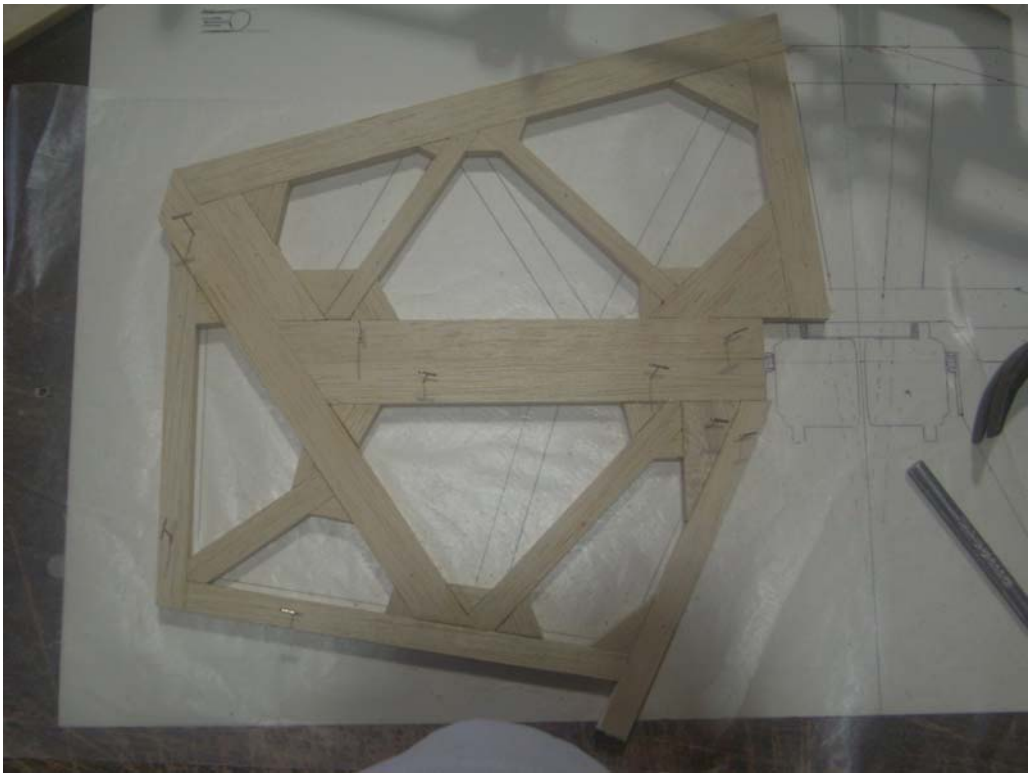
TAIL SECTION IV

- You will need the following tools:
  - Razor saw for cutting the balsa sticks.
  - Thin and medium CA
  - Medium size T-pins
  - Wax paper
  - Sanding block with 80 grit paper
  - Ruler
  - Fine tip pen or pencil
  - Dremel with large cut-off wheels, or old fashioned hinge slot cutter
  - 5 minute epoxy
  - Alcohol
  - Needle nosed pliers

- Parts list:
  - Horizontal stabilizer plan sheet
  - Vertical stabilizer plan sheet
  - 3/8” X ¾” X 36” stock balsa
  - 3/8” X 5/8” X 36” stock (4) balsa
  - 3/8” X ½” X 36” stock (3) balsa
  - .047” X 36” piano wire (2)
  - Bag #4 contents:
    - Rudder servo frame 1/8” lite ply
    - Aft elevator servo spacer ¼” balsa
    - Lower servo frame 1/8” lite ply
    - Gussets 1/8” lite ply
    - Elevator servo screw plates (2) 1/8” lite ply
    - Fly wire hard points (3) ¼” plywood
    - Hinge halves (22)
    - #2 sheet metal screws (3)
    - #2 washers (3)
    - 6” nylon elevator hinge pin tubing (1)

- Lay wax paper over the plans for the tail surfaces.



- Using the 3/8” thick balsa stock, build the tail surfaces as shown on the plans (not in this picture!) Pin the parts to the plans as you build and use **medium CA**.

- The right side of the elevator is a mirror image to the left. There are two techniques for building:
    - One is to cut two of each part using the left side template, then glue one in position on the right.
    - The other is to build the left side, then remove the stabilizer, flip it over, and re-pin upside down. You can then build the opposite side.

- Once dry, remove the surfaces from the plans. If necessary, sand the hinge line edges to ensure they are absolutely straight. Draw a pencil line around each surface on the center of the edges. This line will aid when you shape the surface.

- Round the leading edge of the rudder and stabilizer, but not where the surface will meet the fuselage. Save shaping those areas until the surface has been installed and the fuselage is sheeted.

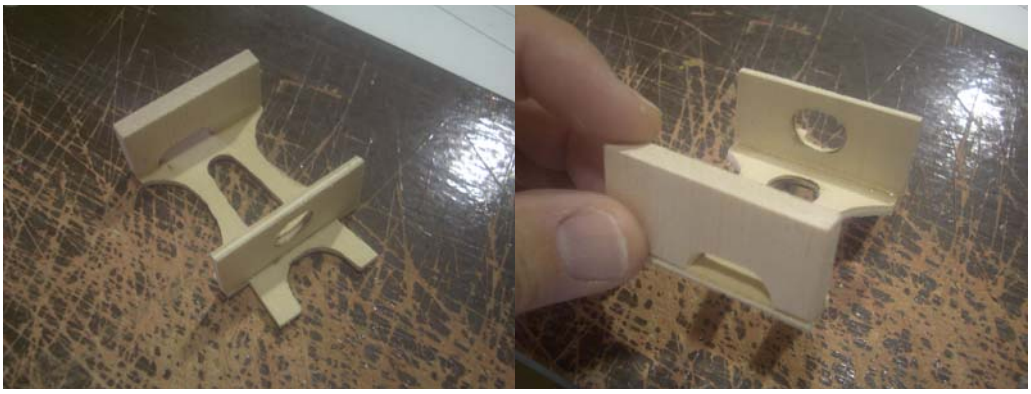
- Sand a 45 degree “V” shaped bevel on the front edge of the elevator and Rudder. Leave about 1/16” flat on the center of the edge where you drew the centerline mark.

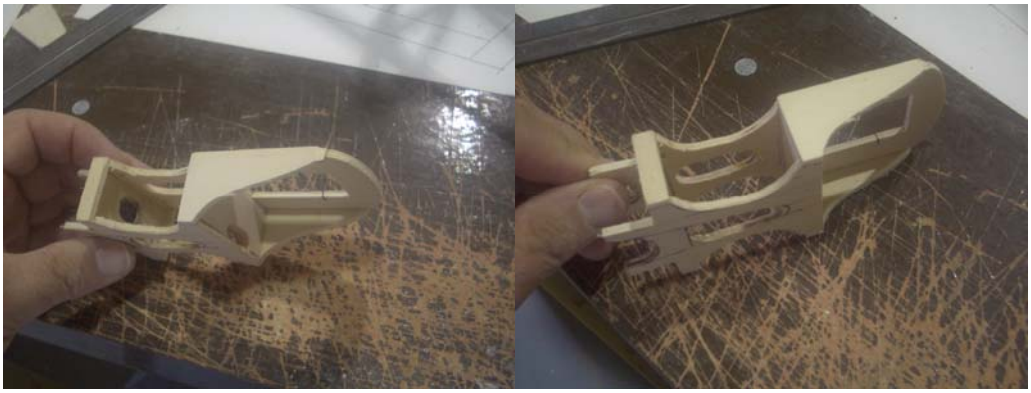
    - Optional: If you desire more than 45 degrees of elevator throw, also bevel a 15 degree “V” bevel into the back of the stabilizer. It is not possible to achieve more than 48 degrees of rudder throw unless you modify the shape of the elevator to prevent interference. To do this, remove some of the inside of the elevator where the rudder will contact it. Add a thicker gusset if necessary.

- The trailing edges of the elevators and rudder may be sanded in one of two manners.
    - Just round the edges as was done on the leading edges. The advantage of this method is resistance to warping. The disadvantage is a slightly heavier surface.
    - Or, sand the entire surface to a tapered edge, about 1/8” to 1/16” thick at the trailing edge. The advantage is weight savings and cosmetic appearance. The disadvantage is a tendency to warp (which can be fixed by re-heating the monokote while holding the surfaces straight.)

- The tip of the elevators remains squared. The tip of the rudder is rounded.

- There are a few things to point out:
    - There are three triangles (one in each surface) cut from 3/8” ply which are hard points for the flying wires.
        - Optional: To save weight, you may eliminate the ply hard points and just drill holes in the balsa. Reinforce the holes with thin CA to prevent the flying wires from opening the hole. You can also drill an oversize hole in the balsa and insert a 3/8” hardwood dowel (not supplied) to drill for the flying wires.
    - The tips of the elevators are left squared off.
    - The top of the rudder is rounded.





- Build the servo box as shown in the photos with **medium CA**. There are 7 **lite ply** parts and one **¼" thick balsa** part, all of which are pre-cut. Build it square. Check the fit with the servos you plan to use for the elevators and rudder. Most standard size servos will fit.

- Now is the time to hinge the elevators and Rudder. The direct drive system requires the use of the supplied Dubro pinned hinges.
    - You will use three hinges in each elevator half. The rudder uses three above the servo and two below.
    - The hinges are ½" in width. Mark the 6 locations where the hinges will be placed on the stabilizers. Place a mark where the edge of each hinge will be.
    - Using a fresh cutoff disc with your dremel, carefully cut the slots straight into the stabilizer along the center line markings you made earlier. Cut until the disc mandrel touches the surface. Work the disc back and forth so the mandrel reaches each of your hinge edge marks you made.
    - The resulting hinge slots will be a little to large for the hinge, allowing some slop to align the hinges.

- Thread a .047 piano wire through six hinges, orienting the first three in one direction, and the other three in the opposite direction.
- Mix your 5 minute epoxy and, using a flat tool, scrape some into each of your hinge slots. Hold the elevator vertically, so gravity will pull the epoxy into the slots. Fill the slots.
- Now work your hinges into the slots, while they are still on the piano wire. Using your tabletop, momentarily turn your stabilizer over and press the hinges into place all at the same time using the top of the table. Press until the piano wire contacts the stabilizer along the entire length. Immediately return the stabilizer back over so the epoxy will not run out onto the hinges.
- As you wait for the epoxy to set, wipe the excess from around each hinge. Use a paper towel soaked with alcohol.
- When the epoxy becomes rubbery, begin to twist the piano wire to free it from the inevitable overflow of epoxy. If you do this to soon, the epoxy will tend to reattach itself to the wire. Wait a minute and try again. When the curing is just right, the wire will break loose with a little effort and remain free. Wait too long and you will have to do some scraping to get the wire out of the hinges.
    - Use a hobby knife to scrape the epoxy from the wire as you turn it.
    - Remove the wire from the hinges.
    - Gently cut any excess epoxy from the hinges with the hobby knife while it is still pliant.

- Install each elevator half as follows:
    - Hold the elevator in place against the stabilizer and mark the location of the three hinges.
        - There should be a 1/16” gap between the stabilizer and the elevator balance tab.
    - Cut your slots as before.
    - Thread the piano wire back into your stabilizer hinges, installing the second half of each hinge as you go. Work on one side at a time and thread the wire from the inside to the outside, stopping when it reaches the edge of the stabilizer.
    - Mix your epoxy and fill each elevator hinge slot as before.

- Holding the elevator vertical, work the stabilizer with the hinges down into the slots. Push until the piano wire contacts the stabilizer for the whole length.
- Wipe excess epoxy as it is curing.
- Once the epoxy has cured to a rubbery state, remove the piano wire by twisting.
    - Remove any excess epoxy with the hobby knife while it is still pliant.
- Repeat with the second elevator half.

- Install 5 hinges into the rudder using the same technique used for the elevators.

- Match and install the three upper hinges into the front vertical stabilizer post. The lower two hinges will mount into the tail of the fuselage and will be installed later.

- Form your piano wire hinge pins as follows:
    - Use side cutters to cut a small piece off the end of a .047" piano wire. This will leave a sharp edge at the end of the wire.
    - Starting from the inside of one elevator, thread the sharp end of the wire through the hinges. When the wire hits the balsa balance tab at the outside of the elevator, begin to twist the wire and "drill" it through the balsa.
        - Once it is through the first balsa diagonal, push it to the elevator end balsa and drill through this also. Be sure to keep the wire in line with the hinges while you are doing this.
        - Remove the wire. Using a drill bit the same size as the nylon hinge pin guide tube, enlarge the hole you just made through the end of the elevator.
        - Cut the guide tube to size and slide into the elevator.
        - Push a piece of piano wire through the tube and adjust the position of the tube so the wire will easily enter the outer hinge.
        - When satisfied, lock the guide tube in place with some thin CA.

- Cut and form a hinge pin for the elevator in the same fashion as is shown here for the aileron. The wire loop will be held in place with a #2 sheet metal screw and #2 washer into the edge of the elevator surface.
- Using a file or grinder, form a blunt point on the tip of your hinge pin. This will make it easier to install the pin through the hinges.
- Check your elevator travel for 45 degrees each direction. You will have to sand the elevator balance tab just forward of the hinge line to clear the stabilizer. Sand only enough to obtain the full 45 degrees of travel, but no more.

- Form the hinge pin for the opposite elevator in the same way.

- Form the rudder hinge pins. The rudder will use two pins. One will start at the top and slide down through the upper three hinges. It is secured with a #2 sheet metal screw and washer into the forward stabilizer post. The lower pin will start at the bottom and go up through the lower two hinges. This will later be secured with a sheet metal screw into the fuselage tail.

- Set your tail assemblies aside on a flat surface for now.