GENERAL DYNAMICS
SATCOM Technologies

**4096-536**
**Revision G**
**June 6, 2016**

**ASSEMBLY MANUAL**

# 4-PC 2.4M ANTENNA SYSTEM W/DUAL AXIS TRACKING MOUNT

**General Dynamics SATCOM Technologies**
**1700 Cable Drive NE**
**Conover NC 28613 USA**
**Phone 770-689-2040**
**www.gdsatcom.com**

# 4-PC 2.4M Antenna System W/ Dual Axis Tracking Mount

| REV. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| G | Add Conover Address | 6/6/16 | RAH |
| F | Revised Company Name, Logo, and Part Tables | 4/5/12 | RAH |
| E | Remove Seatel Controller Instructions | 3/31/05 | CLT |
| D | Revised Address | 2/11/02 | RAH |
| C | Rev. Frame to 0181-990 | 7/13/00 | RAH |
| B | Text revision page 20 | 06/29/99 | RF |
| A | Overall Update | 04/01/98 | PGW |
| - | ORIGINAL RELEASE | 4/14/97 | PGW |

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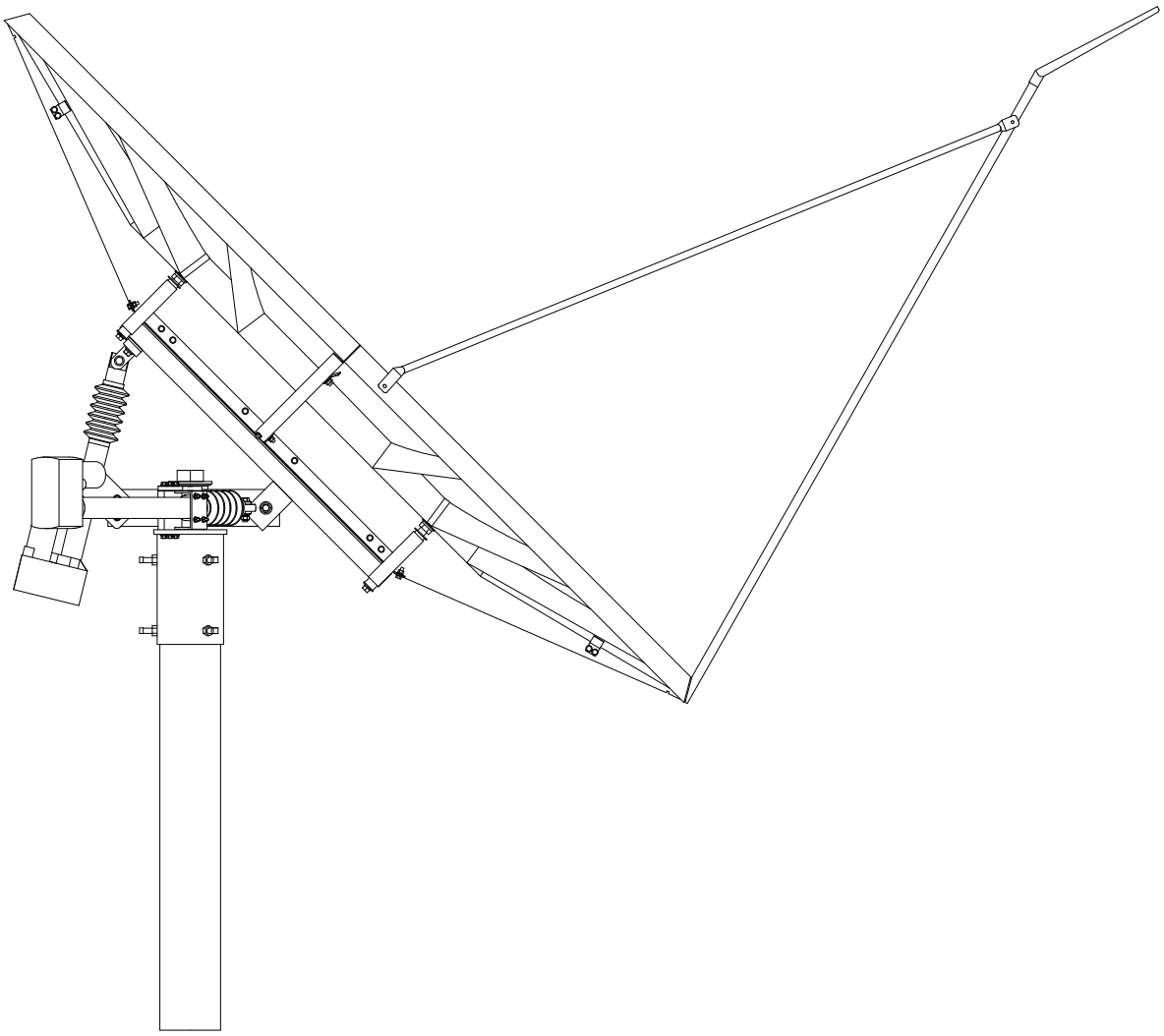


# SECTION I GENERAL INFORMATION

## 1.0 INTRODUCTION

This manual describes the assembly and installation of General Dynamics' 2.4M 4-Piece antenna system with Dual Axis Tracking. The General Dynamics 2.4M is a rugged, reliable antenna system that will operate in the Ku-band frequency 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**
**1700 Cable Drive NE**
**Conover NC 28613 USA**
**Phone 770-689-2040**
**www.gdsatcom.com**
**(828) 464-4141**

## 1.2 MECHANICAL INSTALLATION TOOLS

| HARDWARE SIZE | SAE WRENCH SIZE | METRIC WRENCH SIZE | MAXIMUM REC. TORQUE |
|---|---|---|---|
| **5/16”** | **1 / 2”** | **13 mm** | **12 ft-lbs** |
| **3 / 8”** | **9 / 16”** | **14 mm** | **15 ft-lbs** |
| **1 / 2”** | **3 / 4”** | **20 mm** | **35 ft-lbs** |
| **5 / 8”** | **15 / 16”** | **24 mm** | **70 ft-lbs** |
| **7 / 8”** | **1 – 1 / 4”** | **32 mm** | **190 ft-lbs** |

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

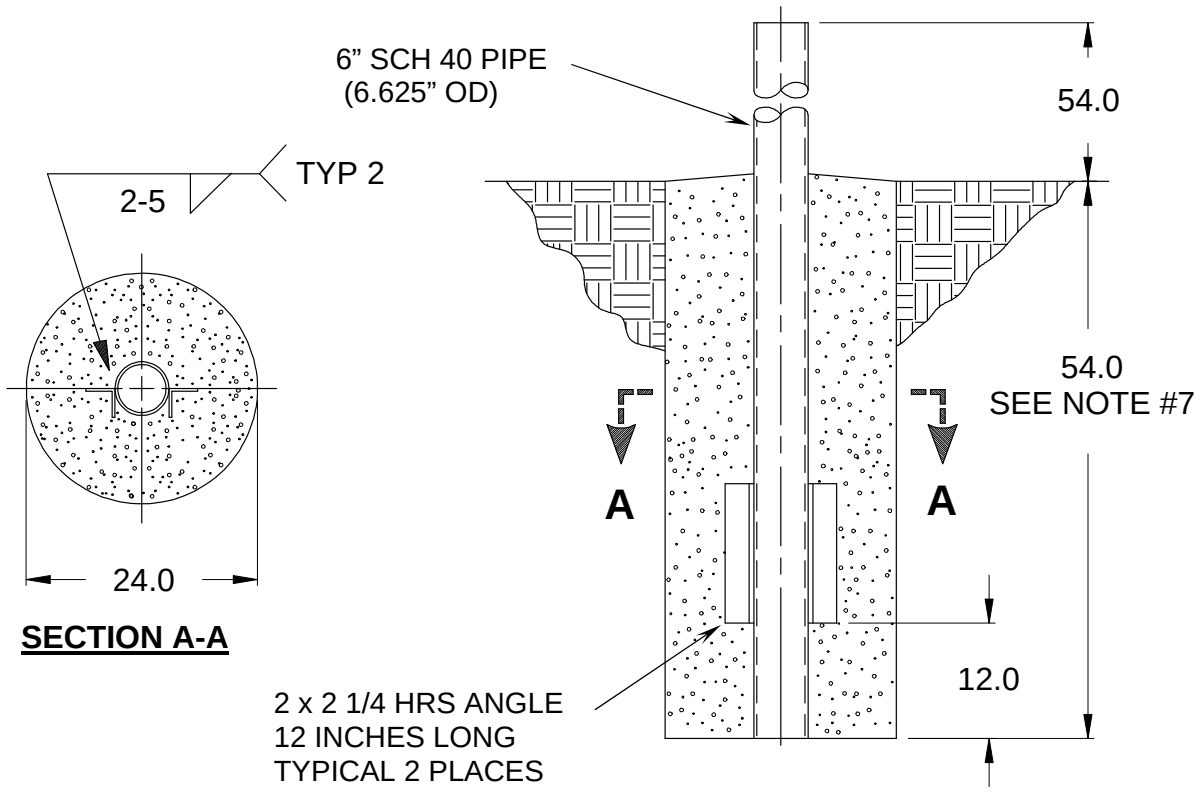
1 Screwdriver, standard blade
1 Screwdriver, cross blade
1 10” adjustable crescent wrench
1 Allen wrench, 5/32”
1 3” (76mm) wrench (socket, crescent or pipe) for 2”-4.5 bolt
1 Cordless Drill, 3/8” ( recommended)
1 Compass
1 Inclinometer
1 ASCII Hand Held Terminal (a personal computer with ASCII Emulator software can be used)

## 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.).

## 1.4 SUGGESTED MAST & FOUNDATION




**SECTION A-A**

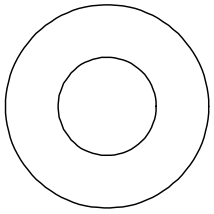
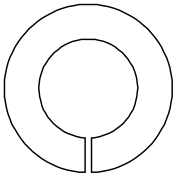
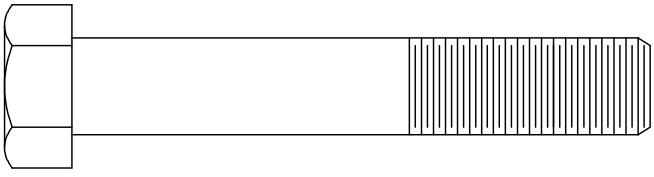
**NOTES:**

1. **2 x 2 x 1/4 HRS Angle and schedule 40 pipe should conform with ASTM A36 and ASTM A53 Type E and S Grade B.**
2. **All concrete should conform to building code standards and have a minimum compressive strength of 3000 PSI at 28 days. (Per ACI-318-77)**
3. **Soil bearing capacity should be no less than 2000 PSF.**
4. **Concrete should be poured against undisturbed soil.**
5. **Allow concrete 24 hours set time before installation of antenna.**
6. **The antenna should be properly grounded to meet applicable local codes.**
7. **Minimum depth as shown or extend to local frost line.**
8. **Foundation meets the design requirements as set forth by the uniform building code. (1982 edition)**

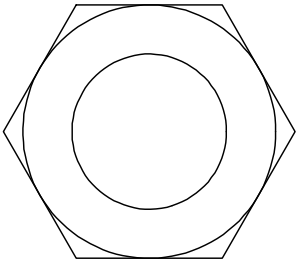
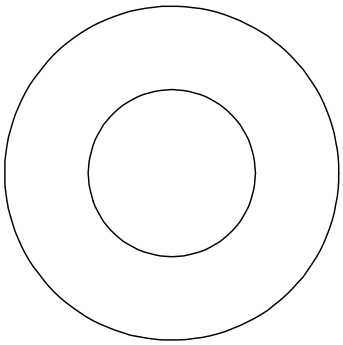
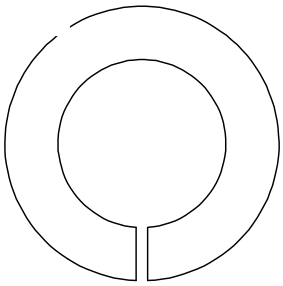
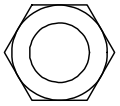
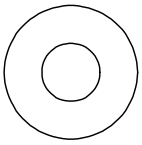
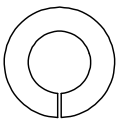
**(GENERAL DYNAMICS DOES NOT REPRESENT OR WARRANT THAT ANY PARTICULAR DESIGN OR SIZE OF FOUNDATION IS APPROPRIATE FOR ANY LOCALITY OR EARTH STATION INSTALLATION.)**

## SECTION II REFLECTOR AND SUPPORT ASSEMBLY

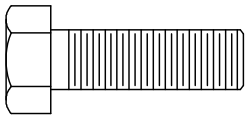
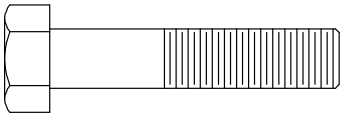
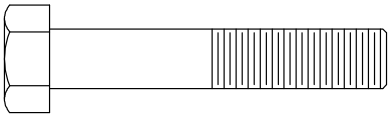
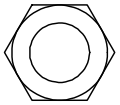
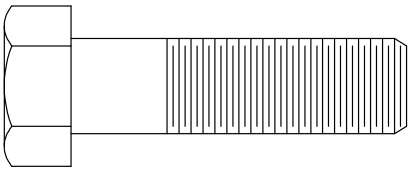
**REFLECTOR AND SUPPORT ASSEMBLY PART LIST- TABLE 2.0**

| ITEM | PART NO. | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | VARIES | 2.4M Reflector Petals | 4 |
| 2 | 0181-986 | 2.4M Tracking Mount assembly | 1 |
| 3 | 0181-294 | Azimuth Actuator / Gimbal Assembly, 18” | 1 |
| 4 | 0181-279 | Elevation Actuator / Gimbal Assembly, 36” | 1 |
| 5 | 0181-990 | Back Frame | 1 |
| 6 | 0181-182 | Major Template Assembly | 1 |
| 7 | 0181-183 | Minor Template Assembly | 1 |
| 8 | 0159-265 | Threaded Insert | 4 |
| 9 | 8201-033G | Green 1/2” Wide washer | 4 |
| 10 | 8201-043 | 1/2” Flatwasher  | 6 |
| 11 | 8202-043 | 1/2” Lockwasher  | 6 |
| 12 | 8033-061 | 1/2”-13 x 9.00 Bolt  | 4 |

**PARTS LIST - CONTINUED**

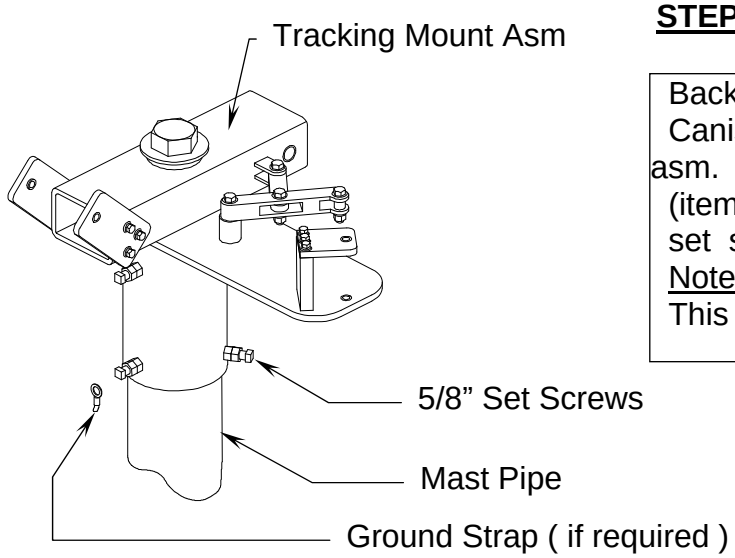
| ITEM | PART NO. | DESCRIPTION | QTY |
|---|---|---|---|
| 13 | 8110-007 | 7/8” Hex Nut  | 4 |
| 14 | 8201-052 | 7/8” Flatwasher  | 4 |
| 15 | 8202-052 | 7/8” Lockwasher  | 4 |
| 16 | 8101-009 | 5/16” Hex Nut  | 12 |
| 17 | 8201-041 | 5/16” Flatwasher  | 84 |
| 18 | 8202-041 | 5/16” Lockwasher  | 12 |

**PARTS LIST - CONTINUED**

| ITEM | PART NO. | DESCRIPTION | QTY |
|---|---|---|---|
| 19 | 8031-008 | 5/16”-18 x 1.00 Bolt  | 8 |
| 20 | 8031-012 | 5/16”-18 x 1.50 Bolt  | 4 |
| 21 | 8031-014 | 5/16”-18 x 1.75 Bolt  | 20 |
| 22 | 8101-005 | 5/16” Nylon Hex Nut  | 20 |
| 23 | 8033-014 | 1/2” –13 x 1.75 Bolt  | 2 |

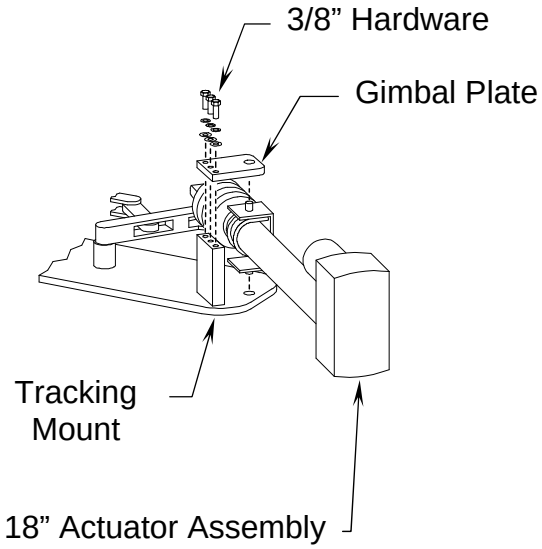
**CAUTION**: During the assembly procedure, the sequence of instructions must be followed. ***Do Not Tighten Any Hardware Until Instructed.*** Refer to the antenna assembly parts list and the following steps.

## 2.1 DUAL AXIS TRACKING MOUNT INSTALLATION




**STEP 1:**

Back out the [6] 5/8" set screws from the Canister and slip the tracking mount asm.
(item 2) over the mast pipe. Tighten the set screws snug against the mast pipe. Note, a ground strap can be attached at This stage to one of the set screws.

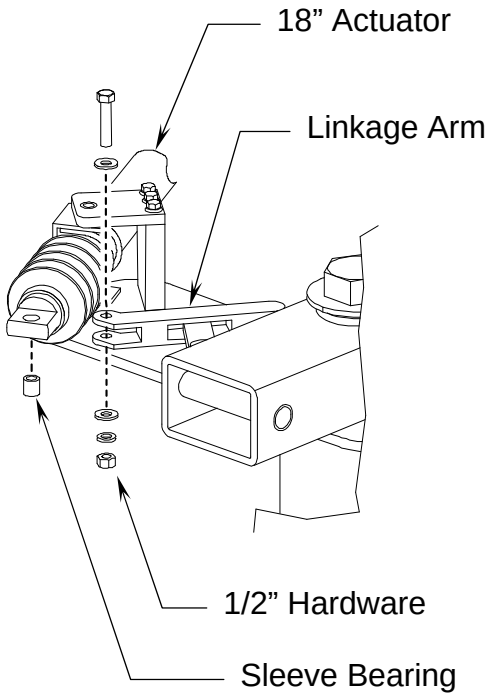



**STEP 2:**

A) Remove the 3/8" hardware and the gimbal mount plate from the tracking mount.

B) Install one post of the 18" actuator (item 3) into the hole in the bottom plate of the tracking mount. Note that the arrow located on the actuator motor must point up.

C) Re install the gimbal mounting plate. Be sure that the bearing face on the plate is towards the gimbal. Note that the actuator/gimbal assembly is pre-set at the factory and needs no adjustment.




**STEP 3:**

A) Remove the 1/2” hardware and sleeve bearing from the tab on the end of the azimuth linkage on the tracking mount.

B) Slide the bearing sleeve through the swivel ball on the end of the 18” actuator.

C) Move the actuator so that the holes in bearing and linkages arm are in line with each other.

D) Reinsert the 1/2” hardware and tighten until the lockwasher is flat. Then tighten another half turn.

## 2.2 REFLECTOR QUADRANT ORIENTATION

The 4-PC 2.4M reflector quadrants are labeled #1, #2, #3 and #4. These numbers may be found molded into the back of each quadrant at the inside corner. Note that each quadrant has a longer side (major axis) and a shorter side (minor axis). In the standard upright position, the antenna elevation angle range is between 12 and 90 degrees. When viewed from behind in the standard position (feed support at the bottom), quadrant #1 should be in the upper left; #2 is lower left; #3 is lower right and #4 in the upper right position. See Figure 1.

However, to allow a lower profile installation or in areas of high snow accumulation, the reflector can be assembled in the inverted position (feed support at the top). In this position, quadrant #1 would be in the lower right; #2 upper right; #3 in upper left and #4 in lower left position. See Figure 2.

When assembling for the inverted position, the Back Frame (item 5) must be turned 180 degrees from its standard position prior to its mounting to the Az/El positioner – see Step 7.

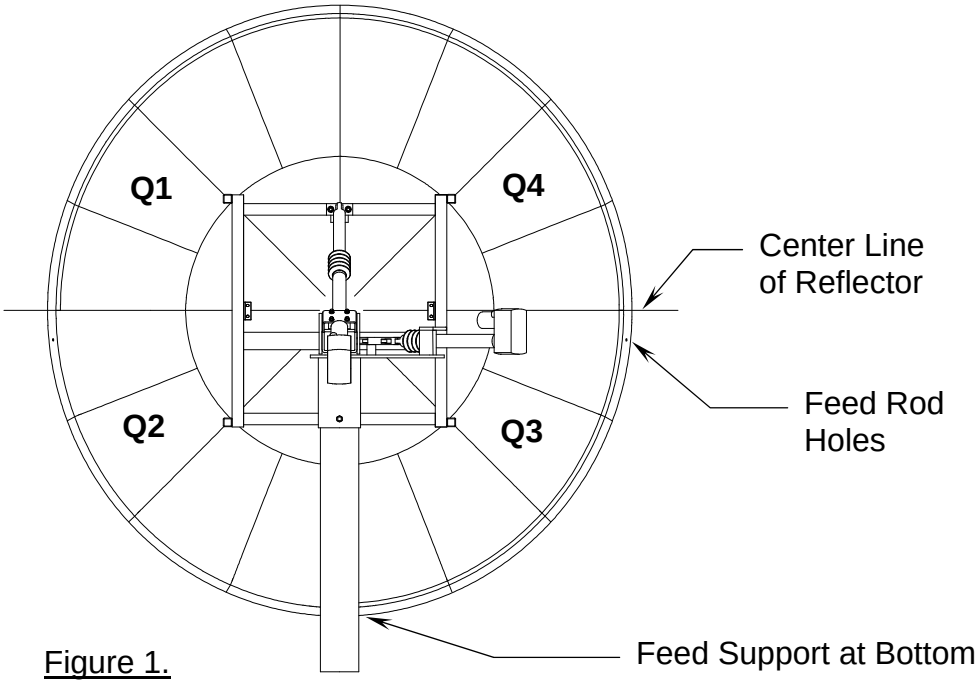



Figure 1.

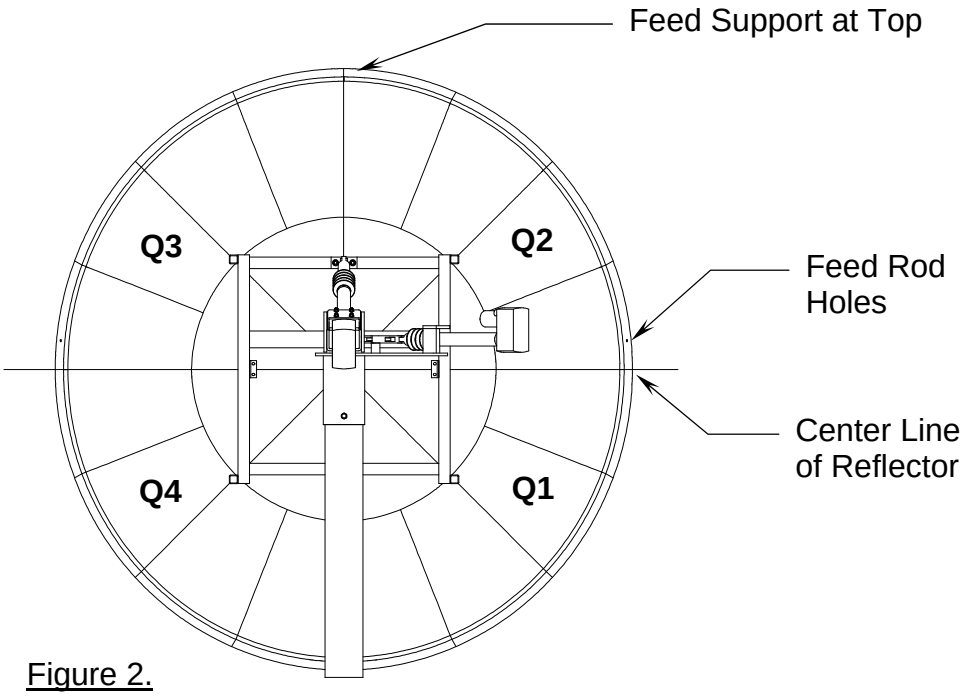
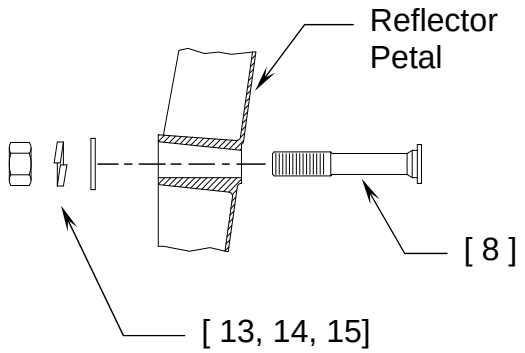



Figure 2.

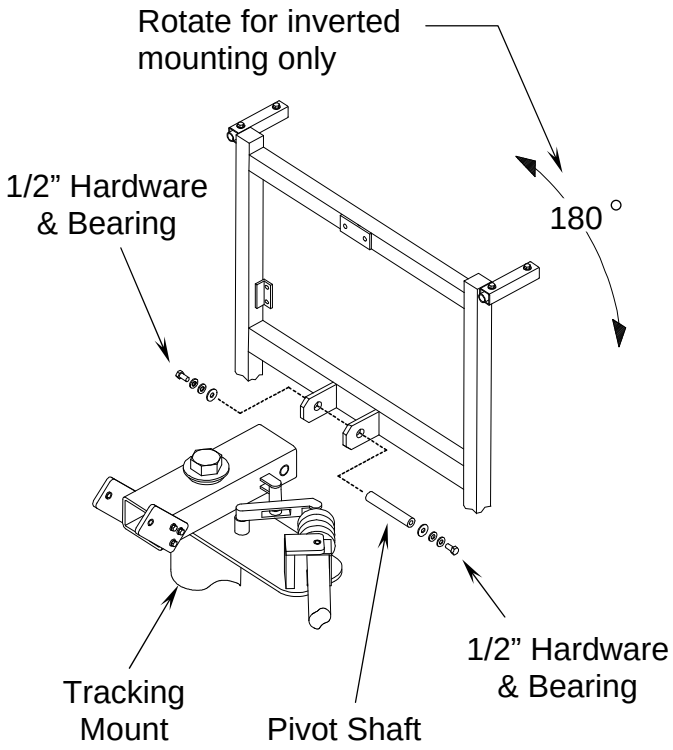
## 2.3 REFLECTOR SUPPORT ASSEMBLY

WARNING! The reflector support frame includes a precision alignment feature. Do not drop or drag the frame during the installation process. Do not attempt to adjust the round tube spacers in the frame assembly, as these are factory pre-set. If these spacers are loose or damaged, or there is any obvious damage to the frame, then you must obtain replacement parts for a successful installation.




**STEP 1:**

Locate quadrant #1 and insert threaded insert (item 8) thru the hole on the face of the reflector. Secure insert with 7/8" hardware (items 13, 14, 15). Snug only to allow freedom of movement for the back frame assembly. Repeat step for quadrants #2, #3 & #4.




**STEP 2:**

A) Remove the 1/2" hardware, bearings and pivot shaft from the back frame assembly (item 5).

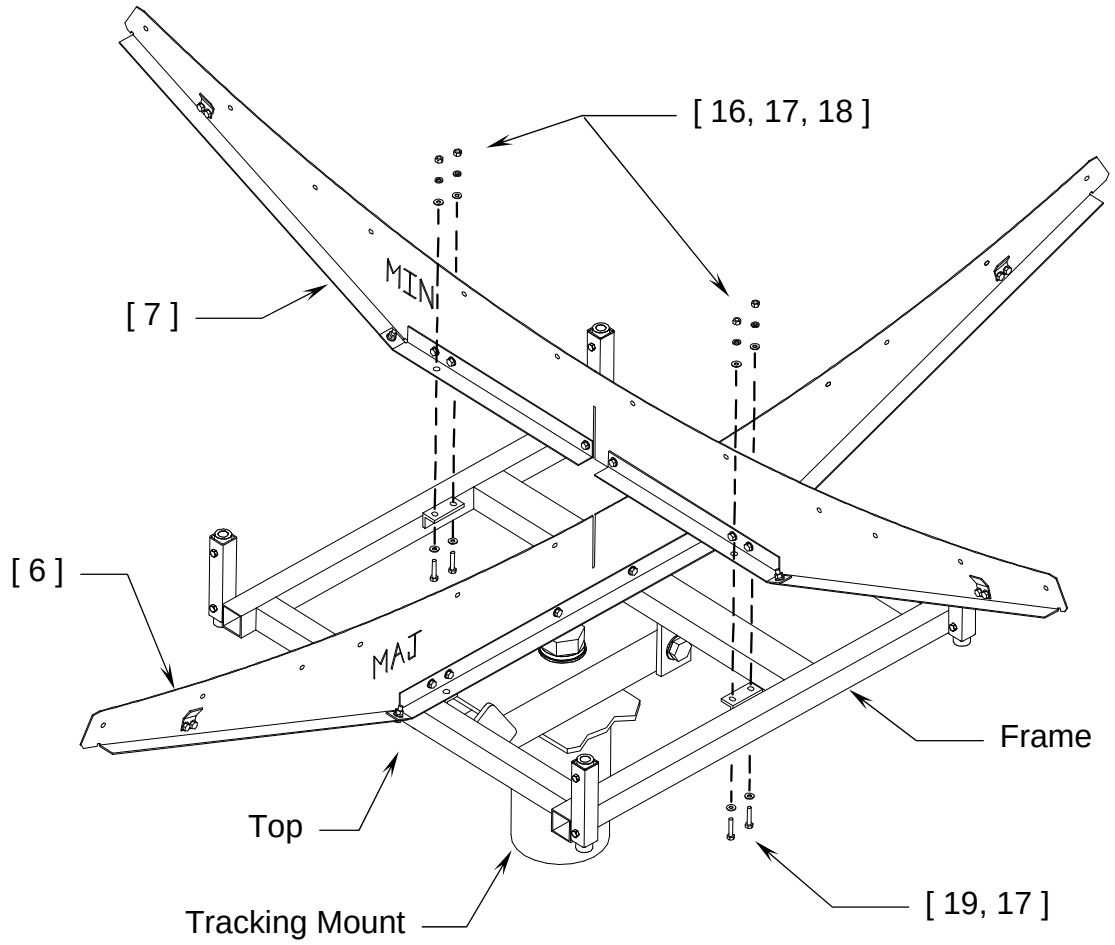
B) Straddle the tabs of the back frame over the holes in the end of the azimuth tube on the tracking mount. Note: For inverted mounting, rotate the frame 180 deg.

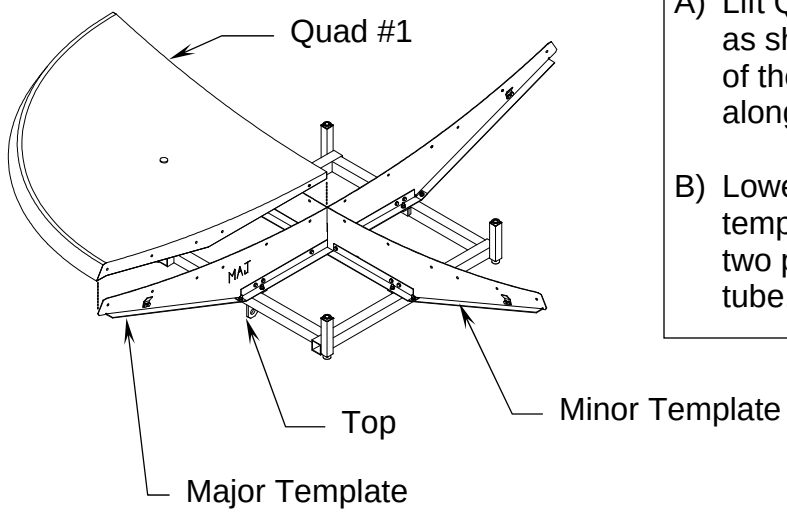
C) Insert the pivot shaft thru the aligned holes. Replace the two bearings on the tabs then secure the assembly with the 1/2" hardware.

D) Tighten snug and let the back frame fall back upon the tracking mount.

**STEP 3:**

A) Place the major template assembly (item 6) on the back of the frame with the letters "MAJ" pointing towards the top of the frame (top being where the positioner is closest to the elevation tab.
B) Insert the 5/16" bolts (item 19) thru the angles in the frame and into the angles on the template. Secure with 5/16" hardware (items 16, 17, 18). Snug hardware but **do not tighten.**
C) Slip minor template assembly (item 7) over the major template as shown and also secure with 5/16" hardware (items 16, 17, 18, 19) but **do not tighten.**

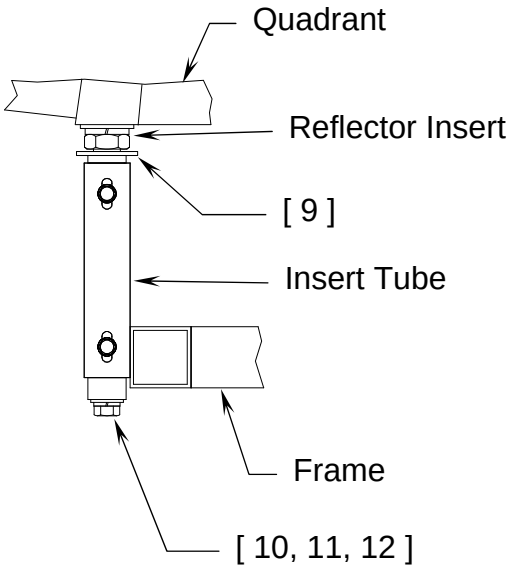





**STEP 4:**

A) Lift Quadrant #1 over the templates as shown. Note that the longer side of the quadrant should be aligned along the major axis.

B) Lower the quadrant between the templates and let it rest upon the two petal helpers and the insert tube.

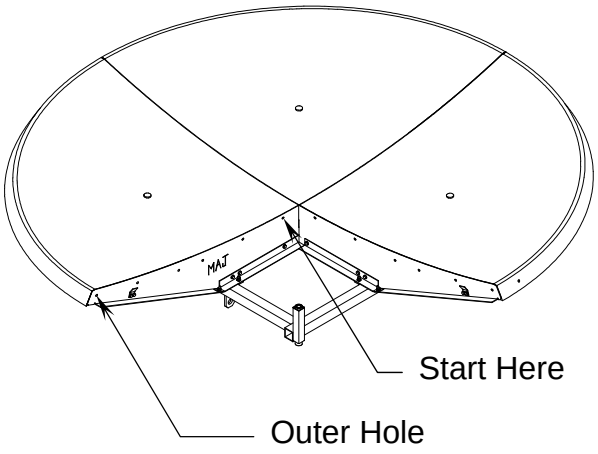


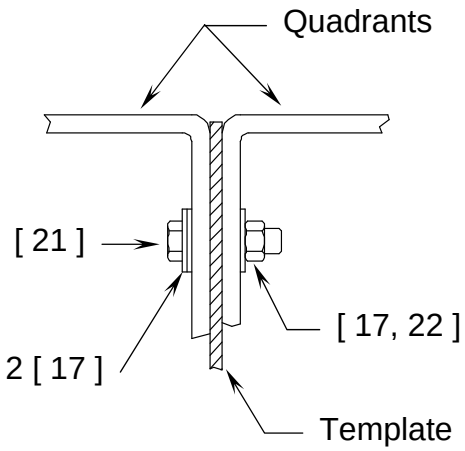

**STEP 5:**

A) Slip a green washer (item 9) between the insert tube on the frame and the reflector insert on the quadrant.

B) Insert the 1/2” x 9” bolt and hardware (items 10, 11, 12) into the bottom of the insert tube, thru the green washer and into the reflector insert. Snug the bolt but do not tighten.

C) Repeat steps 4 and 5 with the three remaining quadrants.




**STEP 6:**

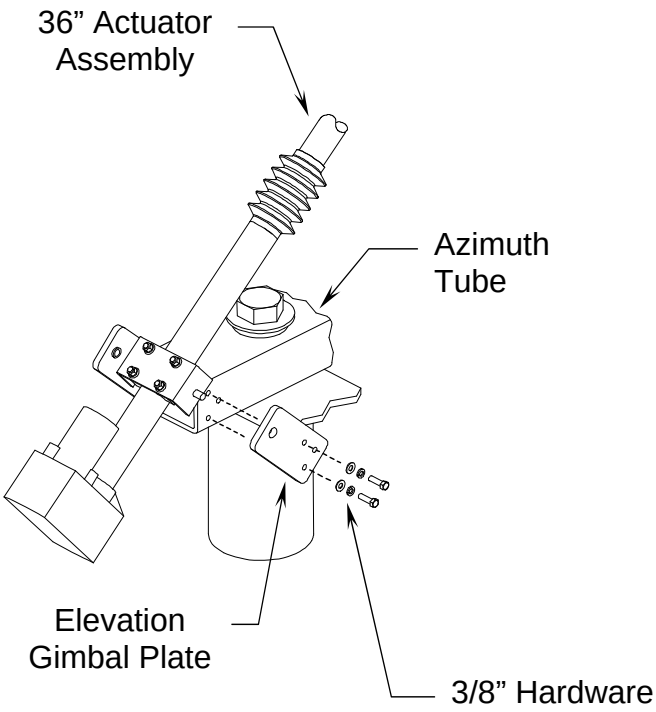
A) Working from the center out, place two 5/16” flatwashers (item 17) under the head of the 5/16” x 1.75” bolt (item 21). Insert bolt thru the holes, place another flatwasher and thread a nylon lock nut (item 22) onto end of bolt and tighten. Leave the outer four holes open. **NOTE: once the nut is tight, the bolt will still be loose. DO NOT add washers or change the bolt length.**

B) For the four remaining holes closest to the outer rim, secure with 5/16” x 1.50 bolt and hardware (items 20, 16, 17, 18). Tightening these last bolts will clamp the petals together – desired result.

C) Now return to where the templates are attached to the frame and securely tighten the eight pieces of hardware.

D) Next tighten the four 1/2” bolts going thru the insert tubes and into the reflector inserts.

E) Now tighten the 7/8” hardware on the reflector inserts that run thru each quadrant. **Do not tighten all at once**. Alternate between the inserts, tightening a little at a time. Follow this pattern until the lockwashers are flat. Be careful not to over tighten as this will damage the boss on the quadrant.

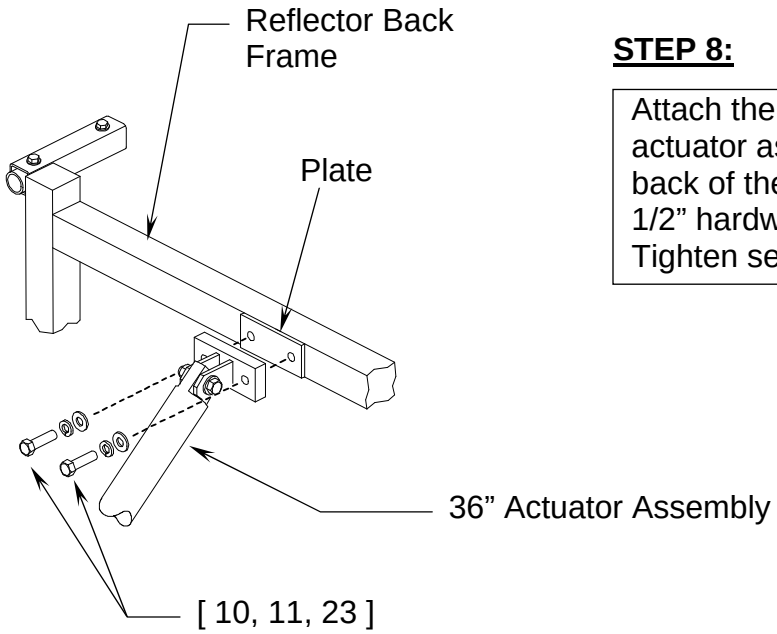



**STEP 7:**

A) Remove one of the elevation gimbal plates from the azimuth tube on the tracking mount.

B) Insert one post of the 36” actuator gimbal assembly (item 4) into the other elevation gimbal plate. Note that the arrow located on the actuator motor must point up.

C) Re install the elevation gimbal plate. Be sure that the bearing face on the plate is towards the gimbal.



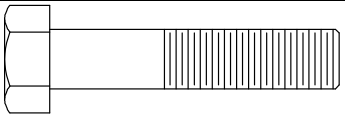
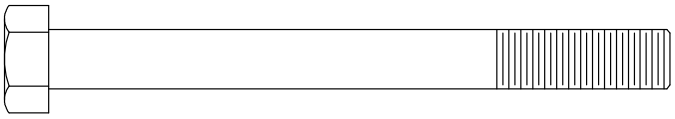
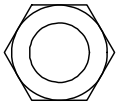
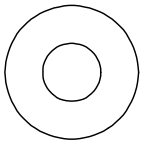
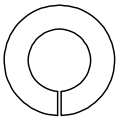

**STEP 8:**

Attach the opposite end of the 36” actuator assembly to the plate on the back of the reflector back frame with 1/2” hardware (items 10, 11, 23). Tighten securely.

## SECTION III FEED SUPPORT ASSEMBLY

The following instructions cover the installation of a typical 2.4M feed system onto the GD 4 pc 2.4M antenna. For details concerning the specific feed and ODU installation, refer to the instructions packaged with the feed system. Refer to the part list below and the following steps.

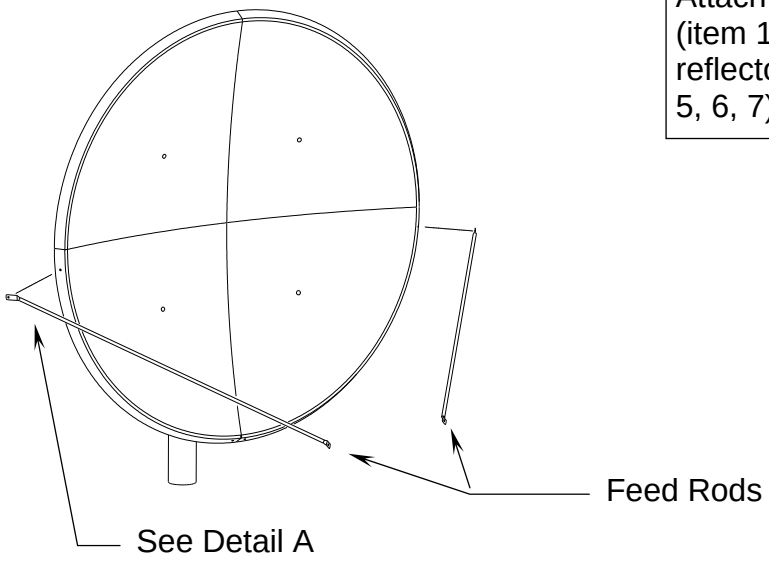
**FEED SUPPORT PART LIST – TABLE 3.0**

| ITEM | PART NO. | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | Varies | Feed Rod | 2 |
| 2 | Varies | Feed Support | 1 |
| 3 | 8031-008 | 5/16”-18 x 1.00 Bolt  | 4 |
| 4 | 8031-026 | 5/16”-18 x 3.25 Bolt  | 1 |
| 5 | 8101-009 | 5/16” Hex Nut  | 5 |
| 6 | 8201-041 | 5/16” Flatwasher  | 10 |
| 7 | 8202-041 | 5/16” Lockwasher  | 5 |

## 3.1 FEED SUPPORT ASSSEMBLY

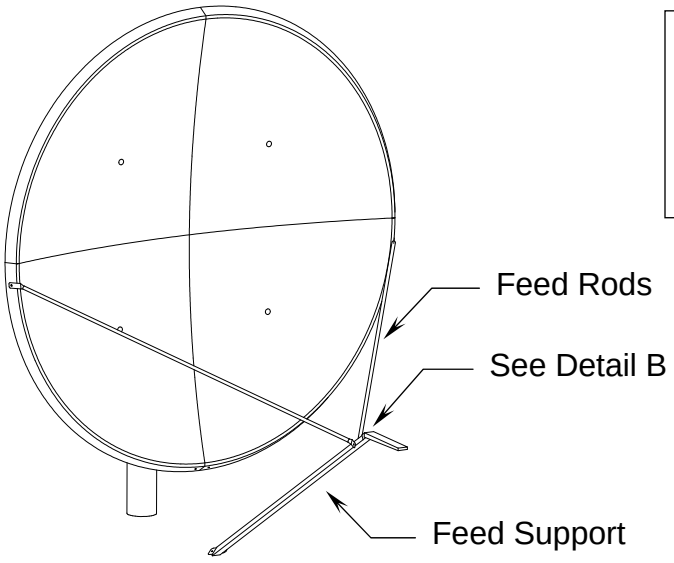
**STEP 1:**

Attach the long end of each feed rod (item 1) loosely to the sides of the reflector with 5/16” hardware (items 3, 5, 6, 7). See detail A



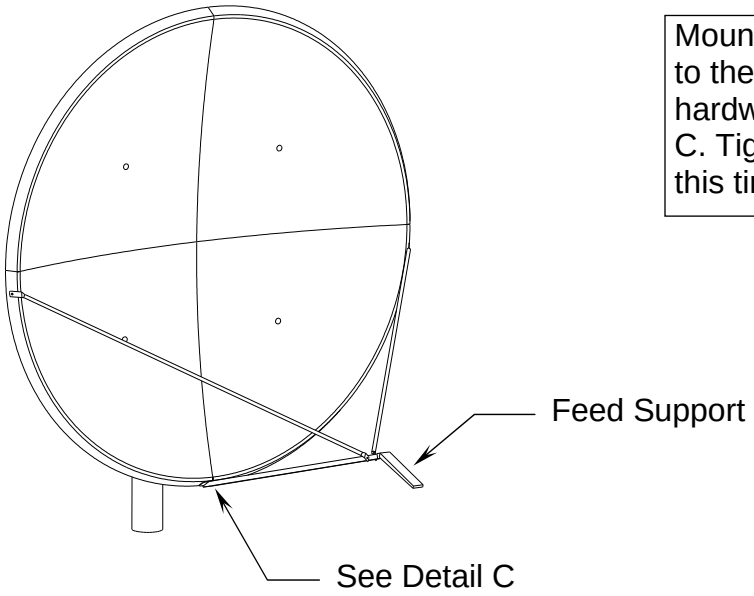

**STEP 2:**

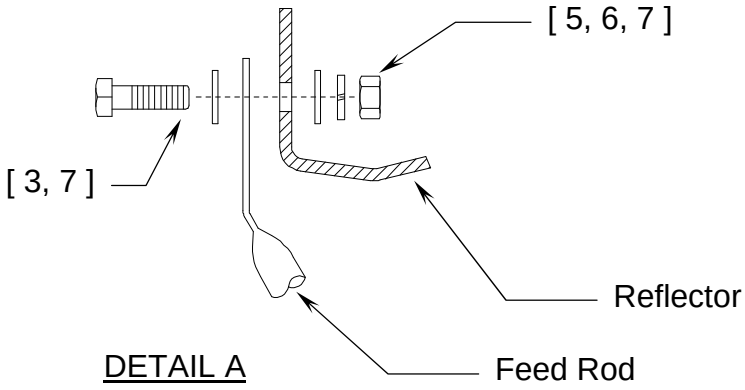
Position the feed support (item 2) in front of the reflector as shown and attach to the to ends of the feed rods with 5/16” hardware (items 4, 5, 6, 7).
See Detail B.



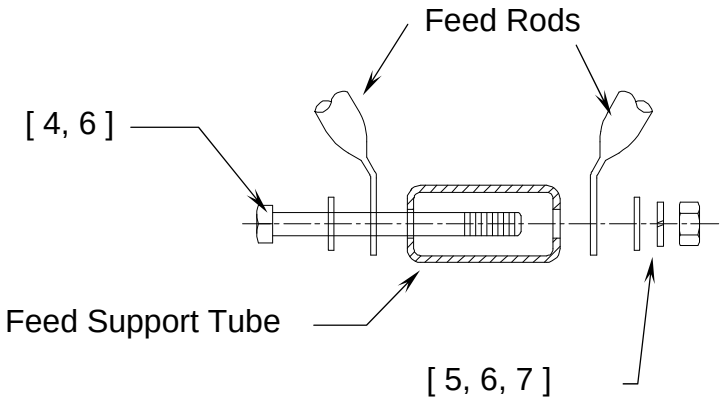
**STEP 3:**

Mount the other end of the feed support to the bottom of the reflector with 5/16" hardware ( items 3, 5, 6, 7 ).See Detail C. Tighten all feed support hardware at this time.

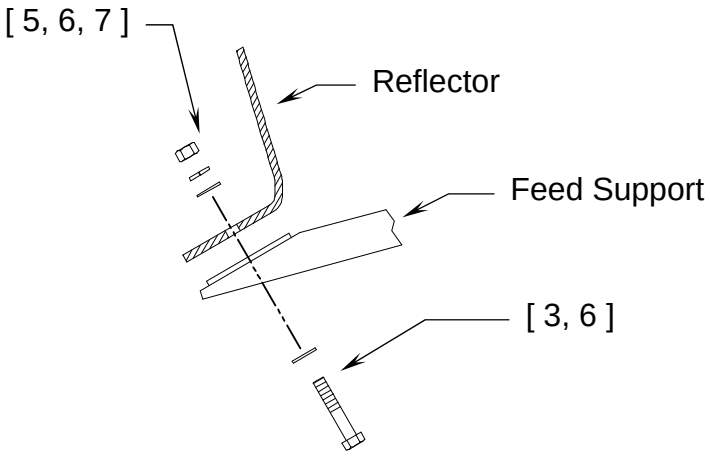



DETAIL A




DETAIL B




DETAIL C

## SECTION IV ANTENNA TRACKING CONTROLLER SET-UP

### 4.0 ANTENNA CONTROLLER UNIT SET-UP

General Dynamics recommends referring to the manual included with the controller for wiring and set-up instructions.

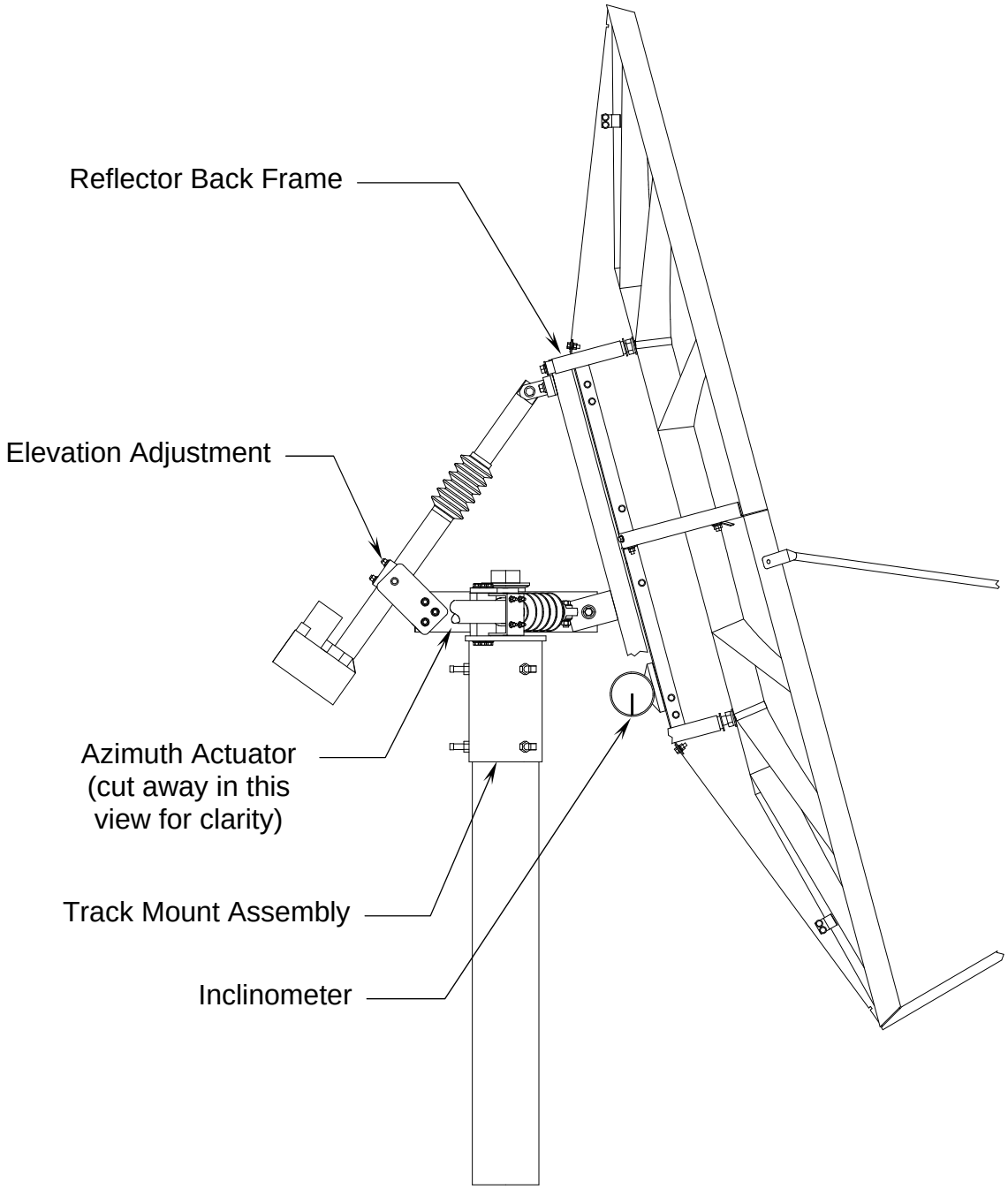

Reflector Back Frame
Elevation Adjustment
Azimuth Actuator
(cut away in this
view for clarity)
Track Mount Assembly
Inclinometer

Figure 5

# SECTION VI MAINTENANCE

## 5.0 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.

## 5.1 PERIODIC INSPECTION

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

NOTE: After any very severe weather conditions, 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 with no failure signs in foundation.

4) Check for corrosion - on the reflector structure and mount.

## 5.2 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 recommendations involving reflector repair.

## 5.3 MOUNT AND REFLECTOR SUPPORT STUCTURE

The mount and reflector support structure supplied with this antenna is of steel construction and has a hot-dipped galvanized finish.

If inspection shows any signs 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 cold, zinc-rich galvanizing paint.

## 5.4 FEED AND FEED SUPPORT

The feed support system should be inspected to insure that all hardware is secure. The feed/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 horn. Replace if damaged.

## 5.5 BEARINGS

The bearings should be lubricated every six months by spraying a light oil on the bearings and allowing the oil to saturate onto the bearing.

## 5.6 ACTUATORS

The actuators are designed to provide years of maintenance free service. Although it might be a good to remove the motor housing covers and spray a light oil on the gears of the limit switches.