

GENERAL DYNAMICS
SATCOM Technologies

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ASSEMBLY MANUAL

4.5 METER RxO
ANTENNA SYSTEM

General Dynamics
SATCOM Technologies
1500 Prodelin Drive
Newton NC 28658

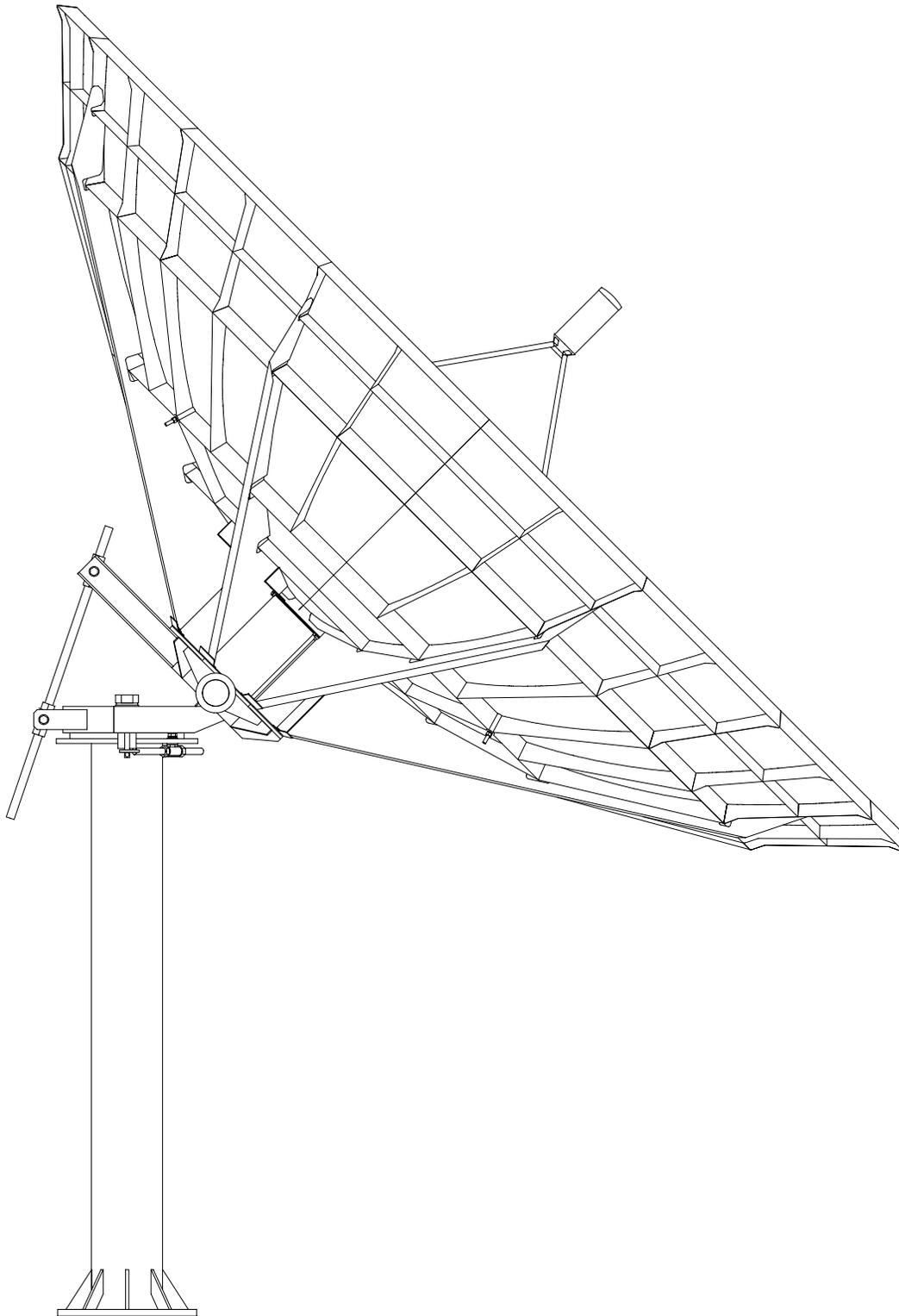
4.5 METER RxO ANTENNA SYSTEM

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F	Revised Company Name, Logo, and Part Tables	7/14/09	RAH
E	Revised Address	1/11/02	RAH
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4.5 METER RxO ANTENNA SYSTEM

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SECTION I **GENERAL INFORMATION**

1.0 **INTRODUCTION**

This manual describes the assembly and installation of General Dynamics' 4.5M RxO antenna system. The General Dynamics 4.5M is a rugged, reliable antenna system that will operate at C-band and Ku-band frequencies with high efficiency and at the same time successfully withstand the effects of the environment.

These instructions are listed by sections that cover all areas of assembly and installation. Additional sections are included in the manual to provide information on antenna alignment to the satellite and maintenance.

1.1 **UNPACKING AND INSPECTION**

- 1. UNPACKING & INSPECTION** - The antenna containers should be unpacked and inspected at the earliest date to ensure that all material has been received and is in good condition. A complete packing list for each major component is supplied.

- 2. FREIGHT DAMAGE** - Any damage to materials while in transit should be immediately directed to the freight carrier. He will instruct you on the matters regarding any freight damage claims.

- 3. MATERIAL - MISSING OR DAMAGED** - Any questions regarding missing or damaged materials that is not due to freight carrier should be directed to General Dynamics' Customer Service Department at:

General Dynamics SATCOM Technologies
1500 Prodelin Drive
Newton NC 28658
USA
(828) 464-4141

1.2 MECHANICAL INSTALLATION TOOLS

HARDWARE SIZE	SAE WRENCH SIZE	METRIC WRENCH SIZE	MAXIMUM REC. TORQUE
1 / 4"	5 / 16"	8 mm	8 in-lbs
5 / 16"	1 / 2"	11 mm	49 in-lbs
3 / 8"	9/16"	14 mm	15 ft-lbs
1 / 2"	3 / 4"	20 mm	35 ft-lbs
3 / 4"	1 – 1 / 8"	28 mm	160 ft-lbs
1"	1 – 1 / 2"	38 mm	220 ft-lbs

NOTE: The Minimum Torque applied should not be less than 10% of maximum recommended torque.

Also recommended for installation:

Adjustable Crescent Wrench 10"
Ratchet (3 / 8" & 1 / 2" Drive)
3" Wrench (socket, crescent or pipe) for 2" bolt
1-7/8" Wrench (Crescent) for 1-1/4" nuts on elevation rod
Screw Driver (standard and cross blade)
Inclinometer
Compass
Step Ladder (8 ft)

1.3 SITE SELECTION

In order to achieve maximum performance of your antenna system, it is important to select the correct location for the antenna. The following guidelines should be observed when selecting a site for the installation.

1. The line of site to the satellite should be clear of any obstructions, such as trees or buildings.
2. The site should be relatively flat and level for ease of installation and access to the antenna.
3. The site should be checked for underground obstruction, such as buried cables or pipes.

4. All local building codes should be adhered to (i.e. grounding, foundation requirements, zoning rules, setbacks, etc.).

SECTION II **SUGGESTED MAST AND FOUNDATIONS**

NOTE: Due to the wide variety of soil conditions, General Dynamics does not warrant that any particular design or size of foundation is appropriate for any locality or earth station installation. It is the responsibility of the installer/user to determine if it meets the site/locality requirements. If there is any doubt, have it checked by an architect or structural engineer.

2.0 PEDESTAL FOUNDATION

Figure 1 shows a suggested Pad Foundation and figure 2 shows a suggested Pier Foundation. Both foundations utilize General Dynamics' Pedestal Mount. To install the Pedestal Mount foundation, follow the steps below.

1. Install one [1] 1½" -6 hex nut and one [1] 1½" flat washer (items 2,3) onto the anchor rod (item 5), then insert the anchor rod into one of the holes in the plywood template (item 6) and install another 1½" -6 hex nut and 1½" flatwasher. Repeat this procedure for the remaining anchor rods. This will keep all the anchor rods in the straight and proper orientation when the concrete is poured. Next, install two [2] 1-8 hex nuts and one [1] flatwasher (items 2,3) on the other end of each anchor rod. See following pad layout and figures 1 & 2.
2. Once the site location is determined, dig up the area where the foundation will be installed. Be careful not to dig too deep because the soil in the bottom and sides of the foundation should be undisturbed. Position the reinforcing bars as shown. Position the anchor rods so that the flatwashers are positioned under the reinforcing bars. Pour concrete and allow it to dry for 24 hours.
3. Once the concrete is dry, remove the plywood template and screw the lower hex nuts as far down on the anchor rods as possible. Then install the mast pipe (item 1) on to the anchor rods. Adjust the lower hex nuts until the mast pipe is level in the vertical position. Reinstall the flatwashers, lockwashers and hex nuts. With the mast pipe tightened down, fill the space between the concrete slab and the mast pipe base with grout.

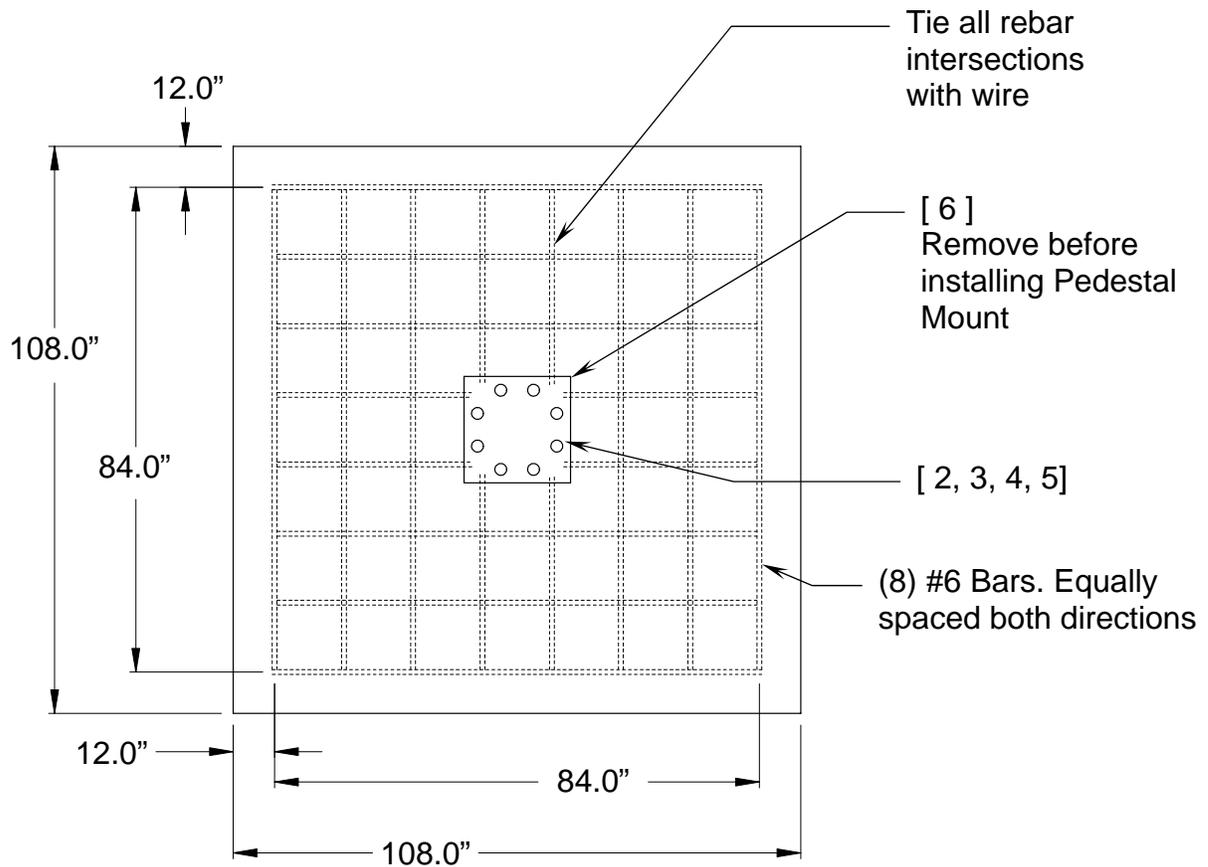
NOTES:

1. ALL CONCRETE SHOULD CONFORM TO BUILDING CODE STANDARDS AND HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT 28 DAYS. (PER ACI-318-77)
2. SOIL BEARING CAPACITY SHOULD BE NO LESS THAN 2000 PSF.
3. CONCRETE SHOULD BE POURED AGAINST UNDISTURBED SOIL.
4. ALLOW CONCRETE 24 HOUR SET TIME BEFORE INSTALLATION OF ANTENNA.
5. THE ANTENNA SHOULD BE PROPERLY GROUNDED TO MEET APPLICABLE LOCAL CODES.
6. MINIMUM DEPTH AS SHOWN OR EXTENDED TO LOCAL FROST LINE.

(GENERAL DYNAMICS DOES NOT REPRESENT OR WARRANT THAT ANY PARTICULAR DESIGN OR SIZE OF FOUNDATION IS APPROPRIATE FOR ANY LOCALITY OR EARTH STATION INSTALLATION.)

PEDESTAL FOUNDATIONS

FOUNDATION PART LIST			
ITEM NO.	PART NO.	DESCRIPTION	QTY
1	0490-483	4.5M PEDESTAL MAST PIPE	1
2	8107-010	1- 1/2" - 6 HEX NUT	16
3	8201-065	1- 1/2" FLATWASHER	16
4	8202-061	1- 1/2" LOCKWASHER	8
5	8500-116	1-1/2" x 6" x 24" ANCHOR ROD	8
6	0274-018	TEMPLATE, PLYWOOD	1



PAD LAYOUT

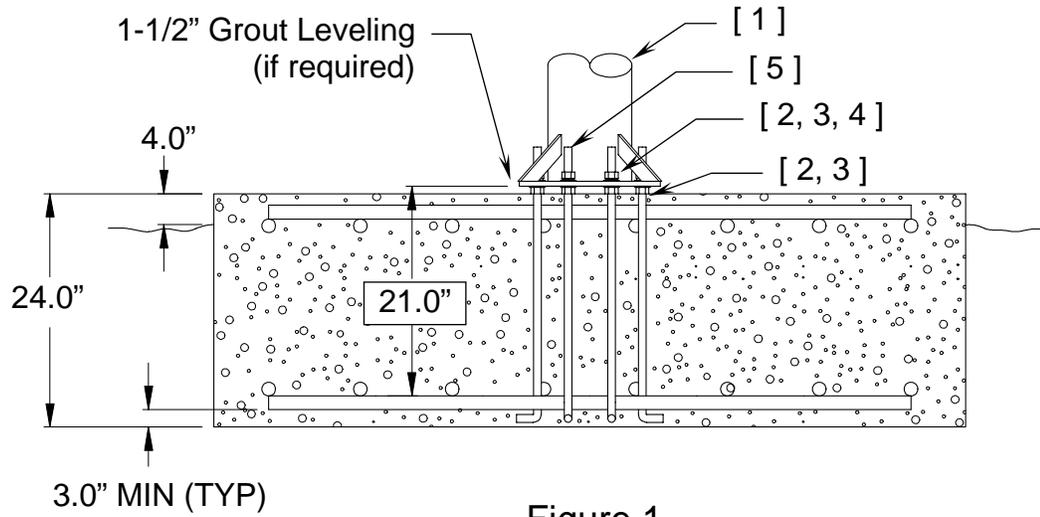


Figure 1

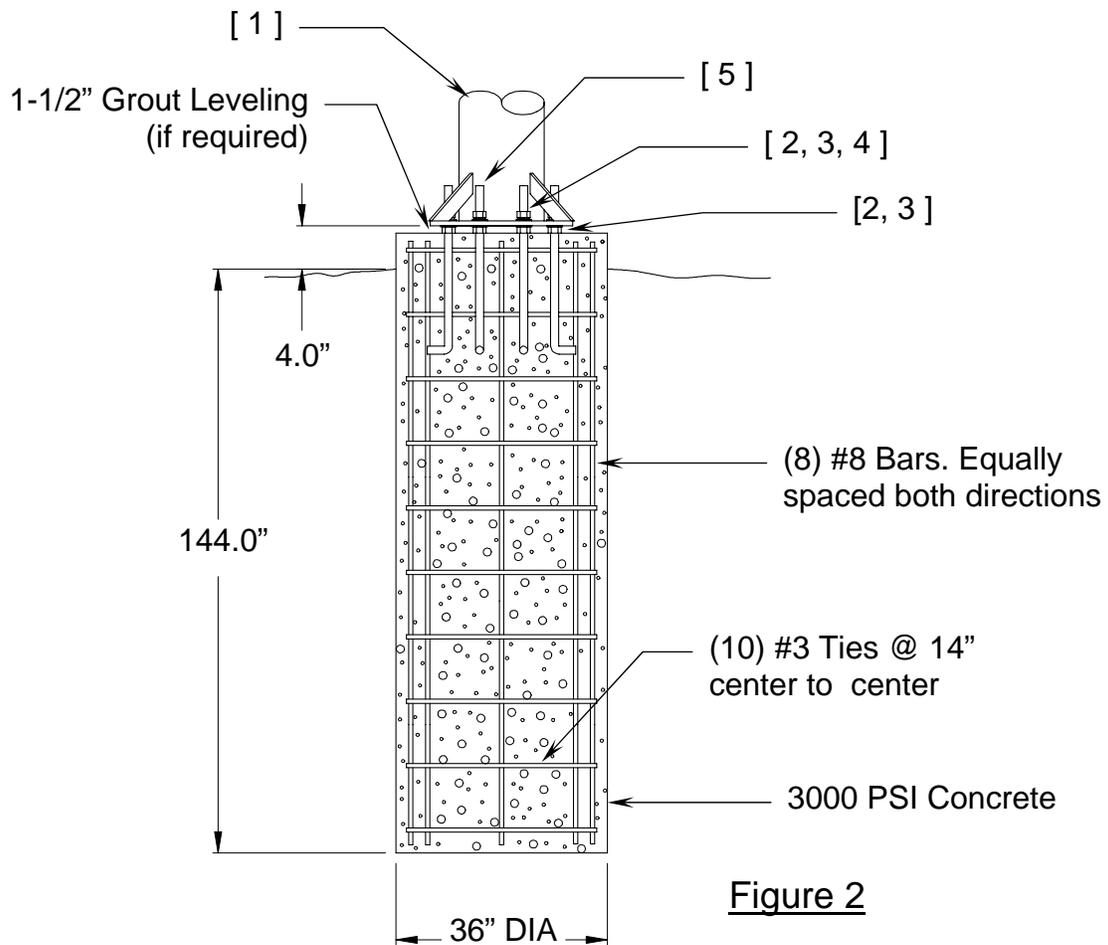


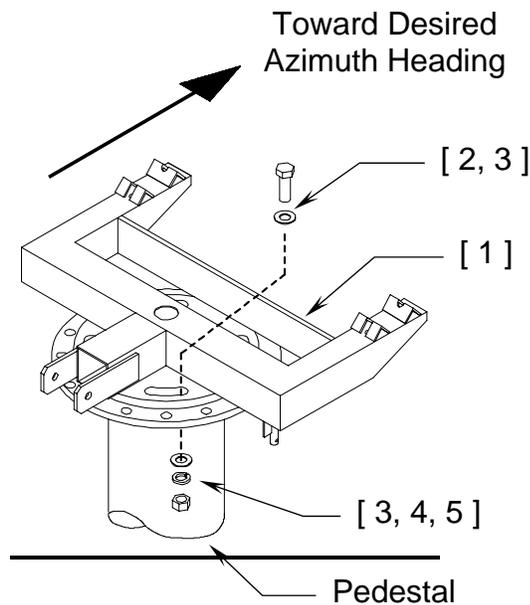
Figure 2

SECTION III **Az/EL POSITIONER ASSEMBLY**

Az/EL POSITIONER ASSEMBLY PART LIST – TABLE 3.0			
ITEM NO.	PART NO.	DESCRIPTION	QTY
1	0490-480	POSITIONER ASSEMBLY- AZIMUTH	1
2	8036-032	1-8 x 4.00" HEX BOLT	4
3	8201-049	1" FLATWASHER	8
4	8202-046	1" LOCKWASHER	4
5	8107-007	1" HEX NUT	6
6	8037-072	2-4.5 x 9.00" HEX BOLT	1
7	8201-050	2' FLATWASHER	1
8	0490-477	AZIMUTH ADJUSTMENT ROD	1
9	0211-700	AZIMUTH TUBE WELMENT	1
10	8035-016	3/4" -10 x 2.00" HEX BOLT	5
11	8201-045	3/4" FLATWASHER	5
12	8202-045	3/4" LOCKWASHER	5
13	8030-010	1/4" - 20 x 1.25" HEX BOLT	1
14	8201-040	1/4" FLATWASHER	2
15	8202-040	1/4" LOCKWASHER	1
16	8100-007	1/4" HEX NUT	1
17	0181-377	ELEVATION / HUB WELDMENT ASSEMBLY	1
18	8403-011	U-BOLT, 5/8"- 11 UNC	2
19	8105-007	5/8" HEX NUT	8
20	8201-044	5/8" FLATWASHER	4
21	0168-127	ELEVATION BLOCK	2
22	0180-284	ELEVATION ADJUSTMENT SCREW	1
23	8109-006	1-1/4" HEX NUT	4
24	8201-066	1-1/4" FLATWASHER	4

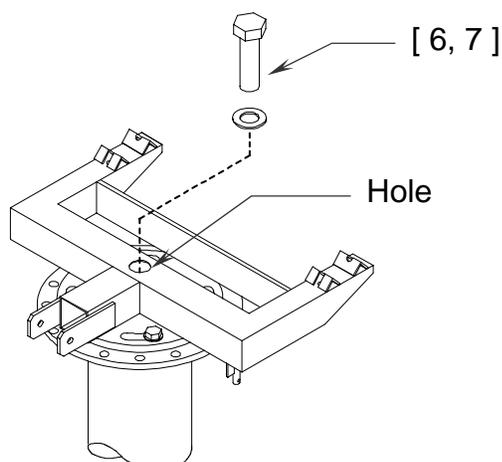
CAUTION: During the assembly procedure, the sequence of instructions must be followed. **Do Not Tighten Any Hardware Until Instructed.** Refer to the antenna assembly parts list and the following steps.

3.1 Az/EI POSITIONER INSTALLATION



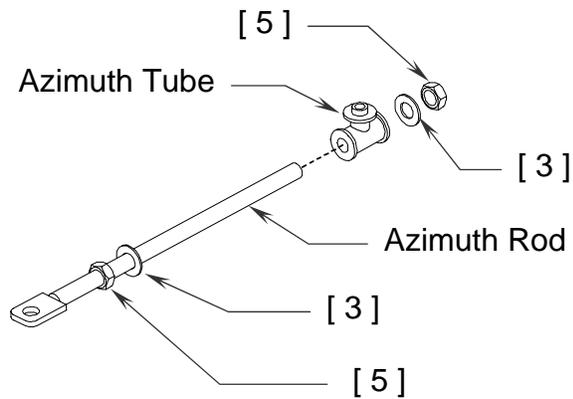
STEP 1:

- Properly orient the positioner assembly (item 1) onto the pedestal.
- Rotate the positioner assembly towards the desired azimuth heading as shown.
- Once the position is located, rotate the positioner in either direction to the nearest set of holes that line up with the ring slots. The result is a coarse azimuth setting (+/- 30 deg.). The fine azimuth setting will be set later.
- Secure the positioner in four places to the pedestal with 1" hardware (items 2, 3, 4, 5).



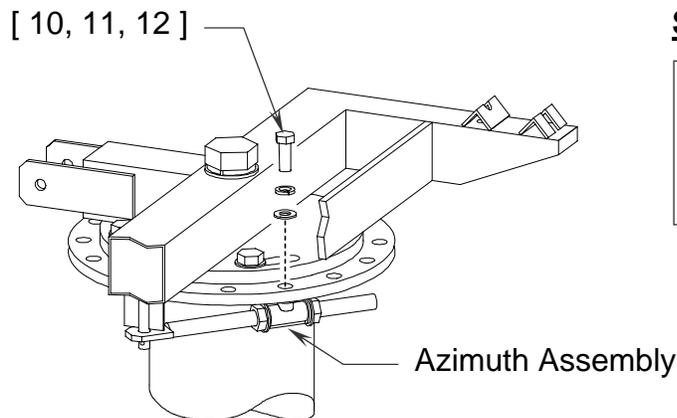
STEP 2:

Install the 2" hardware (items 6, 7) through the center hole of the positioner into the pedestal threaded hole.



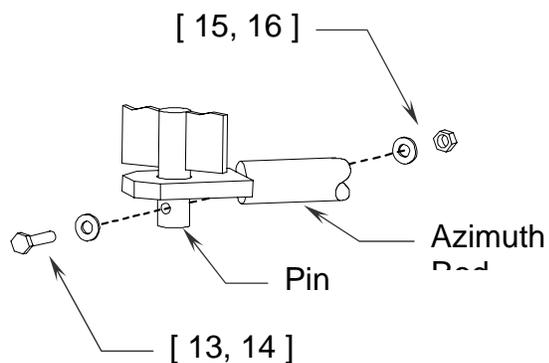
STEP 3:

Thread a 1" hex nut (item 5) onto the azimuth rod, followed with a 1" washer (item 3). Slip the azimuth tube onto the rod and secure in place with another 1" hex nut and washer (items 3, 5). Adjust the hardware until the azimuth tube is centered upon the azimuth rod.



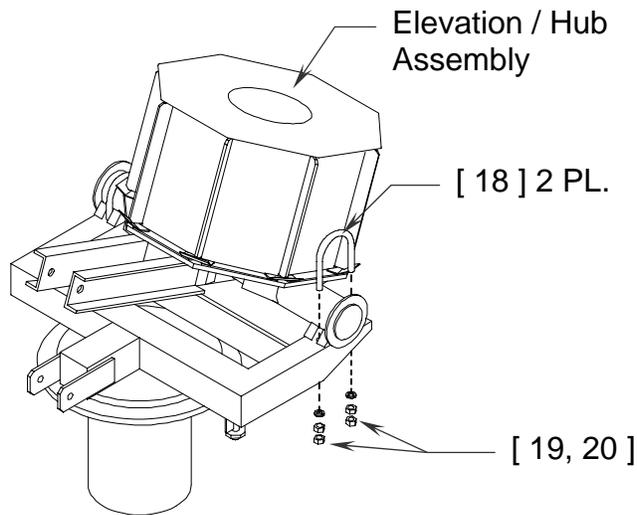
STEP 4:

Secure the completed azimuth assembly (from Step 3) to the pedestal flange with 3/4" hardware (items 10, 11, 12).



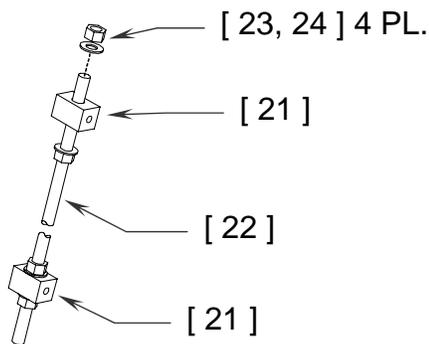
STEP 5:

Place the tab end of the azimuth asm onto the 3/4" dia pin on beneath the positioner and secure in place with 1/4" hardware (items 13, 14, 15, 16).



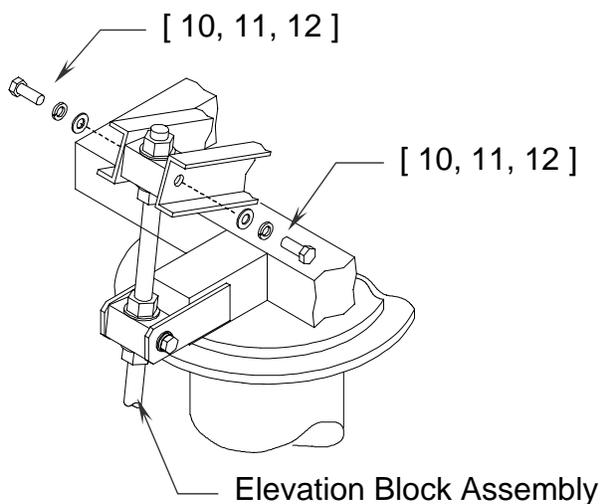
STEP 6:

Place the elevation / hub assembly (item 17) onto the cradles on the positioner assembly and secure with (2) U-bolts and 5/8" hardware (items 18, 19, 20). Note that each leg of the U-bolts requires (2) 5/8" hex nuts.



STEP 7:

- A) Thread a 1-1/4" hex nut (item 23) on to the elevation rod (item 22), followed with a 1-1/4" flatwasher (item 24).
- B) Slip a elevation block (item 21) onto the elevation rod and secure in place with another 1-1/4" hex nut and washer.
- C) Repeat the same procedure for the second elevation block.



STEP 8:

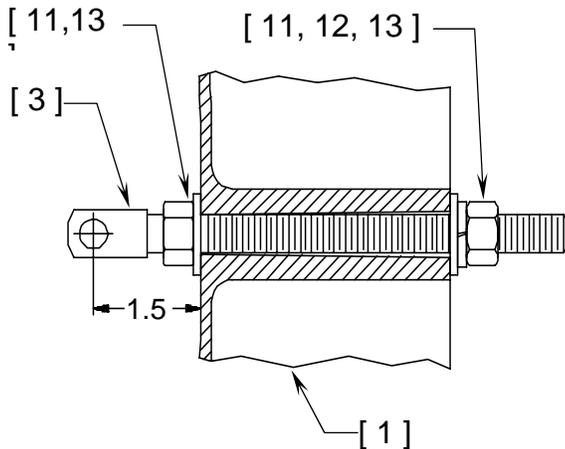
- A) Install the elevation block assembly in-between the clevis tabs on the elevation / hub and the positioner. Secure both blocks in place with 3/4" hardware (items 10, 11, 12).
- B) By adjusting the 1-1/4" nuts on the elevation rod, Adjust the rod so that the elevation / hub assembly is at a 90 deg. elevation angle.
- C) Tighten all fasteners securely.

SECTION IV **REFLECTOR ASSEMBLY**

REFLECTOR ASSEMBLY – TABLE 4.0			
ITEM NO.	PART NO.	DESCRIPTION	QTY
1	0181-362	REFLECTOR PETAL (WITH HOLE)	4
2	0181-374	REFLECTOR PETAL	4
3	0217-073	FEED SUPPORT CLEVIS	4
4	0413-123	RIB	8
5	0211-585	RIB CLIP	8
6	0156-063	PLATE, CENTER HOLE	1
7	0225-539	CLIP, CENTER HOLE	3
8	0211-586	CLIP, HUB	8
9	8304-004	8 - 32 x 1.5" SCREW	6
10	8112-003	8 - 32 HEX NUT	6
11	8201-043	1/2" FLATWASHER	8
12	8202-043	1/2" LOCKWASHER	4
13	8104-007	1/2" HEX NUT	8
14 A	8202-010	3/8" - 16 x 1.25 HEX BOLT	88
14B	8032-012	3/8" - 16 x 1.55 HEX BOLT	8
15	8201-042	3/8"FLATWASHER	192
16	8202-042	3/8" LOCKWASHER	96
17	8102-007	3/8" HEX NUT	96

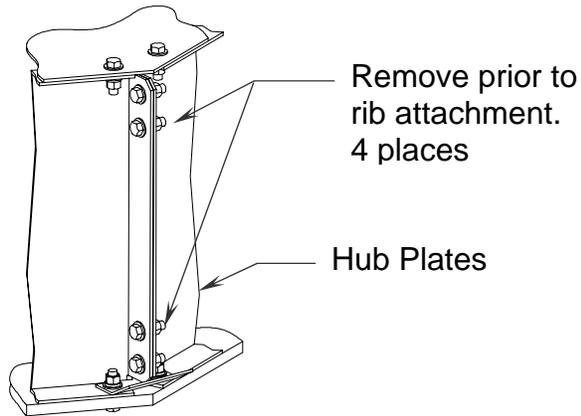
4.1 REFLECTOR PRE-ASSEMBLY

The reflector consists of eight interchangeable petals of compression molded glass-fiber reinforced material. This material is very strong, yet lightweight and easy to handle. The reflector will possess a very accurate parabolic shape when properly assembled and will retain its shape for years under harsh environmental conditions. The microwave reflective surface is provided by a fine mesh screen that lies just beneath the molded surface of the petals.



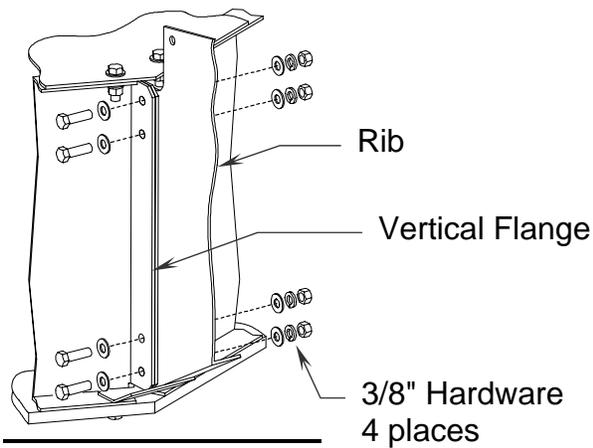
- A) Identify the reflector petals and parts of the reflector support structure according to the parts list.
- B) Note that four of the petals (item 1) have a 1 / 2" hole thru the center. These holes are for the feed support clevis pins. Pre-assemble these reflector petals as follows.
- C) Run the 1 / 2" nut (item 13) up the threads of the clevis (item 3), and place a 1 / 2" flatwasher (item 11) against the nut. Adjust the nut until the distance from the far side of the washer and the center of the clevis hole is 1.5" .
- D) From the face of the petal, insert the clevis assembly thru the hole in the center of the petal. Secure with 1 / 2" hardware. Tighten these nuts only hand tight at this time.

4.2 REFLECTOR ASSEMBLY



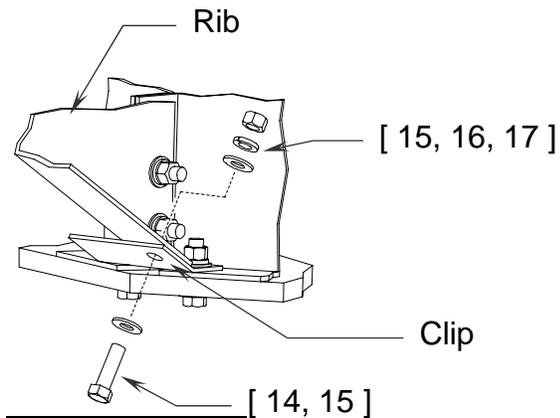
STEP 1:

Note that each vertical flange on the reflector hub assembly has (4) 3/8" bolt assemblies. These bolts must be removed prior to each rib attachment. Replace the hardware to secure rib in place.



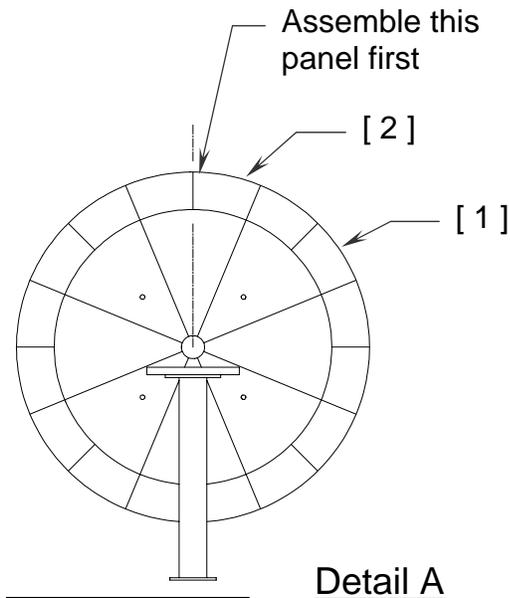
STEP 2:

Attach a rib (item 4) to the right side of the vertical flange on the hub assembly. Replace the 3/8" hardware to secure the rib in place.



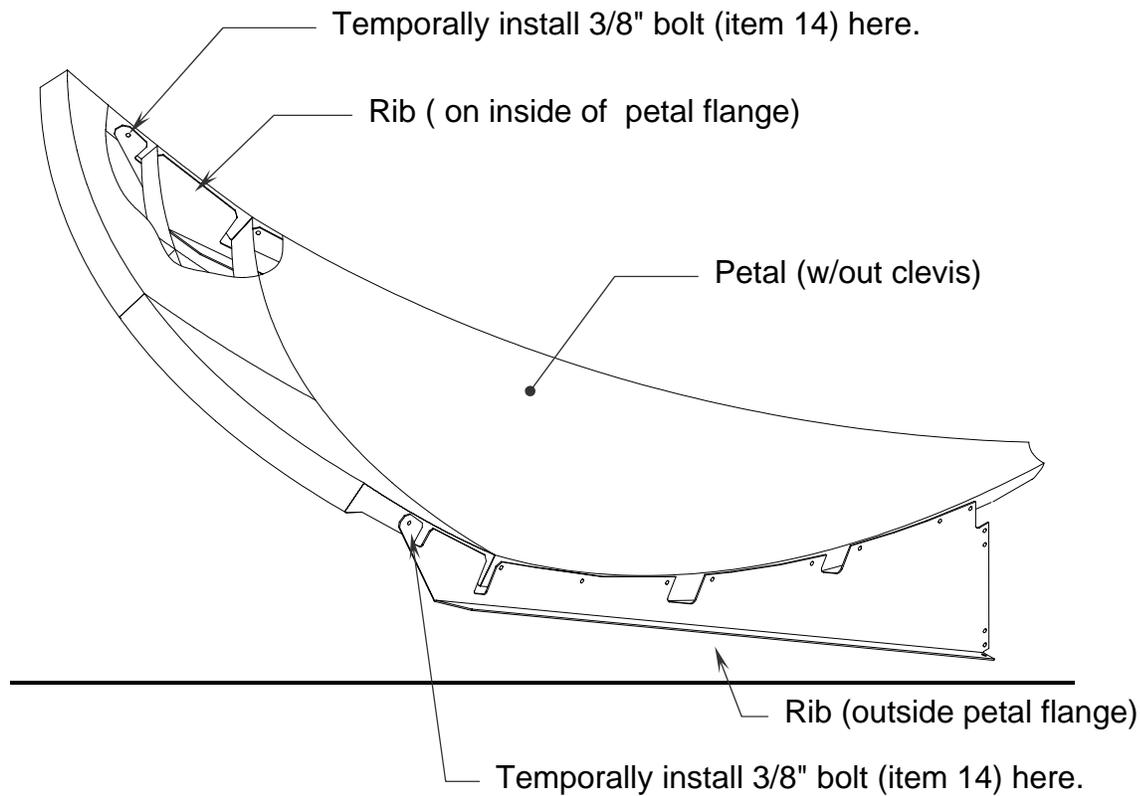
STEP 3:

- A) Secure the flange of the rib to the rib clip at the base of the hub with 3/8" hardware (items 14, 15, 16, 17)
- B) Repeat the above procedures for each of the remaining ribs.



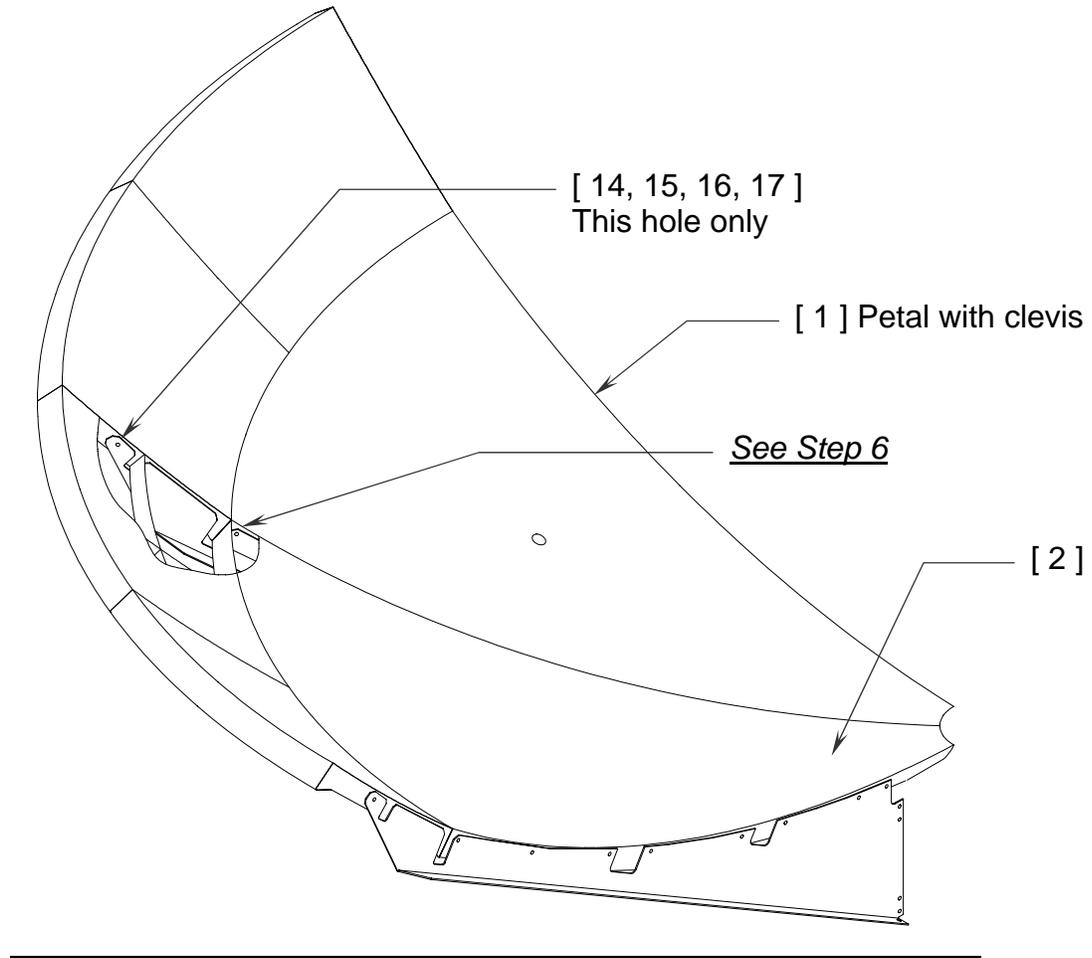
STEP 4:

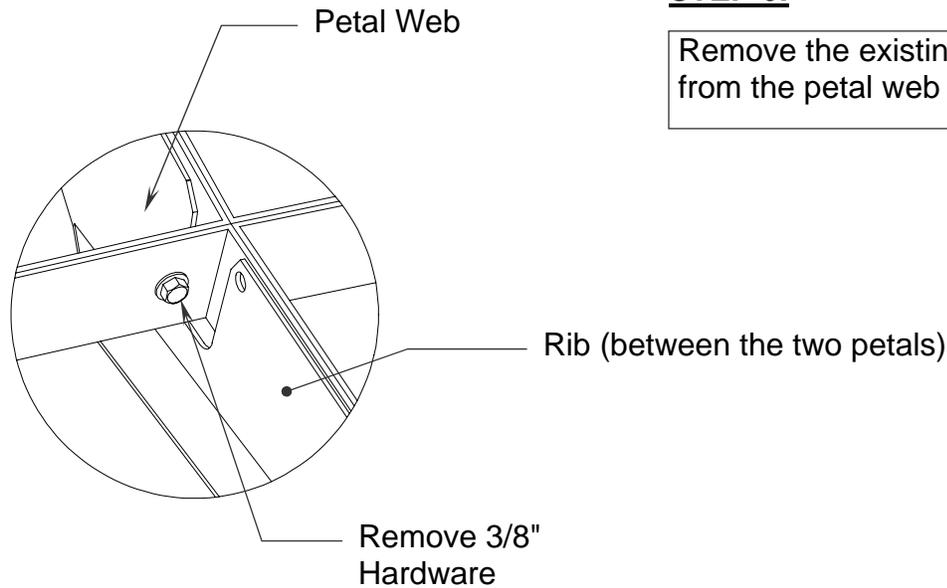
- A) Select a petal without a feed clevis (item 2) and locate it so that its center line will be in a vertical position on the assembled reflector.
See detail A.
- B) Place the panel on top of the ribs so that the petal flanges are to the left of the corresponding rib webs (as viewed from the back of reflector).
- C) Temporarily install (2) 3/8" bolts (item 14) through the outermost rib hole and the mating petal flange hole.



STEP 5:

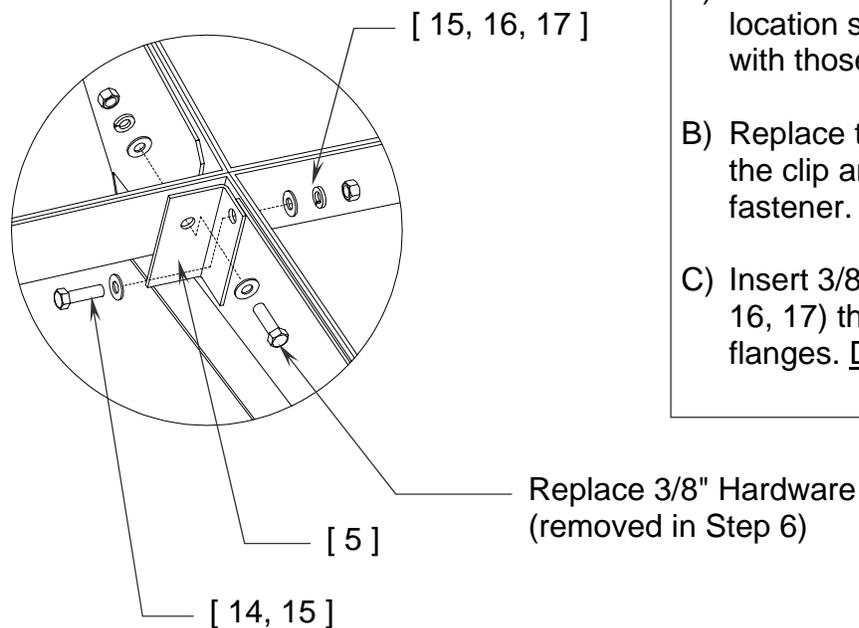
- A) Select a petal *with* a clevis (item 1) and place it next to the petal installed on the previous step. Orient the petal flanges the same as in previous step.
- B) Remove temporary 3/8" bolt where the petal flanges meet.
- C) Align the petal flanges and rib holes and secure at the outermost rib hole with 3/8" hardware (items 14,15,16,17). Do Not Tighten.





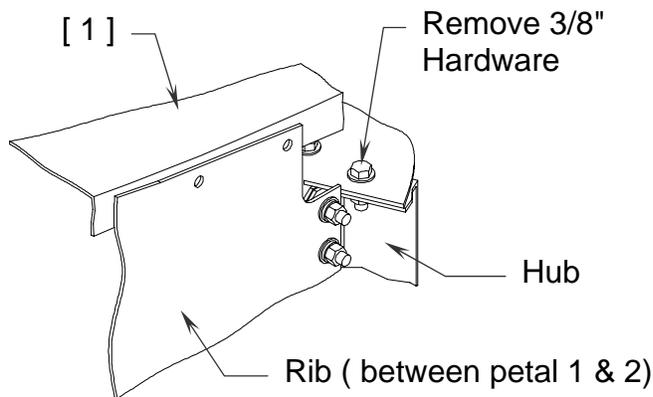
STEP 6:

Remove the existing 3/8" hardware from the petal web hole as shown.



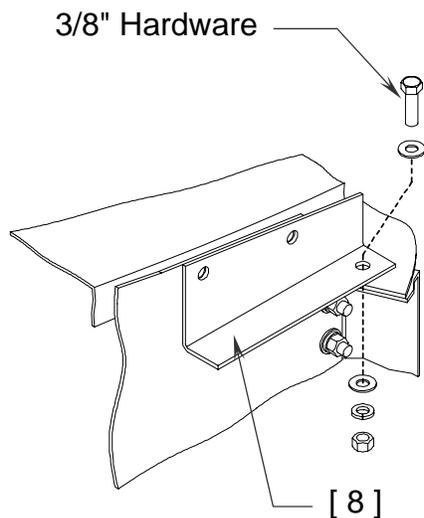
STEP 7:

- A) Place the rib clip (item 5) at the location shown, aligning the holes with those on the web and rib.
- B) Replace the 3/8" hardware through the clip and web and tighten this fastener.
- C) Insert 3/8" hardware (items 14,15, 16, 17) through clip, rib and petal flanges. Do not tighten at this time



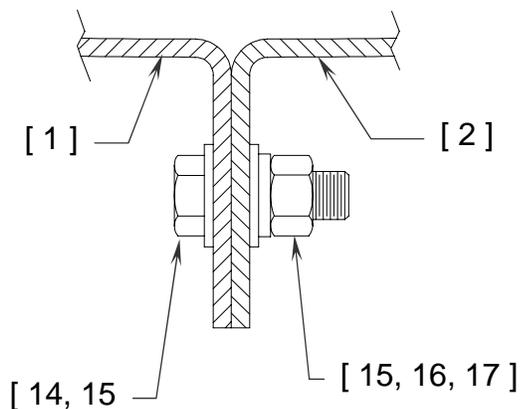
STEP 8:

At the location between petal 1 & 2 - at the hub, Remove the existing 3/8" hardware at location indicated. Note that Petal 2 is not shown for clarity



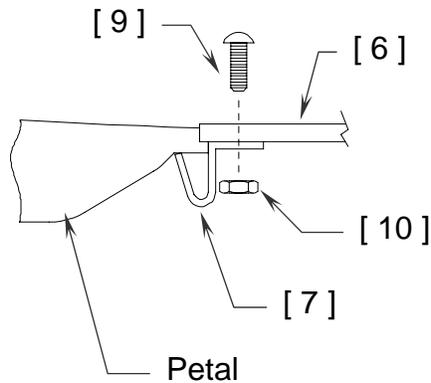
STEP 9:

Place the hub clip (item 8) as shown and replace the 3/8" hardware to secure the clip in place. Do not tighten



STEP 10:

Now place 3/8" hardware (items 14, 15, 16, 17) in the (7) remaining holes at this petal to rib joint. Do not tighten



STEP 11:

- A) Select and install the remaining petals using the steps 5 through 10 above. Be sure to locate the feed clevis petals (item 1) in their proper location.
- B) After all the ribs are in place, install the center hole plate (item 6) and the clips (item 7) at the center hole of the ribs. Secure clips in place with #8 hardware (items 9, 10). Do not tighten.

4.3 REFLECTOR ALIGNMENT

1. Tighten (8) fasteners at the outermost holes in the petals.
2. Use a thin cord across the reflector diameter from rim to rim - at four places. One end of each string should be taped to the rim just to one side of the seam between two petals. The other end should be fastened 180 degrees opposite. All four strings should lightly touch where they cross at the center. The distance from the center of the reflector (cover to plate) to the strings should be 37.5".
3. If the reflector does not check out as described above within approximately 1/4", then reflector adjustment must be done. Identify the point on the rim that is either high or low. Gently push or pull on the reflector rim until it is brought into position. While the other installer holds the rim, the other installer should tighten all the flange bolts fully. Repeat this process as required. Tighten all reflector fasteners at this time.

SECTION V **FEED HORN ASSEMBLY**

5.0 **FEED HORN ASSEMBLY**

C-BAND DUAL-POL FEED

Attach four feed mounting brackets (item 2) to the scalar ring of the C-band feed horn using 940 1/4" X .50" bolts and (4) 1/4" lockwashers (items 3, 4) as shown in Figure 3. Tighten all hardware securely.

C-BAND DUAL POL FEED SUPPORT PART LIST			
ITEM #	PART #	DESCRIPTION	QUANTITY
1	7004-036	C-BAND DUAL-POL FEED HORN	1
2	0211-405	BRACKET, FEED SUPPORT	4
3	8030-004	1/4"-20 x .50 BOLT	4
4	8202-040	1/4" LOCKWASHER	4

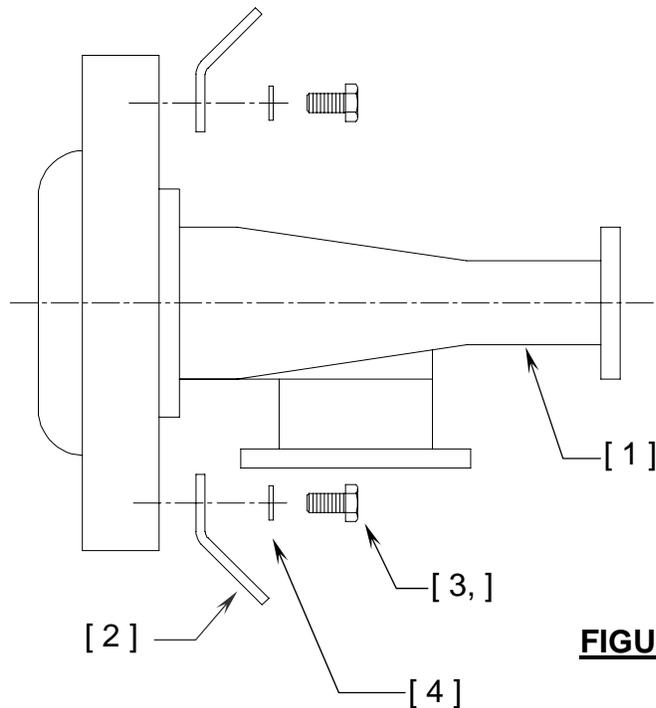


FIGURE 3

Ku-BAND DUAL - POL FEED

Remove outer most (4) #6 Phillips head screws. Position the mounting plate (item 2) over the waveguide flanges until it is flush with the backside of the scalar ring as shown in Figure 4. Re-install the (4) Phillip head screws. Attach (4) feed mounting brackets to the mounting plate with 1/4" hardware (items 4, 5, 6).

Ku-BAND DUAL POL FEED- PARTS LIST			
ITEM #	PART #	DESCRIPTION	QUANTITY
1	7004-035	Ku-BAND DUAL - POL FEED	1
2	0156-078	PLATE, MOUNTING	1
3	0211-405	BRACKET, FEED SUPPORT	4
4	8030-004	1/4"-20 x .50 BOLT	4
5	8202-040	1/4" LOCKWASHER	4
6	8100-007	1/4" HEX NUT	4

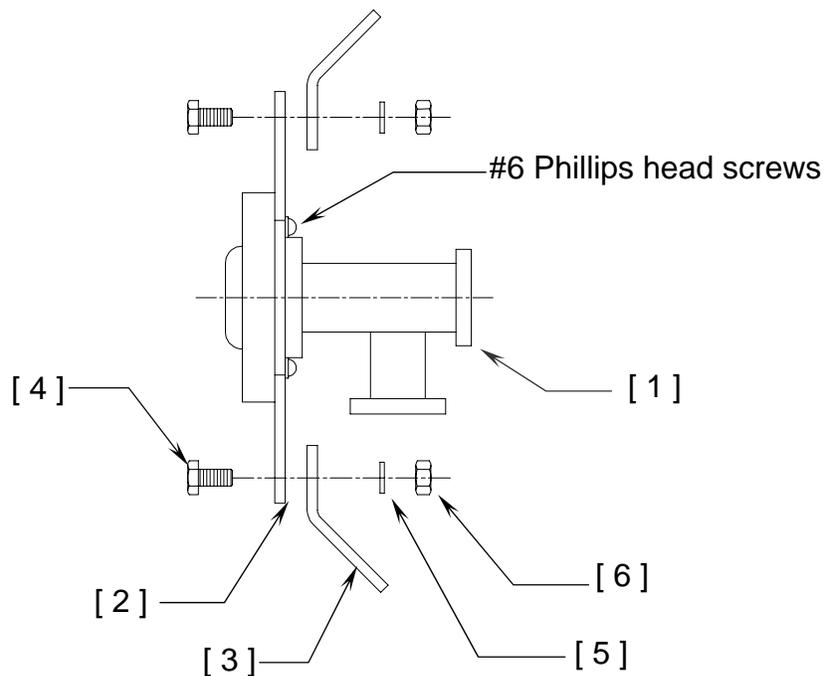


FIGURE 4

C/Ku-BAND 4-PORT FEED

Attach (4) feed mounting brackets (item 2) to the scalar ring of the C/Ku-Band feed horn using 1/4" hardware (items 3, 4, 5) - See Figure 5. Tighten securely.

BAND - PARTS LIST			
ITEM #	PART #	DESCRIPTION	QUANTITY
1	VARIOUS	C/Ku-BAND DUAL - POL FEED HORN	1
2	0211-405	FEED SUPPORT BRACKET	4
3	8030-004	1/4"-20 x .50 BOLT	4
4	8201-040	1/4" FLATWASHER	4
5	8100-007	1/4-20 HEX NUT	4

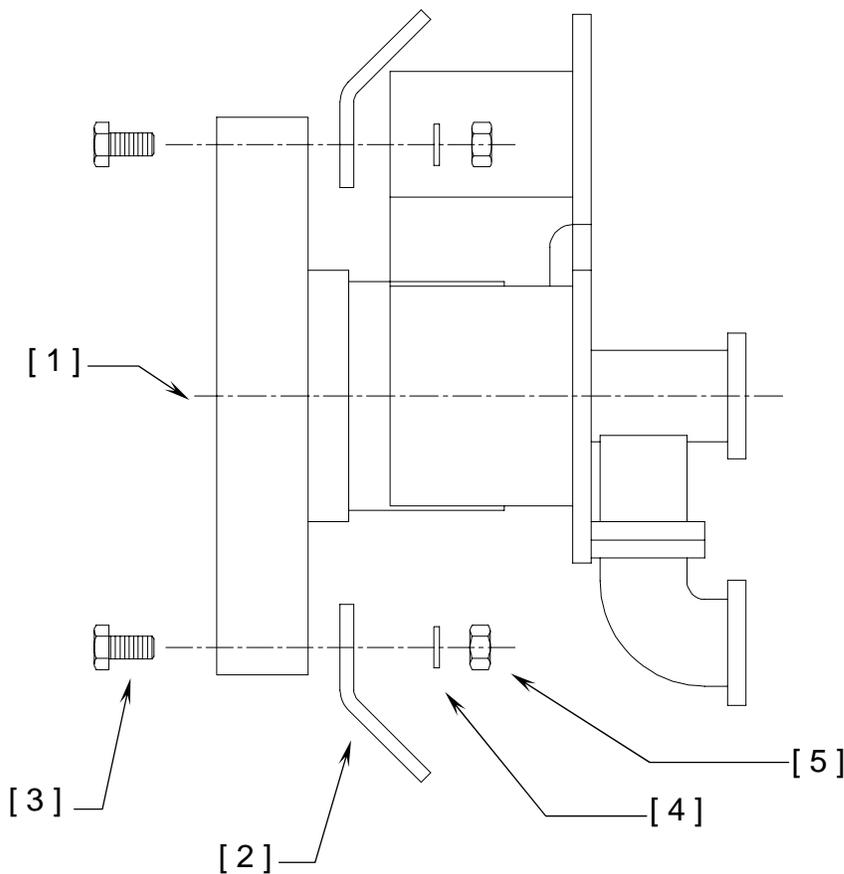
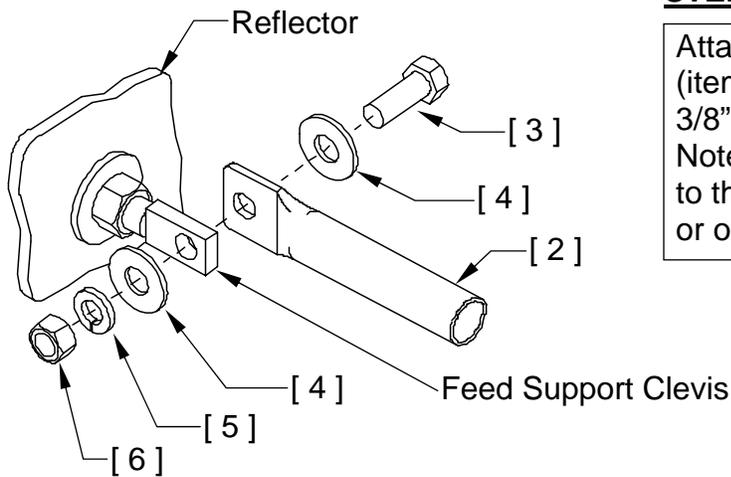


FIGURE 5

5.1 FEED SUPPORT ASSEMBLY

FEED SYSTEM PARTS LIST			
ITEM NO.	PART NO.	DESCRIPTION	QUANTITY
1	VARIES	FEED HORN ASSEMBLY	1
2	0176-225	FEED SUPPORT ROD	4
3	8032-008	3/8-16 x 1.00 BOLT	8
4	8201-042	3/8" FLATWASHER	16
5	8202-042	3/8" LOCKWASHER	8
6	8102-007	3/8" HEX NUT	8

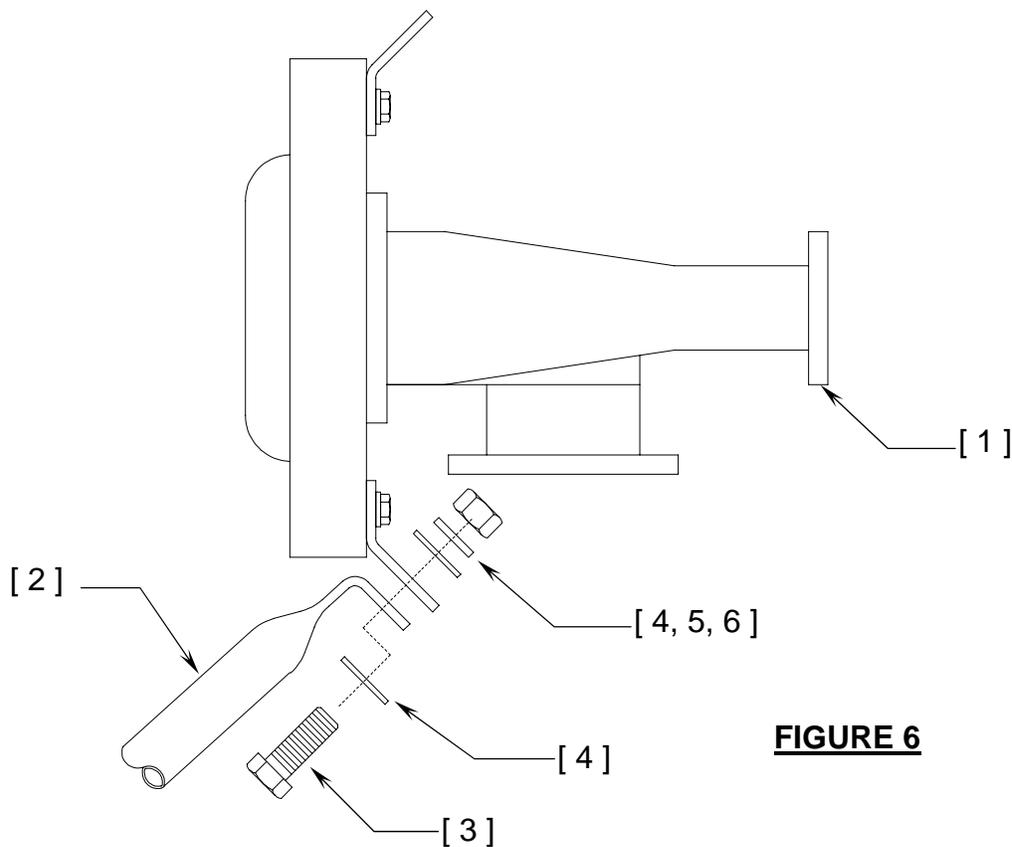


STEP 1:

Attach each of the feed support rods (item 2) to the feed support clevis with 3/8" hardware (items 3, 4, 5, 6). Note that each rod should be attached to the same side of the clevis - (inside or outside).

5.2 FEED INSTALLATION

1. **FOCAL LENGTH** - As shown in figures 6 thru 8, attach the feed horn assembly to the four feed rods with the same 3/8" hardware as above. Tighten the four bolts securely at this time. Check the focal length by measuring from the face of the feed horn to the reflector cover plate as shown in figure 9. If the focal length is incorrect, adjust the feed clevises in or out at the reflector surface as needed. Be sure that the clevises are adjusted equally. When the focal length is correct, tighten all feed support and clevis hardware securely.
2. **POLARITY ADJUSTMENT** - On the C-band, Ku- band and C/Ku- band feed systems, polarity is adjusted by loosening the feed horn bolts as rotating the OMT or the feed horn to the proper polarization, then re-tighten the bolts.



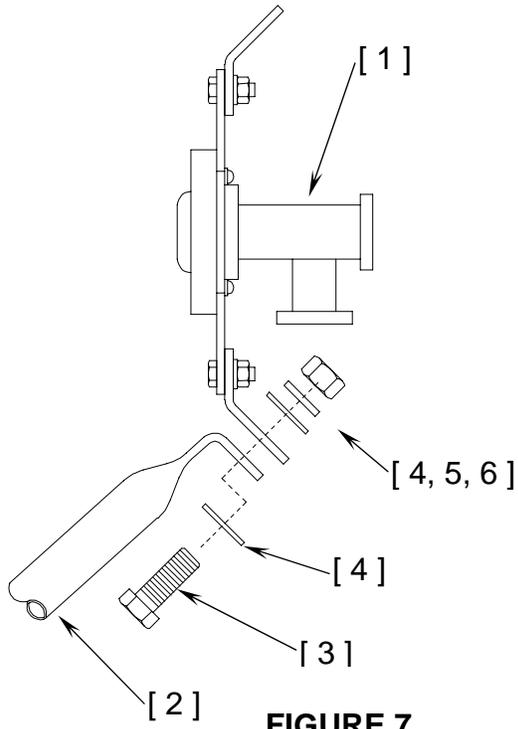


FIGURE 7

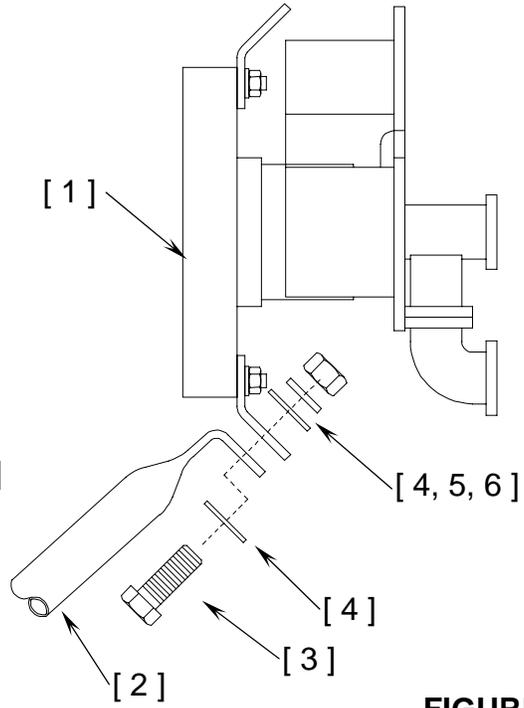


FIGURE 8

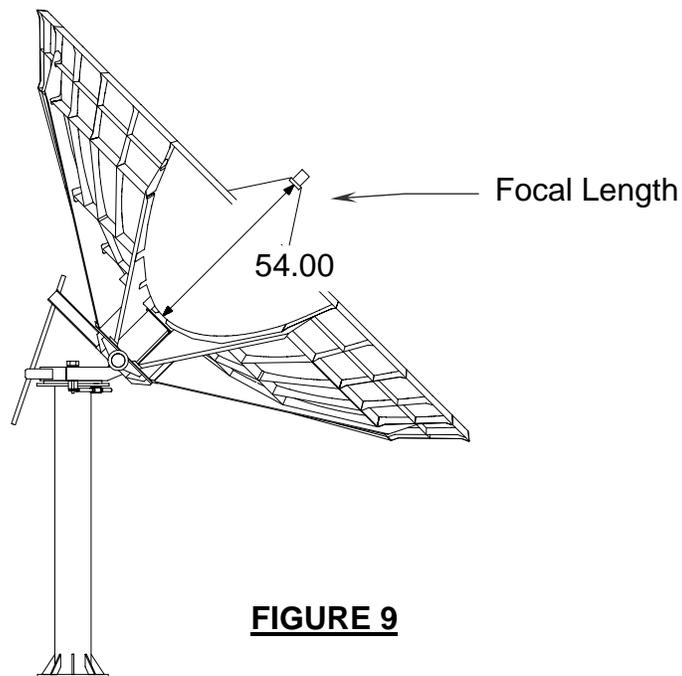


FIGURE 9

SECTION VI **ANTENNA POINTING**

6.0 **ANTENNA ALIGNMENT TO SATELLITE**

1. Set the elevation angle by rotating the 1-1/4" nuts on the elevation adjustment rod. Measure the angle by placing an inclinometer on the reflector hub. See Fig. 10.
2. The correct elevation angle is set, rotate the antenna in azimuth by removing the 1" hardware (4 places) in the positioner plate. See Fig 10.
3. At this time, rotate the antenna in azimuth by turning the 1" nuts located on the azimuth adjustment rod. Rotate in azimuth until a signal is reached.
4. Peak the antenna by fine adjustments made in both elevation and azimuth.
5. Adjust polarization by rotating the feed assembly in its mounting bracket.
6. Re-install the 1" hardware and the Az/EI positioner (from step #2) and tighten all adjustment hardware securely.

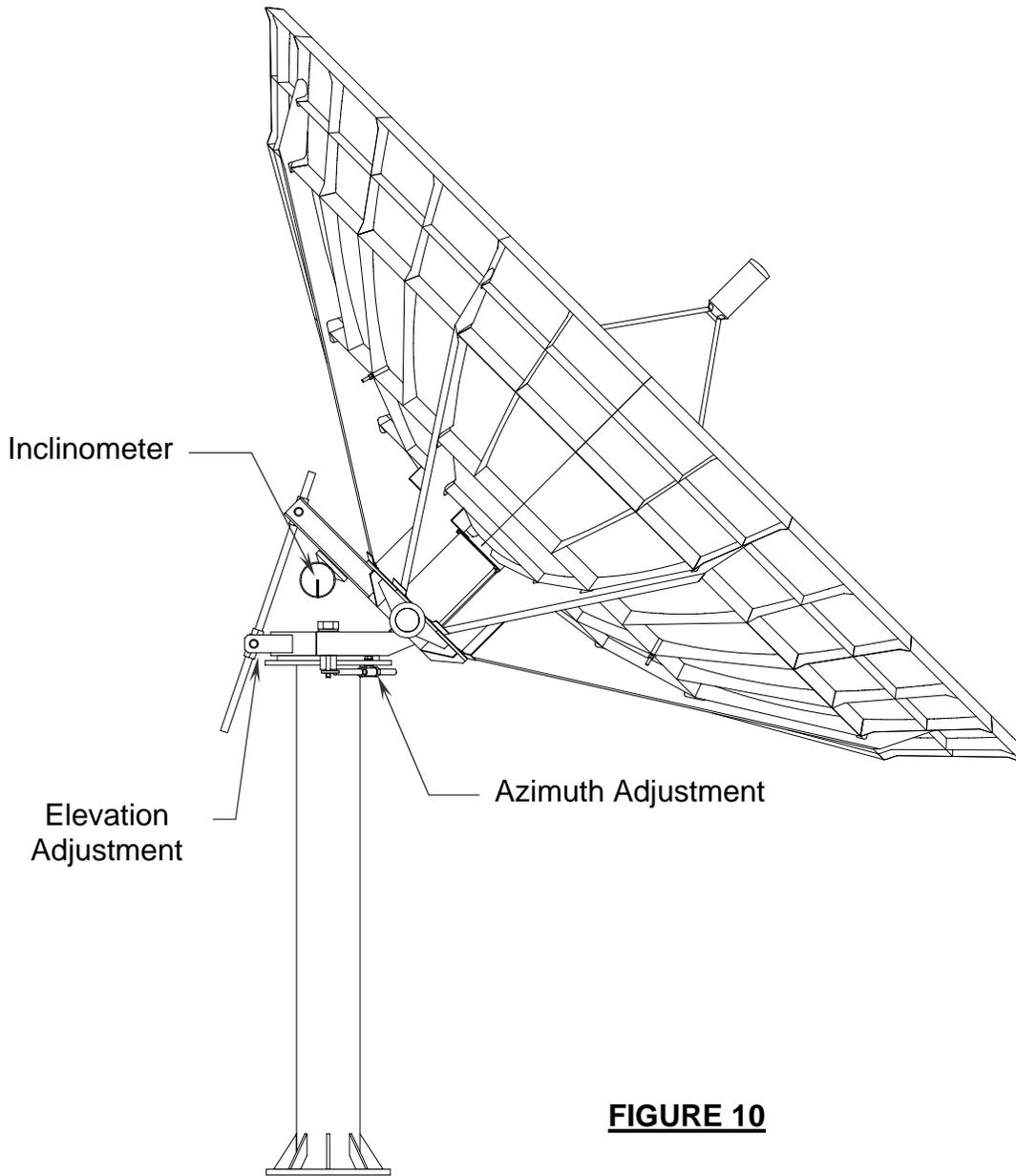


FIGURE 10

SECTION VII **MAINTENANCE**

7.0 **MAINTENANCE OVERVIEW**

After installation, the antenna requires only periodic inspection. It is anticipated that maintenance, if required, will be minimal and easily handled by a local or in house maintenance staff. The materials used in the construction of this Earth Station Antenna virtually eliminate any maintenance repairs.

7.1 **PERIODIC INSPECTION**

It is suggested that a periodic inspection be performed at least every six months.

NOTE: **After any very severe weather condition, inspection of the antenna should be performed to determine if foreign objects have caused damage or if survival specifications have been exceeded.**

This inspection should include the following:

- 1: Check all bolting locations - all bolts should be tight.
- 2: Check all structural members - repair or replace if damaged.
- 3: Check the foundation anchor bolts - they must be secure and have no failure signs in the foundation.
- 4: Check for corrosion - on the reflector structure and the mount.

7.2 **REFLECTOR**

General Dynamics' reflector does not require any maintenance. The composite construction of the reflector is virtually impervious to any damages that could be caused by weather or other atmospheric conditions.

It is only necessary to inspect for any physical damage done by vandalism or very severe weather conditions.

Should any damage be detected to a portion of the reflector, contact the Customer Service Department at General Dynamics for recommendation involving reflector repair.

7.3 MOUNT AND REFLECTOR SUPPORT STRUCTURE

The mount and reflector support structure supplied with this antenna is of steel construction and has a galvanized finish with zinc w/ultraguard finish for hardware.

If inspection shows any sign of structural failure, the mount members that are damaged should be repaired or replaced.

Corrosion: Any corrosion on steel members may be repaired with a zinc rich galvanizing paint.

7.4 FEED AND FEED SUPPORT

The feed support tube and feed rods should be inspected to insure that all hardware is secure. The feed and radio mounting bolts should be tight.

The feed horn window should be inspected to insure that it is intact so that no moisture can collect inside the feed