1/24 Scale Titan Probe

Introduction

Thank you for purchasing this, the first offering from **Space Cadet Models**!

My partner, Scott Brotherton, and I have studied the ESA Huygens probe for months and this is our attempt to render that historic spacecraft in the best possible level of detail.
For more information on the probe and the mission, we have provided a CD-ROM with diagrams, pictures, movies, and copies of spacecraft operational manuals and academic papers gathered painstakingly over the internet during our research.

The team that produced this model is comprised of:

Space Cadet Models is:
Scott Brotherton, Chief Designer
Karl D. Dodenhoff, Chief Cook and Bottle Washer

Other Chiefs:
David "Blappy" Guertin, BLAP! Models, Chief Resin Caster
Jeff "JT" Waclawski, PCS Engineering, Chief Master Parts Printer
John Flemming, Millennia Models International, Chief Photo-Etch Maker

We would like to extend a sincere Thank You to **Dr. Ralph D. Lorenz**, who pointed us to what turned out to be our primary resource document on the Huygens probe, the **Huygens User Manual**, or what we call The Huygens Bible.
A copy of the document is on the CD supplied with this kit (HUYGENS-USER-MANUAL.pdf).

Notes about probe configuration

This kit is made to depict the probe after it landed on Titan, however, there are a few extra parts supplied to help show it as it was configured during the descent, on the main chute, if you should choose to do so.
Keeping in mind that the probe was designed to perform the bulk of its' science during the descent, it utilized 3 separate parachute systems to control the descent rate and the rate of spin.
The pilot chute, used to stabilize the descent immediately after entry, was mounted in the drogue mortar. No parts are supplied for it.
The main parachute was deployed immediately after the aeroshell back cover was jettisoned. It was used to slow down the probe until it reached a more manageable rate of descent (approximately 0.5 mach). The mounts for them are parts #6A & #6B. To depict the main chute before it was jettisoned, you would use parts #6A. After it was jettisoned you use #6B only, as the tops of the mounts went with the main chute. This is how the mounts were configured when the probe touched down.
The stabilizing chute was the primary parachute used during the descent and landing, and it stayed attached to the probe all the way down to the surface. The mounts for it are part #5. The stabilizing chute lines would attach to the probe at the mounts, part #5. This is how the probe looked when it touched down. Also, several inches of string are supplied to depict the parachute lines, as well as the swivel where they all came together. It should be noted, though, that each bridle leg from the probe to the swivel is 3.9 meters long (12.7 feet) or 6.3" long to scale.
The parachute mortar (brass tube) and parachute container (PE part) were both covered in flight, but the covers were blown off to deploy the chutes.
Also, the modeler should bear in mind that the surface of Titan is most likely comprised of an upper layer of frozen water or methane over some type of softer material, though there is still some debate about the true nature of the surface. The crust gave way under the weight of the probe, which was measured by the penetrometer. Therefore, the small stabilizing fins on the bottom of the probe may have crunched their way through the surface and, for all we know, be buried in Titanian soil. The base of the model has been made to depict the landing site based on imagery from the probe during the descent and landing, and on science results from the probe (which seem to indicate it skidded to stop

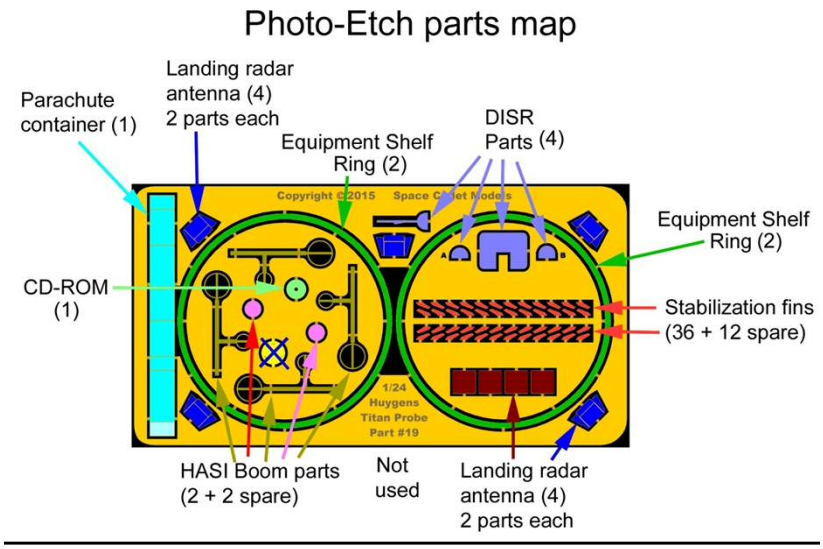
and probably dug a slight trough in the surface). For reference, watch the Quicktime movie "When Huygens Met Titan.mov" in the Movies folder of the CD supplied with this kit.
Having said all that, the modeler may wish to leave off all or some of the stabilizer fins. It also looks more realistic to show the probe landed unevenly (not completely straight in the vertical and horizontal axis).

In General

Precautions – see the attached document for tips and safety precautions
Smaller resin parts are better off being painted while still on the parts trees. Photo-etch part should be primed while on the fret

Parts list

#1 --- Top of probe (After Cone/Top Platform)
#2 --- Equipment Shelf/Experiment Platform
#3 --- Bottom of probe (Fore Dome)
#4 --- S-band Antennae
#5 --- Stabilizer Parachute Bridle Mounts
#6a - Main Parachute Bridle Mounts (while probe is on chute)
#6b - Main Parachute Bridle Mounts (after chute jettison)
#7 --- Main Parachute Swivel
#8 --- Radioactive Heater Units (RHUs)
#9 --- HASI Launch Restraint Lugs
#10 - HASI Boom #1 Mount +Y
#11 - HASI Boom #2 Mount -Y
#12 - HASI stub
#13 – DISR Camera System
#14 – SEPS Spacecraft Separation Mechanism
#15 - HASI hub w/dish arm
#16 – TEM Sensors
#17 – Form for bending parachute container photo etch
#18 – Titan Base
#19 – Photo etch fret (see below)



Other parts included

String for parachute bridle legs
Brass tube 7/32" diameter for Parachute Mortar
Piano wire for Static Electricity Discharge rods
1mm half round styrene rod for HASI booms

Painting instructions

Pale Gold- The main body of the probe and much of the hardware attached to it is a combination of silver and gold, approximately 60/40 ratio but you should start out with gold and gradually mix in the silver unit it reaches the shade you want. The other parts that are this color are: Part #9, the HASI Launch Restraint Lugs, and the stabilizer fins (photo-etch) on the bottom (fore-dome) of the probe. For this reason it is suggested that you assemble these parts together before you proceed to painting the sub-assembly.

Flat black - The DISR head and the two conical S-Band antennae. Also, the inner half length of the static electricity discharge rods (piano wire).

Green zinc chromate – the HASI booms

Chrome Silver - the outer half length of the static electricity discharge rods (piano wire). Also, the HASI Stud, and the 4 radioactive heating units. Also the small detail parts on the DISR head

Aluminum – The SEPS mechanisms and landing radar altimeter antennae, the parachute container (photo-etch) and drogue chute mortar (brass tube),

Light gray – the parachute mounts, parts #5, #6A and #6B (if used – see notes about configuration)

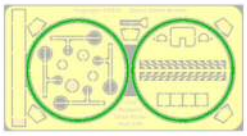
White – the 3 Velcro parachute line runs that go between the main parachute container and the parachute mounts. Also, paint a white circle in the center of the CD-ROM, about half the diameter of the disc

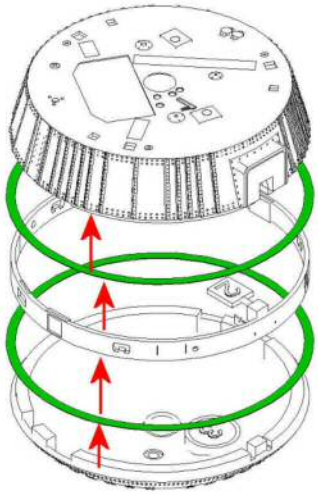
Titan base – Suggested color for the base is a combination of Wood and Dark Tan. Mix them together carefully to come up with a shade you like. Bear in mind that the mission photography was done under the thick Titanian atmosphere, using a bright light for illumination. The effect is a washed out, bland yellow appearance in the photos which isn't very realistic. Because of this it is suggested that you also consider the artist's renderings of the landing when you paint the base. Darken the shade with more brown in the areas where there are depressions in the surface of the base, and lighten the shade with more yellow for the raised areas. You may also want to use a dark wash in the small pits in the surface of the base to make it pop.
An arrow is engraved in the center of the top surface of the base. It points towards the direction that was used as the front of the base during it's creation. It is just a suggestion – there is no real front to the base.

Assembly instructions

Note that the parts for this model were engineered with very tight tolerances. In some cases it may be necessary to slightly modify some areas (sanding and/or filing) to get them to fit together. This was especially noted when installing the photo-etch rings in the first step, and for some of the items around the equipment ring.

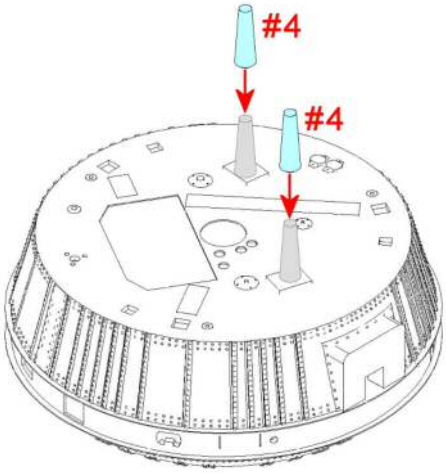
Assemble the main body of the probe



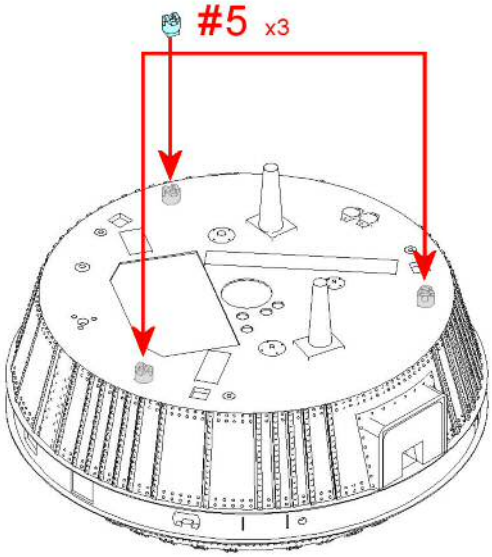


Note that it is essential that the tabs line up from top to bottom.

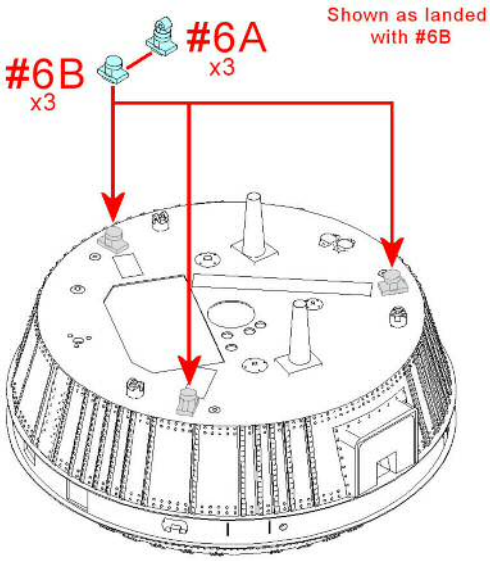
Install items on the top shelf



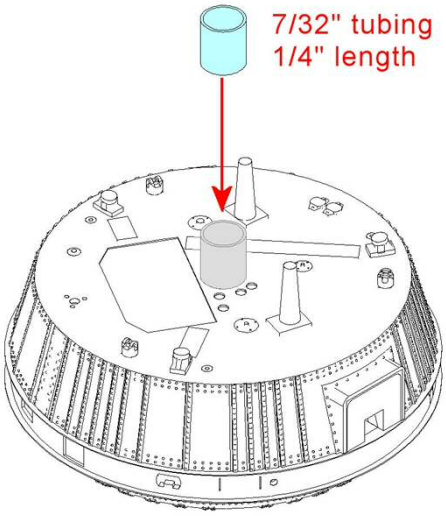
Install the 2 conical S-Band antennae



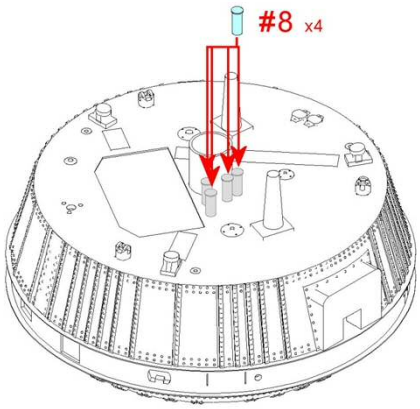
Install the 3 stabilizer parachute mounts



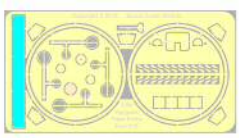
To depict the spacecraft as it appeared after landing, install the bottom section of the main parachute mounts (parts #6B). To depict it descending on the main chutes, install the full mounts (parts #6A)

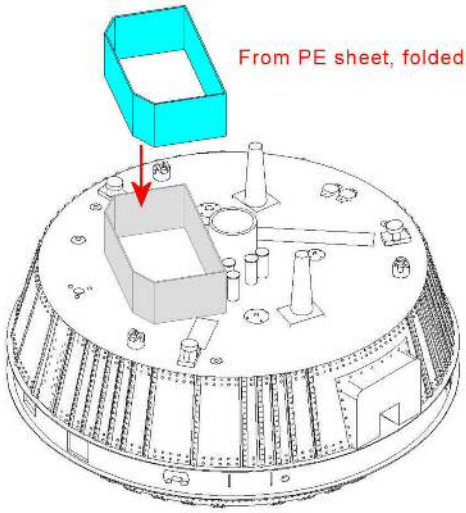


Check length of brass tube is 1/4 inch and install in the circular depression near the center of the top shelf

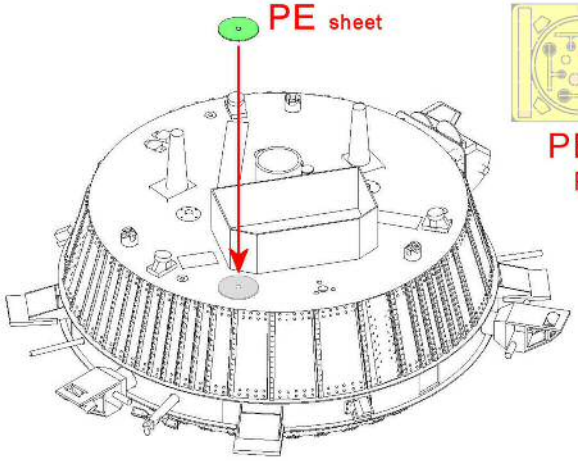


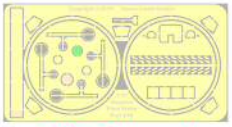
Install the 4 Radioactive Heater Units





Bend the photo-etch part for the parachute container into a 6-sided shape as shown. There are tabs at each end to help glue the ends together.

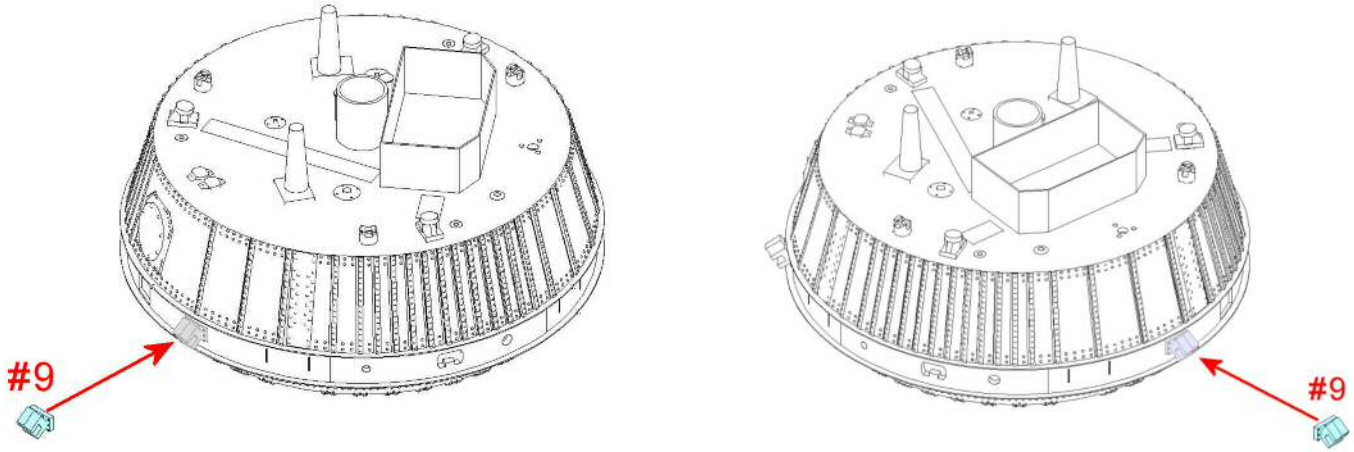




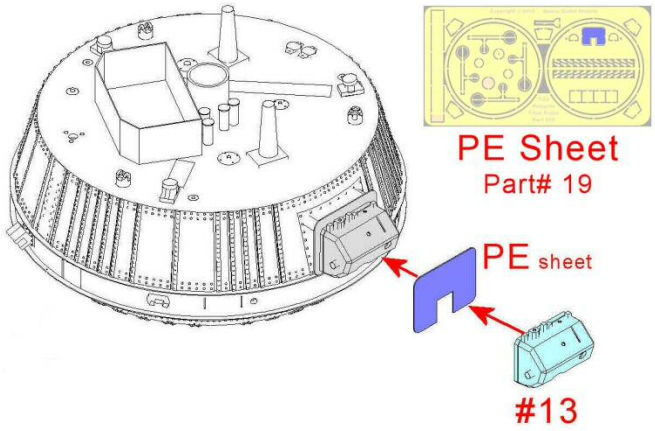
Install the CD-ROM at the corner of the parachute container.
The top shelf of the probe is now complete.

Install the instruments and other items that protrude from the equipment shelf around the periphery of the probe.

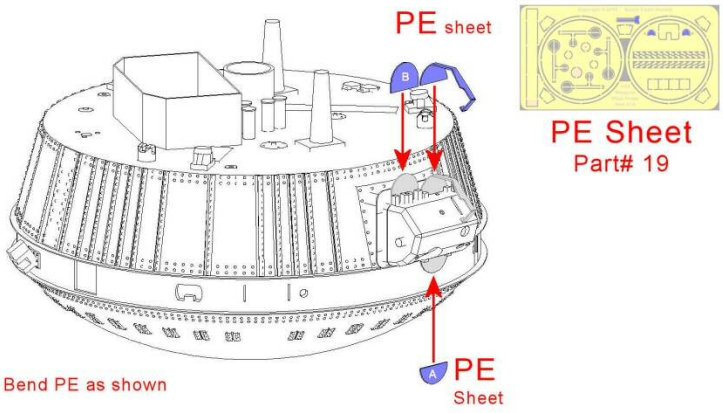
It is imperative that each item be installed in the proper place. Refer to the "Illustrations" and "Attach_Points" documents to help with placement of these items.



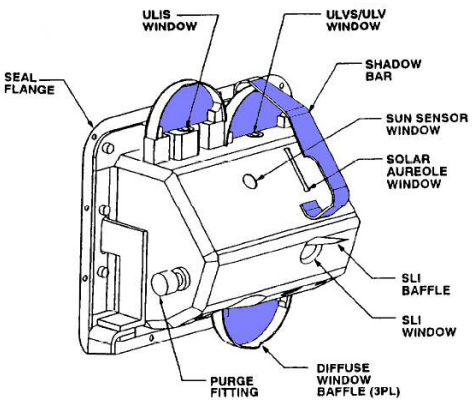
Install the HASI Boom Launch Lugs in the rectangular depressions
Refer to the "Illustrations" and "Attach_Points" documents to help with placement of these items.



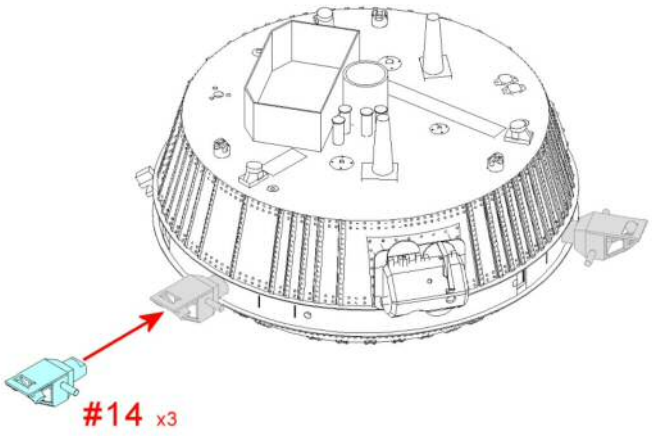
Install the DISR Seal Flange photo-etch part and the DISR Head



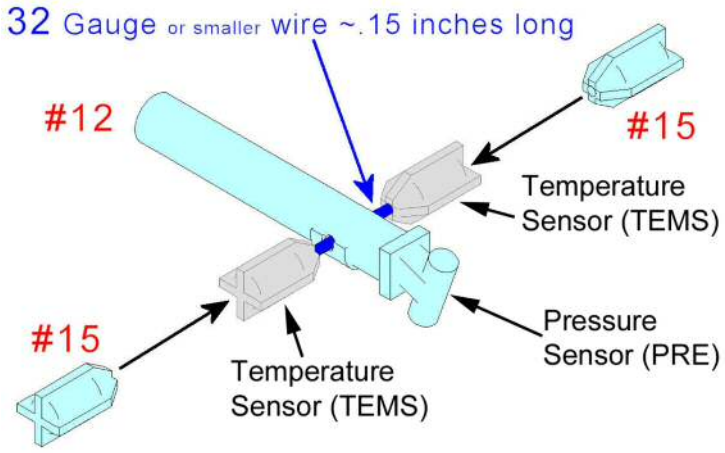
Install the small DISR photo-etch parts see DISR diagram below. The Shadow Bar is attached to one of the Diffuse Window baffles, and needs to be folded slightly as shown



DISR Head details. Blue parts in this diagram represent the photo-etch parts

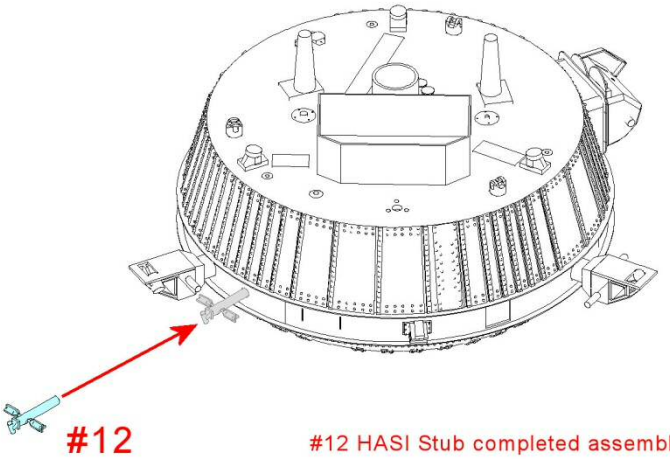


Install the 3 Separation Subsystem (SEPS) mechanisms in the horseshoe-shaped openings. Dry fit these prior to installation and refer to the “Illustrations” and “Attach_Points” documents to help with placement of these items.



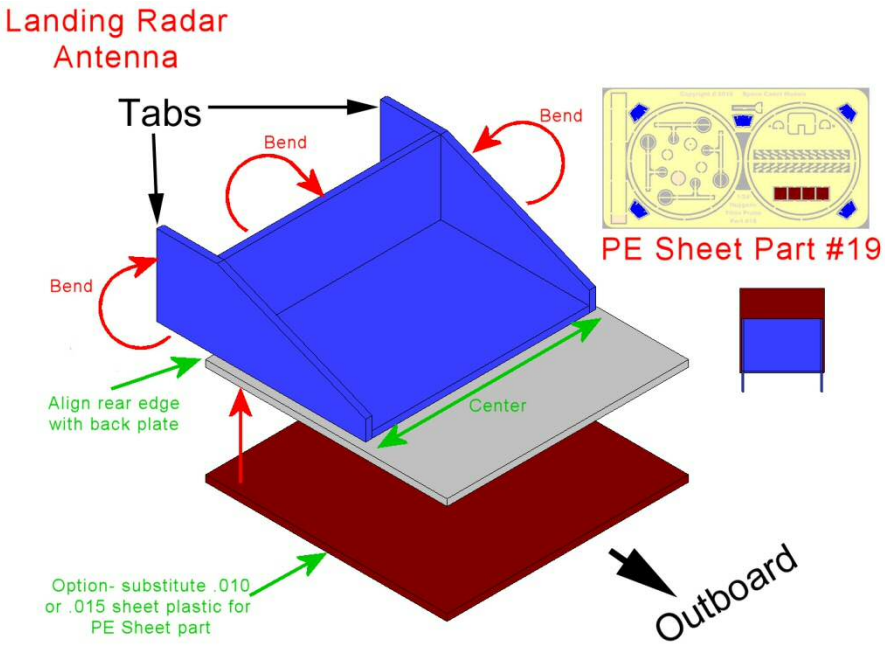
HASI Stub Assembly

Build the HASI Stub. Note the alignment of the pressure sensor (PRE) at the end of the assembly. It is aligned vertically and angled, with the bottom of the tube closer to the side of the spacecraft. It is highly advisable that you drill a hole through the sides of the tube and into the temperature sensors (TEMS) and pin the assembly together, as shown.

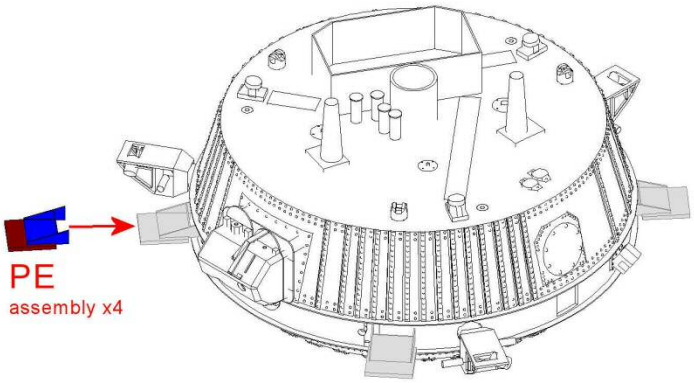


#12 HASI Stub completed assembly

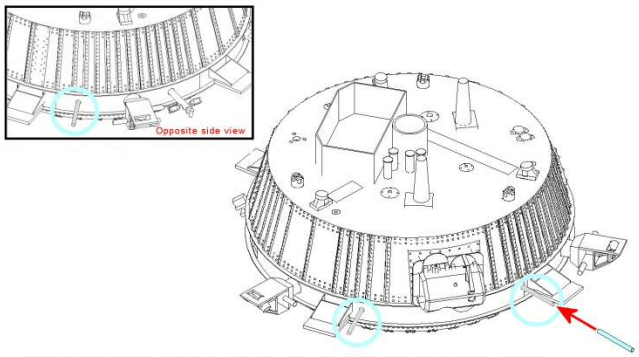
Install the HASI Stub in the correct location. Refer to the “Illustrations” and “Attach_Points” documents to help with placement of this item.



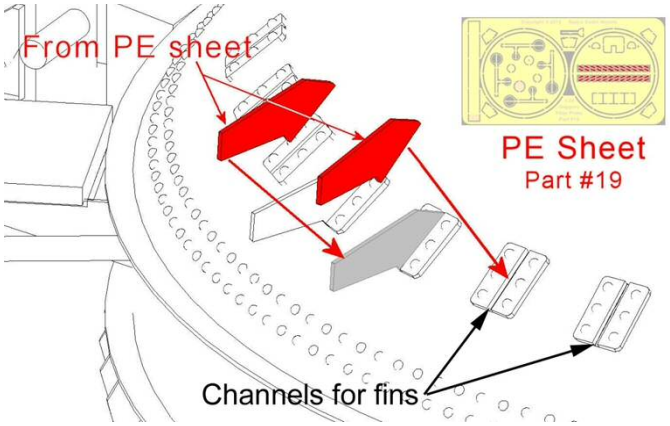
Build the 4 landing radar antennae from photo-etch parts. Once folded, the tabs formed at the back of the assemblies are inserted in slots on the side of the probe. Refer to the "Illustrations" and "Attach_Points" documents to help with placement of these items.



Installation of the 4 landing radar antennae. Insert the tabs at the backs of the assemblies into the slots in the side of the probe.



Insert the short pieces of black piano wire for the static electricity discharge rods into the correct holes, insuring that 0.3" (about 5/16" or 7.9mm) protrudes from the side of the probe. Refer to the "Illustrations" and "Attach_Points" documents to help with placement of these items.



Carefully remove the 36 spin stabilization fins from the photo-etch fret. To aid in the installation of these small parts, it is advisable to increase the depth of the channels they are to fit into by carefully scribing each one with a sharp hobby knife.

Build and install the HASI Booms