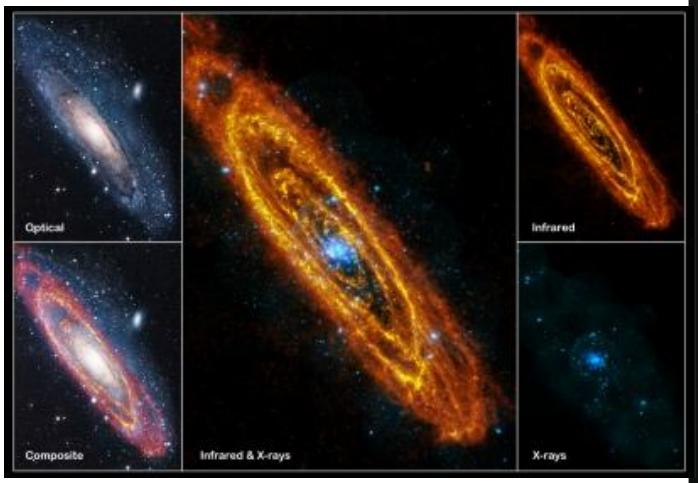
HERSCHEL INFRA-RED OBSERVATORY European Space Agency

1:48 scale



During Christmas 2010, ESA's Herschel and XMM-Newton space observatories targeted the nearest large spiral galaxy M31. This is a galaxy similar to our own Milky Way – both contain several hundred billion stars. This is the most detailed far-infrared image of the Andromeda Galaxy ever taken and shows clearly that more stars are on their way. Sensitive to far-infrared light, Herschel sees clouds of cool dust and gas where stars can form. Inside these clouds are many dusty cocoons containing forming stars, each star pulling itself together in a slow gravitational process that can last for hundreds of millions of years. Once a star reaches a high enough density, it will begin to shine at optical wavelengths. It will emerge from its birth cloud and become visible to ordinary telescopes.

Concept: ESA's Herschel is the first space observatory covering the full far-infrared and submillimetre waveband. It is also the largest to work at those wavelengths. Thanks to this, Herschel will be able to see dusty and cold regions that are opaque to other telescopes, unveiling a face of the early Universe so far hidden. Herschel's main goal is to study how galaxies and stars form and evolve. Other targets include the clouds of gas and dust where new stars are being born, discs out of which planets may form, and cometary atmospheres packed with complex organic molecules.

Primary mirror: 3.5 m in diameter.

Launch: Herschel will be launched in 2008 together with another ESA scientific mission, Planck. Both satellites will separate shortly after launch to operate independently.

Orbit: Herschel will orbit a the L2 virtual point in the Sun-Earth system, located 1.5 million km from Earth.

Instruments: HIFI (Heterodyne Instrument for the Far Infrared), a high-resolution spectrograph; PACS (Photoconductor Array Camera and Spectrometer); and SPIRE (Spectral and Photometric Imaging REceiver). These instruments cover the 60–670 micron waveband. They will be cooled to temperatures very close to absolute zero.

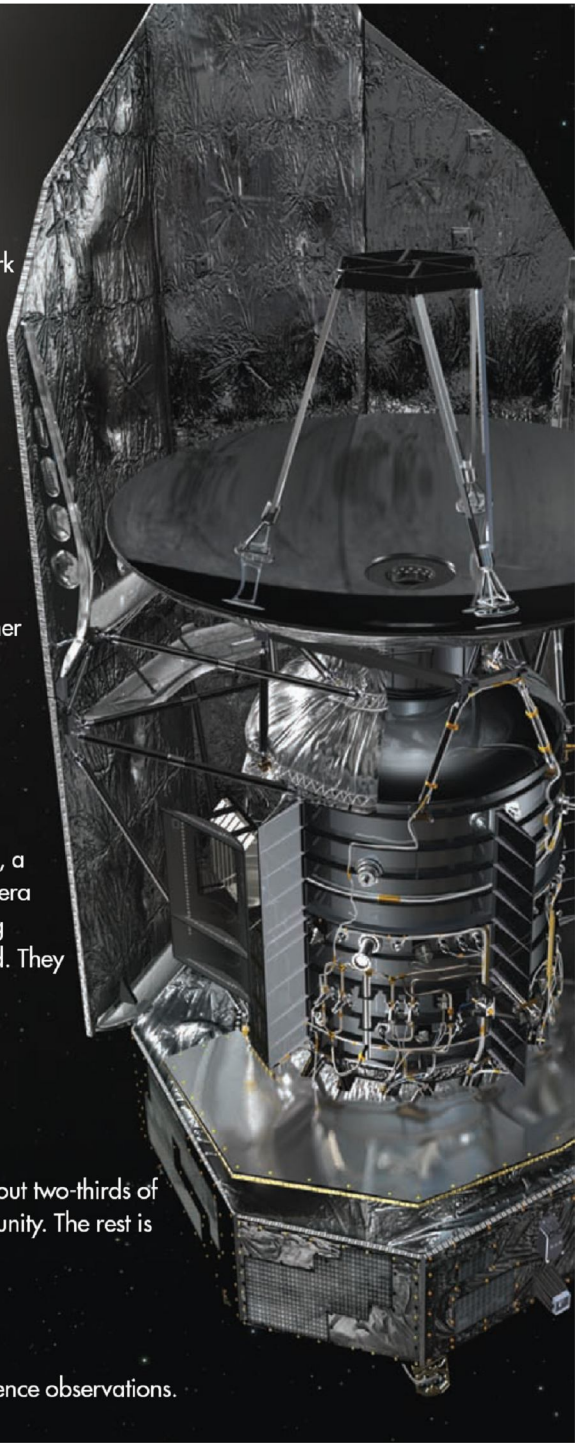
Launch mass: about 3 t.

Dimensions: about 7.5 m high and 4.5 m wide.

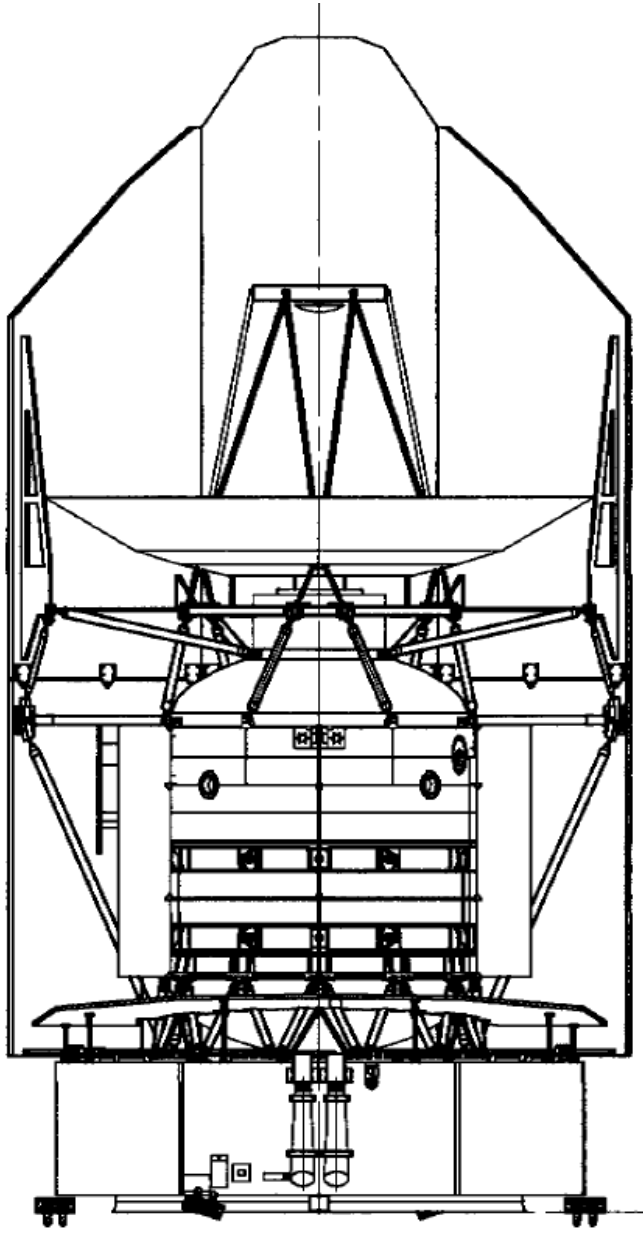
Operations: Herschel will be operated as an observatory. About two-thirds of its observing time will be available to the world's scientific community. The rest is guaranteed time mainly belonging to the instrument consortia.

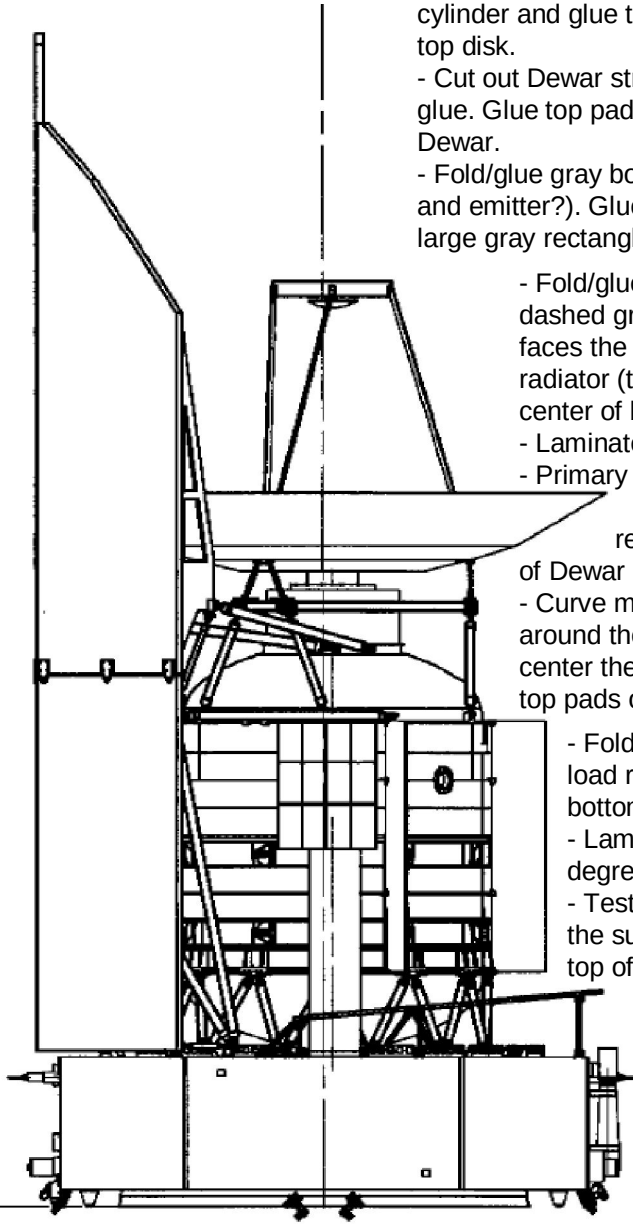
Primary ground station: New Norcia, Australia.

Operational Lifetime: a minimum of 3 years for routine science observations.



HERSCHEL IR OBSERVATORY – 1:48 scale





- Roll Dewar body into cylinder and connect with joiner.
- Curve top, bottom, and intermediate conics and glue to Dewar body. Close bottom with disk. Roll neck into cylinder and glue to top of Dewar assembly, cap with top disk.
- Cut out Dewar struts, laminate, curve into a circle and glue. Glue top pads to gray rectangles around bottom of Dewar.
- Fold/glue gray box and gray/black panel (waveguide and emitter?). Glue panel on top of box, then attach to large gray rectangle on the side of the Dewar.
- Fold/glue radiators, then attach to Dewar on dashed gray lines (see diagrams). White side faces the white side of the Dewar. All black radiator (trim to clear struts if needed) goes in center of black side of Dewar.
- Laminate mirror tripods.
- Primary tripod bends only where the long struts meet the triangles. Struts remain straight. Curve bottom to fit top of Dewar and glue in place.
- Curve mirror parts and glue. Apply glue around the inner rim of the larger conic and center the smaller part to form the mirror. Bend top pads on primary tripod to attach mirror.
- Fold/glue bus into octagonal box. Form load ring into a circle and glue to the bottom of the bus.
- Laminate the sunshade, fold sides to 45 degrees, and glue to top of bus on +Z side.
- Test fit Dewar/mirror to ensure it clears the sunshade evenly, then glue to circle on top of bus. Tics align w/ bottom of struts
- Form/glue star tracker box and conics, then glue parts together. Glue assembly to –Z face of bus where marked.
- Fold down legs of 2ndary mirror tripod and glue to primary mirror; refer to diagrams for positioning.

Y sa_

- Roll or laminate parts for bus thermal shield struts, glue struts to bus, and shield to struts.
- Fold/glue thrusters and attach to bottom of bus. See diagrams to orient nozzles.
- If desired, roll/laminate sunshade struts, trim to length and glue in place per diagrams.

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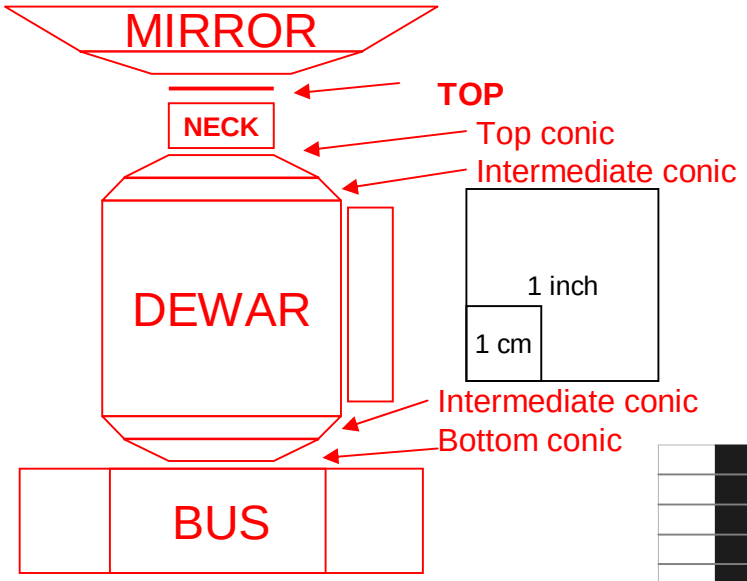
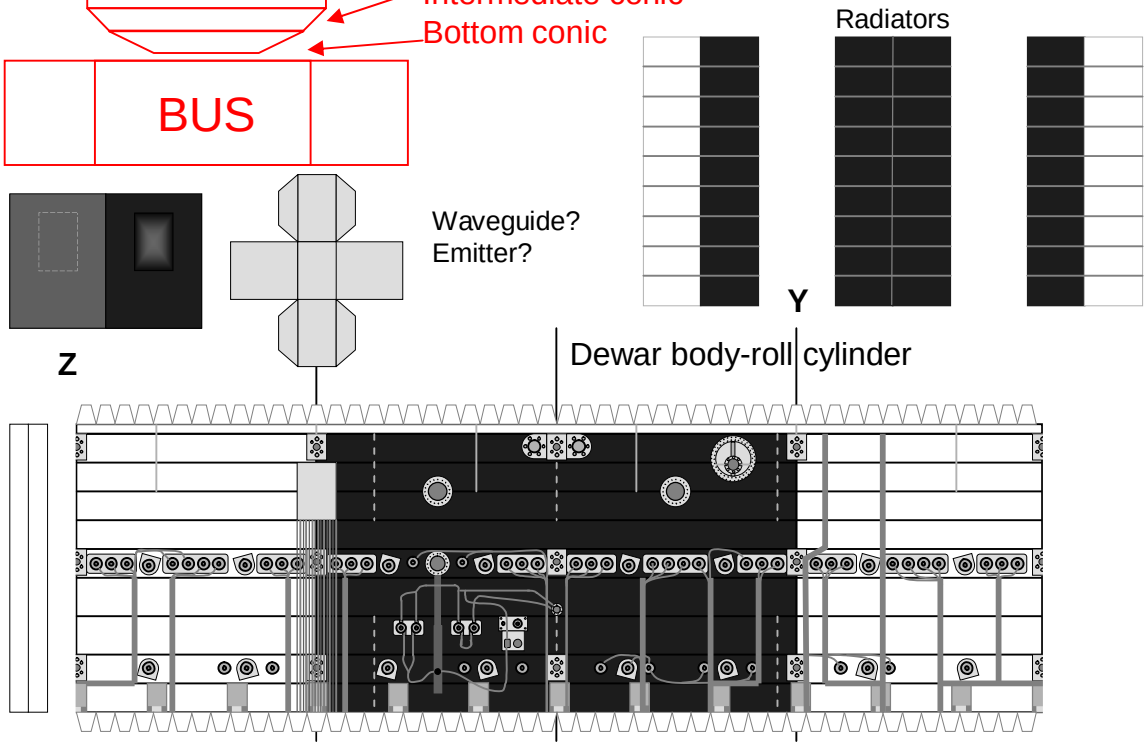
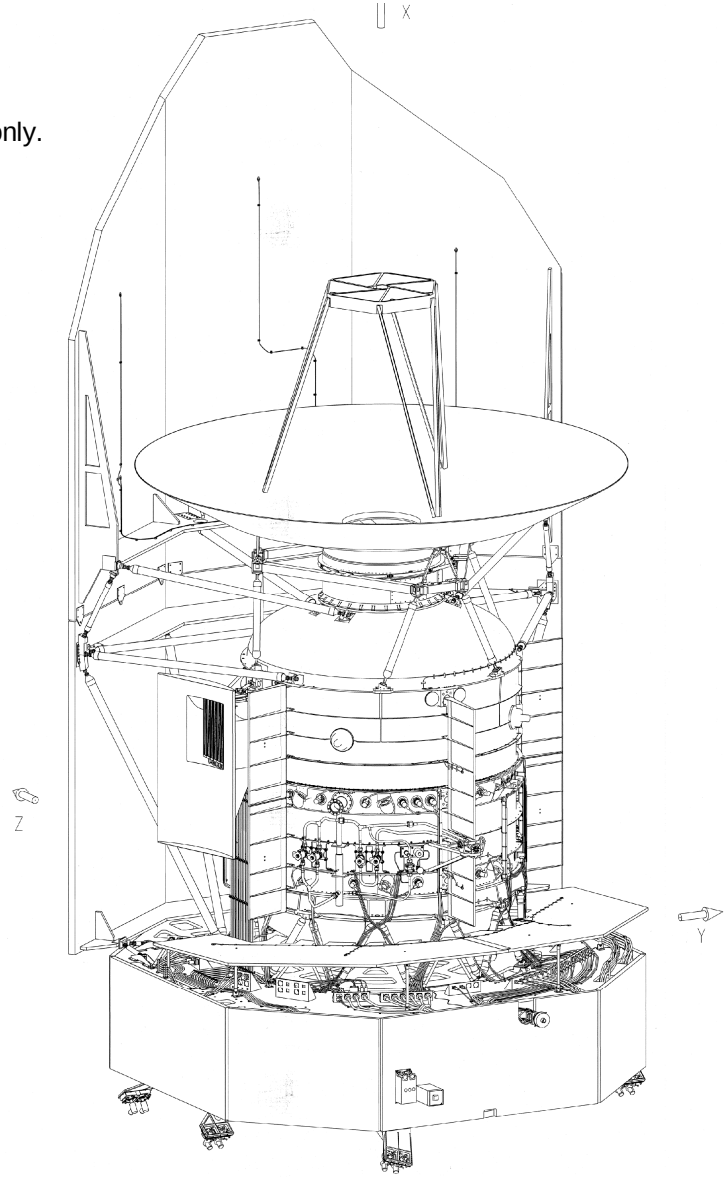
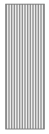


Orientation:
+X is mirror end (top)
+Z is sunshade side (to sun)
Y is side to side as launched

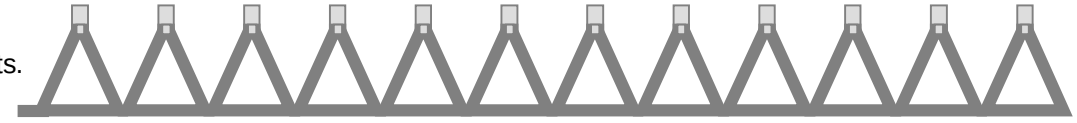


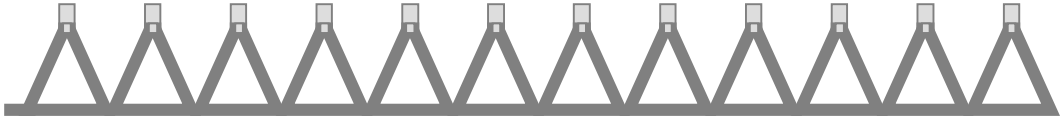


Joiner strip



Cables-after assembling Dewar and lower struts, attach here inside struts. Trim to fit.





Dewar struts-laminate back to back and form into a circle. Use small end tabs to connect circle.

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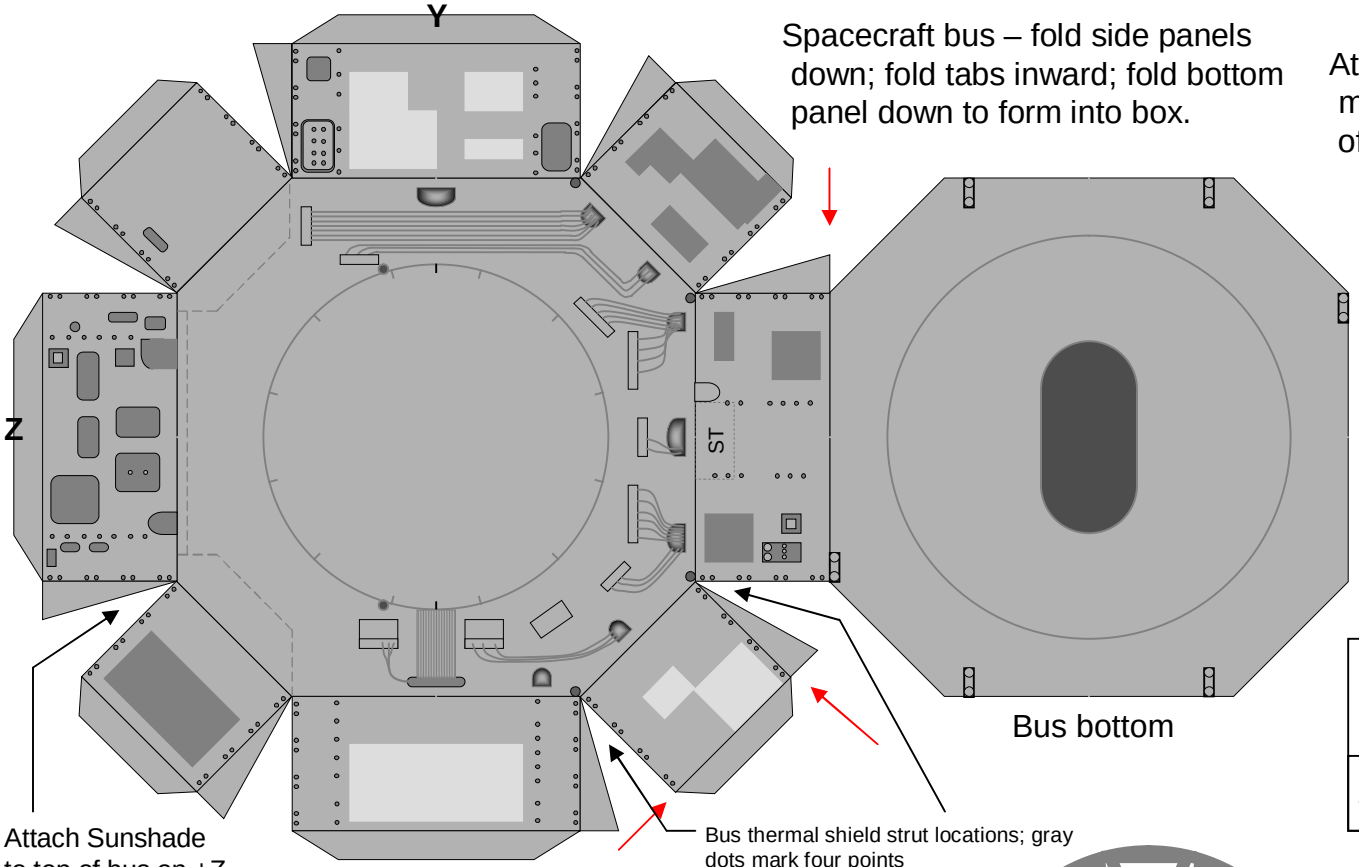
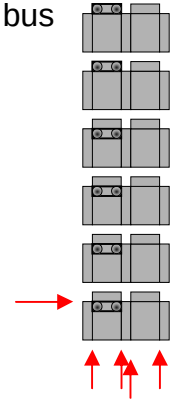
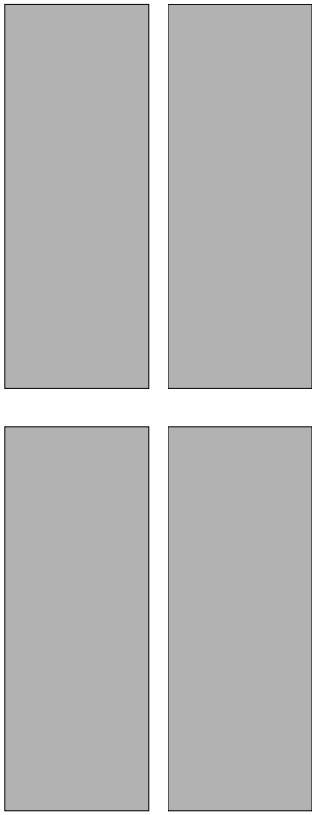
Bus bottom load ring – form into circle



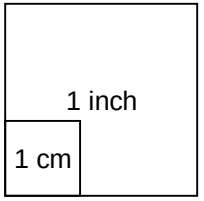
Spacecraft bus – fold side panels down; fold tabs inward; fold bottom panel down to form into box.

Attitude thrusters mount to bottom of bus





Bus bottom



Sunshade support struts-roll thin cylinders or glue to thick card and cut strips. Trim to length.

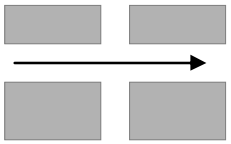
Attach Sunshade to top of bus on +Z side.

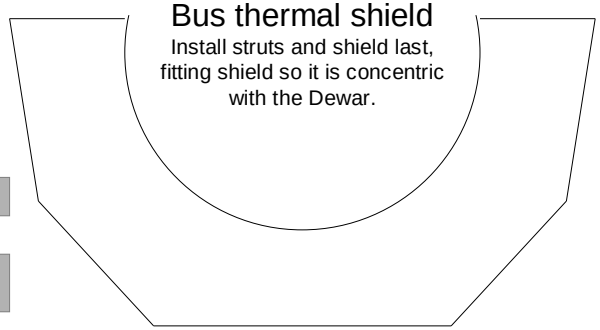
Bus thermal shield strut locations; gray dots mark four points

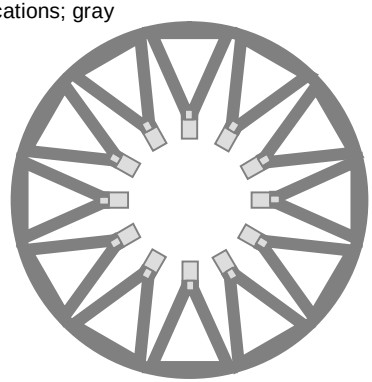
Bus thermal shield

Install struts and shield last, fitting shield so it is concentric with the Dewar.

Roll narrow tubes for support struts

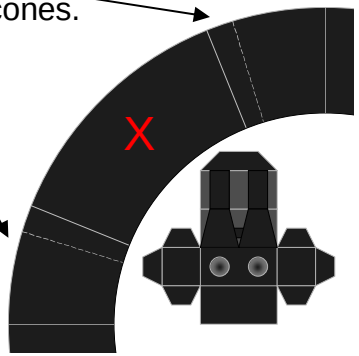


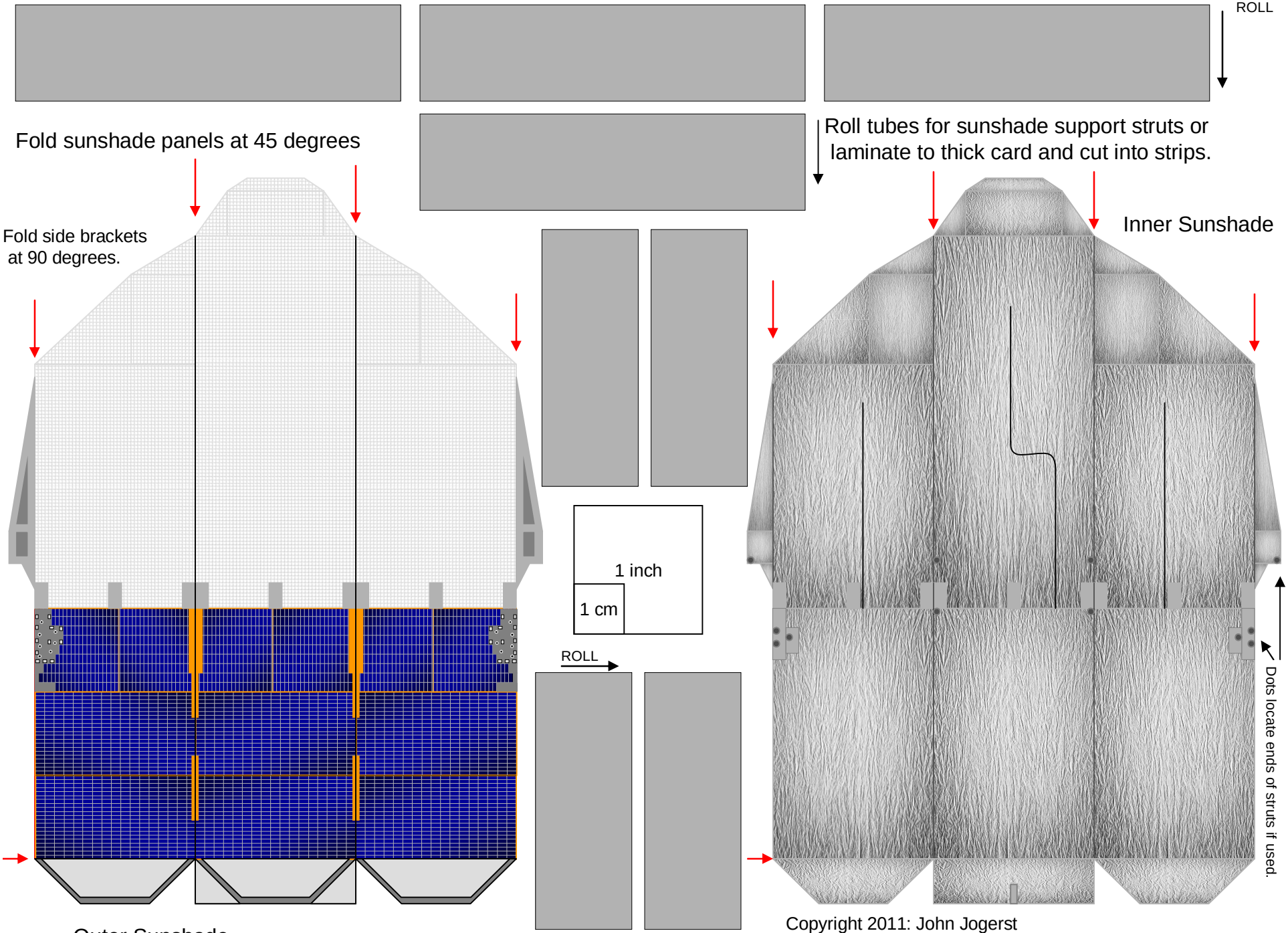




Alternate Dewar struts

Star Tracker (ST)
Roll narrow cones.





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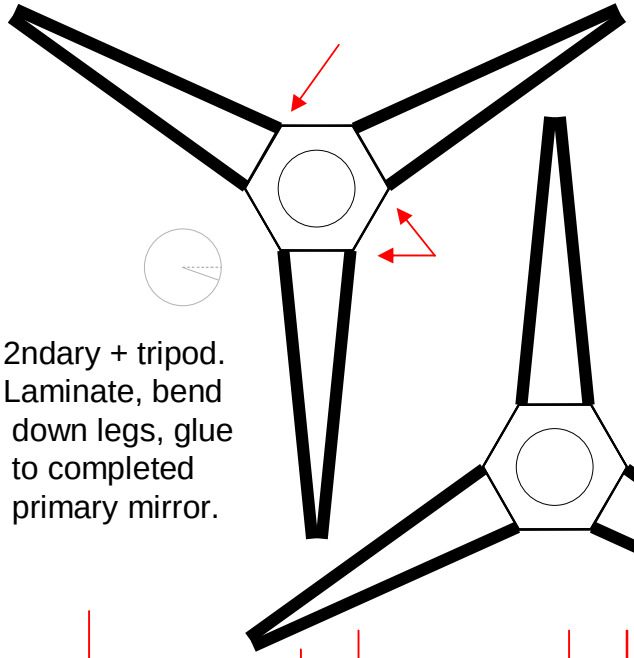
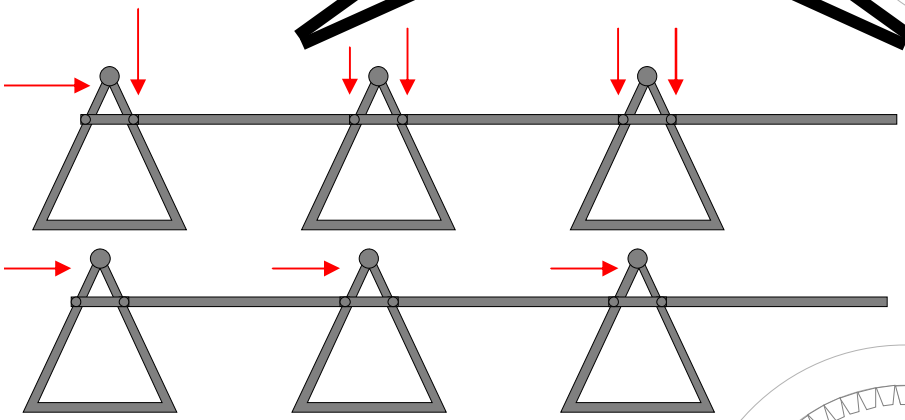
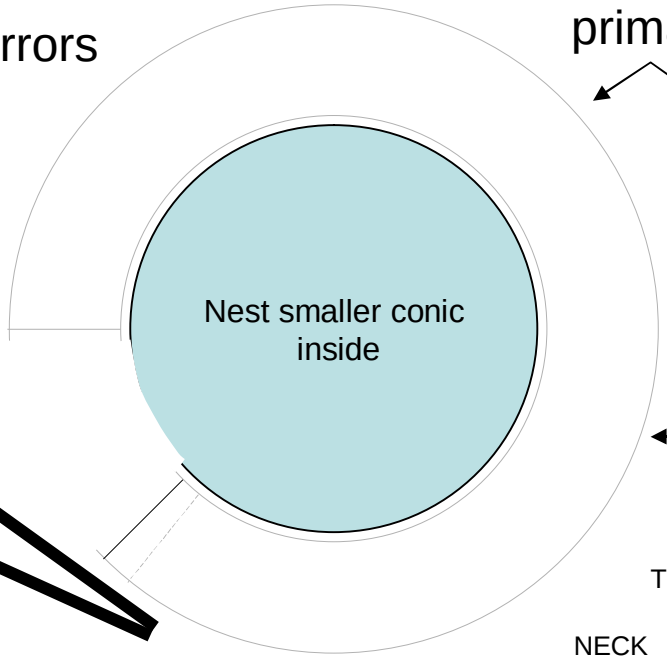
Mirrors



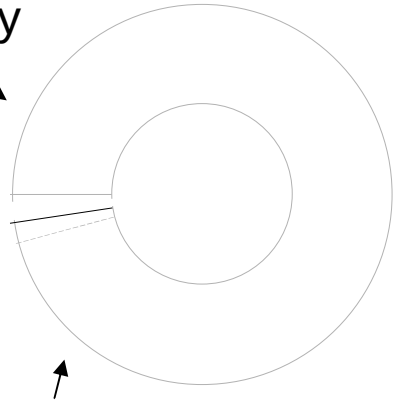
2ndary + tripod. Laminate, bend down legs, glue to completed primary mirror.



Primary mirror tripod – glue unprinted sides together, form bases to fit dewar curve, top horizontal struts remain straight and fold at triangle struts. Circular pads at top bend back to support primary mirror dish.

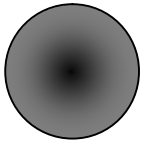


primary

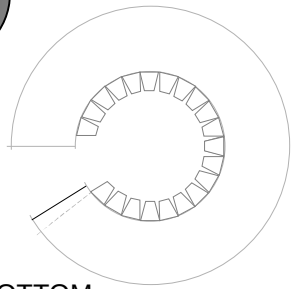


Paint surfaces silver after assembly if desired.

TOP

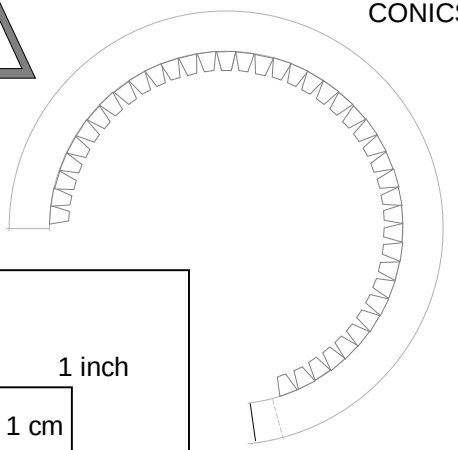


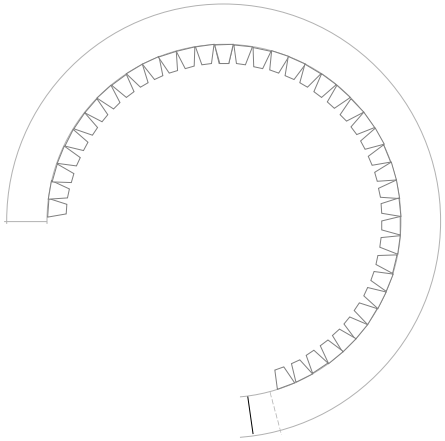
NECK

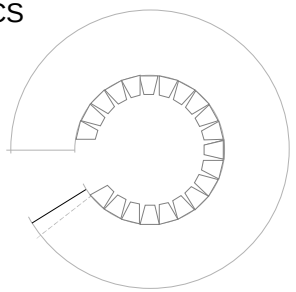


TOP/BOTTOM CONICS

INTERMEDIATE CONICS

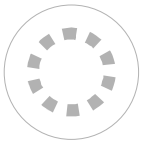






1 inch

1 cm



BOTTOM

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