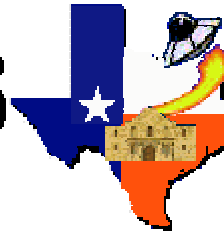


# Art Applewhite Rockets

from deep in the heart of Texas

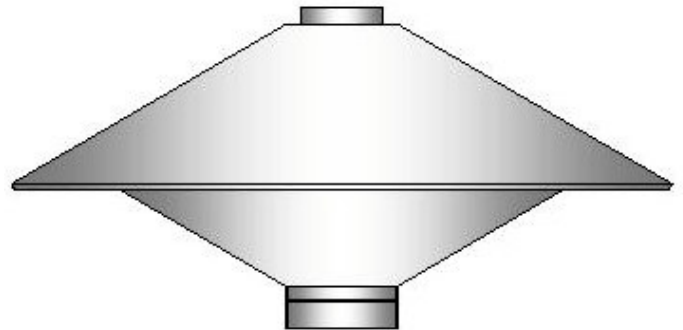
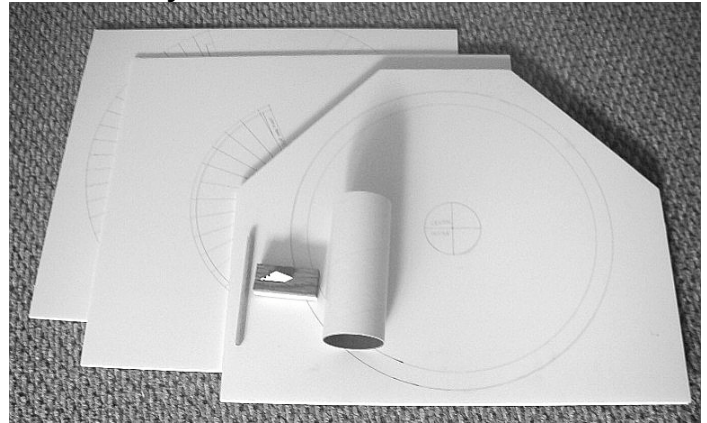


## 18" Delta Flying Saucer Assembly Instructions

Diameter – 18 inches (46cm),  
Height – 8.75 inches (22cm)  
Weight – 24 oz (672gm)

### Parts List

Top, Bottom – 3/16" Foam-backed board  
Center – 1/2" Gatorboard  
Body Tube - 7.5" -x 75mm white paper tube  
Launch Lug - 6" long x 1/4" ID  
54mm & 38mm Motor Mount Kits  
Top and Bottom Seams - Fiberboard  
Fiberglass cloth  
V-Groove Cutting Tool



### Recommended motors:

**54mm:** Ellis Mountain L330P, Pro54, 2 & 3 Grain motors, Aerotech J90W, J180T, J275W

**38mm:** Ellis Mountain I130, J228, J270, Pro38, 4, 5 & 6 grain motors, Aerotech I154W, I161W, I211W, I195J, I284W, J350W

### Tools and supplies needed

Heavy utility knife, #11 X-Acto® knife, Fine-toothed hack saw blade, Scissors, Plastic spatula, Elmer's Glue-All® (white glue), sandpaper, and Epoxy (West Systems 105 Resin, 206 Slow Hardener & 406 Colloidal Silica)

Make sure all the parts in the Parts list are present. Contact [rocket877@aol.com](mailto:rocket877@aol.com) if any parts are missing or damaged.

Tips:

- Read through the entire instructions before beginning.
- Make sure all the parts, tools and supplies are present before beginning.
- Work slowly and carefully, don't get in a hurry.
- Use a new #11 Exacto® knife blade.
- Test fit parts several times before gluing.
- Don't use too much glue
- Work on a clean surface, in a well-lighted and well-ventilated area.
- Wear gloves when working with epoxy.

## **BODY TUBE Preparation**

Note: The names of parts are shown in all capital letters for clarity.

1. Make a pencil line inside the full length of the BODY TUBE. Make sure the line is aligned with the axis of the BODY TUBE. A wide ruler placed inside the BODY TUBE will normally line up perfectly if it is allowed to lay flat against the BODY TUBE.
2. Lightly sand the LAUNCH LUG to remove the glossy finish from it's surface so that the glue will stick better.
3. Glue the LAUNCH LUG on the line inside the BODY TUBE using white glue. One end of the LAUNCH LUG should be even with one end of the BODY TUBE. Do not use too much glue in this step or substitute another kind of glue for white glue. The glue joint will be reinforced in a later step.



## **BOTTOM Assembly**

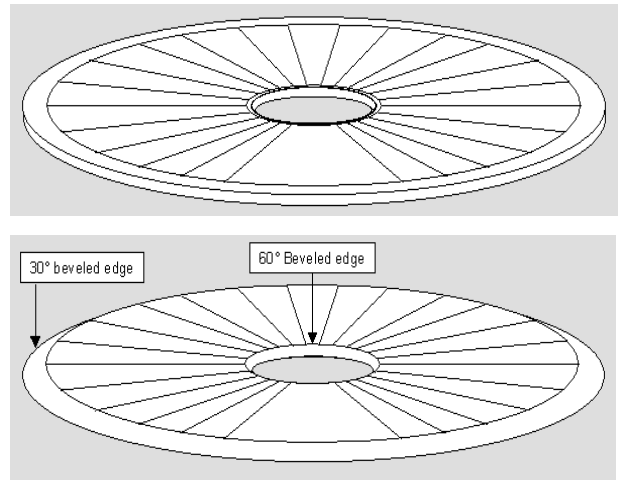
**Note:** The TOP, BOTTOM and CENTER have an INSIDE and OUTSIDE surface and an INNER and OUTER edge. The INSIDE and OUTSIDE surfaces are marked. The INNER edge is the 3" hole in the middle. The OUTER edge is the biggest circle on each piece. In the following steps, make sure you are cutting on the correct surface and edge.

**Note:** Before starting on the BOTTOM, you may want to practice cutting V-grooves on a piece of scrap foamboard

4. On the OUTSIDE surface, cut the BOTTOM out along the circles using a new #11 X-Acto® knife. Make the cuts straight down through the foamboard. It is best to make these cuts in several passes, cutting a little deeper each time and keeping the blade perpendicular with the surface of the foamboard.

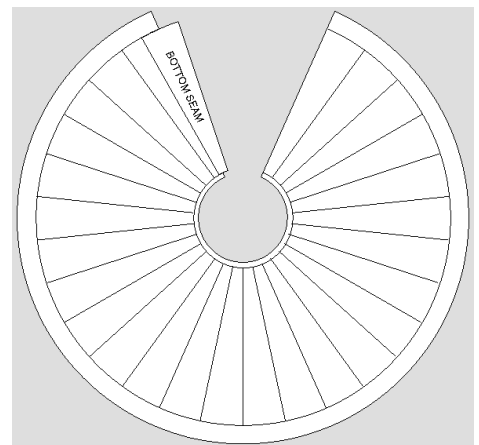
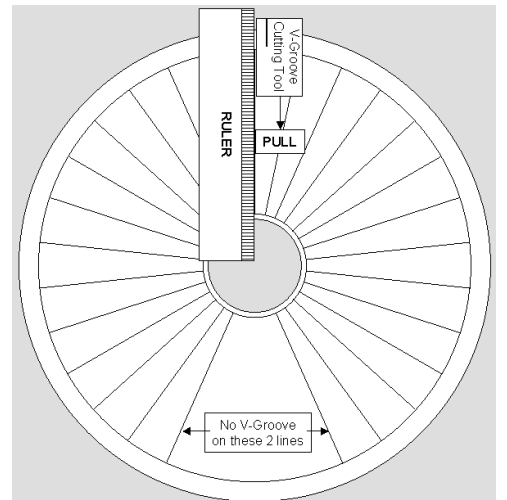
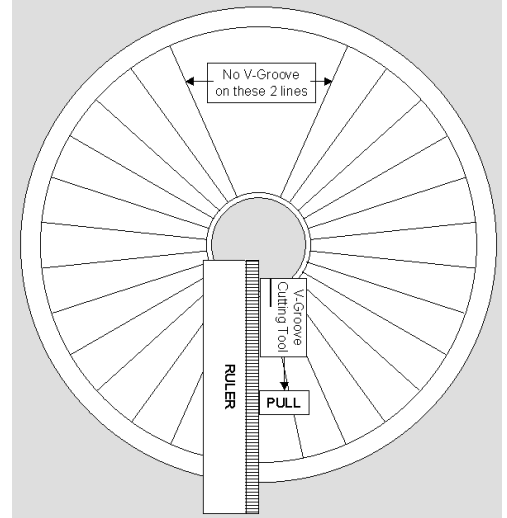
**Note:** A dull knife blade will tear the foam. If the blade begins to drag or tear the foam, replace it with a new one.

5. Flip the BOTTOM over to the INSIDE surface. Make a shallow cut, through the first cardboard layer only, along the remaining circle on the OUTER edge. Slant the blade sharply while making the cut so that the tip of the blade points toward the OUTER edge. On the second pass cut through the foam from the circle to the OUTER edge. The result will be a 30 degree beveled edge around most of the OUTER edge of the BOTTOM. A rough cut is all that is necessary at this point. This edge and the next one will be finished later.
6. Make a shallow cut, through the first cardboard layer only, along the circle on the INNER edge. On the second pass cut through the foam from the line to the INNER edge. The result should be a 60 degree beveled edge.
7. Lay the BOTTOM on a flat surface with the INSIDE surface up. Do not make V-grooves on the first and last lines of the BOTTOM, the lines closest to the open space.



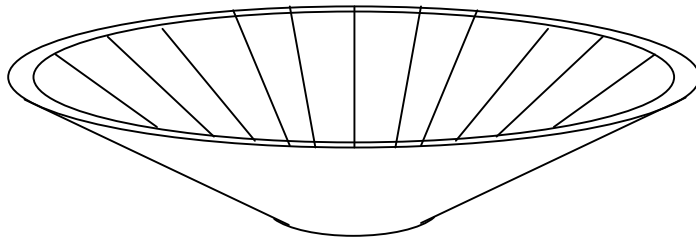
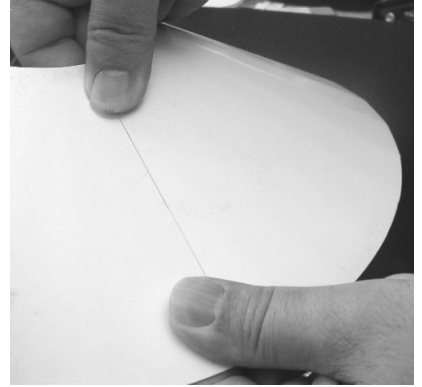
## 18" Delta Flying Saucer Assembly Instructions - Page 3

8. Start cutting the V-grooves on the **INSIDE** surface of the **BOTTOM**. Place the ruler on the bottom half of the **BOTTOM** with the ruler directly on the line. Press the V-groove Cutting Tool against the ruler with the blade pointing down into the center hole. Hold the ruler firmly in place and the V-groove Cutting Tool firmly against the ruler and pull it toward you to the edge. This will make an angled cut, halfway through the thickness of the foamboard. The cut will be about 1/32" away from the line. Rotate the **BOTTOM** slightly and cut the next line. Repeat until all the cuts have been made.
9. Finish the V-grooves by placing the ruler at the top half of the **BOTTOM** and the V-groove Cutting Tool with the blade hanging over the **OUTER** edge. Pull the V-groove Cutting Tool toward the center. The resulting V-groove should be about 1/16" wide and 1/16" deep. Remove the thin, wedge shaped, strips of cardboard and foam.
10. Cut out the remaining wedge-shaped piece from the **BOTTOM** with a #11 X-Acto® knife.
11. Cut out the **BOTTOM SEAM** with a #11 X-Acto® knife.
12. Spread white glue thinly and evenly over the section of the **BOTTOM** on the Inside marked "Glue here first".  
**Note:** The glue will dry more quickly if you don't use too much. Do not substitute another type of glue in this step. Yellow glue or epoxy will not work as well as white glue (trust me).
13. Press the **BOTTOM SEAM** firmly in place but avoid crushing or denting the foamboard. Half of the **BOTTOM SEAM** should extend out past the straight edge of the **BOTTOM**. Let the glue dry completely.
14. Flip the **BOTTOM** over and spread white glue over the remaining exposed part of the **BOTTOM SEAM**. Spread a moderate amount of white glue on the exposed foam edge of the **BOTTOM**. The holes in the foam will absorb most of the glue.
15. Form the **BOTTOM** into a shallow cone with the **BOTTOM SEAM** flat against the **INSIDE** surface and the V-grooves on the inside. Wipe off any excess glue that squeezes out of the seam.

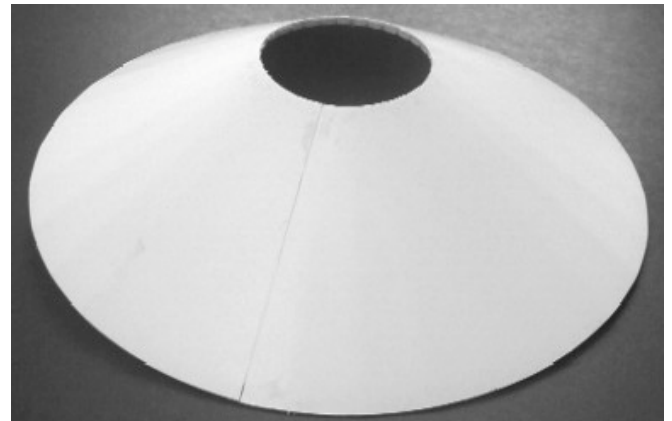


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16. Hold the edges together until the glue is set. If you use clamps be careful not to crush the foam or glue the clamps to the foamboard. The seam should be smooth and flat on the OUTSIDE. Let the glue dry completely. Make a fillet of white glue around the edges of the BOTTOM SEAM on the INSIDE surface.
17. Trim the ends of the BOTTOM SEAM so that they are even with the beveled edges of the foamboard.
18. Lightly sand the INNER edge (now a 3" hole) of the BOTTOM until the BODY TUBE slides snugly but smoothly into it.
19. Lightly sand the OUTER edge of the BOTTOM until it can rest flat against the underside of the CENTER (or other flat surface).
20. The glue should now be dry on the BODY TUBE and LAUNCH LUG. Make a fillet of white glue or epoxy at the joint between the LAUNCH LUG and the BODY TUBE. Do not use too much epoxy. The clearance between the LAUNCH LUG and the 54mm MOTOR MOUNT is tight, so don't get anything on top of the LAUNCH LUG that would make it stick up any higher.



BOTTOM



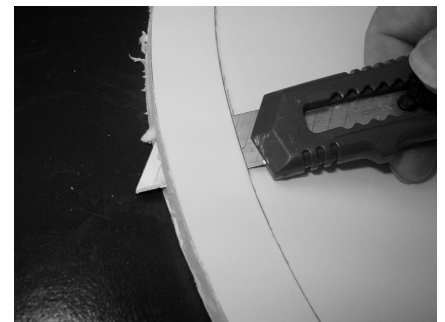
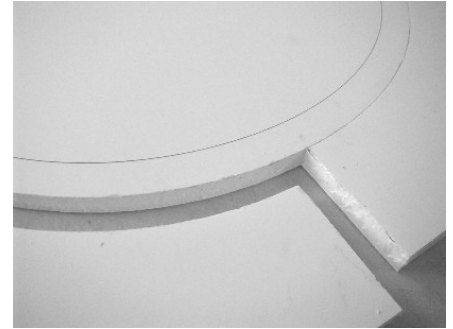
## TOP Assembly

**Note:** The TOP is assembled nearly the same as the BOTTOM but with a couple of minor differences.

21. On the OUTSIDE surface, cut the TOP out along the circles using a new #11 X-Acto® knife. Make the cuts straight down through the foamboard. It is best to make these cuts in several passes, cutting a little deeper each time and keeping the blade perpendicular with the surface of the foamboard.
  22. Make a shallow cut, through the first cardboard layer only, along the semicircle on the INNER edge. On the second pass cut through the foam from the line to the INNER edge. The result should be a 60 degree beveled edge.
- Note:** The OUTER edge will not be trimmed to a bevel because this would weaken it and make it easy to damage.
23. Lay the TOP on a completely flat surface with the INSIDE surface up. Cut V-grooves along the lines as you did with the BOTTOM.
  24. Cut out the remaining wedge-shaped piece from the TOP with a #11 X-Acto® knife.
  25. Cut out the TOP SEAM with a #11 X-Acto® knife.
  26. Spread white glue thinly and evenly over the section of the TOP marked "Glue here first".
  27. Press the TOP SEAM firmly in place but avoid crushing or denting the foamboard. Half of the TOP SEAM should extend out past the straight edge of the TOP. The thin end of the TOP SEAM should be even with the INNER circular edge. There will be a gap between the wide end of the TOP SEAM and the OUTER edge to allow clearance for the CENTER. Let the glue dry completely.
  28. Flip the TOP over and spread white glue over the remaining exposed part of the TOP SEAM. Spread a moderate amount of white glue on the exposed foam edge of the TOP. The holes in the foam will absorb most of the glue.
  29. Form the TOP into a shallow cone with the TOP SEAM flat against the INSIDE surface and the V-grooves on the INSIDE. Wipe off any excess glue that squeezes out of the seam.
  30. Hold the edges together until the glue is set. If you use clamps, be careful not to crush the foam. The seam should be smooth and flat on the OUTSIDE. Let the glue dry completely. Make a fillet of white glue around the edges of the TOP SEAM on the INSIDE.
  31. Trim the INNER end of the TOP SEAM to make it even with the beveled edge of the foamboard.
  32. The OUTER end of the TOP SEAM will be trimmed later so that it does not interfere with the proper fit of the CENTER.
  33. Sand the edge around the INSIDE hole of the TOP so that the BODY TUBE slides snugly but smoothly through the hole.

## CENTER Preparation

34. The CENTER is made out of a material call Gatorfoam, a sandwich of extruded polystyrene foam and Luxcell® wood-fiber veneer. It is responsible for much of flying saucer's strength and resilience. Luxcell® is somewhat brittle and difficult to cut. Be patient and work slowly and carefully.
35. On the OUTSIDE surface, cut through the Luxcell® layer and into the foam along the big X in the middle of the CENTER using a heavy-duty craft knife with a new blade. Make the cut straight down through the Gatorfoam.
36. Carefully cut through the Luxcell® around the 75mm circle in the middle. Cut only halfway through. Don't try to make the cut in one pass, The resulting hole must fit over the 75mm BODY TUBE snugly and smoothly.
37. Flip the CENTER over to the INSIDE surface and cut the big X all the way through. Carefully cut though Luxcell® layer along the 75mm circle. Make several passes to cut though the foam working on a quarter section at a time.
38. Trim and sand the hole until the 75mm BODY TUBE slides through smoothly.
- Note:** You may use a fine-toothed hacksaw or coping saw to make the following cut but the finish may not be as smooth.
39. On the OUTSIDE surface of the CENTER. Cut through the Luxcell® layer along the OUTER circle. Don't cut more than halfway through the foam.
40. Flip the CENTER over to the INSIDE surface and cut through the Luxcell® on the OUTER circle. Cut slowly and carefully, working in sections.
41. From the INSIDE surface, make a shallow cut along the remaining circle near the OUTER edge. Cut only through the Luxcell® layer, not into the foam. Angle this cut toward the OUTER edge as much as possible.
42. Once the Luxcell® layer is penetrated all the way around, run the blade of a long craft knife into the cut and through the foam at a 30 degree angle from the INSIDE surface to the OUTSIDE surface. The knife blade should exit the foam at the OUTER edge of the OUTSIDE surface. This will form a 30 degree, beveled edge. Work in small sections to form a smooth edge. This edge should mate perfectly with the INSIDE of the TOP. The joint between the TOP and the CENTER is important to the strength of the finished rocket and there should be no gaps between them. It may be necessary to trim the end of the TOP SEAM so that it does not interfere with the fit.



## Final Assembly

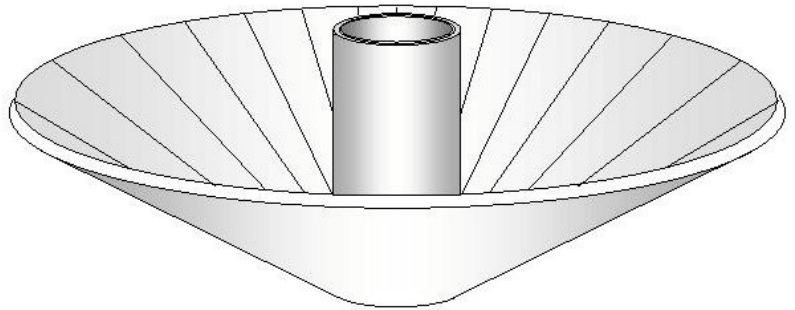
**Note:** Work in a clean, well-lighted and well-ventilated area. Spread newspapers over your work area to protect it from dripping epoxy. Wear gloves when working with epoxy and avoid contact with your skin. Long term exposure to epoxy can cause allergies and worse.

43. Test fit the TOP, CENTER, BOTTOM and BODY TUBE to make sure they all fit together properly. The BODY TUBE should fit smoothly in the holes in the TOP, CENTER & BOTTOM. The CENTER should fit into the TOP with no gaps between them. The BOTTOM should fit flat against the CENTER with no gaps.

44. Lightly sand the forward end (the end furthest from the LAUNCH LUG) of the BODY TUBE to make the glue stick better.

45. Invert the TOP. Use a large, deep bowl or pot to support it. Glue the forward end of the BODY TUBE to the hole in the center of the TOP using white glue.

**Do NOT substitute epoxy or yellow glue for white glue.** The end of the BODY TUBE should be even with the "top" of the TOP. Make sure the BODY TUBE stays straight while the glue sets. It may help to temporarily slide, but do not glue, the CENTER into place.



46. Once the glue sets, remove the CENTER.

47. Spread a thin layer of epoxy (about 2 oz) over the entire **INSIDE** surface of the TOP. Use only enough epoxy to wet the surface of the foamboard and the V grooves. Do not attempt to make the surface smooth or fill in the V-grooves. Excess epoxy will only increase weight without adding strength. Allow a little epoxy to run down and collect at the TOP to BODY TUBE joint.

48. Immediately spread epoxy on the beveled foam edge of the CENTER. Avoid getting epoxy on any other part of the CENTER.

49. Slide the CENTER into place. There should be no gaps between the TOP and the CENTER and there should be a very thin layer of epoxy between them.

50. Make a fillet of epoxy around the BODY TUBE to CENTER joint.

Note: Place something heavy like another bowl or pot on the CENTER until the epoxy sets.

51. Spread a thin layer of **thickened epoxy** (West Systems 105 Rosin, 206 Slow Hardener & 406 Colloidal Silica) on the entire **INSIDE** surface of the BOTTOM including the foam on the **OUTER** beveled edge. Use only enough epoxy to wet the surface completely.

52. Before the epoxy sets, slide the BOTTOM down the BODY TUBE until it makes contact flat against the CENTER. Use a large bowl or pot to apply even pressure on the BOTTOM until the epoxy sets.

## Fiberglassing

Note: West Systems 105 Resin and 206 Slow Hardener are recommended. It is thin and has enough working time for a good result. If you use a different epoxy that is thicker or sets quickly, you may not get the desired results.

53. Carefully unfold the fiberglass cloth. Do not pull or stretch it. Cut out the wedge shaped pattern with a pair of good scissors.

54. Lay the fiberglass cloth on the TOP with the seam in the fiberglass cloth at least a quarter turn away from the seam in the TOP.

**Note:** The fiberglass cloth is made to have a small overlap. The circles on the cloth should extend past the INSIDE and OUTSIDE edges of the TOP. Do not trim the circles on the fiberglass cloth yet. That will be done later.

55. Starting a few inches from the edge, spread epoxy over the fiberglass cloth. Use only enough epoxy to wet the fiberglass cloth and stick it to foamboard underneath. Make sure the fiberglass cloth is flat against the TOP. A small plastic spatula, old credit card, etc. will help spread the resin thinly and evenly. Do not try to fill in the weave or make the surface smooth with epoxy. Be careful not to fray the edges of the fiberglass cloth. Blot the surface with a paper towel to remove excess epoxy. Do not fold the edges of the fiberglass cloth over, let them extend straight out. They will be trimmed later.

**Note:** Excess epoxy will only add weight without adding strength. It is better to use a good paint filler later when finishing the rocket if a smooth surface is desired.

56. Once the epoxy is **fully cured**, trim the fiberglass cloth around the OUTSIDE and INSIDE edges of the TOP using a craft knife. It should trim very easily.

57. Place the TOP upside down in a large bowl. Coat the BOTTOM, CENTER and foam edges of the TOP with epoxy. A light coat is all that is needed to protect the surface and bond the parts together. Fill any small gaps in the joints with thickened epoxy. You will need about 3 to 4 oz of epoxy for this step depending on how well the parts fit together.

58. If you paint this rocket, be careful not to sand too deeply. If you penetrate the epoxy and expose or damage the fiberglass cloth you will greatly reduce the overall strength and impact resistance.



## 18" Delta Flying Saucer Assembly Instructions - Page 9

### **Launch Preparation:**

- Friction fit the motor into the motor mount. A tight fit is NOT necessary. A loose fit ensures that the MOTOR and MOTOR MOUNT can slide at landing and absorb some of the shock.
- Slide the motor mount into the body tube.
- The motor should not stick out more than 1/2" inch below the MOTOR MOUNT. It's okay if the motor sticks out the top.
- To reduce the chance of fire, remove all the ejection charge and plug the ejection charge hole in the forward closure with a piece of recovery wadding and tape.
- To avoid damage from the motor exhaust, support the saucer at least 12 inches above the blast deflector.
- Use caution when launching in winds greater than 10 mph (16km/h). This rocket, like most over-stable rockets, has a tendency to weathercock (point into the wind during flight) in high winds. This tendency is reduced when more powerful motors are used.

Limitation of Liability: High power rockets (HPR) are not toys. HPRs are functional rockets constructed of lightweight materials and launched using pre-manufactured, certified rocket motors in accordance with HPR Safety Codes. HPRs, if misused, can cause injury, property damage and even death. Art Applewhite Rockets certifies that it has exercised reasonable care in the design and manufacture of its products. Once sold, we cannot assume any liability for product storage, transportation or usage. Art Applewhite Rockets shall not be held responsible for any property damage or personal injury whatsoever arising from the handling, storage, use or misuse of our product. The buyer assumes all risks and liabilities there from and accepts and uses Art Applewhite Rockets products on these conditions.

# 18" Delta Flying Saucer Assembly Instructions - Page 10

## WHY? (Frequently asked questions)

1. Why white glue?
  - White glue is readily available and inexpensive.
  - White glue generally has the same qualities everywhere.
  - White glue, if used sparingly, holds parts in place almost immediately and dries quickly.
  - White glue is clear when it dries.
  - White glue won't dissolve the foam.
  - Yellow glues shrinks
  - Yellow glue is not clear when it dries.
  - Epoxy does not hold parts in place while it cures, so they can slip out of alignment.
  
2. Why put the fiberglass on the OUTSIDE of the TOP?
  - To make the surface tougher and more impact resistant.
  - It is easier to do than putting it on the INSIDE.
  - To get the most strength for the least weight.
  
3. Why is there no RockSim file for this rocket?
  - RockSim doesn't simulate rockets well when they don't have any fins.
  - The results from RockSim would be misleading.
  - The rule of thumb for a conventional rocket says that the Center of Gravity or CG, must be one caliber (diameter) ahead of the Center of Pressure, CP. This relationship is meaningless for such a short, large diameter rocket.
  - I am working toward determining the real CP of this and other flying saucers.
  - This rocket has been extensively flight tested and is stable with all recommended motors when they are installed in accordance with the flight preparation instructions.

If you have a "why" question that isn't asked and answered here, please contact me a [rocket887@aol.com](mailto:rocket887@aol.com). I will try to answer your questions and include them in future revisions of these instructions.