

4.3 Instrument Installation & Removal

4.3.1. Installing Instrument on Side Looking Port

1. Description

This section describes the procedures to install the GNIRS onto a side looking port on the Gemini 8M telescope.

2. Nomenclature

89-NOAO-4200-1501 ISS Locating Pin
89-NOAO-4200-1186 ISS Labyrinth Ring
Gemini instrument handling air cart

3. Safety Precautions

Heavy components: Do not attempt to lift components manually. Use proper lifting equipment.

Item	Weight
GNIRS Instrument	2000 Kg

4. Fixtures/Tools

5. Personnel Recommended/Required To Complete Task

The recommended number of personnel to complete this task is 2. The recommended number 2.

6. Procedures

- A. Install (4) 89-NOAO-4200-1501 ISS Locating Pins onto the Gemini ISS, one on each quadrant, using M12x35mm Long Socket Head Cap Screws. Ensure that the ISS Locating Pins are oriented with the hole in the pin pointing inward toward the center of the ISS. See Figures 4.3.1.1 and 4.3.1.2.
- B. Install the 89-NOAO-4200-1186 ISS Labyrinth Ring onto the Gemini ISS using M6X10mm Long Flat Head Screws. Mount the ISS Labyrinth Ring with Environmental cover cutout oriented to the left side.
- C. Mount the instrument onto the Gemini instrument handling air cart in the horizontal orientation. Refer to Sections 8.2.4 and 8.2.5 for Lifting and Handling, and Rotating Instrument procedures if the instrument is not mounted horizontally on the Gemini instrument handling air cart.
- D. If the 89-NOAO-4202-0010 Vertical Installation Frame is installed on the instrument, remove the Vertical Installation Frame per Section 8.3.3.
- E. Engage the instrument onto the ISS Locating Pins. Use Jack Screws as necessary to align the bolt holes on the instrument truss with the bolt holes on the ISS Locating Pins, as shown in Figure 4.3.1.5.
- F. Install the following fasteners:
 - M10x45mm Socket Head Cap Screws (2 per corner)
 - M10x65mm Socket Head Cap Screws (2 per corner)
 - M10x90mm Socket Head Cap Screws (4 per corner, as shown in Figure 4.3.1.5)
- G. Torque fasteners per torque requirements in Section 8.2.1.

- H. Connect Helium lines, electrical cabling, glycol coolant lines & dry air lines, to 89-NOAO-4200-0129 Telescope Interface Panel on instrument and telescope interface panels. These lines are identified in Figure 4.3.1.6.

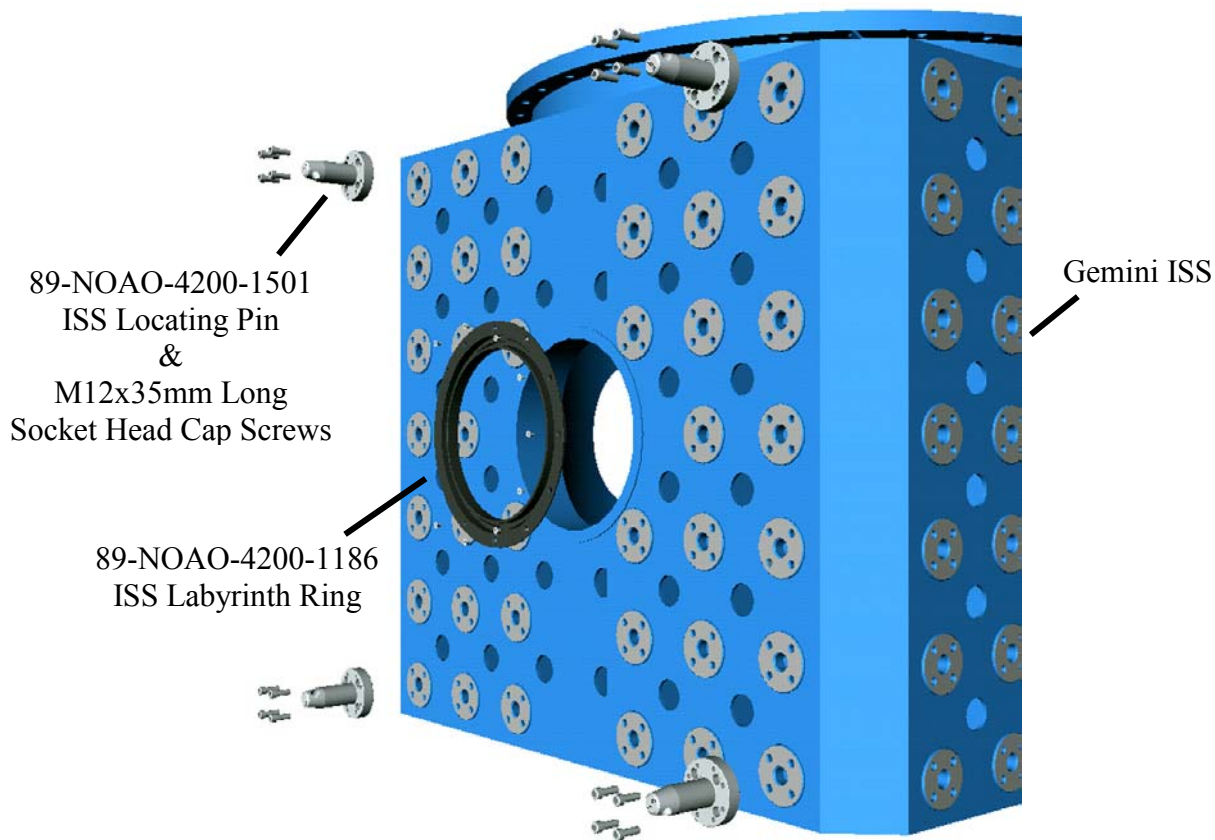


Figure 4.3.1.1. Steps A and B: Install ISS Locating Pins and ISS Labyrinth Ring onto Gemini ISS side looking port. Mount ISS Locating Pins with holes pointing inward toward center of ISS. Mount ISS Labyrinth Ring with Environmental cover cutout oriented to the left side.

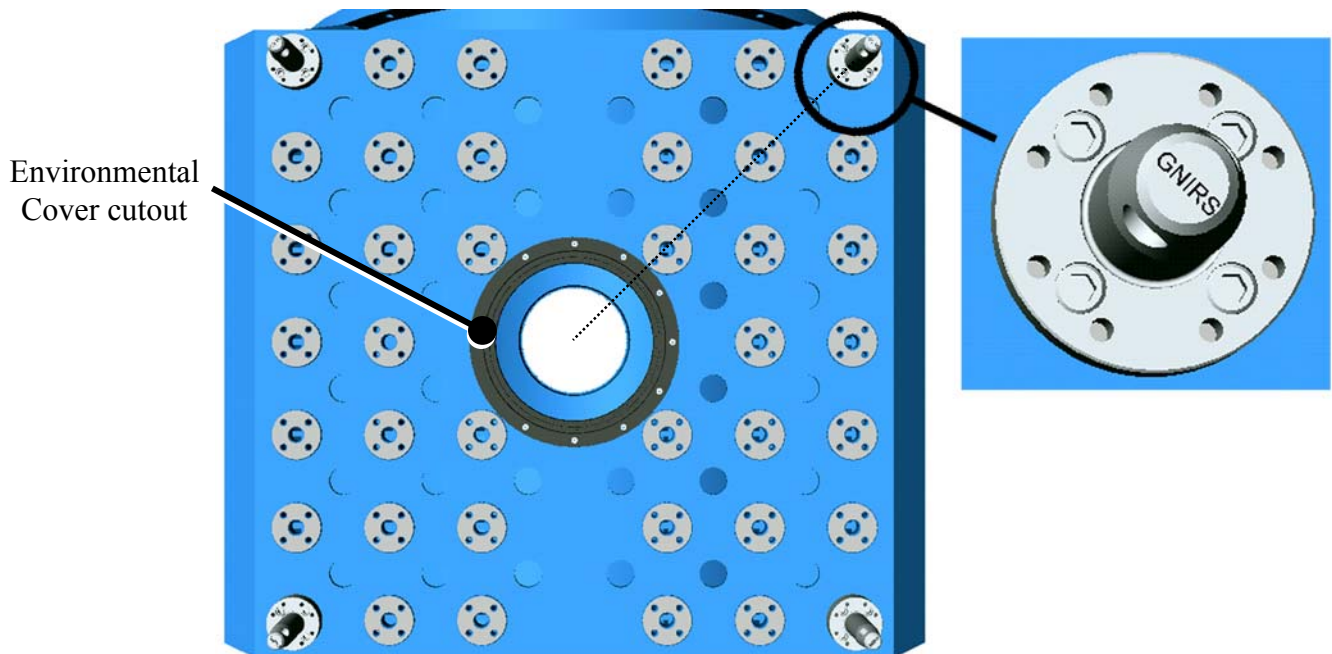


Figure 4.3.1.2. Steps A and B: Mount ISS Locating Pins with holes pointing inward toward center of ISS. Mount ISS Labyrinth Ring with Environmental cover cutout oriented to the left side.

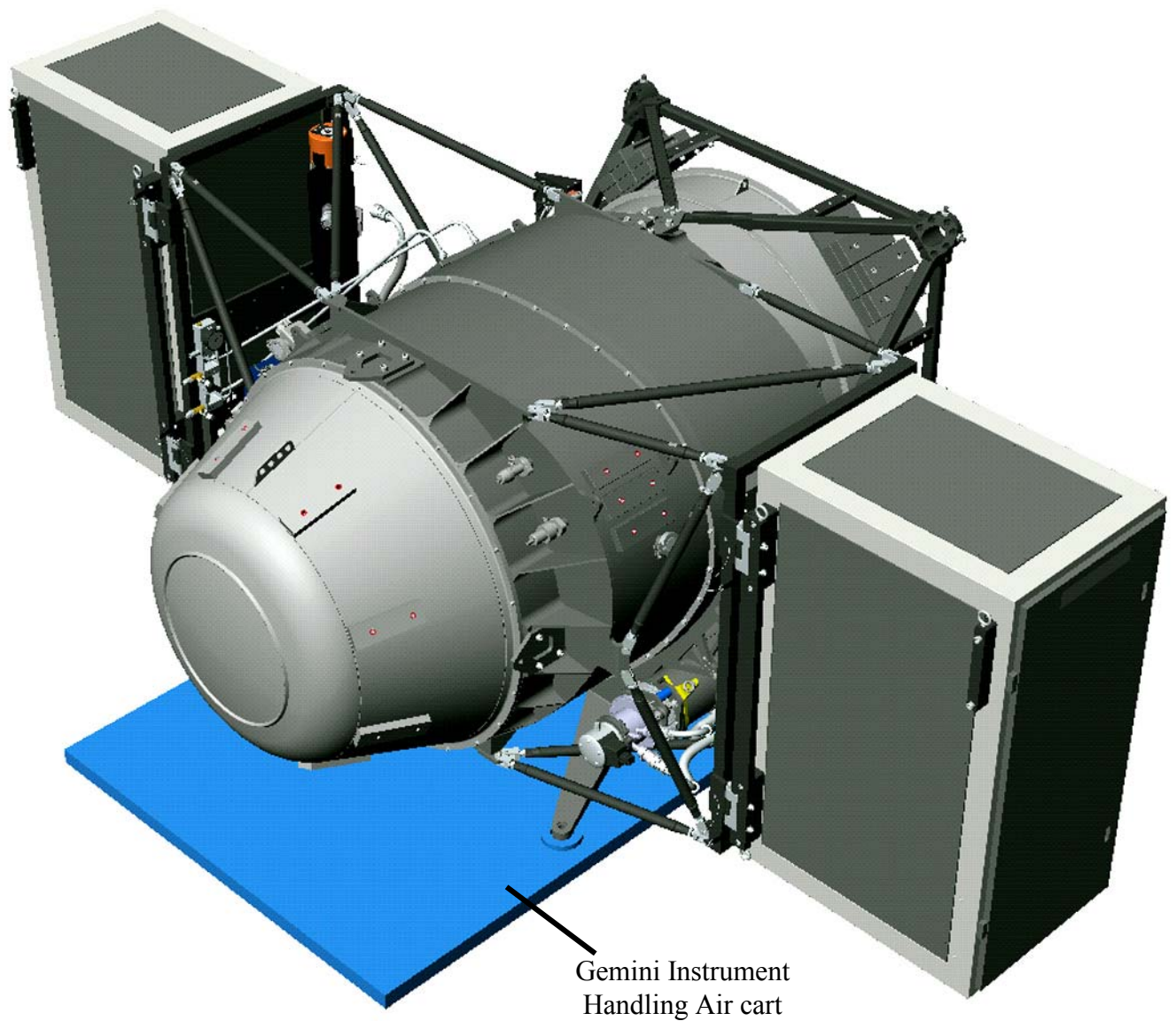


Figure 4.3.1.3. Steps C and D: Mount instrument on Gemini instrument handling air cart in horizontal orientation pre Sections 8.2.4., and 8.2.5. Remove 89-NOAO-4202-0010 Vertical Installation Frame per Section 8.3.3.

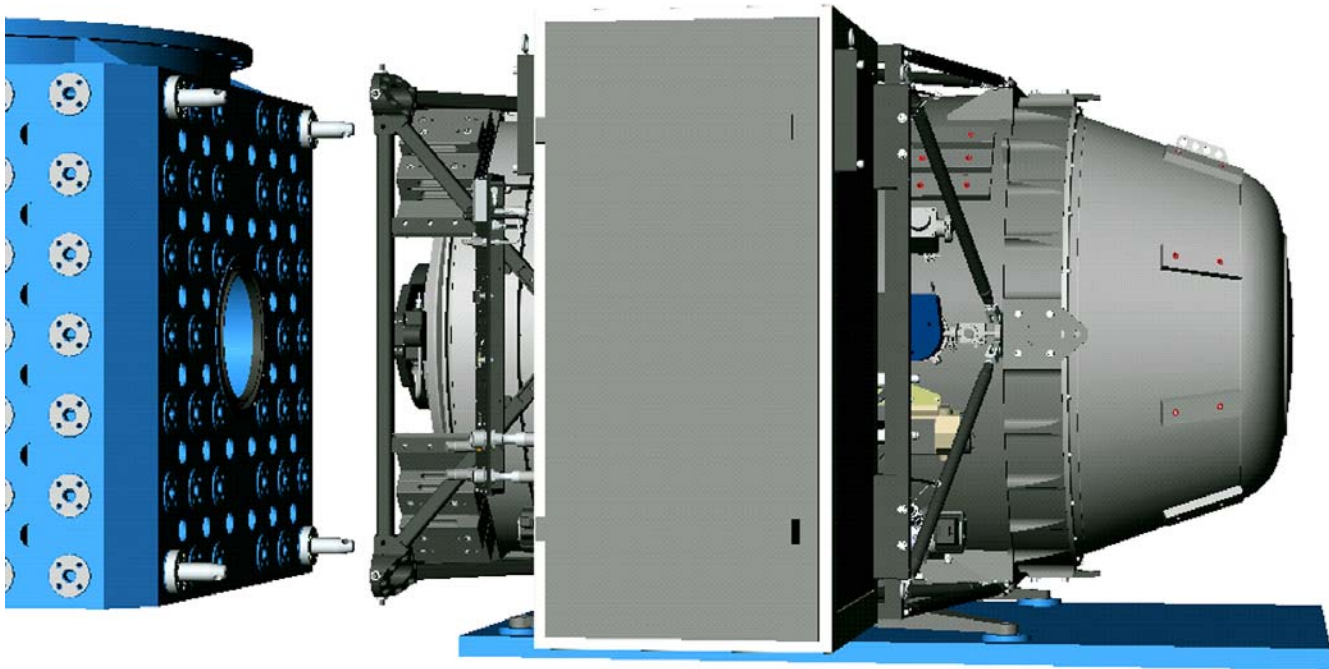


Figure 4.3.1.4. Step E: Engage instrument onto 89-NOAO-4200-1501 ISS Locating Pins.

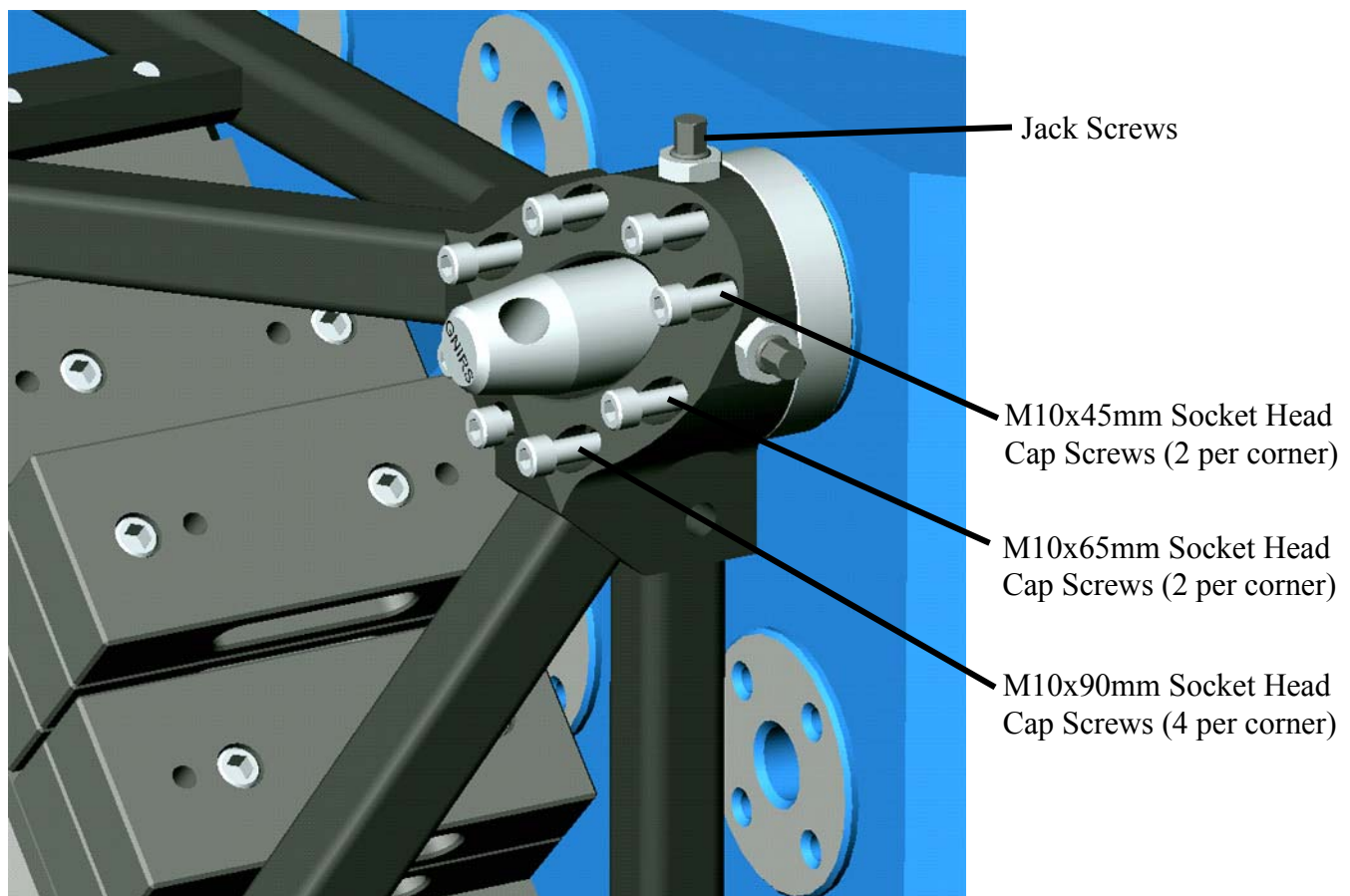
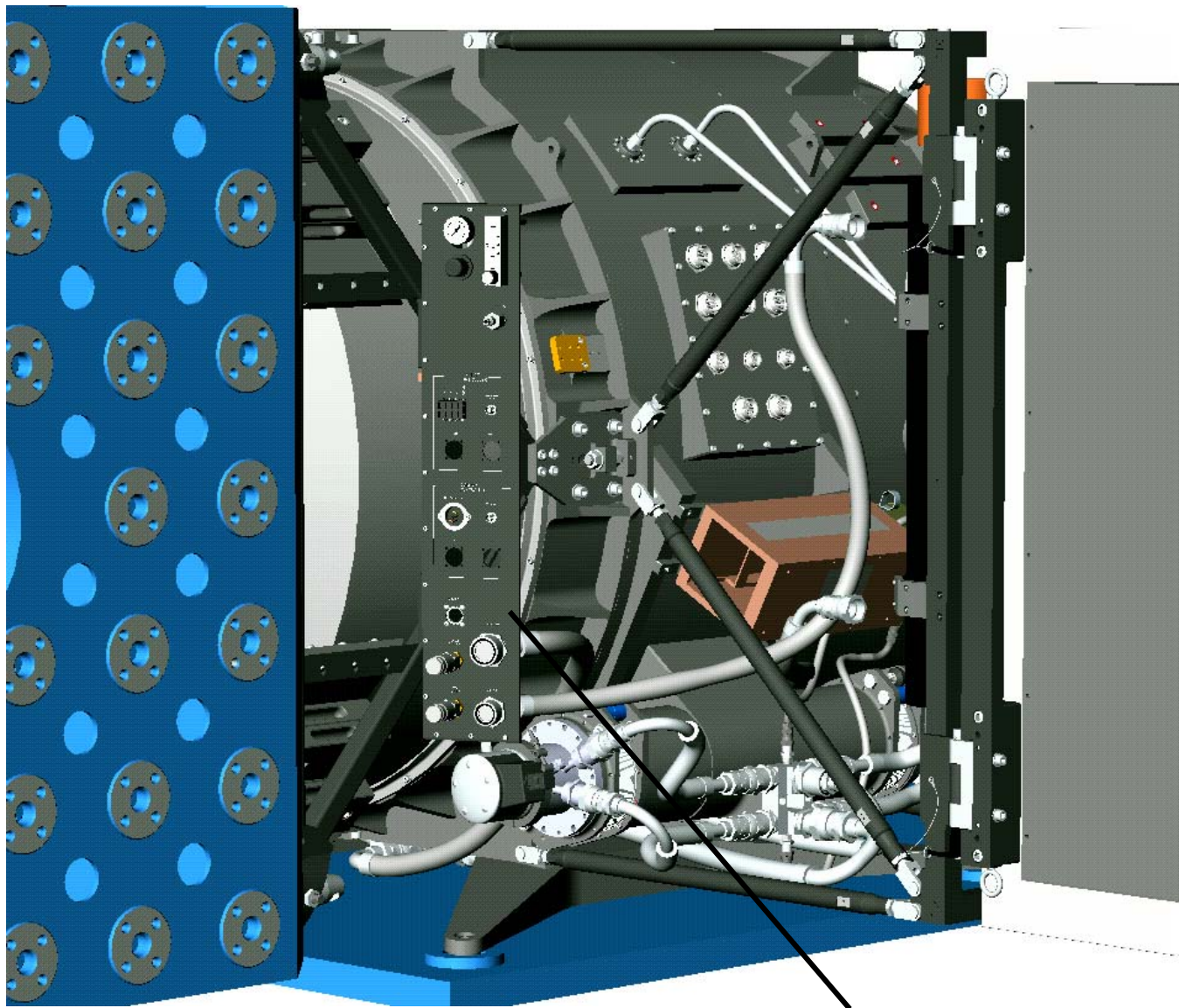


Figure 4.3.1.5. Steps E and F: Facilitate engagement onto ISS Locating Pins using Jack Screws as necessary. Attach instrument to ISS Locating Pins with Socket Head Cap Screws.



89-NOAO-4200-0129
Telescope Interface Panel

Figure 4.3.1.6. Connect Helium lines, electrical cabling, glycol coolant lines, & dry air lines, to 89-NOAO-4200-0129 Telescope Interface Panel on instrument and telescope interface panels.

7. Special Reassembly Procedures

A. Follow removal procedures in reverse order.

8. Summary

This section outlined the procedures to install the GNIRS instrument onto a side looking port on the Gemini 8M telescope.

4.3.2. Installing Instrument on Up Looking Port

1. Description

This section describes the procedures to install the GNIRS onto the up looking port on the Gemini 8M telescope.

2. Nomenclature

89-NOAO-4200-1501 ISS Locating Pin
89-NOAO-4200-1186 ISS Labyrinth Ring
89-NOAO-4202-0010 Vertical Installation Frame Assembly
Gemini instrument handling palette

3. Safety Precautions

Heavy components: Do not attempt to lift components manually. Use proper lifting equipment.

Item	Weight
GNIRS Instrument	2000 Kg

4. Fixtures/Tools

5. Personnel Recommended/Required To Complete Task

The required number of personnel to complete this task is 2. The recommended number is 2.

6. Procedures

- A. Install (4) 89-NOAO-4200-1501 ISS Locating Pins onto the Gemini ISS up looking port, one on each quadrant, using M12x35mm Long Socket Head Cap Screws. Ensure that the ISS Locating Pins are oriented with the hole in the pin pointing inward toward the center of the ISS. See Figures 4.3.2.1 and 4.3.2.2.
- B. Install the 89-NOAO-4200-1186 ISS Labyrinth Ring onto the Gemini ISS using M6x10mm Long Flat Head Screws. Mount the ISS Labyrinth Ring to the ISS with the environmental cover cutout orientation corresponding to the instrument “Port” side.
- C. Mount the instrument onto the Gemini instrument handling palette in the vertical orientation. Refer to Sections 8.2.4 and 8.2.5 for Lifting and Handling, and Rotating Instrument procedures if the instrument is not mounted vertically on the Gemini instrument handling palette.
- D. Raise the instrument using the Gemini instrument handling palette and engage the instrument onto the ISS Locating Pins. Use Jack Screws as necessary to align the bolt holes on the instrument truss with the bolt holes on the ISS Locating Pins as shown in Figure 4.3.2.5.
- E. Install the following fasteners:
 - M10x45mm Socket Head Cap Screws (2 per corner)
 - M10x65mm Socket Head Cap Screws (2 per corner)
 - M10x90mm Socket Head Cap Screws (4 per corner as shown in Figure 4.3.2.5)
- F. Torque fasteners per torque requirements in Section 8.2.1.
- G. Remove the lock pin from the pivoting truss members on the 89-NOAO-4202-0010 Vertical Installation Frame Assembly and lower the truss members. Remove the remaining lock pins from the Vertical Installation Frame Assembly and lower the Vertical Installation Frame Assembly

using the Gemini instrument handling palette. Move the Gemini instrument handling palette away from the instrument.

- H. Connect the Helium lines, electrical cabling, glycol coolant lines, and dry air lines to the 89-NOAO-4200-0129 Telescope Interface Panel on the instrument and telescope interface panels.

7. Special Removal Procedures

- A. Follow removal procedures in reverse order.

8. Summary

This section outlined the procedures to install the GNIRS instrument onto the up looking port on the Gemini 8M telescope.

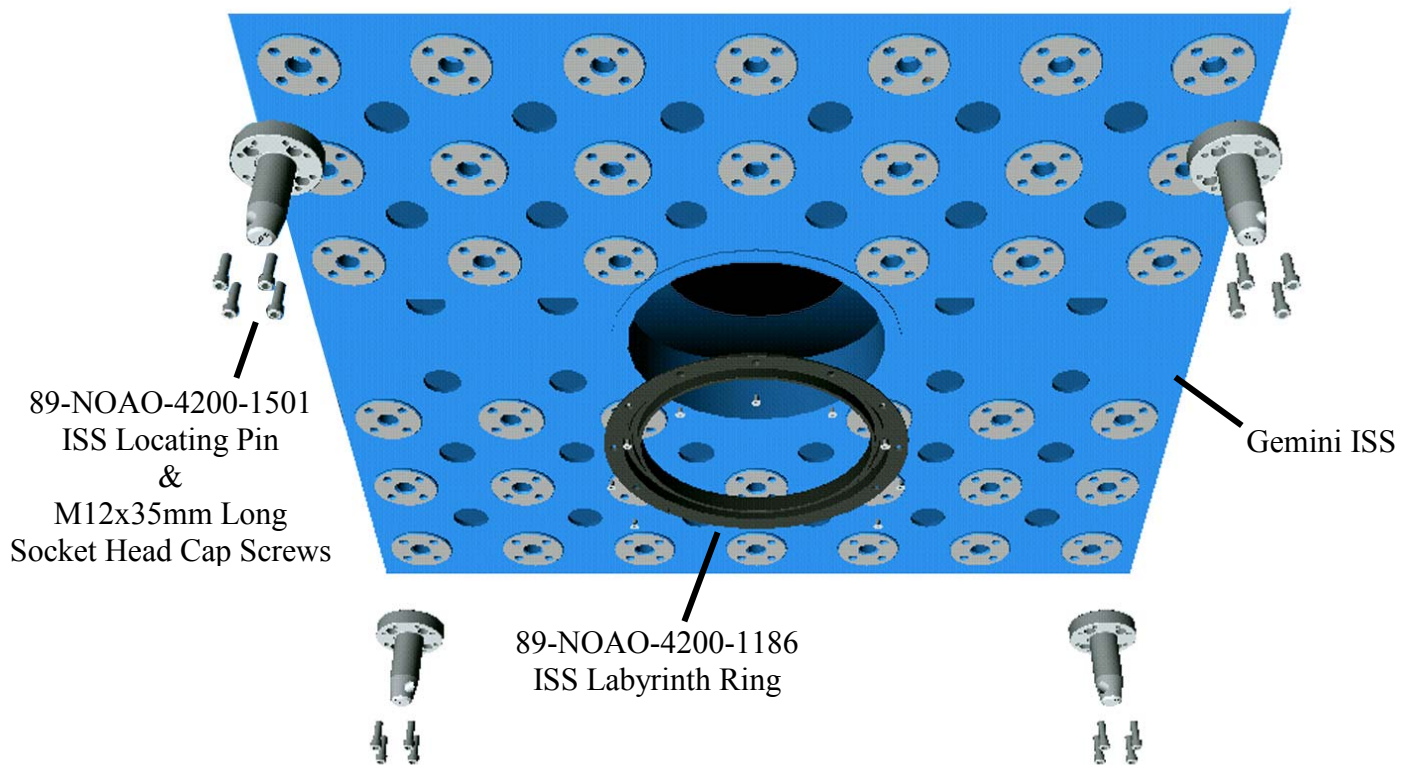


Figure 4.3.2.1. Steps A and B: Install ISS Locating Pins and ISS Labyrinth Ring onto Gemini ISS side looking port. Mount the ISS Locating Pins with the holes pointing inward toward the center of the ISS. Mount the ISS Labyrinth Ring to the ISS with the environmental cover cutout orientation corresponding to the instrument “Port” side.

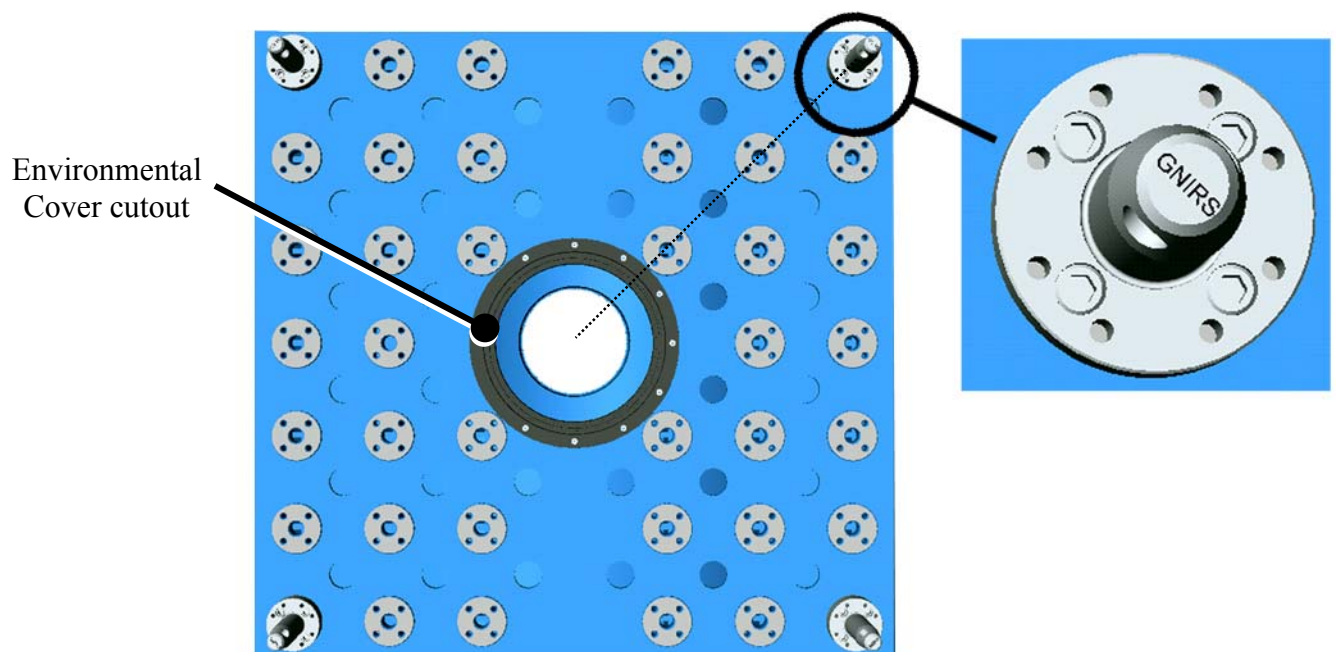


Figure 4.3.2.2. Steps A and B: Mount the ISS Locating Pins with holes pointing inward toward center of ISS. Mount ISS Labyrinth Ring with Environmental cover cutout oriented to the left side.

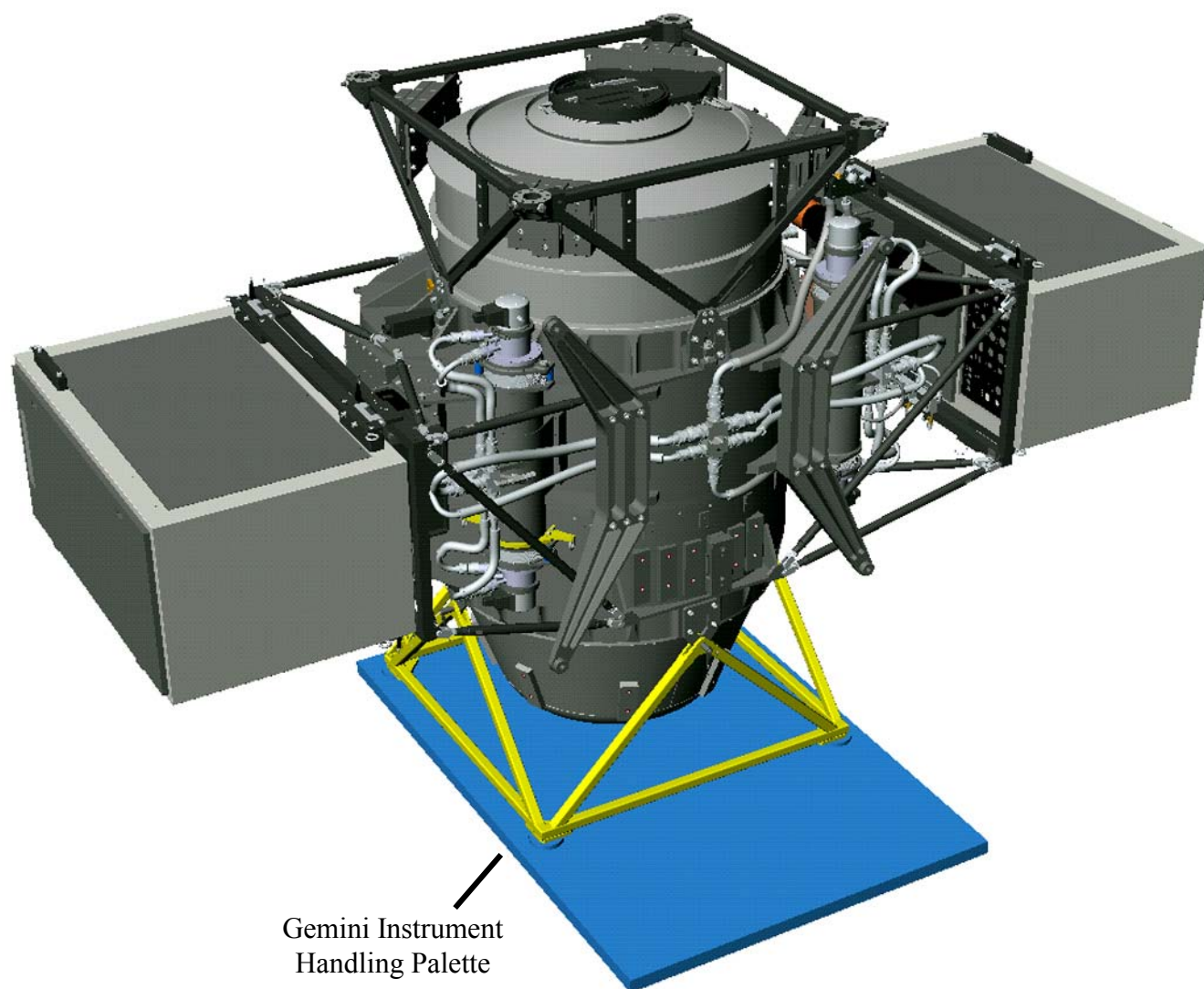


Figure 4.3.2.3. Step C: Mount instrument on Gemini instrument handling palette in vertical orientation per Sections 8.2.4 and 8.2.5.

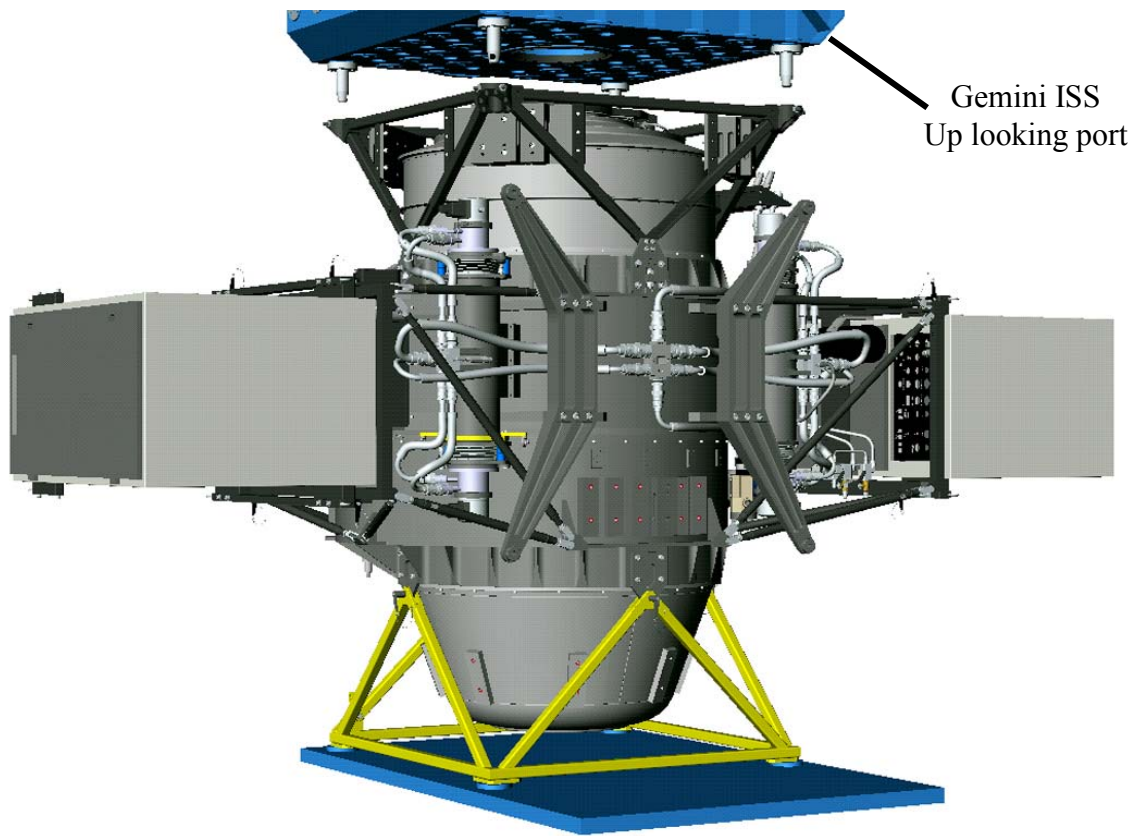


Figure 4.3.2.4. Step D: Engage the instrument onto the 89-NOAO-4200-1501 ISS Locating Pins. Ensure the instrument is oriented with the environmental cover

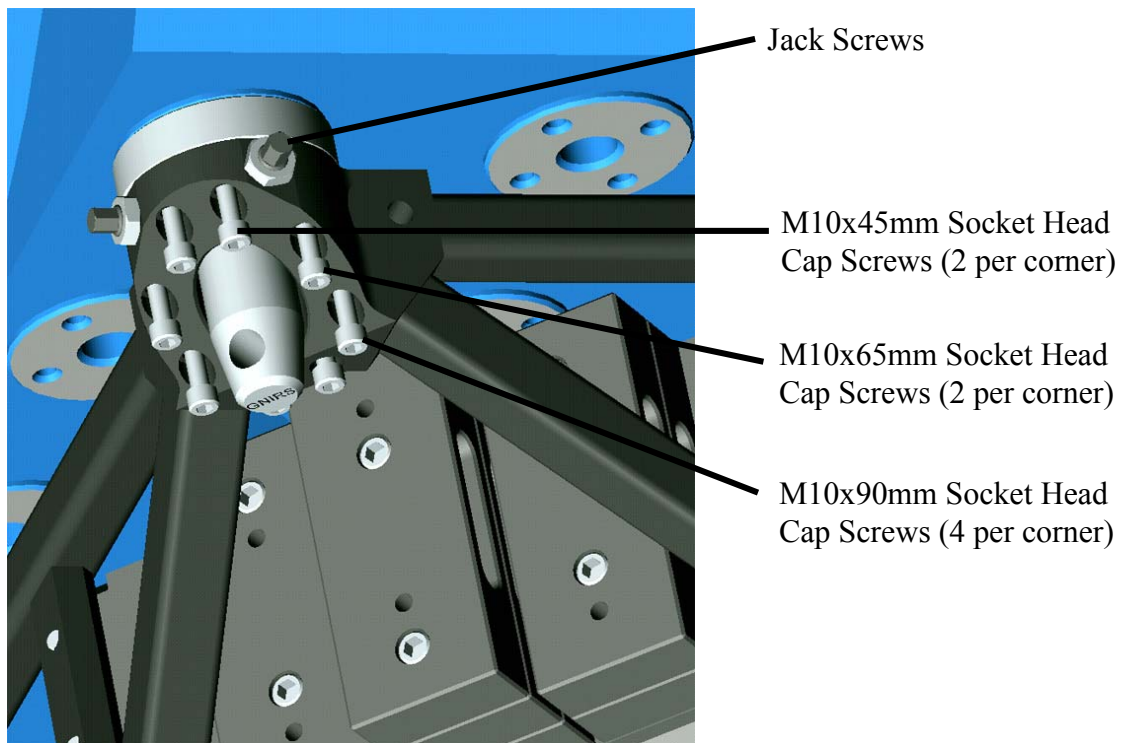


Figure 4.3.2.5. Steps D and E: Facilitate engagement onto the ISS Locating Pins using Jack Screws as necessary. Attach instrument to the ISS Locating Pins with Socket Head Cap Screws.

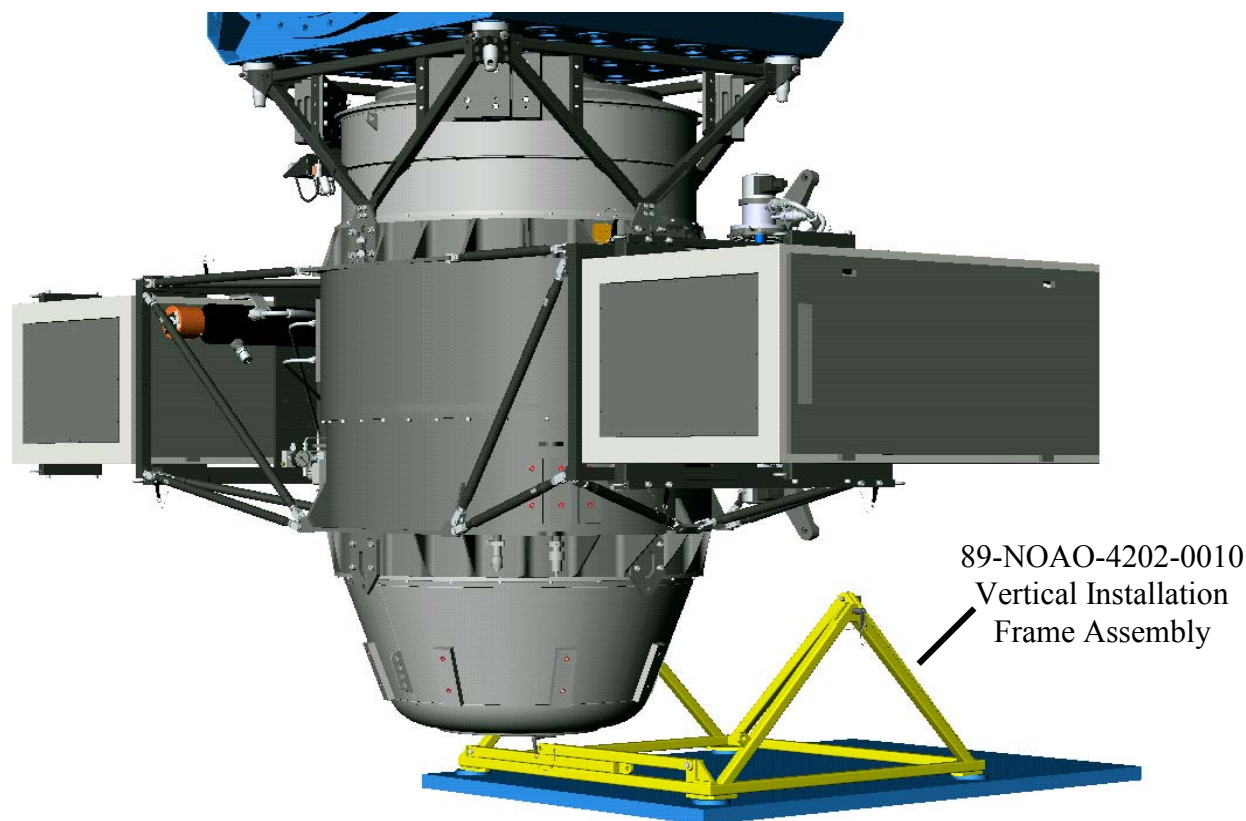


Figure 4.3.2.6. Step G: Remove lock pin from pivoting truss members on 89-NOAO-4202-0010 Vertical Installation Frame Assembly and lower truss members. Remove remaining lock pins from Vertical Installation Frame Assembly and lower Vertical Installation Frame Assembly using Gemini instrument handling palette. Move Gemini instrument handling palette away from the instrument.

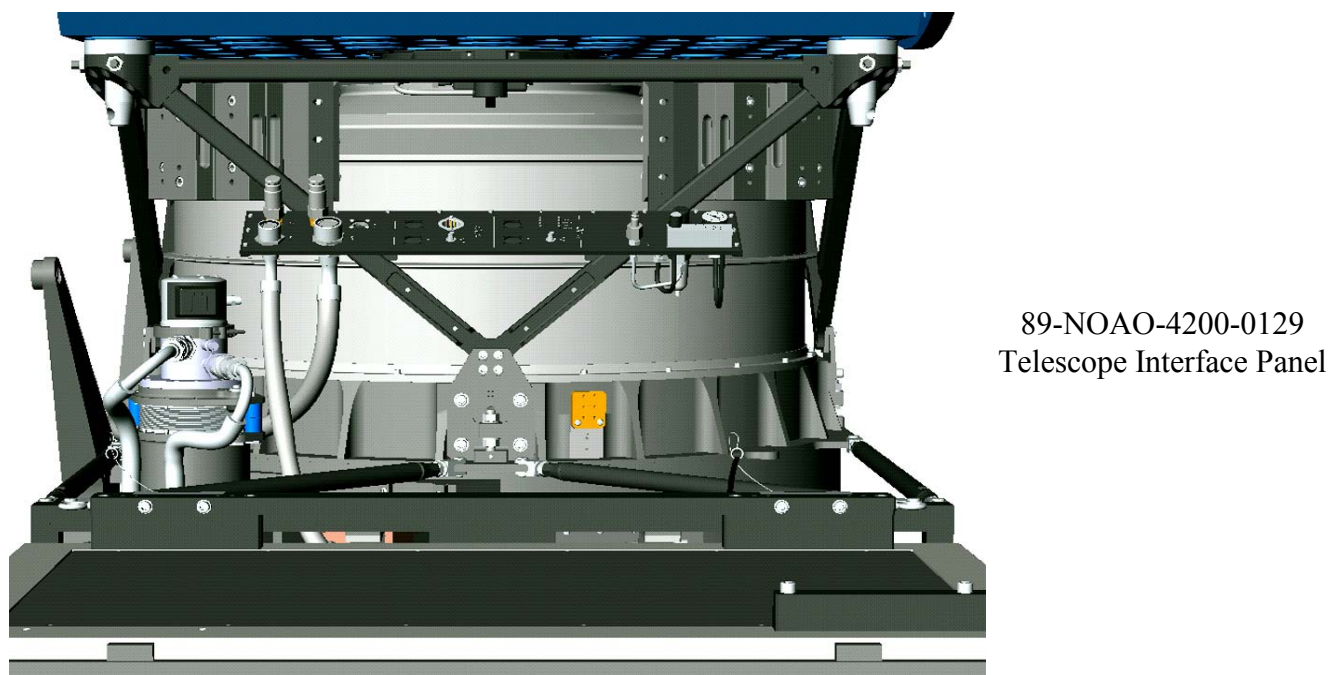


Figure 4.3.2.7. Step H: Connect Helium lines, electrical cabling, glycol coolant lines, & dry air lines, to 89-NOAO-4200-0129 Telescope Interface Panel on instrument and telescope interface panels.

4.3.3. Measuring & Adjusting Instrument Tilt/Focus

1. Description

This section discusses the procedures required to align GNIRS on the telescope. These procedures ensure that the telescope secondary is correctly re-imaged on the cold stop in the fore-optics, which is located at the secondary of the Offner relay (see Section 3 for additional description).

2. Nomenclature

89-NOAO-4200-0021 Instrument Tilt Adjustment Assemblies

3. Safety Precautions

These procedures require loosening fasteners that support the entire instrument. It is imperative that the fasteners do not get removed. Removal of these fasteners *will* result in personal injury and instrument damage.

4. Personnel Recommended/Required To Complete Task

The required number of personnel to complete this task is 2. The recommended number is 2.

5. Determining Tilt and Focus

Alignment Determination - Tilt

The alignment of the telescope secondary on the cold stop is verified using the following procedure:

- A. This procedure is best carried out at night, for maximum contrast between the telescope secondary and spider and the sky viewed past the secondary edge.
- B. Configure the instrument with the blue long camera, K filter (sorter 3, in filter wheel 2), pupil viewer lens (in filter wheel 1), pupil viewer decker position and second pupil viewer lens (slit slide). Insert the acquisition mirror.
- C. Take an image. You should see an image of the cold stop in the approximate center of the array. If the telescope secondary's image is *not* centered on the cold stop, you will see the spider vanes more brightly on one side than on the other. The cold stop is slightly larger than the image of the telescope secondary, so you may see some contrast at the edge of the secondary image as well.
- D. Determine the approximate shift in pixels required in the X (column number) and Y (row number) direction. A shift of 1 pixel corresponds to a tilt of 0.6 [TBD] mrad of the instrument. This is achieved by adjusting opposite arms of the forward truss (see below) by equal and opposite amounts, where an adjustment of 1 mm at each location results in a change in tilt of 1.2 mrad. To move the secondary in the +X direction, move the dewar *out* at the top truss arm and *in* at the bottom truss arm. To move the secondary image in the +Y direction, move the dewar *out* at the port truss arm and *in* at the starboard truss arm. [Signs TBD in reality.] Detailed adjustment procedures are given below.

Alignment Determination – Focus

There are several ways to determine any required focus adjustment. In principle, the telescope focus is set using the PWFS. The instrument focus can be set using either the OIWFS or the science channel. By comparing the focus locations for the two determinations, it is possible to figure out

how much the instrument must be moved in or out from the ISS to place GNIRS at the correct telescope focus. The instrument focus is shifted by moving the dewar at all four arms of the truss by the same amount. If the focus shift is large, it may be necessary to re-check and re-adjust the tilt afterward.

Focus determination with science channel:

- A. Focus the camera on the slit using the half-aperture masks in the filter wheel one and an arc lamp or night sky spectra. When there is no shift between spectra with the different masks, the camera is in focus on the slit. It does not matter which camera is used for this purpose, but the blue long camera is probably best.
- B. Focus the star on the detector with the wide slit using masks, but adjust the *telescope* focus, not the camera focus.

Focus determination with OIWFS:

- A. With a PWFS in focus, image a guide star with the OIWFS. There should be four images of the star seen on the detector. The separation when the focus is correct should be approximately 12 pixels. If the separation is different, there are two options:
- B. Adjust the OIWFS focus until the separation between images is correct. The equivalent shift in the telescope focus is the OIWFS focus shift, multiplied by 32.8.
- C. Alternatively, take the *difference* between the nominal separation and the observed separation, in pixels, and multiply by 0.10 mm. A larger separation implies that the dewar needs to be moved *away* from the ISS by the amount calculated.

6. Adjustment Procedures

- A. Determine the required tilt/focus adjustment from above sub sections.
- B. Move the telescope to the position that orients the instrument vertically upward looking. If the instrument is mounted to the up looking port, point the telescope to the zenith. If the instrument is mounted to a side looking port, point the telescope to the horizon and rotate the ISS until the instrument is vertical. See Figure 4.3.3.1.
- C. At each of the 4 Tilt Adjustment locations, turn the lower adjustment nut (identified in Figure 4.3.3.2) to move away (downward) from the seating surface of the Tilt Adjustment Slider. Turn the upper adjustment nut (identified in Figure 4.3.3.2) to move downward until seating onto the Tilt Adjustment Slider. Slightly preload the upper adjustment nut against the Tilt Adjustment Slider. See Figure 4.3.3.2.
- D. Take note of the position of the alignment mark on the scale at each of the 4 tilt adjustment assemblies. Note that graduations on scale are 2mm.
- E. Loosen the (4) M12 socket head cap screws 1-2 turns. **DANGER: DO NOT REMOVE SCREWS.**
- F. Turn the upper adjustment nut at each of the 4 tilt adjustment locations until the desired focus/tilt is achieved, as indicated in Figure 4.3.3.2.
- G. Tighten the (4) M12 socket head cap screws after making the tilt/focus adjustments.
- H. Turn the lower adjustment nut (upward) until seating against the Tilt Adjustment Slider and tighten.
- I. Re-check the tilt and focus, and repeat the adjustment procedure if necessary.

7. Summary

This section outlined the procedures to align GNIRS on the telescope. These procedures ensure that the telescope secondary is correctly re-imaged on the cold stop in the fore-optics, which is located at the secondary of the Offner relay.

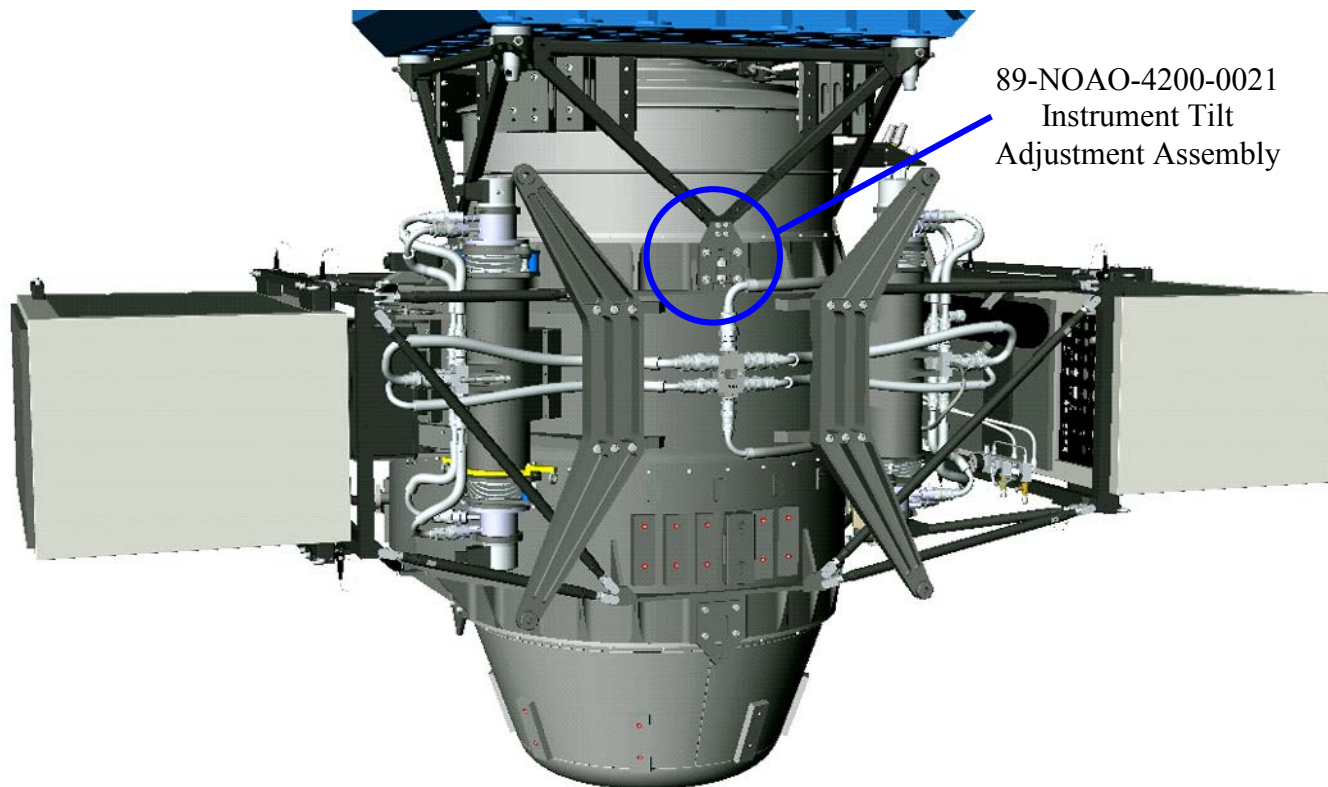


Figure 4.3.3.1. Move the telescope to orient instrument vertically.

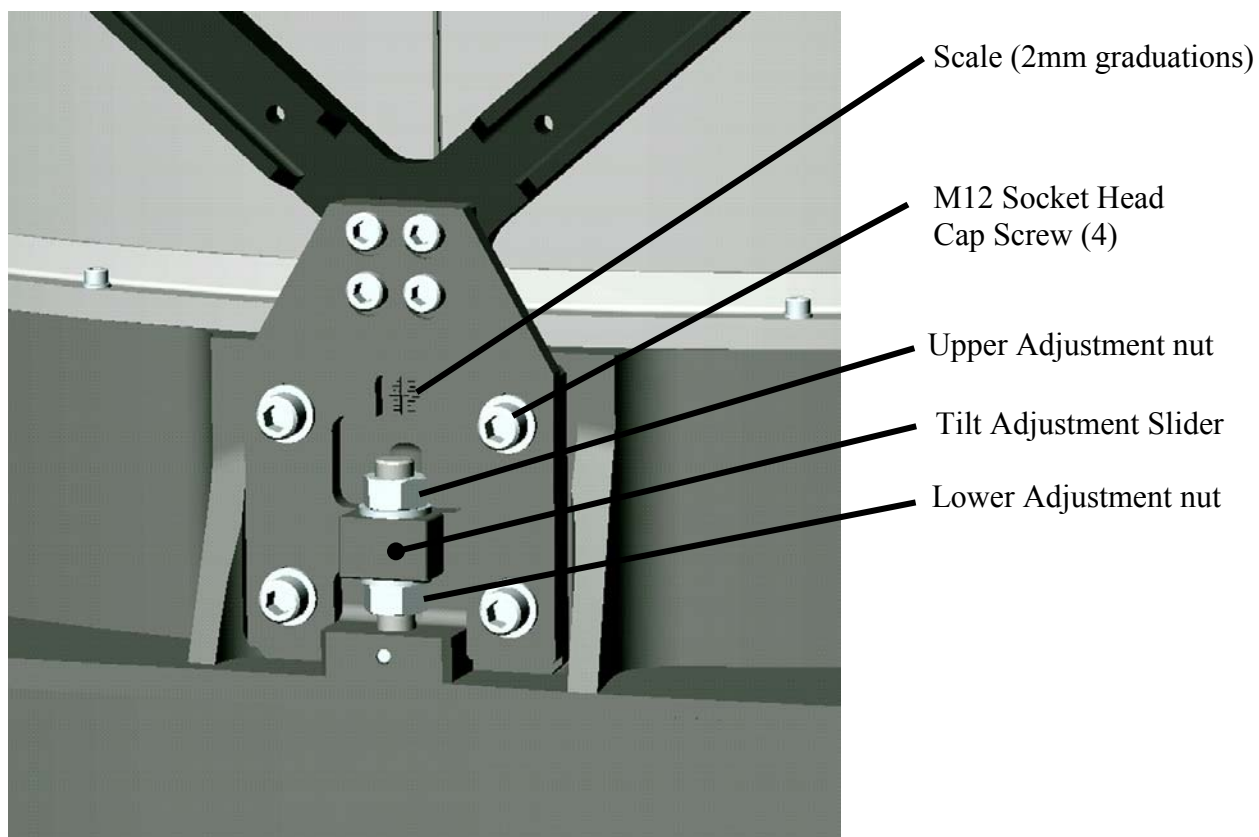


Figure 4.3.3.2. 89-NOAO-4200-0021 Instrument Tilt Adjustment Assembly. **Danger: Do Not Remove the M12 Socket Head Cap Screws.**

4.3.4 Default Ballast Weight Distribution

1. Description

The Gemini requirement for instrument weight and center of mass is as follows:

- Weight 2000Kg
- Center of Mass 1 M from ISS

In order to meet the Gemini weight and center of mass requirement, ballast weights have been mounted to the instrument at stations predetermined by NOAO. The weight and center of mass should not be adjusted unless modifications to the instrument are made to the instrument that would affect weight and center of mass, or there is a need to balance an instrument on the opposite face of the ISS. However, it is likely that modifications that affect these quantities will occur sometime during the lifetime of the instrument. Additionally, it is likely that ballast weight will get added to balance an instrument mounted to the opposite facing port on the Gemini ISS.

GNIRS uses 10 Lb (4.54 Kg) weights that can be mounted to various stations distributed around the instrument to achieve the desired weight and center of mass. The default ballasting of the instrument consists of 25 weights distributed as shown in Figures 4.3.4.2 through 4.3.4.4. This distribution ensures that the instrument meets the above requirement provided that no modifications are made to the instrument. A total of 50 weights have been manufactured thus leaving 25 weights available.

If it is the case where weights have been removed or added for one reason or another and the center of mass needs to be reestablished, the default ballast weight distribution configuration as described in this section should be reestablished prior to making further adjustments.

2. Nomenclature

89-NOAO-4200-1572 Ballast Weight, 10 Lb.



Figure 4.3.4.1. GNIRS 10 Lb (4.54 Kg) Ballast Weight. 25 of 50 weights get installed to meet the Gemini weight and center of mass requirement.

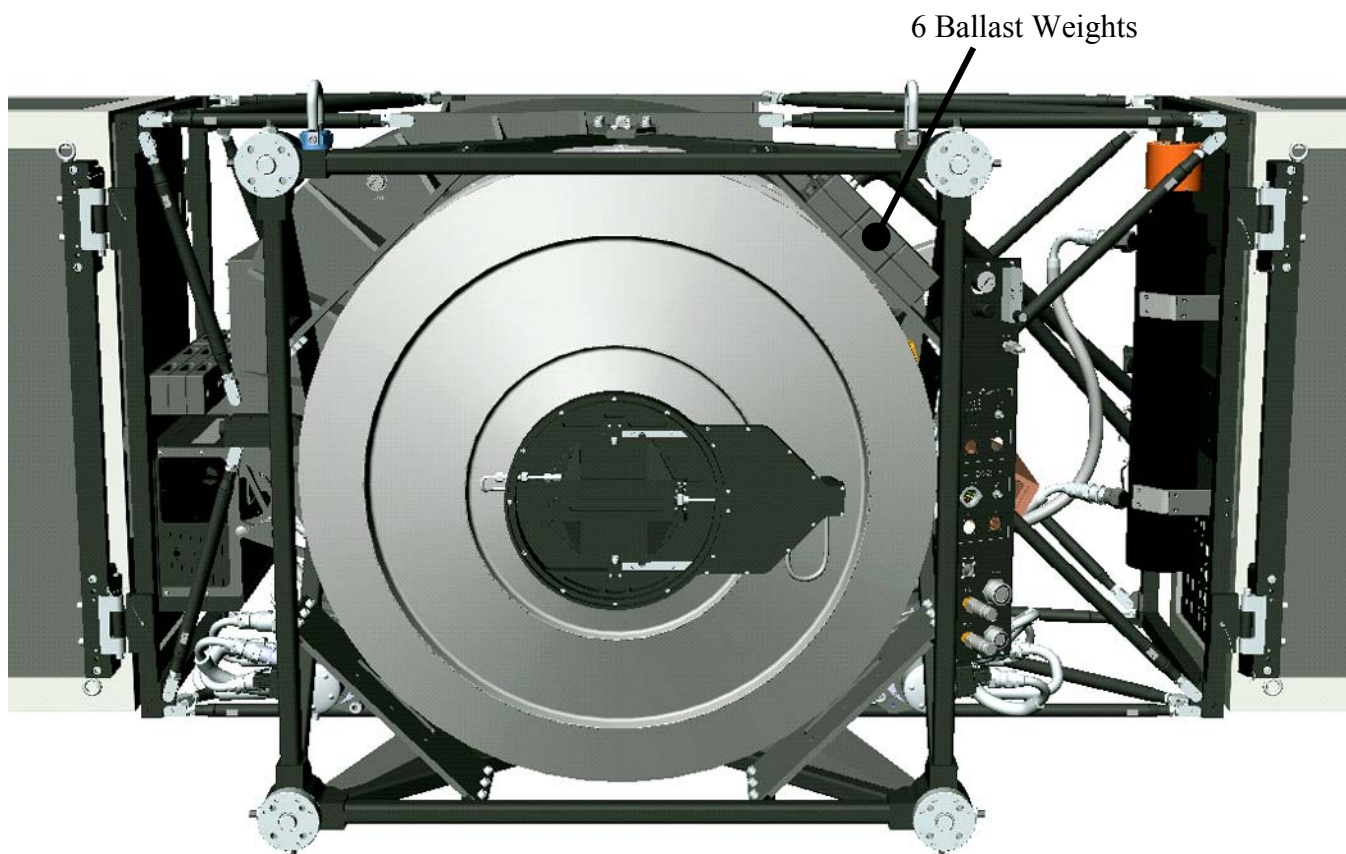


Figure 4.3.4.2. Default Ballast weight distribution. Forward View



Figure 4.3.4.3. Default Ballast weight distribution. Aft View



Figure 4.3.4.4. Default Ballast weight distribution. Starboard View

4.3.5 Definition of Ballast Weight Stations

There are several ballast weight mounting points (stations) distributed around the instrument so that the center of mass can be adjusted by positioning ballast weights as necessary. These stations are defined in Figures 4.3.5.1 through 4.3.5.4. Figure 4.3.5.5 shows a ballast weight station table that is to be used to record locations where ballast weight is added when reconfiguring the instrument center of mass. Note that the table shows the default distribution of weights to meet the Gemini weight and center of mass requirement.

Some of the stations have more than one mounting position for weights. This includes the Forward Truss stations 1-4 where each station has 3 mounting positions, and the Port and Starboard TEC Truss stations. When mounting weights to stations with more than one mounting position, one should mount the weights in a symmetrical manner as a rule of thumb unless other factors dictate otherwise.

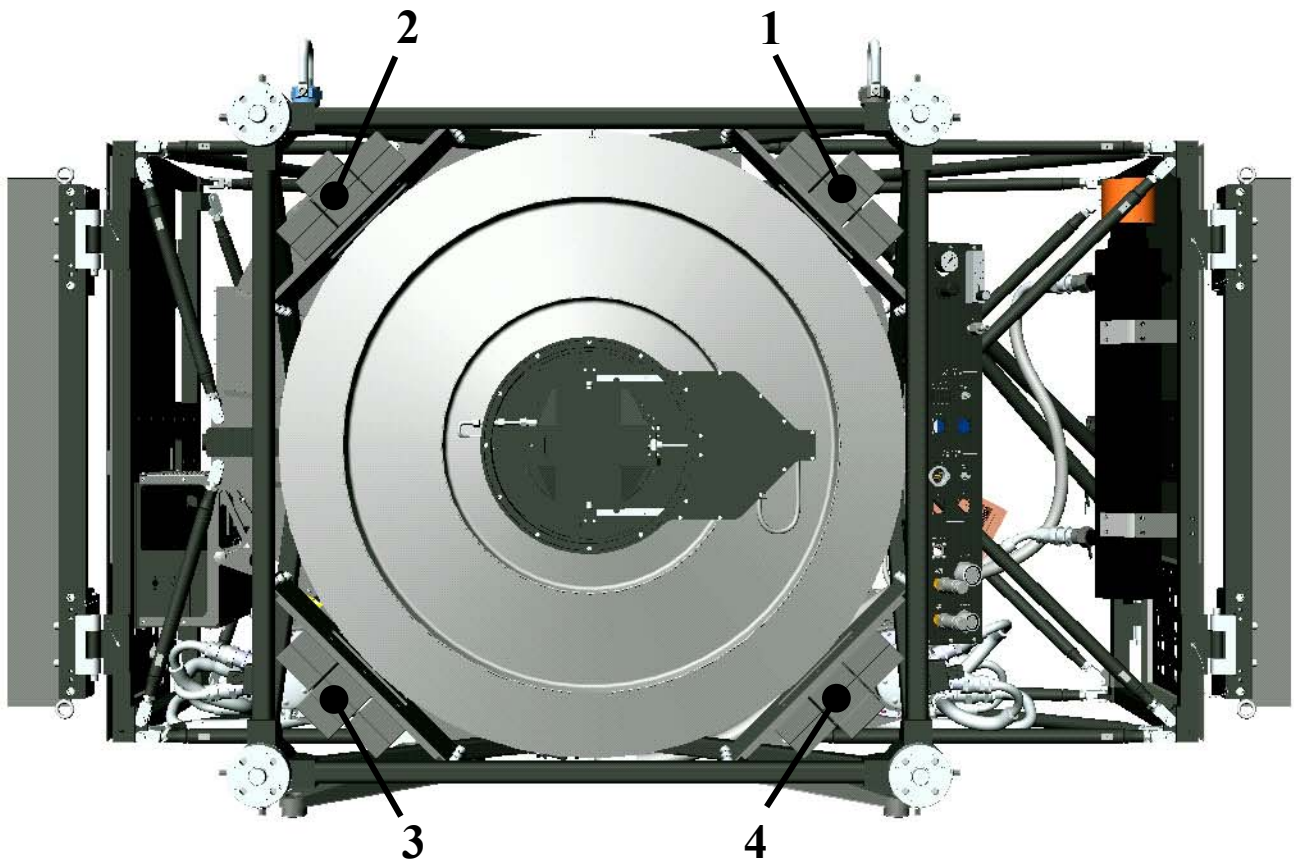


Figure 4.3.5.1. Forward Truss Ballast Stations.

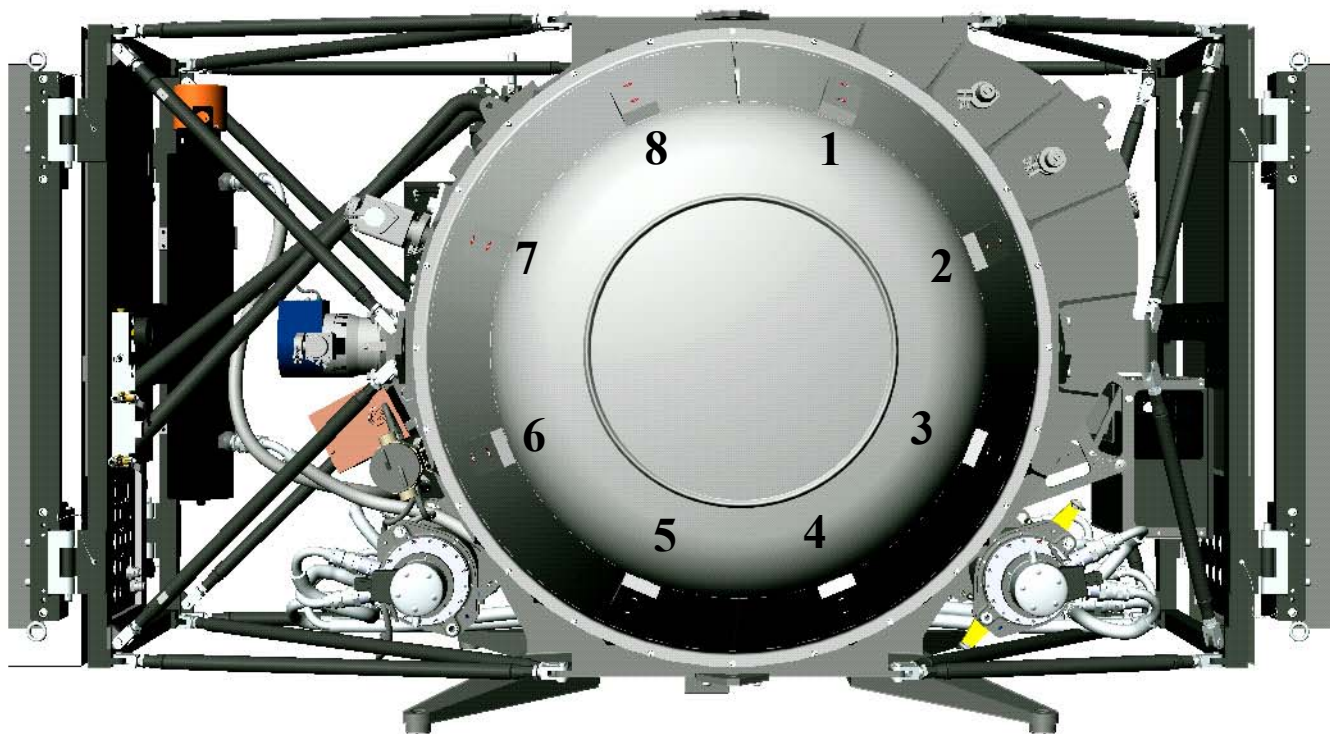


Figure 4.3.5.2. Aft Dewar Shell Ballast Stations.

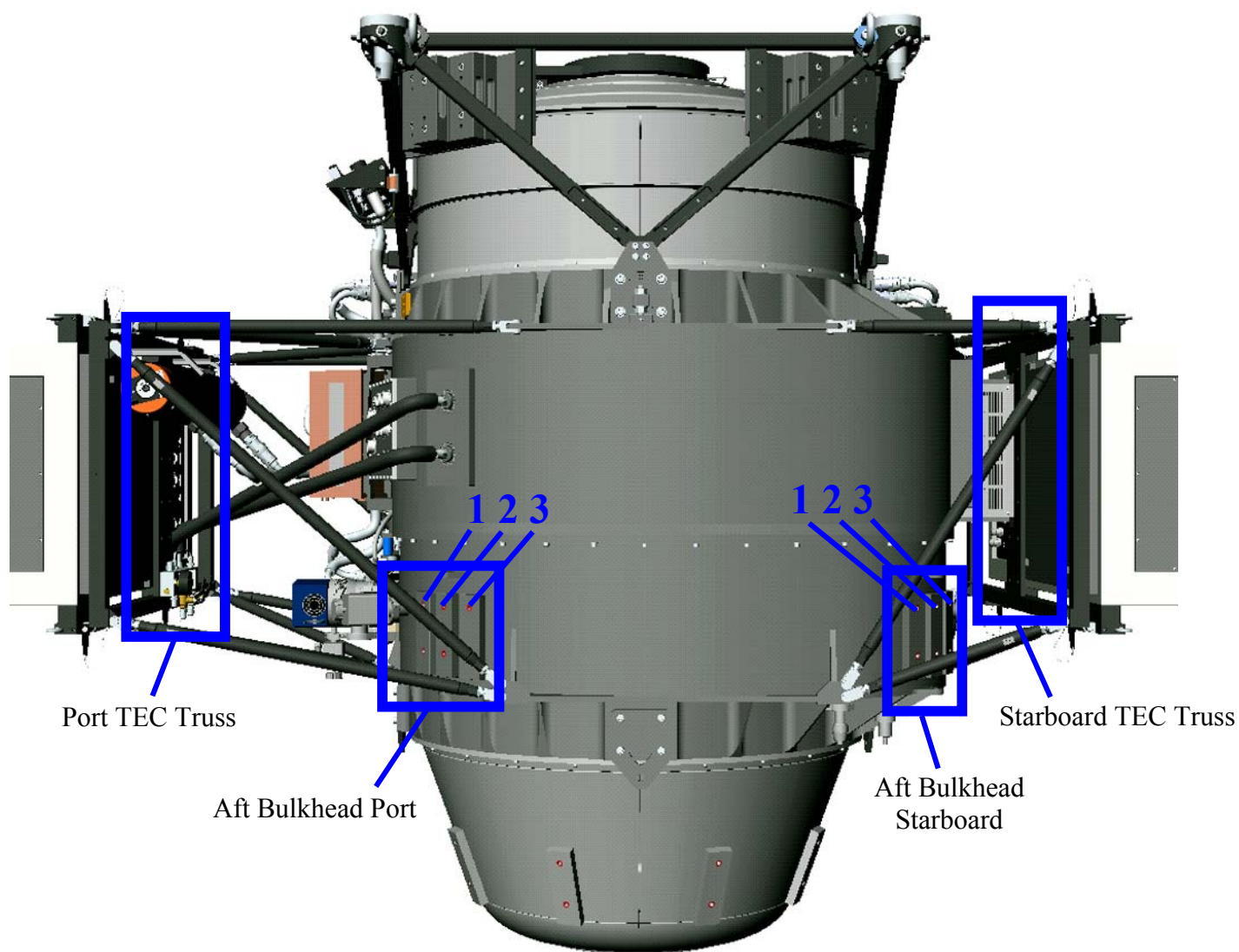


Figure 4.3.5.3. Aft Bulkhead and TEC Truss Ballast Stations.

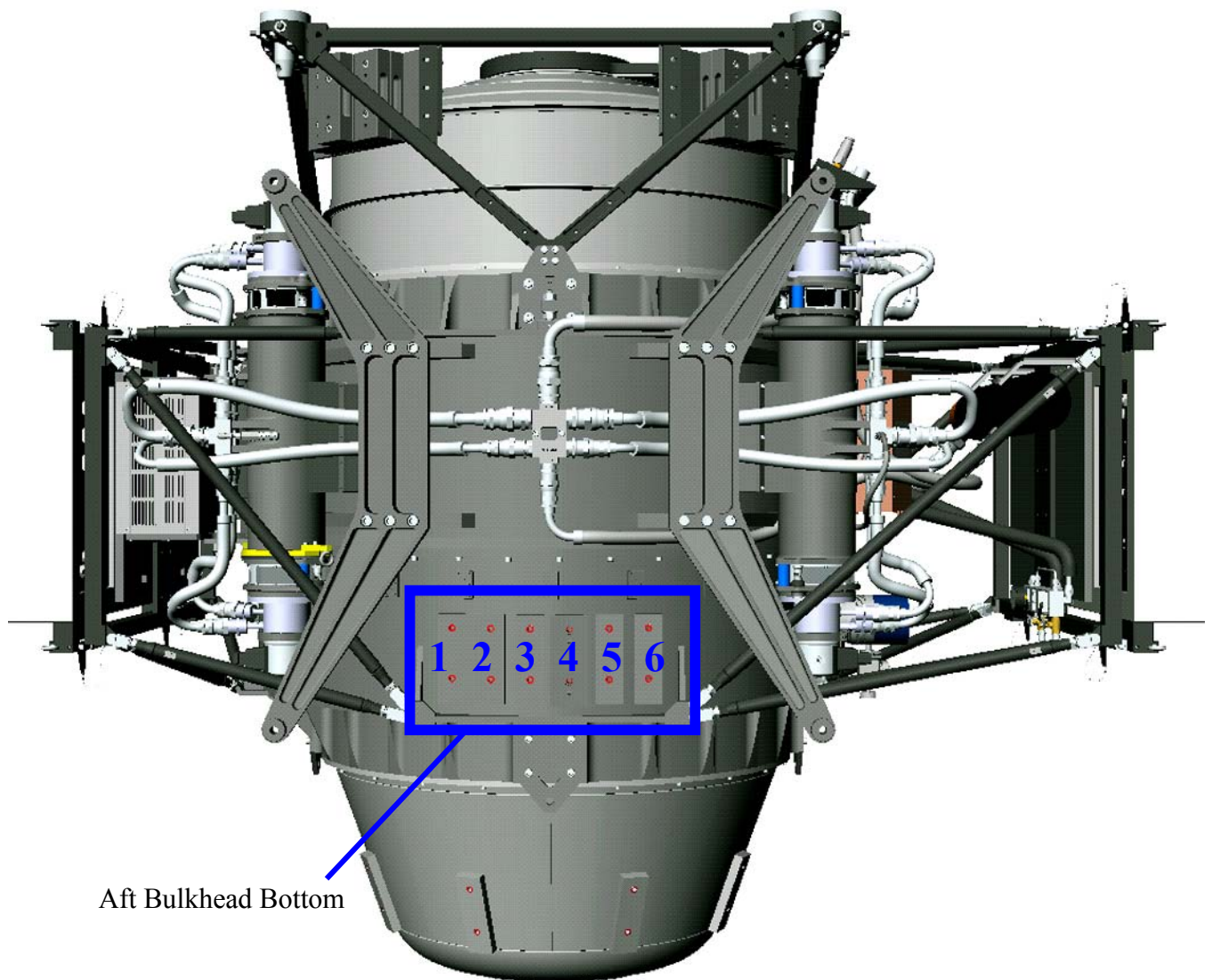


Figure 4.3.5.4. Aft Bulkhead Ballast Stations.

Figure 4.3.5.5. Ballast Weight Station Table.

Location		Number of Ballast Weights	
Forward Truss	1	6	
	2		
	3		
	4		
Aft Dewar Shell	1	1	
	2		
	3		
	4		
	5		
	6		
	7	1	
	8	1	
Aft Bulkhead	Port	1	
		2	
		3	
	Starboard	1	
		2	1
		3	
	Bottom	1	
		2	
		3	
		4	
		5	
		6	
Port TEC Truss		1	
Starboard TEC Truss		1	15

Note: Gray numbers in "Number of Ballast Weights" column represent default distribution of weights to meet weight and center of mass requirement.