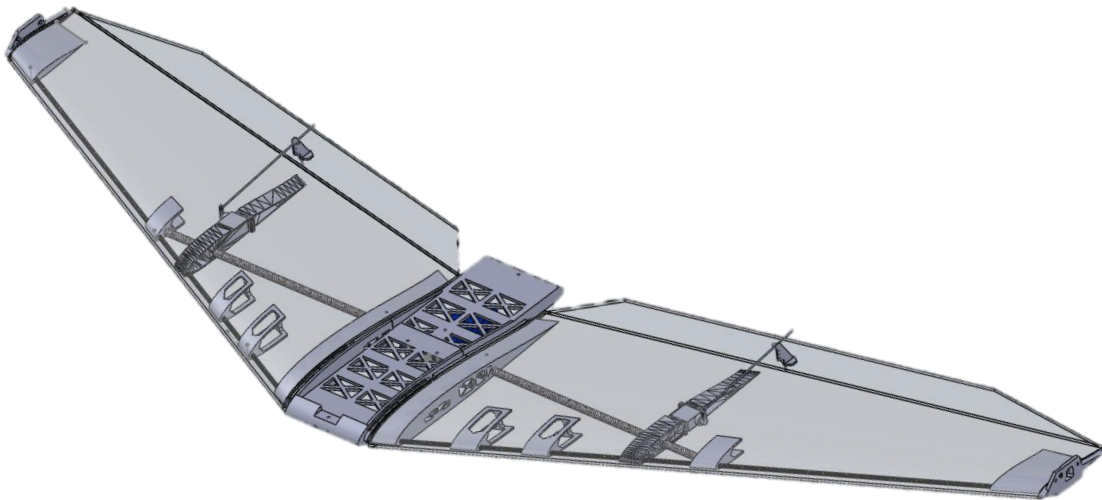


EcoSoar UAS

Manufacturing Guidelines

Virginia Tech Unmanned Systems Lab



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Introduction

- This is an instructional document aimed to go along with the EcoSoar Building Tutorial video series. There are multiple quality checks*
- Wing shape is very important. Do not underestimate the effects of bumpy or bruised foamboard on flight characteristics.

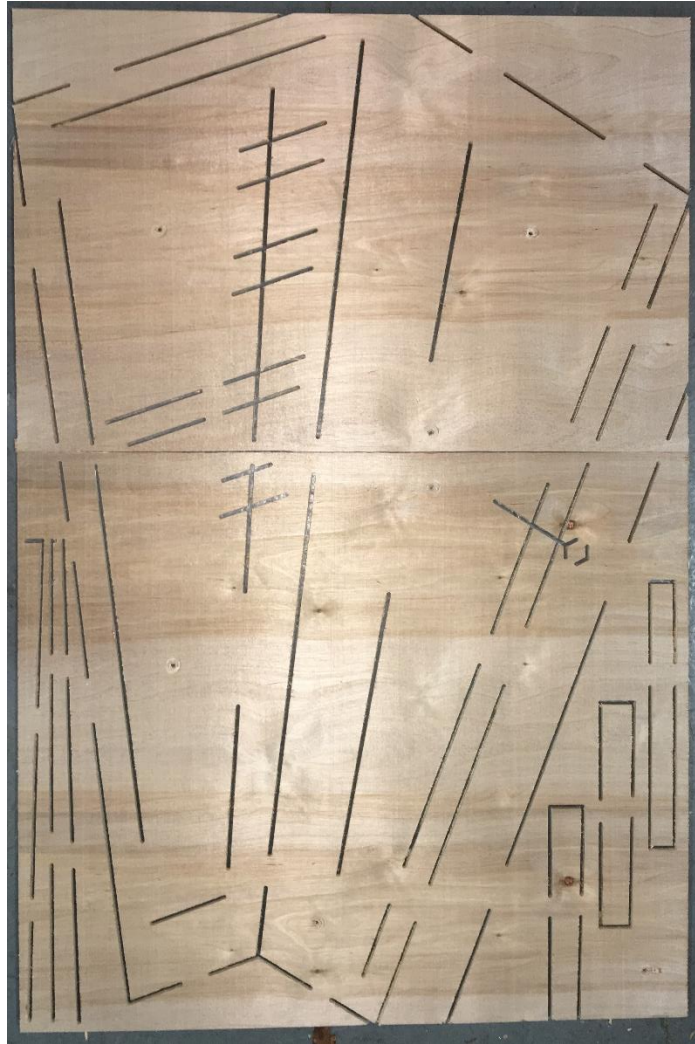


Basic Skills Required

- Using a box cutter:
 - Through Cut – using straight edge cut all the way through foamboard along cut lines
 - 1% cut – cut just enough to pierce top layer of paper along bend lines
 - 90% cut – cut through about 90% of the foamboard, essentially leaving only the paper on bottom side to create a hinge on the hinge lines
 - 45degree cuts – slits along hinge lines, again without cutting through the foamboard to add rotation to the hinge
- Using a hot glue gun:
 - Glue a consistent amount in different patterns

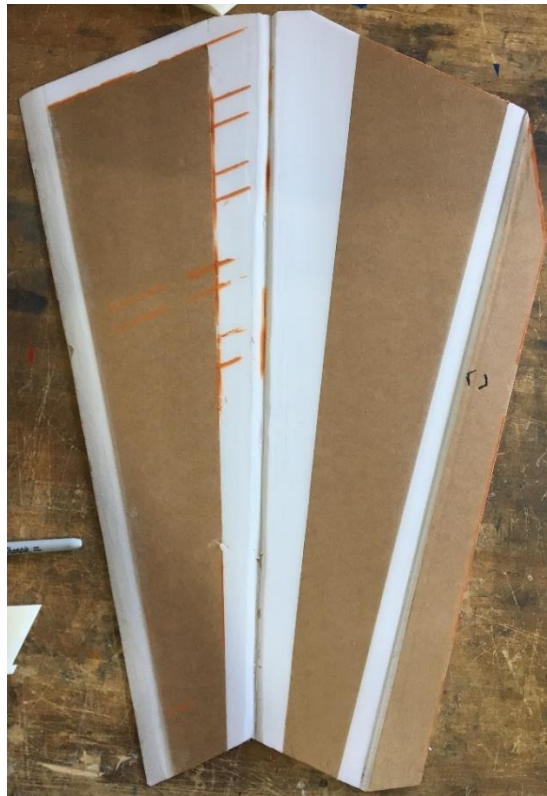
Getting Started

- The EcoSoar wing template is a CNC cut board which is used to locate foamboard cut lines, hinge lines, and part placement lines. It is a key component to turning pieces of 20"x30" foamboard into wings.
- The template shows where to cut the foamboard, place parts, and make hinges. Follow the instructions to figure out which lines are which.



- Align template to a piece of foamboard, then make markings using either a thin marker/pencil or spray-paint. Remove template and retrace lines for completion.

- Remove foamboard on outside parameter of the markings, along the cut lines.
- Perform a 90% cut along hinge lines at leading edge and control surface locations.
- Perform a 45degree cut along both sides of leading edge hinge line.
 - Alternatively, you may sand down the foam here
- Perform a 45 degree cut along the outside of the control surface **hinge line**.
 - Alternatively, you may sand down the foam here. It is generally easier to sand after taping (next page)
- Gently score and remove paper in marked locations to allow foamboard to bend. This will be between bend liens at the quarter chord location on the bottom and the third chord location on the top.
- Gently score and remove paper on the **trailing edges** for a **glue connection spot**. This is done because hot glue attaches better foam to foam.



- Tape outside surface, this is done to reduce skin friction and waterproof the foamboard.
 - Make sure tape is very tight and without air bubbles
 - It is often best to smooth half the tape (along the length) at a time to ensure that the tape stays flat during application.
 - A 1/8" overlap is sufficient for each strip of tape.
 - Optional: differentiate the color scheme, this can help discern the top and bottom surfaces while in flight
- After taping, cut excess tape off foamboard and add the **control horn** marking to the taped side
- Sand down **connections regions** at an angle to form a tapered edge.
- Shape the bending regions with a straightedge.



Control Surface – Part I

- To strengthen the control surface, squeegee hot glue along the hinge. This is done by either cutting or sanding down to

the paper of the control hinge, then applying glue.

- Tape the bottom of the control surface.
- Tape the hinge allowing only slight overlap (about 1/8-3/8") into the connection region. It is best to apply tape when the hinge is bent over a corner like the side of a table.

Part Assembly & Placement

- Assemble parts as shown in picture.
- Align parts on top of markings
- Cut spars to size:
 - Main Spar: 29.75"
 - 4mm Spar: 27"?
- Wiring instructions, wire chase
- Servo note – make sure servo is zeroed perpendicular to servo pointing up out of respective wing.
- Cut out small hole for servo arm.
- Layout wing pieces and check that the appropriate parts (left or right) are used.
- Insert 8mm spar through wing-root, servo-rib, and spar end cap.
- Insert 3mm spar through all wing parts to align.
- Use alignment ridge on the bottom of the wing-root and apply pressure down, and towards the wing to maintain proper alignment.



Closing the Wings

- Make hole for servo arms
- Sand down locations of glue connection on trailing edges.
- Order of glue placements
 - L.E. Parts
 - Spar Joint
 - Servo Rib
 - Winglet Holder
 - Wing Root
 - Foam bridge
 - T.E. Connecting region

Control Surface – Part II

- Glue servo horn down, placement according to template. Note, the holes of the servo horn should be in line with the control surface hinge.

- Control rods - z-bend servo arm side and use rod linkages for servo horn side. May have to drill out hole in servo arms.