



**LaACES
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Course**

Constructing a Standard LaACES Octagon Payload Box



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In this Lecture

- This lecture will cover the steps needed to construct a standard LaACES octagon payload box
- Materials used in this lecture are:
 - Polystyrene foam sheet 3000 cm² (1.4 cm thick)
 - Straight edge/right angle tool
 - Sharpie
 - Band saw
 - Sandpaper
 - Roll of masking tape
 - Polyurethane glue
 - Clamps
 - Tongue depressor
 - Dremel tool
 - Straws
 - Roll of econokote
 - Heat sealing iron
 - 4 plastic grommets



Cutting the Foam

- The enclosure will be an octagonal cylinder 24.4 cm tall with octagon edge lengths of 7.65 cm
- Start by cutting 4 squares of polystyrene foam
 - 2 squares (15.7 cm x 15.7 cm)
 - 2 squares (18.5 cm x 18.5 cm)
- Measure out the octagon sides using right isosceles triangles in the corners (4.6 cm edges for small square, 5.4 cm for large square)
- The smaller octagon should have edge lengths of 6.4 cm and 7.7 cm for the larger

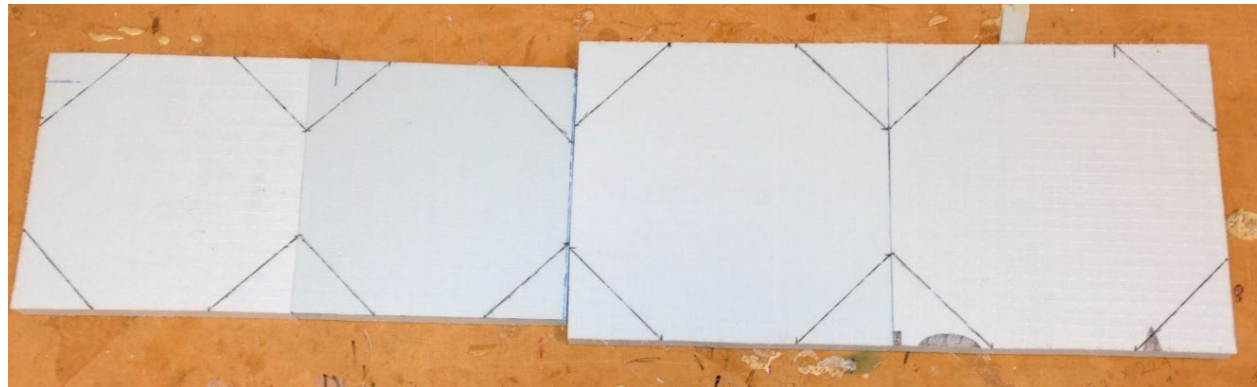


Figure 1: Make 2 different sized octagons from the four squares



Cutting the Foam

- Make the cuts for the octagon using a bandsaw or exacto knife
- If using a bandsaw, you can use a guide such as the one pictured, set at 45°, to help make the cuts.

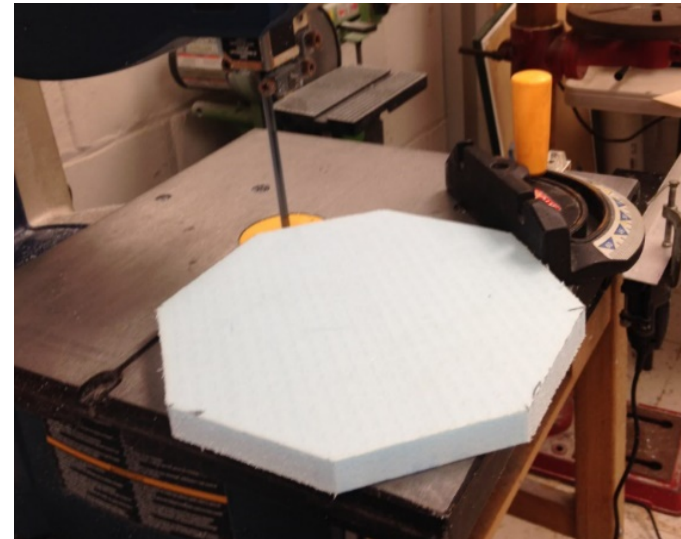
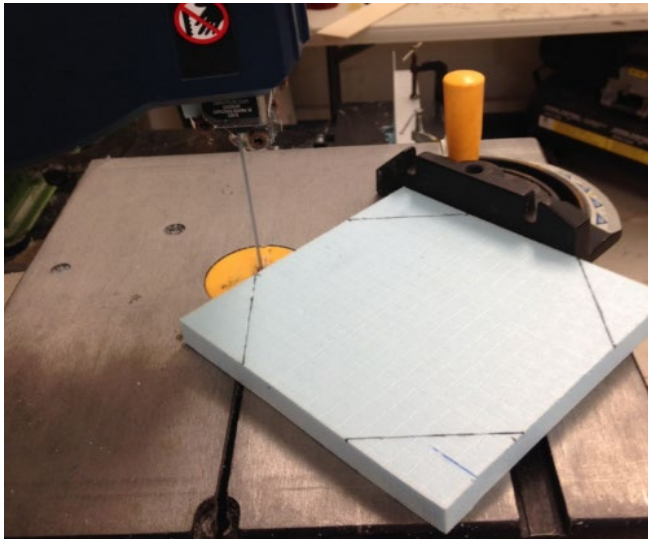


Figure 2: Make the cuts for the octagon with a band saw, using the guide to help



Making the Endcap

- Apply polyurethane glue to one side of the smaller octagon
- Place the smaller octagon in the center of the larger octagon
- Use clamps or weights to apply pressure as the glue cures
 - DO NOT clamp directly onto the foam
- Once the glue is cured, drill two holes on opposite corners of the top of the endcap (17cm apart) for the flight string to pass through



Figure 3: Gluing the endcap together



Cutting the Housing Walls

- Now cut the 8 pieces that make the walls of your payload
- These cuts will need to be made at a 22.5° angle on both sides
- To set up for 22.5° cuts, angle the bandsaw to 22.5° and use clamps and metal 90's to improve the accuracy of the cuts
- The distance between where the blade goes through the platform and the bottom of the metal 90 is 7.1 cm
- Make the cuts on both sides, you should have eight 23 cm long pieces



Figure 4: Bandsaw table angled at 22.5° for the wall cuts



Cutting the Housing Walls

- If a band saw is not available use the mitered corner guide to make the cuts for the wall found in the “Construction Considerations and Techniques” lecture
- Use equation $W = 2(R)\tan(\pi/N)$ to determine the width of your cuts
 - $R = 8.5$ cm and $N = 8$ in this case
- You will make 8 of these cuts on a XPS foam sheet
 - Dimensions: (23cm x 61.6cm)
- This will form the walls of your payload housing



Making Mounting Grooves

- You will now cut grooves on 4 of the wall pieces for straw mounting using the Dremel tool
- The spacing between the metal 90 and the Dremel bit is 0.5 cm.
- The diameter and height of the Dremel bit are both 0.5 cm
- Make sure the longer edge of the wall piece is facing up



Figure 5: Setting up the Dremel tool and making grooves for the straws



Preparing the Walls

- From here, the place the pieces in a line and tape the long edges together, placing grooved edges next to each other for the 2 straw holes
- Dampen one side of each side piece and place polyurethane glue on the other.
- Apply glue to the edges of the small octagon you cut earlier, and glue it to the inside ring of the wall pieces at one end



Figure 6: Tape the walls together on the outside

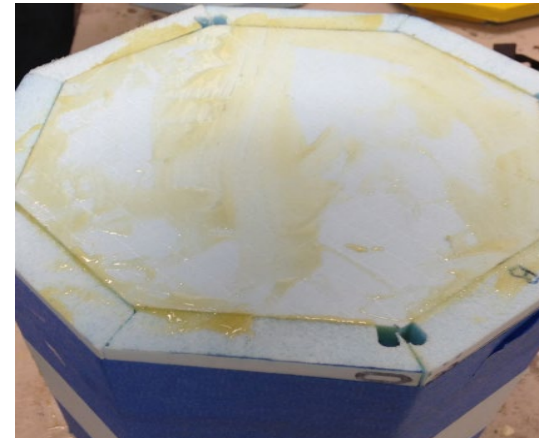


Figure 7: Tape the walls up and allow the glue to cure



Making the Base

- Once the glue on the smaller octagon has cured, apply glue to one side of your last large octagon piece
- Glue the large octagon onto the closed end so that it is flush with the payload walls
- Apply pressure with weights as the glue cures
- Drill two holes into the base to make clean straw holes
- Glue straws into the grooves you cut in the walls



Figure 8: Glue the large octagon to the end



Figure 9: Make straw holes in the base



Applying External Coating

- Use your heat sealing iron to apply a layer of econokote to the entire outside of the payload
- To prevent air bubbles it is best to start in the middle and work your way out to the edge while applying the econokote
- Puncture the econokote where the straw mounting holes are and glue plastic grommets in the holes
- Adding plastic grommets to the end cap and base will further secure the flight strings and keep the strings from wearing away at the foam.



Figure 9: Applying econokote to the endcap



Adding Internal Features

- Once the payload is finished you can add foam inserts and mounts as needed to secure your payload components inside the housing
- See the “Payload Construction Considerations & Techniques” lecture for more ideas



Figure 10: An top-view of an old LaACES video payload with foam inserts and mountings



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References