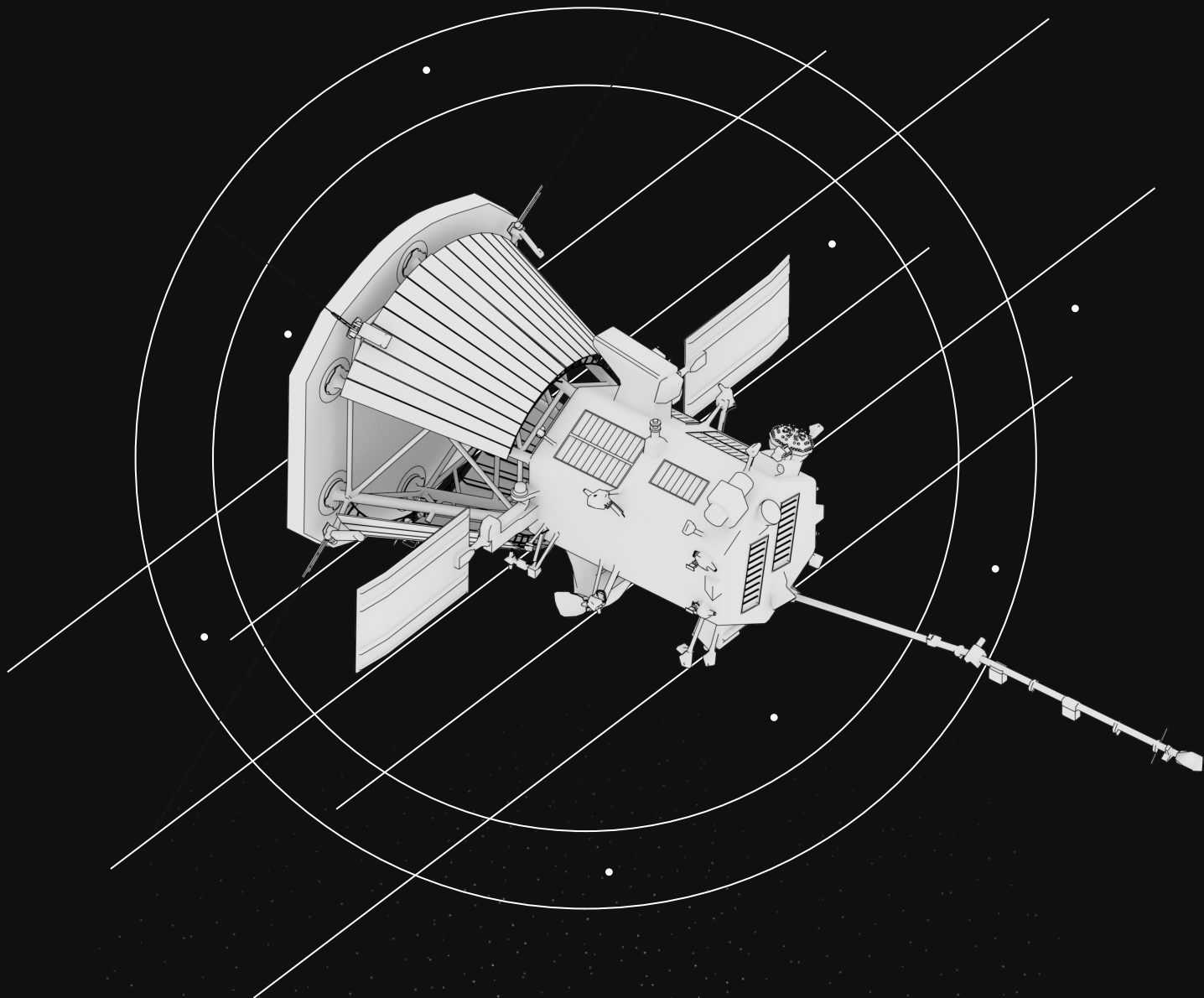


# ADVANCED PAPER MODEL INSTRUCTIONS + AR EXPERIENCE



## PARKER SOLAR PROBE

— A MISSION TO TOUCH THE SUN —

NASA | JOHNS HOPKINS APPLIED PHYSICS LABORATORY

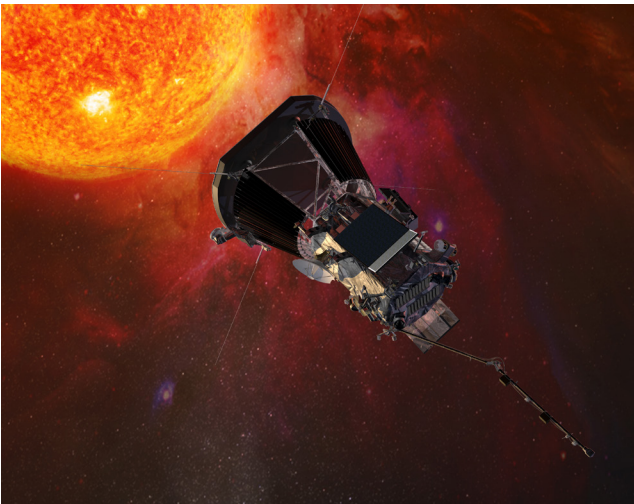
# PARKER SOLAR PROBE



NASA's Parker Solar Probe is changing all we know about the Sun. Launched in 2018, Parker Solar Probe is humanity's first-ever mission to a star, where it is directly exploring the Sun's large atmosphere and making critical contributions to improving forecasts of major space-weather events that impact life on Earth.

Built by the Johns Hopkins Applied Physics Laboratory (APL) in Maryland, the spacecraft will eventually zoom to within just 3.9 million miles of the Sun's surface, facing heat and radiation like no spacecraft ever has! Parker Solar Probe is flying close enough to the Sun to enter its magnetized atmosphere — called the corona — and study the regions where solar energetic particles are blasted into space.

It took years of research and testing to design and build a spacecraft for such a dangerous voyage. Protecting Parker Solar Probe and its instruments from the Sun's heat is a 4.5-inch-thick (11.43-centimeter-thick) carbon-composite shield, which can withstand radiation equal to about 500 times the Sun's radiation here on Earth. This shield is so effective that the instruments that lie in its shadow (called the umbra) operate at a comfortable 85 degrees Fahrenheit (29 degrees Celsius). Only a set of antennas (used to measure electric fields) and a small plasma detector brave direct sunlight.



## **PSP SPACECRAFT 'EXTREME ENGINEERING'**

NASA's Parker Solar Probe is swooping closer to the Sun's surface than any spacecraft ever, facing brutal heat and radiation along its path. Scan to learn more about the clever ways engineers devised to protect Parker Solar Probe and its instruments from the blazing temperature near the Sun -- which can reach nearly 2,500 degrees Fahrenheit (1,377 degrees Celsius) on Parker's closest solar passes.

**DON'T FORGET TO EXPLORE THE AR EXPERIENCE ON THE BACK OF THIS GUIDE**

# ADVANCED PAPER MODEL INSTRUCTIONS

## EXPERIENCE LEVEL — HIGH

Cardstock is used for a wide variety of paper crafts, including greeting cards, paper flowers, origami and modeling. While some models require expensive materials and tools to assemble, paper models are accessible and easily assembled with paper, scissors and glue.

The popularity of paper models — especially replicas of actual launch vehicles and spacecraft at accurate scales — continues to grow. Detailed cardstock models, made for more experienced users, are often showcased in libraries, schools, museums and science centers.

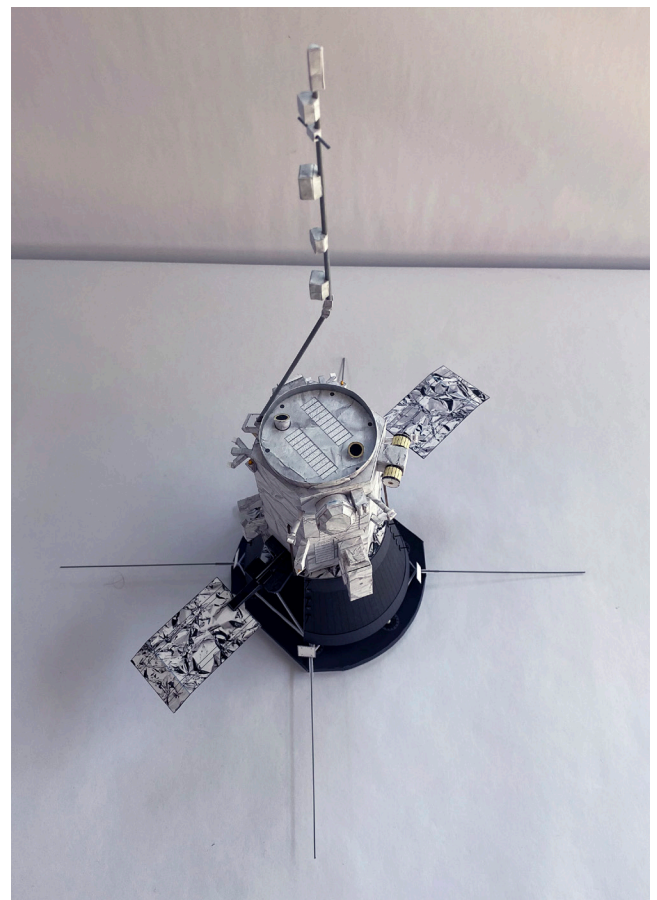
Follow the instructions on these pages to build your own Parker Solar Probe!

### MATERIALS LIST

- Scissors
- Craft knife (optional)
- Super glue
- Hot glue gun (optional)
- Cardstock (white)
- Single hole punch
- Safety ruler
- 4 acrylic rods (or similar material): 0.06 in (1.5 mm) diameter, 2 in (5 cm) long, brown
- 2 wooden dowels: 0.0625 in (2 mm) diameter, 4.5 in (11.5 cm) long
- 10 wooden toothpick tips (colored yellow)
- 18 plastic broom straws (grey)
- Thin music wire or similar material (6 in or longer)
- Grey or silver paint

### ★ TIP

- Check mark the corner of the box, when you're done with the step.

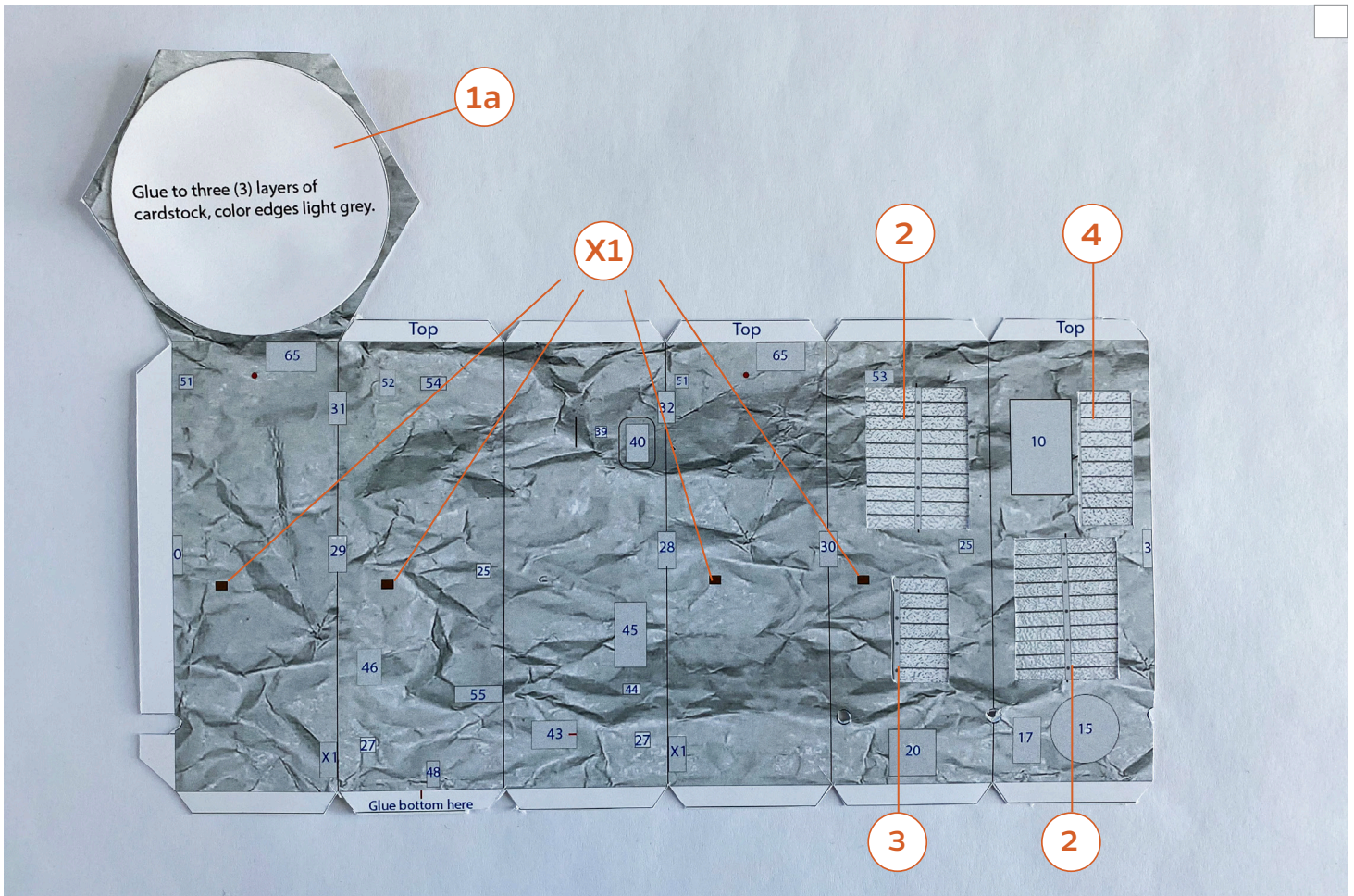


**Parker Solar Probe paper model design by Zach PaperSat Design.**  
These materials may be distributed freely for educational or informational purposes, under NASA's Media Usage Guidelines. Learn more at [www.nasa.gov/multimedia/guidelines/index.html](http://www.nasa.gov/multimedia/guidelines/index.html).

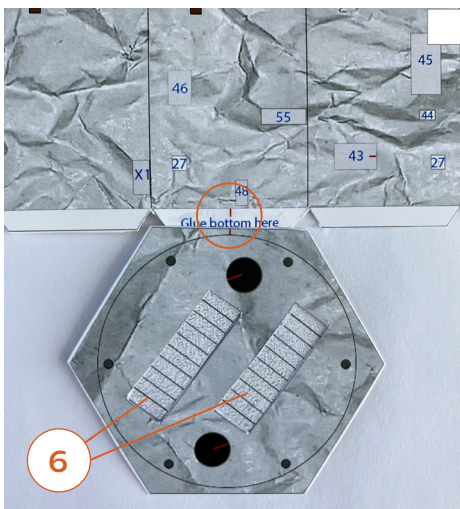


### SHARE IT

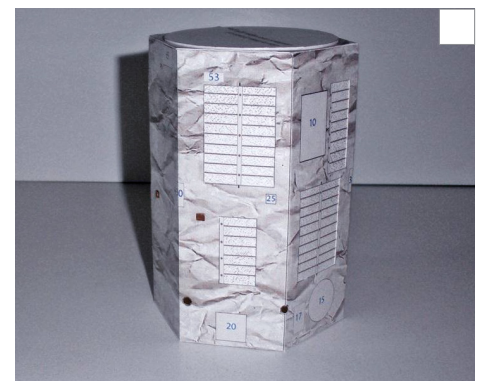
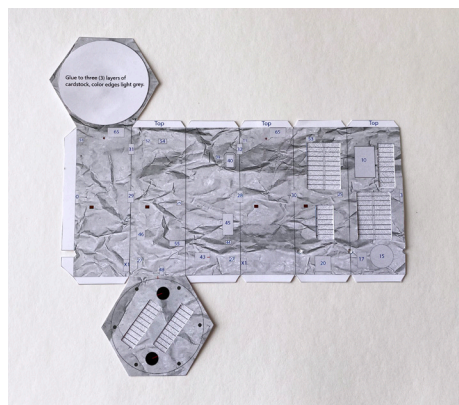
Share your creation with us on social media using the hashtag [#parkerpapercraft](https://twitter.com/parkerpapercraft).



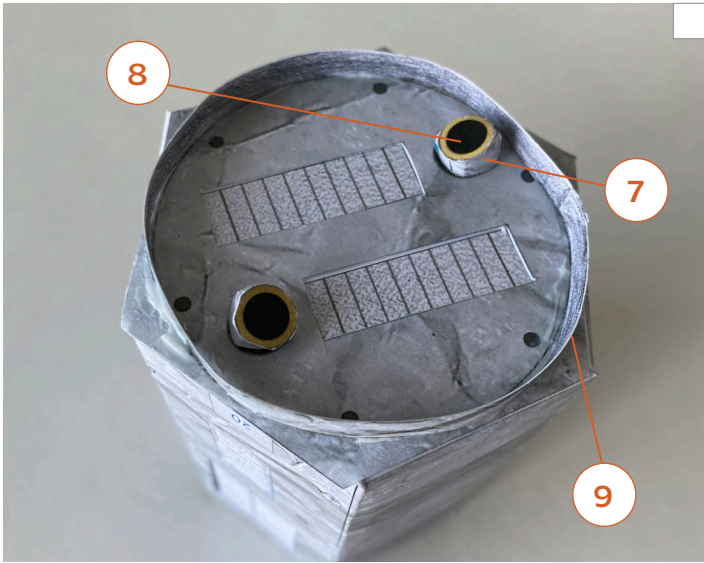
Cut out all blue areas on parts 1 and 5, including the three small blue circles near the bottom of part 1. Glue 2, 3, 4 and 6 to the backs of 1 and 5 as shown. Make very small holes in the two red dots near the top of 1 (only large enough to fit the diameter of the music wire snugly).



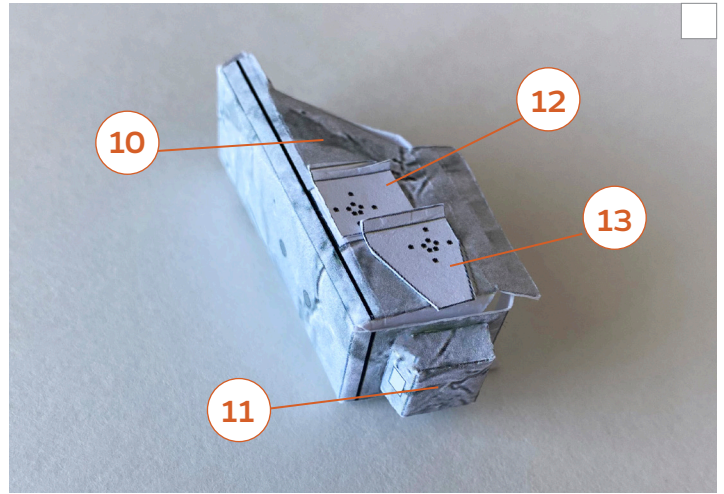
Glue 5 to the marked tab on the bottom of 1 as shown.



Fold on the vertical lines to make an octagonal shape and glue 1 and 5 to the top and bottom tabs, respectively.



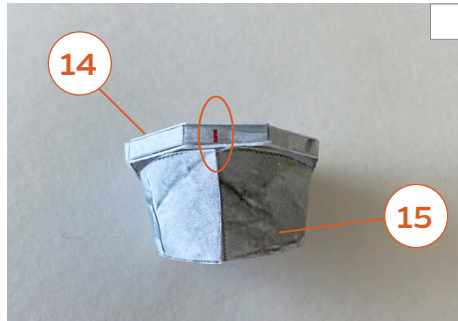
Align the seams on 7 to the red lines on the black circles on the bottom. **Tip:** Use a pencil or pen to roll 7.



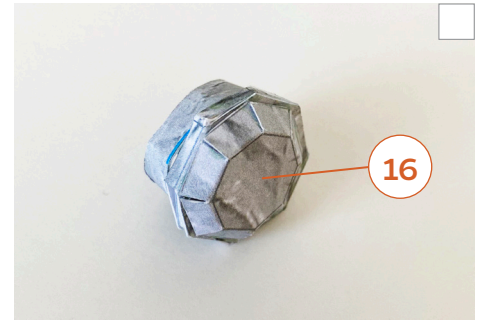
Fold small tabs on 12 and 13 as shown. Glue on the matching graphics on 10.



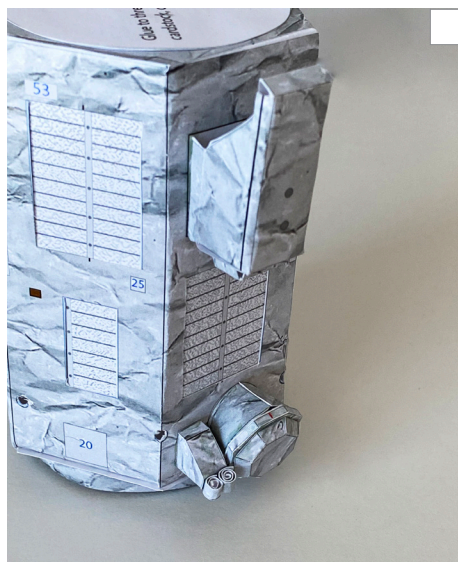
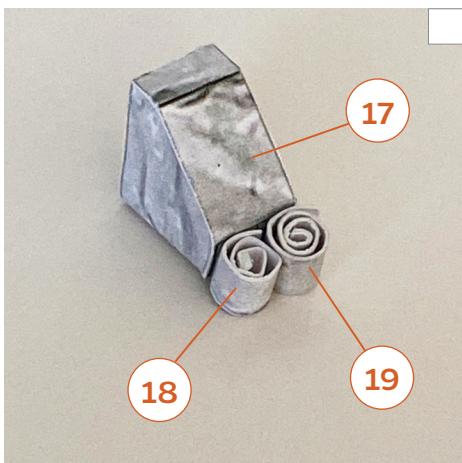
Glue to the labeled area on the body as shown.



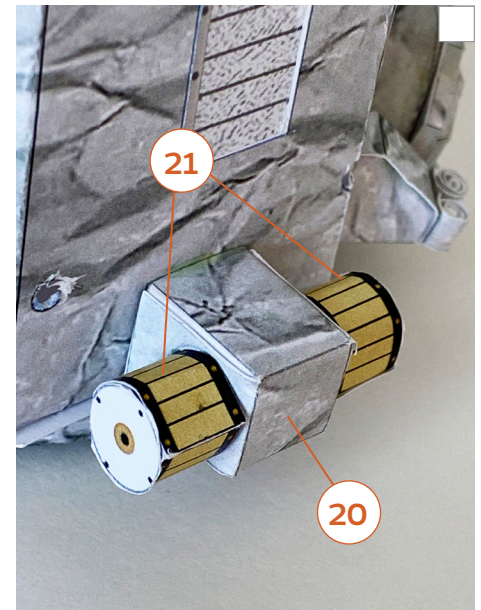
Roll 14 into a thin hexagon drum. Roll 15 to an angled cone. Glue 14 to the side of 15 with the blue marker. Match the seam on 15 to the red line on 14.

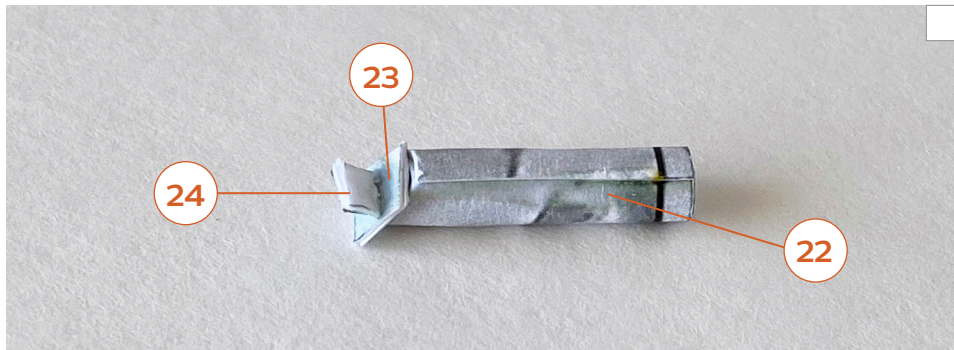


Glue 16 to the other side.

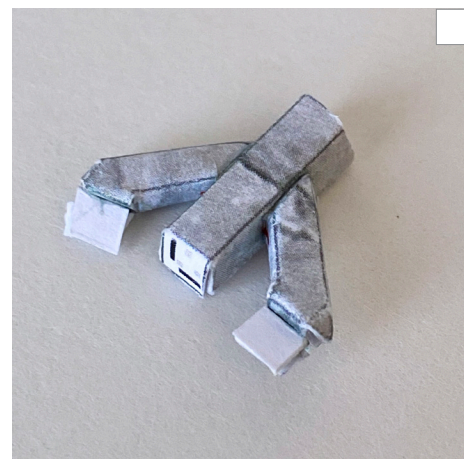
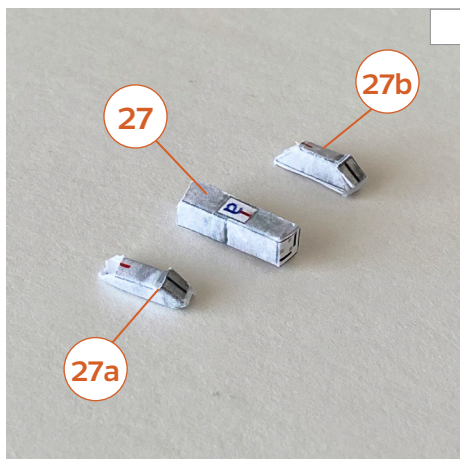
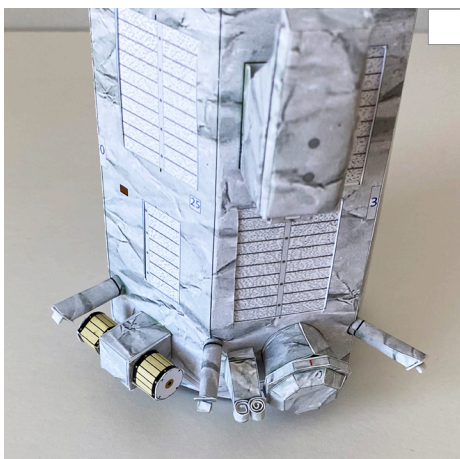


Glue to the labeled areas on the body as shown.



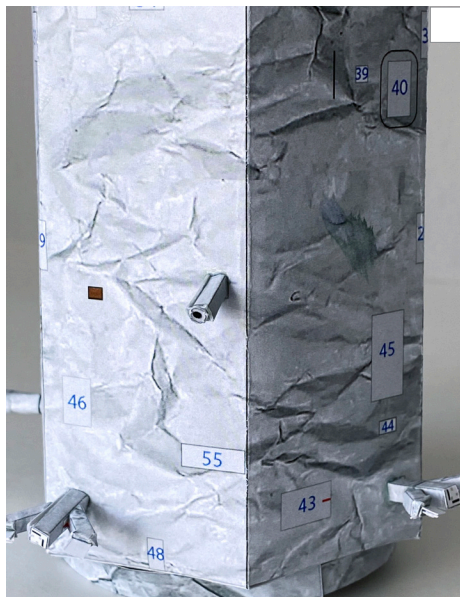


Make three (3) of these assemblies. Roll 22 into to tight solid paper rods. Cut an angle to one end as shown on page 3 of the parts file.



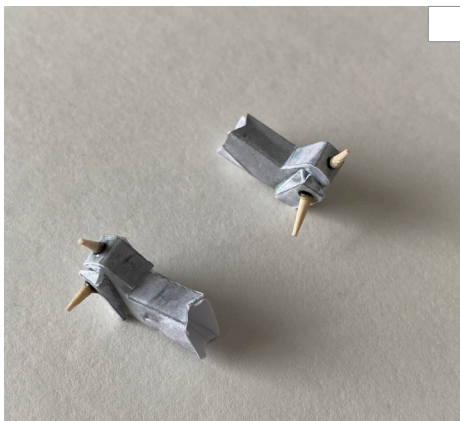
Glue into the three small holes near the bottom up to the black line with the angled side downward.

Glue 27a and 27b to the labeled sides on 27. Make two of these. Glue 24 on the black lines as shown.

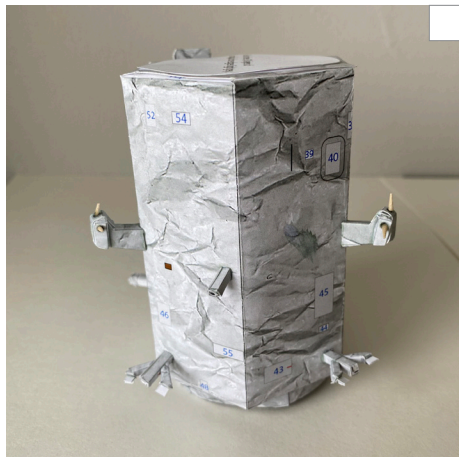


Glue to the labeled squares near the bottom of the body with an upward angle as shown.

Glue 28a and 29a to the labeled squares on 28 and 29 as shown.



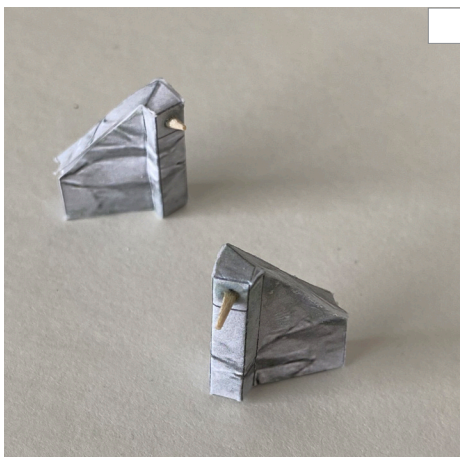
Need 10 flattened pointed tips from toothpicks cut ~3 mm (0.12 in) long, colored dark yellow. Glue to the black dots on 28, 28a, 29 and 29a as shown.



Glue to the labeled squares on the body as shown.



Part 30 with painted end of the toothpick. Make two of these and glue to the labeled squares on the body.



Parts 31 and 32 with painted end of toothpick.



Back view of 31 and 32.



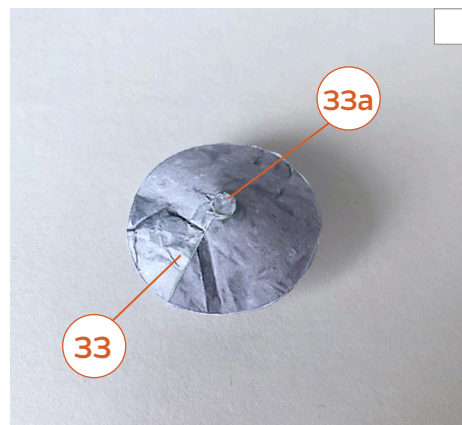
Glue to the labeled squares on the body near the top as shown.



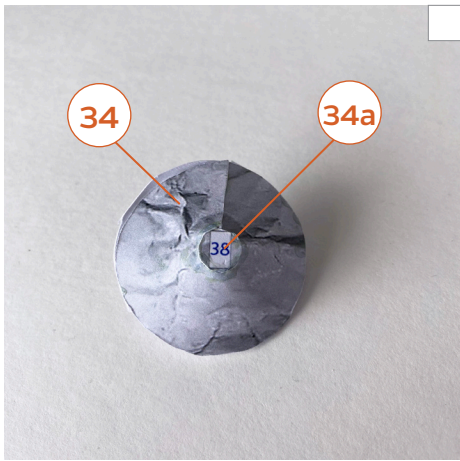
Part X1. Make two of these with painted end of toothpick.



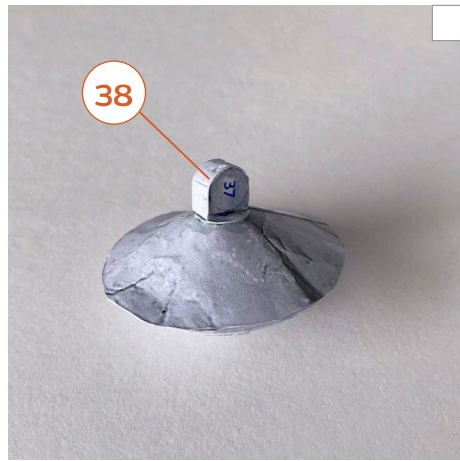
Glue to the labeled squares on the body near the bottom as shown.



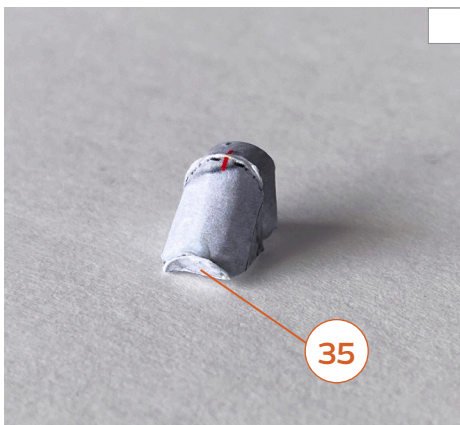
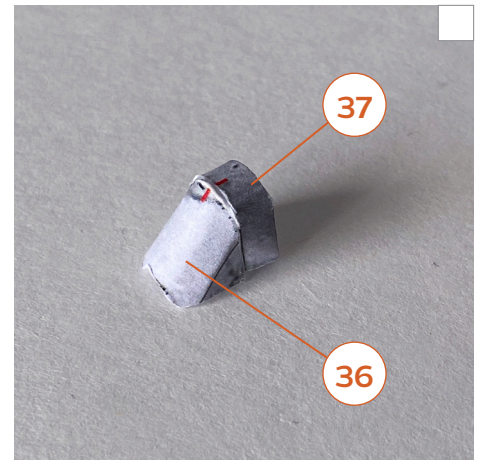
Side 1.



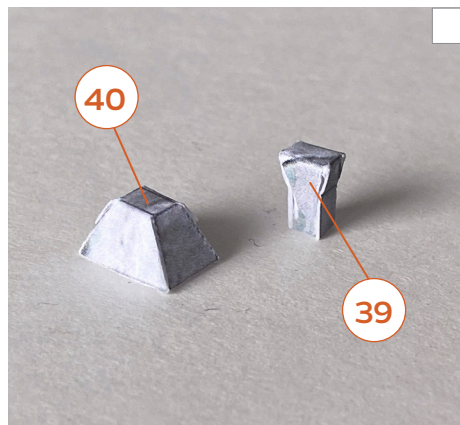
Side 2. Glue the two dishes as shown.



Glue 38 to 34a as shown.



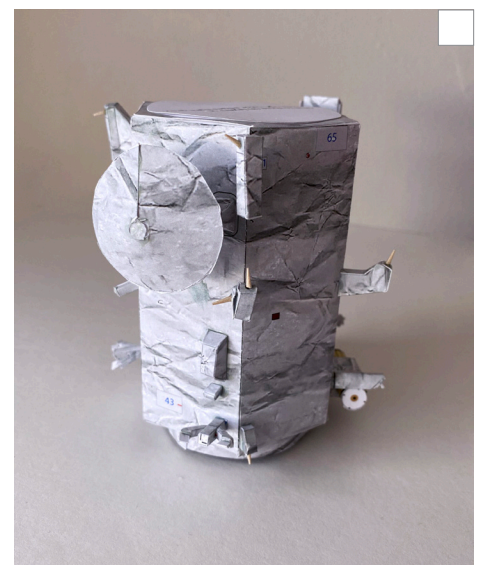
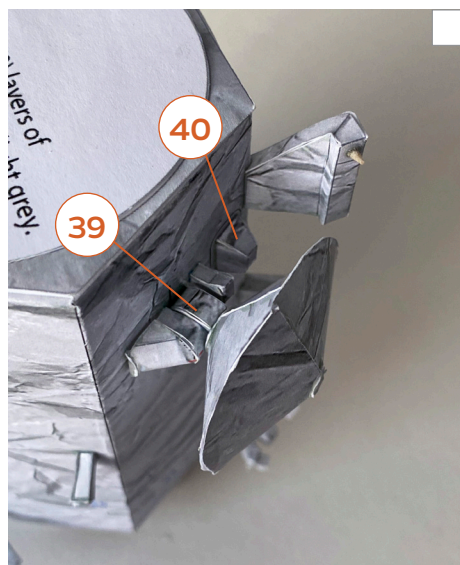
Align the red markers on 36 and 37 as shown and glue on 35.



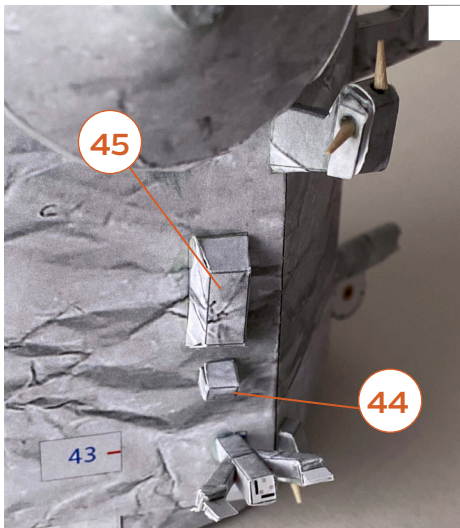
Glue 39 and 40 onto the labeled areas on the body as shown.



Glue 36-37 onto 38 on the dish as shown. You can angle the dish up, down or straight.







Glue 44 and 45 onto the labeled areas on the body as shown. Part 44 should be angled downward.



Align the red markers on 41 and 41a and glue together.



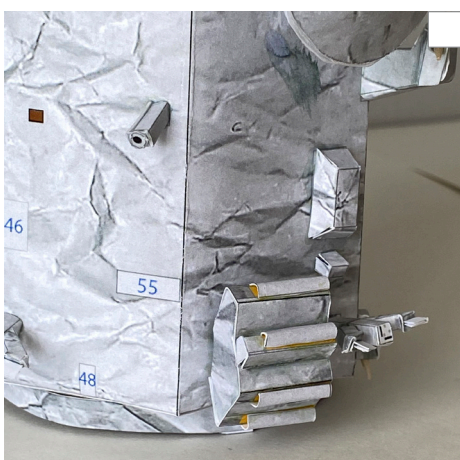
Other side of 41 and 41a.



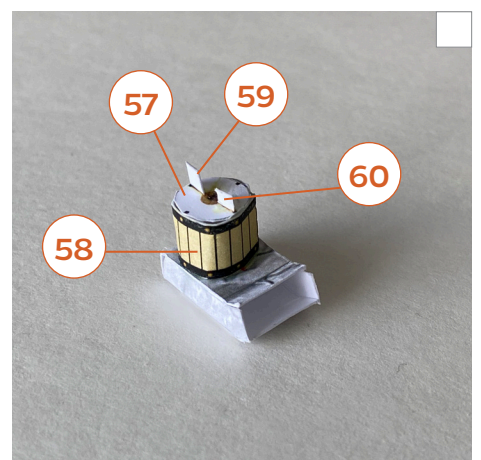
Align the red marker on 43 to the red marker on the bottom of 41.



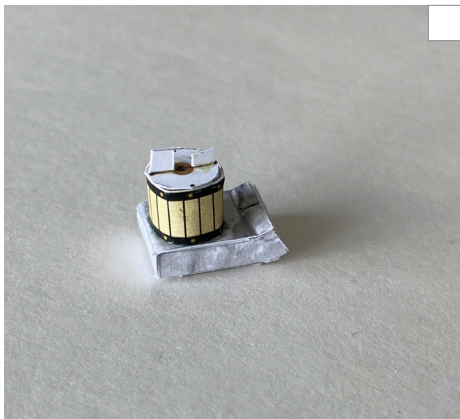
Roll 42 to half circle tubes. Glue over the yellow areas as shown (see next photo).



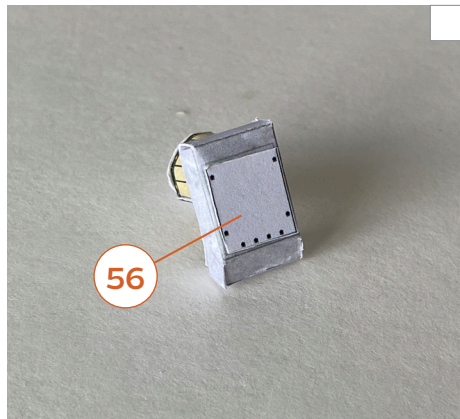
Glue onto the labeled area on the body as shown.



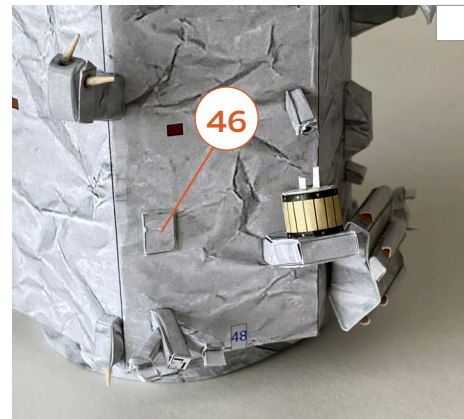
57 59 60 58



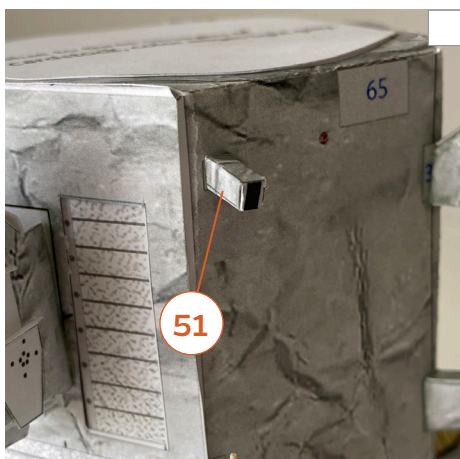
Match the line of 57 to the seam on 58. Match the seam on 58 to the red marker on part 55.



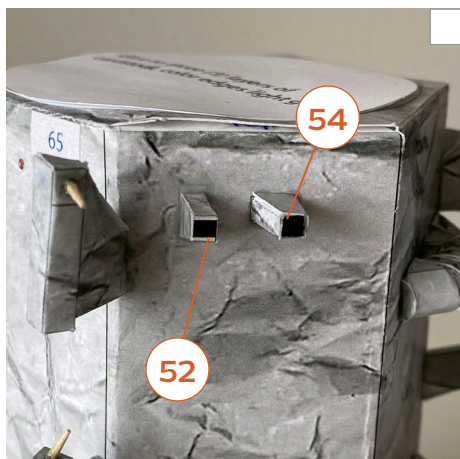
Glue 56 to the bottom.



Glue to the rectangle labeled "55" as shown. Glue 46 as shown.



Make two of 51. Glue onto the labeled areas on the body as shown.



Glue 52 and 54 onto the labeled area on the body as shown.



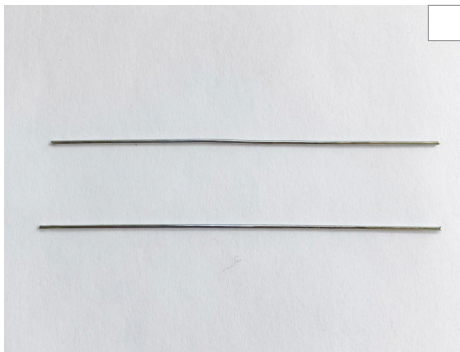
Glue 33 onto the labeled area on the body as shown.



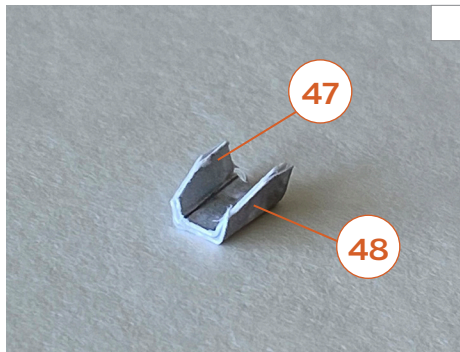
Prepare four (4) acrylic rods according to the instructions on page 3 of the parts file. Glue one end to a small brown square in the middle of the spacecraft body and glue the other end onto the bracket above it as shown.



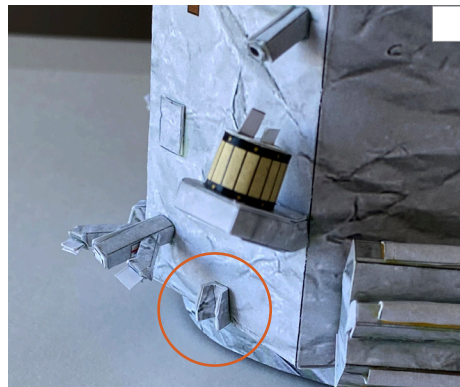
Other side of the body.



Prepare two (2) wooden dowels according to instructions on page 4 of the parts file.



Fold 47 with color inside, and fold 48 with color outside. Glue as shown for strength.



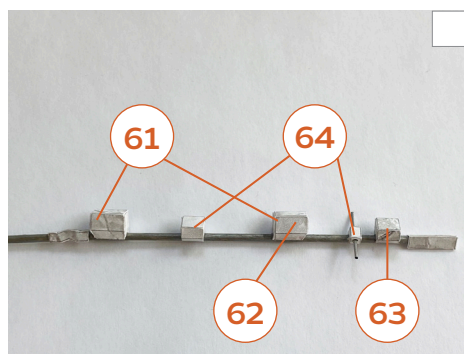
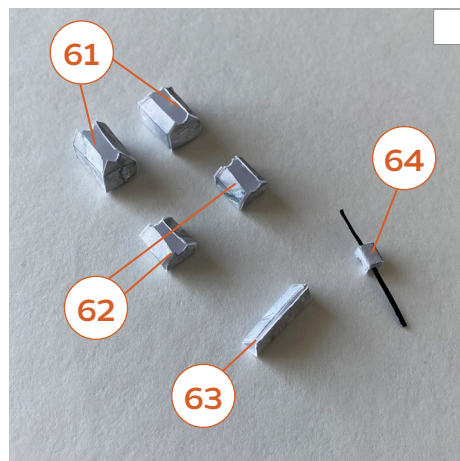
Glue 47 and 48 onto the labeled area on the body near the bottom as shown.



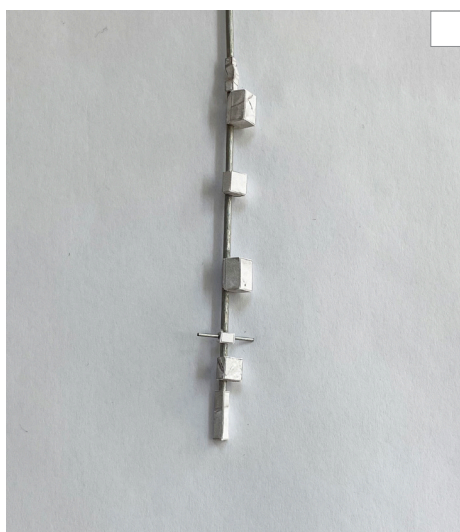
Prepare 49 and 50 the same way as 47 and 48. Glue 49 inside 50 for strength.



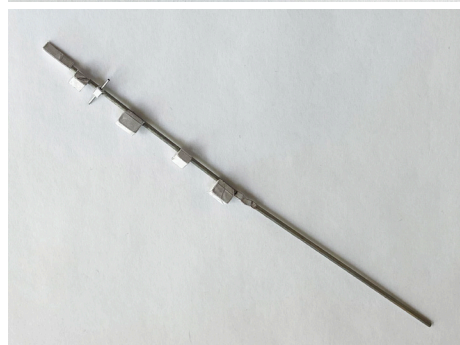
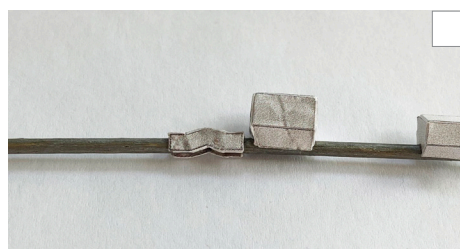
Glue onto end of one of the dowels as shown.



Use the guide on page 4 of the parts file to glue these parts onto the second dowel (without 49 and 50).



Note the locations and angles.

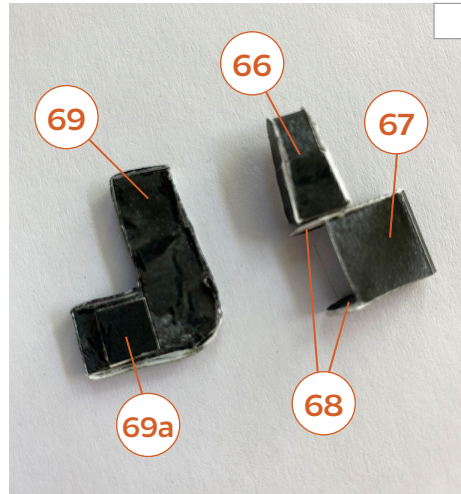


Glue to the other dowel with the hinge (parts 49 and 50) as shown.

This is the magnetometer arm. Set this to the side for now.



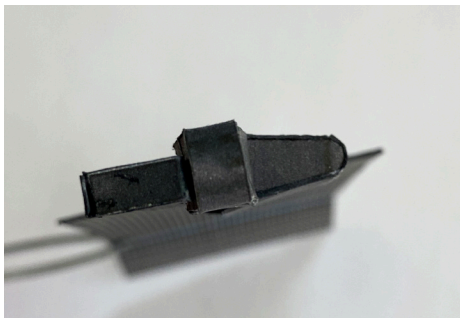
Make two of 65 and glue onto the labeled areas near the top as shown.



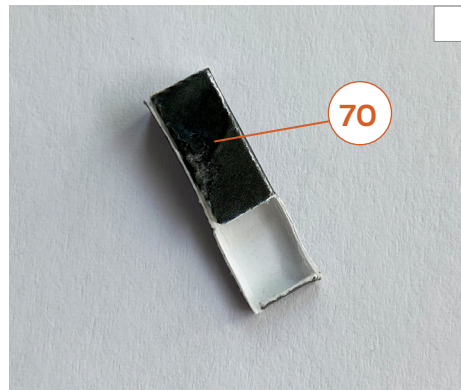
Make two solar panel assemblies. Glue 68 inside to circular areas in 67 as shown.



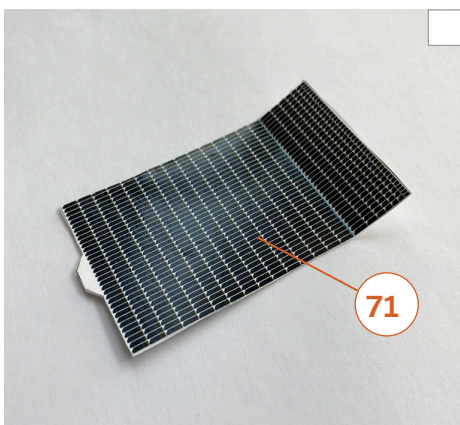
Slide 69 inside 67 and glue in place.



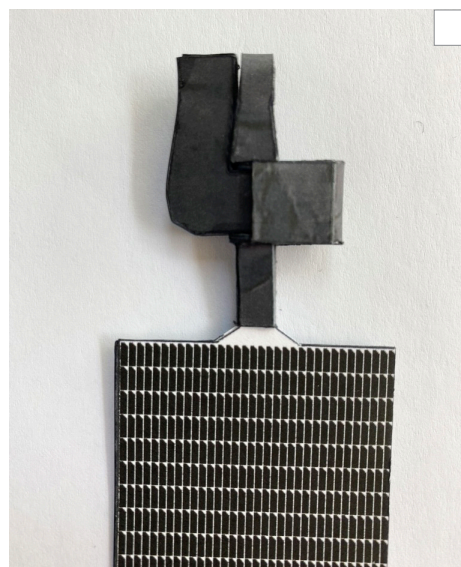
Top view.



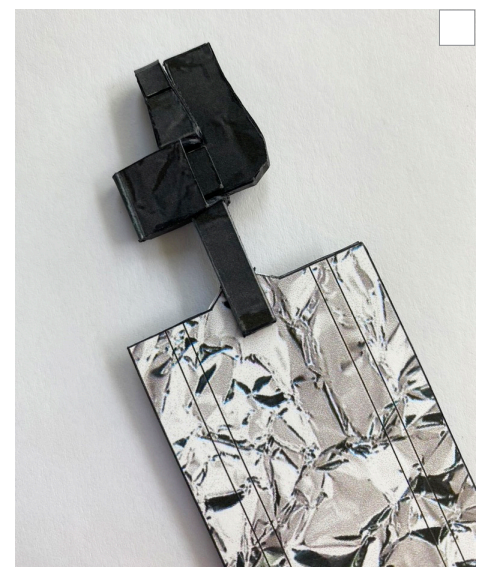
Should look like this.

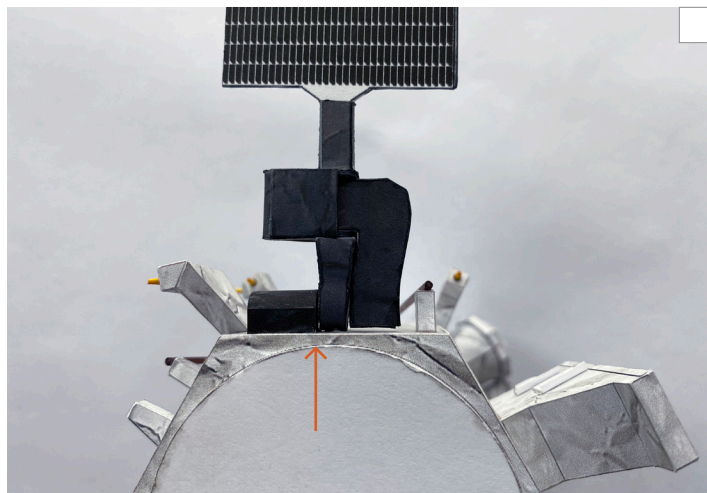


Make two of 71. Fold and glue the solar panels back-to-back. Fold the lower area up just a little at the blue line as shown.



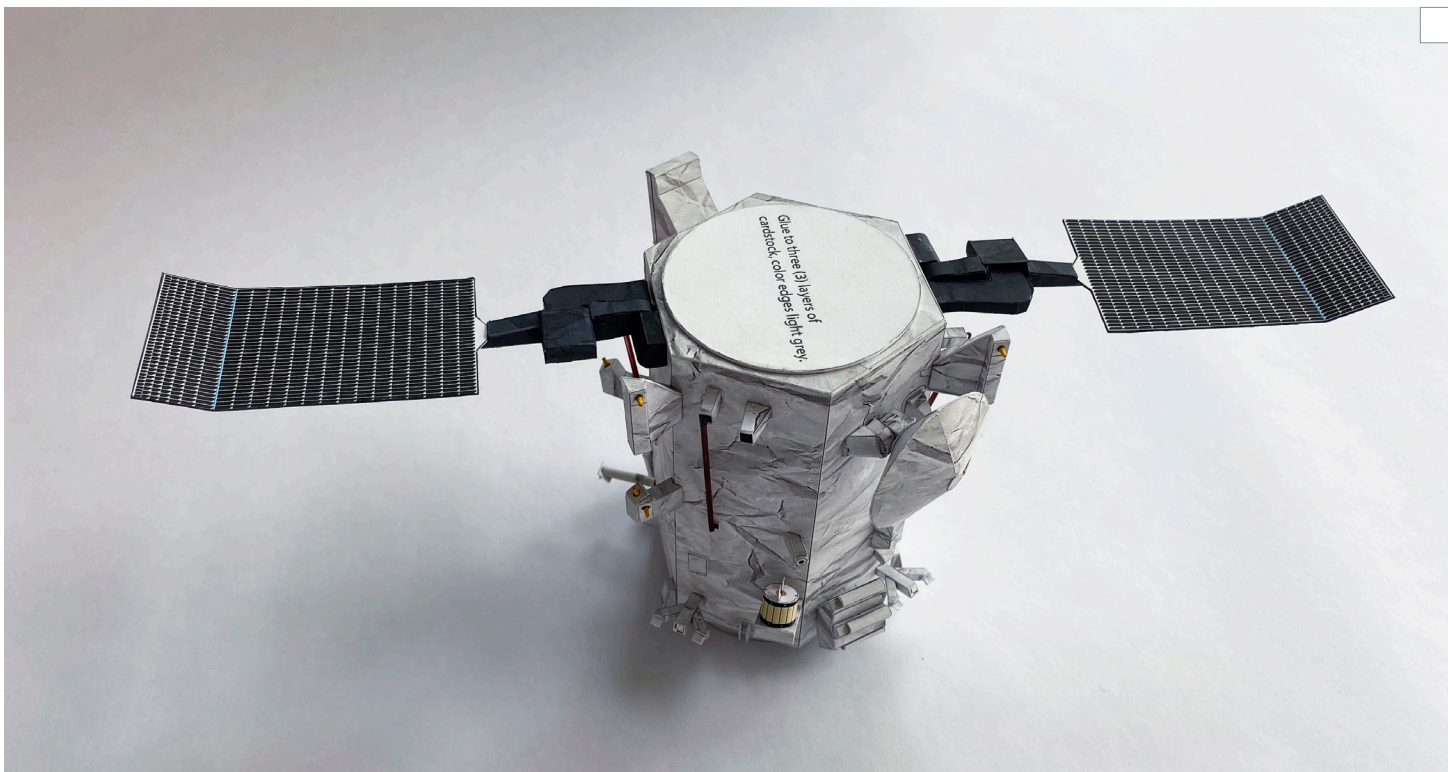
Glue solar panels as shown above and in next photo.





Glue the two solar panel assemblies (on the part 65 side) onto the labeled area on the spacecraft body as shown. Rest the assembly on the support wire.

Cut thin music wire or similar material according to instructions on page 5 of the parts file. Slide the wire through the two holes you made in the two small red dots at the top of part 1. The wire will support the solar panels.





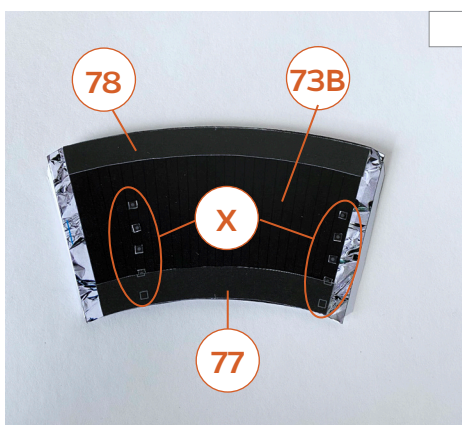
Part 72



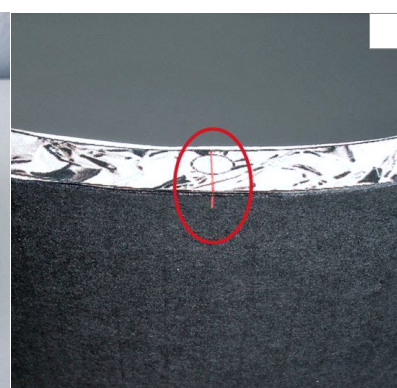
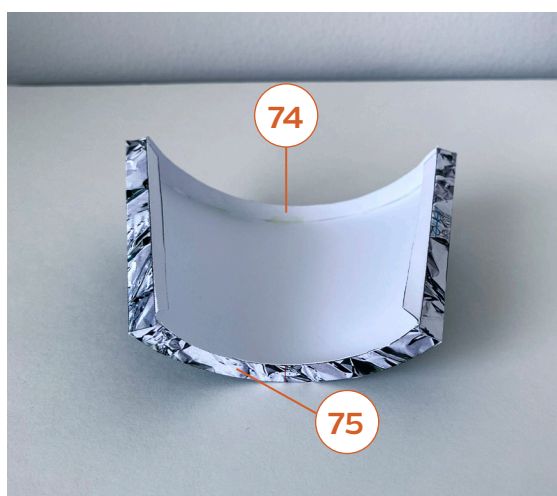
Glue 72a to the back side of 72. The large hole you cut out on 72a should help to align the top perfectly with the body.



Part 73A **only** — Glue X onto the small grey squares as shown. If you plan to use the paper parts on page 8 of the parts file (instead of substituting with toothpicks or lollipop sticks), cut an opening along the blue line on the right side of 73A.



Part 73B **only** — Glue 77 and 78 as shown. Glue X as shown. If you plan to use the paper parts on page 8 of the parts file (instead of substituting with toothpicks or lollipop sticks), cut an opening along the blue line on the right side of 73B.



Glue 73A and 73B assemblies around the outer edges of 74 and 75 as shown. Align red center lines as shown. See important tips below.

## ★ TIPS

Remember to glue 73A and 73B around the **outer** edges of 74 and 75.

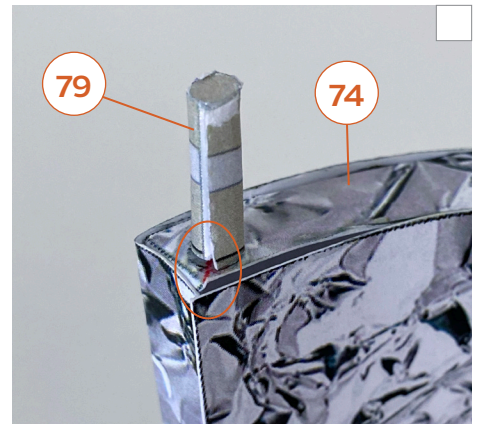
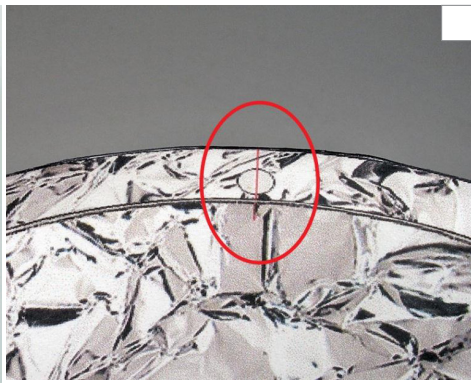
To help prevent the radiators from warping, start by gluing the center of 75 to the center bottoms of 73A and 73B while aligning the red lines. Then glue out from the center red line to one end. Repeat for the other end.

Use the same method when gluing the center of 74 to the center tops of 73A and 73B.

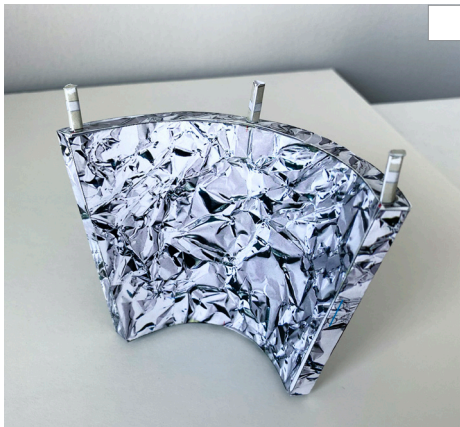
Follow all instructions about alignment of parts.



Glue 76 to the inner edges of 74 and 75, aligning the red lines.



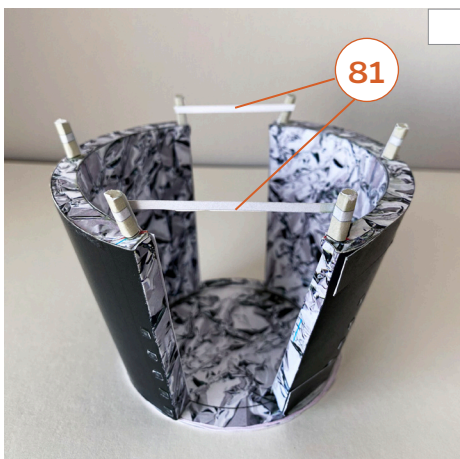
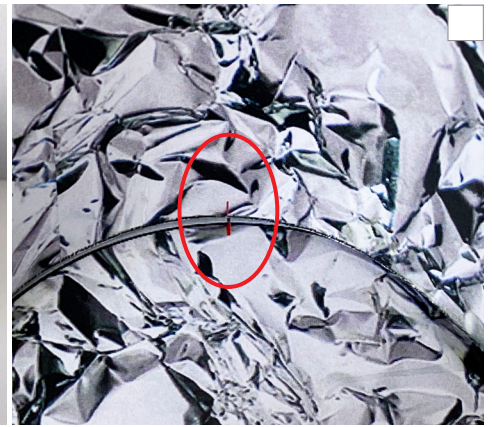
Glue 79 to 74 over the six blue circles. Important: Align the seam of 79 to the red line on 74.



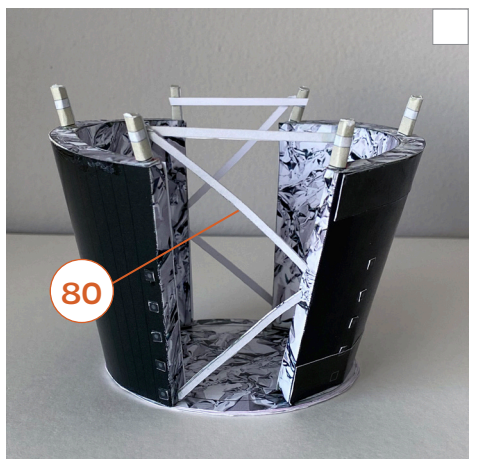
Do this for all six poles.



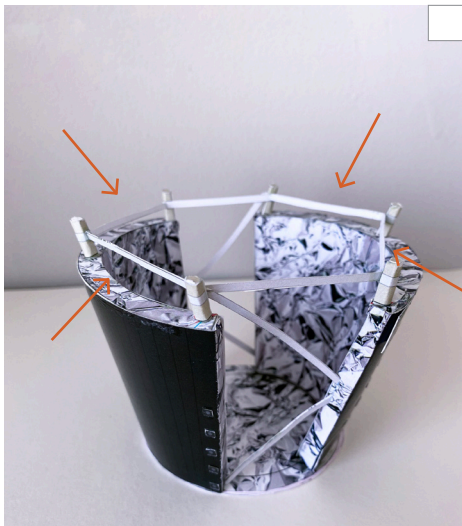
Glue the 75 side of the two radiator assemblies to 72. Important: Align the lines on 72 to the red lines on the radiator assemblies. The six poles should angle outward.



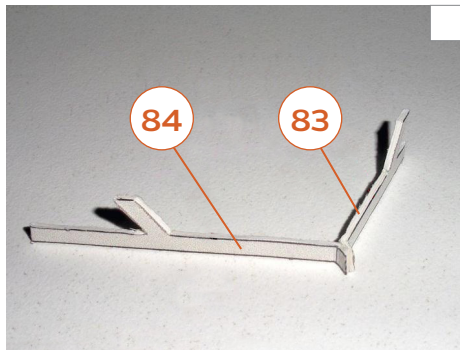
The following parts may need trimming for proper fit. Glue on the grey sections on the poles. For a more realistic look, you can use long toothpicks or paper lollipop sticks colored light grey or silver in place of the paper parts.



The tab on 80 is inserted into the openings on 73A and 73B. If using toothpicks or lollipop sticks instead of the paper part, glue one end of the stick on the circle on the side of 73A and 73B.



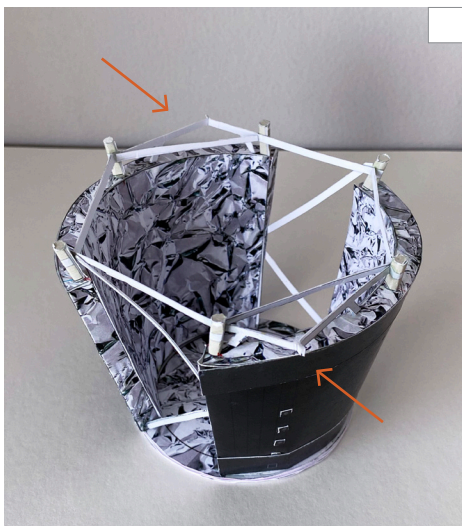
Parts 82.



Make two of these. Score and fold the small tabs of 83 and 84 along the blue line. Glue only the tabs together.

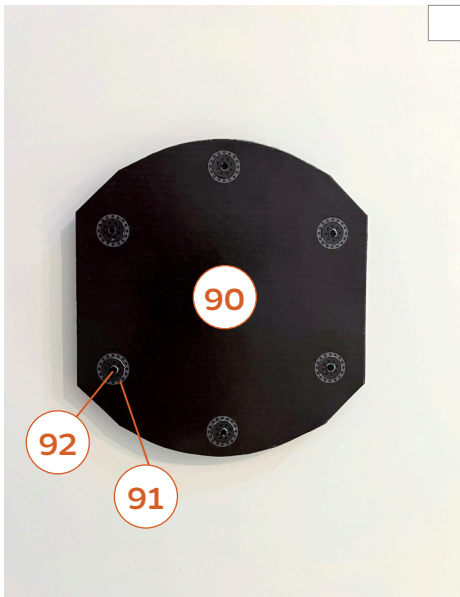


See the parts placement illustration on page 8 of the parts file and the next photo to position and attach 83-84.

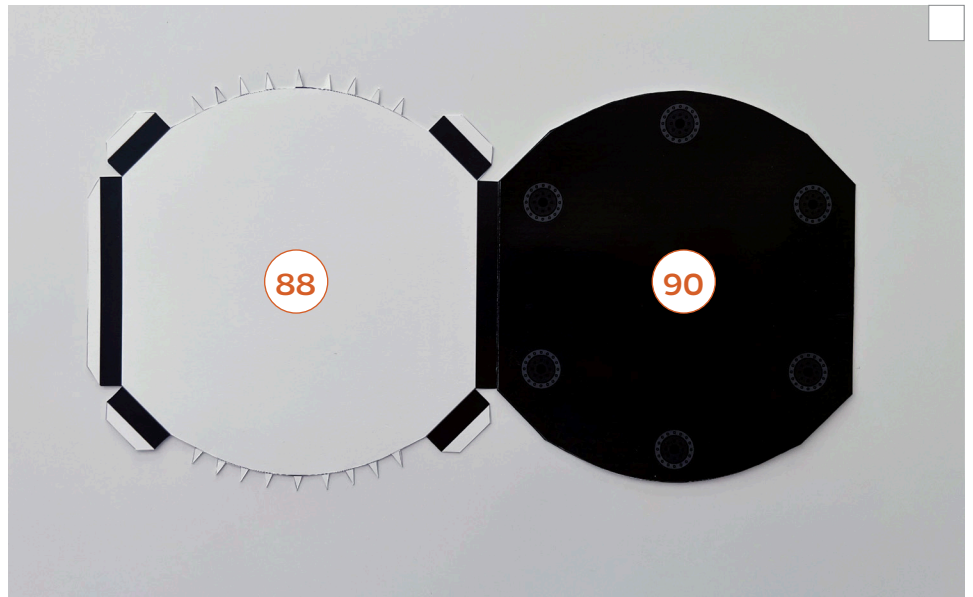


Very important: Align 85 with the blue line. Do the same on the other radiator. See the guide on page 8 of the parts file for reference.

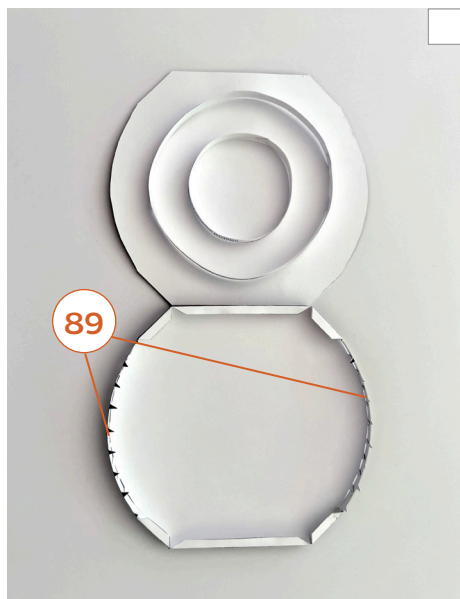




Glue a piece of cardstock, cut to the same shape, to the back side of 90 for strength.



Glue 90 to 88 as shown.



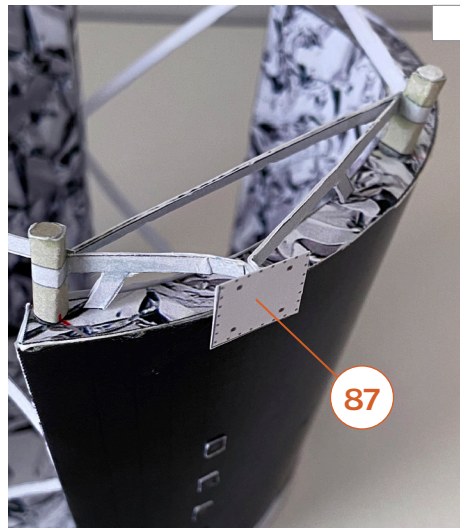
Flip over and glue 89 to the triangle tabs of 88. Glue the internal support rings to the inside of 90 as shown, and then glue the inside edges and rings of 90 to 88 and 89.



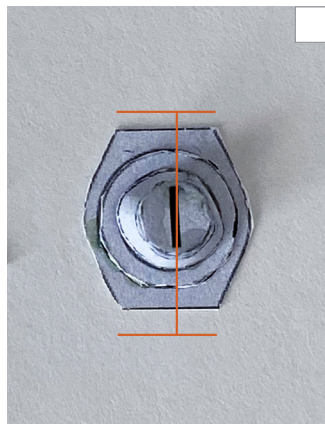
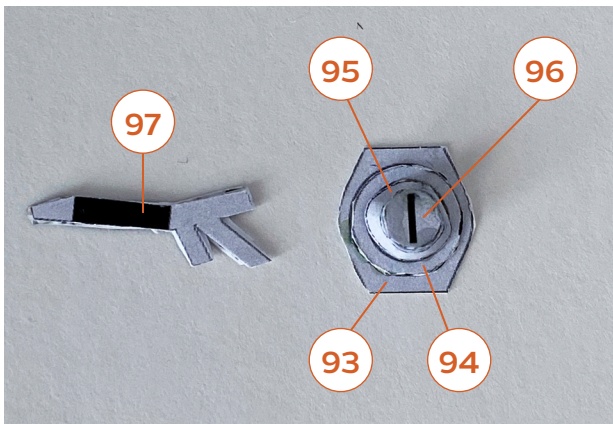
Under side of heat shield.



Top side of heat shield.

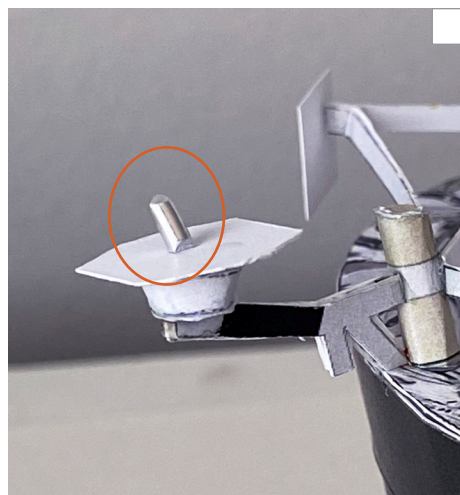
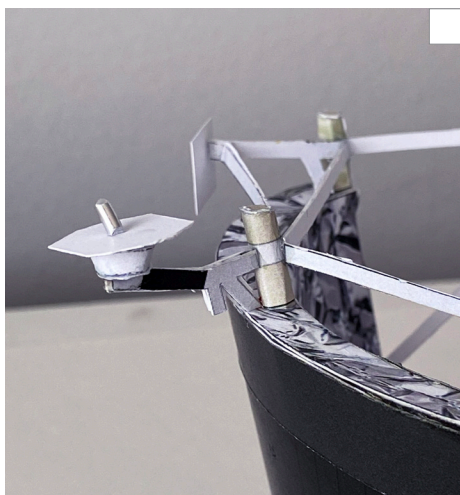


Glue 87 to 85 (left) and to the tab of 83-84 (right) as shown. Do the same on the other radiator. They should have a downward tilt.



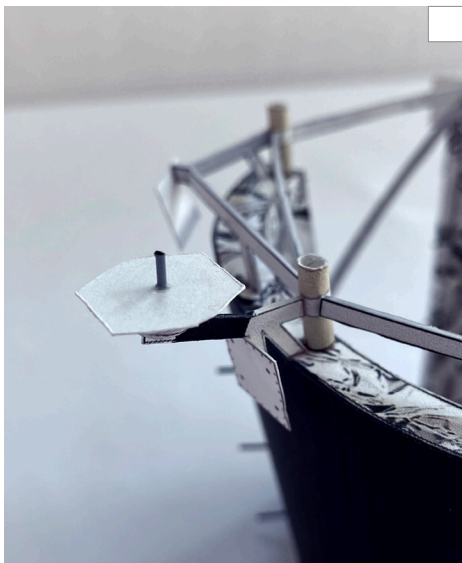
Glue 97 to cardstock and then glue back-to-back with 98. Assemble 93-96 as shown. Position the black line of 96 perpendicular to the straight edges of 93 as shown in the second image.

Glue 97-98 on the black line of 96 as shown.

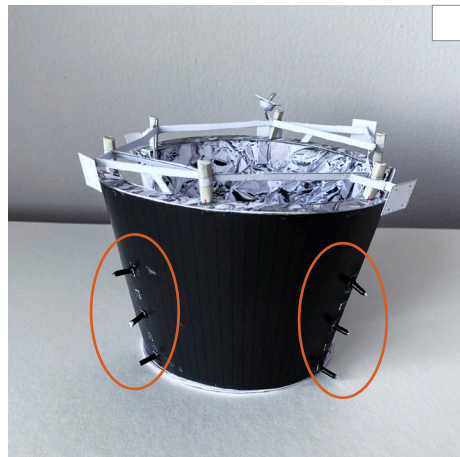


Important: Glue onto the middle pole of the radiator **without** the two black strips (77 and 78).

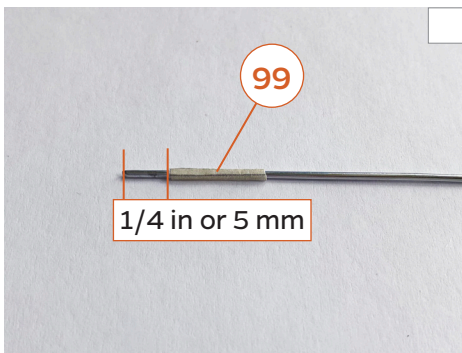
Cut a piece plastic broom straw according to instructions on page 10 of the parts file. Color it light grey or silver and attach as shown.



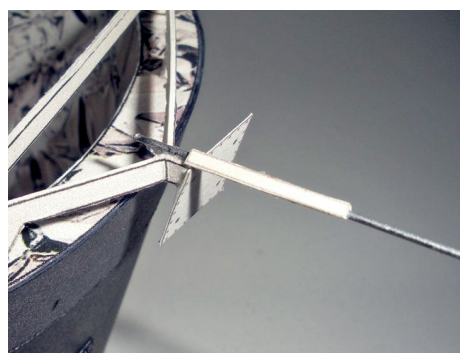
Glue 87 to 97-98 as shown.



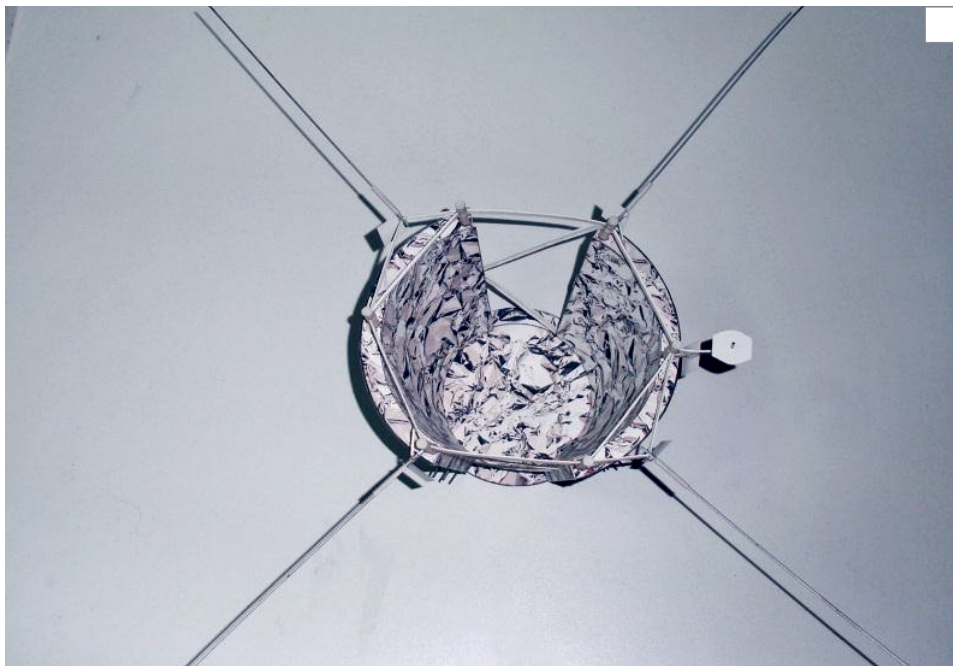
Prepare 12 plastic broom straws according to instructions on pages 6 and 7 of the parts file. Glue 3 on each side of the radiators on a square as shown.

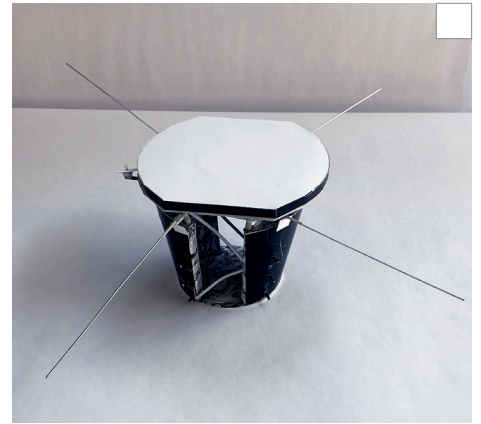
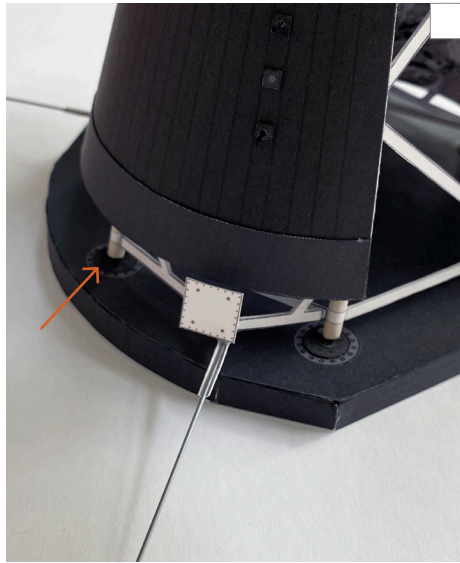
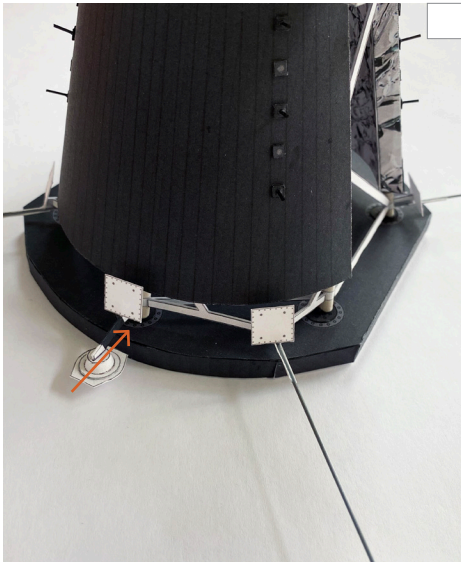


Prepare the four (4) antennas using plastic broom straws according to instructions on page 10 of the parts file. Fold 99 into a "V" shape. Insert the antenna onto 99 and glue around 1/4 in (5 mm) from one end.



Glue each antenna over part 87 on each of the four corners as shown. Using a hot glue gun is recommended.

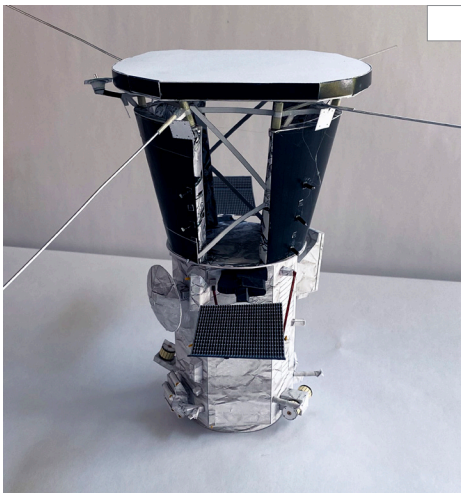




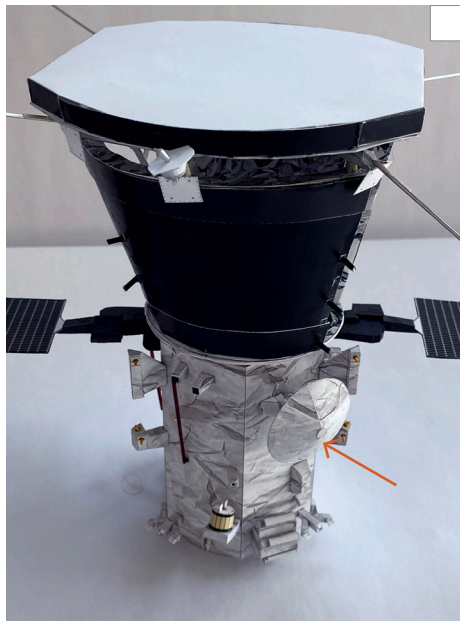
Ready to glue onto the body.

Glue the heat shield onto the radiators. Start with the center poles on the two far ends (see arrows). The poles should align with the center of the pads on each end. The other four side poles should align with the other pads if the center pole is aligned. The position may not be perfect but should be close.

This is why it was important to glue the poles onto the radiators and glue the radiators onto the base (part 72) using the lines or markers per the instructions.

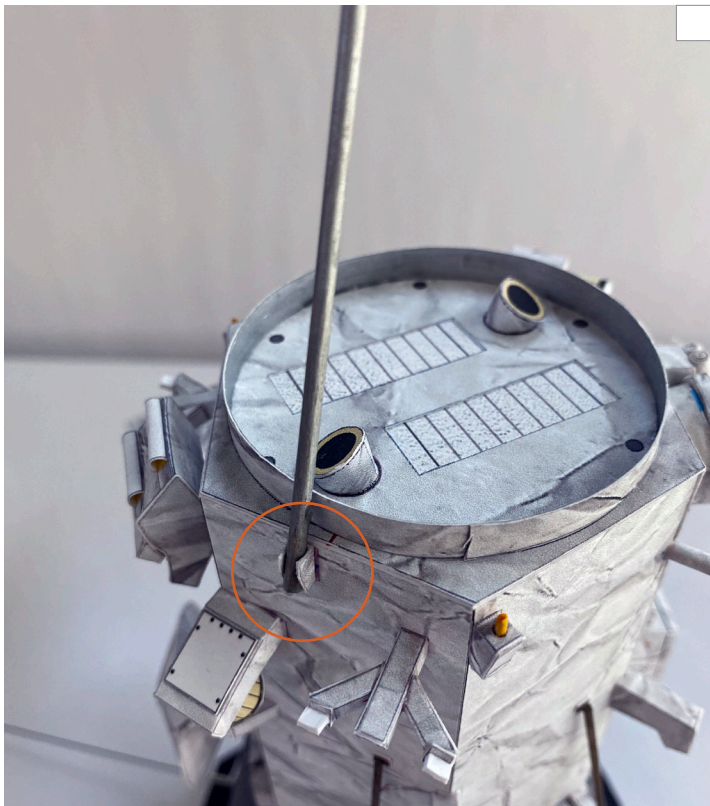


The opening between the radiators should align with the solar panels (see above). The ring (72a) that you glued to back of 72 should fit on top of the circle (1a) that you glued onto the top of the body, and this will align the top perfectly.

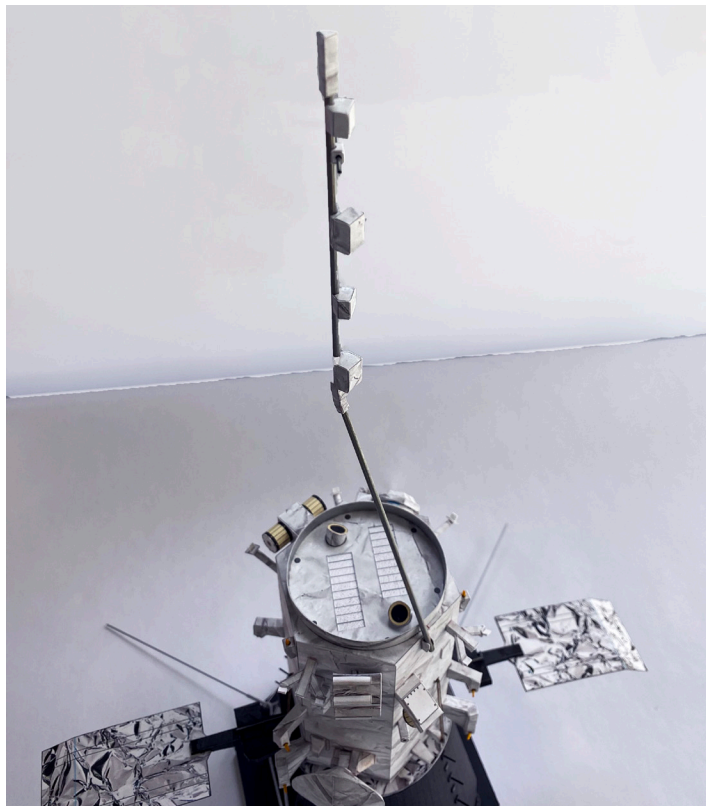


The radiator with the two strips (77 and 78) should be positioned over the telescope (indicated by the blue arrows).

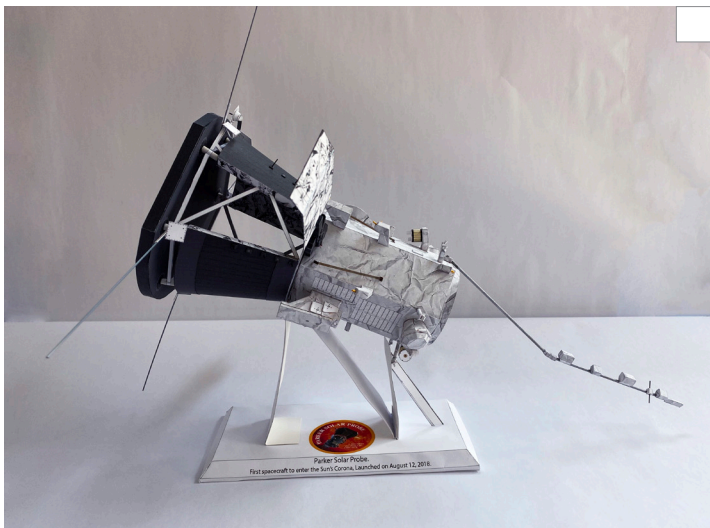
The small antenna should be near the side with the high gain antenna (red arrow).



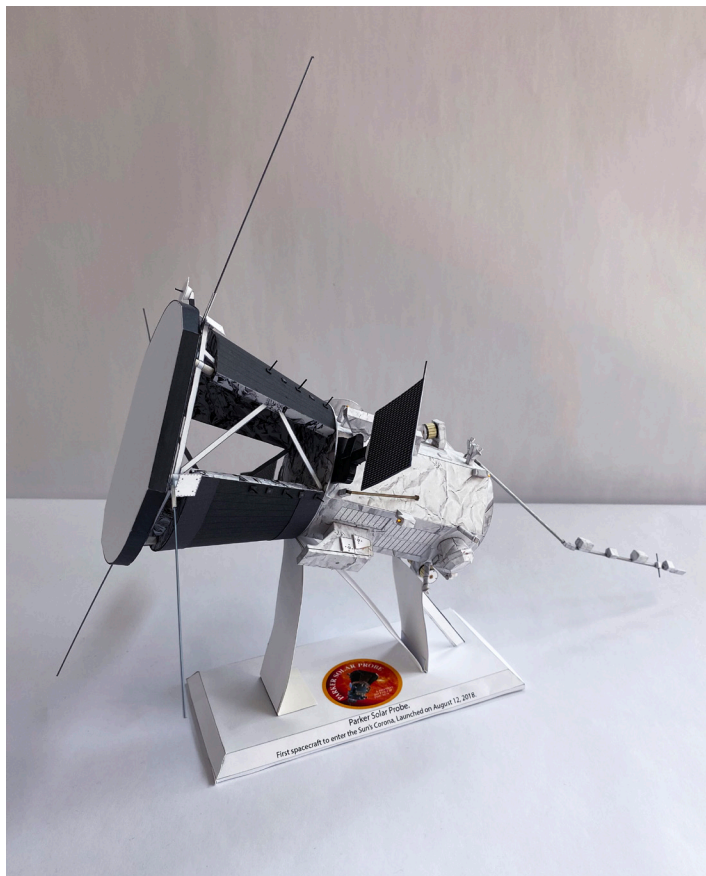
Glue the magnetometer boom arm onto the hinge



The instruments on the arm should face away as shown.



You can create a stand for displaying your model with the magnetometer. See pages 11 and 12 of the parts file for instructions.



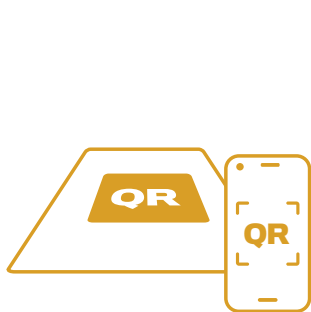
**YOUR MODEL IS DONE!**

# PARKER SOLAR PROBE AR EXPERIENCE

Explore and manipulate the Parker Solar Probe spacecraft on your computer screen or scan the QR code to access an augmented reality version of the spacecraft on your cell phone!

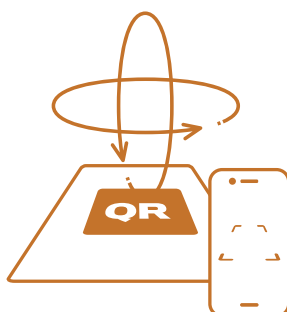


## VIEW THE SPACECRAFT IN YOUR SPACE



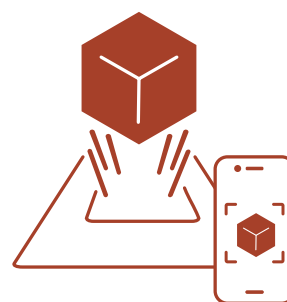
1

Scan QR code through the camera on your phone. Click View Spacecraft in Your Space.



2

Rotate phone around the room.



3

Move around the room to see different angles and sides of the spacecraft.