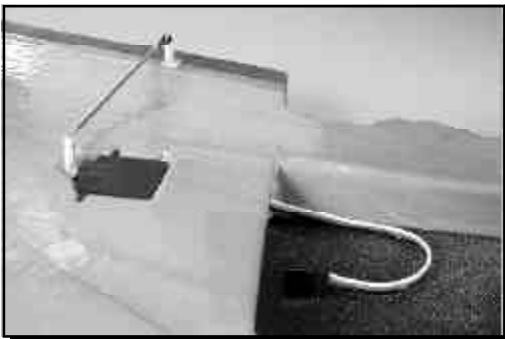


Screw the threaded clevis onto the control rod so that equal threads are showing on both sides of the clevis. Hold the elevon in the neutral position and make a mark where the rod matches the holes in the control arm.



*The diameter of the control rod may be reduced with a file or belt sander to fit better into the control arm. The control arm hole may be enlarged with a drill or by spinning an X-Acto blade in the hole.*

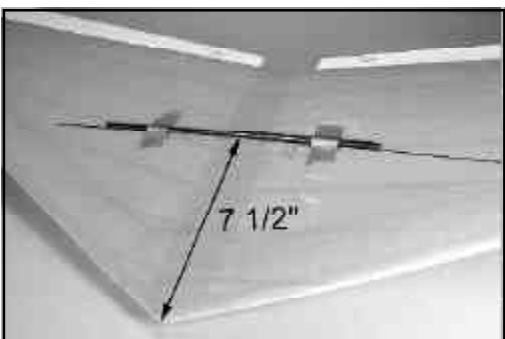
Attach control rods to the servo control arms with a Z-bend. (NOTE: Z-bend pliers may be purchased from your local hobby dealer to make this operation easier.) Long nose pliers will also work to make a Z-bend.



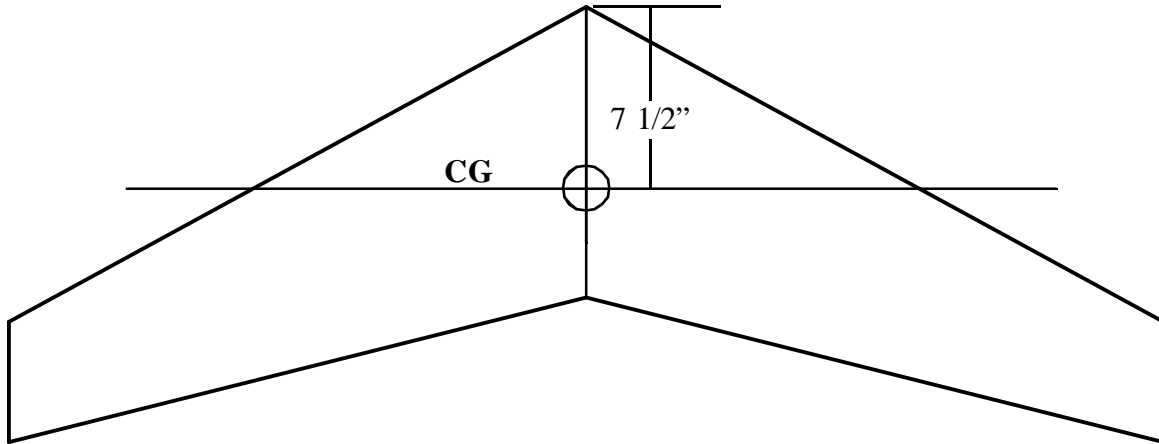
Mechanical centering of the elevon can be achieved by removing the clevis from the control horn and screwing it in or out.



Use two short strips of fiber tape to attach the winglet to the wing-tip. Hold the winglet against the wing-tip and outline the shape of the top of the wing-tip. Cut a slot in the winglet above the outline wide enough to put the fiber tape through. Apply a short strip from the top of the wing through the winglet and around to the bottom. The winglets are at the very back of the airframe where excess weight exacts a high nose-weight penalty. The tape method of fastening is both light and strong. If a different winglet fastening system is preferred, keep the weight down to the weight of two short strips of tape.



Lay the wing bottom-side-up on a table or other flat surface. Tape a 1/4" dowel 8 inches back from the nose. A round pencil can be used. Place the wing right-side-up on a flat surface. Balance is achieved when the wing balances momentarily on the dowel. Add nose weight if the wing returns to the tail down position when pressing the nose down. Remove nose weight if the opposite occurs. The wing should remain nose down when pressed and remain nose up when the tail is pressed to the table.



### Preflight check and glide test

Check the frequencies (channel number) of all pilots within visual range before turning on your transmitter. Turning on your transmitter with the same channel number as someone who is flying will certainly cause his plane to crash. Do a preflight check before every flight. Always turn the transmitter power on before the receiver battery. Make sure that the controls are working properly. Check the trim levers on the transmitter. Pull the elevator control stick back and observe that both elevons move upward. Push the control stick to the right and observe the right elevon moves up and the left elevon moves down. The first glide test should be done on flat land in a light breeze. The wing should be held by the nose with your palm up over your head and your thumb wrapped around to the top. Hold the wing over your head with the nose pointed straight ahead. Run slowly into the wind. Give it a gentle push straight ahead into the wind. Do not point the nose upward. Correct the flight path with the radio control stick. The test is successful when the wing flies straight ahead with a slow sink rate to a sliding landing. If the wing turns in either direction after the launch, compensate by adding 2 or 3 clicks of trim in the opposite direction. If the wing pitches up and immediately dives, add 2 or 3 clicks of down trim. Repeat the glide test until the Zagi THL flies straight ahead with a slow sink rate to a sliding landing. Increase the launch speed each time to provide longer control flights.

*Trick Wings guarantees this kit to be free from defects in both workmanship and material at the date of purchase. This does not cover any components or parts damaged by use, misuse or modification. In no case shall Trick Wings liability exceed the original price of the purchased kit.*

*Since Trick Wings has no control over the final assembly, no liability shall be assumed for any damage resulting from the use by the user of the final user-assembled product. By the act of using the final user-assembled product, the user accepts all resulting liability.*



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