Essence Aerospace Technologies (EAT) – Interstellar Probe – Plan Pak

Overview:

We hope you enjoy this Plan Pak of our version of our Interstellar Probe. This rocket is fairly straightforward, however, due to some less-than-typical techniques, requires careful considerations during the build and finishing process. The most important thing to remember is to read the entire instruction set through before starting. Special attention to detail is presented throughout these instructions and we caution any deviation. EAT can not be responsible for any poor performance if built differently than described below.

Other pre-cautions:

- Do not substitute Epoxy for the White/Yellow Glue (except where noted)
- Do not substitute CA (Super Glue) for the White/Yellow Glue (except where noted)
- Do not add an Estes-type Motor Hook
- Do not Fiberglass the Fins
- Do not substitute Basswood or G10 for the Balsa Fins

We're sure you will enjoy flying this rocket, especially noting the transition from booster to sustainer. There will only a small number of them on the field. If you enjoy this rocket, please let us know. If you need any assistance, please let us know. If you hated this rocket, please let us know.

Plan Pak Parts:

- 1x Cardstock Cone Fin (Printed on 110 lb cardstock)
- 1x Tube Marking Guide (Printed on 110 lb cardstock)
- Decals (optional – printed on decal paper of choice)

Purchase Parts:

- 1x 3mm (1/8") Balsa Piece (5" x 6") (Balsa Machine Services– BS18636)
- 2x BT50 Body Tubes (6.64" and 4") (Balsa Machine Services– T50-34)
- 2x 18mm Motor Mount Tubes (2.75") (Balsa Machine Services– T20-EMT)
- 2x 18mm Motor Thrust Rings (Balsa Machine Services– CR520-P)
- 4x 18mm Centering Rings (Balsa Machine Services– CR2050-F)
- 1x Balsa Nose Cone (Balsa Machine Services- BMS50HJ)
- 1x Cone Fin Centering Ring (Balsa Machine Services– CR5060-F)
- 1x Body Tube Coupler (Balsa Machine Services– C50-1)
- 1x 1/8" Launch Lug (Balsa Machine Services– LL18-125)
- 1x Kevlar Shock Tether (24") (Balsa Machine Services– KC28-10)
- 1x Eye-Screw (medium size) (Balsa Machine Services– SE-W12)
- 1x ¼"-wide Elastic Shock Cord (24") (fabric store)
- 3x Washers (Fender washers ¾" diameter) (hardware store)
- 1x 48" x 1" Plastic Streamer (hardware store)
- 2x Hole Strengtheners (office supply store)
- *optional* - ASP Mylar Sport 'Chute (15")

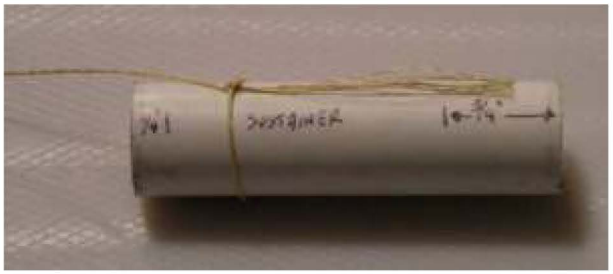
Tools Needed:

- Pencil
- Ruler
- Scissors
- Hobby Knife (Sharp is very important - change the blade to start this project)
- White/Yellow Glue – We ***strongly*** recommend against substituting any other glue unless noted
- CA Glue (Super Glue) (*optional*)
- 5-Minute Epoxy (*optional*)
- Sand Paper (220 grit)
- Filler (Elmers' Fill-n-Finish, Light Spackle, or Bondo Glazing Putty work)

Step 1 – Motor Mounts:

- Ruler
- Pencil
- White **or** Yellow Glue
- 2x 18mm Tube (2.75")
- 2x 18mm Motor Thrust Ring
- 4x 18mm Centering Rings
- 1x Kevlar Shock Tether

Sustainer: Mark one of the 18mm motor casing using a pencil at 1/4" from one end and 3/4" from the other.



On the side marked 1/4", place a narrow ring of glue on the inside surface, at the top, of the motor tube and insert one of the thrust rings into the tube until it is flush with the motor tube edge.

Tie the Kevlar Shock Tether around the sustainer motor tube. Make a double-knot (clear the frayed edges of Kevlar).

Thread the Kevlar through one centering ring and slide it onto the motor tube. Place a ring of glue around the motor tube at the 1/4" mark. Slide the centering ring down into the glue and align at the 1/4" mark. Pull the Kevlar and slide the tied ring up to meet the centering ring.

Place a second centering ring onto the motor tube on the side marked 3/4". Place a ring of glue around the motor tube at the 3/4" mark. Slide the centering ring down into the glue and align to the 3/4" mark.

Set assembly aside to dry.

Booster: Mark the other 18mm motor casing using a pencil at 1/4" from each end.

On one side marked 1/4", place a narrow ring of glue on the inside surface, at the top, of the motor tube and insert one of the thrust rings into the tube until it is flush with the motor tube edge.

Place a centering ring onto the motor tube on the side marked 1/4". Place a ring of glue around the motor tube at the 1/4" mark. Slide the centering ring down into the glue and align to the 1/4" mark.

Repeat for the other side.

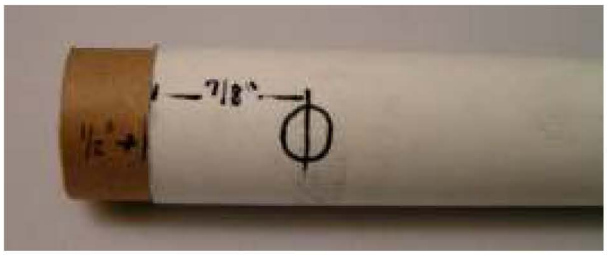
Set assembly aside to dry.

Sustainer <u>and</u> Booster: Add a fillet of glue around both sides of each centering ring. To keep the glue from running, set on end and only do one side (the one facing up) at a time.

Set aside to dry.

Step 2 – Booster Tube Assembly:

- Sharp Hobby Knife
- Ruler
- Pencil
- White **and** Yellow Glue
- 1x Body Tubes (4")
- 1x Body Tube Coupler
- 1x Cardstock Cone Fin
- 1x Cone Fin Centering Ring
- Booster Motor Assembly (from step #1)



Mark the Booster Body Tube 7/8" from the end that the Coupler will be installed. Draw a ¼" circle with the center at the 7/8" mark. With a sharp hobby knife, cut out this circle on the outside of the lines so that the hole is slightly larger than ¼". This is the booster vent hole.

Mark the Body Tube Coupler at ½". Place a ring of glue around one end of the Booster Body Tube (4"). Slide the Body Tube Coupler, with a twisting motion, into the Booster Body Tube up to the ½" Mark.

Place an ample ring of glue on the inside of the Body Tube (4") at the opposite end of the Coupler. **Insert the Booster Assembly** (from step #1), with a twisting motion, and push up until it is completely flush with the bottom of the Body Tube.

Set aside to dry.

Cut out the Booster Cone Fin and Boost Cone Fin Glue Tab. Be sure to cut on the outer edge of the lines. Use a sharp hobby knife to cut out the Launch Rod Hole (not shown).

Using your finger, smear an even, thin coat of **WHITE GLUE** on one side of the Glue Tab and place the Cone Fin onto it. Align it to the dashed line and press firmly and smoothly.

Set aside to dry (at least 30 minutes).

Pre-Shaping the Cone Fin: Using the edge of a table, apply even pressure on the upper side of the Cone Fin at the table edge point. Roll the cone off of the table while following the curve of the Cone Fin (pivoting from the center). The objective is that the table edge is always an equal distance (straight) across the cone. Use your second hand to guide and to pivot the Cone Fin while rolling it off the table.

Using your finger, smear an even, thin coat of **WHITE GLUE** on exposed side of the Glue Tab. Be sure to get it all the way to the inside edge.

Attach the opposite side of the Cone Fin onto the tab and hold, press, smooth, hold, press, smooth, hold, press, and smooth until it is held in place.

Be cautious of rubbing on the outside with your finger too hard as the glue will soften the paper and will cause it to degrade with the rubbing motion. Set aside to dry.

Once dry, test the fit onto the Booster Body Tube. Trim, if needed with a sharp hobby knife.

Attaching the Cone Fin: Place a ring of glue at the upper edge of the Body Tube on the side of the Coupler. Slide the Cone Fin over the top and bring down until the top of the Cone Fin is even with the top of the Body Tube (the Coupler should be sticking out). Set aside to dry.

Installing the Cone Fin Centering Ring: Place the black fiber Centering Ring on the bottom of the Booster Tube. It should be a snug fit, but sand the inside edge slightly, if needed. Using two pencils or pens, press the ring down evenly until it ***just*** touches the Cone Fin evenly on the outside edge. Don't push down so far that it deforms that Cone Fin. Check to see that the cone is even. Using a spare piece of balsa or some folded paper, place some glue on the inside edge and Booster Tube to prevent the Centering Ring from moving. NOTE: The Booster Vent should be cleared if all the prior steps were performed correctly.

(*Optional*) Strengthen the Booster Joint: Using CA glue, soak the outside of the Booster Coupler. Once thoroughly dry, it will need to be sanded to fit into the Sustainer. That can be done at the end of construction.

Once dry, use 5-Minute epoxy and place a thin coat of epoxy on the inside edge of the coupler.

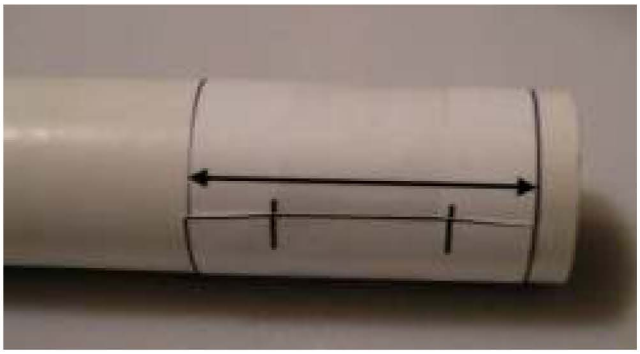
Step 3 – Sustainer Tube Assembly:

- Sharp Hobby Knife
- Ruler
- Pencil
- White **or** Yellow Glue
- Sand Paper (220 grit)
- 1x 3mm (1/8") Balsa Piece (5" x 6")
- 1x Body Tubes (6.64")
- 1x Tube Marking Guide
- 1x 1/8" Launch Lug
- Sustainer Motor Assembly (from step #1)

Insert the Kevlar shock cord tether through the Sustainer Motor tube so that it is strung out the bottom (and out of the way).

Using a piece of balsa (or stick, or chop-stick), place an ample ring of glue at least ½" up, on the inside of the Body Tube (6.64"). **Insert the Sustainer Assembly** (from step #1), with a twisting motion, and push up until it is completely flush with the bottom of the Body Tube.

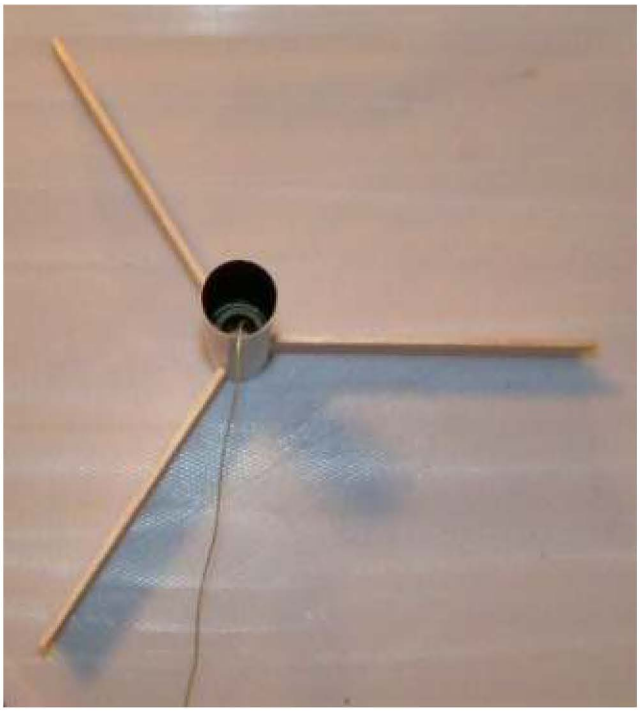
Set aside to dry.



Cut out the Fin Marking Guide. Wrap it around the bottom (end with motor mount) of the Body Tube. Align the marks and tape in position. Using a pencil mark each of the (3) three fin lines at the top and bottom of the Marking Guide.

Remove the Guide. Using a door-jam or other straight-edge, draw a line between the two marks and extend 2" from the bottom of the Body Tube.

Cut out the Fins: Very simple. Take the 5" x 6" Balsa and cut into (3) three 5" x 2" Fins along the grain line. I use a T-Square and mark at 2" from the side, then align the T-Square to the 2" mark and with a couple of passes cut off the 2" wide fin. Then I repeat. Place all the fins together and sand to ensure all are the same size.



Utilize a **"Double Glue" method** to attach the fins. Double Glue Joint: Put a thin coat of glue on the root edge (edge that glues onto the body tube). Wipe off any excess glue off from the coat you just put on the root edge of the fin. You don't need much glue for this. All you need is a thin, flat film of glue. Let it dry before gluing onto the body tube.

Rough up the Body Tube along the left side of each Fin Line using Sand Paper. Just take the shininess off. Brush off the dust.

Glue each Fin to the Body Tube on the left side of each Fin Line so that it is even with the back of the Body Tube and aligned perpendicular (straight up) from the Body Tube and straight along the line. Let dry at least 15 minutes in the upright (fin pointing straight up) position. Use a heavy object to hold the Body Tube on a horizontal surface.

Repeat for the other (2) two fins. When drying the back of the Body Tube will need to hang over the table to allow the current Fin to be in the upright position. Use a heavy object to hold and not allow to spin.

After dry, use glue to **make fin fillets** on each side of the joint. Position so that the glue does not run. (*optional:* 5-Minute Epoxy can be used for the fillets, but keep them on the smaller side)

Step 4 – Nose Cone Assembly:

- White Glue
- 1x Balsa Nose Cone
- 3x Washers
- 1x Eye-Screw

Using just the Eye-Screw, screw it into the center of the Nose Cone ¾ of the way. Remove.

Now, force **WHITE GLUE** into hole just made and allow plenty of glue to cover the Nose Cone bottom.

Place the first washer in place and then put some **WHITE GLUE** on the top of the first washer.

Repeat for the second washer.

Place the third washer on top of the second and screw the Eye-Screw in until it is tight against the top of the third washer. **Do NOT over tighten!**

Place **WHITE GLUE** into the hole of the third washer.

Set upright, perhaps inverted (tip on the inside) in the Sustainer Body.

Wipe any excess that got on the shoulder sides. Let Dry thoroughly.

Step 5 – Nose Cone Assembly:

- White **or** Yellow Glue
- 1x Elastic Shock Cord
- Balsa Nose Cone Assembly (from step #4)
- Sustainer Body Assembly (from step #3)

Tie a knot in the Kevlar Shock Tether at about 8" outside of the Body Tube. Make the loop about ¾" diameter.

Tie the Elastic Shock Cord to the loop you just created.

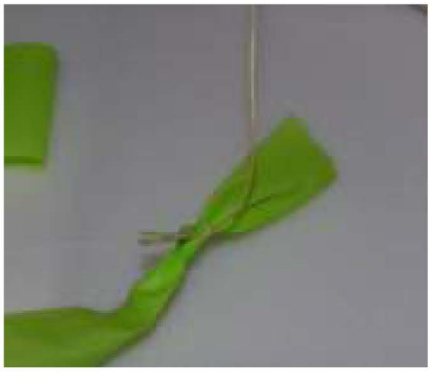
Tie the other end of the Elastic Shock Cord to the Nose Cone Eye-Screw and place a drop of Glue on the knot to secure it.

The remaining section of Kevlar Shock Tether will be used to attach the Streamer (step 6).

Optional: If you desire to use a parachute then trim off the Kevlar leaving just the loop to attach the parachute to. [ASP Mylar Sport 'Chute (15")]

Step 6 – Attaching the Streamer:

- White **or** Yellow Glue
- 1x 48" Streamer
- Sustainer Body Assembly (from step #5)



Nothing magical here. Simply cut off the frayed edges from the Kevlar Leader (the extra line coming off of the knot tied in step #5).

Then tie a double knot **around** the Streamer at about the 1" mark.

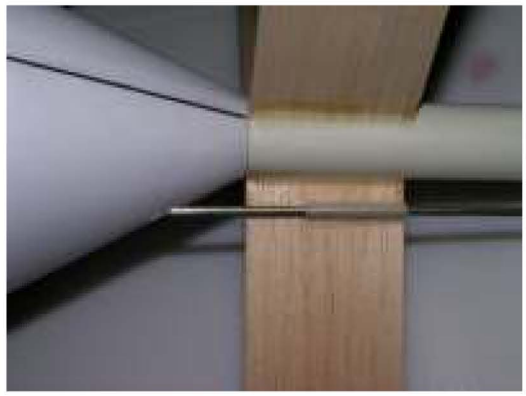
Then tie a single knot **with** the Streamer.

Optional: If you opted for a parachute, assemble the parachute according to the 15" instructions. Then attach to the Kevlar loop – or – to the Nose Cone Eye-Screw.

Step 8 - Booster Test Fit:

- Sand Paper (220 grit)
- Sustainer Body Assembly (from step #5)
- Booster Body Assembly (from step #2)

Slide the Booster into the Sustainer. The fit should be slightly snug, but not take too much force to separate. Sand the Coupler as needed.



Step 8 - Launch Lug Installation:

- White **or** Yellow Glue
- Masking Tape
- Sand Paper (220 grit)
- 1/8" Launch Rod
- Launch Lug

Slide a 1/8" Launch Rod carefully through the Booster Cone Fin and lay it across one of the fins. Turn the Booster body until the Rod is not able to move freely and parallel with the rocket's body. The Rod should clear the Nose Cone's widest part without touching it.

Using sandpaper, slightly rough up one side of the Launch Lug. Slid the Launch Lug onto the Rod and move it down until it is aligned with the top of the Fin's leading edge. Place a line of glue on the Launch Lug (where roughed up) and turn it so that it will adhere to the Fin. Place a piece of Masking Tape over the Lug and onto the Fin so that it will not move. Leave the Rod in place until dry.

Once dry, remove the Rod and fillet both sides of the Launch Lug.

Optional: We have included a small piece of balsa. You my choose to create a stand-off to be attached to the rocket's body. If so, size it, so that the Launch Rod is resting on the stand-off and missing the nose cone. Then glue the Launch Lug to the stand-off.

Step 9 - Finishing:

Finishing the rocket is really up to you but we do have the following recommendations:

- Use Primer in very, very light coats and let dry in-between on the Cone Fin. Have a solid coat prior to painting.
- Plasti-Kote Sandable/Filling Primer is excellent for the Cone Fin and filling nooks and crannies of Balsa
- Don't worry about filling the Fin Balsa if you plan on using the Prismatic Golden Covers (Solar Panels)
- We recommend White for the Body and Nose Cone, Black for Fins, and Gold for the Cone Fin

Step 10 - Preparing for Flight:

- Masking Tape
- Flame Proof Wadding

Recommended Motors: Booster: **B6-0**, C6-0; Sustainer: A8-3, B6-4, **C6-5**

Use masking tape for a friction fit on both 18mm motors. Push each motor up to the thrust ring.

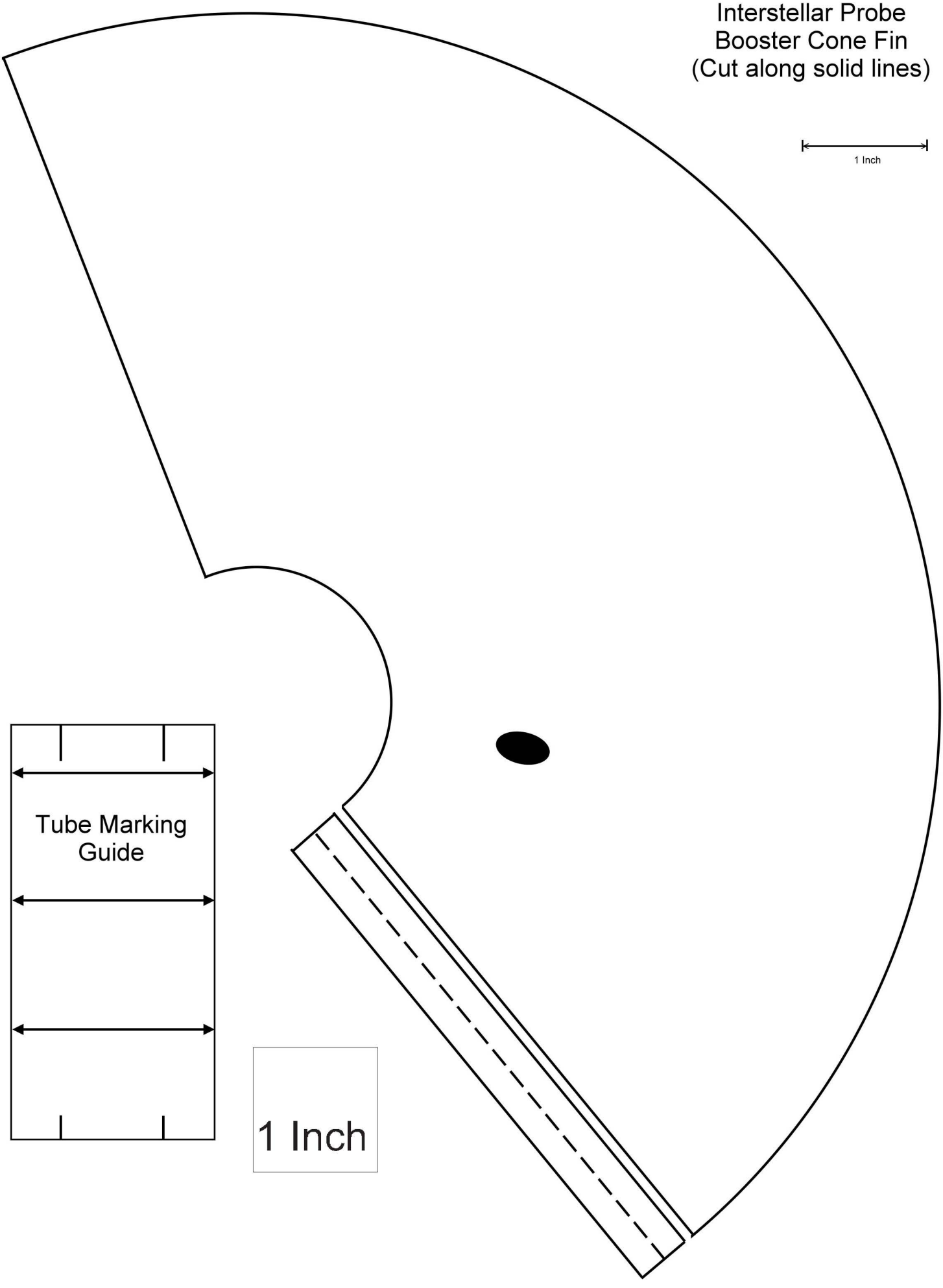
Use enough wadding (3-4 sheets) to protect the streamer. (*optional:* parachute)

Fold the Streamer in half, and then in half again. Then roll. Try to keep at the top of the rocket body (by loading wadding and shock cord first, then the Streamer).

Follow NAR Safety Rules! Avoid windy days! Place on an 1/8" launch rod and let it fly!

Interstellar Probe
Booster Cone Fin
(Cut along solid lines)

1 Inch



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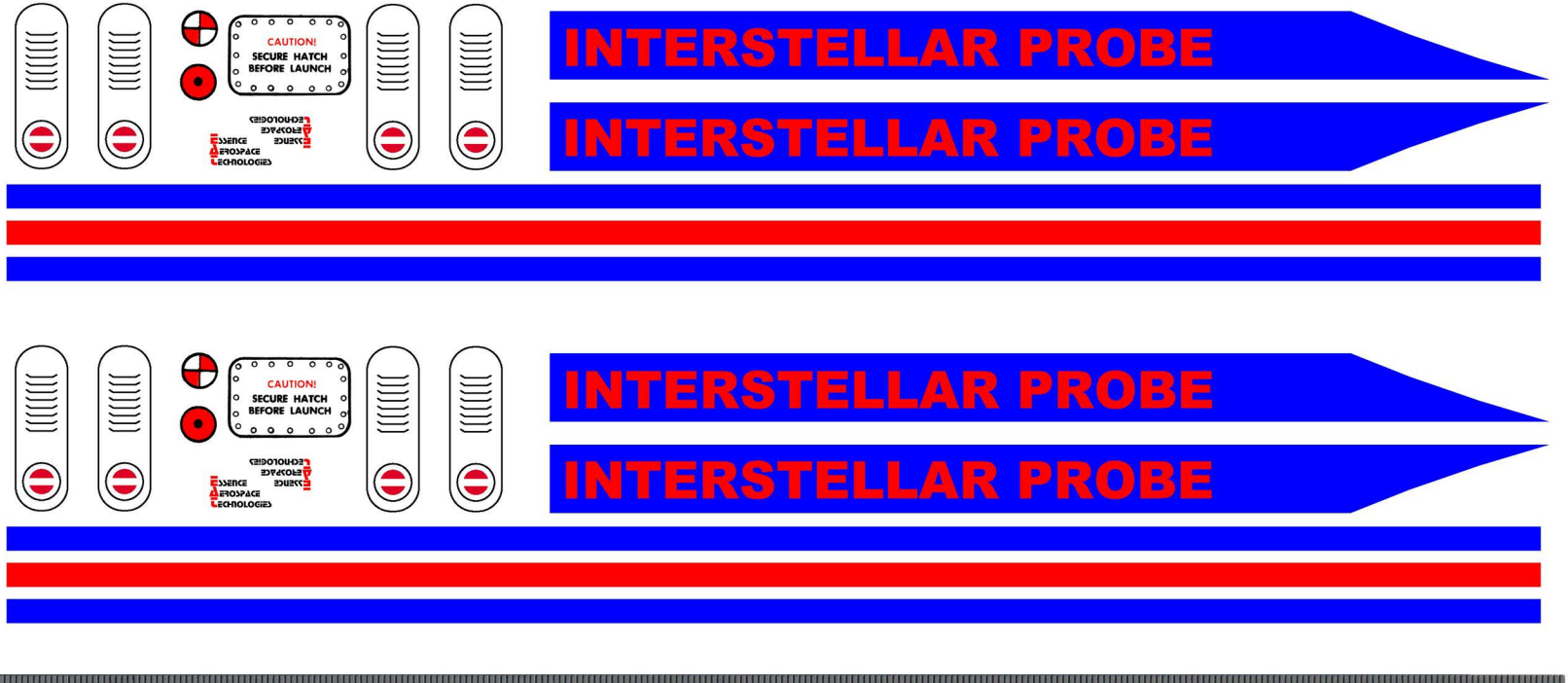
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