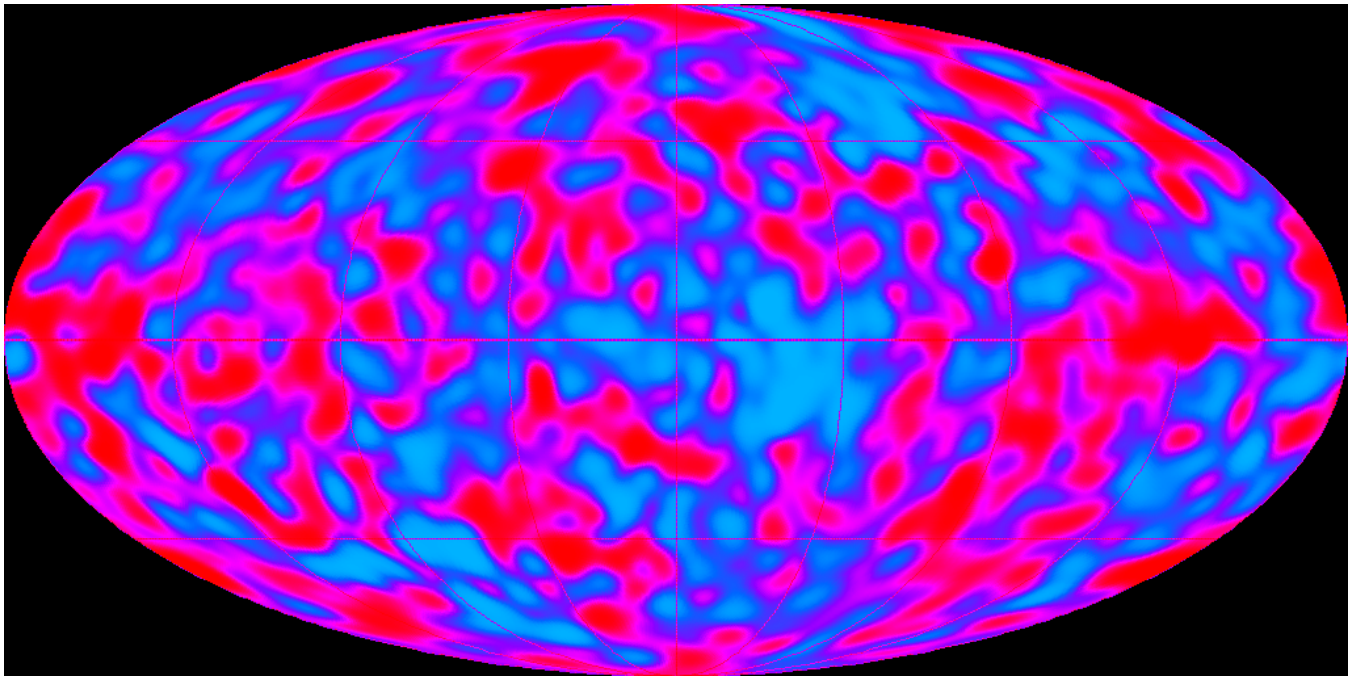
COBE: Cosmic Background Explorer 1:24 scale

The COBE satellite was developed by NASA's Goddard Space Flight Center to measure the diffuse infrared and microwave radiation from the early universe to the limits set by our astrophysical environment. It was launched November 18, 1989 and carried three instruments, a Diffuse Infrared Background Experiment (DIRBE) to search for the cosmic infrared background radiation, a Differential Microwave Radiometer (DMR) to map the cosmic radiation sensitively, and a Far Infrared Absolute Spectrophotometer (FIRAS) to compare the spectrum of the cosmic microwave background radiation with a precise blackbody. Each COBE instrument yielded a major cosmological discovery:

DIRBE - Infrared absolute sky brightness maps in the wavelength range 1.25 to 240 microns were obtained to carry out a search for the cosmic infrared background (CIB). The CIB represents a "core sample" of the Universe; it contains the cumulative emissions of stars and galaxies dating back to the epoch when these objects first began to form. The COBE CIB measurements constrain models of the cosmological history of star formation and the buildup over time of dust and elements heavier than hydrogen, including those of which living organisms are composed. Dust has played an important role in star formation throughout much of cosmic history.

FIRAS - The cosmic microwave background (CMB) spectrum is that of a nearly perfect blackbody with a temperature of 2.725 +/- 0.002 K. This observation matches the predictions of the hot Big Bang theory extraordinarily well, and indicates that nearly all of the radiant energy of the Universe was released within the first year after the Big Bang.

DMR - The CMB was found to have intrinsic "anisotropy," or unevenness for the first time, at a level of a part in 100,000. These tiny variations in the intensity of the CMB over the sky show how matter and energy was distributed when the Universe was still very young. Later, through a process still poorly understood, the early structures seen by DMR developed into galaxies, galaxy clusters, and the large scale structure that we see in the Universe today.



COBE sky map of the cosmic microwave background.

The cosmic microwave background fluctuations are extremely faint, only one part in 100,000 compared to the 2.73 degree Kelvin average temperature of the radiation field. The cosmic microwave background radiation is a remnant of the Big Bang and the fluctuations are the imprint of density contrast in the early universe. The density ripples are believed to have given rise to the structures that populate the universe today: clusters of galaxies and vast regions devoid of galaxies.

COBE: Cosmic Background Explorer 1:24 scale

To assemble your model you will need a knife or small scissors, straight edge, glue, and a fine blunt pointed instrument to score fold lines with. Score all fold lines before cutting to ensure crisp folds. Where it's not obvious, fold lines are indicated with red arrows. Part numbers are indicated in parenthesis and are noted in boxes near the parts.

1. Dewar: Cut out the main body (1), roll it into a cylinder – overlapping the tab – and glue. Cut out the conic (2), roll it into a squat cone – overlapping the tab – and glue. Bend the tabs at the top of part 1 inward and glue part 2 on top.

- Cut out the top of the Dewar (3,4). Cut out the dark areas of part 3, then glue part 4 to the bottom of part 3 with the printed side up to add relief to the instrument apertures. Bend the tabs at the top of the Dewar assembly inward and glue the completed top assembly in place. Note the small register mark on part 3 – this shows where the #2 DMR will be placed later.
- Cut out the shelf support band (9) and glue it in place wrapped around the Dewar cylinder just below the line labelled instrument shelf.
- Cut out the instrument shelf (10), saving the inner cut-out for future reference when aligning parts, and slip it over the top of the Dewar until it rests on the support band, then glue in place – making sure the number 2 on the shelf aligns with the register mark on the top of the Dewar.

2. Satellite Bus: Cut out the bus (5,6) and glue together matching the arrows. Fold the sides into a hexagonal column and glue. Fold down the top and bottom, then glue to form a closed column.

- Cut out part 17, fold, and glue the circles together with the printed sides out. Glue the side marked "to bus" to the top of the satellite bus, ensure it is centered.
- Cut out the sensors (7) and fold them into square, tapering columns using the tabs to glue them together. The sensors will be glued to the bottom of the bus later, located over the gray rectangles with the apertures facing outward. Do not glue the sensors in place now – it will make assembly more difficult.
- Roll the omni-antenna mast and antenna (8) into tight cylinders as indicated, glue and set aside. Assemble and install the antenna to the gray circle on the bottom of the bus after all other assembly is done (refer to technical drawings for more details).

3. Instruments: All three differential microwave radiometers (DMR) are assembled similarly. Cut out the DMR (11, 13, or 15), fold it into an irregular box and glue.

- Roll the rectangular parts into cylinders, gluing the tab to secure each one, then glue the cylinders over the circles on the top of each DMR (note: each DMR uses a different size). When completed, glue each DMR to the instrument shelf centered on its corresponding number.
- Glue the DMR supports (12, 14, or 16) to thick card to strengthen them. Then, cut out the supports and glue them to the outer edge of the instrument shelf under each DMR. Carefully bend in the lower legs and glue them to the outside of the Dewar cylinder.

COBE: Cosmic Background Explorer 1:24 scale

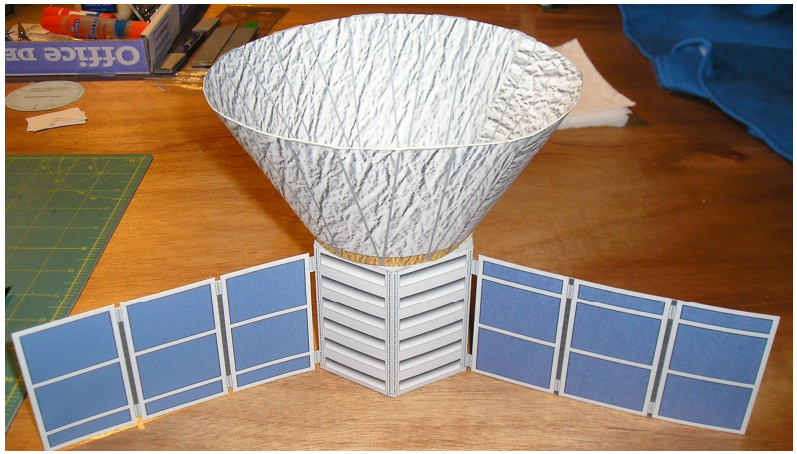
4. Sunshade: Cut out the shade parts (2 each 20,21). Pre-curve the parts, ensuring the printing is on the inside of the curve for parts 20 and on the outside for parts 21. Carefully glue **one-half** of the unprinted side of one part 20 to **one-half** of the unprinted side of one part 21. You will end up with half of each part overlapping. Take the remaining part 20 and glue one-half of its unprinted side to the assembly. Then, use the remaining part 21 to connect and secure the shade (see drawing next to parts).
- Bend the tabs on the bottom of the sunshade inward, then glue to the top of the satellite bus.

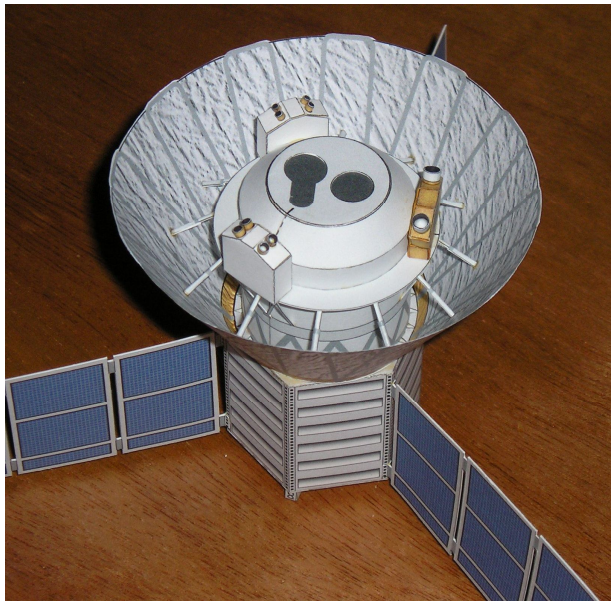
5. Solar Panels: Cut out the solar panels (18) fold and glue them together printed side out. Take care not to glue the mounting tabs shut. Fold the tabs open and glue the panels to the corners of the satellite bus marked with a small gray circle on the bottom of the bus.

6. Dewar installation: Apply glue to the bottom edge of the Dewar assembly and glue to the top of the satellite bus centered on the printed circle. Refer to the cut-out from part 10 for alignment. When looking at it from above, DMR 2 should be aligned with one face of the bus and have a solar panel just clockwise.

7. Shade support struts: Cut out the struts (19) and roll them into tight cylinders. For a simpler model, you can glue the struts to thick card and cut a strip to make the strut. Apply glue to the large end of each strut and glue to the inside of the shade at the gray dots (centered in the gray rectangular outlines). Apply a small amount of glue to the free end of the strut and attach it to the underside of the instrument shelf.

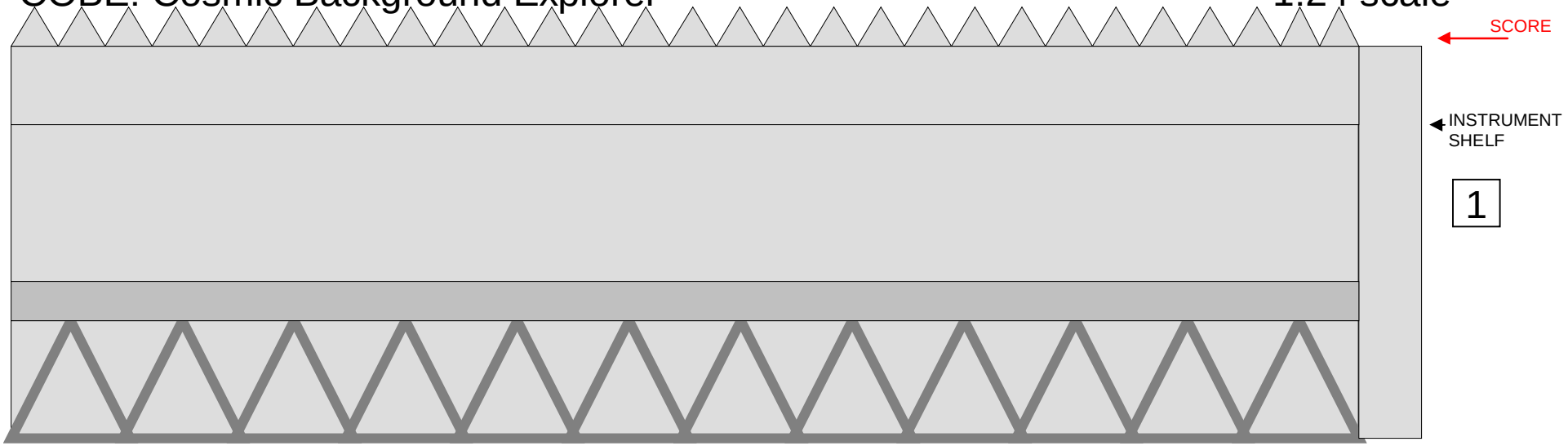
8. Sensor/Antenna installation. Now, glue the assembled sensors to the bottom of the satellite bus over the gray squares with the apertures facing outward.
- Glue the omni-antenna to the center of the bottom of the satellite bus. You can punch a hole in the bottom to insert the antenna or glue it to the surface with a dab of glue.



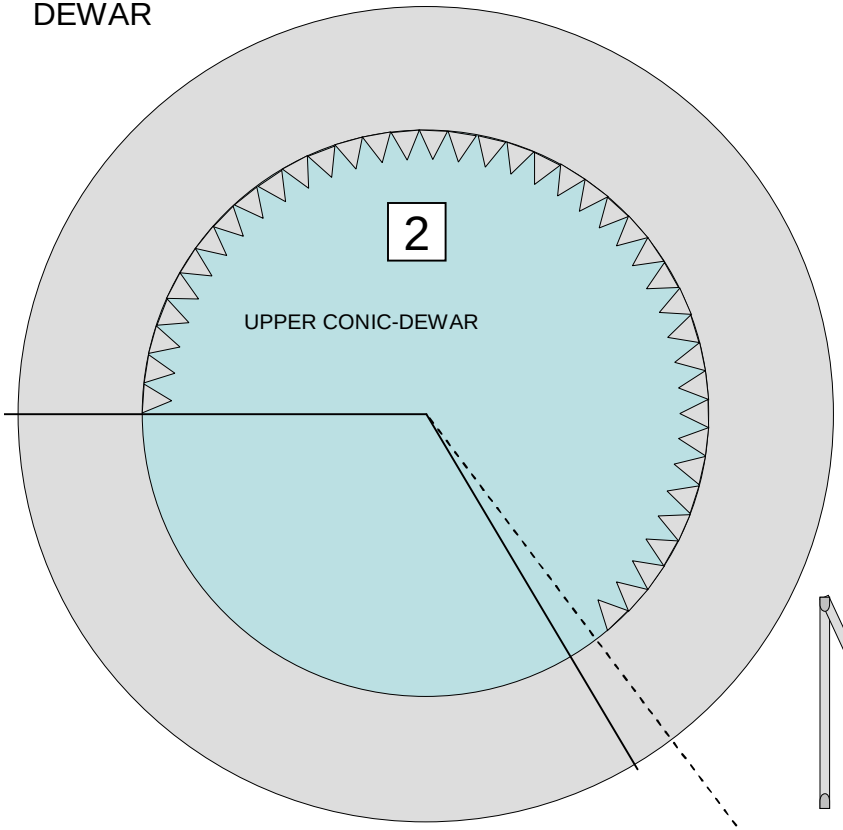


COBE: Cosmic Background Explorer

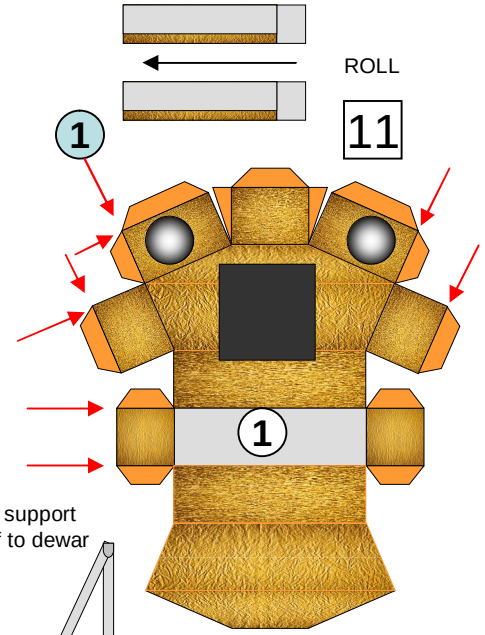
1:24 scale



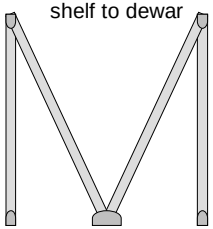
DEWAR



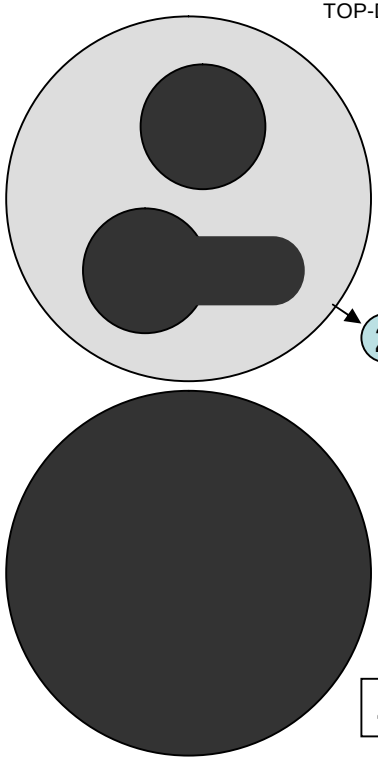
Differential Microwave Radiometer (DMR)
(one of three)



DMR support shelf to dewar



TOP-DEWAR



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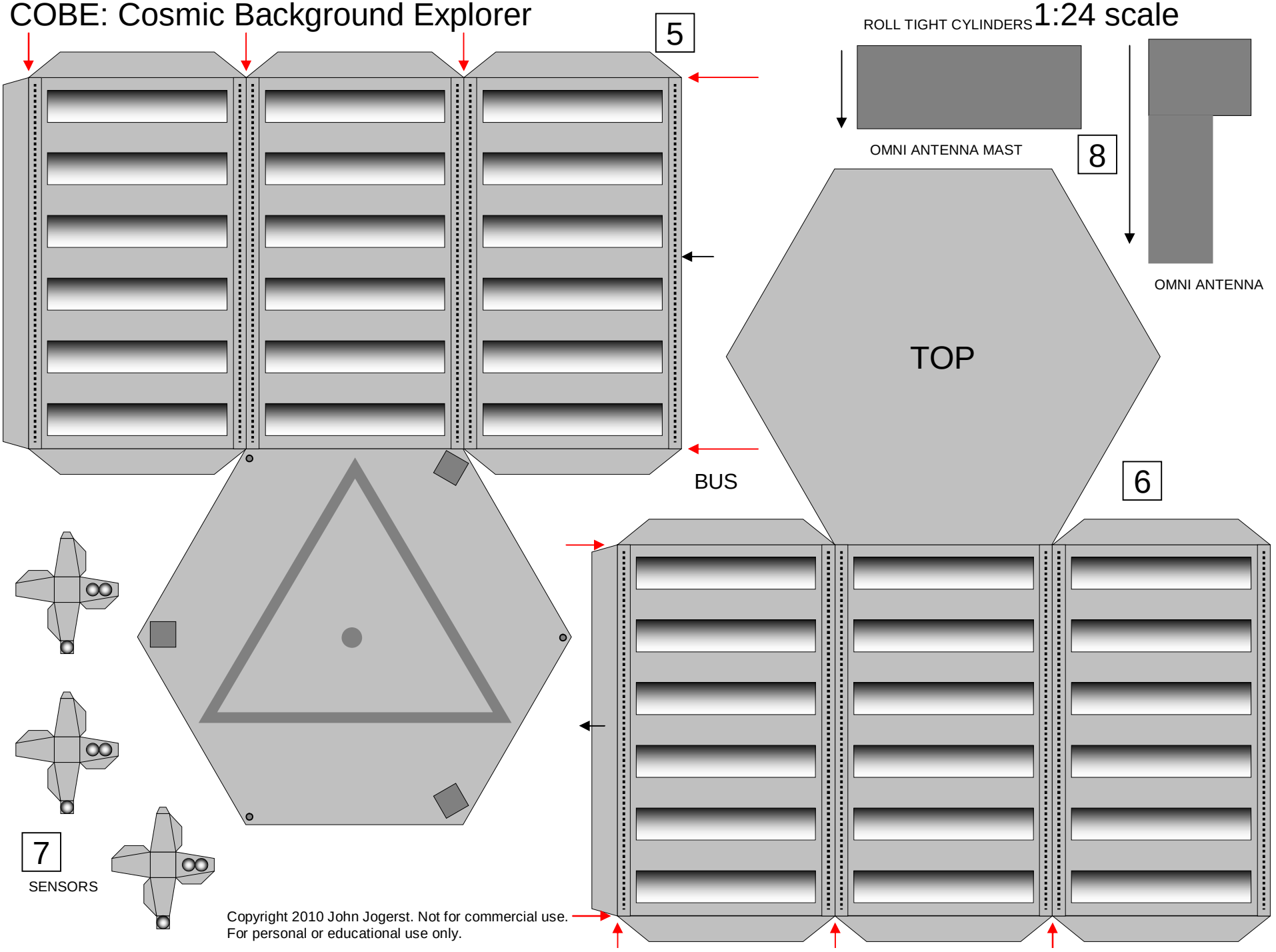
COBE: Cosmic Background Explorer

1:24 scale



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SHELF SUPPORT BAND (MAY NEED EXTRA CARD BLOCKING

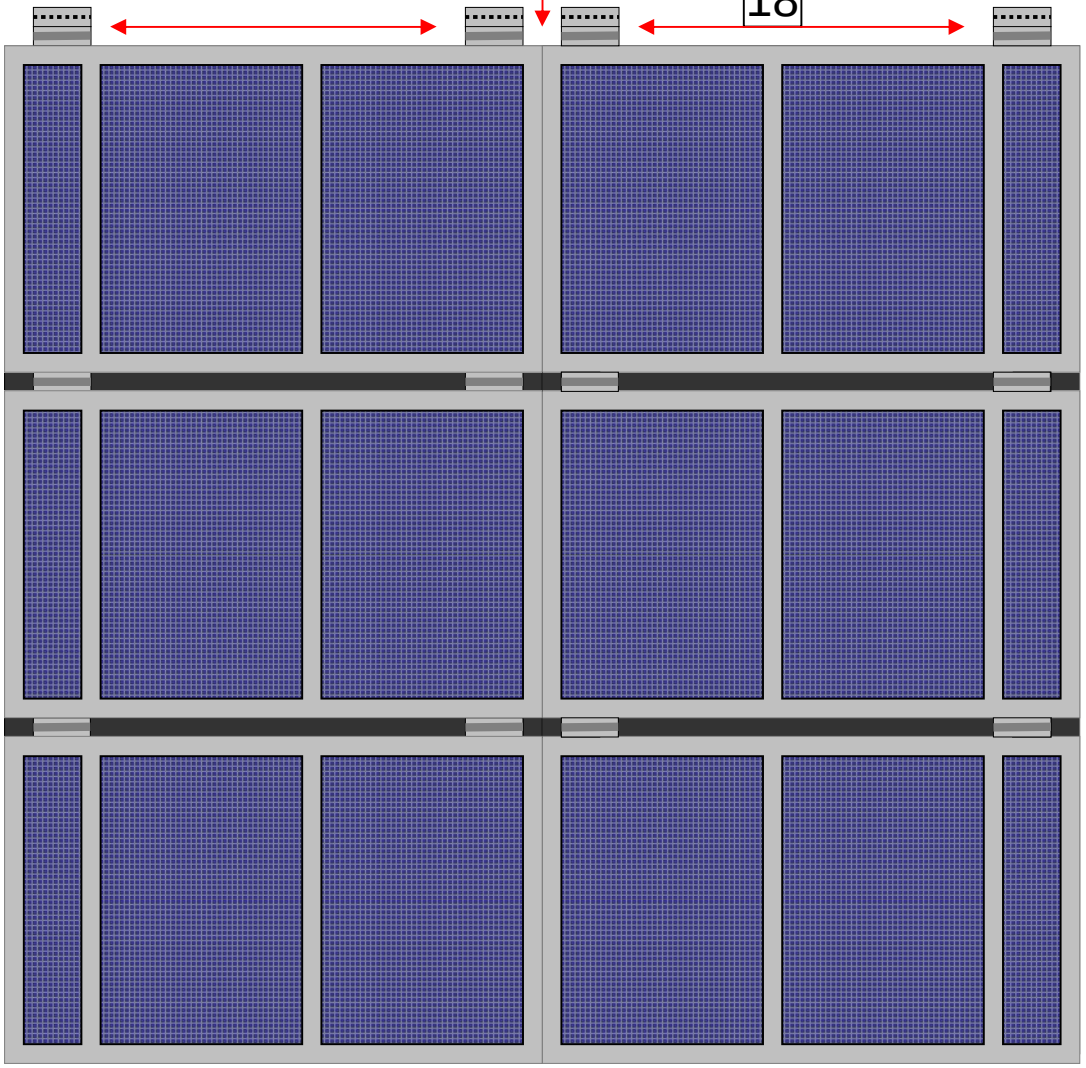
1:24 scale

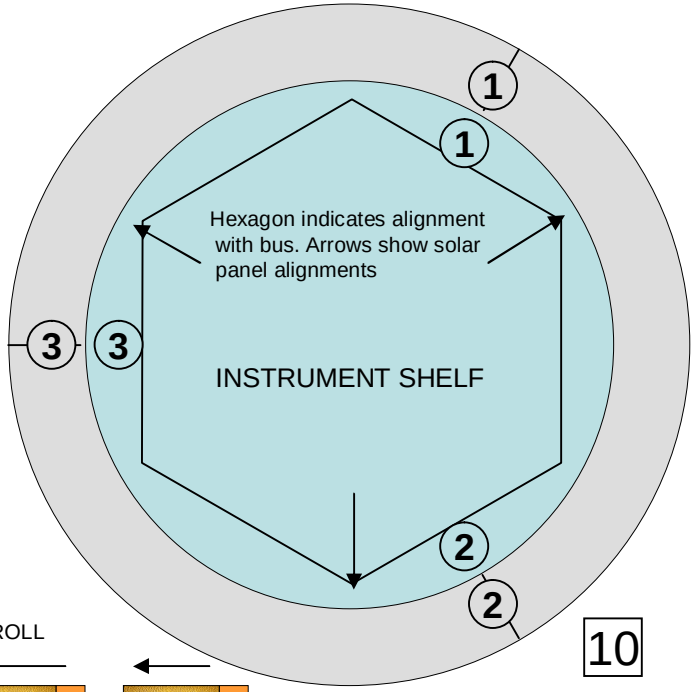
9

ROLL

MOUNTING TABS

18





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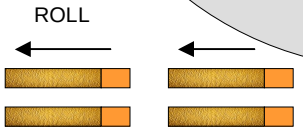
ROLL



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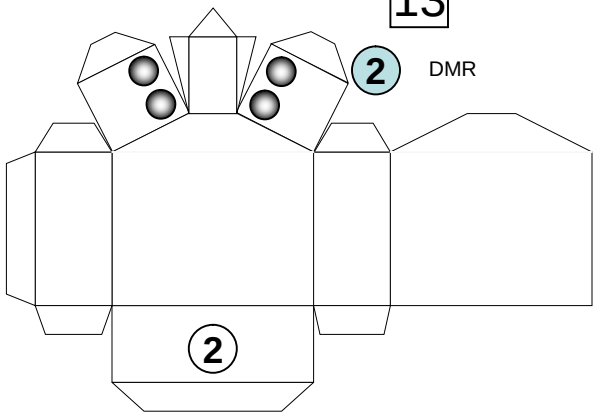
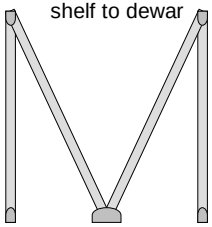


14

DMR support shelf to dewar



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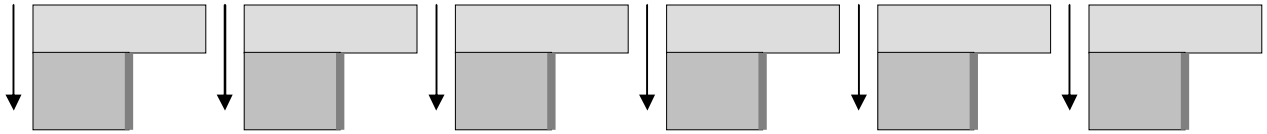
COBE: Cosmic Background Explorer

1:24 scale

SUN/EARTH SHADE SUPPORTS
ROLL TIGHTLY – SECURE BETWEEN
INSTRUMENT SHELF AND SHADE

ROLL



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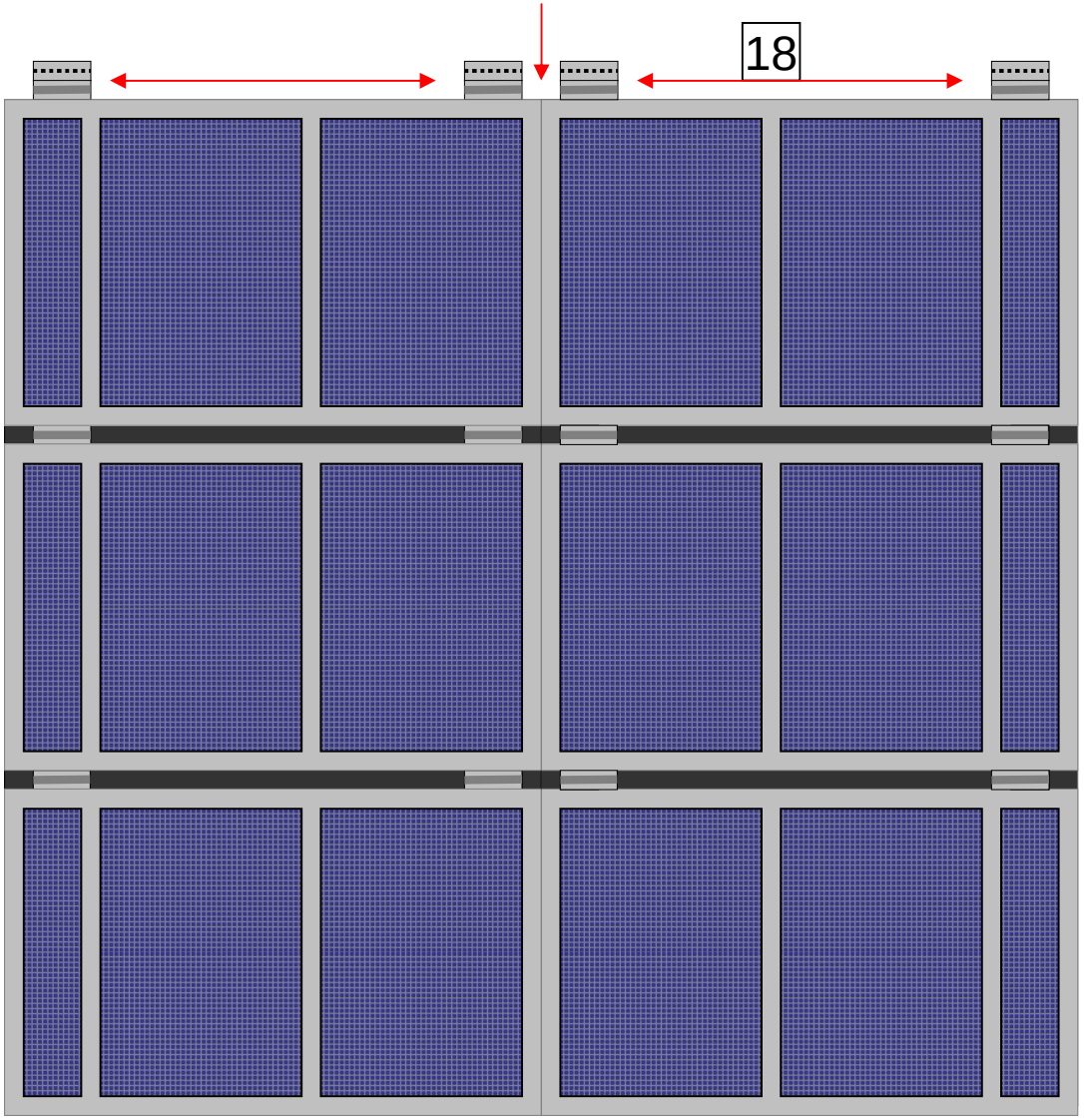
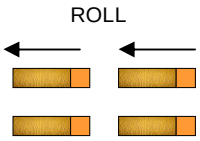


ROLL



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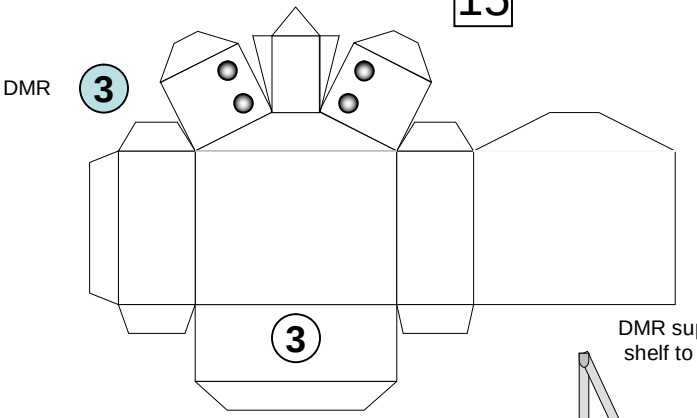
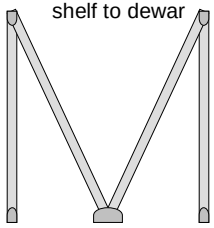
DMR



DMR support
shelf to dewar



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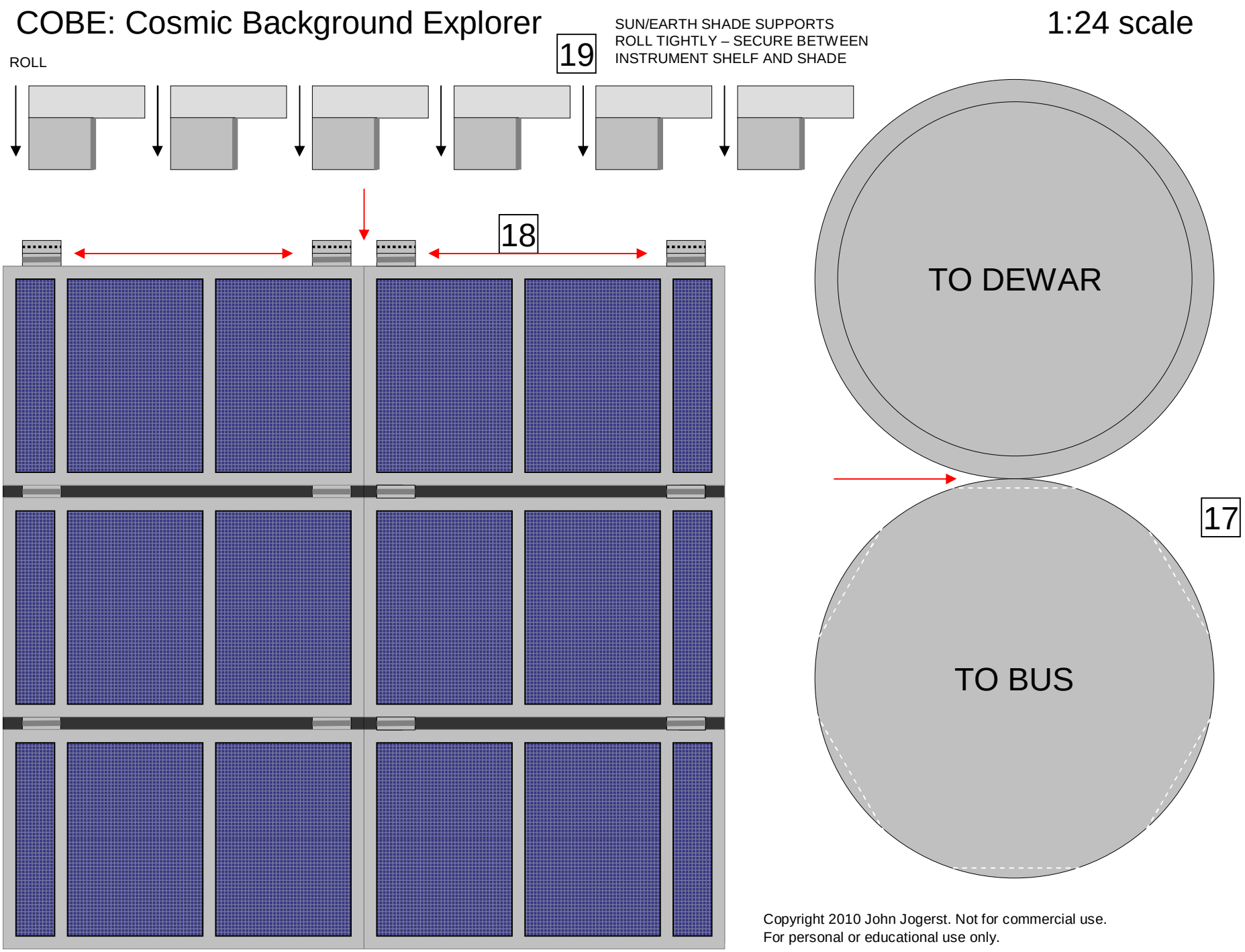
COBE: Cosmic Background Explorer

1:24 scale



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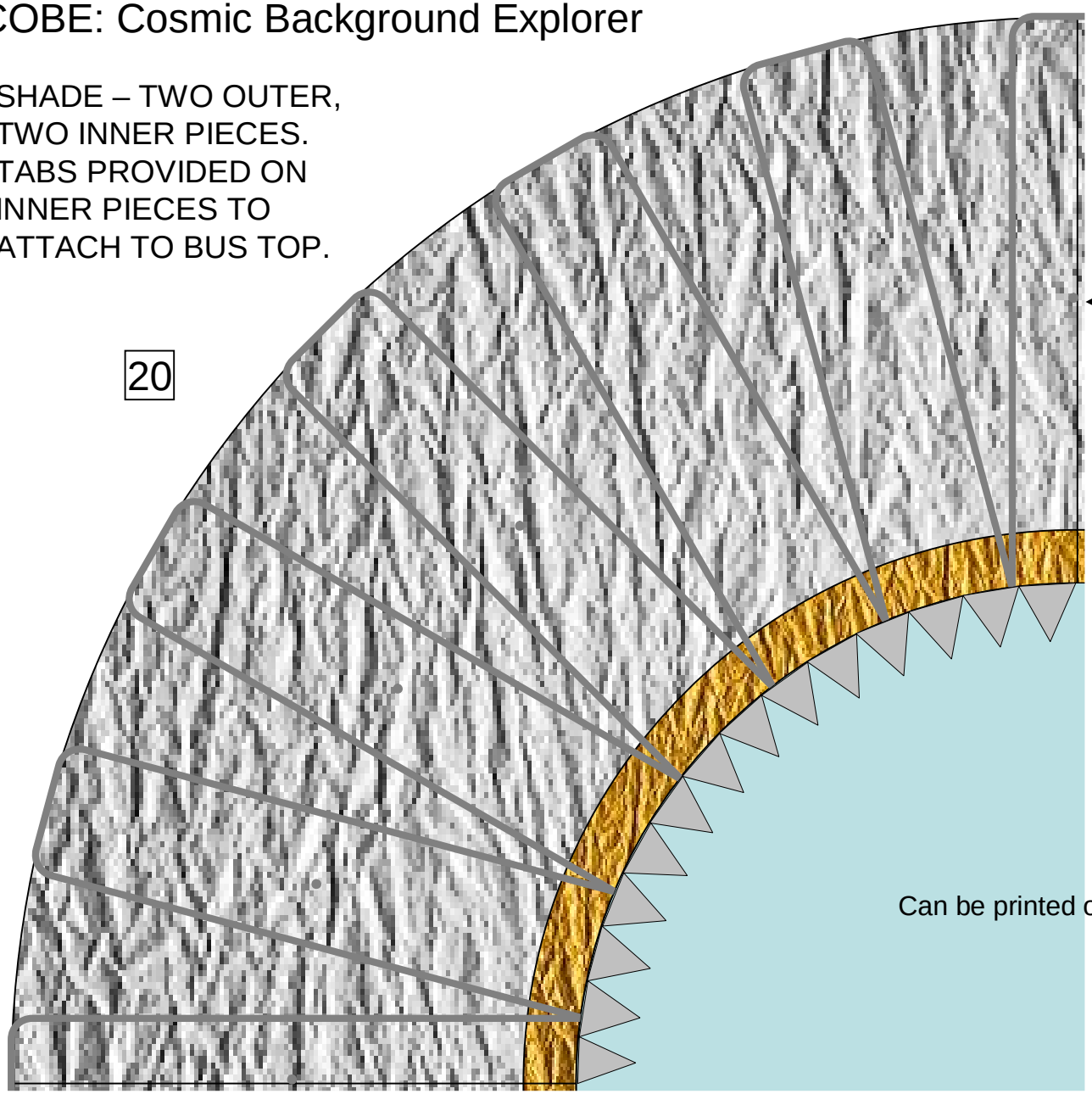
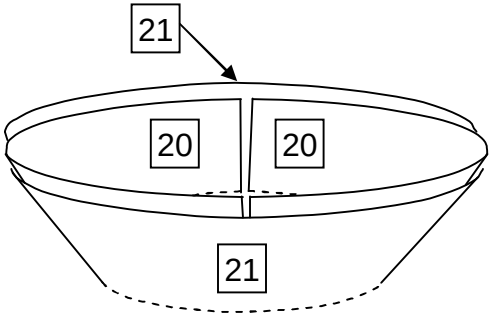
COBE: Cosmic Background Explorer

SHADE – TWO OUTER, TWO INNER PIECES. TABS PROVIDED ON INNER PIECES TO ATTACH TO BUS TOP.

20



GRAY DOTS INDICATE APPROXIMATE LOCATION FOR SHADE SUPPORT STRUTS.



Assembling the Shade

Can be printed on plain paper

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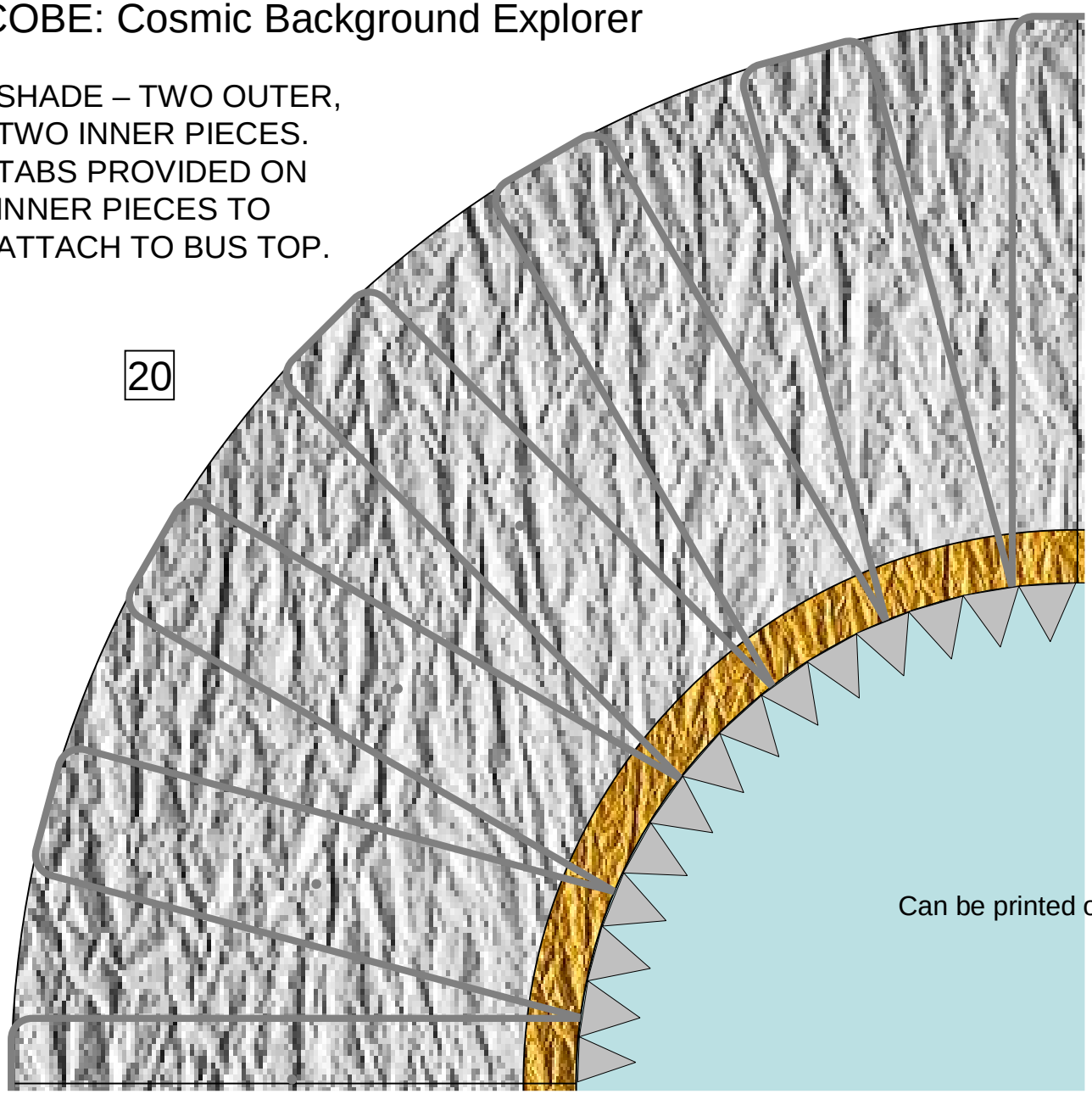
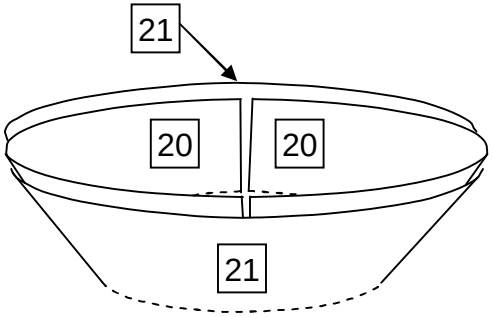
COBE: Cosmic Background Explorer

SHADE – TWO OUTER, TWO INNER PIECES. TABS PROVIDED ON INNER PIECES TO ATTACH TO BUS TOP.



GRAY DOTS INDICATE APPROXIMATE LOCATION FOR SHADE SUPPORT STRUTS.



Assembling the Shade

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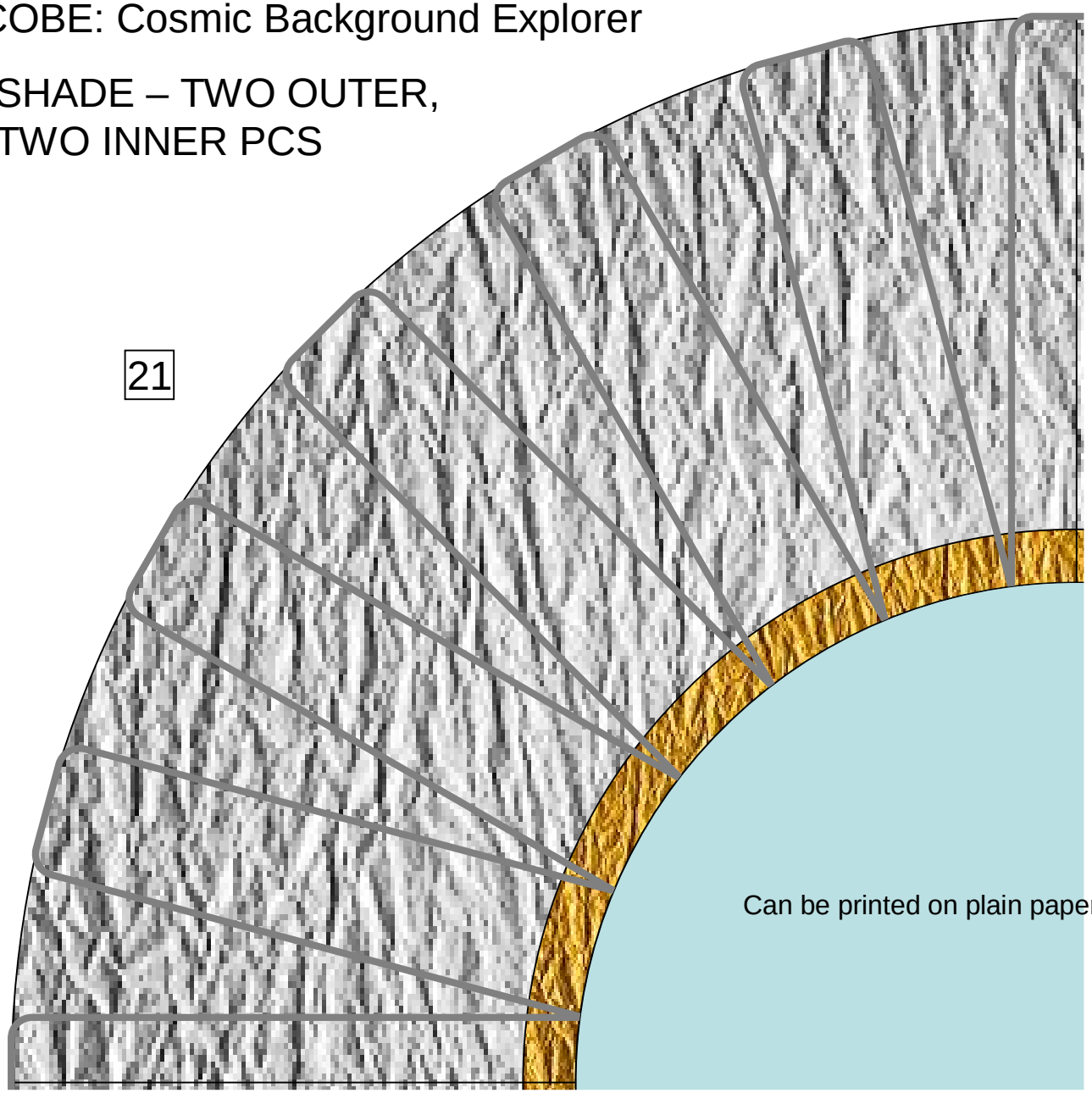
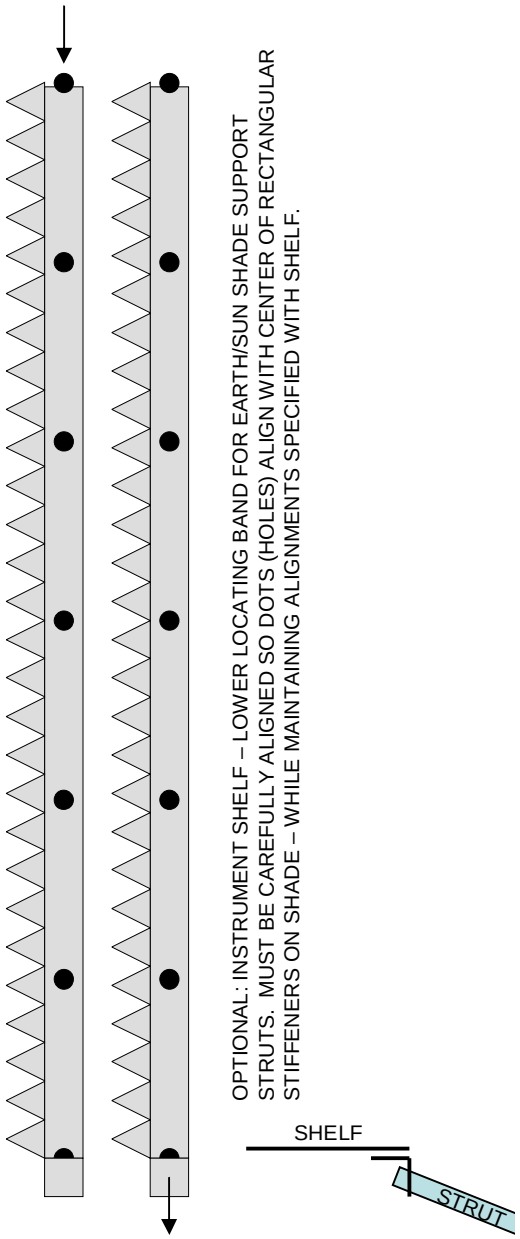
COBE: Cosmic Background Explorer

1:24 scale

SHADE – TWO OUTER, TWO INNER PCS

21





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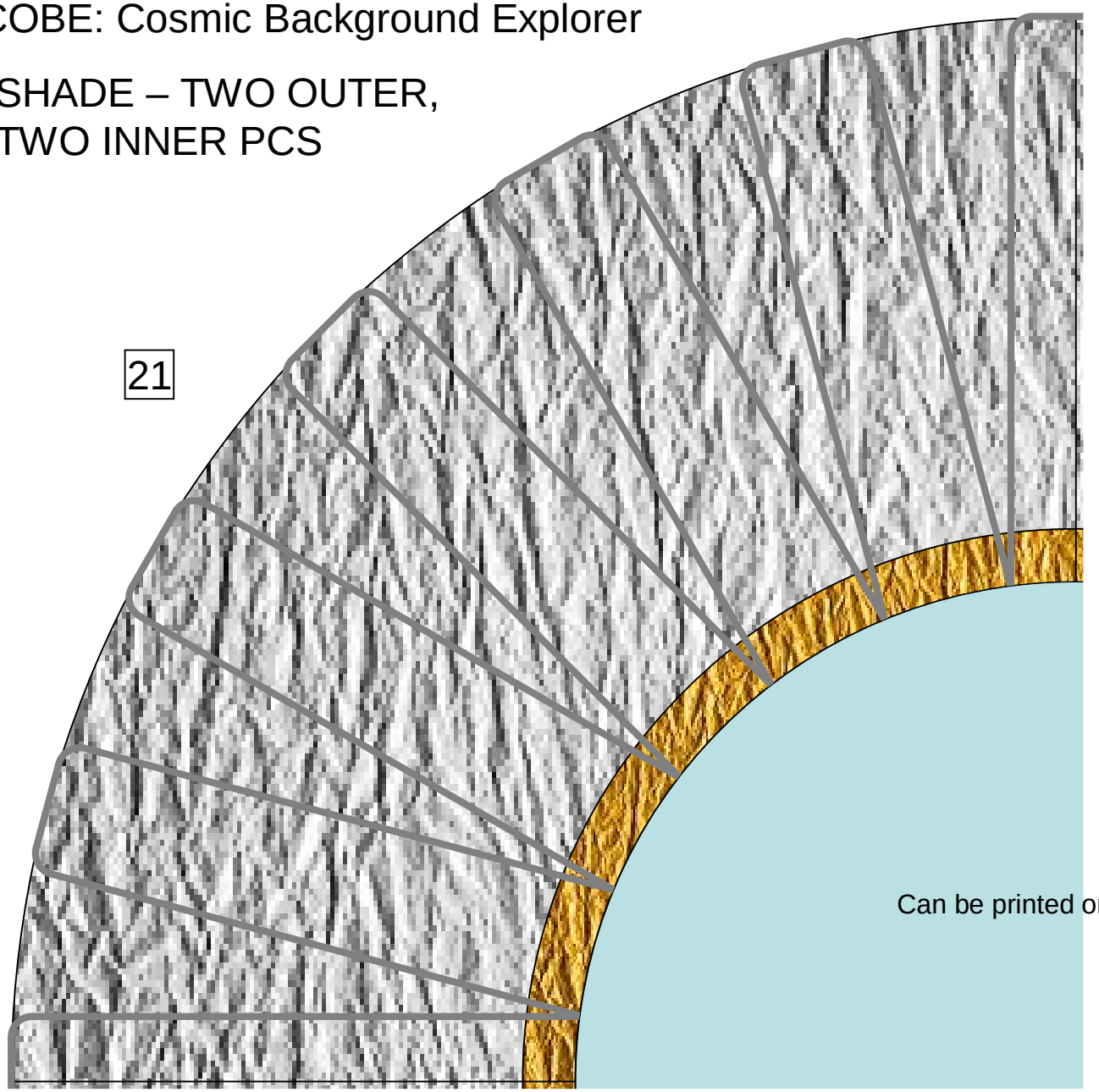
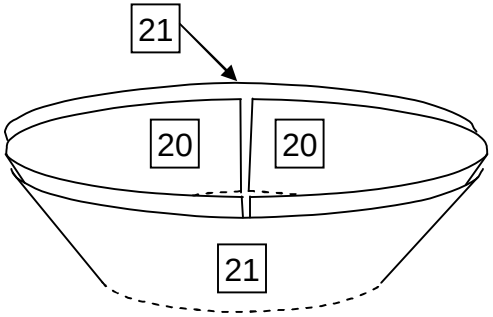
COBE: Cosmic Background Explorer

1:24 scale

SHADE – TWO OUTER,
TWO INNER PCS





Assembling the Shade

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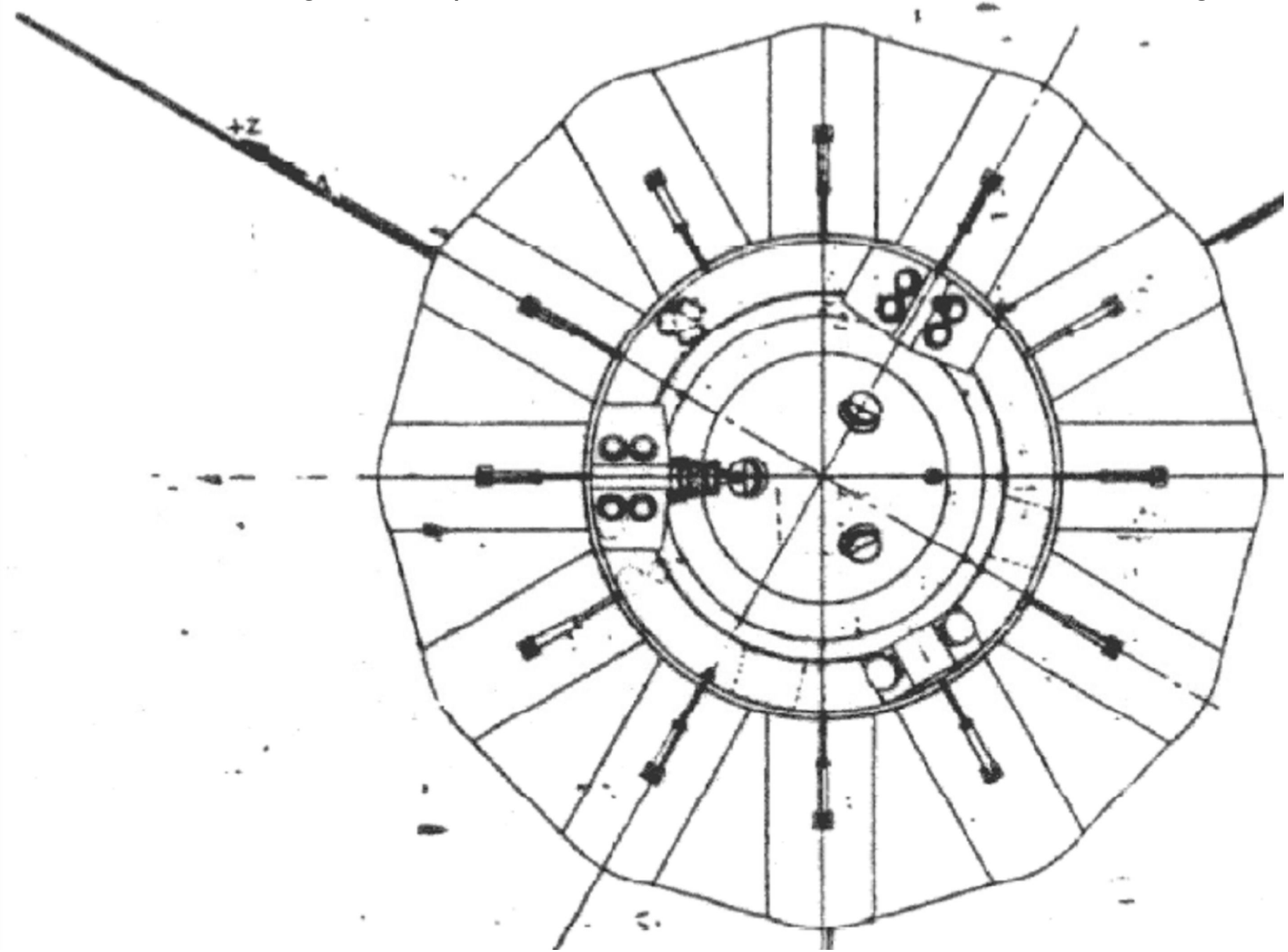
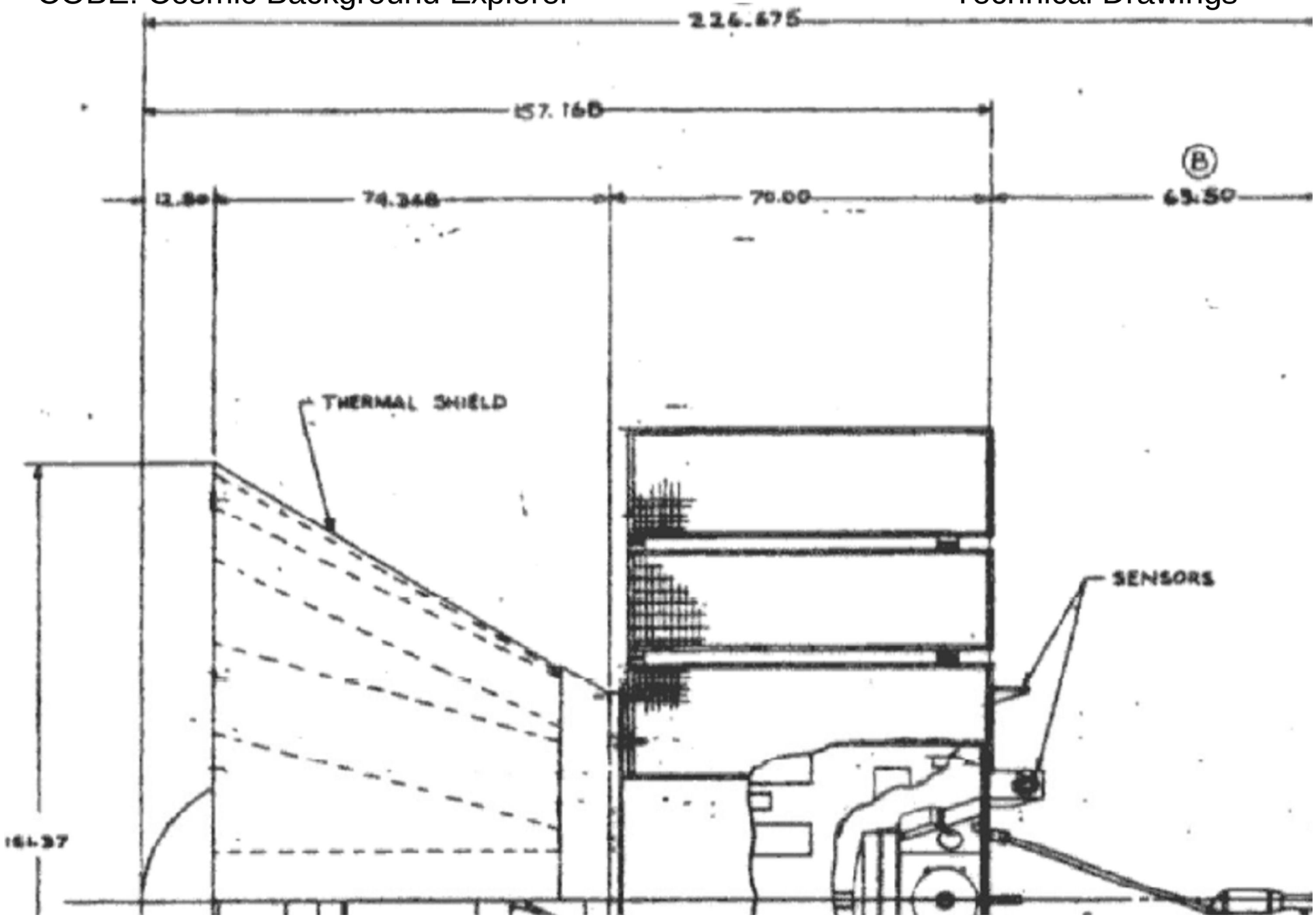
COBE: Cosmic Background Explorer

Technical Drawings

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12.80
74.348
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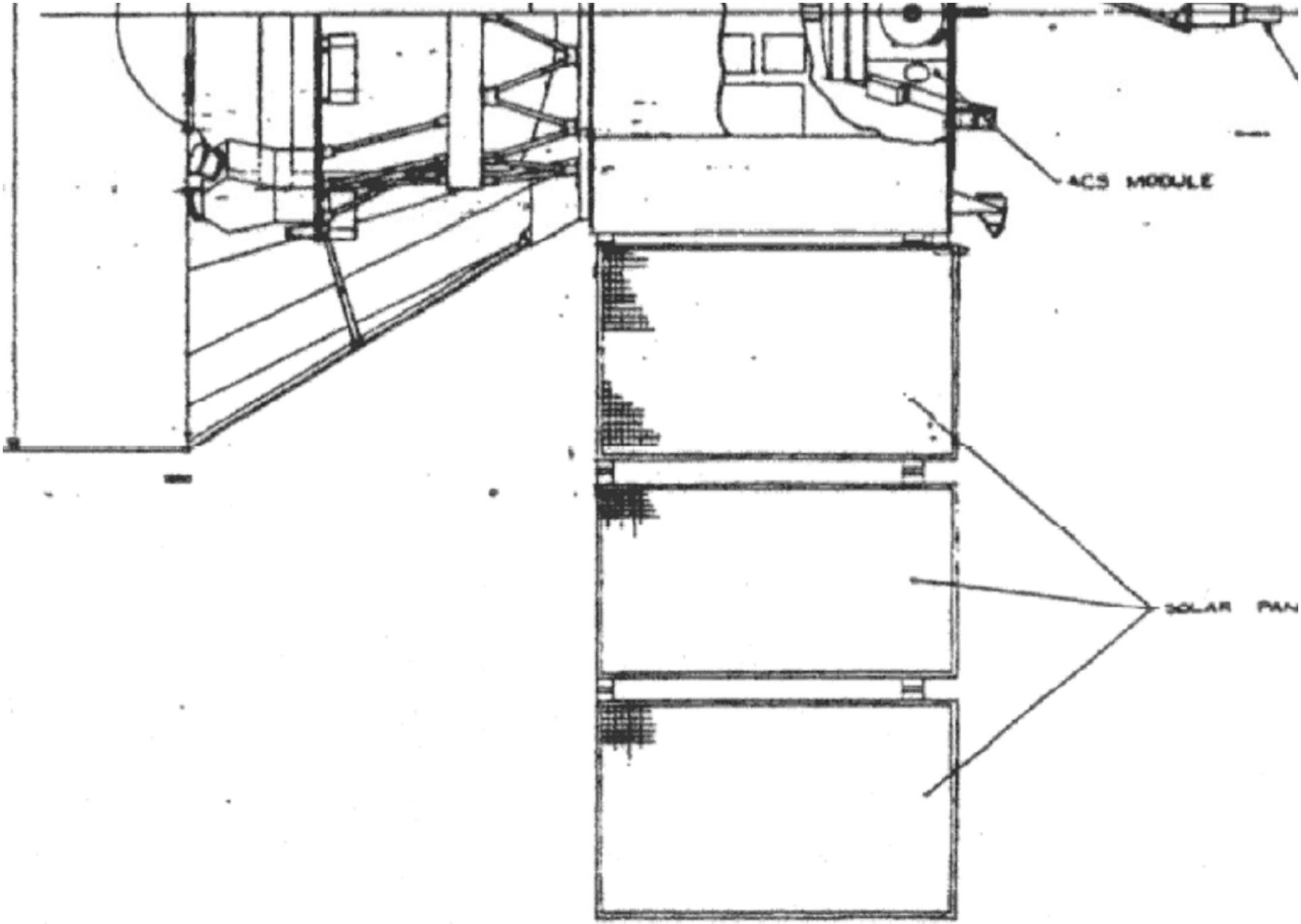
63.50
THERMAL SHIELD
SENSORS
164.37



COBE: Cosmic Background Explorer Technical Drawings

COBE: Cosmic Background Explorer

Technical Drawings