Steve

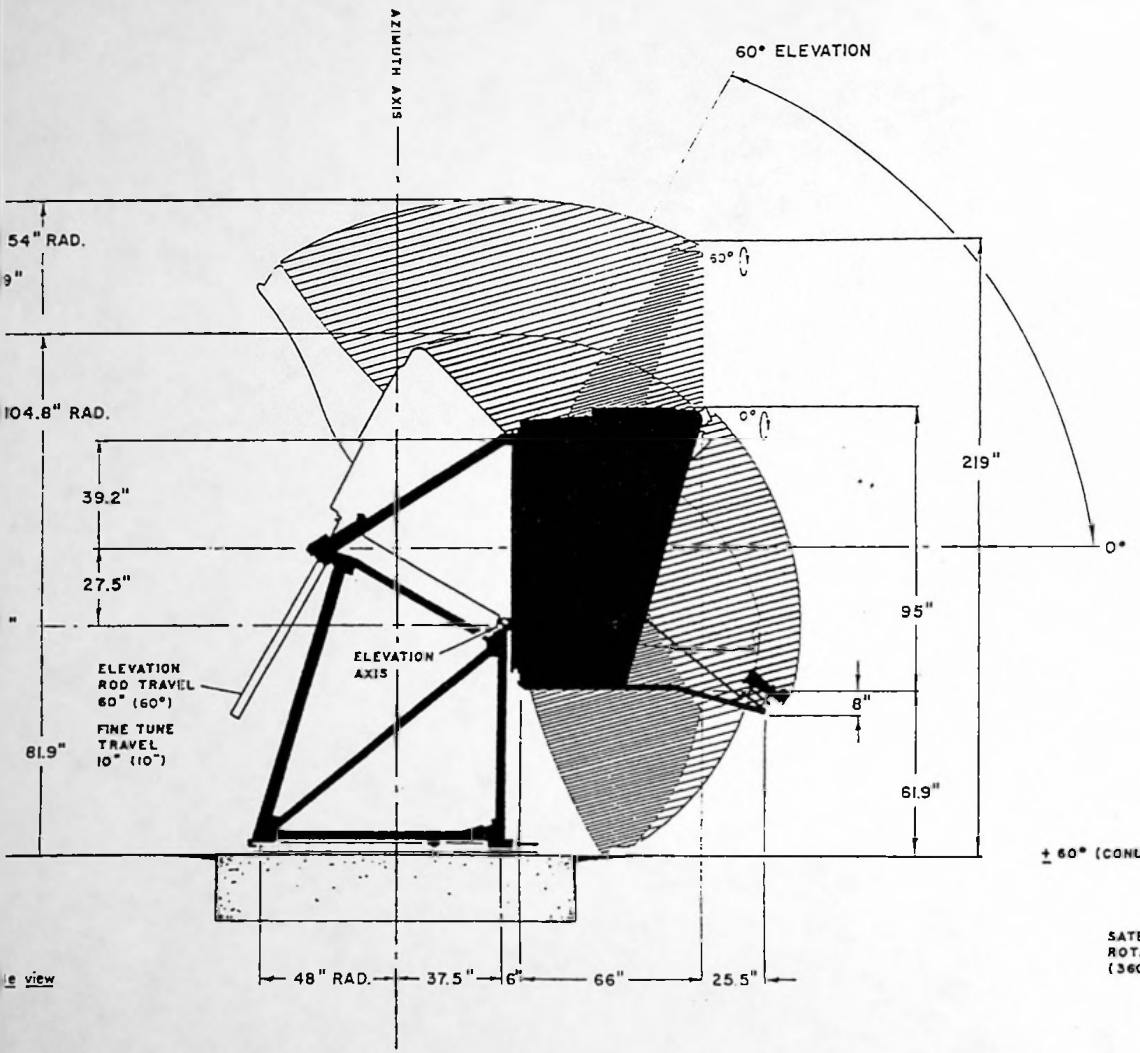
TECHNICAL REPORT #750

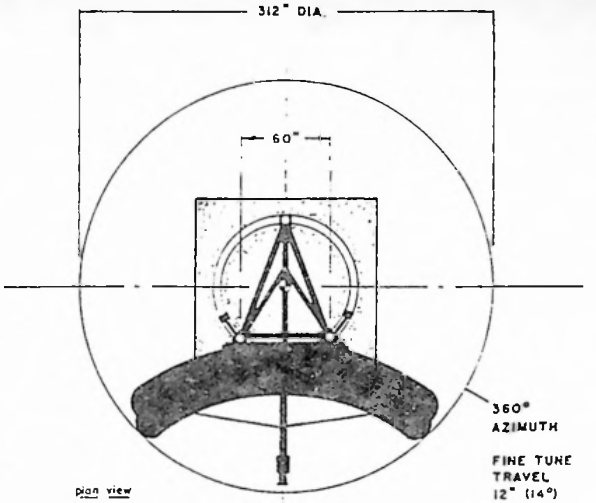
INSTALLATION MAUAL FOR "OFFSAT^{tm}" THE FULL OFFSET ANTENNA (EL/AZ MOUNTED)

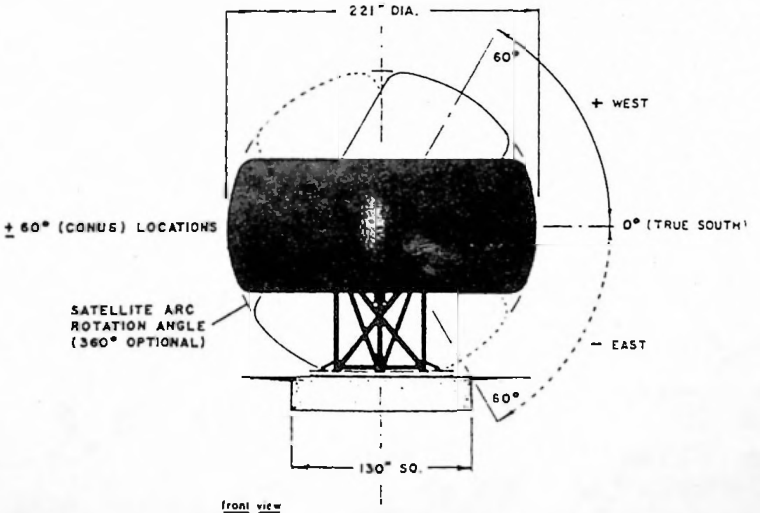
BY:

COMTECH ANTENNA SYSTEMS INC.
3100 COMMUNICATIONS RD.
ST.CLOUD, FL 34769
(407) 892-6111

Revised: Aug. 1990


AZIMUTH AXIS
60° ELEVATION
54" RAD.
104.8" RAD.
39.2"
27.5"
81.9"
ELEVATION ROD TRAVEL 60° (60°)
FINE TUNE TRAVEL 10° (10°)
ELEVATION AXIS
60°
0°
219"
95"
8"
61.9"
48" RAD.
37.5"
6"
66"
25.5"


312" DIA.
60"
360° AZIMUTH
FINE TUNE TRAVEL 12" (14°)
plan view


221" DIA.
60°
+ WEST
± 60° (CONUS) LOCATIONS
0° (TRUE SOUTH)
SATELLITE ARC ROTATION ANGLE (360° OPTIONAL)
- EAST
60°
130" SQ.
front view

FFSAT EL-AZ

COMTECH ANTENNA SYSTEMS INC.

WARRANTY POLICY
(continued)

For shipment of equipment to our Service Department, please use the following procedures so that we may provide fast, efficient service.

Please phone (407) 892-6111 to obtain a Return Material Authorization (RMA) number and shipping instructions. It is imperative that you obtain a RMA number for ALL returns as our Receiving Department will refuse delivery of equipment without the number clearly displayed on the outside of the shipping carton.

TERMS AND CONDITIONS:

Payment Terms - Net 30 days (with approved credit)

F.O.B. Point - ST. CLOUD, FLORIDA

Returns and Restocking:

1. No returns will be accepted unless identified by RMA number obtained from CASI authorized Sales or Customer Service Personnel.

2. Returns must be prepaid.

3. A 20 percent restocking charge will be applied to items returned for credit. No credit will be iussed for special items, or items in buyer's possession more than six months.

4. Prices subject to change without notice.

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TECHNICAL REPORT #750

INSTALLATION MANUAL FOR OFFSAT^{tm} THE FULL OFFSET ANTENNA EL/AZ MOUNTED

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MOUNT ASSEMBLY

847131	(Rev. A)	MOUNT ASSEMBLY
843712	(Rev. E)	FOUNDATION

REFLECTOR ASSEMBLY

847132	(Rev. D)	REFLECTOR ASSEMBLY

FEED ASSEMBLY

847116	(Rev. I)	FEED & SUPPORT, "C" BAND
847124	(Rev. B)	FEED ASSEMBLY - MANUAL "C" BAND
847125	(Rev. D)	FEED ASSEMBLY - MOTORIZED "C" BAND

SECTION I

GENERAL INFORMATION

1.1 SCOPE

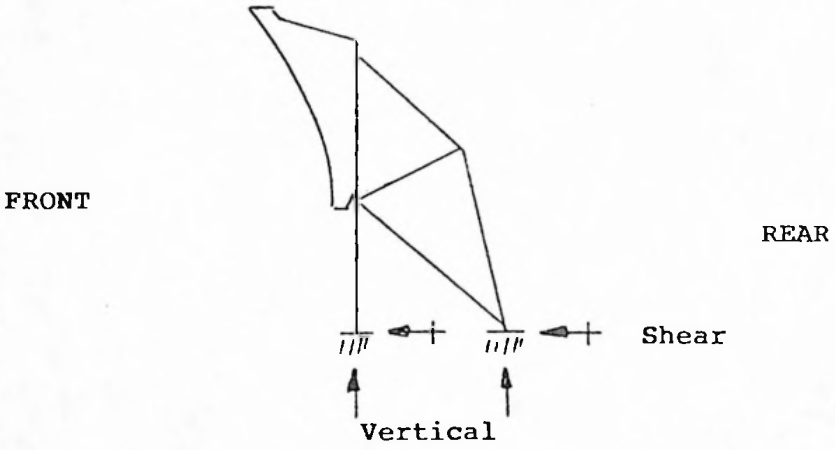
The "OFFSAT^{tm}", a full offset antenna, manufactured by COMTECH ANTENNA CORP., is intended for use in the 4/6 GHz satellite frequency band. This antenna provides quality performance, at low cost, while meeting, without exception, the F.C.C.'s revised version of Section 25.209 of the commissions rules. This revision was released on August 16, 1983 and is part of the "Report and Order" in CC Docket No. 81-704, FCC83-184.

1.2 SYSTEM DESCRIPTION

The COMTECH "OFFSAT" antenna system consists of a fully offset fed, rectangular parabolic reflector, special pyrimidal feed, and heavy duty El/Az pedestal with fine adjustment devices. The pedestal interface is an 8 ft. steel ring which is imbedded in concrete (see Dwg. #843712). Refer to the "OFFSAT" El/Az pedestal base reactions for detail load conditions if roof mounting this antenna is considered (Figure 1-1).

COMTECH ANTENNA CORPORATION

OFFSAT PEDESTAL BASE REACTIONS



WIND SPEED	EA. LEG LBS. SHEAR	VERTICAL (LBS.)* FRONT LEGS	REAR LEG
100 MPH	3,600	4,860	10,100
120 MPH	5,200	6,670	14,500

*INCLUDES ANTENNA WEIGHT: 1,800 LBS.

Figure 1-1

SECTION II

SITE PREPARATION AND SUGGESTED ANTENNA PAD

2.1 SITE SELECTION

The prime consideration in the selection on an earth station is assured unencumbered and unthreatened access to all geostationary satellites of current or anticipated interest. A visually satisfactory site may be further verified by a frequency coordination facility for all satellites of interest using the azimuth and elevation of each selected signal source.

Refer to COMTECH ANTENNA CORP. Dwg. #843712 in Appendix I for detailed suggested foundation design.

Investigate all real estate aspects that affect or may affect antenna location and function, including local zoning, setback requirements, possible construction, natural variables such as trees - their growth patterns and availability for trimming or removal, surface drainage, buried utilities, physical security, power transmission lines, power distribution cables, etc. Check requirements for state and local permits and restraints. Obtain and post all required permits on site in a visible and protected location.

Having selected and validated the site, locate the antenna foundation so that overall cable run to the electronics is as short as possible.

2.2 SITE MAKE-READY - TOOLS AND MATERIALS

The materials and tools for preparing the suggested antenna pad (concrete foundation) shall be furnished by the customer. The azimuth ring assembly is provided as part of the antenna package, and may be delivered in advance.

2.2 SITE MAKE-READY - TOOLS AND MATERIALS (continued)

A. Foundation Tools:

Backhoe
Concrete vibrator
(1) 4' Mason's level
Saw (hand or power)
(1) Shovel
(1) Rake
(1) Wire Brush
(8) C-Clamps 5" - 6"
(1) Trowel
(1) Wooden float
1 Set hand tools including adjustable wrench and hammer

B. Foundation Materials:

Lumber: (4) 2" x 8" x 12'
(4) 2" x 6" x 12'
(1) 2" x 6" x 5' with 1" hole in center
(2) 4" x 4" x 12'
(2) 2" x 4" x 8'
(44) 10'-4" cut pieces of #4 (½") Rebar
(250) Rebar ties (lashing wire)

*10 Cubic yards 2500 psi concrete
(2) Cans, WD-40 Lubricant
(1) Quart 30 weight oil
(1) Can Devcon-Z (for touch-up)
Nails
Rags

*For 10'10" x 10'10" pad with 26" depth.

Increase amount of concrete if deeper foundation is to be installed. Add 1 cubic yard of concrete for each 2-½" of additional depth.

2.2 SITE MAKE-READY - TOOLS AND MATERIALS (continued)

C. Minimum Manpower Requirements:

Foundation - 2 men

Azimuth ring - 2 men

D. Surface Cleaning:

Use the backhoe to clear and level the area for the concrete pad. Scrape a 12' x 12' level area for the excavation, and if possible, a 16' diameter or larger flat area for assembly of the reflector.

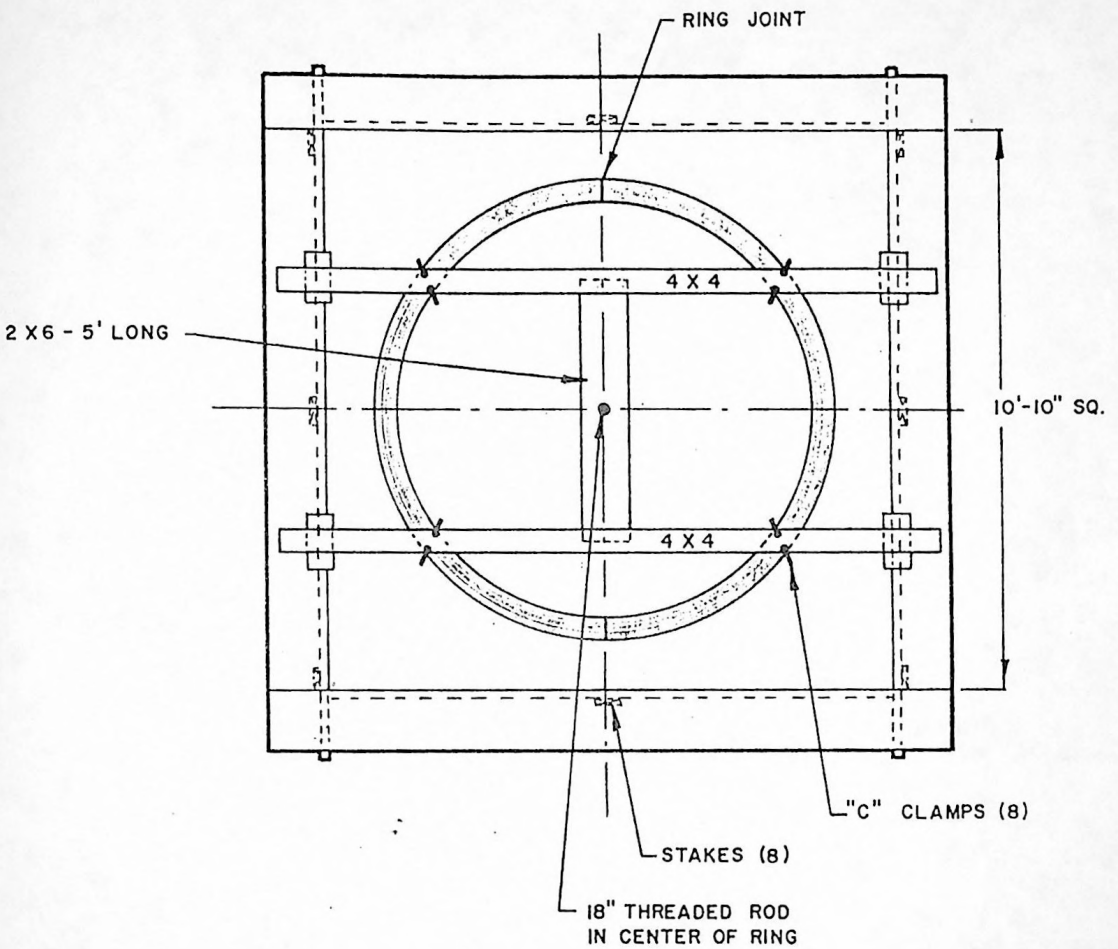
2.3 FOUNDATION FORMWORK AND EXCAVATION

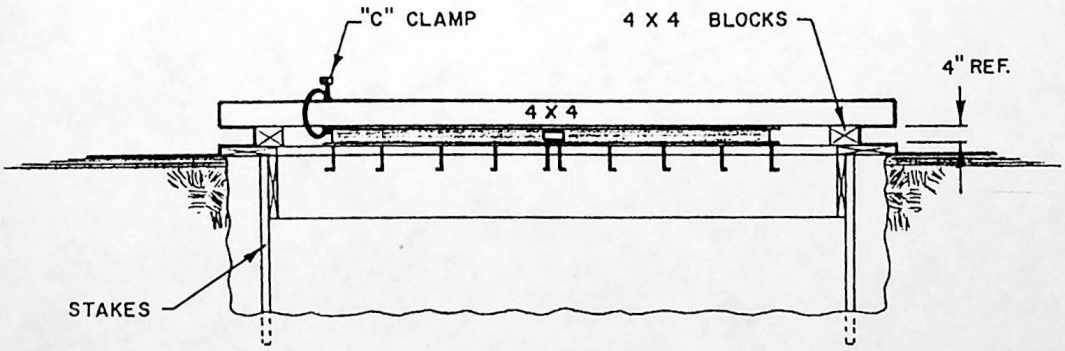
With the backhoe, excavate an area enclosed measuring 12' x 12' square to a depth of not less than 24". The depth may be increased as required to get below the frost level; however, under no circumstances may the depth be reduced to less than 24". Use the hand shovel to manually trim and clean the excavation to the specified dimemsions.

Using the four 2" x 8" x 12' planks construct a square form with interior dimensions of 10'10" by 10'10" and 8" deep. Leave two of the planks in the full 12' length to steady the form and prevent its slipping into the excavation.

Position the form in the excavated area. Using the mason's level, make certain that all four sides of the form are level. Secure form firmly in place using the 2" x 4" lumber for stakes and braces. The concrete pad shall be installed on undisturbed soil.

Cut and fit the four 2" x 6" x 12' planks to provide a horizontal facing to the top of the form on all four sides. This facing provides added stiffness to the formwork and a 6" wide wood surface on all sides. Install facing flush with interior edges to form so that the 10'10" x 10'10" interior dimensions are maintained, and the effective depth of the formwork (thickness of concrete pad) is increased to 26". See Figure 2-1 for details.





FOUNDATION FORM & RING PLACEMENT

FIGURE 2-1

2.3 FOUNDATION FORMWORK AND EXCAVATION (continued)

NOTE: Prefabricated metal forms, that will serve the same purposes and produce the same end result, may be used if available.

2.4 BOTTOM REBAR INSTALLATION

Install 22 of the precut, 10'4" long pieces of #4 rebar, 11 pieces in each direction, spaced 1' apart and 3" from each wall of the excavation, as shown in Figure 2-2. Securely tie the rebars together at each point where they cross.

2.5 AZIMUTH RING ASSEMBLY AND SUSPENSION

Place the two sections of the azimuth ring in the excavation on top of the assembled bottom rebar.

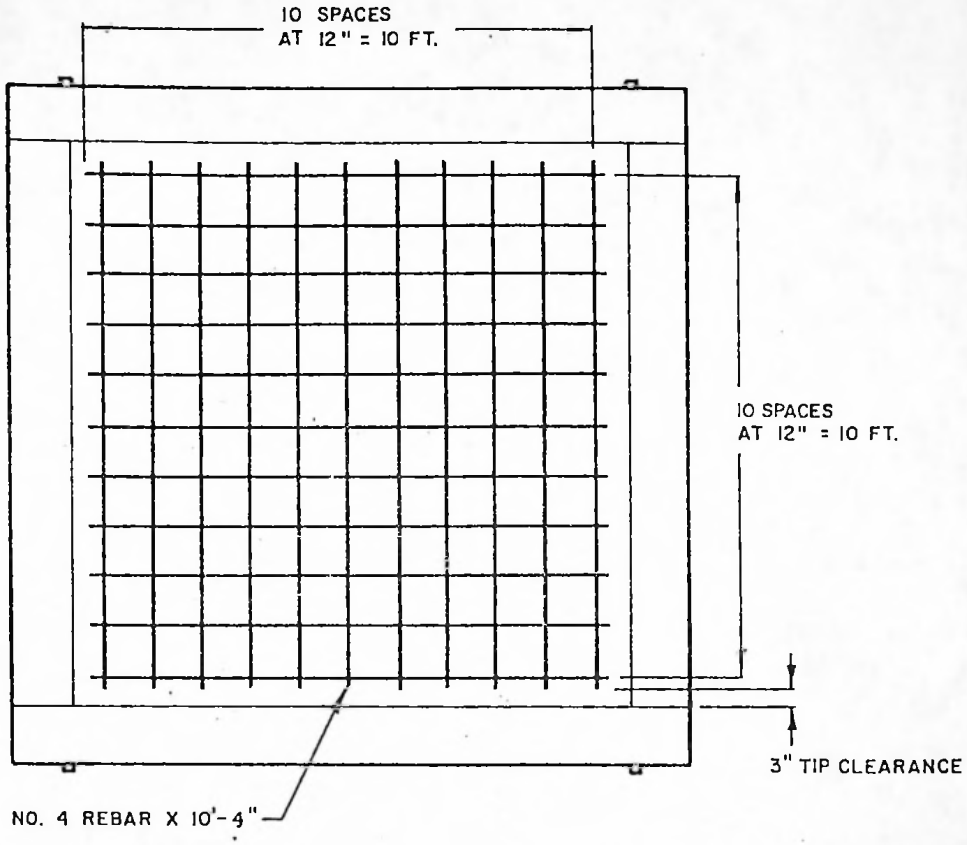
Join the two ring sections together using the joining plates and 3/8" bolts provided; use one square plate on each side of the ring at each joint. Use C-clamps if necessary to obtain smooth, flat joints on the top face of the ring joints so that unimpeded rotation of the antenna mount is assured.

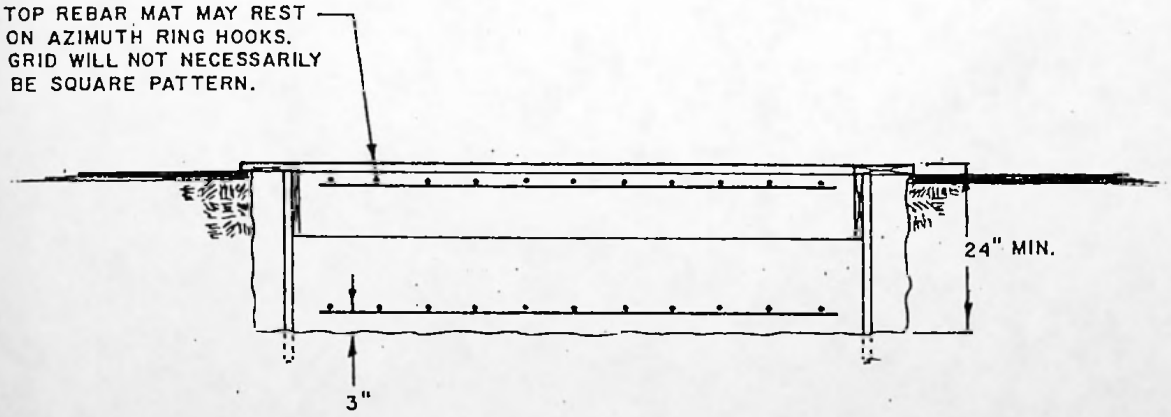
Tighten all ring joints bolts/nuts.

Align azimuth ring so that each ring joint faces the center of the adjacent wall. Center the ring in the excavation.

With two men in the excavation, raise the ring and C-clamp the assembly to the 4 x 4 cross timbers cut for this purpose. Center azimuth ring 14 inches from each side of form. Block up all four ends of the cross timbers with 4 x 4 x 4" blocks so under side of ring is flush and level to top edges of forms.

Using the mason's level, verify that ring top surface is level and flat.





REBAR PLACEMENT
FIGURE 2-2

2.6 TOP REBAR INSTALLATION

Using the remaining 22 precut, 10'4" long, pieces of #4 rebar, assemble a second 11 x 11 grid through the anchor hooks attached to the bottom of the azimuth ring. Form a grid so as to distribute the rebar as uniformly as possible over the entire area; the formation of a square or uniform pattern is secondary to thoroughly interlocking the rebar with the anchor hooks of the azimuth ring. Using the rebar ties, lash all points where the rebar contacts the anchor hooks or other rebar.

2.7 CENTERLINE PIVOT

Install the 2 x 6 x 5' plank as shown in Figure 2-1. Measure from the ring edges to 1" hole and adjust plank until hole is in the center of ring $\pm$ 1/8". Clamp or nail plank in place. Install 1"-8x18" thread rod in hole (see Fdn. Dwg. #843712).

2.8 CONCRETE POURING MAKE-READY

Raise bottom rebar grid and place stones or short blocks of 2" x 4" under the grid to hold it 3 to 4 inches away from the bottom so that the concrete mix can flow under and around the grid.

To prevent concrete from adhering to the azimuth ring, coat the ring with light-weight (20-30W) motor oil. Use a rag to wipe on a thin coat of oil. Do not allow the oil to get on the bottom of the ring which will be contacting the poured concrete.

Recheck the azimuth ring from all angles to verify that it is level and that both ring joints are even and tight.

2.9 CONCRETE POURING

CAUTION: Use extreme care while pouring the concrete so as not to disturb the position and level of the azimuth ring.

Guide the concrete truck delivery chute to first pour the four corners, in any convenient order, then the center of the ring, and finally around the outside of the ring and the top of the form.

Use the electric concrete vibrator while pouring the concrete to assure a good flow over and around the rebar and ring anchors, and to eliminate trapped air.

NOTE: A slight conic rise to the center of the ring will promote better run-off of water through the joint gaps in the azimuth ring.

CAUTION: Do not over vibrate the concrete mix as the aggregate will tend to settle in the concrete.

Upon completion of the concrete pouring, make final check of azimuth ring for level. Adjust as necessary.

Finish concrete surface as desired.

Remove concrete splattering from exposed surfaces of the azimuth rail.

Cover concrete with burlap and keep damp for two to three days. Secure area as much as possible for at least the first 18 hours of curing time.

After 18 hours, the formwork may be removed, and the foundation back-filled as desired.

SECTION III

ANTENNA ASSEMBLY

3.1 GENERAL

As soon as the concrete antenna pad has cured sufficiently, the formwork removed, and the azimuth ring cleaned, the antenna mount can be assembled on the azimuth ring. The reflector will be hoisted into place after the mount assembly is completed. The appropriate feed is installed after the reflector is mounted.

3.2 MOUNT ASSEMBLY

All parts and pieces required for mount assembly are provided. These parts and pieces are enumerated in COMTECH ANTENNA CORP. Dwg. #847131. The hardware required to install the reflector on the mount is included in this drawing. The mount assembly is accomplished most efficiently by two persons working together.

Mark an approximate azimuth indication of the selected satellite on the azimuth ring. Install the front support posts (Item #12 and 13) 60" apart centered on this azimuth mark. Beginning with the left-hand post, install clamp (Item #1). Install with the post blades pointing inward toward the center of the ring and to the right. Install second post clamp and tighten clamp bolts (Items 27, 28, 29). Repeat with right-hand post (Item #12); post blades will point inward and to the left. All bolts are to snug tight only to insure that the mount will not move when the dish is installed.

Join the two front posts by installing the angle (Item #9). Attach this angle as shown in the drawing to tie the bases of the front support posts together, using 2/4"-10-2" bolts, nuts and flatwashers (Items #34, 35, 36).

3.2 MOUNT ASSEMBLY (Continued)

Tighten to finger tightness. This angle installs on the same blades with the same bolts as the bottom ends of the diagonal braces (Item #7).

Diagonals (Item #7) should be installed simultaneously. Install the two diagonals between the top of each front post and the base of the other as shown in the drawing.

Either angle is installed on the front side of the attachment blades with the other angle facing opposite. Use 3/4" x 2" bolting hardware (Items #34, 35, 36) to attach all 4 ends. These two diagonals are bolted together where they cross at Detail B; the space between is filled with 3 washers.

Tighten to finger tightness.

Assemble the back support post (Item #17) to the azimuth ring in the same manner as for the front support posts. Position back post on ring as shown in the drawing. Install both post clamps (Items 1) and secure with 1/2"-13 x 2" bolts, nuts and lockwashers (Items #27, 28, 29). Finger tighten.

Install horizontal braces & tie angles (Item #5) between the back support post and each of the front support posts as shown. Install these angles on the outer faces of attachment blades with the angle legs facing outward. Use 3/4"-10 x 2" bolts, nuts, and flatwashers (Items #34, 35, 36) at all joints. Finger tighten.

Assemble the two halves of the elevation rod clamp, (Items #5 and 6) using four hex head 3/8"-16 x 1-1/2" cap screws, hex nuts, flat and lockwashers (Items #15, 16, 17, 18). Install clamp on elevation adjusting rod (Item #3) near the mid-point of the rod and tighten clamp bolts to finger tight.

Install rod and clamp onto the back support post as shown. Position mounting blade at top of back support post between the double attachment blades of

3.2 MOUNT ASSEMBLY (continued)

the rod clamp, and secure with a 5/8 - 11 x 2" hex bolt, and elastic stop nut (Items #22, 23). Rotate elevation adjusting rod until it is approximately parallel to the back support post and tighten bolt and elastic stop nut snugly.

Defer final tightness of all mount bolts/nuts except post clamp bolts/nuts until the reflector has been installed and the mount has been allowed to adjust to the full operational weight of the reflector. Firmly tighten bolts/nuts of both clamps on each of the three support posts to stabilize the base of the mount before reflector installation.

Install the antenna mounting plates (Items #14, 15, 16), using the 5/8-11 x 2" long bolts and locknuts provided (Items #25 & 26).

Assemble the fine adjustment elevation and azimuth rods according to the details shown on the assembly drawing and Figure 3-1.

3.3 REFLECTOR PREPARATION

The OFFSAT reflector (Dwg. #847132) is shipped in one piece and, therefore, requires no further assembly. Attach the 80" polarization ring to the back of the reflector if not already on. Do not attach feed and support until the reflector has been secured to the mount.

Because of the approximate 1,000# weight of the reflector and ring, the use of a crane is suggested to install the reflector on its mount.

The reflector should be lifted using a 3 cable arrangement as show in Figure 3-2. Cables must be 1/4" or larger and eyes secured with either swagged or bolt type wire clips. Cables are attached to the reflector with 3/8" closed type eye bolts. Use flatwashers and nuts when securing eyebolts to the reflector. Lifting the reflector with the described cable arrangement will tilt the interface ring to approximately a 60° elevation angle. This will assure easy attachment to the El/Az mount which has a 60° max. elevation adjustment.

3.4 REFLECTOR INSTALLATION

Using a small crane or other lifting device (load is 1,000#), lift the reflector, with ring attached (Dwg. #847132), and position over the completed mount assy. Attach the two bottom antenna mounting plates to the steel ring using the 1/2" x 1-3/4" bolts and lockwashers provided for on the mount assy. dwg. (Items 23 & 24).

(3) AFTER CABLE CLAMPS ARE SECURE, TURN 1" HEX NUT, PUSHING DISK DOWN, THEREBY TIGHTENING ALL 3 CABLES.

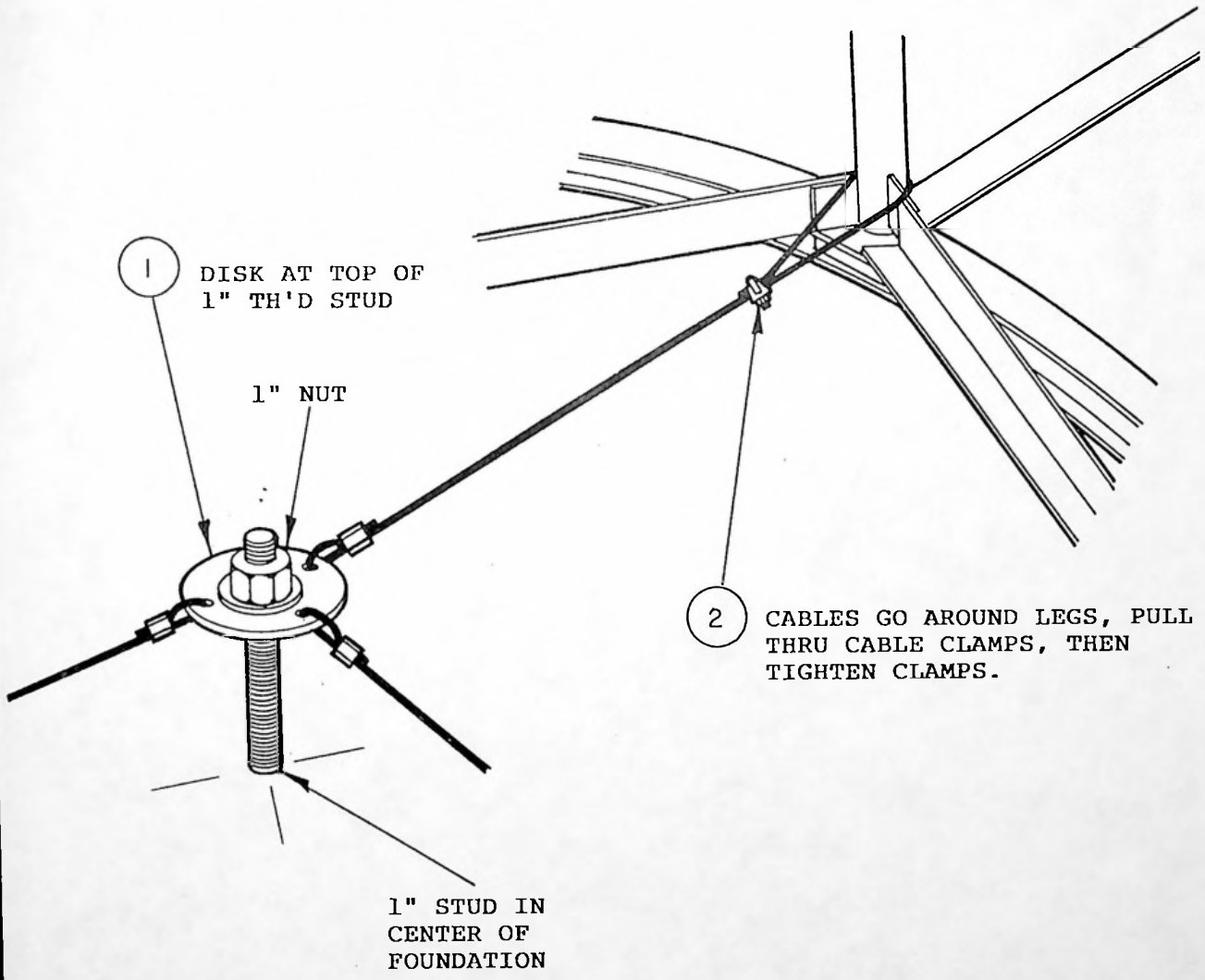
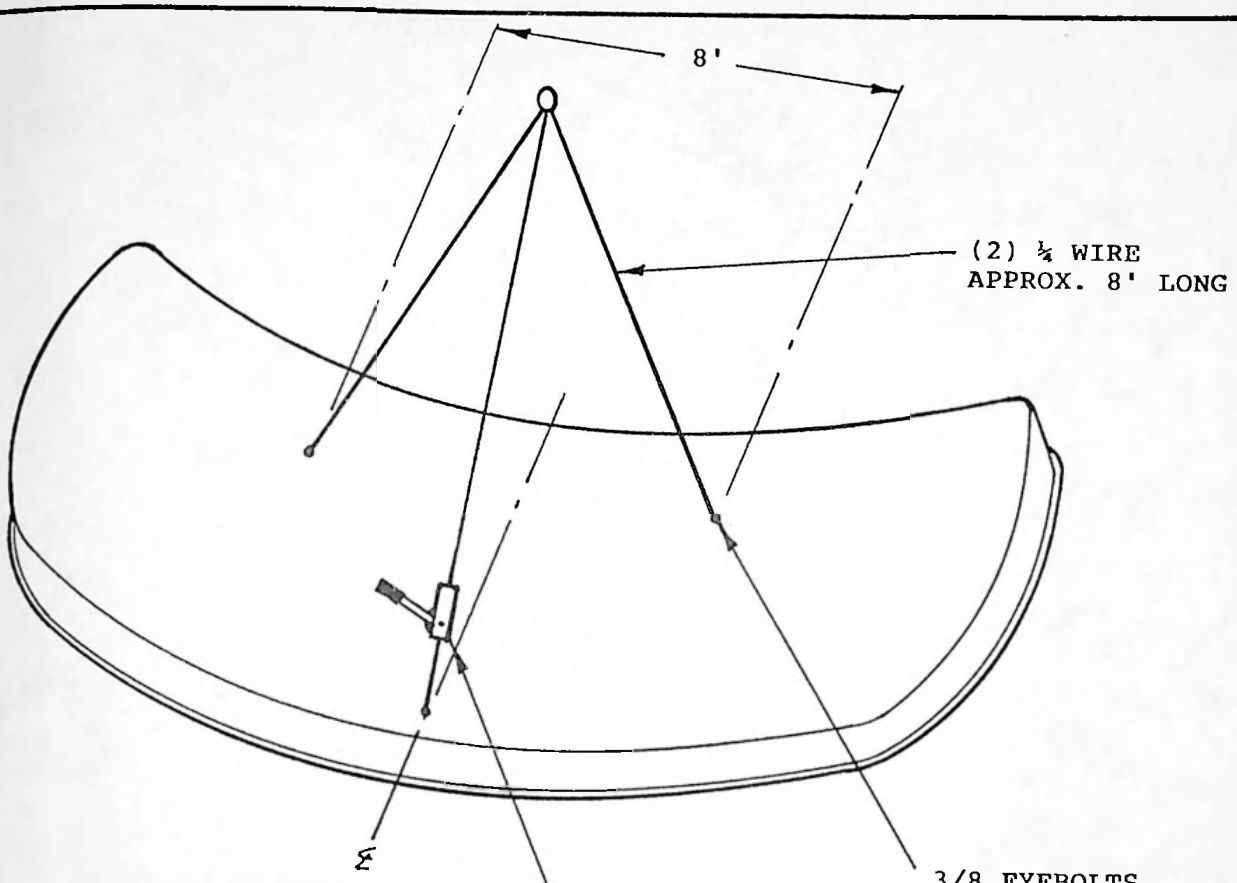
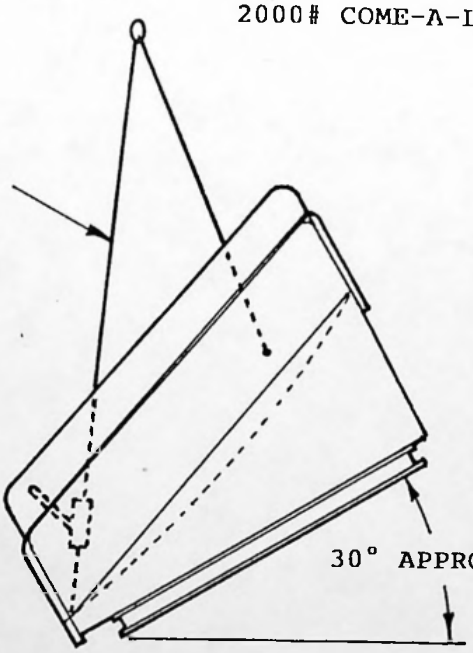


FIGURE 3-1



ARRANGEMENT



LIFTING

NOTE: 7/16" DIA. HOLES USED FOR LIFTING ARE PRE DRILLED IN REFLECTOR

LIFT CABLE ARRANGEMENT
FIGURE 3-2

3.4 REFLECTOR INSTALLATION

Move the elevation pipe to align the top antenna mounting plate with the remaining holes in the reflector ring and secure with the same ½" bolts. Detach lifting cables from reflector and tighten all mount hardware permanently except the elevation and azimuth adjustments.

SECTION IV

FEEDS SYSTEMS

4.1 GENERAL

Special two or three port transmit/receive feeds are available for this antenna. The three port (transmit/receive/receive) feed is normally used when transmit and receive polarizations are alike.

Basic feeds come preassembled and need only to be attached to the support spar before mounting to the reflector. Please refer to Fig. 4-1 & 4-2 for detail feed positioning. It is absolutely necessary that feeds are located properly to assure optimum antenna pattern characteristics.

4.2 INSTALLATION

Refer to Dwg. #847116 for the general assembly drawing showing the feed arrangements. The folding spar, shown, is used only on the transportable antenna package.

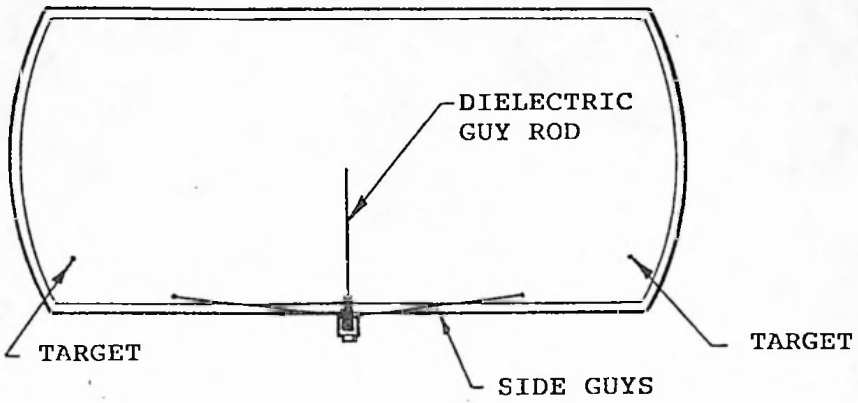
Bolt the feed spar to the reflector edge with the ½" stainless steel bolts provided. Attach both feed support guy wires to the holes along the lower edge of the antenna (these holes are approximately 117" apart). Tighten these guys and measure from the reference targets to the feed spar to align spar properly.

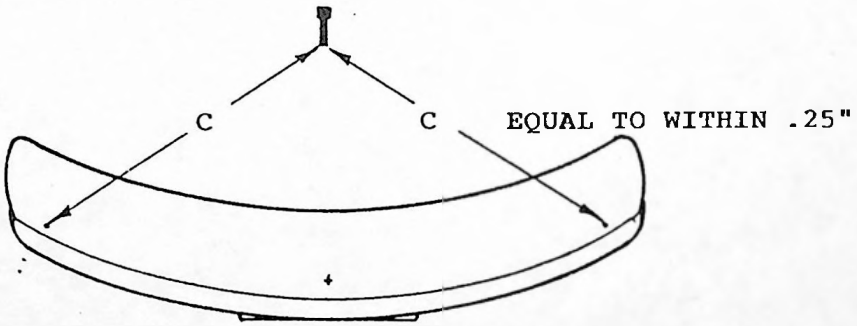
Install the ¼" dielectric guy rod from the center hole in the reflector to the hole provided on the feed horn bracket.

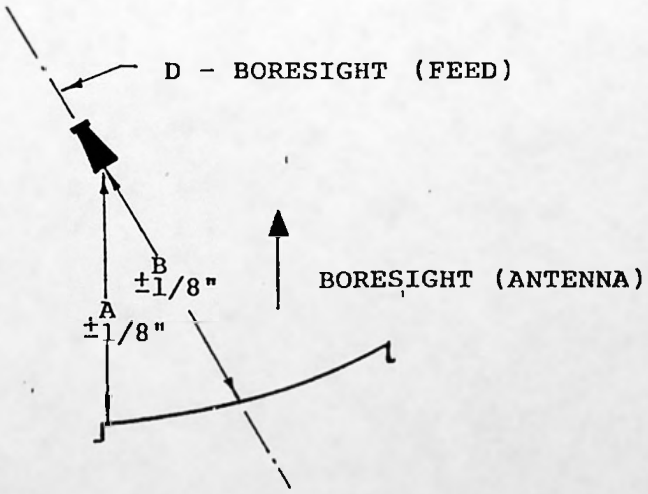
Install feed and align according to Figure 4-1.

Install LNA's or filters and waveguide as necessary.

FEED ALIGNMENT







A = Vertex to window on ℄ horn = 75.25
B = Center hole in antenna to window on ℄ horn = 82.0
C = Equal distances target to horn.
D = Boresight horn to center hole in antenna.
Both side guys may be tight; lock turnbuckles.

FIGURE 4-1

SECTION V

ALIGNMENT & OPERATION

5.1 GENERAL

The **OFFSAT** antenna and mount system has three axes of alignment adjustment. The elevation and azimuth adjustments are similar to most mounts, the third axis allows rotational movement of the reflector and feed. This rotational movement is necessary to position the long centerline of the reflector, tangent to the geostationary satellite arc (see Fig. 5.1). Notice this same rotational movement positions the dual feed ports at the proper polarization angles.

To find the reflector rotation angle, from horizontal, use the following formula:

$$\text{TAN } \theta = \frac{\text{sin. local H.A.}}{\text{tan. site lat.}}$$

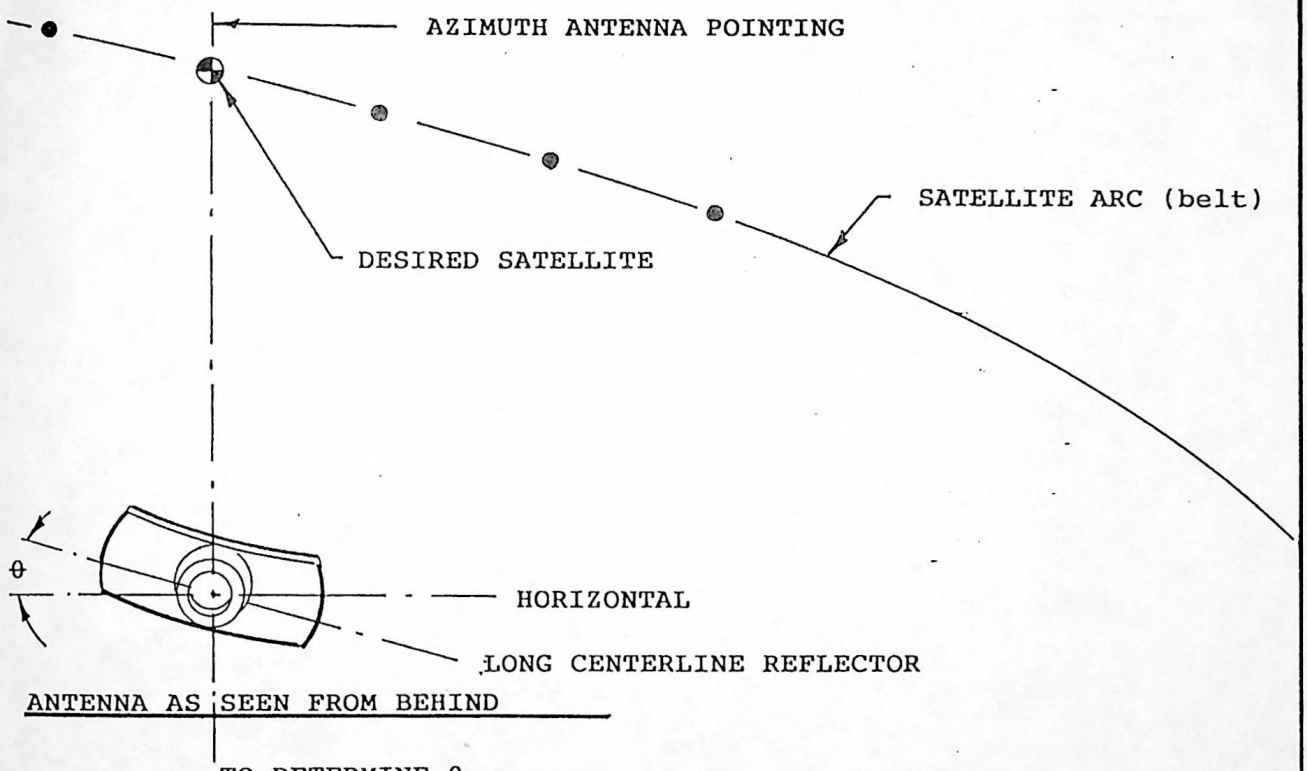
Where local H.A.=diff. between sat. lon. & site lon.

5.2 ALIGNMENT

The mount was assembled with the approximate azimuth position known and should be within $\pm$ 5° at this time.

Adjust elevation of the antenna by extending the elevation pipe by hand or using a come-a-long until the approximate elevation angle is measured on the back of the dish ring. Further elevation adjustments will be made using the fine adjustment rod clamped to the elevation pipe.

Before looking for the satellite, position the reflector in proper rotation for the desired satellite (see Fig. 5.1). Rotate reflector by first loosening the clamps holding reflector to ring, then attach a come-a-long from the 4" hole in the fiberglass support ring to a top reflector mounting plate on the steel ring. You will be pulling the antenna up to rotate, not down. The



TO DETERMINE θ

$$\text{TAN } \theta = \frac{\text{SIN. LOCAL HA}}{\text{TAN. SITE LAT.}}$$

EXAMPLE:

SITE, ATLANTA, GA to F-3R (131°)
LONG. SITE = 84.5° LAT. SITE = 33.75°

LOCAL H.A. = 131 -84.5 = 46.5°

$$\text{TAN } \theta = \frac{.7253}{.668}$$

TAN θ = 1.0857
θ = 47.35°

FIGURE 5-1

5.2 ALIGNMENT (continued)

come-a-long should be attached on the side of the reflector which will go up to do this. The steel ring is marked in 10 degree increments for this purpose with a red indicator stencilled on the reflector. Estimate rotation to within 2 degrees.

Finish the mount alignment by powering the electronics and fine tuning (both elevation and azimuth adjustments). Course polarization is already aligned.*

*Polarization alignment of W-5 only will be approximately 10° in error. Rotate entire reflector to correct this.