

**GENERAL DYNAMICS**  
SATCOM Technologies

**INSTALLATION, OPERATION & MAINTENANCE**  
**MANUAL**  
**FOR**  
**VERTEXRSI MODEL 3.8-METER POST MOUNT ANTENNA**

**500-0631**

**Revision A**  
**May 13, 2004**

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A	Original release	5/13/04	JDT	LJI	JBJ
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Warnings, Cautions and other notes are included throughout this document to provide necessary information. **IGNORING WARNINGS, CAUTIONS AND OTHER NOTES MAY RESULT IN DAMAGE TO THE PRODUCT, INJURY, OR IN EXTREME CASES, DEATH.** You should know the use of Warnings, Cautions and other markings.

Definitions are:

**WARNING!**    **HIGHLIGHTS AN INSTALLATION, OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, STATEMENT, ETC., WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN INJURY TO OR DEATH OF PERSONNEL.**

**CAUTION!**    **HIGHLIGHTS AN INSTALLATION, OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, STATEMENT, ETC., WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO OR DESTRUCTION OF EQUIPMENT OR THE LOSS OF MISSION EFFECTIVENESS OR LONG TERM HEALTH HAZARDS TO PERSONNEL.**

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**ESD:**            **The Electrostatic Sensitive Device (ESD) appears at the beginning of any procedure or procedural step that includes the handling of equipment sensitive to damage from electrostatic discharge.**

General Warnings and Cautions are also provided at the front of the document. These Warnings and Cautions should be read by anyone who is involved with installation, has access to the equipment or is assigned to perform maintenance on the equipment.

### CAUTIONARY NOTICE

Although SATCOM Technologies has attempted to detail in this document all areas of possible danger to personnel in connection with the use of this equipment, personnel should use caution when installing, operating and servicing this equipment. Care should be taken to avoid electrical shock, whether the hazard is caused by design or malfunction. SATCOM Technologies is specifically not liable for any damage or injury arising from a technician's failure to follow the instructions contained in this document or his failure to exercise due care and caution in the installation, operation and service of this equipment. SATCOM Technologies shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.

This document is intended as a general guide for trained and qualified personnel who are aware of the dangers of handling potentially hazardous electrical and electronic circuits. This document is not intended to contain a complete statement of all safety precautions that should be observed by personnel in using this or other electronic equipment.

### ELECTRICAL HAZARDS

The antenna and feed system supplied by SATCOM Technologies is designed to be integrated with various types of electronic equipment. This system, if integrated with high power amplifiers or traveling wave tubes, will be capable of transmitting microwave energy at varying power levels. If transmitting microwave power, SATCOM Technologies cautions the end-user to review all applicable local, federal and international regulations and to comply with all such regulations in the operation and maintenance of the integrated system.

The electrical currents and voltages associated with this equipment, whether supplied by SATCOM Technologies or others, are dangerous. Personnel must at all times observe safety regulations.

- It is recommended that a lockout/tagout process be utilized while servicing the antenna system. In the United States, see OSHA 1910.147.
- Always disconnect power before opening covers, doors, enclosures, gates, panels or shields.
- Always use grounding sticks and short out high voltage points before servicing.
- Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields.
- Keep away from live circuits.
- Know your equipment and do not take risks.
- Always remove all power to the system prior to working on the antenna, the reflector assembly, the reflector backup assembly or the feed assembly.
- Always tag all circuits noting that the power is OFF, the date and your name, prior to commencing any work on that system.

**In case of emergency, be sure that power is disconnected.**

### **POTENTIAL DAMAGE TO ANTENNA**

The antenna limit switches and resolvers have been pre-set to allow maximum antenna performance. Any subsequent adjustment may jeopardize antenna performance and/or result in damage to the antenna.

### **SAFETY NOTICE**

The following safety procedures are listed to remind those performing any work on the antenna system that safety rules must be observed. Failure to observe safety rules may result in serious injury or death. Always work safely and in accordance with established procedures.

- It is recommended that a lockout/tagout process be utilized while servicing the antenna system. In the United States, see OSHA 1910.147.
- Care shall be taken in all operations to safeguard other people as well as property and to comply with all local safety procedures as established by the customer's site representative, as well as local building codes and fire protection standards.
- All persons performing work on the antenna system shall also comply with the Occupational Safety and Health Act (OSHA) standards and all other federal state and local laws, ordinances, regulations and codes relating to designated work.
- Unless the customer's representative on site specifically designates an individual responsible for site safety, the VertexRSI Site Supervisor shall be responsible for and establish a site safety program for the VertexRSI installation work. The site safety program shall incorporate all VertexRSI safety procedures and requirements
- Never make internal adjustments or perform maintenance or service when alone or fatigued.

### **ELECTROMAGNETIC RADIATION**

- It is recommended that a lockout/tagout process be utilized while servicing the antenna system. In the United States, see OSHA 1910.147.
- Do not stand in the direct path of the feed system when the system is transmitting!
- Do not work on the feed system when the system is on!

**ALWAYS WORK SAFELY!**

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## **1.0 INTRODUCTION**

### **1.1 General**

The 3.8-meter dual-offset antenna is designed to work at various radio frequencies and to be assembled easily in the field by the user. This antenna is composed of the main reflector, subreflector, supporting structures and pedestal structures. Once properly assembled, this antenna will achieve high gain and exceptional pattern characteristics.

It is very important to understand the entire installation procedure to avoid any mistakes that could result in permanent damage to the antenna. Therefore, General Dynamics SATCOM Technologies strongly suggests the antenna user read this manual thoroughly before starting the installation and follows the steps precisely. General Dynamics SATCOM Technologies disclaims any liability or responsibility for the results of improper or unsafe installation, operation and maintenance practices. Should any installation, operation or maintenance questions arise that are not answered within this document, please contact:

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## **2.0 WARRANTY**

SATCOM Technologies warrants the items ordered hereunder at the time of shipment to be free from defects in material, workmanship, and to conform to the contract specification. SATCOM Technologies' liability under this Warranty shall terminate one (1) year after date of acceptance or eighteen (18) months from the date of shipment, whichever comes first. Some individual products include extended warranties as stated in brochure(s) and extended warranties may be purchased as requested and quoted. Written notice of any defects shall be given SATCOM Technologies upon discovery and SATCOM Technologies shall promptly correct such defects by repair or replacement, at its option, without charge, either FCA SATCOM Technologies' plant or service in the field.

**IN NO EVENT SHALL SATCOM TECHNOLOGIES' LIABILITY UNDER THIS WARRANTY EXCEED THE COST OF REPAIR OR REPLACEMENT OF SUCH DEFECTIVE ITEM AND UNDER NO CIRCUMSTANCES SHALL SATCOM TECHNOLOGIES BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES.**

Specifically excluded from this Warranty are:

- a. Defects or nonconformance caused by and resulting from improper operation, maintenance, or storage of the equipment.
- b. Items of characteristically indeterminate life, such as bulbs, fuses, etc.

**THIS WARRANTY CONSTITUTES SATCOM TECHNOLOGIES' SOLE AND EXCLUSIVE LIABILITY HEREUNDER AND BUYER'S SOLE AND EXCLUSIVE REMEDY FOR DEFECTIVE OR NONCONFORMING ITEMS AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS IMPLIED OR STATUTORY (INCLUDING THE**

WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE).

### **3.0 INSTALLATION**

#### **3.1 Before Beginning**

##### **3.1.1 Antenna Foundation**

Prior to installation of the antenna, the antenna foundation must be complete. The standard foundation structure drawing is presented in Appendix B. Recommendations for site selection and mounts are presented in Appendix C and E respectively.

##### **3.1.2 Shipment Inspection**

The VertexRSI 3.8-Meter Dual Offset Antenna is packaged in five basic cartons with two optional cartons and one customer-dependent carton. Once received, the antenna shipping cartons should be inspected for exterior damage. If damage is found, please contact General Dynamics SATCOM Technologies for correction. See Appendix D for "Reporting Loss or Visible Damage".

Prior to the installation process, it is recommended that the components in each carton be compared to Table 2-1, Parts List for 3.8-Meter Dual Offset Antenna. Table 2-1 is sorted first by carton number, then part number. A Hardware Kits carton is part of the shipment. A Bill of Material (BOM) is included inside each hardware kit that may be used for inventory of the hardware. Use the Work Order Bill of Material "Unit Qty" and "Catalogue Number" to inventory the hardware as shown in Figure 2-1. Should any part be missing or if damage is apparent, please refer to Appendix D, "Reporting Loss or Visible Damage". A complete 3.8-Meter Dual Offset Antenna shipment contains the following:

<u>Carton #</u>	<u>Description</u>
1	Hub
2	Radial Beams
3	Reflector Panels
4	Pedestal (open skid)
5	Hardware Kits
6	Pedestal Pipe (open skid) [optional]
7	Foundation Installation [optional]
8	Feed Installation [customer dependent]

##### **3.1.3 Unpacking Instructions**

Care should be exercised when uncrating and unpacking the equipment. Each carton should be inspected as it is opened. The contents of each carton should be checked against the work order-packing list inside each carton or Table 2-1 in this manual to verify correct part numbers and quantities.

If a claim for shipping damages is to be made, save the packing material, the container and the accompanying paperwork to substantiate the claim with the carrier. Notify General Dynamics SATCOM Technologies as soon as possible. Do not return any unit, subassembly or assembly until authorization and shipping instructions are received from the factory.



**Table 2-1. Parts List for 3.8-Meter Dual Offset Antenna**

<b>Part Description</b>	<b>Part Number</b>	<b>Qty.</b>	<b>Carton</b>
Hub Assembly	300081-01	1	1
# 1 Radial Beam	300006-01	1	2
# 2 Radial Beam	300006-02	2	2
# 3 Radial Beam	300006-03	2	2
# 4 Radial Beam	300006-04	2	2
Diagonal Tubing Lacing, Right	300010-07	1	2
Diagonal Tubing Lacing, Left	300010-08	1	2
Angle Clip	300010-13	26	2
Lacing, 28-3/8"	300010-15	2	2
Lacing, 29"	300010-16	2	2
Lacing, 22-3/16"	300010-17	2	2
Lacing, 50-7/16"	300010-18	2	2
Lacing, 38-3/4"	300010-19	2	2
Strut Beam, 66-15/16"	300010-20	2	2
Feed Boom Arm, Right	300016-04	1	2
Feed Boom Arm, Left	300016-05	1	2
Feed Boom Diagonal Brace, Long	300016-06	2	2
Standard Mount Channel	300016-07	4	2
Diagonal Brace, Short	300016-08	1	2
Gusset, Feed Boom	300016-09	2	2
Subreflector Assembly	300119-02	1	2
Panel Assembly	300002-01	1	3
Panel Assembly	300002-02	1	3
Panel Assembly	300002-03	1	3
Panel Assembly	300002-04	1	3
Panel Assembly	300003-01	1	3
Panel Assembly	300003-02	1	3
Panel Assembly	300003-03	1	3
Panel Assembly	300003-04	1	3
Panel Assembly	300004-01	1	3
Panel Assembly	300004-02	1	3
Panel Assembly	300004-03	1	3
Panel Assembly	300004-04	1	3
Pedestal Turning Head	033274-02	1	4
Az Fine Adjust Collar w/screw mount	033396-01	1	4
Elevation Jack Threaded Rod	033417-01	1	4
Az Fine Adjust Collar	033396-02	1	4
Antenna Hardware Kit	033428-02	1	5
Reflector Hardware Kit	300001-02	1	5
Rear Feed Support Kit (Feed Optional)	R019468	1	5
Pedestal	033274-01	1	6

\*\*\* DRAFT COPY \*\*\*      W O R K   O R D E R      0001

Release: 126151100      3.8M ANTENNA

Ship To: VERTEX MFG      Entered: 05/12/98  
 VERTEX MFG      Revised: 00/00/00  
 2600 LONGVIEW ST      Priority: 00 00  
 KILGORE, TX      Location: VX

Catalogue: 300001-58      REFLECTOR INSTL BOX 3, PANEL ASSY (3.8M)  
 MODEL 3.8M

Drawing: D-300001      Revision: F  
 Ship Item: 004      Finish: STD  
 Quantity: 50.000      Weight:      Dim A:

Used On:

OPERATIONS

WKCT	NO	DESCRIPTION	MCH	HRS	SETUP	RUN	TOTAL
CR	0005	CRATE PER STANDARD METHOD	175.1	0.25	7.0000	350.2	

OPERATOR INSPECT:                       
 LEADMAN INSPECT:                     

\*\*\*\*\*NOTE: MAKE COPY OF WORK ORDER AND INSERT\*\*\*\*\*  
 \*\*\*\*\*COPY IN CRATE BOX AS "PACKING LIST".\*\*\*\*\*  
 ROUTE TO SAMFG INVENTORY.  
 TURN IN WORK ORDER.  
 SCRW.300001-58.....

B I L L   O F   M A T E R I A L

ITEM	TOTAL QTY	UM	UNIT QTY	CATALOGUE NUMBER	CATEGORY	PSM	ORIGIN
BUYR PLAN REFER			LENGTH	OP			
011-	50.000EA		1.000	300002-03	ANTENNA	M	0002
				PANEL ASSY 3.8M			
012-	50.000EA		1.000	300002-04	ANTENNA	M	0003
				PANEL ASSY 3.8M			
013-	50.000EA		1.000	300002-01	ANTENNA	M	0004
				PANEL ASSY			
				3.8 METER			
014-	50.000EA		1.000	300002-02	ANTENNA	M	0005
				PANEL ASSY			
				3.8 METER			
015-	50.000EA		1.000	300003-03	ANTENNA	M	0006
				PANEL ASSY 3.8M			
016-	50.000EA		1.000	300003-04	ANTENNA	M	0007
				PANEL ASSY 3.8M			
017-	50.000EA		1.000	300003-01	ANTENNA	M	0008
				PANEL ASSY			
				3.8 METER			
018-	50.000EA		1.000	300003-02	ANTENNA	M	0009
				PANEL ASSY			
				3.8 METER			
019-	50.000EA		1.000	300004-03	ANTENNA	M	0010
				PANEL ASSY 3.8M			

Unit Qty

Catalogue Number

Figure 2-1. Work Order Example

### 3.1.4 Tools Recommended for Installation

This 3.8-meter antenna is designed for assembly by a crew of three without special heavy equipment or tooling. The following are recommended hand tools:

**Table 2-2. Tool List**

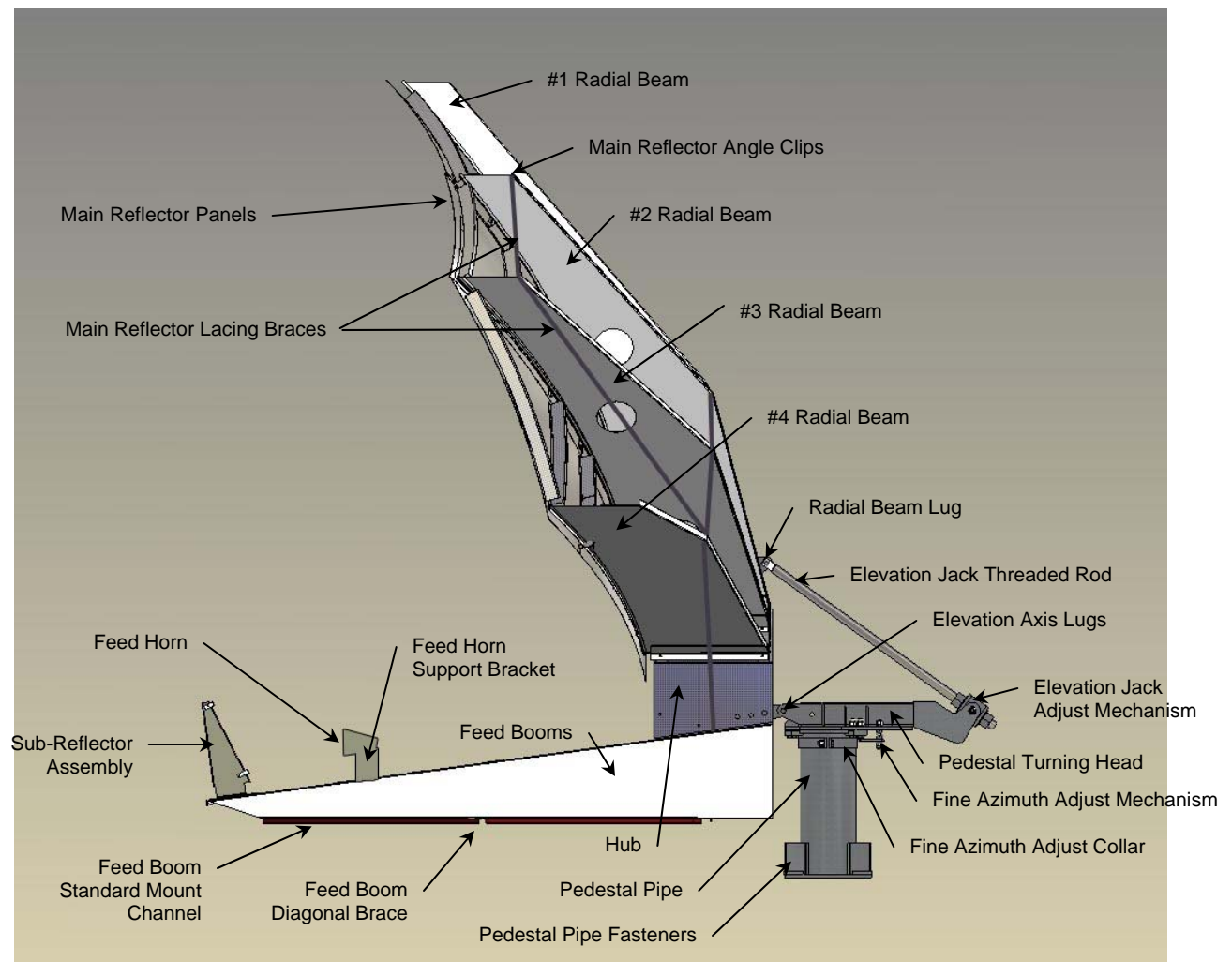
#	Tool Name and Size	Quantity
1	1/2" Drive Ratchet	2
2	1/2" Drive Sockets: 5/16", 3/8", 7/16", 9/16", 3/4", 1-1/16", 1-1/8", 1-1/4", 1-5/8"	2 each size
3	1/2" Drive Deep Socket: 1 5/8"	1
4	1/2" Drive Extension – 10" or 12"	1
5	Open Box Wrench 5/16"	2
6	Open Box Wrench 3/8"	2
7	Open Box Wrench 7/16"	2
8	Open Box Wrench 1 5/8"	2
9	Open Box Wrench 9/16"	2
10	Open Box Wrench 3/4"	1
11	Open Box Wrench 1 1/4"	2
12	Open Box Wrench 2 3/8"	1
13	Open Box Wrench 3 1/2"	1
14	24" Crescent Wrench	1
15	Phillips Screw Driver (+)	2
16	Regular Flat Screw Driver (-)	2
17	25 Ft. Measuring Tape	1
18	Hammer 2 lb, machinist's and claw	1 each
19	Inclinometer	1
20	Compass	1
21	Step ladder 6 Ft. (2m) and 16 Ft. (5m)	1 each

22	12" Pipe Wrench	1
23	Cordless drill (must have a clutch)	1
24	Torque Wrench 1/2" drive (at least 250 ft-lbs)	1
25	Awl (1/8" Diameter)	1
26	Pliers	2
27	Wrecking Bar	1
28	Putty Knives	2
29	Adjustable Spud Wrench	1



### 3.2 Installation Procedure

*Note: Refer to Figure 2-2 during installation. This figure is an overall view of the assembled antenna and can assist the installer with locating parts and understanding the relationship between the components.*



**Figure 2-2. Fully Assembled 3.8-Meter Antenna**

### 3.3 Pedestal Post Installation

1. After verification of the foundation layout per Section 3.1.1, remove both nuts and plywood template from the embedded anchor bolts and install the pedestal post to the foundation. The pedestal should be lifted by placing a minimum of two nylon slings around the upper post. Precaution should be taken to protect the finish of the pedestal. Install the nut and washers to the bolts per drawing 034372 and tighten snug.
2. Verify the pedestal is level in two directions using a spirit level on the vertical pedestal tube.
3. Tighten the anchor bolts securing the pedestal to the foundation per AISC "Turn-of-Nut" procedure by pulling nuts up snug and tightening an additional two flats (unless otherwise specified on installation drawing in print package).
4. Brush clean the top surface of the upper flange of the pedestal post. Make sure that there are no rough burrs and it is free of debris and dirt. Generously apply grease to the top surface only of the upper post flange.



**Figure 2-3. Application of Grease to Top Surface of Pedestal Post**

### 3.4 Pedestal Turning Head Installation

1. Install the elevation trunnion block to the turning head using supplied hardware. Snug, but do not tighten such that block cannot rotate. Install elevation axis pins and retaining rings.
2. Attach lifting straps to each end of the turning head (as shown in Figure 2-4) at the elevation trunnion block and both axis pins. Carefully lift the turning head with the crane and position it over the pedestal. Center the turning head on top of the pedestal so that all the clamp holes are equally visible from all sides below.

**CAUTION! MAINTAIN STRAP TENSION WITH THE CRANE UNTIL TRUNNION IS COMPLETELY SECURED TO THE PEDESTAL.**



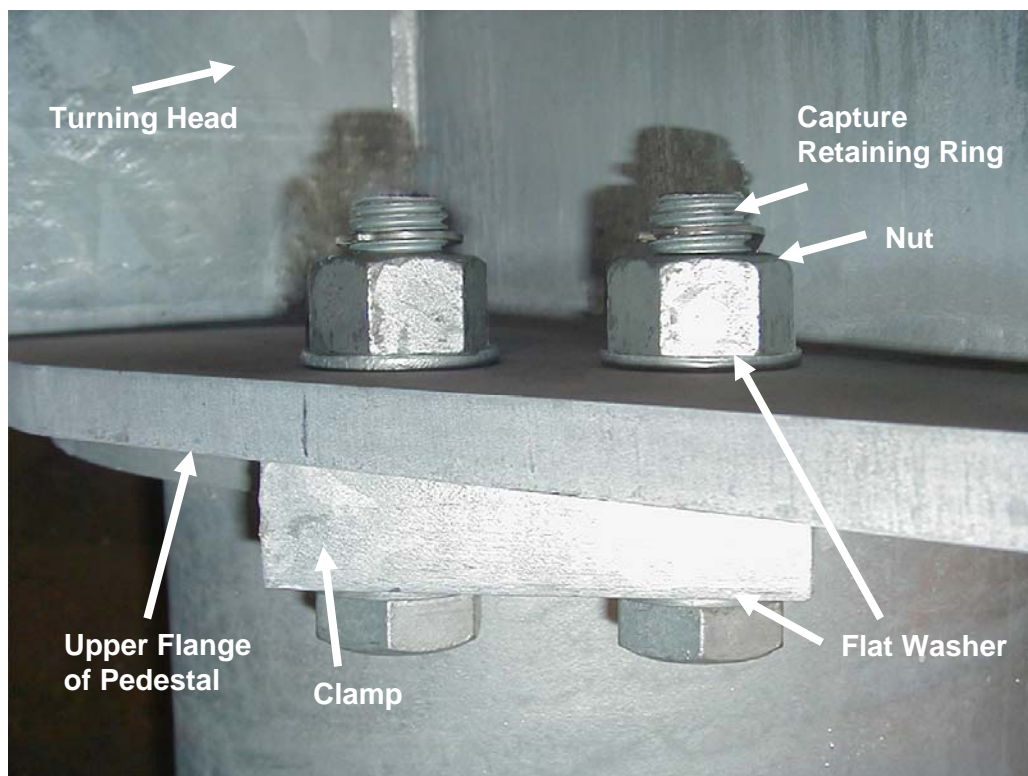
**Figure 2-4. Lifting and Installation of the Pedestal Turning Head**

3. With the turning head centered onto the pedestal post, install each of four clamps to the underside of the turning head plate with the lip of each clamp capturing the bottom edge of the pedestal post's upper flange (see Figures 2-5 and 2-6).

4. Attach each clamp using the supplied 1" hardware using bolt, flatwasher, clamp, flatwasher, and nut, in sequence. Install the bolt from the bottom of the plate with the nut on top. Hand tighten each bolt.
5. With the clamps in place and secured, turn the turning head several rotations on the pedestal post flange to burnish bearing surface such that it rotates smoothly.
6. Tighten all eight bolts with a torque wrench to a minimum torque of 250 ft-lbs lubricated.
7. Permanently install capture retaining rings to each bolt, no more than 1/4" from top of the nut (see Figure 2-5).

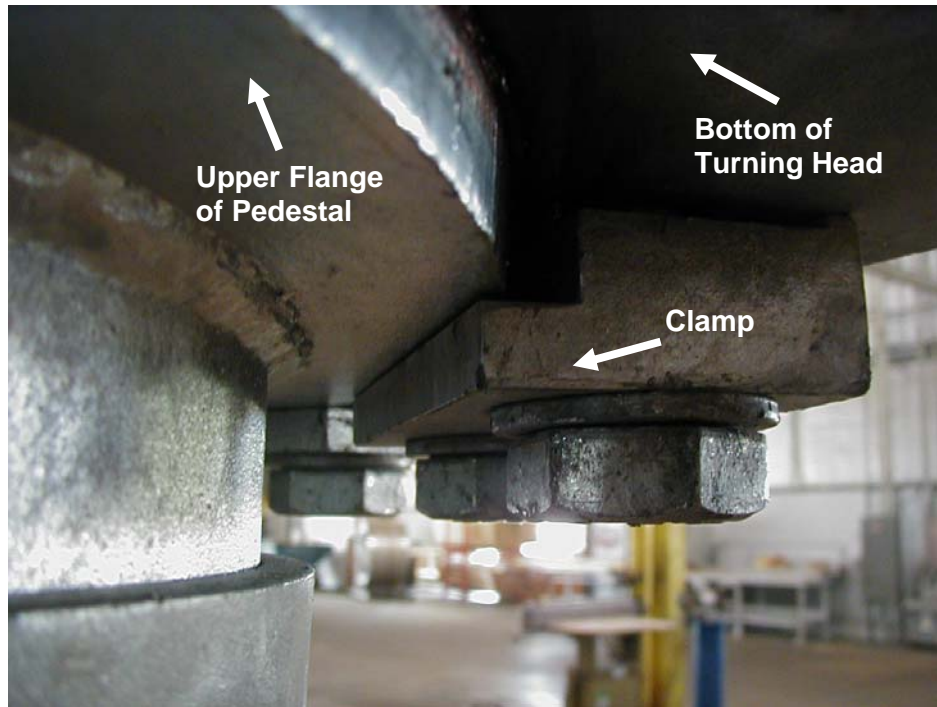
**WARNING! TO PREVENT PERSONAL INJURY OR DAMAGE TO THE ANTENNA, DO NOT REMOVE CAPTURE RETAINING RINGS UNLESS THE ANTENNA IS BEING DISASSEMBLED FOR MAINTENANCE OR RELOCATION.**

8. Only after capture retaining rings have been installed, lower the crane and release the straps (see Figure 2-7). Remove and store elevation axis pins and retaining rings for later use on reflector installation.



**Figure 2-5. Installation of Clamps**





**Figure 2-6. Clamps Installed**



**Figure 2-7. Turning Head Installed**

### 3.5 Elevation Strut Installation

1. With the lower nut removed and the upper nut threaded all the way to the strut clevis, install the elevation strut assembly to the pedestal turning head.

**CAUTION! TAKE CARE NOT TO DAMAGE THREADS ON ELEVATION STRUT.**

2. Secure the strut with a strap and carefully lift it by crane until it's positioned vertically over the elevation strut trunnion block (see Figure 2-8). Slowly lower the screw through the block until it's resting on the top nut.
3. Hand thread the second nut from the bottom until it's snug against the bottom of the trunnion block.
4. Tighten both trunnion bolts using two (2) 1 5/8" wrenches until lock washer is flattened (see Figure 2-8). Release the lifting strap.

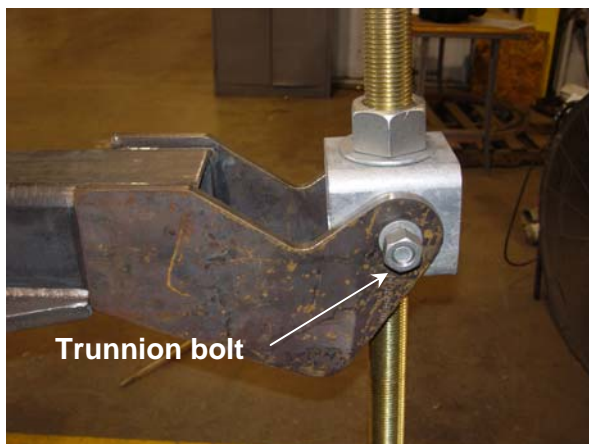


Figure 2-8. Elevation Strut Installation

## Azimuth Fine Adjustment Installation

1. Clamp the adjustment arm brackets to the pedestal post using supplied hardware on both sides (see Figure 2-9). Slide the bracket to approximately 4 inches from the top flange of the pedestal post. Generally orient the bracket such that the bolt connections are parallel to the main tee and the bracket arm is toward the rear of the tee (elevation trunnion block). Hand tighten bolts.
2. Assemble the fine adjustment rod using supplied hardware.
3. Install the fine adjustment rod, one end to the bracket arm and the other end to bottom of the turning head with the fine adjustment rod positioned equal distance from the pivot point. Tighten all hardware snug.



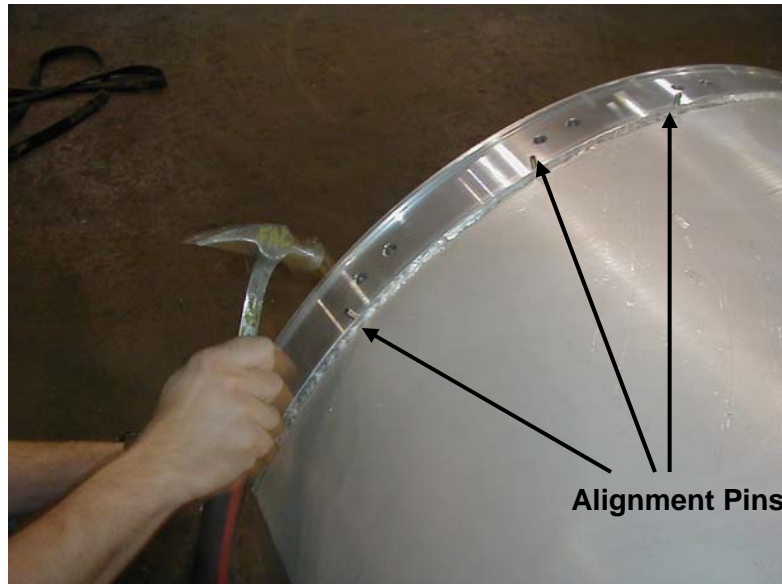
Figure 2-9. Azimuth Fine Adjustment Installation



Figure 2-10. Azimuth Adjustment Rod

### 3.6 Hub Weldment

1. Before mounting the hub, insert the radial alignment pins (see Figure 2-11). Using a hammer, tap the pins into the factory-drilled holes in the hub. There is one alignment pin hole near each pair of bolt holes in the radial mounting bands. Do not drive the pins all the way into the holes. Each pin must protrude out from the hub 1/2" (12.7mm).



**Figure 2-11. Radial Alignment Pins on Hub**

2. Install the elevation axis lugs on the hub using the 3/4" x 2-1/2" hot dip galvanized hardware as shown in Figures 2-12 and 2-13. Do not tighten at this point. Finger-tighten only.

*Note:* This is a permanent structural joint; do not include lock washers.

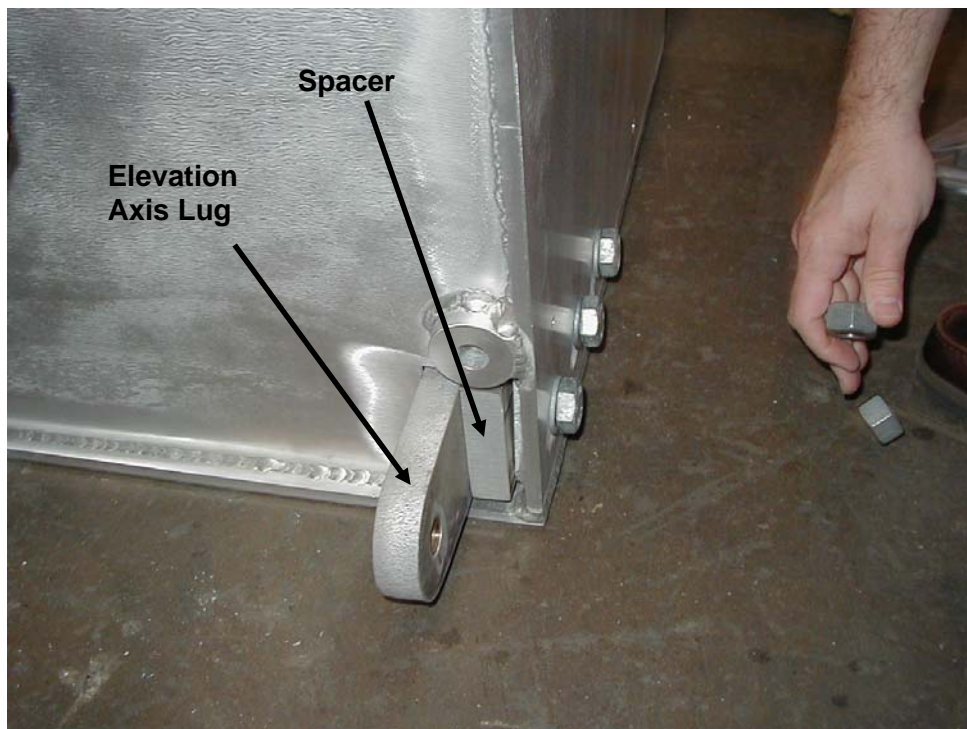
**Important:** Before installing the elevation lugs, insert the 5/8" x 1-3/4" hot dip galvanized hardware into the first hole in the flat bottom of the hub as shown in Figure 2-12.





Insert bolt in hole here prior to installing lug and spacer – both sides of hub

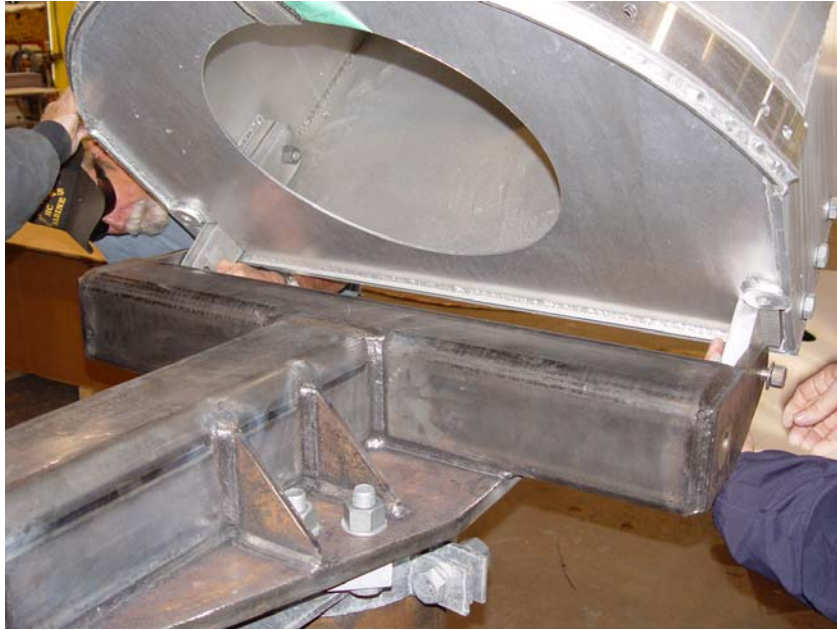
**Figure 2-12. Elevation Axis Lug and Spacer – Inside Hub**



**Figure 2-13. Elevation Axis Lug and Spacer – Outside Hub**

3. Lift hub assembly above the turning head and align hub lugs with turning head lugs. Align the holes in the elevation axis lugs with the turning head lugs and insert the two axis pins as shown in Figure 2-14.

**CAUTION! USE EXTREME CAUTION WHEN LIFTING HUB TO PREVENT DAMAGE TO PERSONNEL OR THE ANTENNA. DO NOT ATTEMPT THIS STEP DURING HIGH WIND CONDITIONS.**



**Figure 2-14. Installing Hub on Turning Head**

4. Install nuts and tighten. Tighten to 150 lb-ft (203 Nm).



**Figure 2-15. Hub Installed on Turning Head**

### 3.7 Radial Beam Structure

1. Identify the radial beams from #1 to #4. Each should have identification from the factory. Improper location will create misalignment during the panel installation.

*Note:* There may be factory-installed, adhesive-backed shims on the hub. Do not remove these shims or misalignment may occur.

**CAUTION!** DO NOT PUSH OR TWIST THE RADIAL BEAMS AT ANY TIME DURING THE INSTALLATION PROCESS. DAMAGE TO THESE MEMBERS WILL RESULT IN DISTORTION OF THE REFLECTOR SURFACE.

*Note:* If this antenna will need to be disassembled for any reason, be sure to apply a lubricant to the threads of all stainless steel hardware to prevent galling on the metal.

2. Bolt the radial beam lugs (two pieces) at the designated place on the back of the #1 radial beam using five 3/4"x 3-1/4" hot dip galvanized hardware as shown in Figure 2-16 (center bolt not shown).

*Note:* Torque limit on the radial beam lug hardware is 150 lb-ft (203 Nm).

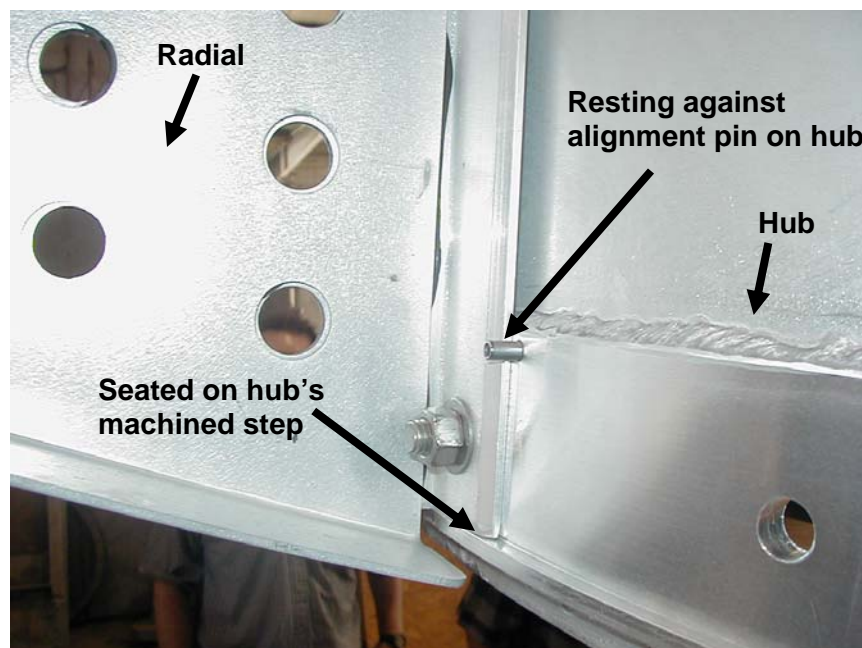


**Figure 2-16. Radial Beam Lugs**

2. Attach the #1 radial beam to the hub with 1/2" x 2" stainless steel hardware (see Figure 2-17). The radial must be seated on the machined step of the hub (no gap between step and bottom of radial) and against the alignment pins installed in Section 2.7, Step 1 (see Figure 2-18). Do not tighten hardware beyond hand-tight until the next step.



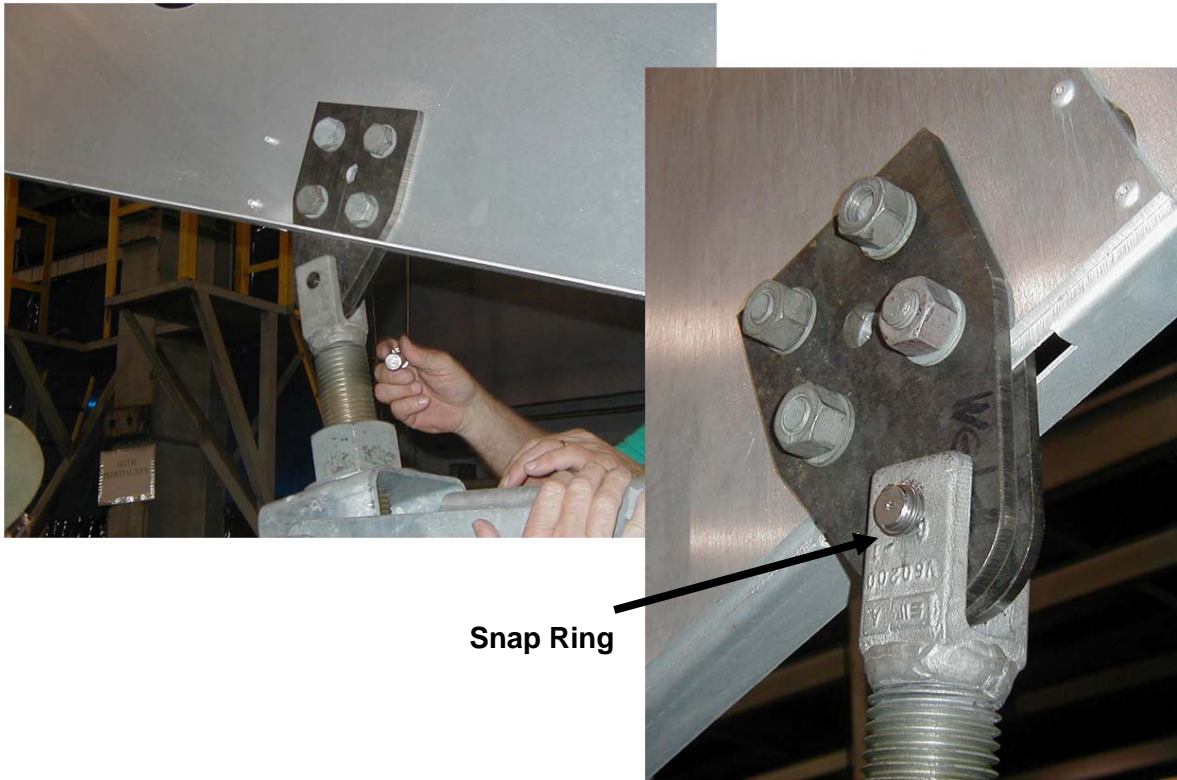
**Figure 2-17. Installing Radial #1**



**Figure 2-18. Positioning of Radial on Hub**

2. Attach the elevation jack screw lug to the radial beam lugs with axis pin and snap ring as shown in Figure 2-19.



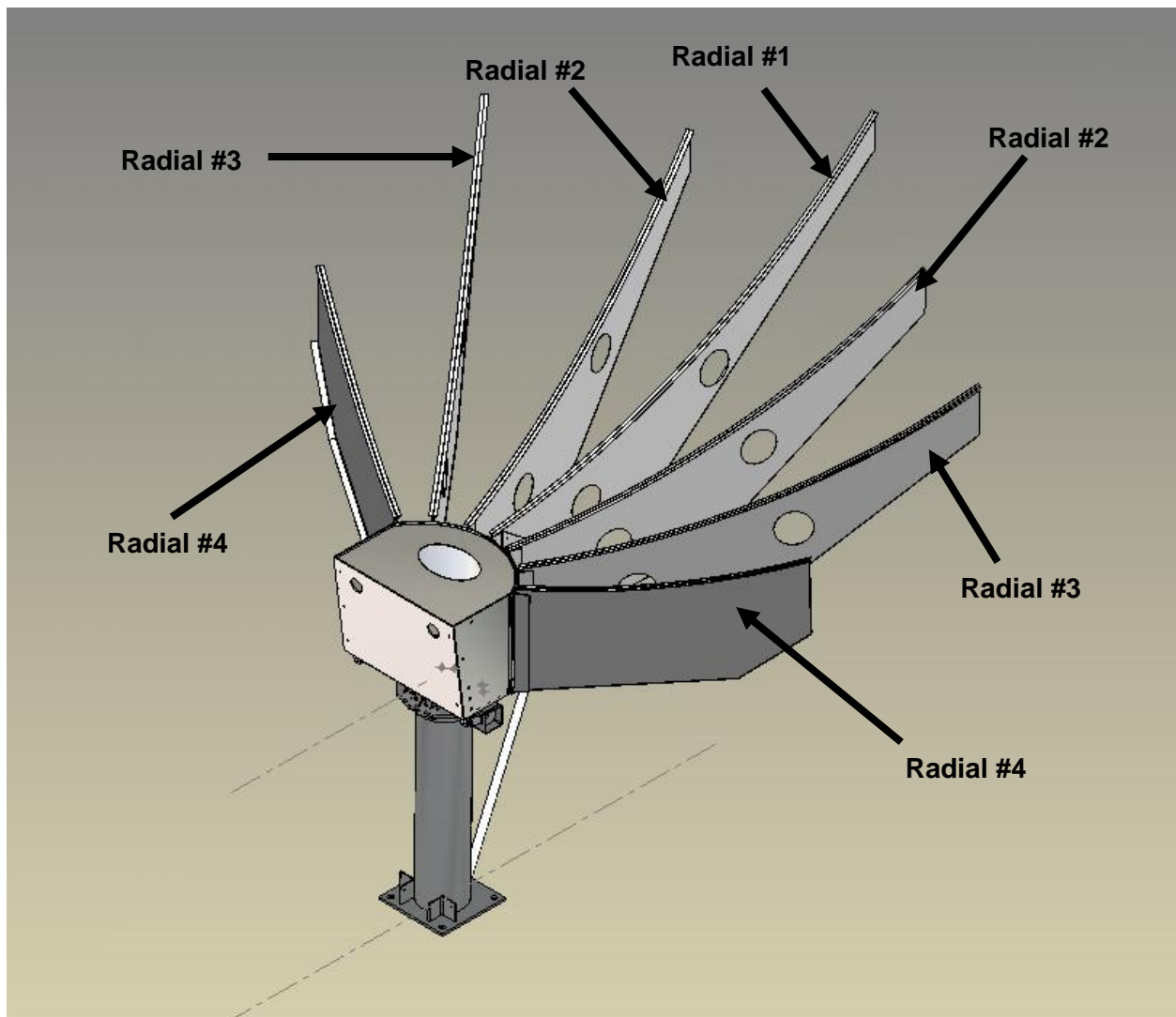


**Figure 2-19. Attaching Elevation Jack Screw to Radial #1**

2. Attach the remaining radials to the hub with 1/2" x 2" stainless steel hardware (see Figures 2-20 and 2-21). Ensure that the radials are seated on the machined step of the hub (no gap between step and bottom of radial) and against the alignment pins on the hub. Do not tighten hardware beyond hand-tight until the next step.



**Figure 2-20. Radials Installed**



**Figure 2-21. Location of Radials**

3. Inspect and verify that each radial beam T-bar is properly seated on the machined step at the rear of the hub weldment. The edge of the radial "T" should also be contacting the alignment pins to the side of each radial. When each radial is correctly in place, fully tighten all hardware holding the radials to the hub.

### 3.8 Reflector Lacing Members

Install the reflector lacing braces and 2" x 2-1/2" angle clips (2-1/2" leg pointed away from the web of the radial) between the installed radial beams at the lacing hole locations with 1/2" x 1-1/2" stainless steel hardware (see Figures 2-22 through 2-26). **Bolt loosely** as shown in Figure 2-22. Lacing will be tightened after installing reflector panels.

*Note: There is a left and a right diagonal tube lacing brace between #3 and #4 radial beams.*

*Note: Refer to drawing for 300001 for use of hardware.*

**CAUTION! DO NOT PUSH OR TWIST THE LACING BRACES. DOING SO MAY CAUSE SERIOUS DAMAGE TO THE REFLECTOR STRUCTURE. ONLY SLOWLY ROTATE THEM UNTIL FINDING THE RIGHT PLANE AT WHICH ALL THE SURFACES BOLT FLUSH.**

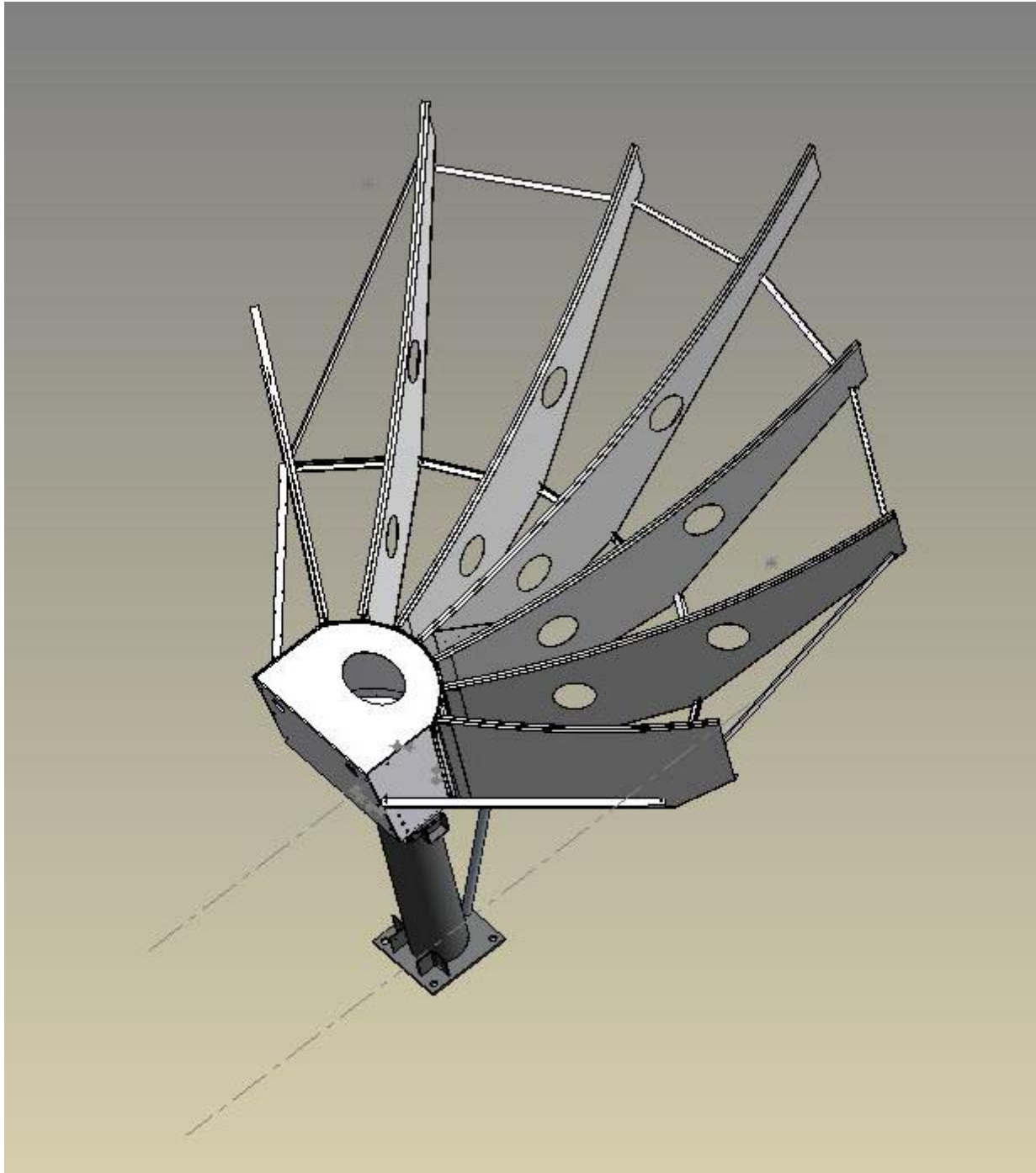


Figure 2-22. Reflector Lacing Assembly





**Figure 2-23. Angle Clips on Radials**



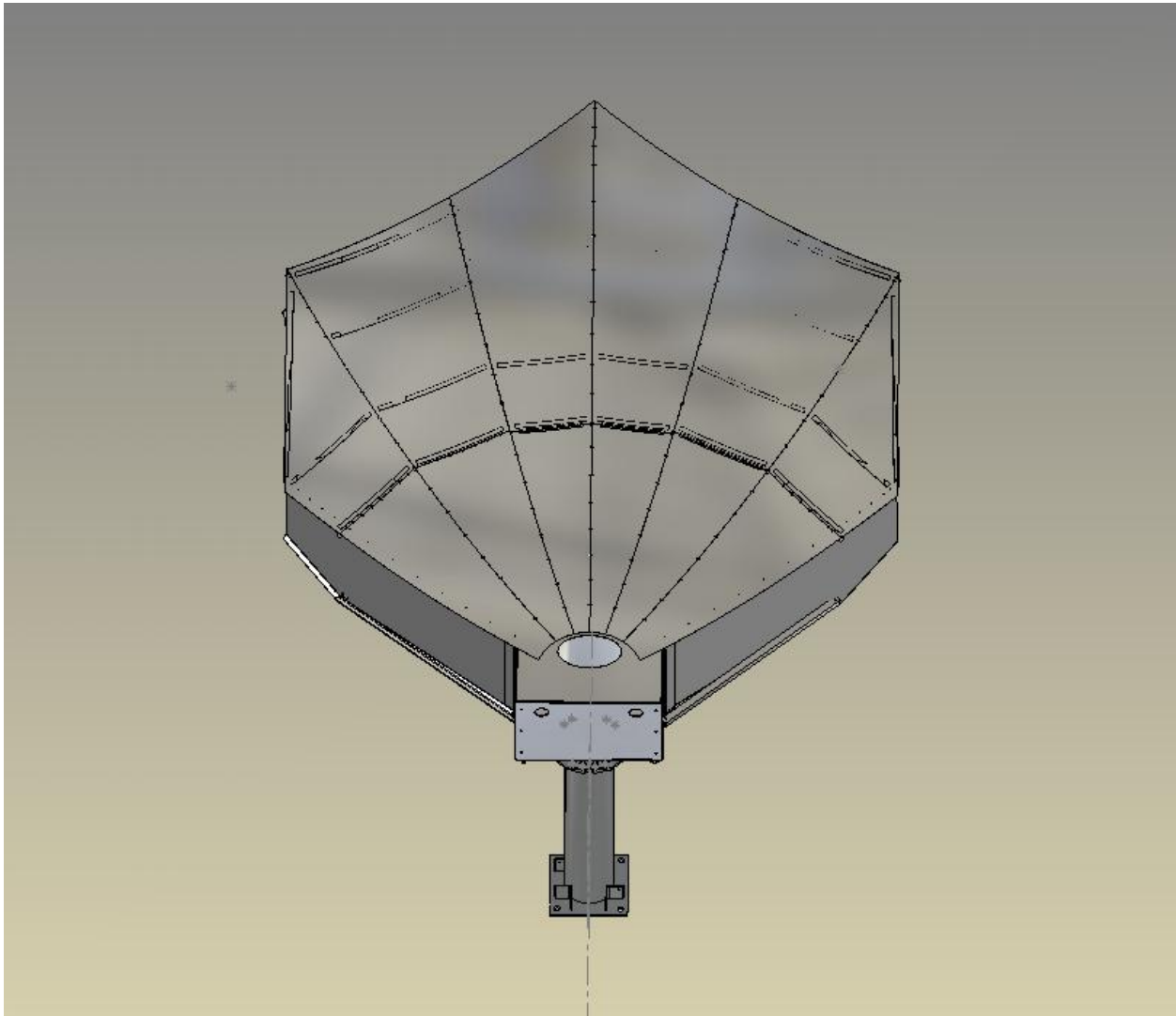
**Figure 2-24. Lacing Between Hub and Radial #4**



**Figure 2-25. Lacing Between Radial #3 and Radial #4**



**Figure 2-26. Lacing Between Radial #2 and #3 and Between #1 and #2**



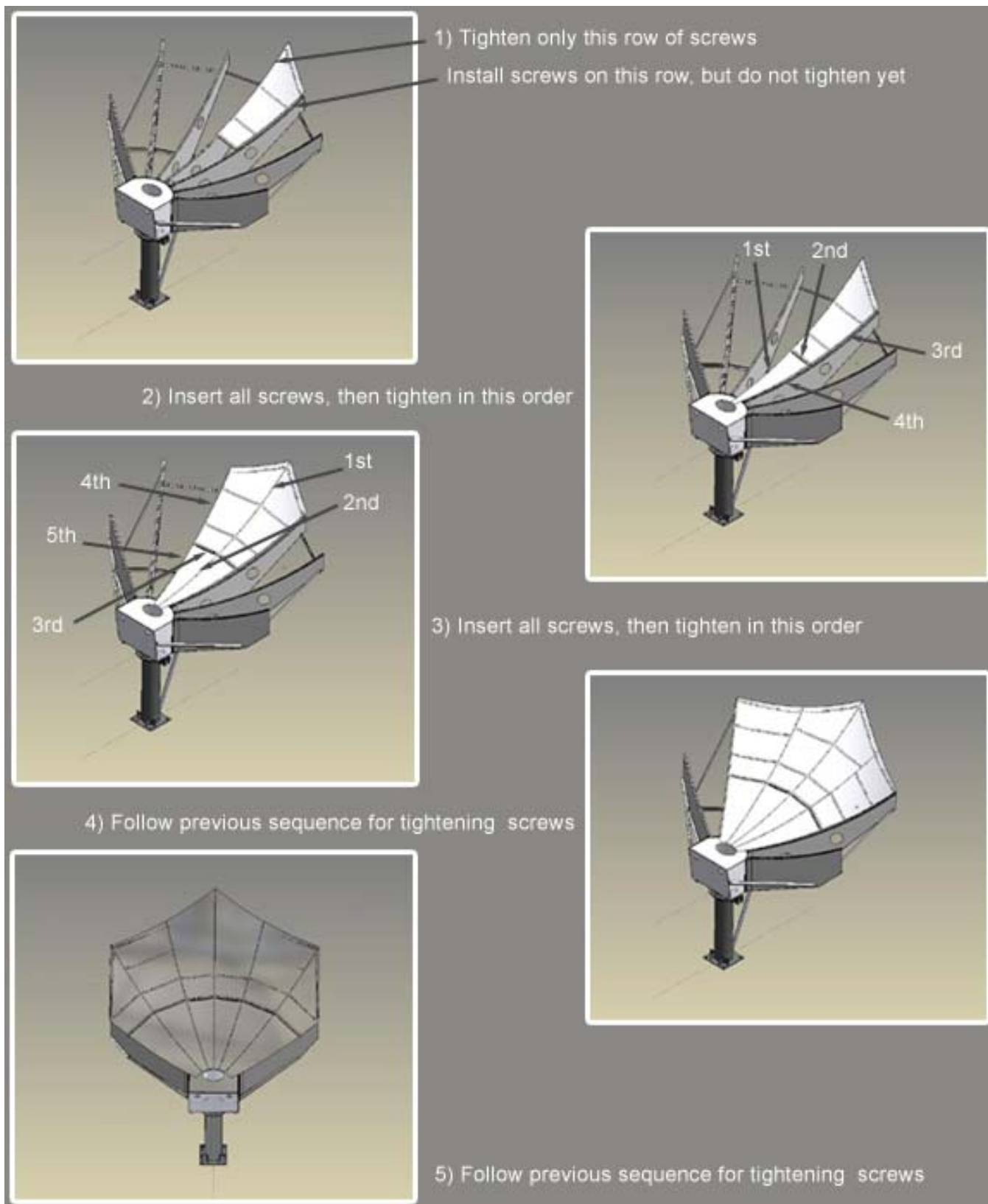
**Figure 2-27. Reflector Panel Assembly**

### **3.9 Reflector Panels**

1. Working from ladders or scaffolding, begin to install reflector panels from the center out in each direction according to the stamped panels indicated in Figures 2-27 and 2-28.

**CAUTION! DO NOT STAND OR LIE ON THE PANELS DURING INSTALLATION. THIS WILL CAUSE PERMANENT DISTORTION TO THE REFLECTOR SURFACE. DO NOT PUSH OR PULL ON THE RADIALS WITH MORE THAN MINIMAL EFFORT TO LINE THE HOLES UP WITH THOSE IN THE PANELS.**

2. Place one of the outer panels between #1 and #2 radial beams, and insert the #10 screws in each hole. Tighten the screws along radial #1 (center radial) only.



**Figure 2-28. Reflector Panel Installation Order**



**CAUTION!** IN ORDER FOR THE PANEL AND THE RADIAL BEAM CONTOURS TO FIT EACH OTHER CORRECTLY, BE SURE THAT THERE ARE NO GAPS OR FOREIGN MATTER BETWEEN THE TOP OF THE RADIAL AND THE BOTTOM OF THE PANEL.

*Note:* Ensure lubricant has been applied to all hardware to prevent galling and for ease of disassembly.

*Note:* Holes in the panels should line up with the holes in the radials when the parts are in their correct positions. An awl may be useful in assisting alignment.

3. Place one of the lower panels between #1 and #2 radial beams (below the panel in Step 2), and insert the #10 screws in each hole. Tighten the screws along radial #1 (center radial) only.
4. Insert and tighten the screws that join the upper and lower panels together as shown in Figure 2-28.
5. Starting from the top and working in sequence toward the hub, tighten the remaining screws on the outer and lower panel installed in Steps 2 and 3.
6. Repeat the installation procedures from Step 2 through Step 5 above for each panel section. Work from the middle toward the outer edge of the reflector. See Figure 2-28 for order of installation.



**Figure 2-29. Panel Installation**

7. Install the radial beam stiffener using the twelve (12)  $\frac{3}{4}$  x 1-3/4" hardware as shown in Figure 2-30.



**Figure 2-30. Install Radial Beam Stiffener**

8. Completely tighten all the stainless steel hardware on the previously installed lacing members from paragraph 2.2.4, Step 1. Be sure that there are no twists to the radial beam structures while tightening down the lacing members.

**CAUTION! DO NOT PUSH OR TWIST THE LACING BRACES. DOING SO COULD DAMAGE THE REFLECTOR STRUCTURE. ONLY ROTATE THEM SLOWLY UNTIL FINDING THE RIGHT PLANE AT WHICH ALL THE SURFACES BOLT FLUSH.**

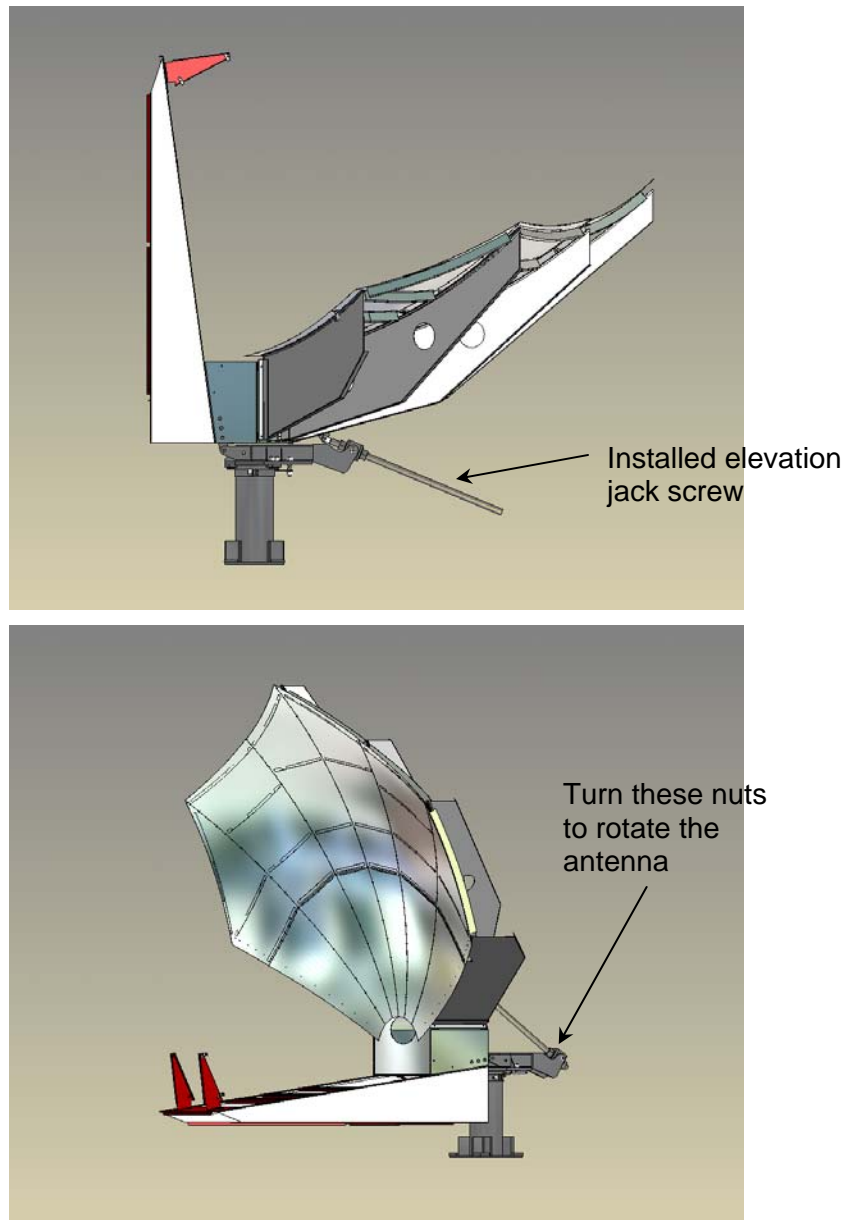
**CAUTION! TIGHTEN THE HARDWARE CONNECTING THE ANGLE CLIPS TO THE RADIALS FIRST, THEN TIGHTEN THE HARDWARE CONNECTING THE LACING TO THE ANGLE CLIP.**

### 3.10 Feed Boom Structure

*Note: All hardware in this section is to be loosely installed. They will be tightened in Section 2.13 after the feed boom alignment.*

*Note: Refer to drawing 300001 for feed boom installation.*

1. Rotate the antenna to an upright position by turning the elevation jack adjusting nuts until the antenna is rotated about 90° as indicated in Figure 2-31.
2. Snug tighten the two elevation jack adjust nuts on both sides of the trunnion block.



**Figure 2-31. Rotating Antenna for Feed Boom Installation**

4. Attach the left and the right feed booms to the bottom of the hub weldment with six 5/8" x 1-3/4" hot dip galvanized hardware, snug tightened.
5. Install the two feed boom gussets to the hub and feed boom with 1/2" x 1-1/2" stainless steel hardware.
6. Loosely attach two feed boom standard mount channels to the top of the feed booms with 3/8" x 1-3/4" stainless steel hardware and install the 1/2" plastic shims between the top of the boom and the bottom of the standard mount channel as shown in Figure 2-32. If you have an early model of the feed boom arms, there will be eight holes on the top of each feed boom arm. Mount these channels on the four middle holes for proper feed installation.



**Figure 2-32. Feed Boom Mount Channels**

7. Loosely attach the other two feed boom standard mount channels and long feed boom diagonal braces to the bottom of the feed booms with 3/8" x 1-1/4" stainless steel hardware.





**Figure 2-33. Feed Boom Braces**

8. Loosely install the short feed boom diagonal brace inside the rear section of the feed booms - underneath the hub weldment -- with 3/8" x 1-1/4" stainless steel hardware between the feed booms and the angle clips, and 1/2" x 1-1/2" stainless steel hardware between the angle clip and brace. (This member is only for manual pedestal models).

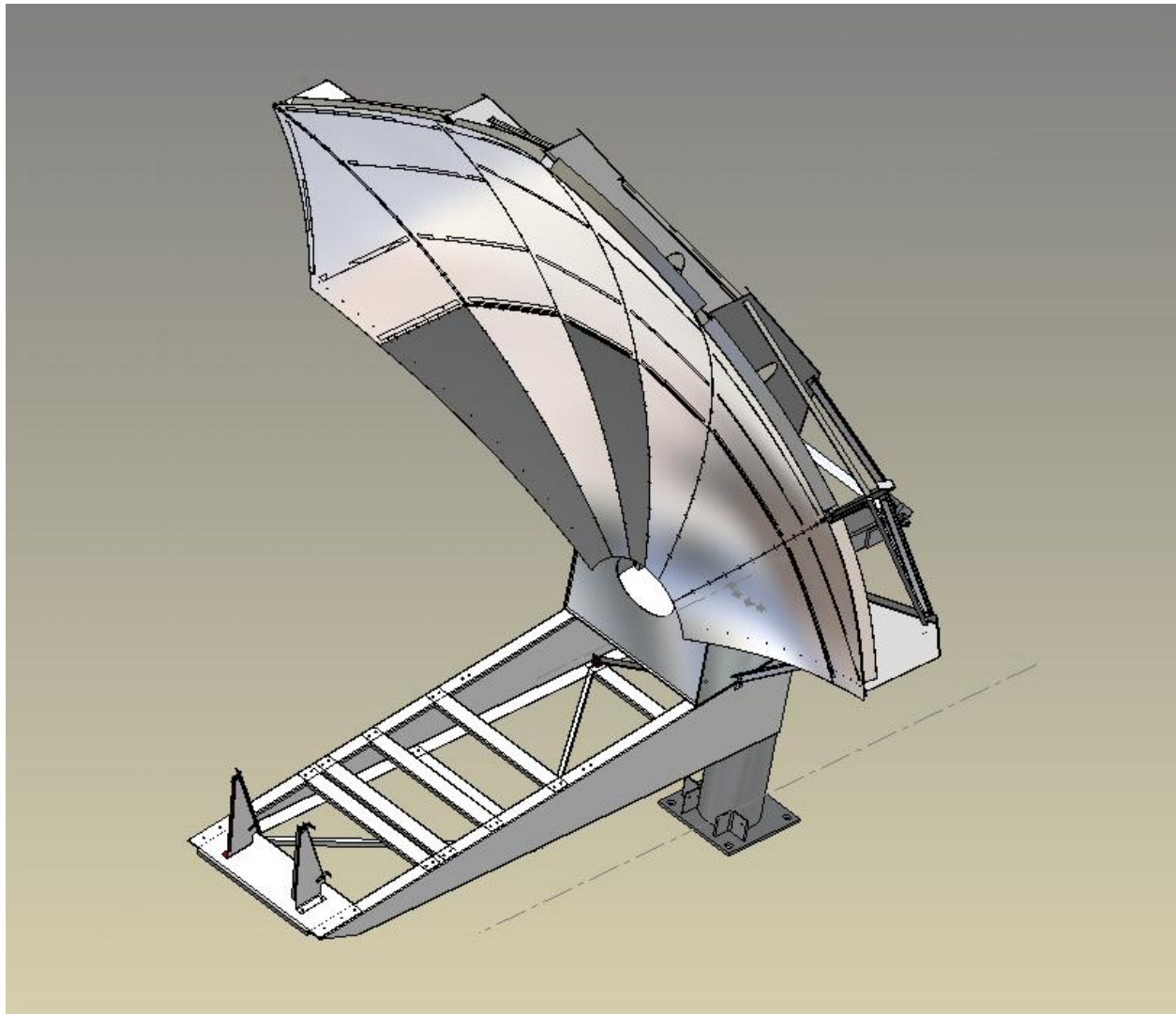


Figure 2-34. Feed Boom Assembly

### 3.11 Subreflector Assembly

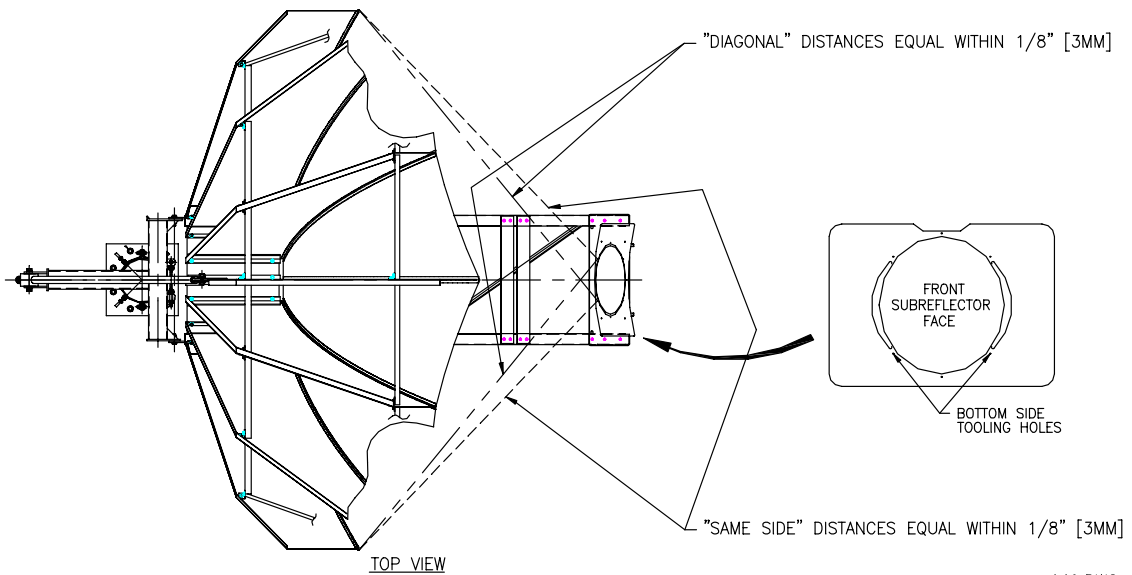
1. Identify a notch at the top of the subreflector. Make sure the subreflector is properly mounted with the notch toward the topside.
2. The subreflector has been factory assembled to the two subreflector brackets using the four subreflector clips with 1/4" x 3/4" stainless steel hardware and the subreflector brackets mounted to the subreflector seat with 3/8" x 1" stainless steel hardware. Items are identified for reference only.
3. Place the factory-assembled subreflector on the end of the feed boom and bolt it down using the 3/8" x 1-1/4" stainless steel hardware.



**Figure 2-35. Attaching the Subreflector**

### 3.12 Feed Boom Alignment

4. Measure both the “same side” and “cross diagonal” distances between the outer panel tips of the reflector and the bottom side tooling holes of the subreflector (see Figure 2-36). The difference between “same side” distances should be no more than 1/8” [3mm]. The difference between “cross diagonal” distances should also be no more than 1/8” [3mm]. Make sure the measurements are taken from the exact opposite points on each side of the main reflector and subreflector.
5. If the difference is more than 1/8” ensure that there is no binding in either the connections between the hub and feed boom arms or the connections between the feed boom arms and cross braces, standard mount channels and subreflector assembly. Moving the feed boom arms side to side should aide in eliminating any binding and locate the subreflector per the tolerance listed in Step 1.
6. Torque the six (6) 5/8" hot dip galvanized connection bolts between the feed booms and the hub weldment. Next, tighten all 3/8" stainless steel hardware on the feed boom including standard mount channels, diagonal braces and subreflector seat (refer to paragraph 2.2.7). Continue double-checking that the distances measured in Step 1 still have less than a 1/8” difference.



**Figure 2-36. Feed Boom Alignment**

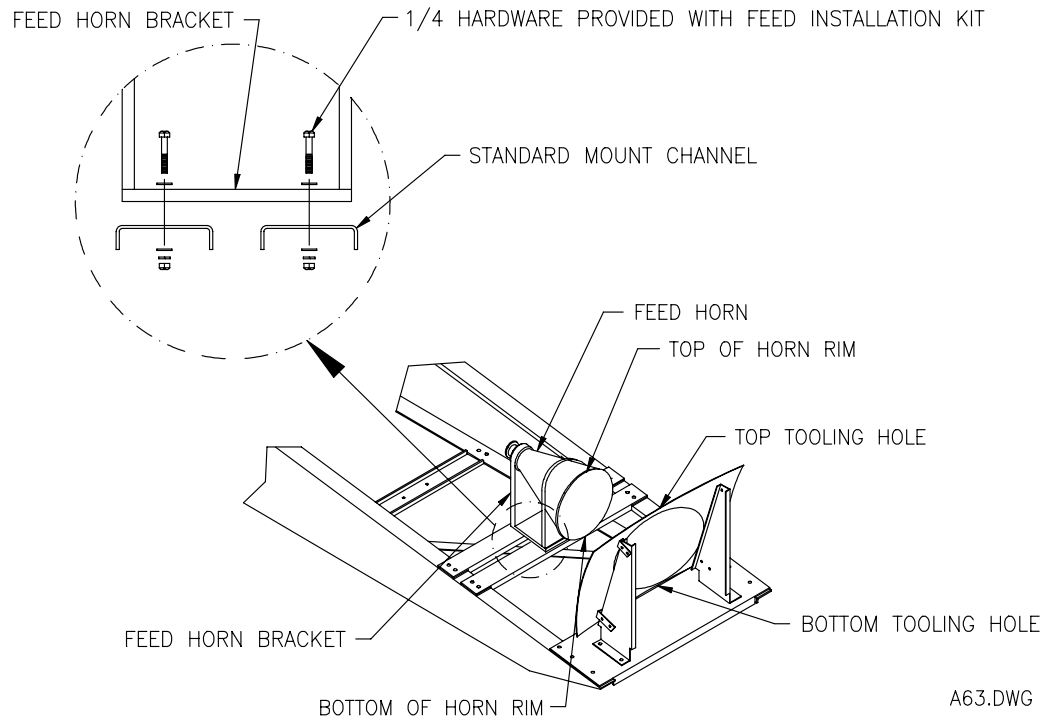
### 3.13 Feed Horn

1. Bolt the feed horn bracket onto the installed feed boom standard mount channels with four 1/4" x 2" stainless steel hardware as shown in Figure 2-37. Check the distances from the top of the feed horn to the top of the subreflector side tooling holes as shown in Figure 2-38. Distance A and B should be equal within 1/8" (3mm). Repeat the above, check for the bottom of the horn to the bottom side tooling holes.

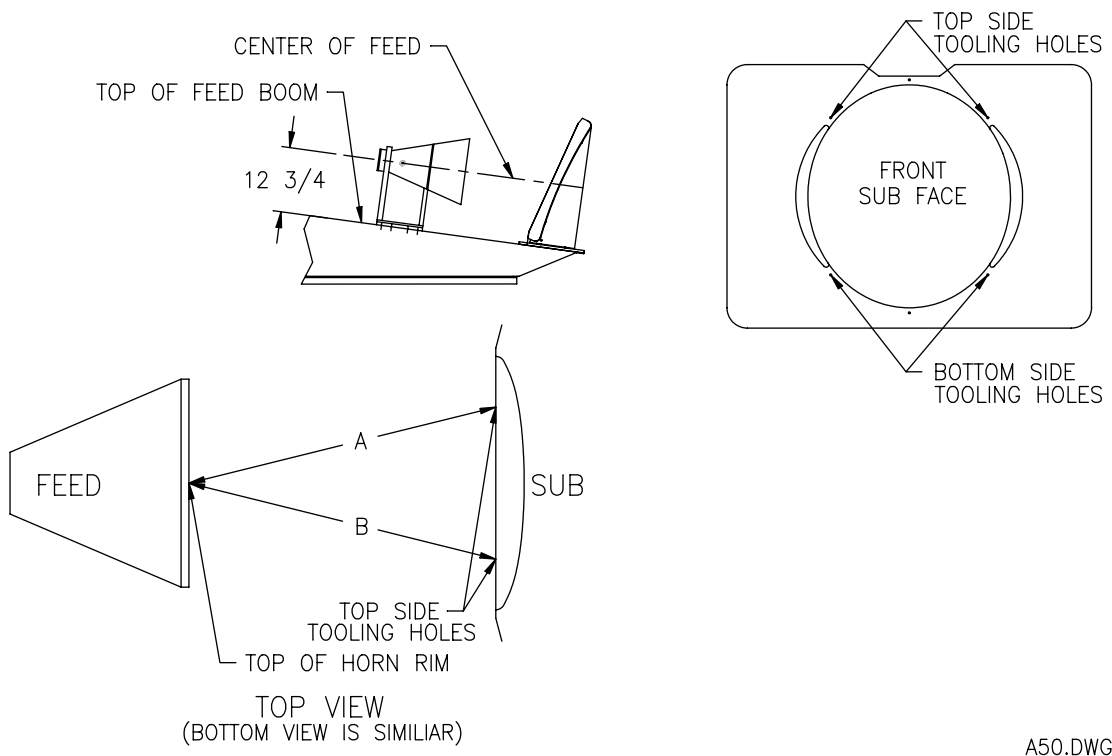
**Note:** *The subreflector and feed alignment are located during the manufacturing process. Do not modify the mounting surfaces or hole locations.*

**Note:** *Each feed ships separately with specific installation instructions, drawings and mounting hardware. Refer to these, as well as the general instructions of this section. With particular feeds, additional holes may be required.*



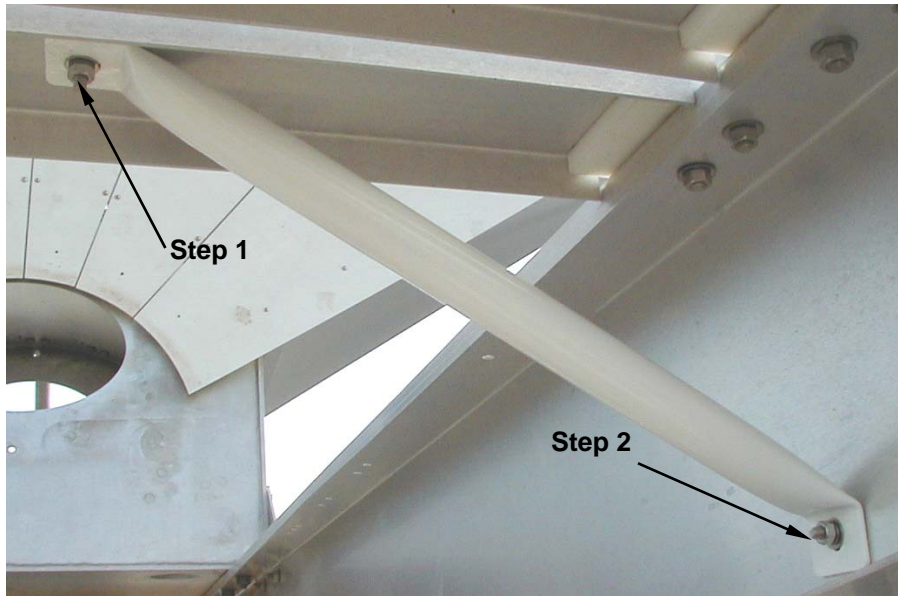


**Figure 2-37. Feed Assembly**



**Figure 2-38. Feed Alignment**

2. Attach one end of a feed support bar to the standard mount channel using the existing hole as shown in Step 1 of Figure 2-39.
3. Match-drill a hole in the feed boom arm and attach the other end of the feed support bar to the feed boom arm using one (1)  $\frac{1}{4}$  x  $\frac{7}{8}$ " hardware as shown in Step 2 of Figure 2-39. Repeat for other side.



**Figure 2-39. Install Feed Support Kit**



**Note:** *If you are using a standard feed, use two (2) ¼ x 7/8" hardware included in the kit to fasten the feed support bars to the standard mount channel as shown in Figure 2-40; or, if you are using a motorized feed, use the existing hardware to fasten the feed support bars to the standard mount channel as shown in Figure 2-41.*



**Figure 2-40. Install Feed Support Kit**



**Figure 2-41. Install Feed Support Kit**

### 3.14 Positioning the Antenna on the Satellite

1. To position the antenna, the elevation and azimuth pointing angles must be known. These angles are specific for each site location and satellite.

#### **Rough Adjustment of Elevation Axis**

2. The elevation look angle can be easily found by using the bottom of the feed boom as the reference datum. The bottom of the feed boom is parallel to the RF axis. Using an inclinometer on the bottom of the feed boom will give the elevation look angle of the antenna. Adjust the antenna in elevation using the adjustment nuts on the elevation jack screw, until the inclinometer is at the desired look angle, as shown in Figure 2-42.

#### **Rough Adjustment of Azimuth Axis**

3. Loosen the 5/8" fine adjust collar bolts, shown in Figure 2-10, until they are finger-loose or until a minimum of three bolt threads are protruding from the nut.
4. Loosen the eight 5/8" turning head bolts, shown in Figure 2-5, three (3) complete turns or until a minimum of three bolt threads are protruding from the nut.

#### **CAUTION! REMOVAL OF THE NUTS FROM THE BOLTS WILL DE-STABILIZE THE ANTENNA.**

5. The antenna may now be rotated around the azimuth axis by pushing on the back of the pedestal turning head.
6. Use a compass to sight along the feed boom to locate the desired angle.

*Note: When using a compass note that true north varies from magnetic north depending on the site location.*

7. Once the desired angle is approximately located, ensure that the fine azimuth adjustment rod is at mid travel to allow for clockwise or counter clockwise fine adjustments as shown in Figure 2-10.
8. Tighten the 5/8" fine adjust collar bolts to 90 ft-lbs. (if a torque wrench is unavailable 90 ft-lbs. is roughly an average person providing full effort on a standard 12 1/2" length 1-1/16" spud wrench).
9. Tighten the eight 5/8" turning head bolts 1/2 turn at a time and sequencing through all eight bolts. Continue the sequence until all eight bolts are tightened to 90 ft-lbs. Recheck each bolt for correct torque.

#### **Fine Adjustment Of Elevation Axis**

*Note: When peaking the antenna on the satellite, a spectrum analyzer should be used with the following instructions.*

10. With the antenna positioned at the maximum signal level in azimuth, adjust the antenna in elevation using the nuts on the elevation jack screw and the inclinometer on the bottom of the feed boom as shown in Figure 2-42.

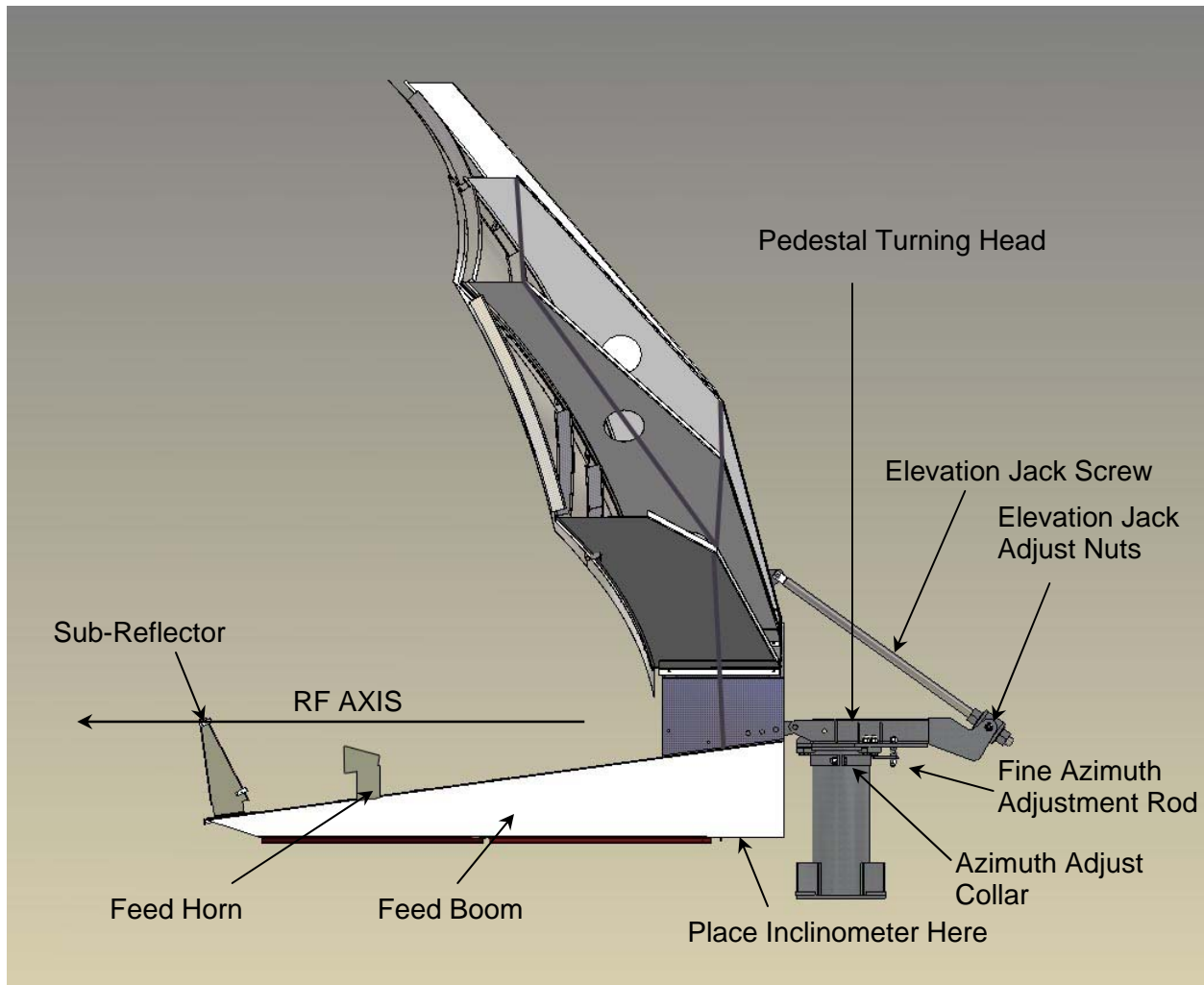
### **Fine Adjustment Of Azimuth Axis**

11. Loosen the eight 5/8" turning head clamp bolts 1/4" turn sequencing through the eight bolts. A match line can be marked on the nut and turning head surface before loosening for reference when retightening.
12. Repeat step 11 four (4) times to make one (1) complete turn.
13. Adjust the azimuth axis by turning the 3/4" fine adjustment nuts. Scan back and forth to locate the maximum (greatest amplitude) transponder signal as shown in Figure 2-43.

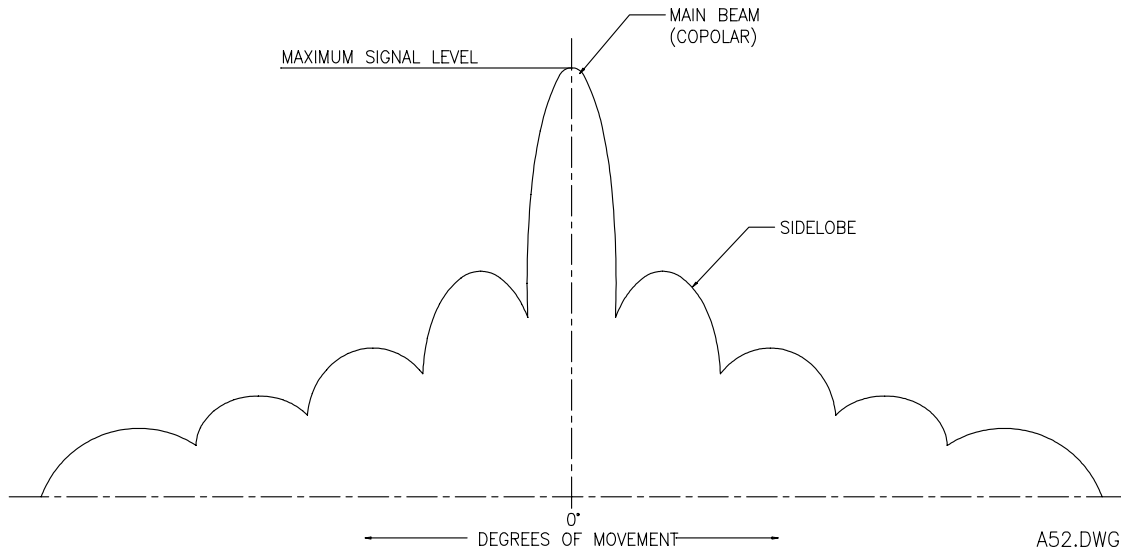
*Note: 2-1/2 turns of the nuts on the adjustment rod is equal to approximately 1° of azimuth rotation.*

*Note: The antenna will not need to rotate more than  $\pm 1.5^\circ$  from the maximum level, or the antenna may receive a signal from a different satellite.*

14. Once the maximum level is found, retighten the eight 5/8" turning head clamp bolts 1/4 turn at a time sequencing through the eight bolts.
15. If a torque wrench is available, repeat Step 14 until a torque of 90 ft-lbs is obtained on all eight bolts. If a torque wrench is unavailable, repeat Step 14 four (4) times to make one (1) complete turn returning to the original nut position.
16. Repeat Steps 10 through 15 for azimuth and elevation until the peak signal level is achieved.

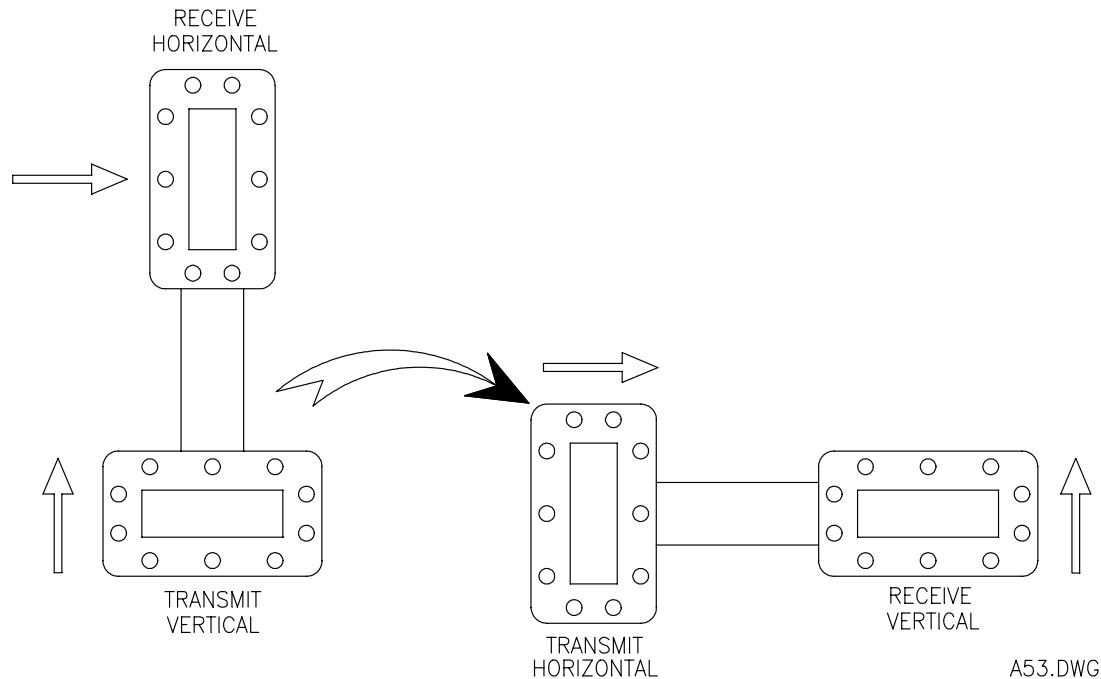


**Figure 2-42. Antenna Position**



**Figure 2-43. RF Pattern**

17. When the antenna is being peaked to the maximum copolar signal level, it is necessary to make sure that the antenna is on the main beam and not a side lobe of the signal as shown in Figure 2-43.
  - a. If the antenna is on a side-lobe the signal on the spectrum analyzer will diminish and not return, or, will decrease, and return to a higher level as the antenna is rotated in azimuth and/or elevation as shown in Figure 2-43.
  - b. If the signal diminishes and does not return, position the antenna back to the original starting point in Step 17 (a). Rotate the antenna in the opposite direction as in Step 17 (a). The signal will decrease then increase to higher level on the spectrum analyzer. The increased signal level is the main signal beam.
  - c. Using this higher signal level repeat Step 17(a) to get the antenna peaked to the maximum transponder signal level.
18. When using a linearly polarized system, always check the feed polarity. Rotate the feed to the optimum polarization setting after the antenna has been peaked on the satellite.
  - a. When receiving true vertical polarization the receive port at the rear of the feed should be in the horizontal position as shown in Figure 2-44. This corresponds to 0° on an angular scale relative to the feed support. In this configuration the antenna will receive true vertical polarization and transmit horizontal polarization. To achieve the opposite hand of polarization in both receive and transmit, the feed must be rotated 90° by loosening the feed clamps and rotating the complete feed 90°. This will correspond to 90° on an angular scale relative to the feed support.



**Figure 2-44. Feed Port Polarization**

- b. In general, the incoming (Rx)/outgoing (Tx) signal polarization on the antenna will not always be perpendicular or parallel to the Earth's surface. Because of this it will be necessary to optimize polarization of the antenna feed by aligning it to the satellite polarization. This is achieved by carefully rotating the feed until the feed and the satellite are in the same polarization, in the following manner.
- c. After successfully aligning the antenna structure with the satellite, set the spectrum analyzer up to receive a clear unmodulated CW carrier from the desired transponder. While monitoring the signal, rotate the feed for maximum signal level. Note the level and reference the signal on the spectrum analyzer. Once the maximum signal has been established and referenced, slowly rotate the feed 90°. The signal will drop to a minimum level and then will begin to rise again. The minimum level is referred to as the cross-pol null. Rotate the feed back into the null and note the position on the vernier scale of the feed horn, then rotate the feed exactly 90° to obtain an optimized signal.

*Note:*                      *Typical analyzer settings for the above referenced exercise are:*

<i>Span:</i>	<i>0 Hz</i>
<i>Resolution Bandwidth:</i>	<i>100 Hz</i>
<i>Video Bandwidth:</i>	<i>30 Hz</i>
<i>Sweep Time:</i>	<i>200 Sec</i>
<i>Scale:</i>	<i>5dB / div</i>



19. Once the antenna is positioned at the peak signal level, check or tighten the following bolts, and/or, nuts:

Elevation jack screw nuts (see Figure 2-42).

Azimuth fine adjust collar and turning head bolts (see Figures 2-10 and 2-5).

20. Once the polarity is set, secure the feed clamps. The system is now completed and no more adjustments need to be made.

## **4.0 MAINTENANCE**

### **4.1 General**

Proper maintenance will keep the antenna in good working condition and ensure the antenna to meet and exceed the designed life expectancy. A protective maintenance program should be followed that routinely cleans, inspects, lubricates and implements corrective measurement as required on all mechanical, structural, electrical and electronic components on the antenna. If there are any discrepancies beyond your ability to remedy, please contact General Dynamics SATCOM Technologies to acquire the information of how to deal with them before you proceed.

### **4.2 Antenna Surface Cleaning**

A periodic surface cleaning is recommended to remove the excessive accumulation of dust and dirt, and contaminants. A mild detergent solution, soft cloth and soft brushes can be used to clean the exterior of the antenna.

### **4.3 Electrical Device Cleaning**

For electrical and electronic parts, visual checking of the wires, cables, wave guides, switches, relays, etc. is required to prevent any bad insulation, or loose connections. To remove dust or loose foreign particles on the electrical and electronic equipment, using vacuuming and soft brush or cloth is recommended. Some electrical and electronic parts are required to be cleaned with special cleaning solvents. Allow them to dry for 10-15 minutes before placing into operation. Always disconnect power and use lock out tags to prevent shock hazards to personnel when servicing any electrical component.

### **4.4 Mechanical Maintenance**

The antenna mechanical and structural parts such as reflector, pedestal, drive system, deicing system (as appropriate), and hardware need to be periodically inspected in order to maintain the antenna in good operational status. Where there are no established wear limits, perform a visual inspection to locate worn or damaged parts to avoid the improper functioning of the earth station. Periodically, check all hardware to make sure it is properly tightened. Motorized antenna lubricants need to be checked every six months at each jack and bearing location.

### **4.5 Pedestal Turning Head and Bearing Plates**

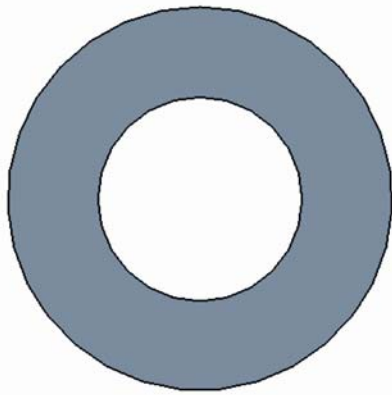
Lubricate with medium grade white lithium grease by inserting the nozzle in the space between the pedestal turning head front and rear sections then between the clamping bolts of the pedestal turning head.

### **4.6 Feed Window Inspection**

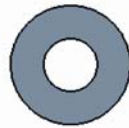
A visual inspection of the feed window needs to be performed periodically to prevent any contaminants from entering the feed. Look to make sure the feed window is tight on the feed horn and has no cracks or splits.

## APPENDIX A. HARDWARE CHARTS

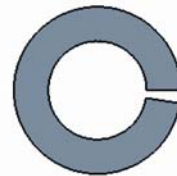
(Figures of hardware are shown actual size for convenient reference.)



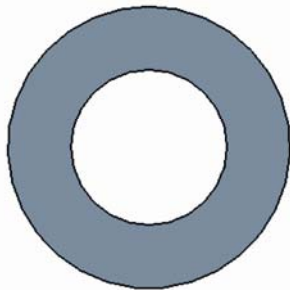
1" Flat Washer HDG



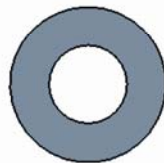
1/4" Flat Washer SS



1/2" Lock Washer SS



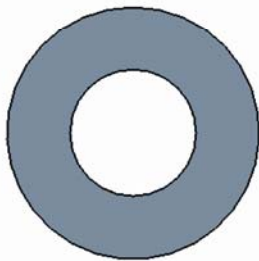
3/4" Flat Washer HDG



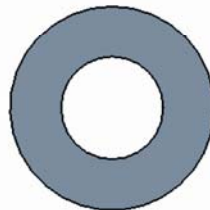
3/8" Flat Washer SS



3/8" Lock Washer SS



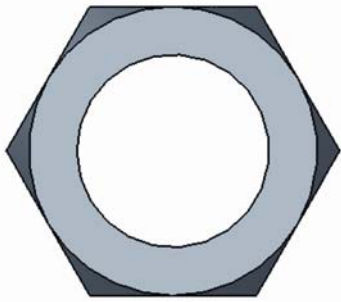
5/8" Flat Washer HDG



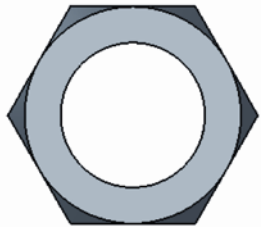
1/2" Flat Washer SS



1/4" Lock Washer SS



1" Hex Nut HDG



3/4" Hex Nut HDG



5/8" Hex Nut HDG



#10 Hex Nut SS



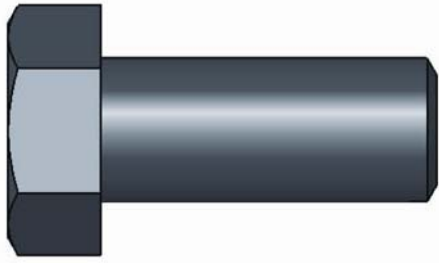
1/4" Hex Nut SS



3/8" Hex Nut SS



1/2" Hex Nut SS



3/4 x 1 3/4 Hex Bolt HDG



5/8 x 1 3/4 Hex Bolt HDG



1/2 x 2 Hex Bolt SS



1/2 x 1 1/2 Hex Bolt SS



3/8 x 1 3/4 Hex Bolt SS



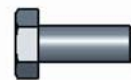
3/8 x 1 1/4 Hex Bolt SS



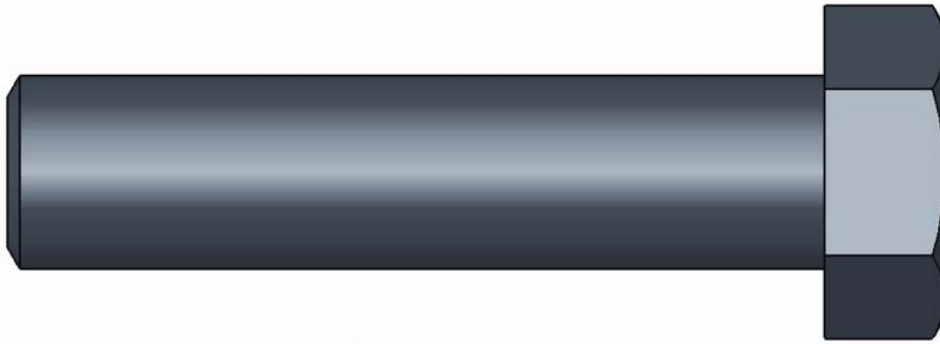
1/4 x 2 Hex Bolt SS



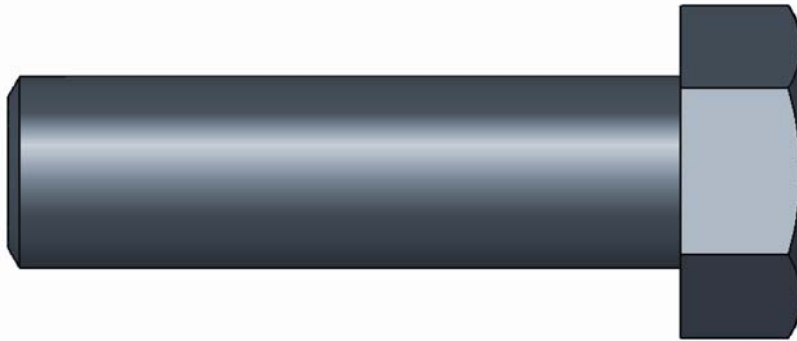
1/4 x 7/8 Hex Bolt SS



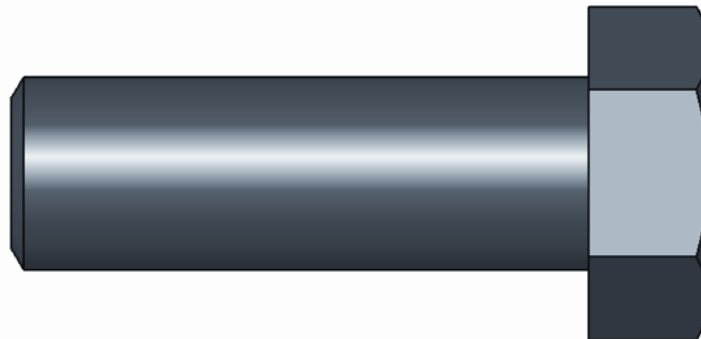
#10 x 1/2 SS Pan Head Machine Screw



1 x 4 1/4 Hex Bolt HDG



1 x 3 1/2 Hex Bolt HDG



1 x 3 Hex Bolt HDG



3/4 x 4 1/4 Hex Bolt HDG



(This drawing is for reference only. Contact General Dynamics SATCOM Technologies for latest revision.)



## APPENDIX C. SITE SELECTION

There are several antenna-mounting methods selected by users. There are some general requirements that need to be followed:

- a. The antenna should have a clear line of sight to the satellite arc, clear of any trees, buildings or other structures.
- b. If a ground mount is chosen, the site should be relatively level, free of underground obstructions and not be subject to excessive rainfall runoff.
- c. If a roof mount is being selected, the roof structure should be designed or verified by a certified professional to withstand the antenna load and forces imposed by wind loads.

## **APPENDIX D. REPORTING LOSS OR VISIBLE DAMAGE**

Some damage may occur to the parts during the shipping process. A claim should be filed with the carrier at the time of receiving the equipment or after completion of parts verification. Follow the "Reporting Loss or Visible Damage", "Reporting Concealed Damage", and "Reporting Missing Parts" when filling a claim with the carrier.

### **Reporting Loss or Visible Damage**

Make a note of any loss or damage on the freight bill or receipt signed by the carrier's agent. Failure to adequately claim such loss or damage may result in the carrier refusing to honor a damage claim. The form for such a claim can be acquired from the carrier.

### **Reporting Concealed Damage**

The contents may be damaged in transit it due to rough handling that may not show any external damage. For any concealed damage discovered after unpacking the unit, make a written request for an inspection by the carrier's agent, and file a claim with the carrier.

### **Reporting Missing Parts**

After opening the shipment, an inventory of the parts should be completed. Check items received in the shipment. If there is any item missing, please notify General Dynamics SATCOM Technologies immediately by contacting Project Managing Department.

### **Returning**

Thorough consideration has been taken by General Dynamics SATCOM Technologies to ensure that all antenna items arrive in safe working order. Occasionally, equipment may be received that is not in working condition due to reasons beyond manufacturer's control. Upon review of the completed claim forms, General Dynamics SATCOM Technologies will determine disposition as to return, repair and/or replacement. The return process can be expedited by following this procedure:

- a. Notify General Dynamics SATCOM Technologies Project Managing Department by call or fax, giving a short description about the missing items or damaged components. (Phone (903) 984-7811, Fax (903) 984-7597).
- b. Tag or identify the defective equipment, noting the defect or circumstance. Pack the equipment in a sturdy shipping container with some protective packing materials, and return to General Dynamics SATCOM Technologies.
- c. When returning items to General Dynamics SATCOM Technologies, please include all available information regarding sales order number, purchase order number, delivery date and other pertinent information to properly identify the antenna. Also, please include the following information:

Your company name

Your address with city, state and country

Your telephone and fax numbers

The individual's name General Dynamics SATCOM Technologies should contact

## APPENDIX E. MOUNTING PROCEDURE

There are two basic mount approaches for small antennas: ground mount and roof mount. For ground mount choice, user should build a qualified antenna foundation and consult a structural professional for the foundation soil structures. For roof mount, some special considerations should be taken as follows:

The antenna system should be properly supported to provide transfer of all the antenna loads into the main building structures, sustaining all the wind loading exerted on the antenna along with the antenna self-weight. The designed roof-mounting frame must distribute loads from the antenna interface location to the building roof beams and columns.

The structural concepts that will be incorporated to achieve an effective frame configuration are as follows:

At each foundation interface location, provide a direct load path for each load vector component.

Where feasible, align axes of framing members to the vector direction of the applied loads. This can reduce bi-axial bending and torsional effects.

Eccentricity between the applied load vector and the framing member centroid can produce large torsional forces. These torsional effects require more complex joint details to transfer forces properly and introduce increased structural deflection.

Reinforcing members are required where the antenna structure is bolted to a beam. The reinforcement should be designed to prevent flange bending and web crippling under concentrated load.

Use correct anchors in concrete surface.

Avoid use of double-nutting (one nut top and one nut bottom of plate) to provide leveling. This will induce undesirable anchor bolt bending conditions.

Use friction type connection where it is possible to provide 100% load reversal capacity.