REPORT GDC-DCL69-003

NASA CONTRACT NAS 8-21460

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATION

GENERAL DYNAMICS

Convair Division

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LARGE ERECTABLE ANTENNA FOR SPACE APPLICATION

FINAL REPORT
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Prepared by

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SUMMARY

This report presents study results of Contract NAS 8-21460, "Large Erectable Antenna for Space Application," The period of performance was August 1968 through September 1969.

It is the second NASA contract on the parabolic expandable truss antenna (illustrated in Figure 1). In the first study, "Feasibility Study of Large Space Erectable Antennas," Volumes I to IV, 23 February 1968, NAS W-1438, conceptual designs and AAP experiments were developed for evaluation and demonstration of antenna performance characteristics in orbit. An operational sequence for a 100-foot-diameter parabolic antenna experiment is given in Figure 2. Experiment objectives were to demonstrate (1) erection of a 100-foot-diameter, high-quality antenna for microwave frequency ranges; (2) evaluate maximum gain RF patterns - particularly peak sidelobes and noise and temperature; (3) pointing and holding of earth targets, lower orbit satellites, and galactic targets; (4) perform transmission tests; and (5) evaluate man's ability to enhance the performance of and simplify a large electromechanical system.

Phase I of NAS W-1438 (Volumes I and II) evaluated existing concepts including inflatables, petals, automated assembly techniques and several new concepts. At midterm, a four-element HF helical array, horn phased array, and expandable truss paraboloid were selected for additional study. Final concept selection was the parabolic expandable truss antenna. Its selection was further confirmed in a related program, "Large Space Structure Experiments for AAP," NAS 8-18188, November 1967, in which more than 25 concepts from industry and NASA agencies were evaluated. Selection criteria along with a description of the expandable truss antenna are reported in Volumes I and V of that program, with particular emphasis on man's participation.

From these studies, several additional analysis and structural component evaluation tasks were identified for the current study contract (NAS 8-21460). An outline of program tasks summarized in this volume is shown in Figure 3.

Task I tested critical elements of the expandable truss. Three designs of the critical midspan hinge were built and tested. The best joint from simplicity, weight, and tolerance is the carpenter tape (Figure 4). A simple pinch clamp will turn the rigid joint into a hinge with a nearly constant energy spring. A large force release occurs as the flat element reverts to its curved shape releasing a kick force at the optimum time when the mesh load is applied. Teflon bearings were used in end and midspan joints. A column test was then performed on the selected carpenter tape midspan joint and tubular surface strut.

Tricot knit mesh material of both gold-plated Chromel-R (40% Ni; 20% Cr, 10% Fe) (Figure 5) and tin-plated copper were tested in the environmental chamber. No RF degradation occurred. The Chromel-R mesh was also tightly compressed in a container and subjected to a hard vacuum for 30 days. No bonding, permanent creasing, or degradation was perceptable. Additional mesh tests were conducted to determine thermal coefficient of expansion and tensile properties of the selected Chromel-R type mesh.

Task II is an analysis of the antenna feed. Blockage effects from structural members, feed module (air lock, electronics, and attitude control equipment); and docked spacecraft are considered for antenna diameters in the 30- to 100-foot range. Conclusions are drawn in Section 2 for the acceptable dimensions of feed struts, feed module, and docked spacecraft as a function of antenna diameter.

A secondary antenna experiment is also considered in Section 4, deploying a 15-foot antenna from the SIVB Workshop and evaluating its RF and mechanical characteristics (Figure 6).

Task III is a detailed analysis of the deployment dynamics. By use of this computer program a step by step analysis of the deployment energy can be made. Total energy of the starting friction, running friction in the joints, and mesh tightening can be compared to the input spring energy. Total input spring energy is bounded by the lock-up moment developed at closure compared to the tube strength. The carpenter tape mid-joint provides a fail safe feature. If the closure bending moment should exceed the tube strength, the flexible center will buckle elasticly absorbing the energy and then recover to form a continuous tube.

Several methods of slowing deployment were studied to develop concepts compatible with sensitive equipment mounted on the periphery of the reflector. Free deployment is the most reliable system but does result in end "g" loading measured by the tolerance on the spring system. By snubbing the spring energy and reducing the angular momentum in the member a closer control of total energy can be achieved with an accompany reduction in the close "g" on the end members. A prime candidate is a pinball-type snubber that slows the entire deployment motion without reducing the final spring energy. Several other concepts were developed and are presented in Section 3.2.

Task V examined the effects of size changes on facilities technology, and priority scheduling for tooling, handling, and test fixtures needed for antenna test sizes from 30 to 70 feet. A typical manufacturing test cycle is illustrated in Figure 7.

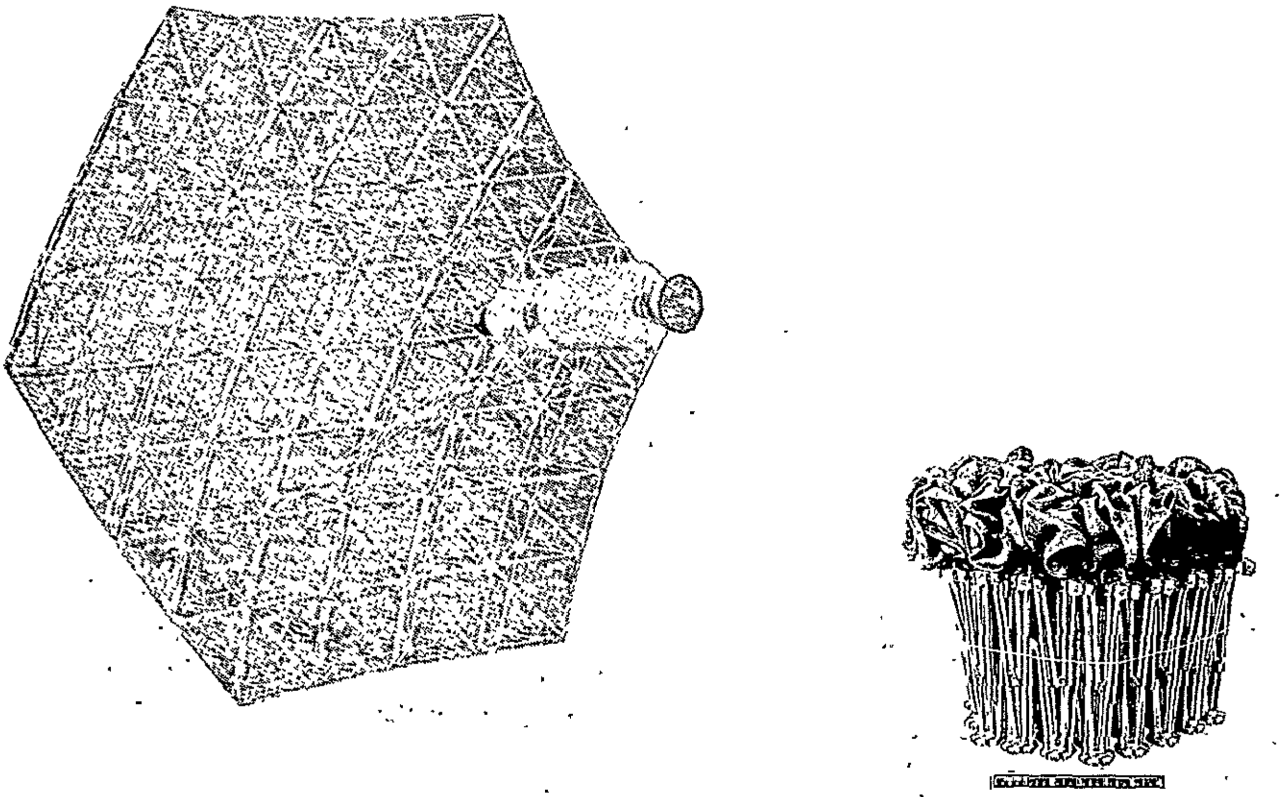
Task VI, a thermal analysis of a 30-foot and 70-foot antenna was performed for the full cycle at synchronous orbit. Results of the thermal and stress analysis computer programs are given in Section 6. Variations can be achieved by varying the thermal coating, effectively dropping the peak distortions while increasing the minimum. A bicoated system with a heat-in coating on the in-facing tubes and a reflective coating on the outer tubes appears to be an optimum. A few sheets of a super-insulation material on each tube could also cause a lower equilbrium condition reducing peak distortions. An $\alpha/\epsilon = 0.22$ will reduce the temperature band to -90° F to -310° F, effectively reducing the differential over the orbit. This substantially reduces antenna distortions. The end result for this study is a completely integrated computer analysis technique that provide a complete thermal, distortion, and best-fit parabola analysis to be made within a short time for any distorted antenna curvature.

A summary of the distortion characteristics for a 30-foot and a 64-foot antenna at synchronous orbit are given in Figure 8. Maximum gain for the best and worst conditions compared with reflector diameter are given in Figure 9. Peak operating frequency for maximum gain is compared with diameter in Figure 10.

The next step in the deployment of the Parabolic Expandable Truss Antenna (PETA) is fabrication and test of a minimum of a four-bay antenna. Two model antennas have been built and demonstrate the deployment feasibility. A larger version in the 30- to 100-foot-diameter range is required to develop the mesh package techniques. Deployment tests, thermal vacuum test, and RF gain, beamwidth, and side lobe characteristic tests would be performed on the flight weight reflector.

Feed boom development to match the reflector is also required. Figure 11 shows one section of an expandable tripod leg. The carpenter tape hinge provides a rigid, zero-tolerance capability for a truss-type boom that is stiff and lightweight and has an excellent packaging ratio.

In conclusion the PETA is the lightest, most rigid, best package volume ratio erectable antenna. It can readily be shaped to different configurations. (See Figures 12, 13, and 14). Large size antennas can fit into available boosters, Table 1. Development of the PETA concept will provide NASA with a versatile structure that can meet many future large spacecraft needs.



DEPLOYED, 74 INCHES

PACKAGED, 9 INCHES

Figure 1. Model of Expandable Truss Antenna Concept (Not to Scale)

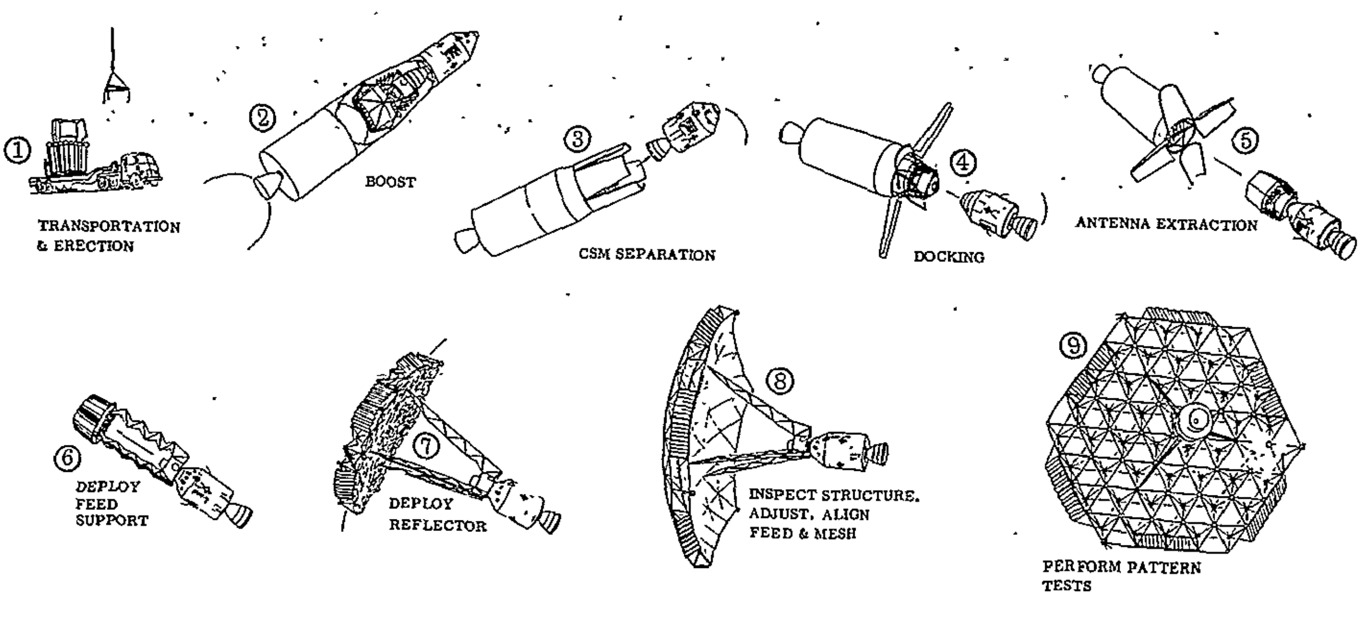


Figure 2. Operational Sequence of a 100-Foot-Diameter Parabolic Antenna Experiment

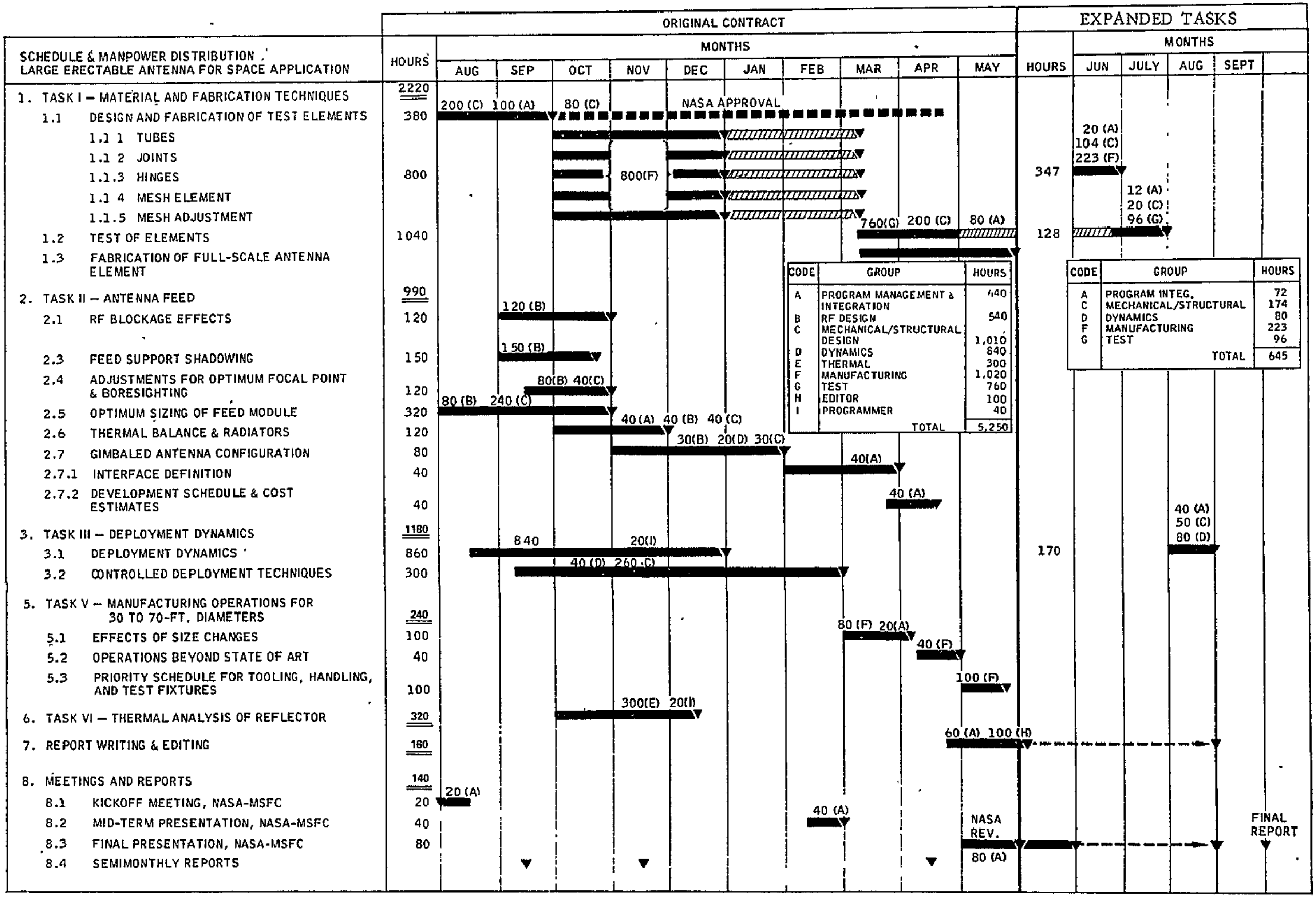


Figure 3. Program Schedule

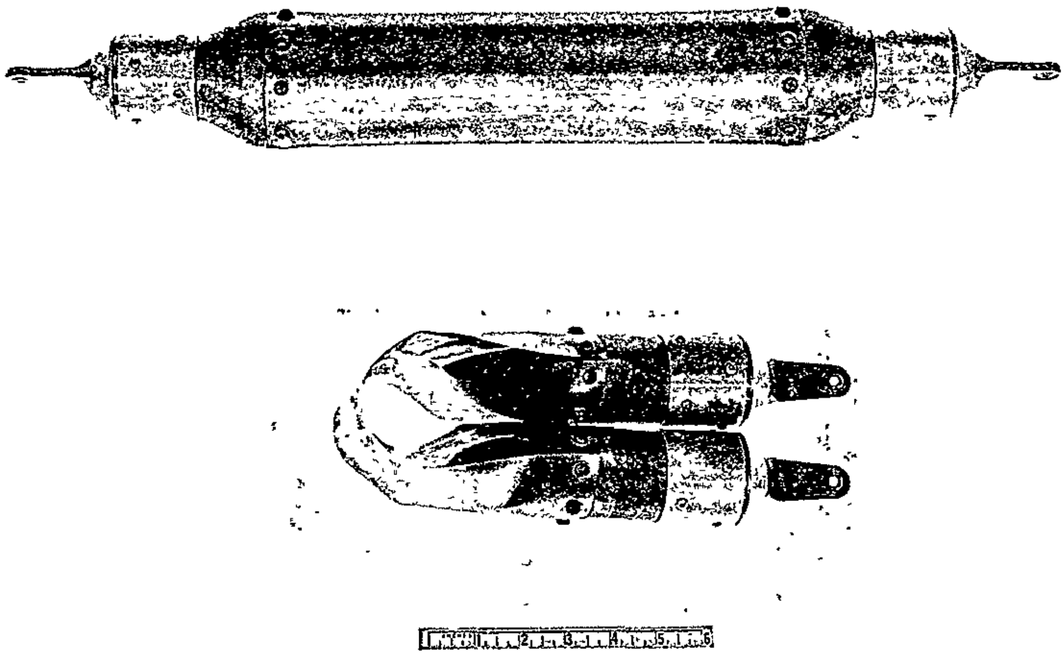


Figure 4. Carpenter Tape Hinge

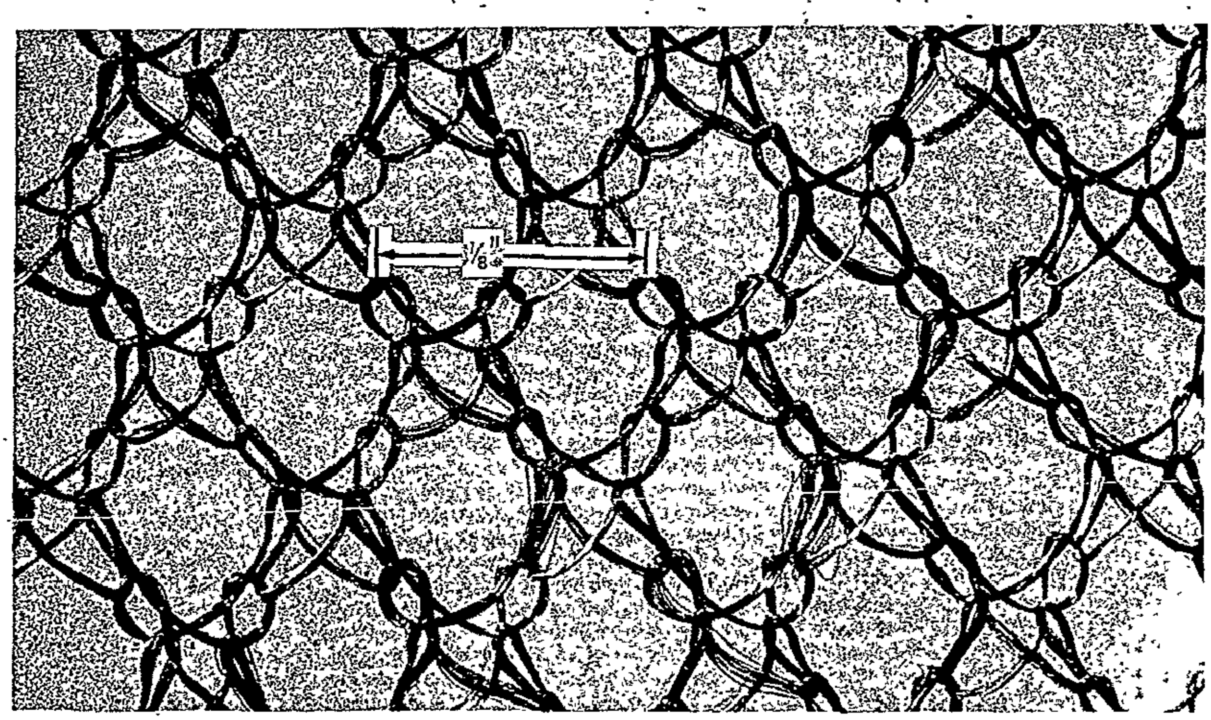


Figure 5. 10X Enlargement of Gold-Plated Chromel-R Tricot Knit Mesh

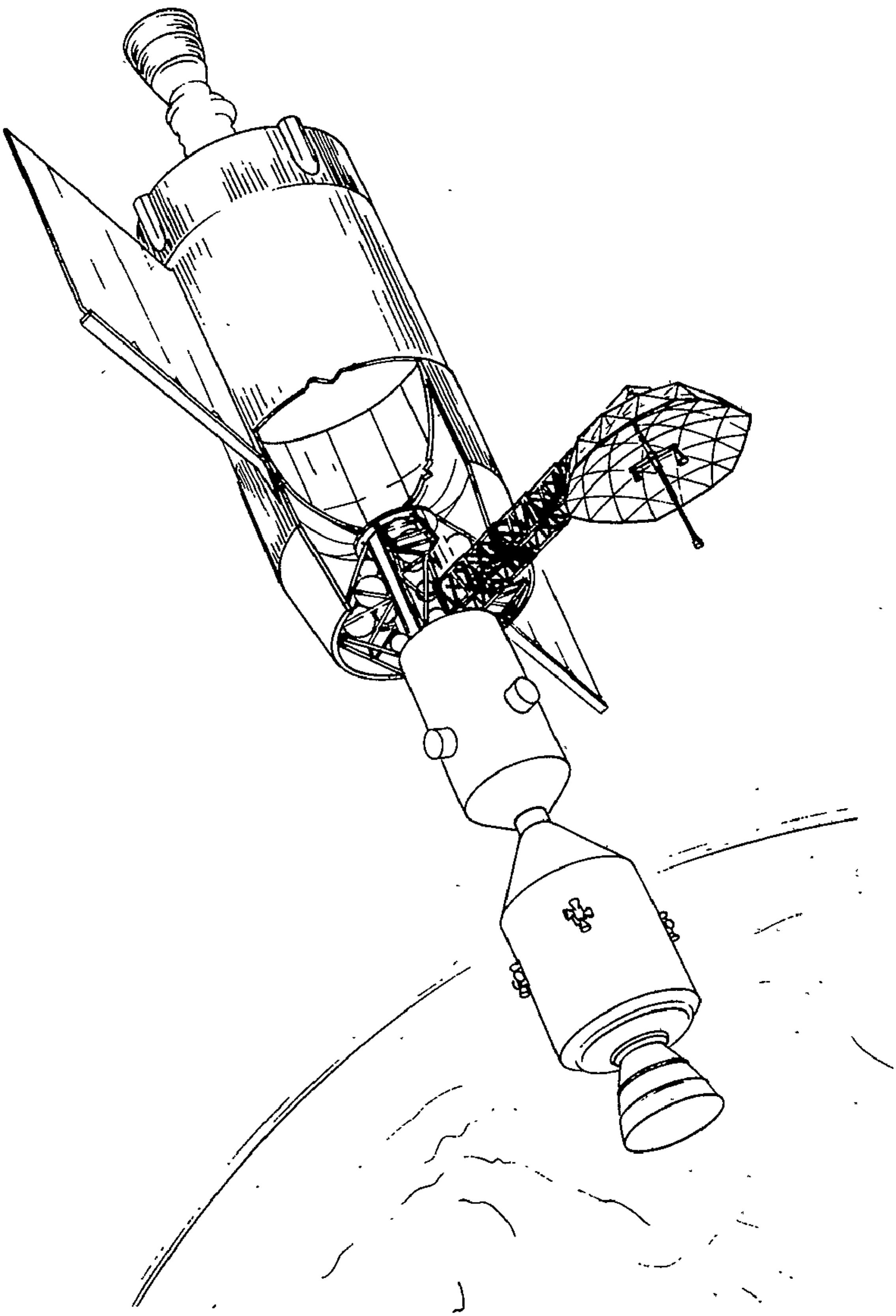


Figure 6. SIVB Workshop Antenna

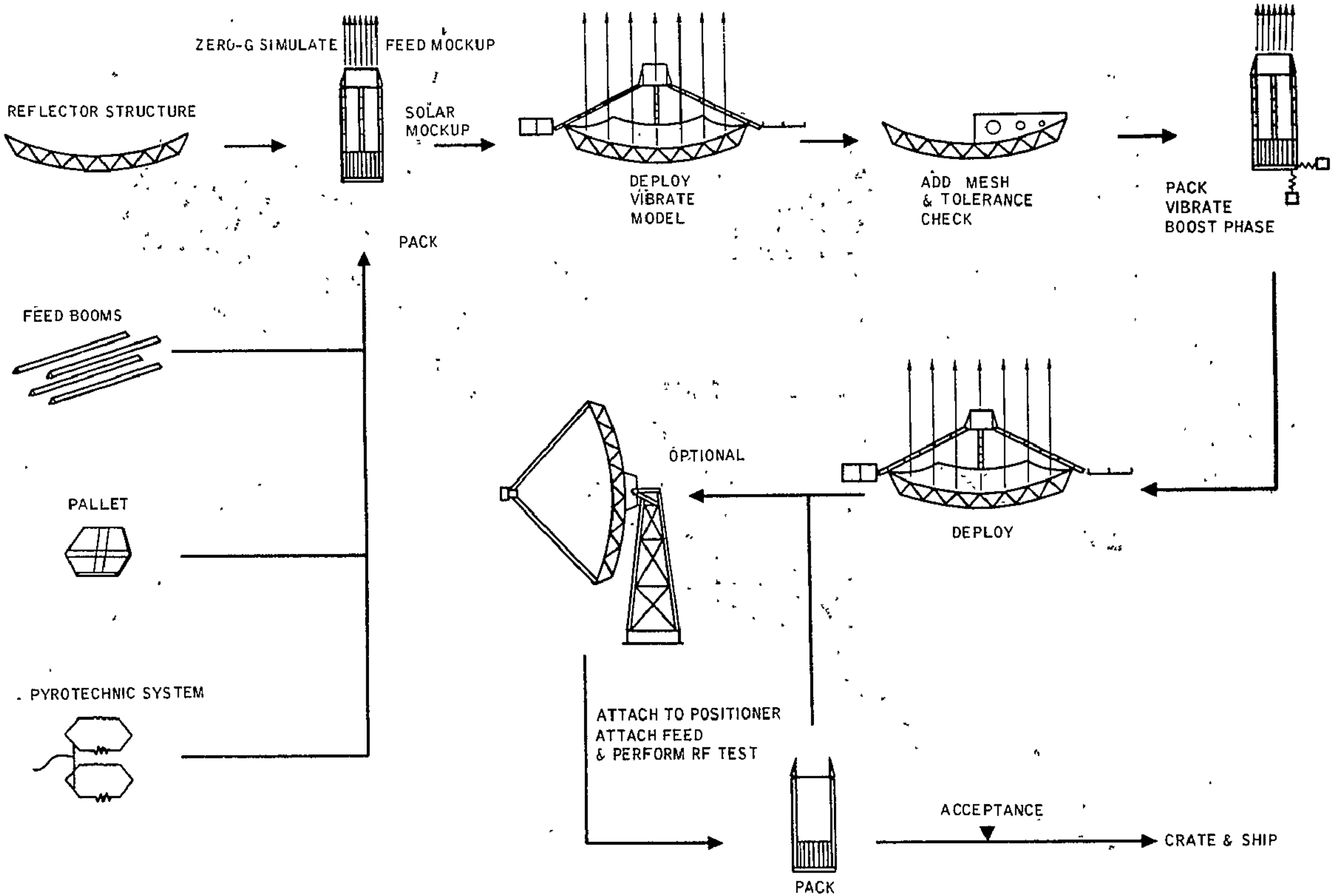


Figure 7. Fabrication and Test Cycle

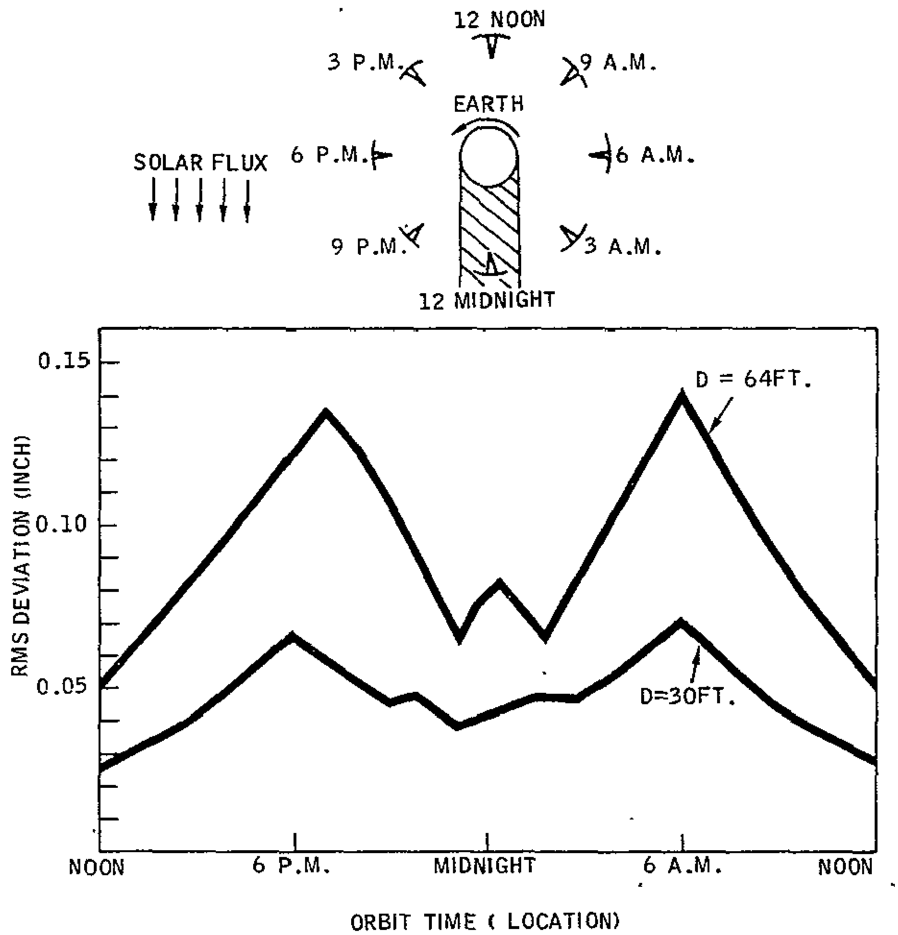


Figure 8. Distortion History, 30- and 64-Foot Titanium Truss Antennas in Synchronous Orbit

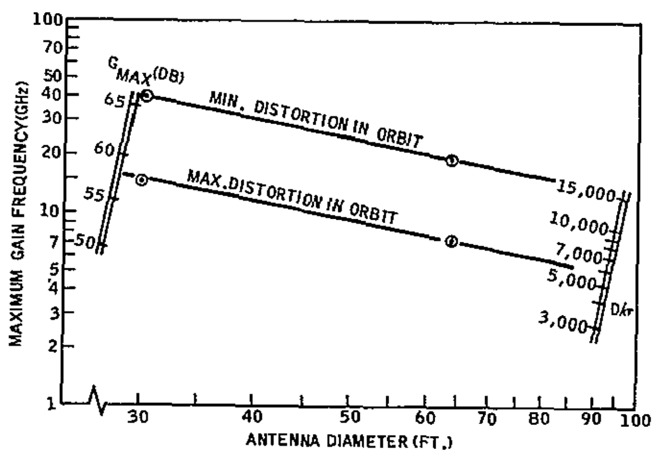


Figure 9. Maximum Gain Frequency Versus Diameter

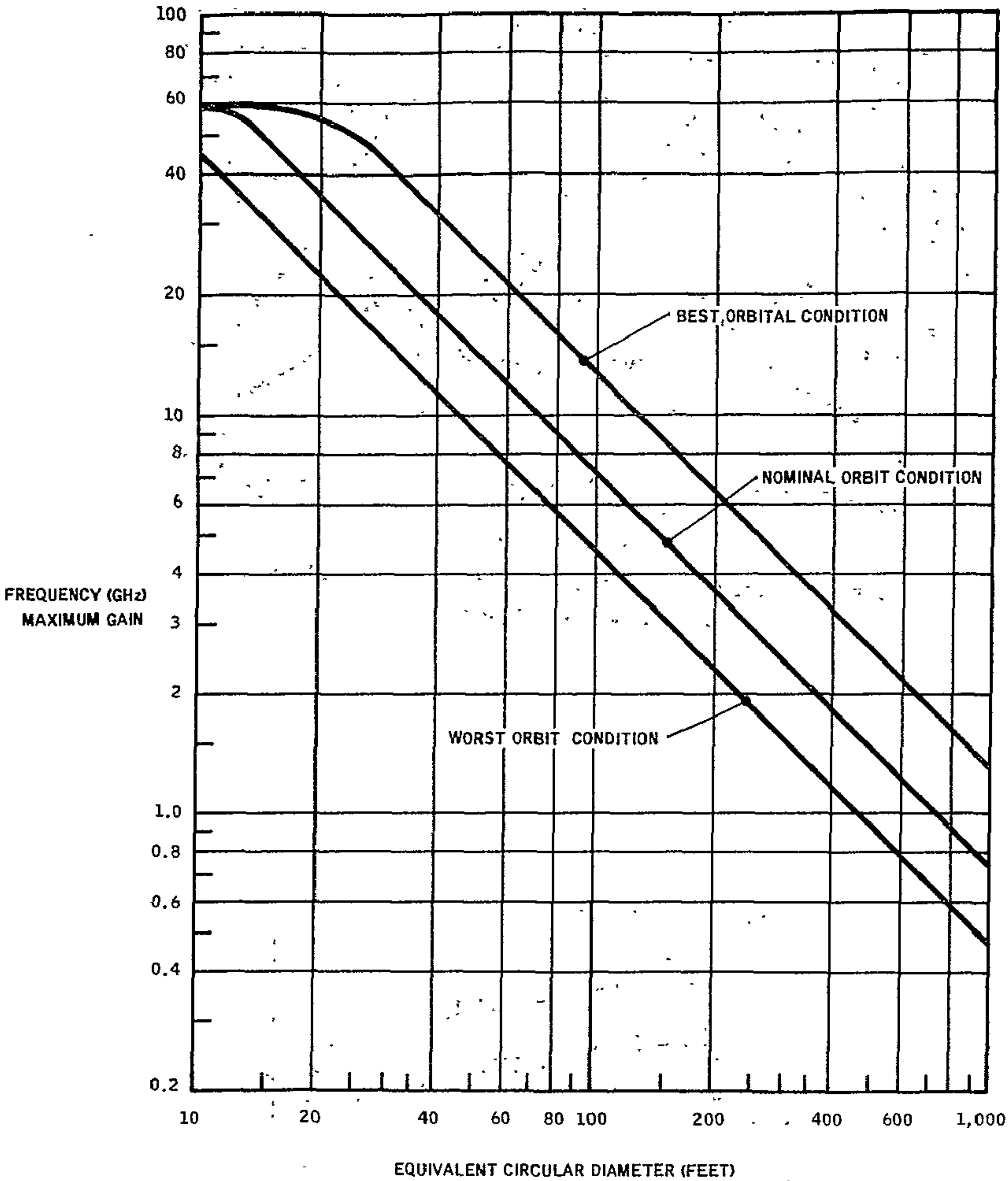


Figure 10. Expandable Truss Antenna Size Versus Frequency Limits in Synchronous Orbit

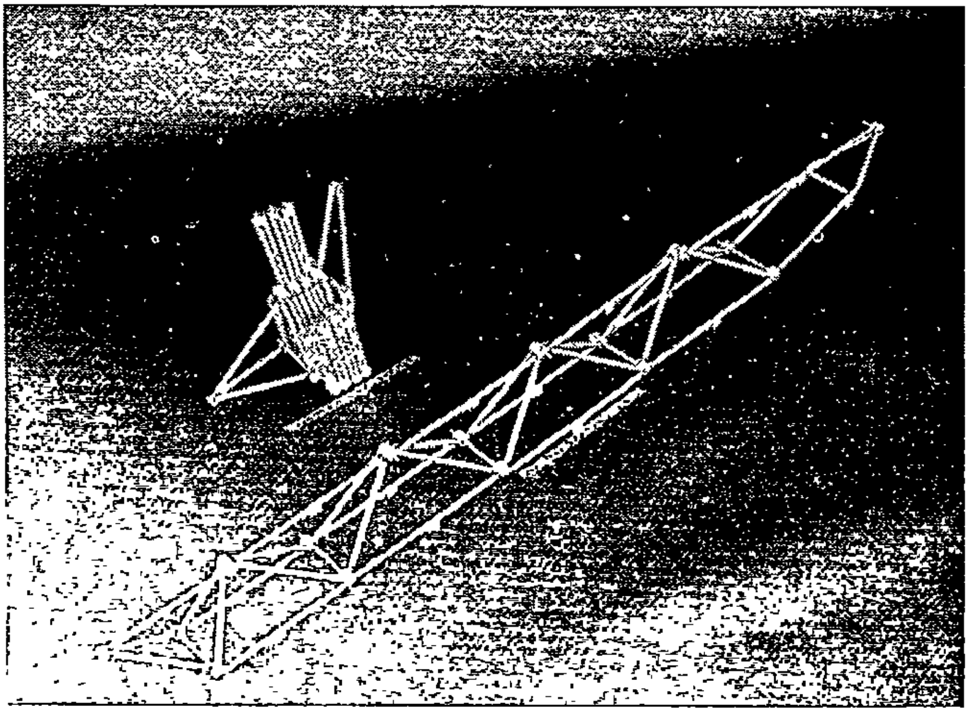


Figure 11. One Section of an Expandable Tripod Leg

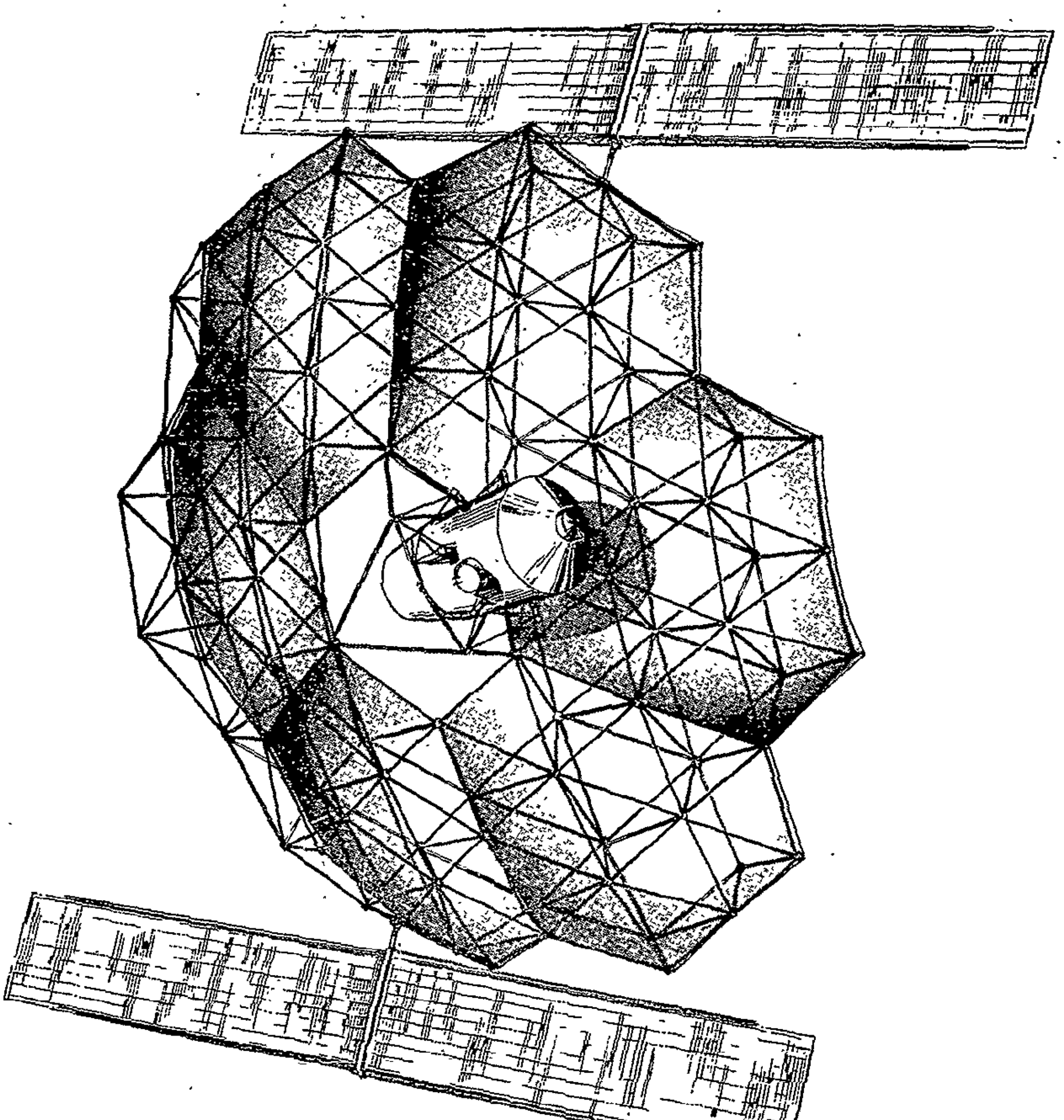


Figure 12. Multiple Beam Antenna with Integrated Structure

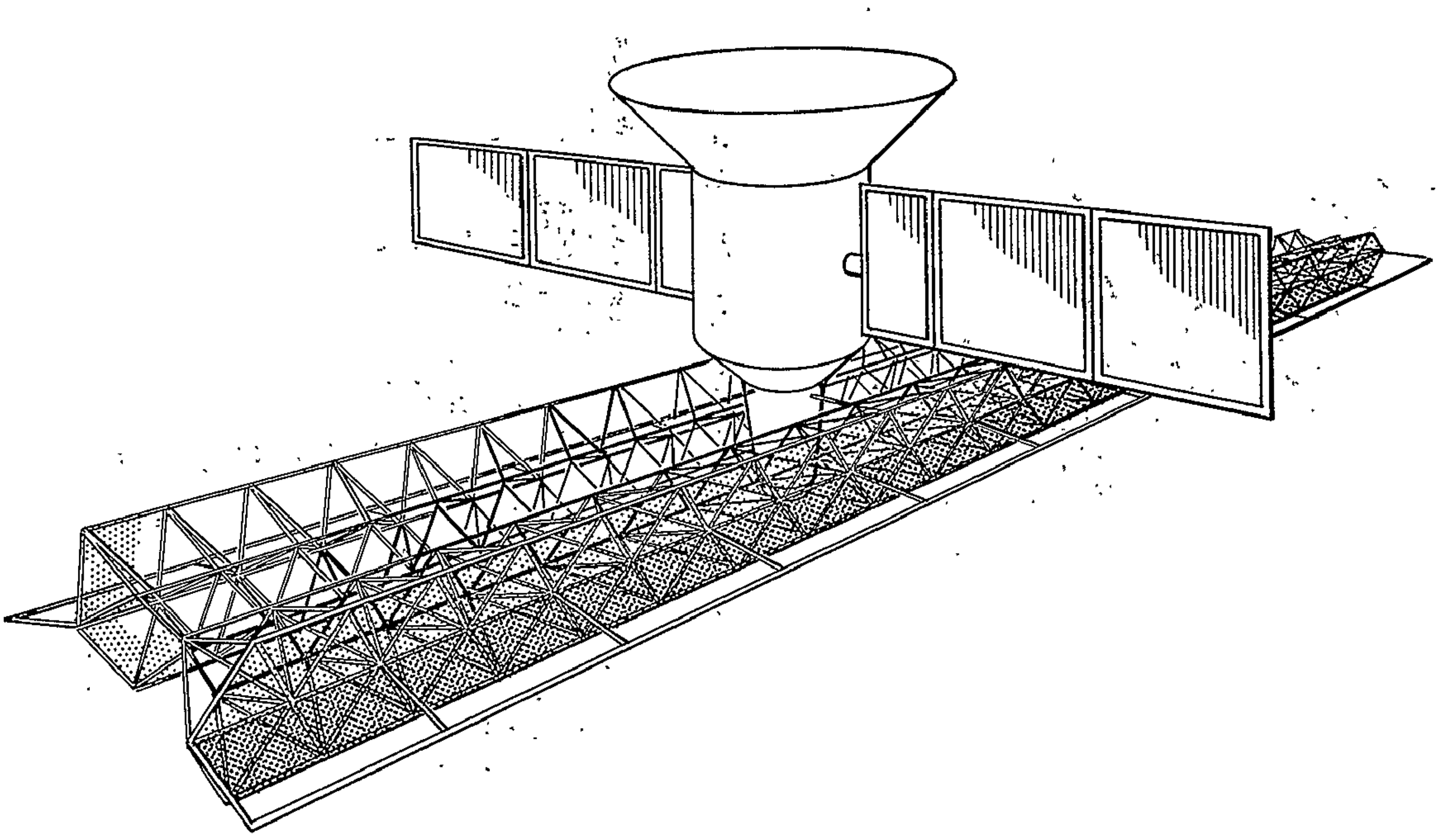


Figure 13. Side-Looking Radar System for Earth Resources and Mapping

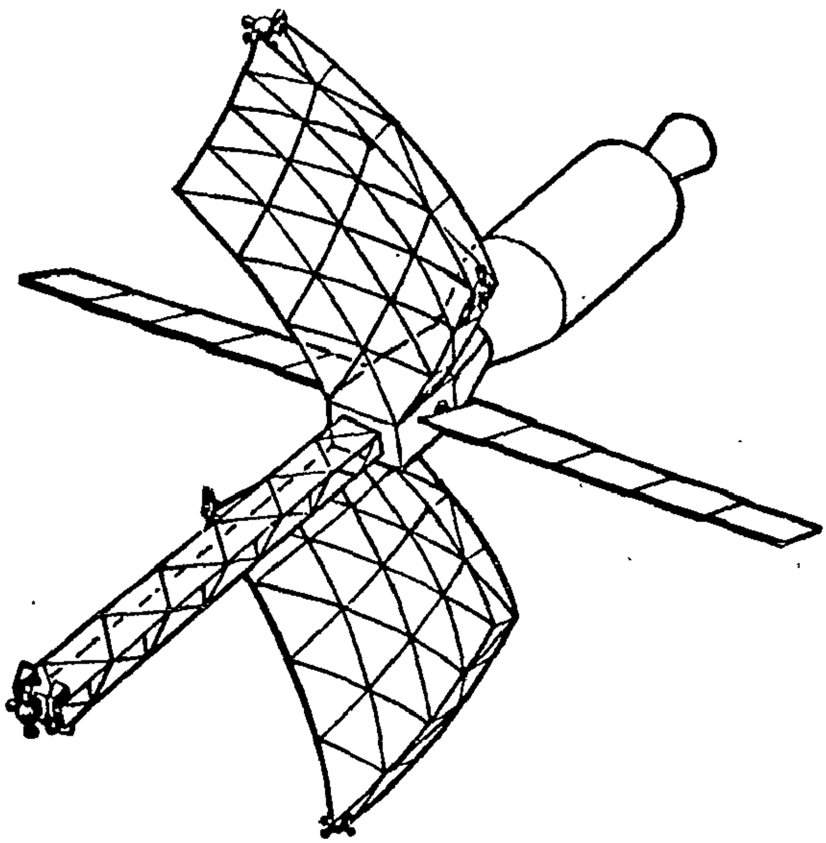


Figure 14. Shaped-Beam Dual Reflector Configuration

Table 1. Maximum Reflector Size for Typical Booster Envelopes

BOOSTER	MAXIMUM PACKAGE DIAMETER (IN.)	PETA TYPE	TYPE A PACKAGING PETA DIA. (FT.)	TYPE C PACKAGING PETA DIA.(FT.)
AGENA	58	8 - BAY ALUM.	32	70
		8 - BAY TITAN.	32	70
		6 - BAY BERYLL.	70	147
ATLAS OR TITAN	108	8 - BAY ALUM.	60	130
		8 - BAY TITAN.	60	130
		6 - BAY BERYLL.	130	270
SATURN V	240	8 - BAY ALUM.	134	290
		8 - BAY TITAN.	134	290
		6 - BAY BERYLL.	290	600

N70-25763

SECTION 1

TASK 1.0 — MATERIAL AND FABRICATION TECHNIQUES

The purpose of this task was to develop antenna hardware elements for the truss tubular strut construction, hinge and spring joints, RF reflective surface mesh, and mesh adjustment. Testing was conducted under the category of feasibility evaluation with emphasis upon space and ground degradation effects.

1.1 DESIGN AND FABRICATION OF TEST ELEMENTS

Critical elements of the expandable truss antenna were designed and fabricated for testing under a combination of ground and simulated space environment conditions. Primarily, the tubular hinges, end joints and RF reflector mesh were considered. The components were designed to simulate hardware for a 70-foot diameter, 8-bay expandable truss antenna, Figure 1-1. Upon completion of the preliminary tests and evaluation, a full-scale (70 foot) triangular tetrahedron element was fabricated using many of the components, hinges, joints, and mesh from the component tests and the spider element for a 100-foot antenna previously built on an in-house Convair program. (See Section 1-3.)

1.1.1 <u>TUBES-SURFACE STRUT AND DIAGONALS</u> — An eight-bay, 70-foot antenna design typically requires a surface strut length 105 inches long and a diagonal member 82.0 inches long.

Previous studies of antenna truss material indicate that the weight, cost, thermal distortion, and packaging size of the reflector are affected by the choice of materials for the tubular struts. These studies have indicated that the following options are available:

a. Aluminum tubes provide the lowest cost material but result in relatively high weight and thermal distortion.

b. Perforated-wall aluminum tubes reduce thermal distortions and weight at some increase in cost.

c. Perforated-wall titanium tubes produce the lowest thermal distortions because of their transparency to solar radiation and low coefficient of expansion. The weight of this material is intermediate between that of tube and perforated wall aluminum.

d. Beryllium tubes produce a very lightweight truss with almost twice the packaging ratio of the perforated aluminum version (because of the smaller tube diameters used). Thermal distortion for the beryllium version is not as low as that of titanium, however, and the cost is significantly greater.

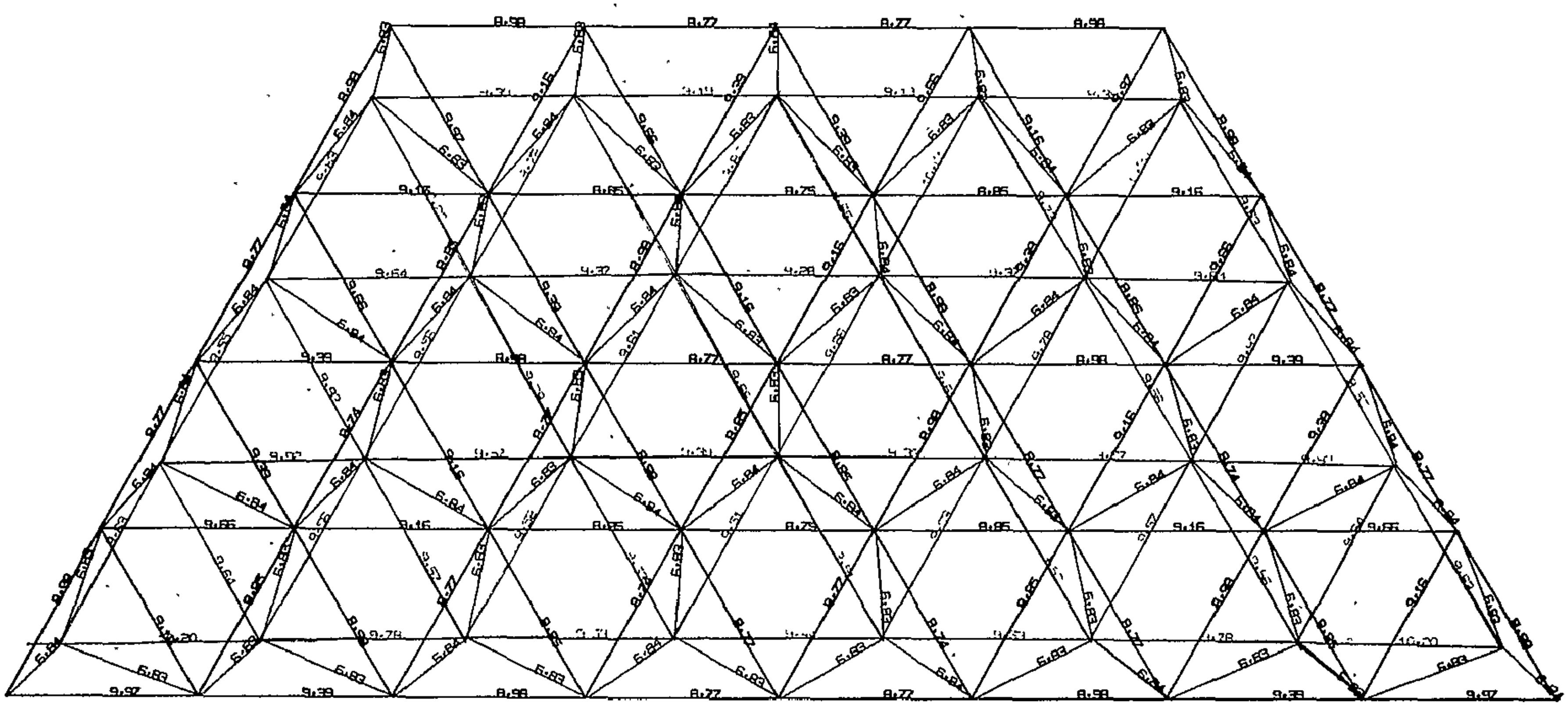


Figure 1-1. AGO Geometry of Eight-Bay, 70-Foot Antenna

The tubes used in the test specimens were standard 0.049 wall 6061-T6 aluminum alloy. The 0.049 gage is a standard ware house stock gage. No attempt was made to chem-mill or reduce weight of the test set-ups. The 6061-T6 Aluminum Alloy tubing was selected for all test set-up as a result of material availability and fabrication costs. The tube diameters were sized to provide a minimum L/p of 150, resulting in a surface strut diameter of 2.00 inches and a diagonal member diameter of 1.50. The allowable column stress is 4,380 psi. Column crippling is not a factor and the load-carrying ability depends upon the tube cross-section area. Analytical results show that as minimum gage (0.020) surface strut tube 2.00 inches diameter will carry 540 pounds. For the diagonal member a 1.50 diameter 0.020 gage tube will carry 410. These loads are greater than those anticipated to exist in the structure at any time due to thermal gradient induced by the space environment. All hinges, end fittings test specimens and tetrahedron elements were sized to accommodate the tube diameter specified above.

1.1.2 JOINTS-END FITTINGS — Spherical ball end joints in Figure 1-2 are used in the antenna design as the interface between the surface struts and the magnesium spiders. During deployment these struts rotate 90 degrees from the packaged to the erected configuration. Since deployment energy is supplied by the mid-strut hinge, it is desirable to obtain a ball end joint which exhibits a constant or repeatable torque when rotated both in air and in a space environment.

A search of proven space components was made to determine if bearings of this type have previously been used in space application. Vendors solicited for strut end bearing data were:

Link-Belt Co.
Philadelphia, Pennsylvania

Industrial Tectonics, Inc.
Compton, California

Carco Electronics
Menlo Park, California

Networks Electronic Corp.
U. S. Bearing Division
Chatsworth, California

General Motors Corp.
Hyatt Bearings Division
Harrison, New Jersey

Coast Centerless Grinding Co.
Raytee Co. Division
Los Angeles, California

Miniature Precision Bearings, Inc.
Keene, New Hampshire

Murray Co. of Texas, Inc.
Boston Gear Works Division
Quincy, Massachusetts

Chain Belt Co.
Shafer Bearing Division
Downers Grove, Illinois

Dodge Mfg. Corp.
Mishawaka, Indiana

Transport Dynamics, Inc.
Fabroid Division
Santa Ana, California

The Timken Roller Bearing Co.
Canton, Ohio

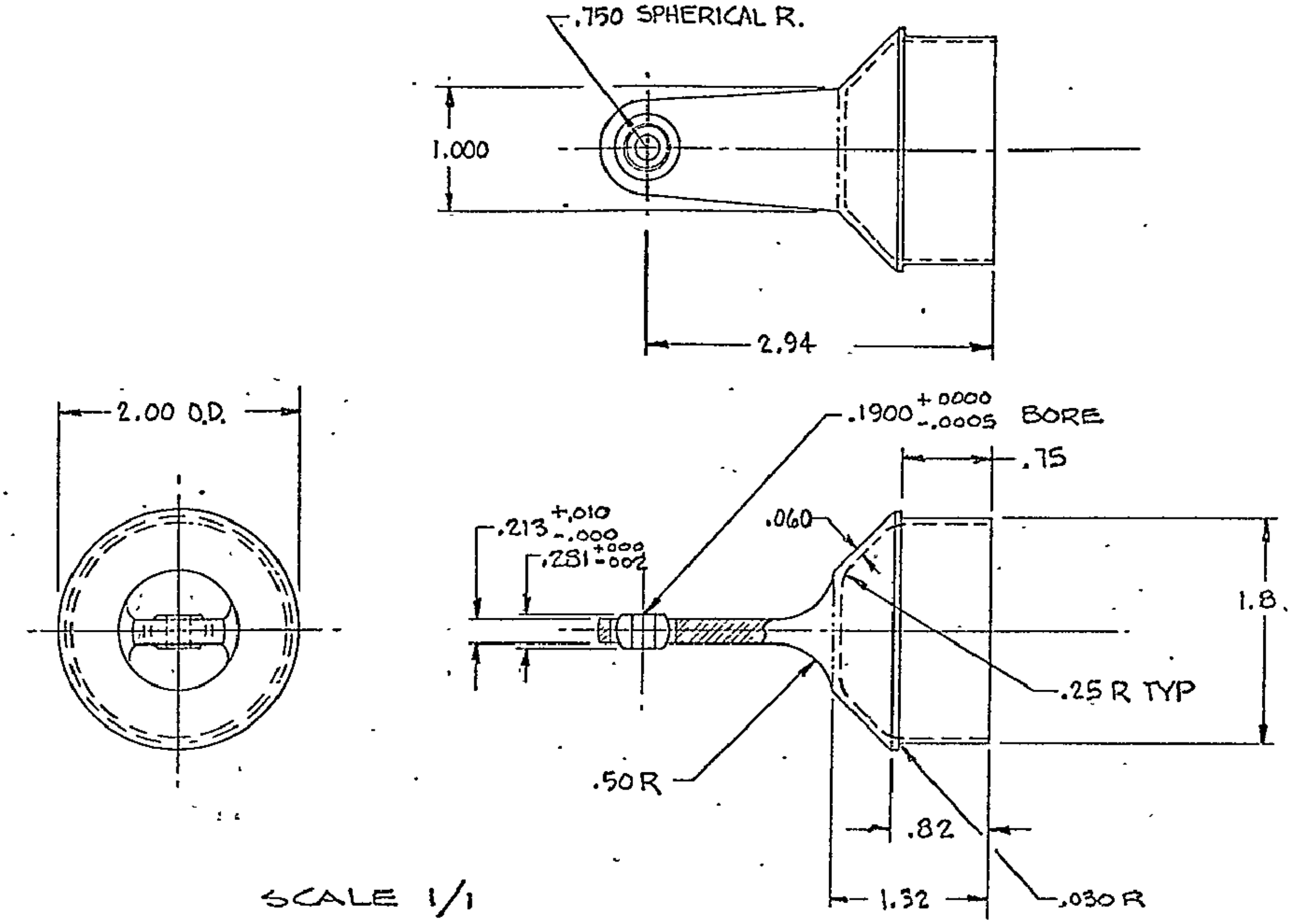


Figure 1-2. Tube End Fitting

General Motors Corp.
New Departure Division
Bristol, Connecticut

Todeco, Inc.
Inglewood, California

The Torrington Co.
Bamtam Bearing Division
South Bend, Indiana

Torrington Co.
Torrington, Connecticut

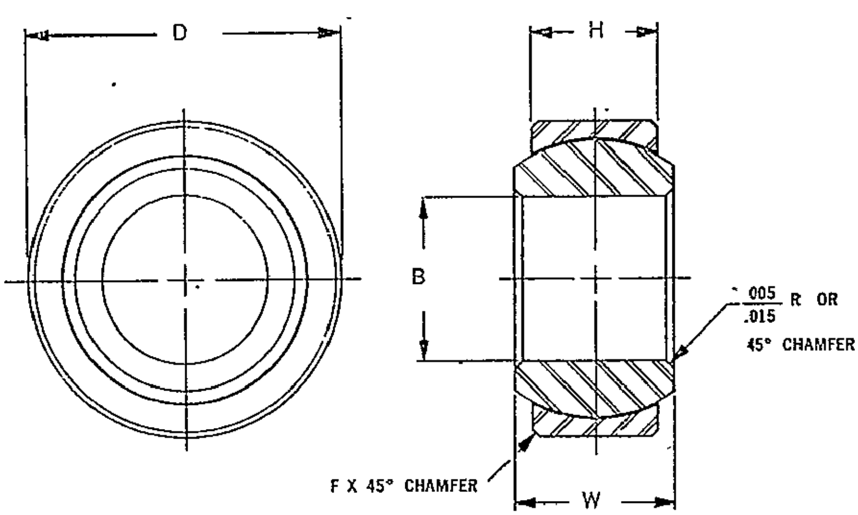
The selected strut-end bearing is a Fabroid lined spherical bearing recommended by Transport Dynamics Corp. This is similar to a Lunar Orbiter bearing. It is described in the vendor data, Figure 1-3, Part No. 03-403-03. An additional vendor data sheet, Figure 1-4, also describes the bearing coefficient of friction versus temperature, surface speed, and load.

A bearing larger than that desired for a 70 foot antenna was selected primarily to utilize existing numerically machined AZ318 magnesium spiders that were available from a previous contract, NASA Contract NAS W 1438, for a 100 foot diameter reflector

SPHERICAL BEARING - [illegible]

	SERIES
FABROID ® SELF-LUBRICATING	03-403
FABROID ® "G" SELF-LUBRICATING	03-703

DASH NO.	B +.0000 −.0005	W +.000 −.005	D +.0000 −.0005	H +.005 −.005	F +.010 −.000	MIS-ALIGN-MENT (APPROX.)	RATED LOADS (LBS.)		BALL DIA. (REF.)	APPROX. WT. (LBS.)
							RADIAL YIELD	DYNAMIC		
-03	.1900	281	5625	.218	010	10°	4,000	1,510	.437	.02
-04	2500	.343	.6562	250	.010	12°	6,150	2,360	.500	.02
-05	.3125	375	.7500	.281	.015	11°	8,430	3,200	.593	.03
-06	3750	.406	.8125	.312	015	10°	10,500	3,800	.625	.04
-07	.4375	.437	9062	.343	.020	9°	13,300	4,800	.687	.05
-08	5000	500	1.0000	.390	020	9°-30′	16,800	6,820	.781	.07
-09	.5625	.562	1.0937	.437	.020	10°	22,000	8,800	.875	.09
-10	.6250	625	1.1875	.500	.020	8°-30′	27,000	10,800	1.000	.12
-12	7500	750	1.4375	.593	.020	8°-30′	40,300	16,800	1.250	.21
-14	.8750	875	1.5625	.703	.030	9°	53,500	22,000	1.375	.27
-16	1 0000	1.000	1.7500	797	.030	9°-30′	69,500	29,000	1.562	.39



MATERIALS FOR VARIOUS SERIES

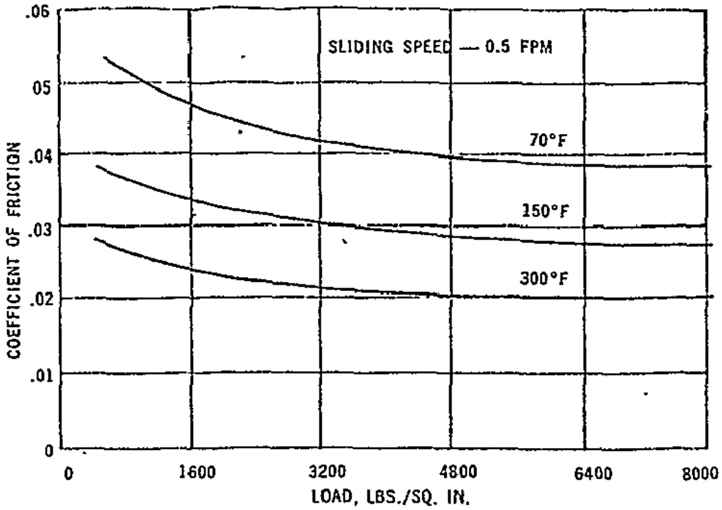
SERIES	OUTER RACE	LINER	BALL
03-403	Stainless Steel—Heat Treated	Fabroid	440 C Stainless Steel
03-703	Stainless Steel—Heat Treated	Fabroid "G"	440 C Stainless Steel

NOTES

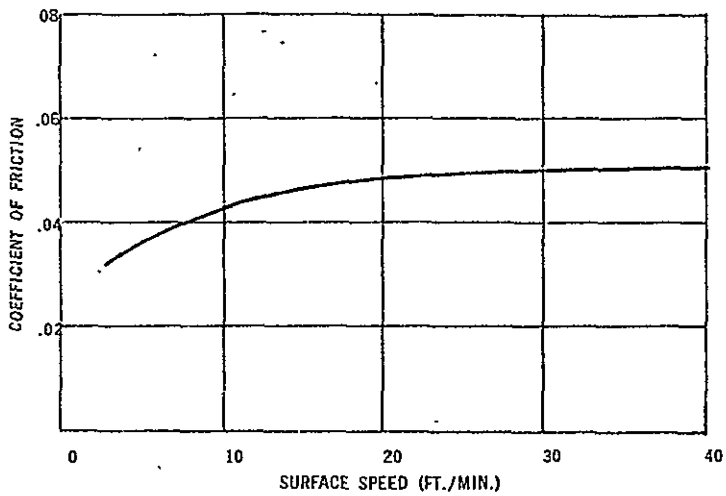
1. Fabroid bearing—do not lubricate.
2. Larger sizes and special configurations available on request.
3. These bearings are available in special materials for cryogenic applications to −420°F.

TRANSPORT DYNAMICS INC.
Subsidiary, American Metal Products

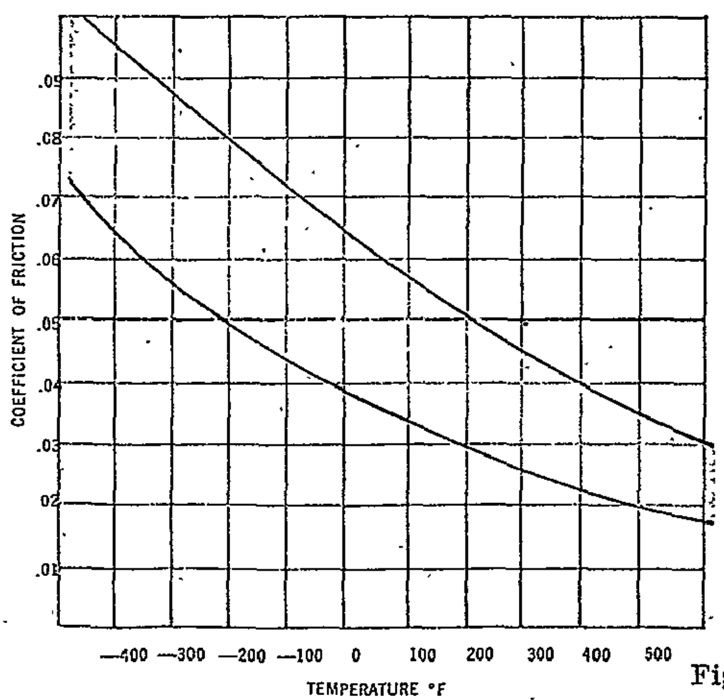
Figure 1-3. Spherical Bearing Data (Transport Dynamics Inc. Vendor Sheet)



Effect of Load and Temperature on Friction of Fabroid Bearings



Coefficient of Friction at 10,000 LBS /SQ IN. Normal Unit Load and 70°F Vs. Surface Speed.



EFFECT OF TEMPERATURE ON COEFFICIENT OF FRICTION

COEFFICIENT OF FRICTION Determination of the coefficient of friction of FABROID* by conventional means and then using this data as absolute values for a specific application is not recommended. The value determined depends on a host of variables, and the interaction between these variables. Variables include surface finish of the metal mating member, the geometry of the member, surface speed, ambient temperature, cooling rates available to the system, the mass of the system and the specific heat of the system.

The values depicted on the graphs represent those attained using a flat plate-sliding block approach. The block carrying the specimen was moved at a constant velocity and the temperature of the system allowed to stabilize. The values are shown only to indicate trends as parameters are changed and not specific application values.

Graph 1 shows the effect of unit load and temperature, keeping the velocity constant. The actual plot is the average of a band of values and it was possible to get some overlapping when plotting specific curves.

Graph 2 shows the effect of speed, keeping the unit loading and temperature constant. The values plotted represent average values and should be used as a guide only.

Graph 3 shows the general effects of temperature on coefficient of friction values. Speed and load are not included and the band shown is representative of friction values that will be encountered in most applications.

Figure 1-4. Spherical Bearing Coefficient of Friction (Transport Dynamics Inc. Vendor Sheet) and sized for larger bearings. Miniature bearings with a smaller ball diameter are available as standard loads in the order of 550 pounds. The cost of miniature bearings in small quantities and the availability of the existing spiders precluded consideration of utilizing the preferred size bearings. The bearings selected were, however, of the same teflon lined configuration. Bearing performance is not affected by the size of the bearings.

An analysis of the tapered cone transition element between the ball joint fitting and the two inch diameter surface struts indicate that it acts as a short compression member and was designed against crippling. When the transition cone is optimized to the same loads as the surface strut (p = 540 lbs) and assuming a minimum wall thickness of 0.020, the cone half angle is 43 degrees, which results in the minimum weight of this element. The use of a larger diameter bearing resulted in the use of a larger lug to house the bearing. The 45° cone angle was maintained to simulate 70 foot diameter antenna end fittings. Wall thickness greater than that required was maintained to be consistent with the standard tube wall thickness selected. The end fittings were machined in-house from 6061-T6 aluminum alloy bar stock. The spherical bearings were procured from Transport Dynamics specifying a no pre-load on the Teflon liner with a maximum torque value of 5 inch-ounces.

1.1.3 HINGES — Three basic types of hinges were designed and fabricated for use as the mid-span antenna strut joint:

a. Tension hinge

b. Torsion hinge

c. Carpenter type hinge

1.1.3.1 Tension and Torsion Spring — The designs for the tension and torsion type hinges were made common for both hinges to allow modification of one configuration into the other thereby substantially reducing the amount of machining and parts required for testing.

The torsion spring hinge is shown in Figure 1-5.

The test specimen is constructed of 6061-T6 aluminum alloy 14.0 inches long with a wall thickness of 0.049. The hinge pin assembly is fitted with a "Turcite" bushing to reduce friction. Turcite is a commercial bearing material consisting mainly of Teflon with a coefficient of static friction of 0.08. Two sizes of torsion springs were fabricated for the hinge tests. They provide torque ratings of 0.7 nominal (12.0 in.-lb.) and 0.4 nominal (8.4 in.-lb.). Due to the limited space between the hinge legs, larger springs capable of greater torque were not fabricated.

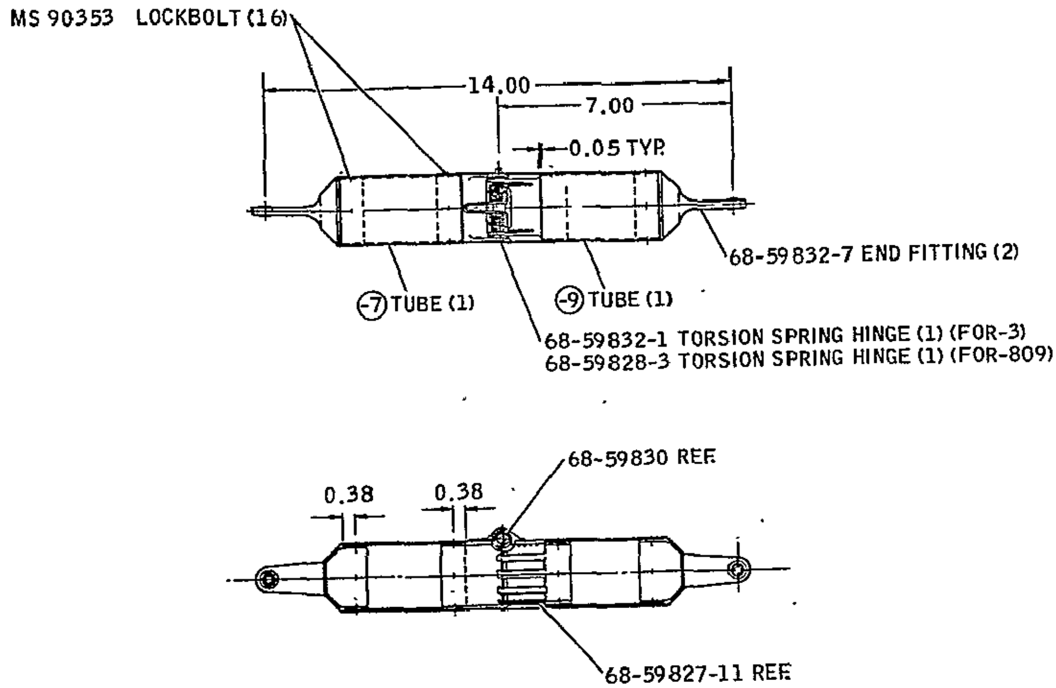


Figure 1-5. Test Specimen, Torsion Spring Hinge Assembly

In one concept, hinge locking is accomplished with the finger springs which are tapered to allow proper engagement. The spring material is 17-7 PH stainless steel. The locking interface is tapered five degrees to allow for joint tolerance and ensure positive locking. The end fittings are fitted with Teflon-lined spherical bearings with a maximum pre-load of 0-5 inch-ounces. The bearings are rated to be capable of a dynamic load of 1,510 pounds.

The weight of the test specimen is 12.5 ounces.

The test specimen is identical to that which would be used in a full scale 70 foot antenna except for the tube length. Tube length would be increased to provide an overall length of 105 inches. The specimen length was shortened to be able to install the specimen in the 30 inch diameter vacuum chamber.

Fabrication of the test specimen has shown two minor design and/or assembly modifications to be required. They are 1) the preloads on the spherical bearings, as received from the vendor, have shown considerable variations in the torque required to turn the bearings. A run-in period was required to obtain bearings of consistent torque values; 2) the lock spring mechanism in the locked position does not lock as tightly as desired. Proper assembly technique or a variation in the taper of the locking interface may solve this problem.

The tension spring hinge, Figure 1-6, was fabricated from 6061-T6 aluminum alloy. The test specimen is identical to the torsion spring test specimen except for the hinge

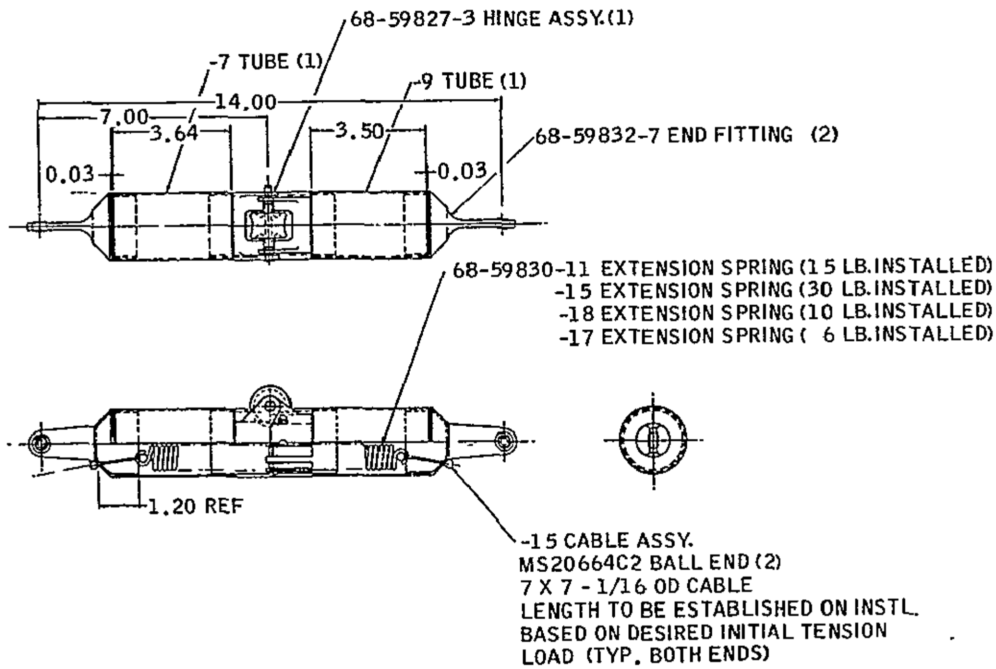


Figure 1-6. Test Specimen, Tension Spring Hinge Assembly

spring mechanism. The hinge spring mechanism consists of a Teflon roller, retained by the hinge pin that guides the tension spring in the folded position. The size of the roller and the spring force provide the torque rating of the assembly. Four sizes, shown in Table 1-1, of tension springs were procured for the test program.

Table 1-1. Tension Spring Characteristics

Rating	Break-Away Torque (in.-lb.)	Spring Rate (lb./in.)
Twice Nominal	42.0	12.7
Nominal	21.6	6.4
0.70 Nominal	15.1	4.2
0.40 Nominal	8.6	2.5

1.1.3.2 Carpenter Tape Hinge — The carpenter tape hinge specimen is shown in Figure 1-7. The hinge consists of two back-to-back curved tapes that can be collapsed and folded without yielding the thin tapes. Several materials were considered for the tape. The are:

a. Beryllium copper

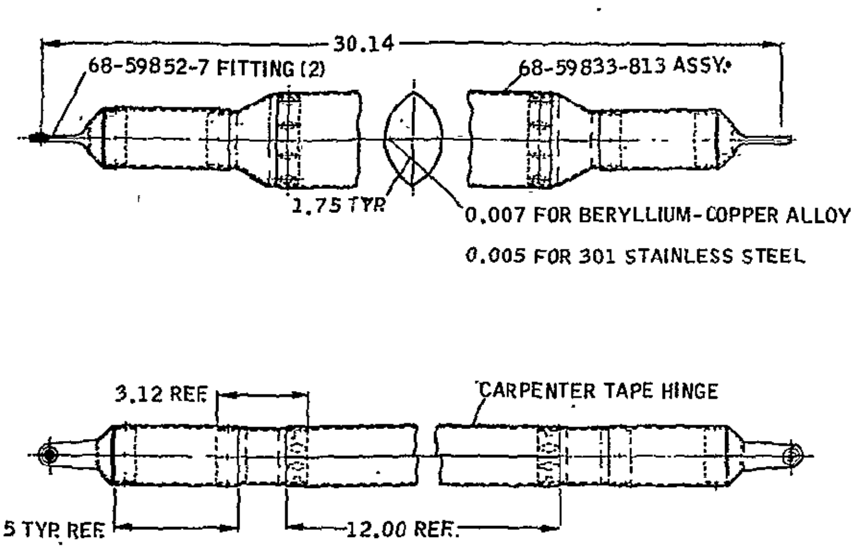


Figure 1-7. Test Specimen, Carpenter Tape Hinge Assembly

b. 301 Stainless steel

c. 6 Al - 4V titanium alloy

d. Fiberglass

The column load that the carpenter's tape is capable of carrying must be developed from test data. The primary mode of failure is local crippling of the free edges of the curved sheet. Small manufacturing imperfections, distortions and wrinkles will significantly affect the load carrying capability of the carpenter tape. The only reliable criteria on which to base the load carrying capability is by test. Preliminary sizing of the carpenter tape was accomplished by establishing the maximum gage of the material that can be bent to within one diameter of the tube without yielding the metal strip. This established the limiting gages that can be considered for the different materials.

The maximum gage thickness is proportional to the material yield strength and inversely to the modulus of elasticity. The initial material selection was based on the F_{TY}/E ratio and the density of the material. Table 1-2 indicates that fiberglass has the highest F_{TY}/E ratio which in turn results in the thickest gage for the tape. The peak torque capable of being generated by the hinge is directly related to the gage thickness by

$$T = \frac{F_{TY}\, bt^2}{6}$$

Hinge torque can therefore be controlled to some degree by the selection of gage thickness.

Table 1-2. Carpenter Tape Hinge Characteristics

	E (10^6)	F_{TY} (10^3)	$\frac{F_{TY}}{E} \times 10^{-3}$	Density $\#/in^3$	$\frac{F_{TY}}{WE} \times 10^{-3}$	t max
Be Cu (Age Hardened)	17	184	10.8	0.297	36.4	0.0266
301 CRES 1/2 H	28	110	3.93	0.296	132.3	0.00968
6 Al - 4F Ti (Annealed)	16	120	7.5	0.16	46.9	0.0185
6 Al - 4V Ti (Heat Treat)	16	148	9.25	0.16	57.8	0.0228
Fiberglass	7	130	18.57	0.076	244.0	0.0458
Al Aly 7075T6	10	60	6.0	0.1	60.0	0.0148

Test specimens of the carpenter tape hinge were fabricated to establish forming and hinge action of the material. The following gage hinges were fabricated: 0.007 beryllium copper, 0.010 and 0.005 301 cres 1/2 hard, 0.010 6 Al-4V titanium alloy and a 0.030 unidirectional fiberglass test specimen. The metal tapes were fabricated by the break sweep form process. The beryllium copper material was age hardened at 600°F for 2 hours after forming. The 6 Al-4V titanium alloy was fabricated in the annealed condition. The fiberglass tape consisted of 90% unidirectional 1448 E glass cloth and 10% fill, 150, 1/0 E glass. The resin material was MX B 7011 resin. The tape was fabricated by vacuum bagging over a mandrel, allowing for 10% bleedout of the resin and cured at 325°F.

Preliminary engineering evaluation indicated the titanium tapes, particularly in the 0.010 to 0.008 range, provided the best characteristics for the hinge. A minimum of wrinkling or yielding occurred when the back to back tapes were flattened then folded to the desired packaged configuration. The tapes were generally stiff, possessed some torsional rigidity, and could withstand reasonable handling. The thinner gage material, particularly the 0.005 301 1/2 hard stainless steel, was susceptible to severe wrinkles, creases and tearing during handling and test deployments. The beryllium copper hinge, though easy to form, is susceptible to substantial distortion during the age hardening treatment. Typical hinge specimens are shown in a later paragraph (Figure 1-15).

Several other hinge concepts were evaluated. They are the mast hinge shown in Figure 1-8 and the bi-stem shown in Figure 1-9. The mast hinge is similar in design to the carpenter tape except the free edges are welded or stitched together. The edge restraint provided by the welding will increase column load carrying capability. However, the width of the hinge in the folded configuration is substantially wider (4.64 inches versus 3.82 inches) and can create some packaging problems. Welding development of the thin gages also precluded consideration at this time.

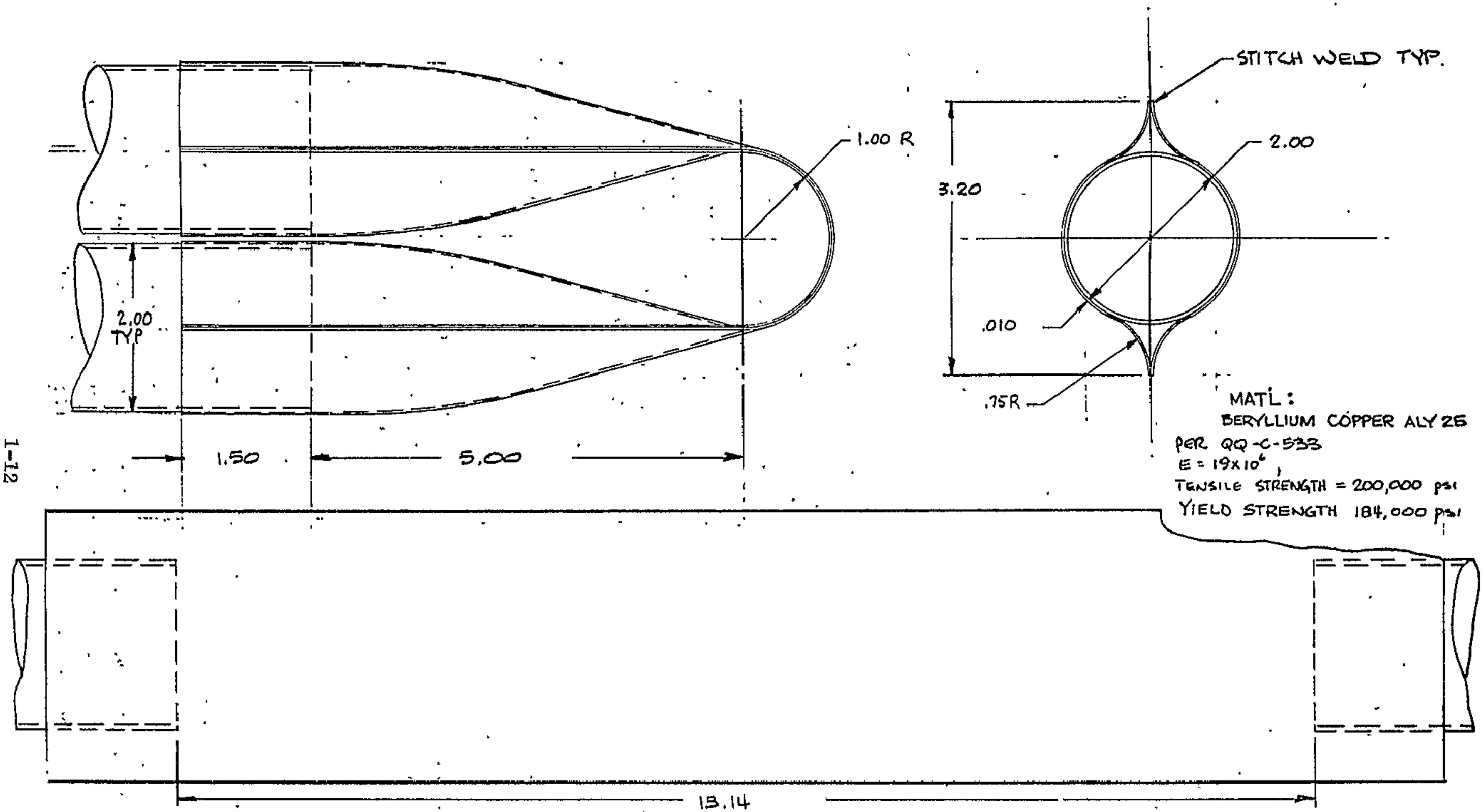


Figure 1-8. Mast Tube Joint

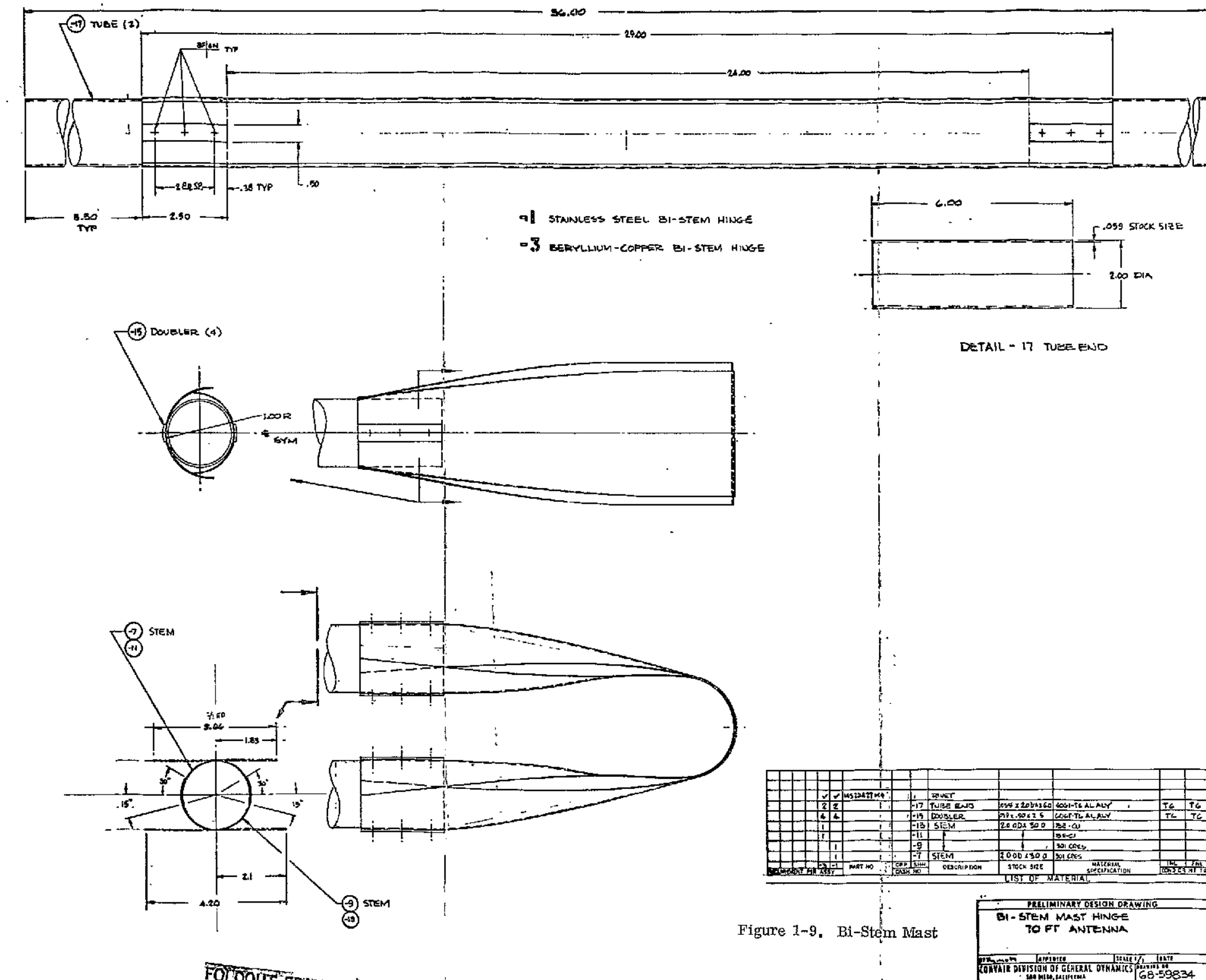


Figure 1-9. Bi-Stem Mast

FOLDOUT FRAME 1

FOLDOUT FRAME 2

The bi-stem hinge is attractive from the load carrying capability since it essentially acts as a tube in compression. Packaging and handling considerations precluded further consideration.

1.1.4 MESH — The preferred antenna reflective surface is a nickel-chrome, tricot knit weave mesh (Figure 1-10). Mesh spacing and gage are a function of the radio frequency. For space applications, gold-plated Chromel-R is light in weight and exhibits excellent RF characteristics. Higher operating frequencies require increasingly tighter weaves. Tests of the mesh material shown in Figure 1-10 showed a 0.1 db loss at S-band and 0.2 db loss at 15 GHz.

A specification outlining mesh requirements for the expandable truss antenna is given in Appendix A.

Detailed testing of surface mesh samples are outlines in Section 1.2.4. Testing included environmental RF degradation, vacuum welding, thermal expansion coefficient, and mechanical properties.

1.1.5 MESH ADJUSTMENT — The antenna reflective surface is supported a short distance above the inner, curved surface of the truss. A system of cabling straps that criss-cross the inner truss surface attaches the mesh to the structure. Adjustable-tension cables control reflector shape by constraining the cabling straps so that

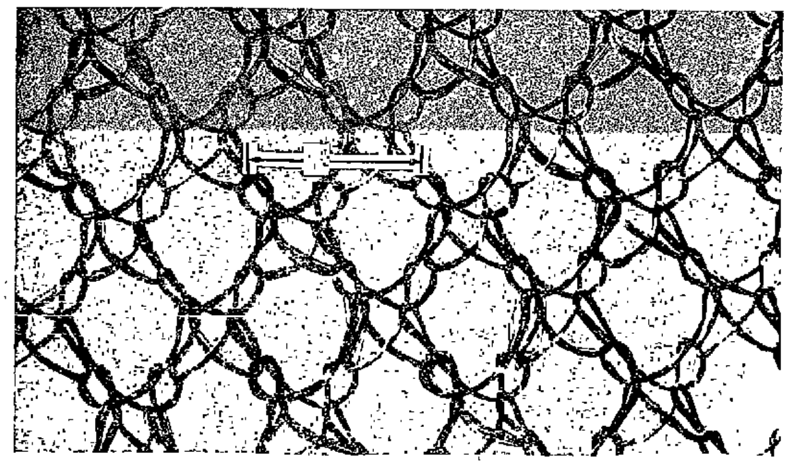


Figure 1-10. Chromel-R Mesh (10X Magnification)

2. The locknut at the base of each anchor post is tightened so as to withdraw the cable lock pin until the tension-tie cable is effectively locked against the edges of the anchor post.

3. Adjusting pegs are released so that the anchor posts assume the tension-tie loads.

4. Surface accuracy is verified and Locktite compound is applied to threads of all anchor posts and standoffs to lock the adjustment.

5. All adjusting pegs are removed and excess tension-tie cable trimmed.

A photograph of a tetrahedron element illustrating the complete mesh adjustment system is shown in Section 1.3.

1.2 TEST OF ELEMENTS

1.2.1 HINGE TEST — Three types of antenna surface strut hinges were fabricated and air environment tested for torque versus hinge angle characteristics. They are:

a. Tension spring hinge

b. Torsion spring hinge

c. Carpenter tape hinge

The test specimens duplicated all major components of a typical hinge that is being considered for a full scale 70 foot eight bay antenna. The test specimen tube lengths were shortened for test purposes. The details of the designs are discussed in Section 1.1.3.

The tension and torsion test specimen is shown in Figure 1-12 and 1-13 in the deployed and packaged configuration respectively. The carpenter tape test specimens are shown in Figure 1-14 with stainless steel and the beryllium copper carpenter tape material installed. Detail specimens of four carpenter tape material cross sections are shown in Figure 1-15.

Four carpenter tape hinge materials were selected and evaluated. They were, 301 corrosion resistant stainless steel, beryllium copper, 6 Al-4V titanium alloy and fiberglass. Material gage thickness varied from 0.005 and 0.010 for the stainless steel, 0.007 for the Beryllium copper, 0.006 and 0.010 for the titanium and 0.030 for the fiberglass. Preliminary engineering evaluation indicated the 0.010 titanium alloy to be the best suited for the intended application. The fiberglass hinge shows promise for further evaluation. The torque generated is substantially greater than that obtainable from metal hinges. Some problems of cracking in the longitudinal direction are evident as a result of the unidirectional fiberglass cloth used. Cross plying will resolve the problem.

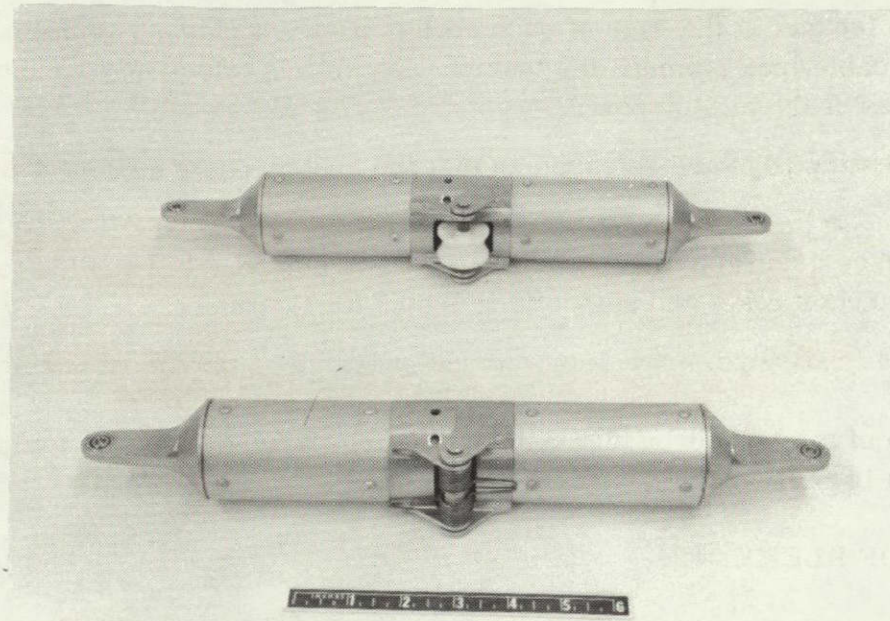


Figure 1-12. Test Specimen — Tension and Torsion Spring Hinge — Deployed

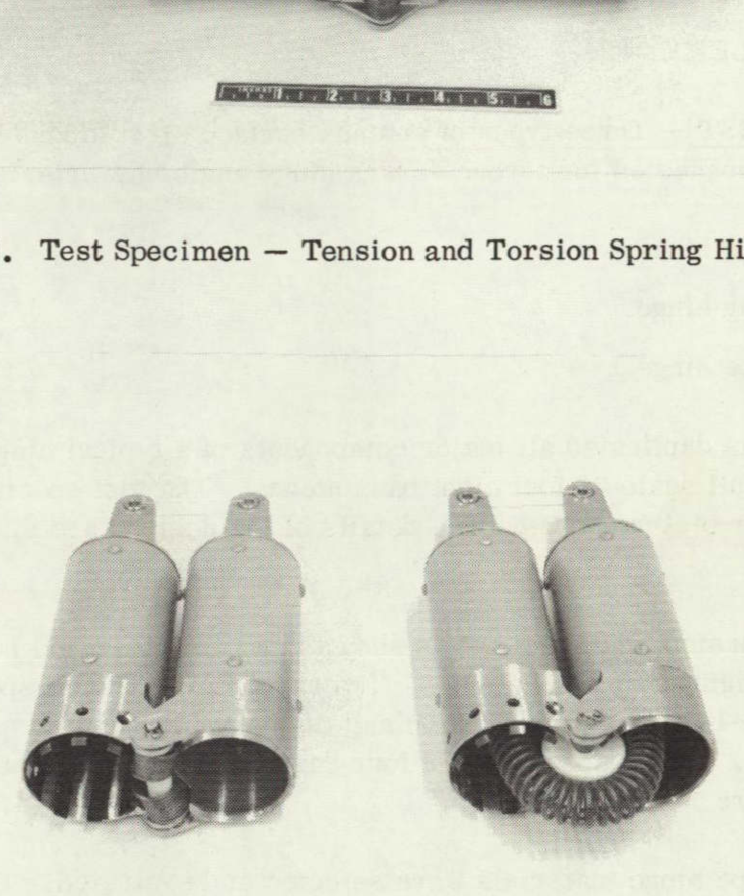


Figure 1-13. Test Specimen — Tension and Torsion Spring Hinge — Packaged

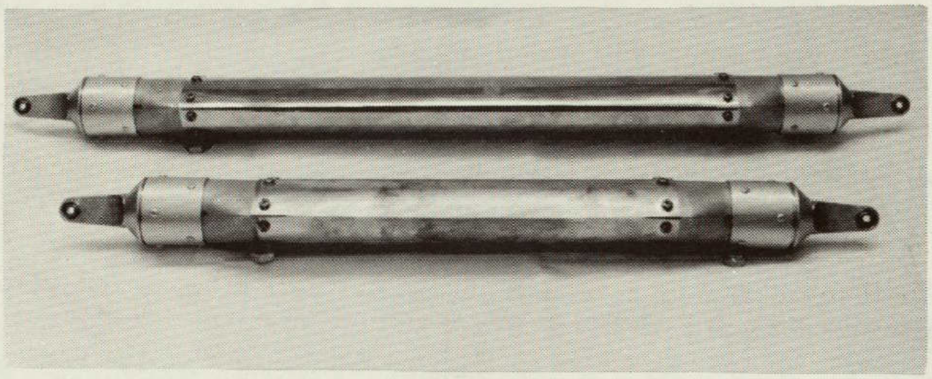


Figure 1-14. Test Specimen — Stainless Steel and Beryllium Copper Carpenter Tape Hinge

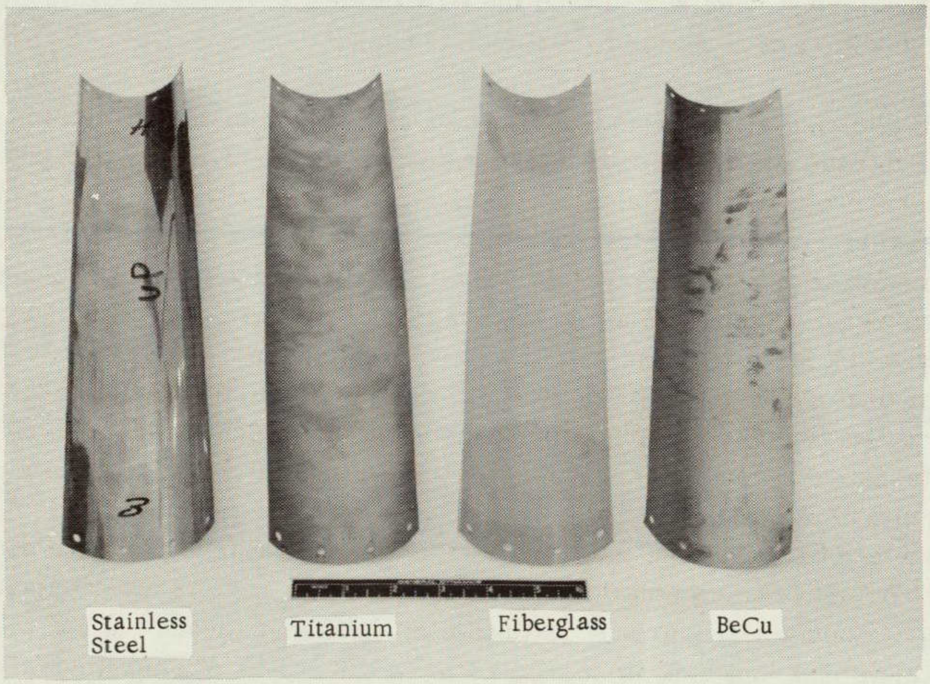


Figure 1-15. Carpenter Tape Hinge

Air environment hinge tests were accomplished using the test set-ups shown in Figures 1-16 and 1-17. Two test set-ups were used for each of the hinges tested. The vertical test set-up shown in Figure 1-16 was used to measure force versus deflection from 0 degrees to 150 degrees. The horizontal test set-up, Figure 1-17, was used to measure force versus deflection from 135 to 180 degrees. The horizontal test set-up was used for the last 45 degrees of deployment in order to reduce test errors. As the hinge approaches full deployment in the vertical test the load approaches infinity. Small vertical displacements result in substantial load increase. Load measurements were accomplished on a Tinnus Olson testing machine. The test machine recorded load and head travel simultaneously to give an x-y plot. The load deflection was then reduced by geometric means to obtain hinge torque versus hinge rotation, Figures 1-18 and 1-19.

1.2.2 <u>BEARING TEST</u> — Bearing friction tests were accomplished on the spherical bearings selected for the strut end fittings. The purpose of the test was to establish the energy loss from the bearings during antenna surface strut deployment, and determine the effects of temperature and vacuum on bearing torque characteristics. The bearing selected for the end fittings of the 70 foot antenna is described in Section 1.1.3. The bearing is a Teflon-lined mono-ball procured from Transport Dynamics Corporation. The bearings were procured to a maximum torque rating of 0-5 inch ounces. The bearings as received from the vendor were found to exhibit considerable variance in the torque required to turn the ball in the race. As a result all bearings were "run-in" with a drill motor to 0-5 inch ounces.

The breakout and running torques were measured before and after vacuum exposure. The test set-up used to measure the running torque is shown in Figures 1-20 and 1-21. Vacuum exposure was accomplished in the G.E. high altitude vacuum chamber. Six spherical bearings were supported in the vacuum chamber with 2 pound weights suspended from each bearing to simulate the loading experienced in the packaged antenna. Two bearings were suspended outside the chamber for data correlation purposes. The specimens were exposed to a vacuum of 1.8×10^{-7} for three days. The maximum chamber temperature was 315°F for one half hour during the vacuum bakeout period. Running torque was accomplished with a constant speed 6 RPM induction motor to simulate antenna deployment speed. The initial breakaway torque, air and vacuum, was measured with a standard hand held torque measuring device. Table 1-3 presents the results of the bearing tests. The room temperature, standard air test data is typical of normal bearing test data. The torque tests results after vacuum exposure indicate a substantial increase in the initial breakout torque on 5 of the 6 specimens. The high breakout load is suspected to be the result of cold flow of the Teflon around the ball during the bakeout period. The test result of the vacuum test indicate that Teflon-lined bearings are not suitable for the antenna end fittings. Figures 1-22 through 1-29 present typical plots of bearing torques.

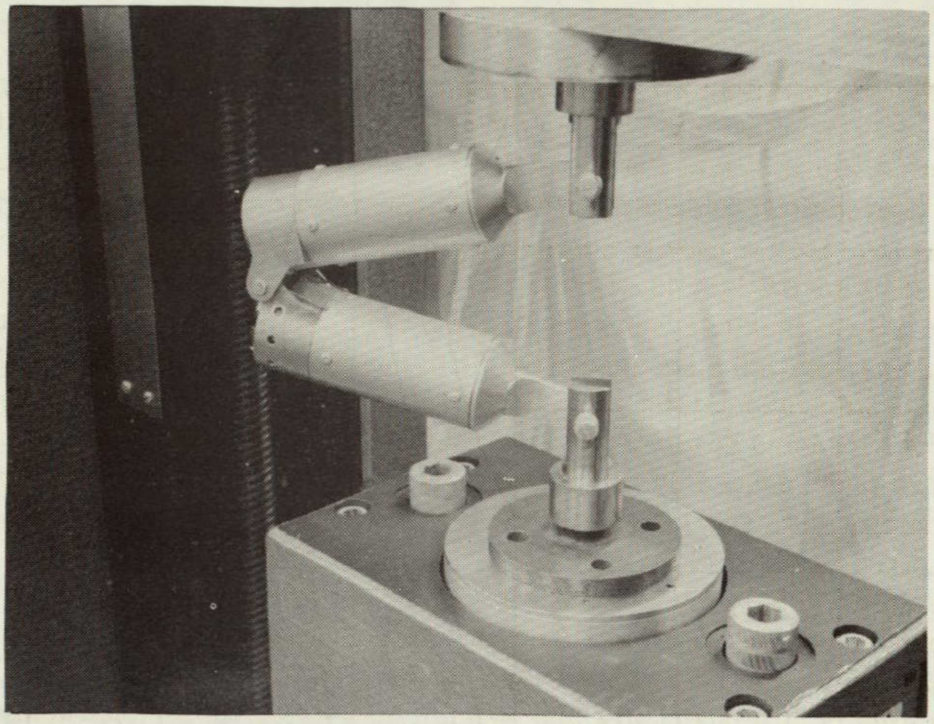


Figure 1-16. Hinge Test — Vertical Test Set-up

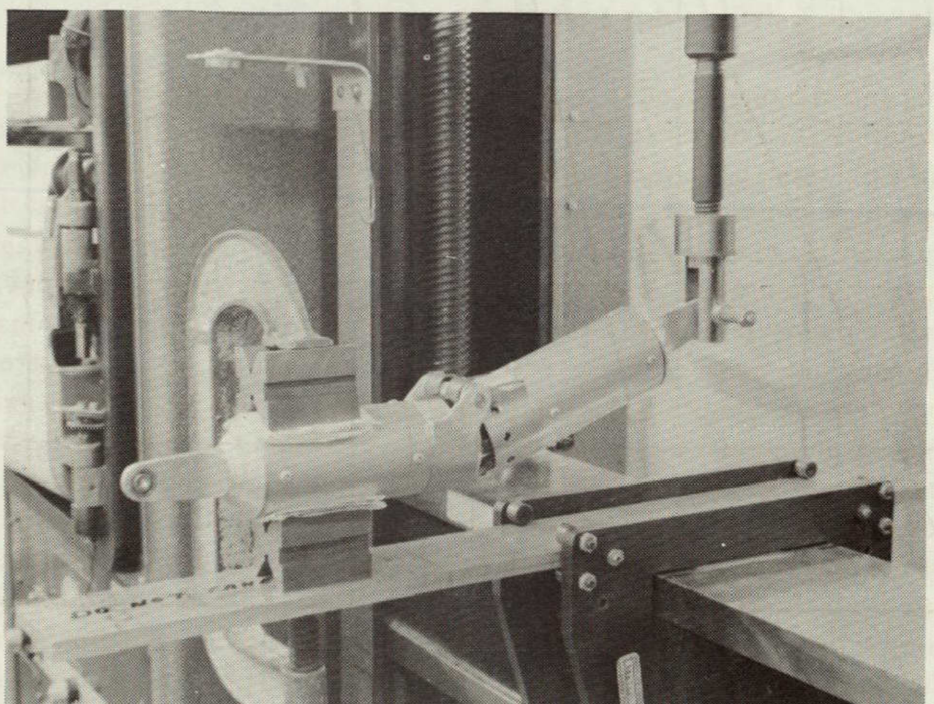


Figure 1-17. Hinge Test — Horizontal Test Set-up

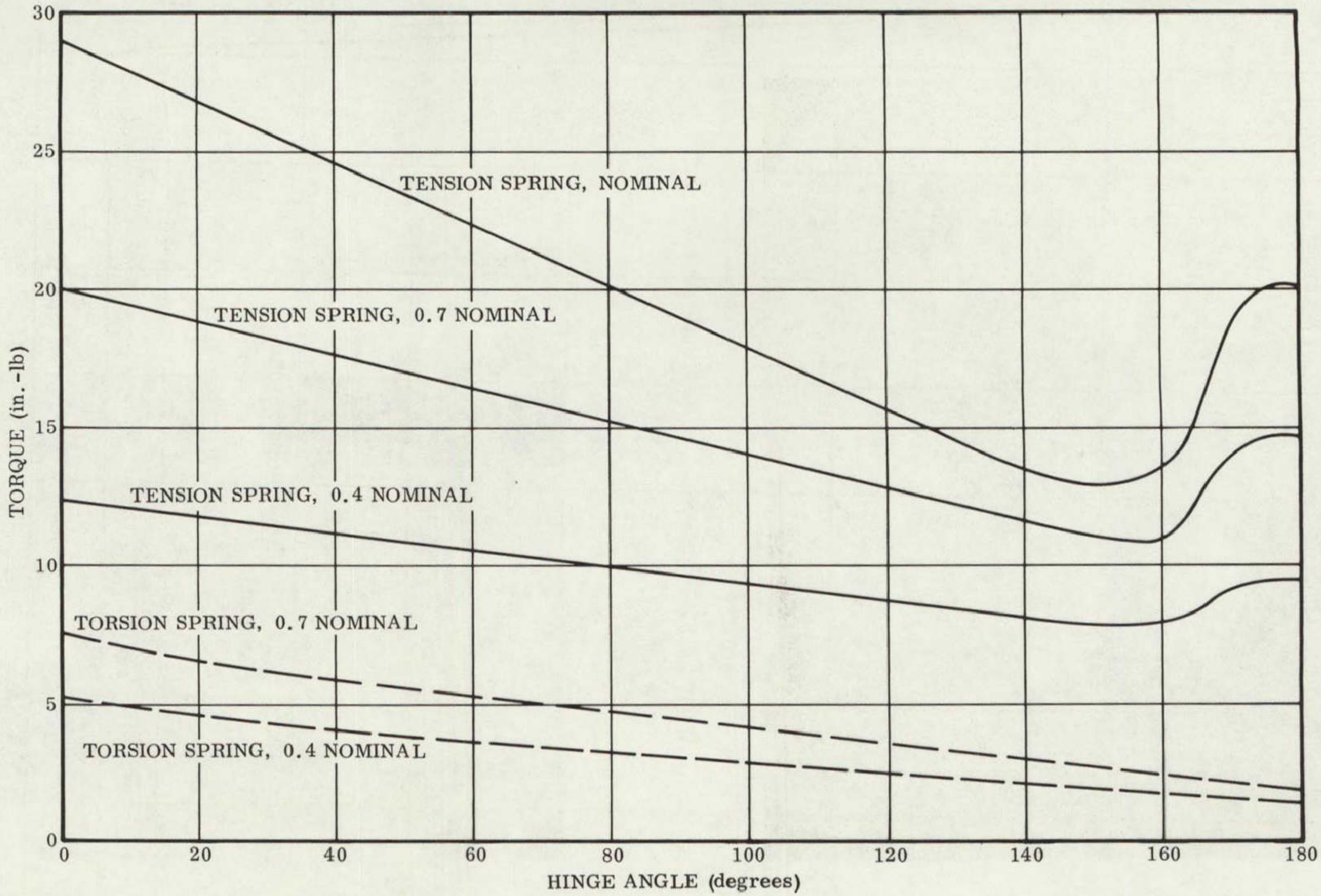


Figure 1-18. Measured Torque Versus Hinge Angle, Tension and Torsion Springs

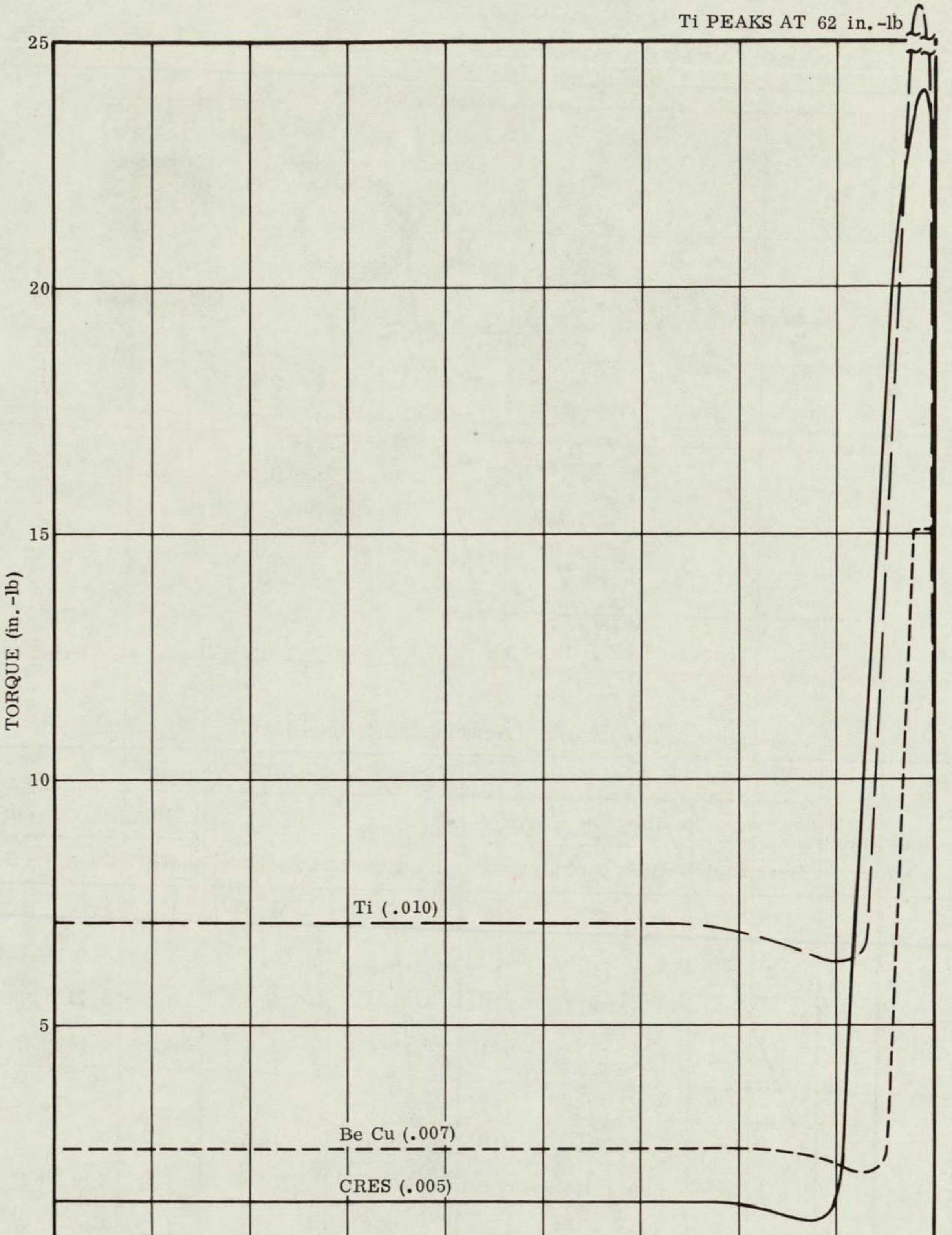


Figure 1-19. Torque Versus Angle, Carpenter Tape Hinge

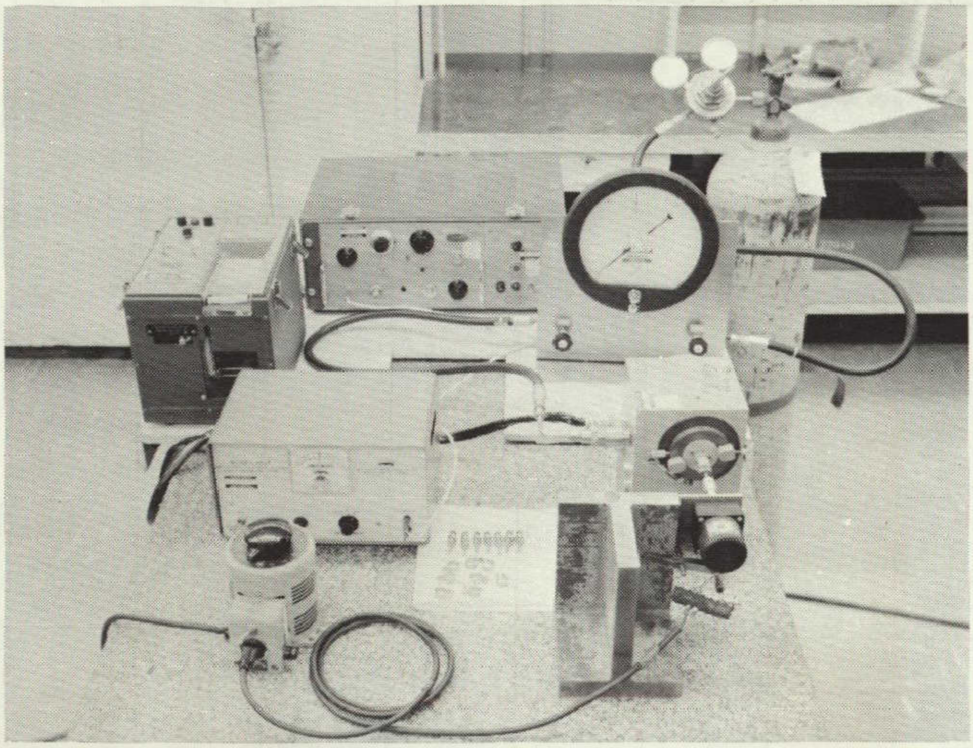


Figure 1-20. Bearing Friction Test Equipment

Table 1-3. Bearing Test Results

Specimen No.	RT/Test				After Vacuum				
	Breakout	Running Torque			Initial Breakout	Breakout	Running Torque		
		Hi	Mean	Low			Hi	Mean	Low
1	5.5	4.2	3.5	2.4	3	4.2	4.2	3.2	2.5
2	3.3	1.1	1.0	0.9	2	4.2	3.5	3.0	2.5
3	5.5	3.8	2.7	1.0	4.3	4.1	3.5	2.25	1.2
4	1.9	1.2	0.8	0.4	17	5.5	6	4.5	3
5	2.5	1.0	0.9	0.8	43.3	5.5	5	4	2
6	3.1	1.6	1.1	0.8	23.7	6.2	4.2	3.5	2.4
7	1.7	1.0	0.75	0.50	79.2	10.5	4.8	3.8	3.0
8	2.5	2.0	1.6	1.1	19	9.8	7.2	6.0	3.8

a. Vacuum was 1.8×10^{-7} for 3 days.

b. Maximum temperature was 315° F for approximately 1/2 hour.

c. Test specimen 1 and 3 exposed to the identical test conditions as 2, 4 through 6 except were not exposed to a vacuum environment.

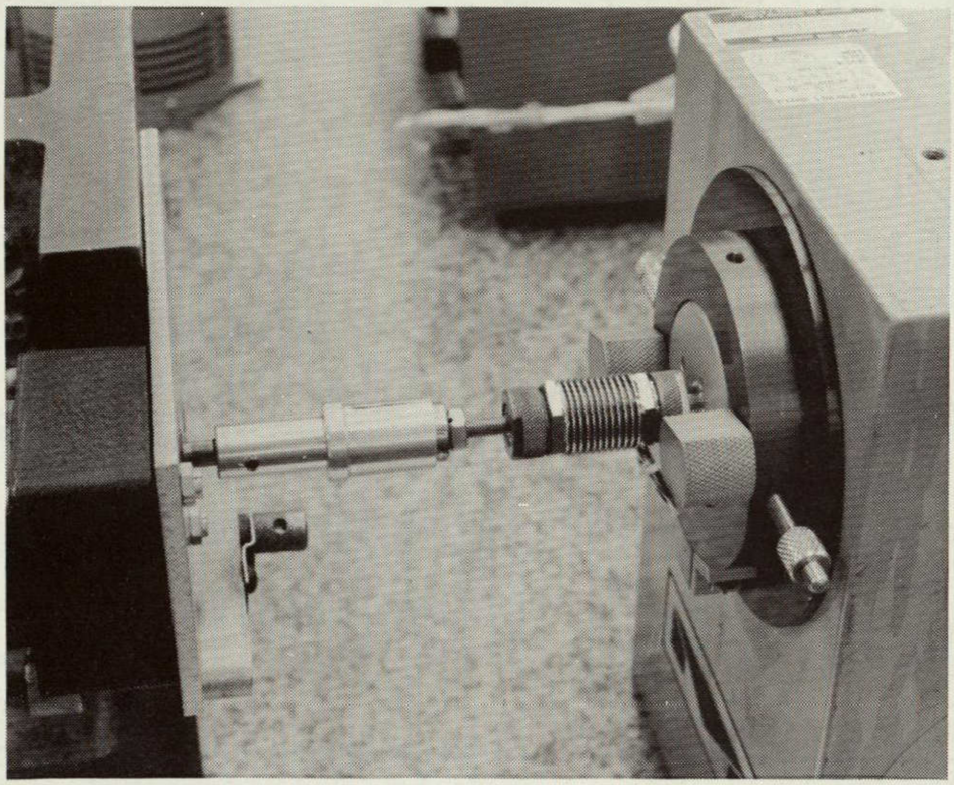
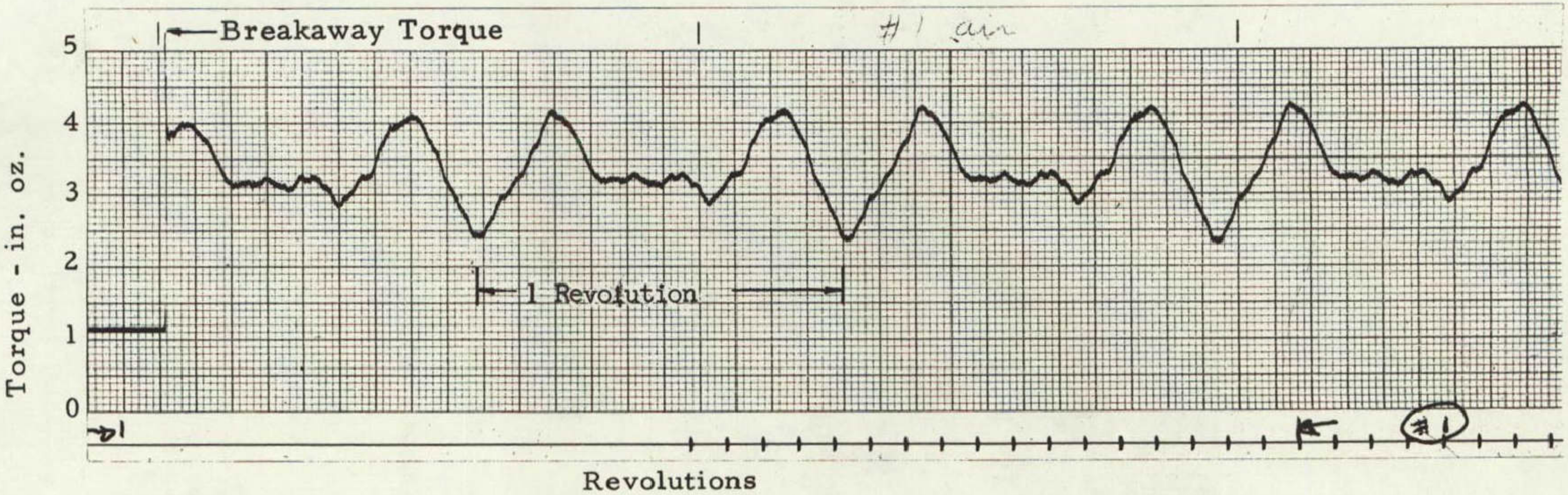
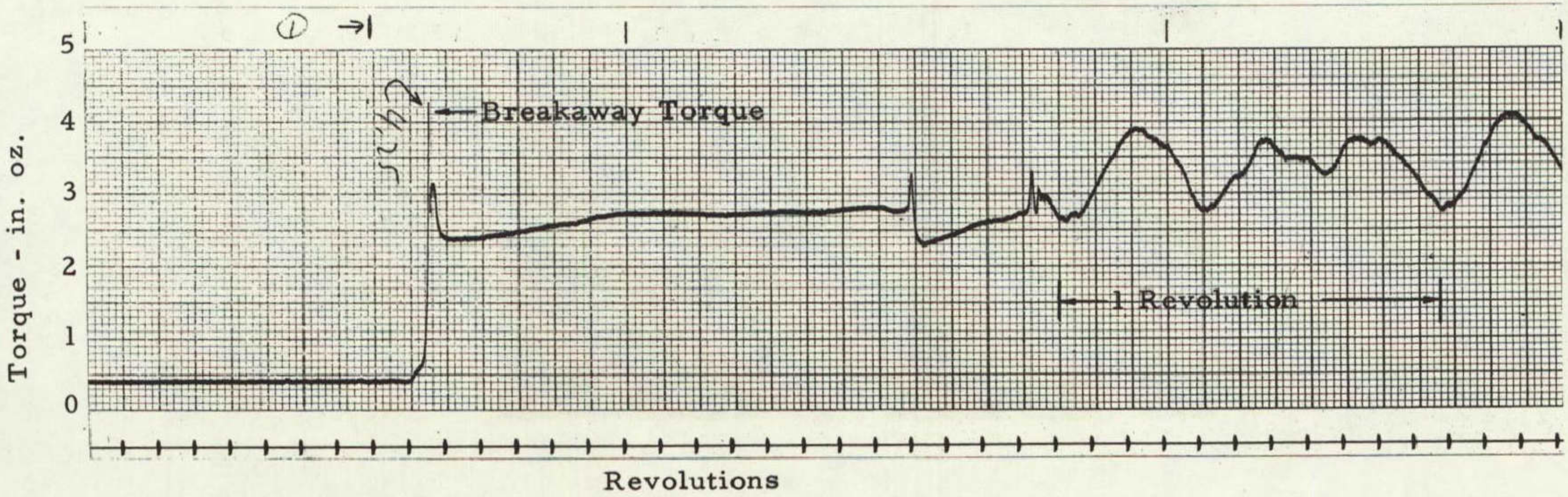


Figure 1-21. Bearing Friction Test

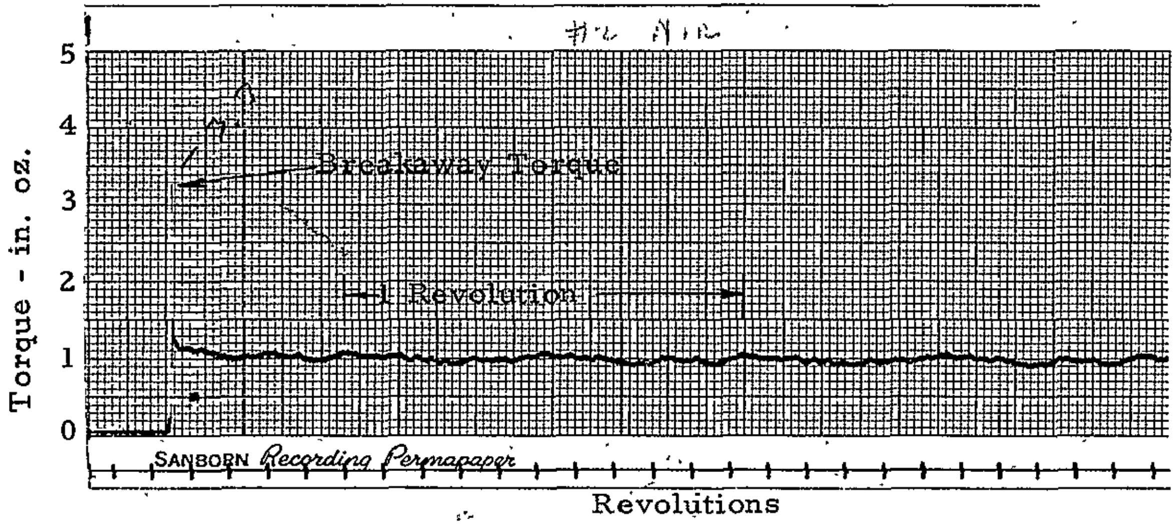


Air Test

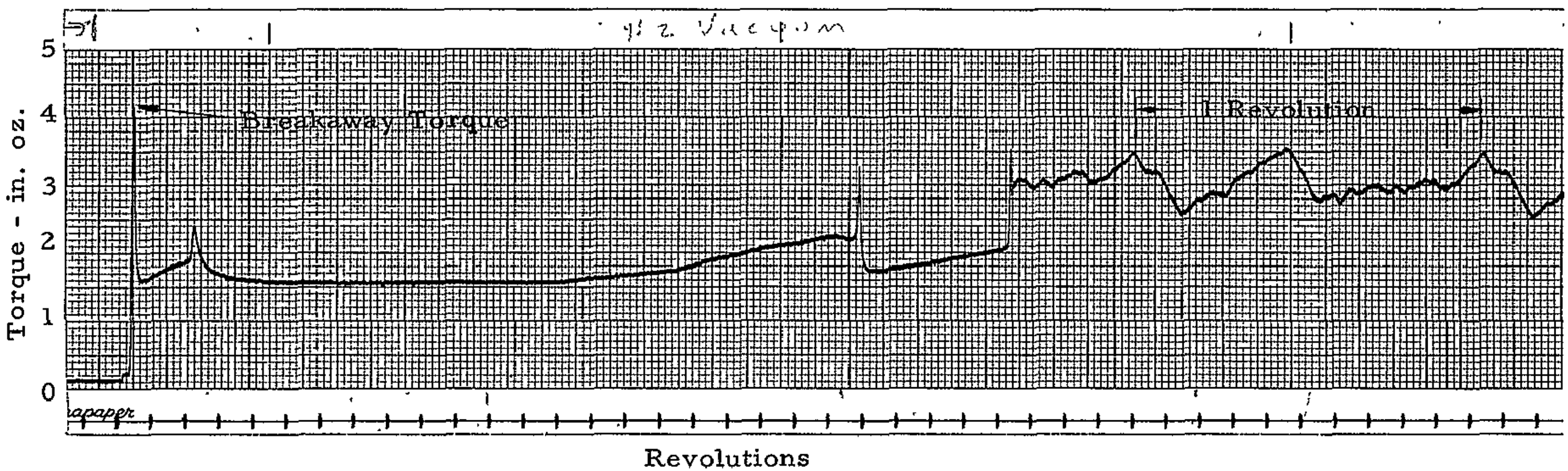


Air Test With 2 lb. Weight

Figure 1-22. Specimen No. 1 Bearing Test

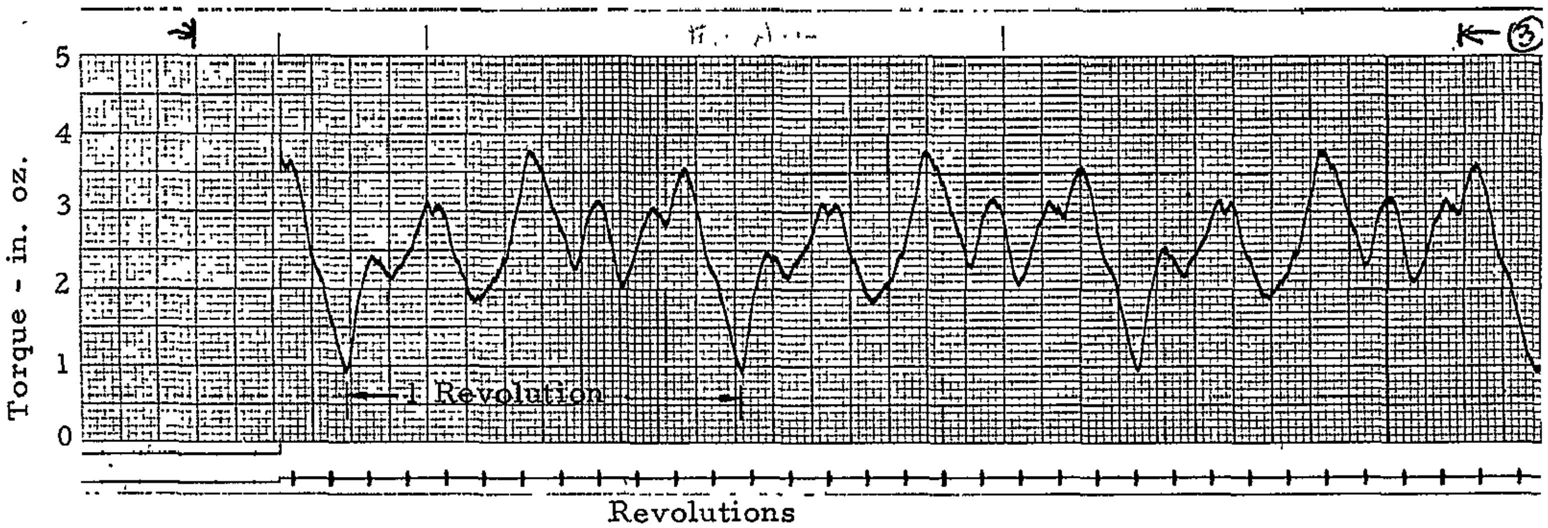


Before Vacuum

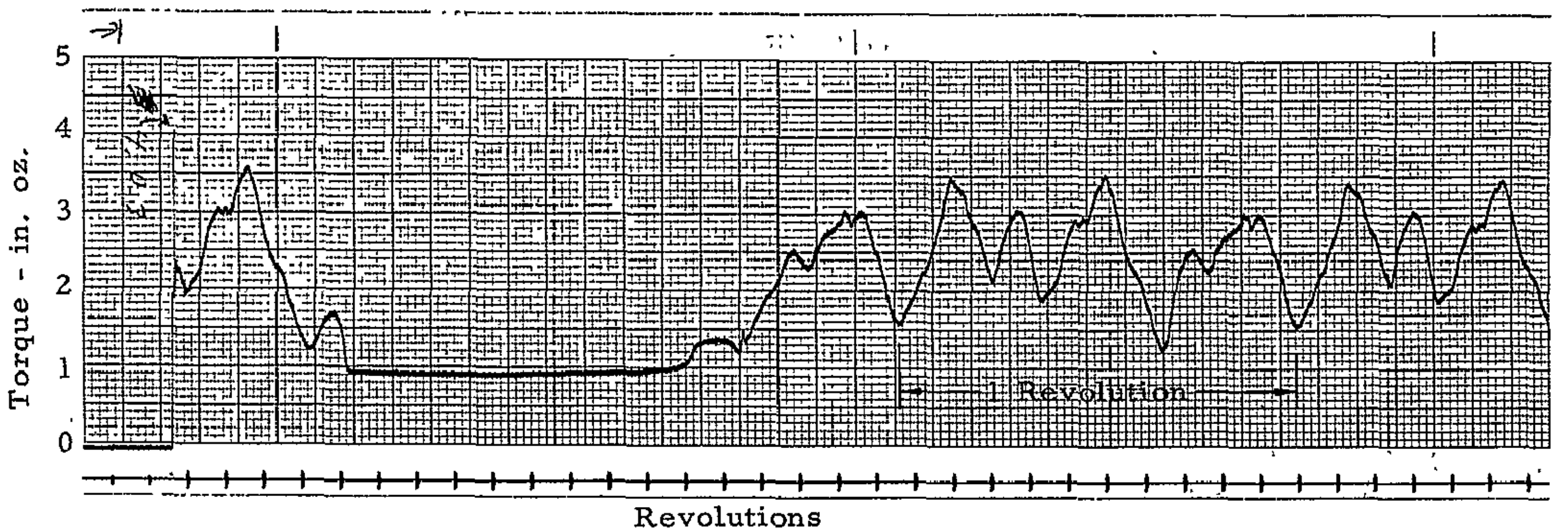


After Vacuum

Figure 1-23. Specimen No. 2 Bearing Test

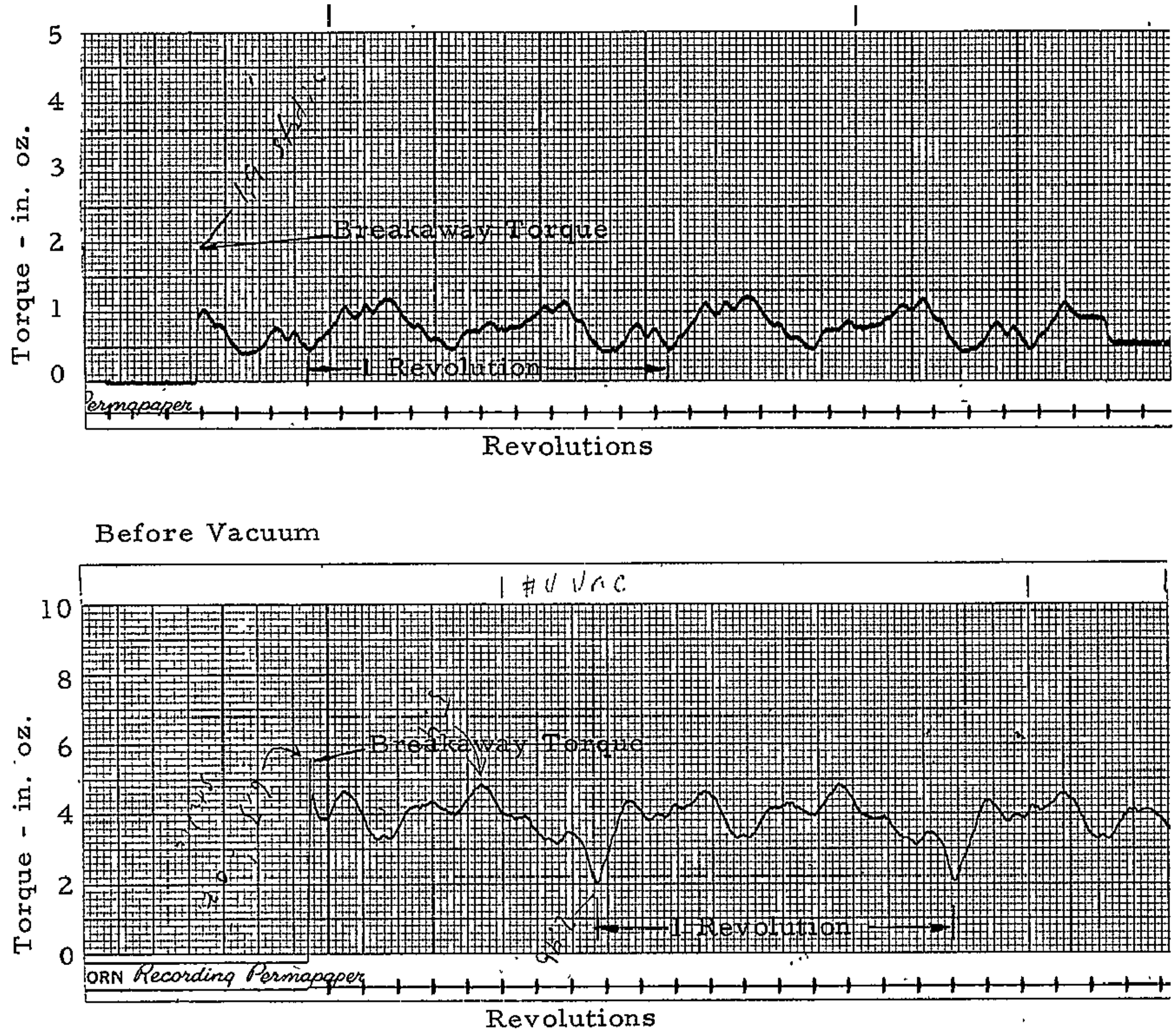


Air Test



Air Test With 2lb Weight

Figure 1-24. Specimen No. 3 Bearing Test



After Vacuum

Figure 1-25. Specimen No. 4 Bearing Test

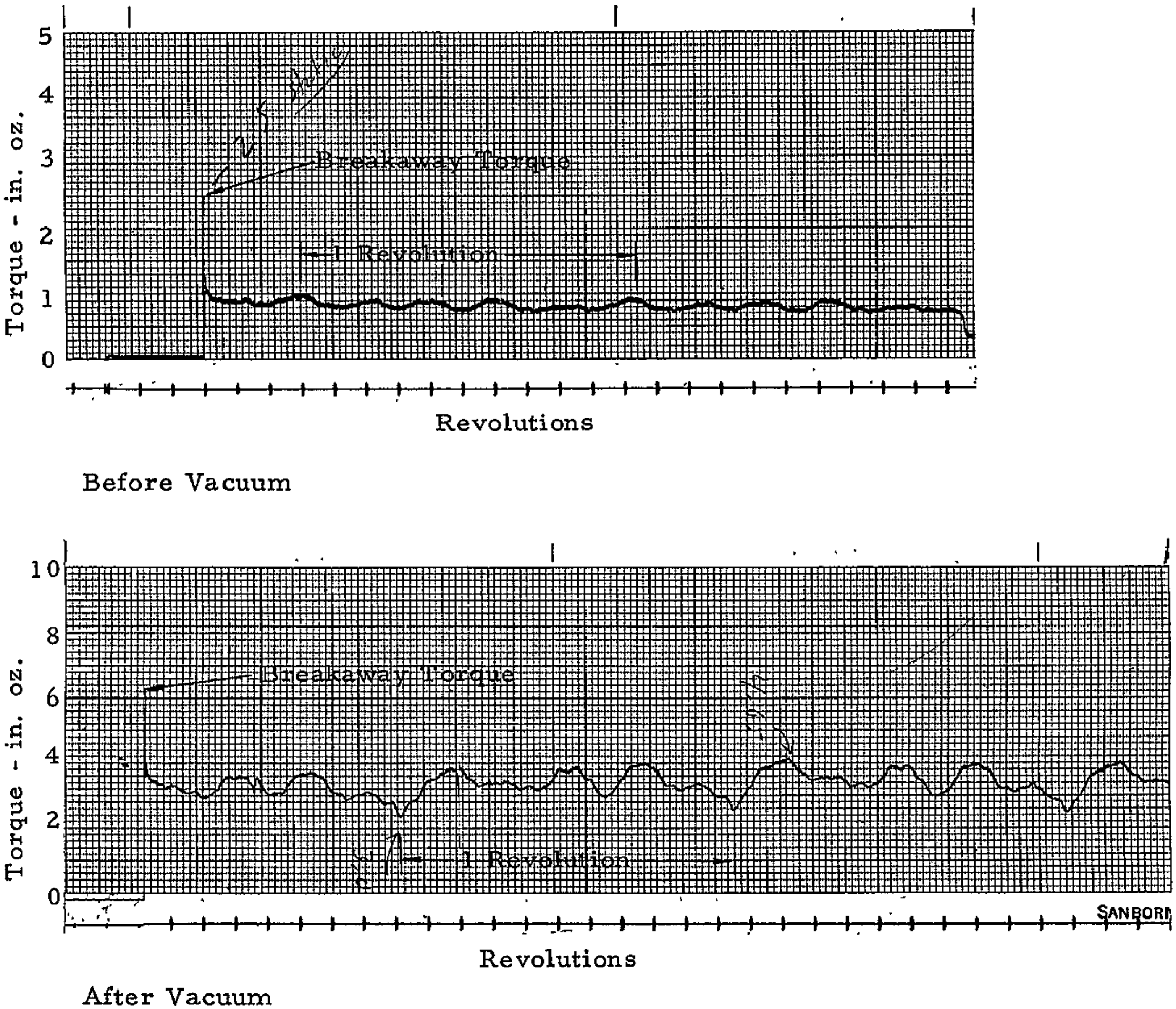
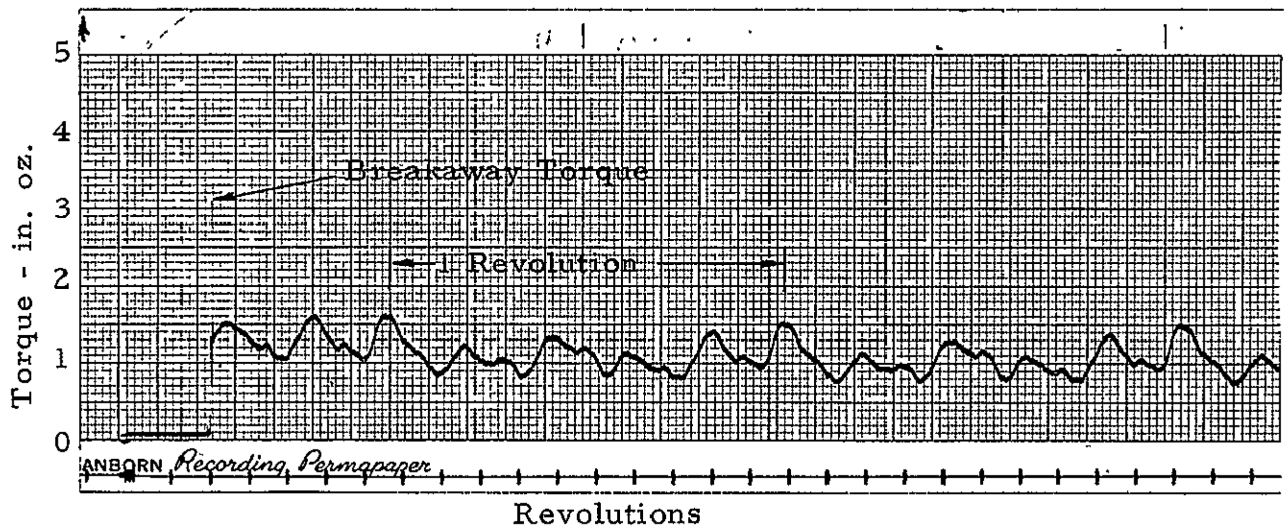
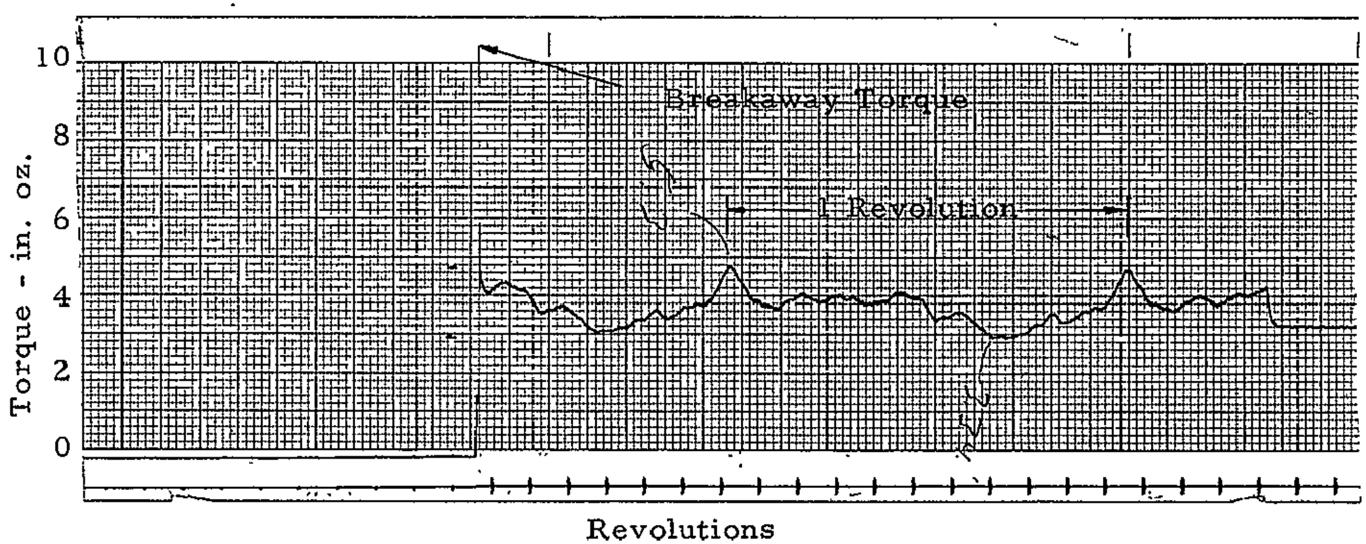


Figure 1-26. Specimen No. 5 Bearing Test

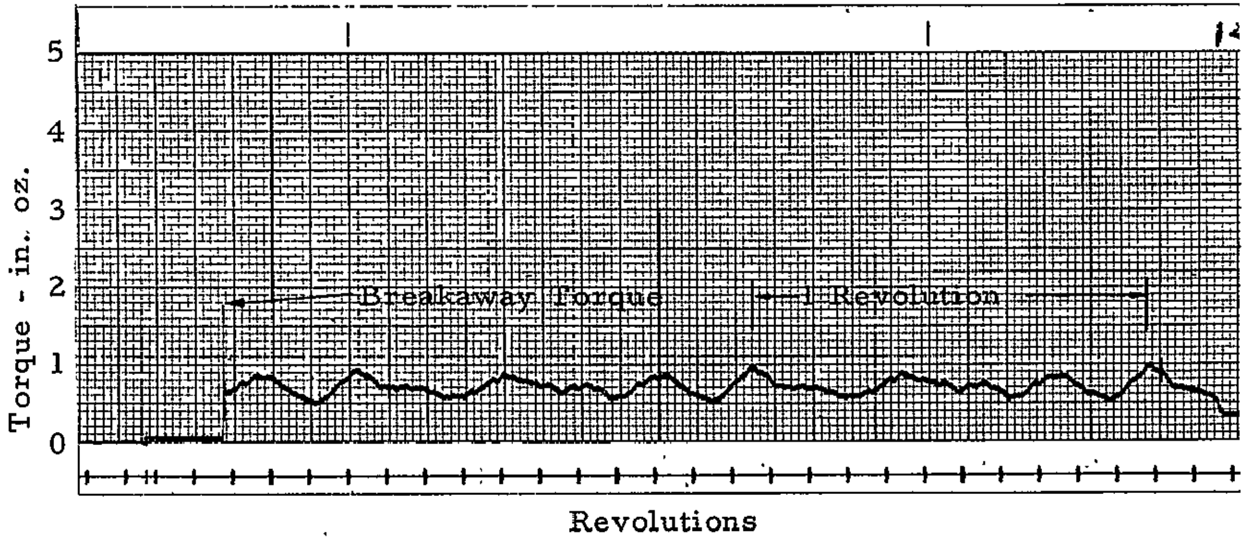


Before Vacuum

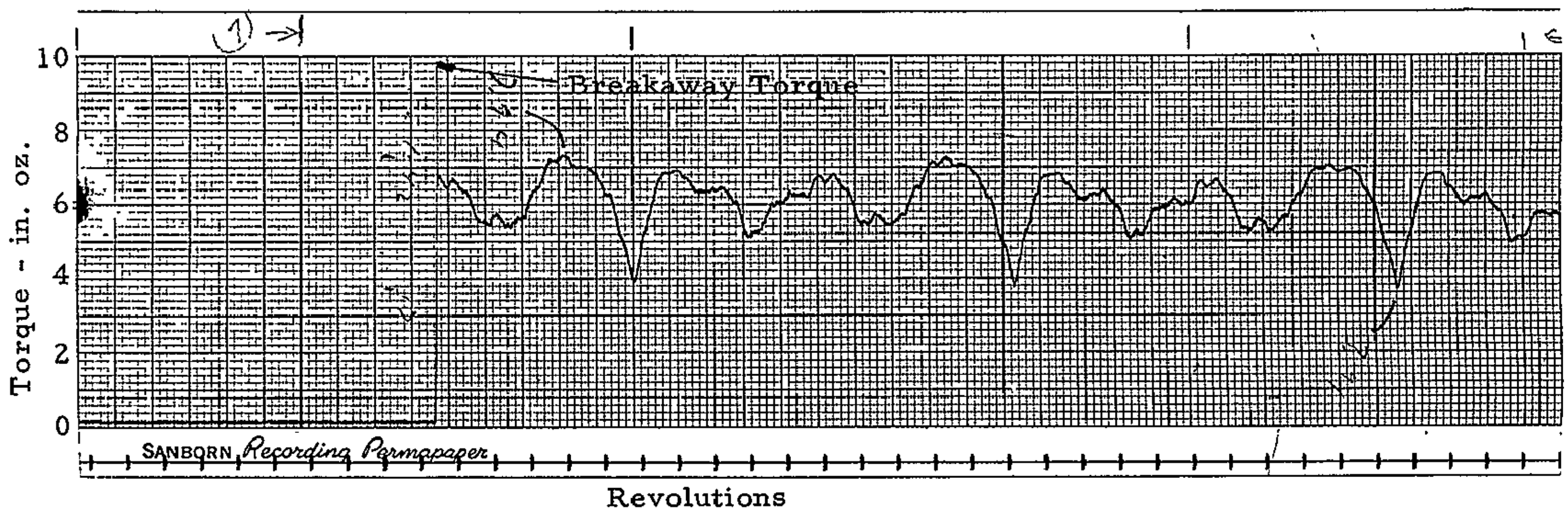


After Vacuum

Figure 1-27. Specimen No. 6 Bearing Test

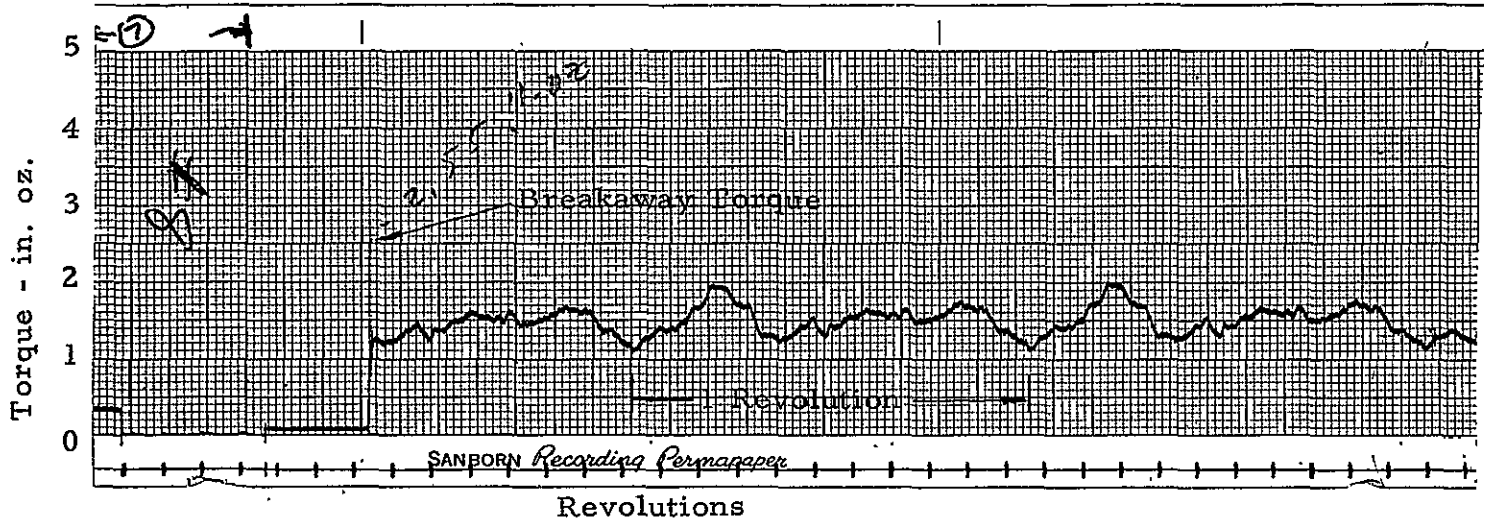


Before Vacuum

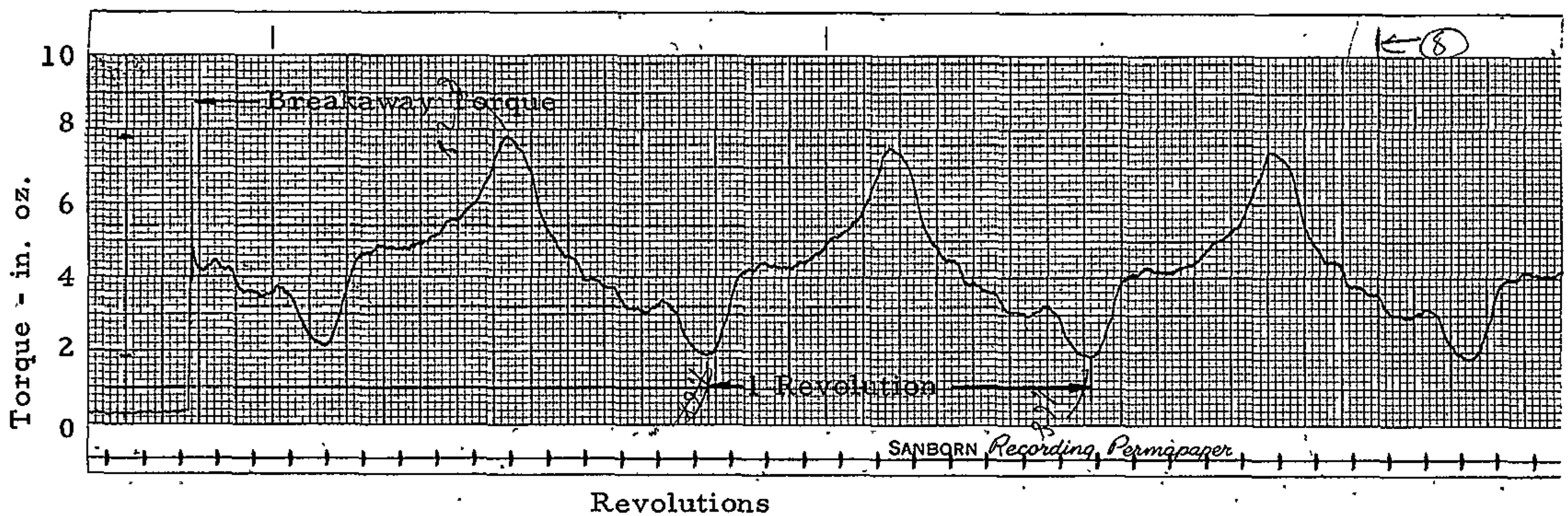


After Vacuum

Figure 1-28. Specimen No. 7 Bearing Test



Before Vacuum



After Vacuum

Figure 1-29. Specimen No. 8 Bearing Test

1.2.3 COLUMN TEST— Column tests were performed on the selected carpenter tape hinge. Detail dimensions of the strut were shown previously in Figure 1-7. The specimens are identical to that which would be used in a 70 foot, 8 bay antenna except the column length was 88.50 inches long. The specimen length was limited to height of the Tinnius Olson machine height. Three gages of hinge material were tested: 0.005, 0.008, and 0.010, 6Al-4V annealed titanium alloy. The column is pin ended. The test objective was to determine the column behavior of the hinge. The total column, positioned in the testing machine is shown in Figure 1-30.

Each column was loaded to collapse and then unloaded. The test was repeated with the same carpenter tape hinge under repeated loadings. The collapsing loads are given in Table 1-4, and the load-deflection curves are shown in Figures 1-31, 1-32, and 1-33. Column failure was by local crippling of the free edge of the carpenter tape as would be anticipated, Figures 1-34 and 1-35. As the column load is applied a local buckle forms along the free edge and travels along the length of the hinge followed by complete buckling of the curved element. A permanent crease was noted in the middle of the curved element, however, had little or no effect in subsequent re-tests of the same hinge. This can be explained by the fact that the crippling load is dependent on the edge restraint rather than any imperfections in the middle of the hinge element.

Table 1-4. Collapsing Loads, Carpenter Tape Hinge Column

	Hinge Thickness (in.)		
	0.005	0.008	0.010
	Load (lb)		
Column #1			
Initial	140	270	345
Rerun #1	135	210	260
Rerun #2	135	220	260
Column #2			
Initial	195	280	340
Rerun #1	195	250	180
Rerun #2		250	165

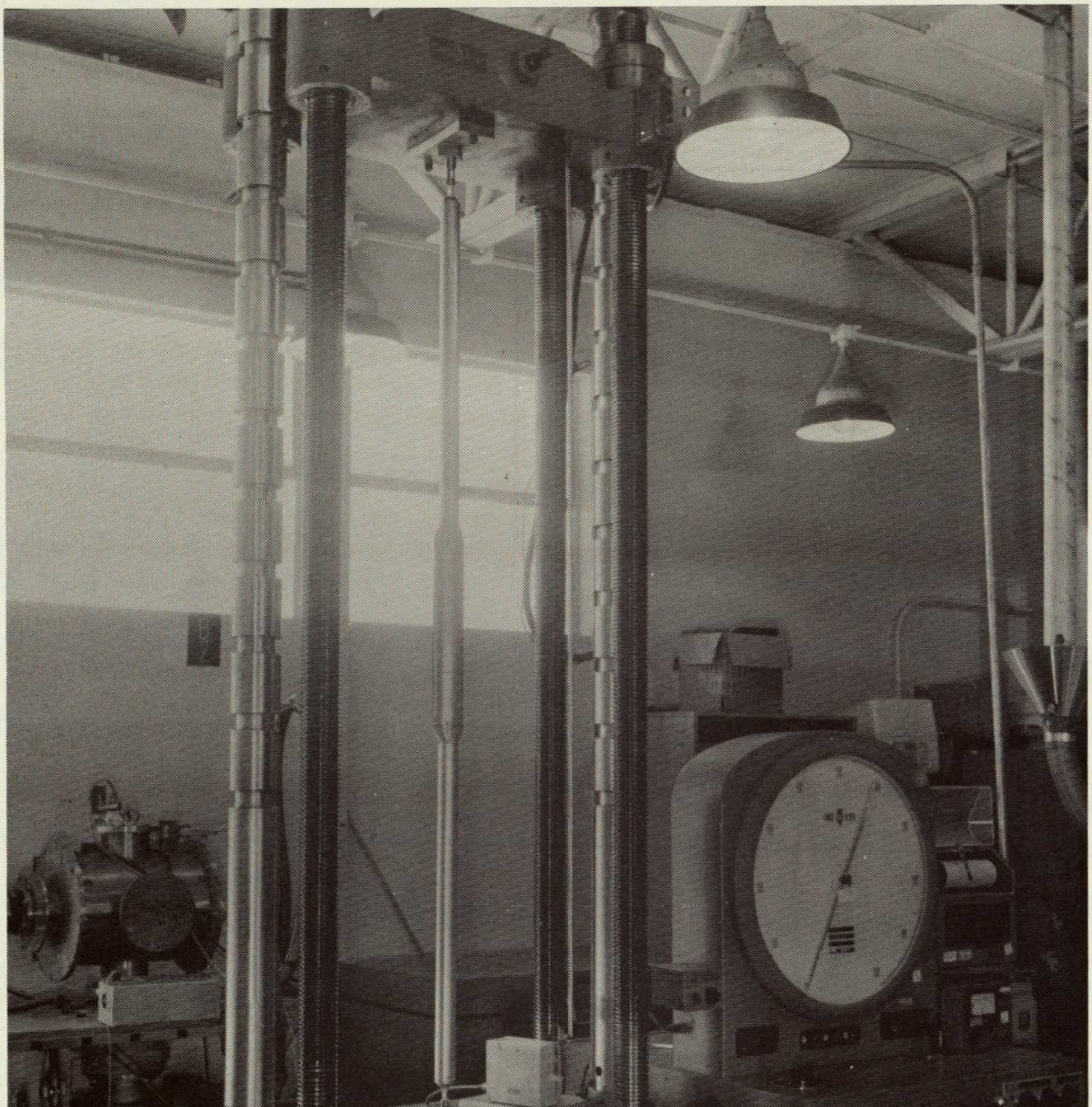
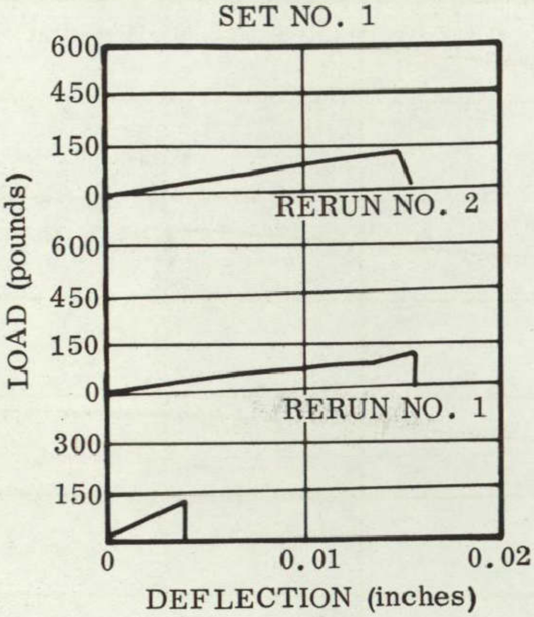


Figure 1-30. Column Test Installation



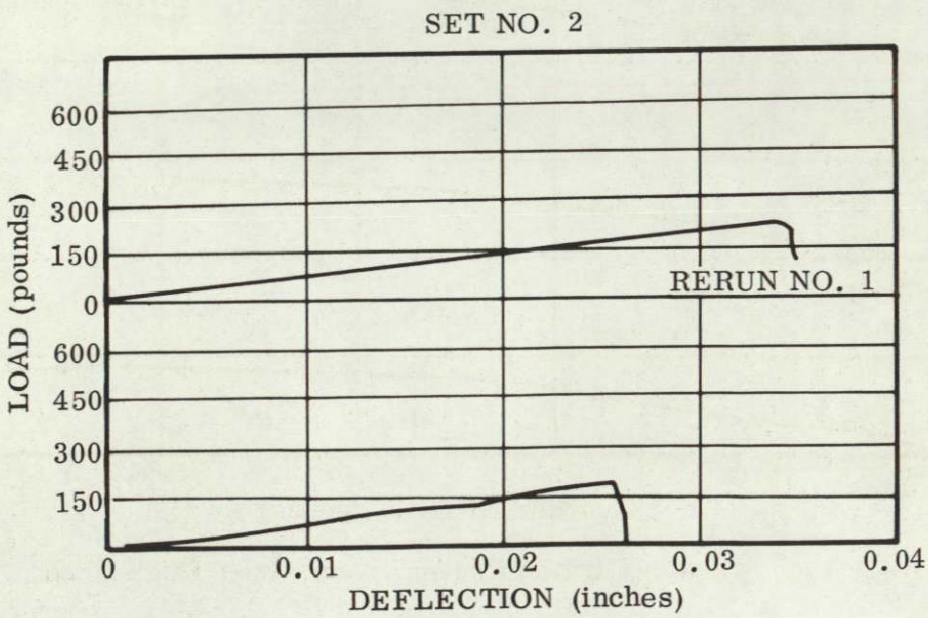


Figure 1-31. Load Deflection Curves, 0.005-Inch-Thick Hinge

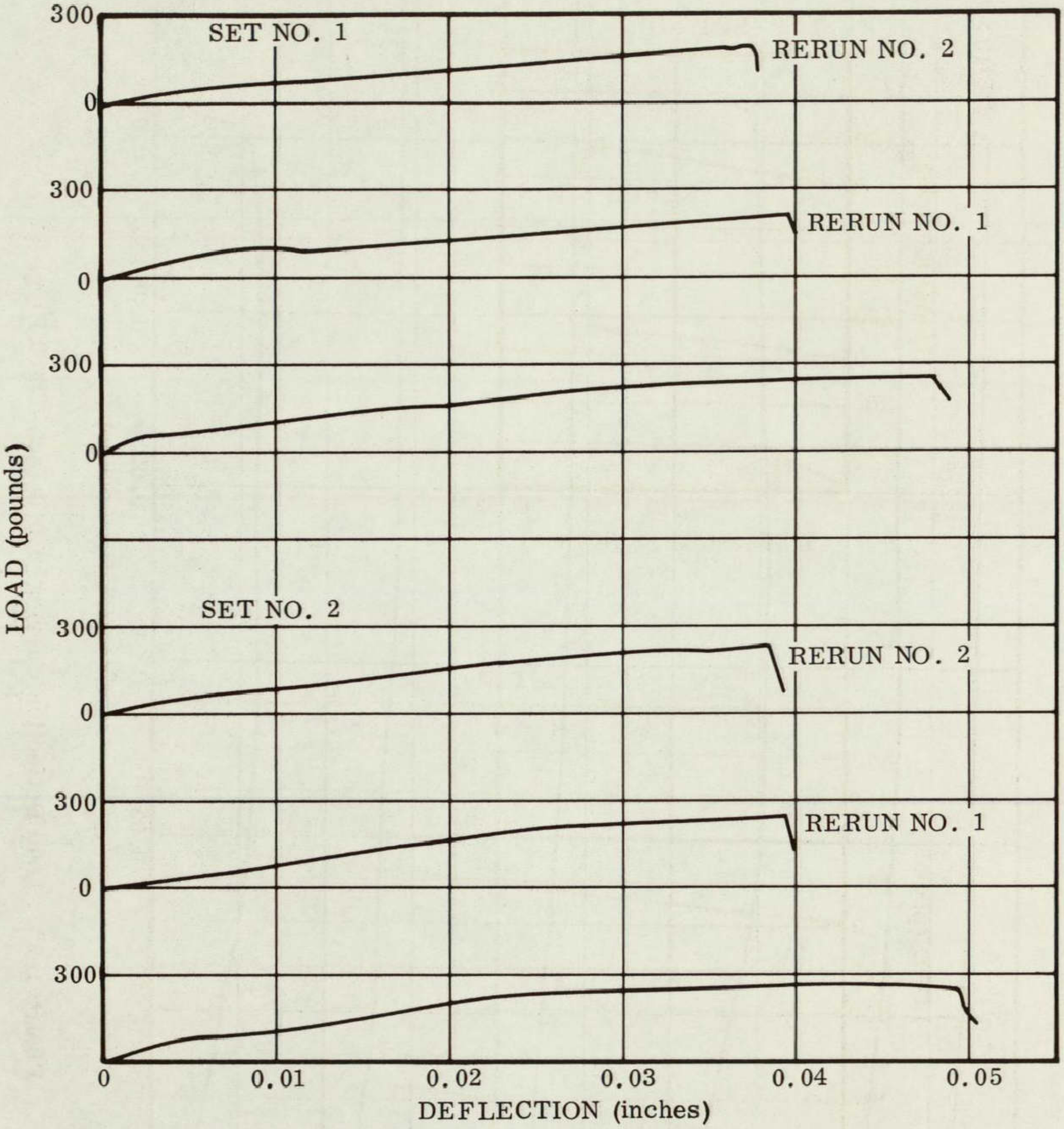


Figure 1-32. Load Deflection Curves, 0.008-Inch Thick Hinge

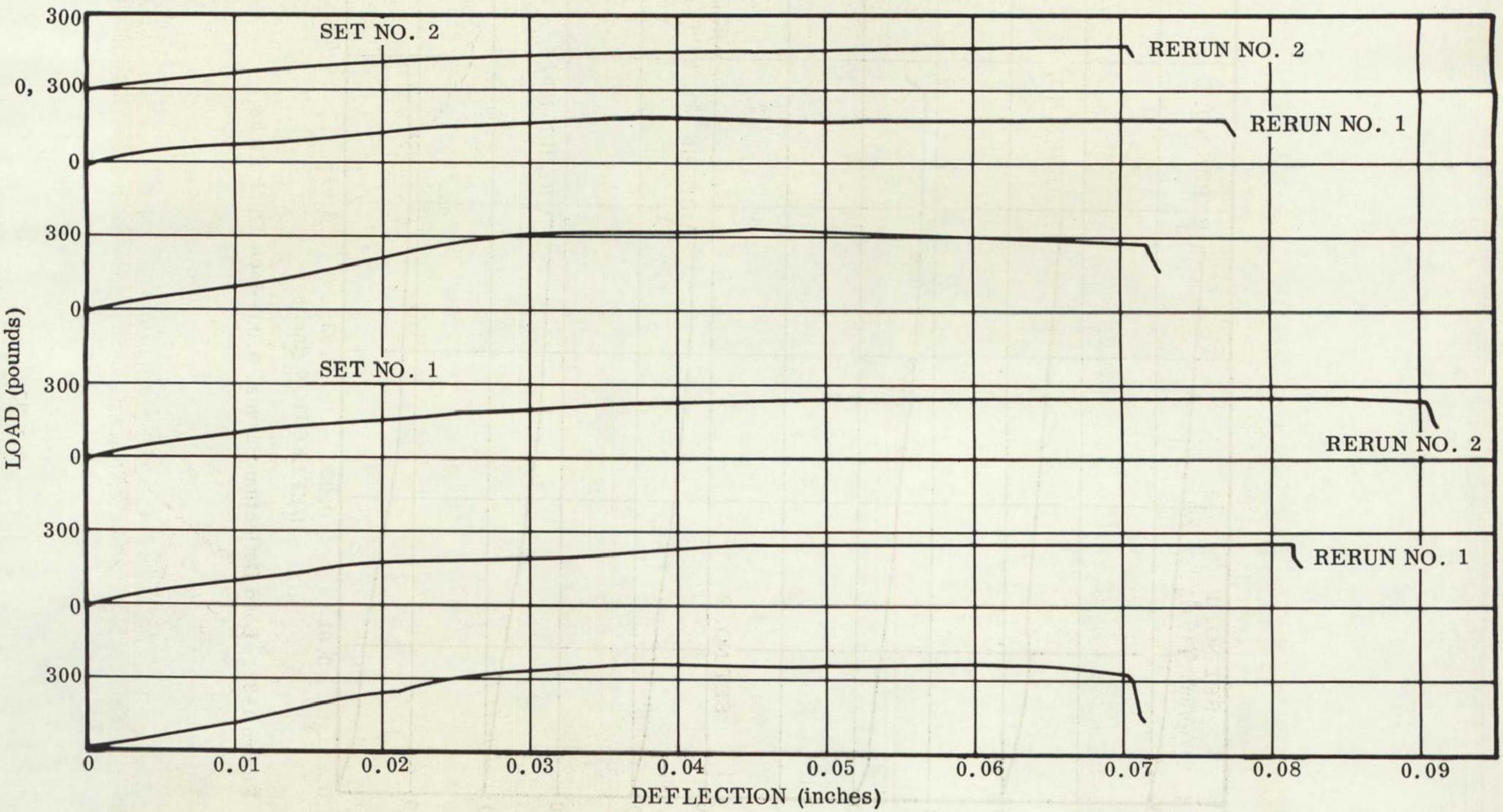


Figure 1-33. Load Deflection Curves, 0.010-Inch-Thick Hinge

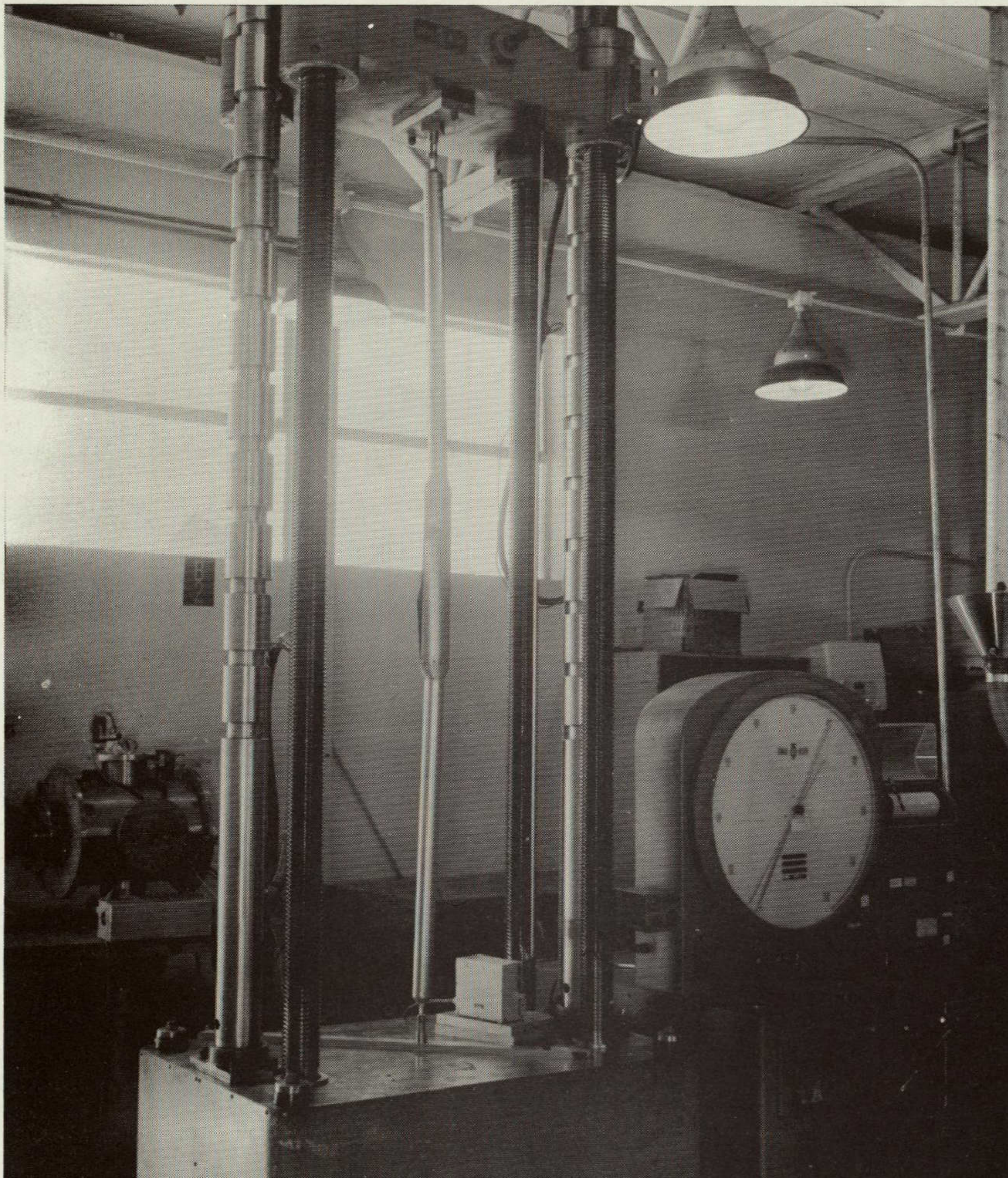


Figure 1-34. Column Test, Buckled Specimen

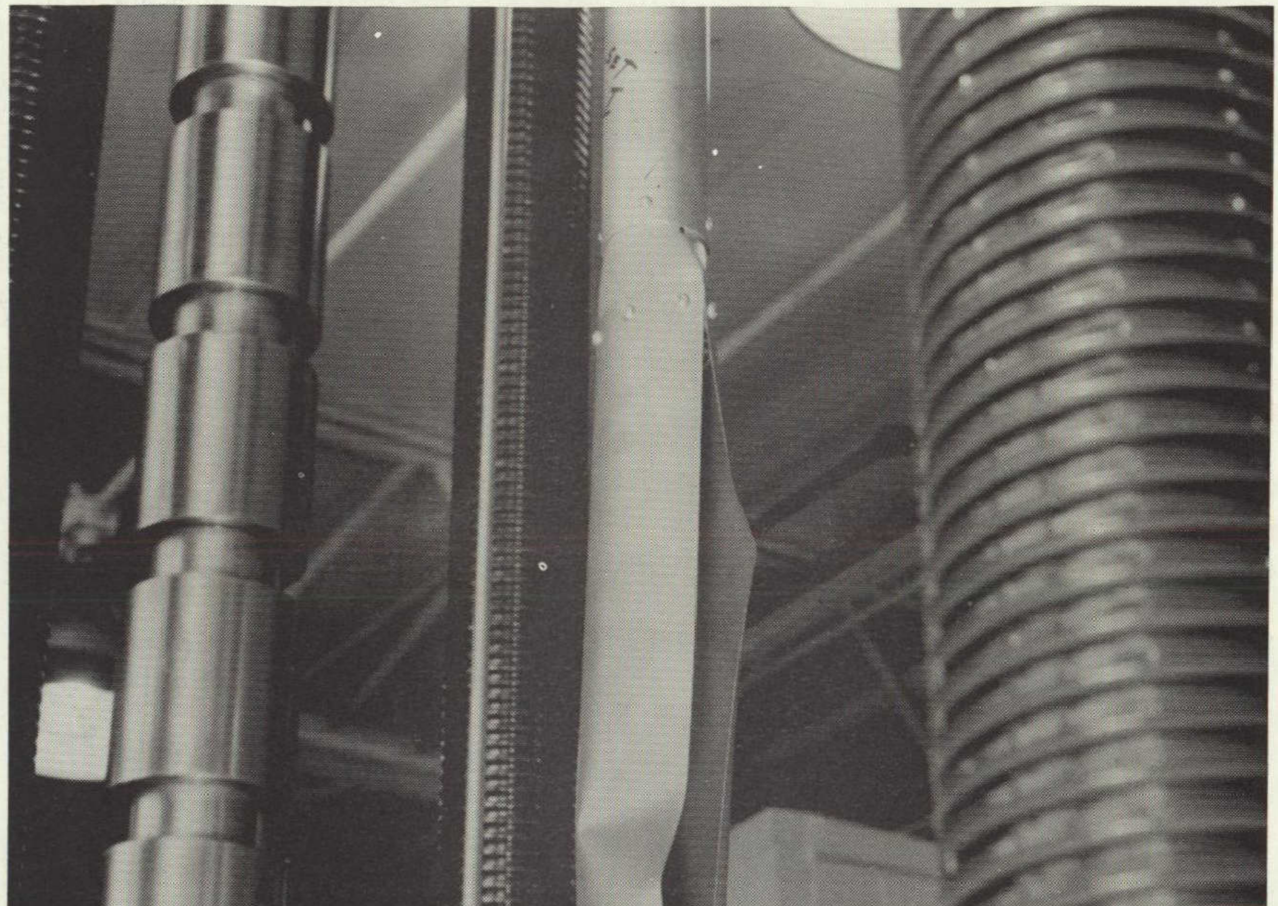


Figure 1-35. Buckled Carpenter Tape Hinge

1.2.4.1 Vacuum Bonding — Three gold-plated chromel-R mesh samples, approximately 7 by 10 inches each, were tightly folded and placed in the fixture shown in Figure 1-36. The fixture contained an electrical heater for heating the specimens to 200°F and a thermocouple for temperature measurement.

Above each specimen, a weight with a particular area of contact was placed to give effective loadings of 10, 60, and 120 lb/in^2.

The fixture was then placed in a General Electric ultra-high vacuum system consisting of a 20-inch ID, 36-inch-long, all stainless steel cylinder that was connected to an 18-inch ID thrust section leading to a 1200-liter-per-second ion pump (see Figure 1-37). After several days pump down, a pressure of 10^{-9} mm Hg was achieved, and the test continued for an additional 30 days.

Actual data indicated that the pressure varied substantially during the test. For the first 3 days pressures as high as 3×10^{-9} were seen at times. For the next 14 days the pressure was always below 10^{-9} (down to 10^{-10}). During the last few days the pressure at times approached 1.4×10^{-9}. The temperature range varied from 187°F to 206°F, but over 95% of the readings were 200 ±5°F.

Following the vacuum exposure for 30 days the specimens were removed from the chamber and carefully examined for vacuum welding. No permanent creasing or vacuum welding was noted.

1.2.4.2 Thermal Growth — A special 6-inch-diameter table faced fixture was designed with built-in cryogenic cooling coils and electrical heaters. A specimen approximately 8-inches in diameter was placed over this table and weights attached at 8 equally spaced points. (See Figure 1-38.) These weights were identified and elevation points established corresponding to elevation points on the table. The weights were designed to be sufficient to remove all slack and a special teflon coated insulation cover was designed to insure even temperature distribution in the specimen. The temperature of the specimen was then cycled three times from-300°F to +400°F with relative changes in the elevation points determined by a cathetometer. The entire fixture was enclosed in a special plexiglass cover and a dry helium purge was maintained around the apparatus. This prevented frost so that the elevation marks could be observed. (See Figure 1-39.)

The data from weights located opposite each other were combined and by subtracting out the expected expansion of the support table, etc, the diametric changes of the specimen were determined across four major diameters. The results are shown in Figure 1-40. The nominal values were determined to be approximately 10×10^{-6} in./in.-°F from room temperature to +400°F and approximately 6×10^{-6} in./in.-°F from -300°F to room temperature.

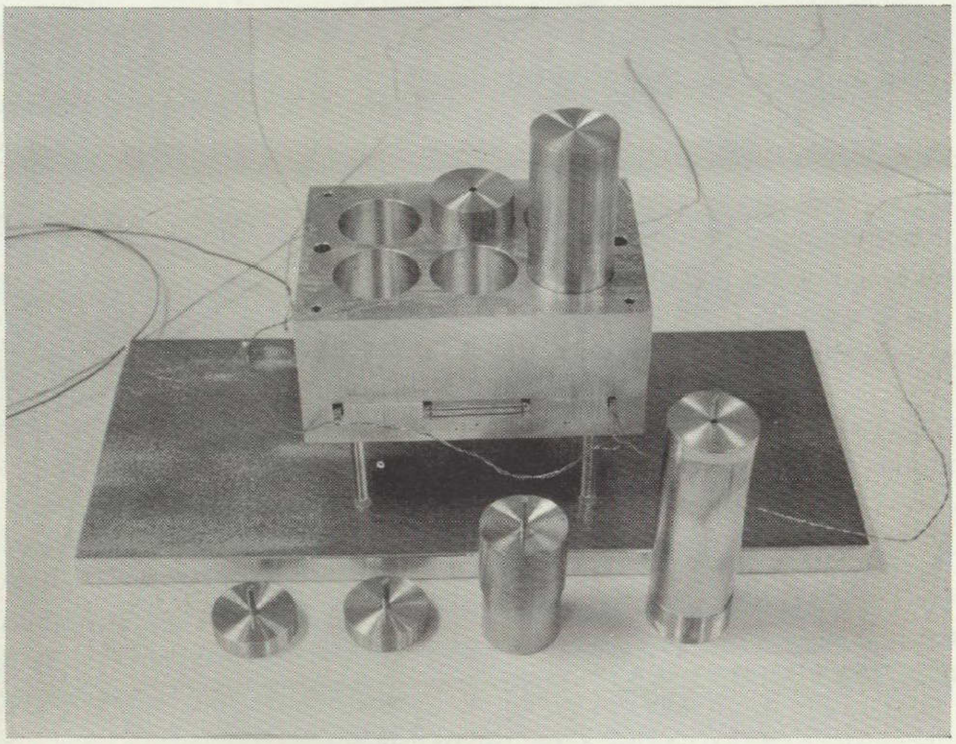


Figure 1-36. Vacuum Welding Test Fixture

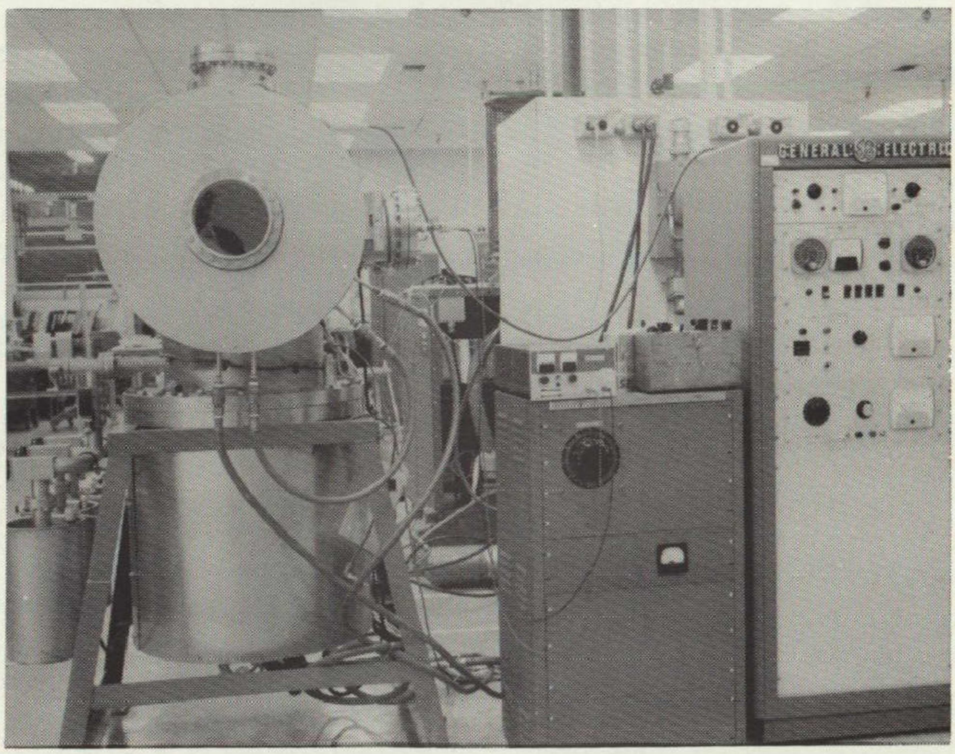


Figure 1-37. G.E. Vacuum System

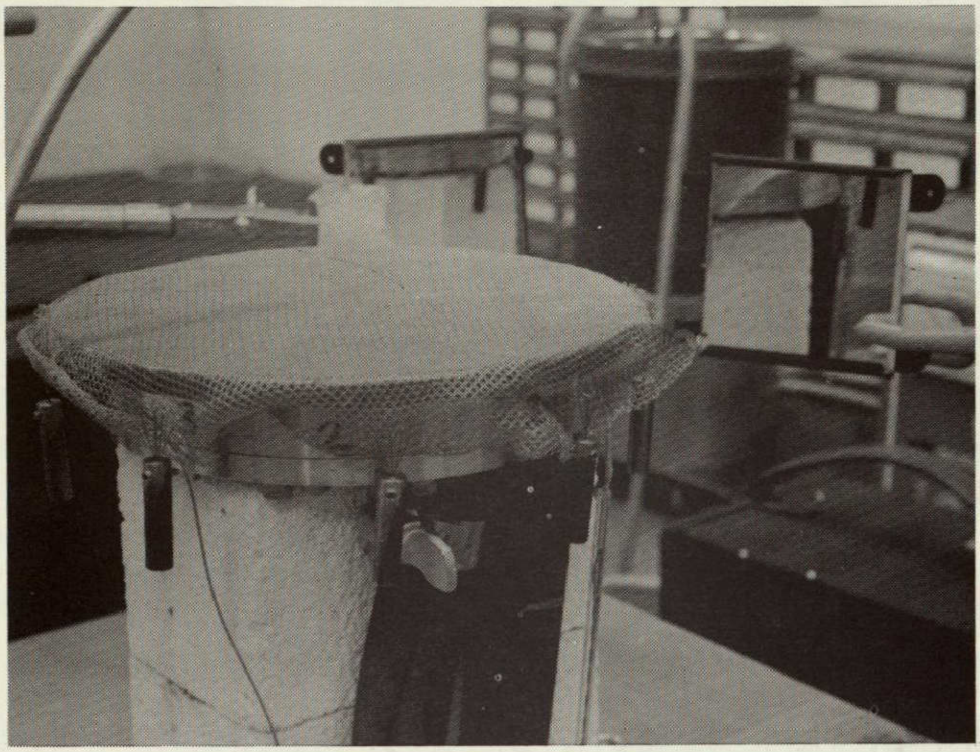


Figure 1-38. Thermal Expansion Test Table and Specimen

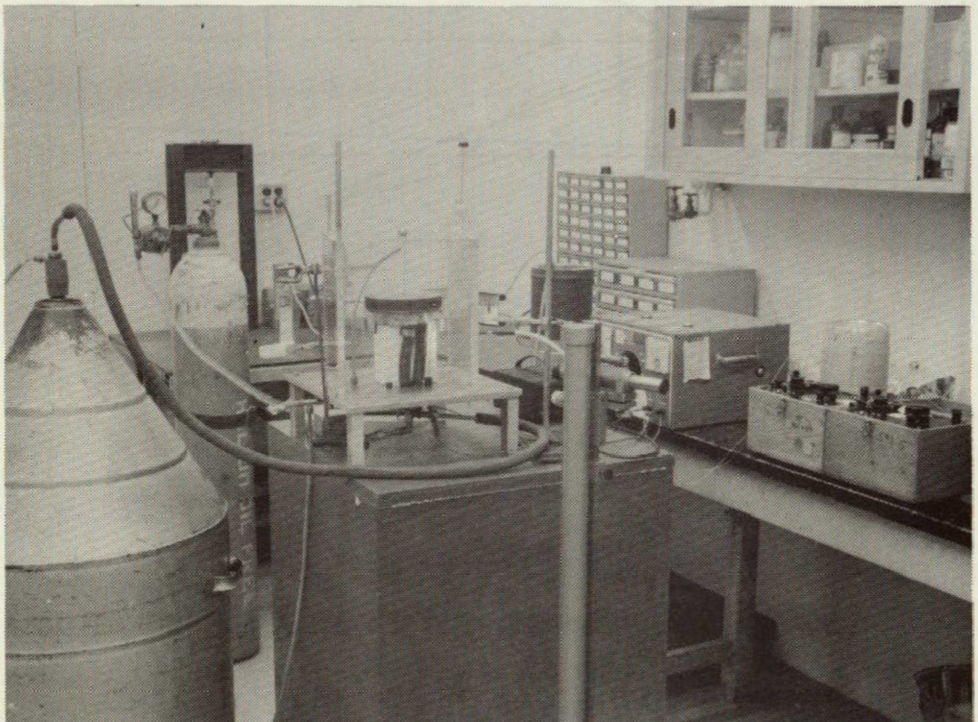


Figure 1-39. Thermal Expansion Test System

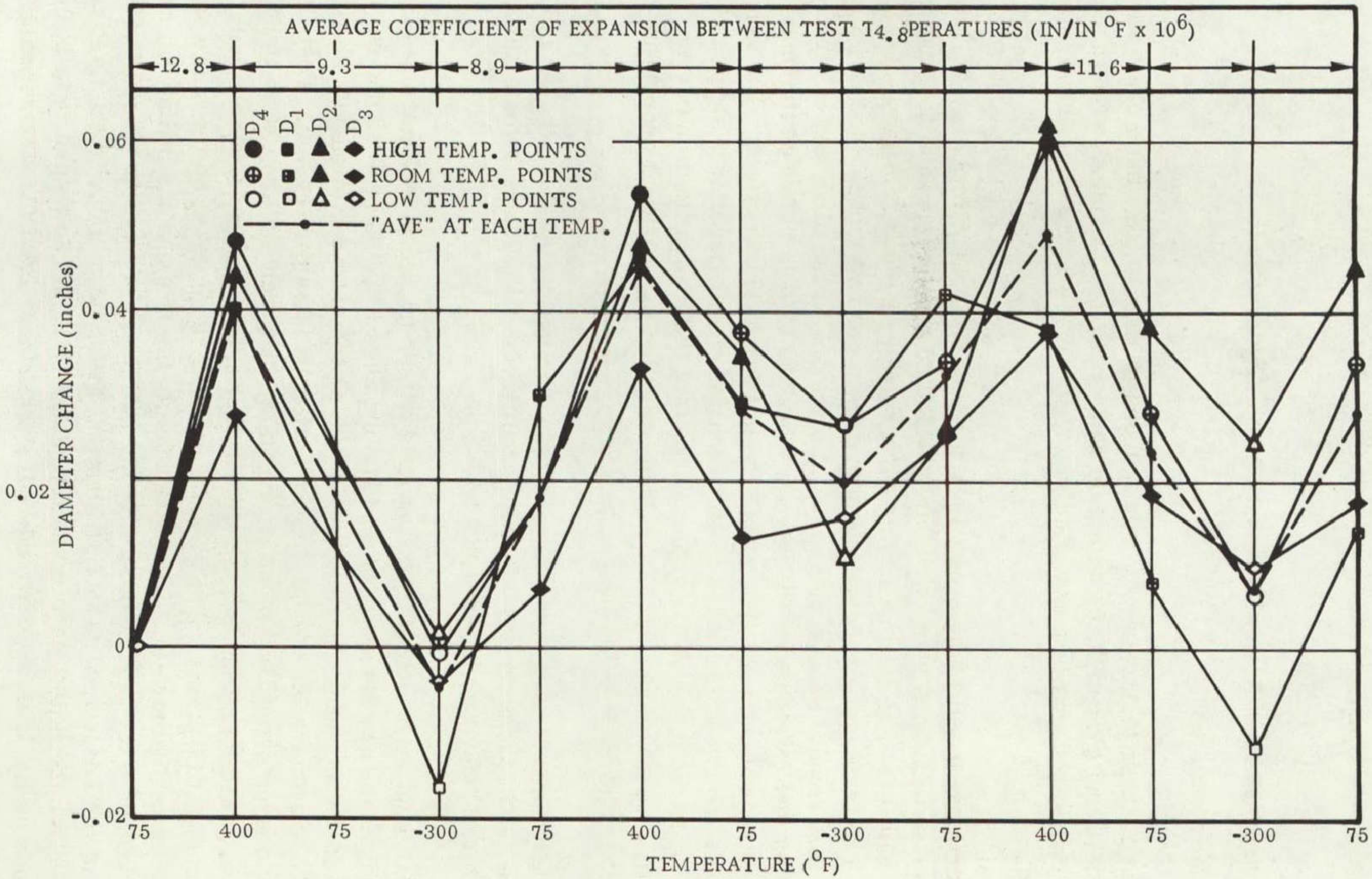


Figure 1-40. Thermal Growth Test, Chromel-R

1.2.4.3 Tensile Tests — Four types of mechanical property tests were accomplished on the gold-plated chromel-R mesh.

a. Unidirectional Tensile Tests

b. Bi-Axial Tensile Tests

c. Bi-directional Tensile Test with a 1/8 inch diameter hole

d. Mesh deflection test

The purpose of these tests were to establish design data on the mesh characteristic, load-deflection and normal force detection data required for mesh adjustment. The mesh material tested was that specified in Section 1.1.4 and procured to the specification cited.

The unidirectional tensile tests were accomplished in three directions, 0°, 45°, and 90°. The material orientations were arbitrarily selected since the weave does not exhibit a significant pattern. The load extension curves are presented in Figures 1-41, 1-42, and 1-43. The tests were accomplished on specimens two inches wide and 5 inches long. The test results show a tightening of the loops in the direction of stretch resulting in bending and extension of the loops. When the load is released the loops do not assume their original shape, thus resulting in the hysterisis effect. The variations in the load-deflection at low loads is an indication of the directional stretch of the material. Once the loops of the material are taut the load deflection curves are similar for the three directions indicating to a larger degree the material properties of the individual threads.

The material in effect goes through two stages during loading: 1) bending and tightening of the loops, and 2) tension and bending of the individual strands of material together with transverse reduction in specimen width.

The bi-axial tests were conducted using the test set-up shown in Figure 1-44. The mesh material was spread over the test fixture shown in Figure 1-45 and cut to a 6 x 6 inch test specimen. The corners of the material was trimmed as shown in Figure 1-46 to remove the corner effects during the bi-axial tension. Tests were run in the 0-90 degree direction and ±45° direction. The results are shown in Figure 1-47. The slope is greater than that of the unidirectional test primarily as a result of the restraint in both directions. The bi-axial tests were repeated on the same sample. Data is shown in Figure 1-48. The difference in the slope of the initial run and re-run can be explained in the permanent set of the individual strands as a result of bending. The slope of the second run is nearly identical to the down slope of the first run indicating that after the initial permanent set reloading of the specimen results in primarily tension loads on the individual strands without further yielding. The repeatability of the load deflection curve after the initial tension tend to indicate that the mesh material should be pre-stretched prior to installation on the antenna.

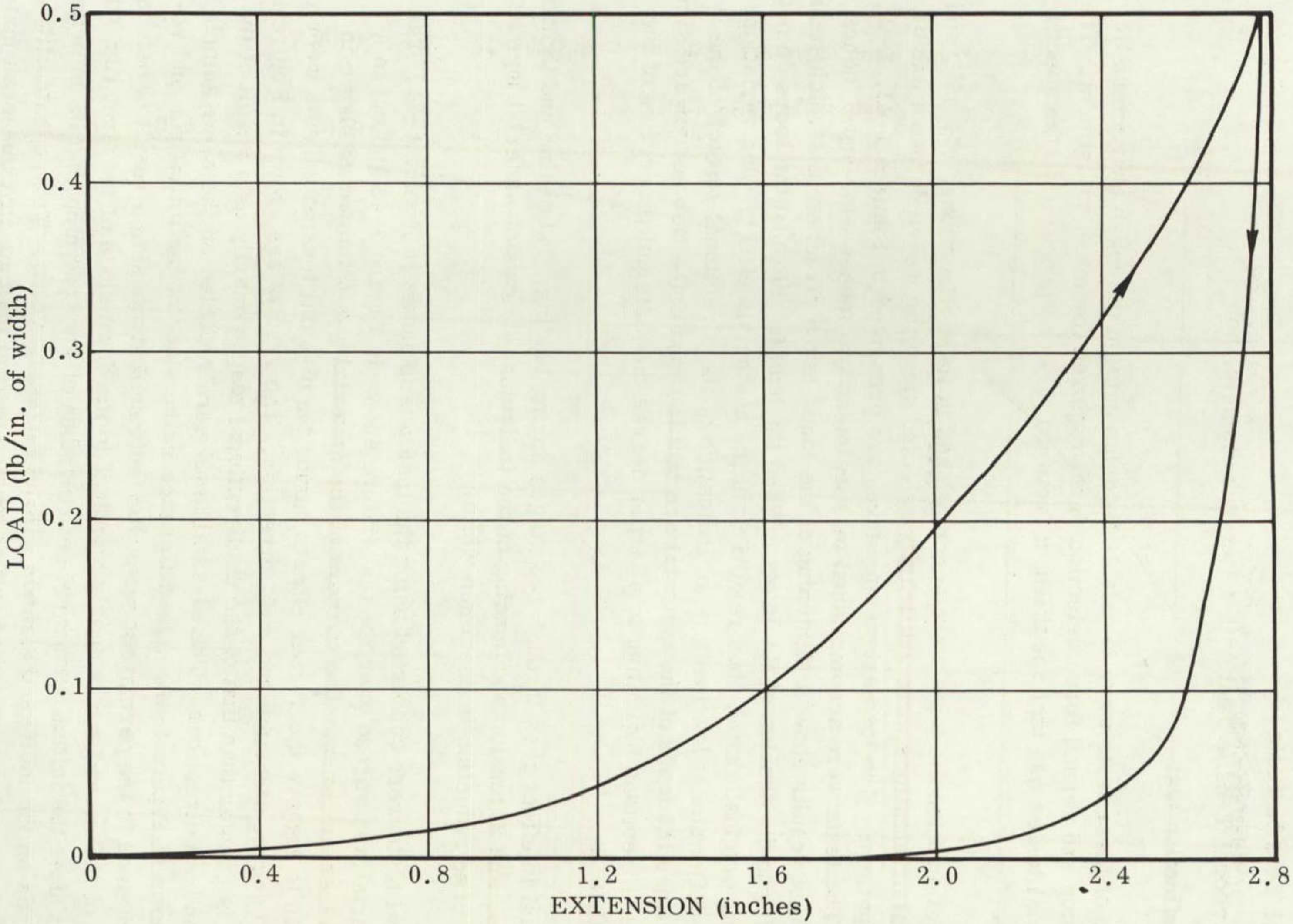


Figure 1-41. Mesh Unidirectional Tensile Test (0 Degrees)

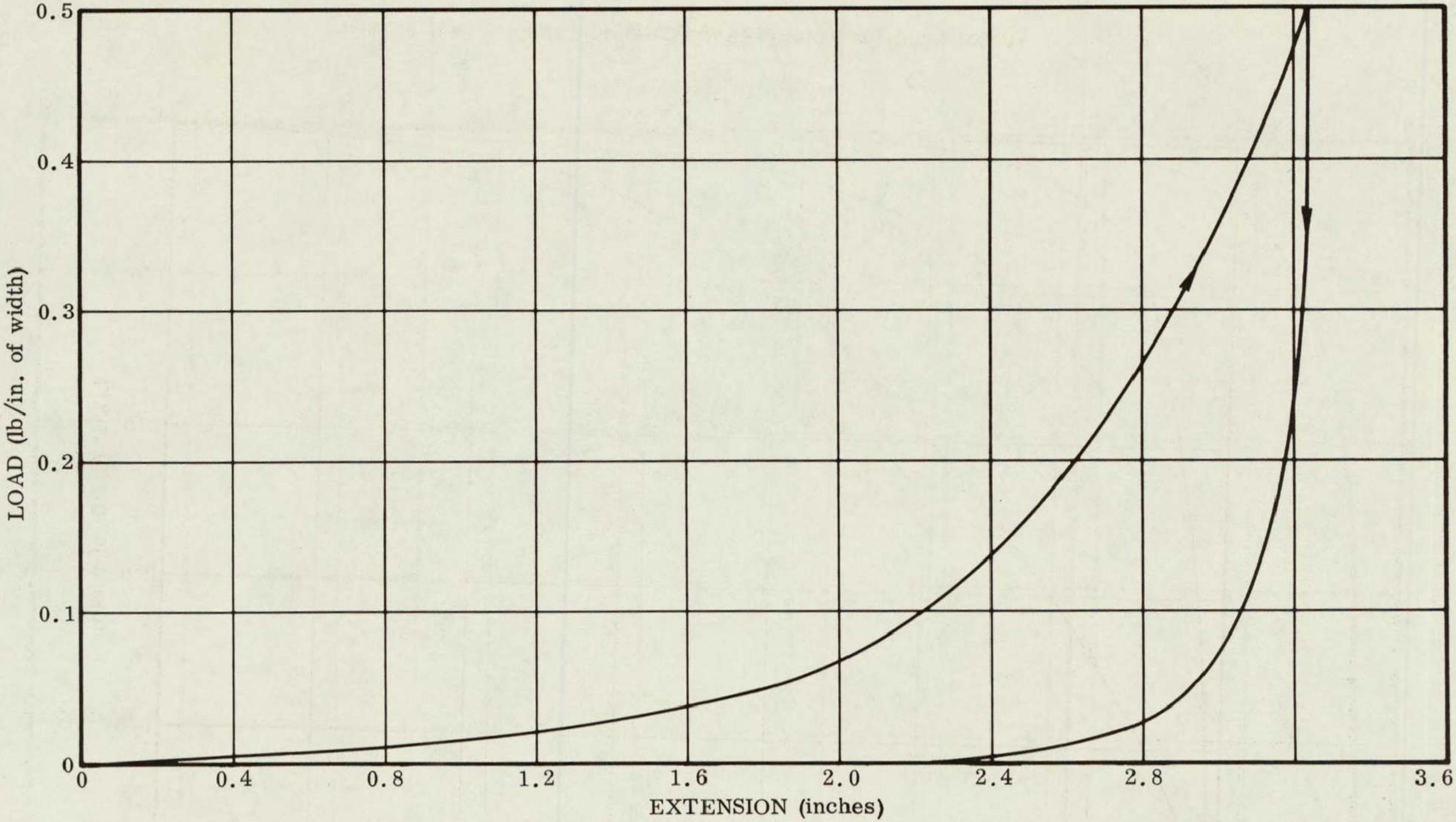


Figure 1-42. Mesh Unidirectional Tensile Test (90 Degrees)

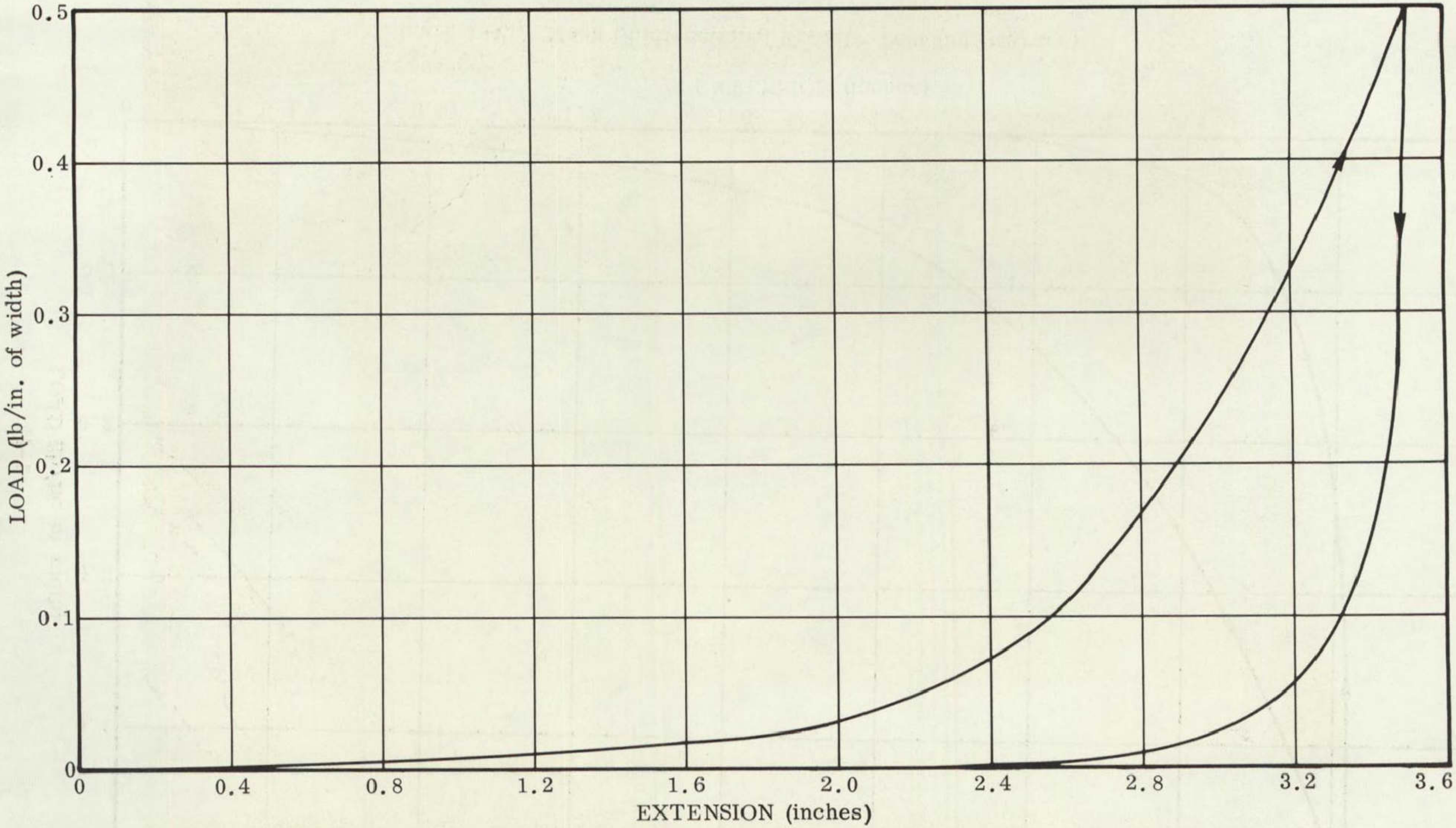


Figure 1-43. Mesh Unidirectional Tensile Test (45 Degrees)

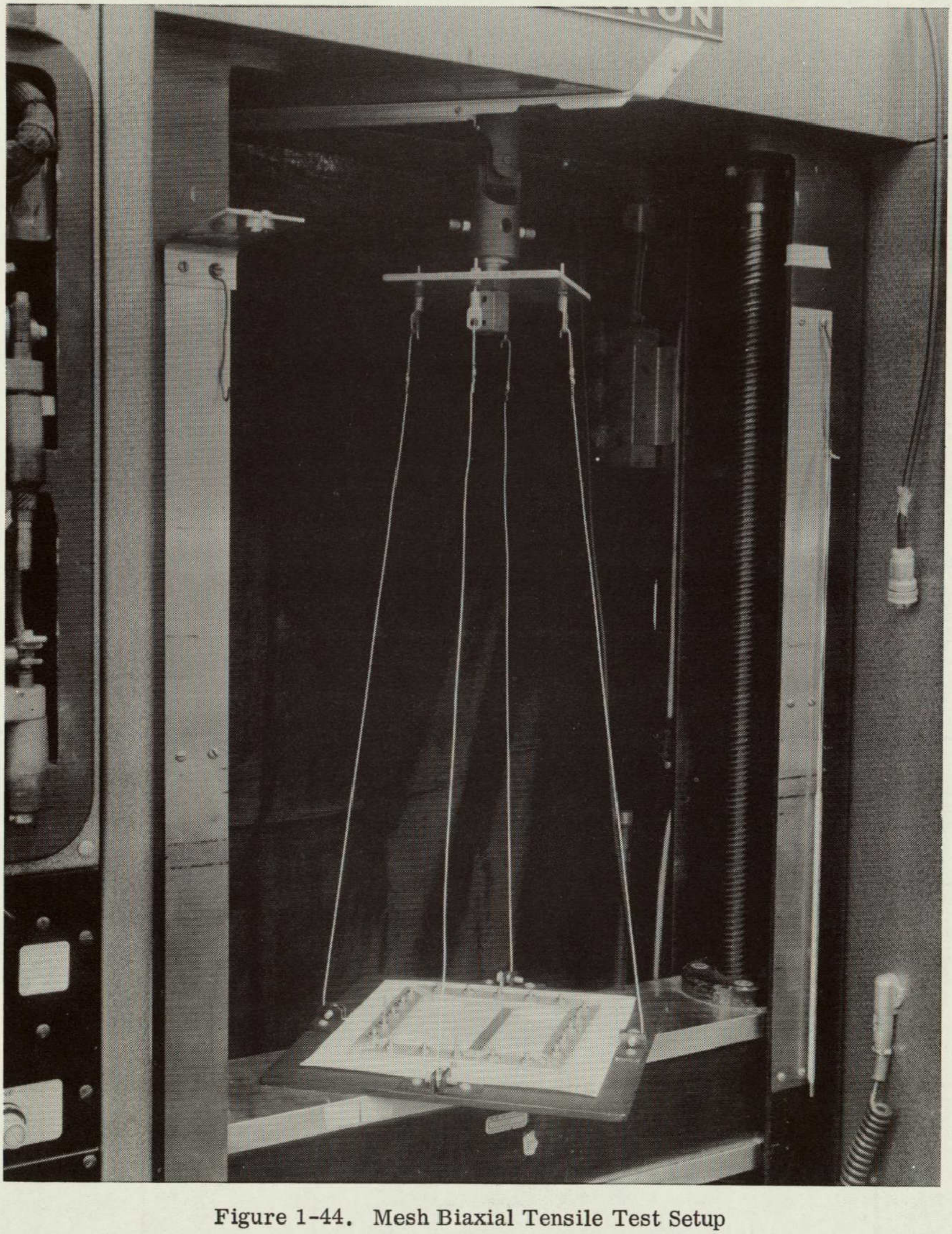


Figure 1-44. Mesh Biaxial Tensile Test Setup

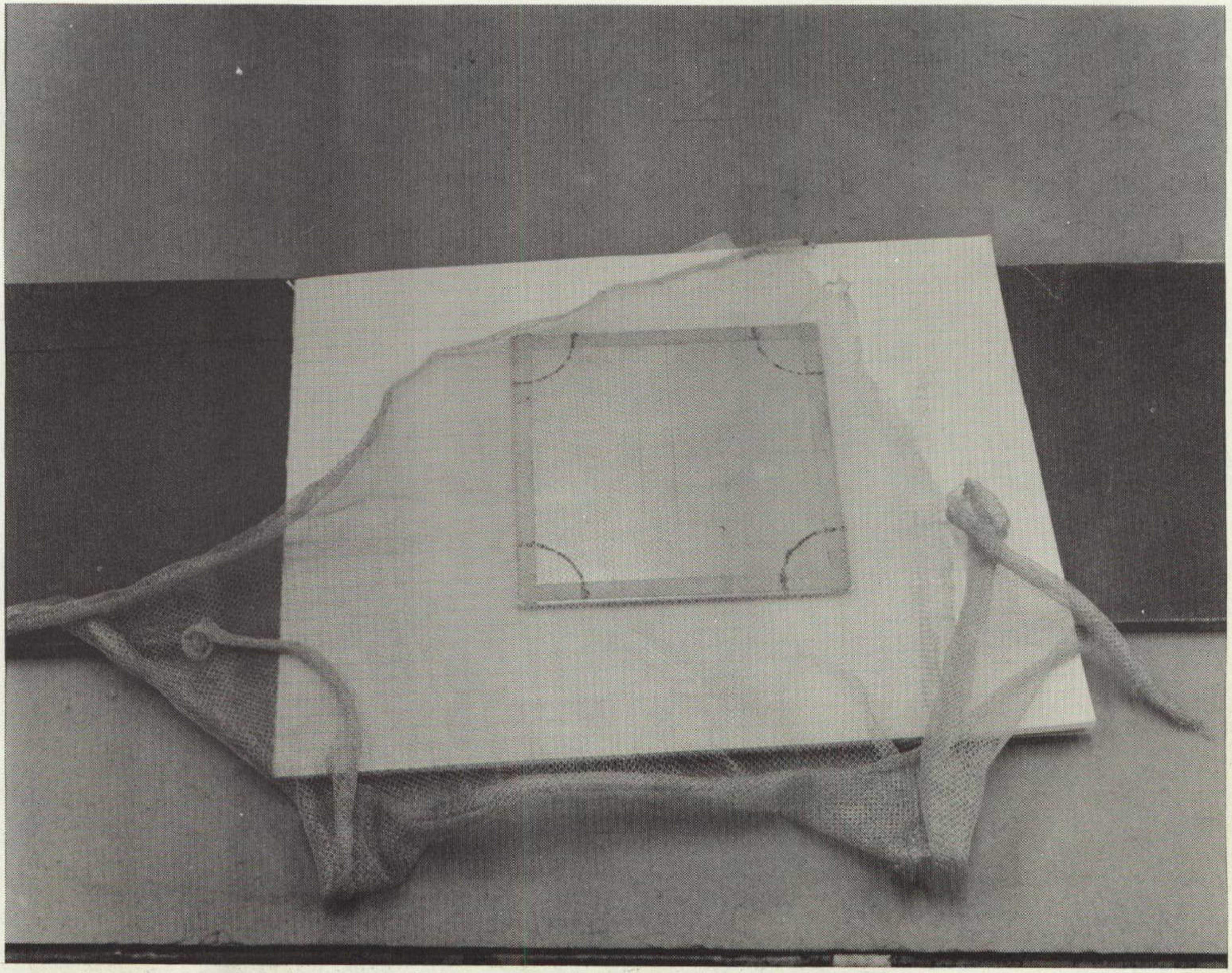


Figure 1-45. Mesh Installation, Biaxial Tensile Test

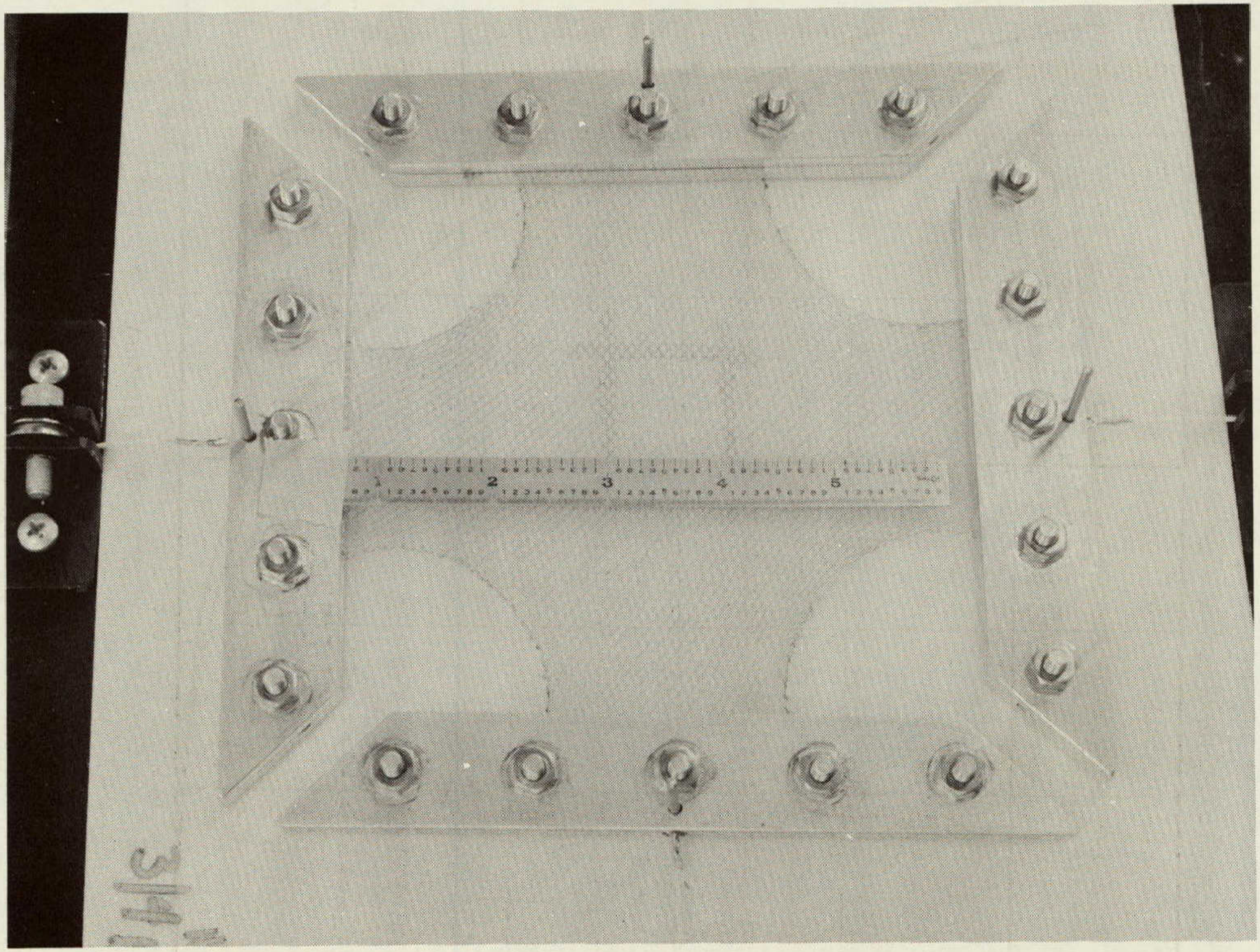


Figure 1-46. Mesh Biaxial Tensile Test Installation

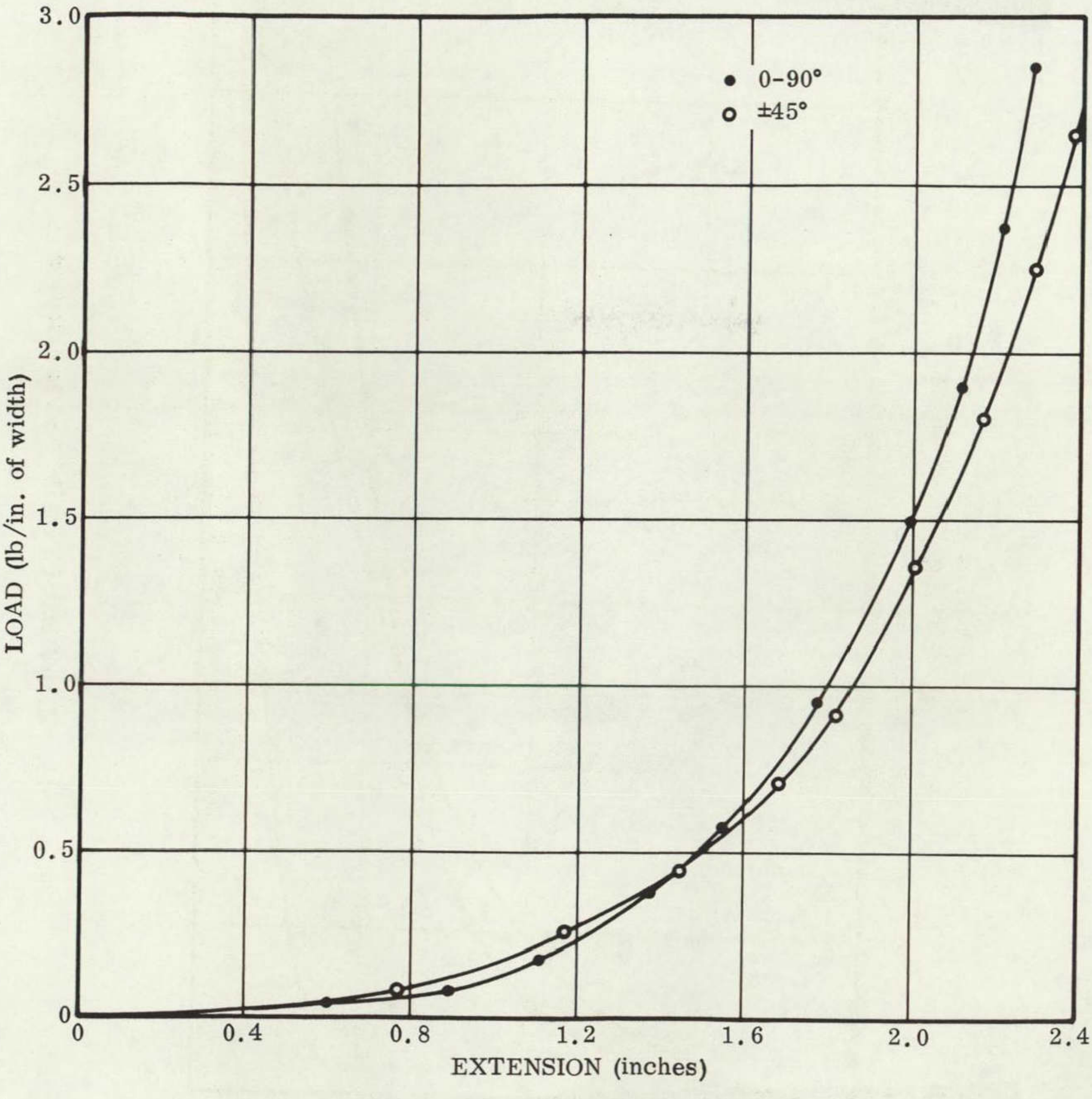


Figure 1-47. Mesh Biaxial Test

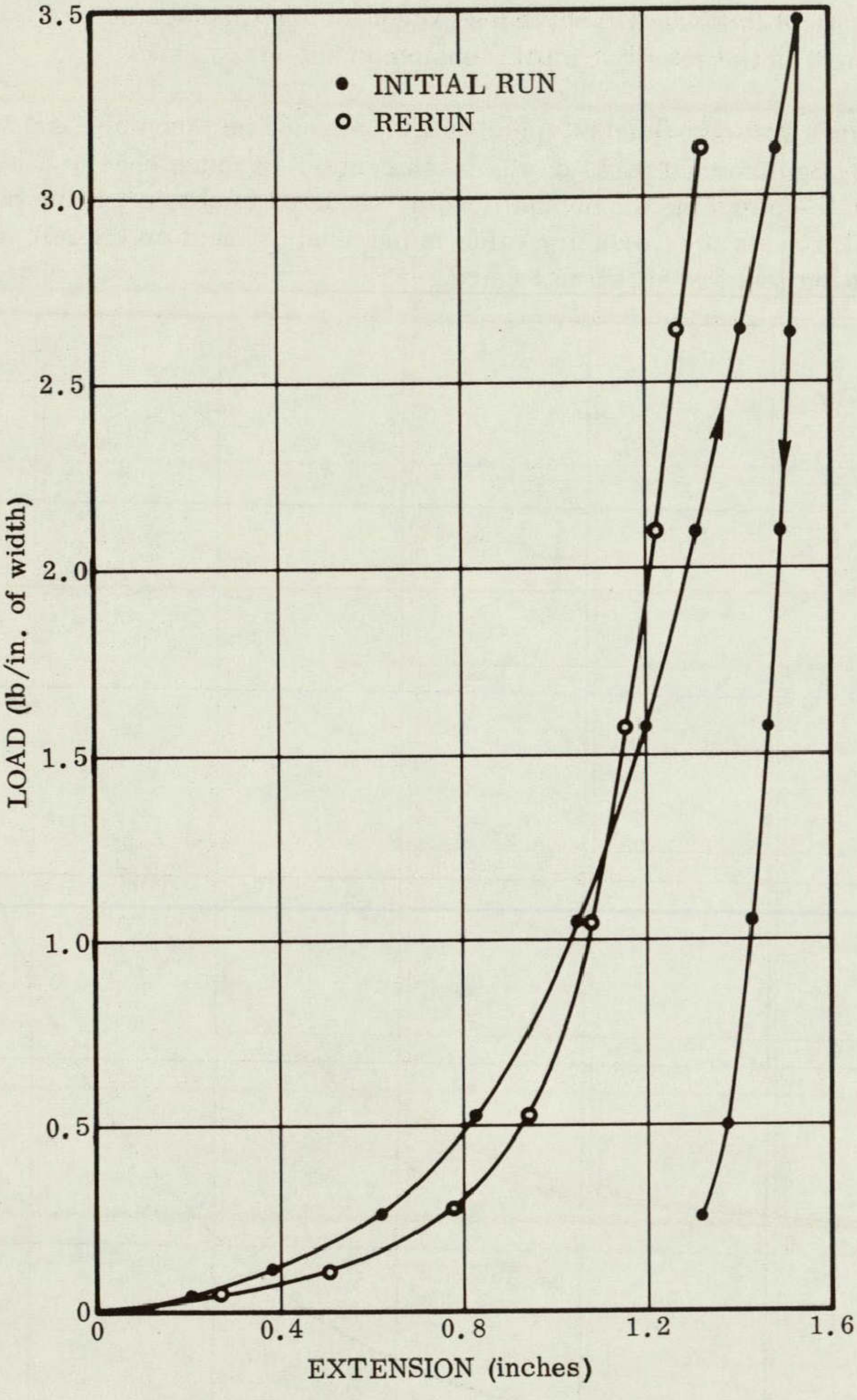


Figure 1-48. Mesh Biaxial Test

Bi-axial tension tests identical to that described above were run on similar specimens with a 1/8 inch hole in the center of the material. The purpose of the test was to establish effects of meteoroid holes or damage as a result of handling on the mesh tension. The load-extension results are shown in Figure 1-49 and 1-50. The load extension slopes are identical to those without holes except for the displacement of the curve. The displacement is the result of initial tension on set-up.

The normal force test consisted of applying a 0.04 pound per inch bi-axial load on the mesh and applying a normal force on the mesh center. (Figure 1-51.) The objective of the test was to determine the normal loading required to obtain a finite normal deflections. This data is of primary value in mesh adjustment on the full scale antenna. The results of the test are shown in Figure 1-52.

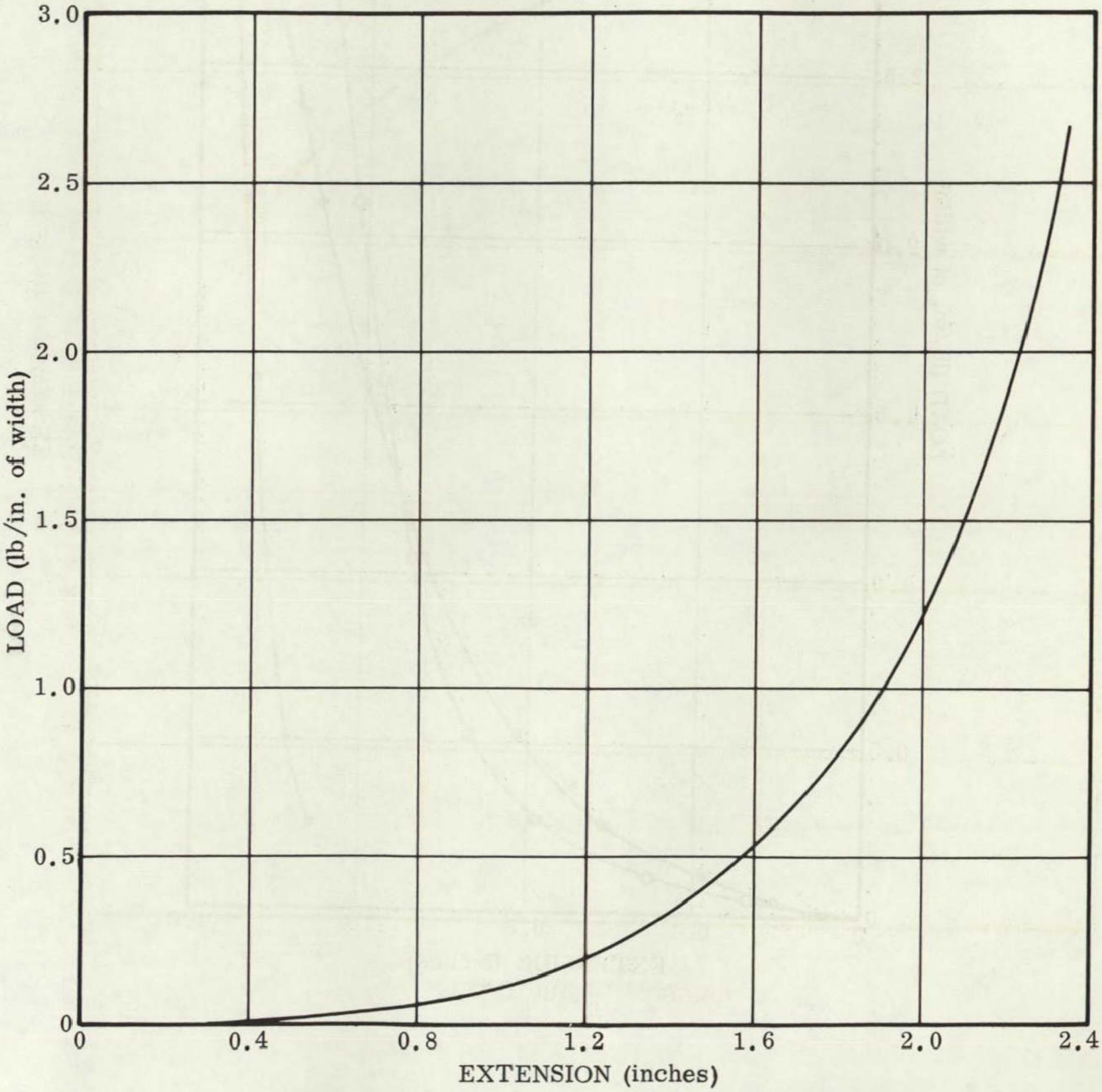


Figure 1-49. Biaxial Specimen No. 1 With 1/8-Inch-Diameter Hole

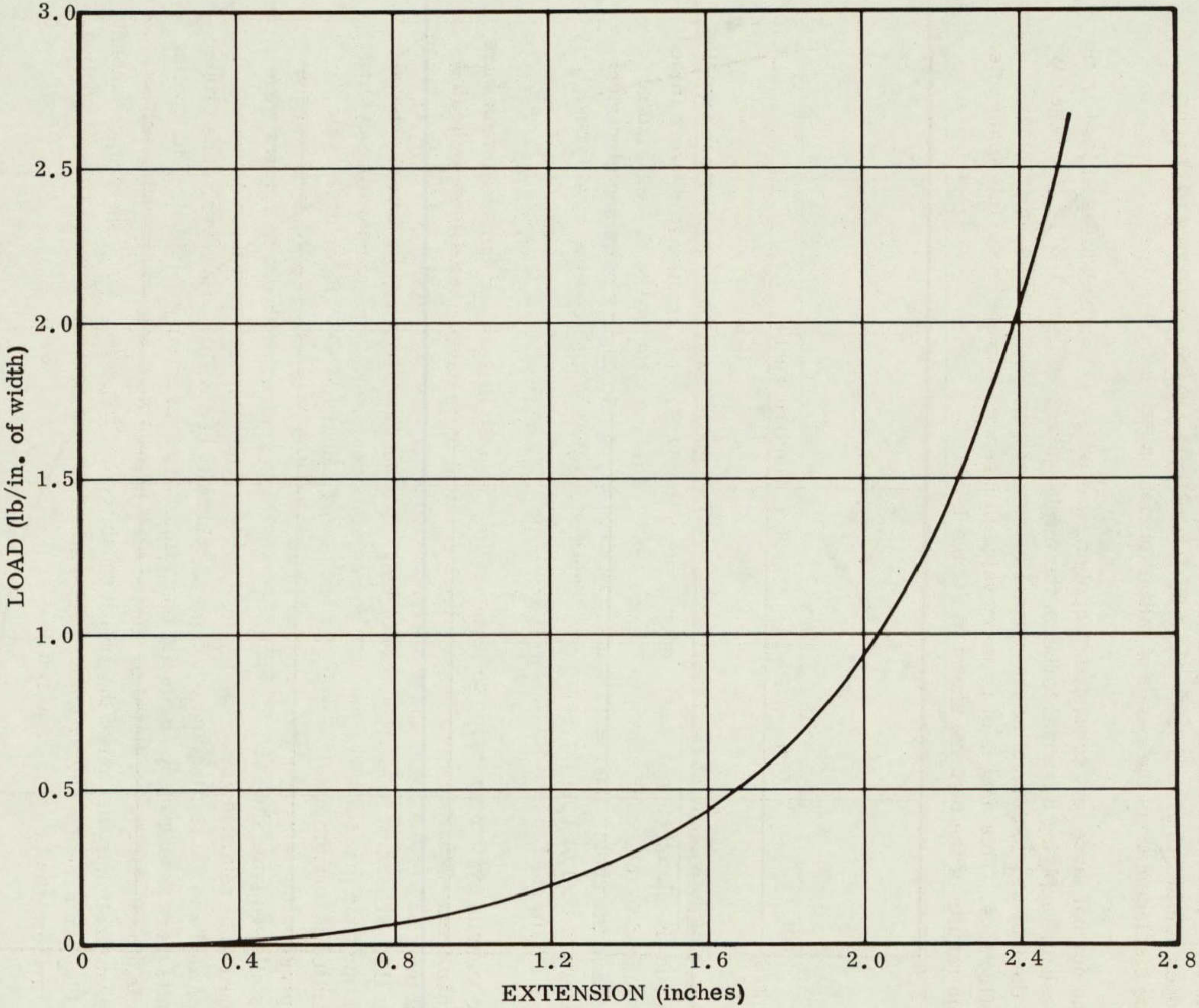


Figure 1-50. Biaxial Specimen No. 2 With 1/8-Inch-Diameter Hole

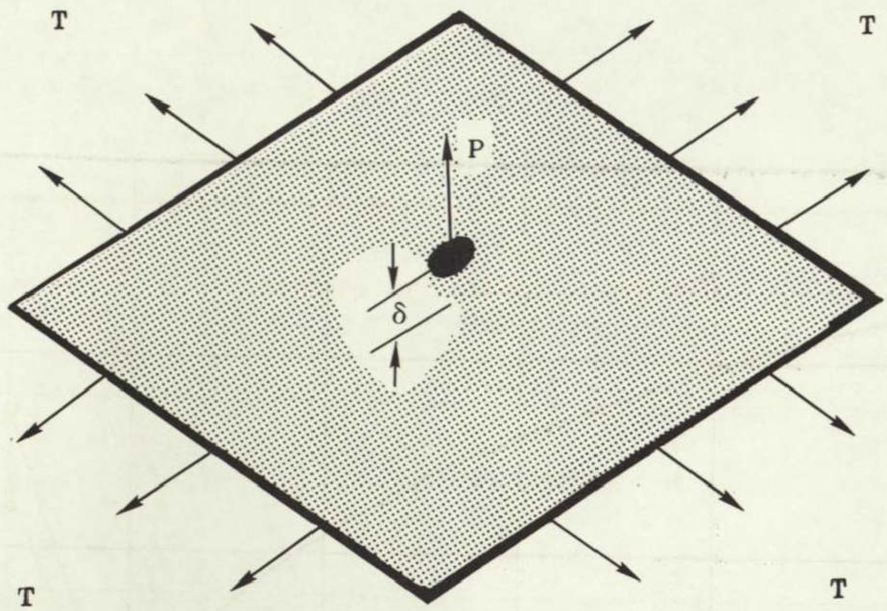


Figure 1-51. Mesh Deflection Test

1.2.4.4 Environmental Degradation Test — Two gold-plated chromel-R mesh samples and one tin-plated copper mesh, each approximately 8 inches in diameter, were folded and placed in the "cup" shown in Figure 1-53. This cup attached to the test fixture shown in the photo. The test fixture contained cryogenic cooling coils and electrical heaters to cool or heat the samples. This fixture then sealed one end of a Pyrex "cross" attached to an Ultek vacuum system.

The vacuum system was used to maintain 10^{-5} mm Hg or less and the specimens were cycled from -320°F to +400°F each day for a total of 30 days. Actual data indicated that over 95% of the time, the pressure varied from approximately 4×10^{-6} to 1.7×10^{-6} mm Hg. (There were short periods where pressures of 10^{-7} mm Hg were achieved and one time pressure was lost but immediately restored.) The temperature cycling resulted in approximately 5 hours at 400°F and 4 hours at -320°F for each cycle. Approximately 3 hours were required to go from 400°F to -320°F. Natural warmup was allowed from the -320°F range to room temperature and then 1 to 2 hours were required to return to 400°F for the next cycle. The temperature was continuously recorded and the heating and cooling was manually controlled. However, once proper limits were determined, automatic operations were essentially obtained. The cooling cycle, for instance, consisted of closing off a filled LN_2 dewar and allowing self-pressurization to discharge the LN_2 through the cooling coils. Once the proper amount of LN_2 and pre-pressurization was determined for the desired rate and time of cooling, no further attention was required.

After 30 days, the samples were carefully removed for examination and further testing. No degradation was observed.

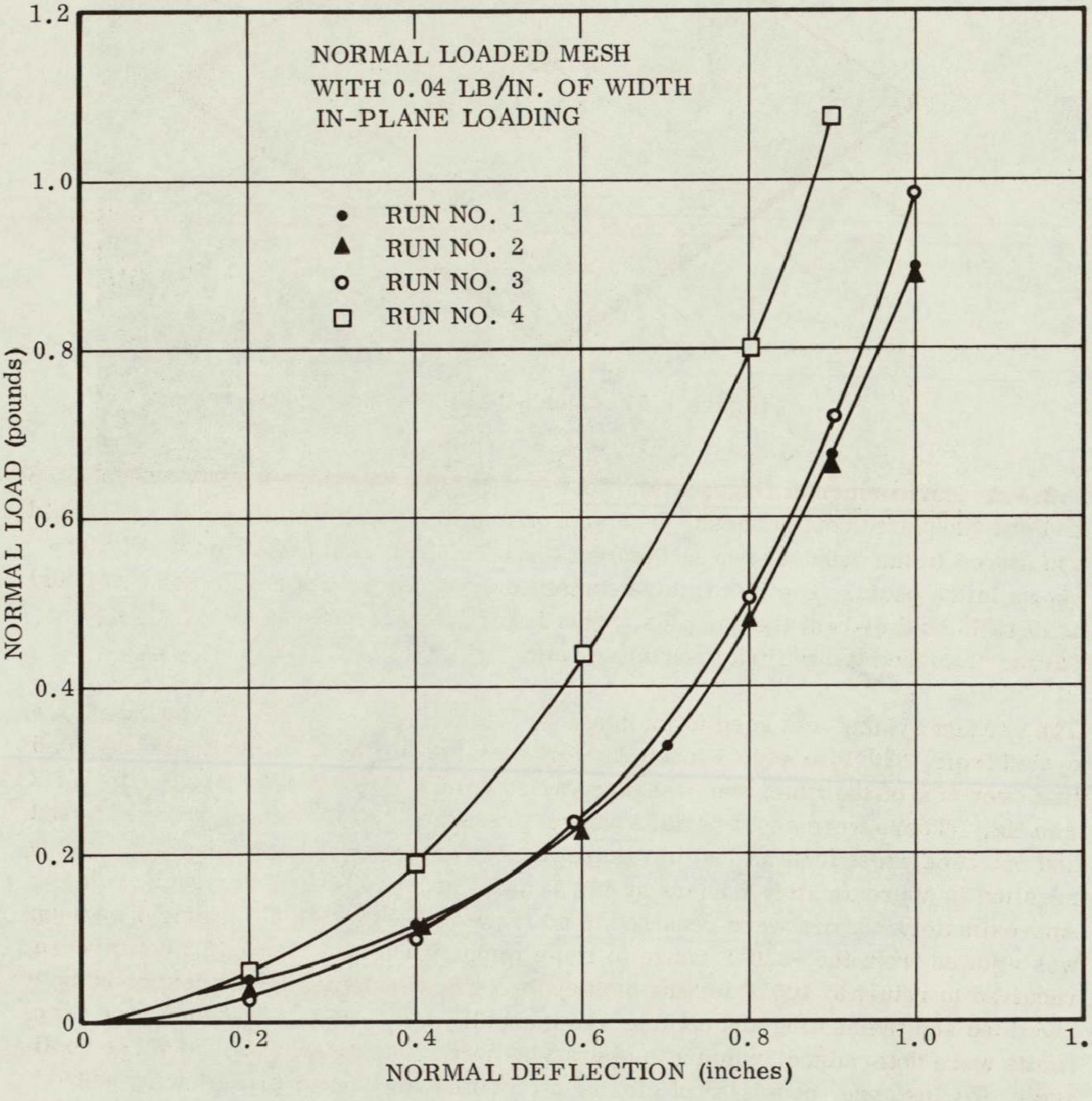


Figure 1-52. Normal Loaded Mesh With 0.04 lb/in. Width, In-Plane Loading

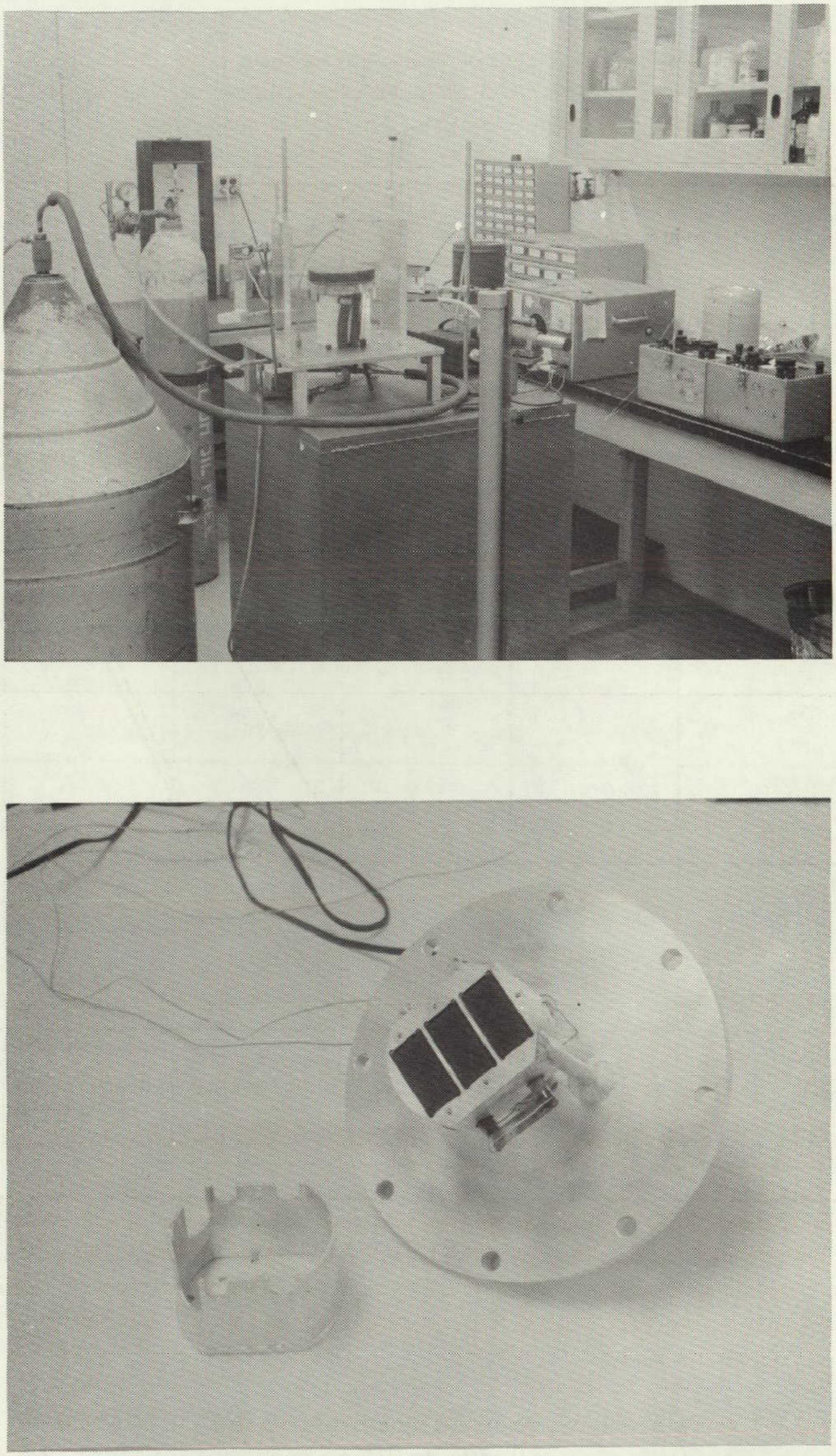


Figure 1-53. Environmental Degradation Test

1.2.4.5 RF Reflectance Test — Prior to the vacuum test, RF reflectivity measurements were conducted on two samples of gold-plated Chromel-R and one sample of tin-plated copper. The material, procured from Prodesco, Inc., was woven in a square mesh from 14 filaments of 1/2 mil wire. Conductor spacing before stretching was 1/14 inch. The mesh was stretched approximately 10% for the test.

A measurement diagram for the reflectivity test is shown in Figure 1-54. In this scheme, the reflected energy from a given size mesh specimen is compared with that from a known conductor (copper) of identical size. The comparison is made from maximum amplitude responses recorded on polar graph paper. Transmission through the mesh or absorption by the mesh reduces the response. The reference pattern of the flat copper sheet was recorded initially; and without changing power levels, patterns of the remaining test materials were recorded. It was necessary to exercise care in substituting the test specimens on the rotating column as the pattern response varied significantly with angular tilt. Errors from this cause were compensated for by maximizing the response with vertical and horizontal movement of one antenna. This test was conducted in an anechoic chamber to minimize reflection errors.

Mesh test sample characteristics are described in Table 1-5.

Table 1-5. Mesh Test Specimen Description

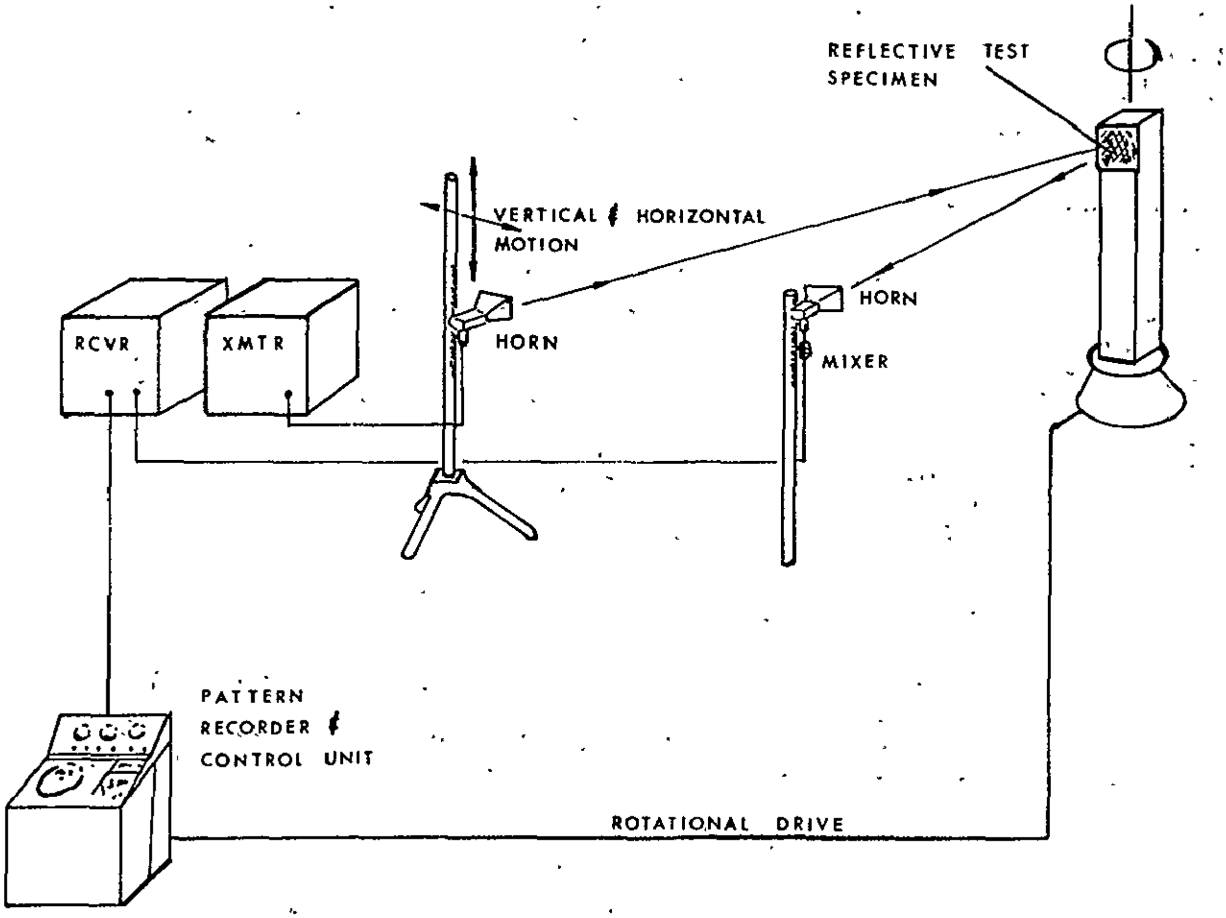
Sample	Description
1. Au C-R#1	Gold-plated Chromel-R purchased from Prodesco, Inc. April, 1969, 14 filaments of 0.5 mil wire, 1/13 inch spacing (stretched)
2. Au C-R#2	Same characteristics as Sample #1
3. Au C-R#3	Same characteristics as Sample #1 and #2 but purchased approximately two years prior
4. C-R	Bare Chromel-R mesh same as Sample #1 but no gold plating
5. Sn-Cu	Tin plated copper in the same mesh pattern as Sample #1

An additional mesh sample purchased approximately two years before this test was included for life degradation characteristics. Also bare Chromel-R (no gold plating) reflectivity data was obtained to determine the basic RF properties of the unplated metallic mesh. Polar recordings of pre-vacuum reflectivity data for these materials are given in Appendix A-1.

After initial RF measurements, the gold-plated Chromel-R and tin-plated copper mesh samples were submitted to a hard vacuum (10^{-5} mm Hg) for 30 days. Reflectivity tests were again run to determine environmental degradation caused by the vacuum. (See Appendix A-2 for recorded data). Results are shown in Figure 1-55 where the first two samples of Chromel-R are plotted against a third sample not submitted to the vacuum test. As indicated in the illustration, no degradation occurred. The data essentially overlaps for the before and after vacuum conditions.

A summary plot of current and previous reflectivity measurements is given in Figure 1-56 to compare mesh material reflectivity values. Materials "a", "b", "c", and "e" have the same geometric pattern with "d" being twice as open.

Tin-plated copper is approximately 0.1 db below the gold-plated Chromel-R of the same weave. Increasing the conductor spacing in the Chromel-R from 1/14 inch to 1/7 inch results in an additional RF loss of 0.2 db. Bare Chromel-R (no gold plating) is approximately 2 db below the copper reference. Material "f" is an S-Band mesh which is too open for the frequencies indicated.



Procedure:
- a. Calibrate pattern paper.
- b. Record pattern of reference material
- c. On same record obtain pattern of material with unknown reflectivity
- d. Difference in reflectivity between reference and test materials is proportional to differential signal levels recorded

Figure 1-54. Reflectivity Test Set-up (Anechoic Chamber)

In summary, these tests have not altered the selection of gold-plated nickel-chrome metallic mesh as the optimum material for the expandable truss antenna.

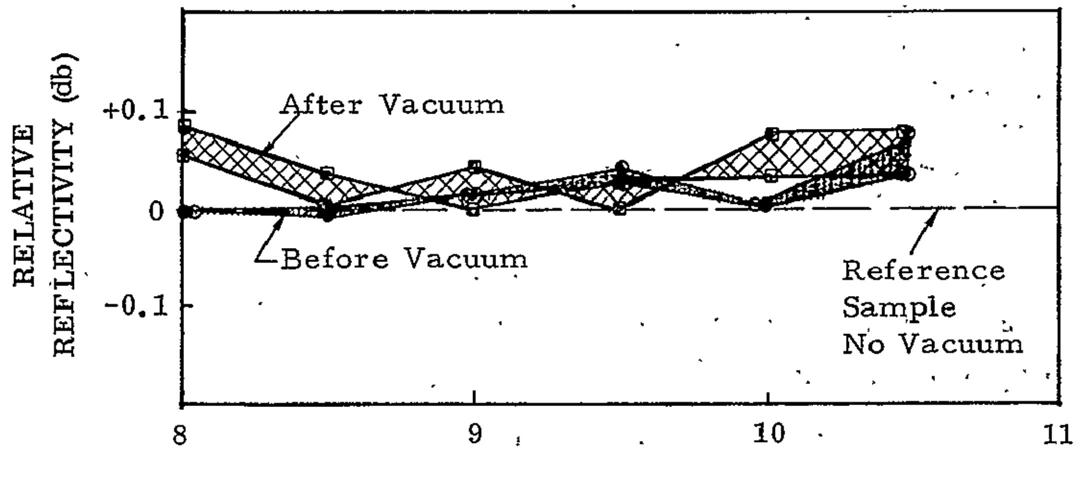


Figure 1-55. Comparison of Gold Plated Chromel-R Reflectivity — Before and After Hard Vacuum.

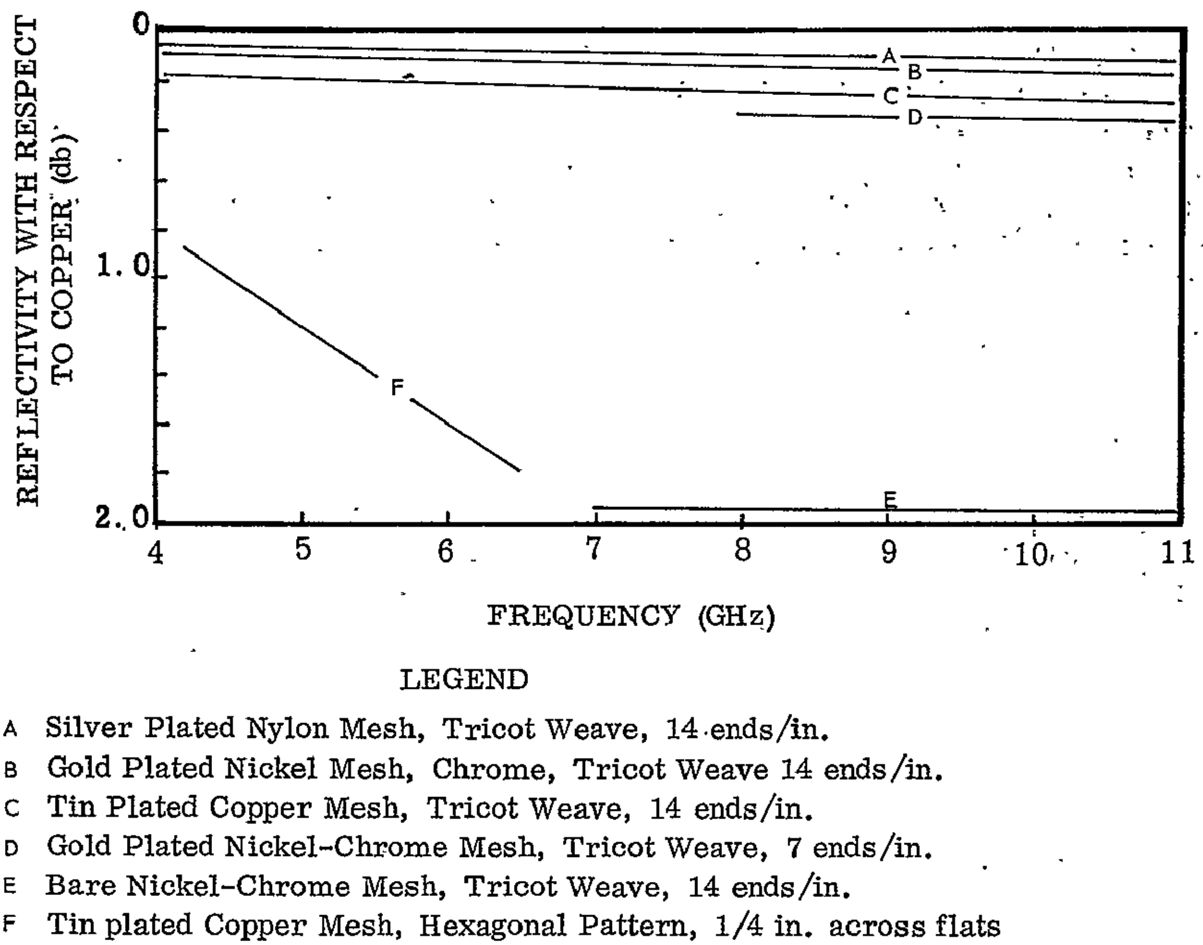


Figure 1-56. Reflectivity of Mesh Materials With Respect to Copper

1.3 FABRICATION AND DESIGN OF FULL SCALE ELEMENT (TETRAHEDRON)

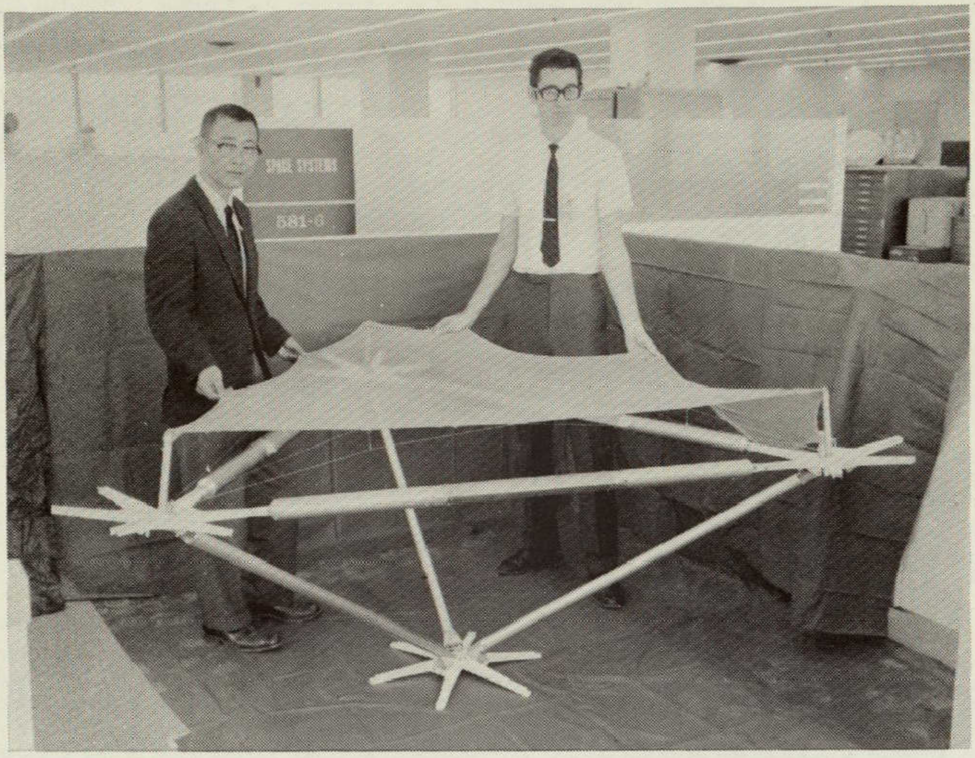
A single bay (tetrahedron) of a full-scale, 70-foot, eight-bay antenna was designed and fabricated. The center bay of the antenna was selected for the basic design configuration (see Figure 1-1).

All essential elements of an eight-bay, 70-foot antenna have been incorporated into the tetrahedron. These elements include:

1. The basic aluminum tubular truss structure including the magnesium spider, titanium carpenter hinge and end fittings.
2. Gold-plated Chromel-R mesh antenna reflector
3. Mesh tension provisions for the adjustment of the antenna contour.

The detail design is shown in Figure 1-57. The truss structure was sized to provide a minimum L/ρ of 150 for all members with the carpenter tape hinge capable of column loads up to 350 pounds. The surface struts are 2 inches in diameter with the diagonal members 1-1/2 inches in diameter.

The mesh adjustment system is identical to that discussed in Section 1.1.5. The tension ties are fabricated from 20 pound test, stainless steel nylon covered cable. Swivels are incorporated in key points of the tension tie system to prevent kinking and permit smooth deployment of the mesh. Standard commercially available wire leader material and crimped sleeves are used as webbing material to tie the tension system to the gold-plated Chromel-R wire mesh. The completed tetrahedron is shown in Figure 1-58.



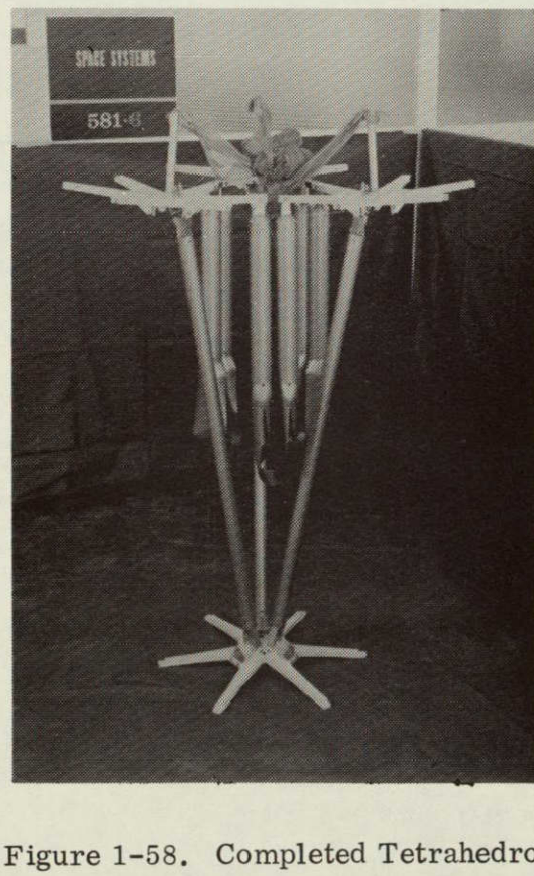


Figure 1-58. Completed Tetrahedron

N70-25764

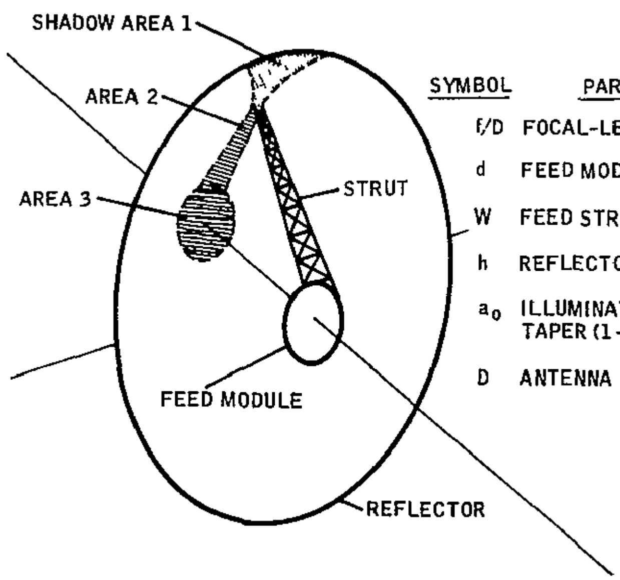
SECTION 2
ANTENNA FEED DESIGN ASPECTS

Parameters for the feed configuration are optimized in this section considering the antenna diameter (30 to 70 ft.), aperture blockage, shadowing by feed support structures, docking requirements, electronic equipment, manned operation, and thermal balance requirements. Related feed adjustment for boresighting and optimum focusing are also considered.

2.1 RF BLOCKAGE EFFECTS

The primary design effort in Reference 2-1 for the feed module design was directed toward achieving an integrated structure that would house the feed electronics, instrumentation equipment, and accommodate a working astronaut. The large antenna diameter (100 feet) allowed a relatively large physical aperture blockage area without serious RF degradation. However, when smaller antenna diameters are considered (i.e., 30 to 70 feet), large physical blockage areas cannot be tolerated. Gain and sidelobe degradation due to aperture blockage (up to 20 percent of aperture diameter) for a range of antenna sizes from 30 to 100 feet are analyzed below. Tolerable blockage ratios are defined.

The general theory for blockage effects have been developed by Wested (Reference 2-2), by dividing the shadow area into three components, as shown in Figure 2-1. The first area is the contribution from feed strut blockage for those rays impinging on the reflector in the area between the feed support attachment and the reflector edge. Areas #2 and #3 arise from the projection of the feed strut and feed module (plus associated equipment) on the reflector.



SYMBOL	PARAMETER	VALUE
f/D	FOCAL-LENGTH/DIAMETER	0.4
d	FEED MODULE SIZE	d/D = 0-0.2
W	FEED STRUT WIDTH	W/D = 0-0.04
h	REFLECTOR ATTACH POINT	h/D = 0.25, 0.38, 0.50
a_0	ILLUMINATION TAPER $(1-a_0\gamma^2)$	a_0 = 0.68, 1.0
D	ANTENNA DIAMETER	30 & 70 FT.

Figure 2-1. Reflector Shadow Areas from Aperture Blockage

A large set of parameters controls the amount of blockage in these areas. Included are:

a. Feed module size

b. Feed strut

   1. Width

   2. Shape (tapered or constant width).

   3. Attachment location on the reflector and on the feed module.

   4. Configuration, (bipod, Tripod, etc.)

c. f/D ratio (assumed to be 0.4 for this analysis)

d. Illumination taper

e. Reflector diameter

Geometric parameters for the analysis are shown in Figure 2-2. The illumination taper across the aperture is given by

$$F(Z) = 1 - \alpha_o \left(\frac{R_F}{R_R}\right)^2 \quad (2\text{-}1)$$

Additional equations from Reference 2-2 for determining blockage degradation follow:

Shadow Area #1 (STRUT)

$$A_1 = 2Q \left[\gamma + \alpha_o \frac{(R_R - \gamma)^3}{3 R_R^2} - \alpha_o \frac{R_R}{3}\right] + (\beta - Q)\left[\gamma + \frac{\alpha_o}{6 R_R^2 \gamma} \left[R_R^4 - (R_R - \gamma)^4\right] - \frac{2}{3} \alpha_o R_R\right] \quad (2\text{-}2)$$

Shadow Area #3 (STRUT)

$$A_2 = (h - R_F)(P + Q) - \frac{\alpha_o}{6 R_R^2} (h - R_F)(P + 3Q) \quad (2\text{-}3)$$

Shadow Area #3 (FEED)

$$A_3 = \frac{\pi}{2} R_F^2 \quad 2 - \alpha_o \left(\frac{R_F^2}{R_R^2}\right) \quad (2\text{-}4)$$

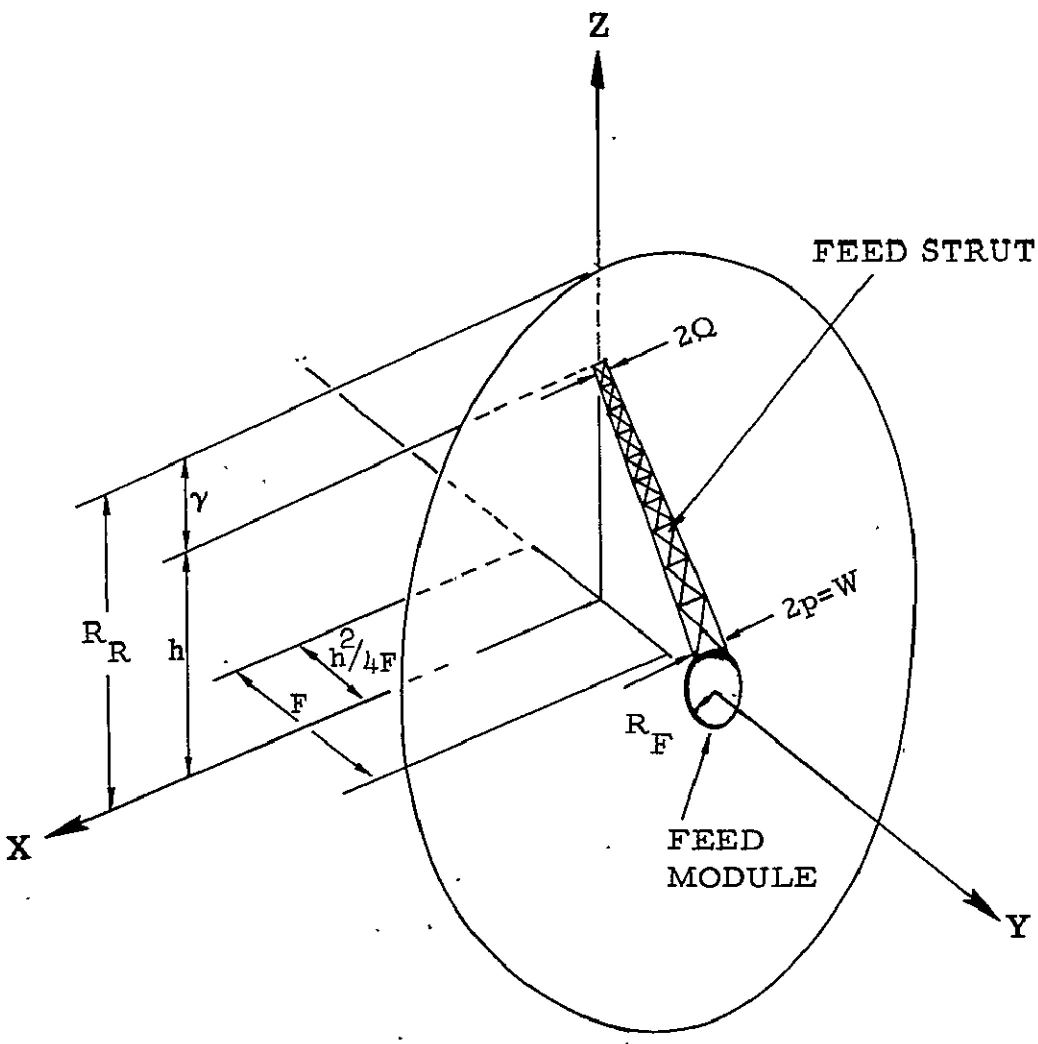


Figure 2-2. Reflector Geometry

Effective Reflector Area

$$A_R = \frac{\pi}{2} R_R^2 (2 - a_o) \quad (2\text{-}5)$$

Blockage Degradation to the Field Intensity

$$\frac{E_S}{E_R} = \frac{\sum \text{Shadow Areas}}{\text{Reflector Effective Area}} \quad (2\text{-}6)$$

Antenna Gain Reduction

$$\text{Gain Loss} = 20 \log \left(1 - \sum \frac{E_S}{E_R}\right) \quad \text{(db)} \quad (2\text{-}7)$$

New Sidelobe Level

$$\text{Actual Sidelobe Level} = \frac{E_N + \frac{E_S}{E_R}}{1 - 3 \frac{E_S}{E_R}} * \quad (2\text{-}8)$$

*(E_N = Normalized sidelobe level with no blockage) The factor of three is for a tripod structure - does not appear in the numerator because of the non additive characteristic of the broad off-axis pattern (Reference 2-3).

2.1.1 COMPUTATIONS - It became necessary to develop a computer program to handle the large number of parameters in the analysis. A protion of the runs are included in Appendix B with the program listing.

The cases for $\gamma = 3/4\, R_R$ shown in later tables were not run to conserve computer time. Interpolation between the values for $\gamma = R_R/2$ and $\gamma = R_R$ is valid. The latter values of γ correspond to feed support attach points at the reflector center and edge respectively. The parameter B (shadow dimension at antenna rim, Figure 2-1) was determined graphically.

Two different illumination tapers were run, the first corresponding to a nominal sidelobe level of -21 db (α_o = 0.684) and the second a highly tapered illumination (α_o = 1.0) giving -25 db sidelobe levels. Other levels can be determined from interpolation and extrapolation. A tripod feed support structure has been assumed for the analysis. Both constant width and tapered struts are considered - the tapered end being at the reflector attach point. Data are tabulated in the next three sub-sections for three reflector sizes, 30, 70, and 100 feet. A summary and normalization of data is discussed in Section 2.1.1.4.

2.1.1.1 Aperture Blockage, 30 Foot Reflector - Pertinent parameters for the 30 foot diameter reflector are given in Table 2-1 and case results listed in Appendix B, Tables B-1 through B-6.

RF degradation as a function of feed strut size and shape (tapered or constant width) are plotted in Figures 2-3 through 2-8. Symbols for each figure are:

Symbol		Feed Support Width: At Reflector (in.)	Feed Support Width: At Feed (in.)
a	(Tapered)	2	W
b	(Tapered)	2	W
c	(Constant)	W	W

As noted in Figure 2-8, there is only a minor contribution to sidelobe level degradation from the feed supports when the module size is very large.

Table 2-1. Table of Parameters for Aperture Blockage Computer Run

(30 Ft. Diameter Antenna; 2, 4, 6-Ft. Feed Module)

Case	R_R	R_F	h	α_γ	α_o	Normalized Sidelobe	P	O	
	in.	in.	in.	in.			in.	in.	in.
1	180	12	90	90	.684	.0891(-21 db)	1-6	1-6	2-30
2	180	12	135	45	.684	.0891(-21 db)	1-6	1-6	2-30
3	180	12	180	0	.684	.0891(-21 db)	1-6	1-6	0
4	180	12	90	90	1.0	.0562(-25 db)	1-6	1-6	2-30
5	180	12	135	45	1.0	.0562(-25 db)	1-6	1-6	2-30
6	180	12	180	0	1.0	.0562(-25 db)	1-6	1-6	0
7	180	24	90	90	.684	.0891(-21 db)	1-6	1-6	2-30
8	180	24	135	45	.684	.0891(-21 db)	1-6	1-6	2-30
9	180	24	180	0	.684	.0891(-21 db)	1-6	1-6	0
10	180	24	90	90	1.0	.0562(-25 db)	1-6	1-6	2-30
11	180	24	135	45	1.0	.0562(-25 db)	1-6	1-6	2-30
12	180	24	180	0	1.0	.0562(-25 db)	1-6	1-6	0
13	180	36	90	90	.684	.0891(-21 db)	1-6	1-6	2-30
14	180	36	135	45	.684	.0891(-21 db)	1-6	1-6	2-30
15	180	36	180	0	.684	.0891(-21 db)	1-6	1-6	0
16	180	36	90	90	1.0	.0562(-25 db)	1-6	1-6	2-30
17	180	36	135	45	1.0	.0572(-25 db)	1-6	1-6	2-30
18	180	36	180	0	1.0	.0562(-25 db)	1-6	1-6	0

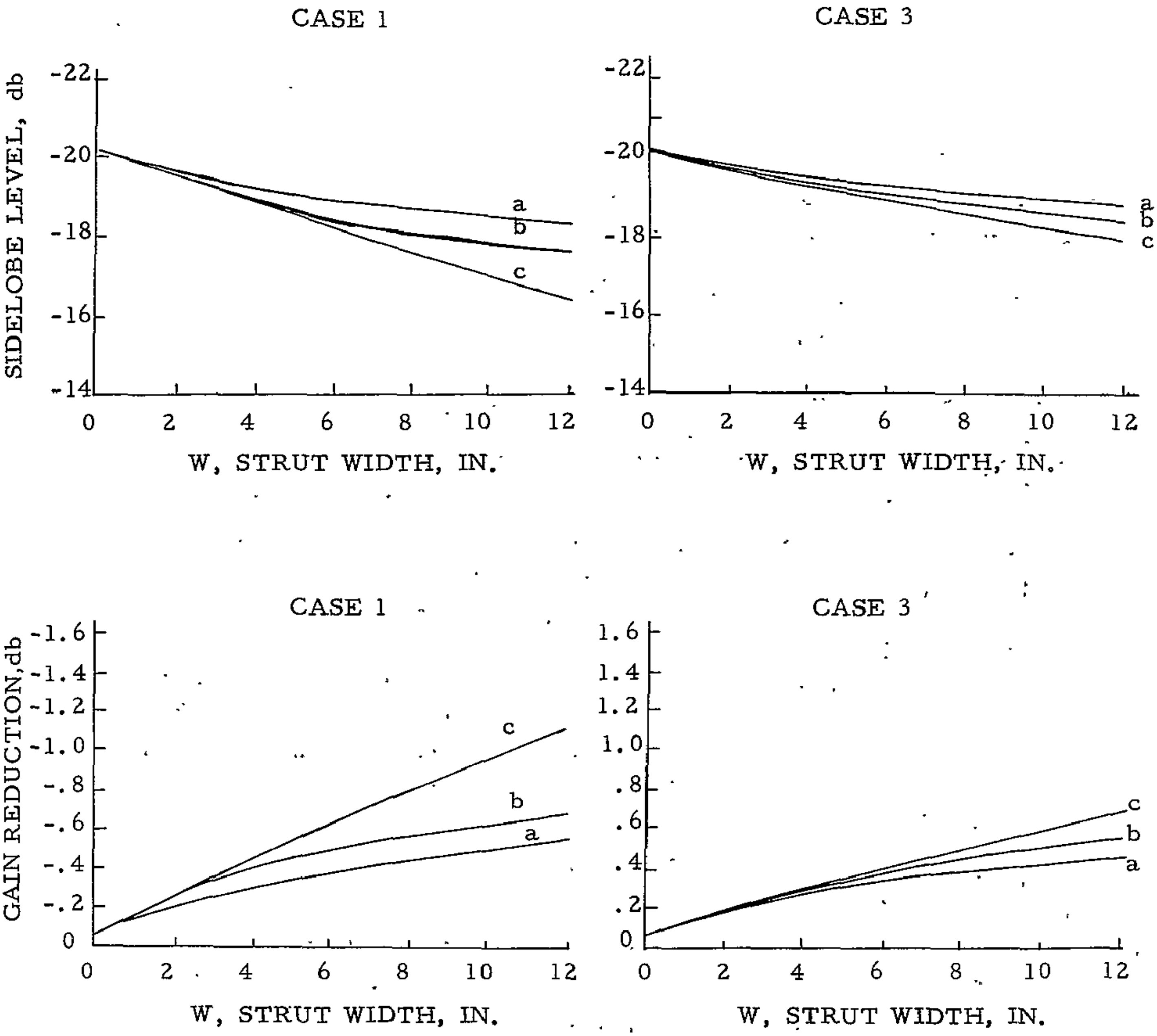


Figure 2-3, Case 1 and Case 3

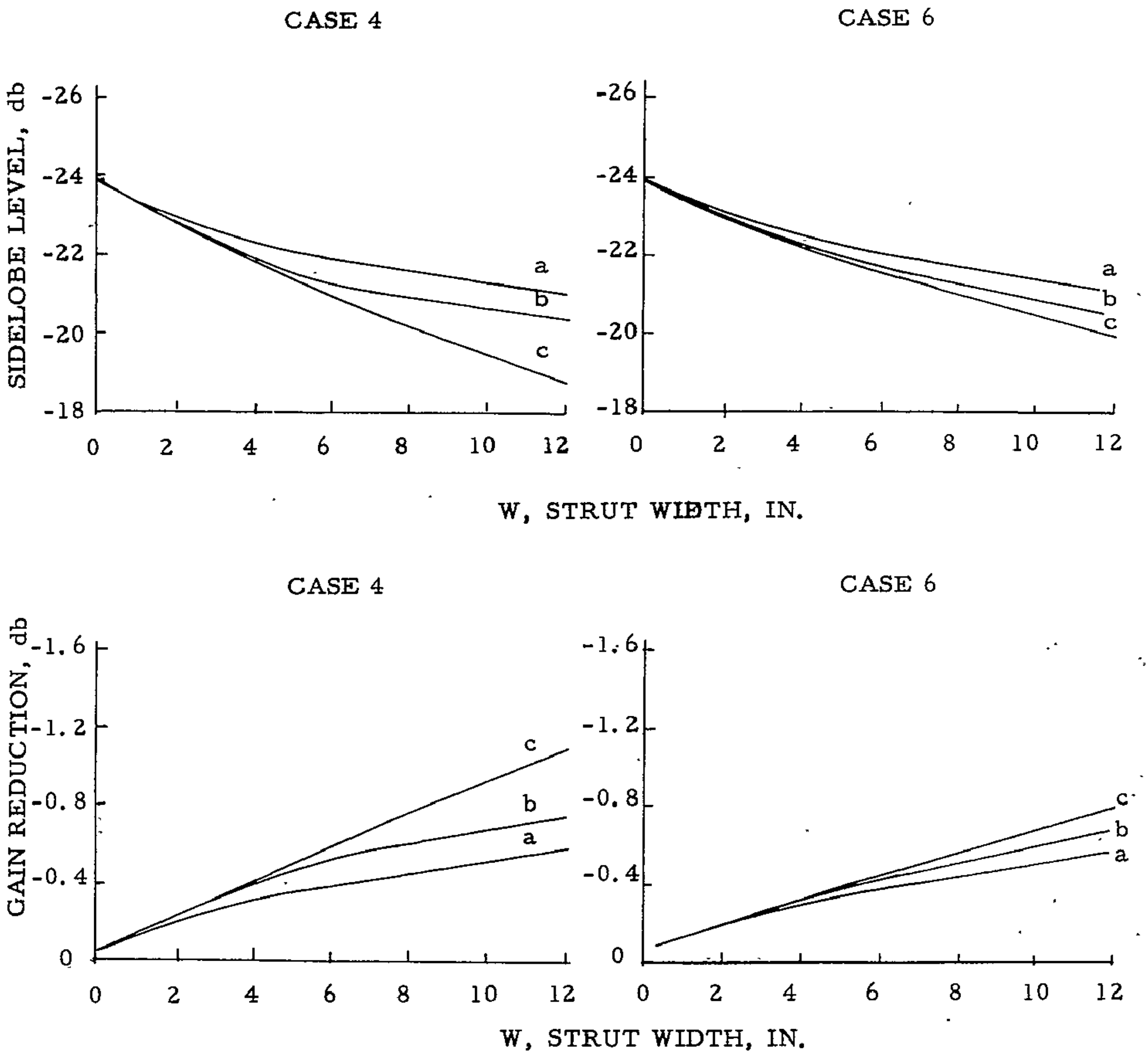


Figure 2-4. Case 4 and Case 6

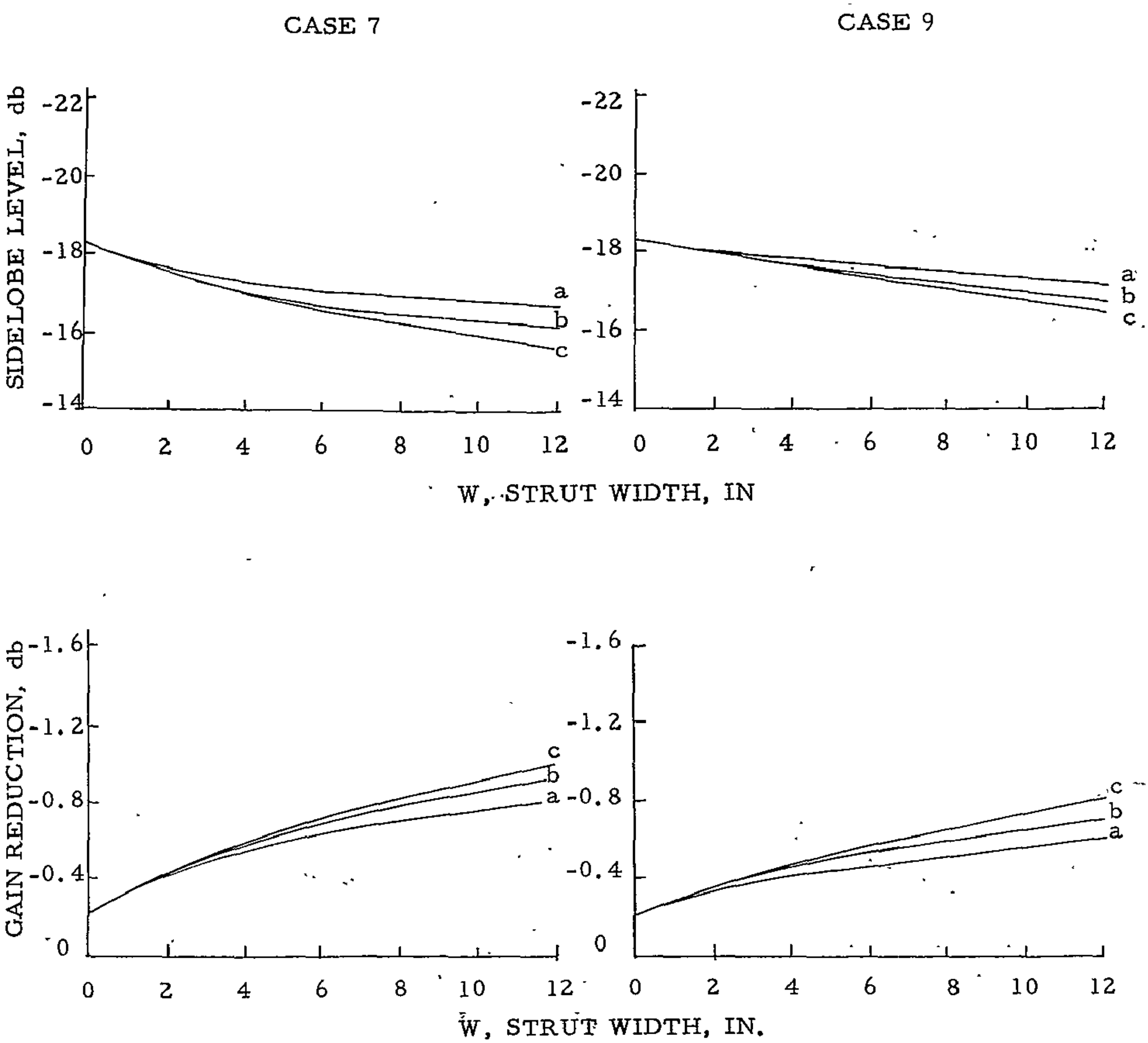


Figure 2-5. Case 7 and Case 9

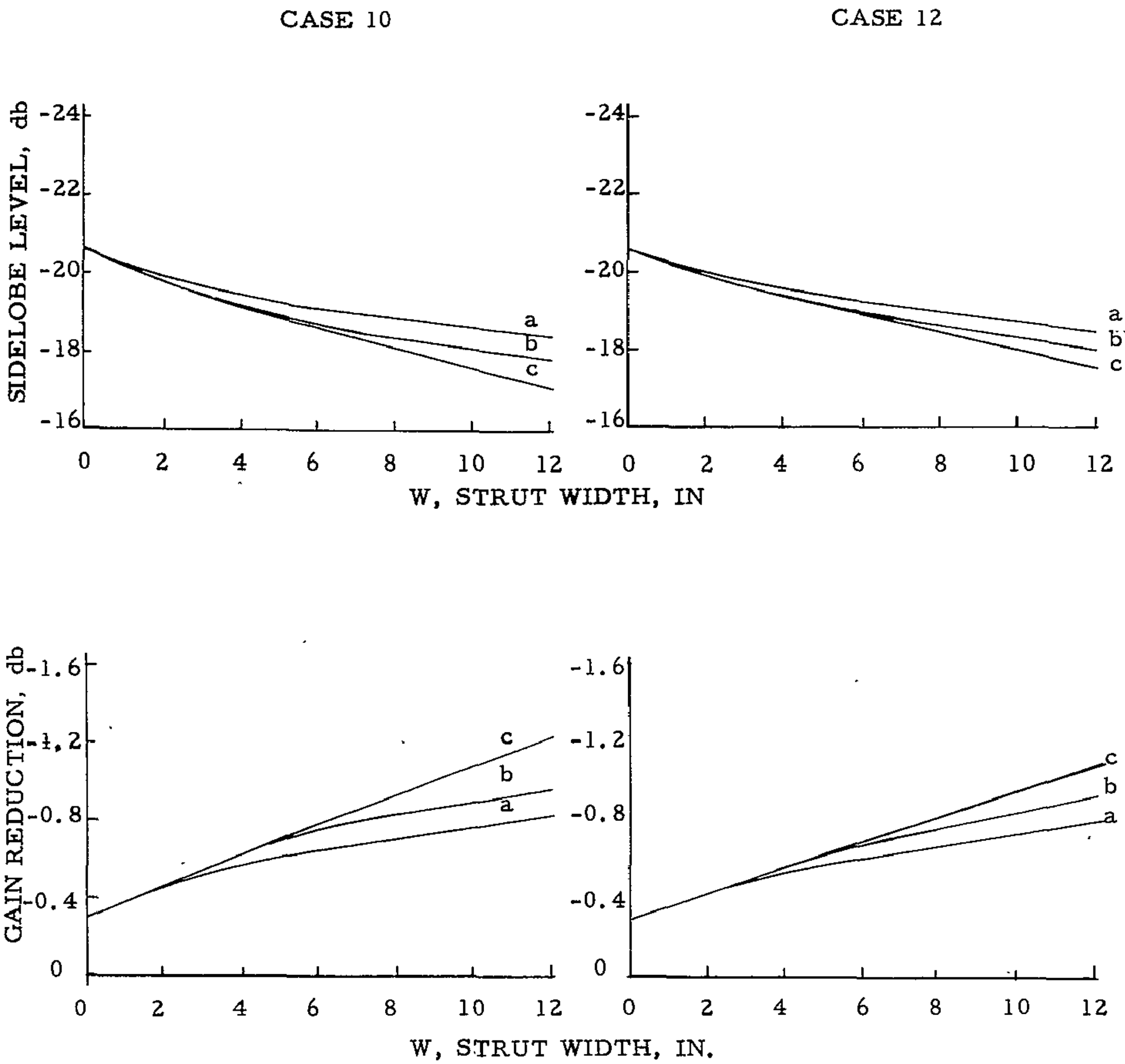


Figure 2-6. Case 10 and Case 12

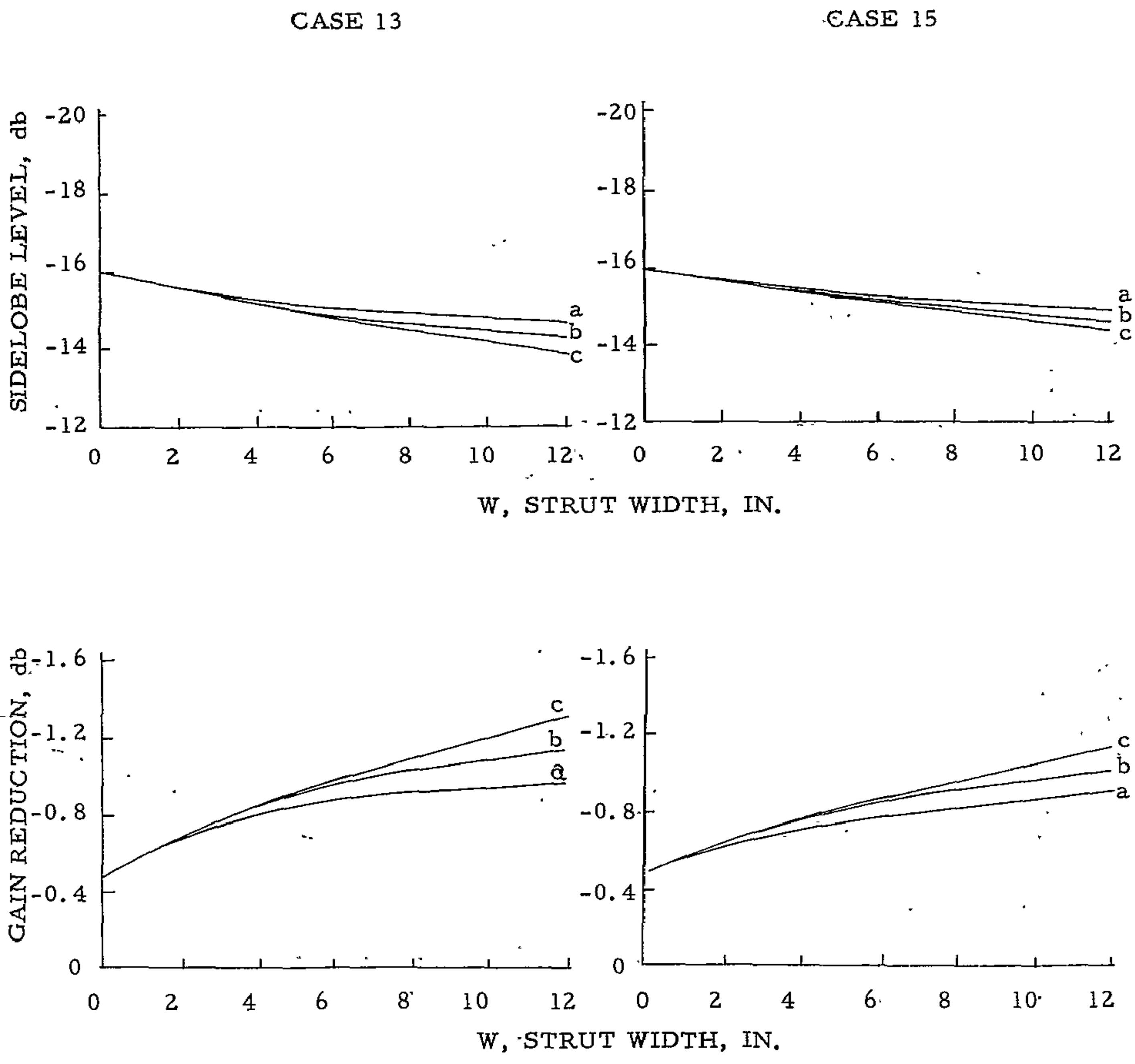


Figure 2-7. Case 13 and Case 15

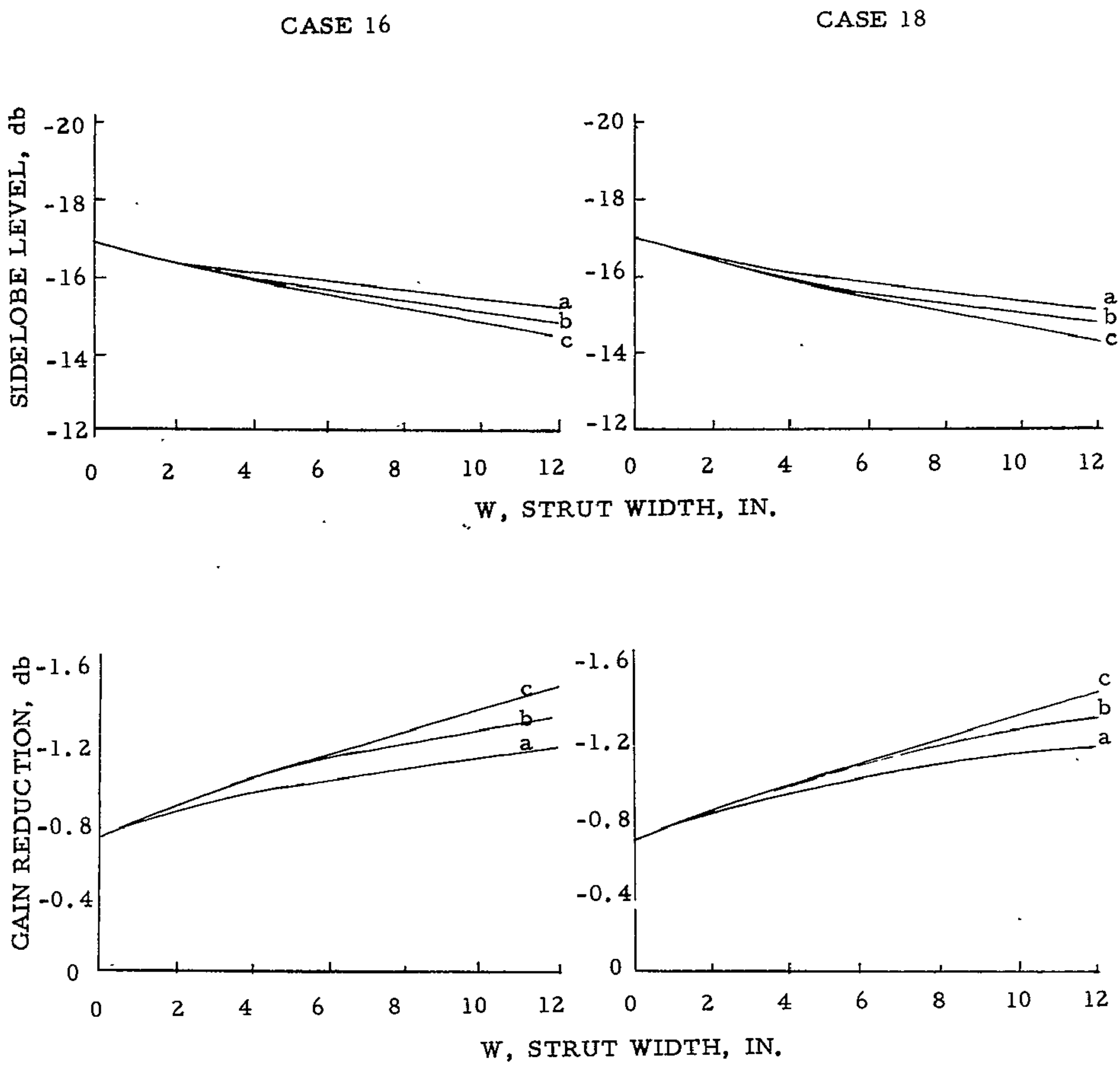


Figure 2-8. Case 16 and Case 18

2.1.1.2 Aperture Blockage - 70 Foot Reflector - Similarly, parameters for the 70 foot diameter antenna blockage analysis are listed in Table 2-2 with particular case results in Appendix B, Tables B-7 through B-12. RF degradation as a function of feed strut size and shape (tapered or constant width) are plotted in Figures 2-9 through 2-14. Symbols for each figure are:

	Symbol	Feed Support Width At Reflector (in.)	Feed Support Width At Feed (in.)
a.	(Tapered)	4	W
b.	(Tapered)	10	W
c.	(Constant)	W	W

Table 2-2. Table of Parameters for Aperture Blockage Computer Run

(70 Ft. Diameter Antenna; 4, 8, 13 Ft. Feed Module Diameter)

Case	R R	R F	h	γ	α_o	Normalized Sidelobe	P	Q	β
19	420	24	210	210	.684	.8991(-21db)	2-10	2-10	4-60
20	420	24	315	105	.684	.0891(-21db)	2-10	2-10	4-60
21	420	24	420	0	.684	.0891(-21db)	2-10	2-10	0
22	420	24	210	210	1.0	.0562(-25db)	2-10	2-10	4-60
23	420	24	315	105	1.0	.0562(-25db)	2-10	2-10	4-60
24	420	24	420	0	1.0	.0562(-25db)	2-10	2-10	0
25	420	48	210	210	.684	.0891(-21db)	2-10	2-10	4-60
26	420	48	315	105	.684	.0891(-21db)	2-10	2-10	4-60
27	420	48	420	0	.684	.0891(-21db)	2-10	2-10	0
28	420	48	210	210	1.0	.0562(-25db)	2-10	2-10	4-60
29	420	48	315	105	1.0	.0562(-25db)	2-10	2-10	4-60
30	420	48	420	0	1.0	.0562(-25db)	2-10	2-10	0
31	420	78	210	210	.684	.0891(-21db)	2-10	2-10	4-60
32	420	78	315	105	.684	.0891(-21db)	2-10	2-10	4-60
33	420	78	420	0	.684	.0891(-21db)	2-10	2-10	0
34	420	78	210	210	1.0	.0562(-25db)	2-10	2-10	4-60
35	420	78	315	105	1.0	.0562(-25db)	2-10	2-10	4-60
36	420	78	420	0	1.0	.0562(-25db)	2-10	2-10	0

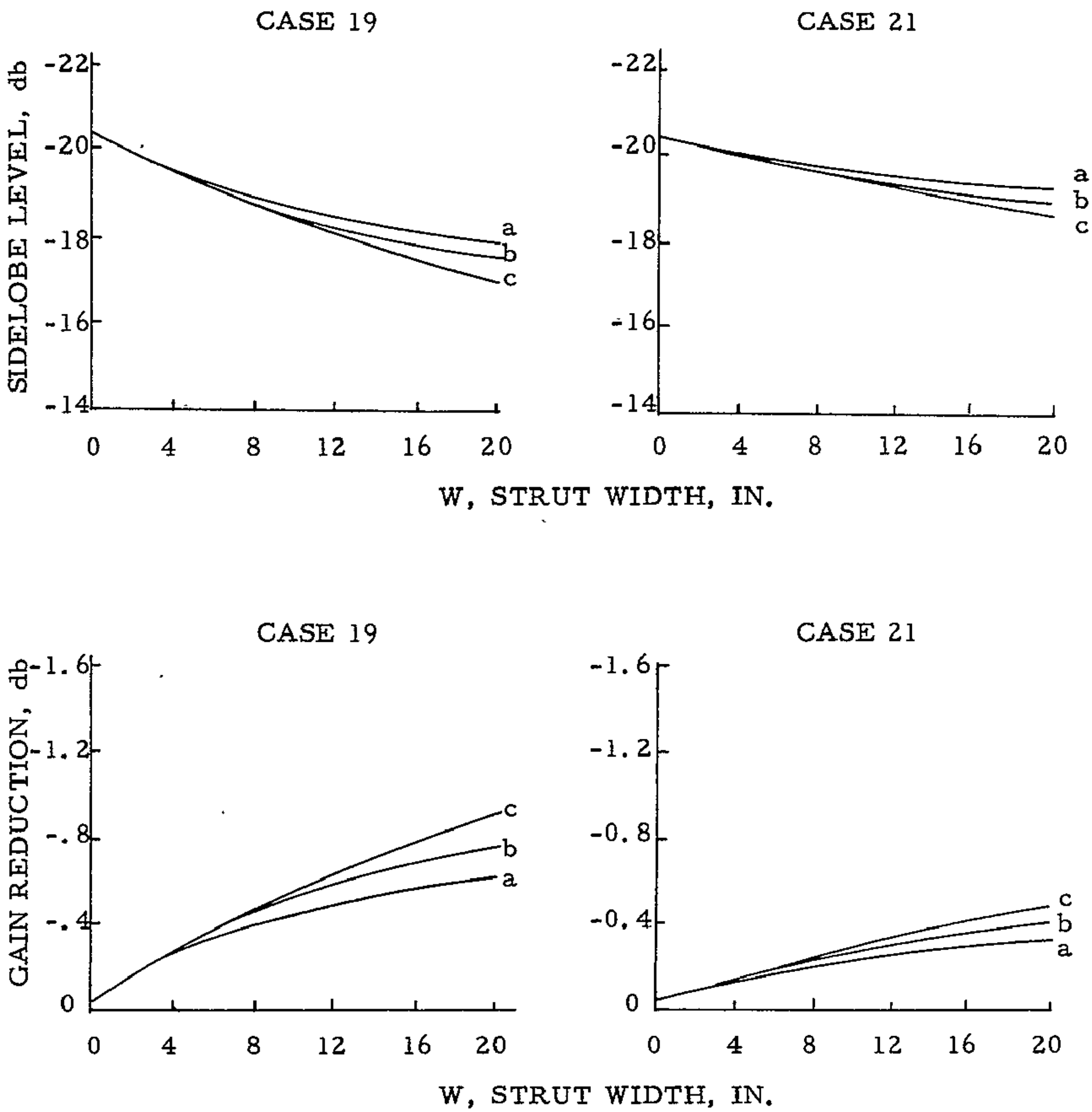


Figure 2-9. Case 19 and Case 21

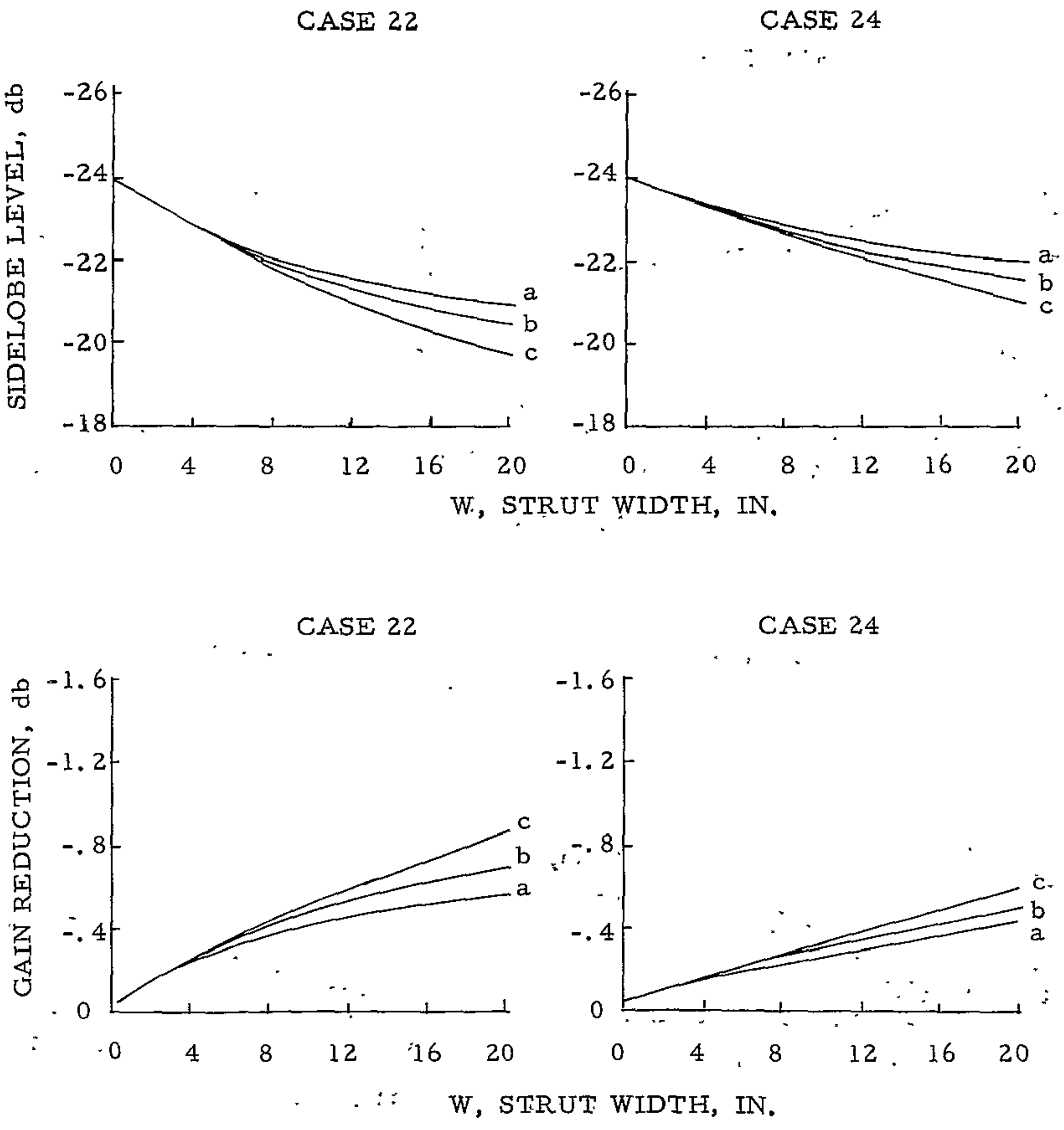


Figure 2-10. Case 22 and Case 24

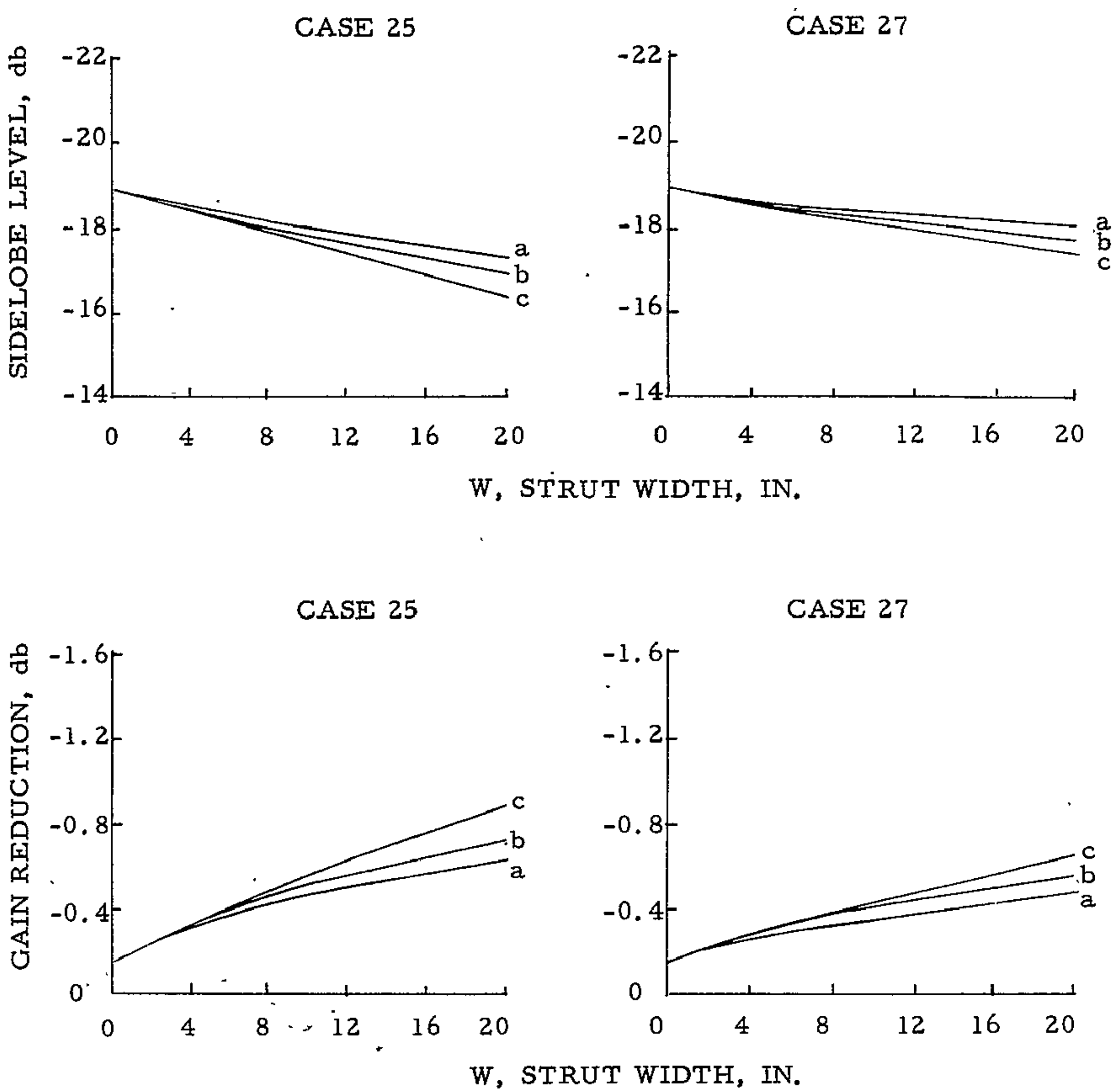


Figure 2-11. Case 25 and Case 27

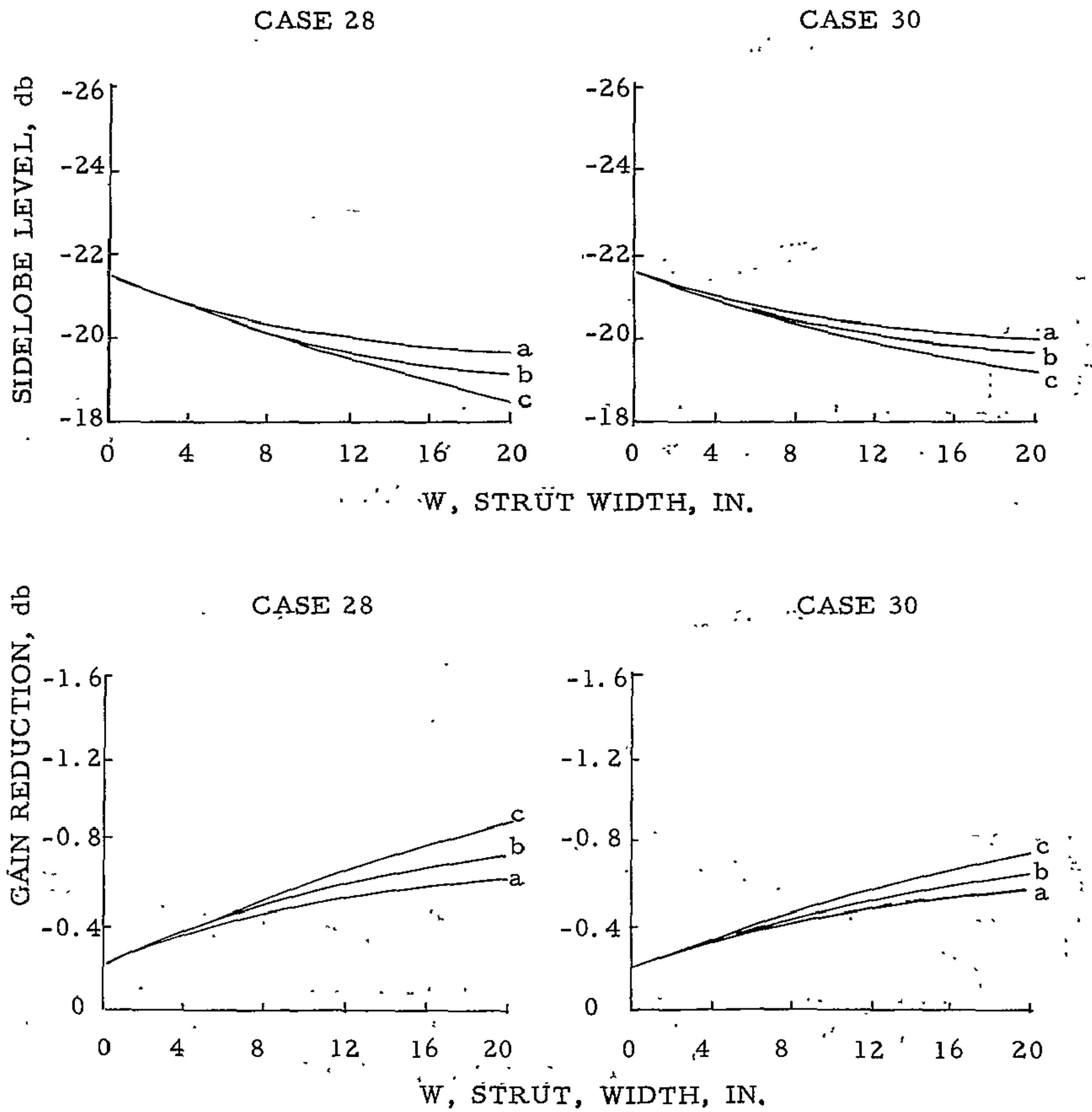


Figure 2-12. Case 28 and Case 30

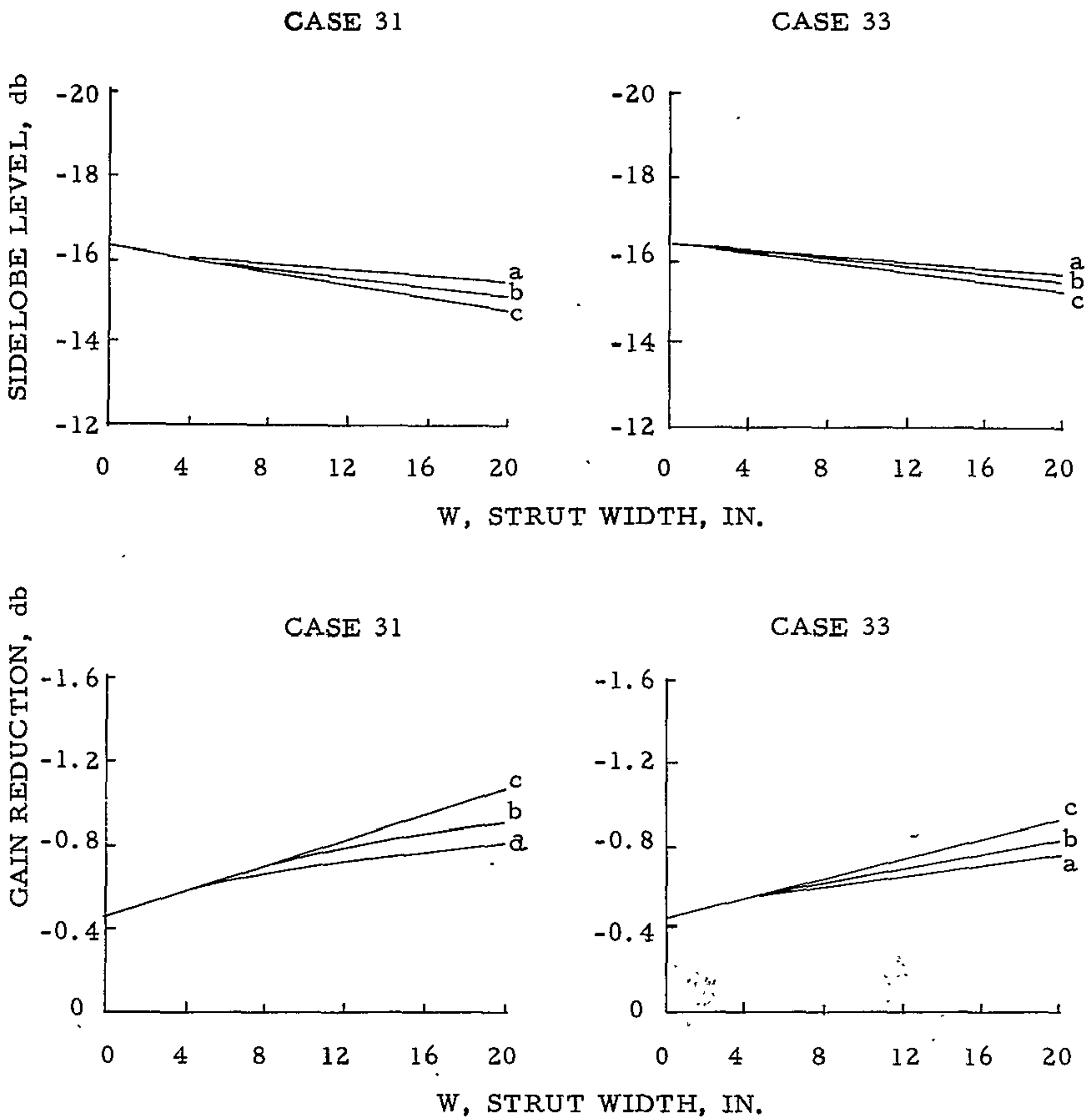


Figure 2-13. Case 31 and Case 33

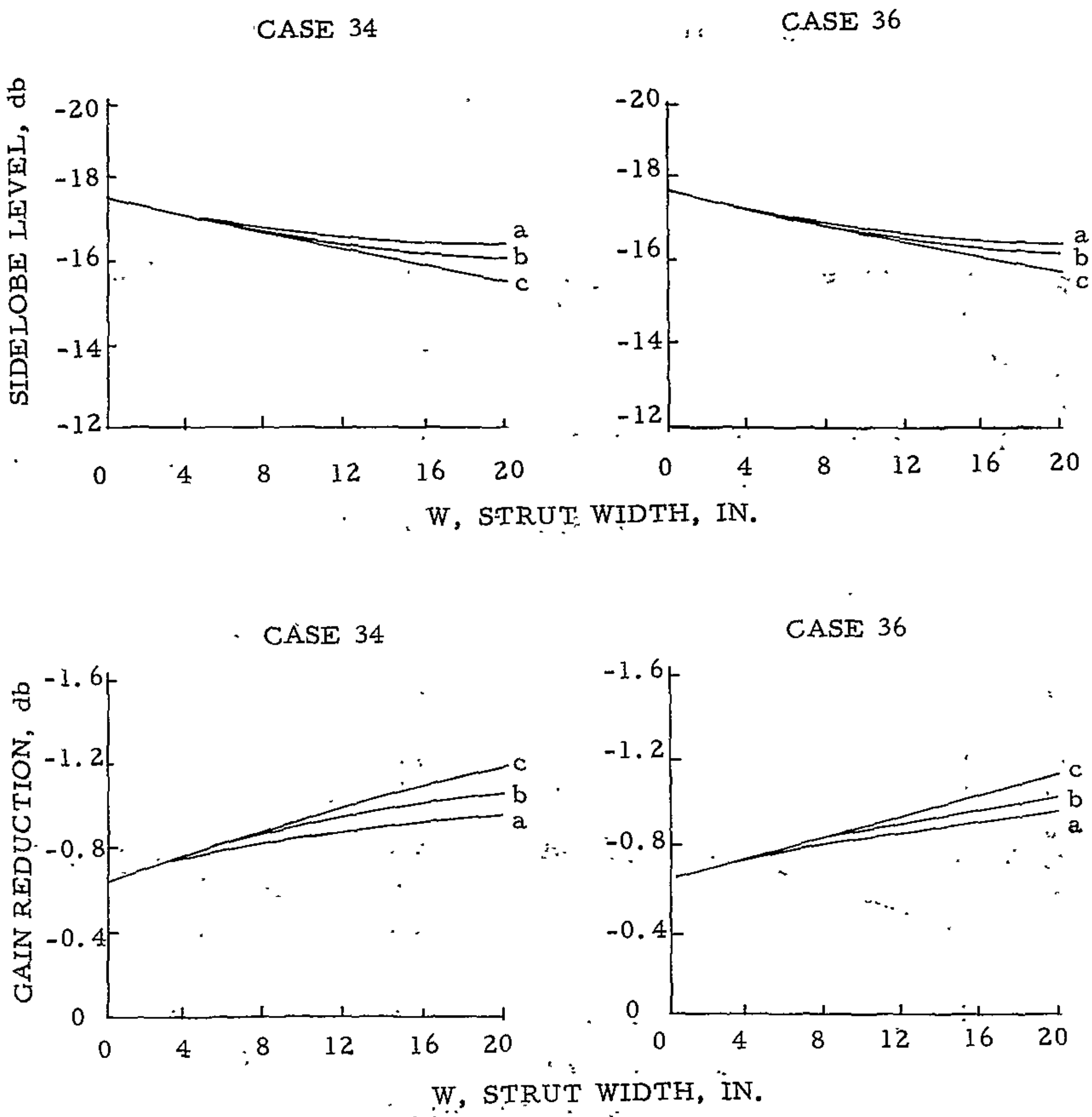


Figure 2-14. Case 34 and Case 36

2.1.1.3 Aperture Blockage - 100 Foot Reflector.- Parameters for this configuration are listed in Table 2-3. Detailed data is not listed as in the 30 and 70 foot cases to conserve space. The data however were combined with that from the two previous antenna sizes to arrive at normalized aperture blockage results independent of antenna size. The normalized data is discussed in the next section. Computer data for the feed support structure at the antenna rim is given in Appendix B.

Table 2-3. Table of Parameters for Aperture Blockage Computer Analysis

(100 Ft. Diameter Antenna; 5, 10, 15 Ft. Feed Module Diameter)

Case	R_R	R_F	h	γ	a_o	Normalized Sidelobe	P	O	
37	600	30	300	300	.684	.0891(-21db)	4-16	0-16	20-160
38	600	30	450	150	.684	.0891(-21db)	4-16	0-16	20-160
39	600	30	600	0	.684	.0891(-21db)	4-16	0-16	0
40	600	30	300	300	1.0	.0562(-25db)	4-16	0-16	20-160
41	600	30	450	150	1.0	.0562(-25db)	4-16	0-16	20-160
42	600	30	600	0	1.0	.0562(-25db)	4-16	0-16	20-160
43	600	60	300	300	.684	.0891(-21db)	4-16	0-16	20-160
44	600	60	450	150	.684	.0891(-21db)	4-16	0-16	20-160
45	600	60	600	0	.684	.0891(-21db)	4-16	0-16	0
46	600	60	300	300	1.0	.0562(-25db)	4-16	0-16	20-160
47	600	60	450	150	1.0	.0562(-25db)	4-16	0-16	20-160
48	600	60	600	0	1.0	.0562(-25db)	4-16	0-16	0
49	600	90	300	300	.684	.0891(-21db)	4-16	0-16	20-160
50	600	90	450	150	.684	.0891(-21db)	4-16	0-16	20-160
51	600	90	600	0	.684	.0891(-21db)	4-16	0-16	0
52	600	90	300	300	1.0	.0562(-25db)	4-16	0-16	20-160
53	600	90	450	150	1.0	.0562(-25db)	4-16	0-16	20-160
54	600	90	600	0	1.0	.0562(-25db)	4-16	0-16	0

2.1.1.4 Aperture Blockage - Normalized Results - Blockage effects from the feed alone depends only on the module size and illumination taper. The plot in Figure 2-15 was derived for illumination tapers giving no-blockage sidelobe levels of -25 db and -21 db. The feed module diameter is given in terms of normalized and actual values. Both the antenna gain and sidelobe level are degraded by larger module sizes. Although no sharp cut-off point is evident in the curves, an arbitrary normalized diameter of 0.1 limits the gain loss to less than 0.2 db and sidelobe degradation to less than 3 db. The increased illumination taper to achieve lower sidelobes is negated by large blockage diameter ratios. If low sidelobe levels are a design criterion, the feed module size must be less than 10% of the antenna diameter. Abscissa scales are plotted in terms of the feed strut width to antenna diameter ratio.

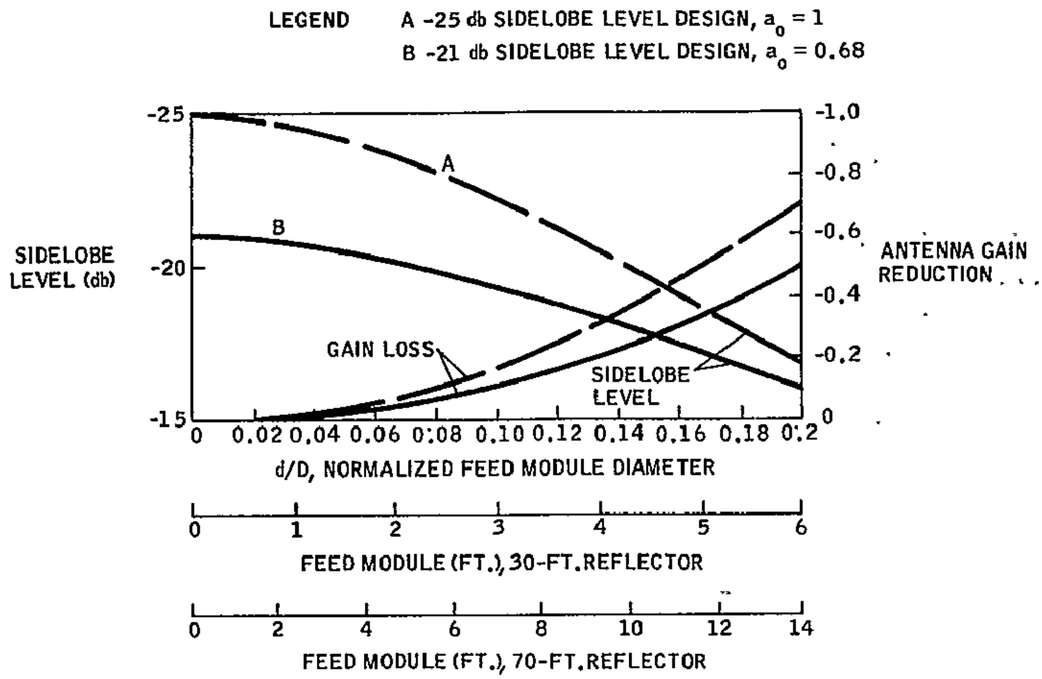


Figure 2-15. The effect of Increasing the Feed Module Size on Antenna Gain and Sidelobe Level (No Feed Supports Included)

From structural considerations, the feed support length to width ratio should be in the order of 20:1. The feed support length is approximately equal to the paraboloidal focal length for f/D ratios considered here. This gives an approximate expression for w/D of (1/20)(f/D) or (1/40) based solely on structural design.

Referring to Figure 2-16 and using a normalized feed module diameter of 0.1, the sidelobe level degradation is nearly doubled when the W/D ratio is 0.02 or 1/50. A smaller feed support width is desirable from RF considerations. Larger feed support degradation effects are illustrated in Figure 2-16. No-blockage sidelobe levels for reference are -21 db and -25 db. Other parameters in the curves are three different normalized feed module sizes (d/D = 0.05, 0.1, 0.15) and two different strut configurations — constant width, and tapered (from a width, w, at the feed module to zero width at the reflector). The initial degradation in the sidelobe level from the reference level (-21 and -25 db) is due to the feed module blockage. Abscissa scales are plotted in terms of the feed strut width to antenna diameter ratio.

An eight-bay truss antenna provides four alternate tripod attach points. Points nearer the center of the antenna increase the pie shaped shadow are (Area No. 3 in Figure 2-1). The optimum attach point is at the edge. When not attached to the rim, further degradation occurs as illustrated in Figure 2-18. An advantage of approximately 0.6 db in sidelobe level and 0.4 db in gain is obtained by attaching at the reflector edge rather than midpoint.

The edge attachment is also preferred from launch and orbital operation criteria since it provides an edge tie point on the payload package and gives the largest base dimension for feed support triangulation.

LEGEND		
A	d/D = 0.05	
B	d/D = 0.10	Normalized Feed Module
C	d/D = 0.15	Blockage
*	O by W Strut	Tapered Strut
O	W by W Strut	Constant Width Strut

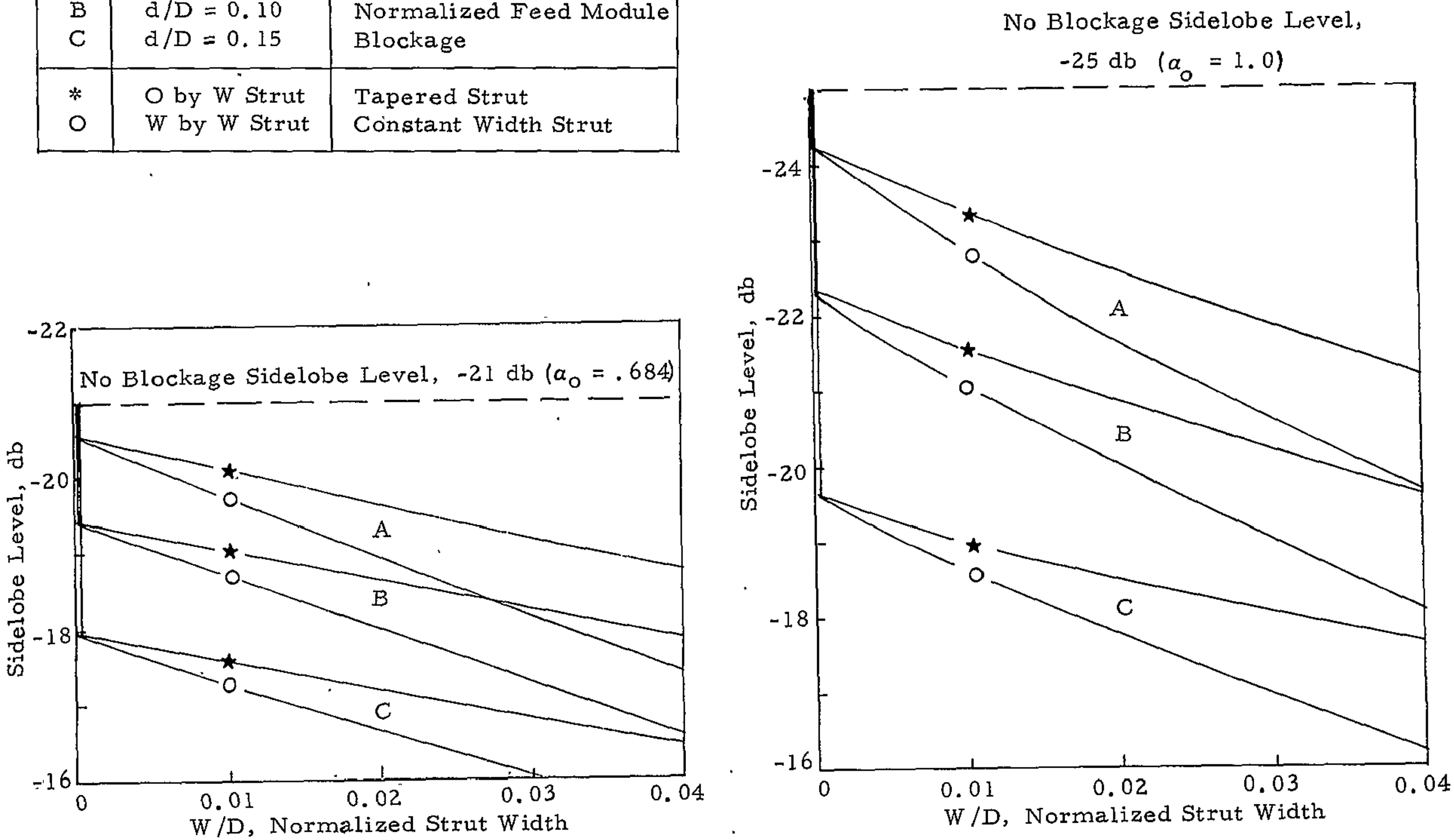
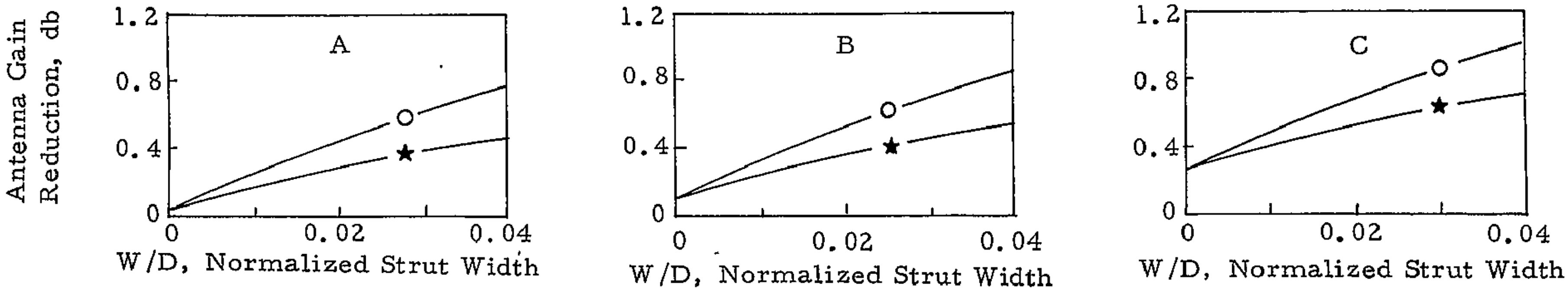
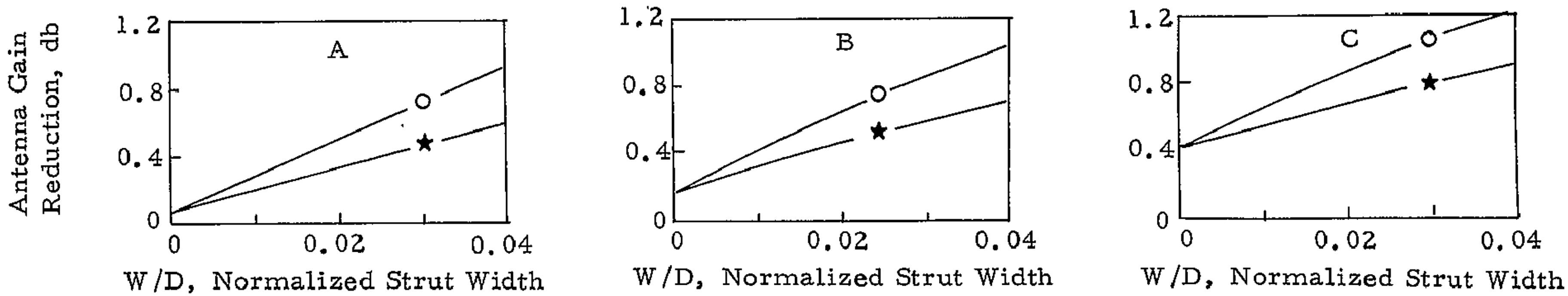


Figure 2-16. Effect of Feed Support Width and Feed Module Blockage on Sidelobe Level

LEGEND		
A	d/D = 0.05	Normalized Feed Module Blockage
B	d/D = 0.10	
C	d/D = 0.15	
*	O by W Strut	Tapered Strut
O	W by W Strut	Constant Width Strut



a) 21 db Sidelobe Design (a_o = .684) Tripod Feed Support Mounted at Antenna Periphery (h=D/2)



b) 25 db Sidelobe Design (a_o = 1.0), Tripod Feed Support Mounted at Antenna Periphery (h = D/2)

Figure 2-17. Effect of Feed Support Width and Feed Module Blockage on Antenna Gain

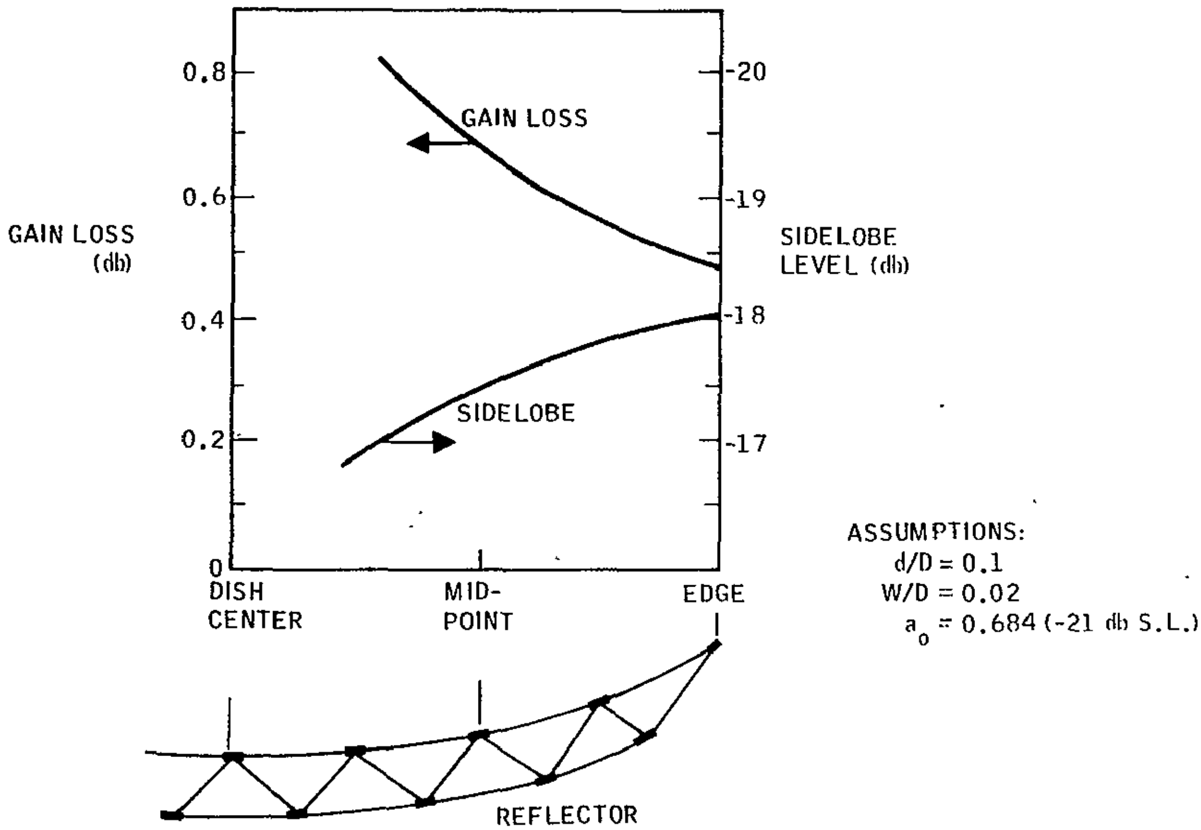


Figure 2-18. Effect of Reflector Attach Point on RF Performance

2.1.1.5 Summary - Blockage Effects - The previous discussion of strut and feed module blockage effects is summarized as follows:

a. The feed module should be less than 1/10 of the antenna diameter for low sidelobe levels.

b. Feed support struts widths less than 2/100 of antenna diameter.

c. Preferable feed support attach point is at antenna rim.

d. Tapered feed supports should be used to reduce aperture blockage.

2.2 FEED POSITIONING ERRORS

Final positioning of the feed affects the antenna RF gain by mispointing the beam and defocussing the antenna. Magnitude of these errors are discussed in the following paragraphs.

2.2.1 LATERAL FEED DISPLACEMENT - Lateral feed displacement squints the RF beam off oxis by an amount nearly equal to the mechanical angle.

The difference depends on a deviation factor, B described in Reference 2-4. For small angles, the RF beam displacement is given by

$$\theta = B \frac{d}{f} \tag{2-9}$$

It is convenient to express this beam tilt in terms of the antenna half-power beamwidth, $\theta_{HP} = 1.27\ (\lambda/D)$, where D/λ is the electrical size of the antenna in wavelengths. Beam tilt in beamwidths then becomes a function of the off-set displacement in wavelengths and the antenna f/D ratio

$$\frac{\theta}{\theta_{HP}} = \frac{B \quad d/\lambda}{1.27\, f/D} \tag{2-10}$$

The angular displacement can also be translated to a loss of gain (decibels) by the approximate beam pattern expression from Reference 2-5

$$\frac{db_1}{db_2} = \left(\frac{\theta_1}{\theta_2}\right)^2 \tag{2-11}$$

When normalized to a 3 db beamwidth,

$$db = 3 \left(\frac{\theta_1}{\theta_{HP}}\right)^2 \tag{2-12}$$

The pointing error, $\theta_e = \frac{\theta_1}{2}$,
then causes a loss of (see Figure 2-19)

$$\text{db}, = 3\left(2\,\frac{\theta_e}{\theta_{HP}}\right)^2 = 12\left(\frac{\theta_e}{\theta_{HP}}\right)^2 = 12\left[\frac{B \quad d/\lambda}{1.27\, f/D}\right]^2 \qquad (2\text{-}13)$$

when the pointing axis is not coincident with the RF axis. For a nominal design having an f/D ratio of 0.4, the pointing loss expression is reduced to

$$\text{db}, = 12\left[\frac{(.875)\, d/\lambda}{(1.27)(0.4)}\right] = 35.6\,(d/\lambda)^2 \qquad (2\text{-}14)$$

This expression is shown graphically in Figure 2-20.

A lateral displacement or misalignment of $\lambda/4$ can cause a significant gain (~2 db).

A loss of 0.5 db or less requires beam alignment within $\lambda/8$.

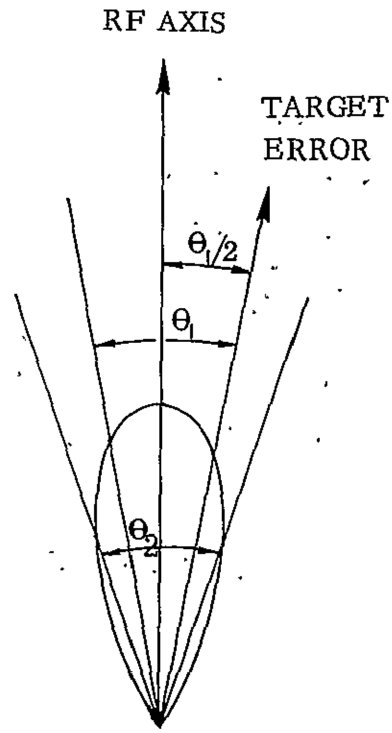


Figure 2-19. Beam Pointing Error

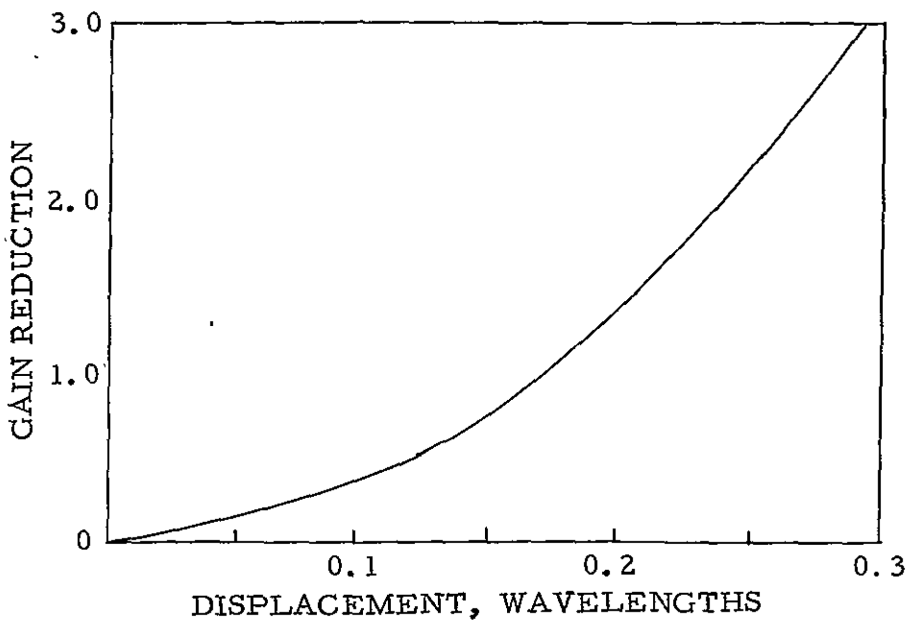


Figure 2-20. Gain Decrease Due to Lateral Feed Position Error

2.2.2 AXIAL POSITIONING OF THE FEED - Axial defocussing losses are not as severe as lateral displacement of the same magnitude. The nominal illumination tapers and f/D ratios, axial defocus gain loss is given approximately by Reference 2-6)

$$\eta = 1 - \frac{\Delta^2}{25} \tag{2-15}$$

where is the phase error in radians. In terms of a displacement error,

$$d, \Delta = 2\pi \frac{d}{\lambda} \quad \text{and}$$

$$\eta = 1 - 1.58 \left(\frac{d}{\lambda}\right)^2 \tag{2-16}$$

This expression is plotted in Figure 2-21. An allowable loss of 0.5 db requires a axial feed placement of less than $\lambda/4$.

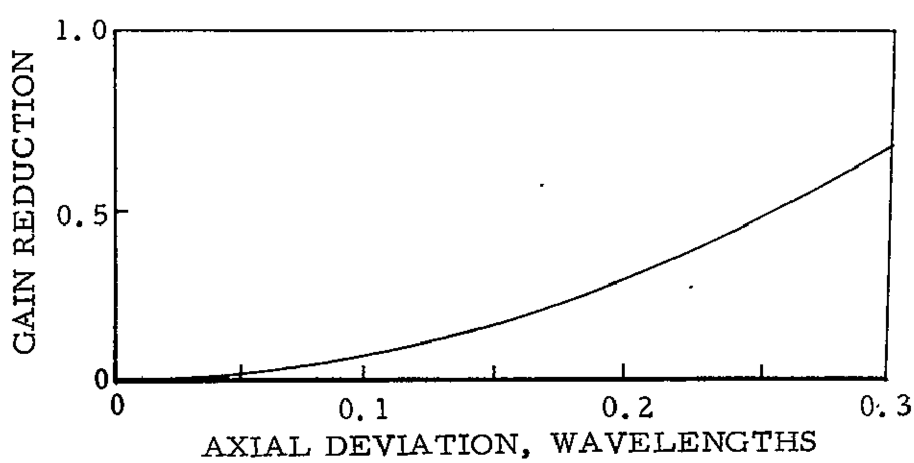


Figure 2-21. Gain Decrease Due to Axial Displacement

2.3 FEED MODULE SIZING

In previous studies (NAS w-1438) of 100 foot diameter antennas it was both convenient and advantageous to locate electronic equipment at the feed. This is a deviation from normal ground based, (one-g) designs when the additional weight cannot be tolerated. The centrally located equipment at the feed allows both short RF transmission lines to the feed, and easy access by an astronaut to feed adjustment devices and electronics.

Mechanical and RF constraints are listed in Figure 2-22 to illustrate the limitations of this type of configuration for manned operation.

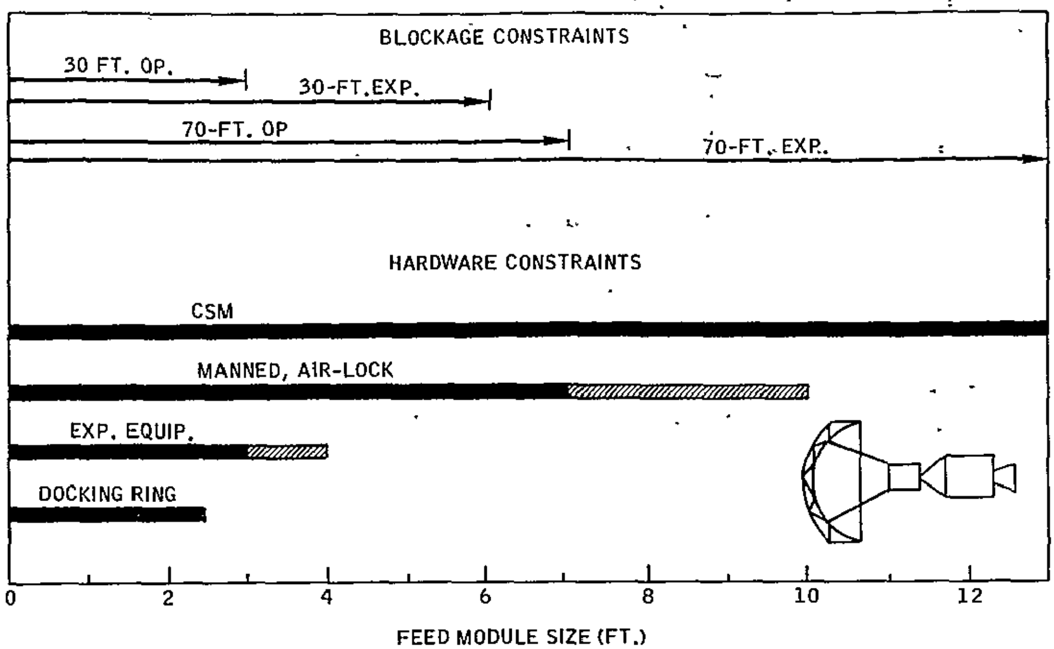


Figure 2-22. Feed Module Sizing

A docking ring for the CSM would be nominally 2.5 feet in diameter. Equipment for an antenna experiment could be packaged in a housing three to four feet in diameter. This would consist basically of experimental transmitting and receiving electronics, tracking, command, telemetry, power conditioning, thermal radiators, attitude control, and sensor systems. To provide working space in the feed area, an air-lock seven feet in diameter and preferably ten feet would be required. The docked CSM would increase the blockage diameter to 13 feet.

Tolerable aperture blockage sizes from RF analysis are given in the upper portion of Figure 2-22 for two conditions. The first is an experimental mode where excessive blockage would be allowed during an equipment check-out phase, and the second, an unmanned operational mode where the CSM has been removed. RF blockage constraints imposed are d/D = 0.1 for an operational system and d/D = 0.2 for an experimental system. When a comparison is made to hardware size requirements, docking at the feed module is not practical for an antenna 30 feet in diameter. (It could be remotely possible by reducing the air-lock to less than six feet). The 70 foot antenna could accommodate the CSM during the experimental phase and seven foot air-lock with docking ring and feed module during long term operation. A minimum antenna size with a feed module/air-lock combination would be approximately 50 feet. An illustration of a 100 foot diameter antenna which satisfies the RF blockage constraints is shown in Figure 2-23. This configuration was studied in detail under Contract NAS w-1438.

An alternate docking position is shown in Figure 2-24 for a rear attached CSM.

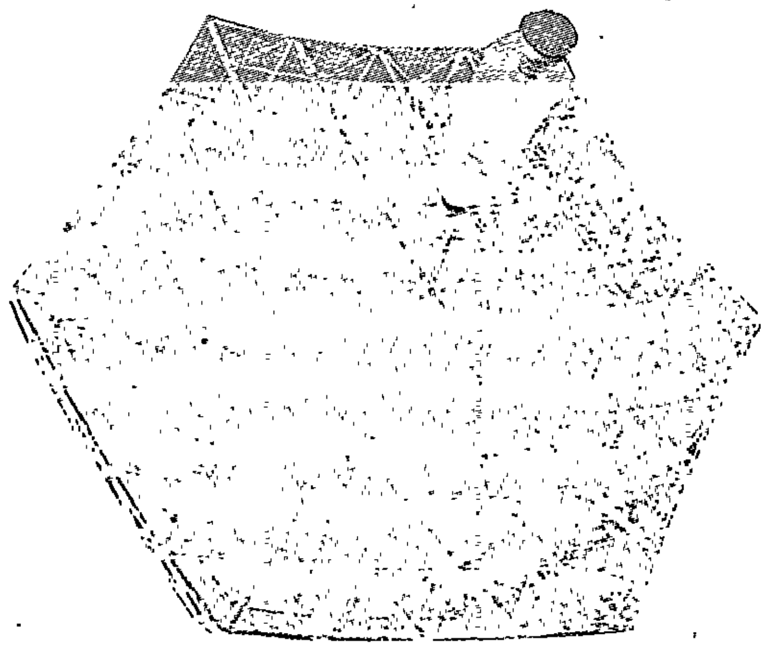


Figure 2-23. Model Simulation of a 100 Foot Diameter Antenna with Docked CSM

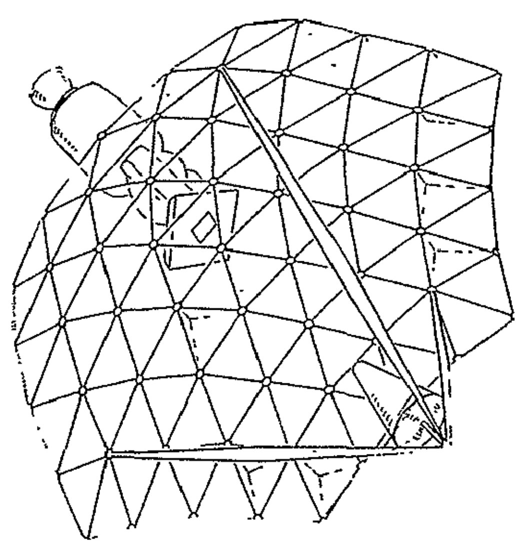


Figure 2-24. Rear Mounted Spacecraft

2.4 THERMAL BALANCE AND RADIATORS

Heat rejection and temperature control are major considerations in designing large communication satellites. Three thermal control systems have potential application; a heat pipe radiator system to cool power amplifier is a passive radiator fed by conduction for cooling auxiliary electronics; and an active thermodynamic boiler-radiator/condensor for cooling the manned module.

2.4.1 HEAT PIPE SYSTEM - A recent study of cooling high-power amplifier tubes with heat pipes was performed under NASA-ERC Contract NAS 12-564. The study yielded data on the weight and area of optimized heat-pipe systems as a function of power dissipation level and source temperature. Relationships for the heat pipe system are presented in Table 2-4.

2.4.2 PASSIVE RADIATOR SYSTEM - Thermal control of secondary electronics and, for relatively low-power systems, the prime transmitter will be by passive conduction to a low temperature panel radiator. Some auxiliary systems can be positioned to radiate directly to space through louvered openings in the spacecraft body. Louver weight and area have been lumped with those of the passive radiator in the sizing expressions. Table 2-4 indicates the resulting sizing expressions for systems using a heat pipe for power amplifier cooling. The table also lists sizing expressions for satellites using only passive radiation for all cooling.

2.4.3 ACTIVE THERMODYNAMIC SYSTEM - For satellites using nuclear power sources, an active system is an integral part of the power system. Requirements for such a system, based upon a source housed in a 10 foot diameter module are listed in Table 2-4. The active air-conditioning system for a manned module is much more difficult to compute. Based upon Convair's BSM study results, a fixed area of 1,000 sq. ft., a fixed weight of 1,300 lb., and a radiator volume of 250 cu.ft. are recommended.

In all cases, the requirements for the active thermodynamic system are in addition to those for the heat pipe and passive electronics cooling radiator systems, or the passive system for total spacecraft heat rejection.

Table 2-4. Thermal Control System Relationships

Heat Pipe System Sizing Relationships

1. Power dissipation = $1 - 1/\eta$ transmitted power, where η = transmitter efficiency.
2. Source temperature = 200°C (390°F).
3. Radiator efficiency = 90%.
4. Non-optimum weight factor = 1.25.
5. Radiator area = 9.0 sq.ft./kw dissipated.
6. Radiator weight = 1.25 lb./sq.ft. (incl. heat pipes).
7. Radiator volume = A/4.

Passive System for Auxiliary Electronics (additive to those of heat pipe system.

1. Power dissipation = Prime power - $1/\eta$ transmitted power, where η = transmitter efficiency.
2. Radiator temperature = 90°F.
3. Radiator panel area = $\ln A = \ln P + 4$, where P is power dissipation in kw.
4. Radiator weight = 1.0 lb./sq.ft.
5. Radiator volume = A/6.

Passive System for Total Spacecraft Heat Rejection

1. Power dissipation = prime power - transmitted power.
2. Radiator temperature = 90°F.
3. Area required = $A_{RD} = A_{total} - A_{effective}$.

   (Note: if $A_{eff} \geq A_{total} - A_{effective}$.
4. $A_{eff} = 2.5\,(V_{EM})^{2/3}$.
5. $\ln A_{total} = \ln P + 4$, where P is power dissipation in kw.
6. Radiator weight = 1.00 A_{RD}.
7. Radiator volume = $A_{RD}/6$.

Nuclear Source Cooling System

1. Radiator area = 20 sq.ft./kw of prime power = 20/P.
2. Module length (for 10-ft. diameter module):

$$\ell_{EM} = \frac{0.05P - 78.6}{25} .$$

3. Module $W_T = 47\,\ell_{EM}$.
4. V_{RD} - 0 (integral with module structure).

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2-3 Gray, C. L., "Estimating the Effect of Feed Support Member Blocking on Antenna Gain and Sidelobe Level," Microwave Journal, Vol. VII, No. 3, March 1964, pg. 88-91.

2-4 Silver, S., Microwave Antenna Theory and Design MIT Rad. Lab. Series, Vol. 12, pg. 488, McGraw Hill Book Co., New York, 1948.

2-5 Jasik, H., Antenna Engineering Handbook, pg. 12-5, McGraw Hill Book Co., New York, 1961.

2-6 Bracewell, R. N., "Tolerance Theory of Large Antennas," IRE Trans. on Antennas and Propagation, January 1961, pg. 57.

SECTION 3

TASK III DEPLOYMENT DYNAMICS

Deployment dynamics are considered in the following sections, first on an unrestrained basis then techniques are devised to retard the speed of deployment.

3.1 ANTENNA REFLECTOR DEPLOYMENT ANALYSIS

Two analysis techniques are developed and results presented for erectable truss parabolic antenna space deployment. These techniques are applicable to:

a. Erectable truss designs for other antenna types and for different space structures.

b. Other deployable space structure designs.

Large space structures must be packaged to fit within launch vehicles and subsequently be deployed. Dynamic analysis must ensure that deployment is reliable, complete, and free from structural damage. The two analytical techniques examine parabolic reflector deployment dynamics, in the zero g space environment. One technique analyzes the loads at latch up caused by link hinge velocity impact and spider deceleration. The key analysis input is kinetic energy at latch up. The technique is used to predict latch up loads, size hinge springs, and aid link design. The digital programs are complete for both six and eight-bay configurations and have been used in the analysis and design of 8-bay, 70-foot diameter, and 6 and 8-bay, 30 foot antennas.

The other analysis technique is reflector deployment time history simulation. It was developed for the 8-bay reflector and for the tetrahedron to be tested. The key analysis input is mesh torque versus hinge angle. This technique will predict loads throughout deployment, obtain time histories of the antenna and its components, examine energy relationships, and compute the latch up antenna energy. This information is particularly useful in examining probability of successful deployment.

Complete deployment will occur when:

a. The hinge springs provide sufficient energy to overcome all energy losses (friction and mesh stretching are dominant).

b. None of the loads during deployment or at latch up cause structural damage.

c. All hinged links latch-noting front surface links must stretch the mesh.

The time history simulation examines these factors, verifying spring size selection for the configuration and confirming the prior assumption that maximum loads occur at latch up.

The component testing is utilized in conjunction with these two analysis techniques as shown on Figure 3-1. Final design is thus obtained from a combination of analysis and tests.

Analysis approach is described and typical results shown in Section 3.1.1 for deployment latch up and in Section 3.1.2 for deployment time history simulation. The analysis discussion is amplified and additional results presented in Appendix C, which includes the references. The paper of Reference C-8 is based on the work discussed in this report.

3.1.1 ANALYSIS OF REFLECTOR DEPLOYMENT AT LATCH UP

3.1.1.1 Energy Requirements and Hinge Spring Sizing - Antenna deployment is powered by the hinge springs. There is one hinge spring at the center of each front and back surface link. Diagonal links (between front and back) do not fold and have no springs. Link hinge springs are sized as follows. Spring energy input to the antenna must exceed the energy losses due to breakaway and viscous frictions, mesh stretching, and the link latching mechanisms, if included. However, the springs must be small enough so that no loads large enough to damage the structure occur at any time. The springs must also be able to power the deployment, including causing breakaway, overpowering friction torques, and stretching the mesh. These considerations are illustrated in Figure 3-2.

It is anticipated that maximum loading will occur at latch up. There is a maximum residual kinetic energy at latch up, $(AKE_L)_{max}$, which corresponds to the acceptable loading. Thus the potential energy supplied by the springs during deployment

$PE_{springs}$, has the bounds

$$(PE_{springs})_{min} = KE_M + KE_F,$$

$$(PE_{springs})_{max} = (PE_{springs})_{min} + (AKE_L)_{max},$$

in which KE_M, and KE_F are the total energy losses due to mesh and friction.

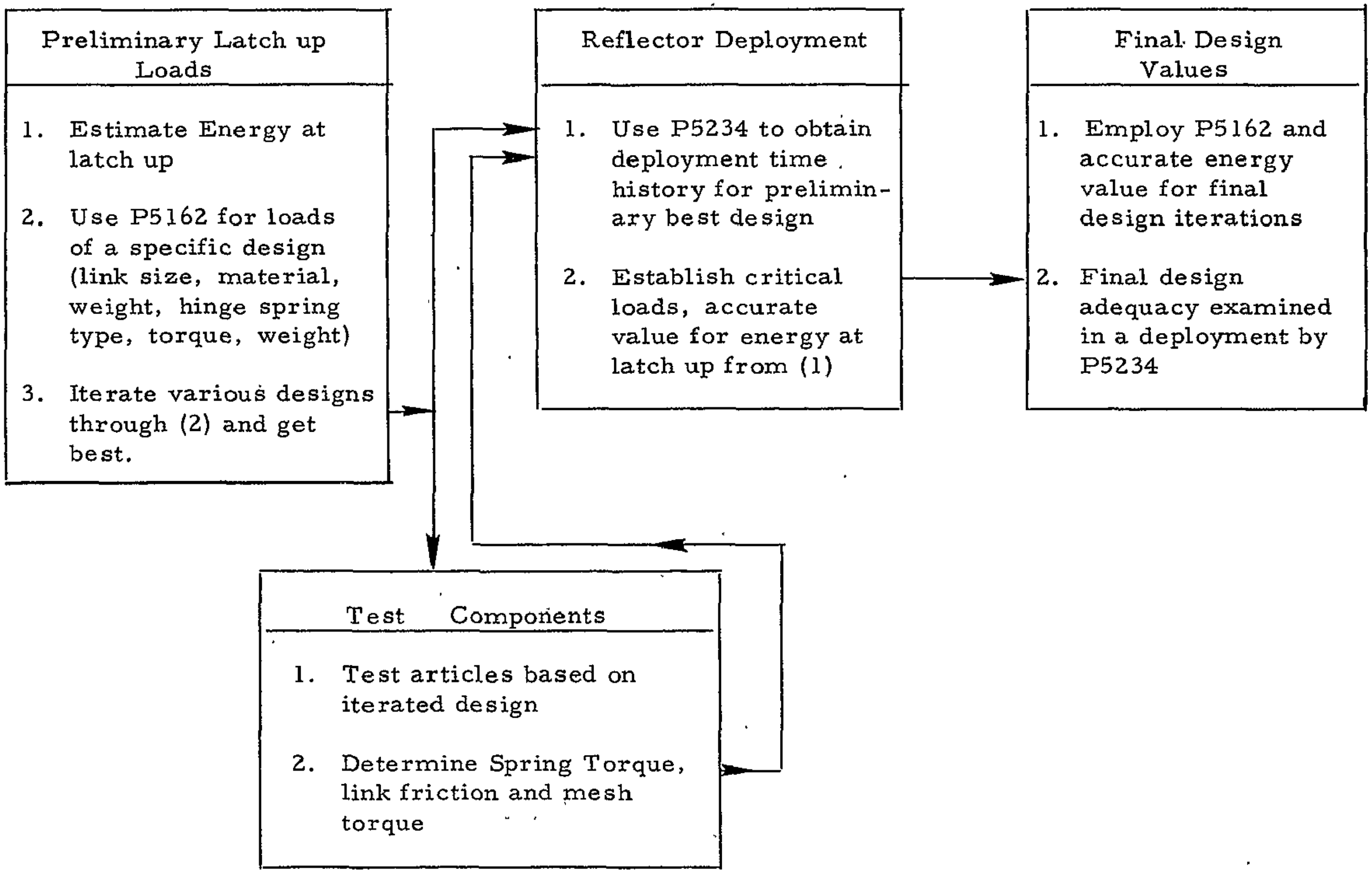


Figure 3-1. Reflector Loads, Hinge Spring Sizing, and Deployment Analysis Using Latch up Load Digital Program (P5162) and Reflector Deployment Time History Digital Simulation (P5234).

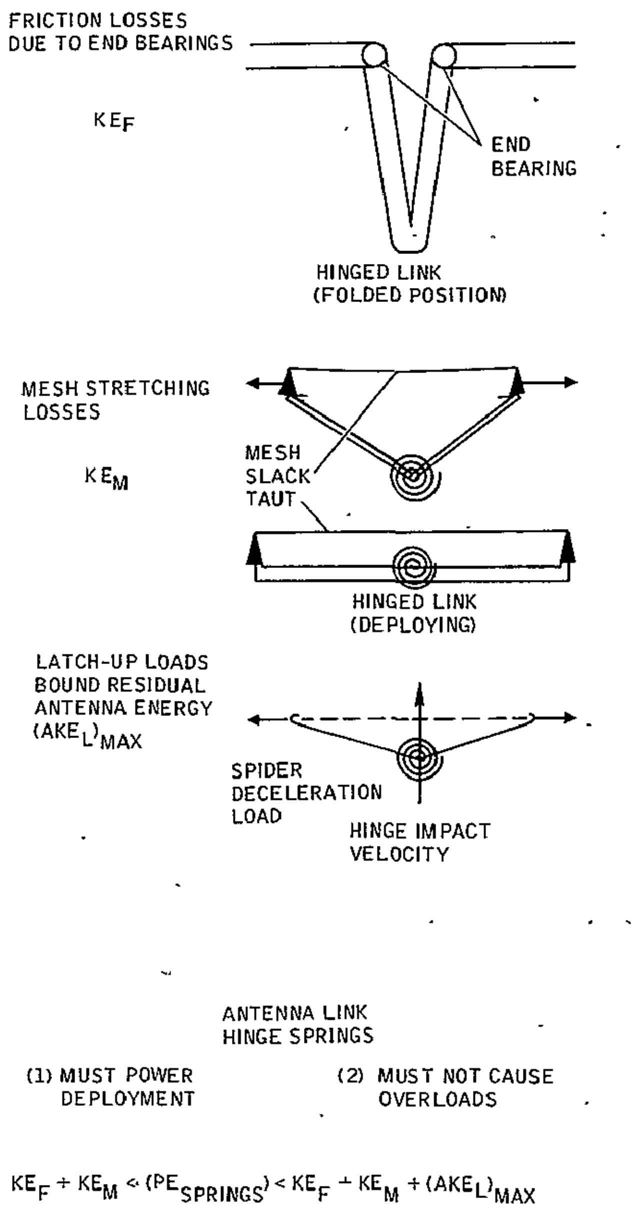


Figure 3-2. Antenna-Link Spring Energy Requirements

Once the desired total spring kinetic energy

$$PE_{springs},$$

has been selected, the average torque per spring, τ, is:

$$\tau = \frac{PE_{springs}}{N_s \, \Delta\theta}$$

in which N_s is the total number of springs (e.e., number of hinged links), and $\Delta\theta$ is the average hinge rotation.

There are 90 hinged links in the front and 63 in the back surface, for a total of 153, in the six bay configuration. The 8-bay reflector has 156 front and 120 in the back, for a total of 276.

The minimum bound for the 6 bay, 30 foot reflector is computed in Appendix C. 1. 1 as 123 ft lbs.

3. 1. 1. 2 Hinge Impact and Deceleration Loads - Major deployment loads are expected to occur at deployment termination (latch up) and are due to link hinge impact and spider deceleration. Analysis techniques for predicting these loads have been developed during this study. Solutions are obtained using a combination of digital programs and hand calculations. The key tool is the latch up analysis program P5162, and its development constituted a major portion of the effort. These analysis techniques and the associated digital programs are described in Appendix C. 1. 2.

The latch up analysis uses antenna kinetic energy as an input parameter. Spider deceleration loads and link hinge impact velocities are obtained as a function of the kinetic energy. Link impact loads are computed for specific links for an arbitrarily selected impact velocity. Since link impact loads scale directly with velocity, load values for specific velocities (i. e., specific values of antenna energy) are readily obtained.

Both analysis loads and allowable stresses are dependent on link specifies. Thus the link design sets an upper limit on allowable stresses. This limit is used with the load data to set the maximum bound for antenna kinetic energy at latch up

$$(PE_{springs})_{max}.$$

The design procedure iterates through several link designs, altering spring sizes, link sizes and materials, and computing loads, to arrive at the final design. Data presented next illustrates the procedure for the final iteration for a reflector using a "carpenters rule" type hinge.

3.1.1.3 Typical Results (30 Ft. 6 bay Antenna) - The spider deceleration load and link hinge velocities are obtained as a function of energy (step two). These are shown in Figure 3-3 and Figure 3-4. The link impact load is obtained for a specific link hinge velocity. The hinge itself consists of two pieces of 0.008 inch titanium, each 3.4 inches wide and 12.0 inches long. Each hinge end attaches to a stainless steel collar. The collar also fastens to the titanium link tube, which is 1.5 inches in diameter and has a 0.010 inch wall. Each of the two tubes halves is 19.90 inches long for link number 34, forming the major portion of the link. The selected link and hinge structural model contained 34 nodes. Model modal characteristics were computed (step one). Link impact load, specifically bending moment, was then obtained (step three) and is shown in Figure 3-5 for link number 34 at an arbitrary velocity of 100 fps. This link, one of the six outer radial links in the front surface, experiences the highest link velocity and is also the longest link.

Experience has shown that the link impact loads dominate the spider deceleration loads for configurations having no mounted equipment attached to the antenna reflector. For this example, 100 foot-pounds of energy give stress values of 743 psi due to spider deceleration, and 40,000 psi due to link No. 34 impact (Appendix C.1.3.7). Spider loads are consequently not used in spring sizing.

Spring torque sizing approach is shown in Figure 6-6.

$$(PE_{springs})_{min},$$

was established as 123 feet-lbs in Section 3.1.1.1. The acceptable stress level due to bending moment is 40,000 psi for the titanium tube. The corresponding bending moment is 705 inch-lbs. Using the data of Figure 3-5, the maximum hinge impact velocity is 26.5 fps.

The maximum residual antenna kinetic energy at latch up,

$$(AKE_L)_{max},$$

is determined from this velocity, using Figure 3-4. Impact velocity is shown in the figure as a function of antenna energy for two cases:

a. All links latching simultaneously

b. Outer front links latch

It is assumed that the energy residual in the outer front links is one-half that for the all-link case.

The impact velocity of 26.5 fps corresponds to 105 foot-pounds of energy for the all link case and 43 foot-lbs among the outer links (or 86 foot-lbs

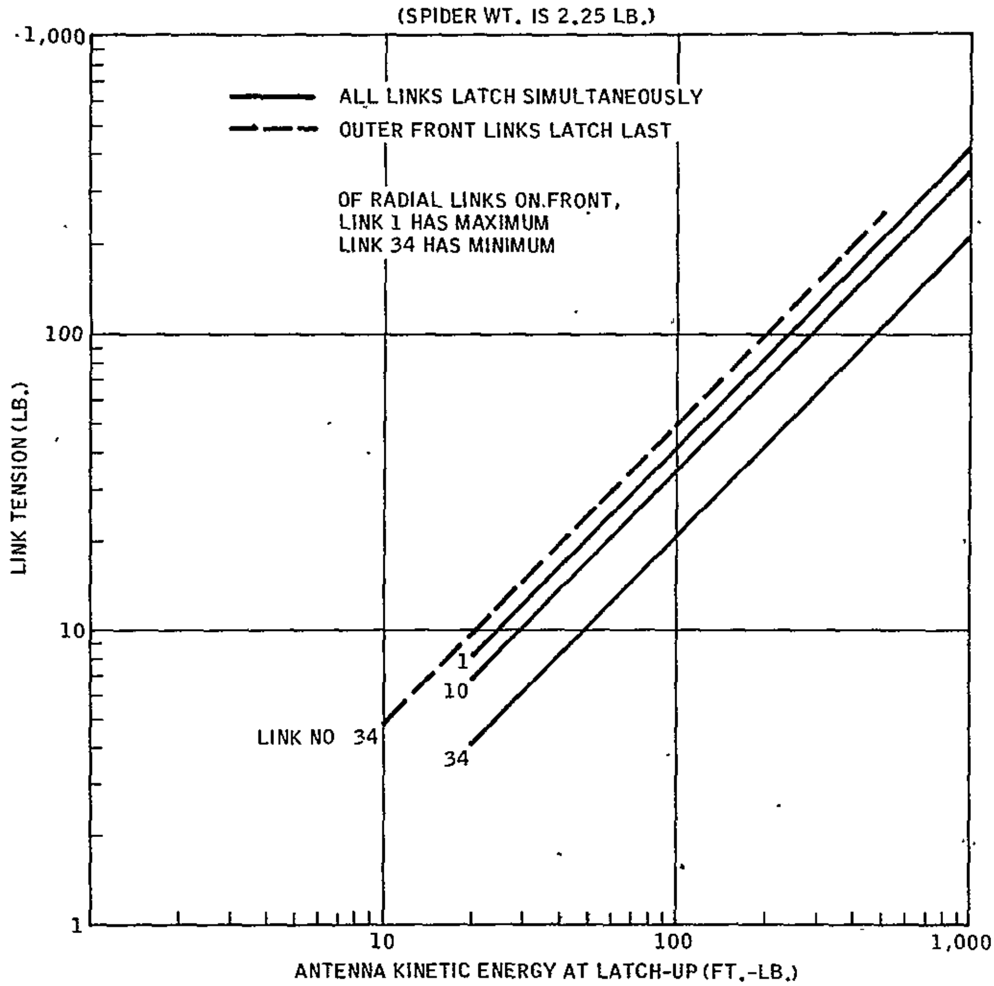


Figure 3-3. Link Tension Due to Spider Deceleration at Latch UP (Six-bay, 30 foot antenna)

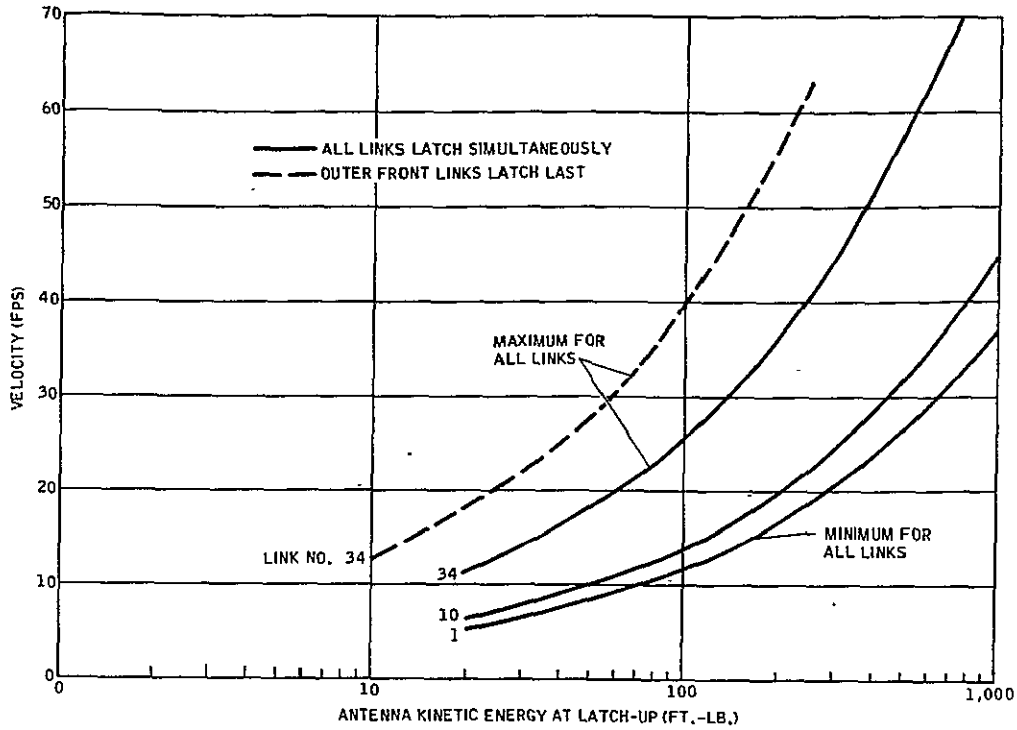


Figure 3-4. Link Hinge Velocity at Latch Up (Six-bay, 30 foot Antenna)

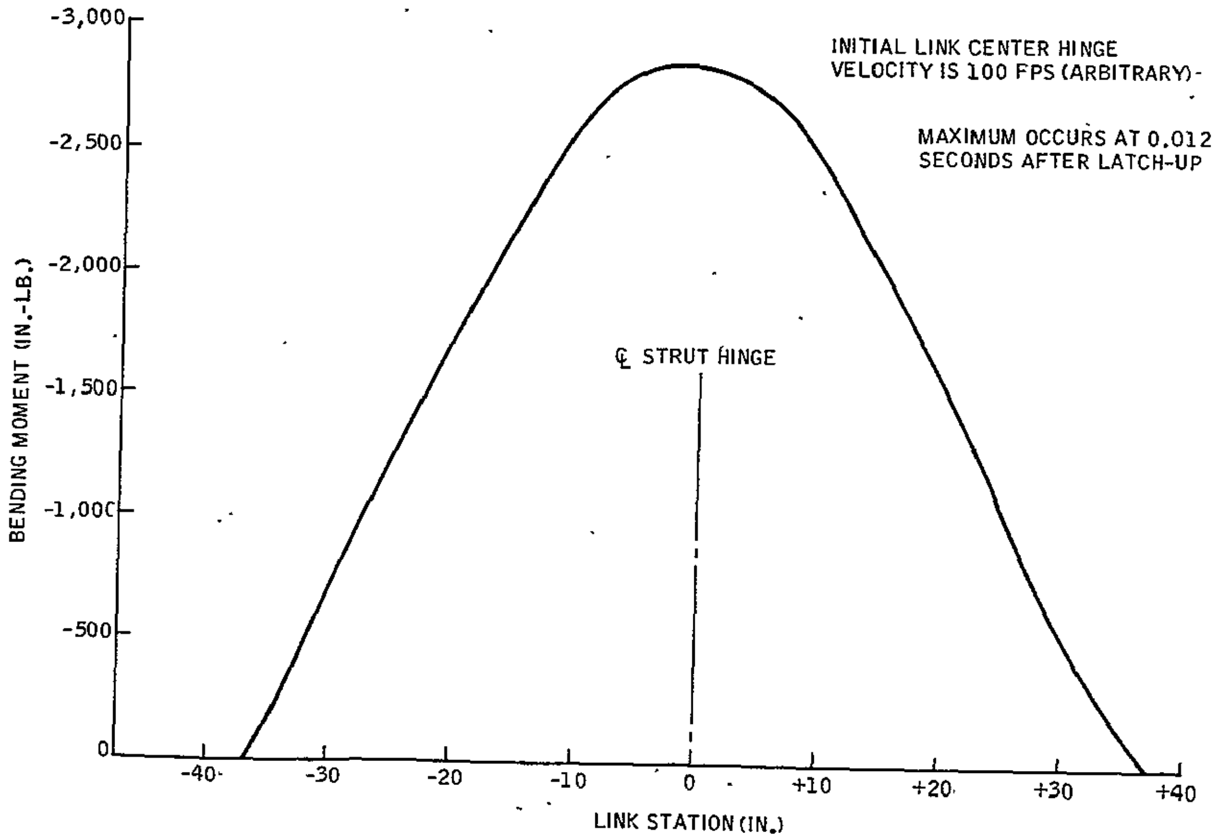


Figure 3-5. Maximum Bending Moment for Link No. 34 (six-bay, 30 foot antenna)

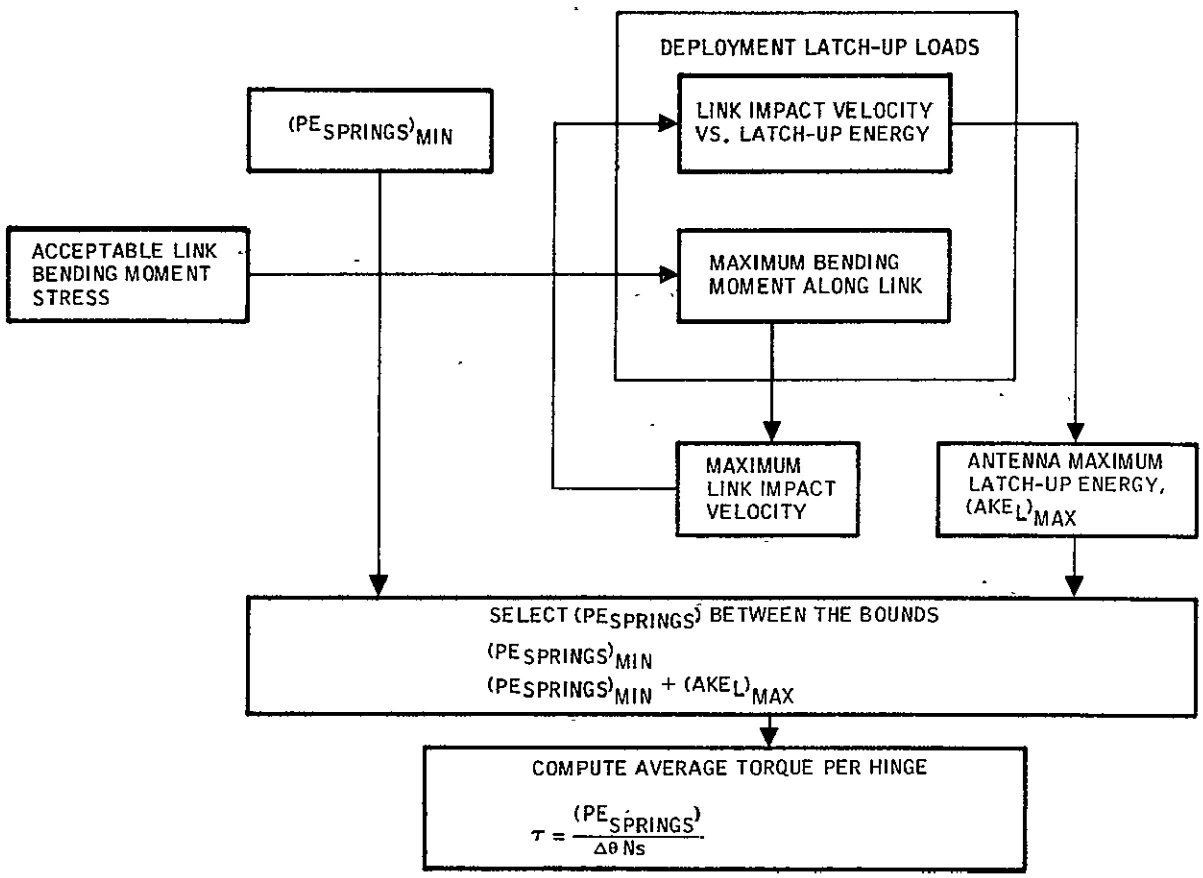


Figure 3-6. Spring Torque Sizing (small spider loads)

total) case. The actual value of

$$(AKE_L)_{max}$$

must lie between 86 and 105 foot-lbs. A value of 95 foot-lbs. has been assumed.

Therefore,

$$123 < (PE_{springs}) < 123 + 95 = 218$$

The $PE_{springs}$ value selected is 160 ft.-lbs, and

$\Delta\theta$ is π radians.

The torque per hinge is:

$$\tau = \frac{160}{153 \times \pi} = 0.333 \text{ foot-lb per radian.}$$

Detailed determination of the above data is given in Appendix C.1.3.8.

3.1.2 REFLECTOR DEPLOYMENT TIME HISTORY SIMULATION -

3.1.2.1 Analysis and Digital Simulation - The deployment time history analysis is based on energy considerations. The reflector is opened to full deployment in twenty to thirty steps. At each step, the kinetic energy is equal to that at the last step, plus the additional energy input of the hinge springs and minus the energy loss due to friction and mesh stretching. This kinetic energy is distributed among the various reflector components. Step time duration is calculated from the velocity and reflector deployment time history results.

The time history computes the reflector energy flow for specific hinge springs and reflector mesh designs and provides the component velocities, including link hinge velocity at latch up, which is anticipated to be critical.

The analysis is based upon geometrical constraints similar to those of the latch up program. Reflector deployment is assumed to occur in a radially symmetric manner, and the spiders are represented by point masses. Thus there is only one degree of freedom.

The program also computes the deployment time history of the tetrahedron test section of the reflector. These points are summarized on Figure 3-7A.

Mesh torque data is estimated, and the program conducts a parametric variation on the input table of values by multiplying the torque with up to seven factors (one of which will usually be one). All affected calculations are carried out separately for each factor.

Simulation is by digital techniques; the program was written in Fortran IV by dynamics personnel. It requires 80,000 to 90,000 words of core in the CDC-6400 when the input deck is in source language. The program was developed for the 8-bay version. Options for fewer bays could be introduced relatively easily; introduction of additional bays would be more complex.

General flow for the digital simulation of reflector deployment is shown on Figure 3-7B. First the numerical identification is assigned to the components and the deployed geometry from the AGO program is input. The analysis then proceeds from the packaged condition. For each of the 20 to 30 steps, the geometry is calculated, the energy changes obtained, the relative velocities obtained and a generalized mass computed. Subroutine RESULT computes normalizing velocity as square root of reflector energy divided by generalized mass, and then time increment and other variables are obtained. Printed results include the time and various energies, and velocities, accelerations, and loads for those components of interest.

The majority of the programming effort is in bookkeeping details for the 109 spiders, 276 hinges, and the 156 front, 144 diagonal, and 120 back links, of the 8-bay parabolic antenna. Conceptually the analysis is relatively simple, carrying out the details was time consuming.

The analysis can be applied to other erectable truss designs and to other types of deployable concepts, using the basic energy approach and applying appropriate geometric constraints. Both the latch up analysis and the deployment simulation are so applicable. Implementation might require considerable reprogramming, but basic program flow would be similar.

3.1.2.2 <u>Comparison of Deployment Simulation and Latch Up Program</u> - It is concluded that the spider translation velocity, and the diagonal links translation and rotational velocities do not constitute effective contributions to the generalized mass near latch up, as was assumed in formulating the latch up analysis. The linear velocity of front and back links do constitute an effective contribution, being typically 50% of the latch up analysis generalized mass, which currently includes only the rotational velocity of the front and back links. The linear velocity of the additional hinge structure and spring mass (mass in excess of average link linear density) is also an effective contribution and can be up to 50% of current latch up analysis general mass. The latch up analysis consequently computes component velocities as being 20 to 40% high and component acceleration as being 50 to 100% high. This results in link over design and unnecessary weight. A factor should be used with latch up analysis program results until the linear velocities of hinged links and of hinges are programmed into the deck. Numerical details for the comparison follow.

Final deployment step size is among the input data. It is convenient to have it identical to the latch up program perturbation. Deployment simulation input was set equal to latch up run 041 for a series of check and debugging

DEPLOYMENT BASED UPON ENERGY CONSIDERATIONS

TOTAL ENERGY AT ANY TIME EQUALS THAT INPUT BY HINGE SPRINGS MINUS FRICTION & MESH STRETCHING LOSSES.

REFLECTOR OPENED IN 20 TO 30 STEPS.

ENERGY CHANGES; RELATIVE VELOCITIES OF ALL LINKS, HINGES & SPIDERS, TIME; ACTUAL VELOCITIES & ACCELERATIONS OF SELECTED COMPONENTS ARE COMPUTED.

ASSUMPTIONS

ONE DEGREE OF FREEDOM

SYMMETRICAL MOTION

SPIDERS ARE POINT MASSES

TETRAHEDRON DEPLOYMENT INCLUDED

SIMULATION BY DIGITAL TECHNIQUES

Figure 3-7A. Reflector Deployment Time History Analysis Approach

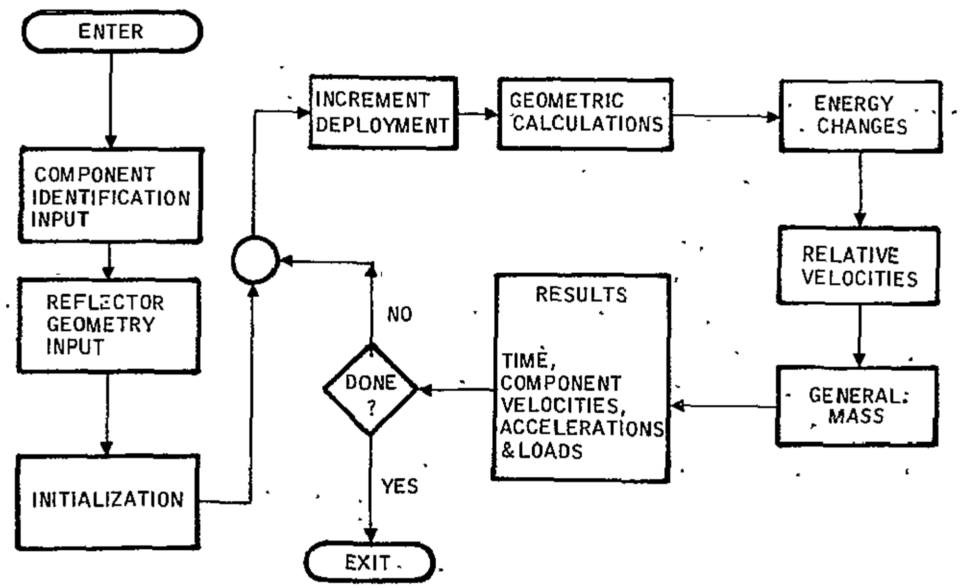


Figure 3-7B. Reflector Deployment Time History Digital Simulation runs, the last of which was run D77, 27 February, 1969. Generalized mass data is shown in Table 3-1.

Agreement to 7.7% is seen for the rotational velocity of front and back links. The antenna configuration includes considerable reflector attached equipment whose weight is assigned to the spiders. The spider translation is unimportant here, and will be a smaller percentage with no attached equipment. Diagonal link contributions are insignificant. Contributions from hinged (front and back) link translation and additional hinge mass translation are important. Percentages will vary with reflector design; the carpenter rule type hinge has zero additional hinge mass, for example.

Table 3-1. Generalized Mass Comparison

Latch up analysis program generalized mass, run 041, assuming only rotational velocity of front and back links

2920.2*

Deployment simulation generalized mass, final step, run D77

Contribution from	Generalized Mass	% of total
Spider translation	74.93	1.46
Additional hinge mass translation	1067.82	20.9
Front and back links translation	1244.69	24.5
rotation	2695.66*	53.0
Diagonal links translation	2.45	0.05
rotation	0.10	
Total	5085.61	

*7.7% different

The normalizing velocity following a deployment step is the square root of reflector energy divided by the generalized mass. Approximately, component velocities vary inversely and step time change varies directly with square root of generalized mass and accelerations inversely with generalized mass. Thus link velocities are expected to be

$$\frac{1}{.53} = 1.37$$

times higher for the latch up data, which is in accord with the data shown in Table 3-2.

Table 3-2. Link Z Axis Velocity Comparison, fps (link hinge impact velocity)

Reflector latch up energy is 690 ft. lbs.			
	Latch up	Deployment	Ratio
Link 58	20	15.11	1.32
Link 1	11	8.17	1.34

Accurate time change and acceleration data was not obtained in deployment run D77 and therefore no comparisons are made. Computation of these values is dependent on size of previous step, and run D77 opened the reflector in just four steps for debugging purposes.

3.1.2.3 Deployment Simulation Accuracy - Reflector deployment is simulated by the digital program, which is an approximation to the actual physical process. Major error sources are summarized, a more detailed discussion is in Appendix C.2.3. Accuracy would be improved by increasing the number of deployment steps, improving step size variations and the computations of time increment and link tensions due to spider deceleration loads. These improvements can be implemented relatively quickly and inexpensively. More steps will increase running time. Computation of generalized mass relative velocities by perturbation of reflector geometry at step end would also improve accuracy. This improvement entails considerable reprogramming and will yield longer running times.

a. Spider Deceleration Values at Latch Up - Spider deceleration values for final step show an upward jump of 2.5 to 3 times values for the previous steps. An increase was anticipated, indeed the latch up program was developed because maximum loads were expected at latch up. Simulation values are in the range obtained by the latch up program. A simple model is used in Appendix C.2.3 to examine the condition of run D80. The model predicts that maximum deceleration will occur at latch up and yield numerical values reasonably close to simulation results.

   The upward trend of spider deceleration values approaching latch up and the range of values computed for the final step are concluded to be correct. Errors are introduced by the approximations of the time increment and generalized mass calculations and the step size discontinuity. Recommended improvements will decrease these errors and yield more accurate acceleration values.

Link tension and stress due to spider deceleration are currently obtained from simulation results for spider loads by hand calculations. This procedure could be implemented in the program.

b. Reflector Packaged Geometry - The simulation assumes that spiders move so that all are at the same fraction of fully deployed radial displacement at any time. The constant width spiders are bound in contact in the package. Radial locations are thus not dependent on deployed geometry and spiders are located at various fractions of deployed radial displacement.

This simulation approximation is not detrimental. Primary effects are on individual component time histories early in deployment and on total spring energy input and friction energy losses. There is no appreciable interest in early component time histories, and deployment total energies are changed by less than one percent.

3.1.2.4 Typical Deployment Simulation Results - Typical results are presented here for both the 8-bay reflector and the tetrahedron. This illustrates simulation capability. Input data for spring, friction and mesh torques are analytical estimates or manufacturer's specifications and weight data is preliminary, for the results shown in this section. This input data is presented in Appendix C.2.4. The antenna reflector uses .018 and .015 inch wall titanium links and the carpenter's rule hinge. (Simulation runs based on measured torque values for the titanium leaf spring are presented in Section 3.1.2.5). The tetrahedron is representative of the test specimen, which has 0.049 inch wall aluminum links and the heavy hinge structure and spring associated with the tension and torsion type hinge springs. "Nominal" springs have a torque of 1.8 ft. lbs at zero hinge angle, decreasing linearly to 0.9 ft. lbs at latch up.

There are 21 deployment steps in these runs. Ten large steps occur before the mesh is encountered. Then ten smaller ones occur, and the final step is tiny. Deployment time remaining before latch up is a desirable independent variable for graphical presentation.

Energies are shown in Figure 3-8 and Figure 3-9 for the reflector and the tetrahedron. Discontinuities due to step size changes do not appear in these energy plots. Only a small portion of the deployment is involved in the important mesh stretching process. It is less than 0.1 seconds in these runs. Prior to simulation completion it had not been realized that this process would occur so rapidly.

Early deployment total reflector energy is almost that input by the springs, because friction torque estimates are small. Late in deployment the mesh begins to be stretched. Then total energy is more noticeably decreased below the spring input energy. Energy loss in stretching the mesh is a small fraction of total energy for these conditions. Consequently varying the mesh torque to 2/3 or 1.5 its nominal value introduces minor changes.

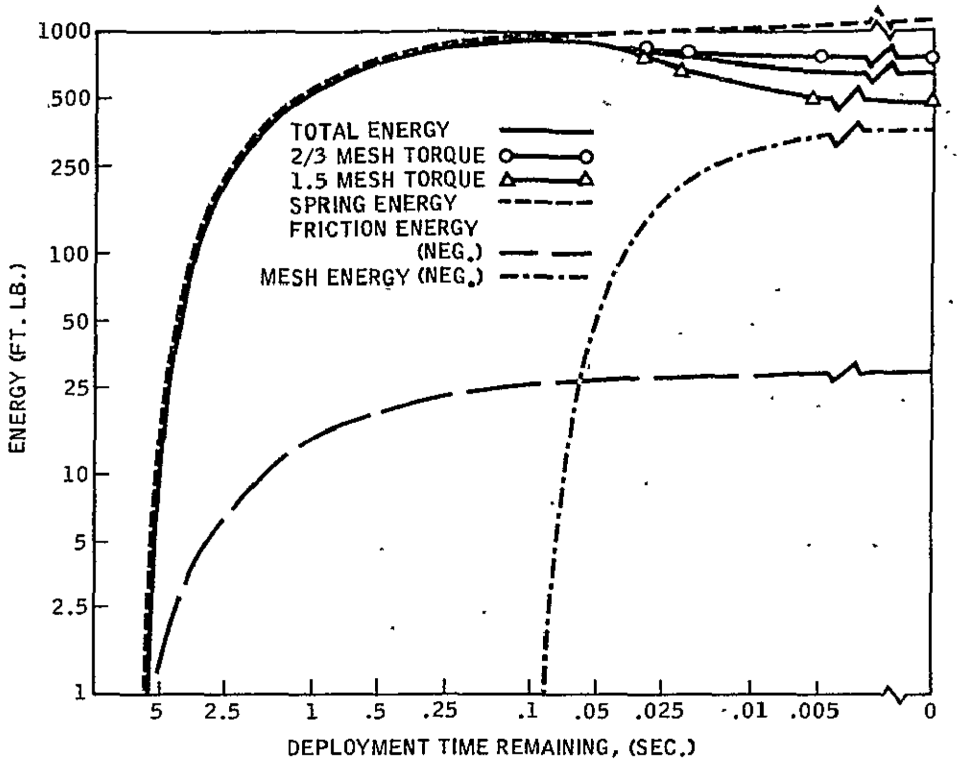


Figure 3-8. Reflector Time History Nominal Springs

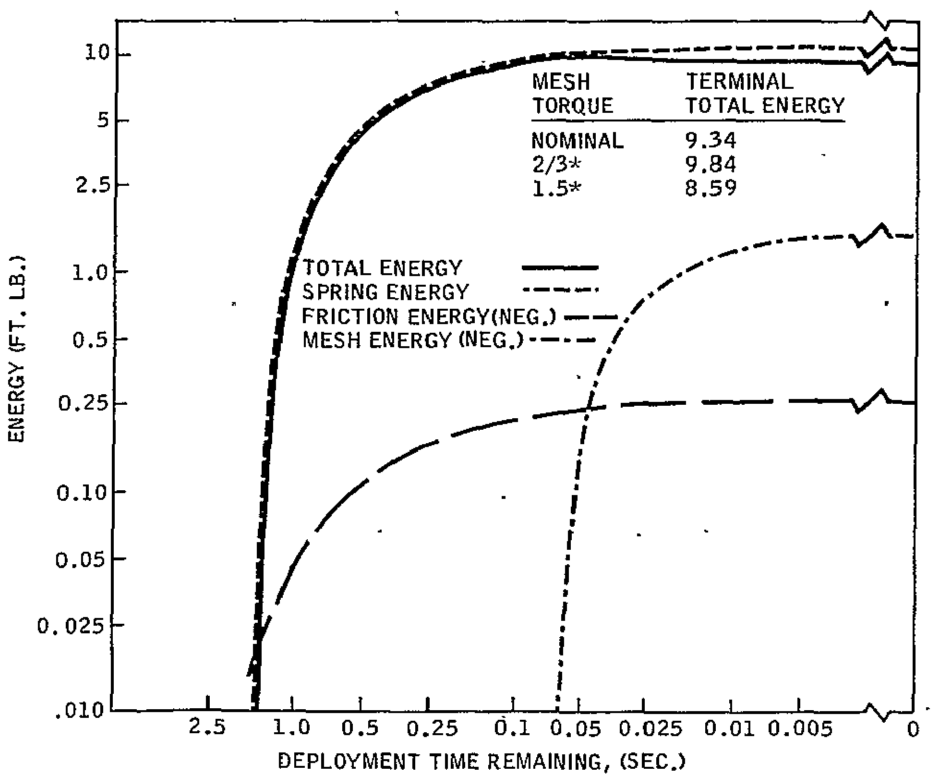


Figure 3-9. Tetrahedron Energy Time History Nominal Springs

The terminal total energy is indicated on Figure 3-9, rather than drawing two additional total energy curves.

Separate calculations are made in the simulation for each of the mesh torque factors. Spring energy is independent of mesh torque. Friction is independent of velocity for these runs and is thus also mesh independent. Reflector total energy, opening velocity, and time to open vary with mesh torque. The lower energy slower moving case on Figure 3-8 has .0054 seconds to go at the triangle denoting KRFACT = 21. The higher energy circle shows .0050 seconds. Component velocities and accelerations also depend on mesh torque. Reflector mesh torque effects for the last four steps of run D 80 are shown in Table 3-3.

A primary failure mode is incomplete deployment. Normally the mesh is stretched and hinged links rotated into latch by the reflector energy supplied by springs, most of which is input before encountering the mesh. Hinge spring torque is usually less than the maximum value of the deployment opposing mesh torque. The reflector total kinetic energy accumulated previously must be sufficient to carry through. Any reflector (or substructure) will eventually not deploy as spring torque is decreased and/or mesh torque is increased.

This is shown in Figure 3-10, where the reflector has 0.7 x nominal spring torque and the three mesh torques considered are above nominal. Deployment does not occur for the 2.68 times mesh torque curve. Latch up energy is only 90 ft. lbs and probability of deployment must be considered marginal for the 1.79 times mesh curve. Spring decreases of 10 to 15% would cause incomplete deployment. Deployment is assured for the 1.19 times mesh curve.

Typical component time histories are shown for reflector and tetrahedron in Figure 3-11 and Figure 3-12. Component integer identification is in Appendix C.2.1. Discontinuities below 0.1 seconds and near .005 seconds are due to abrupt step size changes. Prior to the first step size change, spider acceleration is ploted; subsequently deceleration is shown. Spiders are accelerated by springs below to 0.1 seconds, and then are decelerated by mesh minus spring effects. The sharp deceleration spike shown below 0.1 seconds on both graphs has been painstakingly examined, and it is an unrealistic value due to step size change.

Tetrahedron component motions are anticipated to be considerably larger than component motions for the reflector of which it is a part, because tetrahedron mesh torque per hinge is smaller. Since the tetrahedron is the heavy test specimen and the reflector is a weight optimized design, this is not observed in the data.

General trends are the same for both reflector and tetrahedron. Spider velocity data is for an outer spider lying on the X axis, and the Y axis

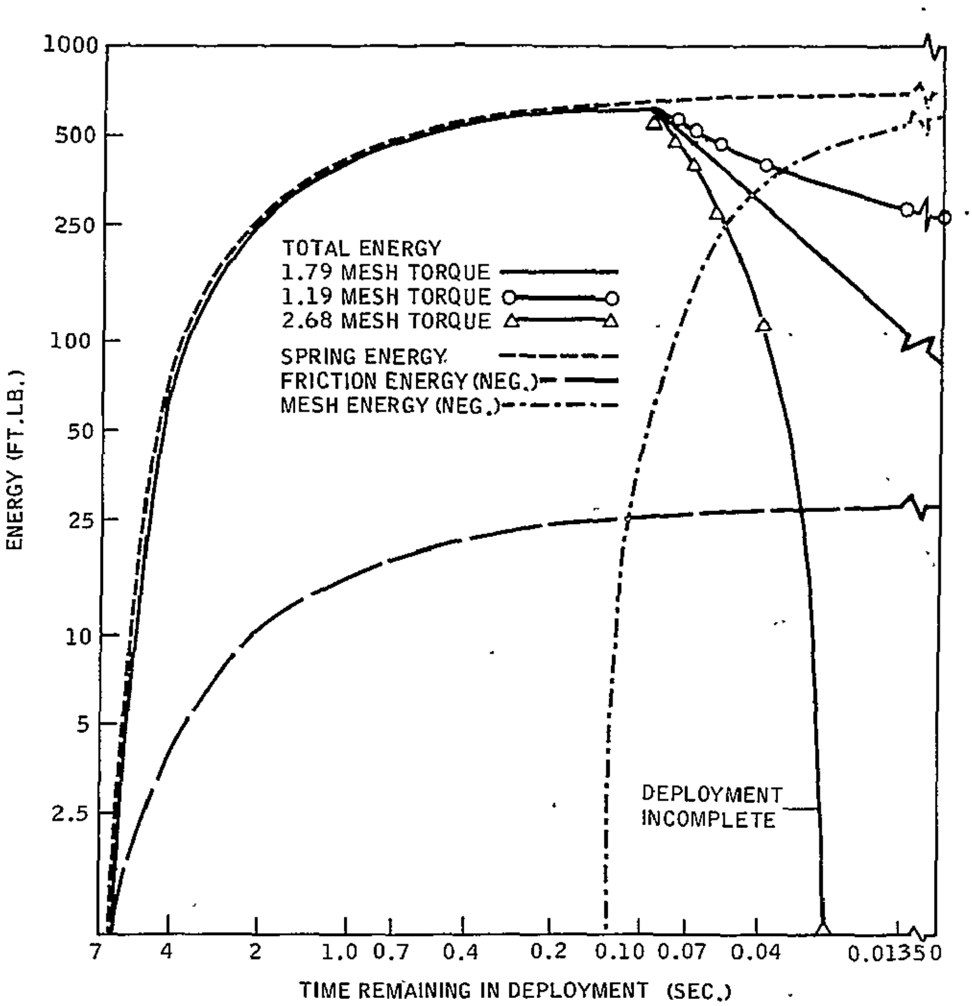


Figure 3-10. Reflector Time History 0.7 x Nominal Springs, Higher Mesh Torque

Table 3-3. Reflector Mesh Torque Effects, Last Four Steps, Run D80.

KRFACT	19	20	21	22
Spring Input Energy, (ft.-lb.)	1004.94	1018.61	1044.66	1050.76
Friction Loss Energy, (ft.-lb.)	27.85	28.35	29.33	29.57
Mesh Loss Energy (ft.-lb.)				
a) nominal mesh	139.30	210.16	333.77	347.62
b) 2/3 nominal	93.33	140.81	223.62	232.91
c) 1.5 nominal	208.95	315.24	500.65	521.43
Total Reflector Energy (ft.-lb.)				
a)	837.80	780.10	681.56	673.57
b)	833.76	849.45	791.70	788.28
c)	768.15	675.02	514.68	499.76
Deployment Duration, Seconds				
a)	5.4209	5.4324	5.4482	5.4534
b)	5.4205	5.4315	5.4465	5.4513
c)	5.4217	5.4338	5.4512	5.4572
Spider No. 1 X Velocity, fps				
a)	5.10	4.19	2.27	ZERO
b)	5.24	4.37	2.45	
c)	4.89	3.89	1.97	
Link Hinge 58, Z Vel., fps				
a)	18.37	18.68	18.21	17.14
b)	18.87	19.49	19.63	18.50
c)	17.60	17.37	15.83	14.76
Spider No. 1 Accel., ft/sec^2				
a)	-96.57	-137.01	-230.54	-877.50
b)	-89.94	-133.37	-243.48	-1021.29
c)	-106.61	-142.53	-210.94	-659.63

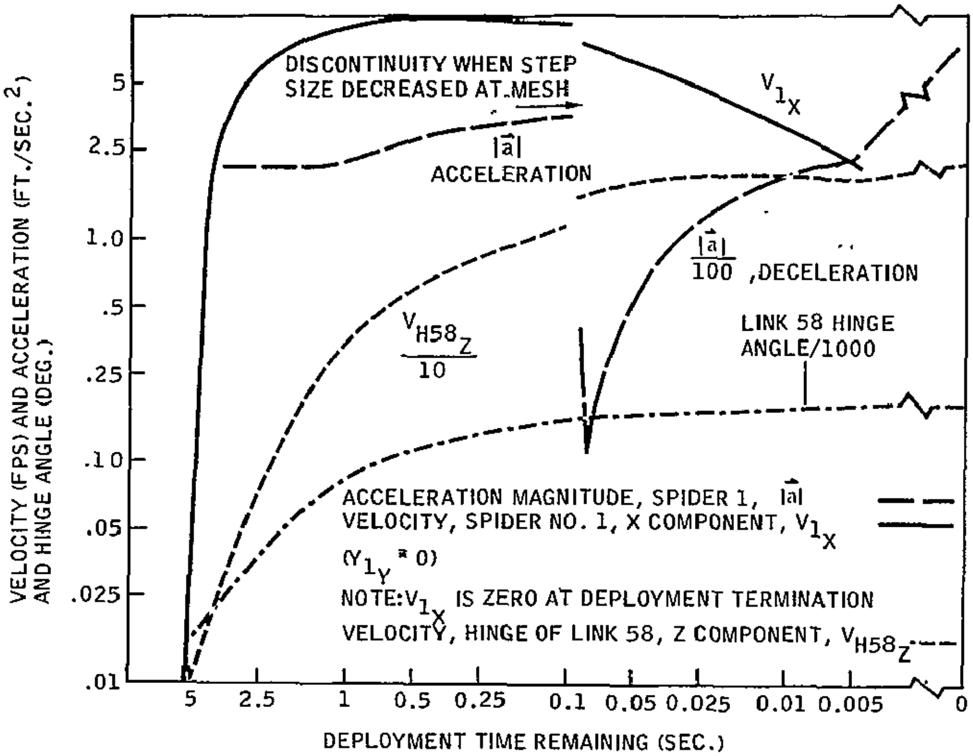


Figure 3-11. Reflector Component Time Histories Nominal Springs and Mesh

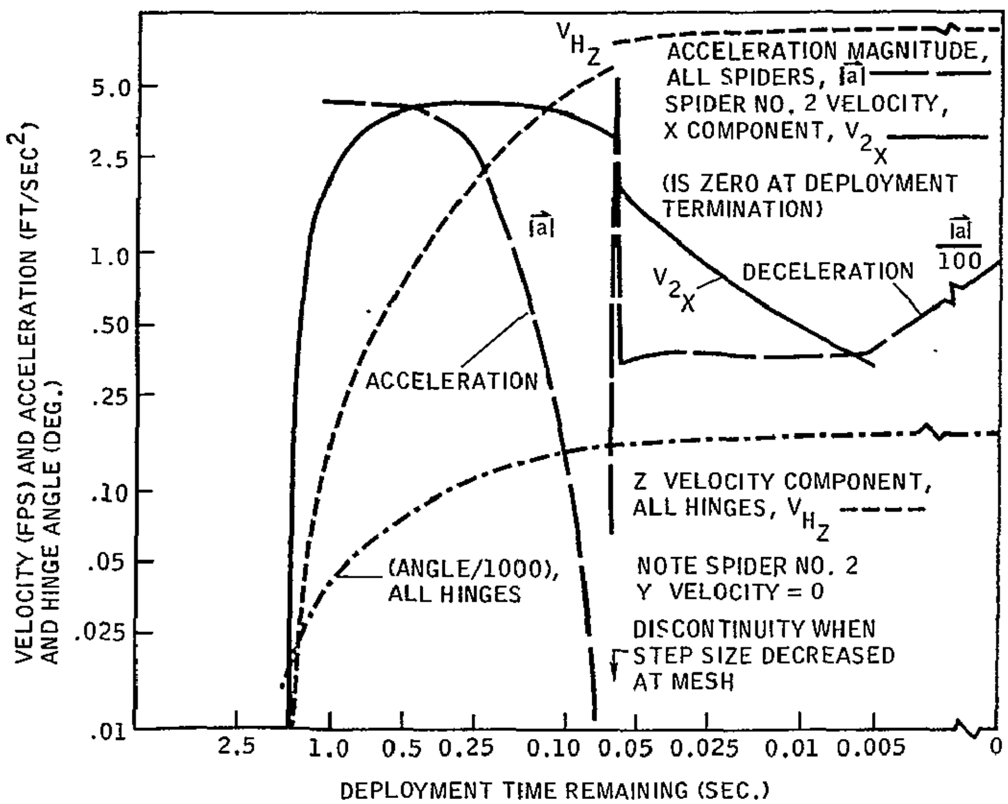


Figure 3-12. Tetrahedron Component Time Histories Nominal Spring and Mesh

velocity is zero. This velocity is already decreasing before the mesh is encountered even though total energy resides in spider radial motion and relatively more in other component motions. Spider radial velocity is zero at latch up.

Spider acceleration is the vector quantity, including Z axis acceleration. Hence total acceleration is still increasing for the reflector just before the mesh because spider one has a large and increasing Z velocity, even though the X axis velocity is slowing down. Tetrahedron spiders have relatively little Z motion, being near the antenna center where the parabolic surface is relatively flat. Consequently tetrahedron acceleration is rapidly decreasing in the same region.

The upward step in terminal acceleration values is discussed in Section 3.1.2.3 and examined in Appendix C.2.3.

Link hinge Z axis velocity is expected to slowly rise during deployment to a near constant value prior to latch up, and this is observed. Link hinge angle time histories are also as anticipated.

Additional insight into reflector deployment and simulation approximations thereto is provided by Appendix C.2.4 data.

3.1.2.5 Deployment Simulation-Based on Measured Torque for .010 Titanium Hinge - Data presented in the previous section (3.1.2.4) was based on predicted hinge performance to illustrate variation in deployment with spring design. This section presents deployment data based on the actual measured torque characteristics of the titanium leaf spring hinge (See Figure 1- 19) Resulting time history simulations are shown in Figures 3-13 and 3-14. Comparable parametric plots were given in Figures 3-8 and 3-11 respectively.

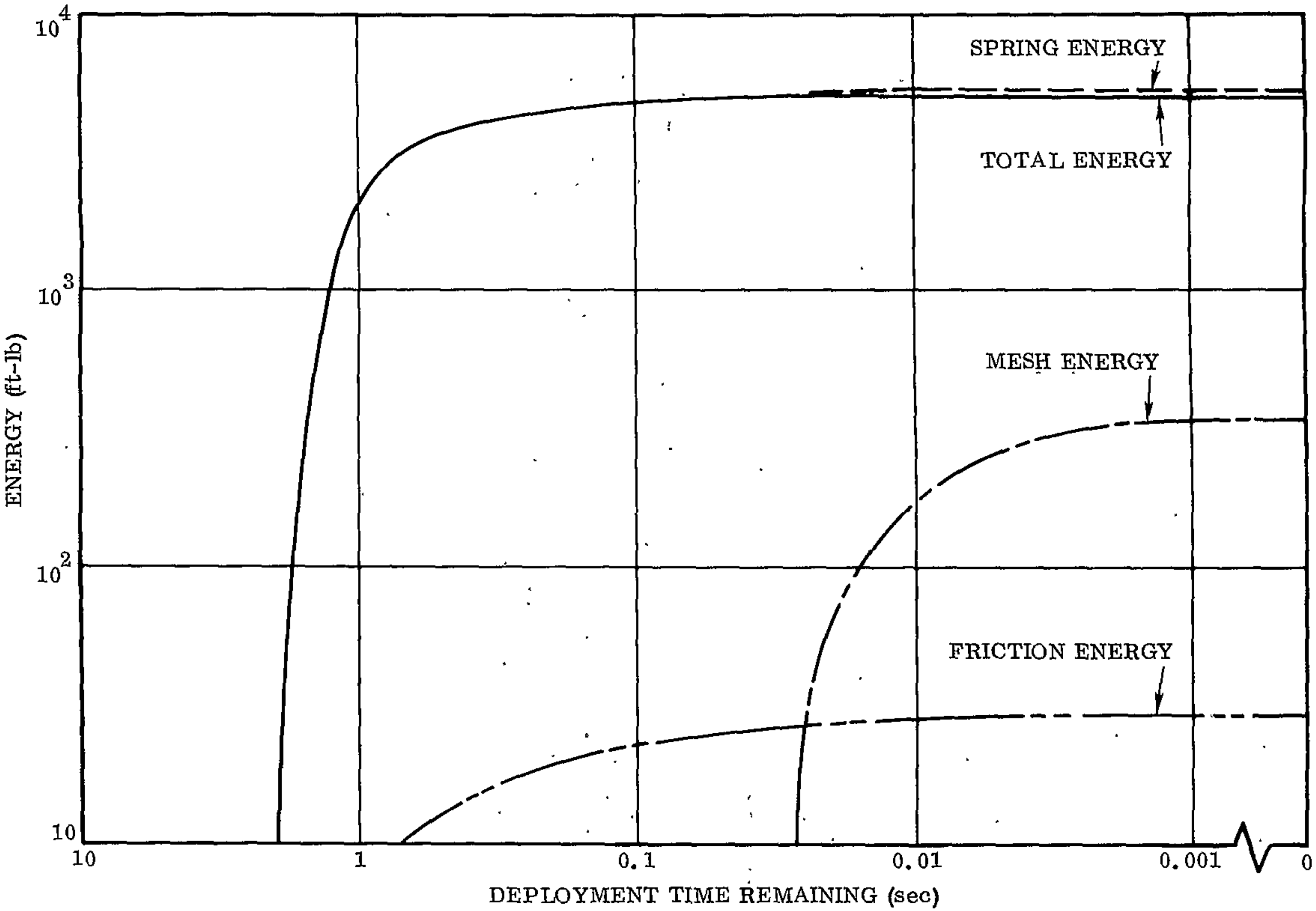


Figure 3-13. Energy Distribution, 0.010-Inch Titanium Hinge Spring

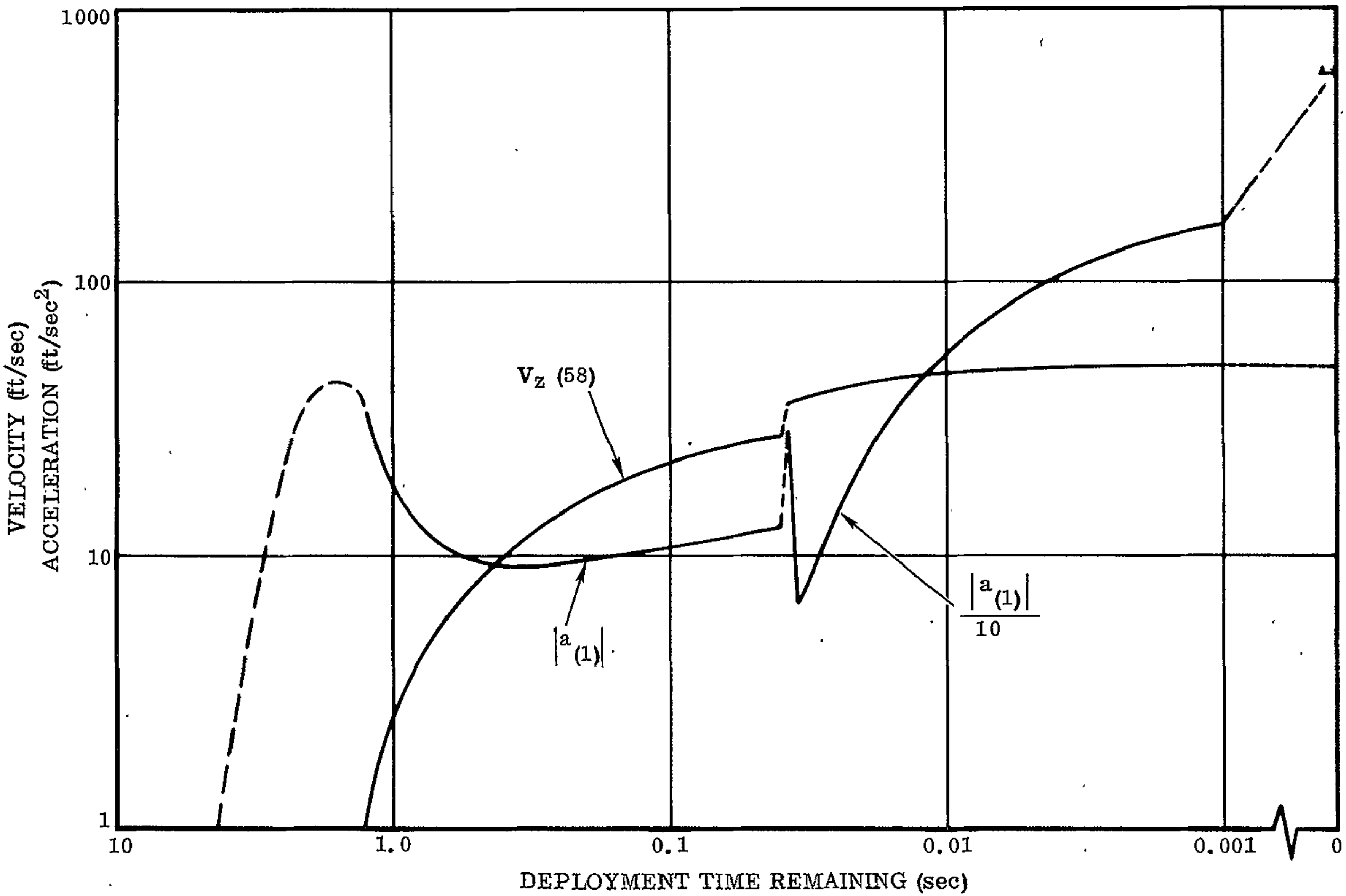


Figure 3-14. Deployment Component Time Histories, 0.010-Inch Titanium Hinge Spring

3.2 CONTROLLED DEPLOYMENT TECHNIQUES

In previous Convair studies, the antenna has been allowed to deploy freely. This method can readily be used and has been demonstrated by the 76 inch diameter model and both on the ground repeatedly, and in the KC-135 airplane under zero-g conditions. Although this method does work successfully it can impose high g loadings on peripheral members. The high peripheral loads could severely affect equipment mounted at these points, such as attitude control or solar cells. As demonstrated in the previous Convair study, one advantage of the erectable truss is its ability to support spacecraft equipment, thus saving equipment-mounted structure. Attitude control jets mounted on the edge of the reflector provide the most efficient moment arm, maximum effectiveness, and minimum total system weight. During the third phase of contract NAS-w-1438, a controlled deployment technique - using winches at discrete spider points feeding cables out to the neighboring spider points - was proposed as a method to control deployment with the ability to stop at any point if the astronaut observed there was some problem area. It would also lock the members in position, allowing the astronaut to work on any member that appeared improperly deployed. Other methods are also possible, such as thermal setting plastic hinges that would deploy the antenna very slowly and retard the internal springs but, due to their thermal set, would reach a point where the total spring load could be applied to lock the elements in place. Several other techniques are discussed below to achieve a controlled deployment of the antenna. Methods are illustrated in Figure 3-15.

Concepts 1 through 5 all depend upon the creep characteristics of plastics for their feasibility, the theory being that the sustained pressure exerted by the deploying energy sources will ultimately cause sufficient creep yield to permit deployment completion.

In each of these concepts it is theoretically feasible to substitute 'memory' plastic which will itself unfold to deployed configuration but at a very moderate rate.

In the evaluation of these 'plastic' concepts it is recognized that temperature control presents a problem and that the solution is either:

a. To control the temperature of the plastic element to design specified temperature.

b. That it is acceptable to allow solar radiation to heat up the package until the desired temperature is attained and then initiate deployment

It is characteristic of these 'plastic' concepts that deployment time would be 30 minutes or more.

Concept 6 deployment time would be very short, a matter of seconds.

The seven concepts are evaluated under seven headings (simplicity, reliability, light weight, design flexibility, thermal stability, reversability, low cost).

'Design Flexibility' indicates the ease with which the concept permits design control of the magnitude of the reactant force and the force profile throughout the deployment stroke.

'Thermal Stability' indicates to what extent the concept is insensitive to temperature change.

'Reversibility' indicates how readily the concept can be returned to its packaged configuration having once been deployed. i.e., in ground test

The remaining headings are self explanatory.

The two more promising concepts (No. 1 and 4) are further considered in detail.

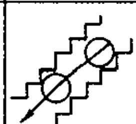
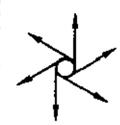
DESCRIPTION	1 DRAG-BALL	2 KNEE JOINT SHEATH	3 KNEE JOINT SLAB	4 SPIDER STRAPS	5 HARNESS	6 STRETCH BINDING	7 WINCH
							
SIMPLICITY	GOOD	EXCELLENT	EXCELLENT	VERY GOOD	AVERAGE	EXCELLENT	AVERAGE
RELIABILITY	GOOD	VERY GOOD	GOOD	GOOD	AVERAGE	AVERAGE	POOR
WEIGHT	2.5%	15.0%	15.0%	1.0%	3.0%	1.0%	15.0%
DESIGN FLEXIBILITY	AVERAGE	AVERAGE	AVERAGE	AVERAGE	EXCELLENT	POOR	GOOD
THERMAL STABIL.	EXCELLENT	POOR	POOR	POOR	AVERAGE	POOR	EXCELLENT
REVERSIBILITY	EXCELLENT	AVERAGE	AVERAGE	AVERAGE	GOOD	POOR	EXCELLENT
COST	AVERAGE	LOW	LOW	AVERAGE	HIGH	LOW	HIGH

Figure 3-15. Deployment Rate Control Systems (Snubbing)

3.2.1 "DRAG-BALL" CONCEPT - As the surface strut straightens during deployment (see Figure 3-16) the cable draws the ball down the tube. The balls are forced to follow an oscillating path thus producing tension in the cable. This escapment device tends to be constant speeding, permits full deployment in 10 to 20 seconds from release, and is unaffected by temperature change. The cable load is felt only locally and does not load the structure. Increasing the number, size, or weight of the balls will slow the mechanism.

By appropriate design acceleration can be induced towards the end of the stroke to assist antenna mesh tensioning. If the balls slipped on the cable and bunched up a jam condition would occur. However, with the proper design, this is most unlikely. Repeated test runs would be made to confirm the system reliability. Fabrication of the components of this system place it in the medium cost bracket.

3.2.2 "SPIDER-STRAP" CONCEPT - In this concept (Figure 3-17) six plastic straps run radially outwards from the hub of each spider to attachment points on each surface strut. The straps stretch during deployment producing a counter moment about the strut pivots. This concept is extremely simple and light in weight. A slight weight penalty may result from the fact the surface struts assume the moment force and therefore may require strengthening. The concept is limited by the sensitivity of the polymer straps to temperature change. A variation of 20°F may result in polymer characteristics that differ from design intent. The only conceivable failure mode is brittle fracture of the polymer due to low temperature and shock loading. The simplicity of this concept places it in the low cost category.

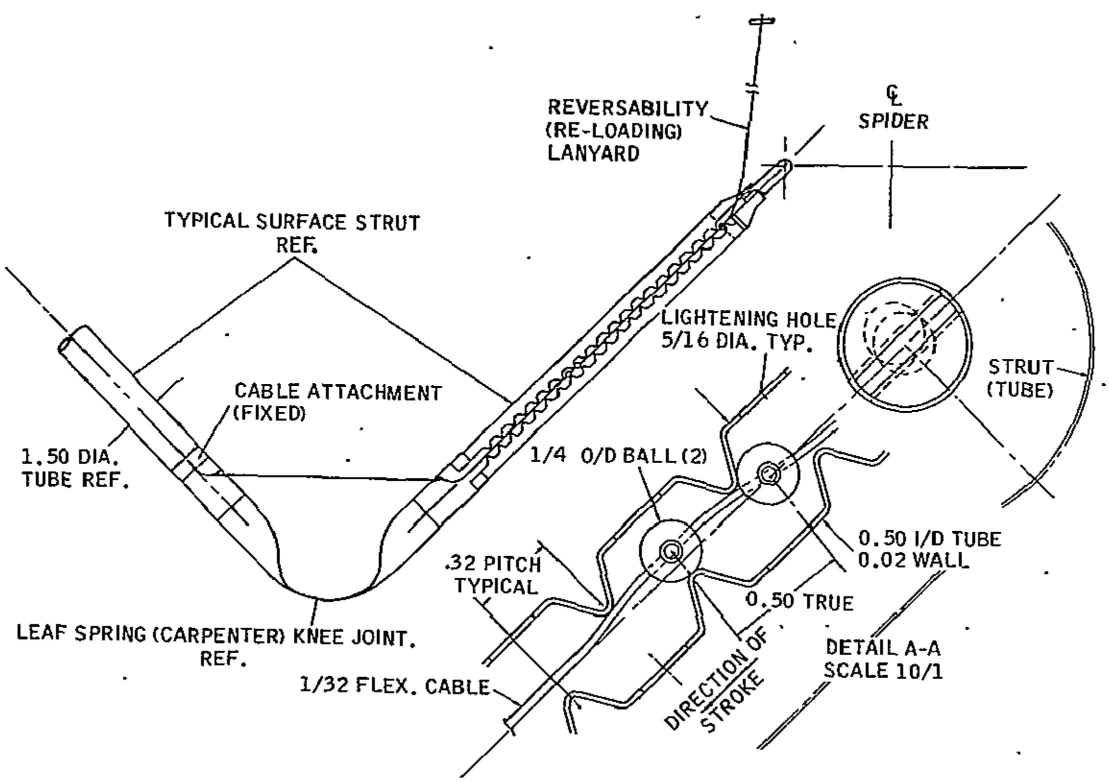


Figure 3-16. Structure Deployment Control - "Drag-Ball" Concept

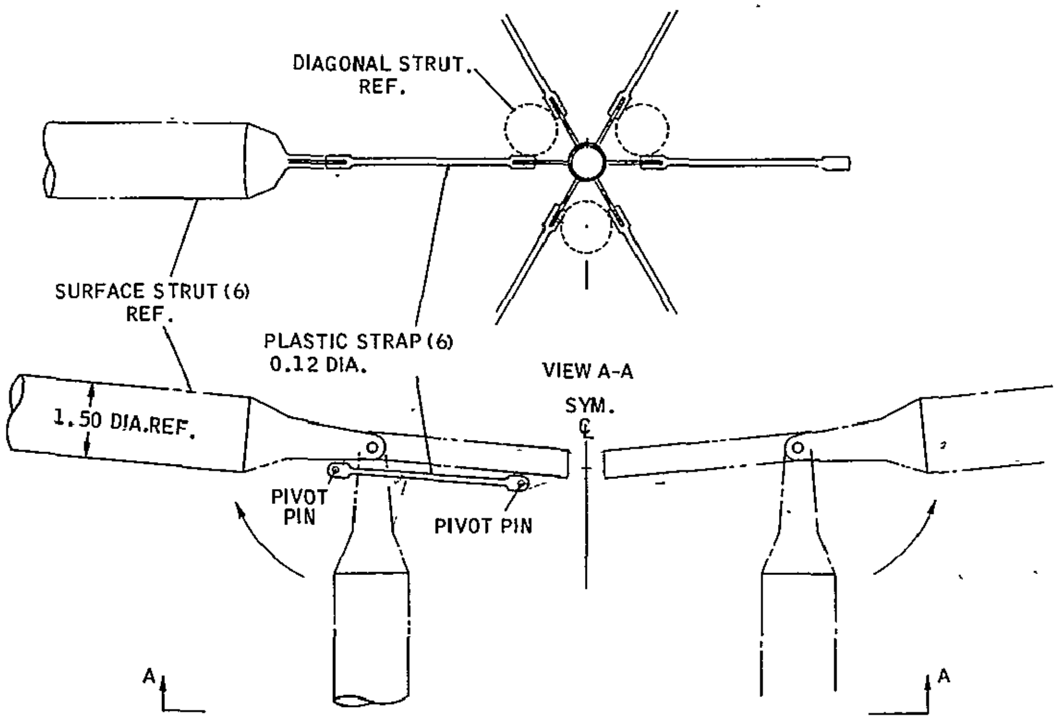


Figure 3-17. Structure Deployment Control - "Spider-Strap" Concept

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SECTION 4

GIMBALED ANTENNA CONFIGURATION - 15 FOOT DIAMETER ANTENNA ON SIVB WORKSHOP

In previous studies, the erectable truss antenna has been considered only as a primary experiment. A secondary experiment configuration is outlined in this section where major contributions to space antenna deployment technology can be made at an order of magnitude reduction in cost over the primary experiment configuration.

4.1 OBJECTIVE

Primary objective of this 15 foot diameter parabolic expandable truss antenna experiment is to demonstrate the technical feasibility of a reflector system capable of meeting the requirements of a multitude of future space missions. The experiment will contribute to an understanding of the versatile expandable truss structural behavior, the deployed reflector RF characteristics, and evaluate man's capability to inspect, adjust and point the antenna. IVA and EVA (optional) operations are outlined in the experiment. While all functions of the antenna are automated, it is uniquely suited for man's integration in all stages of operation. Figure 4-1 summarizes the flight objectives.

OBJECTIVE

Advancement of Space Erectable Antenna Technology

By

Deployment of a 15 foot Expandable Truss Antenna in Space and Recording Orbital Variation of:

- Antenna structural temperatures and elongations
- Reflector mesh contour
- Structural dynamics (deployment and pointing)
- Thermal variations

Recording RF Characteristics at 2 GHz 8 GHz and 12 GHz

- Max gain
- RF Pattern
- Pointing and tracking capability

and Recording Antenna Degradation During Workshop Life

Figure 4-1. Flight Objectives

Equipment complexity can be reduced through man's participation. He monitors deployment, inspects the structure and equipment at each stage of operation, makes physical and electronic measurements, boresights the feed to optimum performance and performs pattern, gain and pointing tests. He can optionally inspect and adjust the tolerance-critical reflector surface.

Strain gages, microswitches, thermocouples, reflectivity gages, accelerometers and motion picture cameras will be used to record the structure condition during deployment and operation. An important evaluation would come from the crew's optional EVA inspection of the deployed structure.

4.2 SIGNIFICANCE

Primary significance of the experiment is the development of a new antenna concept that has broad application. Figure 4-2 summarizes the major areas to which the experiment would contribute. In two NASA studies, NAS W-1438 and NAS 8-18118, the expandable truss concept was selected from 26 different concepts developed in industry and government agencies. With three different high-density packaging ratios and lightweight, 0.1 sq. ft. of aperture, combined with a rigid structure, it is uniquely applicable to a broad range of systems in sizes from 5 ft. to 300 ft. Limitation of a satellite's RF transmission coverage to only the desired area is becoming increasingly important as the communication traffic increases within the already crowded frequency spectrum. In addition, this high gain antenna provides a higher communication capacity for less weight and cost than a system using a high transmitter power levels.

While the experiment will advance the level of large antenna technology, it would also be considered a precursor experiment for the large 100 ft., or greater, antenna proposed as a future Saturn V experiment.

The parabolic antenna experiment is closely related to other studies and contracts.

a. The Parabolic Expandable Truss Antenna study, NAS W-1438, NAS 8-21460, and NAS 8-18118 conducted by General Dynamics Convair, is developing conceptual and preliminary designs of antennas for use at communications frequencies of the type proposed in this experiment.

b. Data Relay Satellite at JPL and NASA/GSFC

c. TV and Voice Communication studies at NASA Lewis and MSFC.

d. Man-made radio frequency radiation measurements from 200 mile orbit performed by Convair studies the problem of locating RF sources.

ERECTABLE ANTENNA DEVELOPMENT

Lightweight (0.1 lb/sq.ft.), rigid, low thermal distortion, good tolerance $\sigma/D = 10^{-4}$, three packaging configurations, growth potential from 5 ft. to 300 ft.

LARGE ANTENNAS NEEDED FOR:

High Data Rate Telemetry from Space Station

High Data Link, Synchronous Orbit Satellites to Ground

Deep Space Communication

RF Spectrum Analysis and Source Location

TV and Voice Communication

Point-To-Point Relay Systems

Avionic Communication, VHF and UHF

Avionic Radar Traffic Control

RF Spectrum Conservation

Economy - High Gain Antenna's are Cheaper than Equivalent Power Systems

PRECURSOR EXPERIMENT FOR LARGE 100 FOOT, OR GREATER, ANTENNA ON ADVANCED WORKSHOP OR AS INDEPENDENT SYSTEM.

Figure 4-2. Experiment Significance

e. Deep Space Communication studies at NASA-Ames evaluating orbital relay of deep space probe information.

f. An Air Force contract at Wright Patterson, conducted by General Dynamics Convair to study the EVA assembly of tubular structures, (F33-615-67-C-1302).

g. ATS-F&G Large Aperture Antenna for NASA-GSFC.

4.3 PRESENT DEVELOPMENT IN THE FIELD

The 100-140 foot antenna experiment has been studied by General Dynamics Convair under two contracts. The first contract included a survey of other types of antenna and resulted in a selection of the expandable truss parabolic antenna as a candidate for further effort. The second contract was aimed specifically at the identification of recommended large structural experiments as a result of detailed analyses of all potentially available systems. Again, the parabolic antenna was selected for further consideration. This concept has been further exercised to optimize weight, configuration, mechanisms and subsystems. Two models have been fabricated and operated to demonstrate stowage and deployment of the expandable truss. Movies have been made of the operations, and are available at NASA-MSFC. RF pattern and gain measurements have been performed on the 6 foot diameter antenna. (Figure 4-3).

Launch of the 15 foot parabolic antenna experiment within 30 months of contract go-ahead can be predicted with a high level of confidence.

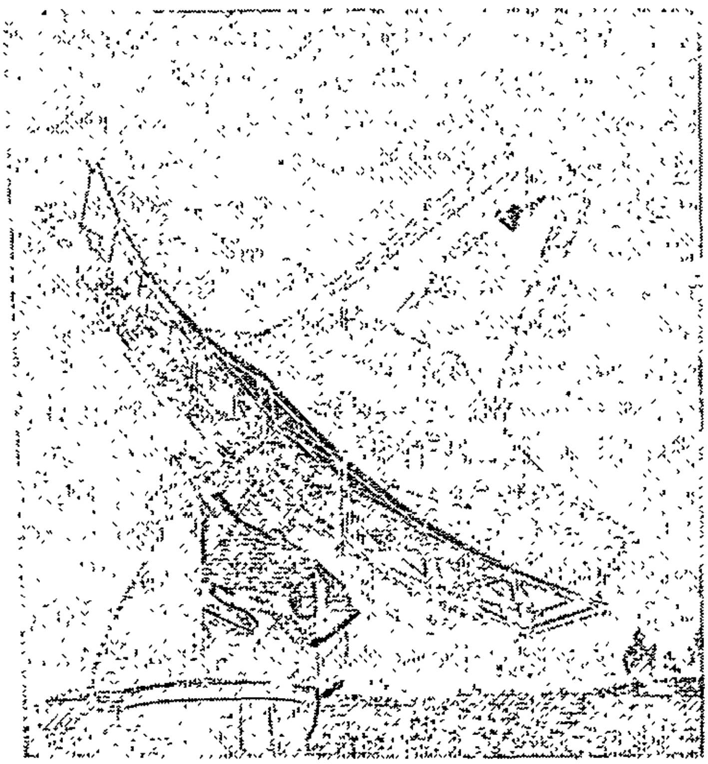
4.4. EXPERIMENT

The experiment is mounted adjacent to the forward bulkhead of the SIVB Workshop between axes I and II, as shown in Figure 4-4. It is attached to and supported by the workshop, the hatch assembly and the MDA. In the stowed configuration it folds within the SLA. A sliding cantilever boom 20 foot long will extend the packaged antenna and its gimbal platform away from the MDA between axes I and II. The reflector will then be released by astronaut command and the 15 foot diameter reflector will automatically deploy. A pneumatically operated feed boom will extend at the same time. Deployment is monitored by visual observations from the CSM, photography and light indications on the control panel in the MDA. Optional EVA inspection and adjustment, if necessary, can be made of the deployed antenna. High speed films of the deployment will also be recovered from the locally mounted cameras. Figure 4-5 illustrates the deployment sequence and Figure 4-6 shows the erected system. Pattern measurement test will then be performed. These tests will be compatible with an SIVB Workshop orbit of:

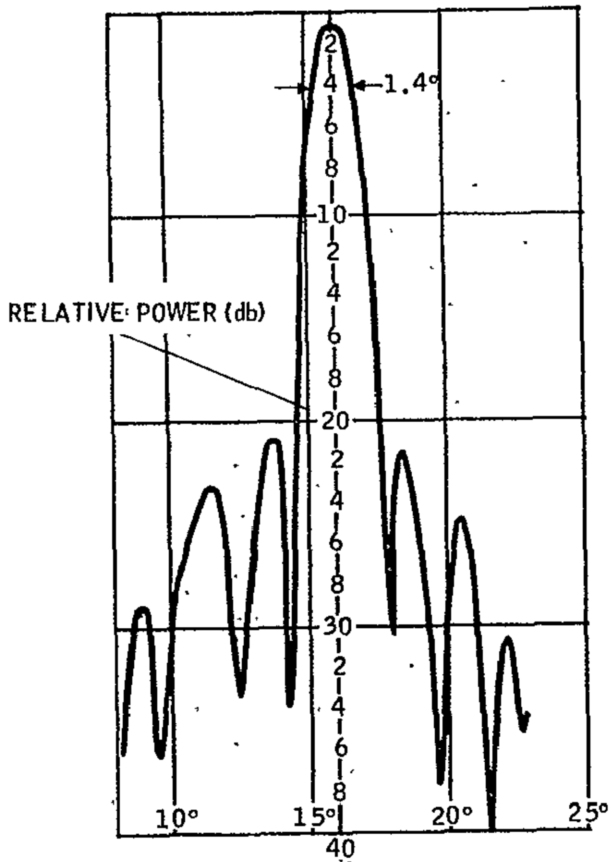
altitude	230 n.mi.
inclination	50 degrees
life time	1 year

Higher orbits would simplify the experiment by providing a longer period in sight of a given ground station that would record the pattern tests at 2 GHz, 8 GHz, and 12 GHz.

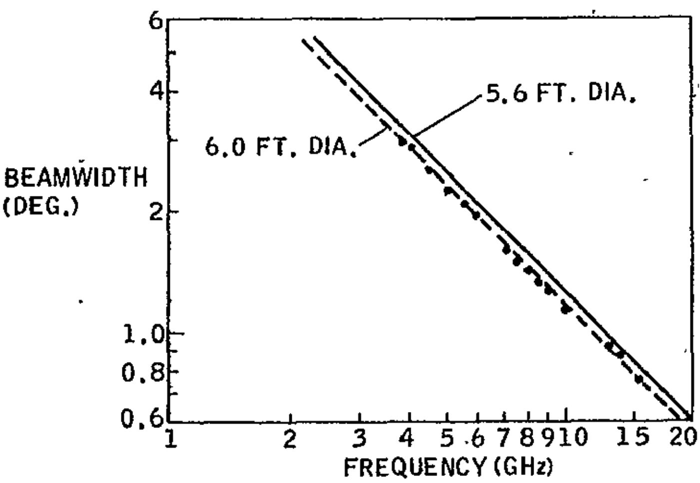
The package experiment including the support boom, requires a 60 in. by 50 in. by 40 in. envelope with the 15 foot reflector in a hexagonal package 27 in. across and 22 in high. After CSM docking to the MDA, umbilical attachments will be made, enabling the antenna to be directed from the



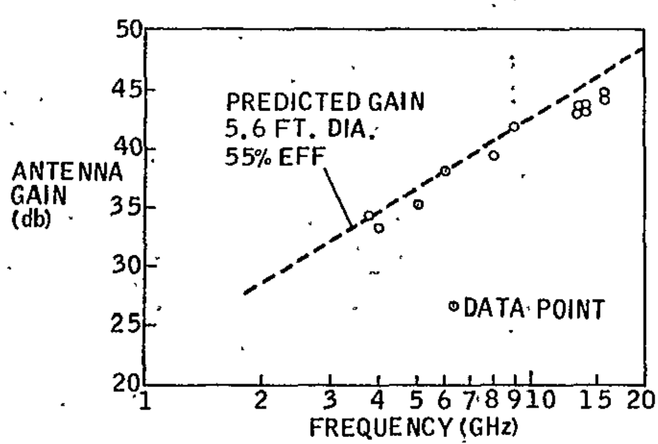
Model Range Installation



8 GHz Antenna Pattern



Beamwidth



Gain

Figure 4-3. RF Measurements for a Six-Foot Expandable Truss Antenna

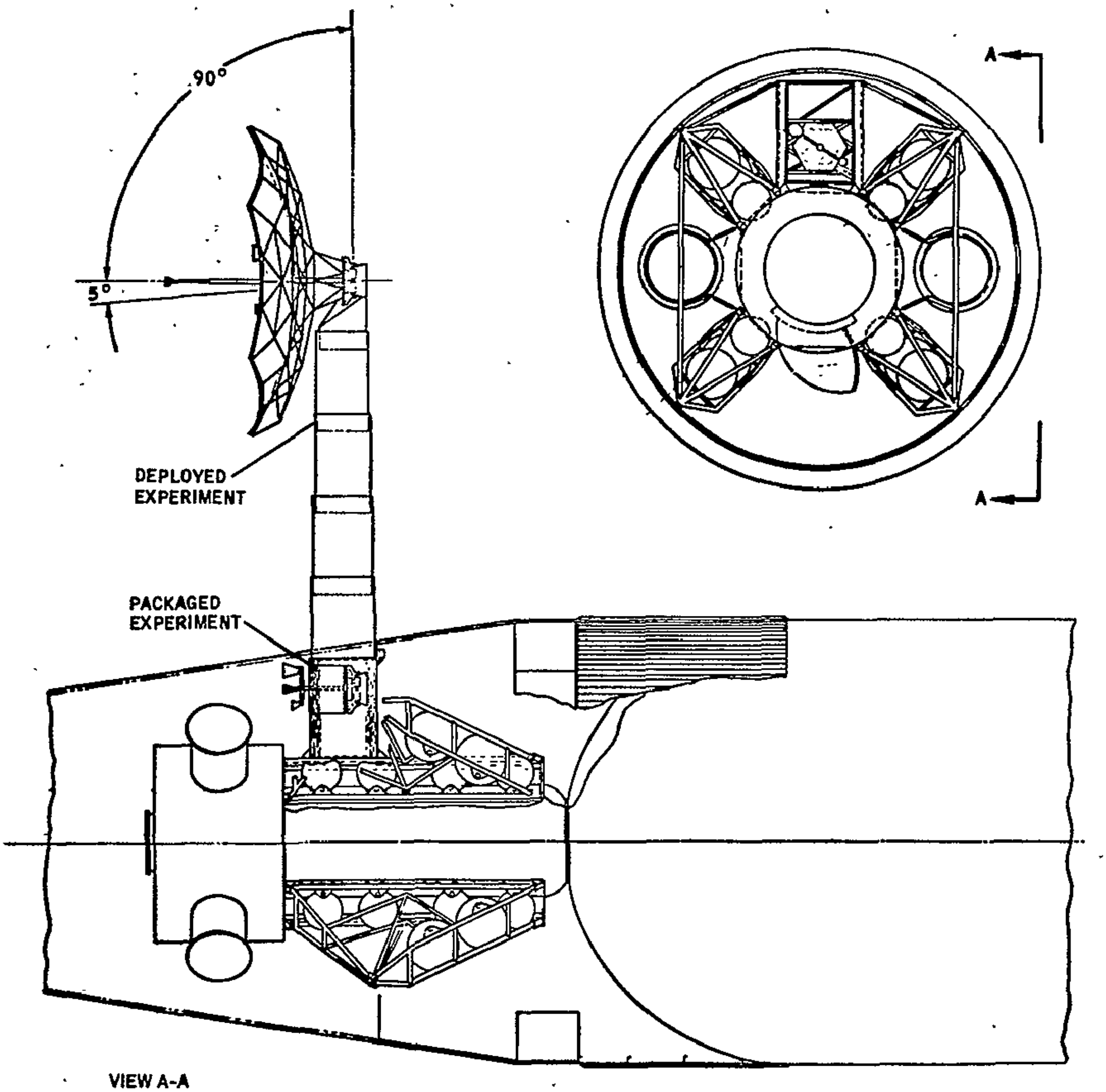
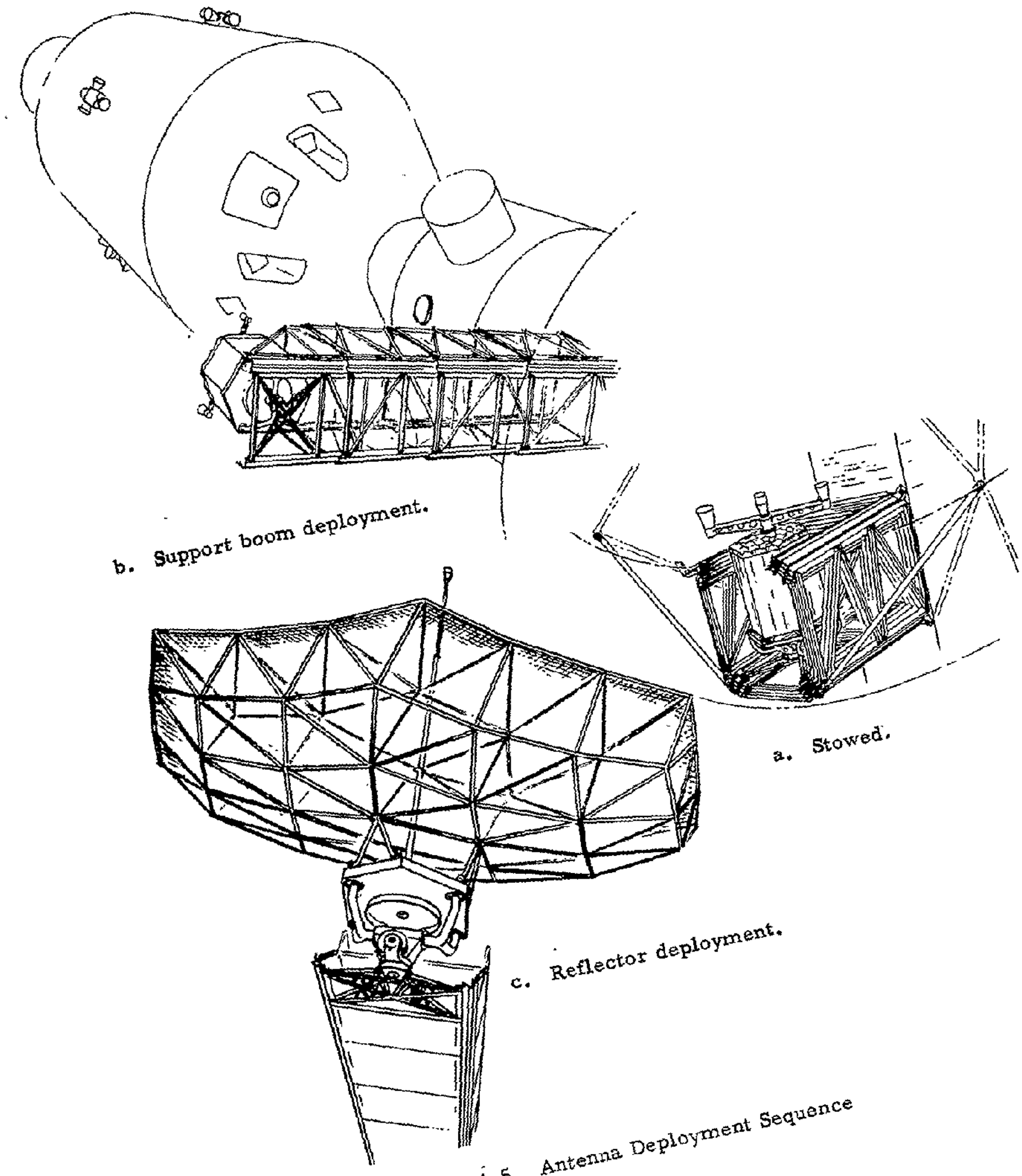


Figure 4-4. Antenna Experiment Installation



b. Support boom deployment.

a. Stowed.

c. Reflector deployment.

Figure 4-5. Antenna Deployment Sequence

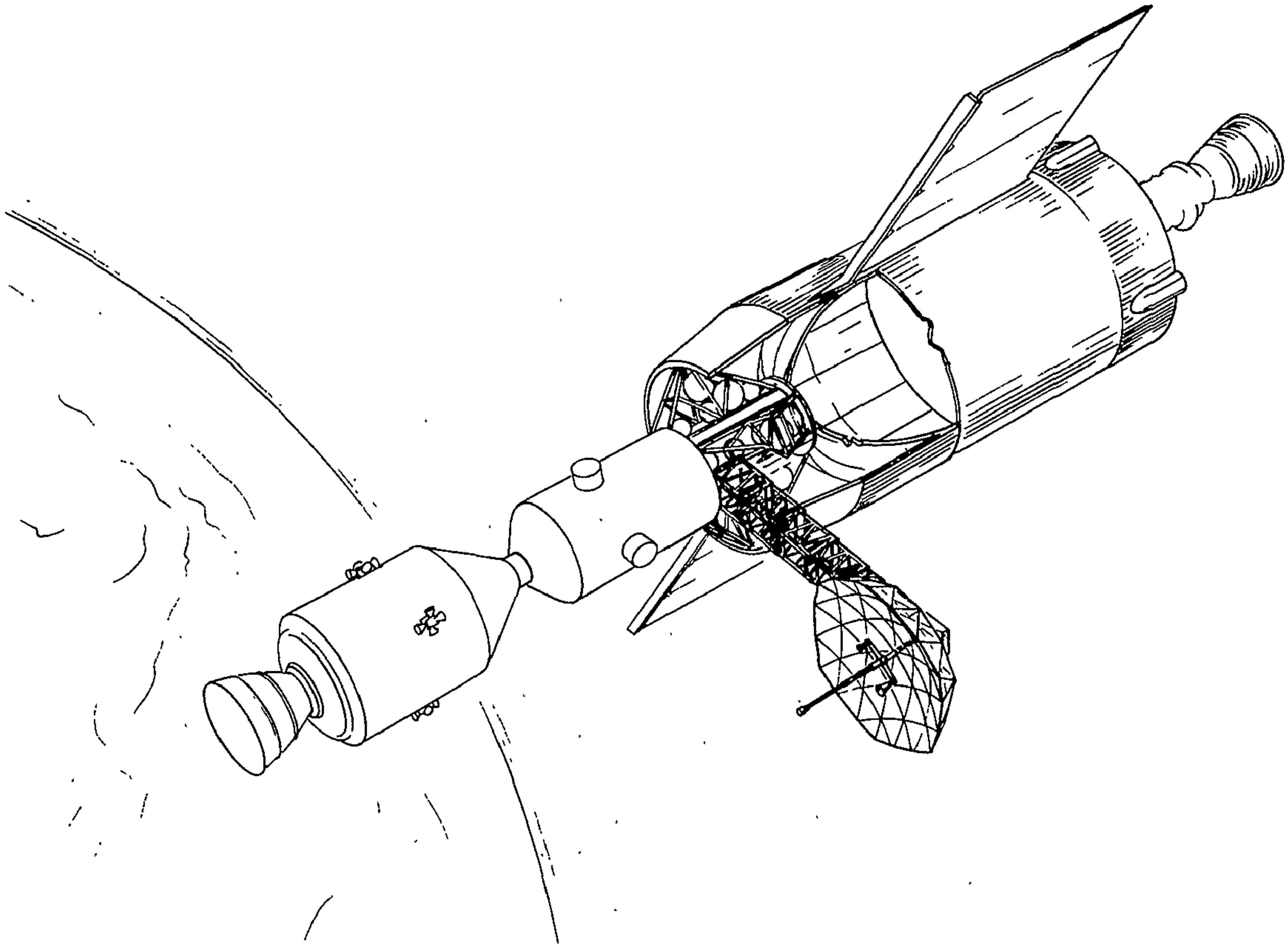


Figure 4-6. Fully-Erected Antenna Experiment

control panel in the MDA. An optional command position in the workshop or CSM will be evaluated in a preliminary study phase. After checkout, the antenna will be deployed. Microswitches at key points will substantiate lock-up of the 20 foot structural boom prior to reflector deployment. A pyrotechnic release system, initiated by the crew, will allow the reflector and feed to automatically deploy. Visual inspection through the MDA and CSM parts will insure that all tubular elements are fully deployed and the mesh is holding a smooth contour. If EVA is required local dutch shoe restraints and belt clip supports will allow the astronaut to work on the antenna. While the antenna has a high reliability the astronaut will be able to repair any malfunction related to deployment with a simple tool kit. From the internal antenna command position, the astronaut will acquire the ground station that has been instrumented to receive antenna pattern measurement data.

From the peak gain achieved, the RMS tolerance of the reflector mesh may be calculated (Ruze Eq.). Variations in gain due to sun angle on the antenna, correlated to the strain gage and thermocouple readings will evaluate the antenna's space environment distortions. Four conditions of sun-side, front, back and total darkness-will be evaluated. Electrical boresighting will be based on measurements taken during a balanced thermal condition. With a remote controlled screw jack system the crew can adjust the feed to the optimum position biasing the reflector contour errors.

The proposed experiment is primarily to evaluate the reflector. Other RF tests (antenna noise temperature, polarization rotation, broadcast transmission tests, atmospheric absorption) and use of the antenna with the workshop Unified S-Band system and satellite relays are feasible with modifications.

4.5 EXPERIMENT PROCEDURE

The procedure for the antenna experiment is based on a cooperative operation between crew members in the MDA, CSM and the ground stations. Two basic types of operations are performed:

a. Deployment of the antenna.

b. Pattern measurements

4.5.1 <u>DEPLOYMENT OF THE ANTENNA</u> - For this function a crew member is required to operate the control panel located in the MDA. A second member, the Command Pilot, is required to be stationed in the CSM for visual observation of the mechanical operation of the antenna during deployment. The following sequence is required for deployment:

a. Activate movie cameras to monitor deployment

b. Energize antenna experiment (IVA/Control Panel Switch).

c. Energize standard gain antenna cross-bar restraints. (IVA/Control Panel Switch).

d. Observe release. (IVA/Control Panel Indicator Light).

e. Initiate support boom deployment (IVA/Control Panel Switch).

f. Observe deployment (IVA/CSM)

g. Complete deployment (IVA/Control Panel indicator light/CSM observation).

h. Initiate reflector deployment (IVA/Control Panel Switch).

i. Complete deployment (IVA/Control Panel indicator light/CSM observation).

j. Initiate feed boom deployment (IVA/Control Panel Switch).

k. Complete deployment (IVA/Control Panel Indicator Light/CSM observation).

l. Confirmation operation of antenna experiment by slewing antenna through its pitch and yaw limits; energizing transmitters and observing RF power output (IVA/Control Panel Switches, Indicator Lights and Meters).

m. Recover movie camers (EVA). (Reduction of coverage could eliminate EVA requirement).

n. Perform routine reporting activities (IVA).

4.5.2 PATTERN MEASUREMENTS - Pattern measurements are based on transmitting from the antenna to ground-located receivers. After the initial acquisition and lock-on the antenna is automatically swept through the mapping region of interest. Antenna patterns, and the mapping region are shown in Figure 4-7.

The following sequence is required for a pattern measurement test:

a. Establish communications with the control ground station to determine coarse pointing requirements for the antenna.

b. Energize antenna experiment

c. Energize gimbal controls

d. Set gimbal angels for acquisition

e. Energize remainder of experiment and set antenna selector switch to "Horn" for acquisition on standard gain antennas

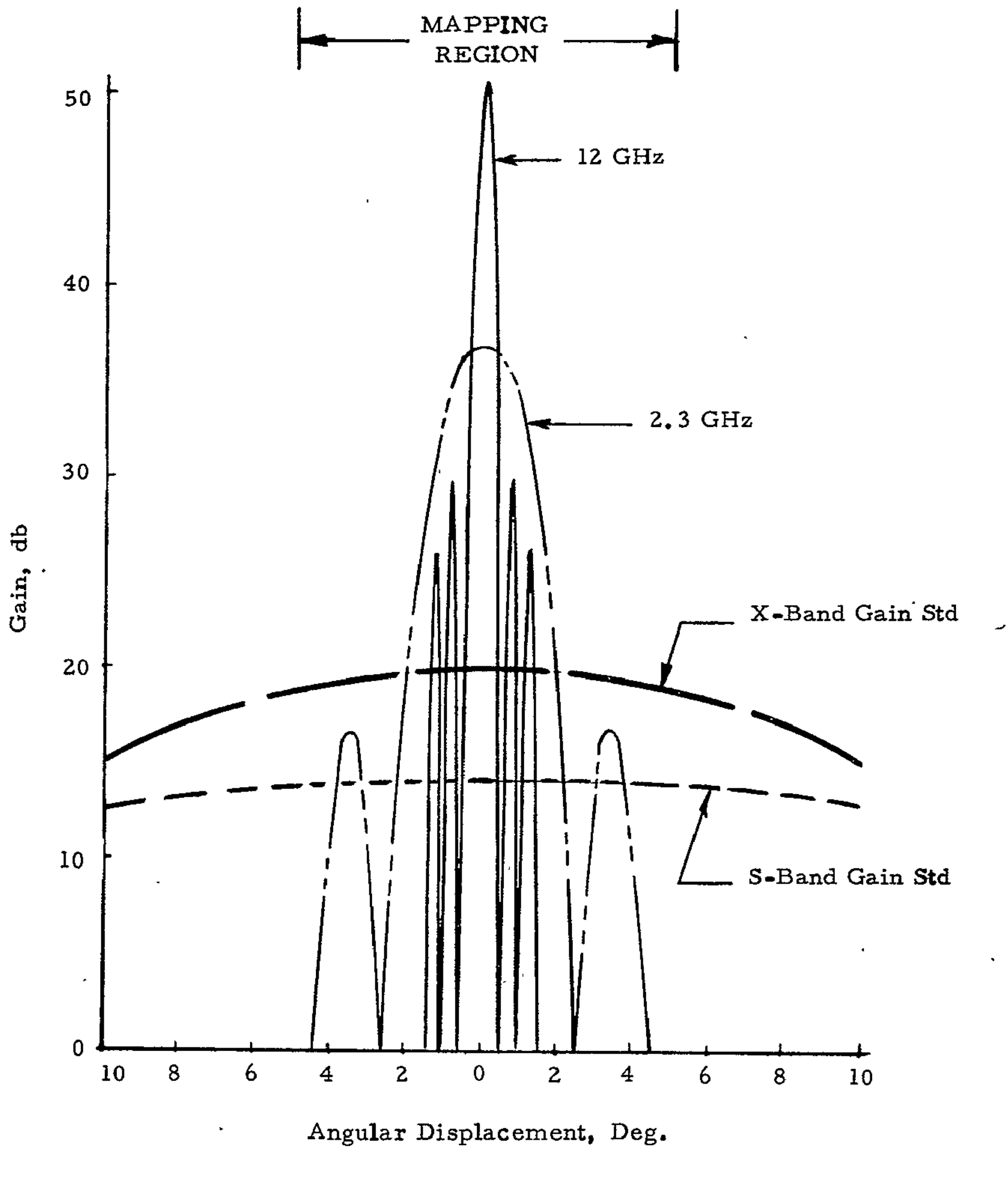


Figure 4-7. Composite Antenna Patterns

f. Switch gimbal to acquisition.

g. Monitor receiver output for ground station signal.

h. Verify (by voice communication with ground station) S-and X-Band reception.

i. Energize data recorder.

j. Switch to "Pattern Scan" and "Antenna Switching Network".

k. Observe performance of pattern mapping sweeps during station pass.

l. Upon completion of station pass de-energize the experiment.

m. Reduce real-time telemetry and receiver data at ground station.

n. Dump data from IU tape recorder for data confirmation.

o. Analyze data and order flight crew to make feed corrections, if required.

p. Repeat experiment per schedule

The time-phasing of the experiment sequence is shown in Figure 4-8.

4.6 MEASUREMENTS

Measurement requirements are summarized in Table 1.

4.7 DATA ANALYSIS

All the data is transmitted to the ground and is processed for shipment in digital print-out or magnetic tape form to the principal investigator. During the initial manned operations, some real-time data processing, computer analysis and evaluation is required at the control ground station to provide the orbital crew with final information on the contour of the antenna. For this purpose, the contour measurement data is immediately processed and plotted. Pattern measurements will also be examined on the ground and recycles of questionable areas requested.

Crew observation of the structure along with the recovered films will supply the primary evaluation of the structure. Micro-switches contact of key structural elements displayed in the spacecraft and on ground will substantiate lock down and position. Accelerometer readings will record deployment dynamics, impact, and pointing effects on the structure. Thermocouples will continually record temperature of mesh, joints and truss elements throughout the flight. Correlation between beam pointing, peak gain and thermal variations will be recorded. Mesh contour will be evaluated on the gain curve using the Ruze equation with the end result the

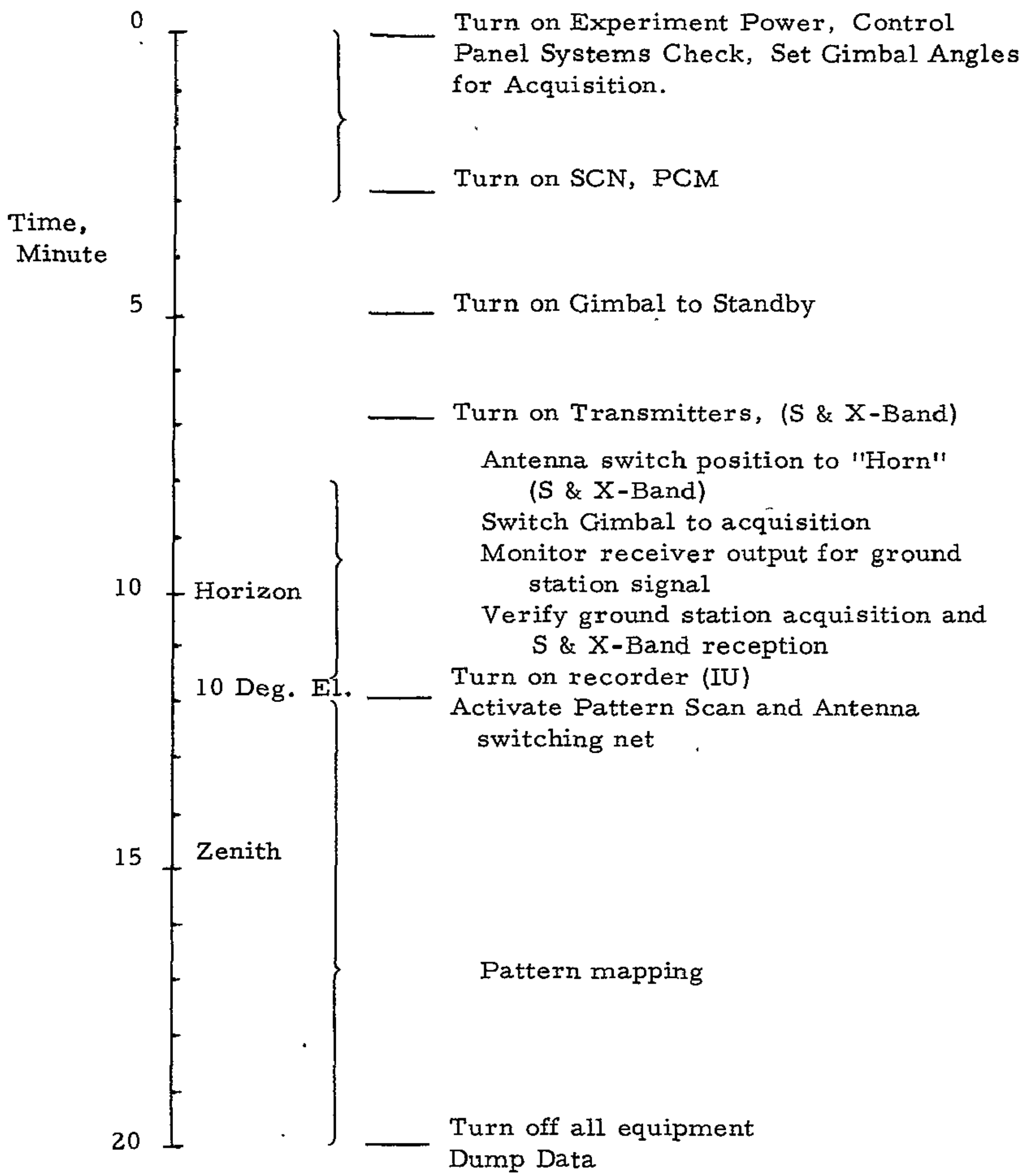


Figure 4-8. Pattern Measurement Experiment Sequence

Table 4-1. Measurement Requirements

Qty.	Measurement	Samples/Sec	Bits/Sample	bps
2	Gimbal Angle	40	13	1040
23	Temperature Antenna Structure (15) Boom & Feed (4)	1	8	184
23	Strain Antenna Structure (15) Boom (4) Feed (4)	1	8	184
2	Temperature S-& X-Band XMTR	1	8	16
1	Temperature Antenna Gimbal	1	8	8
2	Temperature Power Signal Conditioner	1	8	16
1	Temperature Power Inverter	1	8	8
1	Time Word	10	13	130
	Total Bit Rate			1586

effective RMS contour of the reflector. Feed distortion relative to the reflector will be based on the thermocouple readings.

RF measurement and pointing capability will be recorded at the ground receivers. Once boresighted, errors in acquisition of ground target antenna will be noted on each pass of the antenna.

Final report will illustrate the antenna deployment sequence note any malfunction, evaluate critical distortion during maximum temperature excursions, record at two frequencies, max gain, beamwidth and side lobe effects, derive reflector tolerance, and record pointing errors, and transmission variations during typical orbital periods.

4.8 EXPERIMENT HARDWARE

The parabolic antenna experiment will be a completely functional system after initial assembly, alignment, calibration, checkout and testing is performed by the astronaut crew. Six major assemblies make-up the flight article. The vehicle comprises:

a. FA-1, the parabolic dish

b. FA-2, the feed support

c. FA-3, the feed and electronic equipment

d. FA-4, the experiment control panel in the MDA

e. FA-5, the antenna gimbal mount

f. FA-6, antenna deployable support boom

Figure 4-9 shows the major subassemblies for each assembly.

Modular construction of subsystems and maximum use of standard Apollo subsystems will be used to facilitate maintenance of antenna subsystem.

4.8.1 FA-1 PARABOLIC REFLECTOR - The 15 foot diameter parabolic reflector (FA-1) is illustrated in Figure 4-10. Spring loaded 3/4 inch diameter tubular elements are driven out from a tight package to form a stable truss substructure. The six bay reflector is 180 inches (Figure 4-11) when deployed. From the spider points the tricot weave gold plated chromel-R mesh is drawn into the parabolic contour as shown in Figure 4-12. An enlarged section of the mesh is also shown in Figure 4-12. Previous mesh reflectance tests have resulted in a negligible loss at 15 GHz.

The reflector packaged diameter is 32.5 inches when a aluminum tubing is used and 20.3 inches of beryllium tubing is used. Height of both designs are based on the diagonal length (22 inches). Hinge joints, spiders and end fitting are shown in Figure 4-13.

Design manufacturing and adjustment tolerances are approximately 0.016 inch RMS. A worst case thermal distortion, when the solar flux is normal to the antenna axis, would give a total RMS surface deviation of 0.036 inch RMS.

Surface tolerance of the deployed antenna will be evaluated (within 0.010 in.) from the Ruze tolerance gain degradation.

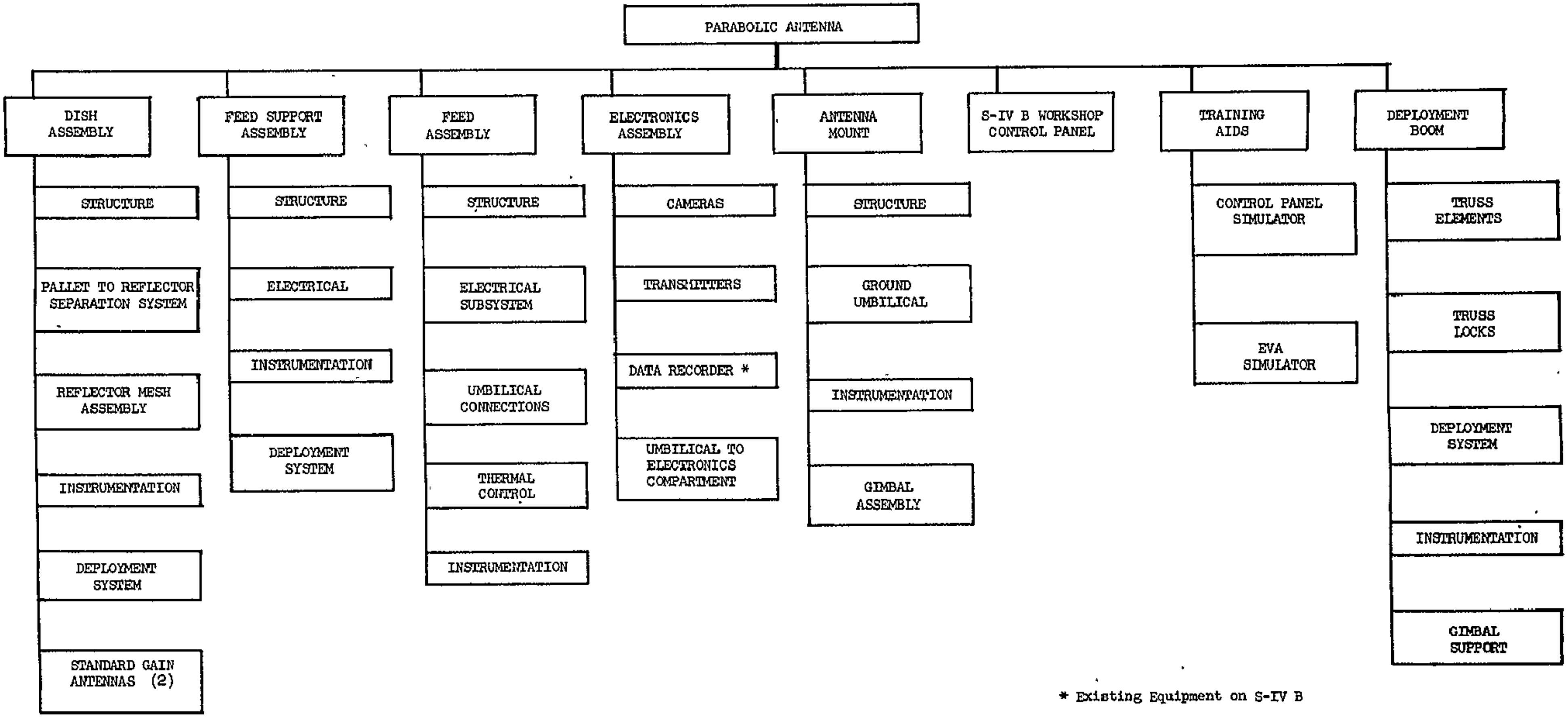


Figure 4-9. Equipment Breakdown

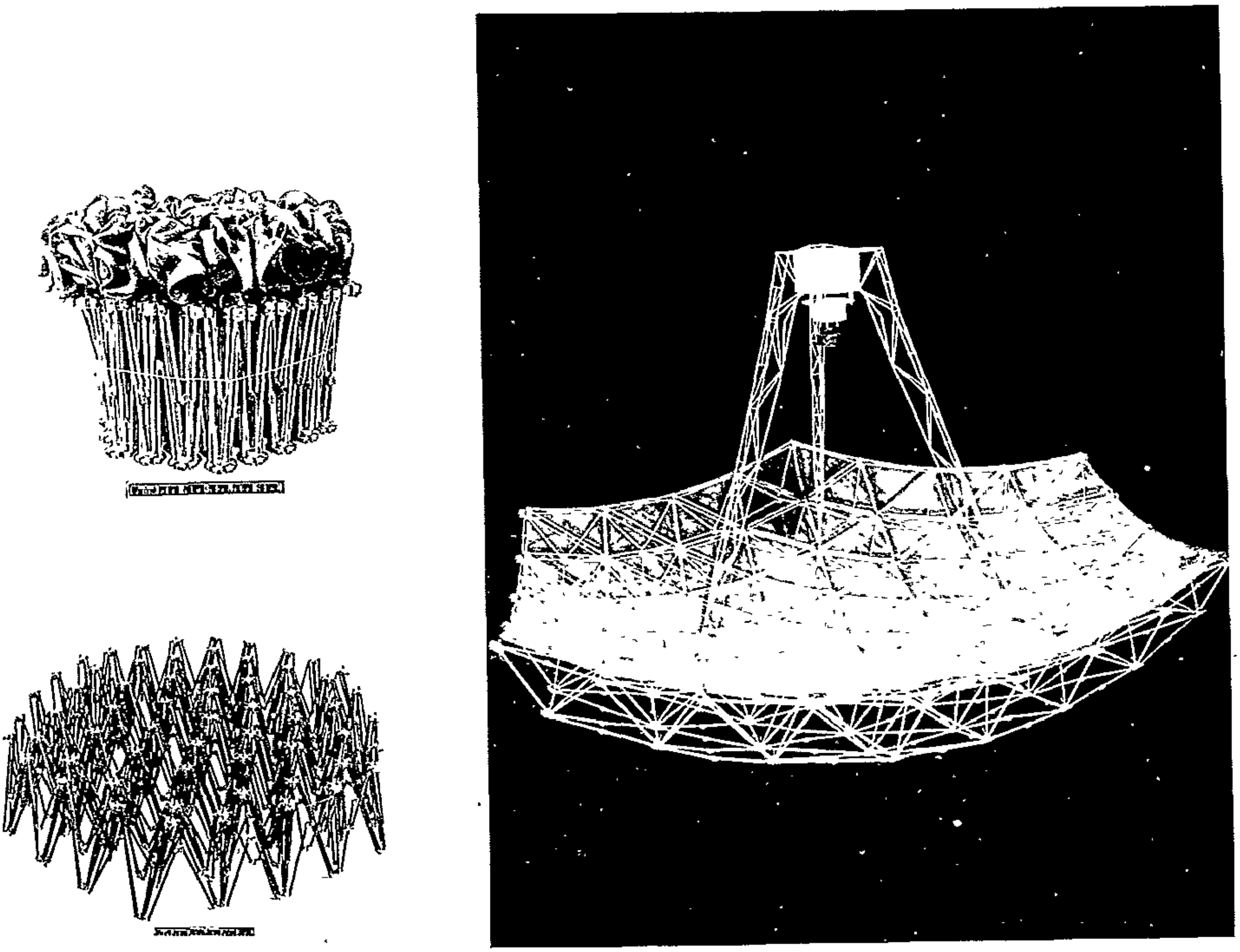


Figure 4-10. Truss Deployment Sequence

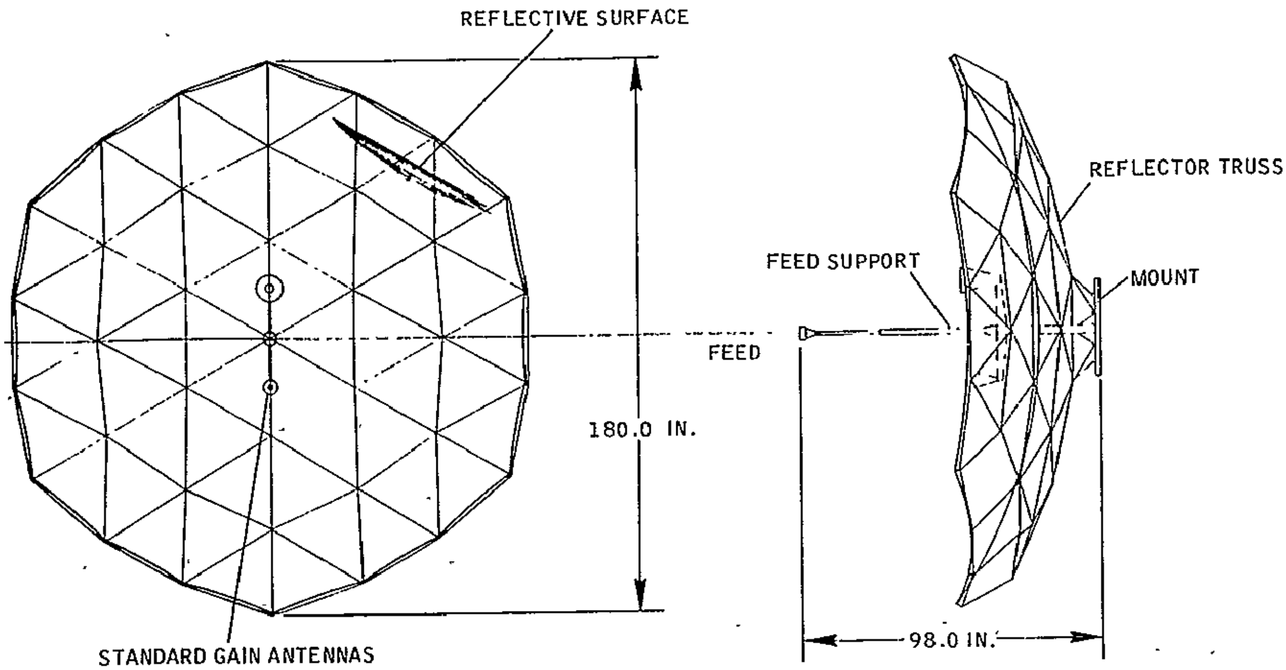


Figure 4-11. FA-1 Reflector and Feed

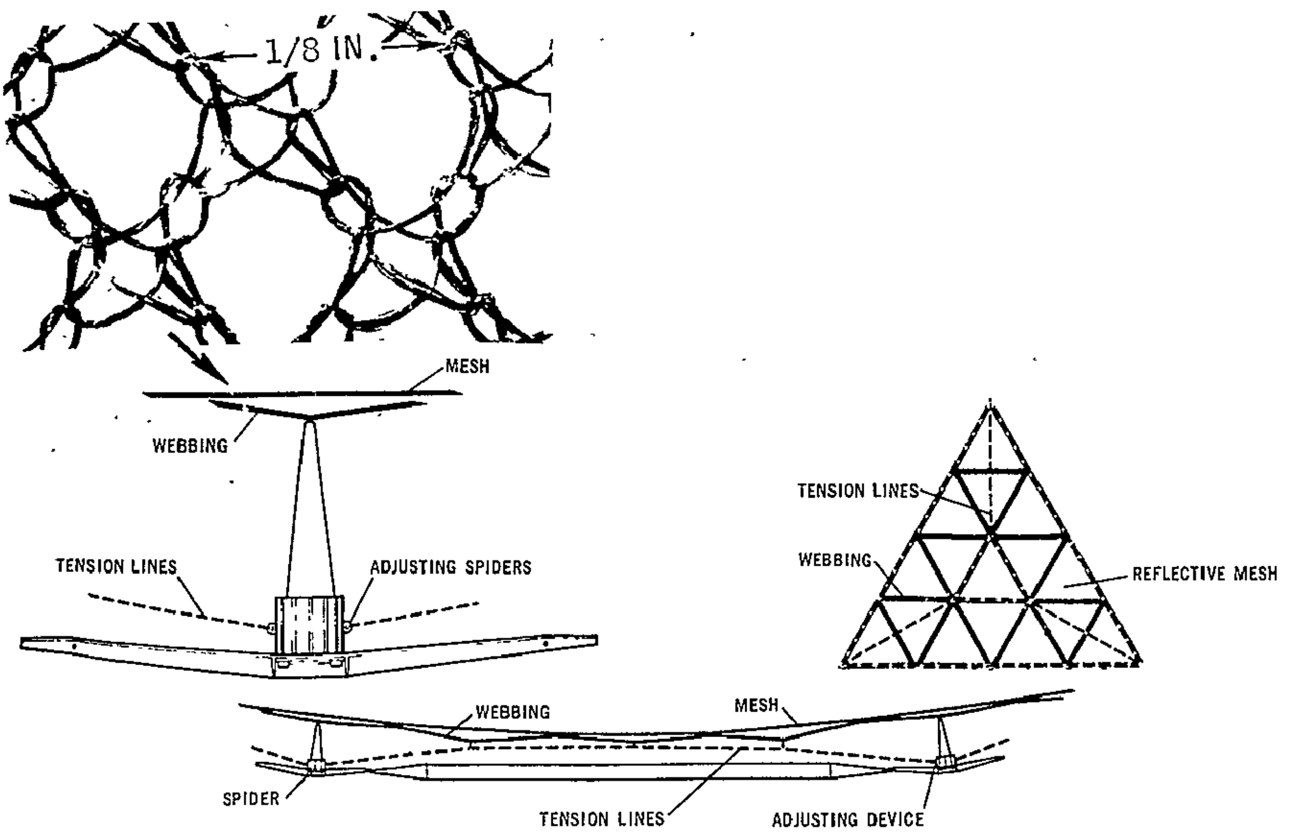


Figure 4-12. Reflector Mesh

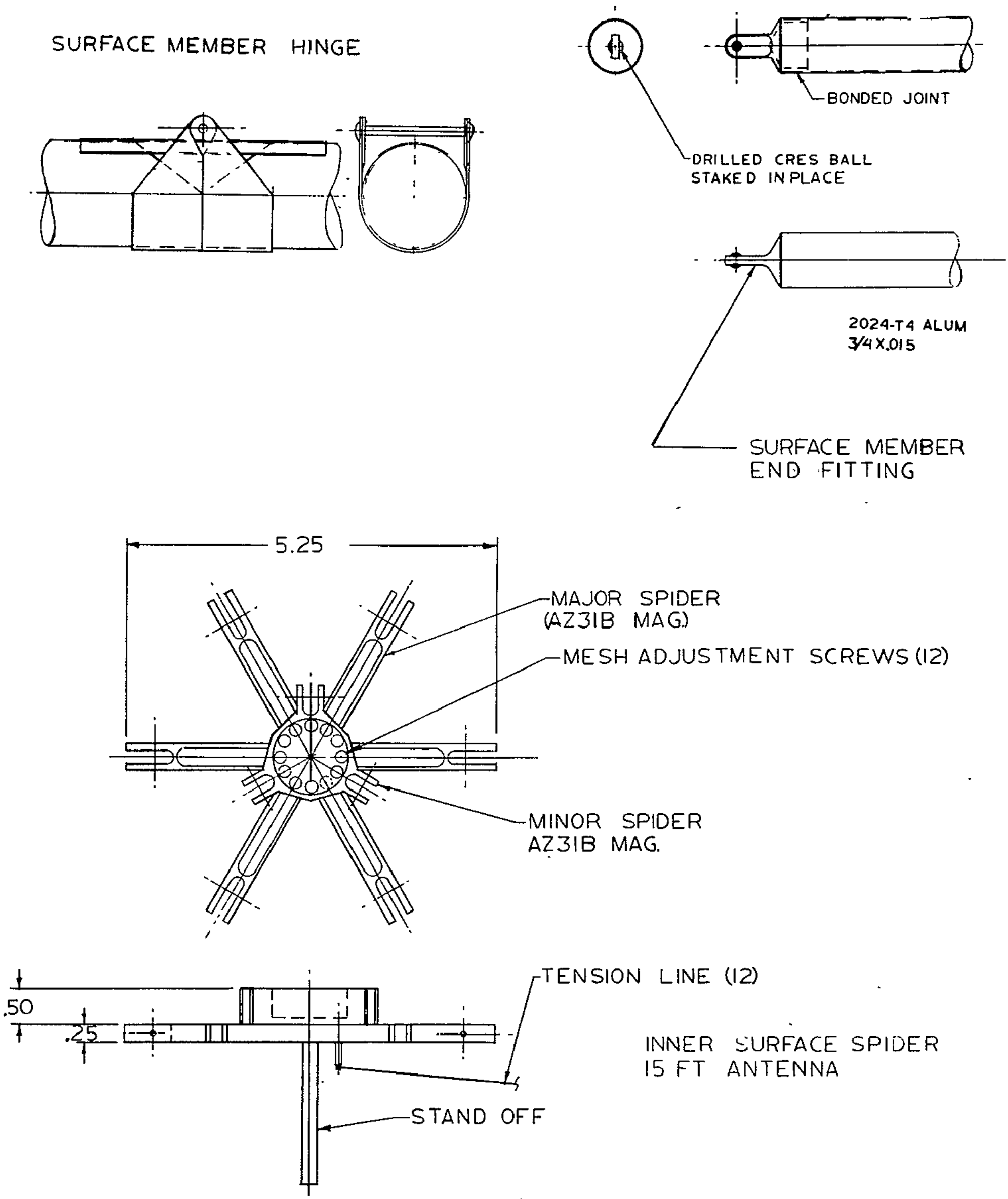


Figure 4-13. Fittings

4.8.2 FA-2 FEED SUPPORT - Feed boom FA-2 is a pyrotechnic - actuated pneumatically deployed, three element, 2 1/2 inch diameter tubular structure 98 inches in length. It's orientation in the packaged and deployed condition is illustrated in Figure 4-14, S-& X-Band standard gain feed horns mount to the first non-deploying tubular element. A motor driven screwjack adjustment at the base will allow the crew to position the feed at the optimum focal point. Maximum thermal gradient with side-sun on the tube is 2.5°F resulting in a tolerable distortion of .015 inch at the feed. With a natural frequency of 5 cps, dynamic oscillations are not critical at the proposed slewing rates.

4.8.3 FA-3 FEED AND ELECTRONICS - A diagram for the spacecraft pattern and gain measurement equipment is shown in Figure 4-15.

In the proposed experiment, transmitting sources are located in the spacecraft and the field intensity measured at the ground station. Radiation levels near the main lobe region are mapped by gimbaling the antenna in a cylincal pattern about ground station line of sight. Encoders on the gimbal axes, inertial angles from the CSM and orbital parameters provide the angle data for the radiation pattern. Absolute gain is determined by gain comparison. Patterns are generated for comparison purposed through a periodic switching of the transmitter from the space erectable antenna to the standard gain antenna as the two patterns sweep through the ground station. Two widely separated test frequencies are required to estimate reflector surface inaccuracies - the upper frequency being in a region where moderate gain degradation has occurred. Proposed transmitting units shown in the illustration operate at 2.3 GHz, 8 GHz, and 12 GHz (subject to frequency allocation).

The composite feed operates at frequencies of 2.1 GHz (up-link tracking) 2.3 GHz (down-link pattern), and 8 GHz (down-link pattern) and 12 GHz (down-link pattern). The feed system (S-Band) forms four lobes in two orthogonal planes for sequential lobing or monopulse operation. Off-axis angular errors are corrected by the tracking and servo systems - driving the antenna to the boresight axis. A pilot signal for tracking is provided by the USBS (CSM) up-data carrier. In addition to automatic tracking, the 15 foot antenna can be pointed manually and programmed electronically for the pattern mapping operations.

Minimum instrumentation, consisting of strain or elongation sensors and temperature sensors are required on key structural members to detect distortion. The distortion data will be recorded and telemetered to ground for correlation with the pattern data containing boresight shift information.

Thermal measurements are also required on the gimbal, and transmitter units. The telemetry processing system combines and formats the strain,

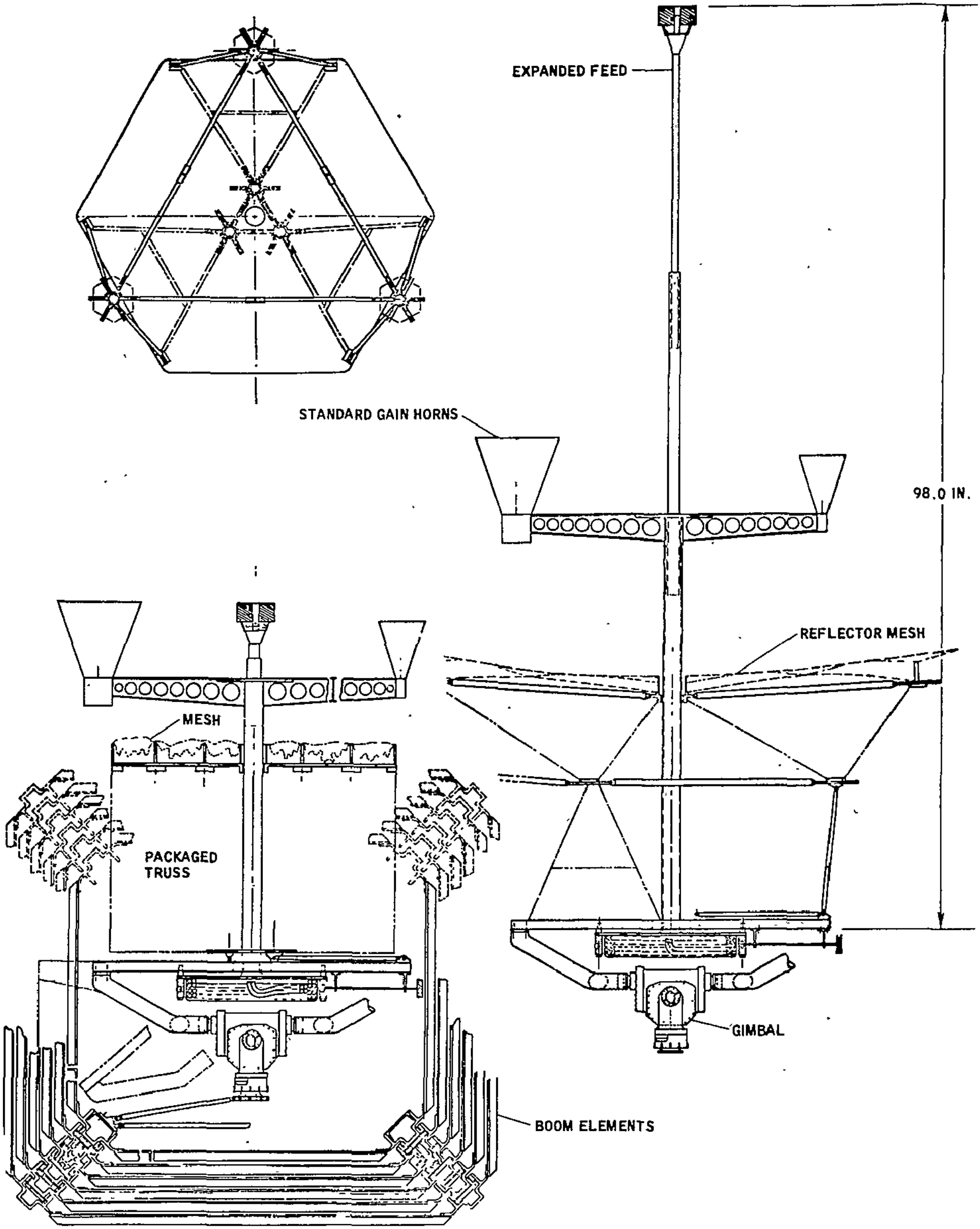


Figure 4-14. FA-2 Feed Boom

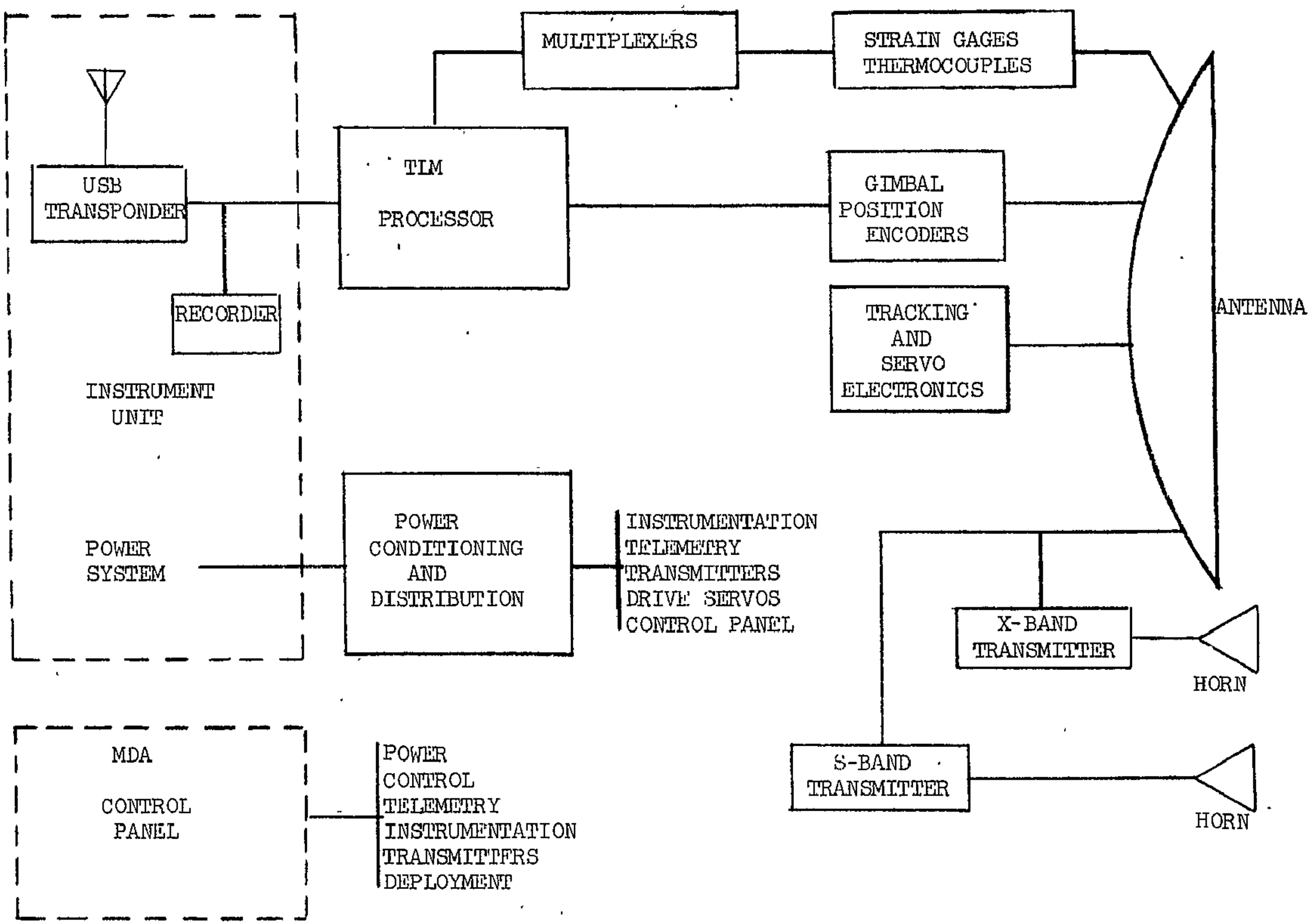


Figure 4-15. Electronic Equipment Block Diagram

temperature, gimbal angle, and timing data for transfer to the ground station.

Electrical interfaces are required for the power conditioning system (28 VDC Instrument Unit), telemetry system (Instrument Unit USB transponder and tape recorder) and astronaut experiment control panel (CSM or MDA).

Basic ground equipment required at an Apollo USB site are X-and S-Band receivers, analog recorders, A/D conversion units, computer facilities, tape unit and X-Y plotters. The 30 ft. USBS ground antenna must be modified to receive X-Band pattern data (e.g. adding a fixed feed cluster around the main feed assembly) or a slaved reflector (approximately 10 ft.) added to the receiving site for this function.

4.8.4 FA-4 EXPERIMENT CONTROL PANEL - This control panel is provided to allow the flight crew to control and monitor the externally-mounted experiment while in the shirtsleeve environment of the MDA.

The panel is divided functionally into four parts, as follows:

a. Power. This section contains the switches, meters and indicator lights to control each element of the experiment. A master control power ON/OFF switch is provided for complete de-energization of the experiment at any time.

b. Antenna Deployment. Deployment of the Support Boom, Reflector and Feed Boom are controlled from this section. A motorized mechanism is used to erect the support boom so a STOP/START/REVERSE push-button control boom so a STOP/START/REVERSE push-button control is used. A SPEED control may be added to this section. Microswitch light combinations are used to indicate full deployment and lock-up.

c. Antenna Pointing. A set of servo-controls and angular position indicating encoders are used to permit the crew to point the antenna to a desired reference - as for ground station acquisition. A control switch for Manual/Automatic/Scan control is also provided.

d. Experiment Operation. This section contains the transmitter, antenna and feed selector switches and indicators. An RF power meter is provided to confirm transmission.

The control panel is presently arranged for mounting in a standard 19-inch rack. It's over-all height is 24 inches.

4.8.5 FA-5 GIMBAL CONTROL SYSTEM - The antenna experiment will require a gimbal control system. This system will consist of a 2 degree of freedom gimbal and the associated control electronics. The gimbal system will permit the antenna to be manually pointed to a particular ground station by proper manipulation of the controls located at the control panel in the MDA. In addition, the gimbal control system will lock on to and automatically track the ground station with appropriate signals from the RF link. The acquisition and tracking of any ground station may be accomplished without imposing any special maneuvering requirements on the SIVB Workshop.

The operation of the gimbal control system includes the manual mode, the automatic-track mode and an automatic scan mode for pattern measurements. In the manual mode, the astronaut will point the antenna toward a ground station by commanding the proper gimbal angles from the control panel. The gimbal angle information would be communicated to the crew from ground control. The gimbals will have the capability of horizon to horizon angular coverage of at least 140 degrees in each axis. In the manual mode the maximum slewing rates will be approximately 5 degree/second and the maximum acceleration will be approximately 0.1 rad/sec^2. A signal intensity meter on the control panel will indicate reception of the RF transmission from the ground station and will provide the astronaut with an indication of approximate acquisition required for changing modes to automatic tracking.

In the automatic track mode, the gimbal control system will be capable of locking on to and tracking of, a particular ground station. For the special case of a ground station in the orbital plant (direct overfly) the maximum rate required by the control system will be approximately 0.9 degrees per second and the maximum acceleration will be 0.2 degrees per second^2. Figure 4-16 shows the gimbal angles and rates for both gimbals when the ground station lies outside of the orbital plane.

A scan mode will be used for making antenna pattern measurements. The ground station will first be acquired in the auto track mode. The astronaut will then charge the mode selection to Scan. An automatic sequence will be initiated which will (1) hole in the tracking command and at the same time will (2) command a plus and minus 5 degree scan cycle. At the end of each scan cycle the automatic tracking will re-acquire the ground station. This sequence will be repeated several times, first in one axis and then in the other. At the completion of the pattern measurement program the mode will automatically revert back to the automatic tracking mode.

The GCS will be supplied from a major subcontractor in the industry such as, Dalmo Victor, the suppliers of the Apollo and LEM antenna systems.

The Dalmo Victor system designed for Apollo contains the gimbal assembly, electronics package and associated controls. The gimbal assembly weighs approximately 20 pounds and contains the prime movers for each axis. The electronics package which weighs approximately 25 pounds contains the control amplifiers, logic and RF electronics. Dimensions of the electronics. Dimensions of the electronics package are approximately 10 X 14 X 4 1/2 inches. The gimbal control system operates on 26 volts AC 400 cycle power and consumes approximately 60 watts under full command and 40 watts in an ideal condition. Dalmo Victor system meets the experiment operational and environmental requirements and will be flight qualified at the time of the workshop flight.

4.8.6 FA-6 DEPLOYMENT BOOM - It consists of a six-section telescoping truss structure, Figure 4-17. The first outside truss is mounted to the MDA. In the retracted condition the reflector and feed packages are mounted inside the retracted boom envelope. This serves to protect the more sensitive antenna structure and mesh during transportation, installation, and boost. During deployment each successive boom section is guided by means of rollers on its neighboring section. Two DC motor driven drum type winches through a planetary reduction train provide the power to deploy the boom. Redundancy is provided by the linked motor. Two sets of cables running over the pulleys mounted in each boom section, similar to an extension ladder, extend the six truss sections. Deployment can be stopped by shutting off the drive motors. A secondary cable system will hold the sections in place at partial deployment.

As each boom section reaches the deployed position a spring actuated tapered lock pin drives into place into a cap section to form a rigid integral structure without variable tolerance accumulation. Limit switches are provided to stop the motors on completion of deployment. Hand holds and dutch shoes are installed at possible work sites. All systems are designed to enable the EVA astronaut to repair malfunctions. A work site will also be incorporated in the last section to enable the astronaut to inspect the deployed reflector. Boom structure materials are primarily aluminum extensions.

4.8.6.1 FA-6 Alternate Boom Concept - An alternate boom configuration is shown in Figure 4-18. This concept employs the same technique used in the erectable truss. While packaging is not as neat as the expanding truss, it is 30% lighter and more rigid. The aluminum tube hinged elements deploys to a triangular cross section truss. A feed out cable will control deployment. Springs drive out the truss elements and locks drop in place upon full deployment.

4.8.7 HARDWARE AVAILABILITY - Experiment hardware and availability are listed in Table 4-2.

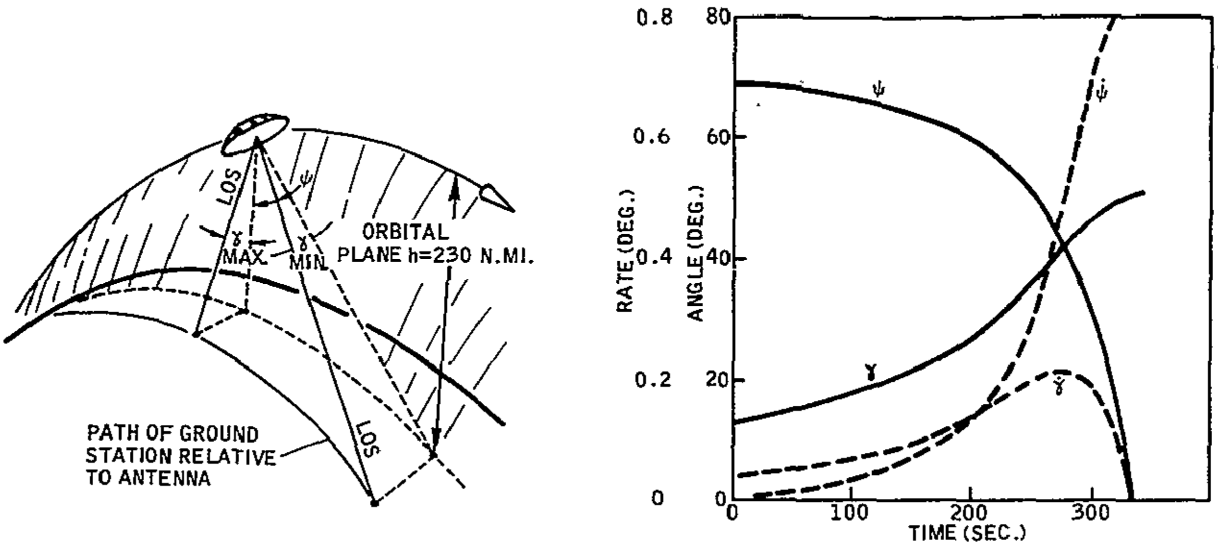


Figure 4-16. 230 n. mi. Orbit Tracking Rate

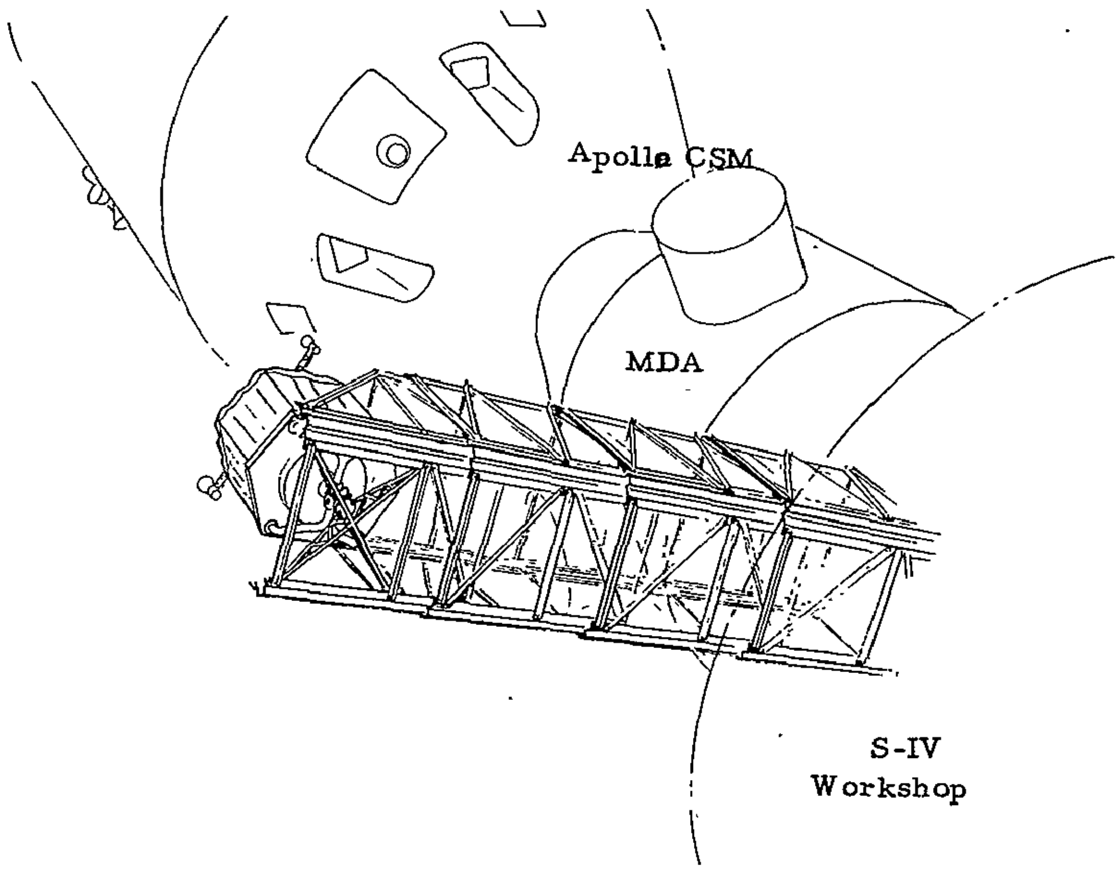


Figure 4-17. FA-6 Deployment Boom

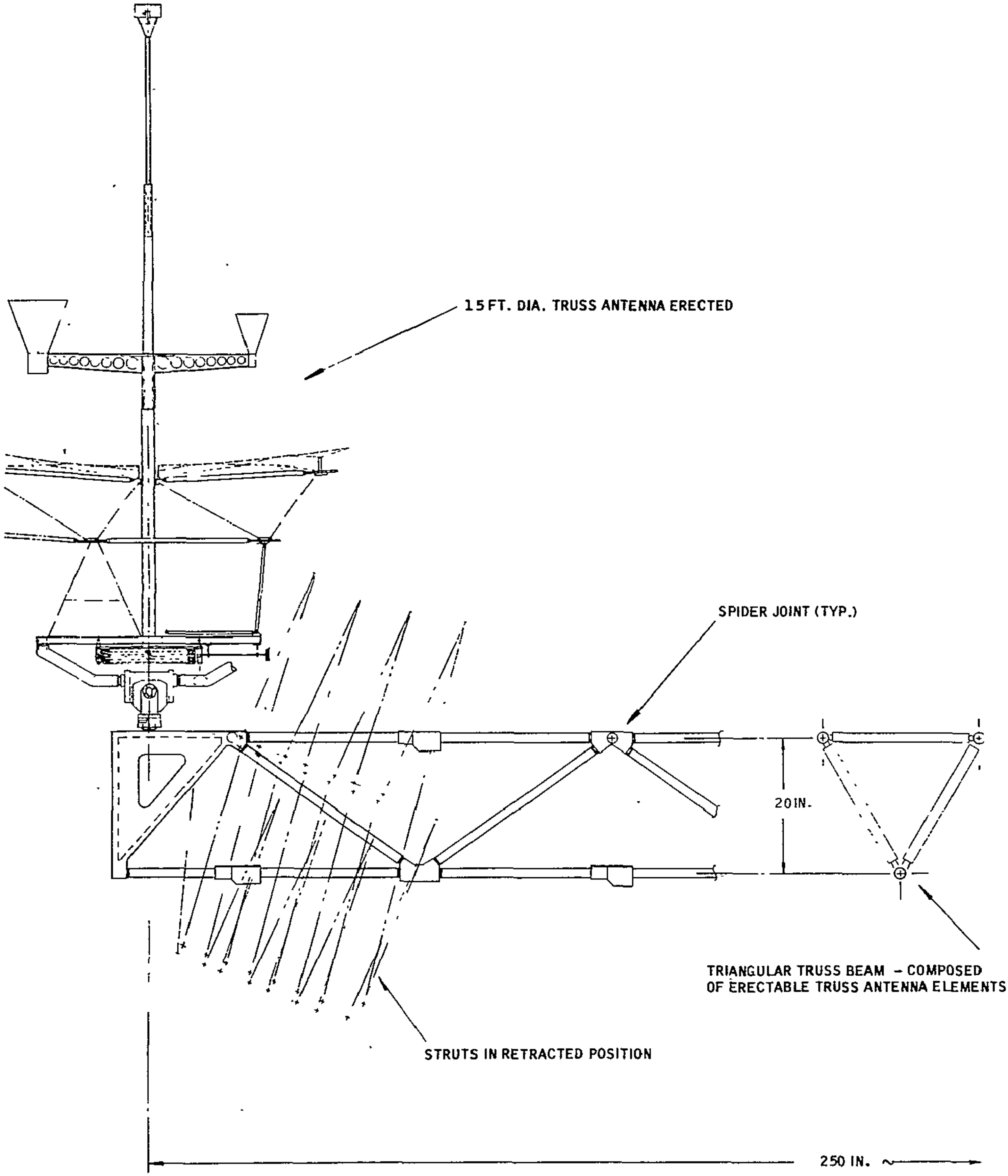


Figure 4-18. FA-6 Alternate Deployment Boom

Table 4-2. Experiment Equipment Availability

Required Equipment	State of Definition
1. Flight Article	Conceptual Design
FA-1, Parabolic Reflector	
FA-2, Feed Assembly	
FA-3, Electronics Assembly	
FA-4, MDA Control Panel	
FA-5, Antenna Gimbal Mount	Existing, Qualified CSM Antenna Mount
FA-6, Deployable Boom	
2. Engineering Model	Conceptual Design Working Model Built
EM-1, Reflector Structural Test	
EM-2, Feed Supports, Structural Test	
EM-3, Feed and Electronics, Structural Test	
EM-4, MDA Experiment Control Panel	
EM-5, Gimbal Mount, Structural Test	Use Existing Qualified Apollo CSM Gimbal Mount
EM-6, Deployable Boom	
3. Engineering Subassembly Test Articles	Conceptual Design
SA-1, Hexagonal Structural Test Unit	
SA-2, Feed Support Strut	
SA-3, Feed and Electronic Soft Mockup	
SA-4, Control Panel Mockup	
SA-5, Control Panel Adapter (Test Accessory)	
SA-6, Attitude Control Module	
SA-7, Harnesses (Test Accessories)	

Table 4-2. Experiment Equipment Availability (Cont'd)

Required Equipment	State of Definition
4. Training Articles	
TA-1, Orbital Slight Simulator	Conceptual Design
TA-2, Structural Element (EVA)	Prototype
5. Ground Support Equipment	
GSE-1, Antenna Experiment Handling and Shipping Pallet	Available Components
GSE-2, Electronic Module Handling Cart	Available Components
GSE-3, Equipment Handling Carts (4)	Available Components
GSE-4, Hoists and Slings (As Required)	Available
GSE-5, Experiment Check-out Console	Conceptual Design
GSE-6, Launch Control Panel	Conceptual Design

4.9 ENVELOPE

The parabolic antenna experiment has five major assemblies. The assemblies. The assemblies, dimensions and configurations are shown in sketches as follows:

a.	Assembly FA-1,	Reflector and Feed	Figure 4-11
b.	Assembly FA-2,	Feed Boom	Figure 4-14
c.	Assembly FA-3,	Electronic Equipment Block Diagram	Figure 4-15
d.	Assembly FA-4,	Experiment Control Panel	Figure 4-19
e.	Assembly FA-5,	Antenna Gimbal Mount	Figure 4-20
f.	Assembly FA-6,	Deployable Support Boom	Figure 4-17

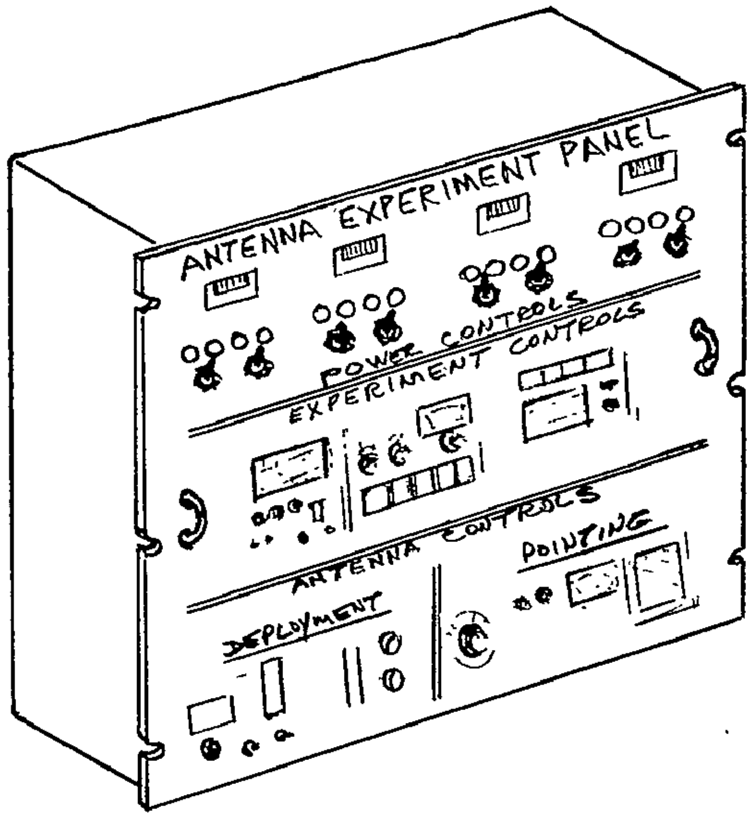


Figure 4-19. Experiment Control Panel Assembly

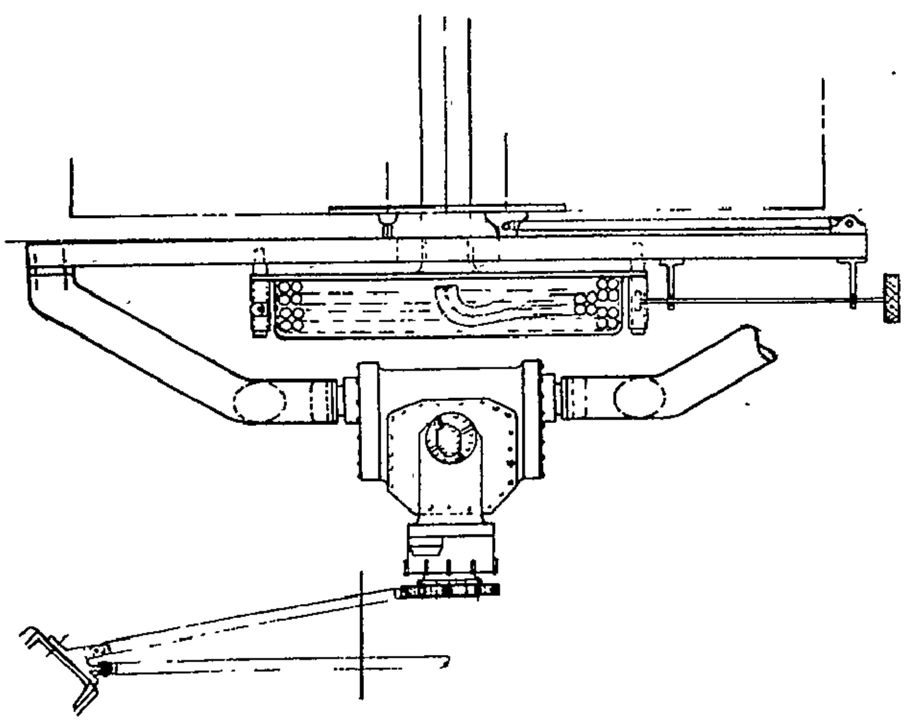


Figure 4-20. Antenna Gimbal Mount

4.10 WEIGHT AND SIZE

	Weight (lbs)	Volume (cu ft Stores) Operation	Dimension (ft) Stored Operation	Shape Stored Operation
FA-1 Reflector	27	(inside FA-6)	1.8x2.6x2.6	Hexagonal
FA-2 Feed Boom	4	(inside FA-6)	.2x.2x3.5	Tubular
FA-3 Feed and Electronic	20	(inside FA-6)	0.5x0.8x2.4	Irregular
FA-4 Experiment Control and Cabling	144	5.7	1.5x1.9x2.0	Boxes
FA-5 Gimbal Mount	30	(inside FA-6)	0.9x0.9x1.0	Irregular
FA-6 Sliding Boom	70	10.2 Ft^3	4.5x4.5x5	Rectangular Box
Total	295			

4.11 POWER

Total Power	Standby Watts	Average Watts	Maximum Watts
Antenna Experiment	0	165, when Energized	225 during Pattern Measurement
	Power Consumption by Assembly		
	Standby	Average	Maximum
FA-1 Reflector	0	0	140 for Deployment
FA-2 Feed Boom	0	0	140 for Deployment
FA-3 Electronics	0	100	140
FA-4 Experiment Control Panel	0	15	15
FA-5 Gimbal Mount	0	50	70
FA-6 Deployment Boom	0	0	200 for Deployment

4.12 SPACECRAFT INTERFACE REQUIREMENTS

The parabolic antenna experiment is mounted on the outside of the MDA within the S-V LEM adapter, except for assembly FA-4, the control panel and related instrumentation that is mounted internally. A communication umbilical is required during pattern measurement from the CSM.

a. Required or Desired Location - The antenna is designed to be carried within the LEM adapter (SLA) compartment on the MDA with feed assembly forward and the folded feed support struts and parabolic dish aft. All launch loads are transmitted through the MDA structure.

b. Mounting Requirements - Assembly FA-5 antenna mount, is designed to mount to the MDA. Power coax and instrumentation penetration of the MDA pressure shell are required.

c. Spacecraft Subsystem Support Requirements - The Workshop provides: electrical power and electrical control signals for attitude control of the combined vehicles, signals for the deployment; checkout capability; and control of the antenna experiments. Controls and indicators for these operations are provided in assembly FA-4, the control panel.

d. Special Mechanical Linkage or Control Requirements - Through the antenna mount the CSM provides for attitude control during deployment, and during potential EVA. Other mechanical interfaces with the antenna: handholds, tether attach points, clothesline supply tie points, and other EVA aids are discussed as equipment required, for the astronaut participation plan herein.

4.13 ENVIRONMENT CONSTRAINTS

Environment extremes for operation of the parabolic expandable truss antenna equipment.

a.

Constraint \ Assembly	FA-1 Dish	FA-2 Struts	FA-3 Feed	FA-4 Control	FA-5 Gimbal	FA-6 Boom
	Condition applies to all assembly except if noted.					
Thermal						
Stored (1)	-65° to $+160^{\circ}F$					
Operational (2)	$70^{\circ} \pm 30^{\circ}F$					
Atmospheric Pressure (1, 2)	(3) Vacuum to 1 atmosphere					
Relative Humidity (1, 2)	5%					
Air Movement Rate (2)	20 fps					
Atmospheric Composition (1)	Dry air or nitrogen					
Contaminats	When in storage, the large structures are protected by a polyethylene dust cover and desiccant bags to lower humidity. In launch configuration, dry cooling air or nitrogen with particle size 15 microns or less.					

ENVIRONMENT CONSTRAINTS (Continued)

Constraint \ Assembly	FA-1 Dish	FA-2 Struts	FA-3 Feed	FA-4 Control	FA-5 Gimbal	FA-6 Boom
Acceleration (Storage)	8G					
Positive (1, 2)	8G					
Negative	3G					
Transverse	3G					
Acceleration (Operational in Orbit)						
Positive	0.3G					
Negative	0.6G					
Transverse	0.1G					
Vibration (Storage) Random Sinusoidal	All assemblies, when packaged for shipment and handling are designed for shock and vibration typical for space hardware					
Vibration (Operational) Random Sinusoidal	Operational vibration and noise conditions are Saturn V launch loadings.					
Noise	Same as above					
Light Tolerance Intensity Wavelength	The experiment is designed for independent operation in orbit and tolerance to light and radiation is designed for the synchronous orbital environment					
Radiation Tolerance						
RFI	No restriction					
EMI	No restriction					

NOTES:

1. When packaged for shipment
2. In the launch configuration
3. The assemblies are not sensitive to atmospheric pressure variation when not in operation.

b. Interference - Since the antenna is an external experiment in orbit, potential interference is minimal. During prelaunch operations, and for the control panel and harness carried in the Workshop, EMI is restricted to meet MIL-STD-826. All systems are inactive during the launch phase.

4.14 DATA MEASUREMENT REQUIREMENTS

The parabolic antenna experiment uses the Apollo data transmission system (DTS) for communication of the experiment data to the ground station. This DTS is located in the MDA. Operation of the experiment places a requirement on the MDA for experiment data transmission as well as for those measurements on the MDA normally made during rendezvous, docking, EVA and other orbital support operations.

4.15 SPACECRAFT ORIENTATION REQUIREMENTS

The interactions between the antenna and the S-IVB Workshop and the astronaut crew are critical to the successful conduct of the experiment as well as the safety of the crew.

a. Manuevers - The antenna experiment is hard-mounted to the S-IVB Workshop through a three degree-of-freedom gimbal system. In orbit the required maneuvers consist primarily of tracking ground stations. This is accomplished through the gimbal system and imposes a little or no maneuvering requirements on the Workshop.

b. Type of Orbit - The antenna experiment is designed to accommodate typical S-IVB Workshop low-altitude orbits.

c. Orbit Parameters -

1.	Perigee	230 n.mi. (nominal)
2.	Apogee	230 n.mi. (nominal)
3.	Period	94 minutes
4.	Inclination	50 degree
5.	Lifetime	1 year

d. Lighting Constraints - There are no lighting constraints.

e. Launch Time - There is no specific launch window required.

f. Number of Measurements Required - The S-IVB Workshop will be required to provide orientation to the combined S-IVB Workshop and antenna throughout the manned measurement program, covering a complete survey of the operation and measurement of the antenna system.

Patterm tests results in bit rates as shown in Table 4-3. The gimbal angle data is relay to the ground station recording the field intensity to develop the RF antenna pattern.

Biomedical information will be based on techniques developed in the work shop tests.

Strain gage, thermocouple and microswitch lock-down instrumentation will be checked periodically, covering approximately 50 data points.

Table 4-3. Pattern and Gain Measurement Bit Rate

Measurements	Total Bits	Sampling Rate Samples/Sec.	Bit Rate B/S
Two gimbal angles	26	40	1040
Strain Gages (23)	184	1	184
Temperatures (29)	232	1	232
Time	13	10	130
		Total	1586

g. Time per measurement - Approximately 20 minutes is required, including energizing the experiment, acquiring the ground station and 10 minute overfly time.

h. Orbital Location During Measurements - Experiments will generally be conducted during periods when the control ground station is in view.

i. Pointing Accuracy - For upper frequency pattern measurements, an initial position pointing accuracy of 0. 1 degrees is required with a gimbal encoder resolution of 0. 05 degrees. Higher resolution pointing information may be available by sensing the automatic tracking servo error signal.

j. Allowable Spacecraft Rate - Allowable rates for the S-IVB Workshop will be very low because of the moment of inertia of the system. Maximum error in attitude rate is required to be 0. 002 degrees per second or less.

4.16 ASTRONAUT TRAINING

a. Course in Paraboloid Antenna Theory — 80 Hr.

b. Equipment Usage — 40 Hr.

c.	Malfunction Detection, Analysis and Reapir	80 Hr.
d.	Safety Procedures	40 Hr.
e.	RF Tests	80 Hr.
	1. Pattern Measurement	
	2. Gain Measurement	
	3. Alignment	
	4. Calibration	
	5. Data Analysis	
f.	EVA Structural Tasks	80 Hr.
	1. Inspection	
	2. Maintenance	
	3. Tool Handling	
	4. Installation of Components	
	5. Electrical Connections	
	6. Repairs	
g.	Pointing Tests	20 Hr.
	1. Acquire Ground Stations	
h.	Mission Simulation and Familiarization	40 Hr.
	Total	460 Hours

4.17 ASTRONAUT PARTICIPATION PLAN

To perform the tasks outlined in Table 4-4 the astronaut will have a control panel console in the MDA. In the pattern measurements, he will steer the antenna to acquire the ground station and monitor pattern measurements throughout the test. Aided by ground control, he will make the decision if sections of the patterns test are questionable and should be repeated.

TABLE 4-4 Preliminary Operational Functional Analysis

NORMAL FUNCTIONS					CORRECTIVE FUNCTION CAPABILITY		
Gross Function	System or Component Function	Elapsed Time (hr. Min.)	Crew Action Or Participation (at MDA Station Unless Otherwise Shown)	Failure Mode/Indication	Crew Action Or Participation Capability	EVA Equipment	Remarks
1. Inspect package experiment from MDA & CSM	Experiment	0:10	Observation	Observed Damage	EVA and Repair	Cutter Power Tool	Equip. depends on task
2. Activate sliding boom	Control Panel Boom	0:10	Press control panel Activate button OK Microswitch Board for lockdown indicator	Incomplete deployment Visual & Microswitch indicator, shorting power telemetry or coax Cable	EVA and Repair		
3. Activate Reflector and Feed	Control Panel Feed Reflects	0.10	Press release at control panel Check Microswitch board	(Same as 2)	EVA and Repair		
4. Inspect Reflector (EVA) Feed and Boom (Optional)	Reflector Feed Boom Coax Power Line Instrumentation	2.00 (3 hr preparation and review)	1) Visually examine each joint 2) Make temperature measurements	1) Incomplete Deployment. 2) Failed element 3) Poor quality mesh area.	1) Second crew member moves to MDA lock 2) Lockup or replace damaged member. 3) Adjust mesh contour cables.	Power Screw Driver (plug-in) Cutter	Provide plug into power system for tools in feed and reflector areas.
5. Checkout Transmitters (2)	At control panel	0:03	At control panel turn on switches, monitor and perform checkout	1) Non-operative 2) Overload and burn out.	Turn off switch to back-up circuits. Install backup transmitter from MDA.		
6. Checkout instrumentation and tape recorder.	1) Telemetry circuits 2) Transmitter	0:04	1) Turn switches 2) Checkout system	Non-operative	1) Check circuitry and power input		
7. Acquire Earth Target	Attitude control system and gimbals	0:05	Steer antenna to acquisition region Verify ground acquistion	1) No signal on tracking receiver monitor	1) Check acquisition system		
8. Start pattern measurement	RF instrumentation	0:08	Activate gimbal scan. Activate antenna switching network.	Component failure 1) no response 2) erronous response to calibrated inputs	Replace component with spare or go to alternate experiment procedure utilizing other equipment.		
9. End scan, check electronics turn off power	Gimbal, power		Stow antenna, perform systems check. Activate Power Change over and Interface switches.		Perform repair function		
10. Dump TLM data	Telemetry	0:02	Activate tape recorder (IU) for data dump				
11. Perform complete EVA inspection of antenna tubular members and mesh and support systems (Optional)	Reflector	5:00	EVA examination of entire antenna. Determine status of damage, changes. Make maintenance correction, evaluate and photo meteoroid impacts or other damage.				

His potential EVA tools and spare parts for repair functions are listed in Table 4-5, "C" clamps have broad application to positioning material to make adjustments or repairs. Cable splicers are needed if deployment or boost vibration should damage the lines coming from the antenna mount to the feed. Metal and mesh cutters could be used to release a damaged truss tube. Redundancy of the truss will allow anyone of the six elements in a hexagonal assembly to be removed without impairing the structural integrity of the antenna. A stadioptic could be used to approximate distances and make measurements of the truss and mesh. Power and coax lines replacements may be stored on the side of the electronic compartment. Test made on the mesh show the Velcro tape is ideal for joining a damaged area. Thermal coating repair of a spray or tape type could be used during the EVA inspection if surfaces were marred during boost or deployment. A lubricant would be useful for the tube and feed hinges and adjustment system.

During all potential EVA, two astronauts would be space suited with one serving as safety man. The third man would remain at the CSM or S-IVB Workshop command position from where he can view the entire operation.

Table 4-5. Astronaut Tools and Spare Parts

TOOLS	SPARES
C-Clamps	
Wire Splicer	Power Line
Coax. Splicer	Coax. Line
Voltmeter	
Metal and Mesh Cutter	Velcro Tape (Mesh)
Power Saw	Thermal Coating (Spray & Tape)
Wrench Socket	Lubricator
Screwdriver	Tube Hinge Locks
Locomotion:	Plug in Electronic Modules
Tethers	Fuses and Fuse Blocks
AMU for safety or rescue, but not required for normal operations	

4.18 PRE-LAUNCH SUPPORT

a. Shipping and Handling Procedures - Material handling and packaging is controlled by National Aerospace Standards (NAS). These standards establish the methods, materials and devices to be used throughout the procurement, receiving, manufacturing and shipping phases of the program. Containers are manned in accordance with MIL-STD-129. A special pallet/shipping trailer is required for shipping and handling the completed antenna assembly.

b. Installation and Checkout - The antenna experiment is designed to make maximum use of the AAP experiment installation and checkout procedures. Mechanical installation procedures will, to the greatest extent practicable, use actual blocks from the LEM procedures. Electrical installation will utilize the existing umbilicals for landline connections.

   As a further check of the compatibility of the antenna systems with the launch vehicle and with the MSFN and DSIF ground stations, the antenna will be shipped to NASA/MSFC for fit checks and RF data link checks prior to being shipped to the launch site.

c. Facilities - In addition to the facilities already available at Complex 39, the antenna will require the use of a Vehicle Assembly Building (VAB) for the performance of engineering confidence tests by the contractor and general checkout prior to delivery to the VAB for installation on the launch vehicle. The assembly area shall be environmentally controlled to the requirements of Federal Standard 2-9, Class 100,000 Clean Rooms.

d. Test Equipment - Checkout of the antenna experiment is accomplished by means of a checkout console. Standard calibration and validation services are required for the quality control of this equipment. In addition, standard electrical/electronic test equipment will be required.

e. Services - Provide dry air in SLA when experiment is installed.

4.19 FLIGHT OPERATIONAL REQUIREMENTS

The antenna experiment is integrated with the S-IVB Workshop when in orbit. As such the communications needs are designed to be accommodated within the capabilities of the USB system(s) contained in the IU.

Support of the MSFN ground is required. Special ground operations will include:

a. Reduction of contour measuring unit information

   1. Recommended mesh correction

   2. Best fit parabola selection to bias tolerance

   3. Direction to move feed to optimum focal point

b. Pattern tests, data reduction

1. Evaluate data

2. recommend reruns on dubious data

3. Direction of electric boresight of feed based on pattern measurements

c. Damage analysis team

1. Review crew reports

2. Recommend corrective action

d. Transmission evaluation

e. Pointing test evaluation

4.20 RECOVERY REQUIREMENTS

None. Experiment is left in orbit with capability to be refurbished, if desired.

4.21 DATA SUPPORT REQUIREMENTS

No pre-flight data support is required except normal Apollo biomedical data. Computer analysis of the pattern data from which the antenna contour information is derived is required in real-time or near real-time. Comparison of this data to previous ground test data is required. Biomedical data taken throughout the experiment will be used to evaluate man's ability in space, and therefore, is part of the experiment, as well as required for normal safety procedures.

4.22 APPLICATION OF THE 15 FOOT ANTENNA TO THE UNIFIED S-BAND DATA LINK

After experiment completion, the 15 foot antenna will be a functional system with a capability of being directly integrated into the workshop data link. This would be accomplished by switching the RF cable from the S-band experiment transmitter to the spacecraft USB transponder system. The automatic tracking function used for the experiment would lock-on desired USB ground stations for high-data rate dumps. The 15 foot erectable antenna would increase system data rate capability by a factor of ten over that provided by a CSM Hi-Gain (Lunar) antenna installation and a factor of 6,000 over a an omni-directional (zero-db) system (see Figure 4-21).

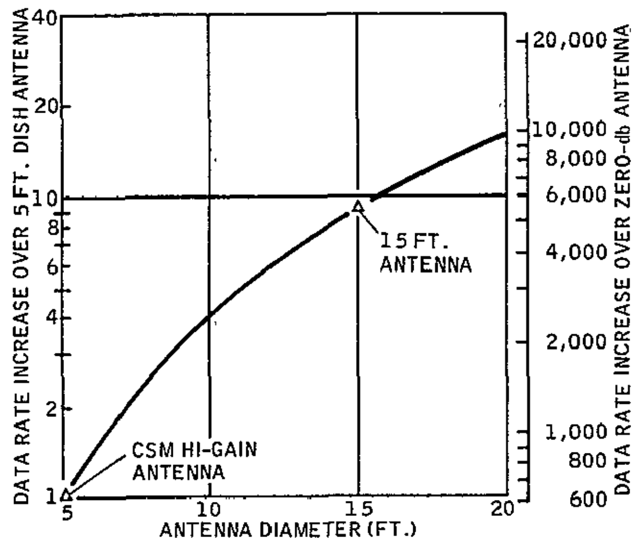


Figure 4-21. Effective Data Rate Increase Compared to CSM Hi Gain Antenna

4.23 RESOURCE REQUIREMENTS

Costs for this program have been divided into three phases:

a. Phase I - Similar to NASA Phase B, would be a definition phase in which trade-off would be made, element testing performed, components selected or specifications written, a detail preliminary design made, and interface requirements specified.

b. Phase II - Would encompass detail design, fabrication, and test of a full-scale prototype antenna and supporting systems. With only non-destructive testing performed, the updated prototype would be used for an early fit check on the MDA and for crew training.

c. Phase III - Covers the design update of the flight antenna to meet qualifications dictated in the test program, fabrication of the flight experiment, qualification testing, and installation on the spacecraft. The final part of Phase III is launch and orbit support, followed by real-time and post-orbit evaluation of the telemetry and recovered data.

The cost estimates and information contained in this section cover the scope of work the Convair division of General Dynamics proposes to accomplish in performance of the described tasks.

Cost estimates listed below are those given in General Dynamics Convair Report No. GDC PIN 68-220, 9 April 1968. A 30 month program was assumed in preparing the estimate. The cost-plus-fixed-fee contract consisted of:

Phase	Total Estimated Cost
I	$ 316,274
II	1,705,220
III	1,091,269
Total	$ 3,112,763

A major subcontract cost of $992,238 resulted from an estimate for using the qualified Apollo CSM antenna gimbal and control system for the prototype and flight experiment. Improved gimbal cost could reduce this cost, while a fuller appreciation of Apollo system qualification requirements could increase it.

A beryllium antenna structure would provide an improved, tighter packaged lighter weight antenna but would cost an additional $259,653.

A 30 month program schedule for the proposed experiment is given in Figure 4-22. Assumed go-ahead is July 1969.

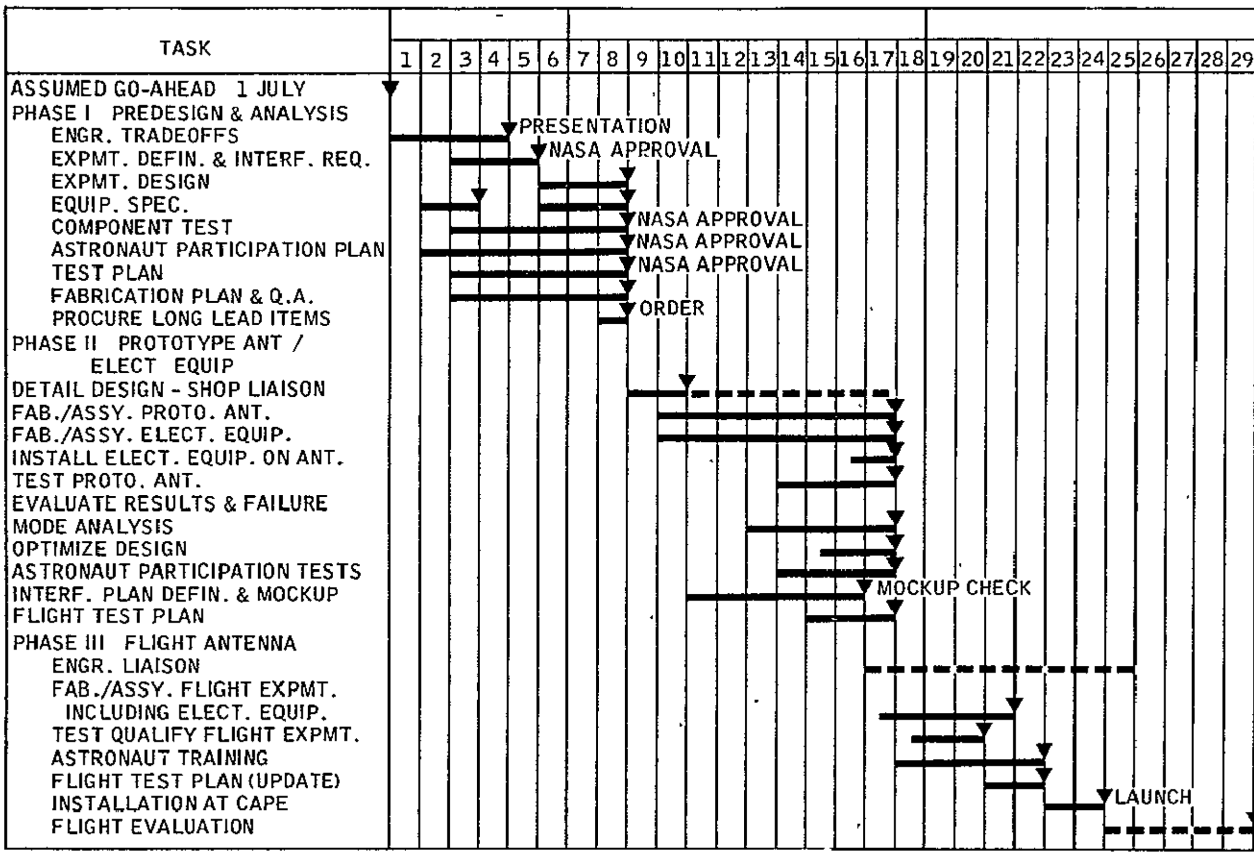


Figure 4-22. Fifteen Foot Antenna for the S-IVB Workshop Experiment Schedule

SECTION 5

MANUFACTURING TECHNOLOGY

In examining the fabrication of 30-foot-, 70-foot-, and 100-foot-diameter erectable antennas, there appears to be no task beyond the present state of art. Tubular members and spiders are similar in design and quality control aspects to aircraft control system components that have been in fabrication for the last 30 years. The major problem is adjusting the mesh reflector surface to the tolerance required. A laser measurement tool with an automatic printout of the antenna contour would provide the quickest, most comprehensive measurement. Unfortunately, this system while feasible has not been reduced to practice. A template system with the antenna mounted to an air-bearing bed rotating around the template with a fixed optical measurement is a feasible alternate in the 30-foot- to 50-foot-diameter region. Adjustment time on a 6-foot truss model and the tetrahedron section proved reasonable. With these small components only a sweep template was used.

In summary all components of the erectable antenna have been produced and assembled. The only missing part of full substantiation of the manufacturing system is the assembly and packaging of a large system. Following are some of the potential development items.

5.1 DEVELOPMENTAL ITEMS FOR IMPROVED PERFORMANCE AND COST SAVING.

Following are some of the areas that if sufficiently developed could provide a significant improvement in weight and cost.

5.1.1 REFLECTOR MESH — The goldplated Chromel-R mesh material (Figure 1-10) is an ideal material for space operation. It has high strength, high RF reflectance excellent foldability, can be woven into the tricot weave required for the reflector surface, and will last indefinately in a hard vacuum environment. The major problem is cost. The Chromel-R is diamond drawn into 1/2 mil filament at a cost of approximately $1000/pound.

It is recommended that an investigation be made to reduce filament cost or substitute a different material that will have similar capability.

5.1.2 TUBING — Convair under an in-house program has obtained 0.020-inch-thick extruded beryllium tubing 9 feet in length. further investigation into production rate and improcess perforation of the tubing is desirable. Up to 50 percent of the weight (Figure 5-1), and improved packaging, can be obtained using beryllium.

Production rate techniques for perforation of tubes (Figure 5-2) is also required. Convair, in-house, has also examined the use of expanded tubes to meet the requirement of attaching the carpenter tape hinge.

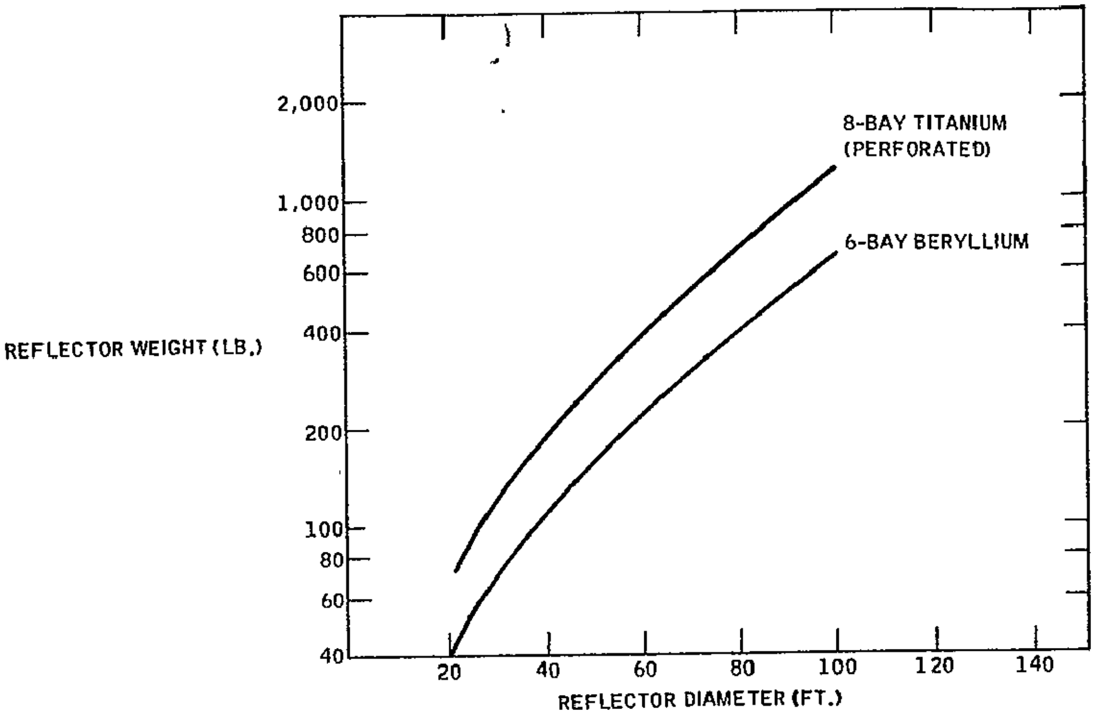


Figure 5-1. Weigh Variation With Reflector Size

5.1.3 SPIDERS — Because of the low quantity needed in test all spiders (Figure 5-3) have been machined to date. Casting offers a possible lower cost alternative. Both magnesium and aluminum castings should be evaluated. With over 120 spiders in an antenna, high-rate production technique are feasible.

5.1.4 BEARINGS — Tolerances on the teflon bearings used in the tests were poor. (Refer to Section 1.) A run-in procedure is required to obtain uniformity of bearings. In addition, several versions of lubricant need to be tested. In general, this is not a major problem since the strut need only move through a 90-degree rotation with a 24-hour period after launch.

5.1.5 USE OF COMPOSITE MATERIALS — For antennas requiring extremely close tolerance (high frequencies), graphite composites with one-tenth the thermal expansion of aluminum hold great promise.

There appears to be no reason why these filaments could not be wound into an ideal tube to reduce the already low truss distortion. Specimens should be made and tested under the space environment conditions and deployment shock loads.

5.1.6 LASER MEASUREMENT UNIT — The development item required to support the antenna measurement is a laser unit to determine the surface contour of the antenna. Approximately 10 techniques have been evaluated, from which a range measurement system was selected.

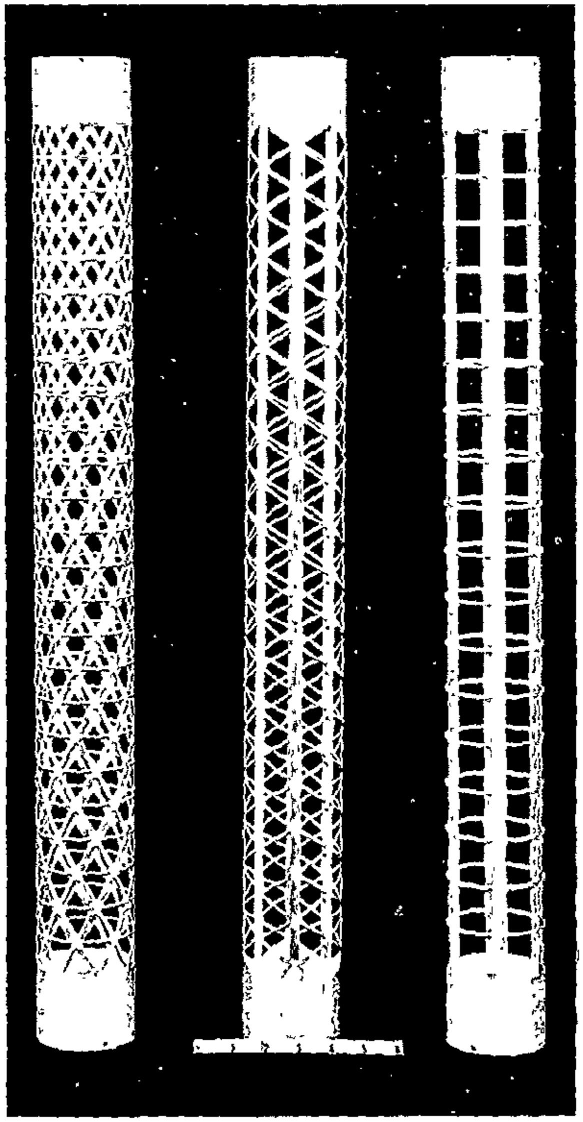


Figure 5-2. Perforated Tubular Aluminum Truss Sections

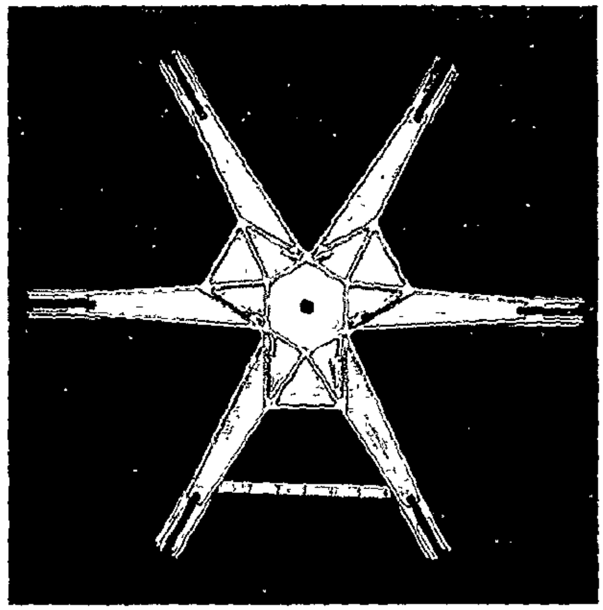


Figure 5-3. Magnesium Spider Element

A block diagram of the amplitude modulated laser instrument is shown in Figure 5-4. Coherent light energy is supplied by a laser. The beam passes through a set of KDP (potassium dihydrogen phosphate) amplitude modulators, which modulate the light. These devices consist of an optical cavity that functions on the same principles as a traveling wave tube. KDP has this property of changing the polarization of light passing through it when it is in an electric field. Modulation of the electric field modulates the polarization angle of the light, hence giving the laser-beam amplitude modulation.

The modulated light beam is then directed toward a set of mirrors that reflect the beam toward the antenna surface. The antenna mesh surface diffusely scatters the incident light energy; however, sufficient reflection is returned to the collecting mirror since the mesh is woven of wire with a circular cross section. The weak reflection is then directed to a collecting lens, passed dhrough a narrow-band pass filter, and focused on the photo-multiplier amplifier. The signal is then compared to the reference signal from the modulation driver in a sensitive phase detector. Cancellation of the phase modulation yields a direct current voltage that is directly proportional to the distance covered by the laser light beam.

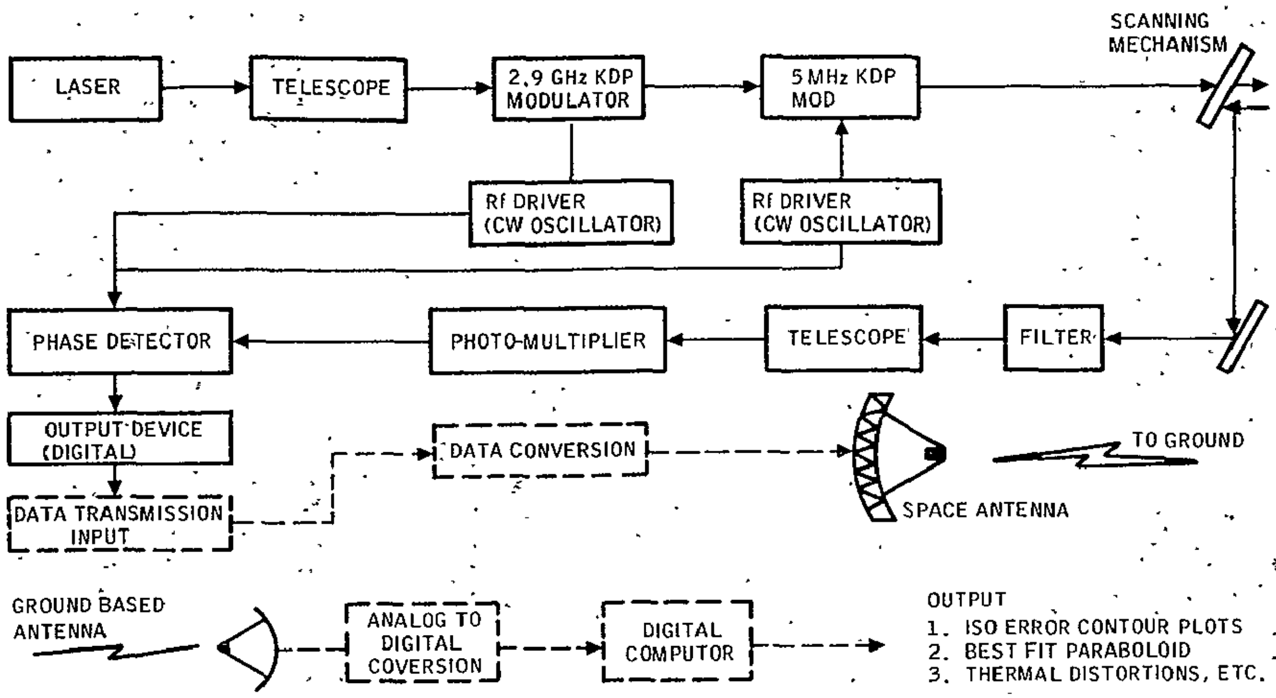


Figure 5-4. Antenna Tolerance Measurement Diagram

In a sense, the technique is analogous to FM radio broadcast wherein the high-frequency carrier is modulated over a bandwidth equal to the audio frequency range. The laser operates at a high frequency with wavelengths in the order of 0.63 microns. The modulation frequencies used for the measurement task are 2.9 GHz and 5 MHz.

The modulation frequency determines the resolution to be expected. A 100-foot-diameter truss antenna is expected to achieve a contour in the order of 0.125-inch RMS of an ideal paraboloid. Measurement of the surface should be done with resolution at least ±0.010 inch over the range of 40 to 60 feet. Amplitude modulators currently available from Sylvania indicate that 2.9 GHz will exceed the ±0.010-inch requirement. Once the frequency of the amplitude oscillator is known, distance measurements are straightforward and consist of making phase comparisons at the selected frequency between the reference and the probing beam. The effective resolution is given by:

$$X = \frac{1}{2} \cdot \frac{\phi}{360} \lambda$$

Where ϕ is the minimum resolution measured by a phase detector, acquracies of one degree are readily obtainable. λ is the wavelength of the modulation frequency. For 2.9 GHz,

$$\lambda = \frac{11,808}{2,900} = 4.08 \text{ in.}$$

The factor of one-half is present since the light must traverse the path difference twice in order to be collected by the detector. Then, the resolution is:

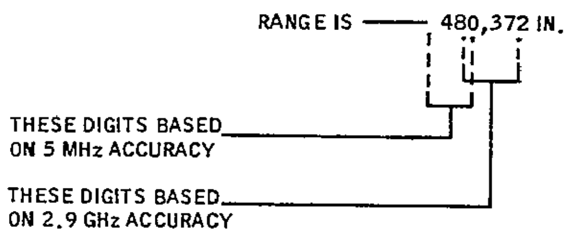
$$X = \frac{1}{2} \cdot \frac{4.08}{360} = 0.00565 \text{ in.}$$

This resolution then yields an accuracy of one part in one million.

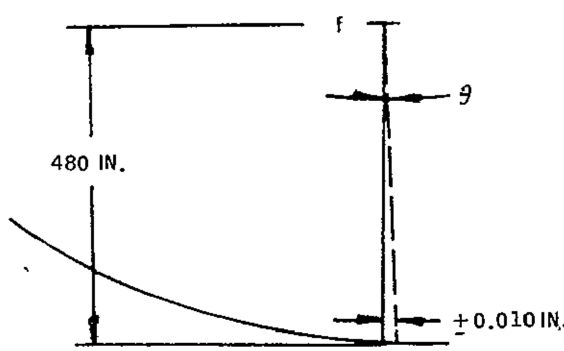
To eliminate the need for one absolute measurement from the instrument to the reflector vertex, another modulator superimposes a frequency of 5 MHz on the beam. At this frequency resolution is:

$$X = \frac{1}{2} \cdot \frac{1}{360} \cdot \frac{11,808}{5} = 3.3 \text{ in.}$$

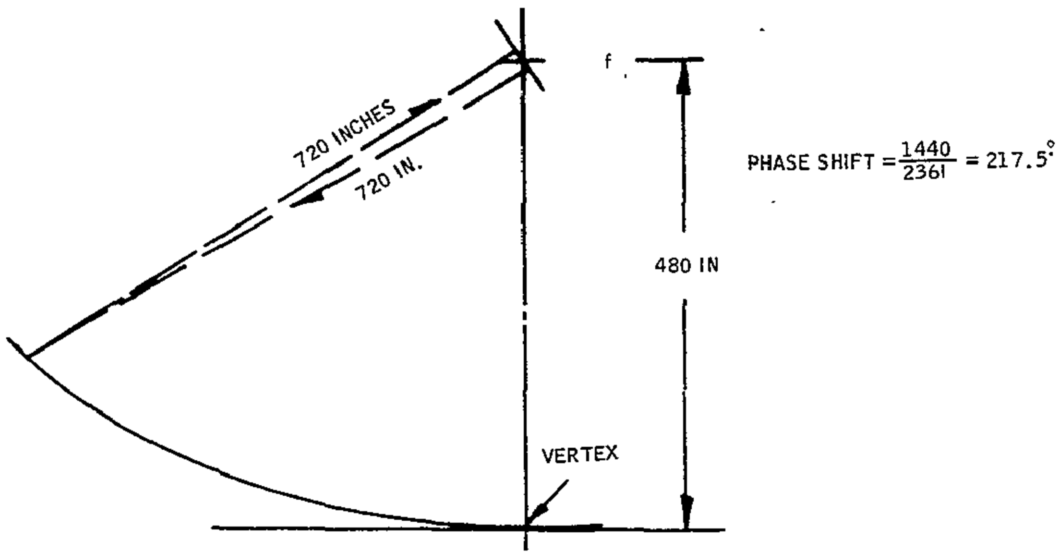
As an example, assume the device indicates the following measurement.



There is a one-digit overlap in the measurement, which makes the range measurement self checking. The wavelength at 5 MHz is 2,361 inches. Distance to a 100-foot reflector varies between 480 inch (40 feet) at the vertex to 720 inches (60 feet) at the periphery. Assuming measurements are normalized at the vertex, the phase detector would indicate a zero-degree shift at the vertex and approximately a 217.5-degree shift at the periphery. Since this only varies between 0 and 218 degrees, not beyond 360 degrees, range is absolute.



The scan technique proposed for measurement of the reflector surface is based on the spherical coordinate system. Consider the laser beam pointing exactly at the vertex. For example, an antenna with f/D = 0.4 and a diameter of 100 feet, the focal length is 40 feet or 480 inches. To preserve range accuracies, an arbitrary lateral uncertainty of ±0.010 inch was established as a system requirement. Thus,



Angular resolution is calculated to be

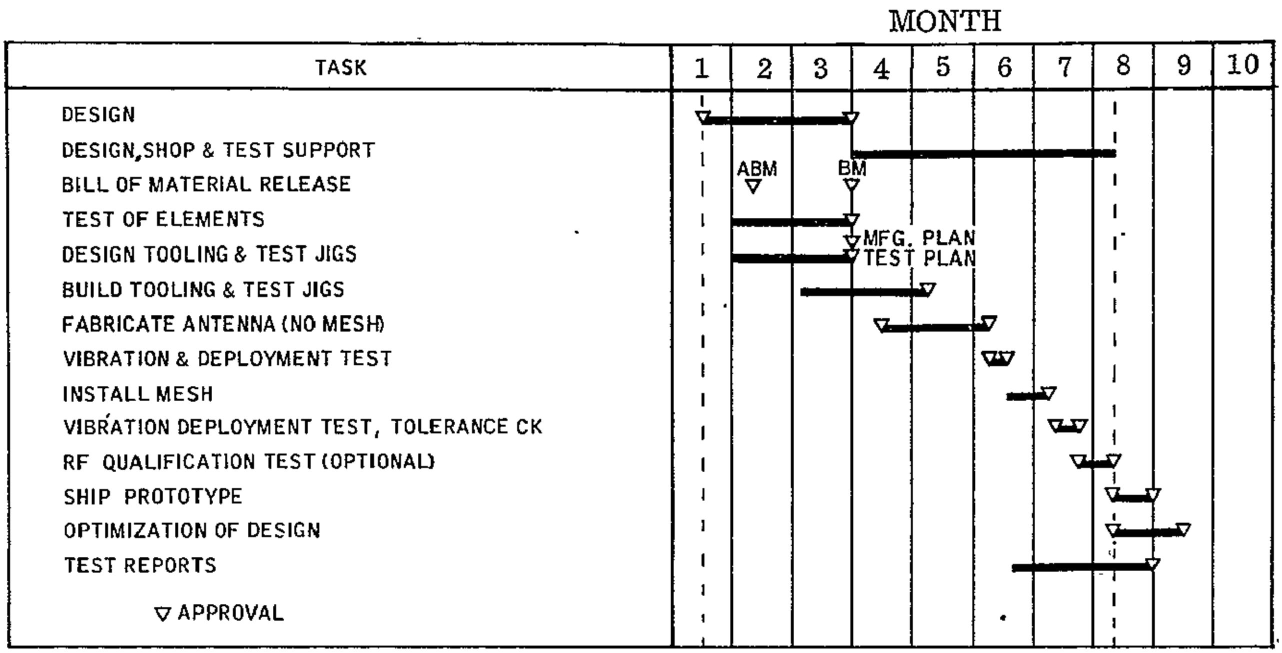
$$\theta = \frac{S}{r} = \frac{0.010}{480} = 0.0000209 \text{ radians}$$

One compact device that is capable of this magnitude of angular resolution is known as the Phasolver, produced by the Whittaker Corporation. The Phasolver precisely measures mechanical displacement by electronic means. As developed, the Phasolver is a highly accurate encoding system that converts minute mechanical movements into large electrical phase shifts. These phase shifts can be displayed in analog form or can be digitized to provide the position of an antenna, star tracker, cinetheodolite, or any similar device. The system is applicable to both linear and rotary measurement.

5.2 MANUFACTURING PLAN FOR 30-FOOT- to 50-FOOT-DIAMETER ANTENNAS

Manufacturing and testing must be integrated to ensure that the deployable antenna is acceptable for each suceeding phase. Figure 5-5 illustrates a combined program.

5.2.1 <u>TYPICAL SCHEDULE</u> — Major manufacturing milestones are shown in the program schedule below. The manufacturing plan is based on a single-shift operation except in those areas where schedule requirements necessitate a second shift. A single-shift operation is preferable since it limits the number of persons assigned to the program, affords closer control, and leads to greater product reliability.



5.2.2 TOOLING — Tooling is required to ensure alignment and tolerance control of antenna components and inspection of the completed antenna. Following is a list of major tools required to support the manufacture of 30-foot reflector.

Quantity	Tool	Description
2	Drill jig	Drills strut-attach holes in upper and lower spiders.
2	Drill fixture	Locates and drills hinge components for surface struts and diagonals.
4	Assembly fixture	Locates hinge joints, tube sections, and end fittings for maintaining precise overall length of diagonal struts.
21	Assembly fixture	Locates hinge joints, tube sections, and end fittings for maintaining overall lengths of surface struts as determined by computer.
1	Assembly fixture	Fixed support tool mounted on air-bearing-equipped turntable has fixed locators for three center lower surface spiders and adjustable supports for remaining lower surface spiders..
1	Inspection gage	Bridge type tool, supported on either end, spans complete reflector, permitting it to be rotated underneath the bridge. Contour template mounted on the bridge together with mechanical or electro/optical inspection equipment will be used to set and inspect mesh contour.

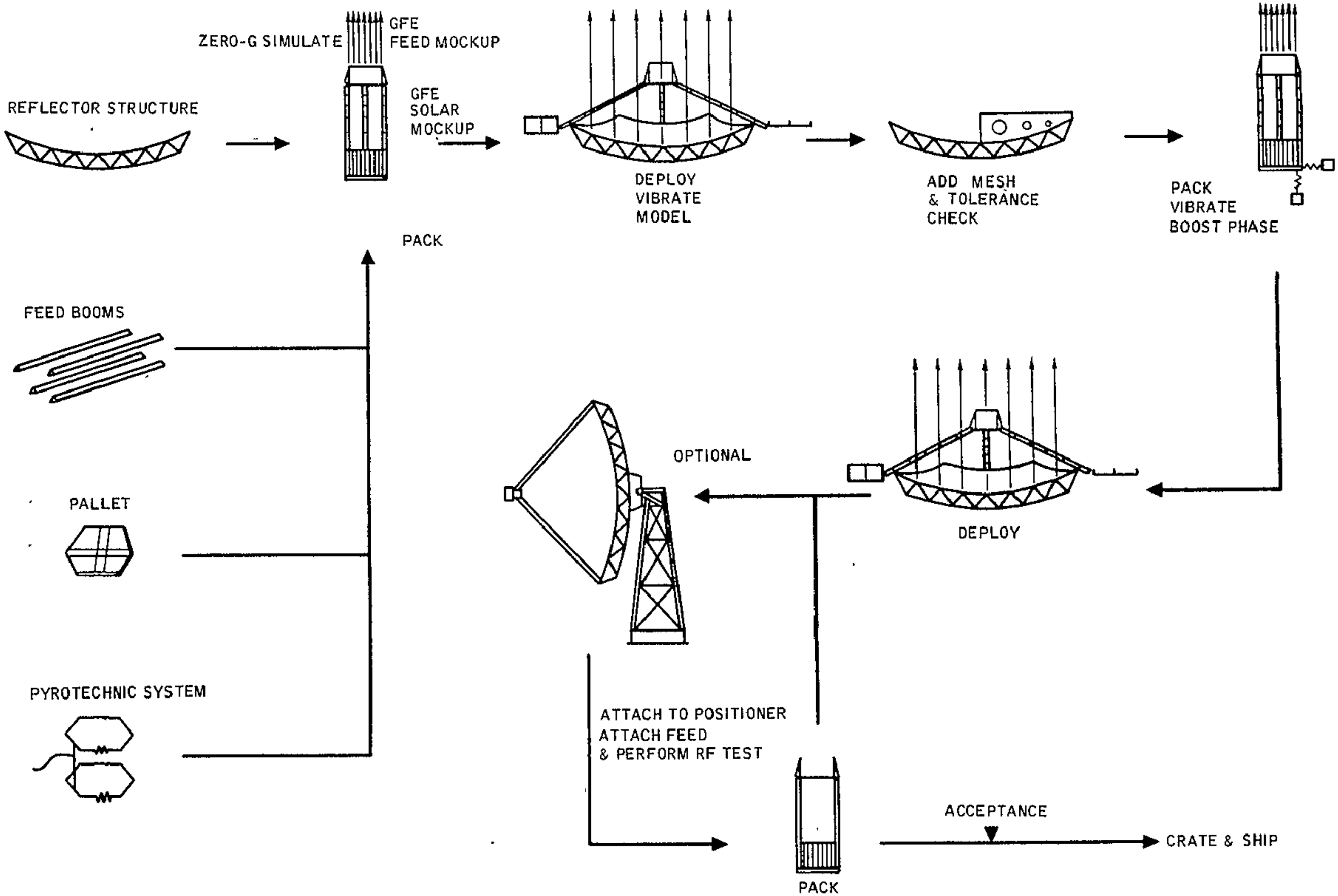


Figure 5-5. Manufacturing and Test Plan for Optimum Configuration

5.2.3 REFLECTOR FABRICATION — Fabrication of the expandable truss is well within the aerospace industry state of the art. Prevention of tolerance buildup through close control of each element of fabrication is the key factor. Elements of the fabrication cycle include:

a. Subassembly hinge joints in special fixtures to ensure alignment of components. Test hinge action.

b. Assembly hinge joints, tubular strut sections, and end fittings in precision assembly jig to fixed overall dimensions established by computer. Equal lengths will be mounted from hinge joints to end fittings by the jig.

c. Numerical-control-mill spider fittings and jib-drill strut-attach holes to ensure dimension control.

d. Locate and assemble the three central lower surface spiders and struts, three diagonals and the central super surface spider on a pedestal type assembly fixture (Figure 5-6).

e. Assembly remaining truss elements in a stress-free fit, working from the center section out. Temporary pedestal supports will be provided for lower spider fittings until struts are all attached, at which time the antenna structure will be self supporting from the center.

f. Subassemble mesh elements to final contour with integral tape pulldown points.

g. Install mesh and attach to tapes. It should be noted that discrepancies in the basic truss from the true geometric shape will be corrected by the mesh offset adjustments. The entire operation will be performed in a constant-temperature room at 70° ±2° F (Figure 5-7).

h. Adjust mesh to contour at the tie points. Initial adjustment will employ a solenoid-actuated electrical probe mounted on the mesh sensor carriage. Probe settings (in the advanced position) will be provided for selected points on the theoretical contour of the reflector.

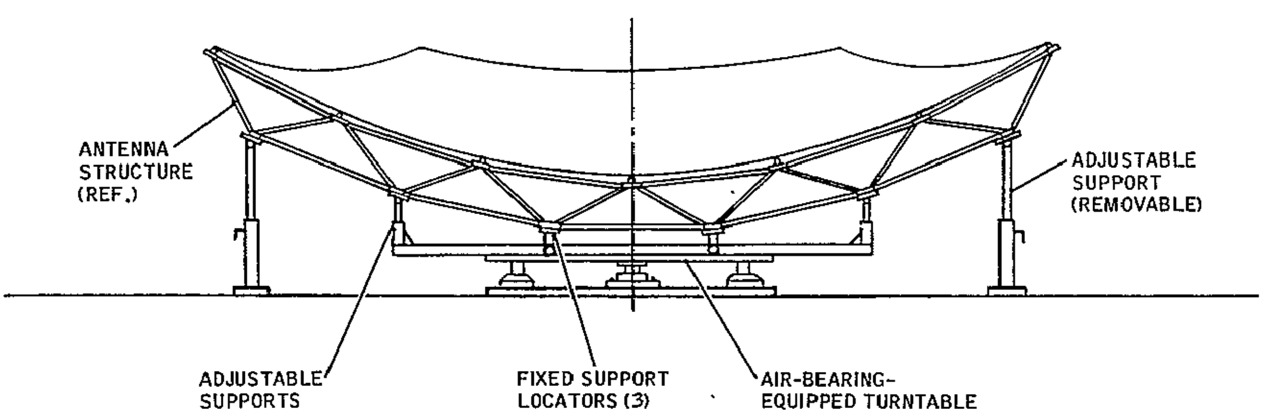
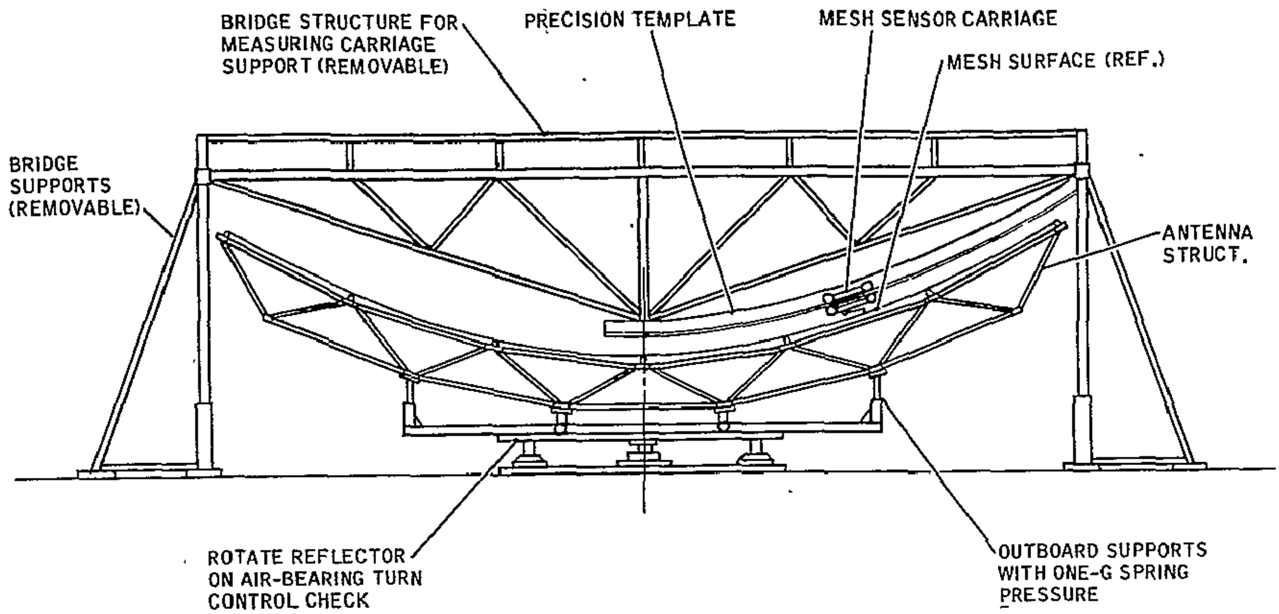


Figure 5-6. Reflector Structure Assembly



MEASURED RUNOUT ON EXISTING AIR-BEARING TURNTABLE	FLATNESS ± .002 IN.	CIRCULAR ± .001 IN.
ANTICIPATED TRUE POSITION OF MEASURING PROBE	± .005 IN. WITH RESPECT TO REFLECTOR CONTOUR	
ANTICIPATED ADJUSTMENT TOLERANCE	± .005 IN. WITH RESPECT TO MEASURING PROBE	

Figure 5-7. Reflector Mesh Adjustment Setup

Adjustment will consist of advancing the probe to its proper position, then tightening the web tension ties until electrical contact is broken. Settings will be made for all points on a given radius before advancing to the next radius. The adjustment process will be continued until all of the approximately 432 points have been set.

Final adjustments of the mesh will be made after substituting an electromechanical sensing probe, with direct signal readout, or an optical device with TV remote view system for the electrical probe.

i. Measure contour of final adjusted reflector mesh on 8.5-inch (approximately) radial increments, employing the electromechanical sensing probe or optical device. Record results on single-channel strip chart recorder, if feasible.

Note - Both methods of contour measurement will be evaluated with respect to cost, reliability, and recording of results. The selected system will be installed on the inspection tool.

5.2.3 TESTS — Tests will be performed on the full-scale prototype antenna to demonstrate that the antenna will successfully:

a. Withstand ground handling, checkout, launch, and orbital environmental conditions.

b. Deploy in orbit.

c. Respond to prescribed attitude control dynamic parameters.

d. Meet specified weight and balance requirements.

e. Meet specified RF requirements.

Tests will also be performed on structural samples to verify basic design limits of components.

The test specimen is the full-scale prototype antenna. Accessory test specimens will be required, and will include such items as the feed support and experiment packages, plus any unique interfacing connectors or hardware. Test specimens for the structural sample test include basic components of the structure and reflective surface.

5.2.4.1 Test Plan — The test plan is based on meeting specified requirements, technical needs, and cost and logistics goals. Testing will be divided into two categories: structural sample tests and full-scale prototype tests.

5.2.4.2 Test Procedures — Detailed test procedures covering each full-scale prototype antenna test are required. The test procedures will include sketches of each proposed test setup, block diagrams of proposed instrumentation, sample data sheets, and a step-by-step sequence of testing events. The reduced test data, in graphical form where applicable, and test results will be integrated into the procedure volume. A chronological log will be maintained indicating the duration and preliminary results of all full-scale tests and significant handling events.

5.2.4.3 Testing — The sequence of testing is established to demonstrate the mechanical design concept and fabrication techniques, to demonstrate structural integrity during simulated launch environment, and to measure the mechanical dynamic characteristics, then to measure RF characteristics. (Test sequence is shown in Figure 5-5.)

a. Structural Sample Tests — The sample will consist of a representation section of the reflecting surface and its supporting structure. Specimens tested will include:

   Antenna hinge

   Antenna bearing

   Antenna mesh

   Antenna strut

   These components will be subjected to the following tests to determine the suitability for use in the proposed design:

1. Structural Design Limits — These tests will verify the basic design limits of components, such as lock breakaway loads, mesh and eyelet tear-out strengths, bearing brinelling loads, joint deflection loads, column load on feed boom and support strut in packaged configuration, and the ultimate strength of each component. The structure sample will be mounted in a suitable fixture and subjected to a static loading test program. Both single and combined loading will be used. Choice of loads, manner of application, increments used, and the parameters measured will be those most advantageous in determining the strength, deflection and localized surface distortion, residual deflection and surface distortion, and flexural rigidity. These tests will be performed at ambient conditions.

2. Environment Tests — These tests will expose the selected components to a simulated space environment. The effect of the surface finishes will be measured. The thermal characteristics can be demonstrated by the exposure to simulated solar radiation while the samples are in the space environment chamber. The moving parts of joints and lock mechanisms will be investigated for potential problems with lubrication after exposure to high vacuum for times equal to the scheduled launch program.

3. RF Reflectivity Measurement — RF test for determining the reflectivity of antenna surface material will involve a comparison of relative power levels reflected from a material of known reflectivity (copper) and that from the test sample.

b. Full-Scale Prototype Tests — The full-scale prototype tests will be performed as follows.

1. Deployment Test — The prototype will be folded in a packaged configuration following assembly, with no mesh, and will be activated in the operating deployment mode. This will be done under simulated zero-g conditions. Each of the 37 spiders (see Figure 5-8) will be supported by a wire to an overhead trolley. Each rail will be shaped to maintain constant tension on each support wire to each spider. The electric-motor-driven trolleys will keep the support wire vertical. At full deployment, the truss struts and joints will be effectively stre stress free. Camera coverage will be used during the deployment operations. At least one additional deployment test will be made with the mesh installed.

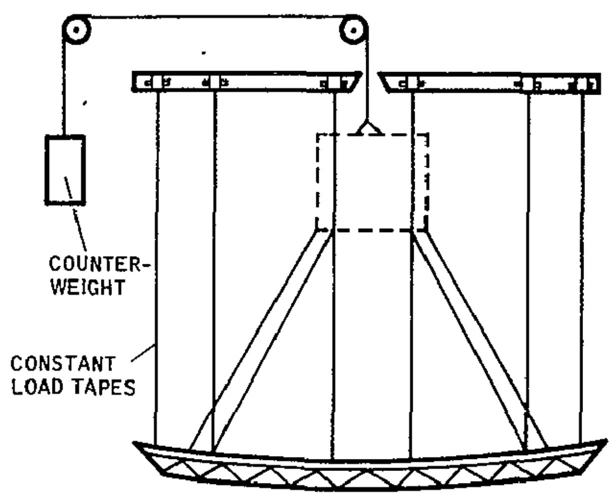


Figure 5-8. Deployment in a Zero-g Field

2. Vibration Survey, Deployed, Without Mesh — The test specimen, consisting of all components except the reflective mesh, will be suspended from overhead members by compliant systems attached to the most massive specimen sections. The suspension-spring/specimen-mass system will have the lowest possible natural frequencies. Because there may be natural specimen modes at frequencies. Because there may be natural specimen modes at frequencies lower than the limits of a practical suspension system, the suspension modes will be extensively investigated and monitored during this free-free test.

The test specimen will be oriented with the thrust axis vertical. As shown in Figure 5-9 low-frequency exciters will be attached through load transducers to the spacecraft area near the attitude control thrusters. Sensitive low-frequency accelerometers will be attached to the specimen in the feed area and on the antenna dish. Torsional forces about the thrust axis will be introduced and modes defined from the acceleration response in the frequency range from 0.1 to 20 Hz. While employing the low-frequency, lightweight exciters for the free-free test, damping will be determined with the logarithmic decrement technique from response-decay records obtained after the ex- exciter armature circuit is opened.

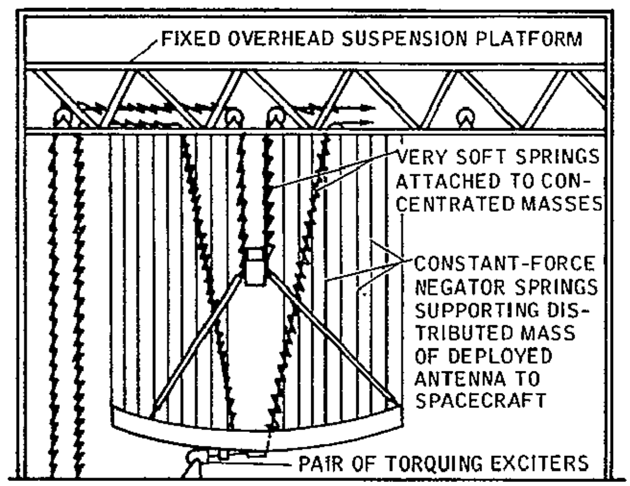


Figure 5-9. Suspension System for Zero-g Free-Free Torsional Survey

Rather than incurring the costs and loss of schedule control inherent in conducting part of the deployed mode vibration survey in a chamber at 10^{-1} Torr, Convair would perform the vibration modal surveys on the full-scale prototype with the reflective mesh not installed. This is feasible with the truss system because the mesh is not part of the primary antenna structure. By demonstrating in a worst-case condition (i.e., without the damping of the mesh material) that antenna structural response is compatible with the attitude control dynamic parameters, the intent of the specifications will be met.

Equivalent viscous damping in the expandable truss antenna while in orbit would be contributed by the classical sources of material deflection and relative motion between contacting surfaces. The mass of the mesh will contribute less than 10 percent to the projected antenna mass. The stiffness of the mesh will also be small; consequently, the dynamic test results without the mesh will be comparable to actual orbital response.

3. Vibration Survey, Translation and Torsion, Stowed, With Mesh

(a) Translation — The antenna assembly (boom supports and reflector) will be attached to an existing rigid fixture that will be modified to accept the test specimen at the antenna feed module. The translation survey will determine major mode shapes, damping, and frequencies in the frequency range from 5 to 2000 Hz in the three orthogonal axes.

(b) Torsion — The test specimen, consisting of the components used during the translation test, will be firmly attached to a rigid vibration fixture that is constrained to rotation about the thrust axis. Phase-locked, coupled forces will be applied to the fixture. Significant torsional mode shapes and modal frequencies in the range from 5 to 150 Hz will be measured. Lower frequencies will be investigated if deemed advisable. Modal damping will be determined from empirical acceleration transmissibility ratios.

(c) Instrumentation — Control instrumentation will consist of three accelerometers rigidly attached to the vibration fixture and oriented in orthogonal directions; one will be sensitive to acceleration in the direction of excitation. Into the automatic control system will also be fed selected signals from response-measuring accelerometers. The weighted signal of maximum amplitude will be automatically selected by the excitation servocontrol to limit both the excitation and response to predetermined amplitudes.

Control and response acceleration channels plus a frequency and a voice channel will be recorded simultaneously on magnetic instrumentation tape. Direct-writing records will be employed at the test control center for real-time data evaluation.

The direct records will be examined, and frequencies of increased transmissibility noted. At those frequencies of indicated modes, low-level excitation will be repeated and steady-state conditions sustained long enough to obtain mode definition with a roving transducer. Tuned band-pass (tracking) filters will be used during the mode definition phase.

4. Vibration Flight Loads, Stowed — The specimen, packaged in the launch configuration, will be subjected to translational vibration test conditions simulating the predicted launch environment. This test will demonstrate the structural integrity of the packaged assembly.

The antenna will be mounted to a rigid fixture as it is during the vibration survey and excited from 5 to 2,000 Hz, sinusoidal and random, at specified amplitudes. The excitation amplitude will be at anticipated flight loads (approximately 1.5 g rms) and will be reduced at frequencies that cause unrealistic specimen response. This reduction or notching must be provided to compensate for the mechanical impedance of the rigid fixture versus the impedance of an actual spacecraft/launch vehicle.

The specimen will be subjected to prescribed test conditions along the thrust axis and along two transverse axes.

5. Deployment, With Mesh — Following all vibration tests and with the reflective mesh installed, the antenna in a packaged configuration will be activated in the operating deployment mode. This task will be performed in the same manner as the initial deployment test.

6. Weight and Balance — The antenna assembly will be weighed and in the deployed mode statically balanced about two transverse axes. Balancing will be performed while the antenna is in the deployment fixture.

7. RF Performance Test — RF tests of the deployed antenna should be conducted on an antenna range of the following description.

$$\text{Length} > \frac{2\,D^2}{\lambda} = \frac{2\,(30)^2}{1.48/12} = 14,700 \text{ feet}$$

At one end of the range a target transmitter site will be established capable of transmitting at 8.0 GHz. This site will be approximately 3 degrees above the intervening terrain when viewed from the opposite end of the range. A fixture will be placed at the receiving end of the range that has a capability of supporting the deployed 30 ft antenna structure in its approximate zero-g shape and rotating the antenna a minimum of ±20 degrees azimuth and ±12 degrees in elevation with respect to the line of sight between the transmitter site and the antenna. The test fixture angular position capability will provide positioning increments of 0.01 degree and provide for recording these positions at greater precision than 0.01 degree. A sketch of the basic antenna range described above is shown in Figure 5-10.

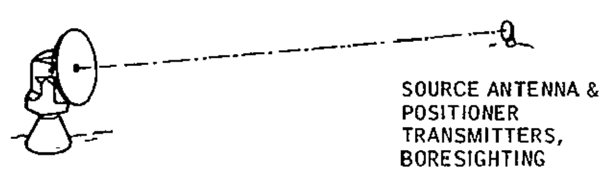


Figure 5-10. Typical Pattern Range

(a) RF Test Equipment and Facilities — Table 5-1 lists test equipment requirements and equi equipment and facility required.

(b) RF Test Program — Radiation patterns will be recorded and gain measurements taken with a primary feed (focused condition at 8 GHz) to establish the integrity and verify gain performance. Antenna patterns will be recorded for the two principal planes. Absolute gain will be determined by comparing the gain of a calibrated antenna to the antenna under test. This will be accomplished by superimposing a pattern of the standard gain antenna over the pattern of the erectable antenna so a direct comparison is presented.

Table 5-1. Test Equipment Required for RF Test

ITEM	DESCRIPTION	AVAILABILITY AT CONVAIR
Transmitter Site	Parking area for mobile unit	Remote site (lease)
1. Transmitter (1)	8 GHz, 1 watt	Available
2. Antenna (1)	Parabolic reflector antennas	Components available
3. Shelter (1)	Truck or trailer	Convair has suitable vehicles with generators
4. Power Supply (1)	1 kw portable generator	Available
Test Site		
1. Positioning fixture	To support prototype in zero-g configuration & control environment of reflector surface	Modification of existing Convair basic structure necessary
2. Test antenna feed	8 GHz focal point feed	Convair will build
3. Standard gain antenna	8.0 GHz	Available
4. Receivers	Antenna range broadband receiver (with range gating function)	Available Convair property
5. Recorders	Antenna pattern recorder	Available Convair property
Communication System	2 citizen-band handy-talkies with 7-mile range	Availability not determined

(c) RF Test Procedures — Complete procedures will be written for the RF test. A typical test procedure requirements is outlined as followes.

Antenna Gain

The purpose of this test is to demonstrate that the antenna satisfies a minimum gain requirement at 8.0 GHz.

Procedure (Single Measurement)

1. Connect the signal generator to the vertically polarized source antenna.
2. Connect the feed output (vertical polarization) to receiver (mixer) and recorder.
3. Point the antenna toward the linear source and tune the receiver for maximum signal.
4. Boresight the antenna (focused feed).
5. Record an azimuth pattern of the main beam for elevation of (4) above.
6. Change the mixer and cable connections from the feed output to the standard gain horn.
7. Without changing the gain controls, superimpose an azimuth pattern of the standard gain horn over the pattern obtained in (5) above.

8. Calculate gain as follows:

$$\text{Gain} = G_H + \Delta G$$

where:

G_H = absolute gain of standard gain horn minus the measured loss between mixer and standard gain horn and the VSWR loss of the horn measured at the input to the horn.

ΔG = difference in peak values between the feed pattern of (5) and horn pattern of (7).

5.3 TYPICAL MANUFACTURING PLAN FOR 10-FOOT- TO 30-FOOT-DIAMETER ANTENNAS

5.3.1 ASSEMBLY — Final assembly and testing of the antenna would be performed in a temperature-controlled area. Functional testing would be integrated with assembly operations to minimize handling. The following assembly and test sequences will be employed:

a. Progressively assemble reflector surface spiders, surface struts, diagonal struts, rear surface spiders and surface struts in deployment fixture shown in Figure 5-11.

b. Attach negator springs, unbolt upper structure, lift from base, using overhead crane, and position on floor.

c. Fold antenna and deploy.

d. Reposition upper structure on fixture base, install base-plate assembly and A-frame strut assembly.

e. Attach support cable to base plate, remove upper structure and position on floor.

f. Fold antenna and deploy.

g. Remove structure assembly portion of deployment fixture, disconnect antenna from support structure, turn over, position on deployment fixture resting on base plate. Remove three sections of feed tube assembly and insert sweep template.

h. Apply mesh tape.

i. Progressively install reflector mesh and adjusting cables, working from the center out. Establish contour using sweep template.

j. Remove sweep template, reinstall feed tube, turn antenna over, attach negator springs.

k. Fold antenna and deploy.

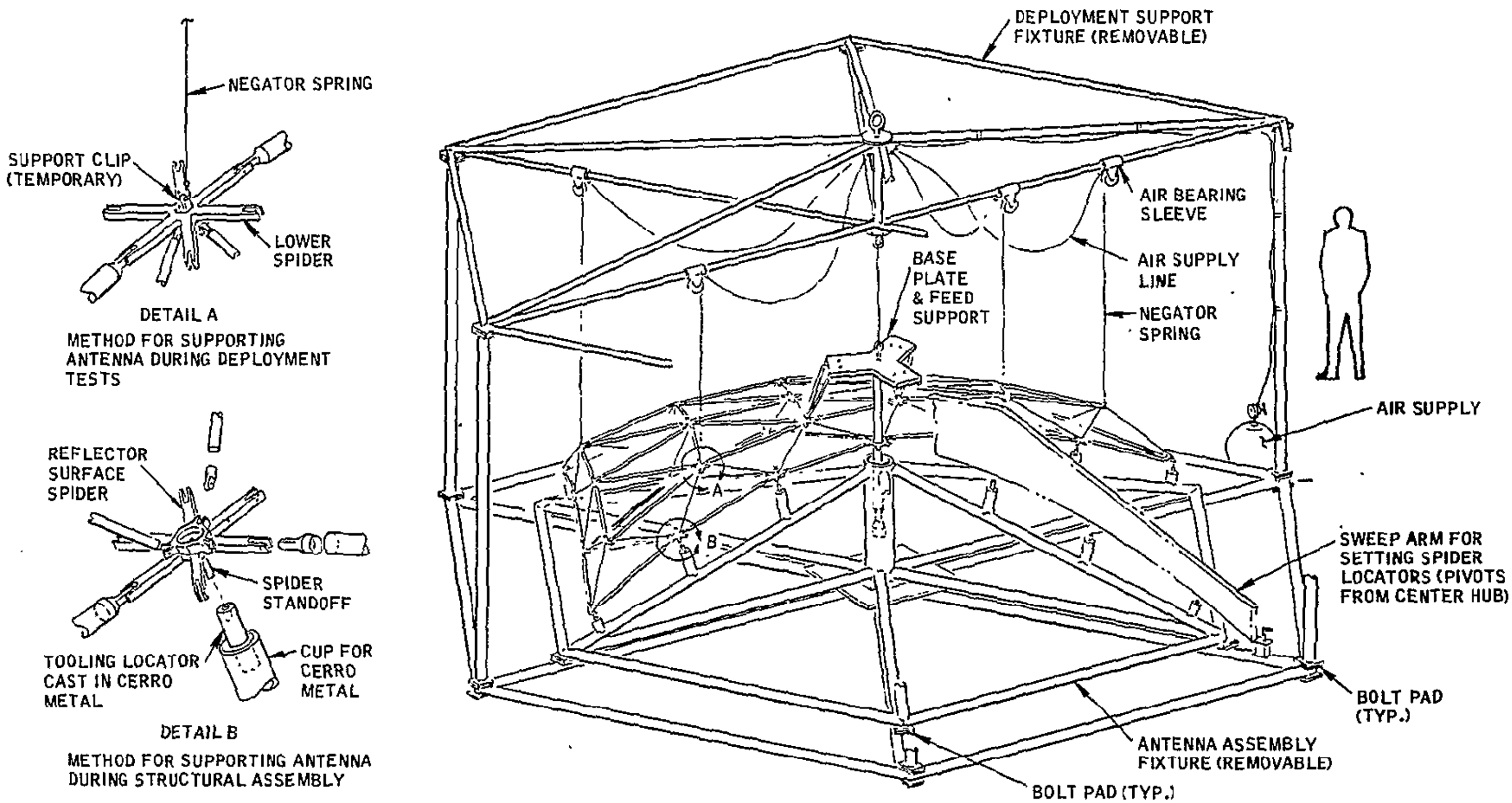


Figure 5-11. Antenna Assembly and Deployment Test Fixture

Major spiders will be numerically milled from magnesium plate stock. A drill jig will be used to drill the strut attach holes in the milled spiders to insure that hole spacing and geometry is held to a tolerance of ±0.002 inch. Minor spiders will be conventionally machined using a turret lathe, Hydrotel mill, and a jig borer. No special tools will be required.

End fittings for surface and diagonal struts will be conventionally machined using a turret lathe, horizontal mill and drill press. Tubular struts will be sawed to length, masked, and chem-milled to reduce the 0.028-inch stock wall thickness to the required 0.015-inch wall thickness. Strut hinges will be blanked and formed from 0.020-inch-thick aluminum sheet stock. Hinges will be line drilled as matched sets in a special drill jig. Strut ends and hinges will be bonded to tubes. A bond fixture will be used to maintain a tolerance of ±0.002 inch on established center distances and hold the parts in alignment during assembly.

A-frames will be assembled from conventionally machined rod ends and chem-milled struts. A special bond fixture will be used to hold components in alignment during the bond operation. The same fixture will also be used for welding struts. The base plate will be conventionally milled from one-inch-thick magnesium plate. Attach hold patterns for A-frame attach fittings will be machined from aluminum bar stock and bolted to the base plate after prime and paint.

5.3.2 TEST PLAN — The objective of the test plan is to demonstrate that the antenna will successfully accomplish the following:

a. Withstand ground handling, checkout, launch, and orbital environmental conditions.

b. Deploy in orbit to required contour within prescribed tolerances.

c. Operate to required performance parameters in a space environment.

d. Provide a test bed for astronaut demonstration of requirements for adjustment, repair, and inspection of space structures.

The test plan is summarized in Figure 5-12.

5.3.2.1 Phase I - Development Testing — These element, component, and subassembly level tests will evaluate the design before design freeze and drawing release. This evaluation includes material selection, design concepts and factory processes. Phase I fabrication and test sequence is shown in Figure 5-13.

Elements

Certain elements of the basic structure require testing to evaluate design parameters. The hinge joints of the surface struts are a good example. Load testing to determine column buckling is necessary. The effects of thermal distortion on the surface struts

	STRUCTURAL	GROUND EQUIPMENT	LAUNCH/BOOST ENVIRONMENT	FUNCTIONAL	SOLAR RADIATION	SPACE VACUUM	INTERFACE CHECK	VIBRATION MODAL SURVEY	DYNAMIC OPERATION	PACKAGING	DEPLOYMENT IN AIR	DEPLOYMENT IN VACUUM	PACKAGED VIBRATION	RF EVALUATION	ACCEPTANCE
PHASE I															
REFLECTOR STRUCTURE ELEMENTS	▼	▼		▼	▼	▼									
REFLECTIVE MESH SAMPLE					▼	▼								▼	
A-FRAME/FEED COLUMN DEPLOY. MECH.				▼						▼	▼				
REFLECTOR ADJUSTMENT MECH.				▼											
PHASE II															
ELECTRONICS		▼	▼	▼	▼	▼	▼								
PROTOTYPE ANTENNA					▼		▼	▼	▼	▼	▼	▼	▼	▼	
PHASE III															
FLIGHT ANTENNA										▼	▼		▼	▼	▼

Figure 5-12. Test Plan Summary

and diagonals at simulated space environment must also be investigated. The structural characteristics of these structural elements at ambient temperature must be determined. Tests will be conducted to provide this information. Samples of the reflective mesh will be exposed to simulated space environment. A comparison of reflectance before and after exposure will establish the existence or degree of degradation to be expected in a space environment.

The information derived in these tests will be used to develop the prototype components.

Mechanical

Certain mechanical design concepts will require early development testing to verify design:

a. Reflective Mesh Support and Adjustment — A sample of the reflective mesh support and adjustment design will be used to evaluate hardware and techniques.

b. Initial Deployment — A module consisting of the A-frame support, base plate, feed column, and first day of the antenna structure will be sued to verify the initial deployment sequence of the antenna structure and the feed column.

c. Antenna Flight Restraint and Deployment — A module representing the final antenna package shape with the deployment restraining and release mechanisms will be used to evaluate the release and initial deployment characteristics.

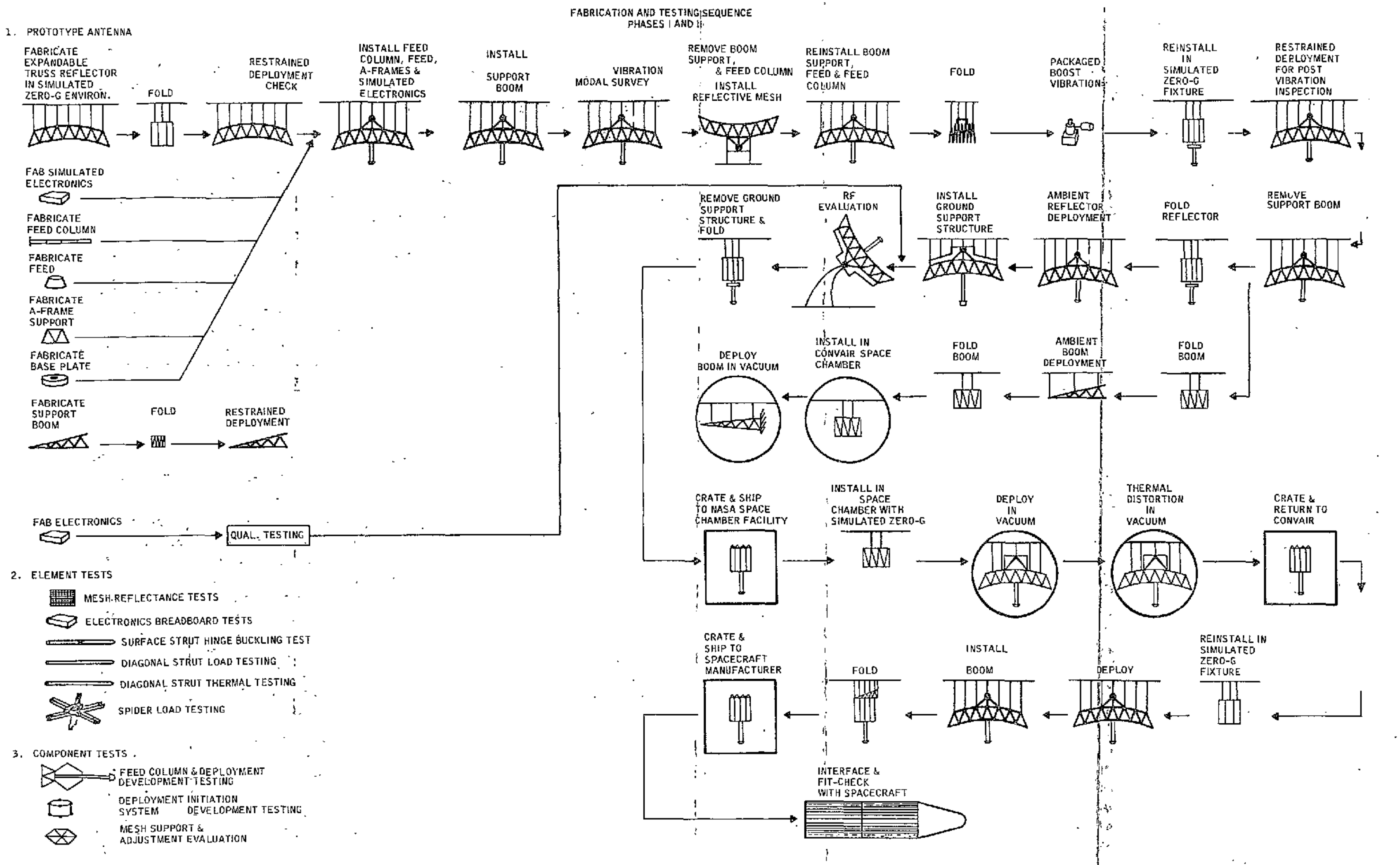


Figure 5-13. Phase I and II Fabrication and Test Sequence

FOLDOUT FRAME 1

FOLDOUT FRAME 2

5.3.2.2 Phase II - Prototype Testing — The component and assembly tests will demonstrate the operability of the antenna experiment. The integration of Phase II fabrication and testing is also shown in Figure 5-13.

Prototype Antenna

The prototype antenna consists of the basic reflector structure, the extendable feed support column, the feed, the base plate and the support A-frames. The reflective mesh is installed after the vibration modal survey testing.

The basic fixture for antenna assembly and testing provides a simulated zero-g environment. This is accomplished through constant-force negator springs and cable reel assemblies that are attached to air bearing sleeves. These sleeves can move freely on a network of tubing mounted overhead to provide antenna support in any position of deployment. The spring and reel assemblies are attached to the reflector structure at each spider on the back side of the antenna. Supporting the antenna in this downward-facing position eliminates the problem of supporting the reflective mesh in a one-g field. The fixture is shown in Figure 5-11.

The prototype antenna will be subjected to the following tests:

a. Vibration Modal Survey — The test specimen, consisting of the complete prototype antenna without the reflective screen, is supported in the simulated zero-g fixture, and is rigidly supported at the antenna spacecraft interface.

   Low-frequency exciters will be attached to the reflector structure. Sensitive low-frequency accelerometers will be attached to the reflector structure and feed column. Torsional forces about one axis at a time will be introduced and modes defined from the acceleration response. Damping will be determined with the logarithmic decrement technique from response decay records obtained after the armature circuit is opened. The vibration modal surveys are accomplished without the reflective screen rather than incurring the cost of testing in a chamber at 10^{-1} Torr. This is feasible since the screen is not part of the primary antenna structure. By demonstrating in a worst-case condition (i.e., without damping of the screen material) that antenna structural response is compatible with the dynamic parameters, the intent of the test will be met.

b. Packaged Vibration Survey Test — This test will be performed in the Convair Vibration Test Laboratory. The specimen is the complete antenna assembly with reflective mesh installed and packaged in the launch configuration. This package will be attached to a rigid fixture at the antenna/spacecraft interface. If a dynamic simulator or actual unit of the antenna/spacecraft adapter is provided as GFE in time for testing, it will be used to attach the antenna package to the rigid vibration fixture.

Testing will include surveys in the launch axis and both transverse axes. Hydrostatic bearings will restrain the excitation to colinear motion. Equivalent viscous damping factors for modes in the packaged configuration will be calculated from ratios of acceleration transmissibility.

c. Packaged Vibration Qualification Test — The complete antenna system packaged in the launch configuration will be subjected to vibration conditions simulating the predicted launch environment.

Following the vibration testing, the antenna will be reinstalled in the simulated zero-g support fixture in the fabrication area in the packaged configuration. The antenna will be slowly deployed by restraining the normal deployment forces. After full deployment, the antenna will undergo a thorough inspection to verify no damage resulting from the vibration testing. Following this inspection, the antenna will be repackaged to the predeployment configuration.

d. Ambient Deployment — Deployment of the support boom and the antenna reflector will be accomplished separately to avoid the complex support mechanism that would be required to provide a simulated zero-g environment for both. The antenna reflector with feed column, feed, and base plate is suspended in the simulated zero-g fabrication and test fixture pointing downward. Each spider is supported by a small cable to a constant-force negator spring/cable reel assembly attached to the airbearing sleeves overhead. During deployment the support cables sill remain vertical, and at full deployment the truss struts and joints will be effectively stress free.

This test demonstrates the process of the antenna reflector changing from the packaged mode to the deployed mode in a controlled atmosphere. Instrumentation will consist of ten 16mm-movie cameras operating at a speed of 400 frames per second.

e. RF Evaluation Tests — This test is required to test the reflective qualities of the mesh surface and the feed match. A structural support system is necessary to adequately support the lightweight reflector structure in the one-g environment. This support structure will be installed after the boom support and gimbal are removed. This structural support will also provide the antenna/facility mount adapter.

1. Pattern Measurements — The pattern tests will be conducted on the Convair antenna pattern range. At one end of the range, a transmitter site will be established capable of transmitting at 15 GHz. At 15 GHz the range distance required will be approximately one mile.

   At the receiving end of the range, a portable antenna mount located on top of Building 54 will be utilized to rotate the test antenna. The pedestal is capable of 360 degrees aximuth and $^{+90}_{-2}$ degrees of elevation. A protective housing consisting of a plastic-covered wood frame will eliminate the effects of wind currents on the lightweight structure. A pulse receiving system will be used to gate out undesired reflected signals.

RF testing will be conducted first with primary waveguide feeds to establish the integrity of the basic reflector. The space antenna feed will then be used to establish the RF characteristics of the experiment antenna. Patterns will be recorded over principal planes.

2. Absolute Gain Measurements — The same range is used for the gain measurements. The test provides a comparison of the gain of a standard antenna with the gain of the test antenna by superimposing the test antenna pattern over the standard pattern.

f. Deployment in Vacuum — The deployment testing in a high vacuum (10^{-4} Torr nominal) will follow the same basic approach as the deployment in air.

g. Thermal Distortion in Vacuum — The same test facility utilized for the reflector assembly vacuum deployment tests will be used. The vacuum requirement will be 10^{-4} Torr maximum. Solar radiation will be one solar constant with carbon arc lamps simulating solar side lighting on one side. This worst-case condition will provide the maximum thermal distortion. The purpose of this test is to evaluate the effects of thermal distortion in structural members on the quality of the antenna reflective surface.

h. Interface and Fit Check — Following completion of the thermal distortion evaluation, the reflector will be returned to Convair for reassembly. The complete antenna will then ve crated and shipped for verification of interface compatibility with the spacecraft mockup.

5.3.2.3 Phase III - Flight Antenna Acceptance — Testing of the flight antenna follows closely the testing previously conducted on the prototype antenna except that emphasis shifts from a demonstration of operability to flight-acceptance-type testing. For all acceptance tests, procedures are approved and tests documented for approval prior to flight. As in the development of the prototype antenna, the testing of the flight antenna is closely integrated with the manufacturing sequence. The manufacturing and test sequence is shown in Figure 5-14. The following major tests are included:

a. Packaged Vibration Qualification Testing — The complete flight antenna system, packaged in the launch configuration, will be subjected to vibration testing simulating the predicted launch environment.

The packaged antenna will be mounted to a rigid fixture at the antenna/spacecraft interface and excited over a range of frequencies at specified amplitudes simulating the launch environment. Vibration will be conducted first along the thrust axis and then along one transverse axis.

Following vibration testing, the antenna will be reinstalled in the simulated zero-g support fixture and allowed to slowly deploy under a partially restrained condition. A thorough inspection of the structure will be conducted.

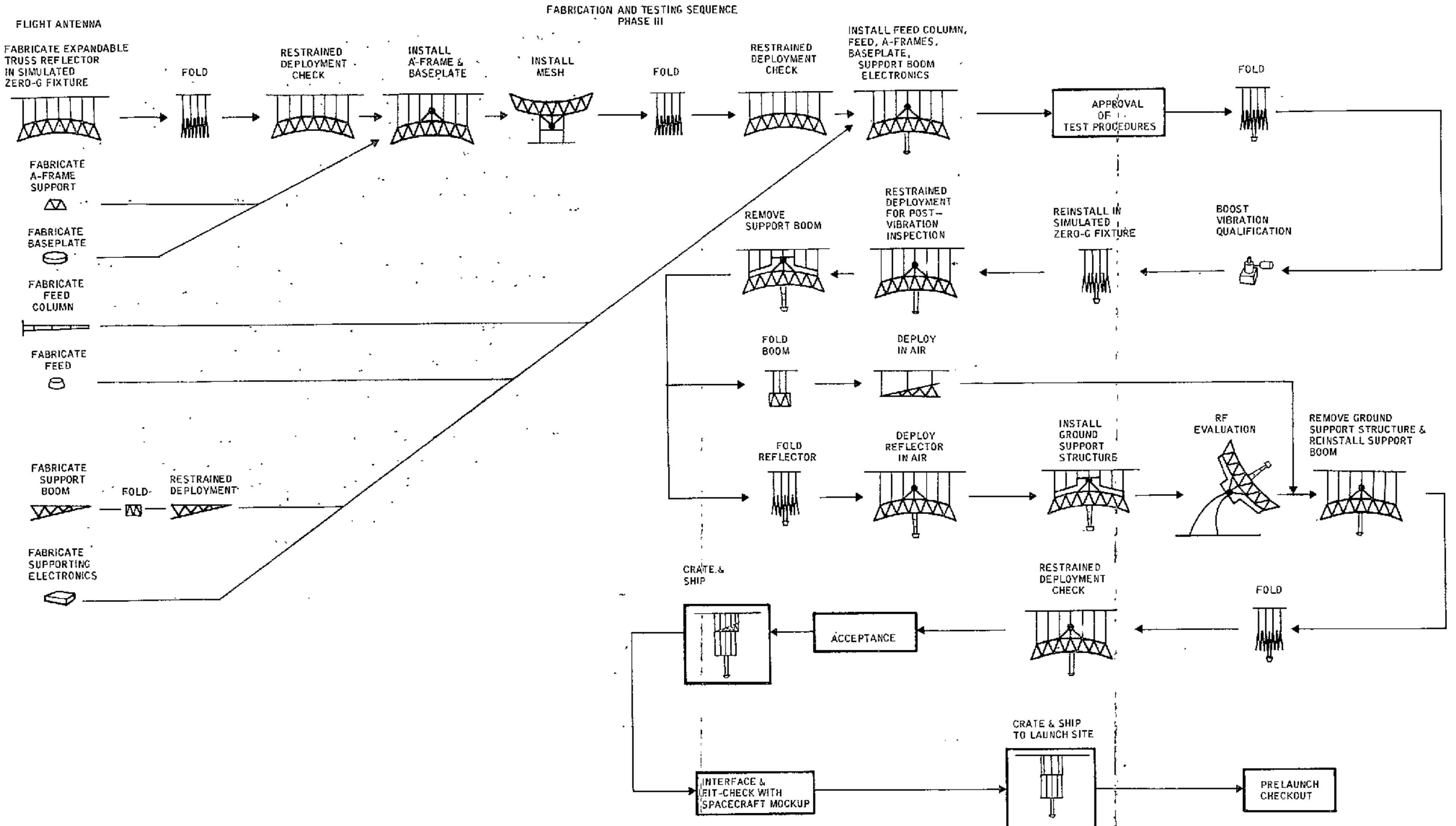


Figure 5-14. Phase III Flight Acceptance Sequence

FOLDOUT FRAME 1

FOLDOUT FRAME 2

b. Deployment in Air — Verification of proper deployment of the complete antenna is required. The reflector, A-frame, base plate, feed column, and feed make up the basic specimen for the reflector deployment test. The reflector is supported in the fabrication/test simulated zero-g fixture and pointing downward. Each spider of the reflector is supported by lightweight cables and constant-force negator spring assemblies attached to airbearing sleeves on an overhead network. During deployment the support cables will remain vertical, and at full deployment the truss struts and joints will be effectively stress free. Instrumentation will consist of ten 16-mm movie cameras operating at a speed of 400 frames per second.

c. RF Acceptance Testing — The purpose of this test is to position the feed mechanism to provide the optimum RF characteristics for the antenna and to provide a baseline for in-orbit performance. The same test range and test equipment used in the prototype antenna RF testing will be utilized for this test.

   1. Pattern Tests — RF tests will be conducted first with primary waveguide feeds to establish the integrity of the basic reflector. The flight feed will then be positioned to provide the optimum RF characteristics of the antenna.

   2. Absolute Gain Tests — The same range is used to perform absolute gain measurements. A pattern of the flight antenna is superimposed over the pattern of a standard gain horn to provide a direct comparison.

d. Spacecraft Interface and Fit Check — After completion of RF testing, the antenna is returned to the assembly and test area, where the ground support structure is removed and the support boom and gimbal reinstalled. The antenna is now ready for crating and shipping, for mating with the spacecraft. This final step in the acceptance cycle will verify proper mating of the antenna experiment with the spacecraft structure.

5.4 MANUFACTURING ABOVE 50-FOOT-DIAMETER ANTENNAS

Testing and manufacturing of components will be similar to the two previous plans that were described in some detail. The major difference is the size of the assembly facility. As the size increases the problems of maintaining an airconditioned constant-temperature (±5°F) facility increase. In addition the feasibility of testing increases because of the size of the reflector and the need for a distant target Figures 5-15 and 5-16 illustrate the techniques Convair has proposed for the large antenna fabrication. A more detailed discussion is presented in a prior study that was devoted to the 100-foot to 140-foot-diameter antenna sizes and the possible integration of man-in-space in the system.

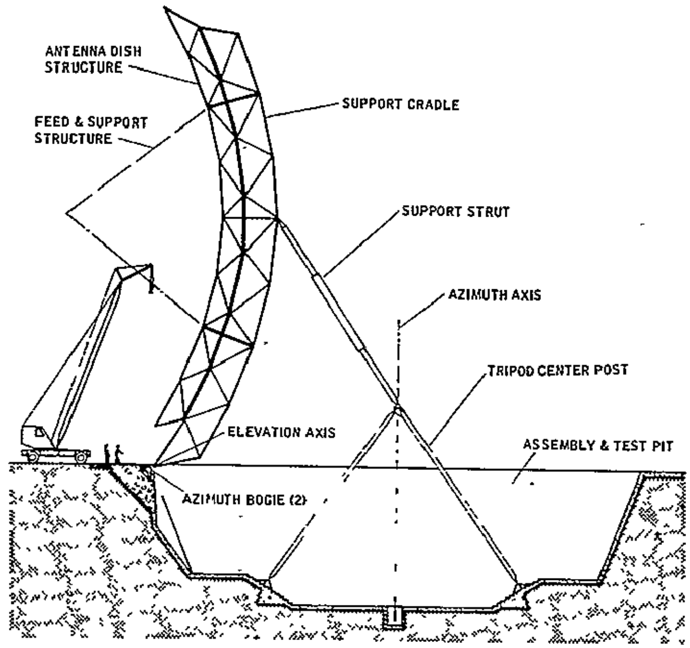


Figure 5-15. RF Test Arrangement

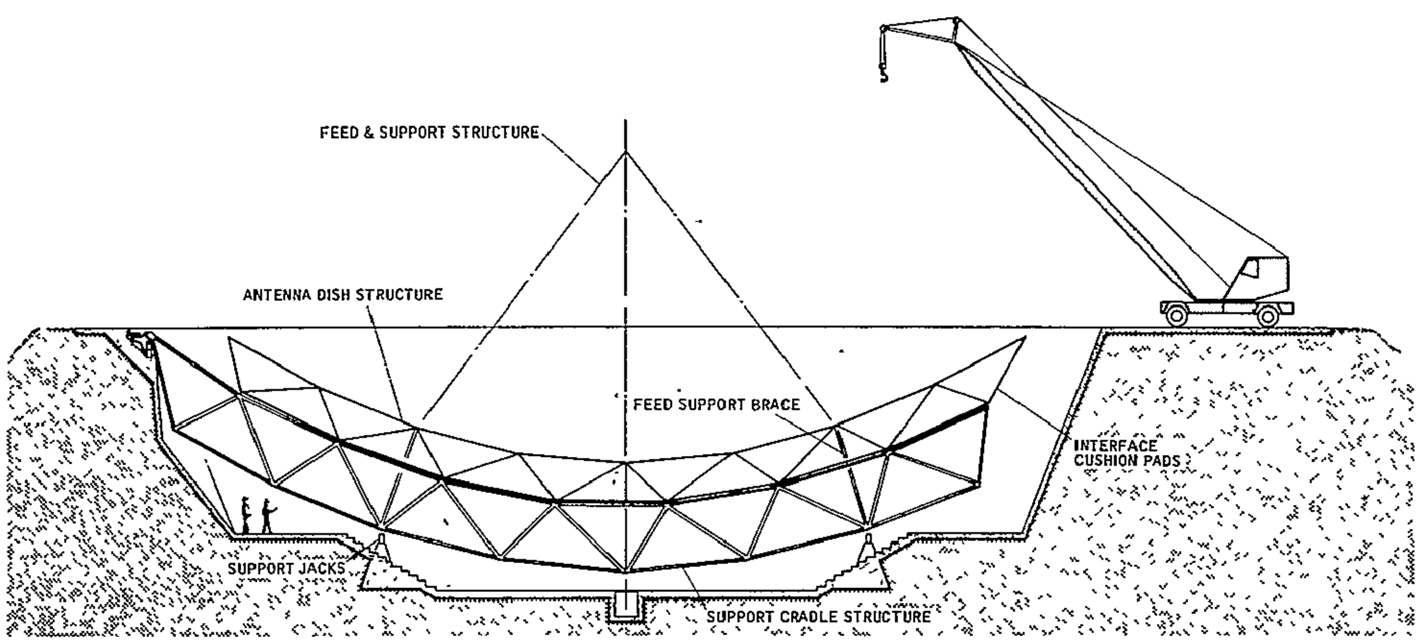


Figure 5-16. Fabrication and Assembly

SECTION 6

N70-25768

THERMAL ANALYSIS OF REFLECTOR

During this study, reflector surface and antenna tube element temperature predictions were obtained for a 6 bay, 32.99 foot diameter, and an 8 bay, 70.0 foot diameter, antenna. Synchronous orbital conditions were used, and a 0-degree angle between the earth-sun vector and the orbit plane was assumed. This orbit plane/earth-sun vector orientation yields the maximum earth shadow time of about 72 minutes, Figure 6-1. Solar and earth-thermal radiation constants of 442.4 Btu/hr-ft^2 and 1.87 Btu/hr-ft^2 respectively were employed. Earth albedo radiation only effects the antenna when the antenna is fully illuminated by the sun. As a result, addition of earth albedo heating has an extremely small effect on antenna temperatures and therefore it was neglected. Earth thermal radiation was included since it limits component temperature excursions to some extent during earth shadow periods.

All temperature predictions presented in this report are based on a +Y flight direction as shown in Figure 6-1. This flight direction was used for two reasons:

a. A large number of surface and bottom struts are nearly normal to the solar flux vector over a large portion of the orbit.

b. The antenna is symetrical about the Y axis, and thus when the apparent path of the sun is in the Y-Z plane, the calculations required to determine the antenna temperature distribution are reduced by almost 50%.

6.1 REFLECTOR SURFACE MESH

A circular wire/square mesh reflector surface configuration with an 80 percent open area was used in the current analysis. Based on these assumptions, the following expressions are obtained for the fraction of open or void area of an element of the semi-transparent reflector surface as a function of the solar incidence angle.

$$K = .8944 - \frac{.0944}{\sin \phi} \tag{6-1}$$

for

$$6.07^\circ \leq \phi \leq 90.0^\circ$$

and

$$K = 0.0$$

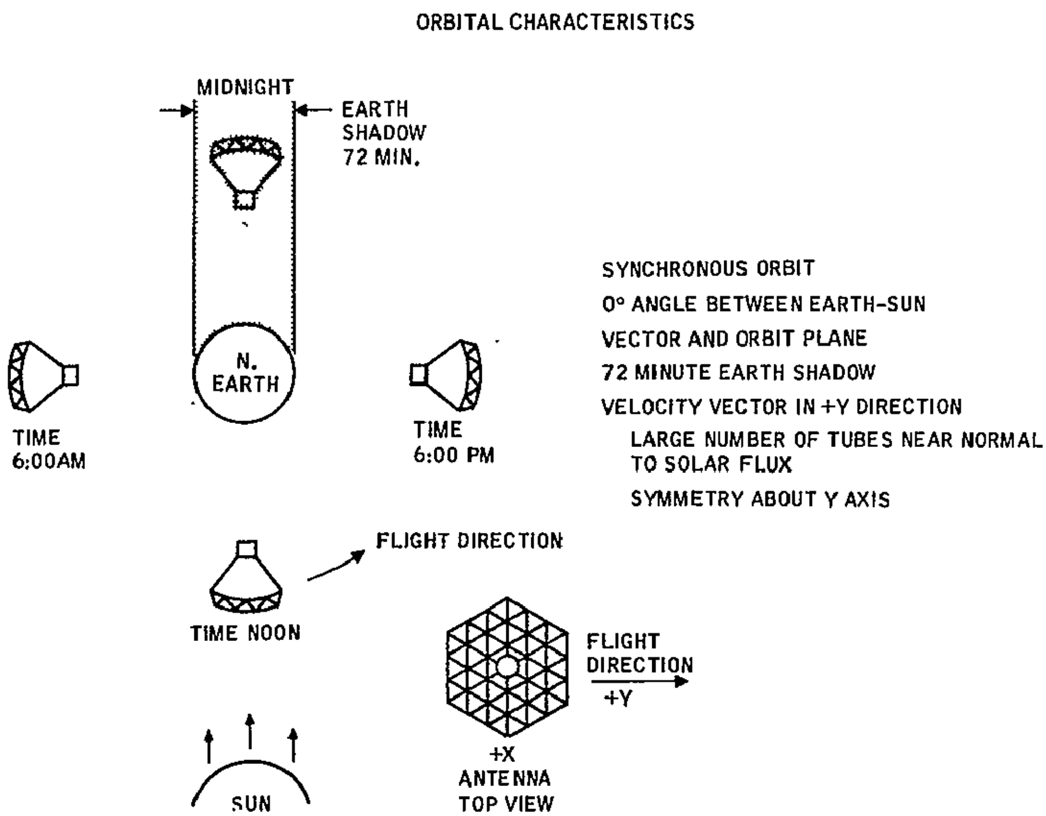


Figure 6-1. Orbital Conditions and Flight Direction

for

$$0.0^{\circ} \leq \phi < 6.07^{\circ}$$

where

K = fraction of open area

ϕ = solar incidence angle

The fraction of open area is presented in Figure 6-2 as a function of solar incidence angle. This reflector surface characteristic was used in a Convair developed computer program which calculates the incident heat rates as a function of location on the reflector surface, orientation with respect to the solar flux vector, and projected area. The indicent heat rate calculations include partial or complete shadowing by other areas of the reflector surface mesh, and complete shadowing by the feed module and the earth. The feed module geometries used for the 32.99 and 70.0 ft. antennas are presented in Figure 6-3.

Transient temperature predictions for the reflector surface mesh were based on the following characteristics:

Weight = 1.35 oz/yd^2

Specific Heat = 0.107 Btu/lb-$^{\circ}$R

Radiating Area = .628 ft^2 per ft^2 of surface area

Solar absorptance = .30

Thermal emittance = .033

The solar absorptance (α_s) and thermal emittance (ϵ) is representative of the bright reflective gold plated finish on the reflector surface mesh.

A listing of reflector mesh temperatures at the surface spider locations is presented in Appendix D, Section D.1 and D.2 for the 32.99 ft. and 70.0 ft. antennas respectively. Examples of the reflector mesh temperature distribution are presented in Figures 6-4 and 6-5 for each antenna at the 6:00 a.m. orbital position. This position was found to be the worst case with respect to overall antenna distortion.

Typical examples of the incident heat rates and the corresponding transient temperature predictions are presented in Figures 6-6, 6-7 and 6-8 for the 70.0 ft antenna at surface spider locations No. 5, 52, and 82 respectively.

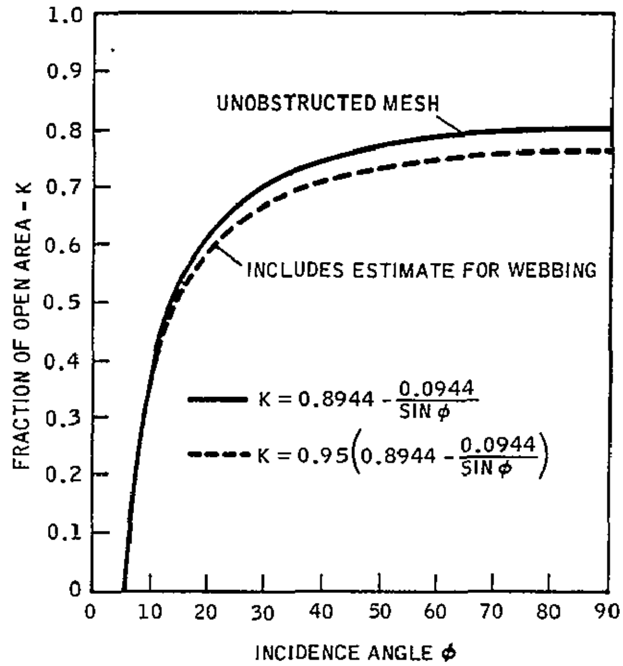
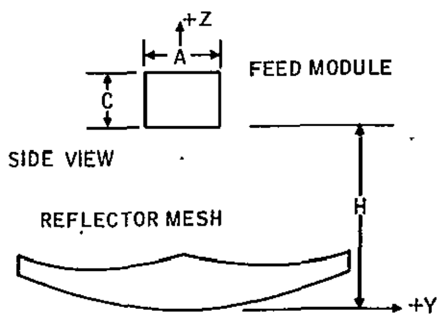


Figure 6-2. Reflector Surface Mesh Transmissivity



SHADOWING BY FEED MODULE

ANTENNA (DIA.)	FEED MODULE (H)	(A x B x C)
33.0 FT.	13.2 FT.	6.0 x 6.0 x 5.33 FT.
70.0 FT.	28.0 FT.	9.0 x 9.0 x 8.0 FT.

Figure 6-3. Antenna Feed Module Geometry

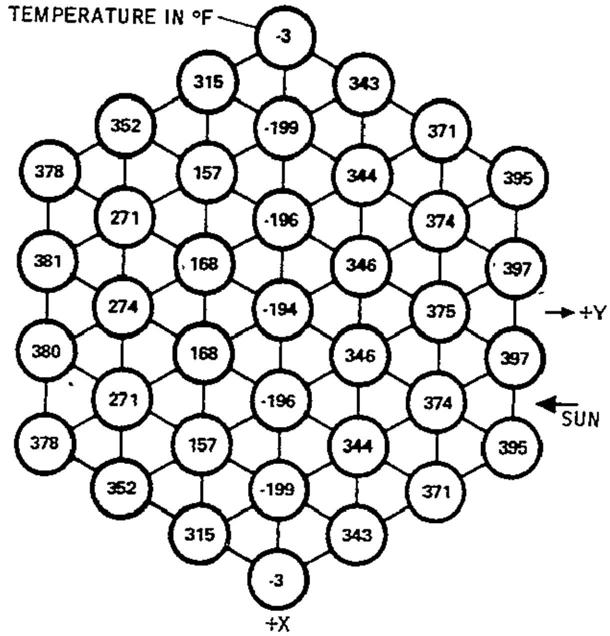


Figure 6-4. Reflector Mesh Temperature Distribution, 32.99 Ft. Antenna, 6:00 a.m. (Worst Case)

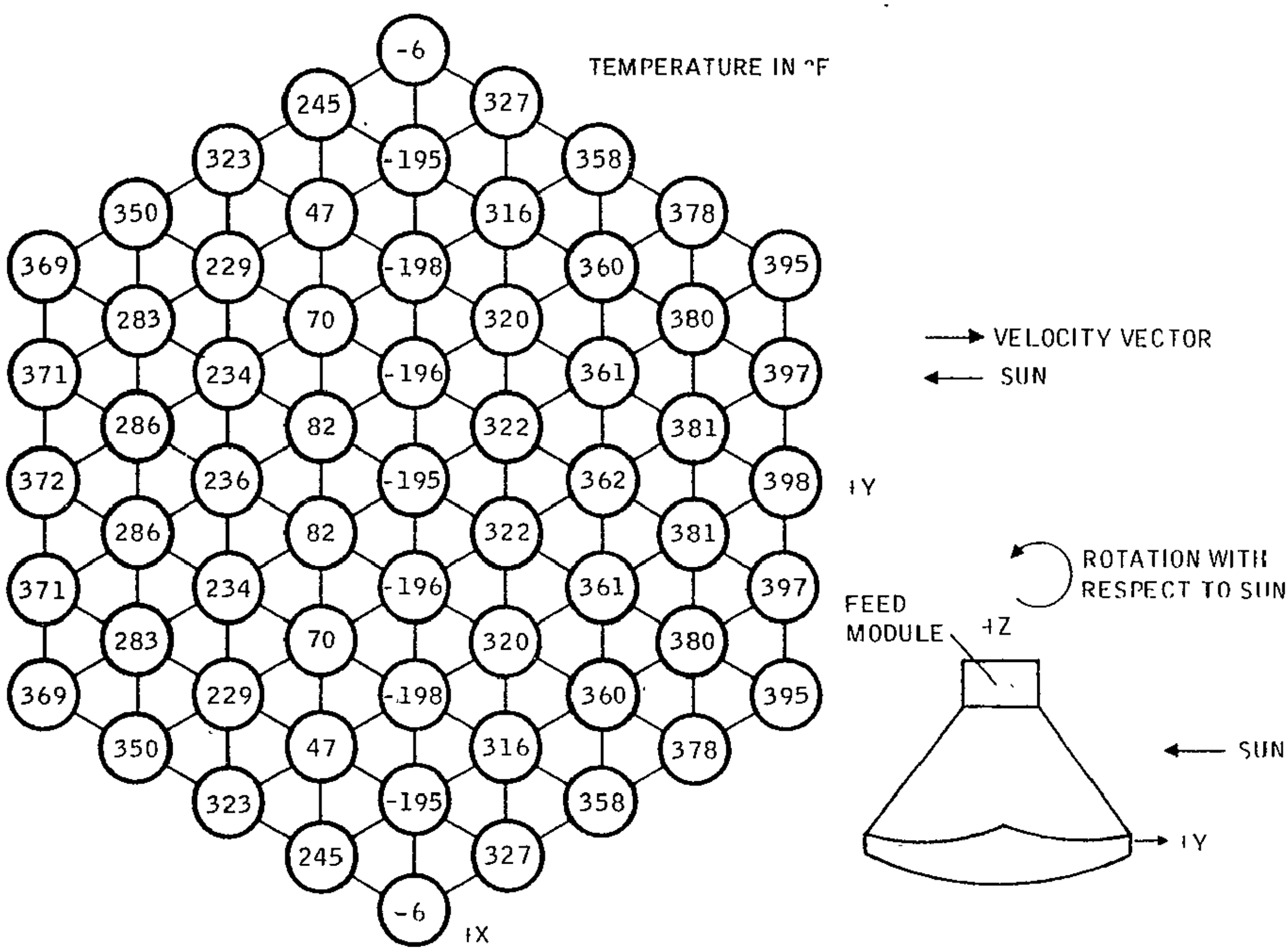


Figure 6-5. Reflector Mesh Temperature Distribution, 70.0 Ft. Antenna, 6:00 a.m. (Worst Case)

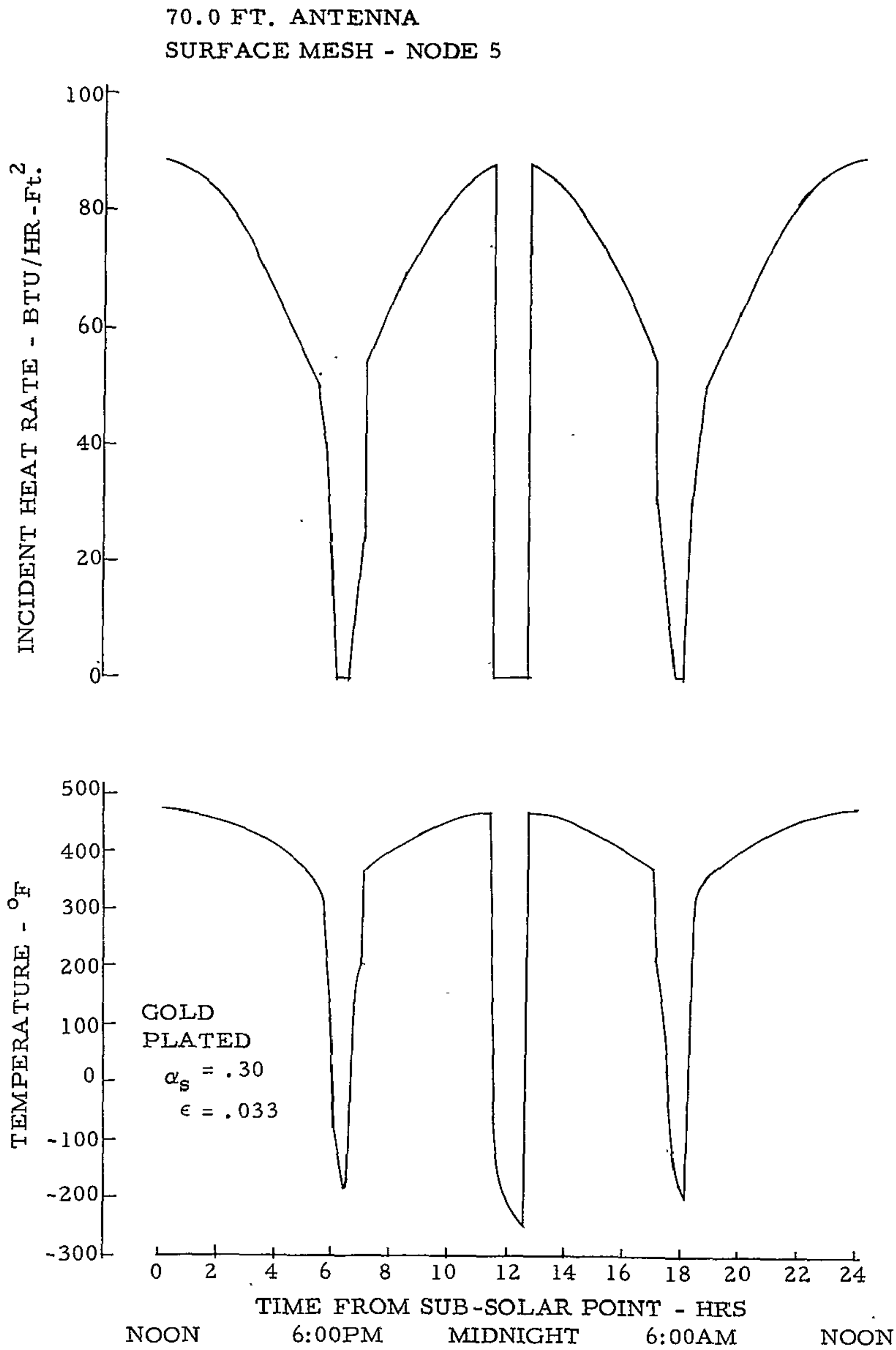


Figure 6-6. Reflector Mesh Transient Temperature Prediction, Spicer Node 5, 70.0 Ft. Antenna

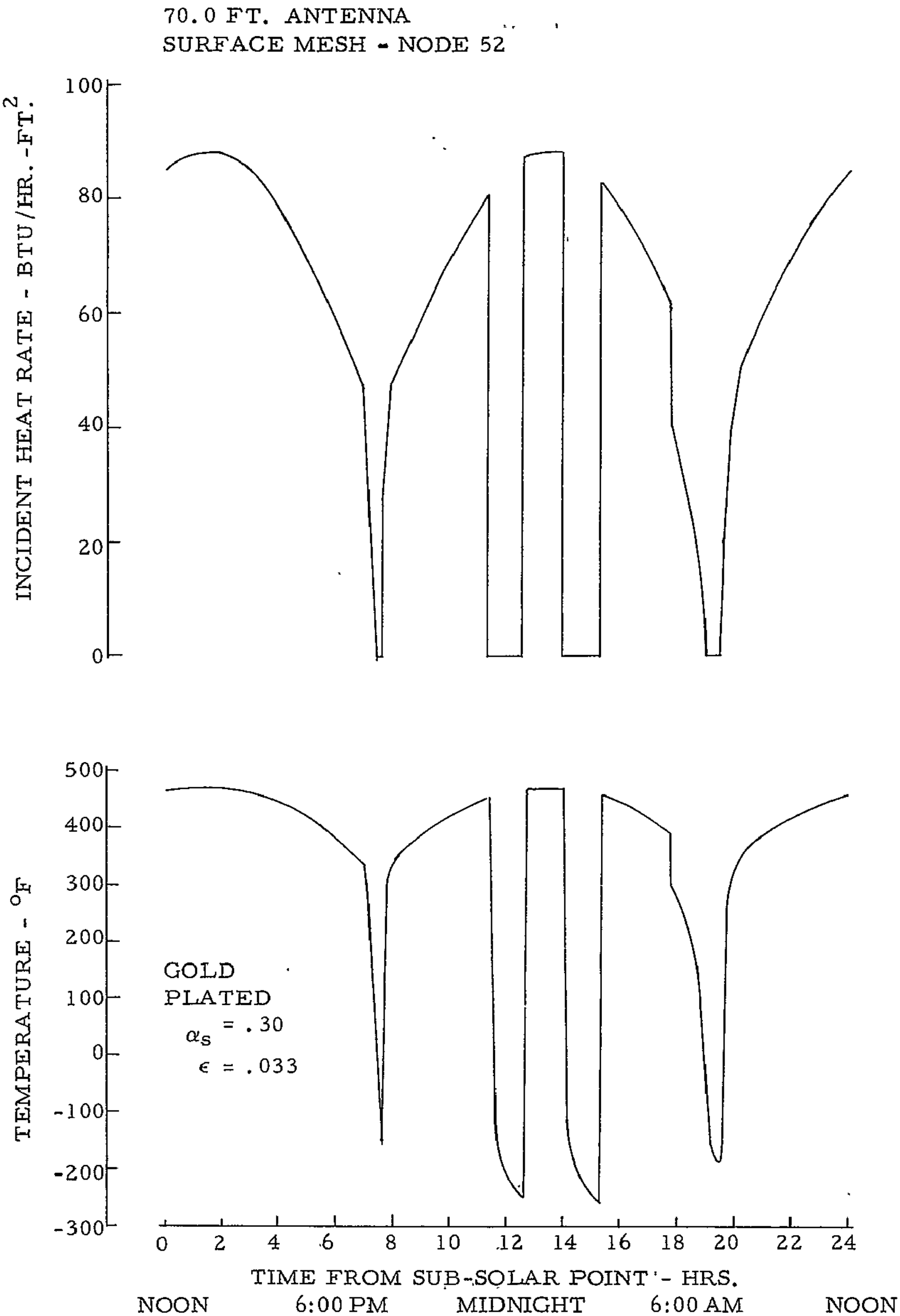


Figure 6-7. Reflector Mesh Transient Temperature Prediction, Spider Node 52, 70.0 Ft. Antenna

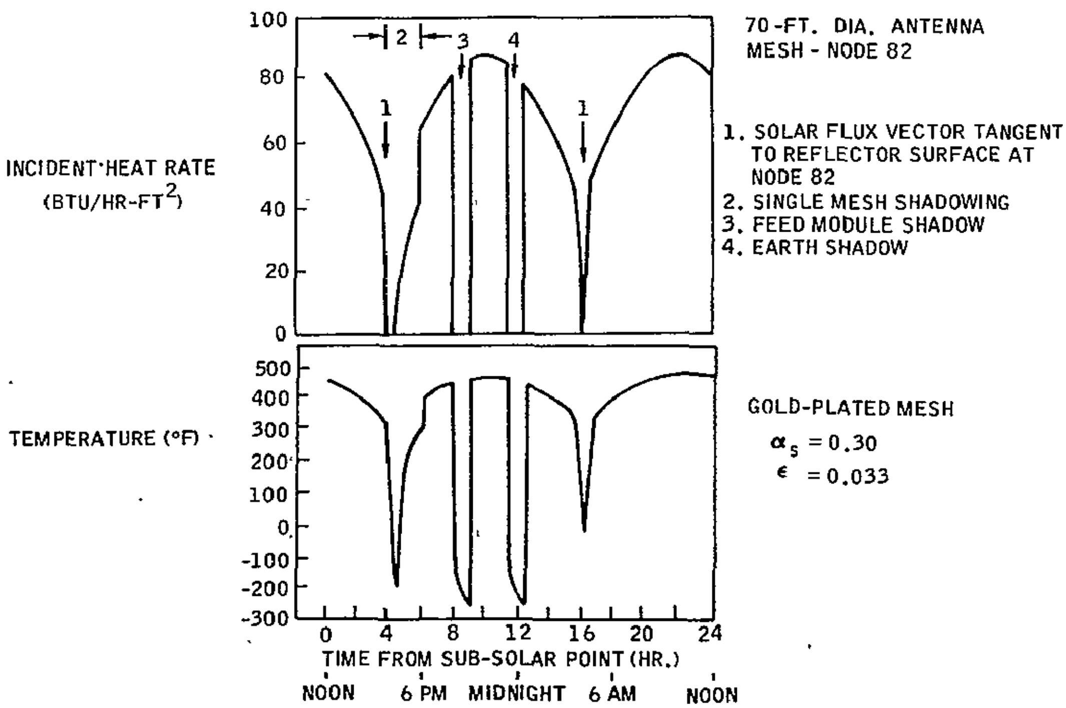


Figure 6-8. Reflector Mesh Transient Temperature Prediction, Spider Node 82, 70.0 Ft. Antenna

The extremely wide temperature fluctuations are attributed to the high α_s/e ratio and the very low thermal mass. The types of shadowing and the orbital position at which they occur for Figures 6-6, 6-7, and 6-8 are presented in Table 6-1.

Table 6-1. Shadowing Characteristics for 70.0 Ft. Reflector Surface Mesh

Reflector Surface Location (Figure No.)	Spider No. 5 (6)	Spider No. 52 (7)	Spider No. 82 (8)
Solar Flux Vector Tangent To Reflector Surface	6.0 and 18.0*	7.5 and 19.5	4.1 and 16.1
Earth Shadow	11.42 to 12.58	Same	Same
Feed Module Shadow	Occurs during earth shadow	14.0 to 15.3	8.0 to 9.15
Shadowing by reflector Surface Mesh	6.0 to 7.0 17.0 to 18.0	7.5 to 7.7 17.0 to 19.5	4.1 to 6.0

* Time in hours from the sub-solar point.

6.2 ANTENNA TUBULAR ELEMENTS

6.2.1 TRANSIENT TEMPERATURE PREDICTIONS - Incident heating rates for the antenna tubular elements were calculated assuming a location which is midway between adjoining spiders. The Convair developed computer program used for determining the incident heating rates includes the effects of partial or complete shadowing by the reflector surface mesh, and complete shadowing by the feed module and the earth. The heating rates and the transient average temperature predictions are based on the assumption that if the midpoint of the tube is shadowed, the whole tube is shadowed. Tube temperature predictions are for isolated elements since the effect of the conduction heat transfer along the thin walled tubes and across the pinned joints is negligible.

The tube sizes used in this study are presented in Table 6-2

Titanium tubes having the following properties were used:

Density =	$0.163\ lb/in^3$
Specific Heat =	$0.125\ Btu/lb\text{-}^oR$
Thermal Conductivity =	$4.2\ Btu/hr\text{-}ft\text{-}^oR$

Table 6-2. Antenna Strut Sizes

	32.99 Ft. Antenna 6 Bay	70.0 Ft. Antenna 8 Bay
Surface Struts	D = 1.5 in. t = 0.010 in.	D = 2.0 in. t = 0.018 in.
Diagonal Struts	D = 1.0 in t = 0.010 in	D = 1.5 in. t = 0.015 in.
Bottom Struts	D = 1.5 in. t = 0.010 in.	D = 2.0 in. t = 0.018 in.

The average equilibrium temperature for a cylindrical strut element can be obtained from the following equation:

$$T = \left[\left(\frac{\alpha_s}{\epsilon} \right) \left(\frac{A_p}{A_t} \right) \left(\frac{1}{\sigma} \right) Q_s \sin \theta_s \right]^{1/4} \qquad (6\text{-}2)$$

where

α_s = solar absorptance

ϵ = thermal emittance

A_p = maximum projected area = diameter x length

A_t = total radiating area = π x diameter x length

Q_s = solar constant = 442.4 Btu/hr-ft^2

θ_s = solar flux incidence angle

σ = Stefan-Boltzmann constant

For the maximum average equilibrium temperature, $\theta_s = 90^\circ$, and equation 6-2 reduces to:

$$T = \left[\frac{\alpha_s}{\epsilon} \quad \frac{Q_s}{\pi \sigma} \right]^{1/4} \qquad (6\text{-}3)$$

Since it may be best from an overall standpoint to design and fabricate the antenna at room temperature, minimum antenna distortion will be obtained when orbital temperatures are the same as the fabrication temperature. Examination of equation 6-3 shows that an α_s/ϵ ratio of 1.0 yields a maximum average tube temperature of about +76°F. For this study, α_s and ϵ values of 0.25 were used for predicting tube element temperatures. α_s and ϵ values of 0.05 or less should give the best reflector performance from a thermal standpoint. A low α_s value is required to minimize distortion due to tube bending, and a low value is required to reduce temperature excursions during shadowed periods. α_s and ϵ values of .05 or less together with an α_s/ϵ ratio near 1.0 are difficult, if not impossible, to obtain. α_s and ϵ values of .25, however, are relatively easy to obtain through the use of a flat reflector type finish typical of aluminum-pigmented paints, for example.

A listing of the surface, diagonal, and bottom strut temperatures at selected orbital positions is presented in Appendix D, Section D.3 and D.4 for the 32.99 and 70.0 foot antennas respectively. Examples of the reflector strut temperature distributions obtained are presented in Figures 6-9, 6-10, and 6-11 for the 32.99 ft. antenna surface, diagonal, and bottom struts respectively, and in Figures 6-12, 6-13, and 6-14 for the 70.0 ft. antenna. These temperature distributions are for the 6:00 a.m. orbital position, which was found to be the worst case with respect to overall antenna distortion.

Nine examples of the detailed incident heat rates and the corresponding transient temperature predictions for selected struts of the 70.0 ft. diameter antenna are presented in Figures 6-15 through 6-23. The wide temperature fluctuations are caused by the relatively high α_s/ϵ ratio and the low thermal mass. The types of shadowing and the orbital position at which they occur for Figures 6-15 through 6-23 are presented in Table 6-3.

6.2.2 <u>TUBE SHADOWING EFFECTS</u> - The major antenna strut temperature fluctuations are caused by the earth and feed module shadowing, and partial or complete shadowing by the semitransparent reflector surface mesh. Shadowing caused by other struts was not included in the temperature predictions presented in Section 6.2.1 because of the complexity of the antenna configuration.

Convair's truss antenna geometry optimization program, P4391, (AGO), was used to obtain the projected plots on an 8 bay antenna at various orientations with respect to the sun. These plots are presented in Appendix D, Section D.5, and examination of these plots shows the complexity of the tube shadowing problem. In many cases, shadowing by other struts effect only small local strut areas such as when the shadow of one strut falls across another at an angle. More severe shadowind does occur, however, and detailed calculations for several cases were obtained and are discussed below.

Figure 6-24 shows the incident heat rate and the temperature predictions for surface strut 81-82 (70.0 ft. antenna) during that portion of the orbit where

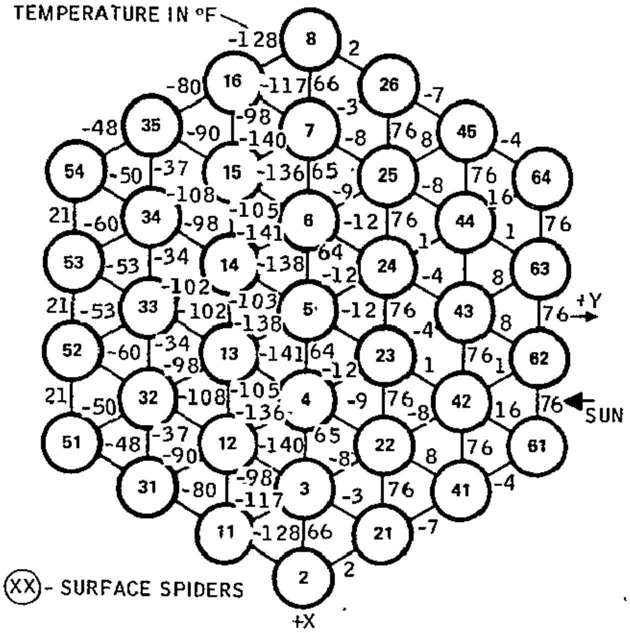


Figure 6-9. Surface strut temperature distribution for 6 a.m. (worst case).

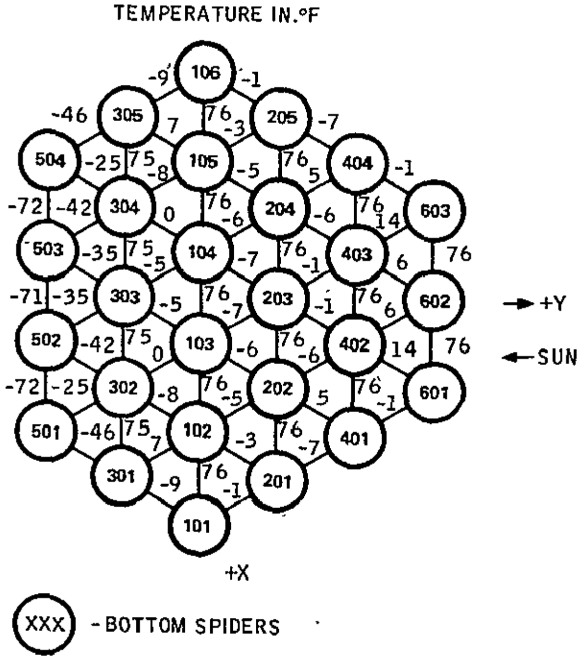


Figure 6-11. Bottom strut temperature distribution for 6 a.m. (worst case).

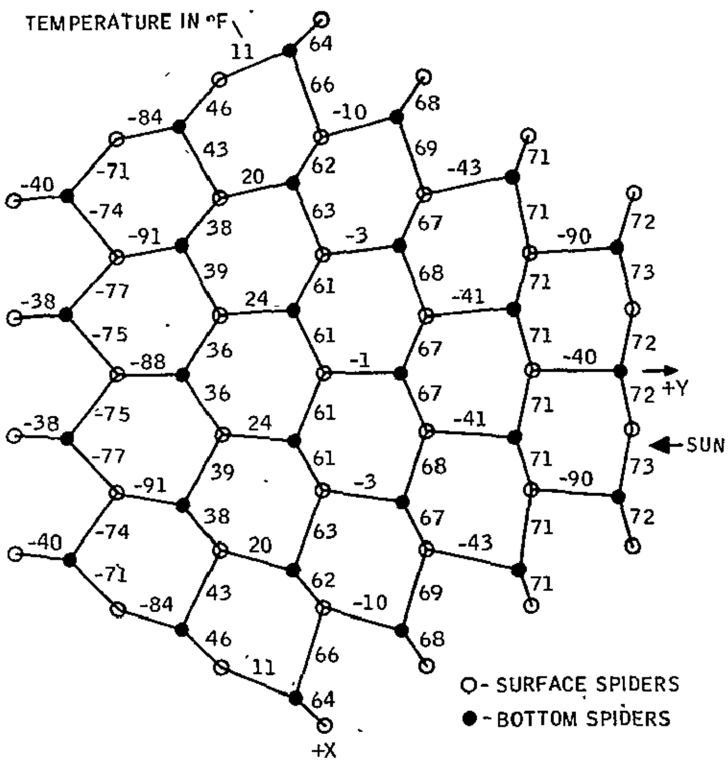
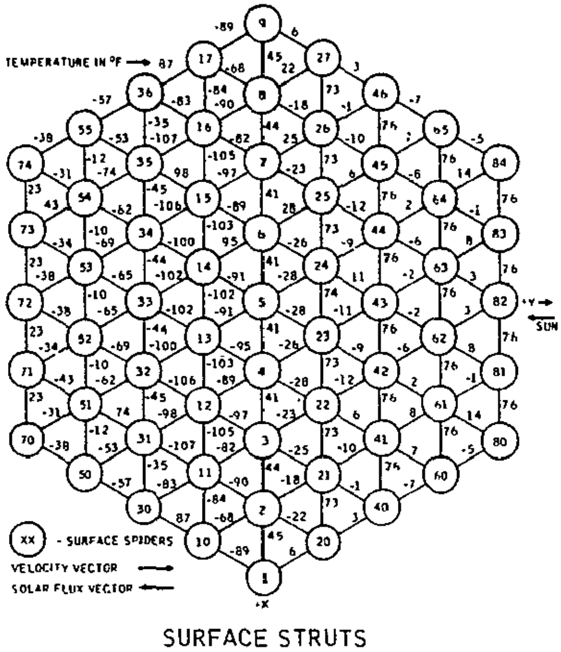


Figure 6-10. Diagonal Strut Temperature Distribution, 32.99 Ft. Antenna, 6:00 a.m. (Worst Case)



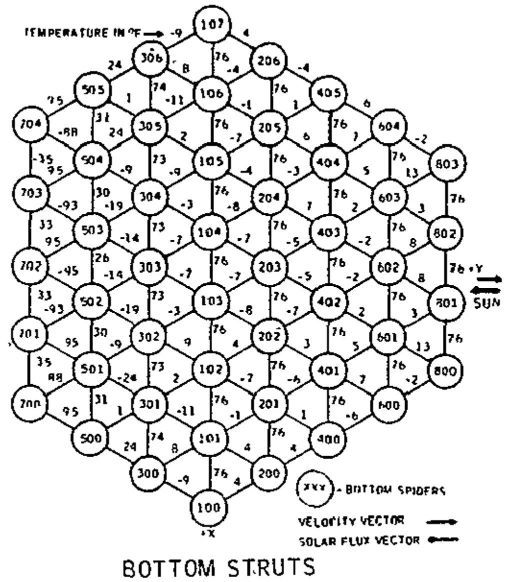


Figure 6-12. Surface Strut Temperature Distribution, 70.0 Ft. Antenna, 6:00 a.m. (Worst Case)

Figure 6-14. Bottom Strut Temperature Distribution, 70.0 Ft. Antenna, 6:00 a.m. (Worst Case)

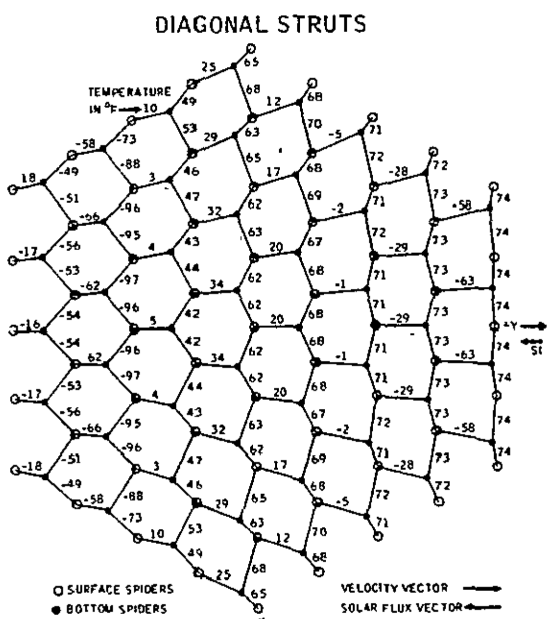


Figure 6-13. Diagonal Strut Temperature Distribution, 70.0 Ft. Antenna, 6:00 a.m. (Worst Case)

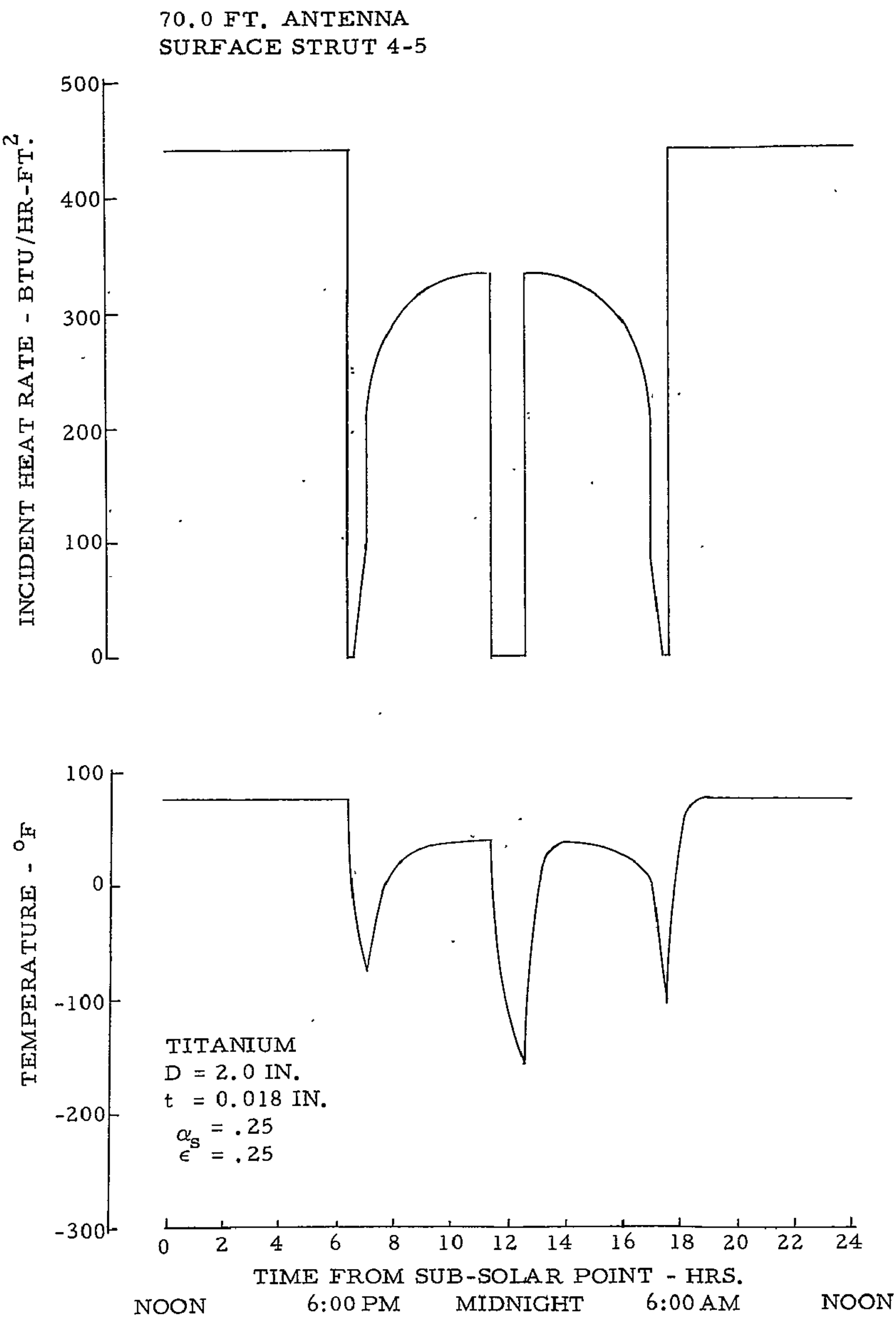


Figure 6-15. Tubular Element Transient Temperature Prediction, Surface Strut 4-5, 70.0 Foot Antenna

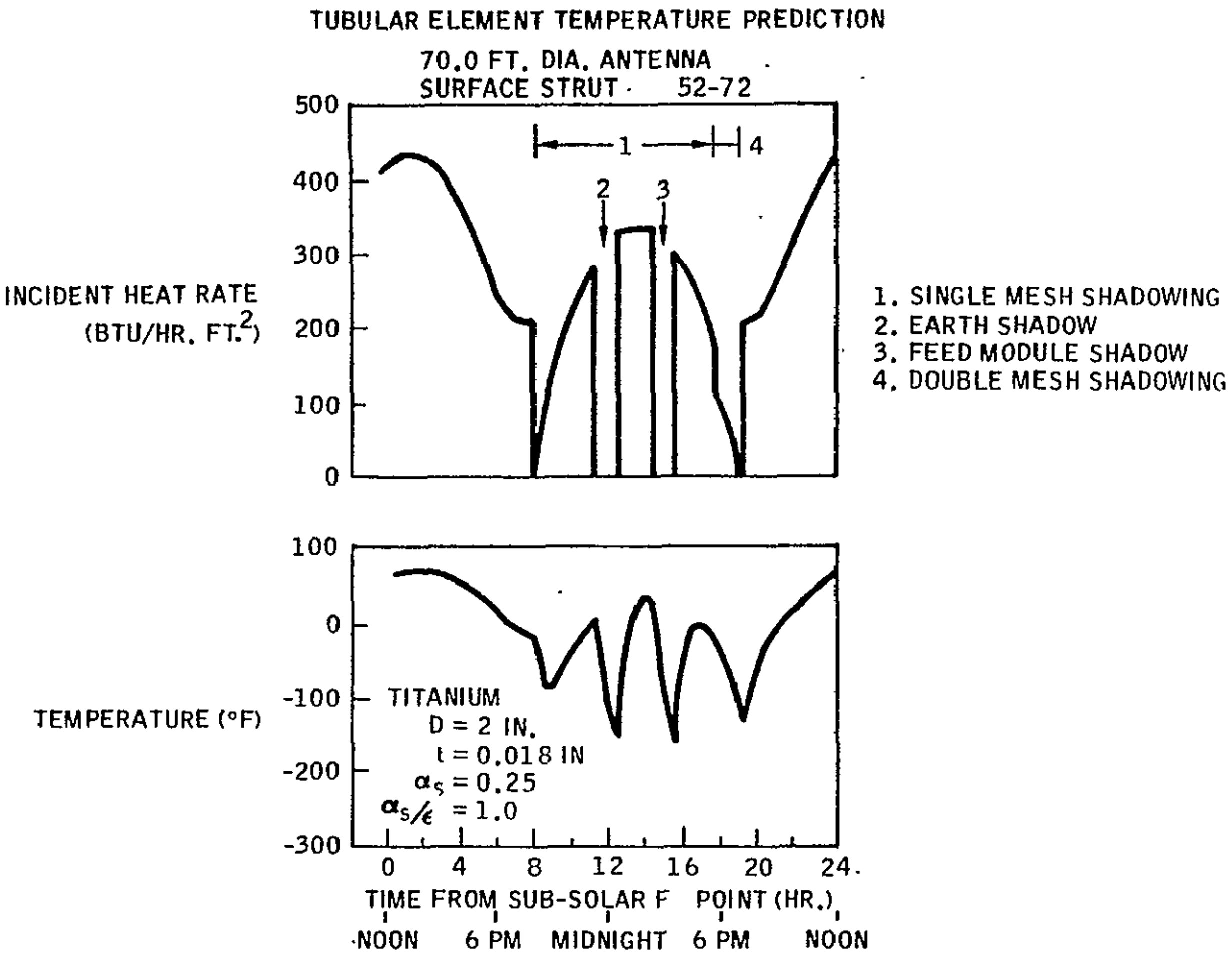


Figure 6-16. Tubular Element Transient Temperature Prediction, Surface Strut 52-72, 70.0 Ft. Antenna

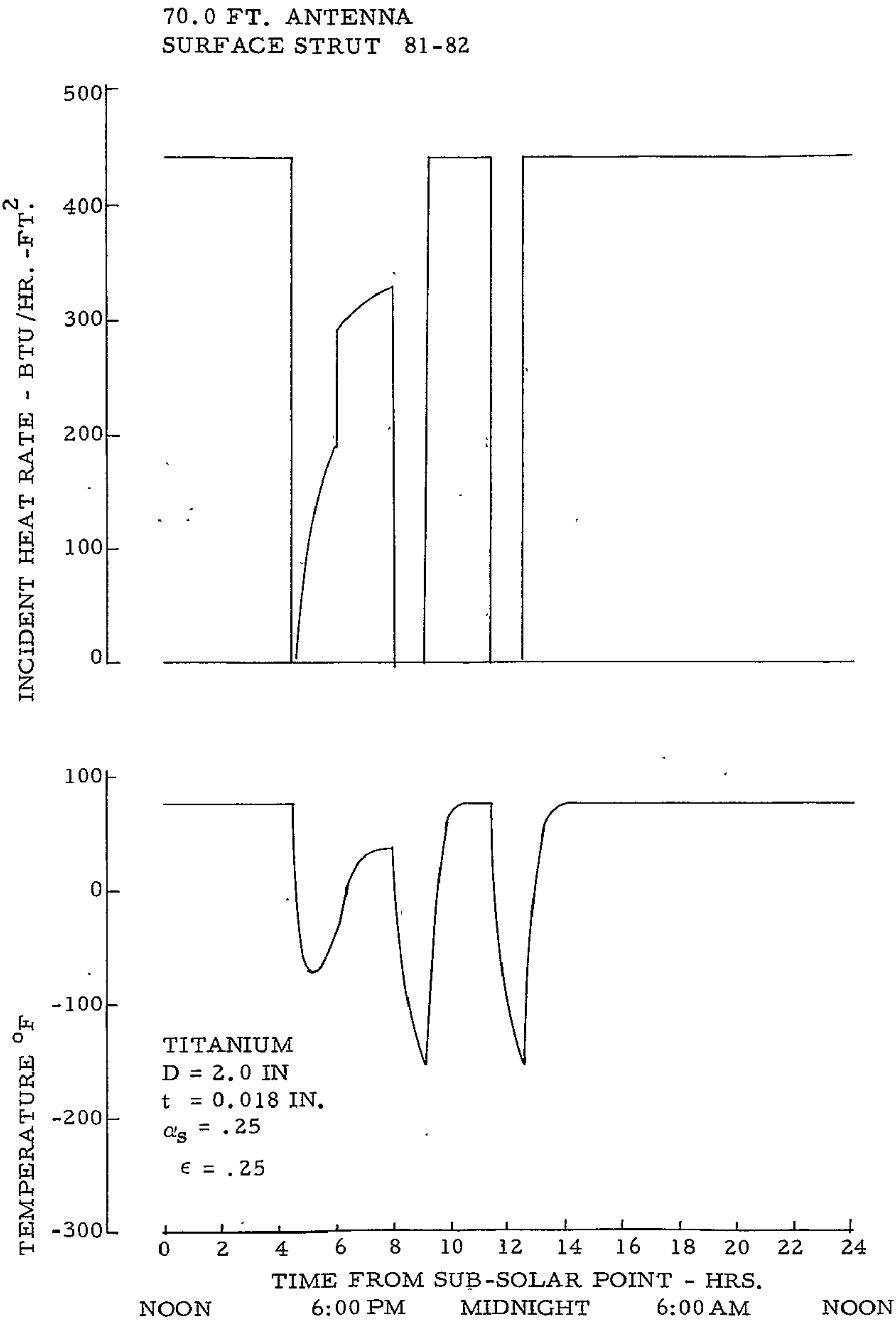
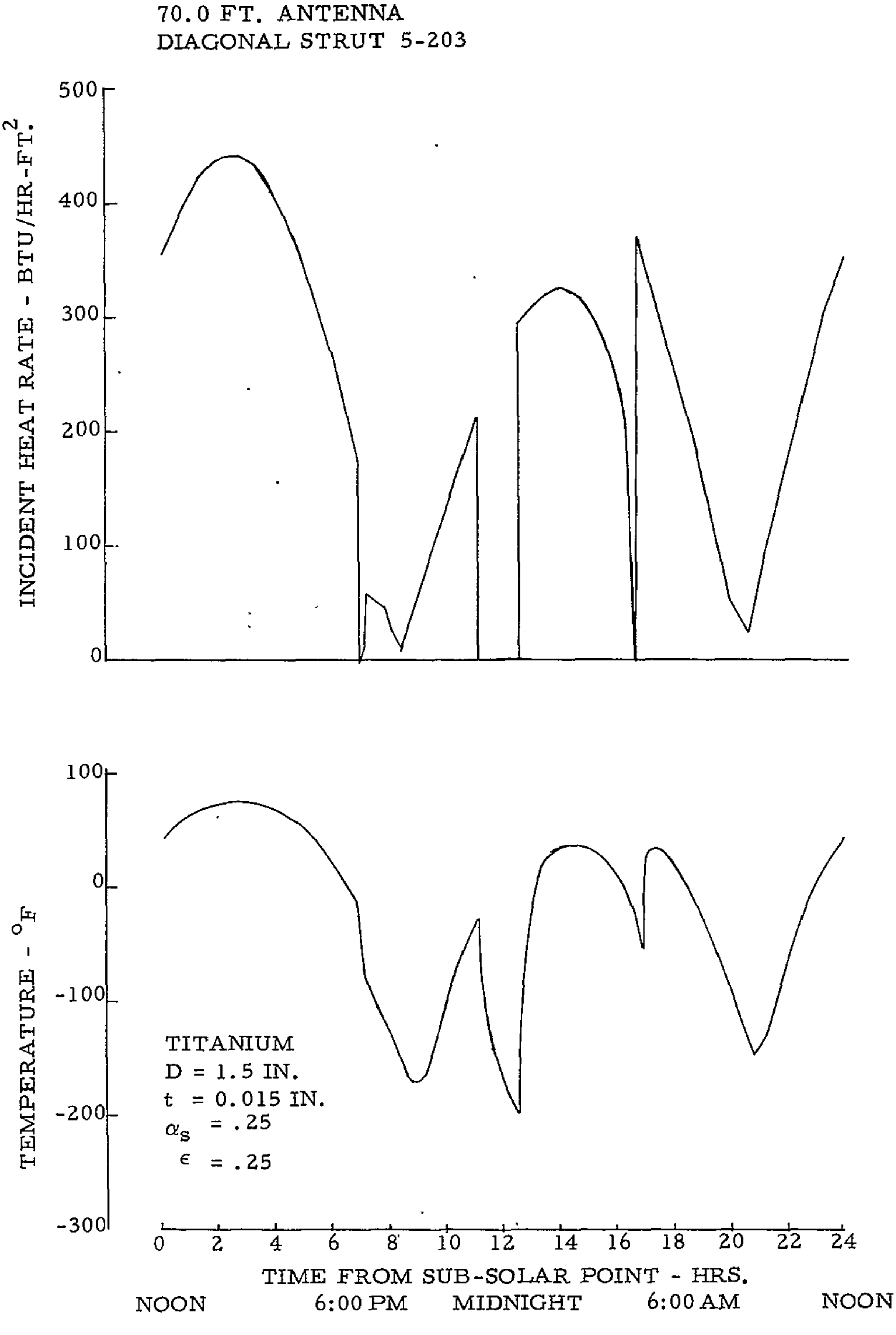


Figure 6-17. Tubular Element Transient Temperature Prediction, Surface Strut 81-82, 70.0 Ft. Antenna



Fugure 6-18. Tubular Element Transient Temperature prediction, Diagonal Strut 5-2-3, 70.0 Ft. Antenna

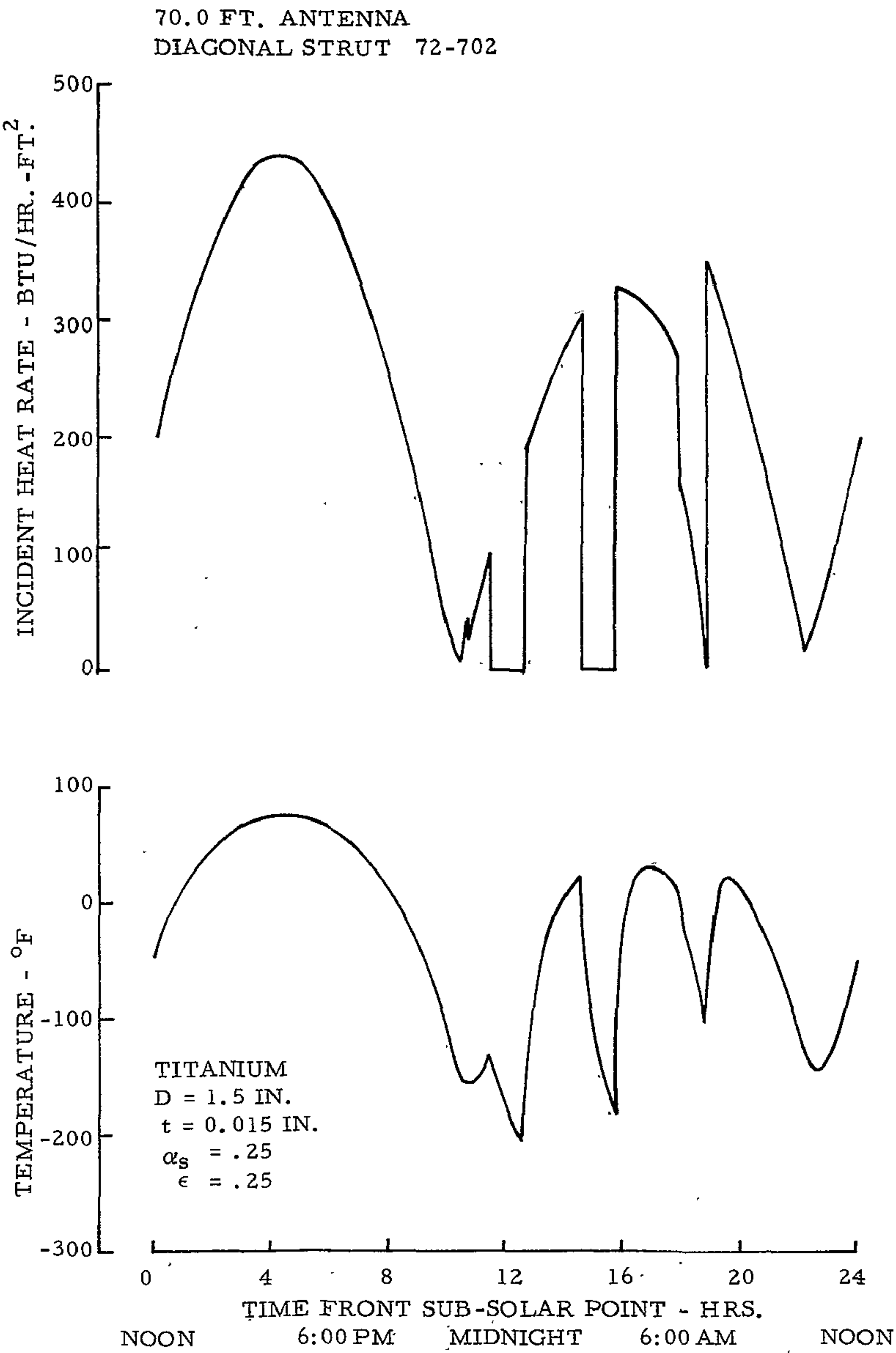


Figure 6-19. Tubular Element Transient Temperature Prediction, Diagonal Strut 72=702, 70.0 Ft. Antenna

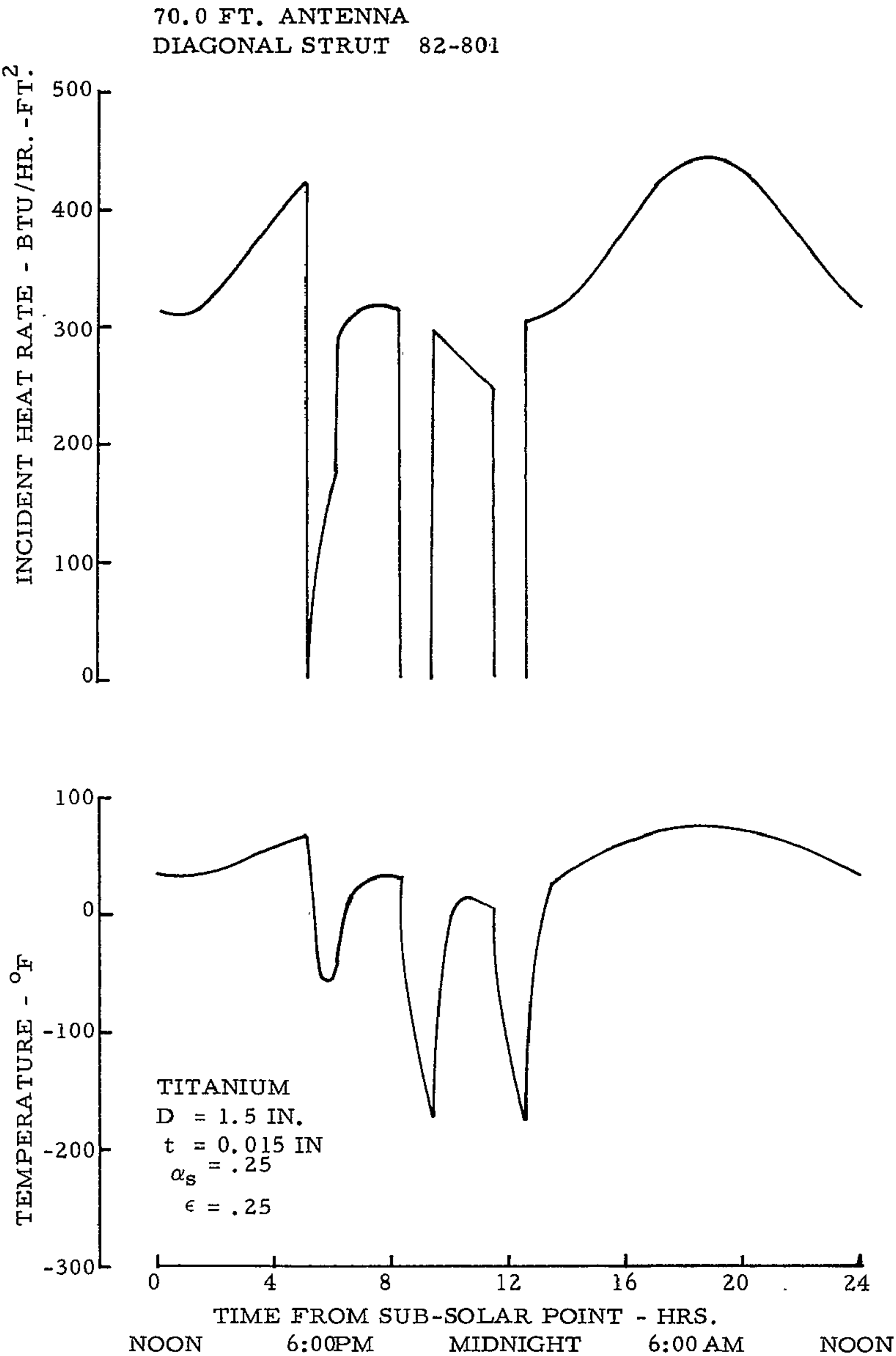


Figure 6-20. Tubular Element Transient Temperature, Prediction Diagonal Strut 82-801, 70.0 Ft, Antenna

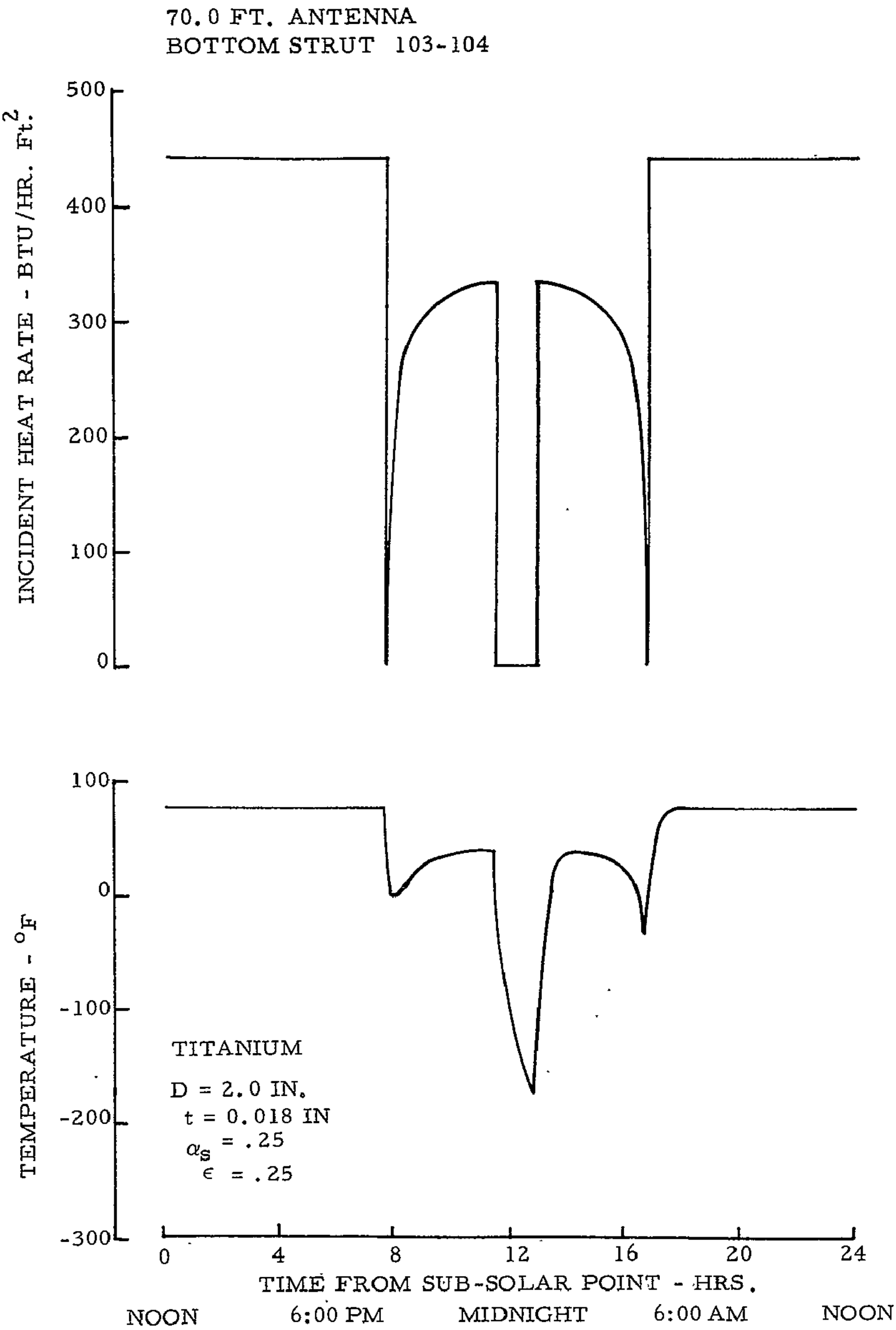


Figure 6-21. Tubular Element Transient Temperature Prediction, Bottom Strut 103-104, 70.0 Ft. Antenna

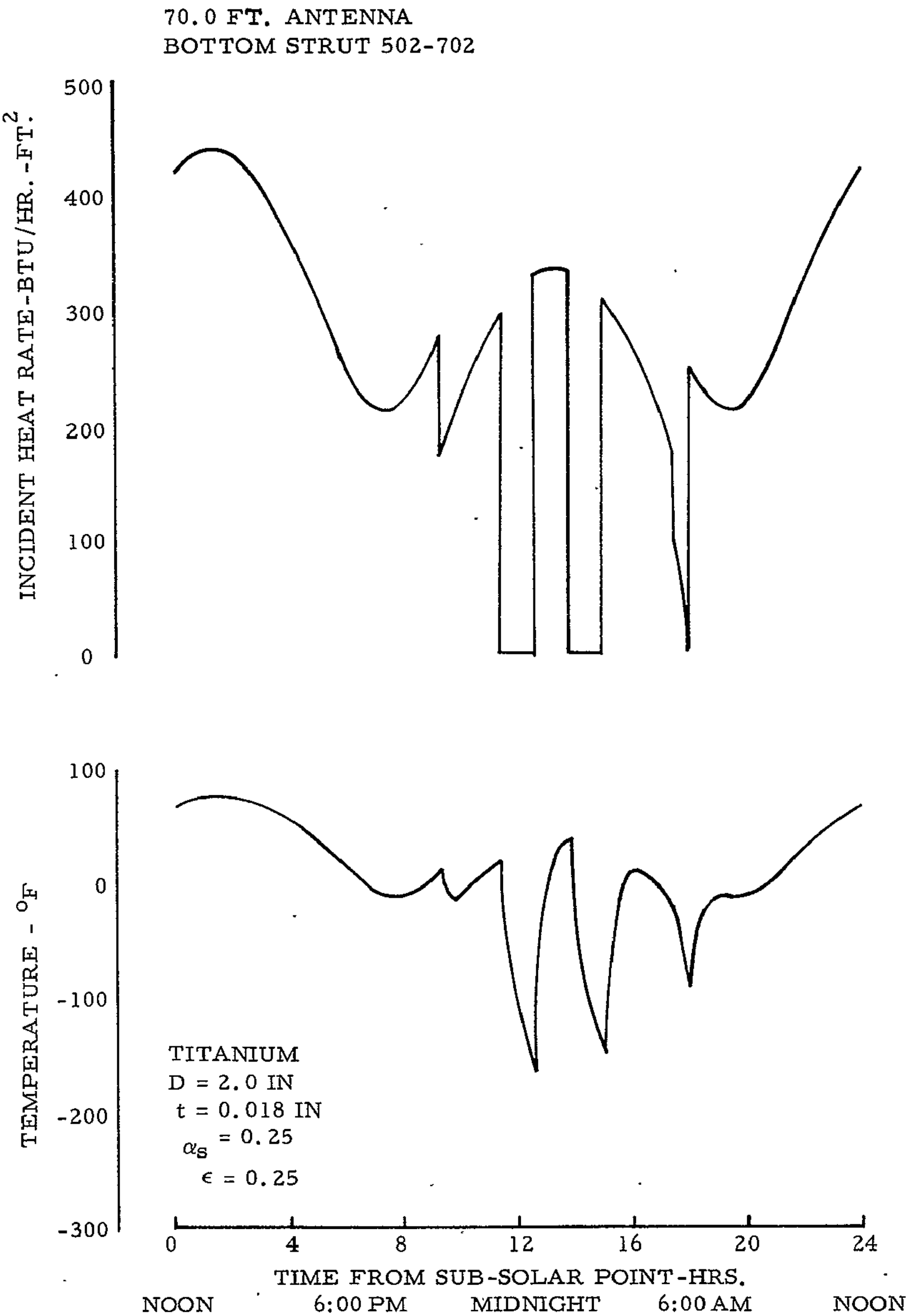


Figure 6-22. Tubular Element Transient Temperature Prediction, Bottom Strut 502-702, 70.0 Ft. Antenna

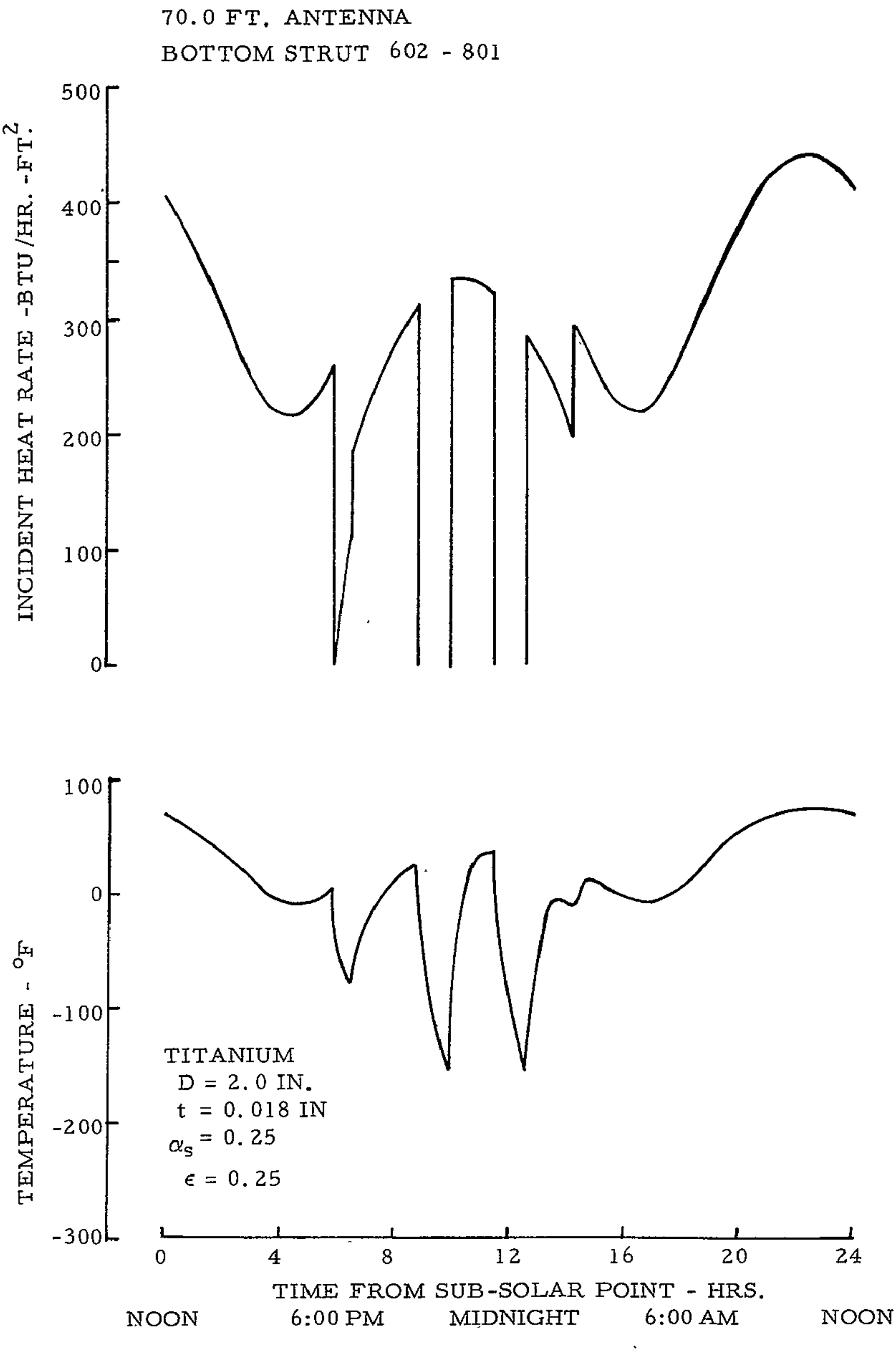


Figure 6-23. Tubular Element Transient Temperature, Prediction Bottom Strut 602-801, 70.0 Ft. Antenna

Table 6-3. Shadowing Characteristics for the 70.0 Ft. Reflector Strut Elements

Strut No. (Figure No.)	4-5 (15)	52-72 (16)	81-82 (17)	5-203 (18)	72-702 (19)	82-801 (20)	103-104 (21)	502-702 (22)	602-801 (23)
Solar Flux Vector Aligned With Strut Direction	-	-	-	8.5 20.5	10.2 22.2	-	-	-	-
Earth Shadow	11.42 to 12.58*	Same	Same	Same	Same	Same	Same	Same	Same
Feed Module Shadow	**	14.4 to 15.7	8.0 to 9.1	11.1 to **	14.5 to 15.7	8.2 to 9.4	** to 12.8	13.8 to 15.0	8.8 to 9.9
Single Shadowing by Reflector Surface Semi-Transparent Mesh	7.1 to 16.9	8.2 to 17.8	6.0 to 9.3	7.2 to 16.6	10.6 to 17.7	6.1 **	7.7 to 16.6	9.3 to 17.4	6.5 to 14.2
Double Shadowing by Reflector Surface Semi-Transparent Mesh	6.4 to 7.1 16.9 to 17.6	8.1 to 8.2 17.8 to 19.3	4.5 to 6.0	7.0 to 7.2 16.6 to 16.8	17.7 to 18.8	5.1 to 6.1	7.6 to 7.7 16.6 to 16.7	17.4 to 18.0	5.9 to 6.5

*Time in hours from subsolar point

**Shadowing starts and/or stops during earth shadow

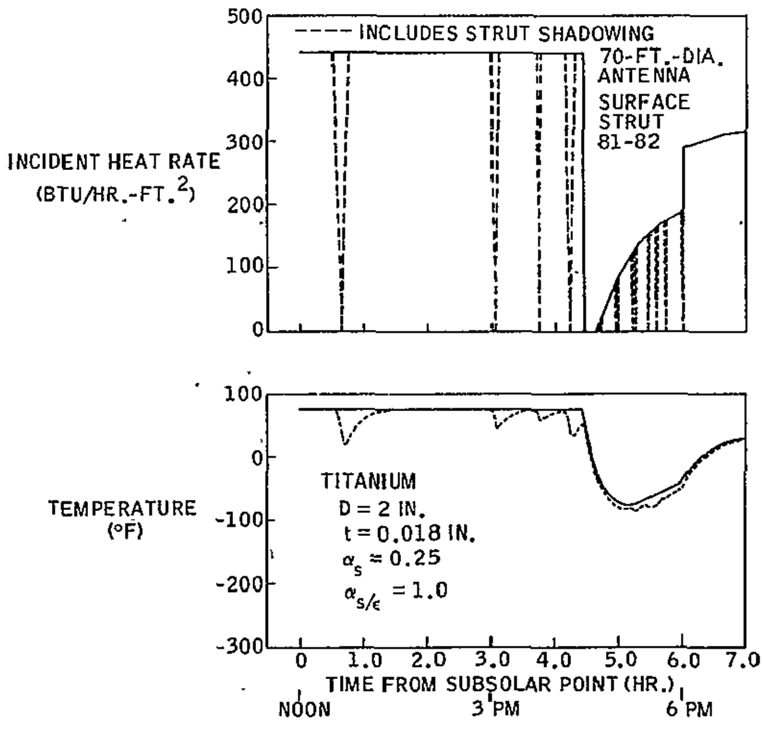


Figure 6-24. Tubular Element Transient Temperature Prediction Including Strut Shadowing Effects, Surface Strut 81-82, 70.0 Ft. Antenna

major strut shadowing occurs. The effect of including the shadowing caused by struts which are essentially parallel to strut 81-82 is clearly indicated. The largest temperature excursions (about 50°F) occur at the 12:45 p.m. and 4:15 p.m. orbital positions when strut 81-82 is shadowed by the struts between bottom spiders 800 and 802 and surface spiders 61 and 63 respectively (refer to Figures 6-11 through 6-13).

The strut shadowed incident heat rates and temperature predictions for diagonal strut 5-203 (70.0 ft. antenna) are presented in Figures 6-25 and 6-26. Diagonal struts 33-303 and 72-702 cast a shadow on strut 5-203 during the period from about 4:50 p.m. to about 7:15 p.m. (Figure 6-25) and diagonal strut 43-602 shadows 5-203 between 3:50 a.m. and 6:05 a.m. (Figure 6-26). The differences in temperature between the shadowed and unshadowed cases are large and reach a maximum of about 150°F. This case is a unique one in that it only occurs when the apparent path of the sun is exactly in the antenna Y-Z plane. For a synchronous equatoral orbit, this case occurs only at the vernal and autumnal equinoxes. For all other conditions, strut shadowing and temperature differences should be significantly less.

The effects of shadowing by struts which are parallel to bottom strut 103-104 are presented in Figures 6-27 and 6-28. The maximum temperature excursions of about 50°F are caused by parallel antenna elements which are closest to 103-104.

The tube shadowing included in the cases presented above was only that caused by parallel tubes due to the relative simplicity of the calculations. It is anticipated that the inclusion of all tube shadowing, especially for tubes near the +Y edge of the antenna prior to the 6:00 p.m. position, and the -Y edge of the antenna just after the 6:00 a.m. position, will cause significantly greater temperature excursion.

6.2.3 TUBE TEMPERATURE GRADIENT - The maximum equilibrium temperature gradient across thin walled tubes can be approximated from the following equation provided the material has a high thermal conductivity or a low solar adsorptance.

$$\Delta T_{max} = \frac{D^2 \alpha_s Q_s}{4tK} \qquad (6\text{-}4)$$

where D = Tube diameter

α_s = Solar adsorptance

Q_s = Solar constant

t = Tube wall thickness

K = Thermal conductivity

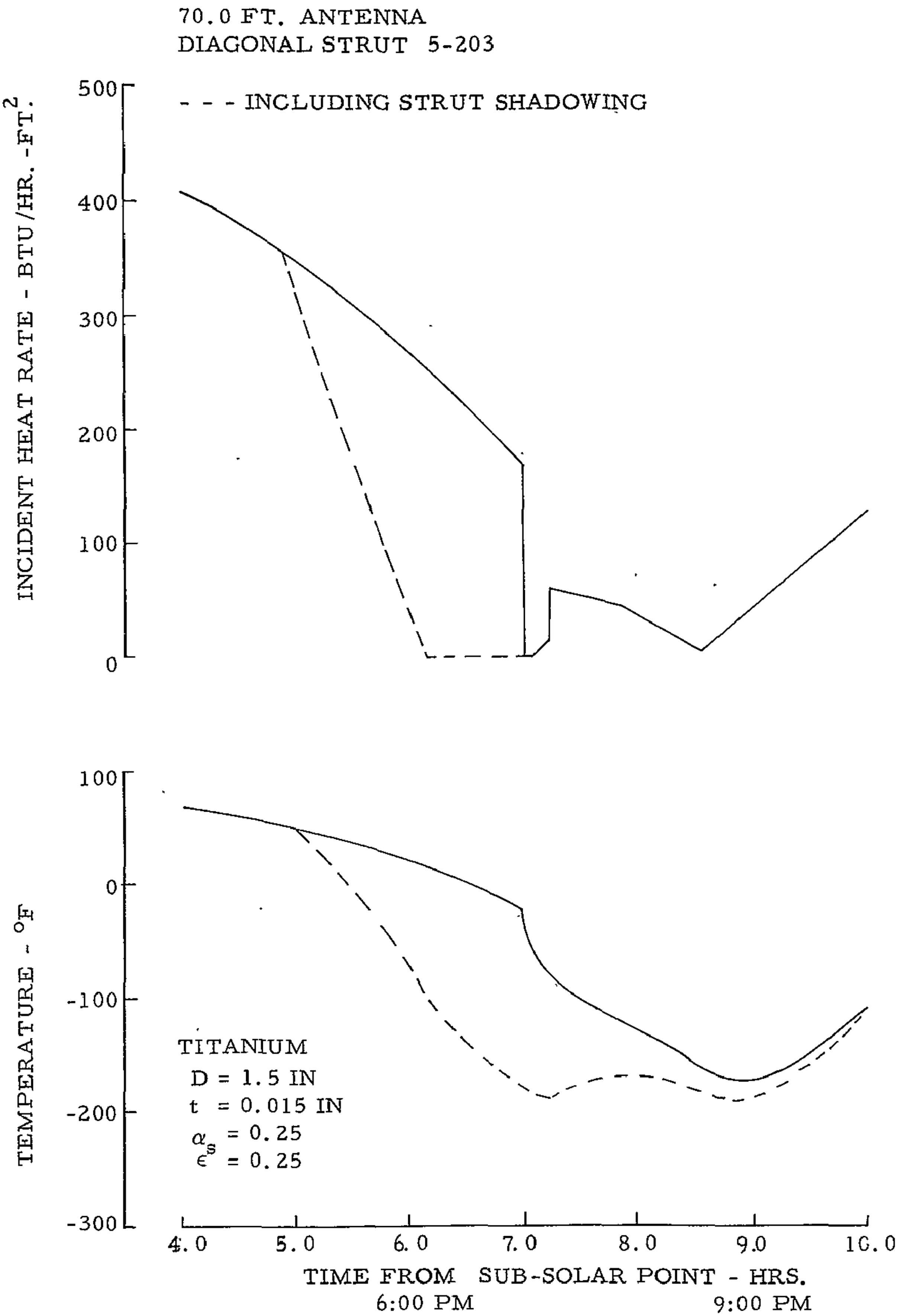


Figure 6-25. Tubular element Transient Temperature Prediction Including Strut Shadowing Effects, Diagonal Strut 5-203, 70.0 Ft. Antenna

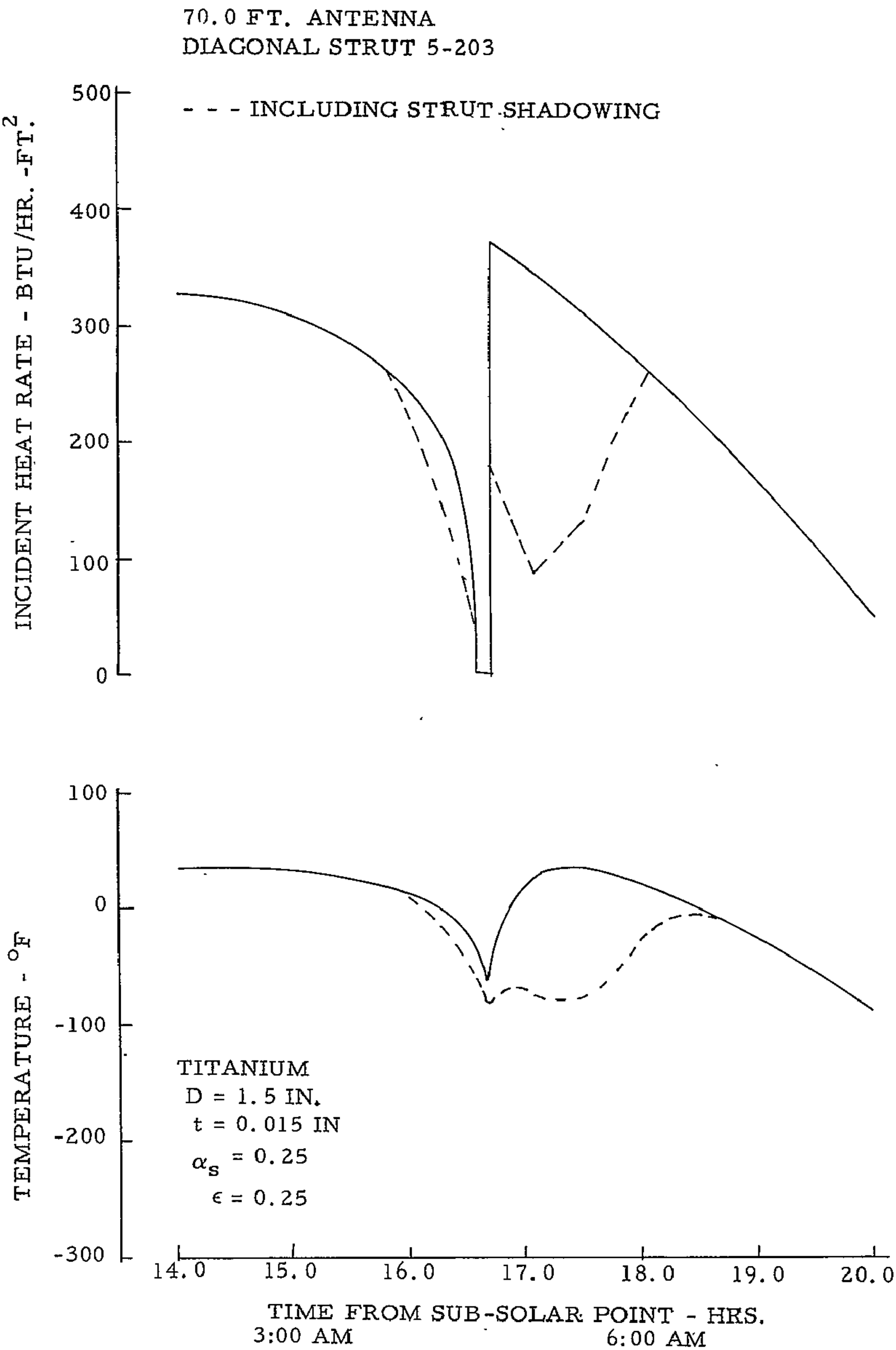


Figure 6-26. Tubular Element Transient Temperature Prediction Including Strut Shadowing Effects, Diagonal Strut 5-203, 70.0 Ft. Antenna

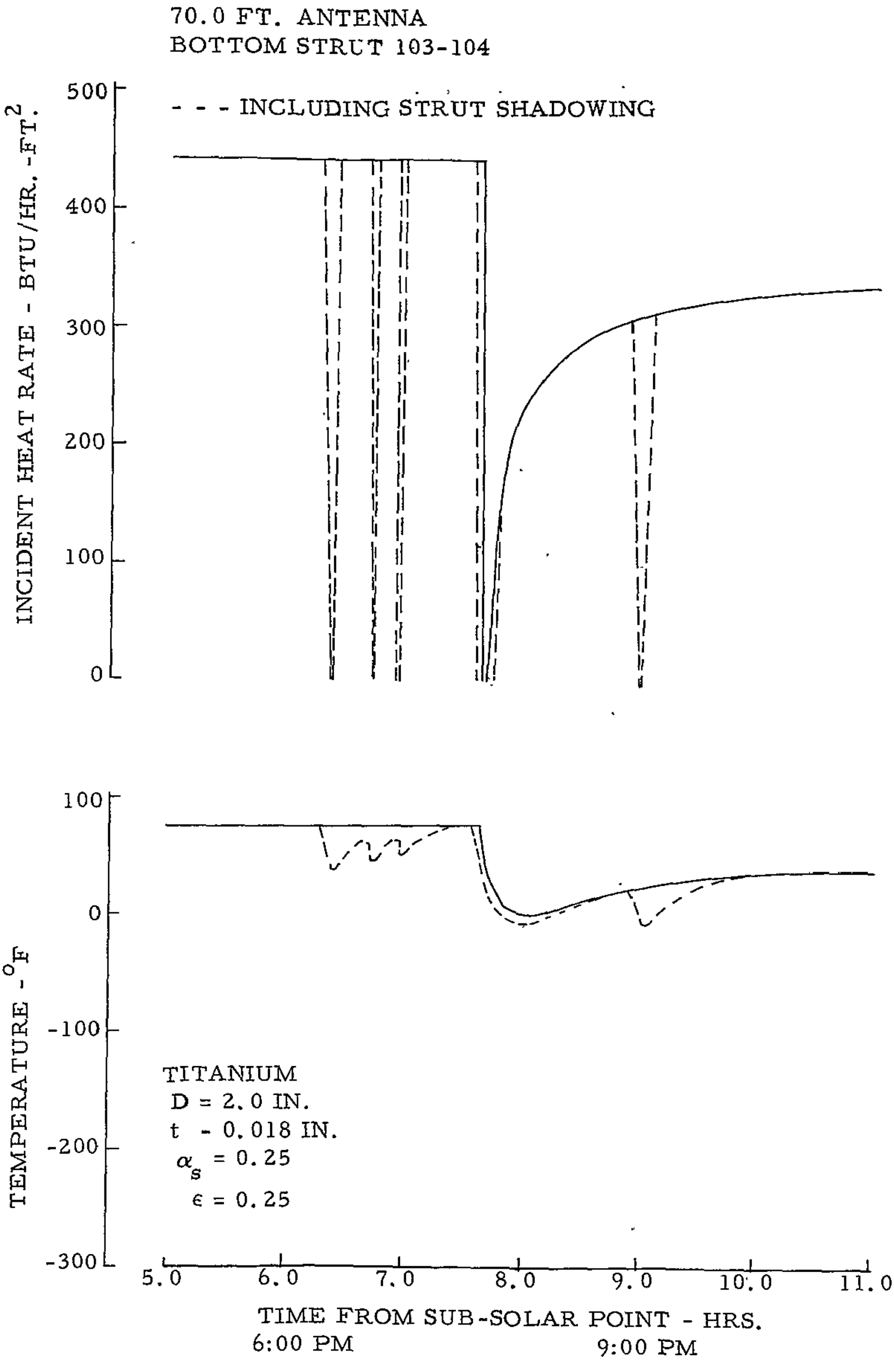


Figure 6-27. Tubular Element Transient Temperature Prediction Including Strut Shadowing Effects, Bottom Strut 103-104, 70.0 Ft. Antenna

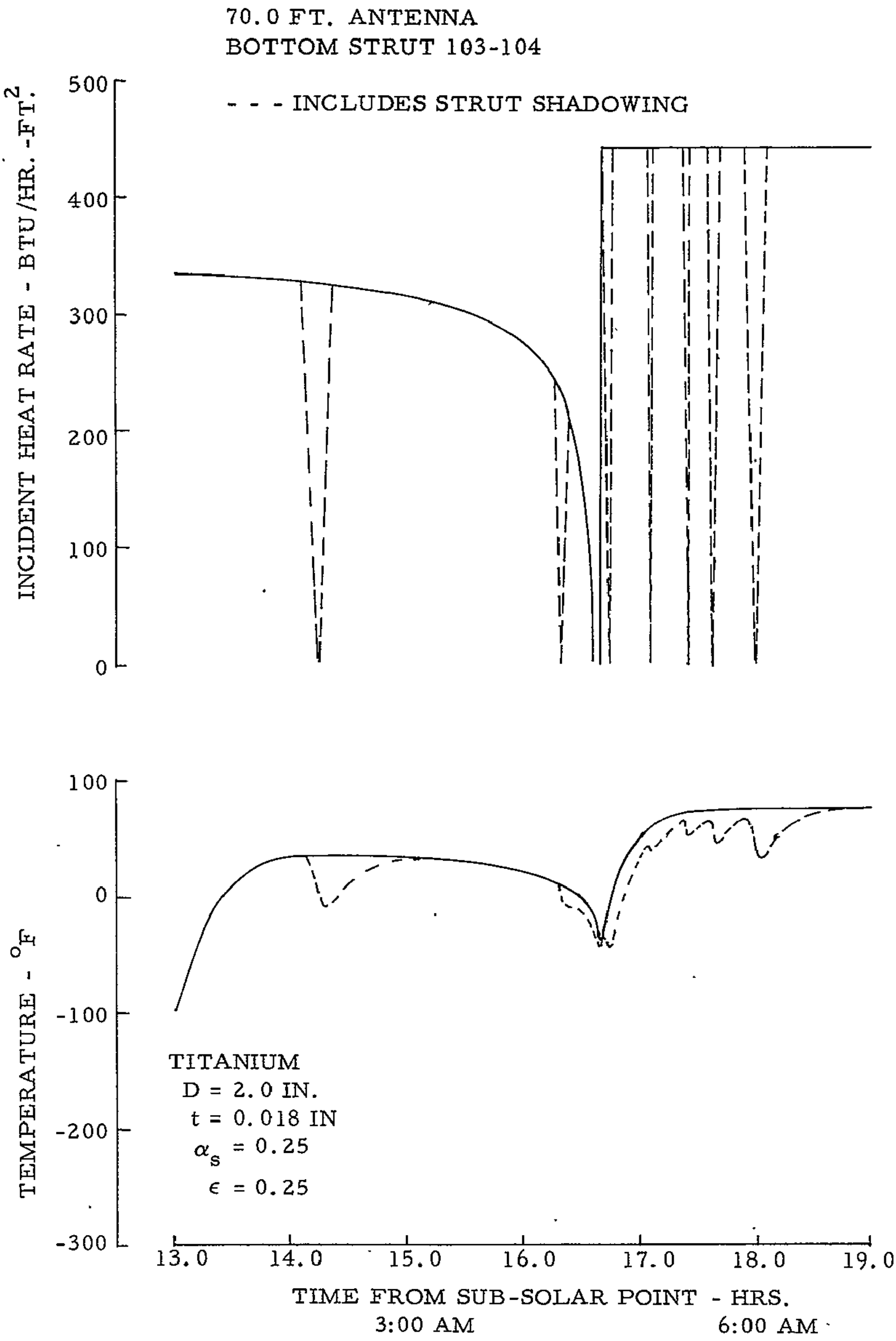


Figure 6-28. Tubular Element Transient Temperature Prediction Including Strut Shadowing Effects, Bottom Strut 103-104, 70.0 Ft. Antenna

The limitations on this equation are:

a. No heat is transferred via radiation across internal surfaces of the tube

b. The temperature gradient is small enough such that for all practical purposes, heat radiated from external surfaces is equally distributed around the periphery of the tube.

Since titanium has a relatively low thermal conductivity, a multi-node thermal model was used for determining tube temperature gradients. Figure 6-29 shows the maximum equilibrium diametric temperature differential for a typical titanium antenna tube as a function of several variables. The error introduced by using the simplified method (Equation 6-4) is clearly indicated. For an external surface solar absorbtance of 0.25, and with little or no heat transferred across internal surfaces of the tube, the maximum equilibrium diametric temperature differential is fairly high (about 85 to 95°F) for the case considered. A significant reduction in temperature gradient can be obtained by using a high emittance (ϵ_i = .9) internal surface coating as indicated.

The results shown in Figure 6-29 are for equilibrium conditions and do not include the effect of transients on the diametric temperature differential. A typical example of these effects are presented in Figure 6-30. Here, the average tube temperature and the diametric temperature differential for surface strut 81-82 (70 ft. antenna) are shown as a function of time during that portion of the orbit where the antenna emerges from the earth's shadow. While the tube temperature is increasing, the diametric temperature differential for the case considered rapidly reaches a peak value about 20% higher than that for equilibrium conditions.

It is anticipated that bending of the tubular antenna elements will have only a small effect on overall antenna distortion. The parabolic reflector mesh support system is attached to the truss structure at the spiders. Thus, distortions are produced indirectly by tube bending in that as the tube bends, the distance between the ends of the tube decreases slightly. This effect is small when compared to the effect of absolute temperature level on tube length.

The rapid tube bending caused by transient temperature gradients could possibly influence the dynamics of the reflector depending on the time spans involved. Further study is required to define the effect of these thermal characteristics on reflector performance.

6.2.4 TUBE COATING SELECTION - Several of the factors involved in selecting antenna tube surface coatings include:

a. A low value of solar absorptance will limit the effect of tube bending on antenna distortion.

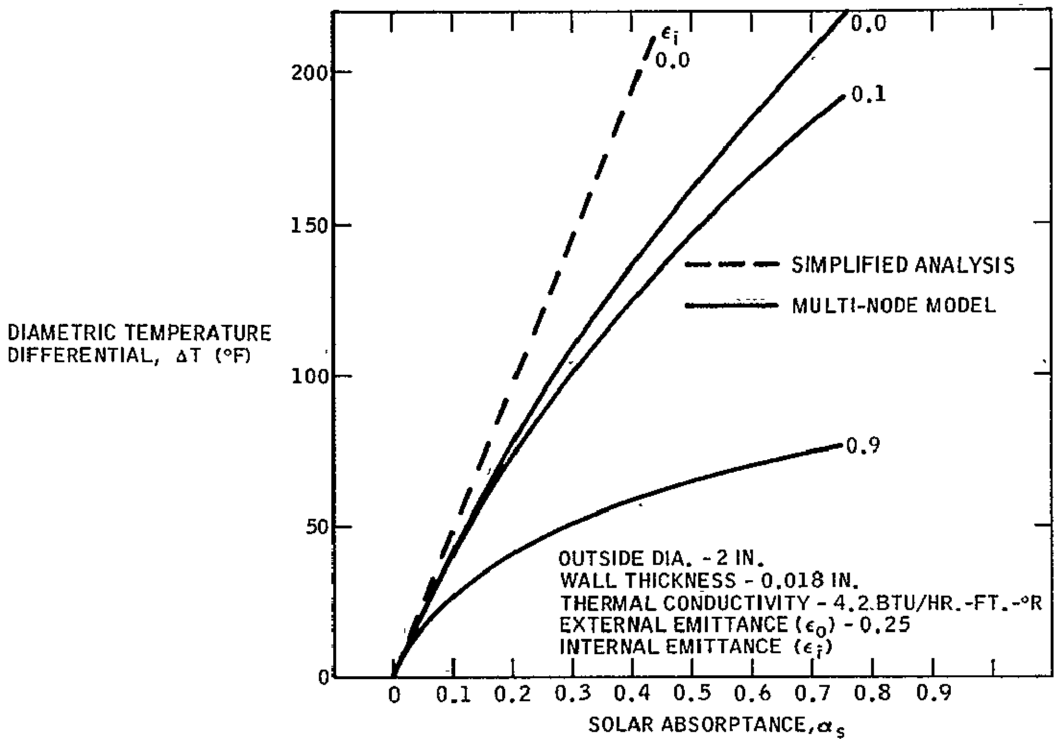


Figure 6-29. Maximum Equilibrium Diametric Temperature Differential

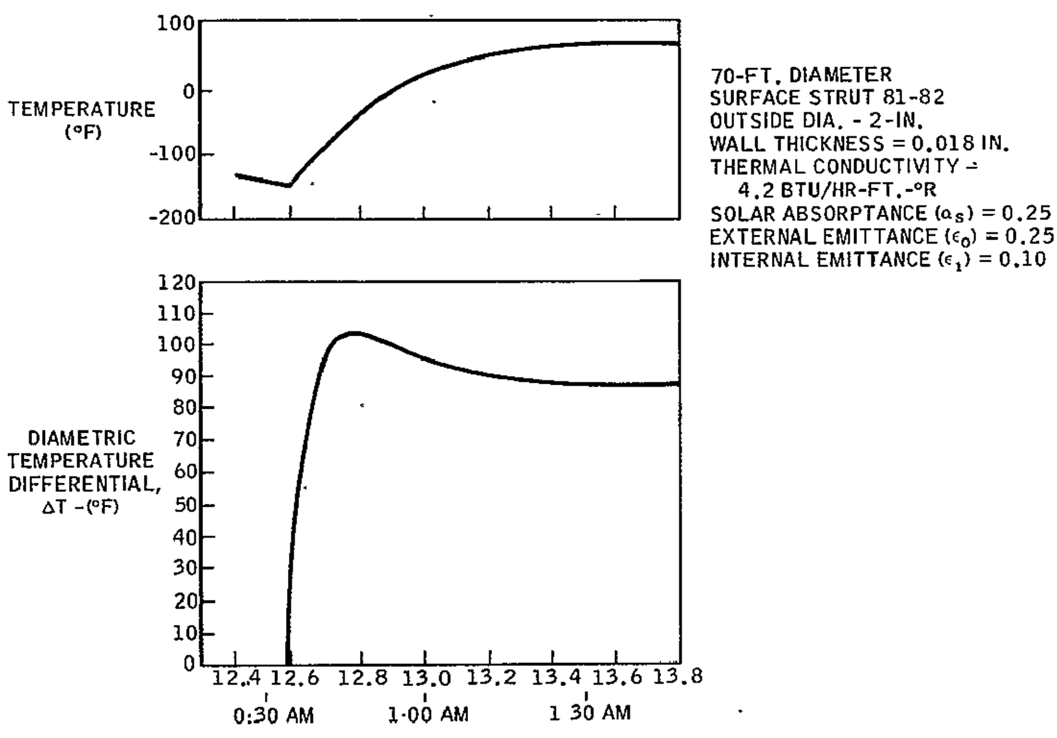


Figure 6-30. Transient Diametric Temperature Differential

b. A low value of thermal emittance will reduce temperature excursions during shadowed periods and when a tube element projected area with respect to the sun is small.

c. A solar absorptance to thermal emittance ratio of about 1.0 will yield a temperature close to the design and fabrication temperature (+ 68°F) for many of the tubes over a large portion of the orbit.

d. A low solar absorptance to thermal emittance ratio will yield a low average tube temperature, and temperature excursions during shadowed periods will be less.

The α_s and ϵ values used in this study are conservative in nature and fairly easy to obtain. Other coating schemes can be used to reduce distortion due to temperature differences. Figure 6-31 shows the results of using two different coating configurations and the comparison with that used in determining antenna distortions during this study (α_s = 0.25, ϵ = 0.25). For the bicoated system. The α_s value used on the side of the tube towards the mesh is higher to compensate for the reflector mesh shadowing. As shown in Figure 6-31, the use of this scheme increased the tube temperatures, especially during the period from about 1:00 a.m. to 7:00 a.m. such that they are closer to the design and fabrication temperature)+68°F) over a greater portion of the orbit. For the particular coatings used, however, the difference between the maximum and minimum temperatures over the orbit increased from about 275°F to 290°F. To reduce temperature excursions over an orbit, low α_s/ϵ ratios must be used. The dashed curve in Figure 6-31 shows the results of using a high ϵ, low α_s/ϵ' ratio coating typical of white pigmented paints. Here, the average tube temperature is significantly below + 68°F, and compensation during design and fabrication will be required to obtain optimum performance in flight. The advantage of this coating is that the differential between maximum and minimum temperatures over an orbit is decreased. For the case shown, the temperature differential decreased from 275°F to 190°F.

The results presented above show the potential for decreasing thermal distortion through proper selection of coatings. It appears that a bicoated system with low α_s/ϵ ratios (significantly less than 1.0) will yield the best performance provided the antenna is designed for the low operating temperature level. This could present problems in ground testing and checkout of the antenna since it will be distorted at + 68°F. Additional effort is required to evaluate the effect of surface coating configurations on overall antenna distortion, and to determine their impact on the design, fabrication and ground testing operations.

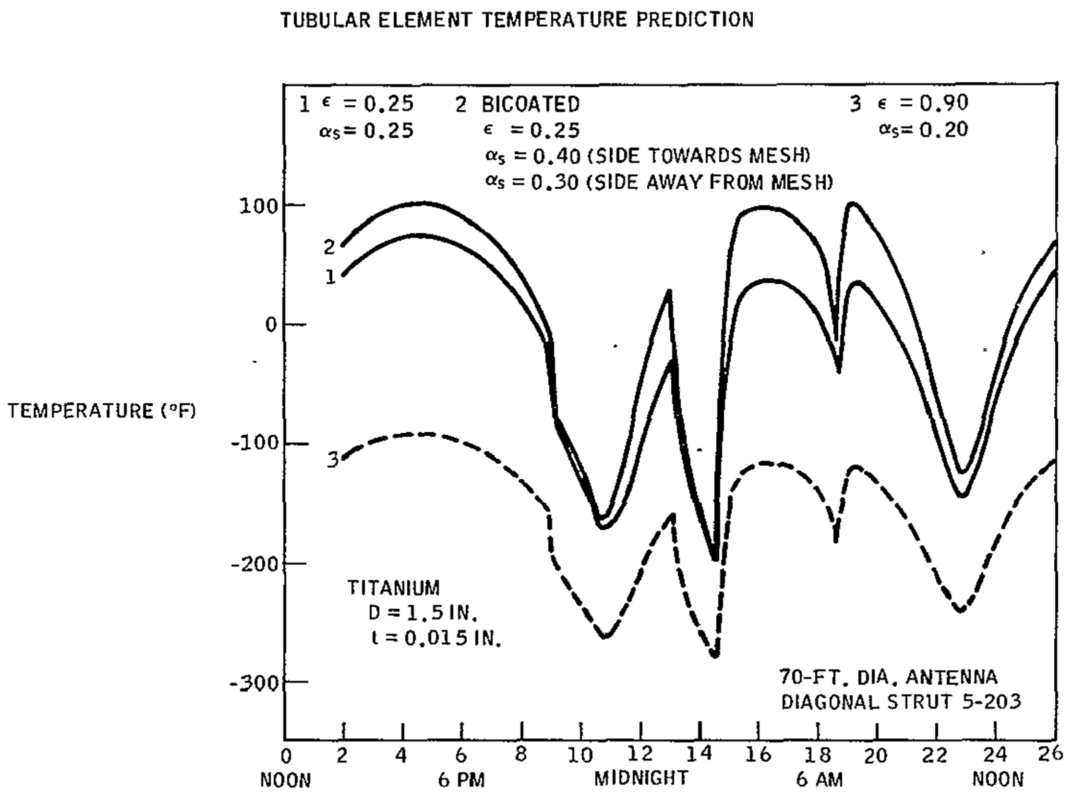


Figure 6-31. Tubular Element Surface Coating Effects

6.3 DISTORTION EFFECTS

The only significant cause of expandable truss antenna performance degradation is thermal distortion of the reflector surface. Manufacturing deviations are controlled to relatively low levels, and distortions resulting from dynamic effects in orbit are negligible because of the stiff truss structure. This section summarizes thermal and manufacturing deviation effects on the antenna RF performance.

6.3.1 TRUSS DISTORTION - Physical effects of the thermal environment of the distortion of two sections of the truss are shown in Figure 6-32 for the 70 foot, eight-bay antenna at six a.m. Mesh shadowing causes the side of the antenna away from the sun to curl up.

Truss thermal distortion analysis was performed with Convair's digital computer program No. 4422. The program calculates X, Y, and Z displacement, and final coordinates. It also calculates the normal displacement and half the path length change (epsilon) of the forward surface nodes. All truss deflections are relative to the center node in the forward surface. The program requires the tubular element temperature distribution previously discussed and the Convair tubular element geometry subroutine (AGO). Of the orbital position times analyzed in the preceding section, the six a.m. case produces the most severe distortions for a synchronous orbit. Mesh shadowing is greatest at this time. The surface normal displacements at 6 am are shown in Figure 6-33 for both a 30 foot six-bay antenna and a 70 foot eight-bay antenna.

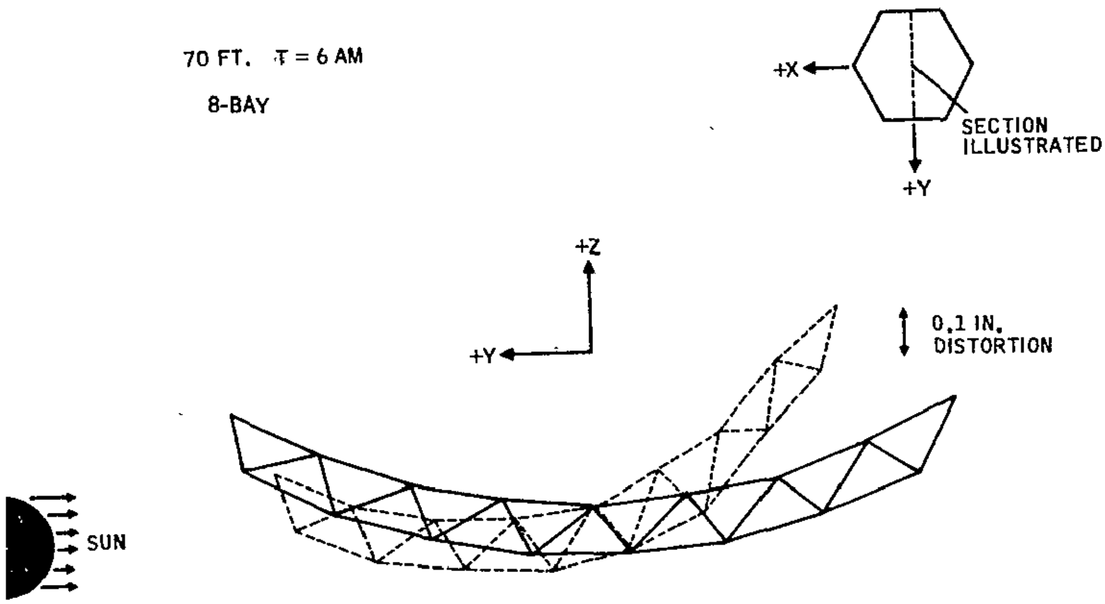
For other orbital positions, rms thermal distortions from the original contour are given in Figure 6-34. The two parameters presented are the rms of the normal displacement and the rms of half the path length change (the axial component of the normal displacement). The rms values are calculated with the following equation:

$$\text{rms} = \left[\frac{\Sigma (X_i)^2 \; W_i}{\Sigma \, W_i}\right]^{\frac{1}{2}}$$

where:

X_i = i^{th} parameter being analyzed.

W_i = i^{th} weighting factor determined by effective area and illumination taper. (Assumed to be a -10 db Gassian taper). The normal displacement and half the path length change are defined in the Figure 6-35. Note that half the path length change is the axial component of the normal displacement, which is required to determine the effect of the distortions on RF performance. The rms half-path length change illustrated in Figure 6-35 is about 10% less than the normal displacement.



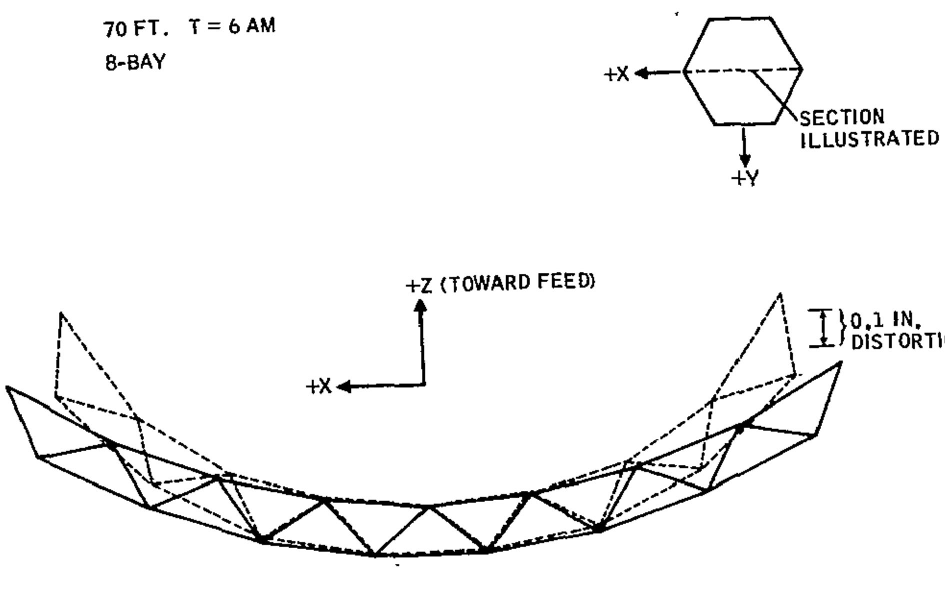
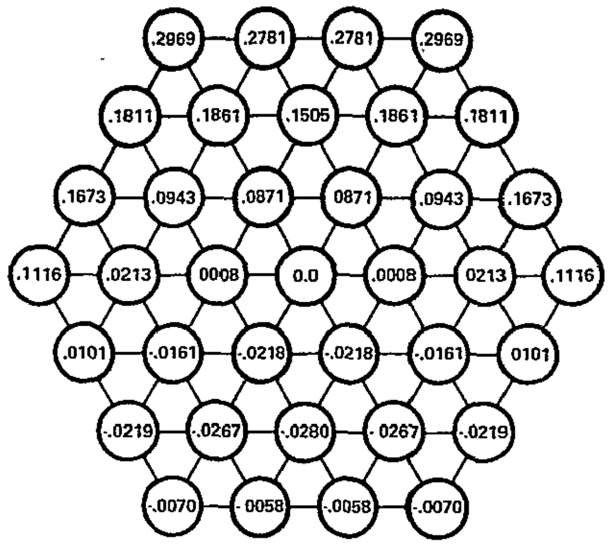


Figure 6-32. Sectional Views of Truss Distortion

30 FT.- 6 BAY NORMAL TRUSS DEFLECTIONS, 6 A.M.
(POSITIVE DEFLECTIONS TOWARDS FEED)



70-FT. 8-BAY NORMAL TRUSS DEFLECTIONS, 6 A.M.
(POSITIVE DEFLECTION TOWARDS FEED)

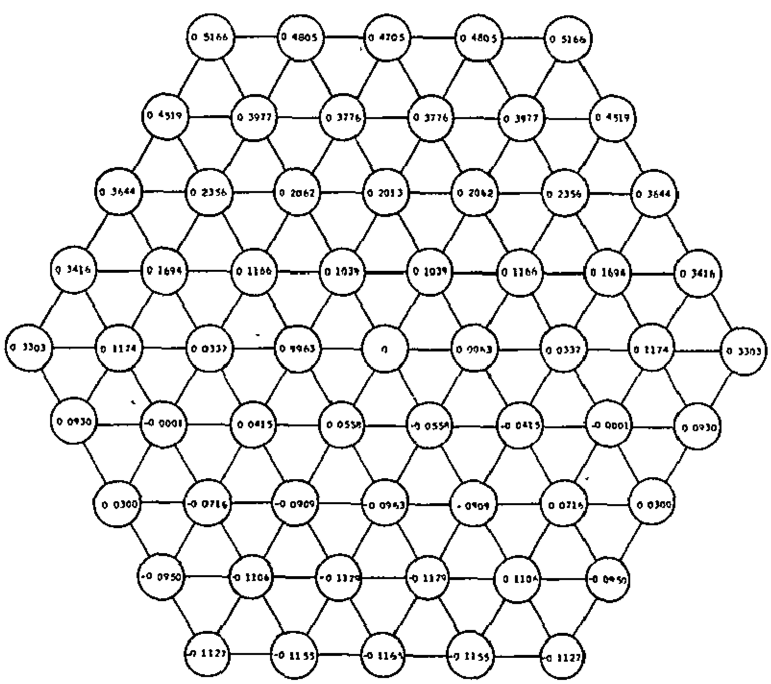
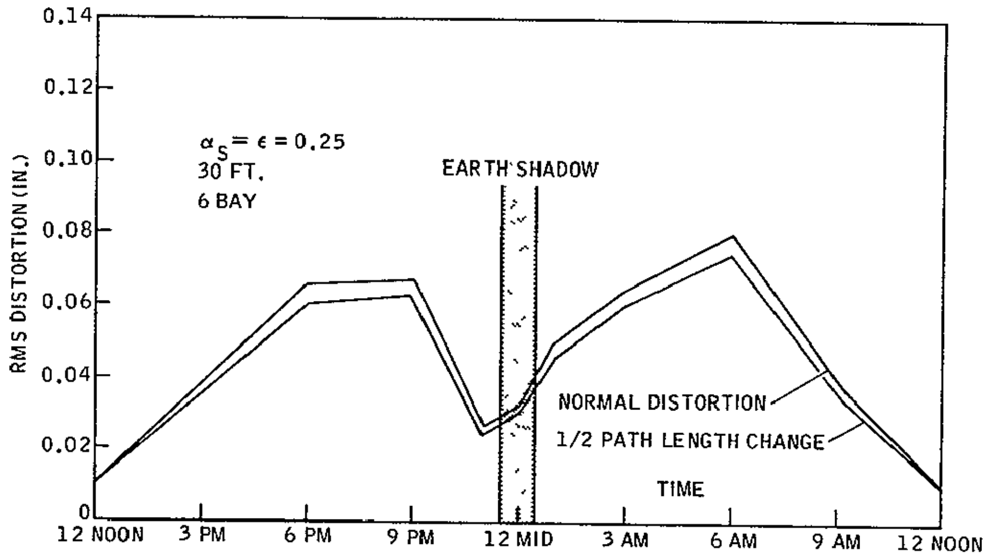


Figure 6-33. Reflector Truss Distortion, Worst-Case



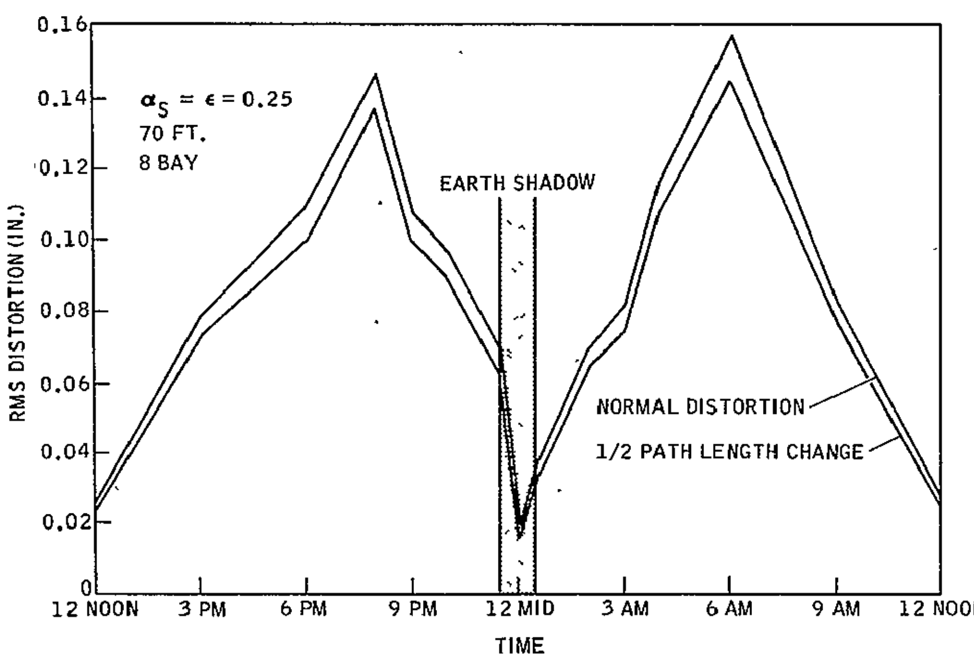


Figure 6-34. Truss RMS Thermal Distortions From Original Contour

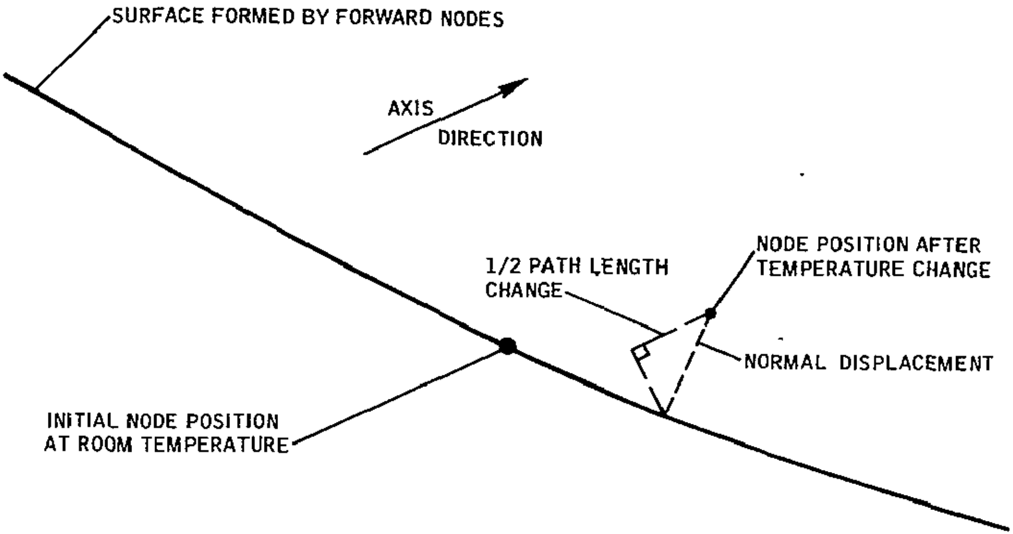


Figure 6-35. Surface Normal and 1/2 Path Length Change

6.3.2 MESH THERMAL DISTORTION - As previsouly described, the mesh surface of the reflector experiences wide temperature variations during orbit and is generally much higher in temperature than the truss and mesh support system. Total distortions for the surface alone are low, however. The worst case for the 30-foot and 70-foot reflectors is 0.010 inch and 0.021 inch, respectively.

The primary factor in the low distortion of the mesh is its low spring factor. While expansion due to thermal variations may be high, the motion of point M, in Figure 6-36, is dictated by the change in spring force ΔP. If the spring were of a constant-load type, such as a Negator spring, the thermal expansion would not change the position of point M. Basically, the knit woven mesh is a low spring factor material; with springs added to the adjustment cables, the effect of thermal change is greatly reduced. The gold-plated Chromel-R requires 0.02 pound per inch of material to pull it taut. The material will readily take 140 pounds per inch, which is substantially below the permanent set point in its thermal cycle variations. Since the material is entirely metallic, ultraviolet radiation or vacuum does not affect it. The low-modulus gold is plated onto the high-modulus Chromel-R. Therefore, thermal cycling will not flake off the coating. Tests at NASA-MSC substantiated this material for the Apollo lunar antenna.

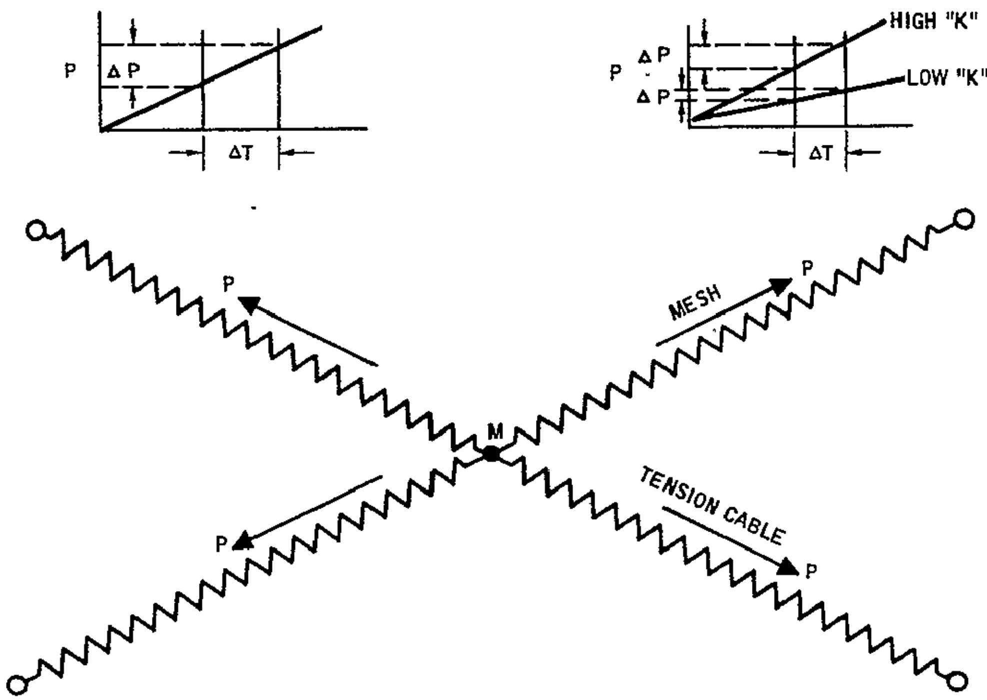


Figure 6-36. Mesh Thermal Deviations, Basic Concept.

6.3.3 DESIGN AND MANUFACTURING SURFACE DEVIATIONS - The desired parabolic contour of the mesh surface is approximated in the expandable truss sign by producing a series of flat facets within each truss bay through the mesh support system. The inherent deviation from a true parabola depends upon the radius of curvature, which is a function of antenna diameter, and upon the size of the flat facet. As the number of bays increases for the same antenna diameter. Figure 6-37 shows the sum of this inherent deviation and the manufacturing tolerance effect for various numbers of bays over the 20 to 100 foot diameter range. A conservative manufacturing tolerance of ± 0.020 inch has been assumed throughout. Note that the total rms deviation for the eight-bay version varies only slightly in the 30 to 60 foot diameter range.

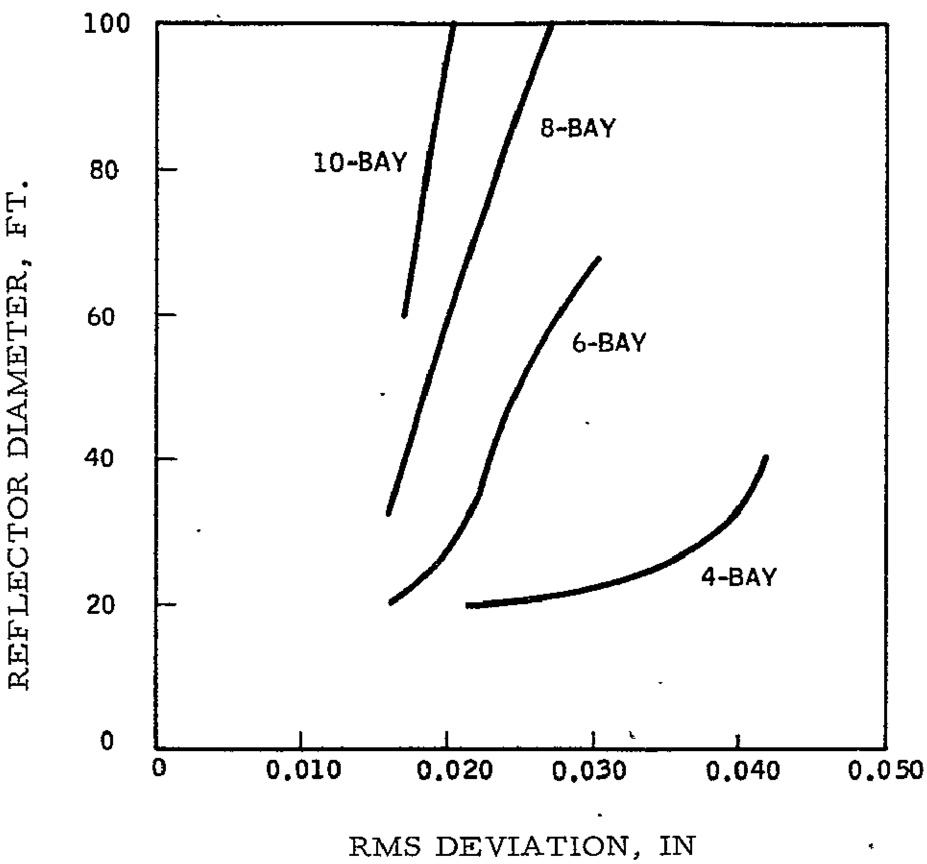


Figure 6-37. Design & Manufacturing RMS Deviation

6.3.4 TOTAL REFLECTOR NORMAL RMS DEVIATION VERSUS TIME - The plot in Figure 6-38 presents total normal rms deviation from the original parabolic contour as a function of time. The data is for 33 foot and 70 foot, eight-bay antennas. Total normal rms deviation includes thermal distortion of the truss and mesh and manufacturing deviations from an ideal parabolic contour.

The total rms value is determined as follows:

$$\delta_{rms} = \sqrt{(\delta_{truss} + \delta_{mesh})^2 + \delta^2_{mfg.}}$$

Except for very small antennas the truss thermal distortion accounts for the major portion of the rms distortion.

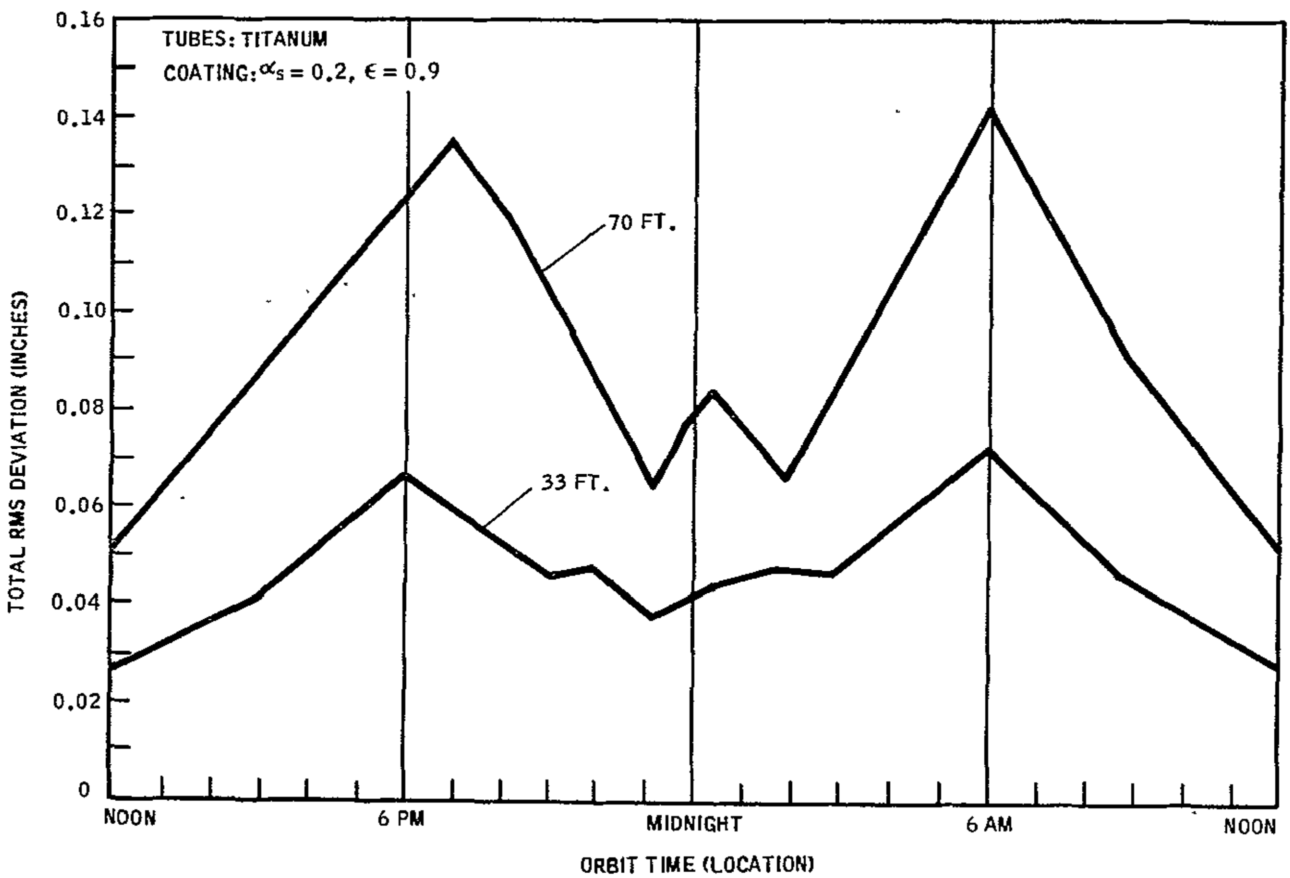


Figure 6-38. Total RMS Deviation VS Time, Synchronous Orbit

6.3.5 MAXIMUM GAIN FREQUENCY - Figure 6-39 gives the maximum gain frequency for given antenna sizes based on the mechanical and thermally induced surface deviations from Figure 6-39. Maximum and minimum distortion values from the analyses were used in the equations:

$$f_{max.} \text{ (Ghz)} = \frac{0.94}{\sigma \text{(in.)}}$$

(derived from Ruze, $\lambda_{min.} = 4\pi\sigma$) to determine maximum frequencies and gain.

In this equation, is the rms value of the effective surface deviations. For a nominal f/D ratio of 0.44, the effective surface deviation is about 10% less than the normal displacement of the antenna surface. The values shown are for titanium tubular elements coated to produce a surface α_s/ϵ ratio of 0.22. The antenna diameter used is the equivalent circular diameter, which is about 9% less than the hexagonal aperture point-to-point dimension .

Distortion values werr further extrapolated in Figure 6-40 to establish general operating frequency limits vs. antenna size.

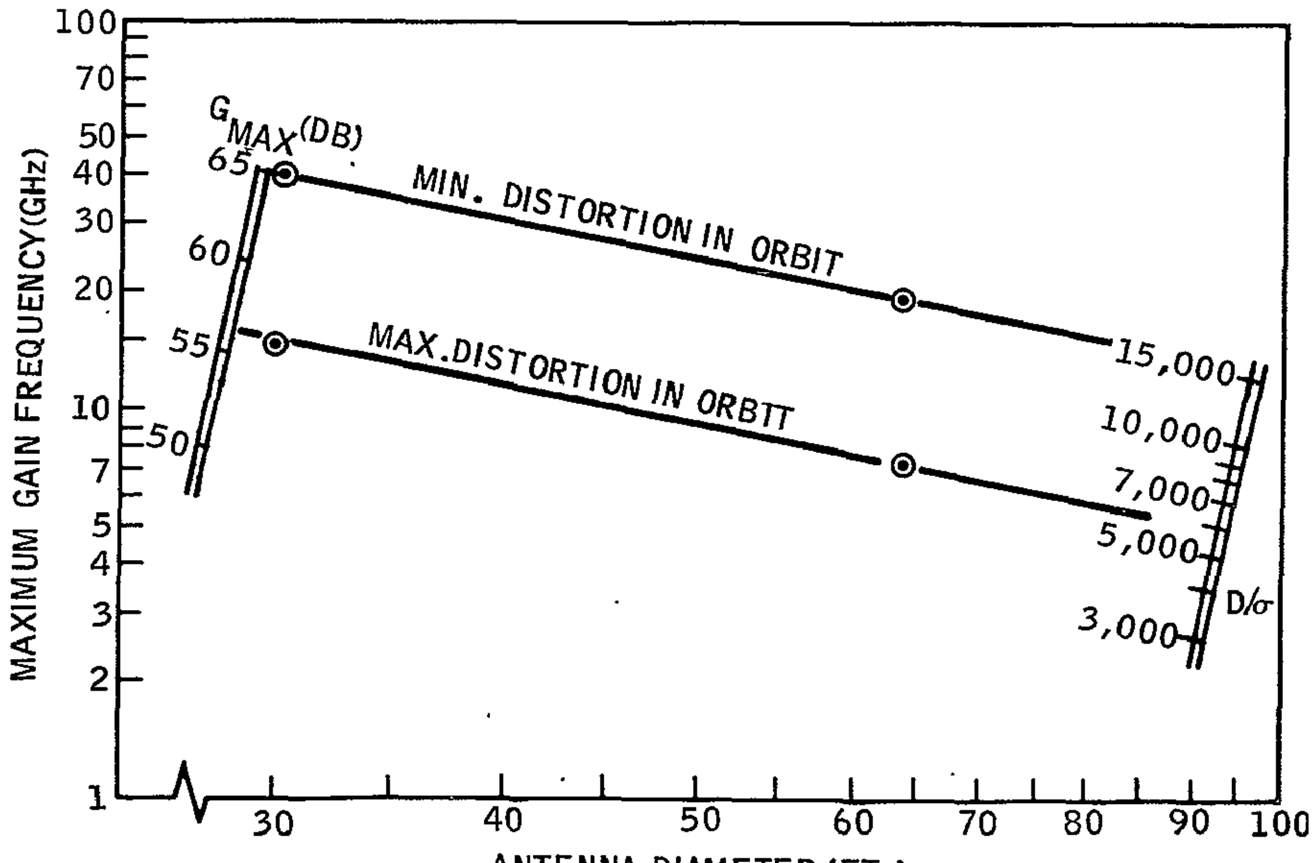


Figure 6-39. Maximum Gain and Frequency Capability of Erectable Truss Antenna in Synchronous Orbit

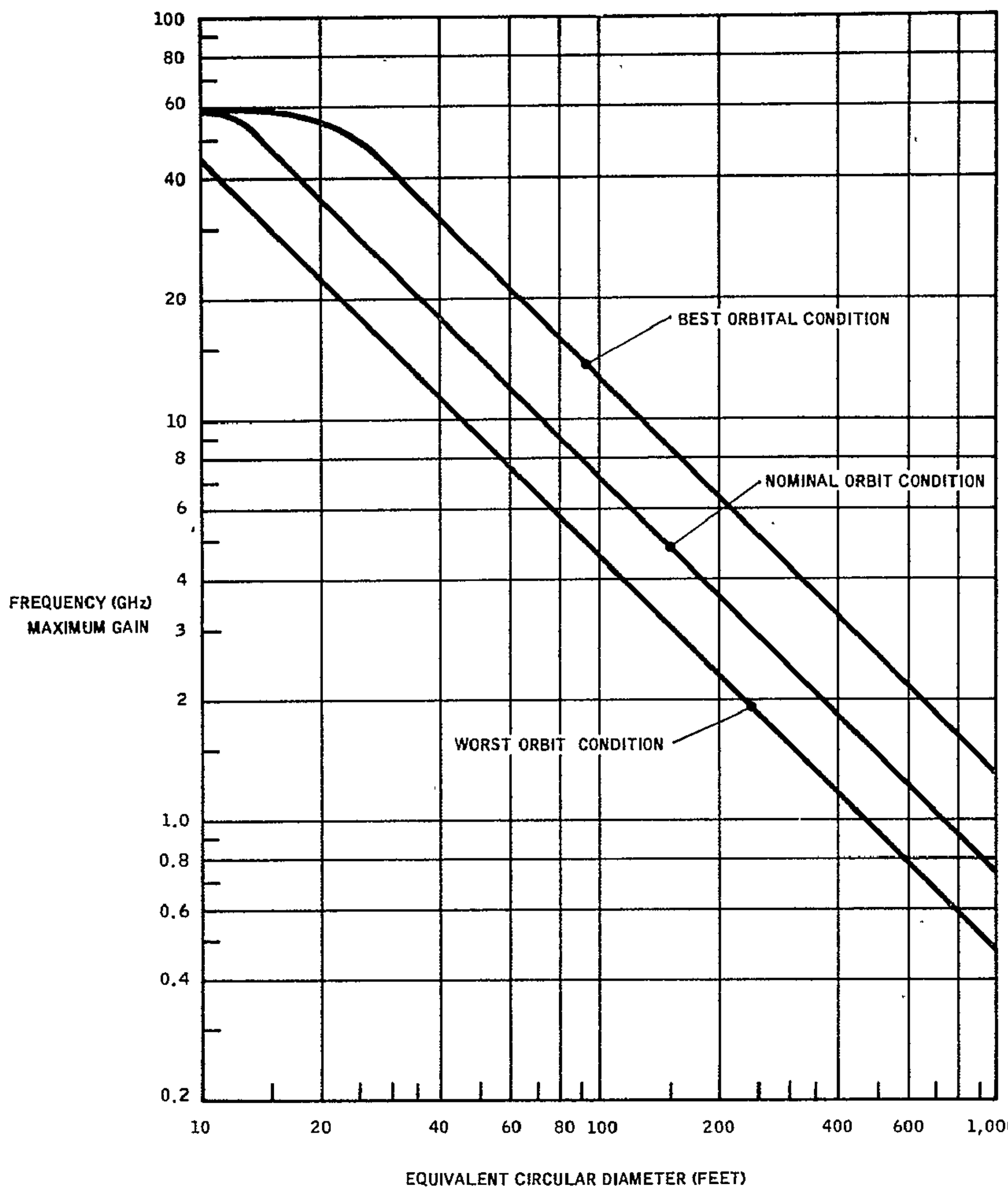


Figure 6-40. Expandable Truss Antenna Size VS. Frequency Limits.

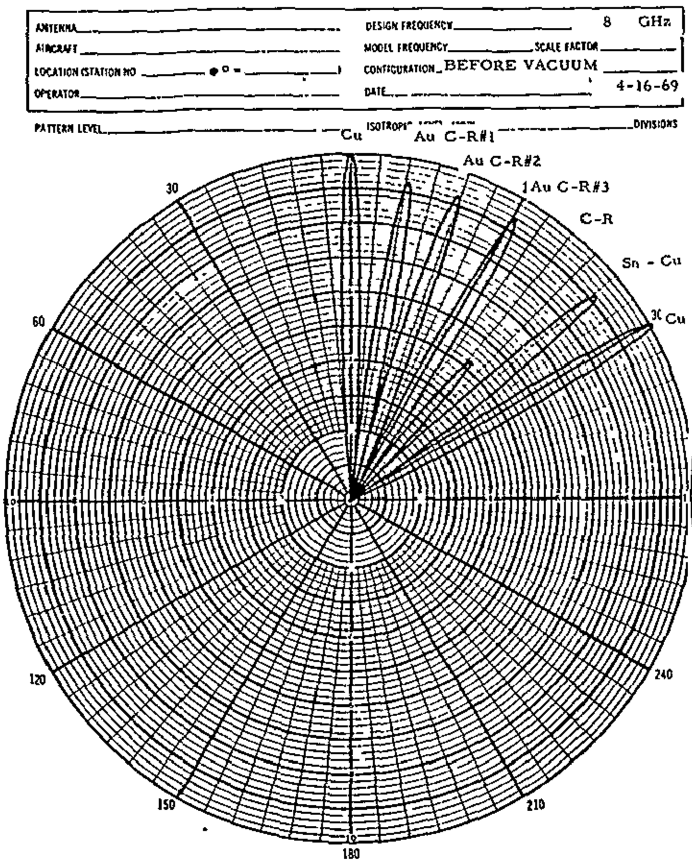
APPENDIX A-1

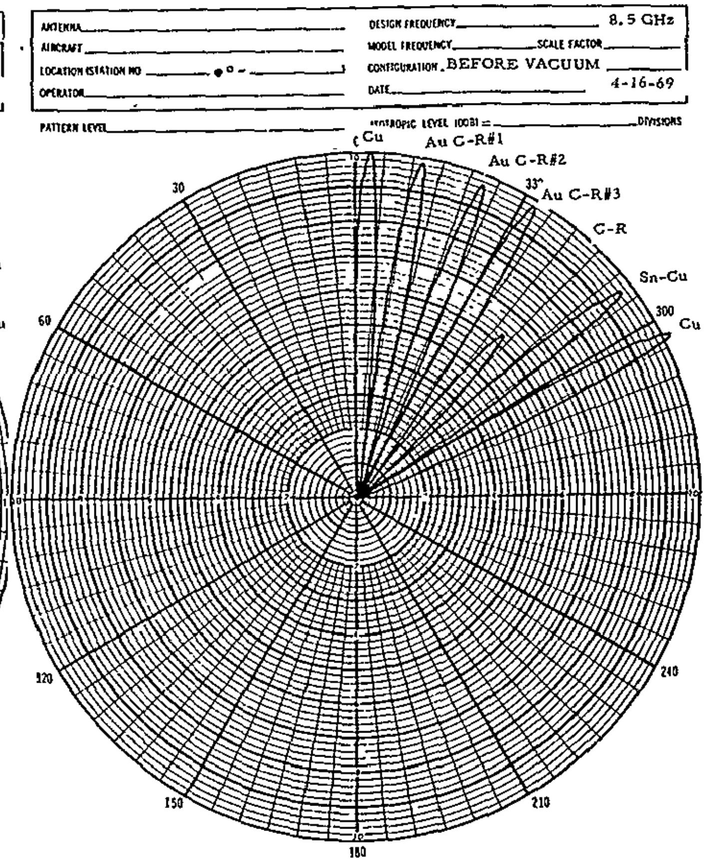
PRE-VACUUM MESH REFLECTIVITY MEASUREMENTS (SEE SECTION 1.2.4.4)

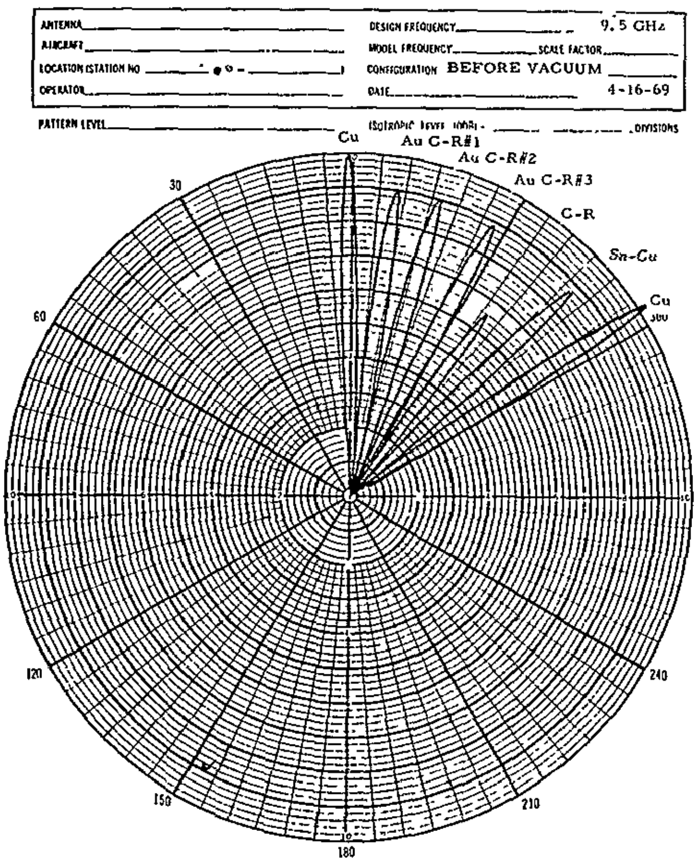
POWER PLOTS

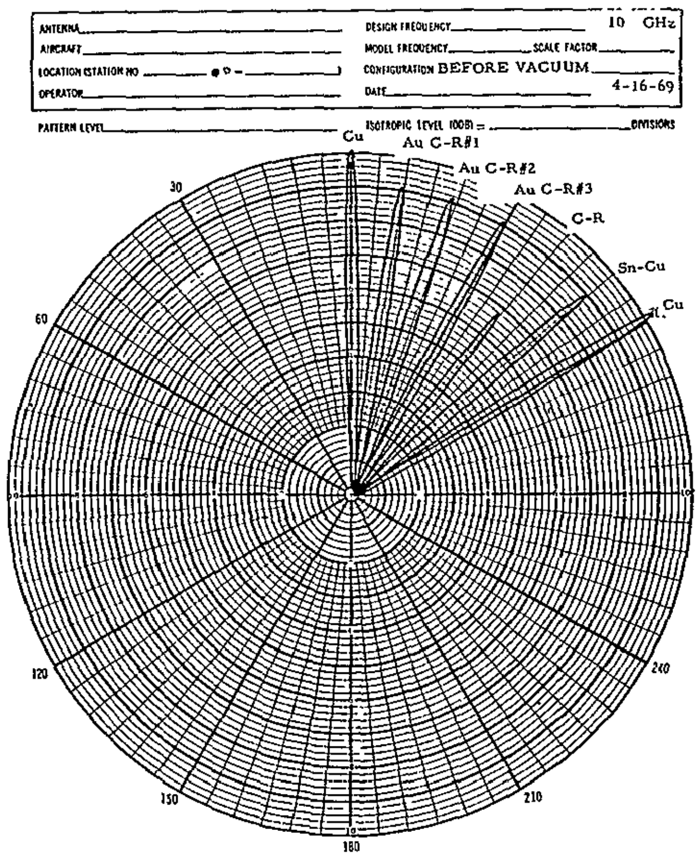
LEGEND

SYMBOL	TEST MATERIAL
Cu	Copper Reference
Au C-R#1	Au Chromel-R Sample #1
Au C-R#2	Au Chromel-R Sample #2
Au C-R#3	Au Chromel-R Sample #3
C-R	Bare Chromel-R
Sn - Cu	Tin Plated Copper


DESIGN FREQUENCY 8 GHz
CONFIGURATION BEFORE VACUUM
DATE 4-16-69
Cu
Au C-R#1
Au C-R#2
Au C-R#3
C-R
Sn - Cu
Cu
30
60
120
150
180
210
240

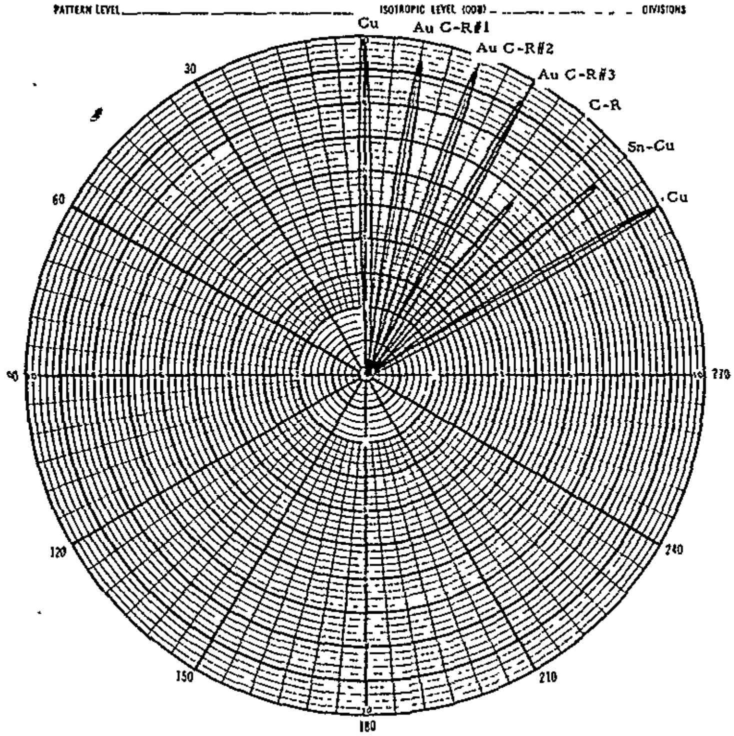

DESIGN FREQUENCY 8.5 GHz
CONFIGURATION BEFORE VACUUM
DATE 4-16-69
Cu
Au C-R#1
Au C-R#2
Au C-R#3
C-R
Sn-Cu
Cu
30
60
120
150
180
210
240
300


DESIGN FREQUENCY 9.5 GHz
CONFIGURATION BEFORE VACUUM
DATE 4-16-69
Cu
Au C-R#1
Au C-R#2
Au C-R#3
C-R
Sn-Cu
Cu
30
60
120
150
180
210
240


DESIGN FREQUENCY 10 GHz
CONFIGURATION BEFORE VACUUM
DATE 4-16-69
Cu
Au C-R#1
Au C-R#2
Au C-R#3
C-R
Sn-Cu
Cu
30
60
120
150
180
210
240

ANTENNA	DESIGN FREQUENCY 10.5 GHz
AIRCRAFT	MODEL FREQUENCY SCALE FACTOR
LOCATION (STATION NO ø ° -)	CONFIGURATION BEFORE VACUUM
OPERATOR	DATE 4-16-69

PATTERN LEVEL ISOTROPIC LEVEL (DDB) DIVISIONS



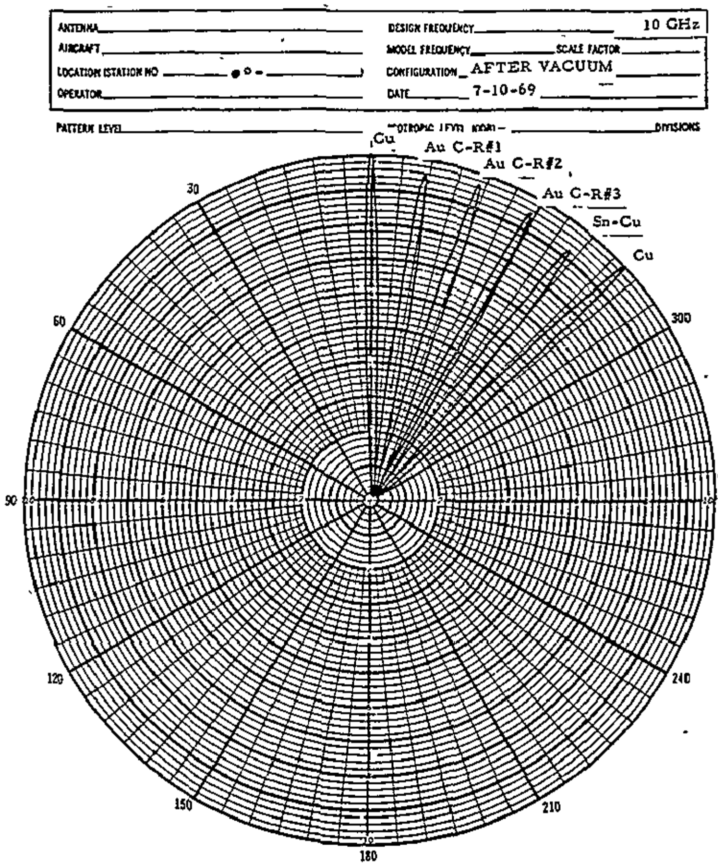
APPENDIX A-2

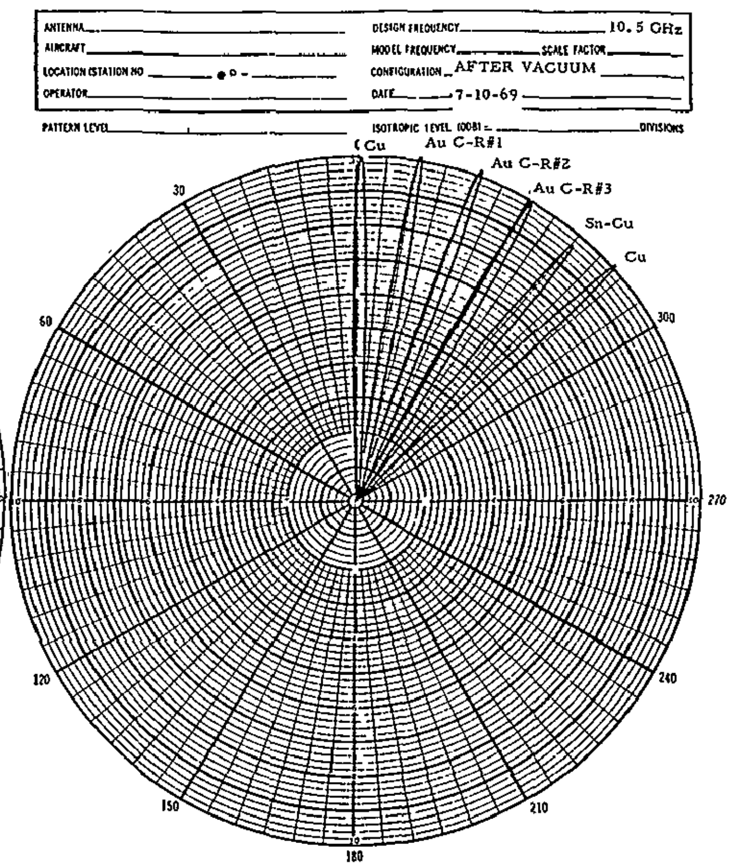
POST-VACUUM MESH REFLECTIVITY MEASUREMENTS (SEE SECTION 1.2.4.4)

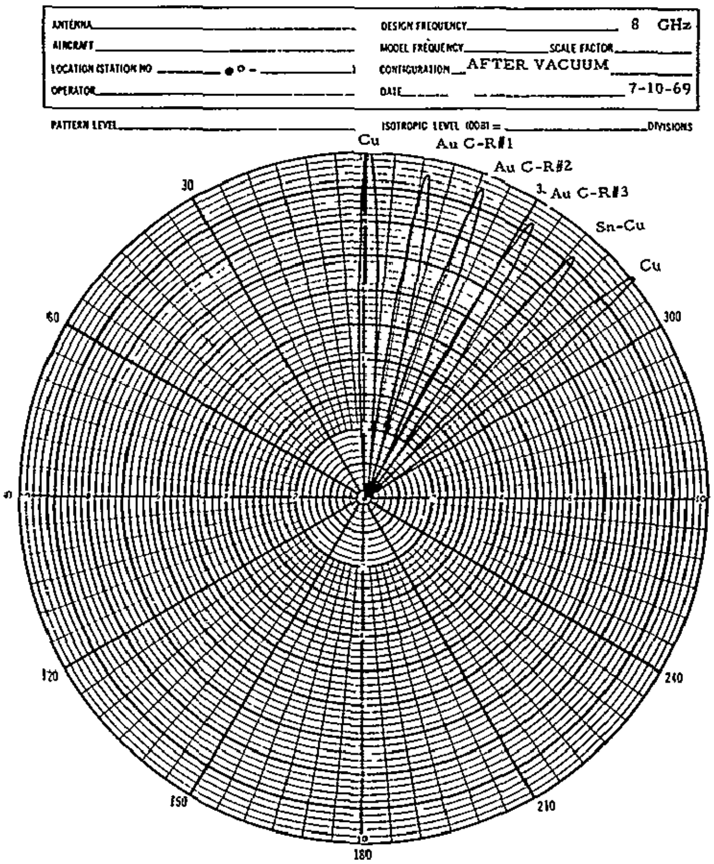
POWER PLOTS

LEGEND

SYMBOL	TEST MATERIAL
Cu	Copper Reference
Au C-R#1	Au Chromel-R Sample #1
Au C-R#2	Au Chromel-R Sample #2
Au C-R#3	Au Chromel-R Sample #3
Sn - Cu	Tin Plated Copper


ANTENNA
DESIGN FREQUENCY 10 GHz
AIRCRAFT
MODEL FREQUENCY
SCALE FACTOR
LOCATION (STATION NO
CONFIGURATION AFTER VACUUM
OPERATOR
DATE 7-10-69
PATTERN LEVEL
DIVISIONS
Cu
Au C-R#1
Au C-R#2
Au C-R#3
Sn-Cu
Cu
30
60
90
120
150
180
210
240
300


ANTENNA
DESIGN FREQUENCY 10.5 GHz
AIRCRAFT
MODEL FREQUENCY
SCALE FACTOR
LOCATION (STATION NO
CONFIGURATION AFTER VACUUM
OPERATOR
DATE 7-10-69
PATTERN LEVEL
ISOTROPIC LEVEL (ODB)
DIVISIONS
Cu
Au C-R#1
Au C-R#2
Au C-R#3
Sn-Cu
Cu
30
60
120
150
180
210
240
270
300


ANTENNA
AIRCRAFT
LOCATION (STATION NO
OPERATOR
DESIGN FREQUENCY 8 GHz
MODEL FREQUENCY
SCALE FACTOR
CONFIGURATION AFTER VACUUM
DATE 7-10-69
PATTERN LEVEL
ISOTROPIC LEVEL (DBI) =
DIVISIONS
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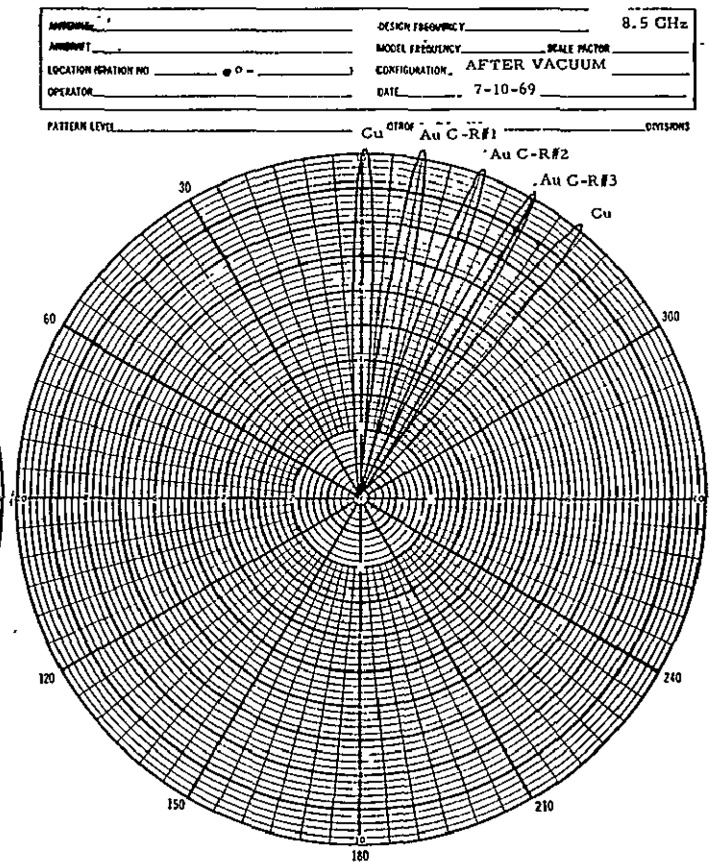
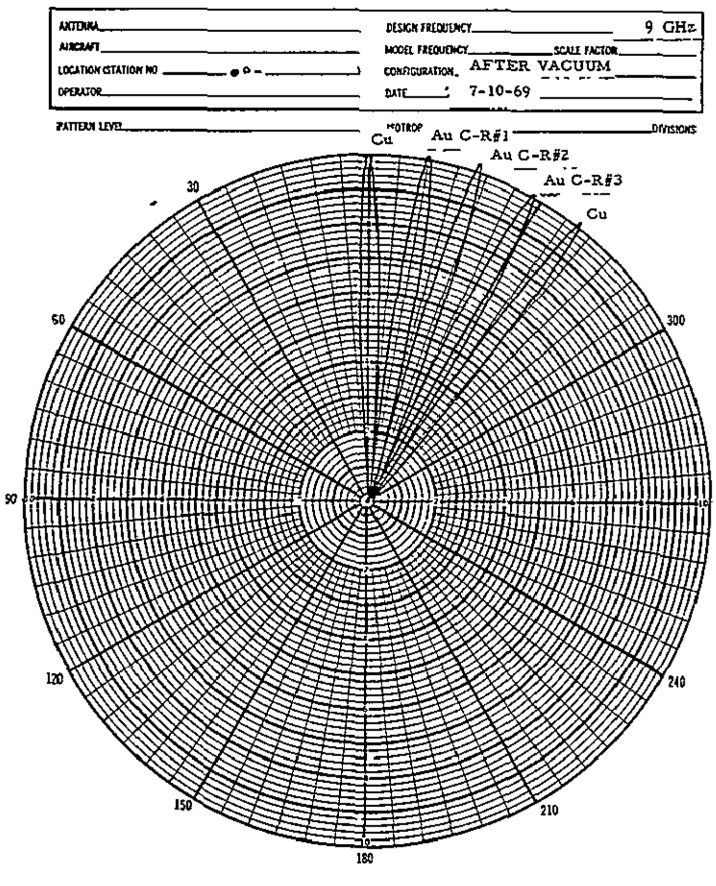
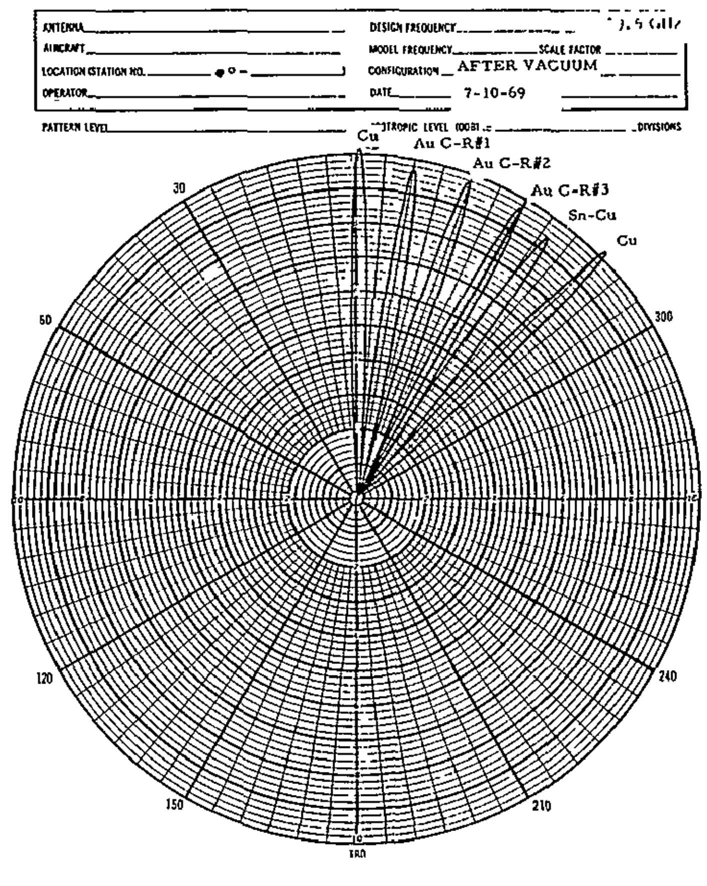
Au C-R#1
Au C-R#2
Au C-R#3
Sn-Cu
Cu
30
60
120
150
180
210
240
300


DESIGN FREQUENCY 8.5 GHz
MODEL FREQUENCY
SCALE FACTOR
LOCATION (STATION NO
OPERATOR
CONFIGURATION AFTER VACUUM
DATE 7-10-69
PATTERN LEVEL
DIVISIONS
Cu
Au C-R#1
Au C-R#2
Au C-R#3
Cu
30
60
120
150
180
210
240
270
300


ANTENNA
AIRCRAFT
LOCATION (STATION NO
OPERATOR
DESIGN FREQUENCY 9 GHz
MODEL FREQUENCY
SCALE FACTOR
CONFIGURATION AFTER VACUUM
DATE 7-10-69
PATTERN LEVEL
DIVISIONS
Cu
Au C-R#1
Au C-R#2
Au C-R#3
Cu
30
60
90
120
150
180
210
240
300


ANTENNA
AIRCRAFT
LOCATION (STATION NO.
OPERATOR
DESIGN FREQUENCY
MODEL FREQUENCY
SCALE FACTOR
CONFIGURATION AFTER VACUUM
DATE 7-10-69
PATTERN LEVEL
DIVISIONS
Cu
Au C-R#1
Au C-R#2
Au C-R#3
Sn-Cu
Cu
30
60
120
150
210
240
270
300

GENERAL DYNAMICS SPECIFICATION

TWO BAR TRICOT KNIT FABRIC

1. SCOPE

1.1 Scope. This specification covers requirements for a particular tricot knit metallic yarn fabric suitable as the reflective medium for RF energy, generated by and suitable for orbiting erectable antennas.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

Federal

PPP-P-1136a	Packaging and Packing of Fabrics

MILITARY

None

GENERAL DYNAMICS

GDC-68258-2	Yarn, Metallic, Continuous Filament
GDC-68258-3	Gold Plating, Electroless

STANDARDS

Military	None

3. REQUIREMENTS

3.1 Material. The fabric shall be manufactured from continuous-filament metallic yarn.

3.2 Construction and Physical Properties. The construction and physical properties of the knitted fabric shall conform to the requirements tabulated in Section 3.2.3.

3.2.1 Width. The width and width tolerance of the fabric shall be as specified by the procuring activity, but in no case shall the width tolerance exceed ± 1 inch.

3.2.2 Length. The length and length tolerance of the fabric shall be as specified by the procuring activity, but in no case shall the length tolerance exceed ± 3 inches.

3.2.3 Fabric Detailed Identify.

3.2.3.1 Pattern. The fabric shall be a two bar tricot knit running every other needle on each bar (half gauge). Knit pattern shall be as follows:

Pattern Front Bar	10/12/23/21
Pattern Back Bar	23/21/10/12

3.2.3.2 Gauge. Gauge of the fabric shall be determined by the following formula, based on the maximum operating frequency at which RF energy loss does not exceed 0.1 db of incident energy.

$$\text{Gauge} = \frac{1}{.05\,\lambda}$$

where λ is the wave length of the highest operating frequency in inches.

Integer gauges shall be one of the following: 7, 14, 28, 16, 32.

If the gauge determined the above formula does not coincide with one of the five specified, the next highest gauge shall be specified. In the event the gauge determined by the above formula exceeds the maximum gauge, the highest gauge is specified.

EXAMPLE

1. λ equals 1 inch

$$\text{Gauge} = \frac{1}{.05\,(1)} = 20$$

Specified gauge is 28

2. λ equals 1/2 inch

$$\text{Gauge} = \frac{1}{.05\,(.5)} = 40$$

Specified gauge is 32

3.2.3.3 Quality. The quality of the fabric shall be equal to one-half the specified gauge.

3.2.3.4 Material. The yarn material shall be per specification GDC-68258-2.

3.2.3.5 Runner Length. The runner length (width of fabric) shall be specified by the procuring activity.

3.2.3.6 Coatings. Any suitable coating, finish, or sizing may be applied to either the yarn or fabric to facilitate knitting, handling, or storage, however, all coatings, finishes, and sizings shall be removed so as to leave a bright, bare, clean knit fabric. The process of removal and cleaning is not specified, but shall not alter or damage in any form the basic yarn material and knit pattern. The fabric shall, after knitting, be plated per GDC-68258-3.

3.2.3.7 Color. The color of the knit material shall be uniform and characteristic of the yarn material.

3.2.3.8 Physical Properties. Physical properties of the fabric shall be as follows:

Weight:	1.35 oz/sq. yard ±20% or less depending on gauge
Transparency:	80% or greater transparency when subjected to a biaxial load which causes no percevial damage to the fabric.

3.2.3.9 Identification of Product. Each roll of fabric shall be marked for identification in accordance with Specification PPP-P-1136a. In addition, the product shall be marked reflecting noted defects, location on the roll, and method of repair.

3.2.3.10 Workmanship. The fabric shall be clean, evenly knitted, and shall conform to the quality and grade of product established by this specification. The finished fabric shall be free from defects except to the extent specified hereafter.

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein, the supplier is responsible for the performance of all inspection requirements prior to submission for inspection by the procuring activity. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the procuring activity. Inspection records of all examinations and tests shall be kept complete and made available upon request to the procuring activity.

4.2 Examination. Continuous visual examination of the fabric will be made during the knitting operation.

4.3 Defects. Defects found during the examination of the end item shall be classified in accordance with 4.3.1, 4.3.2, and 4.3.3.

4.3.1 Yard-By-Yard Examination. The defects listed in Table I shall be counted regardless of their proximity to each other, except where two or more defects represent a single local condition of the fabric, in which case only the more serious defect shall be counted. The acceptable quality level shall be 2.5 major and 10.0 total defects per 100 yards.

Table I. Classification of Defects

Defect	Description	Major	Minor
Missed or dropped stitch	Hole no greater than the area enclosed by 1 wale and course		X
	Hole that is clearly visible and results in a hole greater than the area enclosed by 1 wale and course	X	
Fuzz balls	Small number of filaments of the yarn bunching during the knitting operation:		
	Non-detrimental to strength of fabric		X
	Detrimental to strength of fabric	X	
Hole, cut or tear	Rupture of yarn	X	
Spots, streaks or stains	Clearly visible at normal viewing distance	X	
Crease	Hard embedded and not removable		X
Width	Exceeding tolerance limits		X

4.3.2 Overall Examination. The unit of product shall be the specified length. Each defect listed below shall be counted not more than once in each roll examined. The acceptable number of defects shall be as shown in Table II.

Defects:
- Overall uncleanliness
- Objectional odor
- Color not characteristic of the applied finish
- Uneven knitting clearly visible

Table II. Sample Size

Lot Size in Yards	Max. No. of Defects
0 - 10	0
11 - 60	0
61 - 100	1
101 - 200	2
201 - 300	3

4.3.3 Length Examination. Each unit of product shall be examined for gross length. Any gross length found to be other than specified outside the allowable tolerance limits shall be considered a defect with respect to length. The acceptable number of limits shall be in accordance with Table II.

4.3.4 Repair. Attempts to repair the fabric is authorized. Repairs shall be made using yarn from the same lot shipment. Each repair shall be recorded indicating location, cause of defect, method of repair, and corrective action taken to prevent further defects. Each repair shall be inspected per 4.3 to determine if a satisfactory repair has been accomplished. Satisfactory completion of repair and acceptance shall not be counted in the acceptable quality level.

An acceptable repair is defined to be one that is not readily detected and one that does not alter the stretchability or strength of the fabric.

4.3.5 OPI Acceptance. OPI (Out of Plant Inspection) shall be performed by an authorized representative of the procuring activity. Inspection and acceptance shall be as specified by this specification and shall be performed prior to shipment to the plating facility.

4.3.6 Submission of Samples. Random samples of fabric, as required by the plating facility, shall be furnished. Each sample shall be clearly marked to indicate the location of the sample to the parent yarn.

5. PREPARATION FOR DELIVERY

5.1 Packaging of the mesh shall be in accordance with the applicable requirements for Class 1 fabrics of Specification PPP-P-1136a.

5.2 Shipments shall be marked in accordance with the applicable requirements of Specification PPP-P-1136a.

6. NOTES

6.1 Intended Use. The mesh covered by this specification is intended for use as the reflective medium of RF energy when suitably installed on General Dynamics proprietary erectable antenna structures.

6.2 Ordering Data. Procurement documents should specify the following:

(a) Title, number, and date of this specification

(b) Quantity desired

(c) Width of fabric required

(d) Maximum operating frequency

7. DEFINITIONS OF TERMS

Technical terms used throughout the context of this specification are defined as follows:

Wale –	Vertical row of the stitch
Course –	Horizontal row of the stitches
Rack –	Expressed as a unit of 480 courses

7.

Quality –	Expressed as the inches of fabric per rack
Runner Length –	Expressed as inches of yarn from each beam per rack
Gauge –	Needles per inch used on knitting machine
Yarn –	Material from which the fabric is knitted (see Section 2)
Fabric –	Knitted material as a result of the knitting operation, but before addition or removal of appropriate coatings or finishes as required by the procuring agency
Mesh –	Knitted material suitable for use as an effective RF energy reflective medium

GENERAL DYNAMICS SPECIFICATION

YARN, METALLIC, CONTINUOUS FILAMENT

1. SCOPE

1.1 Scope. This specification covers requirements for continuous filament metallic yarns suitable for knitting into tricot fabrics and subsequent electroplating operations.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and documents, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

Federal	None
Military	None

STANDARDS

Fed. Test Method Std. No. 151a Method 211.1	Test Methods, Metals

GENERAL DYNAMICS

GDC-68258-1	Two Bar Tricot Knit Fabric
GDC-68258-3	Gold Plating, Electroless

3. REQUIREMENTS

3.1 Material. The yarn shall be manufactured from a metallic alloy consisting of:

Nickel	74.0%
Chromium	20.0%
Iron	3.0%
Aluminum	3.0%

3.2 Properties. The yarn shall have the following properties:

3.2.1 Physical and Mechanical Properties

(a) Melting Point - 2550° F.

(b) Density - 0.295 lbs/inch^3

(c) Tensile Strength, annealed yarn - 130,000 psi.

(d) Elongation in 2 inches, annealed .5 mil yarn - 4% minimum, 15% maximum.

3.2.2 Electrical Properties

(a) Resistivity - 800 ohms/CMF 116 microhm/cm^3).

(b) Temperature Coefficient of Resistance - 0 10 ppm/° C - Temp. Range -65 to 150° C.

(c) Thermal EMF vs Copper -0 1 microvolt/C°
Temp. Range -65 to 250° C.

3.2.3 Thermodynamic Properties

(a) Thermal Conductivity 0.14 watts/cm/°C - Temp. Range 20 to 100°C

(b) Specific Heat -0.107 calories/gm/° C - Temp. Range 20 to 100°C.

(c) Thermal Coefficient of Exapansion - 13.5 x 10^{-6} inch/inch/°C.

3.2.4 Others

(a) Specific Gravity - 8.10.

(b) Magnetic Properties - Nonmagnetic

3.3 Yarn Specific Identity.

3.3.1 Filament. The filament from which the yarn is made shall be 0.5 mil wire (.0005 inches). The filament shall be produced by the diamond die drawn process.

3.3.2 Yarn. The yarn shall have 14 filament ends bunched together with nine (9) twists per inch.

3.3.3 Finish. The yarn shall be bright, bare and fully annealed, suitable for subsequent knitting and plating operations.

3.3.4 Tolerance. Tolerance of the filament diameter shall be controlled by the resistivity. Resistivity shall be 2600 ohms ± 10% per foot at room ambient temperature. In no case shall the filament diameter exceed 0.0005 ± 0.0001 inches.

3.3.5 Color. The color of the yarn shall be bright and have a shiney metallic luster, indicative of this type of product.

3.3.6 Identification of product. Each finished spool of yarn shall be identified by a label bearing the following information:

(a) Name of manufacture.

(b) Filament diameter.

(c) Number of filament ends.

(d) Twists per inch.

(e) Net weight of yarn and approximate yardage

(f) Finish

(g) Date of manufacture

3.3.7 Spool Lots. Each spool of yarn shall be wound on appropriate spools, each spool having equal lengths of yarn. Configuration of spool type and length of yarn shall be specified by the selected fabric manufacturer after concurrence by the procuring activity.

3.3.8 Workmanship. The finished yarn shall be clean, uniformly twisted, and shall conform to the quality and grade of product established by this specification. The finished product shall be free from defects except to the extend specified hereafter.

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein, the supplier is responsible for the performance of all inspection requirements prior to submission for inspection by the procuring activity. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the procuring activity. Inspection records of all examinations and tests shall be kept complete and made available upon request to the procuring activity.

4.2 Examination. Continuous visual examination of the twisted yarn will be made during the spool winding operation.

4.3 Defects. Defects found during the examination of the end item shall be classified in accordance with 4.3.1 or 4.3.2.

4.3.1 Continuous Examination. The defects listed in table I shall be counted regardless of their proximity to each other, except where two or more defects represent a single local condition of the yarn. The acceptable quality level shall be no more than 1 major and 2 minor defects per 1000 feet of yarn.

4.3.2 Overall Examination. The unit of product for this examination shall be one roll. Each defect listed below shall be counted not more than once in each roll examined.

Defects

Overall uncleanliness (minor)

Slubs (major)

Improper annealing (major)

4.3.3 Rejection. The finished lot shall be rejected if defects of the lot exceeds the limit specified by 4.3.1 and 4.3.2.

Table I. Classification of Defects

Defect	Description	Major	Minor
Broken filament(s)	Localized break within yarn		X
Incorrect filament	Wrong number of filaments in yarn	X	
Incorrect twist	Incorrect twist over a distance less than 1 foot in length of yarn		X
	Incorrect twist over a distance greater than 1 foot in length of yarn	X	
Property	Exceeding 5% of properties established by 3.2.1	X	
	Exceeding 5% of properties established 3.2.2, 3.2.3, and 3.2.4		X
Slubs	Broken filaments bunching together on yarn	X	

4.4 Test Methods. The method of testing specified in Fed Test Method Std. No. 151a Method 211.1 wherever applicable shall be followed.

4.4.1 Tensile Tests. Tensile tests shall be made of the yarn at the beginning and end of all inprocess lot spools and at the beginning and end of all finished spool lots. If the tensile tests reveal a stress level 5% below that specified by 3.2.1 (a), that finished spool is disqualified.

4.4.2 Strain Test. In concurrence with 4.4.1, strain measurements shall be made, and if the elongation exceeds that specified by 3.2.1 (d), the entire inprocess lot is disqualified.

4.4.3 Report of tests. Unless otherwise specified, a certificate of compliance showing the results of all tests shall be furnished with each purchase order.

4.4.4 Sample. A 12 inch sample of yarn shall be removed from each finished spool of yarn and clearly marked for identification, and shall be made available to the electroplating facility specified by the procuring activity.

5. PREPARATION FOR DELIVERY

5.1 Packaging. A protective shrink-pack cover shall be placed over all yarn spools prior to placing them in a carton for shipment.

5.2 Packing. Each carton shall be fully packed so that movement of the spools of yarn are restrained.

5.3 Marking. Each carton shall contain a label bearing the following information:

(a) Number of spools.

(b) Length of yarn per spool.

(c) Net weight of yarn per spool.

(d) Finish on yarn.

(e) Date of manufacture.

(f) Inspection performance.

(g) Date of acceptance and by whom.

GENERAL DYNAMICS SPECIFICATION

GOLD PLATING, ELECTROLESS

1. SCOPE

1.1 Scope. This specification covers requirements for electrodeposited gold plating on a tricot knit fabric.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

Federal

PPP-P-1136a	Packaging and Packing of Coated and Laminated Fabrics

Military

MIL-G-45204B	Gold Plating, Electrodeposited

General Dynamics

GDC-68258-1	Two Bar Tricot Knit Fabric
GDC-68258-2	Yarn, Metallic; Continuous Filament

STANDARDS None

3. REQUIREMENTS

3.1 Basis Metal. The basis metal will be a nickel-chromium alloy as specified on Specification GDC-68258-2.

3.2 Process. The tricot knit fabric shall be plated by the electroless method.

3.3 Quality. Electroplating of the fabric shall conform to all requirements of Specification MIL-G-45204B, Type I.

3.4 Exceptions. Unless otherwise specified, exception to Specification MIL-G-45204B, Type I shall only include thickness of deposited material. The class designation is specified to be Class 0, 0.000005 inch thick, minimum.

3.5 Tolerance. Thickness of the deposited material is specified by 3.4. Tolerance to this specification shall be 0.000005 inch minimum and 0.000010 inch maximum.

3.6 Workmanship. The finished product shall be uniform in color and be indicative of the quality of this type of process.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. Unless otherwise specified, the supplier is responsible for the performance of all inspection requirements prior to submission for inspection and acceptance by the procuring activity. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory activity. Inspection records of the examination and tests shall be kept complete and made available to the procuring activity as specified in the purchase order.

4.2 Sampling

4.2.1 Visual Examination. Visual examination of the entire lot shall be made. The mesh shall be uniform in color.

4.2.2 Detailed Visual Examination. The mesh material shall be visually inspected for uniform and complete adhesion between the basis metal and the plating metal. This inspection shall be done by an appropriate optical device having at least 30 power magnification. Inspection required by this paragraph shall be done a minimum of 20 times per square yard of mesh.

4.2.3 RF Radiated Energy Reflectance Examination. At the discretion of the procuring activity, this examination shall be performed by either the supplier or the procuring activity, or both. Requirements of this examination be that at random intervals the mesh material will be placed over an open waveguide operating at the maximum specified frequency and shall have less than 0.1 db gain loss.

4.2.4 Acceptance. The mesh shall meet all requirements specified in this specification. In the event the mesh fails to meet these requirements the mesh shall be returned to the supplier for further processing and correction of deficiencies. If the mesh fails to meet these requirements after all exhaustive corrective methods have been attempted, the mesh becomes unacceptable.

A

5. PREPARATION FOR DELIVERY

5.1 The final product, after all required inspections indicate that the end item is completely acceptable, shall be marked and packaged per Specification PPP-P-1136a. Method of shipment of the end item shall be as specified by the procuring activity.

6. INTENDED USE

6.1 The gold plated tricot knit mesh is intended for use as the RF energy reflective medium use on a proprietary erectable parabolic space antenna.

APPENDIX B

APERTURE BLOCKAGE COMPUTER RUNS

This appendix contains tabulations and computer listing support data on RF blockage effects (see Paragraph 2.1).

Table B-1. Case #1 and Case #4

Strut Width	Q	P	β	Case #1 Gain Loss	Case #1 Side-lobe	Case #4 Gain Loss	Case #4 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constant Width)							
2 X 2	1	1	5.2	.25	19.6	.25	22.7
4 X 4	2	2	10	.4	18.9	.4	21.7
6 X 6	3	3	14.5	.6	18.2	.6	21
8 X 8	4	4	19.1	.8	17.5	.75	20.1
10 X 10	5	5	23.5	.95	16.9	.95	19.4
12 X 12	6	6	28.4	1.1	16.3	1.15	18.7
(Tapered)							
2 X 4	1	2	5.4	.25	19.5	.3	22.5
2 X 6	1	3	7.4	.35	19.2	.35	22.1
2 X 8	1	4	9.4	.4	18.9	.43	21.7
2 X 10	1	5	11.6	.48	18.6	.5	21.3
2 X 12	1	6	14.0	.55	18.3	.56	21.0
(Tapered)							
6 X 8	3	4	11.2	.55	18.3	.58	21
6 X 10	3	5	13.2	.6	18.1	.64	20.7
6 X 12	3	6	15.2	.7	17.8	.72	20.4

Table B-2. Case #3 and Case #6

Strut Width	Q	P	β	Case #3 Gain Loss	Case #3 Side-lobe	Case #6 Gain Loss	Case #6 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constant Width)							
2 X 2	1	1	0	.17	19.8	.2	22.9
1 X 4	2	2	0	.28	19.4	.32	22.2
6 X 6	3	3	0	.4	19	.45	21.6
8 X 8	4	4	0	.5	18.6	.58	21
10 X 10	5	5	0	.6	18.2	.7	20.3
12 X 12	6	6	0	.7	17.7	.8	19.9
(Tapered)							
2 X 4	1	2	0	.23	19.8	.23	22.5
2 X 6	1	3	0	.28	19.3	.35	22.1
2 X 8	1	4	0	.35	19.1	.43	21.7
2 X 10	1	5	0	.4	18.9	.5	21.3
2 X 12	1	6	0	.48	18.7	.6	21
(Tapered)							
6 X 8	3	4	0	.45	18.7	.52	21.1
6 X 10	3	5	0	.5	18.5	.6	20.8
6 X 12	3	6	0	.55	18.3	.7	20.4

Table B-3. Case #7 and Case #10

Strut Width	Q	P	β	Case #7 Gain Loss	Case #7 Side-lobe	Case #10 Gain Loss	Case #10 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constant Width)							
2 X 2	1	1	5	-	-	.47	19.8
4 X 4	2	2	9	-	-	.62	19.2
6 X 6	3	3	12	.7	16.8	.78	18.6
8 X 8	4	4	16	.85	16.3	.93	18.
10 X 10	5	5	19	.9	15.9	1.05	17.5
12 X 12	6	6	22	.95	15.5	1.22	17.
(Tapered)							
2 X 4	1	2	8	-	-	.55	19.4
2 X 6	1	3	10	.55	17.4	.62	19.2
2 X 8	1	4	12.5	.6	17.1	.7	18.9
2 X 10	1	5	14	.7	16.9	.75	18.6
2 X 12	1	6	18	.8	16.5	.83	18.3
(Tapered)							
6 X 8	3	4	15	.8	16.6	.83	18.2
6 X 10	3	5	16.5	.85	16.4	.90	18.1
6 X 12	3	6	18	.9	16.2	.96	17.8

Table B-4. Case #9 and Case #12

Strut Width	Q	P	β	Case #9 Gain Loss	Case #9 Side-lobe	Case #12 Gain Loss	Case #12 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constant Width)							
2 X 2	1	1	0	.32	18.1	.45	19.9
4 X 4	2	2	0	.45	17.7	.55	19.4
6 X 6	3	3	0	.55	17.4	.7	18.9
8 X 8	4	4	0	.65	17.	.82	18.4
10 X 10	5	5	0	.75	16.6	.95	17.9
12 X 12	6	6	0	.8	16.3	1.1	17.4
(Tapered)							
2 X 4	1	2	0	.4	17.9	.5	19.8
2 X 6	1	3	0	.45	17.7	.58	19.3
2 X 8	1	4	0	.5	17.5	.67	19.0
2 X 10	1	5	0	.55	17.3	.74	18.7
2 X 12	1	6	0	.63	17.1	.8	18.4
(Tapered)							
6 X 8	3	4	0	.6	17.1	.77	18.6
6 X 10	3	5	0	.65	16.9	.85	18.3
6 X 12	3	6	0	.7	16.7	.93	18.0

Table B-5. Case #13 and Case #16

Strut Width	Q	P	β	Case #13 Gain Loss	Case #13 Side-lobe	Case #16 Gain Loss	Case #16 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constand Width)							
2 X 2	1	1	4	.7	15.6	.86	16.3
4 X 4	2	2	7	.8	15.3	1.0	15.8
6 X 6	3	3	10	.95	14.8	1.1	15.6
8 X 8	4	4	13	1.1	14.5	1.25	15.1
10 X 10	5	5	15	1.2	14.1	1.38	14.7
12 X 12	6	6	18	1.3	13.8	1.5	14.3
(Tapered)							
2 X 4	1	2	6	.75	15.4	.92	16.1
2 X 6	1	3	8	.8	15.2	.97	15.9
2 X 8	1	4	10	.88	15.	1.03	15.7
2 X 10	1	5	11.5	.92	14.8	1.1	15.5
2 X 12	1	6	12.	.96	14.7	1.15	15.3
(Tapered)							
6 X 8	3	4	12	1.0	14.6	1.18	15.3
6 X 10	3	5	13.5	1.07	14.5	1.25	15.1
6 X 12	3	6	14.5	1.11	14.4	1.3	14.8

Table B-6. Case #15 and Case #18

Strut Width	Q	P	β	Case #15 Gain Loss	Case #15 Side-lobe	Case #16 Gain Loss	Case #16 Side-lobe
in. X in	in.	in.	in.	-db	-db	-db	-db
(Constand Width)							
2 X 2	1	1	0	.64	15.7	.85	16.3
1 X 4	2	2	0	.75	15.4	.95	15.9
6 X 6	3	3	0	.85	15.1	1.1	15.5
8 X 8	4	4	0	.95	14.8	1.23	15.1
10 X 10	5	5	0	1.05	14.5	1.36	14.7
12 X 12	6	6	0	1.15	14.2	1.5	14.4
(Tapered)							
2 X 4	1	2	0	.7	15.5	.9	16.1
2 X 6	1	3	0	.75	15.3	1.	15.9
2 X 8	1	4	0	.8	15.2	1.05	15.6
2 X 10	1	5	0	.85	15.	1.13	15.4
2 X 12	1	6	0	.93	14.8	1.2	15.2
(Tapered)							
6 X 8	3	4	0	.91	14.9	1.19	15.3
6 X 10	3	5	0	.96	14.7	1.25	15.1
6 X 12	3	6	0	1.12	14.5	1.32	14.9

Table B-7. Case #19 and Case #22

Strut Width	Q	P	β	Case #19 Gain Loss	Case #19 Side-lobe	Case #22 Gain Loss	Case #22 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constant Width)							
4 X 4	2	2	19	.25	19.6	.25	22.8
8 X 8	4	4	33	.45	18.8	.43	21.8
12 X 12	6	6	44	.6	18.1	.59	21.1
16 X 16	8	8	52	.8	17.6	.73	20.4
20 X 20	10	10	62	.95	17.0	.90	19.7
(Tapered)							
4 X 8	2	4	30	.37	19.0	.35	22.2
4 X 12	2	6	40	.49	18.6	.45	21.8
4 X 16	2	8	46	.57	18.3	.52	21.4
4 X 20	2	10	50	.62	18.0	.58	21.0
(Tapered)							
10 X 12	5	6	44	.59	18.2	.56	21.2
10 X 16	5	8	51	.67	18.0	.62	20.9
10 X 20	5	10	56	.75	17.6	.71	20.6

Table B-8. Case #21 and Case #24

Strut Width	Q	P	β	Case #21 Gain Loss	Case #21 Side-lobe	Case #24 Gain Loss	Case #24 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constant Width)							
4 X 4	2	2	0	.13	20.1	.16	23.3
8 X 8	4	4	0	.23	19.8	.27	22.7
12 X 12	6	6	0	.32	19.3	.38	22.1
16 X 16	8	8	0	.41	18.9	.49	21.6
20 X 20	10	10	0	.51	18.6	.60	21.0
(Tapered)							
4 X 8	2	4	0	.19	19.8	.23	23.0
4 X 12	2	6	0	.24	19.6	.29	22.6
4 X 16	2	8	0	.29	19.4	.36	22.3
4 X 20	2	10	0	.34	19.2	.43	21.9
(Tapered)							
10 X 12	5	6	0	.30	19.4	.35	22.1
10 X 16	5	8	0	.34	19.1	.42	21.9
10 X 20	5	10	0	.41	18.9	.49	21.6

Table B-9. Case #25 and Case #28

Strut Width	Q	P	β	Case #25 Gain Loss	Case #25 Side-lobe	Case #28 Gain Loss	Case #28 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constant Width)							
4 X 4	2	2	12	.34	18.5	.38	20.7
8 X 8	4	4	22	.49	17.9	.52	20.1
12 X 12	6	6	30	.61	17.4	.65	19.5
16 X 16	8	8	37	.75	17.0	.78	19.0
20 X 20	10	10	44	.88	16.5	.92	18.5
(Tapered)							
4 X 8	2	4	19	.41	18.1	.46	20.3
4 X 12	2	6	26	.49	17.9	.52	20.0
4 X 16	2	8	30	.54	17.7	.58	19.8
4 X 20	2	10	33	.60	17.5	.64	19.6
(Tapered)							
10 X 12	5	6	29	.57	17.6	.62	19.7
10 X 16	5	8	34	.65	17.2	.69	19.4
10 X 20	5	10	38	.73	17.1	.74	19.2

Table B-10. Case #27 and Case #30

Strut Width	Q	P	β	Case #27 Gain Loss	Case #27 Side-lobe	Case #30 Gain Loss	Case #30 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constant Width							
4 X 4	2	2	0	.26	18.7	.34	21.0
8 X 8	4	4	0	.35	18.4	.44	20.5
12 X 12	6	6	0	.45	18.1	.55	20.0
16 X 16	8	8	0	.54	17.7	.66	19.5
20 X 20	10	10	0	.63	17.4	.78	19.1
(Tapered)							
4 X 8	2	4	0	.31	18.5	.40	20.7
4 X 12	2	6	0	.36	18.3	.46	20.4
4 X 16	2	8	0	.41	18.2	.53	20.1
4 X 20	2	10	0	.46	18.0	.59	19.8
(Tapered)							
10 X 12	5	6	0	.42	18.1	.53	20.0
10 X 16	5	8	0	.47	17.9	.59	19.8
10 X 20	5	10	0	.52	17.7	.66	19.5

Table B-11. Case #31 and Case #34

Strut Width	Q	P	β	Case #31 Gain Loss	Case #31 Side-lobe	Case #34 Gain Loss	Case #34 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constand Width)							
4 X 4	2	2	8	.59	16.2	.74	17.1
8 X 8	4	4	16	.72	15.8	.86	16.7
12 X 12	6	6	23	.84	15.4	.99	16.3
16 X 16	8	8	29	.94	15.1	1.10	15.9
20 X 20	10	10	34	1.06	14.7	1.20	15.5
(Tapered)							
4 X 8	2	4	14	.69	15.8	.79	16.8
4 X 12	2	6	18	.71	15.7	.84	16.6
4 X 16	2	8	22	.76	15.6	.90	16.5
4 X 20	2	10	26	.81	15.4	.95	16.4
(Tapered)							
10 X 12	5	6	22	.80	15.4	.93	16.4
10 X 16	5	8	26	.85	15.3	.99	16.3
10 X 20	5	10	29	.90	15.2	1.04	16.2

Table B-12. Case #33 and Case #36

Strut Width	Q	P	β	Case #33 Gain Loss	Case #33 Side-lobe	Case #36 Gain Loss	Case #36 Side-lobe
in. X in.	in.	in.	in.	-db	-db	-db	-db
(Constand							
Width	2	2	0	.55	16.3	.72	17.1
4 X 4	2	2	0	.55	16.3	.72	17.1
8 X 8	4	4	0	.64	16.0	.83	16.8
12 X 12	6	6	0	.73	15.7	.94	16.4
16 X 16	8	8	0	.82	15.5	1.05	16.1
20 X 20	10	10	0	.91	15.2	1.17	15.7
(Tapered)							
4 X 8	2	4	0	.60	16.1	.78	16.9
4 X 12	2	6	0	.65	16.0	.84	16.7
4 X 16	2	8	0	.70	15.8	.91	16.5
4 X 20	2	10	0	.75	15.6	.97	16.3
(Tapered)							
10 X 12	5	6	0	.70	15.8	.91	16.5
10 X 16	5	8	0	.75	15.6	.97	16.3
10 X 20	5	10	0	.81	15.5	1.04	16.1

RF blockage for a 100-foot-diameter, rim-mounted feed support.

CASE 39

```
                PROGRAM ANTENNA (INPUT,OUTPUT)
000003          SLN=.0891
000004          RAD=600.
000006          RADF=30.
000007          A0=.684
000011          H=RAD
000012          GAMMA=.0001
000014          R4=RAD**4.
000017          PRINT 80
000023          DO 60 K=0,18,2
000025          DO 60 J=4,18,2
000026          I=0
000027          P=J
000030          Q=K
000031          A=GAMMA+(A0*((RAD-GAMMA)**3.0)/(3.0*RAD*RAD))-(A0*RAD/3.0)
000045          B=GAMMA+(A0*(R4-((RAD-GAMMA)**4.0))/(6.0*RAD*RAD*GAMMA))-(.6666*A0
               1*RAD)
000063          AREAC=0.
000064          AREAP=(H-RADF)*(P+Q)-(((H-RADF)**3.0)*A0*(P+3.*Q))/(6.*RAD*RAD)
000104          AREAR=3.14159*RAD*RAD*(2.0-A0)/2.0
000111          RATIO=(RADF/RAD)**2.0
000115          AREAFM=AREAR*RATIO*(2.0-(A0*RATIO))/(2.0-A0)
000125          STRUT=AREAC+AREAP
000127          SUMSL=STRUT+AREAFM
000131          SUMGN=3.0*STRUT+AREAFM
000133          SL=SUMSL/AREAR
000135          GLOSS=SUMGN/AREAR
000137          SUB=1.0-GLOSS
000140          GAIN=20.0*ALOG10(SUB)
000143          ASLN=(SLN+SL)/SUB
000146          ASL=20.0*ALOG10(ASLN)
000152     80   FORMAT(2H Q,3X,1HP,3X,4HBETA,3X,10HCONVERGING,5X,8HPARALLEL,9X,4HF
               1EED,10X,6HREFLEC,9X,4HGAIN,9X,4HSIDE/16X,4HAREA,11X,4HAREA,13X,4HA
               2REA,10X,4HAREA,11X,4HLOSS,9X,4HLOBE)
000152     50   PRINT 100,K,J,I,    AREAC,AREAP,AREAFM,AREAR,GAIN,ASL
000200    100   FORMAT(3I4,5(F13.3),F13.5)
000200     60   PRINT 80
000210          CALL EXIT
000211          END
```

```
BR.         006172
EXP         006213                RBAREX      003642

GETBA       006271                OUTPTC      003707
                                  INPUTC      006320


INPUTC      006312
KRAKER      006414
OUTPNTR     007445                SIO$        005404

----UNSATISFIED EXTERNALS-----                                    REFERENCES

Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 0   4   0        0.000      2045.422    2825.014   744179.839    -.105    -20.28155
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 0   6   0        0.000      3068.133    2825.014   744179.839    -.142    -20.12131
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 0   8   0        0.000      4090.844    2825.014   744179.839    -.178    -19.96267
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 0  10   0        0.000      5113.556    2825.014   744179.839    -.215    -19.80556
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 0  12   0        0.000      6136.267    2825.014   744179.839    -.251    -19.64994
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 0  14   0        0.000      7158.978    2825.014   744179.839    -.288    -19.49578
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 0  16   0        0.000      8181.689    2825.014   744179.839    -.325    -19.34301
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 0  18   0        0.000      9204.400    2825.014   744179.839    -.363    -19.19161
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 2   4   0        0.000      2833.556    2825.014   744179.839    -.133    -20.15793
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 2   6   0        0.000      3856.267    2825.014   744179.839    -.170    -19.99892
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 2   8   0        0.000      4878.978    2825.014   744179.839    -.206    -19.84146
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 2  10   0        0.000      5901.689    2825.014   744179.839    -.243    -19.68551
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 2  12   0        0.000      6924.400    2825.014   744179.839    -.280    -19.53101
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 2  14   0        0.000      7947.111    2825.014   744179.839    -.317    -19.37793
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 2  16   0        0.000      8969.822    2825.014   744179.839    -.354    -19.22622
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
 2  18   0        0.000      9992.533    2825.014   744179.839    -.392    -19.07584
Q   P   BETA   CONVERGING    PARALLEL      FEED        REFLEC        GAIN       SIDE
               AREA          AREA          AREA        AREA          LOSS       LOBE
```

Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
4	4	0	0.000	3621.689	2825.014	744179.839	-.161	-20.03525
4	6	0	0.000	4644.400	2825.014	744179.839	-.198	-19.87744
4	8	0	0.000	5667.111	2825.014	744179.839	-.235	-19.72115
4	10	0	0.000	6689.822	2825.014	744179.839	-.271	-19.56632
4	12	0	0.000	7712.533	2825.014	744179.839	-.308	-19.41292
4	14	0	0.000	8735.244	2825.014	744179.839	-.346	-19.26090
4	16	0	0.000	9757.955	2825.014	744179.839	-.383	-19.11022
4	18	0	0.000	10780.667	2825.014	744179.839	-.420	-18.96083
6	4	0	0.000	4409.822	2825.014	744179.839	-.189	-19.91350
6	6	0	0.000	5432.533	2825.014	744179.839	-.226	-19.75687
6	8	0	0.000	6455.244	2825.014	744179.839	-.263	-19.60171
6	10	0	0.000	7477.955	2825.014	744179.839	-.300	-19.44798
6	12	0	0.000	8500.667	2825.014	744179.839	-.337	-19.29565
6	14	0	0.000	9523.378	2825.014	744179.839	-.374	-19.14466
6	16	0	0.000	10546.089	2825.014	744179.839	-.412	-18.99498
6	18	0	0.000	11568.800	2825.014	744179.839	-.449	-18.84657
8	4	0	0.000	5197.955	2825.014	744179.839	-.218	-19.79266
8	6	0	0.000	6220.667	2825.014	744179.839	-.254	-19.63717
8	8	0	0.000	7243.378	2825.014	744179.839	-.291	-19.48312
8	10	0	0.000	8266.089	2825.014	744179.839	-.329	-19.33047
8	12	0	0.000	9288.800	2825.014	744179.839	-.366	-19.17918

Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
8	14	0	0.000	10311.511	2825.014	744179.839	-.403	-19.02920
8	16	0	0.000	11334.222	2825.014	744179.839	-.441	-18.88050
8	18	0	0.000	12356.933	2825.014	744179.839	-.479	-18.73304
10	4	0	0.000	5986.089	2825.014	744179.839	-.246	-19.67270
10	6	0	0.000	7008.800	2825.014	744179.839	-.283	-19.51833
10	8	0	0.000	8031.511	2825.014	744179.839	-.320	-19.36536
10	10	0	0.000	9054.222	2825.014	744179.839	-.357	-19.21376
10	12	0	0.000	10076.933	2825.014	744179.839	-.395	-19.06349
10	14	0	0.000	11099.644	2825.014	744179.839	-.432	-18.91450
10	16	0	0.000	12122.355	2825.014	744179.839	-.470	-18.76676
10	18	0	0.000	13145.066	2825.014	744179.839	-.508	-18.62023
12	4	0	0.000	6774.222	2825.014	744179.839	-.274	-19.55361
12	6	0	0.000	7796.933	2825.014	744179.839	-.312	-19.40032
12	8	0	0.000	8819.644	2825.014	744179.839	-.349	-19.24841
12	10	0	0.000	9842.355	2825.014	744179.839	-.386	-19.09784
12	12	0	0.000	10865.066	2825.014	744179.839	-.424	-18.94856
12	14	0	0.000	11887.778	2825.014	744179.839	-.461	-18.80054
12	16	0	0.000	12910.489	2825.014	744179.839	-.499	-18.65373
12	18	0	0.000	13933.200	2825.014	744179.839	-.537	-18.50812
14	4	0	0.000	7562.355	2825.014	744179.839	-.303	-19.43536
14	6	0	0.000	8585.066	2825.014	744179.839	-.340	-19.28314

Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
14	8	0	0.000	9607.778	2825.014	744179.839	-.377	-19.13226
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
14	10	0	0.000	10630.489	2825.014	744179.839	-.415	-18.98269
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
14	12	0	0.000	11653.200	2825.014	744179.839	-.453	-18.83438
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
14	14	0	0.000	12675.911	2825.014	744179.839	-.490	-18.68730
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
14	16	0	0.000	13698.622	2825.014	744179.839	-.528	-18.54141
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
14	18	0	0.000	14721.333	2825.014	744179.839	-.567	-18.39668
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	4	0	0.000	8350.489	2825.014	744179.839	-.332	-19.31793
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	6	0	0.000	9373.200	2825.014	744179.839	-.369	-19.16675
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	8	0	0.000	10395.911	2825.014	744179.839	-.406	-19.01688
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	10	0	0.000	11418.622	2825.014	744179.839	-.444	-18.86829
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	12	0	0.000	12441.333	2825.014	744179.839	-.482	-18.72093
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	14	0	0.000	13464.044	2825.014	744179.839	-.520	-18.57477
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	16	0	0.000	14486.755	2825.014	744179.839	-.558	-18.42978
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	18	0	0.000	15509.466	2825.014	744179.839	-.596	-18.28592
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
18	4	0	0.000	9138.622	2825.014	744179.839	-.360	-19.20131
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
18	6	0	0.000	10161.333	2825.014	744179.839	-.398	-19.05114
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
18	8	0	0.000	11184.044	2825.014	744179.839	-.435	-18.90226
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
18	10	0	0.000	12206.755	2825.014	744179.839	-.473	-18.75462
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
18	12	0	0.000	13229.466	2825.014	744179.839	-.511	-18.60819
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
18	14	0	0.000	14252.177	2825.014	744179.839	-.549	-18.46294
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
18	16	0	0.000	15274.889	2825.014	744179.839	-.587	-18.31882
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
18	18	0	0.000	16297.600	2825.014	744179.839	-.626	-18.17581
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE

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              PROGRAM ANTENNA (INPUT,OUTPUT)
000003        SLN=.0562                          CASE 42
000004        RAD=600.
000006        RADF=30.
000007        AO=1.
000011        H=RAD
000012        GAMMA=.0001
000014        R4=RAD**4.
000017        PRINT 80
000023        DO 60 K=0,18,2
000025        DO 60 J=4,18,2
000026        I=0
000027        P=J
000030        Q=K
000031        A=GAMMA+(AO*((RAD-GAMMA)**3.0)/(3.0*RAD*RAD))-(AO*RAD/3.0)
000045        B=GAMMA+(AO*(R4-((RAD-GAMMA)**4.0))/(6.0*RAD*RAD*GAMMA))-(.6666*AO
             1*RAD)
000063        AREAC=0.
000064        AREAP=(H-RADF)*(P+Q)-(((H-RADF)**3.0)*AO*(P+3.*Q))/(6.*RAD*RAD)
000104        AREAR=3.14159*RAD*RAD*(2.0-AO)/2.0
000111        RATIO=(RADF/RAD)**2.0
000115        AREAFM=AREAR*RATIO*(2.0-(AO*RATIO))/(2.0-AO)
000125        STRUT=AREAC+AREAP
000127        SUMSL=STRUT+AREAFM
000131        SUMGN=3.0*STRUT+AREAFM
000133        SL=SUMSL/AREAR
000135        GLOSS=SUMGN/AREAR
000137        SUB=1.0-GLOSS
000140        GAIN=20.0*ALOG10(SUB)
000143        ASLN=(SLN+SL)/SUB
000146        ASL=20.0*ALOG10(ASLN)
000152   80   FORMAT(2H Q,3X,1HP,3X,4HBETA,3X,10HCONVERGING,5X,8HPARALLEL,9X,4HF
             1EED,10X,6HREFLEC,9X,4HGAIN,9X,4HSIDE/16X,4HAREA,11X,4HAREA,13X,4HA
             2REA,10X,4HAREA,11X,4HLOSS,9X,4HLOBE)
000152   50   PRINT 100,K,J,I,   AREAC,AREAP,AREAFM,AREAR,GAIN,ASL
000200   100  FORMAT(3I4,5(F13.3),F13.5)
000200   60   PRINT 80
000210        CALL EXIT
000211        END
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          BR.            006171
          EXP            006212                  RBAREX         003641

          GETBA          006270                  OUTPTC         003706
                                                 INPUTC         006317

          INPUTC         006311
          KRAKER         006413
          OUTPNTR        007444                  SIOS           005403

          ----UNSATISFIED EXTERNALS-----                                              REFERENCES

Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  0    4    0         0.000     1937.050     2823.897    565486.200        -.134    -23.65911
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  0    6    0         0.000     2905.575     2823.897    565486.200        -.179    -23.38645
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  0    8    0         0.000     3874.100     2823.897    565486.200        -.225    -23.11934
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  0   10    0         0.000     4842.625     2823.897    565486.200        -.271    -22.85750
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  0   12    0         0.000     5811.150     2823.897    565486.200        -.317    -22.60065
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  0   14    0         0.000     6779.675     2823.897    565486.200        -.363    -22.34854
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  0   16    0         0.000     7748.200     2823.897    565486.200        -.410    -22.10094
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  0   18    0         0.000     8716.725     2823.897    565486.200        -.457    -21.85763
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  2    4    0         0.000     2562.625     2823.897    565486.200        -.163    -23.48235
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  2    6    0         0.000     3531.150     2823.897    565486.200        -.209    -23.21331
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  2    8    0         0.000     4499.675     2823.897    565486.200        -.254    -22.94963
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  2   10    0         0.000     5468.200     2823.897    565486.200        -.300    -22.69104
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  2   12    0         0.000     6436.725     2823.897    565486.200        -.347    -22.43728
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  2   14    0         0.000     7405.250     2823.897    565486.200        -.393    -22.18811
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  2   16    0         0.000     8373.775     2823.897    565486.200        -.440    -21.94331
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
  2   18    0         0.000     9342.300     2823.897    565486.200        -.487    -21.70266
Q    P    BETA    CONVERGING     PARALLEL        FEED          REFLEC          GAIN         SIDE
                  AREA           AREA            AREA          AREA            LOSS         LOBE
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4	4	0	0.000	3188.200	2823.897	565486.200	-.192	-23.30794
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	6	0	0.000	4156.725	2823.897	565486.200	-.238	-23.04240
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	8	0	0.000	5125.250	2823.897	565486.200	-.284	-22.78204
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	10	0	0.000	6093.775	2823.897	565486.200	-.330	-22.52660
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	12	0	0.000	7062.300	2823.897	565486.200	-.377	-22.27583
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	14	0	0.000	8030.825	2823.897	565486.200	-.424	-22.02951
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	16	0	0.000	8999.350	2823.897	565486.200	-.471	-21.78741
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	18	0	0.000	9967.875	2823.897	565486.200	-.518	-21.54935
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	4	0	0.000	3813.775	2823.897	565486.200	-.222	-23.13582
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	6	0	0.000	4782.300	2823.897	565486.200	-.268	-22.87366
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	8	0	0.000	5750.825	2823.897	565486.200	-.314	-22.61650
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	10	0	0.000	6719.350	2823.897	565486.200	-.360	-22.36411
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	12	0	0.000	7687.875	2823.897	565486.200	-.407	-22.11623
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	14	0	0.000	8656.400	2823.897	565486.200	-.454	-21.87267
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	16	0	0.000	9624.925	2823.897	565486.200	-.501	-21.63320
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	18	0	0.000	10593.450	2823.897	565486.200	-.548	-21.39764
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	4	0	0.000	4439.350	2823.897	565486.200	-.252	-22.96590
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	6	0	0.000	5407.875	2823.897	565486.200	-.298	-22.70700
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	8	0	0.000	6376.400	2823.897	565486.200	-.344	-22.45295
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	10	0	0.000	7344.925	2823.897	565486.200	-.390	-22.20350
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	12	0	0.000	8313.450	2823.897	565486.200	-.437	-21.95843
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE

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               AREA            AREA           AREA           AREA          LOSS          LOBE
  8  14   0      0.000       9281.975      2823.897    565486.200       -.484    -21.71754
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
  8  16   0      0.000      10250.500      2823.897    565486.200       -.532    -21.48061
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
  8  18   0      0.000      11219.025      2823.897    565486.200       -.579    -21.24748
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 10   4   0      0.000       5064.925      2823.897    565486.200       -.281    -22.79811
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 10   6   0      0.000       6033.450      2823.897    565486.200       -.327    -22.54237
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 10   8   0      0.000       7001.975      2823.897    565486.200       -.374    -22.29132
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 10  10   0      0.000       7970.500      2823.897    565486.200       -.421    -22.04472
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 10  12   0      0.000       8939.025      2823.897    565486.200       -.468    -21.80237
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 10  14   0      0.000       9907.550      2823.897    565486.200       -.515    -21.56406
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 10  16   0      0.000      10876.075      2823.897    565486.200       -.562    -21.32961
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 10  18   0      0.000      11844.600      2823.897    565486.200       -.610    -21.09884
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 12   4   0      0.000       5690.500      2823.897    565486.200       -.311    -22.63238
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 12   6   0      0.000       6659.025      2823.897    565486.200       -.357    -22.37969
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 12   8   0      0.000       7627.550      2823.897    565486.200       -.404    -22.13154
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 12  10   0      0.000       8596.075      2823.897    565486.200       -.451    -21.88771
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 12  12   0      0.000       9564.600      2823.897    565486.200       -.498    -21.64800
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 12  14   0      0.000      10533.125      2823.897    565486.200       -.546    -21.41220
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 12  16   0      0.000      11501.650      2823.897    565486.200       -.593    -21.18014
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 12  18   0      0.000      12470.175      2823.897    565486.200       -.641    -20.95166
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 14   4   0      0.000       6316.075      2823.897    565486.200       -.341    -22.46864
Q    P   BETA  CONVERGING      PARALLEL          FEED           REFLEC      GAIN          SIDE
               AREA            AREA           AREA           AREA          LOSS          LOBE
 14   6   0      0.000       7284.600      2823.897    565486.200       -.388    -22.21891
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Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
14	8	0	0.000	8253.125	2823.897	565486.200	-.434	-21.97357
14	10	0	0.000	9221.650	2823.897	565486.200	-.481	-21.73242
14	12	0	0.000	10190.175	2823.897	565486.200	-.529	-21.49526
14	14	0	0.000	11158.700	2823.897	565486.200	-.576	-21.26190
14	16	0	0.000	12127.225	2823.897	565486.200	-.624	-21.03216
14	18	0	0.000	13095.750	2823.897	565486.200	-.672	-20.80590
16	4	0	0.000	6941.650	2823.897	565486.200	-.371	-22.30682
16	6	0	0.000	7910.175	2823.897	565486.200	-.418	-22.05996
16	8	0	0.000	8878.700	2823.897	565486.200	-.465	-21.81735
16	10	0	0.000	9847.225	2823.897	565486.200	-.512	-21.57879
16	12	0	0.000	10815.750	2823.897	565486.200	-.559	-21.34410
16	14	0	0.000	11784.275	2823.897	565486.200	-.607	-21.11311
16	16	0	0.000	12752.800	2823.897	565486.200	-.655	-20.88563
16	18	0	0.000	13721.325	2823.897	565486.200	-.703	-20.66152
18	4	0	0.000	7567.225	2823.897	565486.200	-.401	-22.14687
18	6	0	0.000	8535.750	2823.897	565486.200	-.448	-21.90278
18	8	0	0.000	9504.275	2823.897	565486.200	-.495	-21.66281
18	10	0	0.000	10472.800	2823.897	565486.200	-.543	-21.42678
18	12	0	0.000	11441.325	2823.897	565486.200	-.590	-21.19449
18	14	0	0.000	12409.850	2823.897	565486.200	-.638	-20.96579
18	16	0	0.000	13378.375	2823.897	565486.200	-.686	-20.74050
18	18	0	0.000	14346.900	2823.897	565486.200	-.735	-20.51849

```
                PROGRAM ANTENNA (INPUT,OUTPUT)
000003          SLN=.0891
000004          RAD=600.                                    CASE 45
000006          RADF=60.
000007          AO=.684
000011          H=RAD
000012          GAMMA=.0001
000014          R4=RAD**4.
000017          PRINT 80
000023          DO 60 K=0,16,2
000025          DO 60 J=4,16,2
000026          I=0
000027          P=J
000030          Q=K
000031          A=GAMMA+(AO*((RAD-GAMMA)**3.0)/(3.0*RAD*RAD))-(AO*RAD/3.0)
000045          B=GAMMA+(AO*(R4-((RAD-GAMMA)**4.0))/(6.0*RAD*RAD*GAMMA))-(.6666*AO
               1*RAD)
000063          AREAC=0.
000064          AREAP=(H-RADF)*(P+Q)-(((H-RADF)**3.0)*AO*(P+3.*Q))/(6.*RAD*RAD)
000104          AREAR=3.14159*RAD*RAD*(2.0-AO)/2.0
000111          RATIO=(RADF/RAD)**2.0
000115          AREAFM=AREAR*RATIO*(2.0-(AO*RATIO))/(2.0-AO)
000125          STRUT=AREAC+AREAP
000127          SUMSL=STRUT+AREAFM
000131          SUMGN=3.0*STRUT+AREAFM
000133          SL=SUMSL/AREAR
000135          GLOSS=SUMGN/AREAR
000137          SUB=1.0-GLOSS
000140          GAIN=20.0*ALOG10(SUB)
000143          ASLN=(SLN+SL)/SUB
000146          ASL=20.0*ALOG10(ASLN)
000152     80   FORMAT(2H Q,3X,1HP,3X,4HBETA,3X,10HCONVERGING,5X,8HPARALLEL,9X,4HF
               1EED,10X,6HREFLEC,9X,4HGAIN,9X,4HSIDE/16X,4HAREA,11X,4HAREA,13X,4HA
               2REA,10X,4HAREA,11X,4HLOSS,9X,4HLOBE)
000152     50   PRINT 100,K,J,I,   AREAC,AREAP,AREAFM,AREAR,GAIN,ASL
000200     100  FORMAT(3I4,5(F13.3),F13.5)
000200     60   PRINT 80
000210          CALL EXIT
000211          END
```

```
BR.        006172
EXP        006213            RBAREX      003642

GETBA      006271            OUTPTC      003707
                             INPUTC      006320

INPUTC     006312
KRAKER     006414
OUTPNTR    007445            SIOS        005404

----UNSATISFIED EXTERNALS-----                                        REFERENCES

Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 0    4    0        0.000       1960.546    11271.045    744179.839    -.203    -19.21952
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 0    6    0        0.000       2940.818    11271.045    744179.839    -.238    -19.07792
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 0    8    0        0.000       3921.091    11271.045    744179.839    -.273    -18.93746
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 0   10    0        0.000       4901.364    11271.045    744179.839    -.309    -18.79811
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 0   12    0        0.000       5881.637    11271.045    744179.839    -.344    -18.65985
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 0   14    0        0.000       6861.910    11271.045    744179.839    -.380    -18.52264
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 0   16    0        0.000       7842.182    11271.045    744179.839    -.416    -18.38645
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 2    4    0        0.000       2741.364    11271.045    744179.839    -.231    -19.10663
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 2    6    0        0.000       3721.637    11271.045    744179.839    -.266    -18.96595
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 2    8    0        0.000       4701.910    11271.045    744179.839    -.301    -18.82638
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 2   10    0        0.000       5682.182    11271.045    744179.839    -.337    -18.68790
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 2   12    0        0.000       6662.455    11271.045    744179.839    -.373    -18.55047
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 2   14    0        0.000       7642.728    11271.045    744179.839    -.409    -18.41408
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 2   16    0        0.000       8623.001    11271.045    744179.839    -.445    -18.27868
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 4    4    0        0.000       3522.182    11271.045    744179.839    -.259    -18.99448
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
 4    6    0        0.000       4502.455    11271.045    744179.839    -.294    -18.85469
Q    P    BETA    CONVERGING    PARALLEL       FEED         REFLEC       GAIN       SIDE
                  AREA          AREA           AREA         AREA         LOSS       LOBE
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4	8	0	0.000	5482.728	11271.045	744179.839	-.330	-18.71599
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
4	10	0	0.000	6463.001	11271.045	744179.839	-.365	-18.57835
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
4	12	0	0.000	7443.274	11271.045	744179.839	-.401	-18.44175
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
4	14	0	0.000	8423.546	11271.045	744179.839	-.437	-18.30615
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
4	16	0	0.000	9403.819	11271.045	744179.839	-.474	-18.17154
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
6	4	0	0.000	4303.001	11271.045	744179.839	-.287	-18.88304
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
6	6	0	0.000	5283.274	11271.045	744179.839	-.322	-18.74412
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
6	8	0	0.000	6263.546	11271.045	744179.839	-.358	-18.60627
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
6	10	0	0.000	7243.819	11271.045	744179.839	-.394	-18.46946
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
6	12	0	0.000	8224.092	11271.045	744179.839	-.430	-18.33366
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
6	14	0	0.000	9204.365	11271.045	744179.839	-.466	-18.19885
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
6	16	0	0.000	10184.638	11271.045	744179.839	-.502	-18.06499
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
8	4	0	0.000	5083.819	11271.045	744179.839	-.315	-18.77230
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
8	6	0	0.000	6064.092	11271.045	744179.839	-.351	-18.63423
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
8	8	0	0.000	7044.365	11271.045	744179.839	-.387	-18.49721
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
8	10	0	0.000	8024.638	11271.045	744179.839	-.423	-18.36121
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
8	12	0	0.000	9004.910	11271.045	744179.839	-.459	-18.22620
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
8	14	0	0.000	9985.183	11271.045	744179.839	-.495	-18.09215
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
8	16	0	0.000	10965.456	11271.045	744179.839	-.531	-17.95904
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
10	4	0	0.000	5864.638	11271.045	744179.839	-.344	-18.66224
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
10	6	0	0.000	6844.910	11271.045	744179.839	-.379	-18.52501
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE

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                AREA           AREA           AREA          AREA            LOSS        LOBE
 10   8   0        0.000       7825.183    11271.045  744179.839          -.415   -18.38880
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 10  10   0        0.000       8805.456    11271.045  744179.839          -.451   -18.25359
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 10  12   0        0.000       9785.729    11271.045  744179.839          -.488   -18.11935
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 10  14   0        0.000      10766.002    11271.045  744179.839          -.524   -17.98605
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 10  16   0        0.000      11746.274    11271.045  744179.839          -.561   -17.85366
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 12   4   0        0.000       6645.456    11271.045  744179.839          -.372   -18.55285
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 12   6   0        0.000       7625.729    11271.045  744179.839          -.408   -18.41644
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 12   8   0        0.000       8606.002    11271.045  744179.839          -.444   -18.28102
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 12  10   0        0.000       9586.274    11271.045  744179.839          -.480   -18.14659
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 12  12   0        0.000      10566.547    11271.045  744179.839          -.517   -18.01309
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 12  14   0        0.000      11546.820    11271.045  744179.839          -.553   -17.88053
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 12  16   0        0.000      12527.093    11271.045  744179.839          -.590   -17.74885
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 14   4   0        0.000       7426.274    11271.045  744179.839          -.401   -18.44411
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 14   6   0        0.000       8406.547    11271.045  744179.839          -.437   -18.30850
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 14   8   0        0.000       9386.820    11271.045  744179.839          -.473   -18.17386
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 14  10   0        0.000      10367.093    11271.045  744179.839          -.509   -18.04018
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 14  12   0        0.000      11347.366    11271.045  744179.839          -.546   -17.90743
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 14  14   0        0.000      12327.638    11271.045  744179.839          -.582   -17.77557
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 14  16   0        0.000      13307.911    11271.045  744179.839          -.619   -17.64460
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 16   4   0        0.000       8207.093    11271.045  744179.839          -.429   -18.33601
Q    P   BETA   CONVERGING     PARALLEL        FEED          REFLEC         GAIN        SIDE
                AREA           AREA           AREA          AREA            LOSS        LOBE
 16   6   0        0.000       9187.366    11271.045  744179.839          -.466   -18.20118
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Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	8	0	0.000	10167.638	11271.045	744179.839	-.502	-18.06730
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	10	0	0.000	11147.911	11271.045	744179.839	-.538	-17.93436
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	12	0	0.000	12128.184	11271.045	744179.839	-.575	-17.80233
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	14	0	0.000	13108.457	11271.045	744179.839	-.612	-17.67118
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	16	0	0.000	14088.730	11271.045	744179.839	-.648	-17.54088
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE

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                  PROGRAM ANTENNA (INPUT,OUTPUT)
000003            SLN=.0562                                CASE 48
000004            RAD=600.
000006            RADF=60.
000007            A0=1.
000011            H=RAD
000012            GAMMA=.0001
000014            R4=RAD**4.
000017            PRINT 80
000023            DO 60 K=0,16,2
000025            DO 60 J=4,16,2
000026            I=0
000027            P=J
000030            Q=K
000031            A=GAMMA+(A0*((RAD-GAMMA)**3.0)/(3.0*RAD*RAD))-(A0*RAD/3.0)
000045            B=GAMMA+(A0*(R4-((RAD-GAMMA)**4.0))/(6.0*RAD*RAD*GAMMA))-(.6666*A0
                 1*RAD)
000063            AREAC=0.
000064            AREAP=(H-RADF)*(P+Q)-(((H-RADF)**3.0)*A0*(P+3.*Q))/(6.*RAD*RAD)
000104            AREAR=3.14159*RAD*RAD*(2.0-A0)/2.0
000111            RATIO=(RADF/RAD)**2.0
000115            AREAFM=AREAR*RATIO*(2.0-(A0*RATIO))/(2.0-A0)
000125            STRUT=AREAC+AREAP
000127            SUMSL=STRUT+AREAFM
000131            SUMGN=3.0*STRUT+AREAFM
000133            SL=SUMSL/AREAR
000135            GLOSS=SUMGN/AREAR
000137            SUB=1.0-GLOSS
000140            GAIN=20.0*ALOG10(SUB)
000143            ASLN=(SLN+SL)/SUB
000146            ASL=20.0*ALOG10(ASLN)
000152      80    FORMAT(2H Q,3X,1HP,3X,4HBETA,3X,10HCONVERGING,5X,8HPARALLEL,9X,4HF
                 1EED,10X,6HREFLEC,9X,4HGAIN,9X,4HSIDE/16X,4HAREA,11X,4HAREA,13X,4HA
                 2REA,10X,4HAREA,11X,4HLOSS,9X,4HLOBE)
000152      50    PRINT 100,K,J,I,   AREAC,AREAP,AREAFM,AREAR,GAIN,ASL
000200      100   FORMAT(3I4,5(F13.3),F13.5)
000200      60    PRINT 80
000210            CALL EXIT
000211            END
```

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          BR.            006171
          EXP            006212                 RBAREX       003641

          GETBA          006270                 OUTPTC       003706
                                                INPUTC       006317

          INPUTC         006311
          KRAKER         006413
          OUTPNTR        007444                 SIOS         005403

          ----UNSATISFIED EXTERNALS-----                                         REFERENCES

Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 0   4   0          0.000     1868.400    11253.175    565486.200       -.263     -21.74026
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 0   6   0          0.000     2802.600    11253.175    565486.200       -.307     -21.51692
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 0   8   0          0.000     3736.800    11253.175    565486.200       -.352     -21.29696
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 0  10   0          0.000     4671.000    11253.175    565486.200       -.397     -21.08023
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 0  12   0          0.000     5605.200    11253.175    565486.200       -.442     -20.86660
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 0  14   0          0.000     6539.400    11253.175    565486.200       -.488     -20.65593
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 0  16   0          0.000     7473.600    11253.175    565486.200       -.533     -20.44812
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 2   4   0          0.000     2511.000    11253.175    565486.200       -.293     -21.58626
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 2   6   0          0.000     3445.200    11253.175    565486.200       -.338     -21.36526
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 2   8   0          0.000     4379.400    11253.175    565486.200       -.383     -21.14754
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 2  10   0          0.000     5313.600    11253.175    565486.200       -.428     -20.93295
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 2  12   0          0.000     6247.800    11253.175    565486.200       -.473     -20.72138
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 2  14   0          0.000     7182.000    11253.175    565486.200       -.519     -20.51269
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 2  16   0          0.000     8116.200    11253.175    565486.200       -.565     -20.30676
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 4   4   0          0.000     3153.600    11253.175    565486.200       -.324     -21.43389
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
 4   6   0          0.000     4087.800    11253.175    565486.200       -.369     -21.21515
Q   P   BETA    CONVERGING    PARALLEL        FEED          REFLEC          GAIN          SIDE
                AREA          AREA            AREA          AREA            LOSS          LOBE
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  4   8   0        0.000     5022.000     11253.175   565486.200           -.414    -20.99960
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  4  10   0        0.000     5956.200     11253.175   565486.200           -.459    -20.78710
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  4  12   0        0.000     6890.400     11253.175   565486.200           -.505    -20.57752
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  4  14   0        0.000     7824.600     11253.175   565486.200           -.550    -20.37075
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  4  16   0        0.000     8758.800     11253.175   565486.200           -.596    -20.16666
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  6   4   0        0.000     3796.200     11253.175   565486.200           -.355    -21.28308
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  6   6   0        0.000     4730.400     11253.175   565486.200           -.400    -21.06655
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  6   8   0        0.000     5664.600     11253.175   565486.200           -.445    -20.85311
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  6  10   0        0.000     6598.800     11253.175   565486.200           -.491    -20.64264
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  6  12   0        0.000     7533.000     11253.175   565486.200           -.536    -20.43500
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  6  14   0        0.000     8467.200     11253.175   565486.200           -.582    -20.23008
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  6  16   0        0.000     9401.400     11253.175   565486.200           -.628    -20.02778
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  8   4   0        0.000     4438.800     11253.175   565486.200           -.386    -21.13380
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  8   6   0        0.000     5373.000     11253.175   565486.200           -.431    -20.91941
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  8   8   0        0.000     6307.200     11253.175   565486.200           -.476    -20.70802
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  8  10   0        0.000     7241.400     11253.175   565486.200           -.522    -20.49951
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  8  12   0        0.000     8175.600     11253.175   565486.200           -.568    -20.29376
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  8  14   0        0.000     9109.800     11253.175   565486.200           -.614    -20.09065
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
  8  16   0        0.000    10044.000     11253.175   565486.200           -.660    -19.89009
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
 10   4   0        0.000     5081.400     11253.175   565486.200           -.417    -20.98600
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
               AREA           AREA             AREA          AREA            LOSS          LOBE
 10   6   0        0.000     6015.600     11253.175   565486.200           -.462    -20.77369
Q   P   BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
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			AREA	AREA	AREA	AREA	LOSS	LOBE
10	8	0	0.000	6949.800	11253.175	565486.200	-.508	-20.56430
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
10	10	0	0.000	7884.000	11253.175	565486.200	-.553	-20.35769
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
10	12	0	0.000	8818.200	11253.175	565486.200	-.599	-20.15377
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
10	14	0	0.000	9752.400	11253.175	565486.200	-.646	-19.95243
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
10	16	0	0.000	10686.600	11253.175	565486.200	-.692	-19.75356
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
12	4	0	0.000	5724.000	11253.175	565486.200	-.448	-20.83964
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
12	6	0	0.000	6658.200	11253.175	565486.200	-.493	-20.62935
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
12	8	0	0.000	7592.400	11253.175	565486.200	-.539	-20.42189
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
12	10	0	0.000	8526.600	11253.175	565486.200	-.585	-20.21714
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
12	12	0	0.000	9460.800	11253.175	565486.200	-.631	-20.01500
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
12	14	0	0.000	10395.000	11253.175	565486.200	-.678	-19.81537
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
12	16	0	0.000	11329.200	11253.175	565486.200	-.724	-19.61815
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
14	4	0	0.000	6366.600	11253.175	565486.200	-.479	-20.69468
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
14	6	0	0.000	7300.800	11253.175	565486.200	-.525	-20.48635
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
14	8	0	0.000	8235.000	11253.175	565486.200	-.571	-20.28077
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
14	10	0	0.000	9169.200	11253.175	565486.200	-.617	-20.07783
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
14	12	0	0.000	10103.400	11253.175	565486.200	-.663	-19.87742
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
14	14	0	0.000	11037.600	11253.175	565486.200	-.710	-19.67945
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
14	16	0	0.000	11971.800	11253.175	565486.200	-.757	-19.48383
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
16	4	0	0.000	7009.200	11253.175	565486.200	-.511	-20.55108
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
16	6	0	0.000	7943.400	11253.175	565486.200	-.556	-20.34465

Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	8	0	0.000	8877.600	11253.175	565486.200	-.602	-20.14089
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	10	0	0.000	9811.800	11253.175	565486.200	-.649	-19.93971
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	12	0	0.000	10746.000	11253.175	565486.200	-.695	-19.74099
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	14	0	0.000	11680.200	11253.175	565486.200	-.742	-19.54465
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	16	0	0.000	12614.400	11253.175	565486.200	-.789	-19.35058
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE

CASE 51

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                 PROGRAM ANTENNA (INPUT,OUTPUT)
000003           SLN=.0891
000004           RAD=600.
000006           RADF=90.
000007           AO=.684
000011           H=RAD
000012           GAMMA=.0001
000014           R4=RAD**4.
000017           PRINT 80
000023           DO 60 K=0,16,2
000025           DO 60 J=4,16,2
000026           I=0
000027           P=J
000030           Q=K
000031           A=GAMMA+(AO*((RAD-GAMMA)**3.0)/(3.0*RAD*RAD))-(AO*RAD/3.0)
000045           B=GAMMA+(AO*(R4-((RAD-GAMMA)**4.0))/(6.0*RAD*RAD*GAMMA))-(.6666*AO
                1*RAD)
000063           AREAC=0.
000064           AREAP=(H-RADF)*(P+Q)-(((H-RADF)**3.0)*AO*(P+3.*Q))/(6.*RAD*RAD)
000104           AREAR=3.14159*RAD*RAD*(2.0-AO)/2.0
000111           RATIO=(RADF/RAD)**2.0
000115           AREAFM=AREAR*RATIO*(2.0-(AO*RATIO))/(2.0-AO)
000125           STRUT=AREAC+AREAP
000127           SUMSL=STRUT+AREAFM
000131           SUMGN=3.0*STRUT+AREAFM
000133           SL=SUMSL/AREAR
000135           GLOSS=SUMGN/AREAR
000137           SUB=1.0-GLOSS
000140           GAIN=20.0*ALOG10(SUB)
000143           ASLN=(SLN+SL)/SUB
000146           ASL=20.0*ALOG10(ASLN)
000152     80    FORMAT(2H 0,3X,1HP,3X,4HBETA,3X,10HCONVERGING,5X,8HPARALLEL,9X,4HF
                1EED,10X,6HREFLEC,9X,4HGAIN,9X,4HSIDE/16X,4HAREA,11X,4HAREA,13X,4HA
                2REA,10X,4HAREA,11X,4HLOSS,9X,4HLOBE)
000152     50    PRINT 100,K,J,I,    AREAC,AREAP,AREAFM,AREAR,GAIN,ASL
000200     100   FORMAT(3I4,5(F13.3),F13.5)
000200     60    PRINT 80
000210           CALL EXIT
000211           END
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          BR.          006172
          EXP          006213                RBAREX        003642

          GETBA        006271                OUTPTC        003707
                                             INPUTC        006320

          INPUTC       006312
          KRAKER       006414
          OUTPNTR      007445                SIOS          005404

          ----UNSATISFIED EXTERNALS-----                                         REFERENCES

Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  0    4    0         0.000     1871.975     25251.065     744179.839        -.368    -17.65592
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  0    6    0         0.000     2807.963     25251.065     744179.839        -.402    -17.53508
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  0    8    0         0.000     3743.951     25251.065     744179.839        -.437    -17.41496
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  0   10    0         0.000     4679.938     25251.065     744179.839        -.471    -17.29553
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  0   12    0         0.000     5615.926     25251.065     744179.839        -.506    -17.17680
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  0   14    0         0.000     6551.914     25251.065     744179.839        -.541    -17.05872
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  0   16    0         0.000     7487.902     25251.065     744179.839        -.576    -16.94130
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  2    4    0         0.000     2639.939     25251.065     744179.839        -.396    -17.55672
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  2    6    0         0.000     3575.926     25251.065     744179.839        -.430    -17.43647
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  2    8    0         0.000     4511.914     25251.065     744179.839        -.465    -17.31692
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  2   10    0         0.000     5447.902     25251.065     744179.839        -.500    -17.19806
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  2   12    0         0.000     6383.889     25251.065     744179.839        -.534    -17.07987
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  2   14    0         0.000     7319.877     25251.065     744179.839        -.569    -16.96233
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  2   16    0         0.000     8255.865     25251.065     744179.839        -.604    -16.84543
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  4    4    0         0.000     3407.902     25251.065     744179.839        -.424    -17.45800
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
  4    6    0         0.000     4343.889     25251.065     744179.839        -.459    -17.33833
Q    P    BETA   CONVERGING     PARALLEL         FEED          REFLEC          GAIN          SIDE
                 AREA           AREA             AREA          AREA            LOSS          LOBE
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Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
4	8	0	0.000	5279.877	25251.065	744179.839	-.493	-17.21935
4	10	0	0.000	6215.865	25251.065	744179.839	-.528	-17.10104
4	12	0	0.000	7151.852	25251.065	744179.839	-.563	-16.98339
4	14	0	0.000	8087.840	25251.065	744179.839	-.598	-16.86637
4	16	0	0.000	9023.828	25251.065	744179.839	-.633	-16.74998
6	4	0	0.000	4175.865	25251.065	744179.839	-.453	-17.35976
6	6	0	0.000	5111.852	25251.065	744179.839	-.487	-17.24066
6	8	0	0.000	6047.840	25251.065	744179.839	-.522	-17.12223
6	10	0	0.000	6983.828	25251.065	744179.839	-.557	-17.00446
6	12	0	0.000	7919.816	25251.065	744179.839	-.592	-16.88733
6	14	0	0.000	8855.803	25251.065	744179.839	-.627	-16.77083
6	16	0	0.000	9791.791	25251.065	744179.839	-.662	-16.65494
8	4	0	0.000	4943.828	25251.065	744179.839	-.481	-17.26199
8	6	0	0.000	5879.816	25251.065	744179.839	-.516	-17.14344
8	8	0	0.000	6815.803	25251.065	744179.839	-.550	-17.02555
8	10	0	0.000	7751.791	25251.065	744179.839	-.585	-16.90831
8	12	0	0.000	8687.779	25251.065	744179.839	-.621	-16.79170
8	14	0	0.000	9623.766	25251.065	744179.839	-.656	-16.67570
8	16	0	0.000	10559.754	25251.065	744179.839	-.691	-16.56031
10	4	0	0.000	5711.791	25251.065	744179.839	-.509	-17.16467
10	6	0	0.000	6647.779	25251.065	744179.839	-.544	-17.04667

Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
10	8	0	0.000	7583.766	25251.065	744179.839	-.579	-16.92931
10	10	0	0.000	8519.754	25251.065	744179.839	-.614	-16.81259
10	12	0	0.000	9455.742	25251.065	744179.839	-.650	-16.69648
10	14	0	0.000	10391.729	25251.065	744179.839	-.685	-16.58098
10	16	0	0.000	11327.717	25251.065	744179.839	-.720	-16.46606
12	4	0	0.000	6479.754	25251.065	744179.839	-.538	-17.06780
12	6	0	0.000	7415.742	25251.065	744179.839	-.573	-16.95033
12	8	0	0.000	8351.729	25251.065	744179.839	-.608	-16.83350
12	10	0	0.000	9287.717	25251.065	744179.839	-.643	-16.71728
12	12	0	0.000	10223.705	25251.065	744179.839	-.679	-16.60167
12	14	0	0.000	11159.693	25251.065	744179.839	-.714	-16.48665
12	16	0	0.000	12095.680	25251.065	744179.839	-.750	-16.37221
14	4	0	0.000	7247.717	25251.065	744179.839	-.567	-16.97137
14	6	0	0.000	8183.705	25251.065	744179.839	-.602	-16.85442
14	8	0	0.000	9119.693	25251.065	744179.839	-.637	-16.73810
14	10	0	0.000	10055.680	25251.065	744179.839	-.672	-16.62238
14	12	0	0.000	10991.668	25251.065	744179.839	-.708	-16.50726
14	14	0	0.000	11927.656	25251.065	744179.839	-.743	-16.39271
14	16	0	0.000	12863.643	25251.065	744179.839	-.779	-16.27872
16	4	0	0.000	8015.680	25251.065	744179.839	-.595	-16.87537
16	6	0	0.000	8951.668	25251.065	744179.839	-.631	-16.75894

Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	8	0	0.000	9887.656	25251.065	744179.839	-.666	-16.64311
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	10	0	0.000	10823.643	25251.065	744179.839	-.701	-16.52788
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	12	0	0.000	11759.631	25251.065	744179.839	-.737	-16.41323
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	14	0	0.000	12695.619	25251.065	744179.839	-.773	-16.29915
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	16	0	0.000	13631.606	25251.065	744179.839	-.809	-16.18561
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE

CASE 54

```
                PROGRAM ANTENNA (INPUT,OUTPUT)
000003          SLN=.0562
000004          RAD=600.
000006          RADF=90.
000007          A0=1.
000011          H=RAD
000012          GAMMA=.0001
000014          R4=RAD**4.
000017          PRINT 80
000023          DO 60 K=0,16,2
000025          DO 60 J=4,16,2
000026          I=0
000027          P=J
000030          Q=K
000031          A=GAMMA+(A0*((RAD-GAMMA)**3.0)/(3.0*RAD*RAD))-(A0*RAD/3.0)
000045          B=GAMMA+(A0*(R4-((RAD-GAMMA)**4.0))/(6.0*RAD*RAD*GAMMA))-(.6666*A0
               1*RAD)
000063          AREAC=0.
000064          AREAP=(H-RADF)*(P+Q)-(((H-RADF)**3.0)*A0*(P+3.*Q))/(6.*RAD*RAD)
000104          AREAR=3.14159*RAD*RAD*(2.0-A0)/2.0
000111          RATIO=(RADF/RAD)**2.0
000115          AREAFM=AREAR*RATIO*(2.0-(A0*RATIO))/(2.0-A0)
000125          STRUT=AREAC+AREAP
000127          SUMSL=STRUT+AREAFM
000131          SUMGN=3.0*STRUT+AREAFM
000133          SL=SUMSL/AREAR
000135          GLOSS=SUMGN/AREAP
000137          SUB=1.0-GLOSS
000140          GAIN=20.0*ALOG10(SUB)
000143          ASLN=(SLN+SL)/SUB
000146          ASL=20.0*ALOG10(ASLN)
000152     80   FORMAT(2H Q,3X,1HP,3X,4HBETA,3X,10HCONVERGING,5X,8HPARALLEL,9X,4HF
               1EED,10X,6HREFLEC,9X,4HGAIN,9X,4HSIDE/16X,4HAREA,11X,4HAREA,13X,4HA
               2REA,10X,4HAREA,11X,4HLOSS,9X,4HLOBE)
000152     50   PRINT 100,K,J,I,   AREAC,AREAP,AREAFM,AREAR,GAIN,ASL
000200    100   FORMAT(3I4,5(F13.3),F13.5)
000200     60   PRINT 80
000210          CALL EXIT
000211          END
```

```
BR.         006171
EXP         006212              RBAREX      003641

GETBA       006270              OUTPTC      003706
                                INPUTC      006317

INPUTC      006311
KRAKER      006413
OUTPNTR     007444              SIOS        005403

----UNSATISFIED EXTERNALS-----                          REFERENCES

Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 0   4   0       0.000      1794.350    25160.602   565486.200    -.482   -19.18816
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 0   6   0       0.000      2691.525    25160.602   565486.200    -.526   -19.01268
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 0   8   0       0.000      3588.700    25160.602   565486.200    -.570   -18.83894
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 0  10   0       0.000      4485.875    25160.602   565486.200    -.614   -18.66688
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 0  12   0       0.000      5383.050    25160.602   565486.200    -.659   -18.49645
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 0  14   0       0.000      6280.225    25160.602   565486.200    -.704   -18.32759
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 0  16   0       0.000      7177.400    25160.602   565486.200    -.749   -18.16025
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 2   4   0       0.000      2445.875    25160.602   565486.200    -.514   -19.06055
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 2   6   0       0.000      3343.050    25160.602   565486.200    -.558   -18.88634
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 2   8   0       0.000      4240.225    25160.602   565486.200    -.602   -18.71382
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 2  10   0       0.000      5137.400    25160.602   565486.200    -.647   -18.54295
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 2  12   0       0.000      6034.575    25160.602   565486.200    -.691   -18.37367
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 2  14   0       0.000      6931.750    25160.602   565486.200    -.736   -18.20592
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 2  16   0       0.000      7828.925    25160.602   565486.200    -.781   -18.03964
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 4   4   0       0.000      3097.400    25160.602   565486.200    -.546   -18.93387
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
 4   6   0       0.000      3994.575    25160.602   565486.200    -.590   -18.76089
Q   P   BETA   CONVERGING   PARALLEL    FEED        REFLEC        GAIN    SIDE
               AREA         AREA        AREA        AREA          LOSS    LOBE
```

4	8	0	0.000	4891.750	25160.602	565486.200	-.635	-18.58958
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	10	0	0.000	5788.925	25160.602	565486.200	-.679	-18.41986
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	12	0	0.000	6686.100	25160.602	565486.200	-.724	-18.25170
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	14	0	0.000	7583.275	25160.602	565486.200	-.769	-18.08503
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
4	16	0	0.000	8480.450	25160.602	565486.200	-.814	-17.91980
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	4	0	0.000	3748.925	25160.602	565486.200	-.578	-18.80809
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	6	0	0.000	4646.100	25160.602	565486.200	-.622	-18.63632
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	8	0	0.000	5543.275	25160.602	565486.200	-.667	-18.46618
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	10	0	0.000	6440.450	25160.602	565486.200	-.712	-18.29759
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	12	0	0.000	7337.625	25160.602	565486.200	-.757	-18.13052
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	14	0	0.000	8234.800	25160.602	565486.200	-.802	-17.96490
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
6	16	0	0.000	9131.975	25160.602	565486.200	-.847	-17.80069
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	4	0	0.000	4400.450	25160.602	565486.200	-.610	-18.68319
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	6	0	0.000	5297.625	25160.602	565486.200	-.655	-18.51261
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	8	0	0.000	6194.800	25160.602	565486.200	-.699	-18.34360
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	10	0	0.000	7091.975	25160.602	565486.200	-.744	-18.17611
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	12	0	0.000	7989.150	25160.602	565486.200	-.789	-18.01010
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	14	0	0.000	8886.325	25160.602	565486.200	-.835	-17.84551
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
8	16	0	0.000	9783.500	25160.602	565486.200	-.880	-17.68230
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
10	4	0	0.000	5051.975	25160.602	565486.200	-.642	-18.55915
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE
			AREA	AREA	AREA	AREA	LOSS	LOBE
10	6	0	0.000	5949.150	25160.602	565486.200	-.687	-18.38972
Q	P	BETA	CONVERGING	PARALLEL	FEED	REFLEC	GAIN	SIDE

Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
10	8	0	0.000	6846.325	25160.602	565486.200	-.732	-18.22182
10	10	0	0.000	7743.500	25160.602	565486.200	-.777	-18.05541
10	12	0	0.000	8640.675	25160.602	565486.200	-.822	-17.89044
10	14	0	0.000	9537.850	25160.602	565486.200	-.868	-17.72685
10	16	0	0.000	10435.025	25160.602	565486.200	-.914	-17.56461
12	4	0	0.000	5703.500	25160.602	565486.200	-.675	-18.43596
12	6	0	0.000	6600.675	25160.602	565486.200	-.720	-18.26764
12	8	0	0.000	7497.850	25160.602	565486.200	-.765	-18.10083
12	10	0	0.000	8395.025	25160.602	565486.200	-.810	-17.93547
12	12	0	0.000	9292.200	25160.602	565486.200	-.855	-17.77151
12	14	0	0.000	10189.375	25160.602	565486.200	-.901	-17.60890
12	16	0	0.000	11086.550	25160.602	565486.200	-.947	-17.44760
14	4	0	0.000	6355.025	25160.602	565486.200	-.707	-18.31358
14	6	0	0.000	7252.200	25160.602	565486.200	-.752	-18.14636
14	8	0	0.000	8149.375	25160.602	565486.200	-.798	-17.98061
14	10	0	0.000	9046.550	25160.602	565486.200	-.843	-17.81626
14	12	0	0.000	9943.725	25160.602	565486.200	-.889	-17.65329
14	14	0	0.000	10840.900	25160.602	565486.200	-.935	-17.49164
14	16	0	0.000	11738.075	25160.602	565486.200	-.981	-17.33126
16	4	0	0.000	7006.550	25160.602	565486.200	-.740	-18.19200
16	6	0	0.000	7903.725	25160.602	565486.200	-.785	-18.02585

Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	8	0	0.000	8800.900	25160.602	565486.200	-.830	-17.86112
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	10	0	0.000	9698.075	25160.602	565486.200	-.876	-17.69778
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	12	0	0.000	10595.250	25160.602	565486.200	-.922	-17.53577
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	14	0	0.000	11492.425	25160.602	565486.200	-.968	-17.37505
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE
16	16	0	0.000	12389.600	25160.602	565486.200	-1.014	-17.21558
Q	P	BETA	CONVERGING AREA	PARALLEL AREA	FEED AREA	REFLEC AREA	GAIN LOSS	SIDE LOBE

APPENDIX C

ANTENNA REFLECTOR DEPLOYMENT DYNAMICS

This appendix provides additional material in support of Section 3.1, antenna reflector deployment dynamics.

C.1 ANALYSIS OF REFLECTOR DEPLOYMENT AT LATCH UP

C.1.1 CALCULATION OF MINIMUM SPRING ENERGY.

a. Mesh - Stress calculations predict 14 inch-lb (1.167 ft.-lb.) of energy required per hinge during deployment. There are 90 front hinges opening against the mesh.

$$KE_M = 1.167 \times 90 = 105 \text{ ft.-lb.}$$

b. Friction - Each end bearing (there are two) in each link, hinged or not, experiences an average frictional torque of 5 oz.-in. per radian (0.0278 ft.-lb. per radian). The end bearings of each front and back link are rotated through an average angle of 90 degrees (1.57 radian), and the end bearings of each intrasurface link are rotated through an average angle of 60 degrees (1.05 radian).

The friction in the carpenter's rule-type link hinge is negligible.

Link Type	No. Links	No. Bearings per Link	Friction Torque, One Bearing, (Ft.-Lb.)	Increment (Radians)	Friction Energy Loss (Ft.-Lb.)
Front	90	2	0.0278	1.57	7.85
Intra	81	2	0.0278	1.05	4.73
Back	63	2	0.0278	1.57	5.50
					18.08

$$KE_F = 18 \text{ Ft.-Lb.}$$

Using the expression from Section 3.1.1.1 for the minimum potential energy supplied by all springs,

$$(PE_{springs})_{min} = KE_M + KE_F = 123 \text{ Ft.-Lb.}$$

C.1.2 LATCH UP LOADS ANALYSIS - Critical design loads are expected to occur at latch up due to spider deceleration and link hinge impact. Analytical tools necessary to compute these loads are described in C.1.2.1 and documentation is discussed in C.1.2.2.

C.1.2.1 Analysis Description - Source of Latch up Loads

The physical situation near latch up is shown in Figure C-1. As the antenna deploys, moving out to the right, the front surface (top of the figure) and back surface links have high hinge velocities and the spiders are subjected to radial (toward the center) deceleration at latch up. There are two major loads placed upon the structure at latch up.

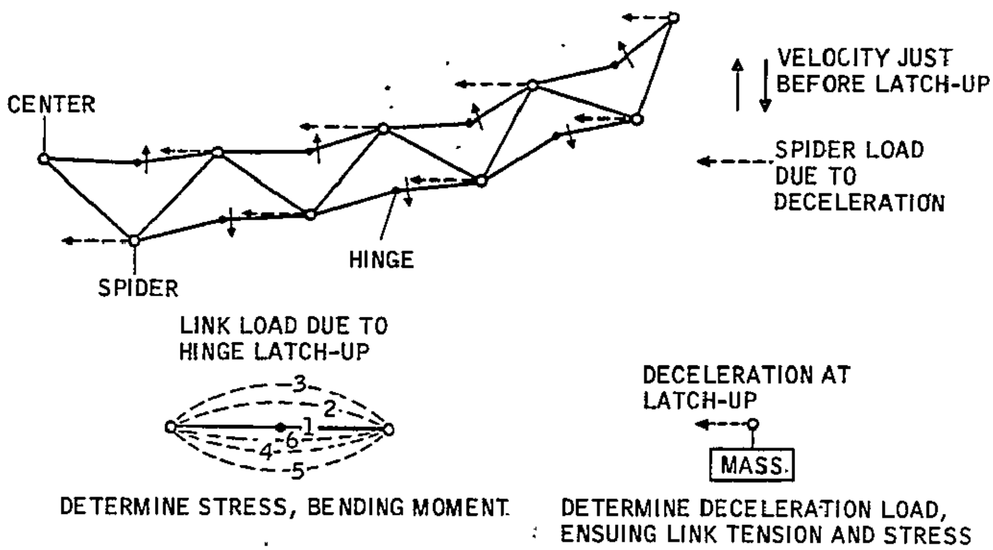
One is the outward spider motion during deployment, which must be decelerated to zero. The links must supply this force, which is dependent upon both the deceleration value and the total weight carried by the spider. Since the spider weight can include localized equipment such as a small antenna, solar panels, feed support structure, and ACS pods, the deceleration force can be quite different for spiders in geometrically similar locations around the reflector. Further, the individual links experience these deceleration loads from spiders located radially outward from themselves, as well as from the spiders at their outer end. This results in the inner links experiencing the greater spider deceleration caused stresses, even though the outer spiders, for most configurations, will produce the largest loads.

Second is that the hinged links (intrasurface links are not hinged) experience loads as they terminate their opening deployment when these links are latched into straight struts. This link hinge impact load will be maximum for a given link at its center, where the hinge is located, and is dependent upon the link hinge velocity at latch up. The outer links will obviously have higher velocities at latch up.

Load evaluation for an antenna design requires consideration of their time histories. Links are relatively long, slender, thin walled tubes. Deceleration will induce a longitudinal, high frequency vibration, and hinge velocity impact will induce a transverse, low frequency vibration.

Link stress due to spider deceleration begins to build up as the spiders slow down while approaching latch up. Maximum occurs near the instant of latch up; and the stress level then exhibits a longitudinal oscillation, with the envelope being approximately described by an exponential decay dependent upon the structural damping and the first mode of the spider induced vibration. Link hinge loading commences at latch up and exhibits the low frequency vibration. For times greater than zero, the sun of the two stresses is the load experienced by the links.

The maximum link stress, which determines the design, and its time of occurrence, varies. It could occur at latch up due to spider load maximum. Also, maximum stress could occur later at the link hinge velocity load maximum, or at an intermediate time, as when the high frequency envelope and the lower frequency cross. The analysis techniques previously available, plus those developed under Contract NAS 8-21460, provide methods for obtaining numerical results for these stress relationships.



ANALYSIS APPROACH STEPS

1. STRUCTURAL CHARACTERISTICS
2. ANTENNA COMPONENT VELOCITIES AND ACCELERATIONS, SPIDER LOADS
3. LOADS (LINK STRESS, BENDING MOMENT, SHEAR) DUE TO HINGE LATCH-UP

Figure C-1. Reflector Latch Up Analysis Hinge Impact and Deceleration Loads.

C. 1.2.2 Latch up Load Analysis Techniques - Latch up loads are obtained in a three step process:

a. Structural characteristics are described by modal representation using either of two techniques previously developed at Convair.

b. Antenna component velocities, accelerations, and spider loads are computed using the truss antenna latch up program developed under Contract NAS 8-21460.

c. Link loads due to hinge velocities are computed using the structural analysis for deploying structures, which Convair has developed under internal funding in 1968 (Program P5201).

The relationship of the calculations involved in the three step analysis is shown on Figure C -2. Four operational Convair digital programs are shown in solid boxes, with the latch up program of this study shown in the heavy lined box. Particularly important computer input data is called out, and information flow is shown and labled. Three simple but necessary hand calculations are shown, which may be incorporated into the programs later. Numerical results are shown in dashed boxes.

First the Convair truss antenna geometry optimization program P4391 (AGO), Reference C-1, provides the coordinates of all spiders and link lengths. Coordinates are easily calculated to 10 decimal digits by the 14-digit CDC 6400 computer - a precision that is desirable for the input to the latch up program. Important inputs to AGO include the antenna diameter, focal length-to-daimeter ratio, and intrasurface length. Component identification is described in Appendix C. 2. 1 and is also in Reference C-1.

1. Step One - Modal representation of structural characteristics is obtained by either the General Missile Vibration Program, P2342D, (GMB), Reference C-4, or the Vibration Modes for Three Dimensional Structures Program, P3684, (3-D), Ref. C-5 and C-6. GMB accepts a two dimensional structure model consisting of beams, translational springs and rotational springs with the effects of both shear stiffness and bending stiffness included. 3-D accepts a three dimensional structural model whose features can include discrete element representation; and one, two, and three dimensional anisotropic elements in three dimensional space. Capacity enables the use of extremely large and complex elastic systems, such as this antenna system, including reflector and appendages thereon (ACS pods; solar panels), feed support structure, and the feed. Output from both programs includes the usual modal frequencies, general masses, deflections, and slopes. Special output used here comprises the shear and bending moment for each mode, calculated for each node in the structural model.

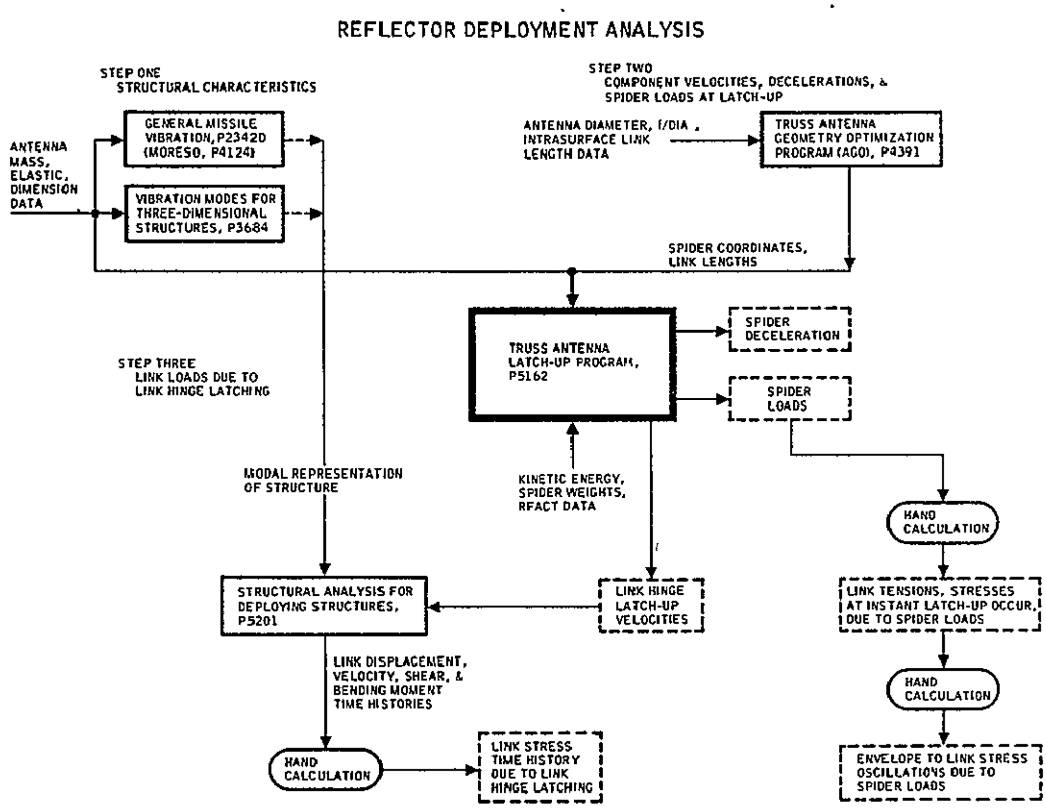


Figure C-2. Analysis Techniques for Deployment Loads at Latch up

GMB accepts the less realistic two dimensional structural model, but the cost of preparing input and computer time are low. 3-D uses a considerably more realistic model, but the costs are appreciable. The skill of the structural dynamicist who models the structure under investigation, for which either program computes a modal representation, is a paramount factor in producing accurate results. Structural model approximations influence computed values of link hinge causedstresses, but not of the spider deceleration stresses.

Utilization of the modal representation is to examine the stress of specific links in Step Three. Thus a structural model is for, or includes, specific links of interest. The link hinge latch up velocity is largest for the outer front links, and they will be crucial.

2. Step Two - Computation of component velocities, decelerations, and loads is performed by the latch up program, (Reference C-3) whose important input includes AGO output, the antenna latch up kinetic energy, the weights of various spiders, and the perturbation size controlling variable, RFACT.

   Convair's experience with deployment of antenna models has been that they open in a symmetrical manner. Toward the end of deployment the center links in both surfaces latch their hinges, and the latching speedily progresses outward. The outer links on the front surface, which are further from center than those on the back, latch last. The latch up program bounds this observed deployment behavior by considering two cases:

   a. All the links latch simultaneously

   b. The outer front surface links latch last

   Relative motion is obtained by subjecting the fully deployed geometry to a small perturbation, and computing the relative velocities and a general mass. The antenna motion at latch up has kinetic energy equal to the potential energy of all the hinge springs less the energy losses in breakaway and viscous friction and those losses due to stretching the mesh. This kinetic energy is to be distributed among the moving links, resulting in a determination of the velocity value of each hinge at deployment termination (latch up). Accelerations can then be obtained.

   The most sensitive item in this entire analysis is the estimate of the kinetic energy which the antenna structure possesses at latch up for the two cases. The link hinge velocities and hence the stresses they cause vary with the square root of the energy whereas the spider decelerations and hence the stresses they cause vary directly with the energy.

Other tasks accomplished under the contract NAS 8-21460 improve the capability to accurately predict the energy. Hinge and tetrahedron tests on actual hardware provide data on friction and the energy which the springs put into the system during deployment. Mesh testing will result in more accurate data for calciations of the mesh stretching energy loss. The deployment time history simulation is based on energy calculations and consequently is used to examine the energy transfer during deployment.

Velocities are computed for each front and back link, and deceleration is computed for all the spiders by the latch up program. Spider loads are dependent on spider weights. The user can input spider weight data for any or all of the spiders, and spider deceleration loads are calculated only for those for which weight is input.

3. Step Three - The structural analysis for deploying structures program (P5201), Reference C-3, computes time histories for the physical behavior (displacement, velocity, bending moment, and shear) of any selected structural member. Input includes the modal representation of that member (which may not include all the modes computed in Step One) and the initial position and velocity conditions along the member. Application to link hinge latching loads results in the initial position being zero. Initial velocity is a triangular distribution having the link hinge velocity from Step Two at the hinge location and zero at both ends.

Shear and bending moment are included in the modal representation input, at each node for each mode. These quantities vary with the member displacement, and their values as a function of time are obtained. Bending moment is the desired physical quantity for this loads analysis, since it is used to calculate stress.

An optional program feature, SEARCH, prints at computation end the maximum value and occurrence time of displacement, velocity, shear, and bending moment for a node specified by the engineer and/or among all nodes along the member.

For a specific modal representation, the computed values (displacement, velocity, shear, and bending moment) are directly proportional to the initial velocity (for this zero-position triangular velocity initial condition). Consequently, the program is run only once for each structural model, and data for another velocity is simply the velocity ratio times the program data.

C. 1. 2. 3 Analysis Documentation - These analysis techniques and the associated digital programs were completed during August, 1968, for an eight bay reflector. Complete documentation of that effect is in Section 3 of Reference C-3, and that material will not be duplicated here. The major improvement since then has been an option for six bay reflector, which necessitated changes in both the AGO geometry and the latch up programs.

This program computes antenna geometry and draws projected pictures, as explained above and in Reference C-1. It was used to calculate the 70 foot diameter antenna geometry (0.4 f/DIA, f = 28 ft., S = 6.84 ft.,) during July, 1968, for an eight bay configuration, as noted in the first monthly report.

Smaller antenna diameters may be better implemented using a six bay rather than an eight bay configuration. Necessary AGO modifications for six bays have been made and are documented in Reference C-2. Computations have been made for both eight and six bay versions of a 30 ft. antenna.

AGO requires as input the desired intra surface strut length, S, which is pre-selected by the engineer. The criteria that the three center intra surface struts (9, 15, and 106) be at 30 degrees from the X-Y plane was developed and used for the 30 foot AGO calculations. The formula for S is included in Reference C-2, and S = 2.90009 Ft. for the eight bay and 3.98161 for the six bay.

The diameter of the "30.0 ft." antenna is selected to be the diameter which results in the projected aperature area being the same as the area of a 30 ft. circle. Thus

$$\text{DIA} = \left[\frac{3\sqrt{3}}{2\pi}\right]^{1/2} (30) = \frac{30}{.90937} = 32.989 \text{ ft.}$$

Several antenna projections from different viewing angles are used in the thermal analysis procedures. The capability of performing the second antenna rotation to the viewing angle about the new Y axis has been added to the previous rotation about the new X axis. This improvement was introduced as an aid to thermal analysis and is also documented in Reference C-2. Several projections have been drawn and are presented in the thermal analysis section.

The loads due to spider deceleration result in alternate tension and compression stresses, varying at the link longitudinal frequency. Since the link is a thin walled column, the acceptable stress level is considerably smaller for compression than for tension. Thus acceptable compression stress forms the design criteria for spider deceleration loads.

Following the AGO runs, the latch up program was used for the eight bay 30 ft. antenna, using preliminary weight data. Runs were made to select RFACT and the value .99994 used previously is again satisfactory.

An improved equation for the perturbation time duration, DELT, was introduced into the simulation, and no significant change in numerical results occurred. The original equation for DELT was DELT = ΔR/OMEGZER in which ΔR is the radial motion of node 1, and OMEGZER if the linear velocity of node 1, OMEGZER being computed from the general mass and the antenna kinetic energy at latch up (KE is an input variable). This equation is an approximation of

$$\Delta R = V_o T + 1/2\, aT^2, \text{ valid for small } T.$$

The new equation for DELT is the angular velocity of link 58 divided into the angle through which the link must move to attain latch up. The new expression is more accurate, but the improvement is not significant for typical values of RFACT, as can be observed from the data of Table C-1.

Table C-1. New DELT Equation Effects

RFACT	ENALL = 1000	ENALL = 20	ENOT = 500	ENOT = 10
	Old equation, runs 042, 42B			
.999 99	.00055	.00386	.00059	.00418
.999 94	.00122	.00863	.00130	.00919
.999	.00387	.02735	.00380	.02690
.99	.00949	.06713	.00811	.05734
	New equations, runs 42C, 42G			
.999 99	.00055	.00386	.00059	.00418
.999 94	.00122	.00863	.00130	.00919
.999	.00388	.02744	.00382	.02700
.99	.00963	.06810	.00823	.05817

The latch up program was easily changed to add the six bay option, since most changes involved elimination of superflous coding. Input includes the flag NBAYS, which may be either eight or six. Several six bay runs have been made.

C.1.3 LATCH UP CALCULATION RESULTS

C.1.3.1 Eight Bay 30 Ft. Diameter Antenna - Results were obtained for an eight bay 30 ft. antenna in latch up program run 042, October 12, 1968. Pertinent data for the antenna configuration follow. The front and back surface links are 1.0 inch dia. 0.010 Al tubing, carrying a hinge structure, including tension spring, of .0467 lbs. Since the 30 foot antenna reflector will not have attached equipment (solar panels, ACS pods, communication antenna), spider deceleration loads were computed for the bare antenna. Each spider was assigned 1.28 lbs. The link tensions are shown in Figure C-3. They are considerably smaller than for the 70 foot antenna, which was also eight bay. The latching velocities of the link hinges are shown in Figure C-4. Note that link 58 (one of six outer radial links in the front surface) has a much larger velocity than other links. Differences of this magnitude were not observed for the 70 foot antenna. Results for the eight bay 70 foot antenna, latch up run 041, are presented in Reference C-3, and illustrative data is shown in C.1.3.5 and C.1.3.6.

The bending moment and shear for a specific link as a function of time after latch up are computed by first obtaining the link structural characteristics (analysis step one) and using program P5201 and the modal data to obtain the time histories for a specific link hinge velocity (analysis step three). Since bending moment and shear scale directly with velocity, the velocity versus energy curves (Figure C-4) can be then used to plot maximum bending moment versus latch up energy. Then bending moment data can be transformed into maximum stress. Such stress data is presented in Figure C-5, for link 58. The structural model utilized the simple assumption that the link was solely an aluminum tube.

The structural characteristics for an improved link design ("carpenter's rule") which used a steel hinge as the "spring" have been obtained for link number one. Maximum bending moment occurs 0.0070 seconds after latch up. This maximum is shown in Figure C-6, as a function of link center velocity of 100 fps. The discontinuity near link center is due to minor input errors which are no longer being made.

C.1.3.2 Six Bay 30 Ft. Diameter Antenna - For this specific configuration, the front and back links are 1.5 inch diameter 0.010 titanium and the hinge spring is a carpenter's rule type device. It consists of two pieces of 0.008 inch titanium, 3.4 inch wide and 12 inches long. The front spiders weight 2.25 lbs., the back spiders 2.03 lbs.

This antenna constitutes the typical results, Reference C-7, used to illustrate the latch up analysis discussion in Section 3.1.1. Accordingly, the typical computer runs presented are for this case. The modal representation of link 34 (analysis step one) was obtained in run B008, 26 November 1968, using the program of Reference C-4. Since this is a Convair standard program, long used for a variety of structures, the computer run is not included. The computer run for link 34 loads (analysis step three) is given in C.1.3.4.

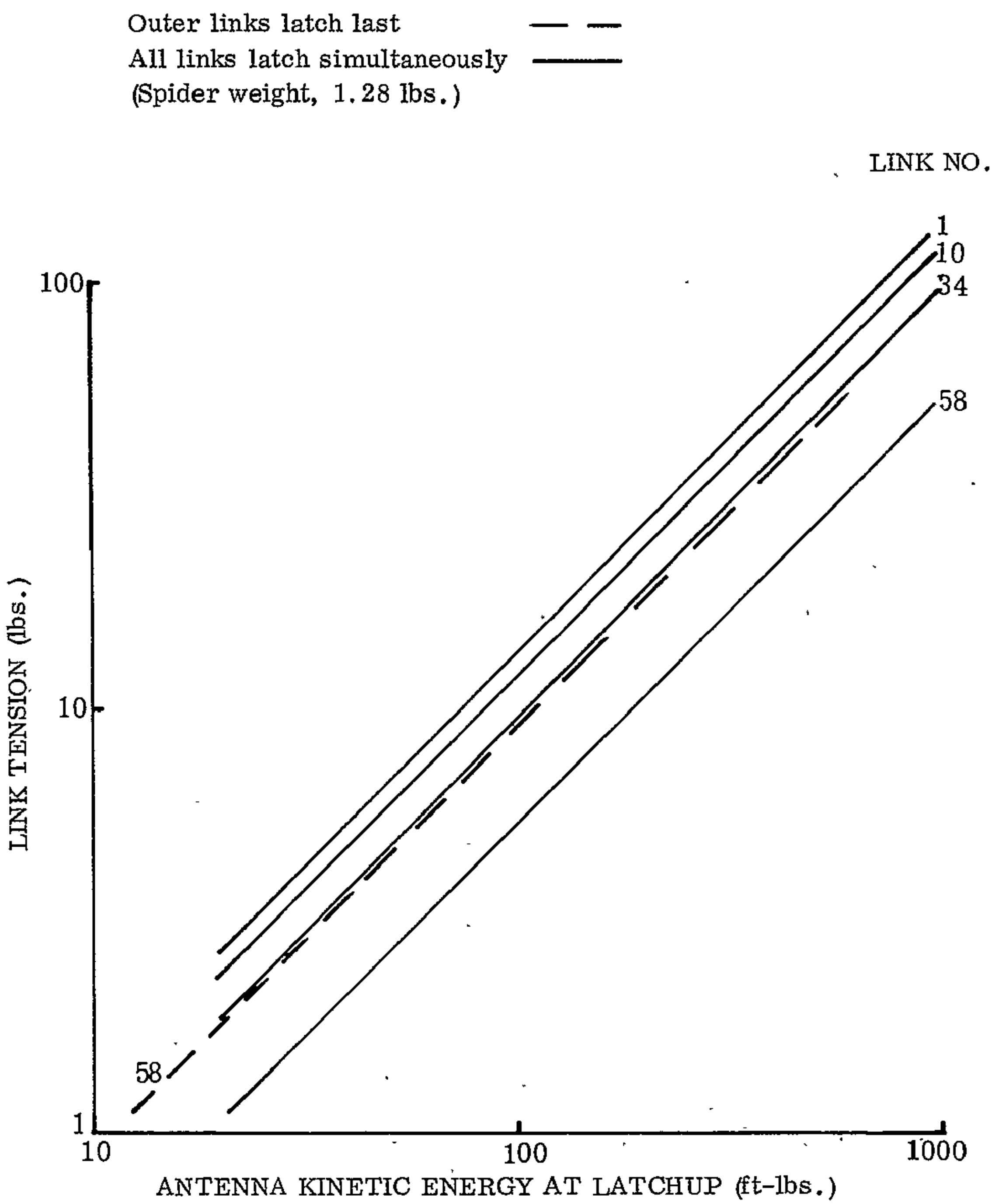


Figure C-3. Spider Deceleration Caused Link Tension for Bare Antenna Versus Latch Up Energy

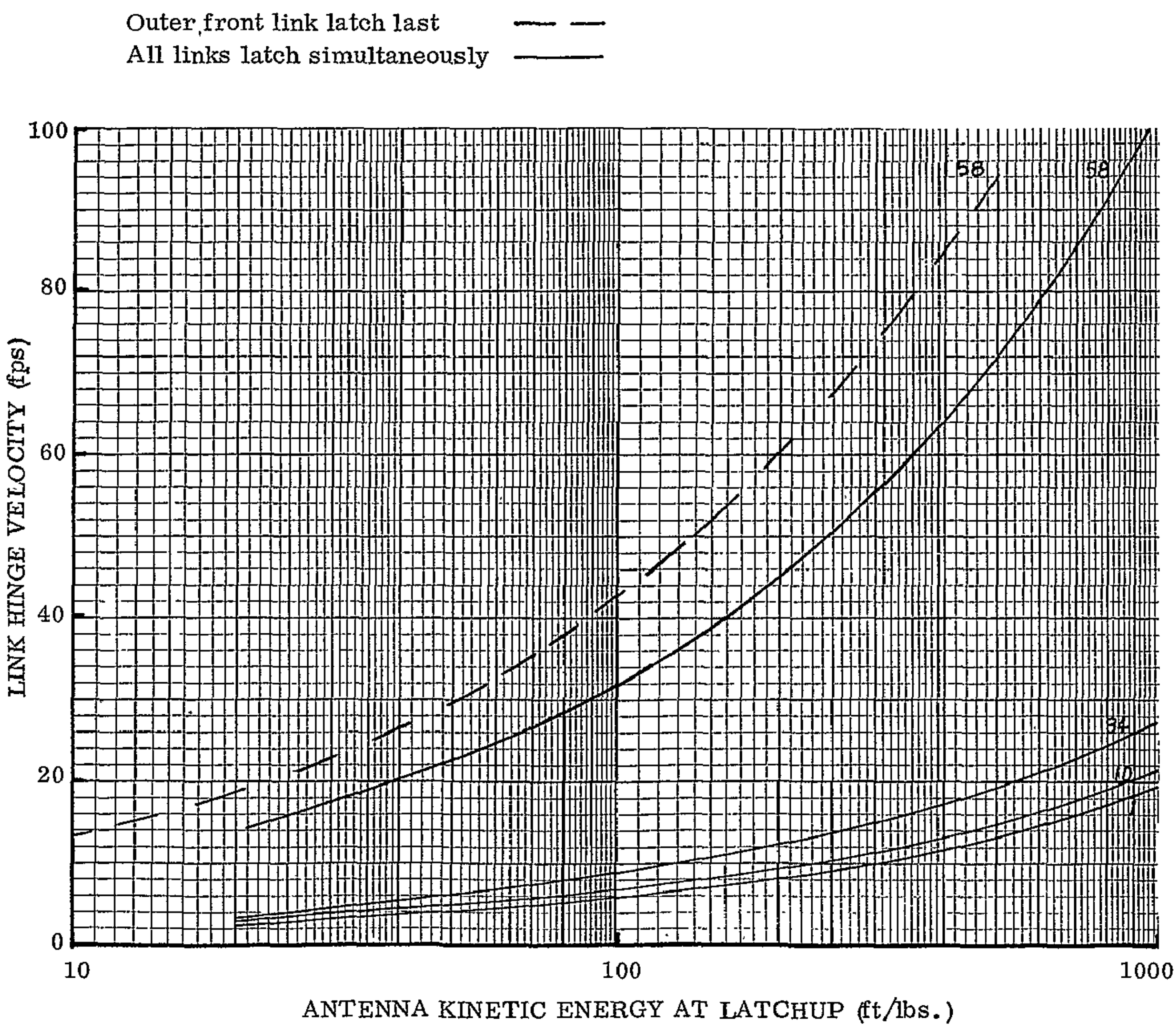


Figure C-4. Link Hinge Velocity Versus Latch Up Energy
(8-Bay, 30-ft Antenna)

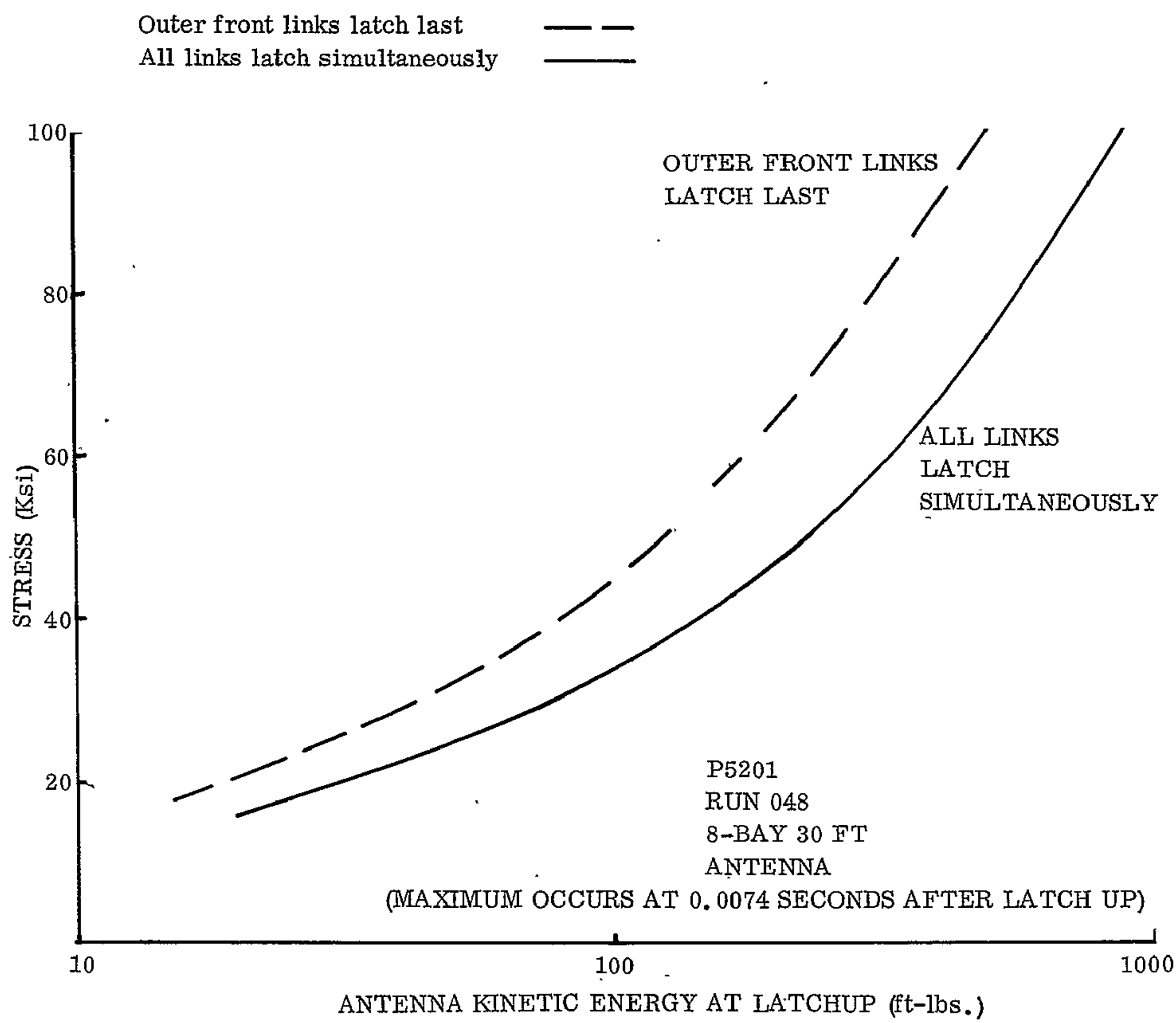


Figure C-5. Maximum Stress Due to Link Hinge Impact Load Versus Latch Up Energy for Link No. 58

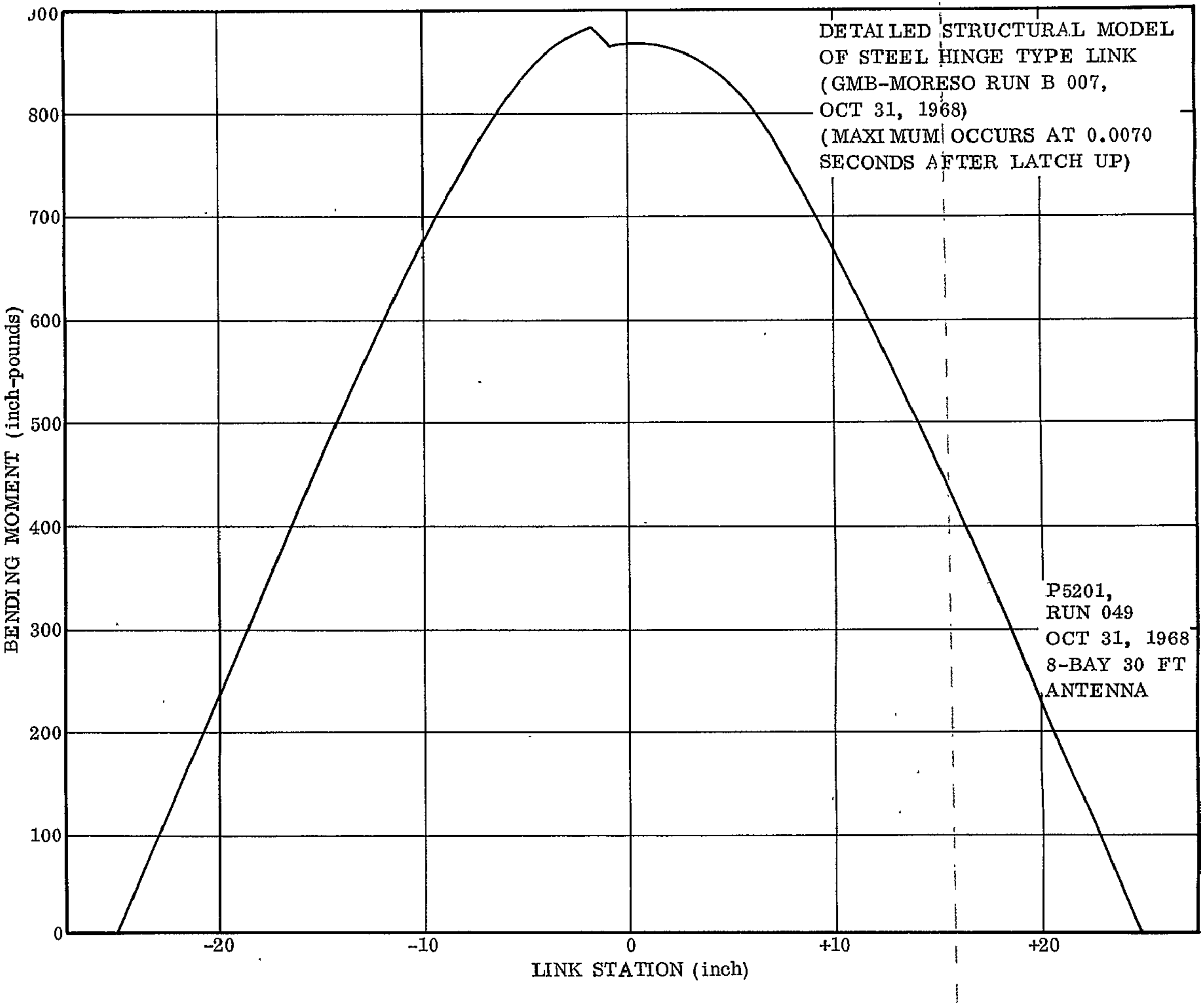


Figure C-6. Maximum Bending Moment versus Link Station, Link No. 1

Link tensions due to spider deceleration and link hinge latching velocity data from the run of Appendix C. 1. 3. 3 are shown in Figures of Section 3. 1. 1. 3. The run of Appendix C. 1. 3. 4 shows that maximum bending moment for link 34 occurs at 0. 012 seconds after latch up. This maximum is also shown in Section 3. 1. 1. 3; note the normalized link center velocity was 100 fps. Portions of this data also are presented in C. 1. 3. 5.

C. 1. 3. 3 Latch Up Program Results, P5162 Six-Bay 30 Foot Antenna - (run 051, November 1968)

```
OPTION FOR SIX BAYS AS WELL AS EIGHT ADDED FOLLOWING RUN 042, OCT12/68. FLAG IS NBAYS, ENTER 8 OR 6. NBAYS IN NAMELIST/ONE/.
FOR EITHER,AGO IS RUN FOR FULL 8 BAYS ( IF 6 DESIRED ENTER (4/3) * DESIRED DIAMETER AS AGO INPUT PARAMETER DIA ) AND 109 AGO NODAL
DATA CARDS ARE INPUT TO THIS PROGRAM. INTERMEDIATE RESULTS UP TO AND INCLUDING CONGMAS ARE COMPUTED AND PRINTED FOR THE 109 NODES
AND 156 FRONT AND 120 BACK LINKS OF THE 8 BAY CONFIGURATION. FINAL RESULTS ( FROM GENERAL MASSES ON ) ARE CALCULATED AND PRINTED
FOR EITHER THE 8 BAY OR THE 6 BAY CONFIGURATION.

THE EIGHT BAY CONFIGURATION CONTAINS 9 EQUIVALENT NODE SETS ON FRONT AND 10 ON BACK, AND 16 EQUIVALENT LINK SETS ON FRONT AND 22 ON
BACK ( AND 26 INTRA LINK SETS NOT USED IN DEPLYEND ). THE SIX BAY CONFIGURATION CONTAINS THE FIRST 6 FRONT NODE SETS AND THE
FIRST 6 BACK NODES SETS, AND THE FIRST 10 FRONT LINK SETS AND THE FIRST 12 BACK LINK SETS ( AND THE FIRST 15 INTRA SETS) OF THE
EIGHT BAY CONFIGURATION.
WT DATA INPUT FOR A SIX BAY RUN ( ARRAY WGHT(2,109) ) NEED NOT INCLUDE ANY OF THE NODES REQUIRED ONLY FOR THE EIGHT
BAY. THESE NODES ARE

NDFS7(I)   =   1  70  74   9  84  80                          NDFS8(I)   =  10  50  71  73  55  17     27  65  83  81  60  20
NDFS9(I)   =  30  72  36  46  82  40
NDBS7(I)   = 100 700 704 107 803 800                          NDBS8(I)   = 300 500 505 306 802 801
NDBS9(I)   = 701 703 206 604 600 200                          NDBS10(I)  = 702 405 400

 INTERMEDIATE RESULTS FOR LINK DATA ( DSTLINK, ALNKEQV, ANGLNK, DEFLNK, ETC ) IS STORED AND PRINTED AS ARRAYS WITH THE DIMENSION
38. FRONT LINK SETS OCCUPY THE FIRST 16 POSITIONS AND BACK LINK SETS THE REMAINING 22. UNDER THE SIX BAY OPTION, THE FIRST 10
POSTIONS REPRESENT THE FRONT LINKS , AND POSITIONS 17 THROUGH 28 REPRESENT THE BACK LINKS, AND DATA IN POSITIONS 11 THROUGH 16
AND 29 THROUGH 38 IS THUS MEANINGLESS.

FOR SIX BAY OPTION, THE OUTER FRONT LINKS ARE
LNKFS6(I)  =  34 183  50 177  42 171                          LNKFS7(I)  =  38 182 181  52  54 176    175  44  46 170 169  36
LNKFS8(I)  = 164 165 123 121 158 159  117 115 152 153 111 109 LNKFS9(I)  =  61 241 200  75  77 235    194  67  69 229 188  59
LNKFS10(I) = 223 140 217 134 211 128
THE OUTER FRONT NODES ARE
NDFS5(I)   =   2  51  54   8  64  61                          NDFS6(I)   =  11  31  52  53  35  16     26  45  63  62  41  21

NODES USED IN THE EIGHT BAY AND NOT IN SIX BAY ARE NDFS7,8,9, AND ARE IDENTIFIED ABOVE IN WT DATA DISCUSSION.
LINKS USED IN  THE EIGHT BAY AND NOT IN THE SIX BAY ARE
LNKFS11(I) =  58 261  74 255  66 249                          LNKFS12(I) =  62 260 259  76  78 254    253  68  70 248 247  60
LNKFS13(I) = 224 243 201 139 218 237  195 133 212 231 189 127 LNKFS14(I) =  83 295 269  88  89 292    267  85  86 289 265  82
LNKFS15(I) = 225 242 199 141 219 236  193 135 213 230 187 129 LNKFS16(I) = 277 286 209 149 274 283    207 147 271 280 205 145
LNKBS13(I) = 389 408 386 405 383 402                          LNKBS14(I) = 390 407 387 404 384 401
LNKBS15(I) = 398 399 395 396 392 393                          LNKBS16(I) = 414 420 413 419 412 418
LNKBS17(I) = 417 416 415                                      LNKBS18(I) = 406 350 403 347 400 344
LNKBS19(I) = 378 338 375 333 372 328                          LNKFS20(I) = 411 351 410 348 409 345
LNKBS21(I) = 376 341 373 336 370 331                          LNKBS22(I) = 381 349 380 346 379 343

 FOR EIGHT BAY OPTION, THE OUTER FRONT LINKS ARE LNKFS11 TO 16, AND THE OUTER FRONT NODES ARE NDFS7,8,9,. THESE EQUIVALENT SETS ARE
IDENTIFIED ABOVE.


C 30 FOOT 6 BAY

              ** THIS SOLUTION IS FOR **     6 BAYS
```

```
$ONE
RFACT   =  0.99994E+00,
NENOT   =  5,
ENOT    =  0.1E+02,  0.3E+02,  0.1E+03,  0.25E+03,  0.5E+03,  0.0,  0.0,  0.0,   0.0,  0.0,
NENALL  =  5,
ENALL   =  0.2E+02,  0.6E+02,  0.2E+03,  0.5E+03,  0.1E+04,  0.0,  0.0,  0.0,   0.0,  0.0,
NRAYS   =  6,
NCHRFAC =  0,
CHRFACT =  0.999E+00,  0.9994E+00,  0.9999E+00,  0.99994E+00,  0.99999E+00,    0.999994E+00,  0.999999E+00,
           0.9999999E+00, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0, -0.0,     -0.0, -0.0, -0.0, -0.0,
IEXIT   =  1,
$END
C  PRINTF CONTAINS THE FLAGS WHICH CONTROL PRINTING
```

```
$PRINTF
IPOLINK =  0,
IPONDCO =  1,
IPODEF  =  1,
IPOHANG =  1,
IPODEFL =  1,
IPODEFN =  1,
IPOOMNR =  1,
IPOINER =  1,
IPOCGMS =  1,
IPOLEQ  =  0,
IPOLAS  =  0,
IPOLAV  =  1,
IPOHLV  =  1,
IPOACC  =  1,
$END
C NOV 13/68 WT DATA, 30 FOOT 6 BAY ANTENNA, BARE SPIDERS, FRONT SPIDERS WITH
C MESH SUPPORT AND MESH ARE 2.25 LBS, BACK ARE 2.030 LBS. HINGE IS STEEL TUBE.
C HINGE STRUCTURE MASS, FRONT AND BACK, SLUGS, IS ZERO.
C  FRONT AND BACK LINKS, 1.5 IN DIA            .00257 SLUGS / FT.
C TO OBTAIN ALL DISTINCT LOADS DUE TO NODAL ACCELERATIONS, WE MUST INCLUDE A
C WEIGHT DATA FOR ONE NODE WITH NO SPECIAL WTS FROM EACH EQUIVALENT SET AND A
C NODE FROM EACH GROUPING OF NODES IN THE SAME EQUIVALENT SET CARRYING THE SAME
C SPECIAL WT.
```

```
$MASSPRO

AMLEDNF =  0.257E-02,

AMLEDNB =  0.257E-02,

WGHT    =  0.5E+01,  0.225E+01,  0.4E+01,  0.225E+01,  0.3E+01,  0.225E+01,      0.12E+02,  0.225E+01,  0.2E+01,
           0.225E+01,  0.11E+02,  0.225E+01,  0.103E+03,  0.203E+01,             0.102E+03,  0.203E+01,  0.303E+03,
           0.203E+01,  0.101E+03,  0.203E+01,  0.301E+03,  0.203E+01,            0.502E+03,  0.203E+01,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,      0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,

NWGHT   =  12,

WTFACT  =  0.1E+01,

HINMASF =  0.0,

HINMASB =  0.0,

$END

WEIGHT DATA IN /MASSPRO/ IS MULTIPLIED BY THE WEIGHT ADJUSTMENT FACTOR, WTFACT=  1.00 TO CONVERT WEIGHT DATA TO THIS SPECIFIC ANTENNA
ARRAY WGHT NOW CONTAINS THE VALUES
    5.0   2.25     4.0   2.25     3.0   2.25    12.0   2.25     2.0   2.25    11.0   2.25   103.0   2.03   102.0   2.03   303.0   2.03
  101.0   2.03   301.0   2.03   502.0   2.03

PRINT OUT PUNCH CARD INPUT FROM AGO

 A=  .0189394000 B=      0.00000 DIA=      43.98540 S=      3.98161     R005 6BAY
```

I	NODE(I)	XTOT(I)	YTOT(I)	ZTOT(I)	I	NODE(I)	XTOT(I)	YTOT(I)	ZTOT(I)
1	1	21.9927220000	0.0000000000	9.0174663775	2	2	16.4945415000	0.0000000000	5.0097035431
3	3	10.9963610000	0.0000000000	2.1470158042	4	4	5.4981805000	0.0000000000	.4294031608
5	5	0.0000000000	0.0000000000	-.1431343869	6	6	-5.4981805000	0.0000000000	.4294031608
7	7	-10.9963610000	0.0000000000	2.1470158042	8	8	-16.4945415000	0.0000000000	5.0097035431
9	9	-21.9927220000	0.0000000000	9.0174663775	10	10	19.2436317500	-4.7615639876	7.2998537342
11	11	13.7454512500	-4.7615639876	3.8646284475	12	12	8.2472707500	-4.7615639876	1.5744782564
13	13	2.7490902500	-4.7615639876	.4294031608	14	14	-2.7490902500	-4.7615639876	.4294031608
15	15.	-8.2472707500	-4.7615639876	1.5744782564	16	16	-13.7454512500	-4.7615639876	3.8646284475
17	17	-19.2436317500	-4.7615639876	7.2998537342	18	20	19.2436317500	4.7615639876	7.2998537342
19	21	13.7454512500	4.7615639876	3.8646284475	20	22	8.2472707500	4.7615639876	1.5744782564
21	23	2.7490902500	4.7615639876	.4294031608	22	24	-2.7490902500	4.7615639876	.4294031608
23	25	-8.2472707500	4.7615639876	1.5744782564	24	26	-13.7454512500	4.7615639876	3.8646284475
25	27	-19.2436317500	4.7615639876	7.2998537342	26	30	16.4945415000	-9.5231279752	6.7273161864
27	31	10.9963610000	-9.5231279752	3.8646284475	28	32	5.4981805000	-9.5231279752	2.1470158042
29	33	-0.0000000000	-9.5231279752	1.5744782564	30	34	-5.4981805000	-9.5231279752	2.1470158042
31	35	-10.9963610000	-9.5231279752	3.8646284475	32	36	-16.4945415000	-9.5231279752	6.7273161864
33	40	16.4945415000	9.5231279752	6.7273161864	34	41	10.9963610000	9.5231279752	3.8646284475
35	42	5.4981805000	9.5231279752	2.1470158042	36	43	0.0000000000	9.5231279752	1.5744782564
37	44	-5.4981805000	9.5231279752	2.1470158042	38	45	-10.9963610000	9.5231279752	3.8646284475
39	46	-16.4945415000	9.5231279752	6.7273161864	40	50	13.7454512500	-14.2846919628	7.2998537342

41	51	8.2472707500	-14.2846919628	5.0097035431
43	53	-2.7490902500	-14.2846919628	3.8646284475
45	55	-13.7454512500	-14.2846919628	7.2998537342
47	61	8.2472707500	14.2846919628	5.0097035431
49	63	-2.7490902500	14.2846919628	3.8646284475
51	65	-13.7454512500	14.2846919628	7.2998537342
53	71	5.4981805000	-19.0462559504	7.2998537342
55	73	-5.4981805000	-19.0462559504	7.2998537342
57	80	10.9963610000	19.0462559504	9.0174663775
59	82	0.0000000000	19.0462559504	6.7273161864
61	84	-10.9963610000	19.0462559504	9.0174663775
63	101	14.6729446483	-1.4877574053	1.7969826665
65	103	2.9862068968	-1.7240873557	-2.1339391933
67	105	-8.9041531049	-1.6447622963	-.8145101083
69	107	-20.2128702096	-1.2540728303	5.6839034850
71	201	11.8970031873	3.5376331480	.5572963388
73	203	-0.0000000000	3.4481747115	-2.1339391933
75	205	-11.8970031873	3.5376331480	.5572963388
77	300	17.3082925565	-6.4898579918	4.2798082612
79	302	5.8764824842	-6.8888416399	-.8145101083
81	304	-5.8764824842	-6.8888416399	-.8145101083
83	306	-17.3082925565	-6.4898579918	4.2798082612
85	401	9.0121817691	8.5342904152	.5572963388
87	403	-3.0276706207	8.5336039362	-.8145101083
89	405	-14.8085745753	8.5497345174	3.2540996192
91	501	8.6249080319	-11.9632641111	1.7969826665
93	503	-2.8848214183	-12.0719235631	.5572963388
95	505	-14.2745281661	-11.7444920541	4.2798082612
97	601	6.0480366165	13.4510215165	1.7969826665
99	603	-6.0480366165	13.4510215165	1.7969826665
101	700	11.1924940340	-16.8778226697	5.6839034850
103	702	-0.0000000000	-17.0994690348	3.2540996192
105	704	-11.1924940340	-16.8778226697	5.6839034850
107	801	3.0337643904	18.2343500459	4.2798082612
109	803	-9.0203761756	18.1318955000	5.6839034850

42	52	2.7490902500	-14.2846919628	3.8646284475
44	54	-8.2472707500	-14.2846919628	5.0097035431
46	60	13.7454512500	14.2846919628	7.2998537342
48	62	2.7490902500	14.2846919628	3.8646284475
50	64	-8.2472707500	14.2846919628	5.0097035431
52	70	10.9963610000	-19.0462559504	9.0174663775
54	72	-0.0000000000	-19.0462559504	6.7273161864
56	74	-10.9963610000	-19.0462559504	9.0174663775
58	81	5.4981805000	19.0462559504	7.2998537342
60	83	-5.4981805000	19.0462559504	7.2998537342
62	100	20.2128702096	-1.2540728303	5.6839034850
64	102	8.9041531049	-1.6447622963	-.8145101083
66	104	-2.9862068968	-1.7240873557	-2.1339391933
68	106	-14.6729446483	-1.4877574053	1.7969826665
70	200	17.5707382568	3.6568612251	3.8597560924
72	202	6.0099117616	3.4698241734	-1.4551827193
74	204	-6.0099117616	3.4698241734	-1.4551827193
76	206	-17.5707382568	3.6568612251	3.8597560924
78	301	11.6708898337	-6.7381913872	1.1001480857
80	303	-0.0000000000	-6.9396483468	-1.4551827193
82	305	-11.6708898337	-6.7381913872	1.1001480857
84	400	14.8085745753	8.5497345174	3.2540996192
86	402	3.0276706207	8.5336039362	-.8145101083
88	404	-9.0121817691	8.5342904152	.5572963388
90	500	14.2745281661	-11.7444920541	4.2798082612
92	502	2.8848214183	-12.0719235631	.5572963388
94	504	-8.6249080319	-11.9632641111	1.7969826665
96	600	11.9523038474	13.3882750811	3.8597560924
98	602	0.0000000000	13.4763827743	1.1001480857
100	604	-11.9523038474	13.3882750811	3.8597560924
102	701	5.6184344094	-17.0451363062	3.8597560924
104	703	-5.6184344094	-17.0451363062	3.8597560924
106	800	9.0203761756	18.1318955000	5.6839034850
108	802	-3.0337643904	18.2343500459	4.2798082612

INITIAL VALUE OF REACT IS .9999400000

OPTIONAL PRINT OF NODAL COORDINATES,, R FOR FULLY DEPLOYED, THET IS INDEPENDENT OF PERTURBATION, -NEW FOR PERTURBED LOCATION

I	NODE	R	THETA(DEGREES)	RNEW	XNEW	YNEW	ZNEW
1	1	21.9927220	0.0000000	21.9914024	21.9914024	0.0000000	7.6645008
2	2	16.4945415	0.0000000	16.4935518	16.4935518	0.0000000	5.0064248
3	3	10.9963610	0.0000000	10.9957012	10.9957012	0.0000000	2.1463268
4	4	5.4981805	0.0000000	5.4978506	5.4978506	0.0000000	.4292618
5	5	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	-.1431344
6	6	5.4981805	180.0000000	5.4978506	-5.4978506	-.0000000	.4292618
7	7	10.9963610	180.0000000	10.9957012	-10.9957012	-.0000000	2.1463268
8	8	16.4945415	180.0000000	16.4935518	-16.4935518	-.0000000	5.0064248
9	9	21.9927220	180.0000000	21.9914024	-21.9914024	-.0000000	7.6645008
10	10	19.8239717	-13.8978862	19.8227823	19.2424771	-4.7612783	5.9472953
11	11	14.5468183	-19.1066054	14.5459455	13.7446265	-4.7612783	3.8622516
12	12	9.5231280	-30.0000000	9.5225566	8.2467759	-4.7612783	1.5739008
13	13	5.4981805	-60.0000000	5.4978506	2.7489253	-4.7612783	.4292618
14	14	5.4981805	-120.0000000	5.4978506	-2.7489253	-4.7612783	.4292618
15	15	9.5231280	-150.0000000	9.5225566	-8.2467759	-4.7612783	1.5739008
16	16	14.5468183	-160.8933946	14.5459455	-13.7446265	-4.7612783	3.8622516
17	17	19.8239717	-166.1021138	19.8227823	-19.2424771	-4.7612783	5.9472953
18	20	19.8239717	13.8978862	19.8227823	19.2424771	4.7612783	5.9472953
19	21	14.5468183	19.1066054	14.5459455	13.7446265	4.7612783	3.8622516
20	22	9.5231280	30.0000000	9.5225566	8.2467759	4.7612783	1.5739008
21	23	5.4981805	60.0000000	5.4978506	2.7489253	4.7612783	.4292618
22	24	5.4981805	120.0000000	5.4978506	-2.7489253	4.7612783	.4292618
23	25	9.5231280	150.0000000	9.5225566	-8.2467759	4.7612783	1.5739008
24	26	14.5468183	160.8933946	14.5459455	-13.7446265	4.7612783	3.8622516
25	27	19.8239717	166.1021138	19.8227823	-19.2424771	4.7612783	5.9472953
26	30	19.0462560	-30.0000000	19.0451132	16.4935518	-9.5225566	5.8925561
27	31	14.5468183	-40.8933946	14.5459455	10.9957012	-9.5225566	3.8622516
28	32	10.9963610	-60.0000000	10.9957012	5.4978506	-9.5225566	2.1463268
29	33	9.5231280	-90.0000000	9.5225566	-.0000000	-9.5225566	1.5739008
30	34	10.9963610	-120.0000000	10.9957012	-5.4978506	-9.5225566	2.1463268
31	35	14.5468183	-139.1066054	14.5459455	-10.9957012	-9.5225566	3.8622516
32	36	19.0462560	-150.0000000	19.0451132	-16.4935518	-9.5225566	5.8925561
33	40	19.0462560	30.0000000	19.0451132	16.4935518	9.5225566	5.8925561
34	41	14.5468183	40.8933946	14.5459455	10.9957012	9.5225566	3.8622516
35	42	10.9963610	60.0000000	10.9957012	5.4978506	9.5225566	2.1463268
36	43	9.5231280	90.0000000	9.5225566	-.0000000	9.5225566	1.5739008
37	44	10.9963610	120.0000000	10.9957012	-5.4978506	9.5225566	2.1463268
38	45	14.5468183	139.1066054	14.5459455	-10.9957012	9.5225566	3.8622516
39	46	19.0462560	150.0000000	19.0451132	-16.4935518	9.5225566	5.8925561
40	50	19.8239717	-46.1021138	19.8227823	13.7446265	-14.2838349	5.9472953
41	51	16.4945415	-60.0000000	16.4935518	8.2467759	-14.2838349	5.0064248
42	52	14.5468183	-79.1066054	14.5459455	2.7489253	-14.2838349	3.8622516
43	53	14.5468183	-100.8933946	14.5459455	-2.7489253	-14.2838349	3.8622516
44	54	16.4945415	-120.0000000	16.4935518	-8.2467759	-14.2838349	5.0064248
45	55	19.8239717	-133.8978862	19.8227823	-13.7446265	-14.2838349	5.9472953
46	60	19.8239717	46.1021138	19.8227823	13.7446265	14.2838349	5.9472953
47	61	16.4945415	60.0000000	16.4935518	8.2467759	14.2838349	5.0064248
48	62	14.5468183	79.1066054	14.5459455	2.7489253	14.2838349	3.8622516
49	63	14.5468183	100.8933946	14.5459455	-2.7489253	14.2838349	3.8622516
50	64	16.4945415	120.0000000	16.4935518	-8.2467759	14.2838349	5.0064248
51	65	19.8239717	133.8978862	19.8227823	-13.7446265	14.2838349	5.9472953
52	70	21.9927220	-60.0000000	21.9914024	10.9957012	-19.0451132	7.6645008
53	71	19.8239717	-73.8978862	19.8227823	5.4978506	-19.0451132	5.9472953
54	72	19.0462560	-90.0000000	19.0451132	-.0000000	-19.0451132	5.8925561
55	73	19.8239717	-106.1021138	19.8227823	-5.4978506	-19.0451132	5.9472953
56	74	21.9927220	-120.0000000	21.9914024	-10.9957012	-19.0451132	7.6645008
57	80	21.9927220	60.0000000	21.9914024	10.9957012	19.0451132	7.6645008
58	81	19.8239717	73.8978862	19.8227823	5.4978506	19.0451132	5.9472953

59	82	19.0462560	90.0000000	19.0451132	-.0000000	19.0451132	5.8925561
60	83	19.8239717	106.1021138	19.8227823	-5.4978506	19.0451132	5.9472953
61	84	21.9927220	120.0000000	21.9914024	-10.9957012	19.0451132	7.6645008
62	100	20.2517362	-3.5502675	20.2505211	20.2116574	-1.2539976	4.3308517
63	101	14.7481771	-5.7896959	14.7472922	14.6720643	-1.4876681	1.7935997
64	102	9.0547880	-10.4656254	9.0542447	8.9036189	-1.6446636	-.8153435
65	103	3.4481747	-30.0000000	3.4479678	2.9860277	-1.7239839	-2.1342989
66	104	3.4481747	-150.0000000	3.4479678	-2.9860277	-1.7239839	-2.1342989
67	105	9.0547880	-169.5343746	9.0542447	-8.9036189	-1.6446636	-.8153435
68	106	14.7481771	-174.2103041	14.7472922	-14.6720643	-1.4876681	1.7935997
69	107	20.2517362	-176.4497325	20.2505211	-20.2116574	-1.2539976	4.3308517
70	200	17.9472415	11.7566962	17.9461647	17.5696840	3.6566418	3.8557170
71	201	12.4118304	16.5601079	12.4110857	11.8962894	3.5374209	.5561027
72	202	6.9396483	30.0000000	6.9392320	6.0095512	3.4696160	-1.4557171
73	203	3.4481747	90.0000000	3.4479678	-.0000000	3.4479678	-2.1342989
74	204	6.9396483	150.0000000	6.9392320	-6.0095512	3.4696160	-1.4557171
75	205	12.4118304	163.4398921	12.4110857	-11.8962894	3.5374209	.5561027
76	206	17.9472415	168.2433038	17.9461647	-17.5696840	3.6566418	3.8557170
77	300	18.4850006	-20.5538636	18.4838915	17.3072541	-6.4894686	3.4448052
78	301	13.4763828	-30.0000000	13.4755742	11.6701896	-6.7377871	1.0975921
79	302	9.0547880	-49.5343746	9.0542447	5.8761299	-6.8884283	-.8153435
80	303	6.9396483	-90.0000000	6.9392320	-.0000000	-6.9392320	-1.4557171
81	304	9.0547880	-130.4656254	9.0542447	-5.8761299	-6.8884283	-.8153435
82	305	13.4763828	-150.0000000	13.4755742	-11.6701896	-6.7377871	1.0975921
83	306	18.4850006	-159.4461364	18.4838915	-17.3072541	-6.4894686	3.4448052
84	400	17.0994690	30.0000000	17.0984431	14.8076861	8.5492215	3.2501988
85	401	12.4118304	43.4398921	12.4110857	9.0116410	8.5337784	.5561027
86	402	9.0547880	70.4656254	9.0542447	3.0274890	8.5330919	-.8153435
87	403	9.0547880	109.5343746	9.0542447	-3.0274890	8.5330919	-.8153435
88	404	12.4118304	136.5601079	12.4110857	-9.0116410	8.5337784	.5561027
89	405	17.0994690	150.0000000	17.0984431	-14.8076861	8.5492215	3.2501988
90	500	18.4850006	-39.4461364	18.4838915	14.2736717	-11.7437874	3.4448052
91	501	14.7481771	-54.2103041	14.7472922	8.6243905	-11.9625463	1.7935997
92	502	12.4118304	-76.5601079	12.4110857	2.8846483	-12.0711992	.5561027
93	503	12.4118304	-103.4398921	12.4110857	-2.8846483	-12.0711992	.5561027
94	504	14.7481771	-125.7896959	14.7472922	-8.6243905	-11.9625463	1.7935997
95	505	18.4850006	-140.5538636	18.4838915	-14.2736717	-11.7437874	3.4448052
96	600	17.9472415	48.2433038	17.9461647	11.9515867	13.3874718	3.8557170
97	601	14.7481771	65.7896959	14.7472922	6.0476737	13.4502145	1.7935997
98	602	13.4763828	90.0000000	13.4755742	-.0000000	13.4755742	1.0975921
99	603	14.7481771	114.2103041	14.7472922	-6.0476737	13.4502145	1.7935997
100	604	17.9472415	131.7566962	17.9461647	-11.9515867	13.3874718	3.8557170
101	700	20.2517362	-56.4497325	20.2505211	11.1918225	-16.8768100	4.3308517
102	701	17.9472415	-71.7566962	17.9461647	5.6180973	-17.0441136	3.8557170
103	702	17.0994690	-90.0000000	17.0984431	-.0000000	-17.0984431	3.2501988
104	703	17.9472415	-108.2433038	17.9461647	-5.6180973	-17.0441136	3.8557170
105	704	20.2517362	-123.5502675	20.2505211	-11.1918225	-16.8768100	4.3308517
106	800	20.2517362	63.5502675	20.2505211	9.0198350	18.1308076	4.3308517
107	801	18.4850006	80.5538636	18.4838915	3.0335824	18.2332560	3.4448052
108	802	18.4850006	99.4461364	18.4838915	-3.0335824	18.2332560	3.4448052
109	803	20.2517362	116.4497325	20.2505211	-9.0198350	18.1308076	4.3308517

OPTIONAL PRINT OF DSTLINK

5.52757	5.49785	5.75975	5.61574	5.52757	6.19730	5.75941	5.95507	5.61565	5.49785
6.10670	5.57778	5.87995	5.75979	5.86076	5.49812	5.97206	6.06332	6.05498	6.04778
5.91114	6.33295	6.10354	6.08765	6.13929	6.22139	5.87264	5.76930	6.09749	5.88971
6.11127	6.05234	6.06716	6.25399	6.56423	5.59644	6.39160	5.65090		

PRINT OF ALNKEQV, LINK LENGTH

5.52791	5.49818	5.76022	5.61615	5.52791	6.19879	5.76022	5.95607	5.61615	5.49818
6.80383	5.95607	6.48311	5.76022	6.19879	5.52791	5.97241	6.06377	6.05534	6.04816
5.91152	6.33431	6.10441	6.08810	6.13973	6.22194	5.87343	5.76964	6.77152	6.17499

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  6.47705   6.14992   6.06753   6.25455   6.56595      5.86734   6.39306   5.65125

 PRINT OF ANGLNK, THE HINGE ANGLE, IN DEGREES
178.72391 178.74471 178.52347 178.61219 178.72967    177.48893 178.06883 177.90412 178.46053 178.74471
127.67248 138.93915 130.17805 178.58963 141.98241    168.09870 178.74471 178.60445 178.74471 178.71896
178.69570 177.61997 178.06494 178.59886 178.64305    178.47987 178.11050 178.74471 128.43720 145.03214
141.30466 159.55951 178.74471 178.47916 177.37316    145.04304 177.55356 178.72464

PRINT OF DEFLNK, THE HINGE LINEAR DEFLECTION, IN   UNITS FROM AGO
   .03078    .03011    .03711    .03401    .03064       .06791    .04854    .05447    .03772    .03011
  1.50004   1.04441   1.36537    .03545   1.00951       .28654    .03271    .03692    .03317    .03381
   .03364    .06578    .05154    .03722    .03635       .04127    .04842    .03160   1.47260    .92760
  1.07292    .54560    .03323    .04150    .07525       .88112    .06824    .03145

THE NORMALIZATION PROCEDURE IS TO DIVIDE THE HINGE LINEAR DEFLECTIONS BY THE RADIAL PERTURBATION OF NODE 1, DELD, =    .0013195633
PRINT OF NORMALIZED LINEAR HINGE DEFLECTIONS FOLLOW
   23.325    22.821    28.123    25.772    23.220       51.466    36.781    41.275    28.588    22.821
 1136.766   791.482  1034.717    26.863   765.036      217.151    24.790    27.981    25.134    25.619
   25.495    49.847    39.058    28.206    27.548       31.274    36.695    23.948  1115.975   702.961
  813.089   413.468    25.185    31.452    57.027      667.736    51.713    23.832

**ANALYSIS THEORY ASSUMES THAT THE LINEAR MOTION  OF THE NODES UNDER THE PERTURBATION IS MUCH SMALLER THAN LINEAR MOTION OF HINGES .
CHECK TO SEE THAT DFLD IS CONSIDERABLY SMALLER THAT ANY DEFLNK

PRINT OF NORMALIZED ANGULAR VELOCITY OF THE HINGED LINKS
NOTE THAT THE ** NORMALIZING ANGULAR VELOCITY ** IS THE LINEAR VELOCITY OF NODE 1
  8.43898   8.30145   9.76441   9.17774   8.40089      16.60506  12.77080  13.85989  10.18062   8.30145
334.15466 265.77333 319.20377   9.32696 246.83416      78.56524   8.30145   9.22892   8.30145   8.47169
  8.62550  15.73867  12.79652   9.26592   8.97370      10.05277  12.49524   8.30145 329.60814 227.68009
251.06757 134.46300   8.30145  10.05743  17.37049     227.61136  16.17778   8.43414

ANALYSIS ASSUMES THAT ANGULAR VELOCITY MAGNITUDE OF THE INTRA SURFACE LINKS IS MUCH SMALLER THAN OF THE HINGED LINKS. AS A CHECK,
THE NORMALIZED ANGULAR VELOCITY OF INTRA SURFACE LINK  84 (OMEGCHN) ON ANTENNA PERIPHERY IS CALCULATED ( N1=1, N2=100,I1=1,I2=62 )

OMEGCHN IS           .0297846617

INERTIA FOR EACH HINGED LINK OF DIFFERENT LENGTH, SLUG FT SQD. THE INERTIA IS TWICE THAT FOR THE HALF OF LINK    BETWEEN BEARING
AND HINGE. LINK IS ASSUMED TO HAVE A CONSTANT LINEAR DENSITY, ONE VALUE FOR FRONT LINKS, ANOTHER FOR BACK
PLUS LINK CENTER HINGE STRUCTURE MASS, ONE VALUE FOR FRONT , ANOTHER FOR BACK
  .036177   .035597   .040933   .037938   .036177      .051012   .040933   .045251   .037938   .035597
  .067455   .045251   .058358   .040933   .051012      .036177   .045625   .047751   .047552   .047383
  .044244   .054431   .048717   .048328   .049568      .051586   .043394   .041134   .066498   .050427
  .058195   .049815   .047840   .052401   .060624      .043259   .055960   .038653

PRINT THE CONTRIBUTION OF EACH DIFFERENT HINGED  LINK LENGTH TO GENERALIZED MASS, CONGNMS
   1.2882    1.2266    1.9513    1.5978    1.2766        7.0327    3.3379    4.3463    1.9660    1.2266
3765.9798 1598.1744 2973.0950    1.7804 1554.0060      111.6518    1.5721    2.0335    1.6385    1.7003
   1.6458    6.7415    3.9887    2.0746    1.9958        2.6066    3.3876    1.4173 3612.2435 1307.0151
1834.1528  450.3349    1.6484    2.6502    9.1462     1120.5544    7.3229    1.3748

GENERALIZED MASS FOR FRONT SURFACE LINKS IN OUTER BAYS ONLY, GNMASOT, IS       165.3586856614
GENERALIZED MASS FOR ALL ANTENNA HINGED LINKS,GNMAS, IS       397.5783584059
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CASE IN WHICH FRONT SURFACE LINKS IN OUTER RAYS LATCH LAST
EXAMINED FOR 5 DIFFFRENT VALUES FOR THE LATCH UP KINETIC ENERGY IN THOSE LINKS

PERTURBATION OF DEPLOYED ANTENNA COMPUTED ABOVE MOVED ALL 109 NODES (SPIDERS) TO NEW LOCATIONS HAVING RADIAL COORDINATES OF .999940 OF DEPLOYED ANTENNA. THUS NODE 1 (AND THE OTHER FIVE NODES ON HEXAGON EXTREMITIES), MOVED .0013 AGO UNITS. THE GENERALIZED MASS FOR THIS CASE AND THIS PERTURBATION IS 165.35869

LATCH UP KINETIC ENERGY OF 10.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY ** (LINEAR VELOCITY OF NODE 1) OF .24592 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00536617 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE.
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

12.65621	LNKFS6	34,183, 50,177, 42,171,	
9.04511	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
10.15024	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
7.03023	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
5.61215	LNKFS10	223,140,217,134,211,128,	

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE. RADIAN/SEC
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

4.08345	LNKFS6	34,183, 50,177, 42,171,	
3.14054	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
3.40837	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
2.50357	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
2.04146	LNKFS10	223,140,217,134,211,128,	

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES IN THIS CASE
ACCELERATION FOR NODESET, NODES IN SET ARE NUMBERED

-68.73737	NDFS5	2, 51, 54, 8, 64, 61,	
-60.62066	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT AND ARE IN THIS CASE.
UNITS ARE WT LBS, ACCELERATION AGO LENGTH UNITS PER SECOND SQD, LOAD LBS TIMES RATIO OF AGO LENGTH UNITS TO FT.
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.

WT	ACCELERATION	LOAD	FOR NODE,	OF NODESET,	NODES IN SET ARE NUMBERED	
2.25	-68.737	-4.803	2	NDFS5	2, 51, 54, 8, 64, 61,	
2.25	-60.621	-4.236	11	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,

LATCH UP KINETIC ENERGY OF 30.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY ** (LINEAR VELOCITY OF NODE 1) OF .42594 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00309816 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE.
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

21.92120	LNKFS6	34,183, 50,177, 42,171,	
15.66660	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
17.58073	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
12.17672	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
9.72053	LNKFS10	223,140,217,134,211,128,	

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

7.07274	LNKFS6	34,183, 50,177, 42,171,	
5.43958	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
5.90347	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
4.33632	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
3.53591	LNKFS10	223,140,217,134,211,128,	

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES IN THIS CASE
ACCELERATION FOR NODESET, NODES IN SET ARE NUMBERED

-206.21210	NDFS5	2, 51, 54, 8, 64, 61,	
-181.86198	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT AND ARE IN THIS CASE.
UNITS ARE WT LBS, ACCELERATION AGO LENGTH UNITS PER SECOND SQD, LOAD LBS TIMES RATIO OF AGO LENGTH UNITS TO FT.
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.

WT	ACCELERATION	LOAD	FOR NODE,	OF NODESET,	NODES IN SET ARE NUMBERED	
2.25	-206.212	-14.409	2	NDFS5	2, 51, 54, 8, 64, 61,	
2.25	-181.862	-12.708	11	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,

LATCH UP KINETIC ENERGY OF 100.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY **
(LINEAR VELOCITY OF NODE 1) OF .77765 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00169693 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE,
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

40.02246	LNKFS6	34,183, 50,177, 42,171,	
28.60316	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
32.09787	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
22.23154	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
17.74718	LNKFS10	223,140,217,134,211,128,	

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

12.91300	LNKFS6	34,183, 50,177, 42,171,	
9.93127	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
10.77820	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
7.91700	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
6.45566	LNKFS10	223,140,217,134,211,128,	

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES IN THIS CASE
ACCELERATION FOR NODESET, NODES IN SET ARE NUMBERED

-687.37368	NDFS5	2, 51, 54, 8, 64, 61,	
-606.20660	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT AND ARE IN THIS CASE.
UNITS ARE WT LBS, ACCELERATION AGO LENGTH UNITS PER SECOND SQD, LOAD LBS TIMES RATIO OF AGO LENGTH UNITS TO FT.
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.
WT ACCELERATION LOAD FOR NODE, OF NODESET, NODES IN SET ARE NUMBERED

2.25	-687.374	-48.031	2	NDFS5	2, 51, 54, 8, 64, 61,
2.25	-606.207	-42.359	11	NDFS6	11, 31, 52, 53, 35, 16, 26, 45, 63, 62, 41, 21,

LATCH UP KINETIC ENERGY OF 250.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY **
(LINEAR VELOCITY OF NODE 1) OF 1.22958 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00107323 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE,
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

63.28106	LNKFS6	34,183, 50,177, 42,171,
45.22557	LNKFS7	38,182,181, 52, 54,176, 175, 44, 46,170,169, 36,
50.75119	LNKFS8	164,165,123,121,158,159, 117,115,152,153,111,109,
35.15115	LNKFS9	61,241,200, 75, 77,235, 194, 67, 69,229,188, 59,
28.06076	LNKFS10	223,140,217,134,211,128,

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

20.41724	LNKFS6	34,183, 50,177, 42,171,
15.70271	LNKFS7	38,182,181, 52, 54,176, 175, 44, 46,170,169, 36,
17.04184	LNKFS8	164,165,123,121,158,159, 117,115,152,153,111,109,
12.51787	LNKFS9	61,241,200, 75, 77,235, 194, 67, 69,229,188, 59,
10.20729	LNKFS10	223,140,217,134,211,128,

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES
IN THIS CASE
ACCELERATION FOR NODESET, NODES IN SET ARE NUMBERED

-1718.43419	NDFS5	2, 51, 54, 8, 64, 61,
-1515.51651	NDFS6	11, 31, 52, 53, 35, 16, 26, 45, 63, 62, 41, 21,

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT AND ARE IN THIS CASE.
UNITS ARE WT LBS, ACCELERATION AGO LENGTH UNITS PER SECOND SQD, LOAD LBS TIMES RATIO OF AGO LENGTH UNITS TO FT,
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND
HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.

WT	ACCELERATION	LOAD	FOR NODE,	OF NODESET,	NODES IN SET ARE NUMBERED
2.25	-1718.434	-120.077	2	NDFS5	2, 51, 54, 8, 64, 61,
2.25	-1515.517	-105.898	11	NDFS6	11, 31, 52, 53, 35, 16, 26, 45, 63, 62, 41, 21,

LATCH UP KINETIC ENERGY OF 500.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY **
(LINEAR VELOCITY OF NODE 1) OF 1.73889 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00075889 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE,
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

89.49294	LNKFS6	34,183, 50,177, 42,171,
63.95861	LNKFS7	38,182,181, 52, 54,176, 175, 44, 46,170,169, 36,
71.77303	LNKFS8	164,165,123,121,158,159, 117,115,152,153,111,109,
49.71124	LNKFS9	61,241,200, 75, 77,235, 194, 67, 69,229,188, 59,
39.68390	LNKFS10	223,140,217,134,211,128,

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

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 29.87434  LNKFS6      34,183, 50,177, 42,171,
 22.20699  LNKFS7      38,182,181, 52, 54,176,  175, 44, 46,170,169, 36,
 24.10080  LNKFS8     164,165,123,121,158,159,  117,115,152,153,111,109,
 17.70295  LNKFS9      61,241,200, 75, 77,235,  194, 67, 69,229,188, 59,
 14.43529  LNKFS10    223,140,217,134,211,128,

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES
IN THIS CASE
ACCELERATION FOR NODESET,     NODES IN SET ARE NUMBERED

 -3436.86839       NDFS5           2, 51, 54,  8, 64, 61,
 -3031.03301       NDFS6          11, 31, 52, 53, 35, 16,   26, 45, 63, 62, 41, 21,

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT  AND ARE IN THIS CASE.
UNITS ARE WT   LBS, ACCELERATION  AGO LENGTH UNITS PER SECOND SQD, LOAD  LBS TIMES RATIO OF AGO LENGTH UNITS TO FT.
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND
HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.
    WT ACCELERATION      LOAD FOR NODE, OF NODESET,    NODES IN SET ARE NUMBERED

  2.25    -3436.868  -240.154       2         NDFS5       2, 51, 54,  8, 64, 61,
  2.25    -3031.033  -211.796      11         NDFS6      11, 31, 52, 53, 35, 16,   26, 45, 63, 62, 41, 21,
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CASE IN WHICH ALL HINGED LINKS LATCH SIMULTANEOUSLY (CALCULATION ASSUMES THE INTRA SURFACE LINKS MAKE A NEGLIGIBLE CONTRIBUTION TO THE LATCH UP KINETIC ENERGY) AND THE KE IS DISTRIBUTED AMONG THE FRONT LINKS AND BACK LINKS., EXAMINED FOR 5 DIFFERENT VALUES FOR THE LATCH UP KINETIC ENERGY IN THOSE LINKS

PERTURBATION OF DEPLOYED ANTENNA COMPUTED ABOVE MOVED ALL 109 NODES (SPIDERS) TO NEW LOCATIONS HAVING RADIAL COORDINATES OF .999940 OF DEPLOYED ANTENNA, THUS NODE 1 (AND THE OTHER FIVE NODES ON HEXAGON EXTREMITIES), MOVED .0013 AGO UNITS. THE GENERALIZED MASS FOR THIS CASE AND THIS PERTURBATION IS 397.57836

LATCH UP KINETIC ENERGY OF 20.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY ** (LINEAR VELOCITY OF NODE 1) OF .22429 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00588365 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE, VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

5.23148	LNKFS1	1, 6, 3, 5, 2, 4,	
5.11854	LNKFS2	12, 28, 27, 20, 19, 11,	
6.30753	LNKFS3	10,105, 26, 99, 18, 93,	
5.78028	LNKFS4	14,104,103, 29, 30, 98,	97, 21, 22, 92, 91, 13,
5.20787	LNKFS5	37,163,122, 51, 53,157,	116, 43, 45,151,110, 35,
11.54306	LNKFS6	34,183, 50,177, 42,171,	
8.24957	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
9.25749	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
6.41190	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
5.11854	LNKFS10	223,140,217,134,211,128,	
5.56003	LNKBS1	307,301,302,	
6.27577	LNKBS2	314,315,310,311,305,306,	
5.63723	LNKBS3	358,355,352,	
5.74602	LNKBS4	313,309,308,304,303,312,	
5.71817	LNKBS5	326,325,322,321,318,317,	
11.17998	LNKBS6	359,369,356,366,353,363,	
8.76010	LNKBS7	360,368,357,365,354,362,	
6.32621	LNKBS8	388,397,385,394,382,391,	
6.17866	LNKBS9	367,339,364,334,361,329,	
7.01431	LNKBS10	327,324,323,320,319,316,	
8.23020	LNKBS11	377,342,374,337,371,332,	
5.37126	LNKBS12	340,335,330,	

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

1.89275	LNKFS1	1, 6, 3, 5, 2, 4,	
1.86190	LNKFS2	12, 28, 27, 20, 19, 11,	
2.19003	LNKFS3	10,105, 26, 99, 18, 93,	
2.05845	LNKFS4	14,104,103, 29, 30, 98,	97, 21, 22, 92, 91, 13,
1.88421	LNKFS5	37,163,122, 51, 53,157,	116, 43, 45,151,110, 35,
3.72430	LNKFS6	34,183, 50,177, 42,171,	
2.86432	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
3.10859	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
2.28338	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
1.86190	LNKFS10	223,140,217,134,211,128,	
1.86190	LNKBS1	307,301,302,	
2.06992	LNKBS2	314,315,310,311,305,306,	
1.86190	LNKBS3	358,355,352,	
1.90009	LNKBS4	313,309,308,304,303,312,	
1.93459	LNKBS5	326,325,322,321,318,317,	
3.52997	LNKBS6	359,369,356,366,353,363,	
2.87009	LNKBS7	360,368,357,365,354,362,	
2.07822	LNKBS8	388,397,385,394,382,391,	

2.01268	LNKBS9	367,339,364,334,361,329,
2.25470	LNKBS10	327,324,323,320,319,316,
2.80252	LNKBS11	377,342,374,337,371,332,
1.86190	LNKBS12	340,335,330,

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES IN THIS CASE

ACCELERATION	FOR NODESET,	NODES IN SET ARE NUMBERED	
0.00000	NDFS1	5,	
-19.05925	NDFS2	4, 13, 14, 6, 24, 23,	
-38.11851	NDFS3	3, 32, 34, 7, 44, 42,	
-33.01160	NDFS4	12, 33, 15, 25, 43, 22,	
-57.17776	NDFS5	2, 51, 54, 8, 64, 61,	
-50.42605	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,
-11.95298	NDBS1	103,104,203,	
-31.38811	NDBS2	102,302,304,105,403,402,	
-24.05605	NDBS3	303,204,202,	
-51.12405	NDBS4	101,501,504,106,603,601,	
-46.71542	NDBS5	301,305,602,	
-43.02519	NDBS6	502,503,205,404,401,201,	

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT AND ARE IN THIS CASE. UNITS ARE WT LBS, ACCELERATION AGO LENGTH UNITS PER SECOND SQD, LOAD LBS TIMES RATIO OF AGO LENGTH UNITS TO FT. NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.

WT	ACCELERATION	LOAD	FOR NODE,	OF NODESET,	NODES IN SET ARE NUMBERED	
2.25	0.000	0.000	5	NDFS1	5,	
2.25	-19.059	-1.332	4	NDFS2	4, 13, 14, 6, 24, 23,	
2.25	-38.119	-2.664	3	NDFS3	3, 32, 34, 7, 44, 42,	
2.25	-33.012	-2.307	12	NDFS4	12, 33, 15, 25, 43, 22,	
2.25	-57.178	-3.995	2	NDFS5	2, 51, 54, 8, 64, 61,	
2.25	-50.426	-3.524	11	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,
2.03	-11.953	-.754	103	NDBS1	103,104,203,	
2.03	-31.388	-1.979	102	NDBS2	102,302,304,105,403,402,	
2.03	-24.056	-1.517	303	NDBS3	303,204,202,	
2.03	-51.124	-3.223	101	NDBS4	101,501,504,106,603,601,	
2.03	-46.715	-2.945	301	NDBS5	301,305,602,	
2.03	-43.025	-2.712	502	NDBS6	502,503,205,404,401,201,	

LATCH UP KINETIC ENERGY OF 60.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY ** (LINEAR VELOCITY OF NODE 1) OF .38848 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00339693 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE,

VELOCITY	FOR LINKSET,	LINKS IN SET ARE NUMBERED	
9.06119	LNKFS1	1, 6, 3, 5, 2, 4,	
8.86558	LNKFS2	12, 28, 27, 20, 19, 11,	
10.92496	LNKFS3	10,105, 26, 99, 18, 93,	
10.01173	LNKFS4	14,104,103, 29, 30, 98,	97, 21, 22, 92, 91, 13,
9.02029	LNKFS5	37,163,122, 51, 53,157,	116, 43, 45,151,110, 35,
19.99316	LNKFS6	34,183, 50,177, 42,171,	
14.28867	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
16.03445	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
11.10574	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
8.86558	LNKFS10	223,140,217,134,211,128,	
9.63026	LNKBS1	307,301,302,	
10.86995	LNKBS2	314,315,310,311,305,306,	

9.76398	LNKBS3	358,355,352,
9.95239	LNKBS4	313,309,308,304,303,312,
9.90417	LNKBS5	326,325,322,321,318,317,
19.36429	LNKBS6	359,369,356,366,353,363,
15.17294	LNKBS7	360,368,357,365,354,362,
10.95732	LNKBS8	388,397,385,394,382,391,
10.70175	LNKBS9	367,339,364,334,361,329,
12.14914	LNKBS10	327,324,323,320,319,316,
14.25512	LNKBS11	377,342,374,337,371,332,
9.30330	LNKBS12	340,335,330,

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

3.27834	LNKFS1	1, 6, 3, 5, 2, 4,	
3.22491	LNKFS2	12, 28, 27, 20, 19, 11,	
3.79324	LNKFS3	10,105, 26, 99, 18, 93,	
3.56533	LNKFS4	14,104,103, 29, 30, 98,	97, 21, 22, 92, 91, 13,
3.26354	LNKFS5	37,163,122, 51, 53,157,	116, 43, 45,151,110, 35,
6.45067	LNKFS6	34,183, 50,177, 42,171,	
4.96115	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
5.38424	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
3.95493	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
3.22491	LNKFS10	223,140,217,134,211,128,	
3.22491	LNKBS1	307,301,302,	
3.58521	LNKBS2	314,315,310,311,305,306,	
3.22491	LNKBS3	358,355,352,	
3.29105	LNKBS4	313,309,308,304,303,312,	
3.35080	LNKBS5	326,325,322,321,318,317,	
6.11410	LNKBS6	359,369,356,366,353,363,	
4.97114	LNKBS7	360,368,357,365,354,362,	
3.59959	LNKBS8	388,397,385,394,382,391,	
3.48607	LNKBS9	367,339,364,334,361,329,	
3.90526	LNKBS10	327,324,323,320,319,316,	
4.85410	LNKBS11	377,342,374,337,371,332,	
3.22491	LNKBS12	340,335,330,	

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES
IN THIS CASE
ACCELERATION FOR NODESET, NODES IN SET ARE NUMBERED

0.00000	NDFS1	5,	
-57.17776	NDFS2	4, 13, 14, 6, 24, 23,	
-114.35553	NDFS3	3, 32, 34, 7, 44, 42,	
-99.03479	NDFS4	12, 33, 15, 25, 43, 22,	
-171.53329	NDFS5	2, 51, 54, 8, 64, 61,	
-151.27814	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,
-35.85894	NDBS1	103,104,203,	
-94.16434	NDBS2	102,302,304,105,403,402,	
-72.16816	NDBS3	303,204,202,	
-153.37215	NDBS4	101,501,504,106,603,601,	
-140.14626	NDBS5	301,305,602,	
-129.07556	NDBS6	502,503,205,404,401,201,	

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT AND ARE IN THIS CASE.
UNITS ARE WT LBS, ACCELERATION AGO LENGTH UNITS PER SECOND SQD, LOAD LBS TIMES RATIO OF AGO LENGTH UNITS TO FT.
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND
HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.

WT	ACCELERATION	LOAD	FOR NODE,	OF NODESET,	NODES IN SET ARE NUMBERED
2.25	0.000	0.000	5	NDFS1	5,

2.25	-57.178	-3.995	4	NDFS2	4, 13, 14, 6, 24, 23,	
2.25	-114.356	-7.991	3	NDFS3	3, 32, 34, 7, 44, 42,	
2.25	-99.035	-6.920	12	NDFS4	12, 33, 15, 25, 43, 22,	
2.25	-171.533	-11.986	2	NDFS5	2, 51, 54, 8, 64, 61,	
2.25	-151.278	-10.571	11	NDFS6	11, 31, 52, 53, 35, 16,	26, 45, 63, 62, 41, 21,
2.03	-35.859	-2.261	103	NDBS1	103,104,203,	
2.03	-94.164	-5.936	102	NDBS2	102,302,304,105,403,402,	
2.03	-72.168	-4.550	303	NDBS3	303,204,202,	
2.03	-153.372	-9.669	101	NDBS4	101,501,504,106,603,601,	
2.03	-140.146	-8.835	301	NDBS5	301,305,602,	
2.03	-129.076	-8.137	502	NDBS6	502,503,205,404,401,201,	

LATCH UP KINETIC ENERGY OF 200.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY **
(LINEAR VELOCITY OF NODE 1) OF .70926 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00186057 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE,
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

16.54340	LNKFS1	1, 6, 3, 5, 2, 4,	
16.18626	LNKFS2	12, 28, 27, 20, 19, 11,	
19.94615	LNKFS3	10,105, 26, 99, 18, 93,	
18.27884	LNKFS4	14,104,103, 29, 30, 98,	97, 21, 22, 92, 91, 13,
16.46872	LNKFS5	37,163,122, 51, 53,157,	116, 43, 45,151,110, 35,
36.50236	LNKFS6	34,183, 50,177, 42,171,	
26.08742	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
29.27476	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
20.27621	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
16.18626	LNKFS10	223,140,217,134,211,128,	
17.58237	LNKBS1	307,301,302,	
19.84572	LNKBS2	314,315,310,311,305,306,	
17.82650	LNKBS3	358,355,352,	
18.17050	LNKBS4	313,309,308,304,303,312,	
18.08245	LNKBS5	326,325,322,321,318,317,	
35.35420	LNKBS6	359,369,356,366,353,363,	
27.70187	LNKBS7	360,368,357,365,354,362,	
20.00524	LNKBS8	388,397,385,394,382,391,	
19.53863	LNKBS9	367,339,364,334,361,329,	
22.18120	LNKBS10	327,324,323,320,319,316,	
26.02618	LNKBS11	377,342,374,337,371,332,	
16.98543	LNKBS12	340,335,330,	

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC
VELOCITY FOR LINKSET, LINKS IN SET ARE NUMBERED

5.98541	LNKFS1	1, 6, 3, 5, 2, 4,	
5.88786	LNKFS2	12, 28, 27, 20, 19, 11,	
6.92548	LNKFS3	10,105, 26, 99, 18, 93,	
6.50938	LNKFS4	14,104,103, 29, 30, 98,	97, 21, 22, 92, 91, 13,
5.95839	LNKFS5	37,163,122, 51, 53,157,	116, 43, 45,151,110, 35,
11.77726	LNKFS6	34,183, 50,177, 42,171,	
9.05778	LNKFS7	38,182,181, 52, 54,176,	175, 44, 46,170,169, 36,
9.83023	LNKFS8	164,165,123,121,158,159,	117,115,152,153,111,109,
7.22067	LNKFS9	61,241,200, 75, 77,235,	194, 67, 69,229,188, 59,
5.88786	LNKFS10	223,140,217,134,211,128,	
5.88786	LNKBS1	307,301,302,	
6.54567	LNKBS2	314,315,310,311,305,306,	
5.88786	LNKBS3	358,355,352,	
6.00861	LNKBS4	313,309,308,304,303,312,	
6.11770	LNKBS5	326,325,322,321,318,317,	

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 11.16276  LNKBS6      359,369,356,366,353,363,
  9.07602  LNKBS7      360,368,357,365,354,362,
  6.57192  LNKBS8      388,397,385,394,382,391,
  6.36466  LNKBS9      367,339,364,334,361,329,
  7.13000  LNKBS10     327,324,323,320,319,316,
  8.86234  LNKBS11     377,342,374,337,371,332,
  5.88786  LNKBS12     340,335,330,

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES
IN THIS CASE
ACCELERATION FOR NODESET,     NODES IN SET ARE NUMBERED

     0.00000        NDFS1           5,
  -190.59255        NDFS2           4, 13, 14,  6, 24, 23,
  -381.18509        NDFS3           3, 32, 34,  7, 44, 42,
  -330.11597        NDFS4          12, 33, 15, 25, 43, 22,
  -571.77764        NDFS5           2, 51, 54,  8, 64, 61,
  -504.26048        NDFS6          11, 31, 52, 53, 35, 16,   26, 45, 63, 62, 41, 21,
  -119.52980        NDBS1         103,104,203,
  -313.88113        NDBS2         102,302,304,105,403,402,
  -240.56054        NDBS3         303,204,202,
  -511.24051        NDBS4         101,501,504,106,603,601,
  -467.15420        NDBS5         301,305,602,
  -430.25186        NDBS6         502,503,205,404,401,201,

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT AND ARE IN THIS CASE.
UNITS ARE WT   LBS, ACCELERATION  AGO LENGTH UNITS PER SECOND SQD, LOAD  LBS TIMES RATIO OF AGO LENGTH UNITS TO FT.
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND
HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.
     WT ACCELERATION       LOAD FOR NODE, OF NODESET,     NODES IN SET ARE NUMBERED

   2.25       0.000     0.000        5         NDFS1       5,
   2.25    -190.593   -13.318        4         NDFS2       4, 13, 14,  6, 24, 23,
   2.25    -381.185   -26.636        3         NDFS3       3, 32, 34,  7, 44, 42,
   2.25    -330.116   -23.067       12         NDFS4      12, 33, 15, 25, 43, 22,
   2.25    -571.778   -39.953        2         NDFS5       2, 51, 54,  8, 64, 61,
   2.25    -504.260   -35.236       11         NDFS6      11, 31, 52, 53, 35, 16,   26, 45, 63, 62, 41, 21,
   2.03    -119.530    -7.536      103         NDBS1     103,104,203,
   2.03    -313.881   -19.788      102         NDBS2     102,302,304,105,403,402,
   2.03    -240.561   -15.166      303         NDBS3     303,204,202,
   2.03    -511.241   -32.230      101         NDBS4     101,501,504,106,603,601,
   2.03    -467.154   -29.451      301         NDBS5     301,305,602,
   2.03    -430.252   -27.125      502         NDBS6     502,503,205,404,401,201,


LATCH UP KINETIC ENERGY OF  500.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY **
(LINEAR VELOCITY OF NODE 1 ) OF     1.12143  UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS     .00117673 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE,
VELOCITY FOR LINKSET,     LINKS IN SET ARE NUMBERED

 26.15741  LNKFS1        1,  6,  3,  5,  2,  4,
 25.59272  LNKFS2       12, 28, 27, 20, 19, 11,
 31.53763  LNKFS3       10,105, 26, 99, 18, 93,
 28.90138  LNKFS4       14,104,103, 29, 30, 98,   97, 21, 22, 92, 91, 13,
 26.03933  LNKFS5       37,163,122, 51, 53,157,  116, 43, 45,151,110, 35,
 57.71529  LNKFS6       34,183, 50,177, 42,171,

 41.24784  LNKFS7       38,182,181, 52, 54,176,  175, 44, 46,170,169, 36,
 46.28746  LNKFS8      164,165,123,121,158,159,  117,115,152,153,111,109,
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  32.05950  LNKFS9     61,241,200, 75, 77,235,  194, 67, 69,229,188, 59,
  25.59272  LNKFS10   223,140,217,134,211,128,
  27.80017  LNKBS1    307,301,302,
  31.37885  LNKBS2    314,315,310,311,305,306,
  28.18617  LNKBS3    358,355,352,
  28.73008  LNKBS4    313,309,308,304,303,312,
  28.59086  LNKBS5    326,325,322,321,318,317,
  55.89990  LNKBS6    359,369,356,366,353,363,
  43.80050  LNKBS7    360,368,357,365,354,362,
  31.63107  LNKBS8    388,397,385,394,382,391,
  30.89329  LNKBS9    367,339,364,334,361,329,
  35.07155  LNKBS10   327,324,323,320,319,316,
  41.15100  LNKBS11   377,342,374,337,371,332,
  26.85632  LNKBS12   340,335,330,

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC
VELOCITY FOR LINKSET,     LINKS IN SET ARE NUMBERED

   9.46376  LNKFS1      1,  6,  3,  5,  2,  4,
   9.30952  LNKFS2     12, 28, 27, 20, 19, 11,
  10.95014  LNKFS3     10,105, 26, 99, 18, 93,
  10.29223  LNKFS4     14,104,103, 29, 30, 98,   97, 21, 22, 92, 91, 13,
   9.42104  LNKFS5     37,163,122, 51, 53,157,  116, 43, 45,151,110, 35,
  18.62148  LNKFS6     34,183, 50,177, 42,171,
  14.32161  LNKFS7     38,182,181, 52, 54,176,  175, 44, 46,170,169, 36,
  15.54295  LNKFS8    164,165,123,121,158,159,  117,115,152,153,111,109,
  11.41689  LNKFS9     61,241,200, 75, 77,235,  194, 67, 69,229,188, 59,
   9.30952  LNKFS10   223,140,217,134,211,128,
   9.30952  LNKBS1    307,301,302,
  10.34962  LNKBS2    314,315,310,311,305,306,
   9.30952  LNKBS3    358,355,352,
   9.50044  LNKBS4    313,309,308,304,303,312,
   9.67293  LNKBS5    326,325,322,321,318,317,
  17.64987  LNKBS6    359,369,356,366,353,363,
  14.35045  LNKBS7    360,368,357,365,354,362,
  10.39111  LNKBS8    388,397,385,394,382,391,
  10.06341  LNKBS9    367,339,364,334,361,329,
  11.27351  LNKBS10   327,324,323,320,319,316,
  14.01259  LNKBS11   377,342,374,337,371,332,
   9.30952  LNKBS12   340,335,330,

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES
IN THIS CASE
ACCELERATION FOR NODESET,     NODES IN SET ARE NUMBERED

       0.00000        NDFS1          5,
    -476.48137        NDFS2          4, 13, 14,  6, 24, 23,
    -952.96273        NDFS3          3, 32, 34,  7, 44, 42,
    -825.28994        NDFS4         12, 33, 15, 25, 43, 22,
   -1429.44410        NDFS5          2, 51, 54,  8, 64, 61,
   -1260.65120        NDFS6         11, 31, 52, 53, 35, 16,   26, 45, 63, 62, 41, 21,
    -298.82449        NDBS1        103,104,203,
    -784.70282        NDBS2        102,302,304,105,403,402,
    -601.40134        NDBS3        303,204,202,
   -1278.10129        NDBS4        101,501,504,106,603,601,
   -1167.88550        NDBS5        301,305,602,
   -1075.62964        NDBS6        502,503,205,404,401,201,

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT  AND ARE IN THIS CASE.
UNITS ARE WT   LBS, ACCELERATION  AGO LENGTH UNITS PER SECOND SQD, LOAD  LBS TIMES RATIO OF AGO LENGTH UNITS TO FT,
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND
HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.
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WT	ACCELERATION	LOAD	FOR NODE,	OF NODESET,	NODES IN SET ARE NUMBERED
2.25	0.000	0.000	5	NDFS1	5,
2.25	-476.481	-33.295	4	NDFS2	4, 13, 14, 6, 24, 23,
2.25	-952.963	-66.589	3	NDFS3	3, 32, 34, 7, 44, 42,
2.25	-825.290	-57.668	12	NDFS4	12, 33, 15, 25, 43, 22,
2.25	-1429.444	-99.884	2	NDFS5	2, 51, 54, 8, 64, 61,
2.25	-1260.651	-88.089	11	NDFS6	11, 31, 52, 53, 35, 16, 26, 45, 63, 62, 41, 21,
2.03	-298.824	-18.839	103	NDBS1	103,104,203,
2.03	-784.703	-49.470	102	NDBS2	102,302,304,105,403,402,
2.03	-601.401	-37.914	303	NDBS3	303,204,202,
2.03	-1278.101	-80.576	101	NDBS4	101,501,504,106,603,601,
2.03	-1167.886	-73.628	301	NDBS5	301,305,602,
2.03	-1075.630	-67.811	502	NDBS6	502,503,205,404,401,201,

LATCH UP KINETIC ENERGY OF 1000.00000 FT LBS RESULTS IN A VALUE FOR THE ** NORMALIZING LINK ANGULAR VELOCITY **
(LINEAR VELOCITY OF NODE 1) OF 1.58595 UNITS OF AGO LENGTH PER SECOND AND THE PERTURBATION TIME IS .00083207 SEC

HINGE LINEAR VELOCITIES AT LATCH UP, IN UNITS OF AGO LENGTH PER SECOND, FOR EACH SET OF EQUIVALENT HINGED LINKS IN THIS CASE,

VELOCITY	FOR LINKSET,	LINKS IN SET ARE NUMBERED
36.99217	LNKFS1	1, 6, 3, 5, 2, 4,
36.19358	LNKFS2	12, 28, 27, 20, 19, 11,
44.60095	LNKFS3	10,105, 26, 99, 18, 93,
40.87273	LNKFS4	14,104,103, 29, 30, 98, 97, 21, 22, 92, 91, 13,
36.82517	LNKFS5	37,163,122, 51, 53,157, 116, 43, 45,151,110, 35,
81.62175	LNKFS6	34,183, 50,177, 42,171,
58.33325	LNKFS7	38,182,181, 52, 54,176, 175, 44, 46,170,169, 36,
65.46036	LNKFS8	164,165,123,121,158,159, 117,115,152,153,111,109,
45.33898	LNKFS9	61,241,200, 75, 77,235, 194, 67, 69,229,188, 59,
36.19358	LNKFS10	223,140,217,134,211,128,
39.31537	LNKBS1	307,301,302,
44.37639	LNKBS2	314,315,310,311,305,306,
39.86127	LNKBS3	358,355,352,
40.63047	LNKBS4	313,309,308,304,303,312,
40.43359	LNKBS5	326,325,322,321,318,317,
79.05440	LNKBS6	359,369,356,366,353,363,
61.94326	LNKBS7	360,368,357,365,354,362,
44.73309	LNKBS8	388,397,385,394,382,391,
43.68971	LNKBS9	367,339,364,334,361,329,
49.59866	LNKBS10	327,324,323,320,319,316,
58.19630	LNKBS11	377,342,374,337,371,332,
37.98057	LNKBS12	340,335,330,

HINGED LINK ANGULAR VELOCITIES AT LATCH UP ABOUT END BEARINGS, FOR EACH OF THE EQUIVALENT HINGED LINK SETS IN THIS CASE, RADIAN/SEC

VELOCITY	FOR LINKSET,	LINKS IN SET ARE NUMBERED
13.38378	LNKFS1	1, 6, 3, 5, 2, 4,
13.16566	LNKFS2	12, 28, 27, 20, 19, 11,
15.48584	LNKFS3	10,105, 26, 99, 18, 93,
14.55541	LNKFS4	14,104,103, 29, 30, 98, 97, 21, 22, 92, 91, 13,
13.32336	LNKFS5	37,163,122, 51, 53,157, 116, 43, 45,151,110, 35,
26.33475	LNKFS6	34,183, 50,177, 42,171,
20.25381	LNKFS7	38,182,181, 52, 54,176, 175, 44, 46,170,169, 36,
21.98106	LNKFS8	164,165,123,121,158,159, 117,115,152,153,111,109,
16.14592	LNKFS9	61,241,200, 75, 77,235, 194, 67, 69,229,188, 59,
13.16566	LNKFS10	223,140,217,134,211,128,
13.16566	LNKBS1	307,301,302,

14.63657	LNKBS2	314,315,310,311,305,306,
13.16566	LNKBS3	358,355,352,
13.43565	LNKBS4	313,309,308,304,303,312,
13.67959	LNKBS5	326,325,322,321,318,317,
24.96069	LNKBS6	359,369,356,366,353,363,
20.29461	LNKBS7	360,368,357,365,354,362,
14.69525	LNKBS8	388,397,385,394,382,391,
14.23181	LNKBS9	367,339,364,334,361,329,
15.94316	LNKBS10	327,324,323,320,319,316,
19.81679	LNKBS11	377,342,374,337,371,332,
13.16566	LNKBS12	340,335,330,

NODE (SPIDER) LINEAR ACCELERATIONS AT LATCH UP, IN UNITS OF AGO LENGTH UNITS PER SECOND SQD, FOR EACH SET OF EQUIVALENT NODES IN THIS CASE

ACCELERATION FOR NODESET,		NODES IN SET ARE NUMBERED
0.00000	NDFS1	5,
-952.96273	NDFS2	4, 13, 14, 6, 24, 23,
-1905.92547	NDFS3	3, 32, 34, 7, 44, 42,
-1650.57987	NDFS4	12, 33, 15, 25, 43, 22,
-2858.88820	NDFS5	2, 51, 54, 8, 64, 61,
-2521.30240	NDFS6	11, 31, 52, 53, 35, 16, 26, 45, 63, 62, 41, 21,
-597.64899	NDBS1	103,104,203,
-1569.40565	NDBS2	102,302,304,105,403,402,
-1202.80268	NDBS3	303,204,202,
-2556.20257	NDBS4	101,501,504,106,603,601,
-2335.77100	NDBS5	301,305,602,
-2151.25928	NDBS6	502,503,205,404,401,201,

NODE (SPIDER) LOAD (DECCELERATION FORCE) DATA AT LATCH UP FOR THOSE NODES WHICH ARE IN THE INPUT ARRAY WGHT AND ARE IN THIS CASE. UNITS ARE WT LBS, ACCELERATION AGO LENGTH UNITS PER SECOND SQD, LOAD LBS TIMES RATIO OF AGO LENGTH UNITS TO FT.
NOTE THAT ALL NODES IN AN EQUIVALENT NODESET HAVE THE SAME ACCELERATION, BUT DO NOT NECESSARILY CARRY THE SAME WEIGHT AND HENCE DO NOT NECESSARILY EXPERIENCE THE SAME LOAD.

WT	ACCELERATION	LOAD	FOR NODE,	OF NODESET,	NODES IN SET ARE NUMBERED
2.25	0.000	0.000	5	NDFS1	5,
2.25	-952.963	-66.589	4	NDFS2	4, 13, 14, 6, 24, 23,
2.25	-1905.925	-133.178	3	NDFS3	3, 32, 34, 7, 44, 42,
2.25	-1650.580	-115.336	12	NDFS4	12, 33, 15, 25, 43, 22,
2.25	-2858.888	-199.767	2	NDFS5	2, 51, 54, 8, 64, 61,
2.25	-2521.302	-176.178	11	NDFS6	11, 31, 52, 53, 35, 16, 26, 45, 63, 62, 41, 21,
2.03	-597.649	-37.678	103	NDBS1	103,104,203,
2.03	-1569.406	-98.941	102	NDBS2	102,302,304,105,403,402,
2.03	-1202.803	-75.829	303	NDBS3	303,204,202,
2.03	-2556.203	-161.152	101	NDBS4	101,501,504,106,603,601,
2.03	-2335.771	-147.255	301	NDBS5	301,305,602,
2.03	-2151.259	-135.623	502	NDBS6	502,503,205,404,401,201,

** NOTE THAT LINK TENSION AT LATCH UP DUE TO NODE(SPIDER) DECCELERATION FORCES IS A VECTOR COMBINATION THEREOF.
THE INNER LINKS MUST CARRY THE FORCE AT THEIR END NODES DUE TO THEIR DECCELERATION * PLUS * SUCH ADDITIONAL FORCES AS ARE REACTED INTO THOSE END NODES.

C.1.3.4 Structural Analysis Results, P5201, of Link No. 34 Hinge Impact Loads, Six Bay 30 Foot Antenna.
(Run 050, 27 November 1968)

```
$FIRST
NMODES  = 7,
NNODES  = 4,
NSTATNS = 21,
IEND    =  ,
NTIME   = 1,
TIME    = 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
          0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,   0.0, 0.0,
ZETA    = 0.5E-01, 0.5E-01, 0.5E-01, 0.5E-01, 0.5E-01, 0.5E-01,   0.5E-01, 0.5E-01, 0.5E-01, 0.5E-01,
IMXDIS  = 3,
IMXVEL  = 3,
IMXSHE  = 3,
IMXMOM  = 3,
NODEDIS = 17,
NODEVEL = 17,
NODESHE = 17,
NODEMOM = 17,
ITIMES  = 1,
TSTART  = 0.0,
ANOPERD = 0.2E+01,
ANDELTA = 0.2E+02,
AFACMIN = 0.2E-01,
$END
```

KB		F	V	KB		F	V
2	0.		0.	3	0.		5.8890000E+01
4	0.		1.1778000E+02	5	0.		1.7670000E+02
6	0.		2.1050000E+02	7	0.		3.7940000E+02
8	0.		5.4840000E+02	9	0.		7.1730000E+02
10	0.		8.8620000E+02	11	0.		9.1040000E+02
12	0.		9.5860000E+02	13	0.		1.0069000E+03

```
  14  0.            1.0552000E+03   15  0.            1.1035000E+03
  16  0.            1.1517000E+03   17  0.            1.2000000E+03
  18  0.            1.1517000E+03   19  0.            1.1035000E+03
  20  0.            1.0552000E+03   21  0.            1.0069000E+03
  22  0.            9.5860000E+02   23  0.            9.1040000E+02
  24  0.            8.8620000E+02   25  0.            7.1730000E+02
  26  0.            5.4810000E+02   27  0.            3.7940000E+02
  28  0.            2.1050000E+02   29  0.            1.7670000E+02
  30  0.            1.1779000E+02   31  0.            5.8890000E+01
  32  0.            0.
C  ITOL REDUCED FROM 4 TO 3 AUG 23/68 BACK TO 4 OCT31/68
C  NONLIN WILL ITERATE FASTER TO BETTER ANSWERS IF USER SELECTS GOOD GUES FOR
C  EACH INPUT. LOWER MODE GUES ARE MOST IMPORTANT
C  MODAL DATA IN THIS RUN IS MODES 2,3,4,5,6, AND 8 FROM GMB-MOPFSO RUN 8 008
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```
$NONLIN1

GUES    =  0.75E+01,  0.1E-02,  0.15E+00,  0.8E-02,  0.4E-01,  0.1E-02,          0.1E-02,  0.1E-02,  0.1E-02,  0.1E-02,
           0.471E+01,  0.157E+01,  0.157E+01,  0.471E+01,  0.471E+01,          0.157E+01,  0.0,  0.0,  0.0,  0.0,

ITOL    =  ,

ICONV   =  20,

$END
```

PRINT INPUT DATA PUNCHED BY PROGRAM MORESO, OPTION IPLOT = 5, UNITS ARE OMEGA (RAD/SEC), STATION (INCH),
GENMASS ((LB SEC SQ)/INCH), DEFMOSO (INCH/INCH), SLOPE (DEG/INCH), WITH GMR FLAG IDIV BLANK OR ZERO

WARNING REMOVE FROM MODAL DATA THOSE MODES NOT PRIMARILY DUE TO BEAM OF INTEREST, ** ESPECIALLY ALL WITH FREQUENCY
BELOW LOWEST FOR BEAM OF INTEREST

I= 1 OMEGA(I)= 1.5065489E+02 GEMMASS(I)= 1.7372762E-03 (MODE 2 IN MORESO OUTPUT)

K	STATION(K) INCHES	DEFMOSO(I,K) INCH/INCH	SLOMOSO(I,K) DEG/INCH	SHEMOSO(I,K) LB/INCH	MOMMOSO(I,K) INCH-LB/INCH
1	-37.200	-9.3174261E-02	-2.9834645E-01	-1.0888920E+00	1.0516032E-11
34	0.000	5.1085493E-02	-6.9926709E-02	1.0888920E+00	-4.0506783E+01
33	37.200	-2.0057543E-01	6.1642183E-01	-1.0888920E+00	-4.5474735E-13
2	-37.200	-9.3029611E-02	-5.3840302E+00	-2.1727987E+01	8.5492502E-11
3	-32.900	2.8681250E-01	-4.4167906E+00	-2.0775134E+01	-9.3430344E+01
4	-31.200	3.8670039E-01	-2.1993316E+00	-1.9870159E+01	-1.2874807E+02
5	-30.100	4.2862853E-01	-2.1680012E+00	-1.8017704E+01	-1.5060525E+02
6	-29.250	4.6072933E-01	-2.1598096E+00	-1.6422044E+01	-1.6592030E+02
7	-24.050	6.4433635E-01	-1.8666033E+00	-1.4948234E+01	-2.5131493E+02
8	-19.150	7.8834474E-01	-1.4852618E+00	-1.3196021E+01	-3.2456127E+02
9	-14.250	8.9575709E-01	-1.0125993E+00	-1.1205067E+01	-3.8922177E+02
10	-9.350	9.5927237E-01	-4.6076141E-01	-9.4226768E+00	-4.4412660E+02
11	-8.750	9.6402871E-01	-4.4767248E-01	-6.6280556E+00	-4.4978021E+02
12	-6.600	9.7989652E-01	-3.9785952E-01	-3.6591556E+00	-4.6403053E+02
13	-6.000	9.8401712E-01	-3.8916858E-01	-2.4049275E+00	-4.6622602E+02
14	-4.500	9.9259172E-01	-2.6577234E-01	-1.6262442E+00	-4.6983341E+02
15	-3.000	9.9792495E-01	-1.4157900E-01	-8.2791608E-01	-4.7227278E+02
16	-1.500	1.0000000E+00	-1.6900386E-02	-6.8623419E-02	-4.7351465E+02
17	0.000	9.9880824E-01	1.0795551E-01	7.5701227E-01	-4.7350719E+02
18	1.500	9.9434945E-01	2.3264618E-01	1.5114386E+00	-4.7237168E+02
19	3.000	9.8663172E-01	3.5688830E-01	2.3009798E+00	-4.7010452E+02
20	4.500	9.7567077E-01	4.8037655E-01	3.0662992E+00	-4.6665305E+02
21	6.000	9.6149038E-01	6.0280350E-01	4.2918645E+00	-4.6205360E+02
22	6.600	9.5513318E-01	6.1141294E-01	7.1857108E+00	-4.5947848E+02
23	8.750	9.3126259E-01	6.6066426E-01	9.8853478E+00	-4.4402920E+02
24	9.350	9.2427687E-01	6.7358071E-01	1.1602713E+01	-4.3809799E+02
25	14.250	8.4294054E-01	1.2161441E+00	1.3476274E+01	-3.8124470E+02
26	19.150	7.1859973E-01	1.6773326E+00	1.5073469E+01	-3.1521096E+02
27	24.050	5.5870751E-01	2.0458843E+00	1.6351417E+01	-2.4135096E+02
28	29.250	3.5945830E-01	2.3253445E+00	1.7596342E+01	-1.5632359E+02
29	30.100	3.2490556E-01	2.3330486E+00	1.9000524E+01	-1.4136670E+02
30	31.200	2.7982817E-01	2.3624140E+00	1.9655392E+01	-1.2046612E+02
31	32.900	1.7736634E-01	4.4335550E+00	2.0244641E+01	-8.7051955E+01
32	37.200	-2.0043029E-01	5.3347623E+00	-2.0244641E+01	-1.4551915E-11

I= 2 OMEGA(I)= 3.7837397E+02 GEMMASS(I)= 1.7650943E-03 (MODE 3 IN MORESO OUTPUT)

K	STATION(K) INCHES	DEFMOSO(I,K) INCH/INCH	SLOMOSO(I,K) DEG/INCH	SHEMOSO(I,K) LB/INCH	MOMMOSO(I,K) INCH-LB/INCH
1	-37.200	-5.9094326E-02	-7.3254417E-02	2.1835555E-01	3.0354386E-11
34	0.000	-1.6240576E-03	-1.1905943E-01	-2.1835555E-01	8.1228265E+00

33	37.200	1.3524020E-01	-2.5669293E-01	2.1835555E-01	4.8885340E-12
2	-37.200	-5.8292488E-02	-1.3359866E+01	-9.0596344E+01	1.8189894E-10
3	-32.900	8.4339740E-01	-9.3268933E+00	-7.2922302E+01	-3.8956428E+02
4	-31.200	9.9252305E-01	-3.1350838E-01	-5.8270911E+01	-5.1353219E+02
5	-30.100	9.9738988E-01	-1.9113001E-01	-3.1081020E+01	-5.7763020E+02
6	-29.250	1.0000000E+00	-1.6054748E-01	-9.2350925E+00	-6.0404906E+02
7	-24.050	9.7502647E-01	7.2217453E-01	4.8325458E+00	-6.5207154E+02
8	-19.150	8.7679168E-01	1.5700898E+00	1.7125136E+01	-6.2839207E+02
9	-14.250	7.0852542E-01	2.3467579E+00	2.7058639E+01	-5.4447890E+02
10	-9.350	4.7951307E-01	2.9800605E+00	3.2678869E+01	-4.1189157E+02
11	-8.750	4.4824610E-01	2.9918359E+00	4.0874896E+01	-3.9228425E+02
12	-6.600	3.3524453E-01	3.0298135E+00	4.7288304E+01	-3.0440322E+02
13	-6.000	3.0348988E-01	3.0352364E+00	4.9715188E+01	-2.7603024E+02
14	-4.500	2.2316665E-01	3.0981813E+00	5.0846577E+01	-2.0145746E+02
15	-3.000	1.4145495E-01	3.1412414E+00	5.1470922E+01	-1.2518759E+02
16	-1.500	5.8880297E-02	3.1640695E+00	5.1951108E+01	-4.7981209E+01
17	0.000	-2.4024687E-02	3.1664470E+00	5.1580074E+01	5.0441969E+01
18	1.500	-1.0665290E-01	3.1429486E+00	5.1237939E+01	1.2781208E+02
19	3.000	-1.8839956E-01	3.0991192E+00	5.0222789E+01	2.0466899E+02
20	4.500	-2.6873539E-01	3.0352272E+00	4.8909434E+01	2.8000317E+02
21	6.000	-3.4714093E-01	2.9517329E+00	4.6111769E+01	3.5336732E+02
22	6.600	-3.7801366E-01	2.9448716E+00	3.8890460E+01	3.8103439E+02
23	8.750	-4.8767422E-01	2.8987720E+00	2.9972901E+01	4.6464887E+02
24	9.350	-5.1795569E-01	2.8849012E+00	2.3902403E+01	4.8263261E+02
25	14.250	-7.3511655E-01	2.1681512E+00	1.3596093E+01	5.9975439E+02
26	19.150	-8.8530559E-01	1.3297279E+00	1.1841384E+00	6.6637524E+02
27	24.050	-9.6117243E-01	4.4334636E-01	-1.2683614E+01	6.7217752E+02
28	29.250	-9.5994116E-01	-4.5503232E-01	-3.3654419E+01	6.0622273E+02
29	30.100	-9.5296204E-01	-4.8567069E-01	-5.9633162E+01	5.7761647E+02
30	31.200	-9.4244196E-01	-6.0787786E-01	-7.3545268E+01	5.1201999E+02
31	32.900	-7.8513513E-01	-9.5805077E+00	-8.9998380E+01	3.8699304E+02
32	37.200	1.3425518E-01	-1.3586862E+01	8.9998380E+01	2.9103830E-11

I= 3 OMEGA(I)= 6.3052225E+02 GEMMASS(I)= 1.3821506E-03 (MODE 4 IN MORESO OUTPUT)

K	STATION(K) INCHES	DEFMOSO(I,K) INCH/INCH	SLOMOSO(I,K) DEG/INCH	SHEMOSO(I,K) LB/INCH	MOMMOSO(I,K) INCH-LB/INCH
1	-37.200	-3.0586331E-02	-6.8212457E-02	-2.8493844E-01	-7.1977979E-12
34	0.000	7.6318383E-04	-8.4401707E-03	2.8493844E-01	-1.0599710E+01
33	37.200	-7.1490797E-02	1.7116174E-01	-2.8493844E-01	-4.5474735E-13
2	-37.200	-2.9463078E-02	-1.4353748E+01	-1.2711110E+02	1.7462298E-10
3	-32.900	9.0615056E-01	-8.6952892E+00	-7.4380550E+01	-5.4657774E+02
4	-31.200	9.8980010E-01	3.4769954E+00	-3.3806901E+01	-6.7302468E+02
5	-30.100	9.2157574E-01	3.6321328E+00	3.5957180E+01	-7.1021227E+02
6	-29.250	8.6742717E-01	3.6681051E+00	8.8578509E+01	-6.7964867E+02
7	-24.050	5.0099281E-01	4.2996482E+00	1.0865069E+02	-2.1904042E+02
8	-19.150	1.3095463E-01	4.2371991E+00	1.1374899E+02	3.1334796E+02
9	-14.250	-2.0312389E-01	3.4531183E+00	1.0584100E+02	8.7071803E+02
10	-9.350	-4.3932087E-01	1.9565229E+00	9.1542827E+01	1.3893389E+03
11	-8.750	-4.5959220E-01	1.9150315E+00	6.8206325E+01	1.4442646E+03
12	-6.600	-5.2839362E-01	1.7495795E+00	4.0159752E+01	1.5909082E+03
13	-6.000	-5.4655740E-01	1.7196275E+00	2.7967622E+01	1.6150041E+03
14	-4.500	-5.8595231E-01	1.2883003E+00	1.9891373E+01	1.6569555E+03
15	-3.000	-6.1392510E-01	8.4750976E-01	1.1380850E+01	1.6867925E+03
16	-1.500	-6.3027059E-01	4.0053547E-01	2.7665981E+00	1.7038638E+03
17	0.000	-6.3487113E-01	-4.9236310E-02	-6.1283230E+00	1.7071565E+03
18	1.500	-6.2770153E-01	-4.9811734E-01	-1.4677330E+01	1.6979640E+03
19	3.000	-6.0882759E-01	-9.4288430E-01	-2.3125503E+01	1.6759480E+03
20	4.500	-5.7840108E-01	-1.3801762E+00	-3.1095273E+01	1.6412598E+03
21	6.000	-5.3666061E-01	-1.8067467E+00	-4.3067749E+01	1.5946169E+03
22	6.600	-5.1758664E-01	-1.8363015E+00	-7.0540154E+01	1.5687762E+03
23	8.750	-4.4557994E-01	-1.9990670E+00	-9.3165187E+01	1.4171149E+03

24	9.350	-4.2443288E-01	-2.0397491E+00	-1.6697879E+02	1.3612158E+03
25	14.250	-1.8281660E-01	-3.4954067E+00	-1.1409618E+02	8.3701971E+02
26	19.150	1.5293785E-01	-4.2337313E+00	-1.0814201E+02	2.7794844E+02
27	24.050	5.2072194E-01	-4.2509482E+00	-8.7279381E+01	-2.5194743E+02
28	29.250	8.8078176E-01	-3.5779025E+00	-3.3847900E+01	-7.0580021E+02
29	30.100	9.3358244E-01	-3.5406230E+00	3.6825114E+01	-7.3457092E+02
30	31.200	1.0000000E+00	-3.3603941E+00	7.7816883E+01	-6.9406330E+02
31	32.900	9.0783138E-01	9.1535398E+00	1.3064525E+02	-5.6177460E+02
32	37.200	-7.0041911E-02	1.4969325E+01	-1.3064525E+02	1.4551915E-11

I= 4 OMEGA(I)= 1.1938264E+03 GEMMASS(I)= 1.1756929E-03 (MODE 5 IN MORESO OUTPUT)

K	STATION(K) INCHES	DEFMOSO(I,K) INCH/INCH	SLOMOSO(I,K) DEG/INCH	SHEMOSO(I,K) LB/INCH	MOMMOSO(I,K) INCH-LB/INCH
1	-37.200	1.0464550E-02	1.3631827E-02	-3.4990569E-02	6.9391604E-11
34	0.000	2.6142473E-05	2.0971891E-02	3.4990569E-02	-1.3016492E+00
33	37.200	-2.3134821E-02	4.3027086E-02	-3.4990569E-02	8.4980911E-12
2	-37.200	9.0680990E-03	1.1282436E+01	1.4347076E+02	-2.0736479E-10
3	-32.900	-6.7784596E-01	4.8957111E+00	2.0622404E+00	6.1692425E+02
4	-31.200	-6.4007247E-01	-7.4537509E+00	-9.1998484E+01	6.2043006E+02
5	-30.100	-4.9571804E-01	-7.5815740E+00	-2.2652818E+02	5.1923173E+02
6	-29.250	-3.8307666E-01	-7.6034720E+00	-3.1983817E+02	3.2668277E+02
7	-24.050	2.9352590E-01	-6.9303977E+00	-2.6767899E+02	-1.2844757E+03
8	-19.150	7.8868315E-01	-4.3606999E+00	-1.5760354E+02	-2.5961028E+03
9	-14.250	1.0000000E+00	-4.1106477E-01	-1.8034884E+01	-3.3683601E+03
10	-9.350	6.4274239E-01	4.1084724E+00	8.0293385E+01	-3.4567311E+03
11	-8.750	7.9919417E-01	4.2090076E+00	2.2577056E+02	-3.4085550E+03
12	-6.600	6.3462384E-01	4.5541581E+00	3.4654265E+02	-2.9231483E+03
13	-6.000	5.8665710E-01	4.6068388E+00	3.9343330E+02	-2.7152227E+03
14	-4.500	4.5736803E-01	5.2449135E+00	4.1607473E+02	-2.1250728E+03
15	-3.000	3.1345108E-01	5.7229170E+00	4.3153953E+02	-1.5009607E+03
16	-1.500	1.5920140E-01	6.0333148E+00	4.3959873E+02	-8.5365143E+02
17	0.000	-9.2616065E-04	6.1714552E+00	4.3959981E+02	2.0301588E+02
18	1.500	-1.6102348E-01	6.0310043E+00	4.3138046E+02	8.6241560E+02
19	3.000	-3.1518271E-01	5.7183273E+00	4.1585935E+02	1.5094863E+03
20	4.500	-4.5895046E-01	5.2381186E+00	3.9313132E+02	2.1332753E+03
21	6.000	-5.8803387E-01	4.5979410E+00	3.4613440E+02	2.7229723E+03
22	6.600	-6.3590669E-01	4.5451178E+00	2.2511638E+02	2.9306529E+03
23	8.750	-8.0012342E-01	4.1992208E+00	7.9470158E+01	3.4146532E+03
24	9.350	-8.4356829E-01	4.0985192E+00	-1.8954530E+01	3.4623353E+03
25	14.250	-9.9974248E-01	-4.2545601E-01	-1.5848725E+02	3.3694581E+03
26	19.150	-7.8721453E-01	-4.3736778E+00	-2.6835773E+02	2.5928705E+03
27	24.050	-2.9119329E-01	-6.9368925E+00	-3.1018188E+02	1.2779176E+03
28	29.250	3.8554245E-01	-7.5994935E+00	-2.2633563E+02	-3.3502814E+02
29	30.100	4.9812162E-01	-7.5771678E+00	-9.1153633E+01	-5.2741343E+02
30	31.200	6.4237452E-01	-7.4476137E+00	3.2453920E+00	-6.2768242E+02
31	32.900	6.7801698E-01	5.0265368E+00	1.4468959E+02	-6.2216526E+02
32	37.200	-2.1429326E-02	1.1467522E+01	-1.4468959E+02	-4.3655746E-11

I= 5 OMEGA(I)= 2.6616197E+03 GEMMASS(I)= 6.4068043E-04 (MODE 6 IN MORESO OUTPUT)

K	STATION(K) INCHES	DEFMOSO(I,K) INCH/INCH	SLOMOSO(I,K) DEG/INCH	SHEMOSO(I,K) LB/INCH	MOMMOSO(I,K) INCH-LB/INCH
1	-37.200	5.4245544E-03	1.1016510E-02	3.7929147E-02	-6.0893512E-12
34	0.000	-5.7011620E-06	3.0600134E-03	-3.7929147E-02	1.4109643E+00
33	37.200	8.3550650E-03	-2.0847421E-02	3.7929147E-02	1.0658141E-12
2	-37.200	1.8326837E-03	9.3144580E+00	1.6900057E+02	-6.6847861E-11
3	-32.900	-4.8669771E-01	9.0092424E-01	-3.1567142E+02	8.1270246E+02
4	-31.200	-3.2574742E-01	-9.9655369E+00	-5.5361034E+02	2.7606105E+02
5	-30.100	-1.3427949E-01	-9.9591731E+00	-7.3474370E+02	-3.3291033E+02
6	-29.250	1.3249291E-02	-9.9257844E+00	-7.2042149E+02	-9.5744247E+02
7	-24.050	7.7332295E-01	-5.9475266E+00	-1.6632885E+02	-4.7036342E+03

8	-19.150	1.0000000E+00	8.2812482E-01	5.2540558E+02	-5.5284456E+03
9	-14.250	6.6471555E-01	6.4451497E+00	9.8654162E+02	-2.9539583E+03
10	-9.350	3.7530224E-02	7.1562683E+00	1.0083071E+03	1.8800957E+03
11	-8.750	-3.7085350E-02	7.0923519E+00	9.7475264E+02	2.4850800E+03
12	-6.600	-2.9669153E-01	6.7071744E+00	6.9411117E+02	4.5807982E+03
13	-6.000	-3.6646194E-01	6.6176802E+00	5.4850321E+02	4.9972649E+03
14	-4.500	-5.2150795E-01	5.1916821E+00	4.2024799E+02	5.6200197E+03
15	-3.000	-6.3660622E-01	3.5741251E+00	2.6369753E+02	6.4503917E+03
16	-1.500	-7.0745480E-01	1.8213250E+00	8.9691889E+01	6.8459380E+03
17	0.000	-7.3135379E-01	-1.3542893E-03	-9.0150684E+01	6.9800615E+03
18	1.500	-7.0738612E-01	-1.8238336E+00	-2.6411814E+02	6.8448355E+03
19	3.000	-6.3647639E-01	-3.5762599E+00	-4.2064239E+02	6.4486583E+03
20	4.500	-5.2132890E-01	-5.1932819E+00	-5.4885195E+02	5.8176947E+03
21	6.000	-3.6624964E-01	-6.6185980E+00	-6.9437626E+02	4.9944168E+03
22	6.600	-2.9646991E-01	-6.7080375E+00	-9.7480767E+02	4.5777910E+03
23	8.750	-3.6837568E-02	-7.0928808E+00	-1.0081379E+03	2.4819545E+03
24	9.350	3.7783069E-02	-7.1567070E+00	-9.8622573E+02	1.8770718E+03
25	14.250	6.6486389E-01	-6.4426086E+00	-5.2498675E+02	-2.9554343E+03
26	19.150	9.9988620E-01	-8.2498786E-01	1.6866870E+02	-5.5278694E+03
27	24.050	7.7300495E-01	5.9487977E+00	7.2053427E+02	-4.7013928E+03
28	29.250	1.2971361E-02	9.9234930E+00	7.3455601E+02	-9.5461455E+02
29	30.100	-1.3452236E-01	9.9567395E+00	5.5309501E+02	-3.3024194E+02
30	31.200	-3.2593824E-01	9.9625683E+00	3.1501670E+02	2.7816257E+02
31	32.900	-4.8628803E-01	-9.3473290E-01	-1.8923046E+02	8.1369096E+02
32	37.200	5.2914554E-03	-9.3585001E+00	1.8923046E+02	1.4551915E-11

I= 6 OMEGA(I)= 3.9152317E+03 GEMMASS(I)= 7.7491179E-04 (MODE 8 IN MORESO OUTPUT)

K	STATION(K) INCHES	DEFMOSO(I,K) INCH/INCH	SLOMOSO(I,K) DEG/INCH	SHFMOSO(I,K) LB/INCH	MOMMOSO(I,K) INCH-LB/INCH
1	-37.200	-1.1045592E-02	-2.1958631E-02	-7.0609336E-02	-1.0511769E-10
34	0.000	4.9048069E-05	-7.1467250E-03	7.0609336E-02	-2.6266673E+00
33	37.200	-1.4618123E-02	3.7359630E-02	-7.0609336E-02	-8.4980911E-12
2	-37.200	4.7850711E-03	1.2727070E+01	3.2726813E+02	-2.3101165E-10
3	-32.900	-5.8587318E-01	-1.8415835E+00	-9.8729341E+02	1.4072530E+03
4	-31.200	-2.8020001E-01	-1.3180588E+01	-1.4301685E+03	-2.7114584E+02
5	-30.100	-2.8882097E-02	-1.2943346E+01	-1.5144751E+03	-1.8443312E+03
6	-29.250	1.6224943E-01	-1.2814563E+01	-1.1349647E+03	-3.1316350E+03
7	-24.050	1.0000000E+00	-4.2656651E+00	4.0985414E+02	-9.0334515E+03
8	-19.150	8.9114133E-01	6.3683281E+00	1.7475795E+03	-7.0251662E+03
9	-14.250	1.1037092E-01	1.0001954E+01	1.9132646E+03	1.5379733E+03
10	-9.350	-4.8089312E-01	1.7570090E+00	1.3097877E+03	1.0912970E+04
11	-8.750	-4.9757758E-01	1.4258760E+00	3.3561786E+02	1.1698843E+04
12	-6.600	-5.2665775E-01	1.1105053E-01	-7.4229724E+02	1.2420421E+04
13	-6.000	-5.2661974E-01	-1.1690529E-01	-1.1951479E+03	1.1975043E+04
14	-4.500	-4.8429632E-01	-3.0378235E+00	-1.4526964E+03	1.0182321E+04
15	-3.000	-3.7214014E-01	-5.4351557E+00	-1.6513250E+03	8.0032763E+03
16	-1.500	-2.0508906E-01	-7.2187014E+00	-1.7582409E+03	5.5262888E+03
17	0.000	-8.0726684E-05	-8.3280417E+00	-1.7582712E+03	-2.8869089E+03
18	1.500	2.0493452E-01	-7.2192276E+00	-1.6514564E+03	-5.5243157E+03
19	3.000	3.7200596E-01	-5.4361761E+00	-1.4528913E+03	-8.0015003E+03
20	4.500	4.8419464E-01	-3.0392736E+00	-1.1953991E+03	-1.0180837E+04
21	6.000	5.2656071E-01	-1.1869688E-01	-7.4259821E+02	-1.1973936E+04
22	6.600	5.2661758E-01	1.0923995E-01	3.3523419E+02	-1.2419495E+04
23	8.750	4.9760668E-01	1.4240094E+00	1.3094610E+03	-1.1698741E+04
24	9.350	4.8094177E-01	1.7551423E+00	1.9129990E+03	-1.0913065E+04
25	14.250	-1.1019257E-01	1.0001075E+01	1.7475816E+03	-1.5393697E+03
26	19.150	-8.9096667E-01	6.3692914E+00	4.1011837E+02	7.0237800E+03
27	24.050	-9.9996179E-01	-4.2637232E+00	-1.1346415E+03	9.0333600E+03
28	29.250	-1.6235756E-01	-1.2813673E+01	-1.5144048E+03	3.1332243E+03
29	30.100	2.8761392E-02	-1.2942540E+01	-1.4304505E+03	1.8459803E+03
30	31.200	2.8006717E-01	-1.3180118E+01	-9.8778532E+02	2.7248477E+02

31	32.900	5.8604030E-01	-1.8594933E+00	3.2715123E+02	-1.4067503E+03
32	37.200	-3.0135780E-03	1.2703956E+01	-3.2715123E+02	1.1641532E-10

STATEMENT 300

NONLIN CALLED SUBROUTINE FVAL 5 TIMES

MODE I	AA(I)	PHI(I)	SINPHI(I)	COSPHI(I)	ZOMPHI(I)
1	-5.8430140E+00	6.9900398E+02	9.9999993E-01	3.8064240E-04	-1.5046931E+02
2	-1.1801110E-01	2.2462387E+02	-1.0000000E+00	-6.1877489E-11	3.7790071E+02
3	3.1792716E-01	-7.3152427E+03	1.0000000E+00	1.8515446E-09	-6.2973360E+02
4	-6.1400398E-03	8.3253016E+01	9.9999967E-01	-8.1049471E-04	-1.1922844E+03
5	-4.5424115E-02	4.7123890E+00	-1.0000000E+00	-2.2471821E-10	2.6582806E+03
6	-5.7914767E-04	1.5707963E+00	1.0000000E+00	6.8850650E-09	-3.9103346E+03

KR	F	V	POSFIT	VELFIT
2	0.	0.	2.0698388E-04	-7.3448070E+01
3	0.	5.8890000E+01	-6.4136604E-04	8.5614208E+01
4	0.	1.1778000E+02	-8.6337231E-04	1.3157901E+02
5	0.	1.7670000E+02	-9.5592092E-04	1.6039711E+02
6	0.	2.1050000E+02	-1.0267669E-03	1.8279328E+02
7	0.	3.7940000E+02	-1.4318246E-03	3.3380277E+02
8	0.	5.4840000E+02	-1.7497005E-03	5.1492283E+02
9	0.	7.1730000E+02	-1.9875832E-03	7.2404765E+02
10	0.	8.8620000E+02	-2.1296533E-03	9.1065882E+02
11	0.	9.1040000E+02	-2.1404504E-03	9.2894868E+02
12	0.	9.5860000E+02	-2.1765669E-03	9.9179706E+02
13	0.	1.0069000E+03	-2.1859718E-03	1.0085480E+03
14	0.	1.0552000E+03	-2.2056892E-03	1.0454307E+03
15	0.	1.1035000E+03	-2.2182691E-03	1.0724646E+03
16	0.	1.1517000E+03	-2.2236528E-03	1.0890487E+03
17	0.	1.2000000E+03	-2.2217988E-03	1.0947963E+03
18	0.	1.1517000E+03	-2.2126773E-03	1.0895218E+03
19	0.	1.1035000E+03	-2.1962768E-03	1.0732876E+03
20	0.	1.0552000E+03	-2.1726102E-03	1.0464354E+03
21	0.	1.0069000E+03	-2.1417090E-03	1.0095281E+03
22	0.	9.5860000E+02	-2.1278059E-03	9.9271852E+02
23	0.	9.1040000E+02	-2.0755241E-03	9.2957935E+02
24	0.	8.8620000E+02	-2.0602009E-03	9.1118566E+02
25	0.	7.1730000E+02	-1.8800489E-03	7.2276107E+02
26	0.	5.4810000E+02	-1.6024002E-03	5.1222160E+02
27	0.	3.7940000E+02	-1.2442584E-03	3.3213943E+02
28	0.	2.1050000E+02	-7.9766984E-04	1.8340216E+02
29	0.	1.7670000E+02	-7.2024865E-04	1.6120115E+02
30	0.	1.1778000E+02	-6.1925827E-04	1.3253257E+02
31	0.	5.8890000E+01	-3.9116108E-04	7.4192390E+01
32	0.	0.	4.4573837E-04	-1.6900816E+02

TIME= 0.0000000000 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT	NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	2.0698E-04	-7.3448E+01	4.9046E-02	-1.9120E-13	3	-6.4137E-04	8.5614E+01	4.6223E-02	2.1090E-01
4	-8.6337E-04	1.3158E+02	4.3742E-02	2.8948E-01	5	-9.5592E-04	1.6040E+02	3.8952E-02	3.3759E-01
6	-1.0268E-03	1.8279E+02	3.4988E-02	3.7070E-01	7	-1.4318E-03	3.3380E+02	3.1920E-02	5.5264E-01
8	-1.7497E-03	5.1492E+02	2.8570E-02	7.0905E-01	9	-1.9876E-03	7.2405E+02	2.4836E-02	8.4904E-01
10	-2.1297E-03	9.1066E+02	2.1360E-02	9.7074E-01	11	-2.1405E-03	9.2895E+02	1.5868E-02	9.8355E-01
12	-2.1766E-03	9.9180E+02	9.8646E-03	1.0177E+00	13	-2.1860E-03	1.0085E+03	7.3080E-03	1.0236E+00
14	-2.2057E-03	1.0454E+03	5.6885E-03	1.0345E+00	15	-2.2183E-03	1.0725E+03	3.9896E-03	1.0431E+00
16	-2.2237E-03	1.0890E+03	2.3406E-03	1.0491E+00	17	-2.2218E-03	1.0948E+03	5.0402E-04	1.0543E+00
18	-2.2127E-03	1.0895E+03	-1.2151E-03	1.0551E+00	19	-2.1963E-03	1.0733E+03	-3.0487E-03	1.0532E+00
20	-2.1726E-03	1.0464E+03	-4.8643E-03	1.0487E+00	21	-2.1417E-03	1.0095E+03	-7.8245E-03	1.0414E+00
22	-2.1278E-03	9.9272E+02	-1.4864E-02	1.0367E+00	23	-2.0755E-03	9.2958E+02	-2.1594E-02	1.0047E+00
24	-2.0602E-03	9.1112E+02	-2.5905E-02	9.9176E-01	25	-1.8800E-03	7.2276E+02	-3.0767E-02	8.6483E-01
26	-1.6024E-03	5.1222E+02	-3.4866E-02	7.1408E-01	27	-1.2443E-03	3.3214E+02	-3.7917E-02	5.4323E-01

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
28	-7.9767E-04	1.834[illegible]E+02	-4.0269E-02	3.4606E-01
30	-6.1926E-04	1.3253E+02	-4.3706E-02	2.6484E-01
32	4.4574E-04	-1.6901E+02	4.4312E-02	3.2153E-14

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
29	-7.2025E-04	1.6120E+02	-4.2719E-02	3.1183E-01
31	-3.9116E-04	7.4192E+01	-4.4312E-02	1.9054E-01

TIME= .0004982520 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-3.6282E-02	-7.3018E+01	-2.3167E+00	1.8190E-11
4	6.1579E-02	1.1510E+02	1.7741E+01	1.0964E+01
6	9.2454E-02	1.9539E+02	1.2633E+01	4.5937E+01
8	2.7203E-01	6.0592E+02	-3.8427E+01	5.8495E+01
10	4.4918E-01	8.9967E+02	-5.4312E+01	-4.0165E+02
12	4.8295E-01	9.4648E+02	-3.4324E+01	-5.4094E+02
14	5.0517E-01	9.7688E+02	-2.0385E+01	-6.0161E+02
16	5.2307E-01	1.0007E+03	-4.5203E+00	-6.5142E+02
18	5.2312E-01	1.0003E+03	1.2478E+01	-6.5381E+02
20	5.0527E-01	9.7587E+02	2.6624E+01	-6.0486E+02
22	4.8303E-01	9.4547E+02	5.0188E+01	-5.4426E+02
24	4.4921E-01	8.9893E+02	5.6377E+01	-4.0329E+02
26	2.7208E-01	6.0947E+02	9.3118E+00	6.1799E+01
28	9.2535E-02	1.9364E+02	-2.0138E+01	2.6871E+01
30	6.1131E-02	1.1019E+02	-1.0840E+01	-9.8428E+00
32	-8.3420E-02	-1.6752E+02	-6.5746E+00	-9.0454E-12

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	3.5947E-02	5.3599E+01	1.2309E+01	-9.9617E+00
5	7.8965E-02	1.6034E+02	1.8186E+01	3.0478E+01
7	1.7940E-01	4.1020E+02	-1.0843E+01	1.1163E+02
9	3.6874E-01	7.7753E+02	-5.5481E+01	-1.2980E+02
11	4.5681E-01	9.1031E+02	-4.9630E+01	-4.3424E+02
13	4.8990E-01	9.5605E+02	-2.6716E+01	-5.6154E+02
15	5.1629E-01	9.9182E+02	-1.2820E+01	-6.3219E+02
17	5.2536E-01	1.0036E+03	4.1201E+00	-6.5999E+02
19	5.1638E-01	9.9102E+02	2.0157E+01	-6.3509E+02
21	4.8999E-01	9.5500E+02	3.4437E+01	-5.6492E+02
23	4.5685E-01	9.0949E+02	5.5102E+01	-4.3636E+02
25	3.6866E-01	7.7868E+02	3.8540E+01	-1.2705E+02
27	1.7979E-01	4.1365E+02	-1.5492E+01	1.0743E+02
29	7.8840E-02	1.5730E+02	-1.7815E+01	9.7535E+00
31	2.9019E-02	3.4740E+01	6.5746E+00	-2.8271E+01

TIME= .0009965041 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-7.2575E-02	-7.2703E+01	5.1867E+00	-3.4764E-11
4	1.1569E-01	1.0952E+02	1.8141E+00	3.0601E+01
6	1.9629E-01	2.2360E+02	-1.7566E+01	2.6091E+01
8	6.0542E-01	7.1672E+02	-4.4017E+01	-2.1807E+02
10	8.9209E-01	8.7509E+02	-4.5066E+01	-6.7517E+02
12	9.3736E-01	8.7960E+02	-2.3400E+01	-7.8186E+02
14	9.6679E-01	8.8169E+02	-1.2369E+01	-8.2151E+02
16	9.9001E-01	8.8248E+02	-1.5262E+00	-8.5067E+02
18	9.8986E-01	8.8261E+02	9.6039E+00	-8.4327E+02
20	9.6651E-01	8.8239E+02	1.9021E+01	-8.0688E+02
22	9.3721E-01	8.8101E+02	3.6758E+01	-7.6353E+02
24	8.9226E-01	8.7764E+02	4.6196E+01	-6.5864E+02
26	6.0833E-01	7.2269E+02	2.7796E+01	-2.3545E+02
28	1.9406E-01	2.1515E+02	8.2230E+00	-1.8074E+01
30	1.1053E-01	9.5776E+01	4.5170E-01	-9.0291E+00
32	-1.6648E-01	-1.6596E+02	-1.9212E+00	-1.6995E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	5.3711E-02	2.7490E+01	4.8811E+00	2.2303E+01
5	1.6109E-01	1.7389E+02	-7.6526E+00	3.2596E+01
7	4.1139E-01	5.1049E+02	-3.1188E+01	-6.5250E+01
9	7.7356E-01	8.3540E+02	-4.9269E+01	-4.3375E+02
11	9.0238E-01	8.7626E+02	-3.7047E+01	-7.0221E+02
13	9.4662E-01	8.8036E+02	-1.7074E+01	-7.9590E+02
15	9.8129E-01	8.8227E+02	-7.0726E+00	-8.4007E+02
17	9.9287E-01	8.8255E+02	4.1963E+00	-8.4956E+02
19	9.8104E-01	8.8262E+02	1.4655E+01	-8.2886E+02
21	9.4641E-01	8.8154E+02	2.4703E+01	-7.7835E+02
23	9.0247E-01	8.7855E+02	4.3092E+01	-6.8450E+02
25	7.7505E-01	8.4048E+02	4.0169E+01	-4.3228E+02
27	4.1380E-01	5.1264E+02	1.5611E+01	-9.9253E+01
29	1.5766E-01	1.6317E+02	1.8682E+00	-1.1084E+01
31	3.5064E-02	3.8582E-02	1.9212E+00	-8.2612E+00

TIME= .0014947561 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-1.0979E-01	-7.2694E+01	1.4708E+01	5.3066E-11
4	1.8142E-01	1.6533E+02	-2.9176E+01	4.1981E+01
6	3.1688E-01	2.6151E+02	-6.3602E+01	-3.3698E+01
8	9.5999E-01	6.7881E+02	-3.2647E+01	-6.2094E+02
10	1.3182E+00	8.3298E+02	-8.6255E+00	-8.5602E+02
12	1.3651E+00	8.4395E+02	3.6825E+00	-8.6068E+02
14	1.3953E+00	8.5080E+02	4.0241E+00	-8.5176E+02
16	1.4189E+00	8.5672E+02	1.2470E+00	-8.4136E+02
18	1.4194E+00	8.5674E+02	-2.2010E+00	-8.3782E+02
20	1.3966E+00	8.5639E+02	-4.1617E+00	-8.4634E+02
22	1.3672E+00	8.5122E+02	-1.5000E+00	-8.5488E+02
24	1.3213E+00	8.4192E+02	1.2095E+01	-8.5440E+02
26	9.6475E-01	6.8049E+02	4.8932E+01	-6.5381E+02
28	3.0794E-01	2.4269E+02	5.2256E+01	-9.3965E+01
30	1.6710E-01	1.4195E+02	1.9591E+01	-1.2079E+01
32	-2.4891E-01	-1.6501E+02	4.9363E+00	-2.3938E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	7.8002E-02	8.5125E+01	-1.2507E+01	6.3243E+01
5	2.5782E-01	2.1964E+02	-5.1278E+01	9.8878E+00
7	6.6897E-01	5.0265E+02	-5.2349E+01	-3.6443E+02
9	1.1825E+00	7.8706E+02	-1.5329E+01	-7.8091E+02
11	1.3289E+00	8.3555E+02	2.4264E-01	-8.6120E+02
13	1.3746E+00	8.4612E+02	4.4697E+00	-8.5847E+02
15	1.4100E+00	8.5427E+02	2.9125E+00	-8.4573E+02
17	1.4221E+00	8.5823E+02	-4.3639E-01	-8.3717E+02
19	1.4109E+00	8.5823E+02	-3.4807E+00	-8.4112E+02
21	1.3765E+00	8.5298E+02	-3.8233E+00	-8.5258E+02
23	1.3318E+00	8.4416E+02	6.1735E+00	-8.5810E+02
25	1.1873E+00	7.9500E+02	2.8842E+01	-7.9513E+02
27	6.7001E-01	4.9535E+02	6.1553E+01	-4.1404E+02
29	2.4664E-01	1.9897E+02	3.4061E+01	-4.9547E+01
31	4.4030E-02	5.0481E+01	-4.9363E+00	2.1226E+01

TIME= .0019930082 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-1.4503E-01	-7.2754E+01	1.2377E+01	7.8688E-11
4	2.8671E-01	2.5760E+02	-3.6605E+01	2.2538E+01
6	4.5752E-01	3.0383E+02	-7.4852E+01	-6.9728E+01

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.4745E-01	1.9384E+02	-1.8049E+01	5.3221E+01
5	3.8312E-01	2.8375E+02	-6.1177E+01	-1.7728E+01
7	9.0036E-01	4.2715E+02	-6.2346E+01	-4.5896E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
8	1.2461E+00	5.5181E+02	-4.0690E+01	-7.6445E+02
10	1.7200E+00	7.8285E+02	-1.4437E+01	-1.0709E+03
12	1.7810E+00	8.2789E+02	-1.1756E-01	-1.0893E+03
14	1.8213E+00	8.5758E+02	8.4483E-01	-1.0878E+03
16	1.8528E+00	8.8243E+02	-1.3634E+00	-1.0865E+03
18	1.8549E+00	8.8421E+02	-3.9356E+00	-1.0944E+03
20	1.8256E+00	8.6262E+02	-4.6873E+00	-1.1073E+03
22	1.7879E+00	8.3463E+02	1.8806E+00	-1.1162E+03
24	1.7287E+00	7.9169E+02	2.0255E+01	-1.1047E+03
26	1.2717E+00	5.5324E+02	6.0254E+01	-8.1408E+02
28	4.3697E-01	2.7541E+02	6.1996E+01	-1.4004E+02
30	2.5774E-01	2.2151E+02	2.5785E+01	-4.1572E+01
32	-3.3091E-01	-1.6405E+02	5.2625E-01	-3.0806E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
9	1.5472E+00	6.7729E+02	-2.1854E+01	-9.6384E+02
11	1.7348E+00	7.9299E+02	-4.5088E+00	-1.0796E+03
13	1.7943E+00	8.3708E+02	1.0570E+00	-1.0893E+03
15	1.8408E+00	8.7280E+02	3.0286E-03	-1.0865E+03
17	1.8573E+00	8.8626E+02	-2.6295E+00	-1.0905E+03
19	1.8438E+00	8.7629E+02	-4.6436E+00	-1.1003E+03
21	1.7998E+00	8.4344E+02	-3.2158E+00	-1.1143E+03
23	1.7423E+00	8.0141E+02	1.2445E+01	-1.1122E+03
25	1.5563E+00	6.8617E+02	3.9061E+01	-1.0055E+03
27	8.9682E-01	4.1708E+02	7.2844E+01	-5.1883E+02
29	3.5890E-01	2.5200E+02	4.1612E+01	-8.7345E+01
31	9.3246E-02	1.4653E+02	-5.2625E-01	2.2629E+00

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-1.8121E-01	-7.2361E+01	-1.9277E+00	1.1203E-10
4	4.3292E-01	3.2067E+02	-2.0359E+01	-2.7913E+01
6	6.2002E-01	3.4829E+02	-5.1985E+01	-8.2270E+01
8	1.5253E+00	5.1503E+02	-6.8718E+01	-6.5736E+02
10	2.0983E+00	7.3252E+02	-6.0668E+01	-1.3274E+03
12	2.1849E+00	7.7953E+02	-3.0926E+01	-1.4672E+03
14	2.2404E+00	8.1074E+02	-1.7913E+01	-1.5206E+03
16	2.2856E+00	8.3645E+02	-6.0697E+00	-1.5656E+03
18	2.2877E+00	8.3735E+02	6.2585E+00	-1.5747E+03
20	2.2465E+00	8.1343E+02	1.7564E+01	-1.5470E+03
22	2.1029E+00	7.8335E+02	4.3016E+01	-1.5055E+03
24	2.1097E+00	7.3767E+02	6.4089E+01	-1.3792E+03
26	1.5317E+00	5.1361E+02	6.1189E+01	-7.4208E+02
28	5.8275E-01	3.1000E+02	4.1921E+01	-1.6591E+02
30	3.8291E-01	2.7299E+02	2.1744E+01	-9.8892E+01
32	-4.1218E-01	-1.6185E+02	-1.4401E+01	-3.7664E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT TIME= .0024912602 SEC
3	2.6328E-01	2.5832E+02	-1.1543E+01	-8.2889E+00
5	5.3852E-01	3.3636E+02	-3.7602E+01	-5.0308E+01
7	1.1075E+00	4.2382E+02	-6.2198E+01	-3.5259E+02
9	1.8681E+00	6.2716E+02	-6.8018E+01	-9.9408E+02
11	2.1179E+00	7.4310E+02	-4.8088E+01	-1.3638E+03
13	2.2019E+00	7.8926E+02	-2.3259E+01	-1.4857E+03
15	2.2683E+00	8.2659E+02	-1.2059E+01	-1.5475E+03
17	2.2921E+00	8.4006E+02	2.6270E-01	-1.5750E+03
19	2.2725E+00	8.2841E+02	1.2153E+01	-1.5653E+03
21	2.2098E+00	7.9277E+02	2.5396E+01	-1.5207E+03
23	2.1286E+00	7.4798E+02	5.6266E+01	-1.4130E+03
25	1.8809E+00	6.3224E+02	6.5937E+01	-1.0652E+03
27	1.0979E+00	4.0801E+02	5.3143E+01	-4.4226E+02
29	4.9578E-01	2.9399E+02	2.8536E+01	-1.3028E+02
31	1.8248E-01	2.0008E+02	1.4401E+01	-6.1926E+01

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-2.1702E-01	-7.1288E+01	-1.5916E+01	1.4831E-10
4	5.9854E-01	3.3966E+02	-1.6769E+01	-9.2070E+01
6	8.0432E-01	3.9048E+02	-4.1409E+01	-1.3459E+02
8	1.8002E+00	5.9810E+02	-8.1880E+01	-6.5344E+02
10	2.4512E+00	6.8421E+02	-8.3031E+01	-1.4962E+03
12	2.5521E+00	6.9359E+02	-4.6552E+01	-1.6955E+03
14	2.6179E+00	6.9967E+02	-2.7932E+01	-1.7773E+03
16	2.6713E+00	7.0476E+02	-9.3903E+00	-1.8475E+03
18	2.6739E+00	7.0542E+02	1.0150E+01	-1.8616E+03
20	2.6251E+00	7.0112E+02	2.7386E+01	-1.8175E+03
22	2.562 E+00	6.9489E+02	6.2406E+01	-1.7534E+03
24	2.4641E+00	6.8450E+02	8.5391E+01	-1.5728E+03
26	1.8025E+00	5.6224E+02	6.2427E+01	-7.6550E+02
28	7.4536E-01	3.4186E+02	3.4933E+01	-2.2585E+02
30	5.2273E-01	2.8416E+02	2.5442E+01	-1.6670E+02
32	-4.9191E-01	-1.5796E+02	-2.8710E+01	-4.3446E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT TIME= .0029895123 SEC
3	3.9371E-01	2.5926E+02	-1.3900E+01	-6.8440E+01
5	7.1474E-01	3.6850E+02	-2.8320E+01	-1.1052E+02
7	1.3388E+00	5.1178E+02	-6.1944E+01	-3.4991E+02
9	2.1858E+00	6.5470E+02	-9.0108E+01	-1.0546E+03
11	2.4741E+00	6.8636E+02	-6.9539E+01	-1.5460E+03
13	2.5727E+00	6.9550E+02	-3.5888E+01	-1.7234E+03
15	2.6509E+00	7.0276E+02	-1.8896E+01	-1.8192E+03
17	2.6790E+00	7.0567E+02	6.1109E-01	-1.8625E+03
19	2.6558E+00	7.0393E+02	1.9279E+01	-1.8464E+03
21	2.5819E+00	6.9689E+02	3.8417E+01	-1.7764E+03
23	2.4864E+00	6.8714E+02	7.7318E+01	-1.6192E+03
25	2.1990E+00	6.5004E+02	7.9363E+01	-1.1544E+03
27	1.3178E+00	4.8096E+02	4.4954E+01	-4.5961E+02
29	6.4854E-01	3.1689E+02	2.6779E+01	-1.9616E+02
31	2.8262E-01	1.9646E+02	2.8710E+01	-1.2345E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-2.5216E-01	-6.9660E+01	-2.4233E+01	1.8500E-10
4	7.7149E-01	3.5530E+02	-4.0155E+01	-1.6051E+02
6	1.0975E+00	4.2290E+02	-6.2108E+01	-2.4935E+02
8	2.1154E+00	6.4364E+02	-6.6886E+01	-8.9688E+02
10	2.7804E+00	6.3742E+02	-5.5895E+01	-1.5334E+03
12	2.8775E+00	6.1876E+02	-2.9450E+01	-1.6618E+03
14	2.9407E+00	6.0593E+02	-1.8639E+01	-1.7140E+03
16	2.9918E+00	5.9462E+02	-9.0991E+00	-1.7628E+03
18	2.9943E+00	5.9336E+02	1.1145E+00	-1.7871E+03
20	2.9479E+00	6.0166E+02	1.1108E+01	-1.7761E+03
22	2.8864E+00	6.1235E+02	3.5993E+01	-1.7482E+03

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT TIME= .0034877643 SEC
3	5.2284E-01	2.6604E+02	-3.3121E+01	-1.0420E+02
5	9.0484E-01	3.9497E+02	-5.2556E+01	-2.0468E+02
7	1.6121E+00	5.7008E+02	-6.6239E+01	-5.7231E+02
9	2.5171E+00	6.6355E+02	-6.3009E+01	-1.2246E+03
11	2.8025E+00	6.3330E+02	-4.4138E+01	-1.5669E+03
13	2.8974E+00	6.1484E+02	-2.2999E+01	-1.6795E+03
15	2.9723E+00	5.9908E+02	-1.3898E+01	-1.7419E+03
17	2.9992E+00	5.9268E+02	-3.8676E+00	-1.7813E+03
19	2.9771E+00	5.9648E+02	6.2239E+00	-1.7854E+03
21	2.9057E+00	6.0912E+02	1.8615E+01	-1.7594E+03
23	2.8130E+00	6.2427E+02	5.0880E+01	-1.6708E+03

24	2.7413E+00	6.2763E+02	6.0091E+01	-1.6403E+03
26	2.1063E+00	6.1940E+02	6.8318E+01	-1.0190E+03
28	9.2207E-01	3.6560E+02	5.8938E+01	-3.4101E+02
30	6.6620E-01	2.9534E+02	4.4277E+01	-2.3631E+02
32	-5.6930E-01	-1.5284E+02	-3.7452E+01	-4.7798E-11

25	2.5247E+00	6.4560E+02	6.6715E+01	-1.3459E+03
27	1.5726E+00	5.2760E+02	6.6000E+01	-6.8421E+02
29	8.1086E-01	3.3522E+02	4.9637E+01	-2.9092E+02
31	3.7925E-01	1.9786E+02	3.7452E+01	-1.6104E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-2.8638E-01	-6.7577E+01	-3.4605E+01	2.2408E-10
4	9.5995E-01	4.0082E+02	-6.4839E+01	-2.4060E+02
6	1.2233E+00	4.4104E+02	-8.2468E+01	-3.7758E+02
8	2.4255E+00	5.7912E+02	-4.9165E+01	-1.1454E+03
10	3.0861E+00	5.8940E+02	-2.4391E+01	-1.5425E+03
12	3.1754E+00	5.8215E+02	-8.1304E+00	-1.5874E+03
14	3.2231E+00	5.7674E+02	-5.7613E+00	-1.6015E+03
16	3.2789E+00	5.7035E+02	-6.3255E+00	-1.6189E+03
18	3.2801E+00	5.6639E+02	-6.9724E+00	-1.6421E+03
20	3.2359E+00	5.6515E+02	-5.8362E+00	-1.6626E+03
22	3.1784E+00	5.6557E+02	5.3419E+00	-1.6732E+03
24	3.0884E+00	5.6651E+02	2.8092E+01	-1.6505E+03
26	2.3987E+00	5.3698E+02	7.1461E+01	-1.2756E+03
28	1.1075E+00	3.7601E+02	8.4705E+01	-4.7125E+02
30	8.2148E-01	3.3085E+02	6.5739E+01	-3.1652E+02
32	-6.4405E-01	-1.4669E+02	-4.7619E+01	-5.1569E-11

TIME= .0039860165 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	6.6673E-01	3.1695E+02	-5.4000E+01	-1.4880E+02
5	1.1089E+00	4.2375E+02	-7.7243E+01	-3.1192E+02
7	1.8896E+00	5.2985E+02	-6.9175E+01	-8.0642E+02
9	2.8335E+00	5.9570E+02	-3.1888E+01	-1.3863E+03
11	3.1065E+00	5.8783E+02	-1.4043E+01	-1.5572E+03
13	3.1934E+00	5.8056E+02	-6.1906E+00	-1.5922E+03
15	3.2616E+00	5.7328E+02	-5.8020E+00	-1.6102E+03
17	3.2851E+00	5.6803E+02	-6.5988E+00	-1.6322E+03
19	3.2637E+00	5.6545E+02	-6.7091E+00	-1.6526E+03
21	3.1966E+00	5.6538E+02	-2.9687E+00	-1.6714E+03
23	3.1093E+00	5.6630E+02	1.8613E+01	-1.6617E+03
25	2.8285E+00	5.6280E+02	4.8415E+01	-1.5129E+03
27	1.8266E+00	4.7742E+02	8.7350E+01	-9.2547E+02
29	9.8324E-01	3.5657E+02	7.5215E+01	-3.9925E+02
31	4.8765E-01	2.4321E+02	4.7619E+01	-2.0476E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-3.1939E-01	-6.4729E+01	-5.3714E+01	2.6679E-10
4	1.1694E+00	4.3530E+02	-6.8566E+01	-3.3902E+02
6	1.4445E+00	4.4436E+02	-7.3988E+01	-4.7664E+02
8	2.6873E+00	4.7870E+02	-5.0104E+01	-1.1761E+03
10	3.3679E+00	5.4193E+02	-3.0079E+01	-1.6034E+03
12	3.4595E+00	5.5677E+02	-1.2147E+01	-1.6643E+03
14	3.5186E+00	5.6617E+02	-7.8317E+00	-1.6854E+03
16	3.5645E+00	5.7155E+02	-5.9734E+00	-1.7072E+03
18	3.5633E+00	5.6618E+02	-4.1387E+00	-1.7255E+03
20	3.5144E+00	5.5017E+02	-1.2353E+00	-1.7360E+03
22	3.4525E+00	5.3351E+02	1.1643E+01	-1.7365E+03
24	3.3565E+00	5.0932E+02	3.2364E+01	-1.6971E+03
26	2.6353E+00	4.1933E+02	6.5832E+01	-1.3023E+03
28	1.2941E+00	3.7079E+02	8.0881E+01	-5.6964E+02
30	9.9489E-01	3.5988E+02	7.5499E+01	-4.1370E+02
32	-7.1530E-01	-1.3894E+02	-6.6360E+01	-5.5364E-11

TIME= .0044842684 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	8.3828E-01	3.6517E+02	-6.3559E+01	-2.3097E+02
5	1.3251E+00	4.4065E+02	-7.3171E+01	-4.1444E+02
7	2.1352E+00	4.6047E+02	-6.4240E+01	-8.6137E+02
9	3.1074E+00	5.0889E+02	-3.7091E+01	-1.4217E+03
11	3.3887E+00	5.4529E+02	-1.9918E+01	-1.6214E+03
13	3.4782E+00	5.5979E+02	-9.1968E+00	-1.6716E+03
15	3.5474E+00	5.7016E+02	-6.7179E+00	-1.6971E+03
17	3.5698E+00	5.7024E+02	-4.9613E+00	-1.7180E+03
19	3.5448E+00	5.5945E+02	-2.8596E+00	-1.7317E+03
21	3.4721E+00	5.3859E+02	2.3032E+00	-1.7378E+03
23	3.3785E+00	5.1471E+02	2.3900E+01	-1.7114E+03
25	3.0823E+00	4.6122E+02	4.8207E+01	-1.5385E+03
27	2.0424E+00	3.9284E+02	7.8859E+01	-9.7971E+02
29	1.1643E+00	3.6626E+02	7.9272E+01	-5.0090E+02
31	6.2185E-01	2.8926E+02	6.6360E+01	-2.8535E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-3.5072E-01	-6.0916E+01	-7.6861E+01	3.1026E-10
4	1.3859E+00	4.2395E+02	-6.2099E+01	-4.4544E+02
6	1.6637E+00	4.3275E+02	-5.1200E+01	-5.6050E+02
8	2.9169E+00	4.5932E+02	-5.9717E+01	-1.0962E+03
10	3.6279E+00	5.0115E+02	-5.4331E+01	-1.6831E+03
12	3.7265E+00	5.1044E+02	-2.9728E+01	-1.8109E+03
14	3.7902E+00	5.1603E+02	-1.8450E+01	-1.8634E+03
16	3.8387E+00	5.1773E+02	-7.7921E+00	-1.9109E+03
18	3.8345E+00	5.1105E+02	3.5816E+00	-1.9285E+03
20	3.7771E+00	4.9609E+02	1.4099E+01	-1.9095E+03
22	3.7065E+00	4.8144E+02	3.7671E+01	-1.8756E+03
24	3.5978E+00	4.6643E+02	5.6920E+01	-1.7647E+03
26	2.8318E+00	3.8710E+02	5.5770E+01	-1.1987E+03
28	1.4745E+00	3.5076E+02	6.0297E+01	-6.4559E+02
30	1.1710E+00	3.4173E+02	7.8030E+01	-5.1654E+02
32	-7.8212E-01	-1.2891E+02	-8.9276E+01	-5.8913E-11

TIME= .0049825204 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.0206E+00	3.5551E+02	-6.7610E+01	-3.3050E+02
5	1.5431E+00	4.2915E+02	-5.4995E+01	-5.1375E+02
7	2.3585E+00	4.4697E+02	-5.4985E+01	-8.2674E+02
9	3.3508E+00	4.7939E+02	-6.0057E+01	-1.3888E+03
11	3.6499E+00	5.0327E+02	-4.4284E+01	-1.7157E+03
13	3.7466E+00	5.1230E+02	-2.3145E+01	-1.8287E+03
15	3.8210E+00	5.1789E+02	-1.3194E+01	-1.8911E+03
17	3.8432E+00	5.1546E+02	-1.9371E+00	-1.9256E+03
19	3.8124E+00	5.0455E+02	9.0704E+00	-1.9231E+03
21	3.7287E+00	4.8587E+02	2.1365E+01	-1.8884E+03
23	3.6225E+00	4.6513E+02	4.9795E+01	-1.7946E+03
25	3.2988E+00	4.2027E+02	5.8580E+01	-1.4858E+03
27	2.2287E+00	3.6749E+02	5.3821E+01	-9.2546E+02
29	1.3433E+00	3.4704E+02	7.0731E+01	-5.9434E+02
31	7.6547E-01	2.7548E+02	8.9276E+01	-3.8389E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-3.7993E-01	-5.6266E+01	-9.4918E+01	3.5026E-10

TIME= .0054807725 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.1847E+00	3.0008E+02	-7.8600E+01	-4.0815E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
4	1.5856E+00	3.7492E+02	-6.8351E+01	-5.4177E+02
6	1.8733E+00	4.0602E+02	-4.5644E+01	-6.6296E+02
8	3.1557E+00	4.9661E+02	-5.7080E+01	-1.1454E+03
10	3.8682E+00	4.6622E+02	-5.4199E+01	-1.7165E+03
12	3.9657E+00	4.5024E+02	-2.9701E+01	-1.8450E+03
14	4.0280E+00	4.3867E+02	-1.7869E+01	-1.8971E+03
16	4.0736E+00	4.2551E+02	-6.3883E+00	-1.9422E+03
18	4.0657E+00	4.1747E+02	5.7987E+00	-1.9536E+03
20	4.0040E+00	4.1506E+02	1.6746E+01	-1.9276E+03
22	3.9300E+00	4.1639E+02	3.9868E+01	-1.8881E+03
24	3.8167E+00	4.1945E+02	5.6599E+01	-1.7720E+03
26	3.0323E+00	4.1863E+02	4.9507E+01	-1.2235E+03
28	1.6413E+00	3.1607E+02	5.7793E+01	-7.3869E+02
30	1.3286E+00	2.8394E+02	8.7755E+01	-6.0649E+02
32	-8.4341E-01	-1.1682E+02	-1.0635E+02	-6.1756E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
5	1.7486E+00	3.9269E+02	-5.4128E+01	-6.1695E+02
7	2.5872E+00	4.7055E+02	-5.0025E+01	-9.0031E+02
9	3.5924E+00	4.9126E+02	-5.9457E+01	-1.4251E+03
11	3.8905E+00	4.6271E+02	-4.4638E+01	-1.7490E+03
13	3.9855E+00	4.4681E+02	-2.2859E+01	-1.8628E+03
15	4.0575E+00	4.3151E+02	-1.2225E+01	-1.9239E+03
17	4.0764E+00	4.2080E+02	-1.0362E-01	-1.9535E+03
19	4.0416E+00	4.1558E+02	1.1571E+01	-1.9449E+03
21	3.9531E+00	4.1583E+02	2.3965E+01	-1.9025E+03
23	3.8425E+00	4.1872E+02	5.0571E+01	-1.8024E+03
25	3.5092E+00	4.2551E+02	5.5347E+01	-1.4947E+03
27	2.4162E+00	3.8488E+02	4.6579E+01	-9.8090E+02
29	1.5058E+00	3.0228E+02	7.5531E+01	-6.8957E+02
31	8.8792E-01	2.1280E+02	1.0635E+02	-4.5730E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.0662E-01	-5.0853E+01	-1.0608E+02	3.8508E-10
4	1.7595E+00	3.2531E+02	-8.9503E+01	-6.2171E+02
6	2.0658E+00	3.6468E+02	-6.0976E+01	-7.8306E+02
8	3.4028E+00	4.8237E+02	-4.0437E+01	-1.3482E+03
10	4.0918E+00	4.3069E+02	-2.5941E+01	-1.7011E+03
12	4.1781E+00	4.0697E+02	-9.7975E+00	-1.7542E+03
14	4.2324E+00	3.9022E+02	-5.0021E+00	-1.7702E+03
16	4.2697E+00	3.7284E+02	-2.0366E+00	-1.7828E+03
18	4.2577E+00	3.6490E+02	8.6274E-01	-1.7855E+03
20	4.1965E+00	3.6668E+02	4.0447E+00	-1.7806E+03
22	4.1252E+00	3.7293E+02	1.4385E+01	-1.7703E+03
24	4.0166E+00	3.8322E+02	2.8211E+01	-1.7258E+03
26	3.2398E+00	3.9884E+02	4.8899E+01	-1.4039E+03
28	1.7870E+00	2.6663E+02	7.6814E+01	-8.4681E+02
30	1.4551E+00	2.2635E+02	1.0529E+02	-6.7628E+02
32	-8.9833E-01	-1.0350E+02	-1.1565E+02	-6.3879E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT TIME= .0059790245 SEC
3	1.3212E+00	2.5287E+02	-9.7382E+01	-4.5617E+02
5	1.9331E+00	3.4773E+02	-7.3989E+01	-7.2017E+02
7	2.8194E+00	4.4884E+02	-5.0632E+01	-1.1001E+03
9	3.8344E+00	4.7009E+02	-3.1586E+01	-1.5464E+03
11	4.1116E+00	4.2546E+02	-1.7462E+01	-1.7167E+03
13	4.1955E+00	4.0193E+02	-6.7058E+00	-1.7601E+03
15	4.2572E+00	3.8043E+02	-3.3788E+00	-1.7777E+03
17	4.2699E+00	3.6763E+02	-4.4514E-01	-1.7848E+03
19	4.2333E+00	3.6462E+02	2.4209E+00	-1.7842E+03
21	4.1474E+00	3.7085E+02	7.0083E+00	-1.7745E+03
23	4.0413E+00	3.8089E+02	2.2670E+01	-1.7394E+03
25	3.7176E+00	4.0170E+02	3.7477E+01	-1.5875E+03
27	2.6040E+00	3.5574E+02	6.1055E+01	-1.1643E+03
29	1.6432E+00	2.4926E+02	9.5670E+01	-7.8152E+02
31	9.7946E-01	1.5998E+02	1.1565E+02	-4.9728E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.3053E-01	-4.5029E+01	-1.1633E+02	4.1583E-10
4	1.9122E+00	2.8841E+02	-1.0569E+02	-6.9130E+02
6	2.2345E+00	3.1045E+02	-7.1598E+01	-8.8272E+02
8	3.6210E+00	3.6444E+02	-2.8667E+01	-1.5038E+03
10	4.2971E+00	3.9369E+02	-6.7551E+00	-1.7050E+03
12	4.3758E+00	3.8981E+02	3.0889E+00	-1.7077E+03
14	4.4247E+00	3.8646E+02	2.9969E+00	-1.7006E+03
16	4.4557E+00	3.8046E+02	2.7413E-01	-1.6932E+03
18	4.4406E+00	3.7313E+02	-2.8542E+00	-1.6942E+03
20	4.3775E+00	3.6446E+02	-4.5668E+00	-1.7044E+03
22	4.3065E+00	3.5760E+02	-1.9770E+00	-1.7138E+03
24	4.1988E+00	3.4819E+02	1.0568E+01	-1.7150E+03
26	3.4156E+00	2.9863E+02	4.8858E+01	-1.5326E+03
28	1.9050E+00	2.0570E+02	8.9274E+01	-9.2729E+02
30	1.5567E+00	1.8246E+02	1.1768E+02	-7.3114E+02
32	-9.4642E-01	-8.9419E+01	-1.2351E+02	-6.5801E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT TIME= .0064772766 SEC
3	1.4415E+00	2.3235E+02	-1.1240E+02	-5.0023E+02
5	2.0949E+00	3.0101E+02	-8.8424E+01	-8.0756E+02
7	3.0224E+00	3.5786E+02	-5.0762E+01	-1.2550E+03
9	4.0514E+00	3.9528E+02	-1.2403E+01	-1.6442E+03
11	4.3153E+00	3.9288E+02	6.1681E-01	-1.7091E+03
13	4.3916E+00	3.8891E+02	3.5453E+00	-1.7059E+03
15	4.4461E+00	3.8363E+02	1.9124E+00	-1.6961E+03
17	4.4537E+00	3.7696E+02	-1.2022E+00	-1.6924E+03
19	4.4146E+00	3.6896E+02	-3.9718E+00	-1.6985E+03
21	4.3286E+00	3.5961E+02	-4.2058E+00	-1.7113E+03
23	4.2232E+00	3.5027E+02	-5.1105E+00	-1.7180E+03
25	3.9006E+00	3.2754E+02	2.6645E+01	-1.6632E+03
27	2.7590E+00	2.5968E+02	7.0374E+01	-1.2932E+03
29	1.7541E+00	1.9570E+02	1.0933E+02	-8.5140E+02
31	1.0523E+00	1.3462E+02	1.2351E+02	-5.3108E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.5141E-01	-3.8723E+01	-1.2913E+02	4.4306E-10
4	2.045[illegible]E+00	2.4073E+02	-1.0431E+02	-7.5259E+02
6	2.3737E+00	2.4741E+02	-6.2191E+01	-9.3647E+02
8	3.7861E+00	2.8720E+02	-3.4243E+01	-1.4932E+03
10	4.4144E+00	3.5848E+02	-1.8838E+01	-1.7788E+03
12	4.5660E+00	3.7337E+02	-5.3047E+00	-1.8143E+03
14	4.6175E+00	3.8258E+02	-1.9411E+00	-1.8220E+03
16	4.6485E+00	3.8693E+02	-4.0149E-01	-1.8265E+03
18	4.6292E+00	3.7970E+02	1.0698E+00	-1.8264E+03

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT TIME= .0069755286 SEC
3	1.5510E+00	2.0163E+02	-1.1607E+02	-5.5527E+02
5	2.2314E+00	2.4461E+02	-8.1341E+01	-8.6733E+02
7	3.1756E+00	2.6348E+02	-4.7611E+01	-1.2599E+03
9	4.2289E+00	3.2298E+02	-2.4060E+01	-1.6609E+03
11	4.5034E+00	3.6187E+02	-1.1244E+01	-1.7901E+03
13	4.5831E+00	3.7638E+02	-3.0261E+00	-1.8175E+03
15	4.6393E+00	3.8616E+02	-1.0135E+00	-1.8250E+03
17	4.6451E+00	3.8478E+02	4.5650E-01	-1.8271E+03
19	4.6006E+00	3.7174E+02	1.9896E+00	-1.8248E+03

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
20	4.5594E+00	3.6104E+02	3.0584E+00	-1.8218E+03
22	4.4814E+00	3.4203E+02	1.1080E+01	-1.8140E+03
24	4.3637E+00	3.1445E+02	2.3486E+01	-1.7791E+03
26	3.5386E+00	2.0410E+02	4.6197E+01	-1.5011E+03
28	1.9915E+00	1.3697E+02	8.1052E+01	-9.5889E+02
30	1.6354E+00	1.2934E+02	1.1863E+02	-7.7368E+02
32	-9.8731E-01	-7.4538E+01	-1.3303E+02	-6.7954E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
21	4.5056E+00	3.4782E+02	5.2868E+00	-1.8172E+03
23	4.3904E+00	3.2060E+02	1.8436E+01	-1.7902E+03
25	4.0449E+00	2.5790E+02	3.3259E+01	-1.6641E+03
27	2.8633E+00	1.6587E+02	6.0738E+01	-1.2747E+03
29	1.8370E+00	1.3485E+02	1.0574E+02	-8.9000E+02
31	1.1119E+00	9.9301E+01	1.3303E+02	-5.7201E+02

TIME= .0074737807 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.6904E-01	-3.1959E+01	-1.3975E+02	4.6458E-10
4	2.1470E+00	1.6430E+02	-9.7734E+01	-7.9684E+02
6	2.4805E+00	1.8072E+02	-4.9441E+01	-9.6343E+02
8	3.9197E+00	2.6018E+02	-4.5720E+01	-1.4434E+03
10	4.6547E+00	3.2517E+02	-3.9395E+01	-1.8852E+03
12	4.7441E+00	3.3512E+02	-1.8827E+01	-1.9749E+03
14	4.7093E+00	3.4094E+02	-9.7778E+00	-2.0065E+03
16	4.8374E+00	3.4272E+02	-1.5503E+00	-2.0296E+03
18	4.8095E+00	3.3592E+02	6.9932E+00	-2.0265E+03
20	4.7307E+00	3.2067E+02	1.4637E+01	-1.9995E+03
22	4.6436E+00	3.0545E+02	3.1170E+01	-1.9657E+03
24	4.5126E+00	2.8332E+02	4.4021E+01	-1.8751E+03
26	3.6312E+00	1.7885E+02	4.4917E+01	-1.4386E+03
28	2.0434E+00	7.1659E+01	6.9465E+01	-9.6287E+02
30	1.6814E+00	5.1982E+01	1.1544E+02	-7.9614E+02
32	-1.0206E+00	-5.8947E+01	-1.3951E+02	-7.0079E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.6354E+00	1.3091E+02	-1.1524E+02	-6.0094E+02
5	2.3361E+00	1.7363E+02	-6.9506E+01	-9.0435E+02
7	3.2943E+00	2.2191E+02	-4.5486E+01	-1.2205E+03
9	4.3815E+00	2.9732E+02	-4.4447E+01	-1.6674E+03
11	4.6753E+00	3.2747E+02	-3.0730E+01	-1.9089E+03
13	4.7619E+00	3.3709E+02	-1.3498E+01	-1.9862E+03
15	4.8228E+00	3.4290E+02	-5.6688E+00	-2.0211E+03
17	4.8279E+00	3.4040E+02	2.9116E+00	-2.0309E+03
19	4.7771E+00	3.2932E+02	1.1023E+01	-2.0160E+03
21	4.6706E+00	3.1008E+02	1.9765E+01	-1.9775E+03
23	4.5423E+00	2.8827E+02	3.9310E+01	-1.8987E+03
25	4.1658E+00	2.3468E+02	4.5051E+01	-1.6594E+03
27	2.9336E+00	1.2488E+02	4.9166E+01	-1.2185E+03
29	1.8866E+00	6.3095E+01	9.7893E+01	-9.0382E+02
31	1.1450E+00	2.8789E+01	1.3951E+02	-5.9989E+02

TIME= .0079720327 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.8322E-01	-2.4987E+01	-1.4237E+02	4.7798E-10
4	2.2071E+00	7.8054E+01	-1.0278E+02	-8.1539E+02
6	2.5538E+00	1.1386E+02	-5.4958E+01	-9.9230E+02
8	4.0502E+00	2.6053E+02	-4.7001E+01	-1.5188E+03
10	4.8083E+00	2.9089E+02	-3.8593E+01	-1.9649E+03
12	4.8988E+00	2.8632E+02	-1.7823E+01	-2.0515E+03
14	4.9543E+00	2.8243E+02	-9.1373E+00	-2.0812E+03
16	4.9862E+00	2.7628E+02	-1.4738E+00	-2.1028E+03
18	4.9601E+00	2.6996E+02	6.5132E+00	-2.1008E+03
20	4.8760E+00	2.6335E+02	1.3854E+01	-2.0756E+03
22	4.7840E+00	2.5817E+02	3.0619E+01	-2.0434E+03
24	4.6459E+00	2.5079E+02	4.5033E+01	-1.9538E+03
26	3.7213E+00	1.7987E+02	4.9956E+01	-1.4982E+03
28	2.0630E+00	7.9288E+00	7.4523E+01	-9.6506E+02
30	1.6863E+00	-3.0123E+01	1.1656E+02	-7.9092E+02
32	-1.0460E+00	-4.3309E+01	-1.3785E+02	-7.1720E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.6789E+00	4.5831E+01	-1.1952E+02	-6.1221E+02
5	2.4037E+00	9.8289E+01	-7.5111E+01	-9.2845E+02
7	3.4004E+00	2.0167E+02	-4.9134E+01	-1.2781E+03
9	4.5281E+00	2.8889E+02	-4.4031E+01	-1.7491E+03
11	4.8292E+00	2.8995E+02	-2.9510E+01	-1.9880E+03
13	4.9168E+00	2.8525E+02	-1.2658E+01	-2.0622E+03
15	4.9775E+00	2.7940E+02	-5.2924E+00	-2.0949E+03
17	4.9804E+00	2.7313E+02	2.6951E+00	-2.1049E+03
19	4.9253E+00	2.6673E+02	1.0347E+01	-2.0911E+03
21	4.8125E+00	2.5970E+02	1.8995E+01	-2.0548E+03
23	4.6771E+00	2.5246E+02	3.9638E+01	-1.9775E+03
25	4.2816E+00	2.2761E+02	4.7946E+01	-1.7331E+03
27	2.9915E+00	1.0573E+02	5.5445E+01	-1.2534E+03
29	1.8998E+00	-8.6833E+00	1.0072E+02	-9.0171E+02
31	1.1389E+00	-5.0852E+01	1.3785E+02	-5.9276E+02

TIME= .0084702848 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.9396E-01	-1.8122E+01	-1.3852E+02	4.8386E-10
4	2.2284E+00	1.2401E+01	-1.1525E+02	-8.1075E+02
6	2.5943E+00	4.9559E+01	-7.3348E+01	-1.0162E+03
8	4.1792E+00	2.0982E+02	-4.2141E+01	-1.6790E+03
10	4.9438E+00	2.5205E+02	-2.3694E+01	-2.0330E+03
12	5.0315E+00	2.4897E+02	-6.7170E+00	-2.0780E+03
14	5.0847E+00	2.4599E+02	-2.3078E+00	-2.0877E+03
16	5.1132E+00	2.4035E+02	-5.0611E-02	-2.0927E+03
18	5.0638E+00	2.3374E+02	2.1972E+00	-2.0920E+03
20	4.9968E+00	2.2622E+02	5.1236E+00	-2.0833E+03
22	4.9026E+00	2.2010E+02	1.6269E+01	-2.0707E+03
24	4.7613E+00	2.1135E+02	3.2779E+01	-2.0201E+03
26	3.8019E+00	1.3237E+02	5.9546E+01	-1.6397E+03
28	2.0525E+00	-4.8780E+01	9.1139E+01	-9.6164E+02
30	1.6556E+00	-8.7589E+01	1.2023E+02	-7.6241E+02
32	-1.0639E+00	-2.8410E+01	-1.2977E+02	-7.3023E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.6861E+00	-1.0532E+01	-1.2653E+02	-5.9565E+02
5	2.4359E+00	3.3353E+01	-9.2600E+01	-9.3752E+02
7	3.4885E+00	1.4332E+02	-5.7420E+01	-1.3976E+03
9	4.6632E+00	2.4538E+02	-3.0110E+01	-1.8855E+03
11	4.9641E+00	2.5146E+02	-1.4303E+01	-2.0472E+03
13	5.0489E+00	2.4821E+02	-3.7720E+00	-2.0820E+03
15	5.1061E+00	2.4333E+02	-1.0154E+00	-2.0911E+03
17	5.1057E+00	2.3715E+02	1.1886E+00	-2.0938E+03
19	5.0475E+00	2.3012E+02	3.5614E+00	-2.0887E+03
21	4.9317E+00	2.2192E+02	8.2476E+00	-2.0757E+03
23	4.7933E+00	2.1334E+02	2.6090E+01	-2.0357E+03
25	4.3863E+00	1.8484E+02	4.4841E+01	-1.8595E+03
27	3.0330E+00	5.3036E+01	7.4293E+01	-1.3480E+03
29	1.8805E+00	-6.5763E+01	1.1069E+02	-8.8417E+02
31	1.0999E+00	-9.8912E+01	1.2977E+02	-5.5802E+02

TIME= .0089685368 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT

2	-5.0132E-01	-1.1501E+01	-1.3408E+02	4.8466E-10	3	1.6736E+00	-3.6751E+01	-1.2720E+02	-5.7653E+02
4	2.2234E+00	-2.9919E+01	-1.1905E+02	-7.9276E+02	5	2.4393E+00	-1.7760E+01	-1.0053E+02	-9.2372E+02
6	2.6043E+00	-8.2622E+00	-8.3547E+01	-1.0092E+03	7	3.5376E+00	5.2809E+01	-6.5407E+01	-1.4436E+03
8	4.2512E+00	1.1295E+02	-4.6305E+01	-1.7641E+03	9	4.7668E+00	1.6807E+02	-3.0961E+01	-1.9910E+03
10	5.0583E+00	2.0629E+02	-2.3380E+01	-2.1427E+03	11	5.0791E+00	2.0933E+02	-1.2505E+01	-2.1567E+03
12	5.1483E+00	2.1941E+02	-4.5951E+00	-2.1836E+03	13	5.1661E+00	2.2201E+02	-1.6535E+00	-2.1864E+03
14	5.2026E+00	2.2725E+02	-3.8858E-01	-2.1889E+03	15	5.2240E+00	2.3005E+02	5.5405E-01	-2.1894E+03
16	5.2303E+00	2.3038E+02	1.0602E+00	-2.1886E+03	17	5.2215E+00	2.2819E+02	1.8044E+00	-2.1871E+03
18	5.1976E+00	2.2350E+02	2.3198E+00	-2.1844E+03	19	5.1587E+00	2.1636E+02	3.2717E+00	-2.1810E+03
20	5.1046E+00	2.0685E+02	4.5521E+00	-2.1760E+03	21	5.0356E+00	1.9506E+02	7.5237E+00	-2.1692E+03
22	5.0049E+00	1.8988E+02	1.5509E+01	-2.1647E+03	23	4.8891E+00	1.7061E+02	2.6469E+01	-2.1314E+03
24	4.8553E+00	1.6504E+02	3.4106E+01	-2.1155E+03	25	4.4599E+00	1.0829E+02	4.9418E+01	-1.9484E+03
26	3.8452E+00	3.9166E+01	6.8098E+01	-1.7062E+03	27	3.0389E+00	-3.0181E+01	8.5062E+01	-1.3725E+03
28	2.0161E+00	-9.5503E+01	9.8701E+01	-9.3020E+02	29	1.8373E+00	-1.0520E+02	1.1273E+02	-8.4631E+02
30	1.6039E+00	-1.1749E+02	1.1821E+02	-7.2230E+02	31	1.0463E+00	-1.1286E+02	1.2124E+02	-5.2134E+02
32	-1.0745E+00	-1.4558E+01	-1.2124E+02	-7.4422E-11					

TIME= .0094667888 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT	NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-5.0545E-01	-5.1155E+00	-1.3080E+02	4.8156E-10	3	1.6492E+00	-6.3797E+01	-1.2024E+02	-5.6243E+02
4	2.1992E+00	-6.8316E+01	-1.1129E+02	-7.6684E+02	5	2.4194E+00	-6.1329E+01	-9.4454E+01	-8.8926E+02
6	2.5878E+00	-5.5772E+01	-8.0778E+01	-9.6955E+02	7	3.5452E+00	-1.4339E+01	-7.1223E+01	-1.3896E+03
8	4.2870E+00	3.9764E+01	-6.1634E+01	-1.7386E+03	9	4.8328E+00	1.0213E+02	-5.1762E+01	-2.0406E+03
10	5.1484E+00	1.5449E+02	-4.3302E+01	-2.2942E+03	11	5.1713E+00	1.5923E+02	-3.0074E+01	-2.3202E+03
12	5.2476E+00	1.7525E+02	-1.6140E+01	-2.3849E+03	13	5.2673E+00	1.7945E+02	-1.0266E+01	-2.3945E+03
14	5.3076E+00	1.8825E+02	-6.6368E+00	-2.4099E+03	15	5.3314E+00	1.9375E+02	-2.9225E+00	-2.4199E+03
16	5.3384E+00	1.9579E+02	5.9478E-01	-2.4243E+03	17	5.3287E+00	1.9427E+02	4.4361E+00	-2.4230E+03
18	5.3024E+00	1.8919E+02	7.9400E+00	-2.4164E+03	19	5.2593E+00	1.8057E+02	1.1624E+01	-2.4044E+03
20	5.1996E+00	1.6858E+02	1.5210E+01	-2.3870E+03	21	5.1235E+00	1.5342E+02	2.0991E+01	-2.3642E+03
22	5.0895E+00	1.4671E+02	3.4680E+01	-2.3516E+03	23	4.9623E+00	1.2177E+02	4.7599E+01	-2.2770E+03
24	4.9251E+00	1.1457E+02	5.5846E+01	-2.2485E+03	25	4.4965E+00	4.4512E+01	6.5253E+01	-1.9748E+03
26	3.8452E+00	-2.9787E+01	7.3930E+01	-1.6551E+03	27	3.0071E+00	-8.9239E+01	8.1783E+01	-1.2928E+03
28	1.9595E+00	-1.2941E+02	9.1332E+01	-8.6757E+02	29	1.7774E+00	-1.3422E+02	1.0270E+02	-7.8994E+02
30	1.5397E+00	-1.4015E+02	1.0846E+02	-6.7697E+02	31	9.8771E-01	-1.2424E+02	1.1455E+02	-4.9258E+02
32	-1.0785E+00	-1.6104E+00	-1.1455E+02	-7.5905E-11					

TIME= .0099650409 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT	NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-5.0647E-01	9.9476E-01	-1.2541E+02	4.7421E-10	3	1.6079E+00	-1.0284E+02	-1.1300E+02	-5.3925E+02
4	2.1547E+00	-1.0969E+02	-1.0423E+02	-7.3135E+02	5	2.3790E+00	-9.9332E+01	-9.0112E+01	-8.4600E+02
6	2.5507E+00	-9.1152E+01	-8.0100E+01	-9.2259E+02	7	3.5311E+00	-3.6698E+01	-7.7767E+01	-1.3391E+03
8	4.2998E+00	1.7585E+01	-7.5888E+01	-1.7202E+03	9	4.8738E+00	6.5893E+01	-7.0290E+01	-2.0920E+03
10	5.2114E+00	9.7685E+01	-6.0871E+01	-2.4364E+03	11	5.2363E+00	1.0008E+02	-4.5326E+01	-2.4730E+03
12	5.3189E+00	1.0798E+02	-2.5993E+01	-2.5704E+03	13	5.3403E+00	1.1001E+02	-1.7514E+01	-2.5860E+03
14	5.3841E+00	1.1399E+02	-1.1811E+01	-2.6123E+03	15	5.4099E+00	1.1596E+02	-5.6772E+00	-2.6300E+03
16	5.4175E+00	1.1589E+02	4.6549E-01	-2.6385E+03	17	5.4070E+00	1.1376E+02	7.0122E+00	-2.6373E+03
18	5.3783E+00	1.0962E+02	1.3133E+01	-2.6268E+03	19	5.3314E+00	1.0350E+02	1.9222E+01	-2.6071E+03
20	5.2665E+00	9.5469E+01	2.4851E+01	-2.5783E+03	21	5.1839E+00	8.5617E+01	3.3148E+01	-2.5410E+03
22	5.1471E+00	8.1300E+01	5.1982E+01	-2.5211E+03	23	5.0092E+00	6.5277E+01	6.6810E+01	-2.4094E+03
24	4.9689E+00	6.0651E+01	7.5724E+01	-2.3693E+03	25	4.5100E+00	1.3744E+01	8.0103E+01	-1.9982E+03
26	3.8253E+00	-4.3054E+01	7.9996E+01	-1.6057E+03	27	2.9586E+00	-9.9105E+01	7.9616E+01	-1.2137E+03
28	1.8895E+00	-1.4905E+02	8.4873E+01	-7.9974E+02	29	1.7047E+00	-1.5603E+02	9.2967E+01	-7.2760E+02
30	1.4636E+00	-1.6475E+02	9.8427E+01	-6.2534E+02	31	9.2922E-01	-1.4756E+02	1.0651E+02	-4.5801E+02
32	-1.0763E+00	1.0469E+01	-1.0651E+02	-7.7067E-11					

TIME= .0104632929 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT	NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-5.0453E-01	6.7035E+00	-1.1596E+02	4.6290E-10	3	1.5486E+00	-1.3066E+02	-1.1062E+02	-4.9862E+02
4	2.0920E+00	-1.3824E+02	-1.0628E+02	-6.8668E+02	5	2.3225E+00	-1.2495E+02	-9.8217E+01	-8.0359E+02
6	2.4990E+00	-1.1451E+02	-9.1736E+01	-8.8707E+02	7	3.5101E+00	-5.0184E+01	-8.6957E+01	-1.3641E+03
8	4.3052E+00	-5.3548E-01	-8.0496E+01	-1.7902E+03	9	4.8981E+00	2.7767E+01	-7.0852E+01	-2.1846E+03
10	5.2445E+00	3.3752E+01	-5.9981E+01	-2.5318E+03	11	5.2698E+00	3.3319E+01	-4.2574E+01	-2.5678E+03
12	5.3536E+00	3.1447E+01	-2.2780E+01	-2.6593E+03	13	5.3753E+00	3.0855E+01	-1.4278E+01	-2.6730E+03
14	5.4195E+00	2.9102E+01	-8.7993E+00	-2.6944E+03	15	5.4451E+00	2.6936E+01	-3.0767E+00	-2.7076E+03
16	5.4520E+00	2.4482E+01	2.5212E+00	-2.7122E+03	17	5.4407E+00	2.1833E+01	8.4679E+00	-2.7064E+03
18	5.4099E+00	1.9161E+01	1.3981E+01	-2.6937E+03	19	5.3607E+00	1.6197E+01	1.9543E+01	-2.6727E+03

20	5.2233E+00	1.3222E+01	2.4781E+01	-2.6434E+03
22	5.1694E+00	8.7775E+00	5.1217E+01	-2.5866E+03
24	4.9840E+00	2.5980E+00	7.6649E+01	-2.4363E+03
26	3.8034E+00	-4.8149E+01	8.8173E+01	-1.6479E+03
28	1.8131E+00	-1.5554E+02	9.1397E+01	-7.4822E+02
30	1.3777E+00	-1.7624E+02	9.4057E+01	-5.6806E+02
32	-1.0683E+00	2.1402E+01	-9.4922E+01	-7.7611E-11

21	5.2075E+00	1.0081E+01	3.2768E+01	-2.6063E+03
23	5.0265E+00	3.9846E+00	6.6933E+01	-2.4765E+03
25	4.5106E+00	-1.4871E+01	8.4264E+01	-2.0607E+03
27	2.9104E+00	-9.7009E+01	8.9919E+01	-1.2158E+03
29	1.6241E+00	-1.6469E+02	9.3158E+01	-6.7054E+02
31	8.4249E-01	-1.5997E+02	9.4922E+01	-4.0817E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.9997E-01	1.1929E+01	-1.0554E+02	4.4963E-10
4	2.0214E+00	-1.4001E+02	-1.1138E+02	-6.4094E+02
6	2.4384E+00	-1.2722E+02	-1.0662E+02	-8.5698E+02
8	4.2918E+00	-6.0635E+01	-8.0402E+01	-1.8808E+03
10	5.2434E+00	-3.8568E+01	-5.1727E+01	-2.5882E+03
12	5.3513E+00	-3.9809E+01	-1.4903E+01	-2.6902E+03
14	5.4158E+00	-4.1167E+01	-3.1111E+00	-2.7103E+03
16	5.4460E+00	-4.4086E+01	4.9707E+00	-2.7133E+03
18	5.4015E+00	-4.7755E+01	1.2807E+01	-2.6889E+03
20	5.2928E+00	-5.1966E+01	2.0731E+01	-2.6446E+03
22	5.1574E+00	-5.5285E+01	4.3401E+01	-2.5970E+03
24	4.9708E+00	-5.9921E+01	7.0084E+01	-2.4680E+03
26	3.7702E+00	-9.2962E+01	9.6008E+01	-1.7143E+03
28	1.7369E+00	-1.5111E+02	1.0175E+02	-7.0574E+02
30	1.2926E+00	-1.6073E+02	9.1924E+01	-5.1290E+02
32	-1.0552E+00	3.1006E+01	-8.2937E+01	-7.7571E-11

NODE DISPLACEMENT VELOCITY SHEAR MOMENT TIME= .0109615450 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.4833E+00	-1.2596E+02	-1.1008E+02	-4.5380E+02
5	2.2575E+00	-1.3289E+02	-1.1002E+02	-7.6346E+02
7	3.4763E+00	-9.0592E+01	-9.5790E+01	-1.4114E+03
9	4.8958E+00	-4.2795E+01	-6.3975E+01	-2.2747E+03
11	5.2686E+00	-3.8793E+01	-3.3010E+01	-2.6192E+03
13	5.3725E+00	-4.0140E+01	-7.4553E+00	-2.6992E+03
15	5.4403E+00	-4.2507E+01	1.1122E+00	-2.7150E+03
17	5.4331E+00	-4.5848E+01	9.0873E+00	-2.7026E+03
19	5.3514E+00	-4.9791E+01	1.6771E+01	-2.6697E+03
21	5.1960E+00	-5.4307E+01	2.7375E+01	-2.6135E+03
23	5.0129E+00	-5.8883E+01	5.9569E+01	-2.5037E+03
25	4.4902E+00	-7.2117E+01	8.3734E+01	-2.1246E+03
27	2.8572E+00	-1.2098E+02	1.0348E+02	-1.2438E+03
29	1.5436E+00	-1.5542E+02	9.6687E+01	-6.1925E+02
31	7.6649E-01	-1.3962E+02	8.2937E+01	-3.5663E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.9271E-01	1.6742E+01	-9.8532E+01	4.3675E-10
4	1.9555E+00	-1.2372E+02	-1.0917E+02	-6.0360E+02
6	2.3736E+00	-1.3129E+02	-1.1030E+02	-8.1821E+02
8	4.2408E+00	-1.4330E+02	-8.4780E+01	-1.8827E+03
10	5.2052E+00	-1.1609E+02	-5.4937E+01	-2.6305E+03
12	5.3144E+00	-1.0912E+02	-1.5854E+01	-2.7391E+03
14	5.3797E+00	-1.0464E+02	-3.2071E+00	-2.7605E+03
16	5.4100E+00	-1.0172E+02	5.5802E+00	-2.7632E+03
18	5.3642E+00	-1.0336E+02	1.4127E+01	-2.7364E+03
20	5.2428E+00	-1.0947E+02	2.2704E+01	-2.6876E+03
22	5.1149E+00	-1.1604E+02	4.6843E+01	-2.6356E+03
24	4.9246E+00	-1.2563E+02	7.4717E+01	-2.4966E+03
26	3.7076E+00	-1.5693E+02	9.9856E+01	-1.6977E+03
28	1.6640E+00	-1.3765E+02	1.0151E+02	-6.5752E+02
30	1.2205E+00	-1.2772E+02	8.6292E+01	-4.6895E+02
32	-1.0376E+00	3.9534E+01	-7.4944E+01	-7.7117E-11

NODE DISPLACEMENT VELOCITY SHEAR MOMENT TIME= .0114597970 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.4267E+00	-1.0020E+02	-1.0583E+02	-4.2369E+02
5	2.1922E+00	-1.2808E+02	-1.1121E+02	-7.2368E+02
7	3.4175E+00	-1.4437E+02	-1.0019E+02	-1.3918E+03
9	4.8524E+00	-1.3124E+02	-6.7841E+01	-2.2981E+03
11	5.2305E+00	-1.1451E+02	-3.5166E+01	-2.6635E+03
13	5.3359E+00	-1.0769E+02	-7.8880E+00	-2.7486E+03
15	5.4044E+00	-1.0263E+02	1.3655E+00	-2.7653E+03
17	5.3966E+00	-1.0196E+02	1.0057E+01	-2.7515E+03
19	5.3129E+00	-1.0588E+02	1.8430E+01	-2.7152E+03
21	5.1543E+00	-1.1403E+02	2.9801E+01	-2.6535E+03
23	4.9676E+00	-1.2349E+02	6.3762E+01	-2.5349E+03
25	4.4361E+00	-1.4418E+02	8.8325E+01	-2.1305E+03
27	2.7879E+00	-1.5580E+02	1.0595E+02	-1.2085E+03
29	1.4713E+00	-1.3342E+02	9.2986E+01	-5.7124E+02
31	7.0676E-01	-9.9331E+01	7.4944E+01	-3.2226E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.8323E-01	2.1301E+01	-9.5315E+01	4.2504E-10
4	1.8978E+00	-1.0938E+02	-1.0020E+02	-5.7710E+02
6	2.3084E+00	-1.2901E+02	-1.0313E+02	-7.7426E+02
8	4.1540E+00	-1.9769E+02	-9.2792E+01	-1.8006E+03
10	5.1278E+00	-1.9440E+02	-6.8055E+01	-2.6522E+03
12	5.2407E+00	-1.8874E+02	-2.4287E+01	-2.7950E+03
14	5.3085E+00	-1.8482E+02	-8.0766E+00	-2.8311E+03
16	5.3408E+00	-1.8135E+02	4.8453E+00	-2.8456E+03
18	5.2946E+00	-1.8093E+02	1.7774E+01	-2.8172E+03
20	5.1708E+00	-1.8351E+02	2.9895E+01	-2.7546E+03
22	5.0400E+00	-1.8674E+02	5.9517E+01	-2.6864E+03
24	4.8456E+00	-1.9147E+02	8.7987E+01	-2.5122E+03
26	3.6192E+00	-1.9072E+02	9.9528E+01	-1.6093E+03
28	1.6003E+00	-1.1751E+02	9.2256E+01	-6.0900E+02
30	1.1649E+00	-9.6899E+01	7.8297E+01	-4.3867E+02
32	-1.0159E+00	4.7456E+01	-7.1061E+01	-7.6200E-11

NODE DISPLACEMENT VELOCITY SHEAR MOMENT TIME= .0119580491 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.3822E+00	-8.1266E+01	-9.8382E+01	-4.0985E+02
5	2.1303E+00	-1.2053E+02	-1.0227E+02	-6.8732E+02
7	3.3367E+00	-1.7375E+02	-1.0001E+02	-1.3105E+03
9	4.7681E+00	-2.0229E+02	-8.1012E+01	-2.2553E+03
11	5.1540E+00	-1.9315E+02	-4.7406E+01	-2.6930E+03
13	5.2631E+00	-1.8754E+02	-1.4396E+01	-2.8095E+03
15	5.3345E+00	-1.8273E+02	-1.5374E+00	-2.8432E+03
17	5.3275E+00	-1.8074E+02	1.1550E+01	-2.8346E+03
19	5.2423E+00	-1.8187E+02	2.4018E+01	-2.7906E+03
21	5.0803E+00	-1.8574E+02	3.8846E+01	-2.7097E+03
23	4.8894E+00	-1.9043E+02	7.7113E+01	-2.5584E+03
25	4.3498E+00	-1.9745E+02	9.6283E+01	-2.0810E+03
27	2.7065E+00	-1.6464E+02	9.8570E+01	-1.1216E+03
29	1.4111E+00	-1.0860E+02	8.3561E+01	-5.3058E+02
31	6.6611E-01	-6.6523E+01	7.1061E+01	-3.0556E+02

NODE DISPLACEMENT VELOCITY SHEAR MOMENT

NODE DISPLACEMENT VELOCITY SHEAR MOMENT TIME= .0124563011 SEC

2	-4.7151E-01	2.5704E+01	-9.2813E+01	4.1373E-10	3	1.3432E+00	-7.6236E+01	-9.3559E+01	-3.9910E+02
4	1.8451E+00	-1.0314E+02	-9.4451E+01	-5.5815E+02	5	2.0718E+00	-1.1472E+02	-9.6224E+01	-6.6204E+02
6	2.2456E+00	-1.2359E+02	-9.7709E+01	-7.4383E+02	7	3.2492E+00	-1.7500E+02	-9.7950E+01	-1.2519E+03
8	4.0500E+00	-2.1706E+02	-9.4784E+01	-1.7319E+03	9	4.6548E+00	-2.5026E+02	-8.5712E+01	-2.1963E+03
10	5.0119E+00	-2.7094E+02	-7.3007E+01	-2.6163E+03	11	5.0379E+00	-2.7251E+02	-5.2383E+01	-2.6601E+03
12	5.1246E+00	-2.7775E+02	-2.7956E+01	-2.7727E+03	13	5.1470E+00	-2.7911E+02	-1.7366E+01	-2.7895E+03
14	5.1925E+00	-2.8188E+02	-1.0408E+01	-2.8156E+03	15	5.2187E+00	-2.8350E+02	-3.0798E+00	-2.8312E+03
16	5.2253E+00	-2.8394E+02	4.1880E+00	-2.8358E+03	17	5.2123E+00	-2.8321E+02	1.1801E+01	-2.8257E+03
18	5.1799E+00	-2.8132E+02	1.8906E+01	-2.8080E+03	19	5.1280E+00	-2.7829E+02	2.5935E+01	-2.7796E+03
20	5.0571E+00	-2.7415E+02	3.2448E+01	-2.7407E+03	21	4.9672E+00	-2.6893E+02	4.2105E+01	-2.6920E+03
22	4.9272E+00	-2.6662E+02	6.4113E+01	-2.6668E+03	23	4.7777E+00	-2.5799E+02	8.1764E+01	-2.5289E+03
24	4.7341E+00	-2.5549E+02	9.2449E+01	-2.4799E+03	25	4.2433E+00	-2.2839E+02	9.8270E+01	-2.0269E+03
26	3.5234E+00	-1.9104E+02	9.7812E+01	-1.5454E+03	27	2.6285E+00	-1.4671E+02	9.3775E+01	-1.0661E+03
28	1.5475E+00	-9.4208E+01	8.6753E+01	-5.7845E+02	29	1.3628E+00	-8.5217E+01	7.8139E+01	-5.0471E+02
30	1.1226E+00	-7.3494E+01	7.3597E+01	-4.1875E+02	31	6.3819E-01	-4.6571E+01	6.8288E+01	-2.9364E+02
32	-9.9033E-01	5.5036E+01	-6.8288E+01	-7.4533E-11					

TIME= .0129545532 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT	NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.5764E-01	2.9959E+01	-8.9703E+01	4.0237E-10	3	1.3067E+00	-6.8348E+01	-9.3673E+01	-3.8572E+02
4	1.7954E+00	-9.5414E+01	-9.5912E+01	-5.4497E+02	5	2.0160E+00	-1.0882E+02	-9.8311E+01	-6.5047E+02
6	2.1853E+00	-1.1915E+02	-9.9147E+01	-7.3403E+02	7	3.1612E+00	-1.8250E+02	-9.5138E+01	-1.2496E+03
8	3.9364E+00	-2.4332E+02	-8.6991E+01	-1.7158E+03	9	4.5182E+00	-3.0104E+02	-7.5031E+01	-2.1420E+03
10	4.8584E+00	-3.4422E+02	-6.2816E+01	-2.5097E+03	11	4.8831E+00	-3.4794E+02	-4.3476E+01	-2.5474E+03
12	4.9650E+00	-3.6051E+02	-2.2268E+01	-2.6409E+03	13	4.9861E+00	-3.6380E+02	-1.3241E+01	-2.6542E+03
14	5.0291E+00	-3.7072E+02	-7.5365E+00	-2.6741E+03	15	5.0536E+00	-3.7510E+02	-1.6700E+00	-2.6854E+03
16	5.0596E+00	-3.7686E+02	4.0252E+00	-2.6879E+03	17	5.0470E+00	-3.7596E+02	1.0028E+01	-2.6791E+03
18	5.0159E+00	-3.7241E+02	1.5603E+01	-2.6640E+03	19	4.9665E+00	-3.6625E+02	2.1249E+01	-2.6406E+03
20	4.8989E+00	-3.5760E+02	2.6621E+01	-2.6088E+03	21	4.8132E+00	-3.4656E+02	3.4934E+01	-2.5688E+03
22	4.7752E+00	-3.4167E+02	5.4279E+01	-2.5479E+03	23	4.6327E+00	-3.2342E+02	7.1275E+01	-2.4312E+03
24	4.5912E+00	-3.1814E+02	8.1887E+01	-2.3884E+03	25	4.1213E+00	-2.6435E+02	9.1061E+01	-1.9872E+03
26	3.4272E+00	-2.0003E+02	9.5821E+01	-1.5410E+03	27	2.5591E+00	-1.3596E+02	9.6054E+01	-1.0714E+03
28	1.5062E+00	-7.1742E+01	8.9547E+01	-5.7195E+02	29	1.3262E+00	-6.1419E+01	8.0128E+01	-4.9584E+02
30	1.0920E+00	-4.8047E+01	7.4132E+01	-4.0769E+02	31	6.2034E-01	-2.3127E+01	6.5504E+01	-2.8167E+02
32	-9.6108E-01	6.2306E+01	-6.5504E+01	-7.2023E-11					

TIME= .0134528052 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT	NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.4168E-01	3.4096E+01	-8.8109E+01	3.9152E-10	3	1.2771E+00	-4.9260E+01	-9.4507E+01	-3.7887E+02
4	1.7511E+00	-8.2026E+01	-9.7456E+01	-5.3953E+02	5	1.9634E+00	-1.0298E+02	-9.9340E+01	-6.4673E+02
6	2.1261E+00	-1.1917E+02	-9.8640E+01	-7.3117E+02	7	3.0627E+00	-2.1638E+02	-8.9932E+01	-1.2441E+03
8	3.8020E+00	-3.0036E+02	-7.6578E+01	-1.6848E+03	9	4.3518E+00	-3.6897E+02	-6.1794E+01	-2.0600E+03
10	4.6696E+00	-4.1267E+02	-5.0379E+01	-2.3628E+03	11	4.6924E+00	-4.1603E+02	-3.2850E+01	-2.3930E+03
12	4.7681E+00	-4.2724E+02	-1.5576E+01	-2.4636E+03	13	4.7876E+00	-4.3014E+02	-8.4321E+00	-2.4730E+03
14	4.8272E+00	-4.3607E+02	-4.2042E+00	-2.4856E+03	15	4.8496E+00	-4.3953E+02	-4.4607E-02	-2.4919E+03
16	4.8548E+00	-4.4048E+02	3.8208E+00	-2.4920E+03	17	4.8429E+00	-4.3891E+02	7.9454E+00	-2.4844E+03
18	4.8138E+00	-4.3484E+02	1.1728E+01	-2.4725E+03	19	4.7676E+00	-4.2829E+02	1.5735E+01	-2.4549E+03
20	4.7045E+00	-4.1933E+02	1.9730E+01	-2.4313E+03	21	4.6246E+00	-4.0802E+02	2.6367E+01	-2.4017E+03
22	4.5891E+00	-4.0301E+02	4.2308E+01	-2.3859E+03	23	4.4562E+00	-3.8432E+02	5.8128E+01	-2.2949E+03
24	4.4174E+00	-3.7889E+02	6.8369E+01	-2.2600E+03	25	3.9763E+00	-3.2050E+02	8.0979E+01	-1.9250E+03
26	3.3183E+00	-2.4185E+02	9.1462E+01	-1.5282E+03	27	2.4882E+00	-1.5250E+02	9.6706E+01	-1.0801E+03
28	1.4752E+00	-5.3790E+01	9.1778E+01	-5.7719E+02	29	1.3017E+00	-3.7641E+01	8.2839E+01	-4.9918E+02
30	1.0758E+00	-1.6778E+01	7.6052E+01	-4.0805E+02	31	6.1718E-01	1.1650E+01	6.4829E+01	-2.7877E+02
32	-9.2827E-01	6.9380E+01	-6.4829E+01	-6.8935E-11					

TIME= .0139510572 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT	NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.2366E-01	3.8221E+01	-8.9712E+01	3.8133E-10	3	1.2569E+00	-3.4458E+01	-9.2183E+01	-3.8576E+02
4	1.7127E+00	-7.4315E+01	-9.2659E+01	-5.4247E+02	5	1.9124E+00	-1.0322E+02	-9.1128E+01	-6.4440E+02
6	2.0655E+00	-1.2555E+02	-8.8407E+01	-7.2186E+02	7	2.9444E+00	-2.5730E+02	-8.0970E+01	-1.1816E+03
8	3.6364E+00	-3.6196E+02	-7.0134E+01	-1.5783E+03	9	4.1506E+00	-4.3602E+02	-5.7777E+01	-1.9220E+03
10	4.4483E+00	-4.7406E+02	-4.7598E+01	-2.2051E+03	11	4.4698E+00	-4.7642E+02	-3.1831E+01	-2.2337E+03
12	4.5409E+00	-4.8401E+02	-1.5785E+01	-2.3021E+03	13	4.5593E+00	-4.8593E+02	-9.0884E+00	-2.3116E+03
14	4.5965E+00	-4.8959E+02	-5.0390E+00	-2.3252E+03	15	4.6177E+00	-4.9121E+02	-9.8844E-01	-2.3328E+03
16	4.6229E+00	-4.9084E+02	2.8277E+00	-2.3342E+03	17	4.6119E+00	-4.8853E+02	6.9040E+00	-2.3285E+03
18	4.5848E+00	-4.8432E+02	1.0654E+01	-2.3181E+03	19	4.5418E+00	-4.7821E+02	1.4584E+01	-2.3021E+03

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
20	4.4829E+00	-4.7021E+02	1.8452E+01	-2.2802E+03
22	4.3750E+00	-4.5592E+02	3.9790E+01	-2.2377E+03
24	4.2144E+00	-4.3477E+02	6.3586E+01	-2.1196E+03
26	3.1848E+00	-2.9189E+02	8.3058E+01	-1.4436E+03
28	1.4514E+00	-4.3123E+01	8.5054E+01	-5.8088E+02
30	1.0744E+00	8.7464E+00	7.5479E+01	-4.2084E+02
32	-8.9192E-01	7.6591E+01	-6.8030E+01	-6.5526E-11

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
21	4.4087E+00	-4.6030E+02	2.4760E+01	-2.2526E+03
23	4.2507E+00	-4.3955E+02	5.4281E+01	-2.1522E+03
25	3.8015E+00	-3.7904E+02	7.4367E+01	-1.8080E+03
27	2.4054E+00	-1.7892E+02	8.7646E+01	-1.0366E+03
29	1.2876E+00	-2.0484E+01	7.9770E+01	-5.0859E+02
31	6.3134E-01	4.2611E+01	6.8030E+01	-2.9253E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-4.0358E-01	4.2420E+01	-9.2756E+01	3.7061E-10
4	1.6739E+00	-8.4429E+01	-8.4794E+01	-5.4900E+02
6	1.9998E+00	-1.3937E+02	-7.3288E+01	-7.0889E+02
8	3.4462E+00	-3.9618E+02	-6.5049E+01	-1.4320E+03
10	4.1987E+00	-5.2615E+02	-4.9011E+01	-2.0332E+03
12	4.2860E+00	-5.3917E+02	-1.9179E+01	-2.1382E+03
14	4.3386E+00	-5.4669E+02	-7.8533E+00	-2.1681E+03
16	4.3642E+00	-5.4926E+02	1.4205E+00	-2.1847E+03
18	4.3294E+00	-5.4215E+02	1.0874E+01	-2.1722E+03
20	4.2350E+00	-5.2556E+02	1.9825E+01	-2.1327E+03
22	4.1347E+00	-5.0848E+02	4.1772E+01	-2.0871E+03
24	3.9854E+00	-4.8316E+02	6.2882E+01	-1.9644E+03
26	3.0318E+00	-3.1741E+02	7.2088E+01	-1.3176E+03
28	1.4307E+00	-4.1523E+01	7.3336E+01	-5.8443E+02
30	1.0812E+00	1.5235E+01	7.3621E+01	-4.4117E+02
32	-8.5187E-01	8.4251E+01	-7.3492E+01	-6.1794E-11

TIME= .0144493093 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.2391E+00	-4.1097E+01	-8.8324E+01	-3.9885E+02
5	1.8585E+00	-1.1542E+02	-7.8374E+01	-6.4227E+02
7	2.8093E+00	-2.8130E+02	-6.9799E+01	-1.0900E+03
9	3.9212E+00	-4.8030E+02	-5.7650E+01	-1.7507E+03
11	4.2190E+00	-5.2920E+02	-3.5132E+01	-2.0626E+03
13	4.3033E+00	-5.4170E+02	-1.2308E+01	-2.1497E+03
15	4.3589E+00	-5.4920E+02	-3.1781E+00	-2.1799E+03
17	4.3544E+00	-5.4690E+02	6.3135E+00	-2.1817E+03
19	4.2897E+00	-5.3504E+02	1.5479E+01	-2.1559E+03
21	4.1656E+00	-5.1372E+02	2.6455E+01	-2.1030E+03
23	4.0191E+00	-4.8888E+02	5.4818E+01	-1.9973E+03
25	3.6021E+00	-4.1740E+02	6.9114E+01	-1.6563E+03
27	2.3125E+00	-1.9097E+02	7.3065E+01	-9.6437E+02
29	1.2790E+00	-1.6744E+01	7.3566E+01	-5.2209E+02
31	6.5582E-01	5.1379E+01	7.3492E+01	-3.1602E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-3.8138E-01	4.6673E+01	-9.4195E+01	3.5769E-10
4	1.6259E+00	-1.1018E+02	-8.0573E+01	-5.5199E+02
6	1.9752E+00	-1.6127E+02	-6.2847E+01	-7.0052E+02
8	3.2449E+00	-4.1142E+02	-5.5559E+01	-1.3178E+03
10	3.9256E+00	-5.6874E+02	-4.2548E+01	-1.8339E+03
12	4.0044E+00	-5.8970E+02	-1.7106E+01	-1.9258E+03
14	4.0519E+00	-6.0252E+02	-7.2522E+00	-1.9528E+03
16	4.0751E+00	-6.0936E+02	9.5752E-01	-1.9683E+03
18	4.0441E+00	-6.0199E+02	9.3730E+00	-1.9584E+03
20	3.9591E+00	-5.8050E+02	1.7290E+01	-1.9241E+03
22	3.8688E+00	-5.5755E+02	3.6380E+01	-1.8844E+03
24	3.7343E+00	-5.2344E+02	5.4274E+01	-1.7777E+03
26	2.8716E+00	-3.7528E+02	6.1272E+01	-1.2221E+03
28	1.4083E+00	-5.0276E+01	6.6231E+01	-5.9603E+02
30	1.0865E+00	3.4729E+00	7.4092E+01	-4.6150E+02
32	-8.0788E-01	9.2384E+01	-7.8033E+01	-5.7665E-11

TIME= .0149475613 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.2129E+00	-6.5536E+01	-8.6442E+01	-4.0504E+02
5	1.7955E+00	-1.3900E+02	-7.0476E+01	-6.4062E+02
7	2.6658E+00	-2.9520E+02	-5.9270E+01	-1.0273E+03
9	3.6750E+00	-5.0704E+02	-4.9777E+01	-1.5900E+03
11	3.9439E+00	-5.7357E+02	-3.0851E+01	-1.8594E+03
13	4.0200E+00	-5.9388E+02	-1.1154E+01	-1.9360E+03
15	4.0703E+00	-6.0771E+02	-3.1221E+00	-1.9636E+03
17	4.0664E+00	-6.0746E+02	5.3156E+00	-1.9664E+03
19	4.0083E+00	-5.9299E+02	1.3459E+01	-1.9443E+03
21	3.8966E+00	-5.6461E+02	2.3077E+01	-1.8982E+03
23	3.7647E+00	-5.3113E+02	4.7469E+01	-1.8062E+03
25	3.3883E+00	-4.3969E+02	5.9100E+01	-1.5117E+03
27	2.2167E+00	-1.9447E+02	6.2668E+01	-9.2191E+02
29	1.2686E+00	-2.6804E+01	7.1126E+01	-5.3974E+02
31	6.7908E-01	3.9898E+01	7.8033E+01	-3.3554E+02

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
2	-3.5707E-01	5.0886E+01	-9.3225E+01	3.4172E-10
4	1.5634E+00	-1.4064E+02	-8.0185E+01	-5.4765E+02
6	1.8378E+00	-1.9104E+02	-5.8112E+01	-6.9378E+02
8	3.0339E+00	-4.3930E+02	-4.2038E+01	-1.2419E+03
10	3.6333E+00	-6.0351E+02	-2.8040E+01	-1.6151E+03
12	3.7007E+00	-6.2655E+02	-9.2237E+00	-1.6720E+03
14	3.7412E+00	-6.4076E+02	-2.9530E+00	-1.6855E+03
16	3.7605E+00	-6.4861E+02	1.5711E+00	-1.6908E+03
18	3.7333E+00	-6.4093E+02	6.0884E+00	-1.6817E+03
20	3.6594E+00	-6.1777E+02	1.0620E+01	-1.6600E+03
22	3.5815E+00	-5.9292E+02	2.3190E+01	-1.6355E+03
24	3.4651E+00	-5.5602E+02	3.7476E+01	-1.5665E+03
26	2.7651E+00	-3.4736E+02	5.1459E+01	-1.1648E+03
28	1.3788E+00	-7.0020E+01	6.4734E+01	-6.1229E+02
30	1.0834E+00	-1.6273E+01	7.6749E+01	-4.7717E+02
32	-7.5977E-01	1.0079E+02	-8.0626E+01	-5.3226E-11

TIME= .0154458134 SEC

NODE	DISPLACEMENT	VELOCITY	SHEAR	MOMENT
3	1.1736E+00	-9.1891E+01	-8.6339E+01	-4.0087E+02
5	1.7189E+00	-1.6909E+02	-6.8154E+01	-6.3585E+02
7	2.5127E+00	-3.2306E+02	-5.0191E+01	-9.9596E+02
9	3.4152E+00	-5.3769E+02	-3.4127E+01	-1.4479E+03
11	3.6489E+00	-6.0881E+02	-1.8650E+01	-1.6319E+03
13	3.7140E+00	-6.3117E+02	-5.3023E+00	-1.6776E+03
15	3.7567E+00	-6.4660E+02	-6.0303E-01	-1.6899E+03
17	3.7527E+00	-6.4673E+02	3.9474E+00	-1.6876E+03
19	3.7022E+00	-6.3126E+02	8.3707E+00	-1.6726E+03
21	3.6055E+00	-6.0057E+02	1.4326E+01	-1.6441E+03
23	3.4914E+00	-5.6433E+02	3.1873E+01	-1.5857E+03
25	3.1631E+00	-4.6655E+02	4.4510E+01	-1.3829E+03
27	2.1158E+00	-2.1438E+02	5.7762E+01	-9.1265E+02
29	1.2507E+00	-4.6559E+01	7.2815E+01	-5.5726E+02
31	6.9487E-01	2.3675E+01	8.0626E+01	-3.4669E+02

C. 1. 3. 5 Comparisonof Eight Bay 70 Ft. and Six Bay 30 Ft. Antennas - The analysis has been applied to six and eight-bay 30 foot and eight bay 70 foot configurations. Comparisons are shown in Figures C-7 and C-8 for the six bay 30 ft. antenna, run 051, November 13, 1968, and the eight bay 70 ft. antenna, run 041, August 21, 1968.

The link hinge velocity data (outermost eight bay radial link is No. 58)shows a considerable difference in total energy, largely because there are 153 springs in the six bay and 276 springs in the eight bay. Nominal kinetic energy design points are shown, being 160 and 1000 ft. lbs., and the values of velocity for the two antenna lie with a factor of two. Spider deceleration data similarly shows the energy for the two configurations is quite different but the operational values of deceleration are comparable.

Spider loads are dependent on spider weights. The user can input spider weight data for any or all of the 109 spiders, and loads are calculated only for those for which weight is input.

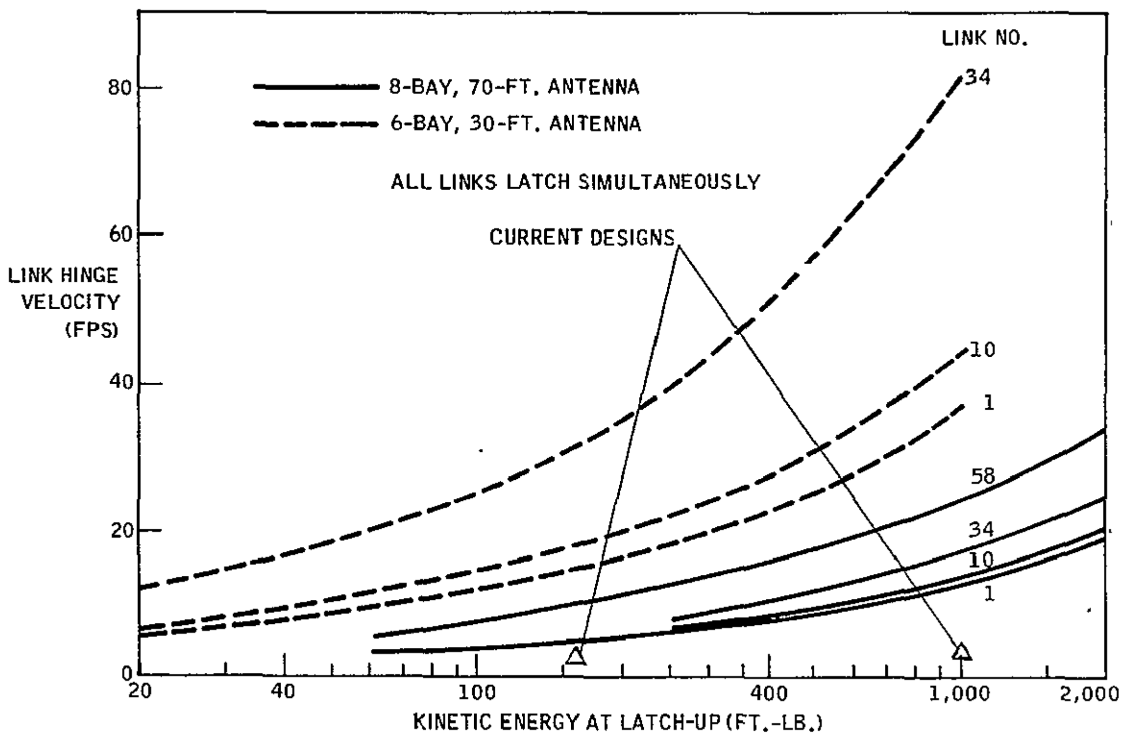


Figure C-7. Link Hinge Velocity at Latch up VS Energy

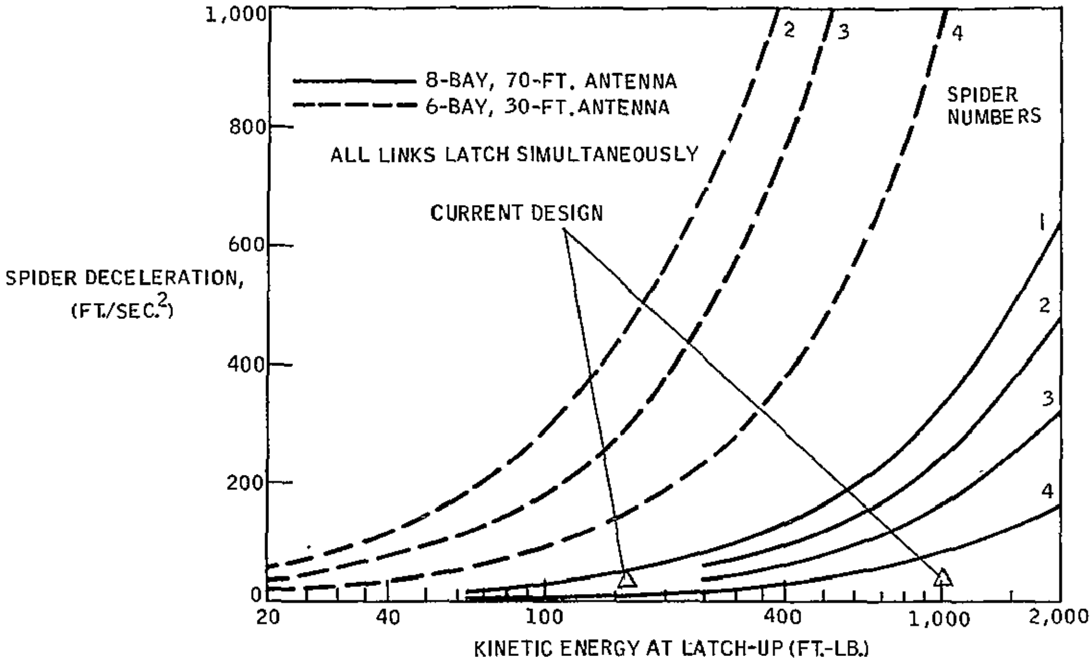


Figure C-8. Spider Deceleration at Latch up VS Energy

C.1.3.6 Additional Eight Bay 70 ft. Antenna Results - The structural analysis for deploying structures program computes time histories for the physical behavior (displacement, velocity, bending moment, and shear) of any selected member. Program results are illustrated in Figure C-9 by showing the time history of stress (obtained from bending moment) at the link center.

Results from the program are obtained for each node in the structural model of the link, as a function of time. Consequently, data is available as a function of link location for each time slice. This is shown in Figure C-10 for shear and bending moment. The mass spring structural model of the link is not completely symmetrical and a limited number (12) of the nodes were used. This is observable on the chart, particularly for stress.

The latch up analysis identifies two major load sources, due to spider deceleration and link hinge impact. Comparison of the resulting maximum link stresses is shown on Figure C-11. Link 1 is in the test tetrahedron. Because link 1 is near the center of the reflector, it experiences near-minimum loads due to hinge impact and maximum loads due to spider acceleration during deployment. Link 58, located near the reflector rim, experiences the maximum hinge impact load. Results show that stress levels are higher for hinge impact than for spider acceleration loads. This is usually the case for configurations which do not carry any reflector mounted equipment.

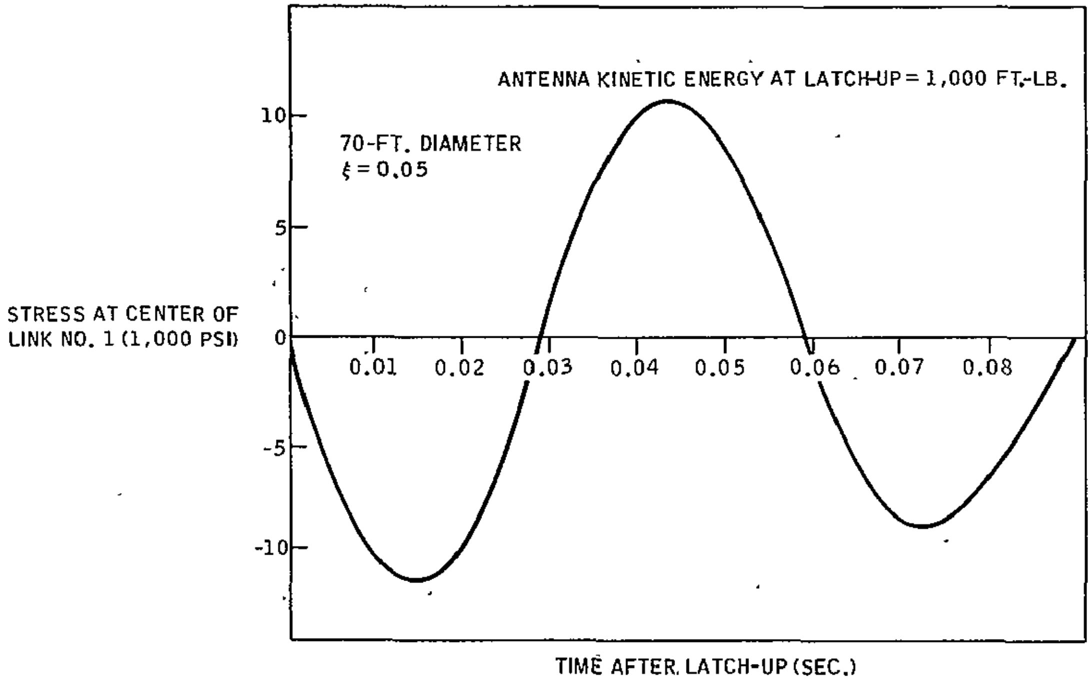


Figure C-9. Link Hinge Impact Stress VS Time

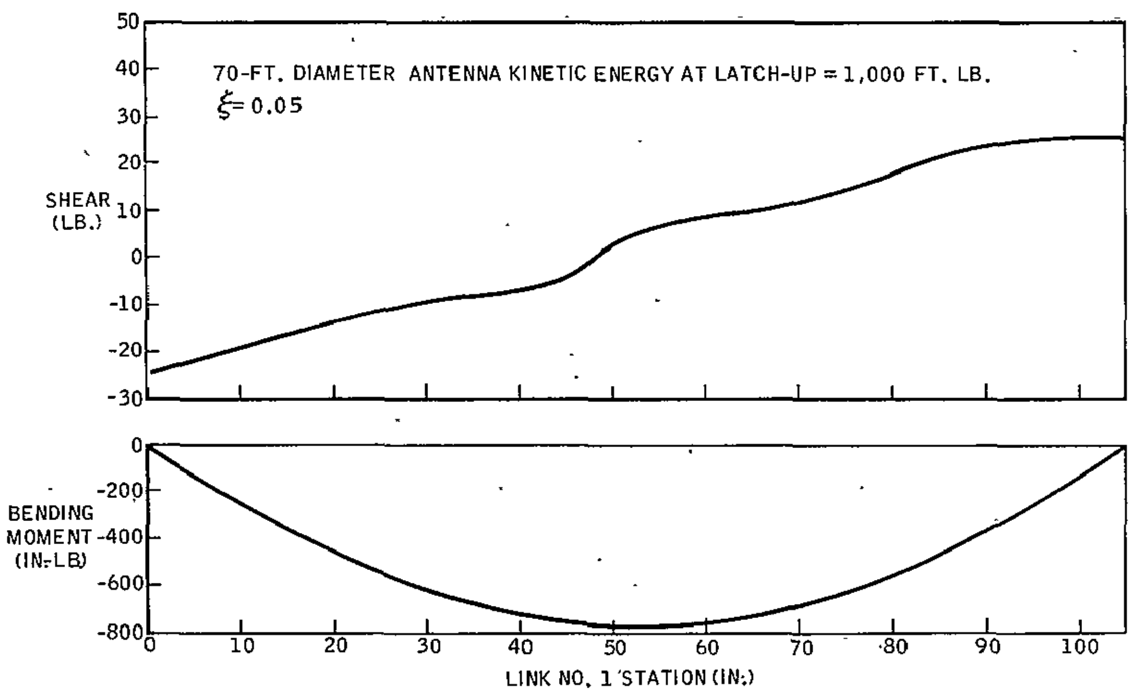


Figure C-10. Link Hinge Impact Shear & Bending Moment, Link No. 1 at 0.0117 Sec. After Latch Up.

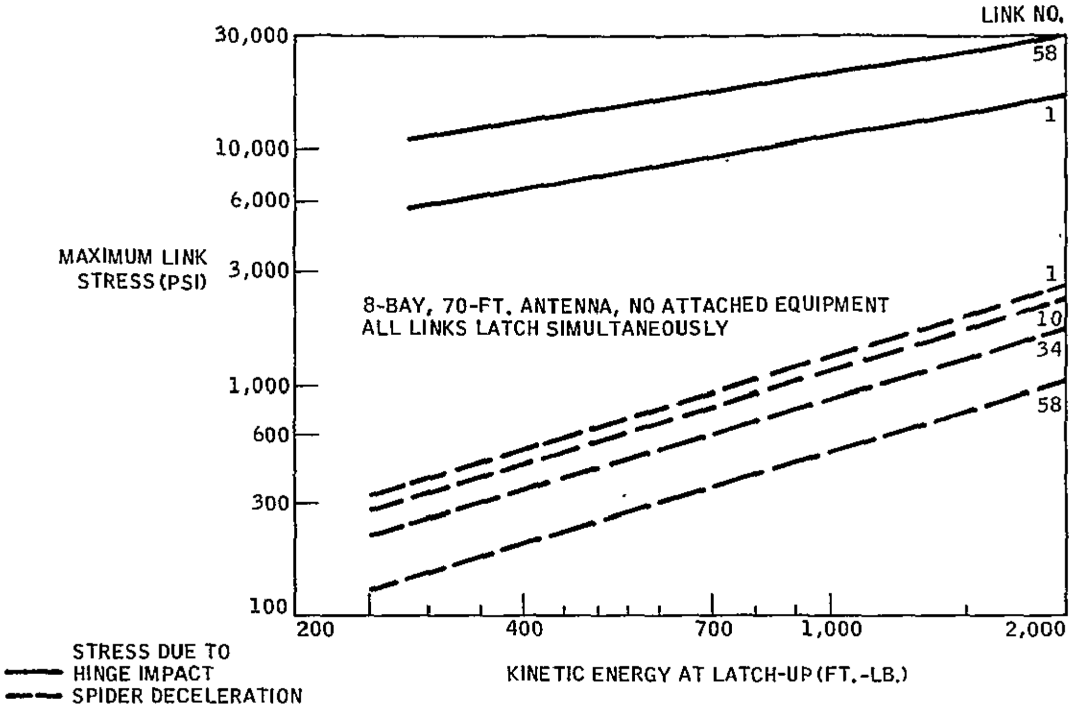


Figure C-11. Link Stress at Latch up VS. Energy

C.1.3.7 Comparison of Spider Deceleration Loads and Link Impact Loads - (Sample Calculation for 100 ft. lb. Kinetic Energy using Figures in Section 3.1.1.3)

Previous experience has shown that the link loads dominate the spider deceleration loads for configurations having no equipment (solar panels, ACS pods) attached to the antenna reflector.

Thisis illustrated by the following example, in which both loads are computed for the arbitrary latch up energy value of 100 ft.-lb.

Spider loads are given a figure as 40 pounds for 100 ft. llb. of energy for the all-link-latch-together case, and 24 pounds for 50 ft. lb. for the outer-front-links-latch last case (assuming half of total energy). Using 35 pounds for the maximum spider load the spider stress is

$$\sigma_{spider_{max}} = \frac{35}{\pi \times 1.5 \times 0.010} = 743 \text{ psi}$$

The first step in obtaining the link impact loads is to get the impact velocity for 100 ft.-lb. of antenna energy from a figure. The all-link-latch-together case predicts 25.5 fps and the outer-front-links-only case predicts 27.5 fps (for 50 ft.-lb.). The impact velocity is taken to be 26.5 fps.

The bending moment associated with a link 34 impact velocity of 100 fps is shown in a Figure to be 2, 650 lb-in. at stations $\pm$ 9. 35 inches. This is the maximum for the 1. 5 inch-diameter, 0. 010 inch wall titanium tube, which is the weakest link component.

The bending moment for 26. 5 fps impact velocity is then

$$M = \frac{26.5}{100} \times 2650 = 705 \text{ in-lb.}$$

The stress due to link impact is then

$$\sigma_{\text{link impact}_{max}} = \frac{M}{\pi R^2 t} = \frac{705}{3.14 \times (0.75)^2 \times 0.010} = 40,000 \text{ psi}$$

Even though acceptable stress levels for longitudinal tension and compression (the spider deceleration induced loads) are smaller than acceptable stress levels for tension and compression due to bending moment induced loads (link hinge impact induced loads), it is clear that link impact dominated the loads.

C. 1. 3. 8 <u>Calculations for the Spring Design of Section 3. 1. 1. 3.</u> (Using Figures from That Section)

a. First, $(AKE_L)_{max}$ is determined, using data from Figures. Maximum loads for this configuration are obtained knowing that link hinge impact is the major load and that the weakest portion of the link is the titanium tube (1.5 inches in diameter, with a 0. 010 inch wall).

The allowable tube stress for bending is 50, 000 psi. A safety factor of 1.25 is used, decreasing the allowable stress to 40, 000 psi.

Maximum acceptable bending moment, M, is calculated from

$$\sigma = \frac{Mc}{I} = \frac{MR}{\pi Rt\, R^2} = \frac{M}{\pi R^2 t}$$

σ = Stress, psi

R = Tube radius, inches

t = Tube wall thickness, inches

$$M = 40,000 \times 3.14 \times (0.75)^2 \times 0.01 = 705 \text{ inch lb.}$$

The bending moment associated with a link 34 impact velocity of 100 fps is shown in a Figure to be 2, 65.0 lb-in. at station $\pm$ 9. 35 in. (tube end).

Maximum acceptable link impact velocity is thus

$$\text{Velocity} = \frac{705}{2,650} \; 100 = 26.5 \text{ fps}$$

The value of $(AKE_L)_{max}$ is obtained from the Figure of velocity against energy. In using this figure it is assumed that the energy residual in the outer front links is half that for the complete antenna.

The outer front links only curve for link 34 has 43 ft. lb. at energy for 26. 5 fps; that is, the outer links case predicts antenna energy of 86 ft. lb. The all links latch together curve for link 34 predicts 105 ft. lb. These two cases bound the antenna energy, which is taken to be 95 ft. lb. as a reasonable value.

b. Next, the hinge spring torque is sized, using the relations of Section 3. 1. 1. 1.

$$(PE_{Springs})_{min} = 123 \text{ ft.-lb. (Appendix C. 1. 1)}$$

$$123 < (PE_{Springs}) < 123 + 95 = 218$$

The value 160 ft.-lb. is selected as providing sufficient energy to deploy the antenna while safety avoiding damaging loads.

Then, the average torque per spring for N_S springs is, noting $\Delta\theta = \pi$

$$\tau = \frac{PE_{Springs}}{\Delta\theta \; N_s} = \frac{160}{\pi 153} = 0.333 \; \frac{\text{ft.-lb.}}{\text{radian}}$$

The corresponding energy supplied to the antenna by each spring is 1. 04 ft. lb.

The corresponding energy minimum and maximum per spring is 0. 80 and 1. 42 ft. lb.

C. 2 REFLECTOR TIME HISTORY SIMULATION

C. 2. 1 ANALYSIS AND DIGITAL SIMULATION

C. 2. 1. 1 Analysis Assumptions - The major analysis assumption is that the reflector deploys in a radially symmetric manner with one degree of freedom. This constrains spider motion to a specific deployment geometry. Spiders are treated as point masses. The single degree of freedom is the ratio of spider instantaneous to fully deployed radial displacement. Spider X and Y components are determined by this ratio. Spider Z component is computed from X, Y, Z location of an adjacent spider on opposite surface and the diagonal link length, s. First spider computation uses spider 5 as the adjacent spider; it does not move in X, Y, Z coordinate system.

The spider motion constraint is fundamental to the simulation; spider locations are the first computation for a deployment step, and all other calculations utilize its values. It is the major assumption of deployment analysis and the most difficult to change in the simulation.

Reasons and justifications for this assumption follow. Practical considerations of manufacturing, reliability and spider geometry make it necessary that each of the spider joints act as limited action universal joints. This type of joint adds hundreds of additional degrees of freedom to the mathematical description. Although it is quite feasible to write the equations, it is not practical to attempt solution of such an extensive system of simultaneous, non-linear, differential equations.

In order to formulate a description of the antenna structure which is amenable to analysis some simplifications were made:

a. All spiders will have zero dimension, i.e. all of the up to nine end joints will rotate about a common point.

b. During deployment all spiders will be constrained to move in a radially proportional manner.

The consequence is to reduce the number of rigid degrees of freedom (excluding the six body degrees of freedom) from hundreds to one. This is equiavalent to saying that the specification of one coordinate of any one element fixes the positions of all other elements.

Justification is found in the many observations of model deployments, both static and dynamic. These observations have shown that the deploying positions of the many elements are not greatly different from one trial to the next. The above assumptions will force the structure to deploy in a nominal manner for which a kinematic solution can be obtained.

Each hinged link is assumed to be in the vertical plane containing its end spiders. This closely approximates actual motion and introduces no significant errors. Diagonal (unhinged) links are exactly in such vertical planes.

A single table describes each of spring, friction and mesh torques as functions of link angles. This represents those physical quantities averaged across reflector links possessing them. (Back links have no mesh, e.g.) Since they are used to compute reflector total energy, little error is introduced.

Note that these torques do actually vary from average, mesh torque on outer links will be less than on inner ones, for example. Since springs have been the same strength for all hinges in reflector designs, the average spring torque curve is a good approximation.

Separate torque tables could be prepared and used for different link groups. Usefulness is influenced by the basic spider geometry constraint. Consider increasing the spring torque in the central hexagon hinges. Simulation implimentation would be simple. However, it would be anticipated that the hexagon would actually expand faster than the rest of the reflector. This would not be observed in the simulation. The increased total energy would be distributed among all components, not just those of the central bay.

A more individualistic representation of these torques thus results in more accurate total energy computation. Variations in relative component velocities which would occur in practice due to component torque differences would not be observed.

Spider weights are exact because separate values can be input for each spider. This simulation features is necessary to compute loads with attached equipment of arbitrary weights and spider locations.

Link and link hinge mass and inertia are subject to two approximations. One is representing each link as having constant linear density plus a hinge mass. This results in approximations for both mass and inertia. Improved representation could readily be introduced, if necessary. Secondly, links and hinge structure, including springs, are assumed constant for all front, all diagonal, and all back links. Present designs contain this constant link relationship; future designs may not, because link wall thickness is sized by latch up loads. Since loads vary across the reflector, weight optimization by decreasing wall thickness on low load links is foreseen.

The simulation could readily be programmed for wall variations. Results would be similar to those for spring changes. Total energy would be affected by the varied link walls, and relative velocities for linkswith different walls would not.

A possibility exists within the analysis approach and simulation implementation to examine independent component motions. The six front corner spiders are relatively independent of adjacent spiders. Each is connected to three front spiders by hinged links and to one back spider by a diagonal link. A corner spider's motion can therefore be faster or slower than reflector deployment, without changing any other spider motion.

Potential thus exists to examine two dominant failure modes; going so much faster than nominal that damage occurs at latch up and going so much slower that latch up does not occur.

This discussion has examined the basic assumptions of the analysis and simulation. Accuracy of simulation solution is discussed in Section 3. 1. 2. 3 and Appendix C. 2. 3.

C. 2. 1. 2 Simulation Description - Digital program P5234 simulates deployment time history of the antenna reflector and/or a central tetrahedron. Multiple case capability exists and considerable logic is utilized to avoid unnecessary calculations. This logic provides major cost savings on successive cases. When weight and mass data is not changed (IMASSCH $\leqslant$ ZERO) link masses and inertias need not be recomputed. When there are no changes in either geometry or weight and mass data, the complex computation of relative velocities and generalized masses can be avoided, for example.

Subroutines and their functions are listed in Table C.2. The driver (DEPLØYT) is examined in detail below, and subroutines are summarized here. DATA contains the varied spider and link identification. Since blank common can not be prestored, considerable core is required. A clear definition of the reflector numbering scheme is desirable for interpreting output data and essential for programming improvements (or checking simulation validity). Accordingly Appendix C. 2. 1. 4 describes "Spider and Link Identification". AGØDATI reads and prints the geometry data from the AGO program.

NAMIN reads input data from five name lists and initializes the reflector and the tetrahedron in the packaged configuration.

Name list FIRST contains logic flags, time initial conditions, and variables controlling deployment steps. The deployment increment (step size) is one value until mesh torque becomes effective at about 160 degrees hinge angle. Step size is then sharply decreases as the mesh is stretched. Final step size is controlled to be the same as the perturbation of the latch up analysis. This is shown in Figure C. 12. The RFACT value at which the mesh torque becomes non zero, RFACTMS, is found by searching the mesh torque table for the first non zero torque hinge angle increment. Then the corresponding RFACT is computed. DELRFA1 does not correspond to an integer number of steps up to RFACTMS, in general. The last step up to RFACTMS is usually less than DELRFA1. RFACTNL is RFACT at beginning of final step; nominally .99994. RFACTEX is RFACT at final step end; ideally one. IF one is input, simulation will blow because the argument of an arcsine in the hinge angle calculation of NODHING will slightly exceed one. Use RFACTNL = .999 999 9. IRFACT is an indicator for deployment phase. KRFACT is step index, being one at beginning of first step. It is two at end of first step,

Table C.2. Deployment Simulation Subroutines

driver is DEPLØYT

Subroutine (calling order)	Function
DATA	Spider, link identification
AGØDAT1	Geometry from program AGØ
NAMIN	Name list input, initializes reflector, tetrahedron
NØDHNG	Geometry: calls DRNØDE, computes hinge angles
DRNODE	Calls NODCALA for the 33 required spiders
NØDCALA	Computes new spider X, Y, Z coordinates
ØLD	Stores step end geometry as next step beginning
J1J2A	Computes length of link between spiders J1, J2
ISUBNDA	Determines subscript for spider number
IFIND	Locates integer in two dimensional spider, link arrays
ENERCA	Energies and energy changes, calls TABMAC
TABMAC	Table look up
NØRVEL	Relative velocities
GNMAS	Generalized masses
RESULT	Computes and prints results

Subroutine IASCEN was used in early check runs; is not currently in deck which is also beginning of second step, etc. End of step 21 is denoted by KRFACT = 22.

NAMIN sets up an additional coordinate system for the tetrahedron. The test tetrahedron is at reflector center, and consists of front spiders 4, 5, and 13, back spider 103, front links 1, 6, and 12 and diagonal links 9, 15, and 106. Tetrahedron geometry during deployment is computed in a separate coordinate system, X1, Y1, Z1, with origin at spider 103, which does not move. Z1 axis is perpendicular to spiders 4, 5, and 13 and X1 axis lies in the plane containing Z1 axis and spider 5. Tetrahedron spiders 1, 2, 3, and and 4 are reflector spiders 4, 5, 13, and 103.

Link lengths are computed, using AGO data. Geometric quantities include spider locations in X, Y, Z coordinate system (Figure C. 12) and link hinge angles.

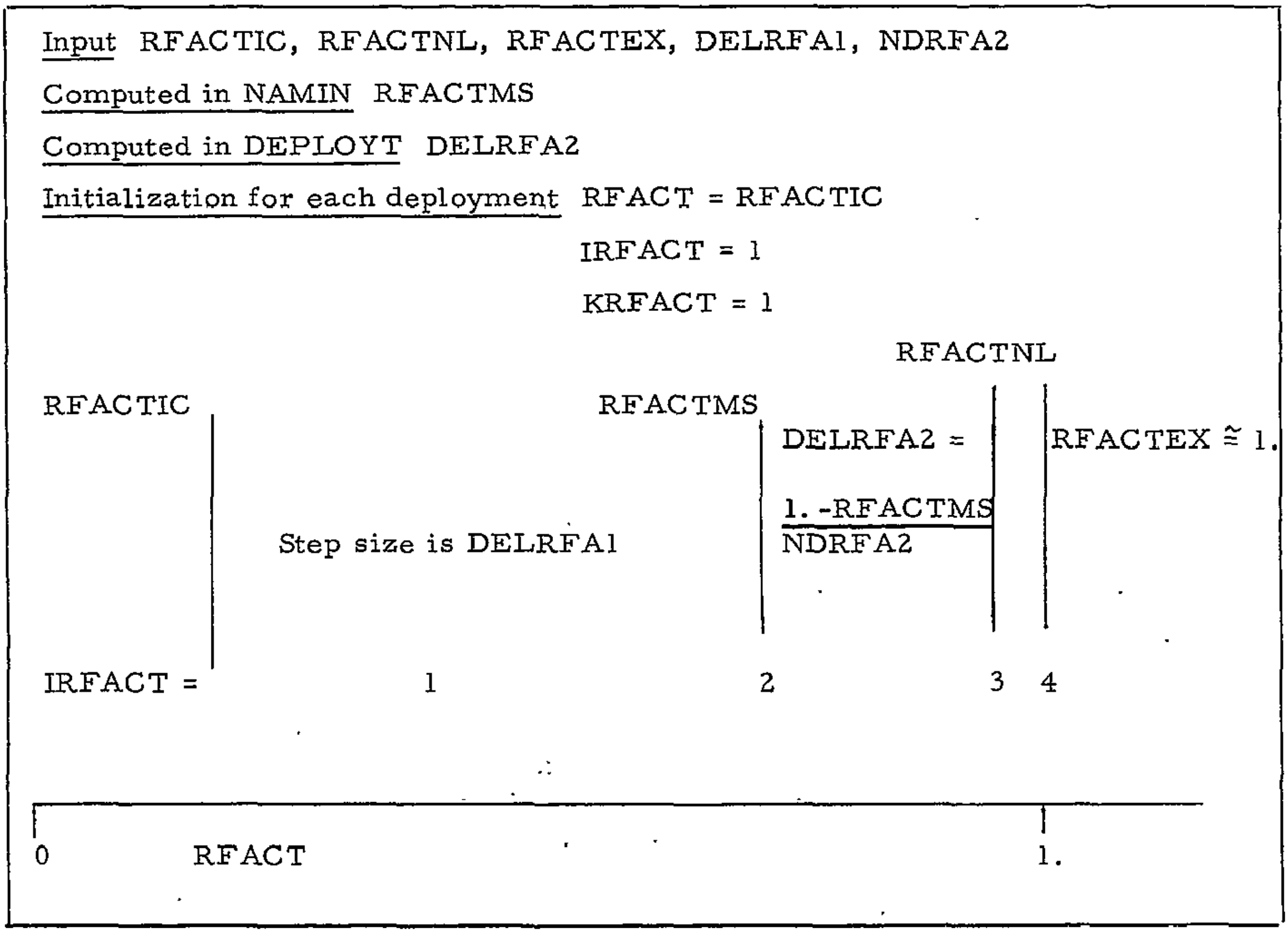


Figure C. 12. Control of Step Size

NAMIN sets RFACT = RFACTIC and computes the initial geometry, using NODHNG.

Name list PRINT has the flags (IPRDUM (40)) controlling the many output print options and those calculations required only for output.

Name list MASSWT has the mass and weight data, with identical features (but distinct numerical values) for the reflector and test tetrahedron. The individual spiders can have a different weight assigned to each. Link mass properties are represented by a constant linear density, distinct values being input for front, diagonal, and back links. Any additional mass associated with link hinge structure and hinge spring is also input, distinct values being input for front and back links. NAMIN uses this data to compute the link masses and inertias.

Name list DTABLE contains friction, spring, and mesh torque in tables as a function of link angles, with distinct values for antenna and tetrahedron. This data is for the average torque for the many hinges. During ENERGY CHANGES, the simulation obtains the angle at step beginning and end for each hinge and computes the energy changes due to friction, spring, and mesh for that hinge. Reflector energy is then the summation over all hinges. DTABLE also contains the total energy loss in overcoming breakaway friction for the reflector and for the tetrahedron.

Mesh torque data is regarded as ill defined, and the program conducts a parametric variation on the input table of values by multiplying the torque with up to seven factors (one of which will usually be one). All affected calculations are carried out separately for each factor. The number of such factors is the input variable NDIFMSH and the factor values are input in array FACMSH (7). The simulation uses the index IMESH,

$$1 \leqslant \text{IMESH} \leqslant \text{NDIFMSH}$$

to denote which factor is being used and it is included in the output.

Name list LAST contains control flags and the initial energy and velocity conditions.

The variables computed by subroutines NODHNG through RESULT must be available for each step. When calculations are not necessary because the variables were computed from identical data and stored in a previous case of the current run, they are skipped. Logic skips portions of subroutines, or entire subroutines, as appropriate.

The geometric calculations are overseen by NODHNG, which calls DRNODE and then computes the hinge angles. DRNODE contains the sequence for computing spider locations. There are 19 equivalent spider sets. Location must be determined for one spider in each set and 14 others, for a total of 33. DRNODE calls NODCALA once for each.

OLD stores the end spider coordinates for a step as the beginning coordinates for the next step. J1J2A computes the link length between spider J1 and spider J2. IFIND accepts an input integer and a flag with 5 possible values, denoting that integer as being a front or back spider or a front, diagonal or back link. It locates the integer in the designated two dimensional array by returning the two subscripts. OLD is called by both DEPLOYT and NAMIN; J1 J2A and IFIND are called only by NAMIN.

ISUBNDA locates an input integer within the array of spider integers, NODE (109), by returning the subscript. NAMIN, NODCALA, J1J2A, and GNMAS call ISUBNDA.

ENERCA computes energy changes and stores concurrent energy values. Breakaway friction energy loss, and viscous friction, mesh and spring torques are included. NDIFMSH mesh energies are considered. TABMAC performs table look up for the torques.

NORVEL obtains the relative (normalized) velocities of reflector components. It is not necessary to perform the computations for each component because all items in an equivalent set have the same relative velocity. NORVEL computes relative translational velocities for 33 spiders, and then computes the required link velocities from spider velocities. Link velocities are computed only for the first link in each set. Reflector normalizing velocity is the X axis translation velocity of spider number 1, which is one of the six outer corner spiders on the front surface. Tetrahedron normalizing velocity is X1 component of tetrahedron spider 1.

GENMAS includes six different contributions; spider translation, hinged link translation, hinge translation, hinged link rotation, diagonal link translation and diagonal link rotation. Generalized masses are computed for reflector and for tetrahedron due to these six.

When all items in an equivalent set have the same mass or inertia, the set's contribution to the generalized mass is that for any item (usually the first) times number in set. The analysis assumptions force all members of any link set to have identical mass and inertia, and GNMAS so treats the link sets.

Spider weight can be input different for any and all spiders. Usually some spider sets will have all members of same weight and others will not. During the weight manipulation portion of NAMIN, the array flag ICHNDWT (19) is set zero if all same weight and one if there are differences for the 19 front and back spider sets. If zero for a set, GNMAS multiplies contribution of first set item by number thereof, as for links. Note that all items in any set have the same velocity, hence relative velocity, in R, Z coordinates. Also, generalized mass depends on velocity squared. If one for a set, GNMAS multiplies square of relative velocity for first spider in set times sum of set spider masses.

RESULT computes and prints computed results. Friction and mesh losses and spring input energies at step end are obtained using the energy changes computed in ENERCA. Normalizing velocity is calculated as the square root of total energy divided by generalized mass. This velocity is then used to compute step time increment. Time is obtained by adding increment to time at end of last step.

Since all component relative velocities have been computed or are available from symmetry, actual velocities are readily calculated. Actual velocities, fps or radian/sec., are computed for components of interest. Currently front spiders 1, 2, 3, 4, hinges for front links 58, 34, 10, 1, front links 58, 34, 10, 1, diagonal links 84, 65, 64, 41, 40, 17, 15, 9, and back links 389, 359, 314, 307 are included. These are identified on Figure C-16.

Acceleration and load are currently obtained for front spiders 1, 2, 3, and 4. Spider deceleration is computed using the velocity vector change in the step divided by the time change. The final step predicts a terminal spider velicity, but terminal spider velocities are actually zero and acceleration calculation for the final step utilize this. Spider load is computed multiplying spider mass times acceleration.

These actual velocity acceleration and load calculations are done for all tetrahedron components.

Additional components can be added as desired; simple programming in RESULT will suffice. Printing and those calculations necessary only for printing are controlled by the array flag IPRDUM (40). IPRDUM also controls printing of intermediate values throughout the simulation, such as spider locations, generalized masses and energy changes.

Concurrent rough working documentation was prepared during the simulation development. This material was continually revised and updated as the effort progressed. Included are all common and name lists, variables and their definitions, variables and their utilization in commons and subroutines, bound books (4) of pertinent computer runs, equations and derivations thereof, and flow charts of complex subroutines. No special tape handling is required by the simulation; plotted output capability has not been introduced. It has not been deemed desirable to stuff this appendix with this large mass of paper, which is extremely important to engineers checking or improving the simulation. No one else is likely to be interested in examining these nitty gritty details; it is important to be aware that the material exists.

One sample is included, for the driver, DEPLØYT. This serves two purposes, illustrating the working documentation and providing additional insight into overall simulation flow.

C.2.1.3 DEPLOYT (Driver) Documentation - Variables used are defined in Table C.3 and should be self explainatory. BLANK common is 19 cards long. It is placed in core originally occupied by the loader, no additional core being required, and so most array variables are placed there. The variable RFACTIC, initial (packaged) value of RFACT for both reflector and tetrahedron, is not used in DEPLOYT. RFACTIC is read into NAMIN by NAMELIST FIRST. RFACT is set equal to RFACTIC as NAMIN initializes each case. Antenna reflector and tetrahedron associated variables are usually but not always, denoted by final letter being an A or T, e.g. IVISFA, IVISFT. Variables ending in A or T are not necessarily associated with antenna or tetrahedron, e.g. RFACT is the independent variable for both.

DEPLOYT flow chart is shown in Figure C.13. It is typical, but the driver has deliberately been kept smaller than the major subroutines. They are more complex. Statements down to 100 are used only once per run, regardless of the number of cases.

Commons are defined and the fail safe and initialization of variables for the entire run is done. ITABLE, IMASSCH, NTABLE, IFIRST, IEXIT and IAGO are set to one here, but those in NAMELISTS can be changed by input data. DATA stores spider and link identification and creates additional useful arrangements of those integers. AGODAT1 inputs spider locations for deployed reflector, as punched by program AGO, Reference C-1.

Following completion of a deployment (i.e., one case), reentry is to point A1 if all name lists will be read and is to point A2 for only name lists DTABLE and LAST. NAMIN initializes the deployment simulation and DELRFA2 is computed. Reentry is to point B when all computations for a step are complete, and more steps are required to complete deployment.

The statements from 200 to 300 increment RFACT as explained above for Figure C.12.

When the first three name lists are not read (NTABLE = 2) or AGO data was input on a previous case (IAGO $\leqslant$0) and no changes were made to the RFACT step sizes (IFIRST$\leqslant$0) transfer is to 320. This is because necessary geometry has been computed and stored on a previous case. If not, pertinent step size variable are printed. NODHNG then computes the geometry at step end.

The energy changes for the step and total energy are computed by ENERCA. When the relative velocites for current conditions have been computed on a previous case (IAGO $\leqslant$ 0 and IFIRST $\leqslant$ 0) it is not necessary to call NORVEL unless link angular velocities are needed for the viscous friction (IVISFA$>$0, IVISFT $>$ 0). It is not necessary to recompute the relative velocities if only mass and weight is changed from previous case. When relative velocities are changed (or on first case) NORVEL is called.

Table C-3. DEPLOYT Variable Definitions

Variable	Definition
BLANK	Blank common
CALWTS	A labeled common, weight and mass data, partially variables from NAMELIST MASSWT
CFIRST	A labeled common, partially variables from NAMELIST FIRST
CLAST	A labeled common, only variable IEXIT from NAMELIST LAST
CPRINT	A labeled common, solely variables from NAMELIST PRINT
CRFACTI	A labeled common, solely variables controlling RFACT, mostly variables from NAMELIST FIRST.
DELRFA1	RFACT increment (step size) before mesh, in NAMELIST FIRST, in CRFACTI
DELRFA2	RFACT increment (step size) after mesh up to final step, computed in DEPLOYT
KRFACT	Step index, in CFIRST, initially set at 1 in NAMIN, set by DEPLOYT
IAGO	Flag for AGO data, >0 changed, $\leqslant 0$ no change this case, in CALWTS
IEXIT	Flag for run termination, >0 more cases, $\leqslant 0$ end run, in NAMELIST LAST, in CLAST
IFIRST	Flag for CFIRST, >0 changed, $\leqslant 0$ no change this case, in CFIRST
IMASSCH	Flag for weight, mass input data, >0 changed, $\leqslant 0$ no change this case, in CALWTS
IRFACT	Flag for deployment phase, = 1 before mesh, = 2 after mesh and before last step, =3 last step, = 4 end deployment, in CFIRST, initially set at 1 in NAMIN, set by DEPLOYT
ITABLE	Flag for reading NAMELISTS on next case, =1 read all, =2 read only DTABLE and LAST, in NAMELIST LAST, in CFIRST

Table C-3. DEPLOYT Variable Definitions (Cont'd)

Variable	Definition
IVISFA, IVISFT	Flag for viscous friction dependence on rotational velocity, >0 does, ≦ 0 does not, reflector and tetrahedron, in NAMELIST DTABLE, in common RAD
NDRFA2	Number of steps between mesh and final step, in NAMELIST FIRST, in CRFACTI
NTABLE	Flag for reading NAMELISTS on this case, =1 read all, =2 read only DTABLE and LAST, in CFIRST, set by DEPLOYT
RAD	A labeled common: also constant, number of degrees per radian, in common RAD
RFACT	The simulation independent variable, ratio of current to fully deployed radial distance for all spiders, in common RAD, initially set equal to RFACTIC in NAMIN, then computed by DEPLOYT
RFACTEX	Final RFACT value (fully deployed), in NAMELIST FIRST, in CRFACTI, nominally .999 999 9.
RFACTMS	RFACT value in which mesh first encountered, computed in NAMIN, in CRFACTI
RFACTNL	RFACT value at beginning of final step, in NAMELIST FIRST, in CRFACTI, nominally .99994
RTEMP	Temporary RFACT value, used only in DEPLOYT

Logic avoids GNMAS if first three name lists are not read (NTABLE = 2). Otherwise, if and only if AGO data is read this case (IAGO >0) or data in CFIRST changed (IFIRST >0) or weight, mass data changed (IMASSCH >0), GNMAS must be called.

RESULT concludes calculations for the step. When deployment is not yet complete, IRFACT is three or less. OLD stores the geometry for end of just completed step as geometry for beginning of next step. Transfer to re-entry point B initiates calculations for next step.

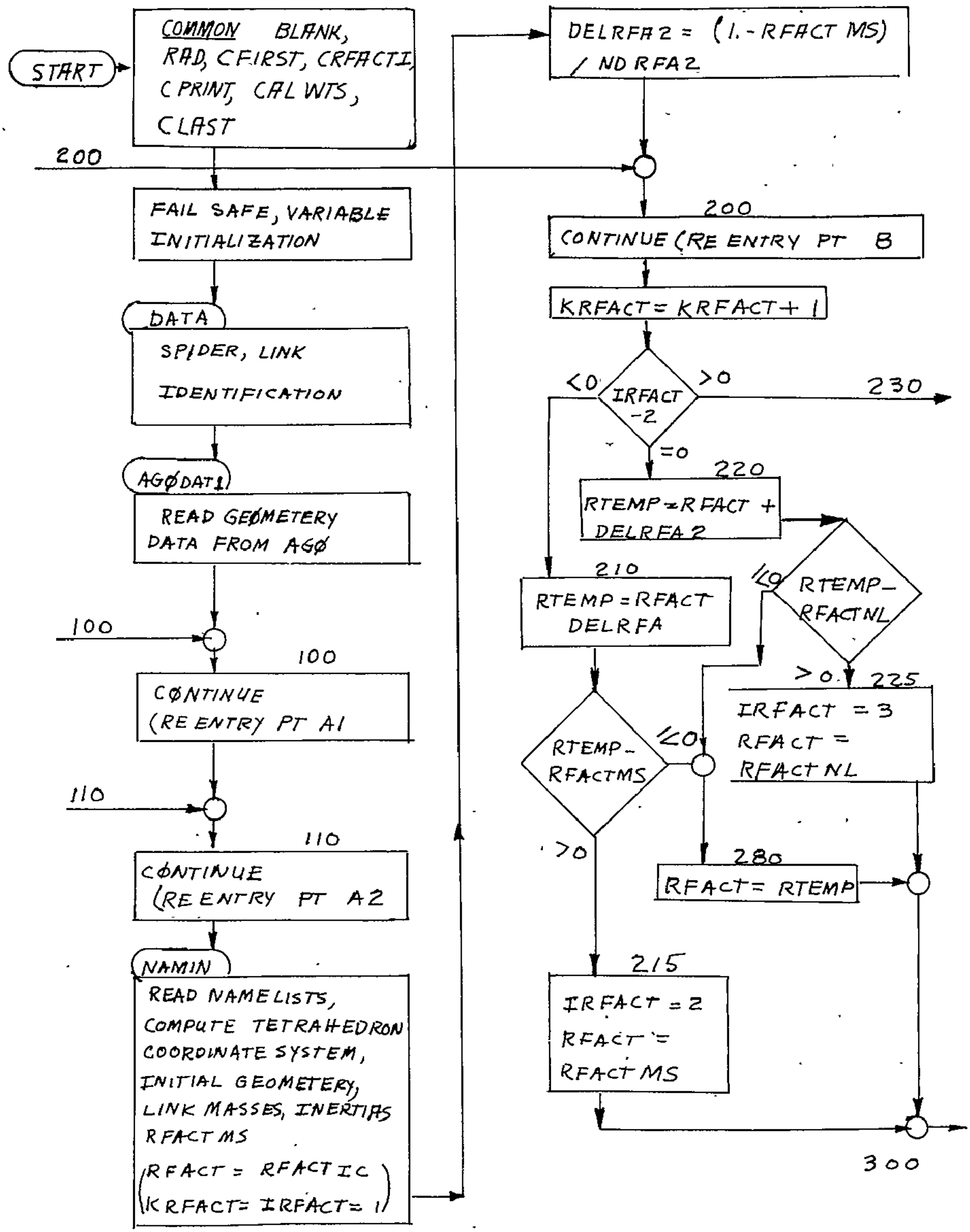


Figure C.13A. Flow Chart For DEPLØYT

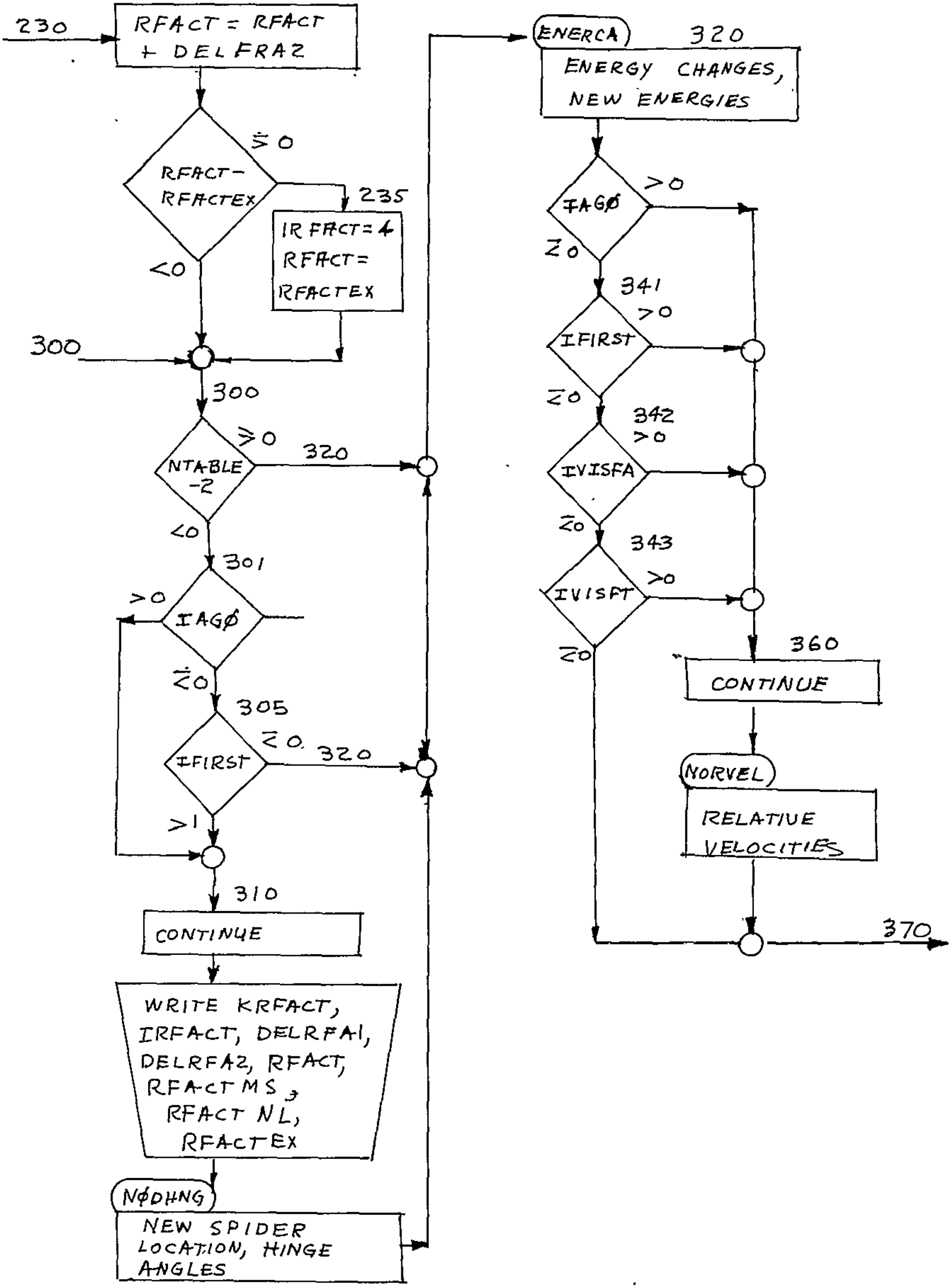


Figure C. 13B. Flow Chart for DEPLØYT

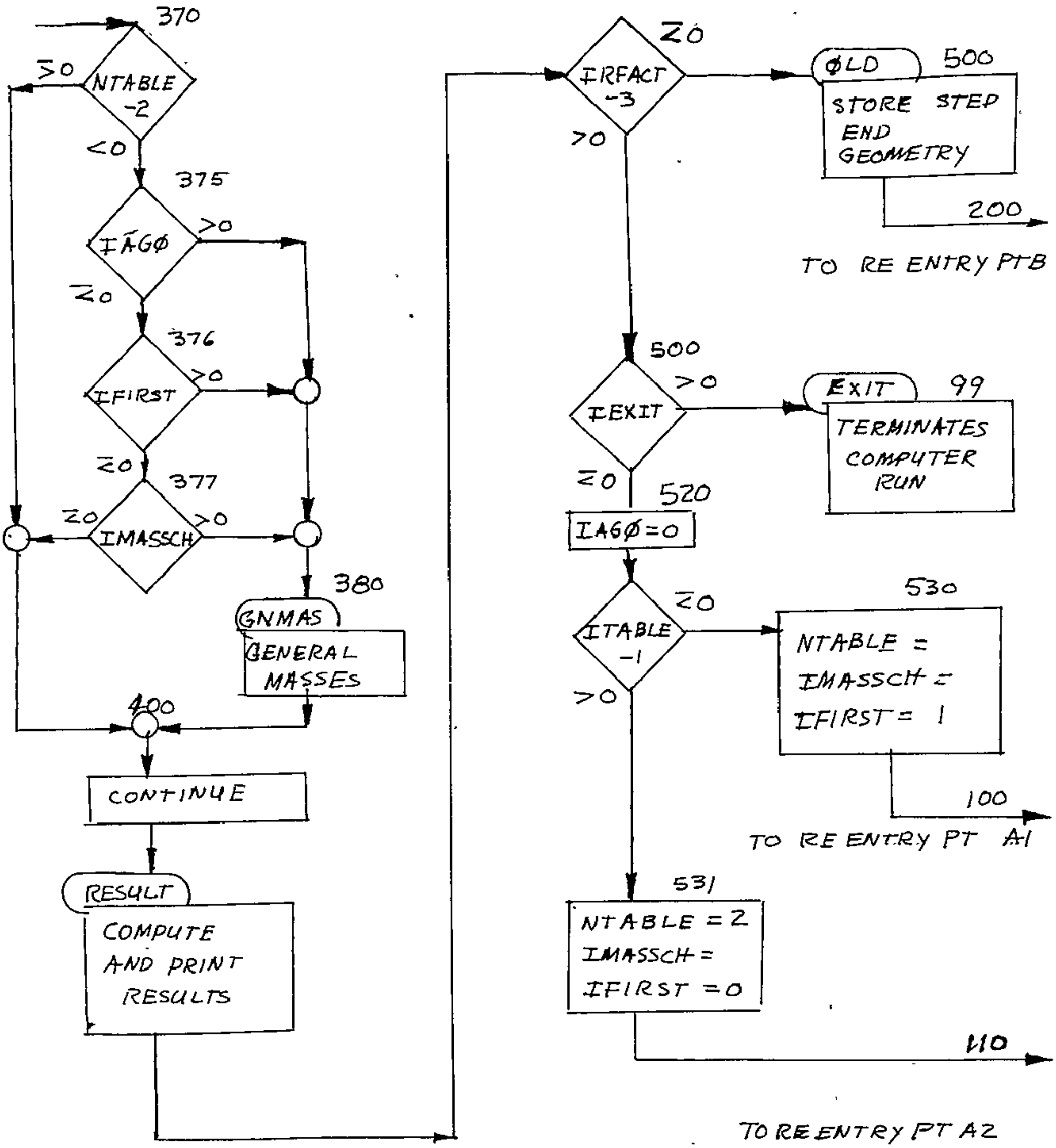


Figure C. 13C. Flow Chart for DEPLØYT

Case is complete when IRFACT =4, and IEXIT is checked for additional cases. If one, run is terminated, if zero a new deployment is initiated. AGO data has been read, so IAGO = 0. ITABLE indicates how much new data (2 or 5 NAMELISTS) will be input to NAMIN on new case, and NTABLE is so set. When NTABLE = 2, IMASSCH and IFIRST must be zero, since weight, mass or CFIRST data can not be changed. When ITABLE is zero, IMASSCH and IFIRST will in general be one. Input data can set either back to zero if changes are not made. Reentry to point A1 or A2 initiates deployment for new case by calling NAMIN.

C.2.1.4 Spider and Link Identification - The 109 spiders and 420 links of the 8 bay reflector are identified by the integer identification scheme used in geometry calculation program (AGO) output, Reference C-1. Spiders are referred to as "nodes" and the non hinged diagonal links between the surfaces are referred to as "intra surface" links in that Reference. Six and Four bay identification are central subsets of the 8 bay data. Identification is identical for the latch up program and the deployment simulation.

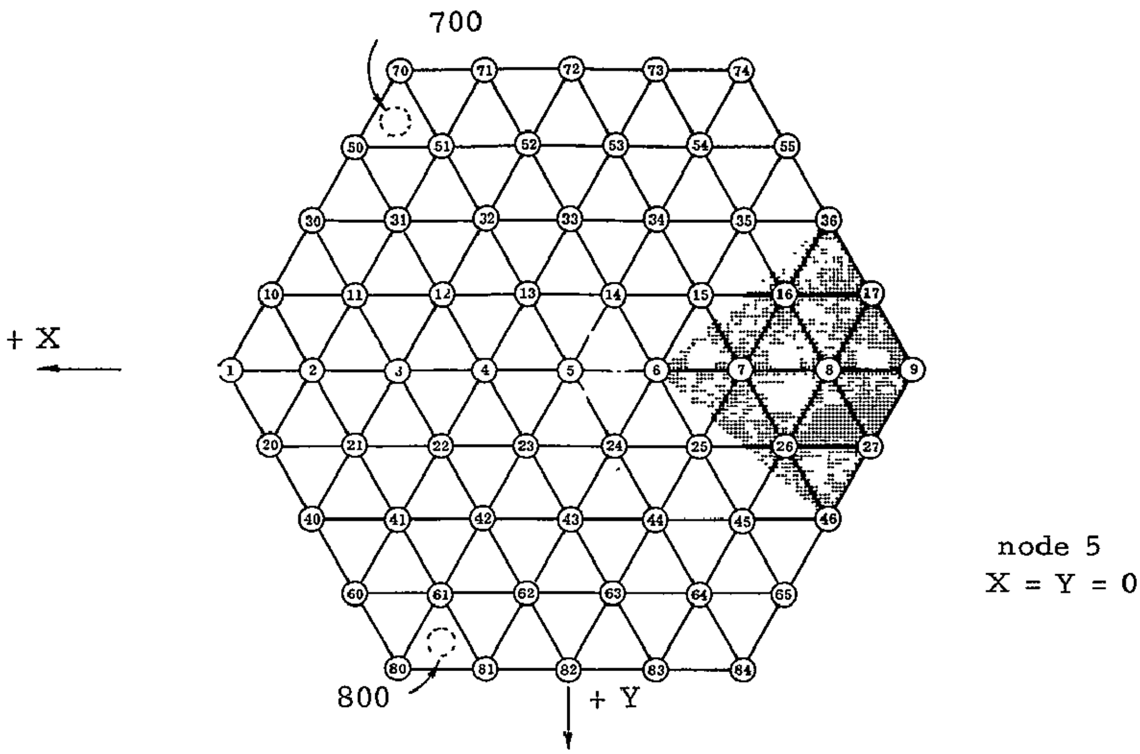
The 109 spiders are identified by integers ranging from 1 to 803, as seen in Figure C-14. This spider identification is used in other analyses, such as thermal and stress, which use AGO punched cards as input. Relationship of front to back surface is ascertainable by noting that back spider 700 lies below the triangle of 50, 51, and 70 and that 800 lies below the triangle of 61, 80, and 81.

Reflector coordinate system is conveniently shown on the Figure. Origin is above the center node (5) on the parabolic surface. Plus X axis goes through 1, plus Y through 82, and plus Z up out of Figure. Thus node 5 has a slightly negative Z component.

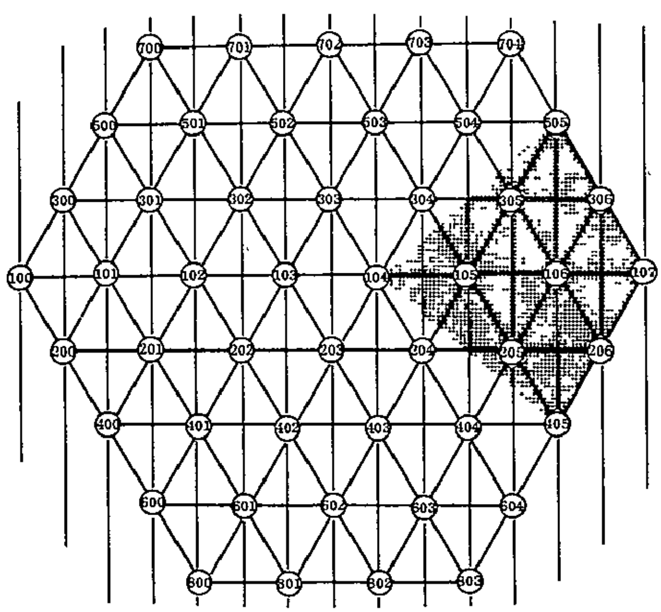
The 420 links are numbered from 1 to 420, with links 301 to 420 being on back surface. They are identified in Table C-4. The two end spiders for each link number are listed, ordered by lower spider number. Link identification and relationships to the spiders is illustrated for four bays in Figure C-15, which is not to scale.

Spider and link totals are shown in Table C-5 for 4, 6, and 8 bays. The equivalent sets are shown in Table C-6 . All components in the same set have identical radial and Z axis coordinates.

Digital computer results presented in Section 3.1 and Appendix C are for specific spiders and links. Location of these components is shown in Figure C-16.



FRONT SURFACE



BACK SURFACE
(ignore vertical lines)

Figure C-14. Notation for Antenna Nodes (Spiders)

Table C-4. Link Identification, 8 Bays

Link	End Spider	Link No.	Link	End Spider	Link No.
1	2	58	7	15	157
1	10	83	7	16	176
1	20	82	7	25	116
1	100	84	7	26	175
2	3	34	7	105	178
2	10	62	7	106	180
2	11	61	7	205	179
2	20	60	8	9	255
2	21	59	8	16	235
2	100	65	8	17	254
2	101	64	8	26	194
2	200	63	8	27	253
3	4	10	8	106	256
3	11	38	8	107	258
3	12	37	8	206	257
3	21	36	9	17	292
3	22	35	9	27	267
3	101	41	9	107	299
3	102	40	10	11	224
3	201	39	10	30	277
4	5	1	10	100	278
4	12	14	10	300	279
4	13	12	11	12	164
4	22	13	11	30	225
4	23	11	11	31	223
4	102	17	11	101	226
4	103	15	11	300	228
4	202	16	11	301	227
5	6	5	12	13	104
5	13	6	12	31	165
5	14	3	12	32	163
5	23	4	12	102	166
5	24	2	12	301	168
5	103	9	12	302	167
5	104	8	13	14	28
5	203	7	13	32	105
6	7	99	13	33	103
6	14	27	13	103	106
6	15	98	13	302	108
6	24	20	13	303	107
6	25	97	14	15	30
6	104	100	14	33	29
6	105	102	14	34	26
6	204	101	14	104	31
7	8	177	14	303	32

Table C-4. Link Identification, 8 Bays, Contd

Link	End Spider	Link No.	Link	End Spider	Link No.
14	304	33	26	206	198
15	16	159	26	405	197
15	34	53	27	46	207
15	35	158	27	206	268
15	105	161	30	31	242
15	304	160	30	50	286
15	305	162	30	300	287
16	17	237	30	500	288
16	35	217	31	32	182
16	36	236	31	50	243
16	106	239	31	51	241
16	305	238	31	301	244
16	306	240	31	500	246
17	36	283	31	501	245
17	107	294	32	33	122
17	306	293	32	51	183
20	21	127	32	52	181
20	40	145	32	302	184
20	200	146	32	501	186
21	22	109	32	502	185
21	40	129	33	34	51
21	41	128	33	52	123
21	200	131	33	53	121
21	201	130	33	303	124
21	400	132	33	502	126
22	23	91	33	503	125
22	41	111	34	35	54
22	42	110	34	53	52
22	201	113	34	54	50
22	202	112	34	304	56
22	401	114	34	503	55
23	24	19	34	504	57
23	42	93	35	36	219
23	43	92	35	54	77
23	202	95	35	55	218
23	203	94	35	305	221
23	402	96	35	504	220
24	25	21	35	505	222
24	43	22	36	55	274
24	44	18	36	306	285
24	203	23	36	505	284
24	204	24	40	41	187
24	403	25	40	60	205
25	26	117	40	400	206
25	44	43	41	42	169
25	45	115	41	60	189
25	204	118	41	61	188
25	205	120	41	400	191
25	404	119	41	401	190
26	27	195	41	600	192
26	45	134	42	43	151
26	46	193	42	61	171
26	205	196	42	62	170

Table C-4. Link Identification, 8 Bays, Contd

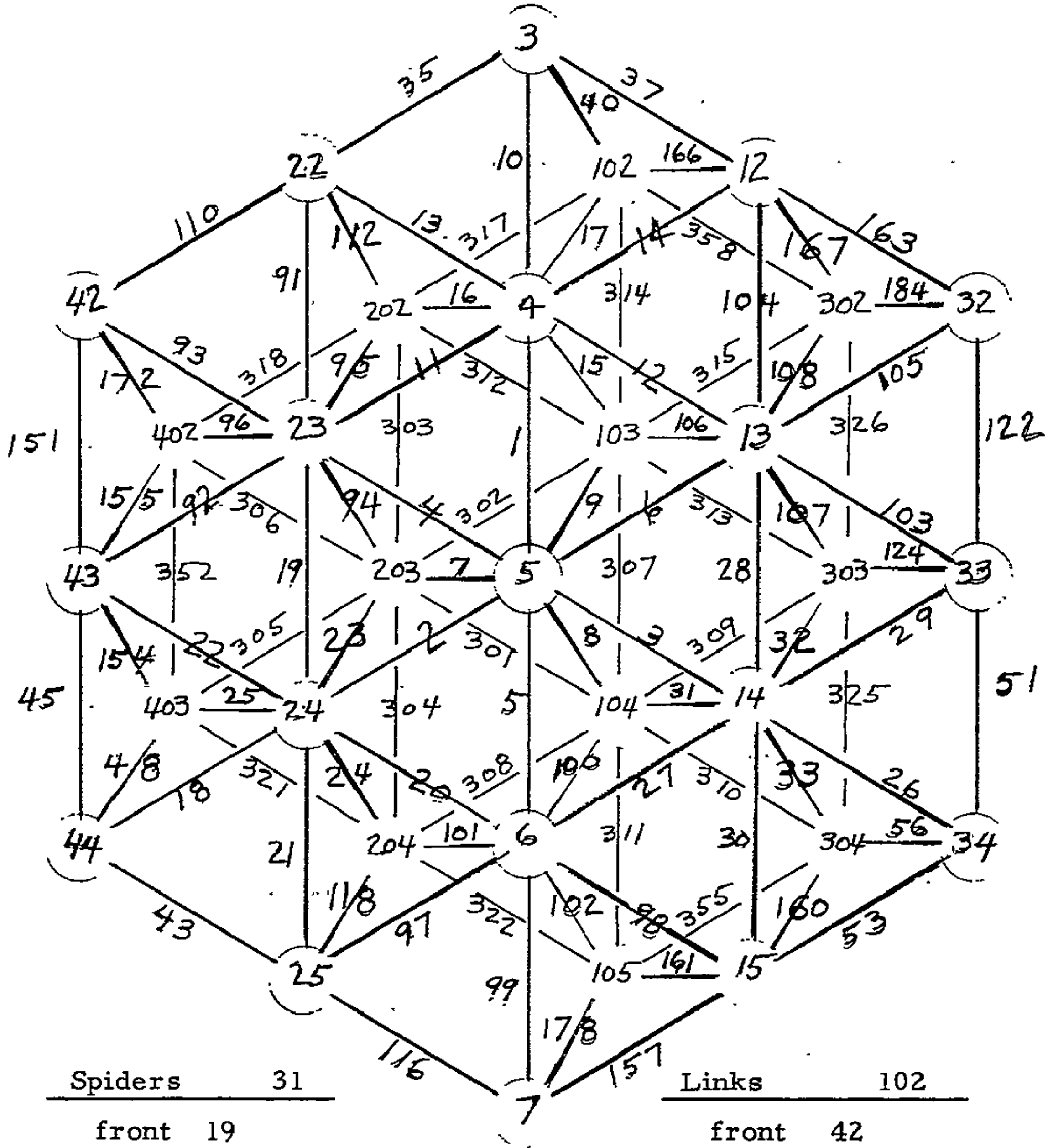
Link	End Spider	Link No.
42	401	173
42	402	172
42	601	174
43	44	45
43	62	153
43	63	152
43	402	155
43	403	154
43	602	156
44	45	44
44	63	46
44	64	42
44	403	48
44	404	47
44	603	49
45	46	135
45	64	67
45	65	133
45	404	136
45	405	138
45	604	137
46	65	147
46	405	208
50	51	260
50	70	295
50	500	296
50	700	297
51	52	200
51	70	261
51	71	259
51	501	262
51	700	264
51	701	263
52	53	140
52	71	201
52	72	199
52	502	202
52	701	204
52	702	203
53	54	75
53	72	141
53	73	139
53	503	142
53	702	144
53	703	143
54	55	78
54	73	76
54	74	74
54	504	80
54	703	79
54	704	81
55	74	89
55	505	276
55	704	275
60	61	247
60	80	265
60	600	266
61	62	229
61	80	249
61	81	248
61	600	251
61	601	250
61	800	252
62	63	211
62	81	231
62	82	230
62	601	233
62	602	232
62	801	234
63	64	69
63	82	213
63	83	212
63	602	215
63	603	214
63	802	216
64	65	68
64	83	70
64	84	66
64	603	72
64	604	71
64	803	73
65	84	85
65	604	148
70	71	269
70	700	300
71	72	209
71	701	270
72	73	149
72	702	210
73	74	88
73	703	150
74	704	90
80	81	289
80	800	298
81	82	280
81	800	291
81	801	290
82	83	271
82	801	282
82	802	281
83	84	86
83	802	273

Table C-4. Link Identification, 8 Bays, Contd

Link	End Spider	Link No.	Link	End Spider	Link No.
83	803	272	205	405	373
84	803	87	206	405	380
100	101	389	300	301	398
100	200	345	300	500	417
100	300	414	301	302	368
101	102	359	301	500	399
101	200	344	301	501	397
101	201	332	302	303	326
101	300	390	302	501	369
101	301	388	302	502	367
102	103	314	303	304	325
102	201	329	303	502	327
102	202	317	303	503	324
102	301	360	304	305	357
102	302	358	304	503	339
103	104	307	304	504	356
103	202	312	305	306	396
103	203	302	305	504	385
103	302	315	305	505	395
103	303	313	306	505	416
104	105	311	400	401	370
104	203	301	400	600	379
104	204	308	401	402	361
104	303	309	401	600	372
104	304	310	401	601	371
105	106	366	402	403	352
105	204	322	402	601	363
105	205	364	402	602	362
105	304	355	403	404	334
105	305	365	403	602	354
106	107	405	403	603	353
106	205	374	404	405	336
106	206	403	404	603	337
106	305	394	404	604	333
106	306	404	405	604	346
107	206	410	500	501	407
107	306	419	500	700	420
200	201	328	501	502	377
200	400	343	501	700	408
201	202	316	501	701	406
201	400	331	502	503	340
201	401	330	502	701	378
202	203	303	502	702	376
202	401	319	503	504	342
202	402	318	503	702	341
203	204	304	503	703	338
203	402	306	504	505	387
203	403	305	504	703	350
204	205	323	504	704	386
204	403	321	505	704	413
204	404	320	600	601	400
205	206	375	600	800	409
205	404	335	601	602	391

Table C-4. Link Identification, 8 Bays, Contd

Link	End Spider	Link No.
601	800	402
601	801	401
602	603	382
602	801	393
602	802	392
603	604	347
603	802	384
603	803	383
604	803	348
700	701	411
701	702	381
702	703	349
703	704	351
800	801	418
801	802	415
802	803	412



Spiders	31
front	19
back	12

Links	102
front	42
intra	36
back	24

Figure C-15. 4 Bay Antenna, Spider and Link Numbering

Table C-5. Spider and Link Totals

	Reflector Bays 8	6	4
Spiders			
front	61	37	19
back	48	27	12
Total	109	64	31
Links			
front	156	90	42
back	120	63	24
diagonal	144	81	36
Total	420	234	102
Hinged links	276	153	66

Table C-6. Spider and Link Equivalent Sets, 8 Bays

Equivalent Spider Sets

FRONT

Set Number	Spider Numbers
1.	5
2	4, 13, 14, 6, 24, 23
3	3, 32, 34, 7, 44, 42
4	12, 33, 15, 25, 43, 22
5	2, 51, 54, 8, 64, 61
6	11, 31, 52, 53, 35, 16, 26, 45, 63, 62, 41, 21
7	1, 70, 74, 9, 84, 80
8	10, 50, 71, 73, 55, 17, 27, 65, 83, 81, 60, 20
9	30, 72, 36, 46, 82, 40

Sets 1 through 6 for 6 bay reflector
Sets 1 through 4 for 4 bay reflector

Table C-6. Spider and Link Equivalent Sets, 8 Bay (Cont'd)

BACK

Set Number	Spider Numbers
1	103, 104, 203
2	102, 302, 304, 105, 403, 402
3	303, 204, 202
4	101, 501, 504, 106, 603, 601
5	301, 305, 602
6	502, 503, 205, 404, 401, 201
7	100, 700, 704, 107, 803, 800
8	300, 500, 505, 306, 802, 801
9	701, 703, 206, 604, 600, 200
10	702, 405, 400

Sets 1 through 6 for 6 bay reflector
Sets 1 through 3 for 4 bay reflector

Equivalent Link Sets

FRONT

Set Number		Link Numbers
1	1, 6, 3,	5, 2, 4
2	12, 28, 27,	20, 19, 11
3	10, 105, 26,	99, 18, 93
4	14, 104, 103,	29, 30, 98, 97, 21, 22 92, 91, 13
5	37, 163, 122,	51, 53, 157, 116, 43, 45, 151, 110, 35
6	34, 183, 50,	177, 42, 171
7	38, 182, 181,	52, 54, 176, 175, 44, 46, 170, 169, 36
8	164, 165, 123,	121, 158, 159, 117, 115, 152, 153, 111, 109
9	61, 241, 200,	75, 77, 235, 194, 67, 69, 229, 188, 59
10	223, 140, 217,	134, 211, 158
11	58, 261, 74,	255, 66, 249
12	62, 260, 259,	76, 78, 254, 253, 68, 70, 248, 247, 60
13	224, 243, 201,	139, 218, 237, 195, 133, 212, 231, 189, 127
14	83, 295, 269,	88, 89, 292, 267, 85, 86, 289, 265, 82
15	225, 242, 199,	141, 219, 236, 193, 135, 213, 230, 187, 129
16	277, 286, 209,	149, 274, 283, 207, 147, 271, 280, 205, 145

Sets 1 through 10 for 6 bay reflector
Sets 1 through 5 for 4 bay reflector

Table C-6. Spider and Link Equivalent Sets, 8 Bay (Cont'd)

Equivalent Link Sets

BACK

Set Number	Link Numbers	
1	307, 301, 302	
2	314, 315, 310,	311, 305, 306
3	358, 355, 352	
4	313, 309, 308,	304, 303, 312
5	326, 325, 322,	321, 318, 317
6	359, 369, 356,	366, 353, 363
7	360, 368, 357,	365, 354, 362
8	388, 397, 385,	394, 382, 391
9	367, 339, 364,	334, 361, 329
10	327, 324, 323,	320, 319, 316
11	377, 342, 374,	337, 371, 332
12	340, 335, 330	
13	389, 408, 386,	405, 383, 402
14	390, 407, 387,	404, 384, 401
15	398, 399, 395,	396, 392, 393
16	414, 420, 413,	419, 412, 418
17	417, 416, 415	
18	406, 350, 403,	347, 400, 344
19	378, 338, 375,	333, 372, 328
20	411, 351, 410,	348, 409, 345
21	376, 341, 373,	336, 370, 331
22	381, 349, 380	346, 379, 343

Sets 1 through 12 for 6 bay reflector
Sets 1 through 5 for 4 bay reflector

Diagonal (intra surface)

1	9, 8, 7	
2	15, 106, 31,	100, 23, 94
3	17, 108, 33,	102, 25, 96
4	107, 32, 101,	24, 95, 16
5	40, 184, 56,	178, 48, 172
6	166, 167, 160,	161, 154, 155
7	124, 118, 112	

Table C-6. Spider and Link Equivalent Sets, 8 Bay (Cont'd)

Diagonal (intra surface)

Set Number	Link Numbers	
8	41, 186, 57,	180, 49, 174
9	185, 55, 179,	47, 173, 39
10	168, 162, 156	
11	126, 125, 120,	119, 114, 113
12	64, 262, 80,	256, 72, 250
13	226, 245, 220,	239, 214, 233
14	227, 244, 221,	238, 215, 232
15	202, 142, 196,	136, 190, 130
16	65, 264, 81,	258, 73, 252
17	263, 79, 257,	71, 251, 63
18	228, 246, 222,	240, 216, 234
19	204, 143, 198,	137, 192, 131
20	203, 144, 197,	138, 191, 132
21	84, 300, 90,	299, 87, 298
22	278, 297, 275,	294, 272, 291
23	279, 296, 276,	293, 273, 290
24	287, 288, 284,	285, 281, 282
25	270, 150, 268,	148, 266, 146
26	210, 208, 206	

Sets 1 through 15 for 6 bay reflector
Sets 1 through 7 for 4 bay reflector

C.2.2 COMPARISON OF DEPLOYMENT SIMULATION AND LATCH UP PROGRAM - The latch up program considers only rotational energy of the hinged links in general mass whereas deployment considers six energy contributions. Latch up accuracy would be improved by adding hinged links and additional hinge links and additional hinge mass translational energy to the general mass, as shown in Section 3.1.2.2.

Sole input data difference involves spider weights, and the only results effected are the loads due to spider deceleration. Total reflector weight is assigned to the spiders in the latch up program, while link and hinge weights are not included in the spider weights for deployment. Consequently latch up spider loads are based on acceleration of entire reflector mass with attached equipment while deployment loads are based on acceleration of spiders, mesh, mesh standoff structure, and attached equipment.

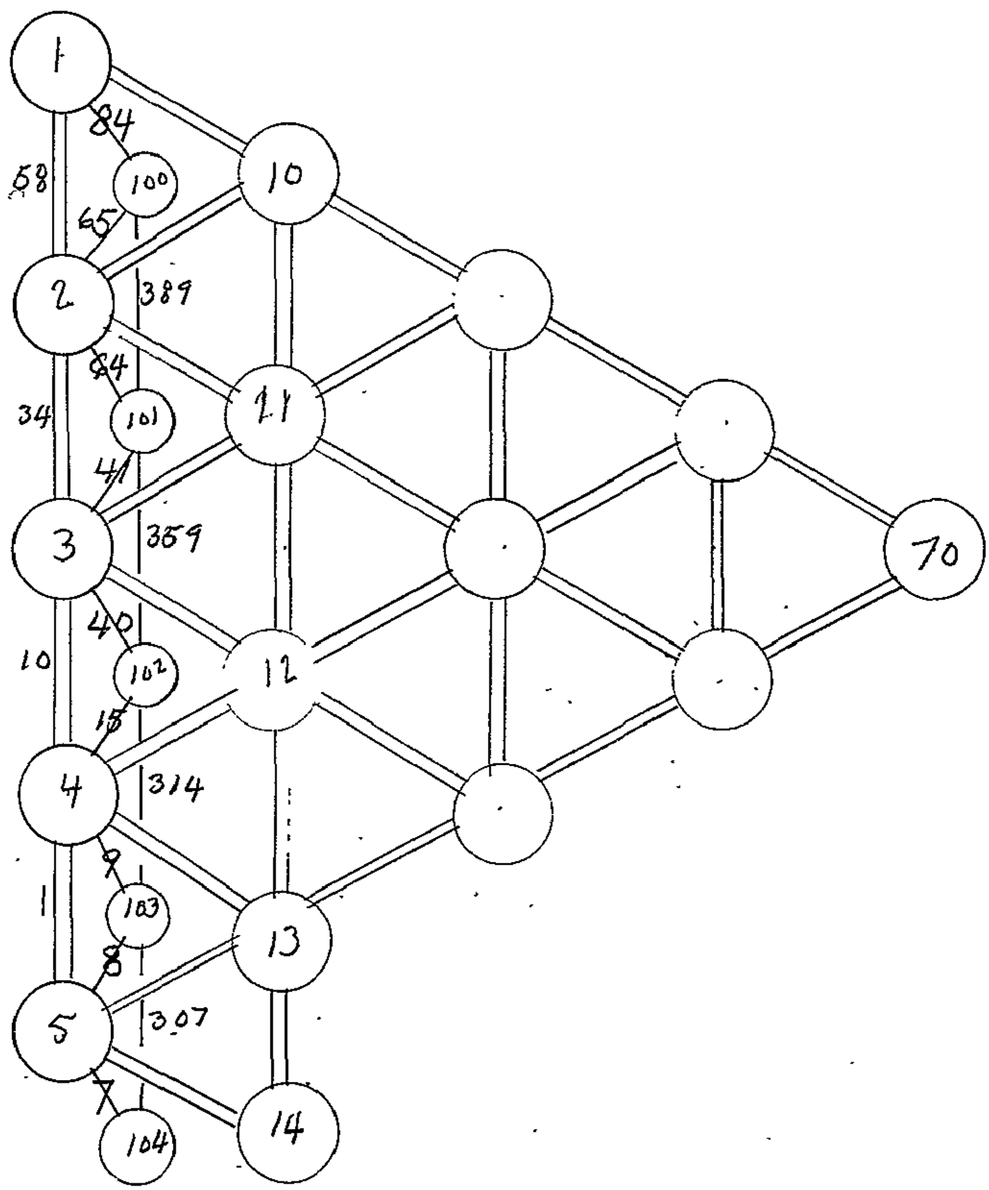


Figure C-16. Component Identification for Results Presentation

One difference in computed results involves spider acceleration. Latch up computes radial acceleration. Deployment computes total acceleration, which is the vector sum of Z axis and radial acceleration. Spider loads depend on acceleration as well as weight, thus loads will disagree for two reasons.

Integer identification for the spiders and links and for the equivalent sets thereof is identical for the two programs. Techniques for storing and manipulating this integer data are different for the two programs; accuracy and computed values should not be affected assuming the techniques are correctly implemented. These differences do require that extreme care be used while introducing changes and new features. Subroutines and smaller program blocks can not be checked in one program and simply inserted in the other.

Storage differences are that integer identification data is usually in one dimensional arrays in the latch up program and in two dimensional arrays in the deployment simulation. The same integers groups are stored in several ways in deployment, to simplify various processes. Manipulation techniques are easier to program using two dimensional arrays; two DO loop many times with only array name changes.

Either 6 or 8 bay reflectors can be handled by the latch up program, while the deployment simulation can presently treat only 8 bays.

C.2.3 DEPLOYMENT SIMULATION ACCURACY

C.2.3.1 Number of Deployment Steps - The continuously varying non-linear deployment is approximated in the simulation by opening the reflector in a finite number of steps. Variables are assumed to vary linearly across each step. Clearly accuracy is improved and computer running time increased by using more steps. Typical results shown in this report are for 21 steps; program is dimensioned for a maximum of 30. This maximum can readily be increased since the program length is below computer capacity.

General mass computation accuracy is particularly dependent on step width. Relative velocities are based on geometric displacement changes from step beginning to step end. In addition to assuming linear behavior, this procedure yields an average general mass across the step rather than for step end geometry. This is an error source because the energy associated with the general mass to compute velocity is for step end rather than being the average energy across the step. A more accurate general mass would be obtained by perturbing the geometry at step end. Relative velocities would then be obtained from the geometry change. The necessary programming changes could be implimented, but computer run time would increase.

C. 2. 3. 2 Step Size Variations - Additional inaccuracies result from variation of step size as the reflector deploys. It is economically desirable to initially use a large step size. Size is reduced when the mesh is encountered because the large mesh torque causes more rapid variations of deployment variables. Final step size is the tiny value of the latch up perturbation, so that simulation results can be compared with latch up program results.

Two errors result from off optimal step size variation;

a. Errors due to averaging variables across the step increase.

b. The hinge angle changes greatly differ.

Changes in variables should be constant with step size, before or after the mesh, to obtain similar approximation errors throughout deployment. Hinge angle change keys this because the basic energy interrelationships are dependent on link angles.

Currently a fixed step size is used initially, a considerably smaller size is used after mesh encounter and final step is the perturbation size. Averaging variable errors at step size discontinuities are illustrated by the tetrahedron general mass data presented in C. 2. 4. Hinge angle changes are shown in Figure C. 17. Step size variations which produce constant hinge angles changes e. g. 12 degrees before mesh and 2. 5 degrees after mesh, are desirable.

Alternate step size variations techniques can be easily implimented in the simulation program.

C. 2. 3. 3 Step Time Increment Calculation - The time increment associated with each step is displacement divided by average velocity during the step for a specific reflector component. This is an approximate calculation because average velocity is an approximation; displacement is exact. The average component velocity is computed as the sum of initial and final velocities for the step divided by two. The initial and final step velocities are not exact because the general mass calculation is not exact.

The average velocity computation assumes that the component velocity varies linearly across the step. Deployment is highly non linear. Low acceleration components have slowly varying velocities and are most nearly linear. During early deployment all velocities are small and accelerating rapidly. As latch up is approached the link hinge Z velocities are nearly constant. Spider one X velocity is used for the time increment calculation on all simulation steps except the final step. Link hinge 58 Z velocity is used for the final step (and is also used in the latch up program).

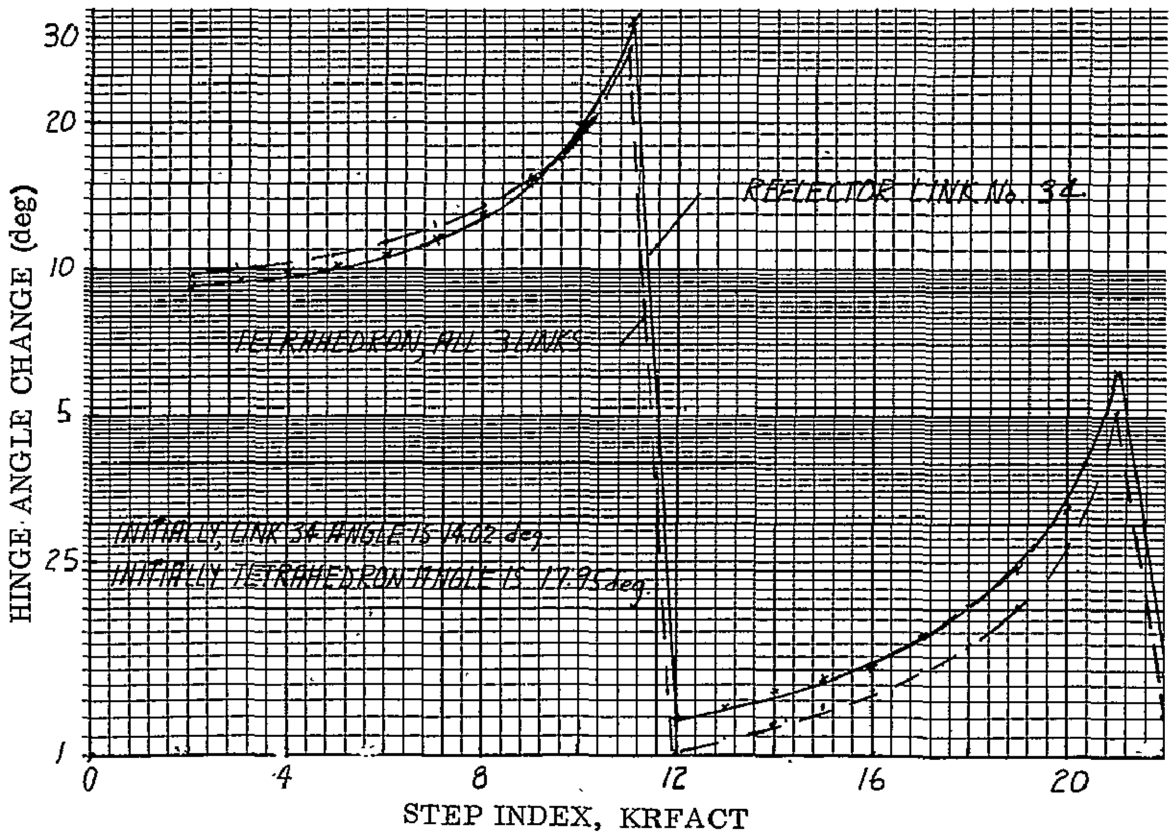


Figure C-17. Link Hinge Angle Changes for 21 Deployment Steps

These are compared for the steps subsequent to encountering the mesh in Table C-7. This data shows that the differences increase as spider sharply decelerates near latch up. The large difference for the step from KRFACT = 11 to 12 is due to the effect of the step size decrease at KRFACT = 11 on the general mass calculation.

Time increment calculation errors effect spider deceleration and load results as well as the deployment time duration. Simulation accuracy would be improved by using hinge 58 velocity for several steps prior to latch up.

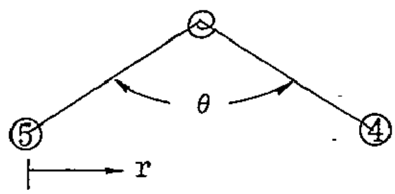
Table C-7. Time Increment Computation Comparison, Reflector Run D 80

Step Start	KRFACT End	Spider No. 1 X Velocity	Hinge No. 58 Z Velocity
11	12**	.00648	.00910
12	13	.00735	.00761
13	14	.00751	.00780
14	15	.00773	.00806
15	16	.00801	.00832
16	17	.00840	.00891
17	18	.00895	.00965
18	19	.00983	.01084
19	20	.01145	.0133
20	21	.0158	.0230
21	22	.0184*	.0520

* Spider No. 1 X velocity assumed zero at latch up (KRFACT = 22)
** First step after mesh encountered and step size decreased

C.2.3.4 Spider Deceleration Values at Latch Up - Spider deceleration values for final step show an upward jump of 2.5 to three times values for the previous steps. Validity of these values is discussed here. An increase was anticipated; indeed the latch up program was developed because maximum loads were expected at latch up. Simulation values are in the range obtained by the latch up program. A simple model is used below to examine the condition of run D 80. The model predicts that maximum deceleration will occur at latch up and yields numerical values reasonably close to simulation results. The upward trend of spider deceleration values approaching latch up and the range of values computed for the final step are therefore concluded to be correct. Errors are introduced by the approximations of the time increment and general mass calculations and the step size discontinuity. Recommended improvements will decrease these errors and yield more accurate acceleration values.

A simple planar model is used to examine spider deceleration near latch up. Spider No. 4 is selected. Its motion does not depend on motion of inner adjacent spiders because only the non moving center spider 5, is inward. Further the paraboloid is relatively flat in the center, diminishing Z motion effects.



The radial displacement of spider 4 is

$r = 2\, \ell' \sin(\theta/2)$, in which

ℓ' = link 1 half length, ft.

θ = link 1 hinge angle, radians.

Radial velocity and displacement are thus

$$\frac{dr}{dt} = \ell' \cos(\theta/2) \frac{d\theta}{dt}$$

$$\frac{d^2r}{dt^2} = -\frac{\ell'}{2} \sin(\theta/2) \left(\frac{d\theta}{dt}\right)^2 + \ell' \cos(\theta/2) \frac{d\theta}{dt} \frac{d^2\theta}{dt^2} .$$

The acceleration equation is the difference of two terms. Latch up occurs at 180 degree hinge angle, where sin(θ/2) is one and cos(θ/2) is zero. Then the first term is maximum and second is zero, and the most negative spider acceleration is anticipated. Simple model gross features are thus compatible with simulation results.

Model acceleration values are compared to cimulation results for the final two reflector steps of run D 80. Noting that link 1 is 8.78 ft. long and that a link's rotation velocity about end is half hinge angle derivative, the data shown in Table C-8 is assembled. Comparison of acceleration values for the simple model and from the simulation is well within a factor of two. This is good.

C.2.3.5 Link Stress Due to Spider Deceleration Loads - Link tension and stress due to spider deceleration loads are currently obtained by hand calculations using the spider deceleration loads digitally computed by either the than being computed exactly. Radial geometry is assumed to be proportional to the fully deployed geometry. All spiders are treated as though the ratios (RFACT) of center radial displacement to its fully deployed displacement are instantaneously identical. This is true for the fully deployed reflector, but not when packaged.

The packaged configuration is tightly bound with the spiders in contact, and their locations are determined by package characteristics.

An approximate formula is obtained for RFACTIC using the side view of Figure C-18. This view is not exact since the package is 3 dimensional. Spiders 100 to 107 do not lie in the same XZ plane and none are in the Y=0 plane.

Spider 1 is at $4W_S$ packaged and DIA/2 fully deployed. Spider 100 is at 3.5 W_S packaged. Spider 100 fully deployed is observed in Figure C-16 to be at approximately (DIA/2)(3/4)(7/6). Data for seven spiders is shown in Table C-9, and RFACTIC for each is $4W_S$/(DIA/2).

Table C-9. Approximate Spider RFACTIC

Spider No.	Radial Displacement Packaged	Radial Displacement Deployed	RFACTIC
1	4 W_S	DIA/2	4 W_S/(DIA/2)
2	3 W_S	3 DIA/8	Same
3	2 W_S	DIA/4	Same
4	W_S	DIA/8	Same
100	3.5 W_S	(DIA/2)(3/4)(7/6)	Same
101	2.5 W_S	(DIA/2)(1/2)(5/4)	Same
102	1.5 W_S	(DIA/2)(1/4)(3/2)	Same
103	0.5 W_S	(DIA/2)(1/4)(1/2)	Same

Table C-8. Spider 4 and Link 1 Data

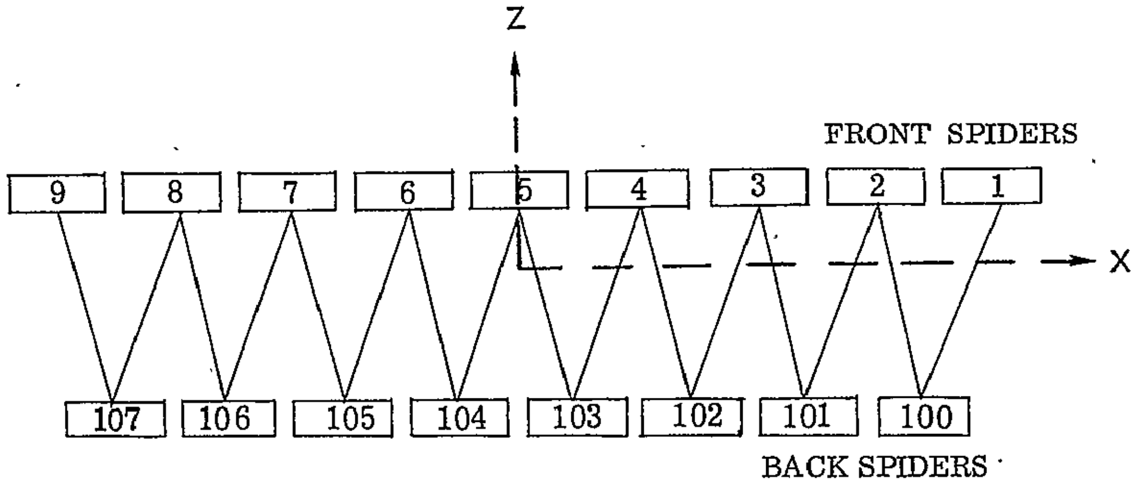
Simulation Results			
KRFACT	20	21	22
$(\frac{1}{2})\ d\theta/dt$ radian/sec	2.746	3.089	3.332
$\vec{a}$ ft/sec^2		-31.25	-112.7

Obtained from Simulation Results		
STEP	KRFACT = 20 to 21	KRFACT = 21 to 22
θ, degrees	174°	179°
$\frac{1}{2}\ (d\theta/dt)$ radian/sec.	3	3.210
$d^2\theta\ /dt^2$ radian/sec.^{2}	+43.4	+93.3
Simple Model Values Using Above Inputs		
$\vec{a}_r$, ft/sec.^{2}	-49.4	-77.3
Radial Component of Simulation Results		
$\vec{a}_r$, ft/sec.^{2}	-30.3	-89.3

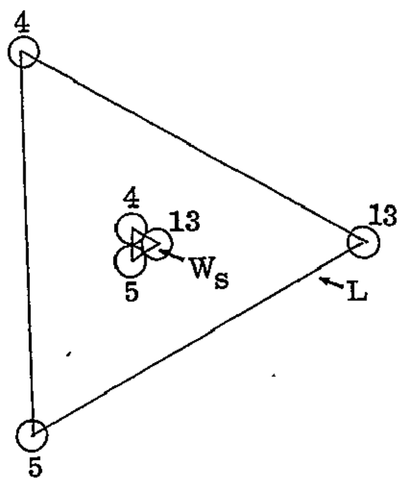
latch up program or the deployment simulation. Since latch up acceleration and spider loads are radial, the link tension is taken to be the arithmetic sum of loads due to outward spiders. Thus link 10 tension is the sum of the loads for spiders 3, 2, and 1.

Deployment simulation acceleration and spider loading are three dimensional vectors; considerable arithmetic is required to produce link tension and stress. This arithmetic could readily be introduced into the simulation. Stress personnel should confirm or improve the tension calculations before initiating programming changes.

C.2.3.6 Geometry Approximation of Packaged Configuration - Reflector packaged configuration geometry is approximated by the simulation, rather



(a) Reflector Side View of X-Z Plane



(b) Tetrahedron Top View of Front Spiders, Packaged and deployed

Figure C-18. Packaged Geometry

The 70 foot reflector spiders will be 22 inches wide, yielding 0.210 for RFACTIC.

This simulation approximation is not detrimental to computational accuracy. Primary effects are on individual component time histories early in deployment and on total spring energy input and driction energy losses. There is no appreciable engineering interest in early component time histories since significant loads occur late. Spring and friction torques are treated by the simulation as average values per hinge. No additional approximations are introduced by the use of an average packaged geometry if RFACTIC is indeed the effective average spider radial displacement ratio.

Titrahedron packaged configuration geometry is exactly computed by the simulation. There are only three moving spiders and they move together. Geometry is shown in Figure C-18, and

$$RFACTIC = \frac{W_S}{L}$$, where L is front link length.

The test tetrahedron has a spider width of 19.0 inches and a 9.74 ft. link, yielding 0.180 for RFACTIC.

An additional approximation is introduced when the simulation capability of simultaneously deploying reflector and tetrahedron is used. Both computations use the same RFACT value; RFACTIC is then a compromise between the two. This can be avoided by opening the reflector on one case of a computer run and the tetrahedron on the next. Runs D 79 and D 80 did this. It is less costly to perform simultaneous deployment. Runs D 79 and D 80 used .131 for reflector and .156 for tetrahedron RFACTIC. This increased spring input and friction loss energies by 8% and 1%.

C.2.4 TYPICAL DEPLOYMENT SIMULATION RESULTS-

C.2.4.1 Input Data - Input data is either based on analytical calculations, or anticipation that hardware will exhibit the manufacturer's specifications. An analytical computation of average mesh torque per hinge was made by stress personnel in November, 1968, for a 8 bay 30 ft. reflector. This data was extrapolated to the 8 bay 70 ft. reflector using the factor $(70/33.0)^2$, after first setting torque to zero at 180.1 degrees. Tetrahedron mesh torque scaling is obtained by noting the hinge torque is mesh force times moment arm. Moment arm is proportional to link half length, which is taken to average 4.35 ft. across the reflector while tet length is 4.13 ft. Mesh force is approximately proportional to width of mesh being stretched while being independent of mesh length. Having computed reflector mesh width as 4.69 ft. and tet width as 1.115 ft., the tet mesh torque is

$$\left(\frac{4.13}{4.35}\right)\left(\frac{1.115}{4.69}\right) = .226$$

times 8 bay 70 ft. torque. Resulting torques are shown on Figure C-19.

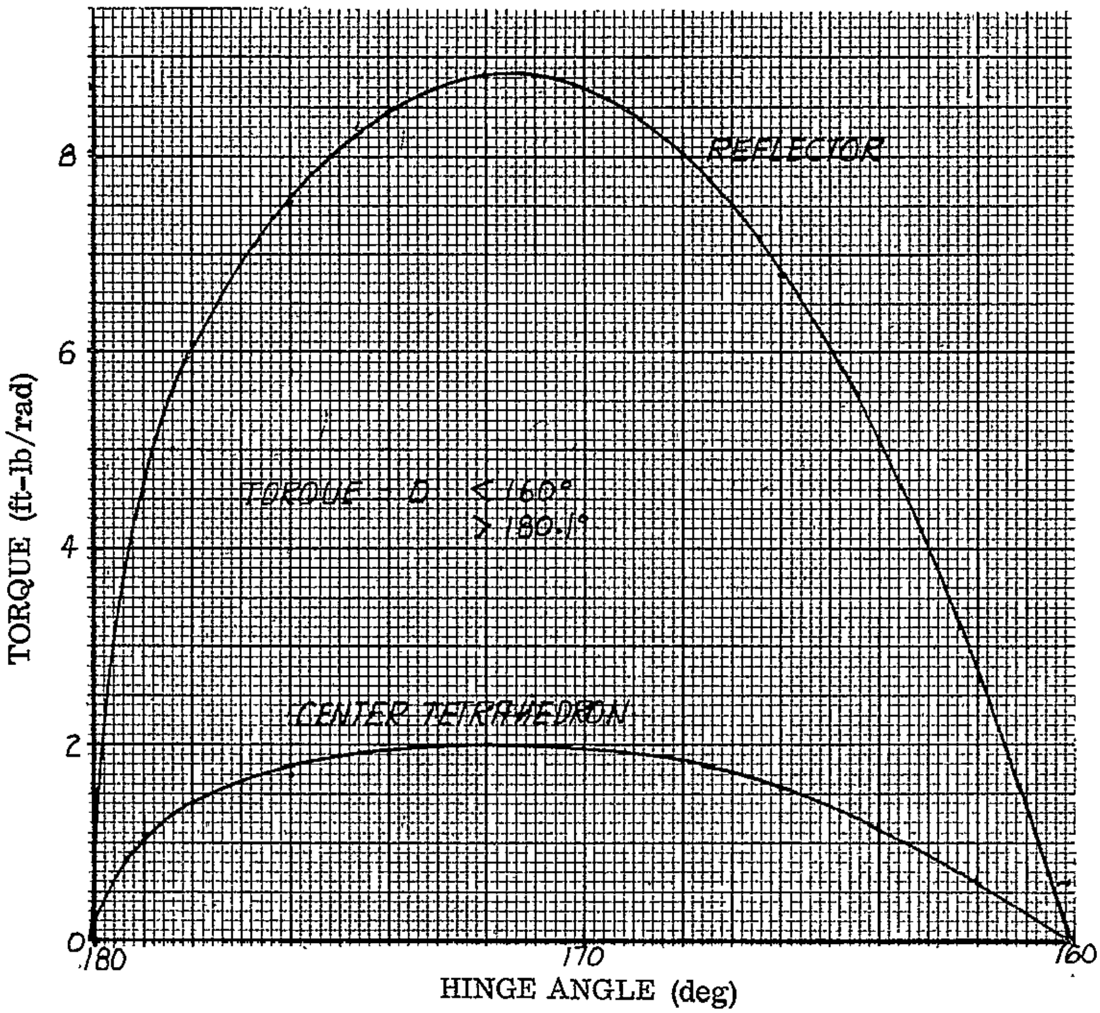


Figure C-19. Average Mesh Torque VS Hinge Angle
8 bay 70 ft. Antenna

Nominal spring torque is 1.8 ft. lbs/radian at breakaway, decreasing linearly to 0.9 ft. lbs/radian at latch up, for both reflector and tet. Data is actually entered as 1.8 at zero degrees hinge angle and .9 at 180; initial hinge angles are around 14 for reflector and are 18 for tet in runs D 79 and D 80.

Viscous friction torque is set at 5 ounce inches per radian for each link end bearing, which was originally assumed to be conservative because manufacturer's specs were 5 ounce inches maximum. This value is taken to be independent of link rotational velocity at the bearing. An option of considering viscous friction as a function of velocity by entering it in units of ft. lbs.

per radian per (radian/second) and multiplying by current velocity is included in the simulation. This option has not been checked.

Currently the simulation makes no torque calculations for the diagonal links, noting they have no hinge springs and do not stretch mesh. Diagonal link friction losses are included by multiplying the bearing friction by an appropriate factor. Noting that the average diagonal link rotates 60 degrees about each end bearing and assuming hinged links rotate 90 degrees,

$$F = 1 + \left(\frac{60}{90}\right) \frac{\text{No Diagonal Links}}{\text{No Hinged Links}}$$, obtaining for the

reflector and tet

$$F = 1 + \left(\frac{60}{90}\right)\left(\frac{144}{276}\right), = 1 + \left(\frac{60}{90}\right)\left(\frac{3}{3}\right)$$

finally obtaining .0352 ft. lbs per radian for antenna and .0304 ft. lbs per radian for tet. Other potential sources of viscous friction, such as hinges, were ignored.

Breakaway friction torque is assumed to be 1.5 x 5 oz inch per radian initially, decreasing linearly to zero at 5 degrees of movement, yielding an energy loss of .00182 ft. lbs. per bearing, for reflector. Tetrahedron loss per bearing is arbitrarily set at 0.7 times reflector. Total breakaway friction energy losses are then 1.529 and .01529 ft. lbs. for reflector and tet, noting that reflector has 420 links, tet has six , and each link has two end bearings.

Weight data for the reflector and the tetrahedron test specimen are given in Table C-10. Reflector design has been weight optimized, iterating through the analysis for latch up loads. Links are .015 or .018 inch wall titanium. The reflector hinge spring is the light weight carpenter's rule type. Tetrahedron test specimen uses .049 inch wall aluminum links and its spiders were originally sized for a 100 ft. design. Hinge structure and spring are sized for the relatively heavy tension and torsion spring types. There are no weight contributions for attached equipment.

C.2.4.2 Generalized Mass Contributions - Variations in generalized mass contributions during deployment provide insight into the relative importance of various component types in the kinetic energy distribution. Six contributions are considered to be significant and are included. It is anticipated that the spiders and diagonal links will initially move rapidly, carrying a major portion of reflector energy. They will continually slow down as deployment proceeds. Angular rotation of hinged links will continually be more important. Linear translation of hinged links will be significant throughout. Linear translation of the additional hinge mass becomes increasingly important as the structure deploys. The simulation formulation includes the additional hinge mass in computing hinged link inertia about end bearing and

Table C-10. Weight Data in Deployment Runs

	Reflector 8 bay 70 ft.	Test Tetrahedron Central tet of Reflector
Front spider weight lbs.	1.422	1.36
Back spider weight lbs.	.432	*
Link material	titanium	aluminum
Link density, lbs/in^3	.160	.0956
Hinged links dimension	2 in OD, .018 in wall	2 in OD, .049 in wall
Diagonal links dimension	1.5 in OD, .015 in wall	1.5 in OD, .049 in wall
Front link linear density, slugs/ft.	.00673	.01096
Diagonal link linear density, slugs/ft.	.00529	.00823
Back link linear density, slugs/ft.	.00673	*
Front link additional hinge structure and spring mass, slugs	0	.01222
Back link additional hinge structure and spring mass, slugs	0	*

* Components not included in tetrahedron

its effects are therefore included in hinged link, rotation. This mass is not included in computing mass of the hinged links and therefore is not included in hinged translation. Its translational energy is handled separately, as the additional hinge mass contribution.

General trends observed in simulation data for the contributions, illustrated on Figure C-20, for the tetrahedron, are similar for the reflector. Step size changes are also observable. Tetrahedron data is presented because its additional hinge mass is non zero. The variable RFACT is the ratio of current spider radial displacement. KRFACT is the index on step number, 2 being the end of first step. Second from last step ends at KRFACT being 20. A contribution includes all components of its type, thus spider translation fraction is due to total number of spiders.

Spider translation and diagonal link translation and rotation are seen to continually decrease as deployment proceeds, being insignificant near latch up. Hinged link rotation contribution is observed to be always significant. Its relative importance increases through deployment, then exhibits a small downward trend near latch up. Additional hinge mass translation is seen to be initially small, and then speeds up as the hinged link rotate toward latch up. Hinged link translation is also seen to be significant through out deployment, initially decreasing slightly and then gently rising near latch up. This translation is initially large due to radial motion, which declines relative to other component velocities as deployment occurs. During later deployment, the hinged links acquire substantial Z axis (parabola symmetry axis) velocity and the translation increases. The minor dip in relative hinged link rotation near latch up is due to the increases in hinge and hinged links translation.

Step size change at mesh occurs at 1 RFACT equals .015 and the resulting generalized mass discontinuities are clearly observable. The generalized mass is the average generalized mass across the step, but is used in calculations and plotted here for step end. Plotting general mass data at step center would result in smooth curves. The last large step is from .086 to .015, with a center at .051, for example. Moving plotted points from .015 to .051 yields smooth curves. Future runs will utilize better step size selection, improving accuracy.

These general trends for relative importance of the several components will appear in all deployment runs; actual values will vary with specific configurations. The additional hinge mass is approximately zero for the carpenter's rule type hinge. Relative values for the reflector change because there are 276 hinged and 144 diagonal links; the tetrahedron has three and three. Further, reflector link walls are thinner and heavy equipment may be attached to the reflector.

C.2.4.3 <u>8 Bay Reflector, Nominal Springs</u> - Data is conveniently plotted against deployment time remaining to obtain a feel for this smoothly changing complex non linear physical process. Examination of simulation accuracy is

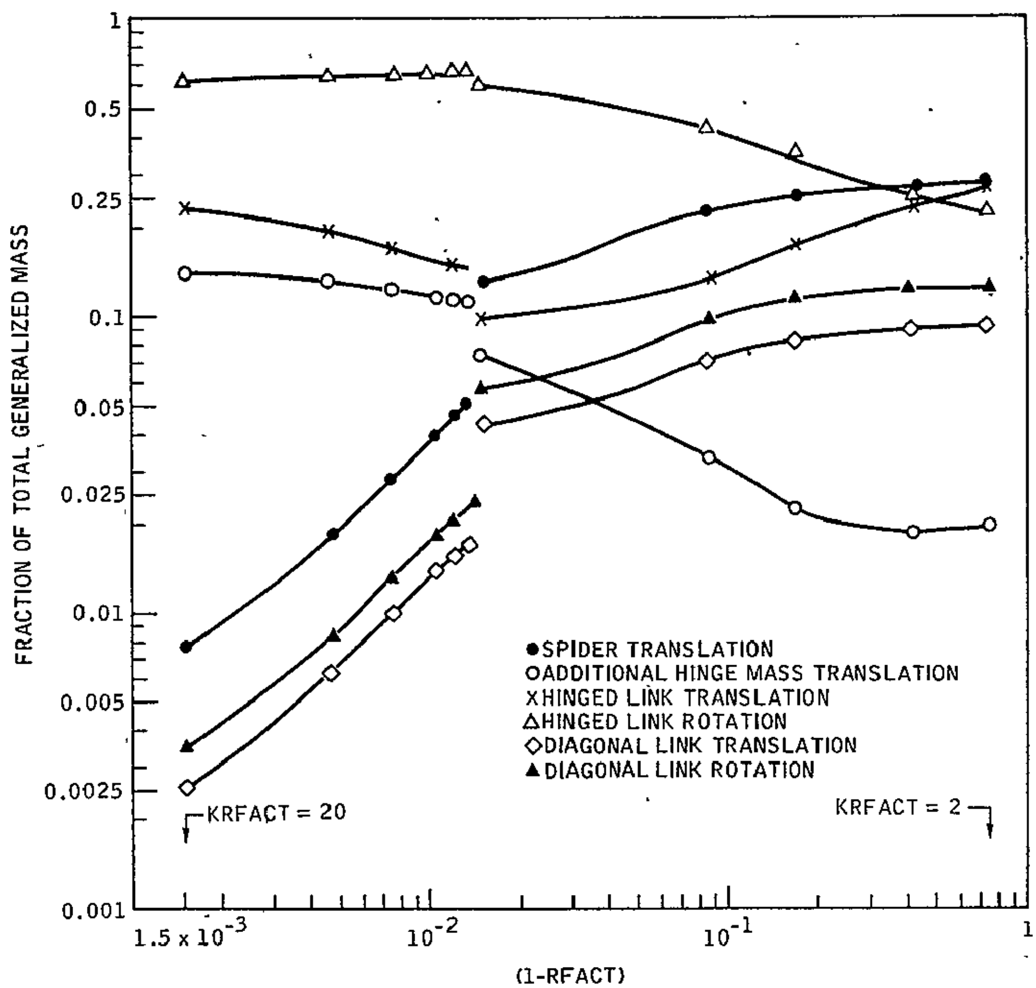


Figure C-20. Tetrahedron Generalized Mass Contributions conveniently done in plots against the step index, KRFACT. Initial geometric arrangement is for KRFACT =1, and end of first step is KRFACT =2. For these runs, step size change occurs at KRFACT = 11, where the mesh is encountered, and at KRFACT = 21, which is beginning of final step. End of final step is KRFACT = 22.

Energies vs KRFACT are shown in Figure C-21. Note negative values are plotted for friction and mesh. Time increases very slightly from KRFACT = 11 to latch up; this increase may not be observable on the Figure. Concurrent testing indicates that viscous friction losses are probably larger than those input for these runs. The discontinuities due to step size change are clear.

Simulation determination of mesh encounter is when that hinge which opens fastest (link 12, which is a link in outer edge of center front surface hexagon) first enters the hinge angle increment whose initial mesh torque is zero and whose final torque is non-zero (160 to 161 degrees for these runs). Mesh energy loss on first few steps is finite but below plot. Not all hinges have encountered the mesh and average mesh torque is low for hinge angles slightly above 160 degrees. Table C-11 shows mesh parameters including the rise in mesh energy. Six steps are required before all front hinges commence mesh stretching.

Table C-11. Mesh Parameters

KRFACT	No of Front Link Sets having angle > 160°	Mesh Energy Total ft. lbs.
11	0	0
12	8	-.36
13	10	-2.77
14	11	-8.29
15	12	-18.13
16	14	-33.20
17	16	-56.04
are 16 front link sets		

Changes in energies, time, and hinge angle are shown in Figure C-22. Change in total reflector energy is the most interesting curve. The increase per step initially increases because the hinge change increases faster than the linear decrease of spring torque. After encountering the mesh at KRFACT = 11

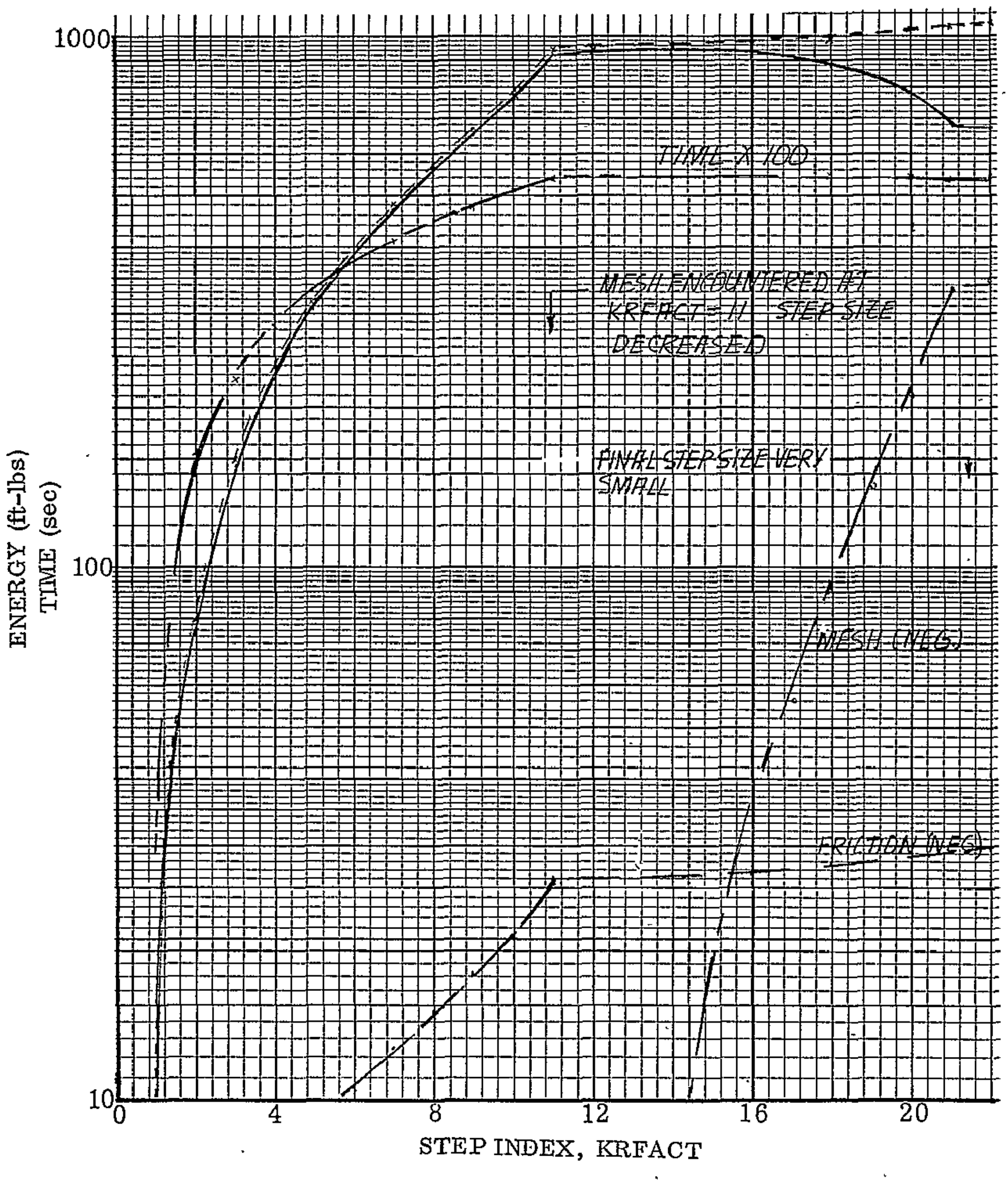


Figure C-21. Reflector Energy vs Step Index, Nominal Springs

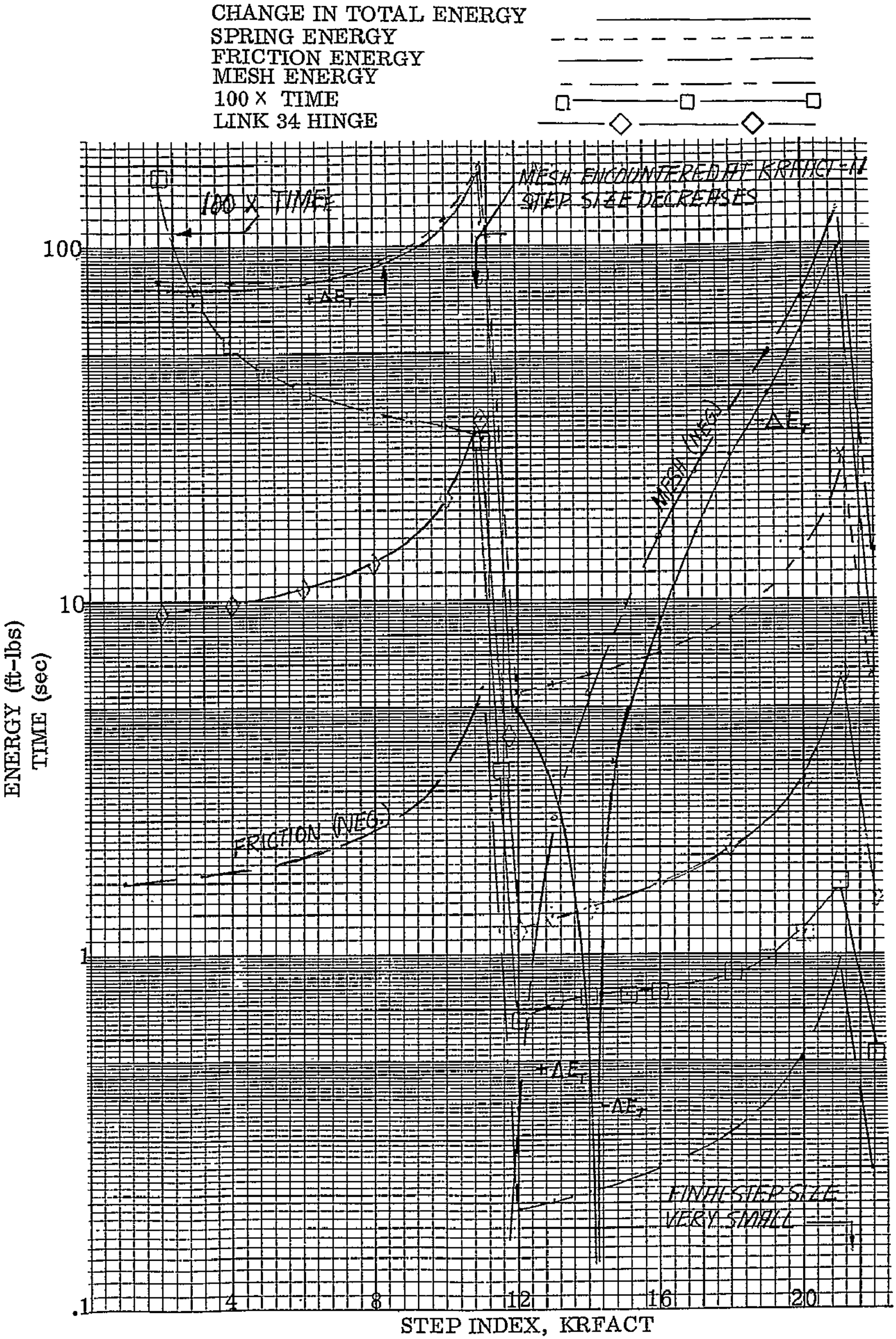


Figure C-22. Reflector Energy Changes vs Step Index, Nominal Springs the total energy increase gets smaller. The total change becomes negative at KRFACT =14. Changes associated with the very small final step are less than proceeding steps, but not less than changes in first step after mesh for several quantities. This occurs despite sharp mesh torque drop near latch up because the links move through appreciable angles on final step. Largest such angle is for front link set 11, which moves through 1.998 degrees. The angle plotted, for link 34 in front set 6, which is representative, moves through 1.5 degrees, and the smallest, link set 2, moves through 1.255 degrees.

Hinge angle change is a key indicator of step size appropriateness, because energy changes are dependent on it, and is discussed in Section 3.1.2.3 and Appendix C.2.3.

Velocity and acceleration of components involved in determining the key latch up loads are shown in Figure C-23. Link 58, an outer radial link in the front surface, sustains the highest hinge velocity impact load. Spider No. 1, an outer front corner spider, sustains the highest deceleration. Link tensions due to spider deceleration are largest for the inner radial link, which must react loads from spiders, 1, 2, 3, and 4. Velocity of spider No. 1 is plotted as a matter of interest. Since the motion of these specific components lies in the X-Z plane, Y velocities (and accelerations) are zero. The simulation outputs velocities and accelerations for all disimilar reflector components in the X-Z plane, and can readily compute and print these values for any reflector components, since all relative velocities are computed at each step.

Maximum load due to spider deceleration will always be in the front surface for a bare reflector; front spider weights always exceed back weights by mesh and mesh standoff mechanism weights. Back spider decelerations are comparable, but slightly smaller than similarly located front spiders. The weight of equipment which may be attached to the reflector can be larger than spider weights; maximum spider load location is then configuration dependent.

Link angular velocities about the end bearings are shown in Figure C-24, with the faster and slowest being indicated for front, diagonal, and back links. Recalling that total mesh energy loss is not significant before KRFACT = 14, the diagonal links are observed to be slowing down before the mesh effectively reduces total energy.

Outer components usually move faster than inner components of the same type. This is not true in general for diagonal links as adjacent ones move through different total angles.

C.2.4.4 Tetrahedron, 0.4 x Nominal Springs - Energy and component time histories are shown in Figure C-25 and C-26 with 0.4 nominal springs and nominal mesh. These Figures illustrate the effects of changing spring torque by comparison with similar figures for nominal springs in Section 3.1.2.4. General features are the same. Mesh is identical and the energy

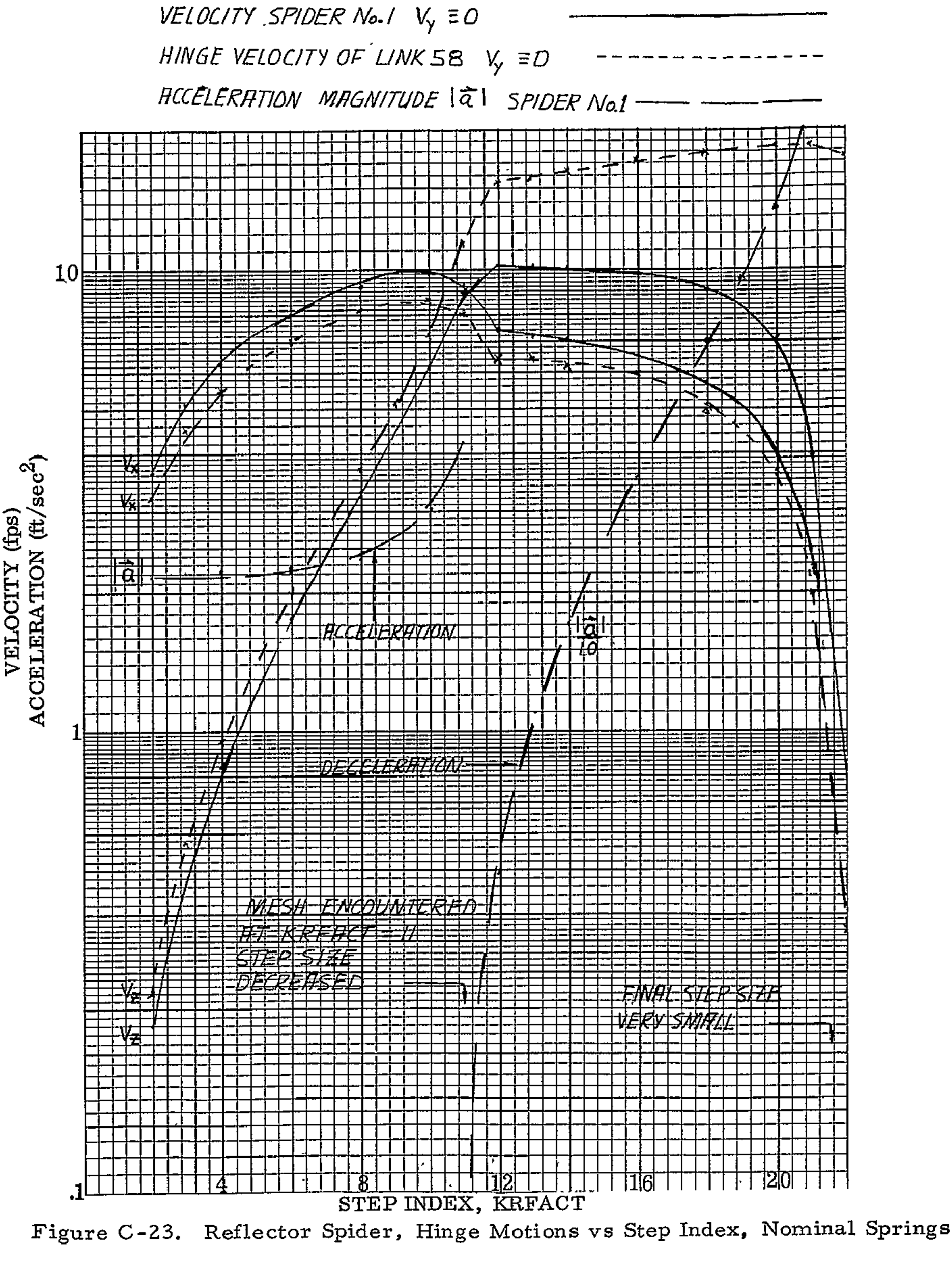


Figure C-23. Reflector Spider, Hinge Motions vs Step Index, Nominal Springs

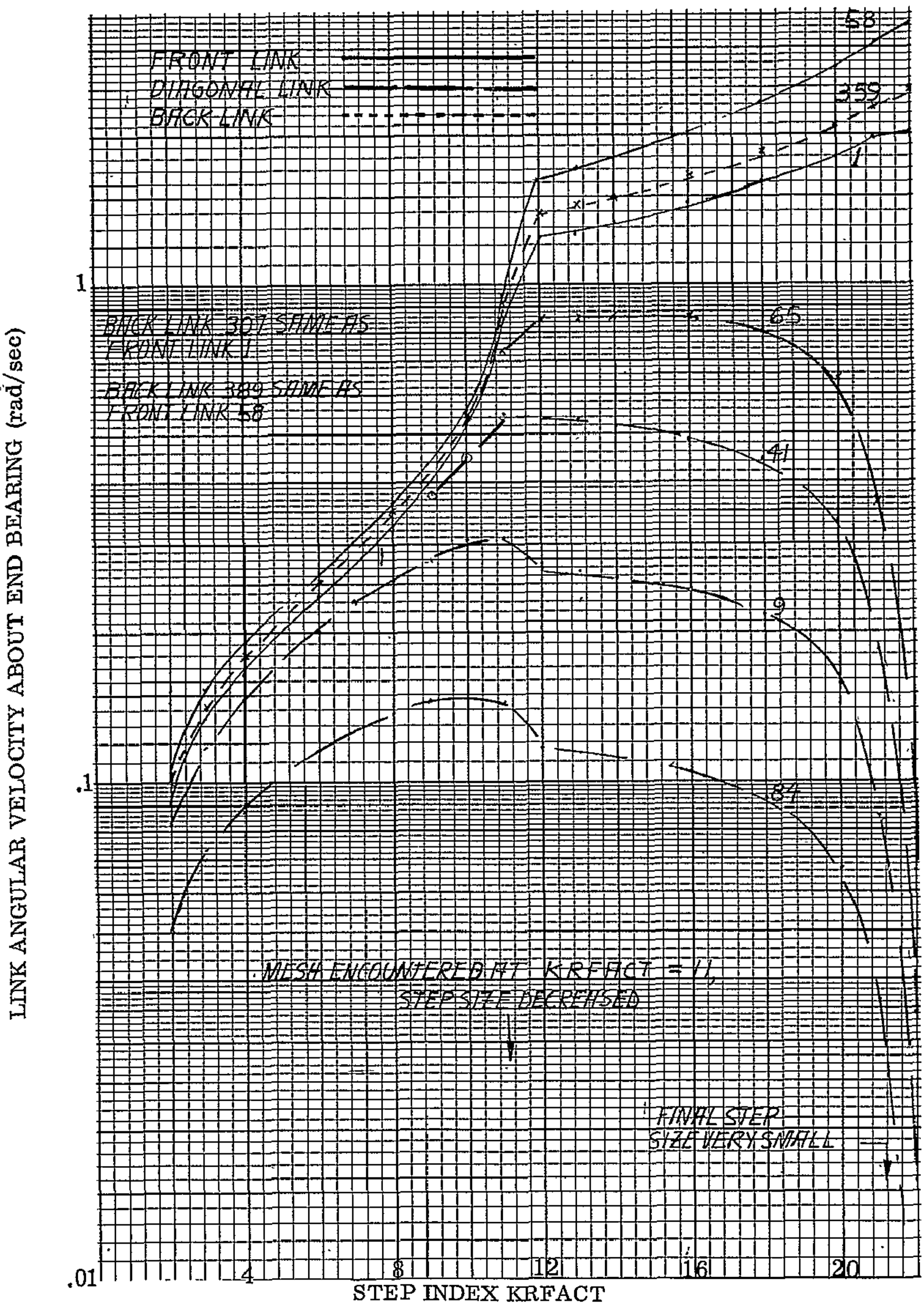


Figure C-24. Reflector Link Angular Velocities vs Step Index, Nominal Springs

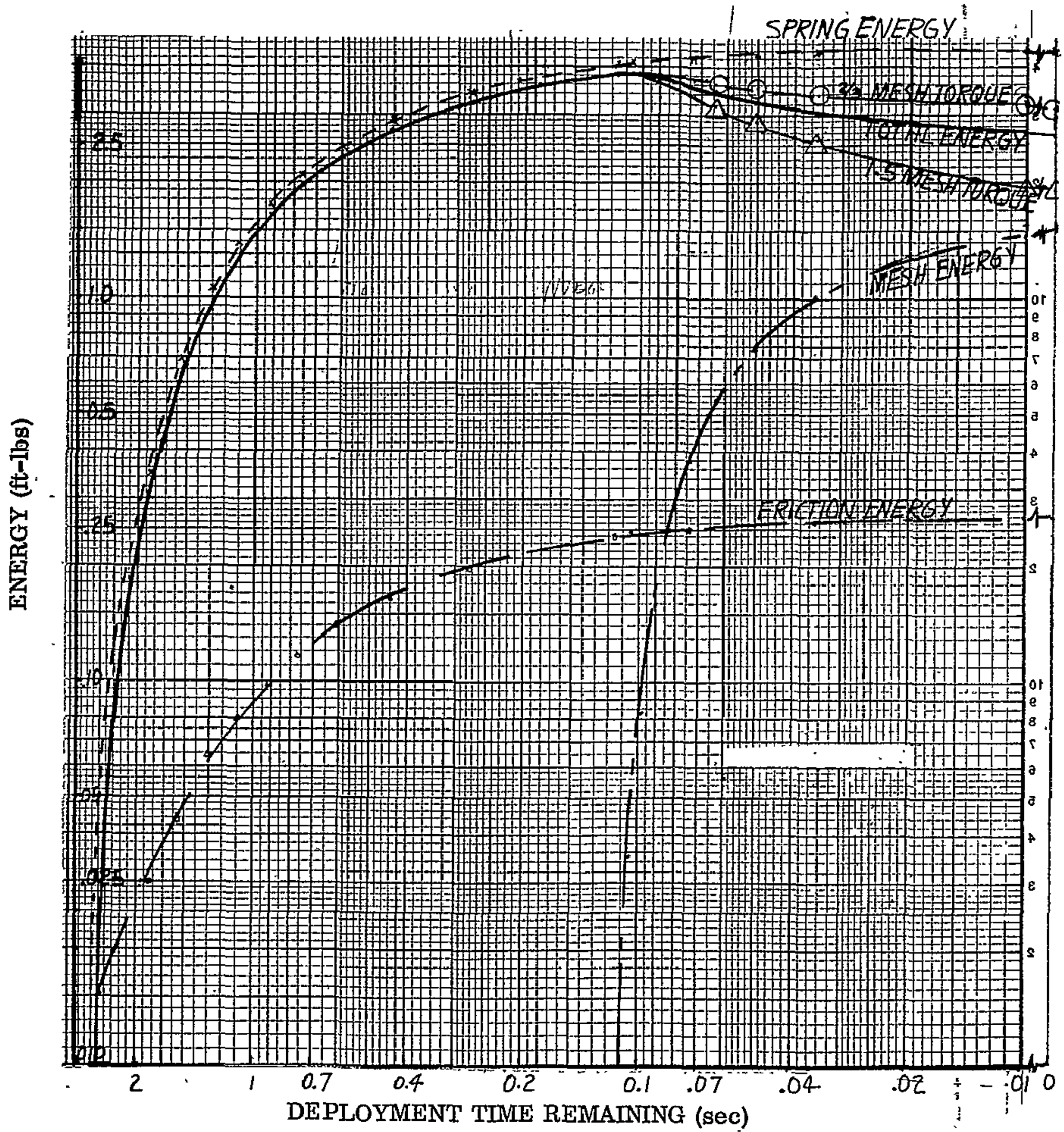


Figure C-25. Tetrahedron Energy Time History, 0.4 X Nominal Springs

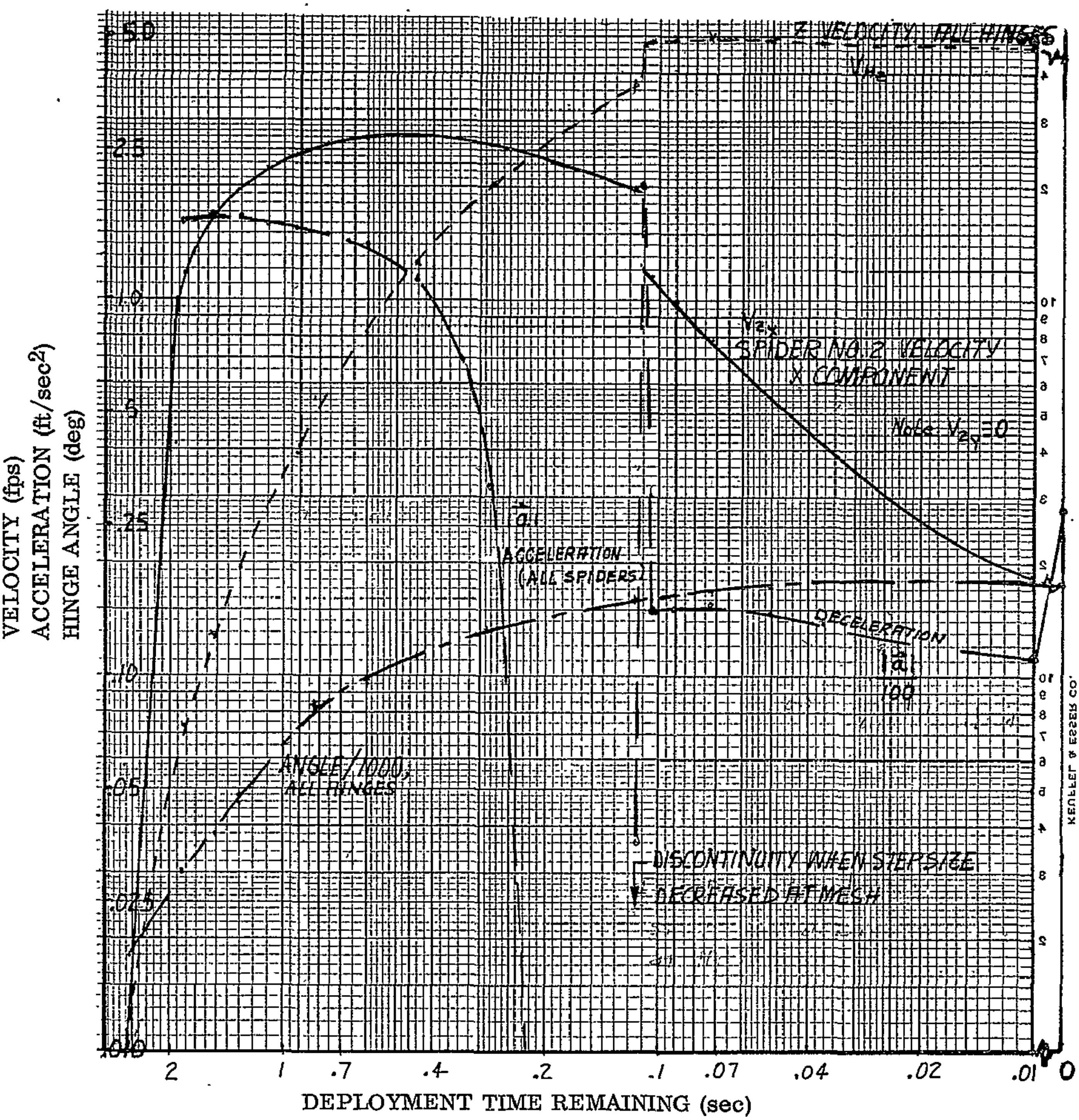


Figure C-26. Tetrahedron Component Time Histories 0.4 X Nominal Springs loss due to mesh tightning causes a larger decrease in total energy for the weaker springs. Total 0.4 nominal spring energy input is 4.2 ft. lbs and the nominal mesh removes 1.6 ft. lbs, yielding 2.6 ft. lbs of latch up energy. Similar numbers for nominal springs are 10.5, 1.5 and 9.0 ft. lbs. Velocities are observed to vary with the square root and accelerations directly with total energy.

Table C-12. Deployment Times, Seconds

	Nominal Springs	0.4 X Nominal Springs
Prior to mesh	1.525	2.465
After mesh	0.068	0.117
Total	1.593	2.582

Large springs produce faster deployments, as seen in Table C-12. Duration of the particularly important mesh stretching phase is shown by the simulation to be quite short, about 4% of total.

Portions of this reflector data are in Section 3.1.1.3, plotted as a function of deployment remaining time. The associated discussion is not completely duplicated here.

REFERENCES

C.1 Westerwick, R. A., and Downing, M., "Truss Antenna Geometry Optimization Program (AGO), User's Manual," Convair Report GDC-ERR-AN-1088, May 1967.

C.2 Downing, M., "Improvements to Truss Antenna Optimization Program (AGO), P4391," Convair Dynamics Group Memo, AD-68-38, November 1968.

C.3 Fager, J. A., "Second Monthly Report - Large Erectable Antenna for Space Application," 1 August 1968 to 1 September 1968, Contract NAS 8-21460, Convair Space Systems (Dept. 581-6) Report, September 1968.

C.4 Gieseke, R. K., Appleby, B., and Tonelli, W. C., "General Missile Vibration Program," Convair Report GDA-DDE-050, 20 August 1964.

C.5 Wissmann, J. W., "Preliminary User's Manual for the Convair Vibration Modes Program (No. P3684) for Three-Dimensional Structures," Convair Report GDC-ERR-AN-1019, 29 December 1966.

C.6 Gieseke, R. K., "Frequencies and Mode Shapes of a 100 foot Space Erectable Antenna," ASME/AIAA 10th Structures, Structural Dynamics and Materials Conference, New Orleans, La., April 14-16, 1969.

C.7 "Large Erectable Antenna for Space Application, Midterm Presentation," NASA Contract NAS 8-21460, General Dynamics Convair, 6 February 1969.

C.8 Downing, M., and Mitchell, H. A., "Deployment Latch Up Dynamics of an Erectable Truss Antenna," 15th Annual Meeting, American Astronautical Society, Denver, Colorado, June 17-20, 1969.

APPENDIX D

THERMAL ANALYSIS

D.1 REFLECTOR MESH TEMPERATURE LISTINGS, 32.99 Ft. ANTENNA.

GOLD PLATED MESH - $\alpha_s = .30$ $\epsilon = .035$

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME NOON

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	451.11	(3, -0)	460.77	(4, -0)	467.74	(5, -0)	470.35	(6, -0)	467.74
(7, -0)	460.77	(8, -0)	451.11	(11, -0)	454.64	(12, -0)	462.90	(13, -0)	467.68
(14, -0)	467.68	(15, -0)	462.90	(16, -0)	454.64	(21, -0)	454.78	(22, -0)	463.05
(23, -0)	467.83	(24, -0)	467.83	(25, -0)	463.05	(26, -0)	454.78	(31, -0)	454.60
(32, -0)	460.66	(33, -0)	462.85	(34, -0)	460.66	(35, -0)	454.60	(41, -0)	454.84
(42, -0)	460.87	(43, -0)	463.09	(44, -0)	460.87	(45, -0)	454.84	(51, -0)	450.93
(52, -0)	454.55	(53, -0)	454.55	(54, -0)	450.93	(61, -0)	451.28	(62, -0)	454.90
(63, -0)	454.90	(64, -0)	451.28	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

1:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	446.97	(3, -0)	456.40	(4, -0)	463.23	(5, -0)	465.76	(6, -0)	463.23
(7, -0)	456.40	(8, -0)	446.97	(11, -0)	455.74	(12, -0)	464.05	(13, -0)	468.85
(14, -0)	468.85	(15, -0)	464.05	(16, -0)	455.74	(21, -0)	445.18	(22, -0)	452.99
(23, -0)	457.52	(24, -0)	457.52	(25, -0)	452.99	(26, -0)	445.18	(31, -0)	460.89
(32, -0)	467.14	(33, -0)	469.43	(34, -0)	467.14	(35, -0)	460.89	(41, -0)	439.73
(42, -0)	445.28	(43, -0)	447.32	(44, -0)	445.28	(45, -0)	439.73	(51, -0)	462.13
(52, -0)	465.95	(53, -0)	465.95	(54, -0)	462.13	(61, -0)	431.05	(62, -0)	434.22
(63, -0)	434.22	(64, -0)	431.05	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

2:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	436.01	(3, -0)	444.83	(4, -0)	451.22	(5, -0)	453.59	(6, -0)	451.22
(7, -0)	444.83	(8, -0)	436.01	(11, -0)	449.81	(12, -0)	457.83	(13, -0)	462.50
(14, -0)	462.50	(15, -0)	457.83	(16, -0)	449.81	(21, -0)	428.44	(22, -0)	435.46
(23, -0)	439.53	(24, -0)	439.53	(25, -0)	435.46	(26, -0)	428.44	(31, -0)	459.96
(32, -0)	466.17	(33, -0)	468.46	(34, -0)	466.17	(35, -0)	459.96	(41, -0)	417.16
(42, -0)	421.86	(43, -0)	423.59	(44, -0)	421.86	(45, -0)	417.16	(51, -0)	465.86
(52, -0)	469.78	(53, -0)	469.78	(54, -0)	465.86	(61, -0)	402.89	(62, -0)	405.43
(63, -0)	405.43	(64, -0)	402.89	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 3:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	416.67	(3, -0)	424.34	(4, -0)	429.93	(5, -0)	432.00	(6, -0)	429.93
(7, -0)	424.34	(8, -0)	416.67	(11, -0)	435.22	(12, -0)	442.56	(13, -0)	446.82
(14, -0)	446.82	(15, -0)	442.56	(16, -0)	435.22	(21, -0)	402.96	(22, -0)	408.69
(23, -0)	412.02	(24, -0)	412.02	(25, -0)	408.69	(26, -0)	402.96	(31, -0)	450.12
(32, -0)	456.01	(33, -0)	458.17	(34, -0)	456.01	(35, -0)	450.12	(41, -0)	385.41
(42, -0)	388.89	(43, -0)	390.17	(44, -0)	388.89	(45, -0)	385.41	(51, -0)	460.53
(52, -0)	464.33	(53, -0)	464.33	(54, -0)	460.53	(61, -0)	365.08	(62, -0)	366.68
(63, -0)	366.68	(64, -0)	365.08	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

4:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	390.11	(3, -0)	396.14	(4, -0)	400.50	(5, -0)	402.13	(6, -0)	400.50
(7, -0)	396.14	(8, -0)	390.11	(11, -0)	413.33	(12, -0)	419.60	(13, -0)	423.22
(14, -0)	423.22	(15, -0)	419.60	(16, -0)	413.33	(21, -0)	369.71	(22, -0)	373.57
(23, -0)	375.84	(24, -0)	375.84	(25, -0)	373.57	(26, -0)	369.71	(31, -0)	432.91
(32, -0)	438.22	(33, -0)	440.14	(34, -0)	438.22	(35, -0)	432.91	(41, -0)	345.06
(42, -0)	346.75	(43, -0)	347.41	(44, -0)	346.75	(45, -0)	345.06	(51, -0)	447.76
(52, -0)	451.28	(53, -0)	451.28	(54, -0)	447.76	(61, -0)	136.93	(62, -0)	141.16
(63, -0)	141.16	(64, -0)	136.93	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

5:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	355.09	(3, -0)	358.64	(4, -0)	361.26	(5, -0)	362.23	(6, -0)	361.26
(7, -0)	358.64	(8, -0)	355.09	(11, -0)	382.66	(12, -0)	387.27	(13, -0)	389.97
(14, -0)	389.97	(15, -0)	387.27	(16, -0)	382.66	(21, -0)	272.71	(22, -0)	285.19
(23, -0)	292.32	(24, -0)	292.32	(25, -0)	285.19	(26, -0)	272.71	(31, -0)	406.67
(32, -0)	410.99	(33, -0)	412.59	(34, -0)	410.99	(35, -0)	406.67	(41, -0)	-174.89
(42, -0)	-174.36	(43, -0)	-174.17	(44, -0)	-174.36	(45, -0)	-174.89	(51, -0)	425.77
(52, -0)	428.84	(53, -0)	428.84	(54, -0)	425.77	(61, -0)	215.69	(62, -0)	222.11
(63, -0)	222.11	(64, -0)	215.69	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 6:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	-2.66	(3, -0)	2.89	(4, -0)	6.72	(5, -0)	8.18	(6, -0)	6.72
(7, -0)	2.89	(8, -0)	-2.66	(11, -0)	343.82	(12, -0)	346.09	(13, -0)	347.41
(14, -0)	347.41	(15, -0)	345.09	(16, -0)	343.82	(21, -0)	77.25	(22, -0)	99.04
(23, -0)	118.55	(24, -0)	118.55	(25, -0)	99.04	(26, -0)	77.25	(31, -0)	372.27
(32, -0)	375.21	(33, -0)	376.27	(34, -0)	375.21	(35, -0)	372.27	(41, -0)	293.27
(42, -0)	266.41	(43, -0)	269.06	(44, -0)	266.41	(45, -0)	293.27	(51, -0)	395.71
(52, -0)	398.08	(53, -0)	398.08	(54, -0)	395.71	(61, -0)	337.22	(62, -0)	340.92
(63, -0)	340.92	(64, -0)	337.22	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

7:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	354.08	(3, -0)	357.52	(4, -0)	208.64	(5, -0)	210.92	(6, -0)	208.64
(7, -0)	357.52	(8, -0)	354.08	(11, -0)	254.49	(12, -0)	-173.62	(13, -0)	-173.21
(14, -0)	-173.21	(15, -0)	-173.62	(16, -0)	254.49	(21, -0)	381.92	(22, -0)	386.51
(23, -0)	389.19	(24, -0)	389.19	(25, -0)	386.51	(26, -0)	381.92	(31, -0)	280.39
(32, -0)	292.05	(33, -0)	295.45	(34, -0)	292.05	(35, -0)	280.39	(41, -0)	405.99
(42, -0)	410.73	(43, -0)	412.33	(44, -0)	410.73	(45, -0)	405.99	(51, -0)	355.94
(52, -0)	357.27	(53, -0)	357.27	(54, -0)	355.94	(61, -0)	425.22	(62, -0)	428.28
(63, -0)	428.28	(64, -0)	425.22	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

8:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	389.43	(3, -0)	395.51	(4, -0)	399.45	(5, -0)	401.19	(6, -0)	399.45
(7, -0)	395.51	(8, -0)	389.43	(11, -0)	368.81	(12, -0)	372.62	(13, -0)	374.87
(14, -0)	374.87	(15, -0)	372.62	(16, -0)	368.81	(21, -0)	412.70	(22, -0)	418.94
(23, -0)	422.58	(24, -0)	422.58	(25, -0)	418.94	(26, -0)	412.70	(31, -0)	342.44
(32, -0)	323.98	(33, -0)	325.81	(34, -0)	323.98	(35, -0)	342.44	(41, -0)	432.56
(42, -0)	437.38	(43, -0)	439.32	(44, -0)	437.38	(45, -0)	432.56	(51, -0)	36.67
(52, -0)	41.18	(53, -0)	41.18	(54, -0)	36.67	(61, -0)	447.51	(62, -0)	-50.03
(63, -0)	-50.03	(64, -0)	447.51	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 9:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	416.20	(3, -0)	423.83	(4, -0)	429.86	(5, -0)	431.74	(6, -0)	429.86
(7, -0)	423.83	(8, -0)	416.20	(11, -0)	402.33	(12, -0)	408.04	(13, -0)	411.36
(14, -0)	411.36	(15, -0)	408.04	(16, -0)	402.33	(21, -0)	434.89	(22, -0)	442.24
(23, -0)	446.49	(24, -0)	446.49	(25, -0)	442.24	(26, -0)	434.89	(31, -0)	384.58
(32, -0)	388.15	(33, -0)	389.42	(34, -0)	388.15	(35, -0)	384.58	(41, -0)	449.85
(42, -0)	456.21	(43, -0)	-82.94	(44, -0)	456.21	(45, -0)	449.85	(51, -0)	364.03
(52, -0)	365.60	(53, -0)	365.60	(54, -0)	364.03	(61, -0)	460.36	(62, -0)	-251.92
(63, -0)	-251.92	(64, -0)	460.36	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

10:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	435.71	(3, -0)	444.56	(4, -0)	450.48	(5, -0)	452.91	(6, -0)	450.48
(7, -0)	444.56	(8, -0)	435.71	(11, -0)	428.01	(12, -0)	435.02	(13, -0)	439.09
(14, -0)	439.09	(15, -0)	435.02	(16, -0)	428.01	(21, -0)	449.59	(22, -0)	457.58
(23, -0)	-26.38	(24, -0)	-26.38	(25, -0)	457.58	(26, -0)	449.59	(31, -0)	416.59
(32, -0)	421.00	(33, -0)	422.74	(34, -0)	421.00	(35, -0)	416.59	(41, -0)	459.86
(42, -0)	465.63	(43, -0)	-253.78	(44, -0)	465.63	(45, -0)	459.86	(51, -0)	402.17
(52, -0)	404.69	(53, -0)	404.69	(54, -0)	402.17	(61, -0)	465.86	(62, -0)	469.45
(63, -0)	469.45	(64, -0)	465.86	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

11:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	446.82	(3, -0)	456.24	(4, -0)	463.52	(5, -0)	465.98	(6, -0)	463.52
(7, -0)	456.24	(8, -0)	446.82	(11, -0)	444.91	(12, -0)	452.71	(13, -0)	457.24
(14, -0)	457.24	(15, -0)	452.71	(16, -0)	444.91	(21, -0)	455.69	(22, -0)	464.00
(23, -0)	-250.38	(24, -0)	-250.38	(25, -0)	464.00	(26, -0)	455.69	(31, -0)	439.34
(32, -0)	445.17	(33, -0)	447.20	(34, -0)	445.17	(35, -0)	439.34	(41, -0)	460.94
(42, -0)	467.61	(43, -0)	469.49	(44, -0)	467.61	(45, -0)	460.94	(51, -0)	430.53
(52, -0)	433.70	(53, -0)	433.70	(54, -0)	430.53	(61, -0)	462.29	(62, -0)	466.25
(63, -0)	466.25	(64, -0)	462.29	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME MIDNIGHT

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	-204.53	(3, -0)	-204.36	(4, -0)	-204.23	(5, -0)	-232.78	(6, -0)	-204.23
(7, -0)	-204.36	(8, -0)	-204.53	(11, -0)	-204.49	(12, -0)	-204.34	(13, -0)	-204.25
(14, -0)	-204.25	(15, -0)	-204.34	(16, -0)	-204.49	(21, -0)	-204.45	(22, -0)	-204.30
(23, -0)	-204.60	(24, -0)	-204.60	(25, -0)	-204.30	(26, -0)	-204.45	(31, -0)	-204.51
(32, -0)	-204.40	(33, -0)	-204.36	(34, -0)	-204.40	(35, -0)	-204.51	(41, -0)	-204.44
(42, -0)	-204.33	(43, -0)	-204.28	(44, -0)	-204.33	(45, -0)	-204.44	(51, -0)	-204.59
(52, -0)	-204.53	(53, -0)	-204.53	(54, -0)	-204.59	(61, -0)	-204.48	(62, -0)	-204.42
(63, -0)	-204.42	(64, -0)	-204.48	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

1:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	447.02	(3, -0)	456.46	(4, -0)	463.29	(5, -0)	465.93	(6, -0)	463.29
(7, -0)	456.46	(8, -0)	447.02	(11, -0)	455.77	(12, -0)	464.06	(13, -0)	-270.55
(14, -0)	-270.55	(15, -0)	464.06	(16, -0)	455.77	(21, -0)	445.24	(22, -0)	453.06
(23, -0)	457.59	(24, -0)	457.59	(25, -0)	453.06	(26, -0)	445.24	(31, -0)	460.89
(32, -0)	467.15	(33, -0)	469.43	(34, -0)	467.15	(35, -0)	460.89	(41, -0)	439.84
(42, -0)	445.37	(43, -0)	447.41	(44, -0)	445.37	(45, -0)	439.84	(51, -0)	462.11
(52, -0)	465.95	(53, -0)	465.95	(54, -0)	462.11	(61, -0)	431.15	(62, -0)	434.34
(63, -0)	434.34	(64, -0)	431.15	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

2:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	435.91	(3, -0)	444.70	(4, -0)	451.08	(5, -0)	453.31	(6, -0)	451.08
(7, -0)	444.70	(8, -0)	435.91	(11, -0)	449.66	(12, -0)	457.70	(13, -0)	-293.01
(14, -0)	-293.01	(15, -0)	457.70	(16, -0)	449.66	(21, -0)	428.31	(22, -0)	435.33
(23, -0)	439.39	(24, -0)	439.39	(25, -0)	435.33	(26, -0)	428.31	(31, -0)	459.80
(32, -0)	466.02	(33, -0)	-205.58	(34, -0)	466.02	(35, -0)	459.80	(41, -0)	417.04
(42, -0)	421.75	(43, -0)	423.47	(44, -0)	421.75	(45, -0)	417.04	(51, -0)	465.73
(52, -0)	469.64	(53, -0)	469.64	(54, -0)	465.73	(61, -0)	402.77	(62, -0)	405.32
(63, -0)	405.32	(64, -0)	402.77	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 6:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	-2.70	(3, -0)	-199.31	(4, -0)	-196.09	(5, -0)	-193.50	(6, -0)	-196.09
(7, -0)	-199.31	(8, -0)	-2.70	(11, -0)	314.54	(12, -0)	156.62	(13, -0)	167.64
(14, -0)	167.64	(15, -0)	156.62	(16, -0)	314.54	(21, -0)	342.67	(22, -0)	344.38
(23, -0)	345.71	(24, -0)	345.71	(25, -0)	344.38	(26, -0)	342.67	(31, -0)	352.42
(32, -0)	271.33	(33, -0)	273.96	(34, -0)	271.33	(35, -0)	352.42	(41, -0)	371.32
(42, -0)	374.27	(43, -0)	375.35	(44, -0)	374.27	(45, -0)	371.32	(51, -0)	378.37
(52, -0)	380.79	(53, -0)	380.79	(54, -0)	378.37	(61, -0)	394.89	(62, -0)	397.26
(63, -0)	397.26	(64, -0)	394.89	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

7:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	353.94	(3, -0)	357.43	(4, -0)	360.06	(5, -0)	360.97	(6, -0)	360.06
(7, -0)	357.43	(8, -0)	353.94	(11, -0)	252.58	(12, -0)	266.20	(13, -0)	275.74
(14, -0)	275.74	(15, -0)	266.20	(16, -0)	252.58	(21, -0)	381.74	(22, -0)	386.36
(23, -0)	389.03	(24, -0)	389.03	(25, -0)	386.36	(26, -0)	381.74	(31, -0)	-113.55
(32, -0)	-101.27	(33, -0)	-96.19	(34, -0)	-101.27	(35, -0)	-113.55	(41, -0)	405.91
(42, -0)	410.22	(43, -0)	411.80	(44, -0)	410.22	(45, -0)	405.91	(51, -0)	196.98
(52, -0)	200.84	(53, -0)	200.84	(54, -0)	196.98	(61, -0)	425.17	(62, -0)	428.21
(63, -0)	428.21	(64, -0)	425.17	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

8:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	389.38	(3, -0)	395.44	(4, -0)	399.69	(5, -0)	401.43	(6, -0)	399.69
(7, -0)	395.44	(8, -0)	389.38	(11, -0)	368.84	(12, -0)	372.66	(13, -0)	374.68
(14, -0)	374.68	(15, -0)	372.66	(16, -0)	368.84	(21, -0)	412.72	(22, -0)	418.98
(23, -0)	422.61	(24, -0)	422.61	(25, -0)	418.98	(26, -0)	412.72	(31, -0)	343.28
(32, -0)	345.06	(33, -0)	345.34	(34, -0)	345.06	(35, -0)	343.28	(41, -0)	432.39
(42, -0)	437.78	(43, -0)	439.73	(44, -0)	437.78	(45, -0)	432.39	(51, -0)	-50.45
(52, -0)	-44.30	(53, -0)	-44.30	(54, -0)	-50.45	(61, -0)	447.33	(62, -0)	450.85
(63, -0)	450.85	(64, -0)	447.33	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 9:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	416.14	(3, -0)	423.77	(4, -0)	429.37	(5, -0)	431.41	(6, -0)	429.37
(7, -0)	423.77	(8, -0)	416.14	(11, -0)	402.23	(12, -0)	407.92	(13, -0)	411.24
(14, -0)	411.24	(15, -0)	407.92	(16, -0)	402.23	(21, -0)	434.82	(22, -0)	442.17
(23, -0)	446.42	(24, -0)	446.42	(25, -0)	442.17	(26, -0)	434.82	(31, -0)	384.49
(32, -0)	387.95	(33, -0)	389.18	(34, -0)	387.95	(35, -0)	384.49	(41, -0)	449.84
(42, -0)	455.71	(43, -0)	457.87	(44, -0)	455.71	(45, -0)	449.84	(51, -0)	364.00
(52, -0)	365.43	(53, -0)	365.43	(54, -0)	364.00	(61, -0)	460.35	(62, -0)	464.15
(63, -0)	464.15	(64, -0)	460.35	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

10:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	435.62	(3, -0)	444.55	(4, -0)	450.88	(5, -0)	453.31	(6, -0)	450.88
(7, -0)	444.55	(8, -0)	435.62	(11, -0)	428.01	(12, -0)	435.03	(13, -0)	438.98
(14, -0)	438.98	(15, -0)	435.03	(16, -0)	428.01	(21, -0)	449.50	(22, -0)	457.61
(23, -0)	462.26	(24, -0)	462.26	(25, -0)	457.61	(26, -0)	449.50	(31, -0)	416.53
(32, -0)	421.25	(33, -0)	422.95	(34, -0)	421.25	(35, -0)	416.53	(41, -0)	459.71
(42, -0)	466.06	(43, -0)	468.34	(44, -0)	466.06	(45, -0)	459.71	(51, -0)	401.95
(52, -0)	404.58	(53, -0)	404.58	(54, -0)	401.95	(61, -0)	465.72	(62, -0)	469.61
(63, -0)	469.61	(64, -0)	465.72	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

11:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	446.81	(3, -0)	456.23	(4, -0)	463.07	(5, -0)	465.60	(6, -0)	463.07
(7, -0)	456.23	(8, -0)	446.81	(11, -0)	444.88	(12, -0)	452.70	(13, -0)	457.21
(14, -0)	457.21	(15, -0)	452.70	(16, -0)	444.88	(21, -0)	455.70	(22, -0)	464.00
(23, -0)	468.81	(24, -0)	468.81	(25, -0)	464.00	(26, -0)	455.70	(31, -0)	439.35
(32, -0)	444.87	(33, -0)	446.88	(34, -0)	444.87	(35, -0)	439.35	(41, -0)	460.96
(42, -0)	467.20	(43, -0)	469.49	(44, -0)	467.20	(45, -0)	460.96	(51, -0)	430.59
(52, -0)	433.67	(53, -0)	433.67	(54, -0)	430.59	(61, -0)	462.30	(62, -0)	466.14
(63, -0)	466.14	(64, -0)	462.30	(					

LARGE EPECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 3:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	416.77	(3, -0)	424.45	(4, -0)	430.04	(5, -0)	432.14	(6, -0)	430.04
(7, -0)	424.45	(8, -0)	416.77	(11, -0)	435.30	(12, -0)	442.66	(13, -0)	446.92
(14, -0)	446.92	(15, -0)	442.66	(16, -0)	435.30	(21, -0)	403.09	(22, -0)	408.82
(23, -0)	412.16	(24, -0)	412.16	(25, -0)	408.82	(26, -0)	403.09	(31, -0)	450.19
(32, -0)	456.08	(33, -0)	-271.02	(34, -0)	456.08	(35, -0)	450.19	(41, -0)	385.54
(42, -0)	389.04	(43, -0)	390.31	(44, -0)	389.04	(45, -0)	385.54	(51, -0)	460.60
(52, -0)	-188.51	(53, -0)	-188.51	(54, -0)	460.60	(61, -0)	365.25	(62, -0)	366.86
(63, -0)	366.86	(64, -0)	365.25	(					

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

4:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	390.04	(3, -0)	396.02	(4, -0)	400.40	(5, -0)	402.06	(6, -0)	400.40
(7, -0)	396.02	(8, -0)	390.04	(11, -0)	413.22	(12, -0)	419.49	(13, -0)	423.21
(14, -0)	423.21	(15, -0)	419.49	(16, -0)	413.22	(21, -0)	369.63	(22, -0)	373.49
(23, -0)	375.74	(24, -0)	375.74	(25, -0)	373.49	(26, -0)	369.63	(31, -0)	432.79
(32, -0)	438.07	(33, -0)	439.94	(34, -0)	438.07	(35, -0)	432.79	(41, -0)	344.11
(42, -0)	340.14	(43, -0)	341.12	(44, -0)	340.14	(45, -0)	344.11	(51, -0)	447.61
(52, -0)	-267.46	(53, -0)	-267.46	(54, -0)	447.61	(61, -0)	138.54	(62, -0)	142.72
(63, -0)	142.72	(64, -0)	138.54	(					

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LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

5:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, -0)	355.25	(3, -0)	358.81	(4, -0)	341.74	(5, -0)	342.89	(6, -0)	341.74
(7, -0)	358.81	(8, -0)	355.25	(11, -0)	382.82	(12, -0)	387.42	(13, -0)	390.13
(14, -0)	390.13	(15, -0)	387.42	(16, -0)	382.82	(21, -0)	275.35	(22, -0)	-105.11
(23, -0)	-95.78	(24, -0)	-95.78	(25, -0)	-105.11	(26, -0)	275.35	(31, -0)	406.80
(32, -0)	411.14	(33, -0)	412.82	(34, -0)	411.14	(35, -0)	406.80	(41, -0)	265.26
(42, -0)	275.27	(43, -0)	278.91	(44, -0)	275.27	(45, -0)	265.26	(51, -0)	425.89
(52, -0)	429.02	(53, -0)	429.02	(54, -0)	425.89	(61, -0)	354.62	(62, -0)	355.94
(63, -0)	355.94	(64, -0)	354.62	(					

D.2 REFLECTOR MESH TEMPERATURE LISTINGS, 70.0 FT. ANTENNA.

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

GOLD PLATED MESH - $\alpha_S = .30$, $\epsilon = .033$

TIME NOON

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	451.11	(2, -0)	458.50	(3, -0)	464.69	(4, -0)	468.86	(5, -0)	470.34
(6, -0)	468.86	(7, -0)	464.69	(8, -0)	458.50	(9, -0)	451.11	(10, -0)	454.11
(11, -0)	460.87	(12, -0)	466.03	(13, -0)	468.84	(14, -0)	468.84	(15, -0)	466.03
(16, -0)	460.87	(17, -0)	454.11	(20, -0)	454.18	(21, -0)	460.93	(22, -0)	466.09
(23, -0)	468.90	(24, -0)	468.90	(25, -0)	466.09	(26, -0)	460.93	(27, -0)	454.18
(30, -0)	455.12	(31, -0)	460.83	(32, -0)	464.63	(33, -0)	465.99	(34, -0)	464.63
(35, -0)	460.83	(36, -0)	455.12	(40, -0)	455.26	(41, -0)	460.97	(42, -0)	464.77
(43, -0)	466.13	(44, -0)	464.77	(45, -0)	460.97	(46, -0)	455.26	(50, -0)	454.02
(51, -0)	458.40	(52, -0)	460.79	(53, -0)	460.79	(54, -0)	458.40	(55, -0)	454.02
(60, -0)	454.25	(61, -0)	458.62	(62, -0)	461.01	(63, -0)	461.01	(64, -0)	458.62
(65, -0)	454.25	(70, -0)	450.97	(71, -0)	454.00	(72, -0)	455.06	(73, -0)	454.00
(74, -0)	450.97	(80, -0)	451.24	(81, -0)	454.28	(82, -0)	455.33	(83, -0)	454.28
(84, -0)	451.24	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 1:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	446.97	(2, -0)	454.21	(3, -0)	460.26	(4, -0)	464.33	(5, -0)	465.76
(6, -0)	464.33	(7, -0)	460.26	(8, -0)	454.21	(9, -0)	446.97	(10, -0)	453.83
(11, -0)	460.60	(12, -0)	465.76	(13, -0)	468.56	(14, -0)	468.56	(15, -0)	465.76
(16, -0)	460.60	(17, -0)	453.83	(20, -0)	445.95	(21, -0)	452.40	(22, -0)	457.32
(23, -0)	460.01	(24, -0)	460.01	(25, -0)	457.32	(26, -0)	452.40	(27, -0)	445.95
(30, -0)	458.79	(31, -0)	464.63	(32, -0)	468.51	(33, -0)	469.88	(34, -0)	468.51
(35, -0)	464.63	(36, -0)	458.79	(40, -0)	442.90	(41, -0)	448.22	(42, -0)	451.78
(43, -0)	453.02	(44, -0)	451.78	(45, -0)	448.22	(46, -0)	442.90	(50, -0)	461.55
(51, -0)	466.13	(52, -0)	468.60	(53, -0)	468.60	(54, -0)	466.13	(55, -0)	461.55
(60, -0)	437.84	(61, -0)	441.82	(62, -0)	443.98	(63, -0)	443.98	(64, -0)	441.82
(65, -0)	437.84	(70, -0)	462.12	(71, -0)	465.34	(72, -0)	466.47	(73, -0)	465.34
(74, -0)	462.12	(80, -0)	431.03	(81, -0)	433.70	(82, -0)	434.62	(83, -0)	433.70
(84, -0)	431.03	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 2:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	436.01	(2, -0)	442.79	(3, -0)	448.43	(4, -0)	452.25	(5, -0)	453.59
(6, -0)	452.25	(7, -0)	448.43	(8, -0)	442.79	(9, -0)	436.01	(10, -0)	446.66
(11, -0)	453.12	(12, -0)	458.09	(13, -0)	460.79	(14, -0)	460.79	(15, -0)	458.09
(16, -0)	453.12	(17, -0)	446.66	(20, -0)	430.68	(21, -0)	436.53	(22, -0)	441.02
(23, -0)	443.45	(24, -0)	443.45	(25, -0)	441.02	(26, -0)	436.53	(27, -0)	430.68
(30, -0)	455.38	(31, -0)	461.10	(32, -0)	464.92	(33, -0)	466.28	(34, -0)	464.92
(35, -0)	461.10	(36, -0)	455.38	(40, -0)	423.21	(41, -0)	427.88	(42, -0)	431.01
(43, -0)	432.09	(44, -0)	431.01	(45, -0)	427.88	(46, -0)	423.21	(50, -0)	461.82
(51, -0)	466.40	(52, -0)	468.89	(53, -0)	468.89	(54, -0)	466.40	(55, -0)	461.82
(60, -0)	413.80	(61, -0)	417.15	(62, -0)	418.97	(63, -0)	418.97	(64, -0)	417.15
(65, -0)	413.80	(70, -0)	465.86	(71, -0)	469.15	(72, -0)	470.28	(73, -0)	469.15
(74, -0)	465.86	(80, -0)	402.86	(81, -0)	405.00	(82, -0)	405.72	(83, -0)	405.00
(84, -0)	402.86	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 3:00 PM

REFLE TOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	416.67	(2, -0)	422.56	(3, -0)	427.50	(4, -0)	430.81	(5, -0)	432.00
(6, -0)	430.81	(7, -0)	427.50	(8, -0)	422.56	(9, -0)	416.67	(10, -0)	430.85
(11, -0)	436.73	(12, -0)	441.21	(13, -0)	443.67	(14, -0)	443.67	(15, -0)	441.21
(16, -0)	436.73	(17, -0)	430.85	(20, -0)	406.77	(21, -0)	411.64	(22, -0)	415.36
(23, -0)	417.41	(24, -0)	417.41	(25, -0)	415.36	(26, -0)	411.64	(27, -0)	406.77
(30, -0)	443.20	(31, -0)	448.53	(32, -0)	452.09	(33, -0)	453.35	(34, -0)	452.09
(35, -0)	448.53	(36, -0)	443.20	(40, -0)	394.60	(41, -0)	398.24	(42, -0)	400.66
(43, -0)	401.53	(44, -0)	400.66	(45, -0)	398.24	(46, -0)	394.60	(50, -0)	453.15
(51, -0)	457.53	(52, -0)	459.89	(53, -0)	459.89	(54, -0)	457.53	(55, -0)	453.15
(60, -0)	380.50	(61, -0)	382.89	(62, -0)	384.19	(63, -0)	384.19	(64, -0)	382.89
(65, -0)	380.50	(70, -0)	460.53	(71, -0)	463.71	(72, -0)	464.84	(73, -0)	463.71
(74, -0)	460.53	(80, -0)	365.06	(81, -0)	366.39	(82, -0)	366.86	(83, -0)	366.39
(84, -0)	365.06	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 4:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	390.11	(2, -0)	394.71	(3, -0)	398.60	(4, -0)	401.20	(5, -0)	402.13
(6, -0)	401.20	(7, -0)	398.60	(8, -0)	394.71	(9, -0)	390.11	(10, -0)	407.80
(11, -0)	412.72	(12, -0)	416.47	(13, -0)	418.54	(14, -0)	418.54	(15, -0)	416.47
(16, -0)	412.72	(17, -0)	407.80	(20, -0)	375.22	(21, -0)	378.68	(22, -0)	381.33
(23, -0)	382.76	(24, -0)	382.76	(25, -0)	381.33	(26, -0)	378.68	(27, -0)	375.22
(30, -0)	423.67	(31, -0)	428.36	(32, -0)	431.49	(33, -0)	432.59	(34, -0)	431.49
(35, -0)	428.36	(36, -0)	423.67	(40, -0)	357.84	(41, -0)	359.98	(42, -0)	361.45
(43, -0)	361.95	(44, -0)	361.45	(45, -0)	359.98	(46, -0)	357.84	(50, -0)	437.09
(51, -0)	441.05	(52, -0)	443.21	(53, -0)	443.21	(54, -0)	441.05	(55, -0)	437.09
(60, -0)	338.36	(61, -0)	339.38	(62, -0)	339.93	(63, -0)	339.93	(64, -0)	339.38
(65, -0)	338.36	(70, -0)	447.76	(71, -0)	450.72	(72, -0)	451.75	(73, -0)	450.72
(74, -0)	447.76	(80, -0)	136.40	(81, -0)	139.97	(82, -0)	141.18	(83, -0)	139.97
(84, -0)	136.40	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 5:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	355.09	(2, -0)	357.82	(3, -0)	360.12	(4, -0)	361.69	(5, -0)	362.23
(6, -0)	361.69	(7, -0)	360.12	(8, -0)	357.82	(9, -0)	355.09	(10, -0)	376.02
(11, -0)	379.50	(12, -0)	382.17	(13, -0)	383.65	(14, -0)	383.65	(15, -0)	382.17
(16, -0)	379.50	(17, -0)	376.02	(20, -0)	334.91	(21, -0)	336.25	(22, -0)	337.32
(23, -0)	337.92	(24, -0)	337.92	(25, -0)	337.32	(26, -0)	336.25	(27, -0)	334.91
(30, -0)	395.22	(31, -0)	398.89	(32, -0)	401.32	(33, -0)	402.19	(34, -0)	401.32
(35, -0)	398.89	(36, -0)	395.22	(40, -0)	-18.21	(41, -0)	-15.42	(42, -0)	-13.67
(43, -0)	-13.02	(44, -0)	-13.67	(45, -0)	-15.42	(46, -0)	-18.21	(50, -0)	411.94
(51, -0)	415.25	(52, -0)	417.03	(53, -0)	417.03	(54, -0)	415.25	(55, -0)	411.94
(60, -0)	-166.77	(61, -0)	-141.77	(62, -0)	-129.80	(63, -0)	-129.80	(64, -0)	-141.77
(65, -0)	-166.77	(70, -0)	425.79	(71, -0)	428.37	(72, -0)	429.26	(73, -0)	428.37
(74, -0)	425.79	(80, -0)	215.80	(81, -0)	221.19	(82, -0)	222.95	(83, -0)	221.19
(84, -0)	215.80	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 6:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	-2.66	(2, -0)	1.65	(3, -0)	5.15	(4, -0)	7.32	(5, -0)	8.18
(6, -0)	7.32	(7, -0)	5.15	(8, -0)	1.65	(9, -0)	-2.66	(10, -0)	336.11
(11, -0)	337.53	(12, -0)	338.64	(13, -0)	339.27	(14, -0)	339.27	(15, -0)	338.64
(16, -0)	337.53	(17, -0)	336.11	(20, -0)	-102.22	(21, -0)	-154.42	(22, -0)	-128.28
(23, -0)	-112.66	(24, -0)	-112.66	(25, -0)	-128.28	(26, -0)	-154.42	(27, -0)	-102.22
(30, -0)	358.61	(31, -0)	360.82	(32, -0)	362.29	(33, -0)	362.83	(34, -0)	362.29
(35, -0)	360.82	(36, -0)	358.61	(40, -0)	214.27	(41, -0)	220.56	(42, -0)	226.26
(43, -0)	228.36	(44, -0)	226.26	(45, -0)	220.56	(46, -0)	214.27	(50, -0)	378.67
(51, -0)	380.98	(52, -0)	382.26	(53, -0)	382.26	(54, -0)	380.98	(55, -0)	378.67
(60, -0)	275.33	(61, -0)	279.88	(62, -0)	282.45	(63, -0)	282.45	(64, -0)	279.88
(65, -0)	275.33	(70, -0)	395.75	(71, -0)	397.71	(72, -0)	398.41	(73, -0)	397.71
(74, -0)	395.75	(80, -0)	337.26	(81, -0)	340.33	(82, -0)	341.40	(83, -0)	340.33
(84, -0)	337.26	(							

D-13

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 7:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	354.08	(2, -0)	356.85	(3, -0)	204.53	(4, -0)	210.10	(5, -0)	210.92
(6, -0)	210.10	(7, -0)	204.53	(8, -0)	356.85	(9, -0)	354.08	(10, -0)	329.11
(11, -0)	-194.54	(12, -0)	-185.06	(13, -0)	-176.92	(14, -0)	-176.92	(15, -0)	-185.06
(16, -0)	-194.54	(17, -0)	329.11	(20, -0)	375.14	(21, -0)	378.75	(22, -0)	381.26
(23, -0)	382.71	(24, -0)	382.71	(25, -0)	381.26	(26, -0)	378.75	(27, -0)	375.14
(30, -0)	16.75	(31, -0)	13.41	(32, -0)	15.68	(33, -0)	16.52	(34, -0)	15.68
(35, -0)	13.41	(36, -0)	16.75	(40, -0)	394.51	(41, -0)	398.26	(42, -0)	400.71
(43, -0)	401.58	(44, -0)	400.71	(45, -0)	398.26	(46, -0)	394.51	(50, -0)	335.83
(51, -0)	336.74	(52, -0)	337.25	(53, -0)	337.25	(54, -0)	336.74	(55, -0)	335.83
(60, -0)	411.33	(61, -0)	414.76	(62, -0)	416.60	(63, -0)	416.60	(64, -0)	414.76
(65, -0)	411.33	(70, -0)	355.96	(71, -0)	357.08	(72, -0)	357.49	(73, -0)	357.08
(74, -0)	355.96	(80, -0)	425.24	(81, -0)	427.79	(82, -0)	428.69	(83, -0)	427.79
(84, -0)	425.24	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 8:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	389.42	(2, -0)	393.79	(3, -0)	397.54	(4, -0)	400.15	(5, -0)	401.19
(6, -0)	400.15	(7, -0)	397.54	(8, -0)	393.79	(9, -0)	389.42	(10, -0)	374.38
(11, -0)	377.58	(12, -0)	380.22	(13, -0)	381.65	(14, -0)	381.65	(15, -0)	380.22
(16, -0)	377.58	(17, -0)	374.38	(20, -0)	407.34	(21, -0)	411.89	(22, -0)	415.82
(23, -0)	417.86	(24, -0)	417.86	(25, -0)	415.82	(26, -0)	411.89	(27, -0)	407.34
(30, -0)	355.97	(31, -0)	358.86	(32, -0)	360.35	(33, -0)	360.85	(34, -0)	360.35
(35, -0)	358.86	(36, -0)	355.97	(40, -0)	423.19	(41, -0)	427.61	(42, -0)	430.74
(43, -0)	431.84	(44, -0)	430.74	(45, -0)	427.61	(46, -0)	423.19	(50, -0)	334.80
(51, -0)	336.27	(52, -0)	337.07	(53, -0)	337.07	(54, -0)	336.27	(55, -0)	334.80
(60, -0)	436.70	(61, -0)	440.35	(62, -0)	442.46	(63, -0)	442.46	(64, -0)	440.35
(65, -0)	436.70	(70, -0)	32.35	(71, -0)	36.06	(72, -0)	37.30	(73, -0)	36.06
(74, -0)	32.35	(80, -0)	447.51	(81, -0)	450.47	(82, -0)	240.16	(83, -0)	450.47
(84, -0)	447.51	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 9:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	416.20	(2, -0)	422.17	(3, -0)	427.42	(4, -0)	430.76	(5, -0)	431.74
(6, -0)	430.76	(7, -0)	427.42	(8, -0)	422.17	(9, -0)	416.20	(10, -0)	406.18
(11, -0)	411.34	(12, -0)	414.81	(13, -0)	416.86	(14, -0)	416.86	(15, -0)	414.81
(16, -0)	411.34	(17, -0)	406.18	(20, -0)	430.45	(21, -0)	436.45	(22, -0)	440.83
(23, -0)	443.27	(24, -0)	443.27	(25, -0)	440.83	(26, -0)	436.45	(27, -0)	430.45
(30, -0)	393.88	(31, -0)	397.50	(32, -0)	399.93	(33, -0)	400.79	(34, -0)	399.93
(35, -0)	397.50	(36, -0)	393.88	(40, -0)	442.90	(41, -0)	448.34	(42, -0)	451.91
(43, -0)	453.16	(44, -0)	451.91	(45, -0)	448.34	(46, -0)	442.90	(50, -0)	379.62
(51, -0)	381.99	(52, -0)	383.28	(53, -0)	383.28	(54, -0)	381.99	(55, -0)	379.62
(60, -0)	452.93	(61, -0)	457.54	(62, -0)	-145.27	(63, -0)	-145.27	(64, -0)	457.54
(65, -0)	452.93	(70, -0)	364.01	(71, -0)	365.32	(72, -0)	365.79	(73, -0)	365.32
(74, -0)	364.01	(80, -0)	460.36	(81, -0)	463.55	(82, -0)	-245.46	(83, -0)	463.55
(84, -0)	460.36	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 10:00 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	435.70	(2, -0)	442.21	(3, -0)	447.71	(4, -0)	451.52	(5, -0)	452.92
(6, -0)	451.52	(7, -0)	447.71	(8, -0)	442.21	(9, -0)	435.70	(10, -0)	430.30
(11, -0)	435.78	(12, -0)	440.40	(13, -0)	442.86	(14, -0)	442.86	(15, -0)	440.40
(16, -0)	435.78	(17, -0)	430.30	(20, -0)	446.48	(21, -0)	452.64	(22, -0)	457.71
(23, -0)	460.40	(24, -0)	460.40	(25, -0)	457.71	(26, -0)	452.64	(27, -0)	446.48
(30, -0)	422.73	(31, -0)	427.18	(32, -0)	430.34	(33, -0)	431.43	(34, -0)	430.34
(35, -0)	427.18	(36, -0)	422.73	(40, -0)	455.24	(41, -0)	460.68	(42, -0)	464.49
(43, -0)	-188.84	(44, -0)	464.49	(45, -0)	460.68	(46, -0)	455.24	(50, -0)	413.22
(51, -0)	416.56	(52, -0)	418.37	(53, -0)	418.37	(54, -0)	416.56	(55, -0)	413.22
(60, -0)	461.74	(61, -0)	465.94	(62, -0)	127.17	(63, -0)	127.17	(64, -0)	465.94
(65, -0)	461.74	(70, -0)	402.16	(71, -0)	404.29	(72, -0)	405.01	(73, -0)	404.29
(74, -0)	402.16	(80, -0)	465.86	(81, -0)	469.15	(82, -0)	469.94	(83, -0)	469.15
(84, -0)	465.86	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 11:00 PM

REFLE-TOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	446.83	(2, -0)	454.16	(3, -0)	460.55	(4, -0)	464.64	(5, -0)	466.00
(6, -0)	464.64	(7, -0)	460.55	(8, -0)	454.16	(9, -0)	446.83	(10, -0)	445.73
(11, -0)	452.58	(12, -0)	457.15	(13, -0)	459.84	(14, -0)	459.84	(15, -0)	457.15
(16, -0)	452.58	(17, -0)	445.73	(20, -0)	453.77	(21, -0)	460.63	(22, -0)	465.74
(23, -0)	-205.83	(24, -0)	-205.83	(25, -0)	465.74	(26, -0)	460.63	(27, -0)	453.77
(30, -0)	442.60	(31, -0)	448.00	(32, -0)	451.57	(33, -0)	452.83	(34, -0)	451.57
(35, -0)	448.00	(36, -0)	442.60	(40, -0)	458.79	(41, -0)	464.73	(42, -0)	468.61
(43, -0)	470.10	(44, -0)	468.61	(45, -0)	464.73	(46, -0)	458.79	(50, -0)	437.45
(51, -0)	441.43	(52, -0)	443.59	(53, -0)	443.59	(54, -0)	441.43	(55, -0)	437.45
(60, -0)	461.62	(61, -0)	466.54	(62, -0)	468.66	(63, -0)	468.66	(64, -0)	466.54
(65, -0)	461.62	(70, -0)	430.56	(71, -0)	433.23	(72, -0)	434.14	(73, -0)	433.23
(74, -0)	430.56	(80, -0)	462.27	(81, -0)	465.48	(82, -0)	466.70	(83, -0)	465.48
(84, -0)	462.27	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 11:25 PM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	449.78	(2, -0)	457.16	(3, -0)	463.29	(4, -0)	467.43	(5, -0)	175.86
(6, -0)	467.43	(7, -0)	463.29	(8, -0)	457.16	(9, -0)	449.78	(10, -0)	450.42
(11, -0)	457.06	(12, -0)	462.13	(13, -0)	464.87	(14, -0)	464.87	(15, -0)	462.13
(16, -0)	457.06	(17, -0)	450.42	(20, -0)	455.13	(21, -0)	461.93	(22, -0)	467.11
(23, -0)	-244.49	(24, -0)	-244.49	(25, -0)	467.11	(26, -0)	461.93	(27, -0)	455.13
(30, -0)	449.07	(31, -0)	454.57	(32, -0)	458.25	(33, -0)	459.56	(34, -0)	458.25
(35, -0)	454.57	(36, -0)	449.07	(40, -0)	458.54	(41, -0)	464.36	(42, -0)	468.24
(43, -0)	469.58	(44, -0)	468.24	(45, -0)	464.36	(46, -0)	458.54	(50, -0)	445.66
(51, -0)	449.84	(52, -0)	452.11	(53, -0)	452.11	(54, -0)	449.84	(55, -0)	445.66
(60, -0)	459.78	(61, -0)	464.27	(62, -0)	466.74	(63, -0)	466.74	(64, -0)	464.27
(65, -0)	459.78	(70, -0)	440.39	(71, -0)	443.22	(72, -0)	444.22	(73, -0)	443.22
(74, -0)	440.39	(80, -0)	458.91	(81, -0)	462.06	(82, -0)	463.16	(83, -0)	462.06
(84, -0)	458.91	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 12:00 PM (MIDNIGHT)

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	-204.78	(2, -0)	-204.65	(3, -0)	-204.53	(4, -0)	-204.46	(5, -0)	-208.42
(6, -0)	-204.46	(7, -0)	-204.53	(8, -0)	-204.65	(9, -0)	-204.78	(10, -0)	-204.74
(11, -0)	-204.67	(12, -0)	-204.52	(13, -0)	-204.47	(14, -0)	-204.47	(15, -0)	-204.52
(16, -0)	-204.62	(17, -0)	-204.74	(20, -0)	-204.72	(21, -0)	-204.59	(22, -0)	-204.49
(23, -0)	-270.91	(24, -0)	-270.91	(25, -0)	-204.49	(26, -0)	-204.59	(27, -0)	-204.72
(30, -0)	-204.74	(31, -0)	-204.63	(32, -0)	-204.56	(33, -0)	-204.54	(34, -0)	-204.56
(35, -0)	-204.63	(36, -0)	-204.74	(40, -0)	-204.68	(41, -0)	-204.57	(42, -0)	-204.50
(43, -0)	-204.48	(44, -0)	-204.50	(45, -0)	-204.57	(46, -0)	-204.68	(50, -0)	-204.77
(51, -0)	-204.69	(52, -0)	-204.64	(53, -0)	-204.64	(54, -0)	-204.69	(55, -0)	-204.77
(60, -0)	-204.69	(61, -0)	-204.61	(62, -0)	-204.56	(63, -0)	-204.56	(64, -0)	-204.61
(65, -0)	-204.69	(70, -0)	-204.84	(71, -0)	-204.79	(72, -0)	-204.76	(73, -0)	-204.79
(74, -0)	-204.84	(80, -0)	-204.73	(81, -0)	-204.68	(82, -0)	-204.65	(83, -0)	-204.68
(84, -0)	-204.73	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 00:35 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	-253.61	(2, -0)	-253.42	(3, -0)	-253.24	(4, -0)	-253.14	(5, -0)	-254.62
(6, -0)	-253.14	(7, -0)	-253.24	(8, -0)	-253.42	(9, -0)	-253.61	(10, -0)	-253.54
(11, -0)	-253.35	(12, -0)	-253.21	(13, -0)	-253.14	(14, -0)	-253.14	(15, -0)	-253.21
(16, -0)	-253.35	(17, -0)	-253.54	(20, -0)	-253.53	(21, -0)	-253.34	(22, -0)	-253.20
(23, -0)	-285.81	(24, -0)	-285.81	(25, -0)	-253.20	(26, -0)	-253.34	(27, -0)	-253.53
(30, -0)	-253.51	(31, -0)	-253.36	(32, -0)	-253.25	(33, -0)	-253.22	(34, -0)	-253.25
(35, -0)	-253.36	(36, -0)	-253.51	(40, -0)	-253.49	(41, -0)	-253.34	(42, -0)	-253.23
(43, -0)	-253.20	(44, -0)	-253.23	(45, -0)	-253.34	(46, -0)	-253.49	(50, -0)	-253.55
(51, -0)	-253.43	(52, -0)	-253.36	(53, -0)	-253.36	(54, -0)	-253.43	(55, -0)	-253.55
(60, -0)	-253.52	(61, -0)	-253.40	(62, -0)	-253.33	(63, -0)	-253.33	(64, -0)	-253.40
(65, -0)	-253.52	(70, -0)	-253.63	(71, -0)	-253.56	(72, -0)	-253.52	(73, -0)	-253.56
(74, -0)	-253.63	(80, -0)	-253.59	(81, -0)	-253.52	(82, -0)	-253.48	(83, -0)	-253.52
(84, -0)	-253.59	(							

D-17

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 1:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	446.99	(2, -0)	454.23	(3, -0)	460.28	(4, -0)	464.35	(5, -0)	465.80
(6, -0)	464.35	(7, -0)	460.28	(8, -0)	454.23	(9, -0)	446.99	(10, -0)	453.87
(11, -0)	460.63	(12, -0)	465.78	(13, -0)	-270.58	(14, -0)	-270.58	(15, -0)	465.78
(16, -0)	460.63	(17, -0)	453.87	(20, -0)	445.97	(21, -0)	452.43	(22, -0)	457.37
(23, -0)	460.06	(24, -0)	460.06	(25, -0)	457.37	(26, -0)	452.43	(27, -0)	445.97
(30, -0)	458.82	(31, -0)	464.65	(32, -0)	468.53	(33, -0)	470.07	(34, -0)	468.53
(35, -0)	464.65	(36, -0)	458.82	(40, -0)	442.94	(41, -0)	448.26	(42, -0)	451.82
(43, -0)	453.08	(44, -0)	451.82	(45, -0)	448.26	(46, -0)	442.94	(50, -0)	461.56
(51, -0)	466.13	(52, -0)	468.60	(53, -0)	468.60	(54, -0)	466.13	(55, -0)	461.56
(60, -0)	437.88	(61, -0)	441.88	(62, -0)	444.03	(63, -0)	444.03	(64, -0)	441.88
(65, -0)	437.88	(70, -0)	462.13	(71, -0)	465.34	(72, -0)	466.46	(73, -0)	465.34
(74, -0)	462.13	(80, -0)	431.10	(81, -0)	433.74	(82, -0)	434.69	(83, -0)	433.74
(84, -0)	431.10	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 2:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	435.84	(2, -0)	442.60	(3, -0)	448.26	(4, -0)	452.06	(5, -0)	453.49
(6, -0)	452.06	(7, -0)	448.26	(8, -0)	442.60	(9, -0)	435.84	(10, -0)	446.48
(11, -0)	452.97	(12, -0)	457.92	(13, -0)	460.40	(14, -0)	460.40	(15, -0)	457.92
(16, -0)	452.97	(17, -0)	446.48	(20, -0)	430.52	(21, -0)	436.36	(22, -0)	440.83
(23, -0)	443.28	(24, -0)	443.28	(25, -0)	440.83	(26, -0)	436.36	(27, -0)	430.52
(30, -0)	455.22	(31, -0)	460.95	(32, -0)	464.75	(33, -0)	-232.18	(34, -0)	464.75
(35, -0)	460.95	(36, -0)	455.22	(40, -0)	423.03	(41, -0)	427.70	(42, -0)	430.82
(43, -0)	431.91	(44, -0)	430.82	(45, -0)	427.70	(46, -0)	423.03	(50, -0)	461.68
(51, -0)	466.25	(52, -0)	468.89	(53, -0)	468.89	(54, -0)	466.25	(55, -0)	461.68
(60, -0)	413.62	(61, -0)	416.97	(62, -0)	418.78	(63, -0)	418.78	(64, -0)	416.97
(65, -0)	413.62	(70, -0)	465.72	(71, -0)	468.98	(72, -0)	470.14	(73, -0)	468.98
(74, -0)	465.72	(80, -0)	402.69	(81, -0)	404.80	(82, -0)	405.56	(83, -0)	404.80
(84, -0)	402.69	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 3:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	416.72	(2, -0)	422.62	(3, -0)	427.54	(4, -0)	430.88	(5, -0)	432.07
(6, -0)	430.88	(7, -0)	427.54	(8, -0)	422.62	(9, -0)	416.72	(10, -0)	430.91
(11, -0)	436.78	(12, -0)	441.26	(13, -0)	443.86	(14, -0)	443.86	(15, -0)	441.26
(16, -0)	436.78	(17, -0)	430.91	(20, -0)	406.83	(21, -0)	411.69	(22, -0)	415.41
(23, -0)	417.46	(24, -0)	417.46	(25, -0)	415.41	(26, -0)	411.69	(27, -0)	406.83
(30, -0)	443.24	(31, -0)	448.58	(32, -0)	452.13	(33, -0)	453.44	(34, -0)	452.13
(35, -0)	448.58	(36, -0)	443.24	(40, -0)	394.67	(41, -0)	398.30	(42, -0)	400.75
(43, -0)	401.61	(44, -0)	400.75	(45, -0)	398.30	(46, -0)	394.67	(50, -0)	453.20
(51, -0)	457.57	(52, -0)	-242.69	(53, -0)	-242.69	(54, -0)	457.57	(55, -0)	453.20
(60, -0)	380.56	(61, -0)	382.96	(62, -0)	384.26	(63, -0)	384.26	(64, -0)	382.96
(65, -0)	380.56	(70, -0)	460.58	(71, -0)	463.76	(72, -0)	-58.78	(73, -0)	463.76
(74, -0)	460.58	(80, -0)	365.14	(81, -0)	366.47	(82, -0)	366.93	(83, -0)	366.47
(84, -0)	365.14	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 4:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	389.97	(2, -0)	394.54	(3, -0)	398.42	(4, -0)	401.03	(5, -0)	402.04
(6, -0)	401.03	(7, -0)	398.42	(8, -0)	394.54	(9, -0)	389.97	(10, -0)	407.64
(11, -0)	412.56	(12, -0)	416.29	(13, -0)	418.28	(14, -0)	418.28	(15, -0)	416.29
(16, -0)	412.56	(17, -0)	407.64	(20, -0)	375.07	(21, -0)	378.52	(22, -0)	381.15
(23, -0)	382.58	(24, -0)	382.58	(25, -0)	381.15	(26, -0)	378.52	(27, -0)	375.07
(30, -0)	423.50	(31, -0)	428.19	(32, -0)	431.31	(33, -0)	432.37	(34, -0)	431.31
(35, -0)	428.19	(36, -0)	423.50	(40, -0)	356.09	(41, -0)	359.84	(42, -0)	361.28
(43, -0)	361.78	(44, -0)	361.28	(45, -0)	359.84	(46, -0)	356.09	(50, -0)	436.92
(51, -0)	440.88	(52, -0)	443.18	(53, -0)	443.18	(54, -0)	440.88	(55, -0)	436.92
(60, -0)	325.53	(61, -0)	327.43	(62, -0)	328.47	(63, -0)	328.47	(64, -0)	327.43
(65, -0)	325.53	(70, -0)	447.59	(71, -0)	450.54	(72, -0)	-252.41	(73, -0)	450.54
(74, -0)	447.59	(80, -0)	133.18	(81, -0)	136.67	(82, -0)	137.84	(83, -0)	136.67
(84, -0)	133.18	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 5:00 AM

REFLE-TOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	355.16	(2, -0)	357.89	(3, -0)	328.98	(4, -0)	331.48	(5, -0)	332.46
(6, -0)	331.48	(7, -0)	328.98	(8, -0)	357.89	(9, -0)	355.16	(10, -0)	376.11
(11, -0)	379.57	(12, -0)	382.28	(13, -0)	383.74	(14, -0)	383.74	(15, -0)	382.28
(16, -0)	379.57	(17, -0)	376.11	(20, -0)	325.25	(21, -0)	281.02	(22, -0)	58.36
(23, -0)	71.22	(24, -0)	71.22	(25, -0)	58.36	(26, -0)	281.02	(27, -0)	325.25
(30, -0)	395.30	(31, -0)	398.96	(32, -0)	401.41	(33, -0)	402.23	(34, -0)	401.41
(35, -0)	398.96	(36, -0)	395.30	(40, -0)	-12.46	(41, -0)	-188.38	(42, -0)	-187.70
(43, -0)	-187.38	(44, -0)	-187.70	(45, -0)	-188.38	(46, -0)	-12.46	(50, -0)	412.00
(51, -0)	415.30	(52, -0)	417.01	(53, -0)	417.01	(54, -0)	415.30	(55, -0)	412.00
(60, -0)	323.29	(61, -0)	329.53	(62, -0)	332.90	(63, -0)	332.90	(64, -0)	329.53
(65, -0)	323.29	(70, -0)	425.85	(71, -0)	428.42	(72, -0)	429.26	(73, -0)	428.42
(74, -0)	425.85	(80, -0)	354.76	(81, -0)	355.86	(82, -0)	356.25	(83, -0)	355.86
(84, -0)	354.76	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 6:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	-6.04	(2, -0)	-194.97	(3, -0)	-198.23	(4, -0)	-195.61	(5, -0)	-194.75
(6, -0)	-195.61	(7, -0)	-198.23	(8, -0)	-194.97	(9, -0)	-6.04	(10, -0)	244.83
(11, -0)	46.85	(12, -0)	70.49	(13, -0)	82.11	(14, -0)	82.11	(15, -0)	70.49
(16, -0)	46.85	(17, -0)	244.83	(20, -0)	327.08	(21, -0)	315.78	(22, -0)	320.03
(23, -0)	322.33	(24, -0)	322.33	(25, -0)	320.03	(26, -0)	315.78	(27, -0)	327.08
(30, -0)	323.18	(31, -0)	228.85	(32, -0)	234.03	(33, -0)	235.65	(34, -0)	234.03
(35, -0)	228.85	(36, -0)	323.18	(40, -0)	357.63	(41, -0)	359.67	(42, -0)	361.11
(43, -0)	361.63	(44, -0)	361.11	(45, -0)	359.67	(46, -0)	357.63	(50, -0)	349.33
(51, -0)	283.47	(52, -0)	285.62	(53, -0)	285.62	(54, -0)	283.47	(55, -0)	349.33
(60, -0)	377.83	(61, -0)	380.12	(62, -0)	381.39	(63, -0)	381.39	(64, -0)	380.12
(65, -0)	377.83	(70, -0)	368.98	(71, -0)	371.17	(72, -0)	371.72	(73, -0)	371.17
(74, -0)	368.98	(80, -0)	395.00	(81, -0)	396.95	(82, -0)	397.65	(83, -0)	396.95
(84, -0)	395.00	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 7:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	354.03	(2, -0)	356.77	(3, -0)	359.02	(4, -0)	360.57	(5, -0)	361.07
(6, -0)	360.57	(7, -0)	359.02	(8, -0)	356.77	(9, -0)	354.03	(10, -0)	317.71
(11, -0)	310.83	(12, -0)	315.03	(13, -0)	318.93	(14, -0)	318.93	(15, -0)	315.03
(16, -0)	310.83	(17, -0)	317.71	(20, -0)	375.14	(21, -0)	378.61	(22, -0)	381.29
(23, -0)	382.73	(24, -0)	382.73	(25, -0)	381.29	(26, -0)	378.61	(27, -0)	375.14
(30, -0)	-199.65	(31, -0)	-195.35	(32, -0)	-192.81	(33, -0)	-192.53	(34, -0)	-192.81
(35, -0)	-195.35	(36, -0)	-199.65	(40, -0)	394.46	(41, -0)	398.31	(42, -0)	400.75
(43, -0)	401.61	(44, -0)	400.75	(45, -0)	398.31	(46, -0)	394.46	(50, -0)	18.10
(51, -0)	19.29	(52, -0)	24.46	(53, -0)	24.46	(54, -0)	19.29	(55, -0)	18.10
(60, -0)	411.29	(61, -0)	414.59	(62, -0)	416.37	(63, -0)	416.37	(64, -0)	414.59
(65, -0)	411.29	(70, -0)	196.61	(71, -0)	200.33	(72, -0)	200.71	(73, -0)	200.33
(74, -0)	196.61	(80, -0)	425.25	(81, -0)	427.79	(82, -0)	428.70	(83, -0)	427.79
(84, -0)	425.25	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 8:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	389.44	(2, -0)	394.01	(3, -0)	397.86	(4, -0)	400.47	(5, -0)	401.36
(6, -0)	400.47	(7, -0)	397.86	(8, -0)	394.01	(9, -0)	389.44	(10, -0)	374.44
(11, -0)	377.63	(12, -0)	380.36	(13, -0)	381.63	(14, -0)	381.63	(15, -0)	380.36
(16, -0)	377.63	(17, -0)	374.44	(20, -0)	407.23	(21, -0)	411.95	(22, -0)	415.75
(23, -0)	417.78	(24, -0)	417.78	(25, -0)	415.75	(26, -0)	411.95	(27, -0)	407.23
(30, -0)	356.57	(31, -0)	358.74	(32, -0)	360.17	(33, -0)	360.73	(34, -0)	360.17
(35, -0)	358.74	(36, -0)	356.57	(40, -0)	423.17	(41, -0)	427.58	(42, -0)	430.69
(43, -0)	431.79	(44, -0)	430.69	(45, -0)	427.58	(46, -0)	423.17	(50, -0)	319.30
(51, -0)	322.03	(52, -0)	324.18	(53, -0)	324.18	(54, -0)	322.03	(55, -0)	319.30
(60, -0)	436.63	(61, -0)	440.59	(62, -0)	442.75	(63, -0)	442.75	(64, -0)	440.59
(65, -0)	436.63	(70, -0)	-46.60	(71, -0)	-41.55	(72, -0)	-35.61	(73, -0)	-41.55
(74, -0)	-46.60	(80, -0)	447.36	(81, -0)	450.32	(82, -0)	451.34	(83, -0)	450.32
(84, -0)	447.36	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 9:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	416.16	(2, -0)	422.07	(3, -0)	427.00	(4, -0)	430.32	(5, -0)	431.47
(6, -0)	430.32	(7, -0)	427.00	(8, -0)	422.07	(9, -0)	416.16	(10, -0)	406.16
(11, -0)	411.17	(12, -0)	414.75	(13, -0)	416.89	(14, -0)	416.89	(15, -0)	414.75
(16, -0)	411.17	(17, -0)	406.16	(20, -0)	430.47	(21, -0)	436.41	(22, -0)	440.88
(23, -0)	443.33	(24, -0)	443.33	(25, -0)	440.88	(26, -0)	436.41	(27, -0)	430.47
(30, -0)	394.23	(31, -0)	397.77	(32, -0)	400.20	(33, -0)	400.93	(34, -0)	400.20
(35, -0)	397.77	(36, -0)	394.23	(40, -0)	442.90	(41, -0)	448.59	(42, -0)	452.15
(43, -0)	453.41	(44, -0)	452.15	(45, -0)	448.59	(46, -0)	442.90	(50, -0)	379.62
(51, -0)	381.97	(52, -0)	383.42	(53, -0)	383.42	(54, -0)	381.97	(55, -0)	379.62
(60, -0)	452.92	(61, -0)	457.29	(62, -0)	459.65	(63, -0)	459.65	(64, -0)	457.29
(65, -0)	452.92	(70, -0)	364.08	(71, -0)	365.41	(72, -0)	365.79	(73, -0)	365.41
(74, -0)	364.08	(80, -0)	460.37	(81, -0)	463.56	(82, -0)	464.67	(83, -0)	463.56
(84, -0)	460.37	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 10:00 AM

REFLE TOR MFSH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	435.65	(2, -0)	442.50	(3, -0)	448.12	(4, -0)	451.95	(5, -0)	453.26
(6, -0)	451.95	(7, -0)	448.12	(8, -0)	442.50	(9, -0)	435.65	(10, -0)	430.24
(11, -0)	435.87	(12, -0)	440.40	(13, -0)	442.77	(14, -0)	442.77	(15, -0)	440.40
(16, -0)	435.87	(17, -0)	430.24	(20, -0)	446.35	(21, -0)	452.65	(22, -0)	457.62
(23, -0)	460.30	(24, -0)	460.30	(25, -0)	457.62	(26, -0)	452.65	(27, -0)	446.35
(30, -0)	422.37	(31, -0)	427.05	(32, -0)	430.16	(33, -0)	431.28	(34, -0)	430.16
(35, -0)	427.05	(36, -0)	422.37	(40, -0)	455.14	(41, -0)	460.56	(42, -0)	464.38
(43, -0)	465.71	(44, -0)	464.38	(45, -0)	460.56	(46, -0)	455.14	(50, -0)	413.07
(51, -0)	416.39	(52, -0)	418.09	(53, -0)	418.09	(54, -0)	416.39	(55, -0)	413.07
(60, -0)	461.61	(61, -0)	466.20	(62, -0)	468.67	(63, -0)	468.67	(64, -0)	466.20
(65, -0)	461.61	(70, -0)	401.99	(71, -0)	404.12	(72, -0)	405.03	(73, -0)	404.12
(74, -0)	401.99	(80, -0)	465.71	(81, -0)	468.97	(82, -0)	470.13	(83, -0)	468.97
(84, -0)	465.71	(							

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 11:00 AM

REFLECTOR MESH

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, -0)	446.83	(2, -0)	454.06	(3, -0)	460.11	(4, -0)	464.19	(5, -0)	465.62
(6, -0)	464.19	(7, -0)	460.11	(8, -0)	454.06	(9, -0)	446.83	(10, -0)	445.72
(11, -0)	452.28	(12, -0)	457.17	(13, -0)	459.90	(14, -0)	459.90	(15, -0)	457.17
(16, -0)	452.28	(17, -0)	445.72	(20, -0)	453.78	(21, -0)	460.63	(22, -0)	465.79
(23, -0)	468.59	(24, -0)	468.59	(25, -0)	465.79	(26, -0)	460.63	(27, -0)	453.78
(30, -0)	443.04	(31, -0)	448.31	(32, -0)	451.87	(33, -0)	453.04	(34, -0)	451.87
(35, -0)	448.31	(36, -0)	443.04	(40, -0)	458.81	(41, -0)	465.06	(42, -0)	468.97
(43, -0)	470.34	(44, -0)	468.97	(45, -0)	465.06	(46, -0)	458.81	(50, -0)	437.50
(51, -0)	441.47	(52, -0)	443.72	(53, -0)	443.72	(54, -0)	441.47	(55, -0)	437.50
(60, -0)	461.64	(61, -0)	466.23	(62, -0)	468.69	(63, -0)	468.69	(64, -0)	466.23
(65, -0)	461.64	(70, -0)	430.62	(71, -0)	433.30	(72, -0)	434.18	(73, -0)	433.30
(74, -0)	430.62	(80, -0)	462.29	(81, -0)	465.50	(82, -0)	466.61	(83, -0)	465.50
(84, -0)	462.29	(							

D. 3 TUBULAR ELEMENT TEMPERATURE LISTINGS, 32.99 FT. ANTENNA

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA. [COATING $K_S = \epsilon = .25$]

TIME - NOON

SURFACE STRUTS

[TITANIUM O.D. = 1.5" t = 0.010"]

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	60.43	(2, 11)	73.85	(2, 21)	72.50	(3, 4)	70.02	(3, 11)	68.74
(3, 12)	75.64	(3, 21)	70.85	(3, 22)	74.95	(4, 5)	75.48	(4, 12)	72.46
(4, 13)	76.02	(4, 22)	73.68	(4, 23)	76.03	(5, 6)	75.48	(5, 13)	74.95
(5, 14)	74.95	(5, 23)	75.66	(5, 24)	75.66	(6, 7)	70.02	(6, 14)	76.02
(6, 15)	72.46	(6, 24)	76.03	(6, 25)	73.88	(7, 8)	60.43	(7, 15)	75.64
(7, 16)	68.74	(7, 25)	74.95	(7, 26)	70.85	(8, 16)	73.85	(8, 26)	72.50
(11, 12)	65.62	(11, 31)	76.00	(12, 13)	73.37	(12, 31)	63.89	(12, 32)	74.94
(13, 14)	76.20	(13, 32)	68.73	(13, 33)	72.44	(14, 15)	73.37	(14, 33)	72.44
(14, 34)	68.73	(15, 16)	65.62	(15, 34)	74.94	(15, 35)	63.89	(16, 35)	76.00
(21, 22)	65.62	(21, 41)	76.03	(22, 23)	73.37	(22, 41)	66.77	(22, 42)	75.61
(23, 24)	76.20	(23, 42)	70.82	(23, 43)	73.84	(24, 25)	73.37	(24, 43)	73.84
(24, 44)	70.82	(25, 26)	65.62	(25, 44)	75.61	(25, 45)	66.77	(26, 45)	76.03
(31, 32)	70.01	(31, 51)	72.48	(32, 33)	75.48	(32, 51)	58.26	(32, 52)	68.71
(33, 34)	75.48	(33, 52)	63.97	(33, 53)	63.97	(34, 35)	70.01	(34, 53)	68.71
(34, 54)	58.26	(35, 54)	72.48	(41, 42)	70.01	(41, 61)	73.87	(42, 43)	75.48
(42, 61)	61.91	(42, 62)	70.80	(43, 44)	75.48	(43, 62)	66.76	(43, 63)	66.76
(44, 45)	70.01	(44, 63)	70.80	(44, 64)	61.91	(45, 64)	73.87	(51, 52)	73.37
(52, 53)	76.19	(53, 54)	73.37	(61, 62)	73.37	(62, 63)	76.19	(63, 64)	73.37

DIAGONAL STRUTS

[TITANIUM O.D. = 1.0" t = 0.010"]

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,101)	14.22	(3,101)	75.77	(3,102)	27.96	(3,201)	62.77	(4,102)	69.90
(4,103)	43.57	(4,202)	57.01	(5,103)	58.44	(5,104)	58.44	(5,203)	54.57
(6,104)	43.57	(6,105)	69.90	(6,204)	57.01	(7,105)	27.96	(7,106)	75.77
(7,205)	62.77	(8,106)	14.22	(11,101)	52.86	(11,301)	36.71	(12,102)	43.49
(12,301)	75.42	(12,302)	49.13	(13,103)	37.33	(13,302)	70.02	(13,303)	60.75
(14,104)	37.33	(14,303)	60.75	(14,304)	70.02	(15,105)	43.49	(15,304)	49.13
(15,305)	75.42	(16,106)	52.86	(16,305)	36.71	(21,201)	7.48	(22,201)	72.01
(22,202)	24.10	(22,401)	70.35	(23,202)	60.29	(23,203)	43.12	(23,402)	67.72
(24,203)	43.12	(24,204)	60.29	(24,403)	67.72	(25,204)	24.10	(25,205)	72.01
(25,404)	70.35	(26,205)	7.48	(31,301)	28.94	(31,501)	57.21	(32,302)	18.81
(32,501)	75.81	(32,502)	65.81	(33,303)	14.70	(33,502)	72.29	(33,503)	72.29
(34,304)	18.81	(34,503)	65.81	(34,504)	75.81	(35,305)	28.94	(35,504)	57.21
(41,401)	6.81	(42,401)	65.17	(42,402)	26.91	(42,601)	75.17	(43,402)	48.17
(43,403)	48.17	(43,602)	74.60	(44,403)	26.91	(44,404)	65.17	(44,603)	75.17
(45,404)	6.81	(51,501)	1.75	(52,502)	-6.62	(53,503)	-6.62	(54,504)	1.75
(61,601)	12.83	(62,601)	56.22	(62,602)	35.29	(63,602)	35.29	(63,603)	56.22
(64,603)	12.83	(							

BOTTOM STRUTS

[TITANIUM O.D. = 1.5" t = 0.010"]

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	63.98	(101,201)	72.29	(101,301)	75.55	(102,103)	72.99	(102,201)	73.39
(102,202)	74.91	(102,301)	68.01	(102,302)	76.06	(103,104)	76.20	(103,202)	75.59
(103,203)	76.07	(103,302)	72.05	(103,303)	74.83	(104,105)	72.99	(104,203)	76.07
(104,204)	75.59	(104,303)	74.83	(104,304)	72.05	(105,106)	63.98	(105,204)	74.91
(105,205)	73.39	(105,304)	76.06	(105,305)	68.01	(106,205)	72.29	(106,305)	75.55
(201,202)	68.90	(201,401)	76.00	(202,203)	75.36	(202,401)	69.85	(202,402)	75.63
(203,204)	75.36	(203,402)	73.56	(203,403)	73.56	(204,205)	68.90	(204,403)	75.63
(204,404)	69.85	(205,404)	76.00	(301,302)	69.37	(301,501)	74.79	(302,303)	75.41
(302,501)	62.09	(302,502)	71.87	(303,304)	75.41	(303,502)	67.50	(303,503)	67.50
(304,305)	69.37	(304,503)	71.87	(304,504)	62.09	(305,504)	74.79	(401,402)	72.80
(401,601)	73.64	(402,403)	76.20	(402,601)	65.15	(402,602)	70.19	(403,404)	72.80
(403,602)	70.19	(403,603)	65.15	(404,603)	73.64	(501,502)	73.18	(502,503)	76.20
(503,504)	73.18	(601,602)	75.31	(602,603)	75.31	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 MAY 32.99 FT. DIA.

TIME 1:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	61.38	(2, 11)	64.80	(2, 21)	75.81	(3, 4)	70.38	(3, 11)	75.14
(3, 12)	69.65	(3, 21)	58.78	(3, 22)	75.19	(4, 5)	75.52	(4, 12)	75.82
(4, 13)	73.14	(4, 22)	64.81	(4, 23)	73.14	(5, 6)	75.52	(5, 13)	75.19
(5, 14)	75.19	(5, 23)	69.66	(5, 24)	69.66	(6, 7)	70.38	(6, 14)	73.14
(6, 15)	75.82	(6, 24)	73.14	(6, 25)	64.81	(7, 8)	61.38	(7, 15)	69.65
(7, 16)	75.14	(7, 25)	75.19	(7, 26)	58.78	(8, 16)	64.80	(8, 26)	75.81
(11, 12)	66.25	(11, 31)	73.14	(12, 13)	73.53	(12, 31)	73.33	(12, 32)	75.19
(13, 14)	76.20	(13, 32)	75.14	(13, 33)	75.82	(14, 15)	73.53	(14, 33)	75.82
(14, 34)	75.14	(15, 16)	66.25	(15, 34)	75.19	(15, 35)	73.33	(16, 35)	73.14
(21, 22)	66.25	(21, 41)	73.14	(22, 23)	73.53	(22, 41)	51.79	(22, 42)	69.65
(23, 24)	76.20	(23, 42)	58.78	(23, 43)	64.81	(24, 25)	73.53	(24, 43)	64.81
(24, 44)	58.78	(25, 26)	66.25	(25, 44)	69.65	(25, 45)	51.79	(26, 45)	73.14
(31, 32)	70.38	(31, 51)	75.81	(32, 33)	75.52	(32, 51)	70.62	(32, 52)	75.14
(33, 34)	75.52	(33, 52)	73.33	(33, 53)	73.33	(34, 35)	70.38	(34, 53)	75.14
(34, 54)	70.62	(35, 54)	75.81	(41, 42)	70.38	(41, 61)	64.80	(42, 43)	75.52
(42, 61)	44.10	(42, 62)	58.78	(43, 44)	75.52	(43, 62)	51.79	(43, 63)	51.79
(44, 45)	70.38	(44, 63)	58.78	(44, 64)	44.10	(45, 64)	64.80	(51, 52)	73.53
(52, 53)	76.19	(53, 54)	73.53	(61, 62)	73.53	(62, 63)	76.19	(63, 64)	73.53

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,101)	-8.66	(3,101)	74.16	(3,102)	8.35	(3,201)	73.41	(4,102)	64.76
(4,103)	29.10	(4,202)	71.01	(5,103)	49.03	(5,104)	49.03	(5,203)	69.92
(6,104)	29.10	(6,105)	64.76	(6,204)	71.01	(7,105)	8.35	(7,106)	74.16
(7,205)	73.41	(8,106)	-8.66	(11,101)	68.66	(11,301)	15.88	(12,102)	63.80
(12,301)	72.49	(12,302)	32.48	(13,103)	60.49	(13,302)	62.91	(13,303)	48.97
(14,104)	60.49	(14,303)	48.97	(14,304)	62.91	(15,105)	63.80	(15,304)	32.48
(15,305)	72.49	(16,106)	68.66	(16,305)	15.88	(21,201)	-12.09	(22,201)	69.08
(22,202)	9.19	(22,401)	75.65	(23,202)	54.28	(23,203)	33.17	(23,402)	75.20
(24,203)	33.17	(24,204)	54.28	(24,403)	75.20	(25,204)	9.19	(25,205)	69.08
(25,404)	75.65	(26,205)	-12.09	(31,301)	55.19	(31,501)	41.57	(32,302)	49.39
(32,501)	72.53	(32,502)	54.11	(33,303)	47.11	(33,502)	64.83	(33,503)	64.83
(34,304)	49.39	(34,503)	54.11	(34,504)	72.53	(35,305)	55.19	(35,504)	41.57
(41,401)	-7.16	(42,401)	61.70	(42,402)	17.59	(42,601)	74.36	(43,402)	42.29
(43,403)	42.29	(43,602)	74.85	(44,403)	17.59	(44,404)	61.70	(44,603)	74.36
(45,404)	-7.16	(51,501)	39.20	(52,502)	34.60	(53,503)	34.60	(54,504)	39.20
(61,601)	3.48	(62,601)	52.48	(62,602)	29.55	(63,602)	29.55	(63,603)	52.48
(64,603)	3.48	(							

BOTTOM STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	64.29	(101,201)	75.80	(101,301)	69.17	(102,103)	73.07	(102,201)	63.68
(102,202)	75.24	(102,301)	74.94	(102,302)	73.14	(103,104)	76.20	(103,202)	69.32
(103,203)	73.15	(103,302)	75.80	(103,303)	75.29	(104,105)	73.07	(104,203)	73.15
(104,204)	69.32	(104,303)	75.29	(104,304)	75.80	(105,106)	64.29	(105,204)	75.24
(105,205)	63.68	(105,304)	73.14	(105,305)	74.94	(106,205)	75.80	(106,305)	69.17
(201,202)	69.18	(201,401)	73.14	(202,203)	75.39	(202,401)	57.00	(202,402)	69.50
(203,204)	75.39	(203,402)	64.13	(203,403)	64.13	(204,205)	69.18	(204,403)	69.50
(204,404)	57.00	(205,404)	73.14	(301,302)	69.48	(301,501)	75.33	(302,303)	75.43
(302,501)	72.56	(302,502)	75.78	(303,304)	75.43	(303,502)	74.75	(303,503)	74.75
(304,305)	69.48	(304,503)	75.78	(304,504)	72.56	(305,504)	75.33	(401,402)	72.98
(401,601)	64.54	(402,403)	76.20	(402,601)	49.53	(402,602)	57.89	(403,404)	72.98
(403,602)	57.89	(403,603)	49.53	(404,603)	64.54	(501,502)	73.21	(502,503)	76.20
(503,504)	73.21	(601,602)	75.38	(602,603)	75.38	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 RAY 32.99 FT. DIA.

TIME 2:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS	(2, 3)	64.24	(2, 11)	49.41	(2, 21)	72.58	(3, 4)	71.45	(3, 11)	74.82
	(3, 12)	57.30	(3, 21)	40.42	(3, 22)	68.96	(4, 5)	75.64	(4, 12)	72.58
	(4, 13)	63.86	(4, 22)	49.42	(4, 23)	63.86	(5, 6)	75.64	(5, 13)	68.96
	(5, 14)	68.96	(5, 23)	57.30	(5, 24)	57.30	(6, 7)	71.45	(6, 14)	63.86
	(6, 15)	72.58	(6, 24)	63.86	(6, 25)	49.42	(7, 8)	64.24	(7, 15)	57.30
	(7, 16)	74.82	(7, 25)	68.96	(7, 26)	40.42	(8, 16)	49.41	(8, 26)	72.58
	(11, 12)	68.12	(11, 31)	63.85	(12, 13)	74.02	(12, 31)	75.83	(12, 32)	68.96
	(13, 14)	76.20	(13, 32)	74.82	(13, 33)	72.58	(14, 15)	74.02	(14, 33)	72.58
	(14, 34)	74.82	(15, 16)	68.12	(15, 34)	68.96	(15, 35)	75.83	(16, 35)	63.85
	(21, 22)	68.12	(21, 41)	63.85	(22, 23)	74.02	(22, 41)	30.58	(22, 42)	57.30
	(23, 24)	76.20	(23, 42)	40.42	(23, 43)	49.42	(24, 25)	74.02	(24, 43)	49.42
	(24, 44)	40.42	(25, 26)	68.12	(25, 44)	57.30	(25, 45)	30.58	(26, 45)	63.85
	(31, 32)	71.44	(31, 51)	72.58	(32, 33)	75.64	(32, 51)	75.81	(32, 52)	74.82
	(33, 34)	75.64	(33, 52)	75.83	(33, 53)	75.83	(34, 35)	71.44	(34, 53)	74.82
	(34, 54)	75.81	(35, 54)	72.58	(41, 42)	71.44	(41, 61)	49.41	(42, 43)	75.64
	(42, 61)	20.19	(42, 62)	40.42	(43, 44)	75.64	(43, 62)	30.58	(43, 63)	30.58
	(44, 45)	71.44	(44, 63)	40.42	(44, 64)	20.19	(45, 64)	49.41	(51, 52)	74.01
	(52, 53)	76.19	(53, 54)	74.01	(61, 62)	74.01	(62, 63)	76.19	(63, 64)	74.01
DIAGONAL STRUTS	(2,101)	-17.16	(3,101)	71.72	(3,102)	-2.32	(3,201)	75.56	(4,102)	59.77
	(4,103)	19.48	(4,202)	75.87	(5,103)	41.62	(5,104)	41.62	(5,203)	75.81
	(6,104)	19.48	(6,105)	59.77	(6,204)	75.87	(7,105)	-2.32	(7,106)	71.72
	(7,205)	75.56	(8,106)	-17.16	(11,101)	75.57	(11,301)	-.54	(12,102)	74.19
	(12,301)	68.02	(12,302)	17.52	(13,103)	72.97	(13,302)	54.87	(13,303)	37.28
	(14,104)	72.97	(14,303)	37.28	(14,304)	54.87	(15,105)	74.19	(15,304)	17.52
	(15,305)	68.02	(16,106)	75.57	(16,305)	-.54	(21,201)	-13.26	(22,201)	66.44
	(22,202)	5.81	(22,401)	72.45	(23,202)	50.64	(23,203)	29.20	(23,402)	73.82
	(24,203)	29.20	(24,204)	50.64	(24,403)	73.82	(25,204)	5.81	(25,205)	66.44
	(25,404)	72.45	(26,205)	-13.26	(31,301)	70.39	(31,501)	24.87	(32,302)	67.54
	(32,501)	66.52	(32,502)	40.36	(33,303)	66.40	(33,502)	54.84	(33,503)	54.84
	(34,304)	67.54	(34,503)	40.36	(34,504)	66.52	(35,305)	70.39	(35,504)	24.87
	(41,401)	-2.93	(42,401)	59.89	(42,402)	18.83	(42,601)	65.01	(43,402)	41.39
	(43,403)	41.39	(43,602)	66.40	(44,403)	18.83	(44,404)	59.89	(44,603)	65.01
	(45,404)	-2.93	(51,501)	61.87	(52,502)	59.31	(53,503)	59.31	(54,504)	61.87
	(61,601)	9.24	(62,601)	52.06	(62,602)	31.76	(63,602)	31.76	(63,603)	52.06
	(64,603)	9.24	(							
BOTTOM STRUTS	(101,102)	66.18	(101,201)	72.65	(101,301)	56.43	(102,103)	73.54	(102,201)	47.69
	(102,202)	69.07	(102,301)	74.98	(102,302)	63.85	(103,104)	76.20	(103,202)	56.76
	(103,203)	63.86	(103,302)	72.89	(103,303)	69.28	(104,105)	73.54	(104,203)	63.86
	(104,204)	56.76	(104,303)	69.28	(104,304)	72.89	(105,106)	66.18	(105,204)	69.07
	(105,205)	47.69	(105,304)	63.85	(105,305)	74.98	(106,205)	72.65	(106,305)	56.43
	(201,202)	70.36	(201,401)	63.85	(202,203)	75.52	(202,401)	38.10	(202,402)	57.14
	(203,204)	75.52	(203,402)	48.57	(203,403)	48.57	(204,205)	70.36	(204,403)	57.14
	(204,404)	38.10	(205,404)	63.85	(301,302)	70.45	(301,501)	69.45	(302,303)	75.53
	(302,501)	75.91	(302,502)	73.14	(303,304)	75.53	(303,502)	75.18	(303,503)	75.18
	(304,305)	70.45	(304,503)	73.14	(304,504)	75.91	(305,504)	69.45	(401,402)	73.57
	(401,601)	49.28	(402,403)	76.20	(402,601)	28.15	(402,602)	39.64	(403,404)	73.57
	(403,602)	39.64	(403,603)	28.15	(404,603)	49.28	(501,502)	73.63	(502,503)	76.20
	(503,504)	73.63	(601,602)	75.54	(602,603)	75.54	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 3:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS	(2, 3)	68.19	(2, 11)	28.51	(2, 21)	62.27	(3, 4)	72.97	(3, 11)	67.21
	(3, 12)	38.84	(3, 21)	17.44	(3, 22)	55.88	(4, 5)	75.82	(4, 12)	62.28
	(4, 13)	48.04	(4, 22)	28.52	(4, 23)	48.04	(5, 6)	75.82	(5, 13)	55.89
	(5, 14)	55.89	(5, 23)	38.84	(5, 24)	38.84	(6, 7)	72.97	(6, 14)	48.04
	(6, 15)	62.28	(6, 24)	48.04	(6, 25)	28.52	(7, 8)	68.19	(7, 15)	38.84
	(7, 16)	67.21	(7, 25)	55.88	(7, 26)	17.44	(8, 16)	28.51	(8, 26)	62.27
	(11, 12)	70.74	(11, 31)	48.04	(12, 13)	74.71	(12, 31)	70.83	(12, 32)	55.88
	(13, 14)	76.20	(13, 32)	67.22	(13, 33)	62.28	(14, 15)	74.71	(14, 33)	62.28
	(14, 34)	67.22	(15, 16)	70.74	(15, 34)	55.88	(15, 35)	70.83	(16, 35)	48.04
	(21, 22)	70.74	(21, 41)	48.04	(22, 23)	74.71	(22, 41)	6.05	(22, 42)	38.84
	(23, 24)	76.20	(23, 42)	17.44	(23, 43)	28.52	(24, 25)	74.71	(24, 43)	28.52
	(24, 44)	17.44	(25, 26)	70.74	(25, 44)	38.84	(25, 45)	6.05	(26, 45)	48.04
	(31, 32)	72.97	(31, 51)	62.27	(32, 33)	75.82	(32, 51)	73.29	(32, 52)	67.21
	(33, 34)	75.82	(33, 52)	70.83	(33, 53)	70.83	(34, 35)	72.97	(34, 53)	67.21
	(34, 54)	73.29	(35, 54)	62.27	(41, 42)	72.97	(41, 61)	28.51	(42, 43)	75.82
	(42, 61)	-5.19	(42, 62)	17.44	(43, 44)	75.82	(43, 62)	6.05	(43, 63)	6.05
	(44, 45)	72.97	(44, 63)	17.44	(44, 64)	-5.19	(45, 64)	28.51	(51, 52)	74.70
	(52, 53)	76.19	(53, 54)	74.70	(61, 62)	74.70	(62, 63)	76.19	(63, 64)	74.70
DIAGONAL STRUTS	(2,101)	-1.78	(3,101)	69.05	(3,102)	4.98	(3,201)	68.61	(4,102)	56.56
	(4,103)	20.65	(4,202)	71.26	(5,103)	39.49	(5,104)	39.49	(5,203)	72.03
	(6,104)	20.65	(6,105)	56.56	(6,204)	71.26	(7,105)	4.98	(7,106)	69.05
	(7,205)	68.61	(8,106)	-1.78	(11,101)	73.32	(11,301)	-1.11	(12,102)	74.96
	(12,301)	62.99	(12,302)	12.01	(13,103)	75.41	(13,302)	48.23	(13,303)	30.18
	(14,104)	75.41	(14,303)	30.18	(14,304)	48.23	(15,105)	74.96	(15,304)	12.01
	(15,305)	62.99	(16,106)	73.32	(16,305)	-1.11	(21,201)	6.71	(22,201)	64.96
	(22,202)	17.51	(22,401)	59.91	(23,202)	51.05	(23,203)	33.95	(23,402)	62.82
	(24,203)	33.95	(24,204)	51.05	(24,403)	62.82	(25,204)	17.51	(25,205)	64.96
	(25,404)	59.91	(26,205)	6.71	(31,301)	75.56	(31,501)	13.60	(32,302)	75.07
	(32,501)	58.74	(32,502)	28.50	(33,303)	74.78	(33,502)	44.50	(33,503)	44.50
	(34,304)	75.07	(34,503)	28.50	(34,504)	58.74	(35,305)	75.56	(35,504)	13.60
	(41,401)	17.27	(42,401)	60.56	(42,402)	30.66	(42,601)	45.65	(43,402)	46.34
	(43,403)	46.34	(43,602)	47.78	(44,403)	30.66	(44,404)	60.56	(44,603)	45.65
	(45,404)	17.27	(51,501)	73.16	(52,502)	72.11	(53,503)	72.11	(54,504)	73.16
	(61,601)	26.80	(62,601)	55.43	(62,602)	41.30	(63,602)	41.30	(63,603)	55.43
	(64,603)	26.80	(							
BOTTOM STRUTS	(101,102)	69.13	(101,201)	62.25	(101,301)	37.57	(102,103)	74.30	(102,201)	26.34
	(102,202)	55.96	(102,301)	67.51	(102,302)	48.04	(103,104)	76.20	(103,202)	38.19
	(103,203)	48.04	(103,302)	62.76	(103,303)	56.38	(104,105)	74.30	(104,203)	48.04
	(104,204)	38.19	(104,303)	56.38	(104,304)	62.76	(105,106)	69.13	(105,204)	55.96
	(105,205)	26.34	(105,304)	48.04	(105,305)	67.51	(106,205)	62.25	(106,305)	37.57
	(201,202)	72.13	(201,401)	48.04	(202,203)	75.72	(202,401)	15.15	(202,402)	38.81
	(203,204)	75.72	(203,402)	27.85	(203,403)	27.85	(204,205)	72.13	(204,403)	38.81
	(204,404)	15.15	(205,404)	48.04	(301,302)	72.06	(301,501)	56.76	(302,303)	75.72
	(302,501)	71.51	(302,502)	63.38	(303,304)	75.72	(303,502)	68.19	(303,503)	68.19
	(304,305)	72.06	(304,503)	63.38	(304,504)	71.51	(305,504)	56.76	(401,402)	74.40
	(401,601)	28.91	(402,403)	76.20	(402,601)	4.73	(402,602)	17.52	(403,404)	74.40
	(403,602)	17.52	(403,603)	4.73	(404,603)	28.91	(501,502)	74.32	(502,503)	76.20
	(503,504)	74.32	(601,602)	75.76	(602,603)	75.76	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS . 6 BAY 32.99 FT. DIA.

TIME 4:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	72.09	(2, 11)	5.63	(2, 21)	45.65	(3, 4)	74.52	(3, 11)	53.00
	(3, 12)	16.49	(3, 21)	-4.65	(3, 22)	36.97	(4, 5)	76.00	(4, 12)	45.66
	(4, 13)	27.13	(4, 22)	5.64	(4, 23)	27.13	(5, 6)	76.00	(5, 13)	36.98
	(5, 14)	36.98	(5, 23)	16.49	(5, 24)	16.49	(6, 7)	74.52	(6, 14)	27.13
	(6, 15)	45.66	(6, 24)	27.13	(6, 25)	5.64	(7, 8)	72.09	(7, 15)	16.49
	(7, 16)	53.00	(7, 25)	36.97	(7, 26)	-4.65	(8, 16)	5.63	(8, 26)	45.65
	(11, 12)	73.38	(11, 31)	27.12	(12, 13)	75.42	(12, 31)	59.00	(12, 32)	36.97
	(13, 14)	76.20	(13, 32)	53.00	(13, 33)	45.66	(14, 15)	75.42	(14, 33)	45.66
	(14, 34)	53.00	(15, 16)	73.38	(15, 34)	36.97	(15, 35)	59.00	(16, 35)	27.12
	(21, 22)	73.38	(21, 41)	27.12	(22, 23)	75.42	(22, 41)	-13.54	(22, 42)	16.49
	(23, 24)	76.20	(23, 42)	-4.64	(23, 43)	5.64	(24, 25)	75.42	(24, 43)	5.64
	(24, 44)	-4.64	(25, 26)	73.38	(25, 44)	16.49	(25, 45)	-13.54	(26, 45)	27.12
	(31, 32)	74.51	(31, 51)	45.65	(32, 33)	76.00	(32, 51)	63.76	(32, 52)	53.00
	(33, 34)	76.00	(33, 52)	59.00	(33, 53)	59.00	(34, 35)	74.51	(34, 53)	53.00
	(34, 54)	63.76	(35, 54)	45.65	(41, 42)	74.51	(41, 61)	5.63	(42, 43)	76.00
	(42, 61)	-20.34	(42, 62)	-4.65	(43, 44)	76.00	(43, 62)	-13.54	(43, 63)	-13.54
	(44, 45)	74.51	(44, 63)	-4.65	(44, 64)	-20.34	(45, 64)	5.63	(51, 52)	75.41
	(52, 53)	76.19	(53, 54)	75.41	(61, 62)	75.41	(62, 63)	76.19	(63, 64)	75.41
DIAGONAL STRUTS										
	(2,101)	24.27	(3,101)	66.82	(3,102)	24.52	(3,201)	52.94	(4,102)	56.03
	(4,103)	31.63	(4,202)	57.72	(5,103)	43.33	(5,104)	43.33	(5,203)	59.20
	(6,104)	31.63	(6,105)	56.03	(6,204)	57.72	(7,105)	24.52	(7,106)	66.82
	(7,205)	52.94	(8,106)	24.27	(11,101)	62.65	(11,301)	14.65	(12,102)	67.14
	(12,301)	58.68	(12,302)	19.27	(13,103)	69.06	(13,302)	45.11	(13,303)	30.76
	(14,104)	69.06	(14,303)	30.76	(14,304)	45.11	(15,105)	67.14	(15,304)	19.27
	(15,305)	58.68	(16,106)	62.65	(16,305)	14.65	(21,201)	32.44	(22,201)	64.98
	(22,202)	36.35	(22,401)	37.84	(23,202)	55.10	(23,203)	44.67	(23,402)	42.02
	(24,203)	44.67	(24,204)	55.10	(24,403)	42.02	(25,204)	36.35	(25,205)	64.98
	(25,404)	37.84	(26,205)	32.44	(31,301)	72.15	(31,501)	13.79	(32,302)	73.75
	(32,501)	51.02	(32,502)	23.23	(33,303)	74.18	(33,502)	36.84	(33,503)	36.84
	(34,304)	73.75	(34,503)	23.23	(34,504)	51.02	(35,305)	72.15	(35,504)	13.79
	(41,401)	40.32	(42,401)	63.32	(42,402)	46.52	(42,601)	15.13	(43,402)	54.79
	(43,403)	54.79	(43,602)	17.69	(44,403)	46.52	(44,404)	63.32	(44,603)	15.13
	(45,404)	40.32	(51,501)	75.38	(52,502)	75.63	(53,503)	75.63	(54,504)	75.38
	(61,601)	46.39	(62,601)	61.15	(62,602)	53.63	(63,602)	53.63	(63,603)	61.15
	(64,603)	46.39	(							
BOTTOM STRUTS										
	(101,102)	72.28	(101,201)	45.30	(101,301)	14.90	(102,103)	75.13	(102,201)	3.51
	(102,202)	36.86	(102,301)	53.14	(102,302)	27.13	(103,104)	76.20	(103,202)	15.94
	(103,203)	27.13	(103,302)	46.11	(103,303)	37.53	(104,105)	75.13	(104,203)	27.13
	(104,204)	15.94	(104,303)	37.53	(104,304)	46.11	(105,106)	72.28	(105,204)	36.86
	(105,205)	3.51	(105,304)	27.13	(105,305)	53.14	(106,205)	45.30	(106,305)	14.90
	(201,202)	73.99	(201,401)	27.13	(202,203)	75.94	(202,401)	-5.63	(202,402)	16.84
	(203,204)	75.94	(203,402)	5.79	(203,403)	5.79	(204,205)	73.99	(204,403)	16.84
	(204,404)	-5.63	(205,404)	27.13	(301,302)	73.83	(301,501)	38.22	(302,303)	75.92
	(302,501)	60.01	(302,502)	47.24	(303,304)	75.92	(303,502)	54.40	(303,503)	54.40
	(304,305)	73.83	(304,503)	47.24	(304,504)	60.01	(305,504)	38.22	(401,402)	75.26
	(401,601)	7.15	(402,403)	76.20	(402,601)	-11.67	(402,602)	-2.55	(403,404)	75.26
	(403,602)	-2.55	(403,603)	-11.67	(404,603)	7.15	(501,502)	75.11	(502,503)	76.20
	(503,504)	75.11	(601,602)	75.98	(602,603)	75.98	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 5:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	74.88	(2, 11)	-8.81	(2, 21)	24.00	(3, 4)	75.65	(3, 11)	32.63
	(3, 12)	-2.59	(3, 21)	-12.23	(3, 22)	14.78	(4, 5)	76.13	(4, 12)	24.00
	(4, 13)	5.61	(4, 22)	-8.80	(4, 23)	5.61	(5, 6)	76.13	(5, 13)	14.78
	(5, 14)	14.78	(5, 23)	-2.59	(5, 24)	-2.59	(6, 7)	75.65	(6, 14)	5.61
	(6, 15)	24.00	(6, 24)	5.61	(6, 25)	-8.80	(7, 8)	74.88	(7, 15)	-2.59
	(7, 16)	32.63	(7, 25)	14.78	(7, 26)	-12.23	(8, 16)	-8.81	(8, 26)	24.00
	(11, 12)	75.28	(11, 31)	5.60	(12, 13)	75.94	(12, 31)	40.30	(12, 32)	14.78
	(13, 14)	76.20	(13, 32)	32.63	(13, 33)	24.00	(14, 15)	75.94	(14, 33)	24.00
	(14, 34)	32.63	(15, 16)	75.28	(15, 34)	14.78	(15, 35)	40.30	(16, 35)	5.60
	(21, 22)	75.28	(21, 41)	5.60	(22, 23)	75.94	(22, 41)	-12.63	(22, 42)	-2.59
	(23, 24)	76.20	(23, 42)	-12.23	(23, 43)	-8.80	(24, 25)	75.94	(24, 43)	-8.80
	(24, 44)	-12.23	(25, 26)	75.28	(25, 44)	-2.59	(25, 45)	-12.63	(26, 45)	5.60
	(31, 32)	75.65	(31, 51)	24.00	(32, 33)	76.13	(32, 51)	46.89	(32, 52)	32.63
	(33, 34)	76.13	(33, 52)	40.30	(33, 53)	40.30	(34, 35)	75.65	(34, 53)	32.63
	(34, 54)	46.89	(35, 54)	24.00	(41, 42)	75.67	(41, 61)	-106.31	(42, 43)	76.13
	(42, 61)	-109.40	(42, 62)	-108.18	(43, 44)	76.13	(43, 62)	-109.26	(43, 63)	-109.26
	(44, 45)	75.67	(44, 63)	-108.18	(44, 64)	-109.40	(45, 64)	-106.31	(51, 52)	75.94
	(52, 53)	76.19	(53, 54)	75.94	(61, 62)	-107.41	(62, 63)	-105.52	(63, 64)	-107.41
DIAGONAL STRUTS										
	(2,101)	47.58	(3,101)	65.78	(3,102)	45.39	(3,201)	27.12	(4,102)	58.61
	(4,103)	46.83	(4,202)	33.59	(5,103)	51.70	(5,104)	51.70	(5,203)	35.60
	(6,104)	46.83	(6,105)	58.61	(6,204)	33.59	(7,105)	45.39	(7,106)	65.78
	(7,205)	27.12	(8,106)	47.58	(11,101)	42.39	(11,301)	36.32	(12,102)	49.57
	(12,301)	56.65	(12,302)	35.19	(13,103)	52.77	(13,302)	47.18	(13,303)	39.24
	(14,104)	52.77	(14,303)	39.24	(14,304)	47.18	(15,105)	49.57	(15,304)	35.19
	(15,305)	56.65	(16,106)	42.39	(16,305)	36.32	(21,201)	53.59	(22,201)	66.61
	(22,202)	54.12	(22,401)	4.26	(23,202)	61.45	(23,203)	56.94	(23,402)	8.87
	(24,203)	56.94	(24,204)	61.45	(24,403)	8.87	(25,204)	54.12	(25,205)	66.61
	(25,404)	4.26	(26,205)	53.59	(31,301)	59.29	(31,501)	26.17	(32,302)	62.85
	(32,501)	46.06	(32,502)	28.19	(33,303)	63.93	(33,502)	35.62	(33,503)	35.62
	(34,304)	62.85	(34,503)	28.19	(34,504)	46.06	(35,305)	59.29	(35,504)	26.17
	(41,401)	58.63	(42,401)	67.36	(42,402)	60.73	(42,601)	-29.90	(43,402)	63.80
	(43,403)	63.80	(43,602)	-28.36	(44,403)	60.73	(44,404)	67.36	(44,603)	-29.90
	(45,404)	58.63	(51,501)	68.08	(52,502)	69.54	(53,503)	69.54	(54,504)	68.08
	(61,601)	62.08	(62,601)	67.43	(62,602)	64.76	(63,602)	64.76	(63,603)	67.43
	(64,603)	62.08	(							
BOTTOM STRUTS										
	(101,102)	74.73	(101,201)	22.90	(101,301)	-4.06	(102,103)	75.79	(102,201)	-9.71
	(102,202)	14.23	(102,301)	32.11	(102,302)	5.61	(103,104)	76.20	(103,202)	-2.62
	(103,203)	5.61	(103,302)	24.04	(103,303)	15.16	(104,105)	75.79	(104,203)	5.61
	(104,204)	-2.62	(104,303)	15.16	(104,304)	24.04	(105,106)	74.73	(105,204)	14.23
	(105,205)	-9.71	(105,304)	5.61	(105,305)	32.11	(106,205)	22.90	(106,305)	-4.06
	(201,202)	75.42	(201,401)	5.60	(202,203)	76.11	(202,401)	-10.50	(202,402)	-1.54
	(203,204)	76.11	(203,402)	-7.06	(203,403)	-7.06	(204,205)	75.42	(204,403)	-1.54
	(204,404)	-10.50	(205,404)	5.60	(301,302)	75.27	(301,501)	16.24	(302,303)	76.09
	(302,501)	41.15	(302,502)	25.79	(303,304)	76.09	(303,502)	34.08	(303,503)	34.08
	(304,305)	75.27	(304,503)	25.79	(304,504)	41.15	(305,504)	16.24	(401,402)	75.89
	(401,601)	-5.81	(402,403)	76.20	(402,601)	-7.29	(402,602)	-7.74	(403,404)	75.89
	(403,602)	-7.74	(403,603)	-7.29	(404,603)	-5.81	(501,502)	75.76	(502,503)	76.20
	(503,504)	75.76	(601,602)	76.13	(602,603)	76.13	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 6:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	76.08	(2, 11)	-4.23	(2, 21)	1.66	(3, 4)	76.15	(3, 11)	8.81
	(3, 12)	-7.37	(3, 21)	1.36	(3, 22)	-4.07	(4, 5)	76.19	(4, 12)	1.67
	(4, 13)	-7.32	(4, 22)	-4.22	(4, 23)	-7.32	(5, 6)	76.19	(5, 13)	-4.06
	(5, 14)	-4.06	(5, 23)	-7.37	(5, 24)	-7.37	(6, 7)	76.15	(6, 14)	-7.32
	(6, 15)	1.67	(6, 24)	-7.32	(6, 25)	-4.22	(7, 8)	76.08	(7, 15)	-7.37
	(7, 16)	8.81	(7, 25)	-4.07	(7, 26)	1.36	(8, 16)	-4.23	(8, 26)	1.66
	(11, 12)	76.11	(11, 31)	-7.33	(12, 13)	76.18	(12, 31)	16.37	(12, 32)	-4.07
	(13, 14)	76.20	(13, 32)	8.81	(13, 33)	1.67	(14, 15)	76.18	(14, 33)	1.67
	(14, 34)	8.81	(15, 16)	76.11	(15, 34)	-4.07	(15, 35)	16.37	(16, 35)	-7.33
	(21, 22)	-82.89	(21, 41)	-140.90	(22, 23)	-81.61	(22, 41)	-136.29	(22, 42)	-138.49
	(23, 24)	-81.39	(23, 42)	-135.69	(23, 43)	-136.45	(24, 25)	-81.61	(24, 43)	-136.45
	(24, 44)	-135.69	(25, 26)	-82.89	(25, 44)	-138.49	(25, 45)	-136.29	(26, 45)	-140.90
	(31, 32)	76.15	(31, 51)	1.66	(32, 33)	76.19	(32, 51)	23.69	(32, 52)	8.81
	(33, 34)	76.19	(33, 52)	16.37	(33, 53)	16.37	(34, 35)	76.15	(34, 53)	8.81
	(34, 54)	23.69	(35, 54)	1.66	(41, 42)	-84.00	(41, 61)	-121.94	(42, 43)	-79.29
	(42, 61)	-106.77	(42, 62)	-114.99	(43, 44)	-79.29	(43, 62)	-109.60	(43, 63)	-109.60
	(44, 45)	-84.00	(44, 63)	-114.99	(44, 64)	-106.77	(45, 64)	-121.94	(51, 52)	76.17
	(52, 53)	76.19	(53, 54)	76.17	(61, 62)	-35.41	(62, 63)	-33.92	(63, 64)	-35.41
DIAGONAL STRUTS										
	(2,101)	64.41	(3,101)	66.15	(3,102)	61.99	(3,201)	-10.10	(4,102)	63.24
	(4,103)	60.88	(4,202)	-3.11	(5,103)	61.34	(5,104)	61.34	(5,203)	-1.03
	(6,104)	60.88	(6,105)	63.24	(6,204)	-3.11	(7,105)	61.99	(7,106)	66.15
	(7,205)	-10.10	(8,106)	64.41	(11,101)	11.75	(11,301)	55.41	(12,102)	21.42
	(12,301)	57.43	(12,302)	52.14	(13,103)	25.68	(13,302)	53.33	(13,303)	51.38
	(14,104)	25.68	(14,303)	51.38	(14,304)	53.33	(15,105)	21.42	(15,304)	52.14
	(15,305)	57.43	(16,106)	11.75	(16,305)	55.41	(21,201)	68.05	(22,201)	69.27
	(22,202)	67.37	(22,401)	-42.81	(23,202)	68.05	(23,203)	67.39	(23,402)	-41.26
	(24,203)	67.39	(24,204)	68.05	(24,403)	-41.26	(25,204)	67.37	(25,205)	69.27
	(25,404)	-42.81	(26,205)	68.05	(31,301)	36.72	(31,501)	43.35	(32,302)	42.22
	(32,501)	45.52	(32,502)	40.31	(33,303)	43.92	(33,502)	41.13	(33,503)	41.13
	(34,304)	42.22	(34,503)	40.31	(34,504)	45.52	(35,305)	36.72	(35,504)	43.35
	(41,401)	3.15	(42,401)	-8.70	(42,402)	3.40	(42,601)	-146.64	(43,402)	-2.90
	(43,403)	-2.90	(43,602)	-149.06	(44,403)	3.40	(44,404)	-8.70	(44,603)	-146.64
	(45,404)	3.15	(51,501)	51.50	(52,502)	54.21	(53,503)	54.21	(54,504)	51.50
	(61,601)	-61.97	(62,601)	-58.80	(62,602)	-58.74	(63,602)	-58.74	(63,603)	-58.80
	(64,603)	-61.97	(							
BOTTOM STRUTS										
	(101,102)	76.02	(101,201)	-.74	(101,301)	-7.97	(102,103)	76.15	(102,201)	-3.24
	(102,202)	-5.35	(102,301)	6.80	(102,302)	-7.32	(103,104)	76.20	(103,202)	-6.54
	(103,203)	-7.32	(103,302)	.59	(103,303)	-4.28	(104,105)	76.15	(104,203)	-7.32
	(104,204)	-6.54	(104,303)	-4.28	(104,304)	.59	(105,106)	76.02	(105,204)	-5.35
	(105,205)	-3.24	(105,304)	-7.32	(105,305)	6.80	(106,205)	-.74	(106,305)	-7.97
	(201,202)	76.12	(201,401)	-7.32	(202,203)	76.19	(202,401)	4.95	(202,402)	-5.68
	(203,204)	76.19	(203,402)	-1.25	(203,403)	-1.25	(204,205)	76.12	(204,403)	-5.68
	(204,404)	4.95	(205,404)	-7.32	(301,302)	76.07	(301,501)	-2.84	(302,303)	76.18
	(302,501)	16.18	(302,502)	3.01	(303,304)	76.18	(303,502)	9.51	(303,503)	9.51
	(304,305)	76.07	(304,503)	3.01	(304,504)	16.18	(305,504)	-2.84	(401,402)	76.17
	(401,601)	-.62	(402,403)	76.20	(402,601)	14.20	(402,602)	6.39	(403,404)	76.17
	(403,602)	6.39	(403,603)	14.20	(404,603)	-.62	(501,502)	76.13	(502,503)	76.20
	(503,504)	76.13	(601,602)	-62.76	(602,603)	-62.76	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS #6 BAY 32.99 FT. DIA.

TIME 7:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS	(2, 3)	-59.90	(2, 11)	16.68	(2, 21)	-96.49	(3, 4)	-111.31	(3, 11)	-102.91
	(3, 12)	-101.07	(3, 21)	-65.51	(3, 22)	-104.32	(4, 5)	-107.81	(4, 12)	-104.88
	(4, 13)	-103.09	(4, 22)	-103.59	(4, 23)	-113.69	(5, 6)	-107.81	(5, 13)	-104.41
	(5, 14)	-104.41	(5, 23)	-107.51	(5, 24)	-107.51	(6, 7)	-111.31	(6, 14)	-103.09
	(6, 15)	-104.88	(6, 24)	-113.69	(6, 25)	-103.59	(7, 8)	-59.90	(7, 15)	-101.07
	(7, 16)	-102.91	(7, 25)	-104.32	(7, 26)	-65.51	(8, 16)	16.68	(8, 26)	-96.49
	(11, 12)	75.61	(11, 31)	-.55	(12, 13)	76.03	(12, 31)	-6.60	(12, 32)	-6.59
	(13, 14)	76.20	(13, 32)	-9.44	(13, 33)	-9.61	(14, 15)	76.03	(14, 33)	-9.61
	(14, 34)	-9.44	(15, 16)	75.61	(15, 34)	-6.59	(15, 35)	-6.60	(16, 35)	-.55
	(21, 22)	2.24	(21, 41)	-57.03	(22, 23)	-6.29	(22, 41)	-26.70	(22, 42)	-56.21
	(23, 24)	-4.58	(23, 42)	-37.22	(23, 43)	-45.75	(24, 25)	-6.29	(24, 43)	-45.75
	(24, 44)	-37.22	(25, 26)	2.24	(25, 44)	-56.21	(25, 45)	-26.70	(26, 45)	-57.03
	(31, 32)	75.82	(31, 51)	-9.62	(32, 33)	76.15	(32, 51)	-1.99	(32, 52)	-9.44
	(33, 34)	76.15	(33, 52)	-6.60	(33, 53)	-6.60	(34, 35)	75.82	(34, 53)	-9.44
	(34, 54)	-1.99	(35, 54)	-9.62	(41, 42)	23.61	(41, 61)	-28.39	(42, 43)	25.20
	(42, 61)	-4.86	(42, 62)	-19.38	(43, 44)	25.20	(43, 62)	-11.11	(43, 63)	-11.11
	(44, 45)	23.61	(44, 63)	-19.38	(44, 64)	-4.86	(45, 64)	-28.39	(51, 52)	76.02
	(52, 53)	76.19	(53, 54)	76.02	(61, 62)	31.90	(62, 63)	32.47	(63, 64)	31.90
DIAGONAL STRUTS	(2,101)	73.50	(3,101)	67.92	(3,102)	72.10	(3,201)	-77.50	(4,102)	68.48
	(4,103)	70.69	(4,202)	-73.44	(5,103)	69.45	(5,104)	69.45	(5,203)	-73.49
	(6,104)	70.69	(6,105)	68.48	(6,204)	-73.44	(7,105)	72.10	(7,106)	67.92
	(7,205)	-77.50	(8,106)	73.50	(11,101)	-30.02	(11,301)	68.40	(12,102)	-19.98
	(12,301)	60.92	(12,302)	65.38	(13,103)	-15.89	(13,302)	61.34	(13,303)	62.90
	(14,104)	-15.89	(14,303)	62.90	(14,304)	61.34	(15,105)	-19.98	(15,304)	65.38
	(15,305)	60.92	(16,106)	-30.02	(16,305)	68.40	(21,201)	-32.23	(22,201)	-41.69
	(22,202)	-74.25	(22,401)	-144.60	(23,202)	-70.87	(23,203)	-71.17	(23,402)	-160.57
	(24,203)	-71.17	(24,204)	-70.87	(24,403)	-160.57	(25,204)	-74.25	(25,205)	-41.69
	(25,404)	-144.60	(26,205)	-32.23	(31,301)	2.21	(31,501)	58.84	(32,302)	9.41
	(32,501)	50.00	(32,502)	54.23	(33,303)	11.60	(33,502)	51.09	(33,503)	51.09
	(34,304)	9.41	(34,503)	54.23	(34,504)	50.00	(35,305)	2.21	(35,504)	58.84
	(41,401)	11.66	(42,401)	6.92	(42,402)	10.60	(42,601)	-149.22	(43,402)	11.05
	(43,403)	11.05	(43,602)	-189.76	(44,403)	10.60	(44,404)	8.92	(44,603)	-149.22
	(45,404)	11.66	(51,501)	23.65	(52,502)	27.67	(53,503)	27.67	(54,504)	23.65
	(61,601)	28.85	(62,601)	29.23	(62,602)	29.71	(63,602)	29.71	(63,603)	29.23
	(64,603)	28.85	(							
BOTTOM STRUTS	(101,102)	75.74	(101,201)	-13.31	(101,301)	7.96	(102,103)	76.07	(102,201)	18.54
	(102,202)	-8.39	(102,301)	-13.83	(102,302)	-.54	(103,104)	76.20	(103,202)	8.86
	(103,203)	-.54	(103,302)	-12.31	(103,303)	-7.62	(104,105)	76.07	(104,203)	-.54
	(104,204)	8.86	(104,303)	-7.62	(104,304)	-12.31	(105,106)	75.74	(105,204)	-8.39
	(105,205)	18.54	(105,304)	-.54	(105,305)	-13.83	(106,205)	-13.31	(106,305)	7.96
	(201,202)	75.88	(201,401)	-78.43	(202,203)	76.16	(202,401)	-82.25	(202,402)	-87.79
	(203,204)	76.16	(203,402)	-83.03	(203,403)	-83.03	(204,205)	75.88	(204,403)	-87.79
	(204,404)	-82.25	(205,404)	-78.43	(301,302)	75.97	(301,501)	-6.30	(302,303)	76.17
	(302,501)	-9.51	(302,502)	-9.85	(303,304)	76.17	(303,502)	-10.92	(303,503)	-10.92
	(304,305)	75.97	(304,503)	-9.85	(304,504)	-9.51	(305,504)	-6.30	(401,402)	-14.95
	(401,601)	-44.04	(402,403)	-12.95	(402,601)	-24.65	(402,602)	-32.84	(403,404)	-14.95
	(403,602)	-32.84	(403,603)	-24.65	(404,603)	-44.04	(501,502)	76.10	(502,503)	76.20
	(503,504)	76.10	(601,602)	25.89	(602,603)	25.89	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   6 BAY   32.99 FT. DIA.

TIME 8:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	12.77	(2, 11)	40.22	(2, 21)	-50.21	(3, 4)	17.15	(3, 11)	-76.91
(3, 12)	-37.43	(3, 21)	-3.01	(3, 22)	-38.54	(4, 5)	19.98	(4, 12)	-67.91
(4, 13)	-46.85	(4, 22)	-9.03	(4, 23)	-27.13	(5, 6)	19.98	(5, 13)	-56.54
(5, 14)	-56.54	(5, 23)	-16.93	(5, 24)	-16.93	(6, 7)	17.15	(6, 14)	-46.85
(6, 15)	-67.91	(6, 24)	-27.13	(6, 25)	-9.03	(7, 8)	12.77	(7, 15)	-37.43
(7, 16)	-76.91	(7, 25)	-38.54	(7, 26)	-3.01	(8, 16)	40.22	(8, 26)	-50.21
(11, 12)	-17.93	(11, 31)	20.35	(12, 13)	-11.86	(12, 31)	-116.62	(12, 32)	-96.41
(13, 14)	-9.54	(13, 32)	-109.60	(13, 33)	-103.60	(14, 15)	-11.86	(14, 33)	-103.60
(14, 34)	-109.60	(15, 16)	-17.93	(15, 34)	-96.41	(15, 35)	-116.62	(16, 35)	20.35
(21, 22)	26.46	(21, 41)	-21.55	(22, 23)	29.56	(22, 41)	11.69	(22, 42)	-10.30
(23, 24)	30.70	(23, 42)	6.63	(23, 43)	-.76	(24, 25)	29.56	(24, 43)	-.76
(24, 44)	6.63	(25, 26)	26.46	(25, 44)	-10.30	(25, 45)	11.69	(26, 45)	-21.55
(31, 32)	-79.70	(31, 51)	-.94	(32, 33)	-75.99	(32, 51)	-46.42	(32, 52)	-39.64
(33, 34)	-75.99	(33, 52)	-44.16	(33, 53)	-44.16	(34, 35)	-79.70	(34, 53)	-39.64
(34, 54)	-46.42	(35, 54)	-.94	(41, 42)	33.08	(41, 61)	1.38	(42, 43)	34.98
(42, 61)	20.73	(42, 62)	9.72	(43, 44)	34.98	(43, 62)	16.18	(43, 63)	16.18
(44, 45)	33.08	(44, 63)	9.72	(44, 64)	20.73	(45, 64)	1.38	(51, 52)	75.55
(52, 53)	76.19	(53, 54)	75.55	(61, 62)	36.76	(62, 63)	-16.38	(63, 64)	36.76

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,101)	75.60	(3,101)	-4.85	(3,102)	-2.10	(3,201)	-133.37	(4,102)	-2.06
(4,103)	1.28	(4,202)	-152.67	(5,103)	.90	(5,104)	.90	(5,203)	-174.49
(6,104)	1.28	(6,105)	-2.06	(6,204)	-152.67	(7,105)	-2.10	(7,106)	-4.85
(7,205)	-133.37	(8,106)	75.60	(11,101)	-73.48	(11,301)	75.10	(12,102)	-129.88
(12,301)	26.23	(12,302)	-12.10	(13,103)	-129.43	(13,302)	-18.78	(13,303)	-12.53
(14,104)	-129.43	(14,303)	-12.53	(14,304)	-18.78	(15,105)	-129.88	(15,304)	-12.10
(15,305)	26.23	(16,106)	-73.48	(16,305)	75.10	(21,201)	21.00	(22,201)	22.34
(22,202)	23.80	(22,401)	-111.14	(23,202)	24.97	(23,203)	25.42	(23,402)	-158.10
(24,203)	25.42	(24,204)	24.97	(24,403)	-158.10	(25,204)	23.80	(25,205)	22.34
(25,404)	-111.14	(26,205)	21.00	(31,301)	-47.00	(31,501)	70.00	(32,302)	-39.81
(32,501)	57.48	(32,502)	66.04	(33,303)	-37.73	(33,502)	61.73	(33,503)	61.73
(34,304)	-39.81	(34,503)	66.04	(34,504)	57.48	(35,305)	-47.00	(35,504)	70.00
(41,401)	29.89	(42,401)	32.65	(42,402)	32.12	(42,601)	-75.51	(43,402)	33.30
(43,403)	33.30	(43,602)	-97.11	(44,403)	32.12	(44,404)	32.85	(44,603)	-75.51
(45,404)	29.89	(51,501)	-16.46	(52,502)	-13.01	(53,503)	-13.01	(54,504)	-18.46
(61,601)	33.47	(62,601)	36.29	(62,602)	35.21	(63,602)	35.21	(63,603)	36.29
(64,603)	33.47	(							

BOTTOM STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	23.05	(101,201)	-63.50	(101,301)	31.54	(102,103)	-22.81	(102,201)	-32.34
(102,202)	-60.10	(102,301)	-15.64	(102,302)	20.36	(103,104)	-21.57	(103,202)	-37.90
(103,203)	-47.13	(103,302)	-4.35	(103,303)	8.11	(104,105)	-22.81	(104,203)	-47.13
(104,204)	-37.90	(104,303)	8.11	(104,304)	-4.35	(105,106)	23.05	(105,204)	-60.10
(105,205)	-32.34	(105,304)	20.36	(105,305)	-15.64	(106,205)	-63.50	(106,305)	31.54
(201,202)	15.94	(201,401)	-28.27	(202,203)	18.73	(202,401)	1.07	(202,402)	-16.10
(203,204)	18.73	(203,402)	-5.91	(203,403)	-5.91	(204,205)	15.94	(204,403)	-16.10
(204,404)	1.07	(205,404)	-28.27	(301,302)	75.06	(301,501)	8.85	(302,303)	76.07
(302,501)	-22.80	(302,502)	-2.89	(303,304)	76.07	(303,502)	-13.88	(303,503)	-13.88
(304,305)	75.06	(304,503)	-2.89	(304,504)	-22.80	(305,504)	8.85	(401,402)	30.26
(401,601)	1.16	(402,403)	31.59	(402,601)	16.72	(402,602)	10.19	(403,404)	30.26
(403,602)	10.19	(403,603)	16.72	(404,603)	1.16	(501,502)	75.70	(502,503)	76.20
(503,504)	75.70	(601,602)	35.93	(602,603)	35.93	(			

TIME 9:00 PM

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS									
(2, 3)	23.85	(2, 11)	58.76	(2, 21)	-19.27	(3, 4)	29.59	(3, 11)	-34.85
(3, 12)	5.41	(3, 21)	21.92	(3, 22)	-7.02	(4, 5)	32.88	(4, 12)	-22.11
(4, 13)	-1.51	(4, 22)	18.23	(4, 23)	3.62	(5, 6)	32.88	(5, 13)	-10.76
(5, 14)	-10.76	(5, 23)	12.09	(5, 24)	12.09	(6, 7)	29.59	(6, 14)	-1.51
(6, 15)	-22.11	(6, 24)	3.62	(6, 25)	18.23	(7, 8)	23.85	(7, 15)	5.41
(7, 16)	-34.85	(7, 25)	-7.02	(7, 26)	21.92	(8, 16)	58.76	(8, 26)	-19.27
(11, 12)	19.51	(11, 31)	42.83	(12, 13)	24.71	(12, 31)	-56.12	(12, 32)	-21.85
(13, 14)	26.57	(13, 32)	-43.11	(13, 33)	-31.45	(14, 15)	24.71	(14, 33)	-31.45
(14, 34)	-43.11	(15, 16)	19.51	(15, 34)	-21.85	(15, 35)	-56.12	(16, 35)	42.83
(21, 22)	30.90	(21, 41)	28.82	(22, 23)	35.25	(22, 41)	29.72	(22, 42)	13.96
(23, 24)	36.87	(23, 42)	26.44	(23, 43)	21.27	(24, 25)	35.25	(24, 43)	21.27
(24, 44)	26.44	(25, 26)	30.90	(25, 44)	13.96	(25, 45)	29.72	(26, 45)	28.82
(31, 32)	6.17	(31, 51)	21.44	(32, 33)	10.48	(32, 51)	-88.91	(32, 52)	-68.02
(33, 34)	10.48	(33, 52)	-77.80	(33, 53)	-77.80	(34, 35)	6.17	(34, 53)	-68.02
(34, 54)	-88.91	(35, 54)	21.44	(41, 42)	35.48	(41, 61)	58.33	(42, 43)	-57.57
(42, 61)	34.79	(42, 62)	28.14	(43, 44)	-57.57	(43, 62)	-156.93	(43, 63)	-156.93
(44, 45)	35.48	(44, 63)	28.14	(44, 64)	34.79	(45, 64)	58.33	(51, 52)	74.86
(52, 53)	76.19	(53, 54)	74.86	(61, 62)	38.40	(62, 63)	-195.62	(63, 64)	38.40
DIAGONAL STRUTS									
(2,101)	70.17	(3,101)	24.93	(3,102)	25.65	(3,201)	-81.33	(4,102)	29.04
(4,103)	28.94	(4,202)	-117.31	(5,103)	30.25	(5,104)	30.25	(5,203)	-150.61
(6,104)	28.94	(6,105)	29.04	(6,204)	-117.31	(7,105)	25.65	(7,106)	24.93
(7,205)	-81.33	(8,106)	70.17	(11,101)	-67.02	(11,301)	74.83	(12,102)	-138.79
(12,301)	11.12	(12,302)	16.53	(13,103)	-176.46	(13,302)	15.70	(13,303)	17.57
(14,104)	-176.46	(14,303)	17.57	(14,304)	15.70	(15,105)	-138.79	(15,304)	16.53
(15,305)	11.12	(16,106)	-67.02	(16,305)	74.83	(21,201)	25.42	(22,201)	34.17
(22,202)	29.61	(22,401)	-49.07	(23,202)	34.91	(23,203)	33.02	(23,402)	-71.44
(24,203)	33.02	(24,204)	34.91	(24,403)	-71.44	(25,204)	29.61	(25,205)	34.17
(25,404)	-49.07	(26,205)	25.42	(31,301)	-97.19	(31,501)	75.29	(32,302)	-148.18
(32,501)	-7.74	(32,502)	2.07	(33,303)	-151.88	(33,502)	.30	(33,503)	.30
(34,304)	-148.18	(34,503)	2.07	(34,504)	-7.74	(35,305)	-97.19	(35,504)	75.29
(41,401)	26.92	(42,401)	37.06	(42,402)	30.81	(42,601)	-19.81	(43,402)	34.81
(43,403)	34.81	(43,602)	-136.39	(44,403)	30.81	(44,404)	37.06	(44,603)	-19.81
(45,404)	26.92	(51,501)	-80.43	(52,502)	-75.70	(53,503)	-75.70	(54,504)	-80.43
(61,601)	28.37	(62,601)	36.82	(62,602)	-176.00	(63,602)	-176.00	(63,603)	36.82
(64,603)	28.37	(							
BOTTOM STRUTS									
(101,102)	19.56	(101,201)	-25.36	(101,301)	52.25	(102,103)	24.42	(102,201)	14.30
(102,202)	-11.74	(102,301)	-50.02	(102,302)	-13.92	(103,104)	26.33	(103,202)	8.50
(103,203)	-.22	(103,302)	-35.97	(103,303)	-23.37	(104,105)	24.42	(104,203)	-.22
(104,204)	8.50	(104,303)	-23.37	(104,304)	-35.97	(105,106)	19.56	(105,204)	-11.74
(105,205)	14.30	(105,304)	-13.92	(105,305)	-50.02	(106,205)	-25.36	(106,305)	52.25
(201,202)	30.23	(201,401)	3.35	(202,203)	33.84	(202,401)	25.91	(202,402)	13.38
(203,204)	33.84	(203,402)	20.97	(203,403)	20.97	(204,205)	30.23	(204,403)	13.38
(204,404)	25.91	(205,404)	3.35	(301,302)	6.33	(301,501)	31.81	(302,303)	8.33
(302,501)	-39.77	(302,502)	-12.58	(303,304)	8.33	(303,502)	-21.88	(303,503)	-21.88
(304,305)	6.33	(304,503)	-12.58	(304,504)	-39.77	(305,504)	31.81	(401,402)	35.92
(401,601)	22.46	(402,403)	37.83	(402,601)	32.75	(402,602)	-37.61	(403,404)	35.92
(403,602)	-37.61	(403,603)	32.75	(404,603)	22.46	(501,502)	75.02	(502,503)	76.20
(503,504)	75.02	(601,602)	38.94	(602,603)	38.94	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 RAY 32.39 FT. DIA.

TIME 10:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	25.53	(2, 11)	70.88	(2, 21)	44.17	(3, 4)	33.04	(3, 11)	-4.94
(3, 12)	26.20	(3, 21)	34.61	(3, 22)	15.83	(4, 5)	37.40	(4, 12)	6.00
(4, 13)	21.75	(4, 22)	32.95	(4, 23)	23.63	(5, 6)	37.40	(5, 13)	14.94
(5, 14)	14.94	(5, 23)	29.37	(5, 24)	29.37	(6, 7)	33.04	(6, 14)	21.75
(6, 15)	6.00	(6, 24)	23.63	(6, 25)	32.95	(7, 8)	25.53	(7, 15)	26.20
(7, 16)	-4.94	(7, 25)	15.83	(7, 26)	34.61	(8, 16)	70.88	(8, 26)	44.17
(11, 12)	26.72	(11, 31)	60.66	(12, 13)	32.96	(12, 31)	-18.12	(12, 32)	10.58
(13, 14)	35.27	(13, 32)	-6.73	(13, 33)	2.94	(14, 15)	32.96	(14, 33)	2.94
(14, 34)	-6.73	(15, 16)	26.72	(15, 34)	10.58	(15, 35)	-18.12	(16, 35)	60.66
(21, 22)	31.33	(21, 41)	60.51	(22, 23)	37.35	(22, 41)	38.12	(22, 42)	30.28
(23, 24)	-9.22	(23, 42)	37.47	(23, 43)	-156.25	(24, 25)	37.35	(24, 43)	-156.25
(24, 44)	37.47	(25, 26)	31.33	(25, 44)	30.28	(25, 45)	38.12	(26, 45)	60.51
(31, 32)	25.75	(31, 51)	44.39	(32, 33)	30.30	(32, 51)	-34.29	(32, 52)	-12.53
(33, 34)	30.30	(33, 52)	-22.61	(33, 53)	-22.61	(34, 35)	25.75	(34, 53)	-12.53
(34, 54)	-34.29	(35, 54)	44.39	(41, 42)	35.64	(41, 61)	70.78	(42, 43)	-201.37
(42, 61)	39.69	(42, 62)	37.83	(43, 44)	-201.37	(43, 62)	-225.40	(43, 63)	-225.40
(44, 45)	35.64	(44, 63)	37.83	(44, 64)	39.69	(45, 64)	70.78	(51, 52)	74.15
(52, 53)	76.19	(53, 54)	74.15	(61, 62)	38.57	(62, 63)	21.97	(63, 64)	38.57

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,101)	57.87	(3,101)	34.14	(3,102)	24.20	(3,201)	-28.67	(4,102)	36.24
(4,103)	30.11	(4,202)	-46.72	(5,103)	34.51	(5,104)	34.51	(5,203)	-57.32
(6,104)	30.11	(6,105)	36.24	(6,204)	-46.72	(7,105)	24.20	(7,106)	34.14
(7,205)	-28.67	(8,106)	57.87	(11,101)	-16.11	(11,301)	68.24	(12,102)	-82.22
(12,301)	30.60	(12,302)	29.45	(13,103)	-112.60	(13,302)	33.26	(13,303)	32.66
(14,104)	-112.60	(14,303)	32.66	(14,304)	33.26	(15,105)	-82.22	(15,304)	29.45
(15,305)	30.60	(16,106)	-16.11	(16,305)	68.24	(21,201)	16.12	(22,201)	37.78
(22,202)	22.85	(22,401)	-6.25	(23,202)	35.45	(23,203)	29.87	(23,402)	-131.33
(24,203)	29.87	(24,204)	35.45	(24,403)	-131.33	(25,204)	22.85	(25,205)	37.78
(25,404)	-6.25	(26,205)	16.12	(31,301)	-76.34	(31,501)	74.97	(32,302)	-150.22
(32,501)	22.55	(32,502)	26.80	(33,303)	-176.46	(33,502)	26.20	(33,503)	26.20
(34,304)	-150.22	(34,503)	26.80	(34,504)	22.55	(35,305)	-76.34	(35,504)	74.97
(41,401)	15.08	(42,401)	36.95	(42,402)	22.45	(42,601)	12.42	(43,402)	-179.55
(43,403)	-179.55	(43,602)	-218.91	(44,403)	22.45	(44,404)	36.95	(44,603)	12.42
(45,404)	15.08	(51,501)	-129.03	(52,502)	-147.13	(53,503)	-147.13	(54,504)	-129.03
(61,601)	15.95	(62,601)	33.27	(62,602)	-62.61	(63,602)	-62.61	(63,603)	33.27
(64,603)	15.95	(							

BOTTOM STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	27.18	(101,201)	3.99	(101,301)	56.95	(102,103)	33.84	(102,201)	31.68
(102,202)	14.39	(102,301)	-9.83	(102,302)	18.49	(103,104)	36.29	(103,202)	28.42
(103,203)	22.64	(103,302)	1.89	(103,303)	11.45	(104,105)	33.84	(104,203)	22.64
(104,204)	28.42	(104,303)	11.45	(104,304)	1.89	(105,106)	27.18	(105,204)	14.39
(105,205)	31.68	(105,304)	18.49	(105,305)	-9.83	(106,205)	3.99	(106,305)	56.95
(201,202)	33.26	(201,401)	23.38	(202,203)	38.18	(202,401)	36.99	(202,402)	30.25
(203,204)	38.18	(203,402)	-18.34	(203,403)	-18.34	(204,205)	33.26	(204,403)	30.25
(204,404)	36.99	(205,404)	23.38	(301,302)	26.54	(301,501)	52.47	(302,303)	31.04
(302,501)	-27.86	(302,502)	-4.36	(303,304)	31.04	(303,502)	-15.00	(303,503)	-15.00
(304,305)	26.54	(304,503)	-4.36	(304,504)	-27.86	(305,504)	52.47	(401,402)	37.42
(401,601)	35.13	(402,403)	-152.09	(402,601)	39.74	(402,602)	-198.46	(403,404)	37.42
(403,602)	-198.46	(403,603)	39.74	(404,603)	35.13	(501,502)	36.69	(502,503)	43.04
(503,504)	36.69	(601,602)	39.92	(602,603)	39.92	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   6 BAY   32.99 FT. DIA.

TIME 11:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	24.83	(2, 11)	75.66	(2, 21)	61.69	(3, 4)	34.07	(3, 11)	17.58
	(3, 12)	35.71	(3, 21)	38.36	(3, 22)	30.95	(4, 5)	39.36	(4, 12)	25.04
	(4, 13)	34.80	(4, 22)	39.55	(4, 23)	35.93	(5, 6)	39.36	(5, 13)	30.92
	(5, 14)	30.92	(5, 23)	-134.01	(5, 24)	-134.01	(6, 7)	34.07	(6, 14)	34.80
	(6, 15)	25.04	(6, 24)	35.93	(6, 25)	39.55	(7, 8)	24.83	(7, 15)	36.71
	(7, 16)	17.58	(7, 25)	30.95	(7, 26)	38.38	(8, 16)	75.66	(8, 26)	61.69
	(11, 12)	28.56	(11, 31)	71.59	(12, 13)	36.09	(12, 31)	9.10	(12, 32)	29.09
	(13, 14)	38.84	(13, 32)	17.50	(13, 33)	24.24	(14, 15)	36.09	(14, 33)	24.24
	(14, 34)	17.50	(15, 16)	28.56	(15, 34)	29.09	(15, 35)	9.10	(16, 35)	71.59
	(21, 22)	39.50	(21, 41)	71.76	(22, 23)	37.92	(22, 41)	38.42	(22, 42)	38.40
	(23, 24)	-194.76	(23, 42)	40.03	(23, 43)	-225.01	(24, 25)	37.92	(24, 43)	-225.01
	(24, 44)	40.03	(25, 26)	30.50	(25, 44)	38.40	(25, 45)	38.42	(26, 45)	71.76
	(31, 32)	30.85	(31, 51)	61.67	(32, 33)	36.17	(32, 51)	-1.18	(32, 52)	15.03
	(33, 34)	36.17	(33, 52)	7.66	(33, 53)	7.66	(34, 35)	30.85	(34, 53)	15.03
	(34, 54)	-1.18	(35, 54)	61.67	(41, 42)	34.86	(41, 61)	75.69	(42, 43)	5.75
	(42, 61)	36.96	(42, 62)	40.13	(43, 44)	5.75	(43, 62)	38.35	(43, 63)	38.35
	(44, 45)	34.86	(44, 63)	40.13	(44, 64)	36.96	(45, 64)	75.69	(51, 52)	73.61
	(52, 53)	76.19	(53, 54)	73.61	(61, 62)	73.59	(62, 63)	76.18	(63, 64)	73.59
DIAGONAL STRUTS										
	(2,101)	3.25	(3,101)	37.93	(3,102)	12.84	(3,201)	5.74	(4,102)	37.12
	(4,103)	22.79	(4,202)	-3.62	(5,103)	31.50	(5,104)	31.50	(5,203)	-91.04
	(6,104)	22.79	(6,105)	37.12	(6,204)	-3.62	(7,105)	12.84	(7,106)	37.93
	(7,205)	5.74	(8,106)	3.25	(11,101)	-10.56	(11,301)	17.97	(12,102)	-25.59
	(12,301)	36.99	(12,302)	25.75	(13,103)	-36.84	(13,302)	36.62	(13,303)	32.51
	(14,104)	-36.84	(14,303)	32.51	(14,304)	36.62	(15,105)	-25.59	(15,304)	25.75
	(15,305)	36.99	(16,105)	-10.56	(16,305)	17.97	(21,201)	-1.39	(22,201)	37.98
	(22,202)	9.36	(22,401)	19.84	(23,202)	31.84	(23,203)	-171.93	(23,402)	-217.56
	(24,203)	-171.93	(24,204)	31.84	(24,403)	-217.56	(25,204)	9.36	(25,205)	37.98
	(25,404)	19.84	(26,205)	-1.39	(31,301)	-46.30	(31,501)	28.82	(32,302)	-70.36
	(32,501)	34.69	(32,502)	33.13	(33,303)	-81.68	(33,502)	35.55	(33,503)	35.55
	(34,304)	-70.36	(34,503)	33.13	(34,504)	34.69	(35,305)	-46.30	(35,504)	28.82
	(41,401)	-3.36	(42,401)	33.97	(42,402)	9.24	(42,601)	30.58	(43,402)	-85.40
	(43,403)	-85.40	(43,602)	24.39	(44,403)	9.24	(44,404)	33.97	(44,603)	30.58
	(45,404)	-3.36	(51,501)	-92.33	(52,502)	-116.91	(53,503)	-116.91	(54,504)	-92.33
	(61,601)	-1.24	(62,601)	27.44	(62,602)	12.94	(63,602)	12.94	(63,603)	27.44
	(64,603)	-1.24	(							
BOTTOM STRUTS										
	(101,102)	28.07	(101,201)	23.89	(101,301)	35.20	(102,103)	36.46	(102,201)	38.61
	(102,202)	30.79	(102,301)	15.69	(102,302)	33.71	(103,104)	39.49	(103,202)	38.33
	(103,203)	35.80	(103,302)	23.68	(103,303)	29.82	(104,105)	36.46	(104,203)	35.80
	(104,204)	38.33	(104,303)	29.82	(104,304)	23.68	(105,106)	28.07	(105,204)	30.79
	(105,205)	38.61	(105,304)	33.71	(105,305)	15.69	(106,205)	23.89	(106,305)	35.20
	(201,202)	33.54	(201,401)	35.22	(202,203)	39.63	(202,401)	39.51	(202,402)	38.84
	(203,204)	39.63	(203,402)	-195.88	(203,403)	-195.88	(204,205)	33.54	(204,403)	38.84
	(204,404)	39.51	(205,404)	35.22	(301,302)	31.33	(301,501)	26.70	(302,303)	36.98
	(302,501)	4.82	(302,502)	21.34	(303,304)	36.98	(303,502)	14.00	(303,503)	14.00
	(304,305)	31.33	(304,503)	21.34	(304,504)	4.82	(305,504)	26.70	(401,402)	37.49
	(401,601)	39.66	(402,403)	-173.39	(402,601)	38.30	(402,602)	28.63	(403,404)	37.49
	(403,602)	28.63	(403,603)	38.30	(404,603)	39.66	(501,502)	32.15	(502,503)	34.93
	(503,504)	32.15	(601,602)	39.71	(602,603)	39.71	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME MIDNIGHT

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	-150.56	(2, 11)	-143.27	(2, 21)	-144.33	(3, 4)	-148.93	(3, 11)	-150.45
	(3, 12)	-148.18	(3, 21)	-148.40	(3, 22)	-148.74	(4, 5)	-177.58	(4, 12)	-149.39
	(4, 13)	-148.26	(4, 22)	-148.04	(4, 23)	-148.19	(5, 6)	-177.58	(5, 13)	-61.18
	(5, 14)	-61.18	(5, 23)	-218.04	(5, 24)	-218.04	(6, 7)	-148.93	(6, 14)	-148.26
	(6, 15)	-149.39	(6, 24)	-148.19	(6, 25)	-148.04	(7, 8)	-150.56	(7, 15)	-148.18
	(7, 16)	-150.45	(7, 25)	-148.74	(7, 26)	-148.40	(8, 16)	-143.27	(8, 26)	-144.33
	(11, 12)	-149.80	(11, 31)	-143.42	(12, 13)	-148.50	(12, 31)	-151.61	(12, 32)	-148.92
	(13, 14)	-148.04	(13, 32)	-150.39	(13, 33)	-149.49	(14, 15)	-148.50	(14, 33)	-149.49
	(14, 34)	-150.39	(15, 16)	-149.80	(15, 34)	-148.92	(15, 35)	-151.61	(16, 35)	-143.42
	(21, 22)	-149.62	(21, 41)	-143.42	(22, 23)	-148.34	(22, 41)	-148.65	(22, 42)	-148.02
	(23, 24)	-239.93	(23, 42)	-148.18	(23, 43)	-160.17	(24, 25)	-148.34	(24, 43)	-160.17
	(24, 44)	-148.18	(25, 26)	-149.62	(25, 44)	-148.02	(25, 45)	-148.65	(26, 45)	-143.42
	(31, 32)	-149.27	(31, 51)	-144.33	(32, 33)	-148.37	(32, 51)	-153.10	(32, 52)	-150.68
	(33, 34)	-148.37	(33, 52)	-151.74	(33, 53)	-151.74	(34, 35)	-149.27	(34, 53)	-150.68
	(34, 54)	-153.10	(35, 54)	-144.33	(41, 42)	-148.91	(41, 61)	-143.27	(42, 43)	-148.29
	(42, 61)	-149.15	(42, 62)	-148.25	(43, 44)	-148.29	(43, 62)	-148.60	(43, 63)	-148.60
	(44, 45)	-148.91	(44, 63)	-148.25	(44, 64)	-149.15	(45, 64)	-143.27	(51, 52)	-143.56
	(52, 53)	-143.21	(53, 54)	-143.56	(61, 62)	-143.56	(62, 63)	-143.21	(63, 64)	-143.56
DIAGONAL STRUTS										
	(2,101)	-156.52	(3,101)	-148.48	(3,102)	-154.26	(3,201)	-152.18	(4,102)	-148.87
	(4,103)	-152.02	(4,202)	-153.43	(5,103)	-147.46	(5,104)	-147.46	(5,203)	-207.99
	(6,104)	-152.02	(6,105)	-148.87	(5,204)	-153.43	(7,105)	-154.26	(7,106)	-148.48
	(7,205)	-152.18	(8,106)	-156.52	(11,101)	-154.76	(11,301)	-153.13	(12,102)	-156.93
	(12,301)	-148.54	(12,302)	-151.32	(13,103)	-158.61	(13,302)	-148.87	(13,303)	-149.85
	(14,104)	-158.61	(14,303)	-149.85	(14,304)	-148.87	(15,105)	-156.93	(15,304)	-151.32
	(15,305)	-148.54	(16,106)	-154.76	(16,305)	-153.13	(21,201)	-157.61	(22,201)	-148.71
	(22,202)	-154.96	(22,401)	-150.27	(23,202)	-150.01	(23,203)	-231.30	(23,402)	-189.51
	(24,203)	-231.30	(24,204)	-150.01	(24,403)	-189.51	(25,204)	-154.96	(25,205)	-148.71
	(25,404)	-150.27	(26,205)	-157.61	(31,301)	-161.17	(31,501)	-150.57	(32,302)	-164.65
	(32,501)	-148.71	(32,502)	-149.49	(33,303)	-166.35	(33,502)	-148.83	(33,503)	-148.83
	(34,304)	-164.65	(34,503)	-149.49	(34,504)	-148.71	(35,305)	-161.17	(35,504)	-150.57
	(41,401)	-157.94	(42,401)	-149.55	(42,402)	-154.83	(42,601)	-148.99	(43,402)	-153.40
	(43,403)	-153.40	(43,602)	-149.19	(44,403)	-154.83	(44,404)	-149.55	(44,603)	-148.99
	(45,404)	-157.94	(51,501)	-170.91	(52,502)	-175.44	(53,503)	-175.44	(54,504)	-170.91
	(61,601)	-157.26	(62,601)	-150.84	(62,602)	-153.84	(63,602)	-153.84	(63,603)	-150.84
	(64,603)	-157.26	(							
BOTTOM STRUTS										
	(101,102)	-149.95	(101,201)	-149.62	(101,301)	-148.37	(102,103)	-148.48	(102,201)	-148.20
	(102,202)	-148.74	(102,301)	-150.65	(102,302)	-148.41	(103,104)	-99.26	(103,202)	-148.01
	(103,203)	-184.63	(103,302)	-149.56	(103,303)	-148.80	(104,105)	-148.48	(104,203)	-184.63
	(104,204)	-148.01	(104,303)	-148.80	(104,304)	-149.56	(105,106)	-149.95	(105,204)	-148.74
	(105,205)	-148.20	(105,304)	-148.41	(105,305)	-150.65	(106,205)	-149.62	(106,305)	-148.37
	(201,202)	-149.06	(201,401)	-148.33	(202,203)	-148.02	(202,401)	-148.33	(202,402)	-147.97
	(203,204)	-148.02	(203,402)	-240.50	(203,403)	-240.50	(204,205)	-149.06	(204,403)	-147.97
	(204,404)	-148.33	(205,404)	-148.33	(301,302)	-149.24	(301,501)	-149.21	(302,303)	-148.27
	(302,501)	-152.15	(302,502)	-149.83	(303,304)	-148.27	(303,502)	-150.82	(303,503)	-150.82
	(304,305)	-149.24	(304,503)	-149.83	(304,504)	-152.15	(305,504)	-149.21	(401,402)	-148.45
	(401,601)	-148.09	(402,403)	-150.92	(402,601)	-148.75	(402,602)	-148.33	(403,404)	-148.45
	(403,602)	-148.33	(403,603)	-148.75	(404,603)	-148.09	(501,502)	-148.91	(502,503)	-148.43
	(503,504)	-143.91	(601,602)	-149.13	(602,603)	-148.13	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 1:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	-5.70	(2, 11)	46.43	(2, 21)	59.73	(3, 4)	6.81	(3, 11)	11.46
	(3, 12)	6.53	(3, 21)	-7.79	(3, 22)	11.91	(4, 5)	-110.89	(4, 12)	13.89
	(4, 13)	11.52	(4, 22)	.68	(4, 23)	10.72	(5, 6)	-110.89	(5, 13)	-201.95
	(5, 14)	-201.95	(5, 23)	-2.62	(5, 24)	-2.62	(6, 7)	6.81	(6, 14)	11.52
	(6, 15)	13.89	(6, 24)	10.72	(6, 25)	.68	(7, 8)	-5.70	(7, 15)	6.53
	(7, 16)	11.46	(7, 25)	11.91	(7, 26)	-7.79	(8, 16)	46.43	(8, 26)	59.73
	(11, 12)	1.62	(11, 31)	56.64	(12, 13)	11.64	(12, 31)	10.05	(12, 32)	13.54
	(13, 14)	-222.27	(13, 32)	13.41	(13, 33)	-66.02	(14, 15)	11.64	(14, 33)	-66.02
	(14, 34)	13.41	(15, 16)	1.62	(15, 34)	13.54	(15, 35)	10.05	(16, 35)	56.64
	(21, 22)	-.12	(21, 41)	56.64	(22, 23)	9.98	(22, 41)	-16.72	(22, 42)	4.77
	(23, 24)	.44	(23, 42)	-7.48	(23, 43)	-1.57	(24, 25)	9.98	(24, 43)	-1.57
	(24, 44)	-7.48	(25, 26)	-.12	(25, 44)	4.77	(25, 45)	-16.72	(26, 45)	56.64
	(31, 32)	7.22	(31, 51)	59.73	(32, 33)	14.21	(32, 51)	6.74	(32, 52)	13.02
	(33, 34)	14.21	(33, 52)	10.78	(33, 53)	10.78	(34, 35)	7.22	(34, 53)	13.02
	(34, 54)	6.74	(35, 54)	59.73	(41, 42)	3.65	(41, 61)	46.43	(42, 43)	10.71
	(42, 61)	-27.34	(42, 62)	-9.75	(43, 44)	10.71	(43, 62)	-17.72	(43, 63)	-17.72
	(44, 45)	3.65	(44, 63)	-9.75	(44, 64)	-27.34	(45, 64)	46.43	(51, 52)	56.95
	(52, 53)	60.27	(53, 54)	56.95	(61, 62)	56.95	(62, 63)	60.27	(63, 64)	56.95
DIAGONAL STRUTS										
	(2,101)	-86.93	(3,101)	10.55	(3,102)	-66.29	(3,201)	8.73	(4,102)	.92
	(4,103)	-41.14	(4,202)	6.91	(5,103)	-222.56	(5,104)	-222.56	(5,203)	-1.39
	(6,104)	-41.14	(6,105)	.92	(6,204)	6.91	(7,105)	-66.29	(7,106)	10.55
	(7,205)	8.73	(8,106)	-86.93	(11,101)	2.53	(11,301)	-57.68	(12,102)	-2.12
	(12,301)	9.97	(12,302)	-36.93	(13,103)	-226.49	(13,302)	-.32	(13,303)	-223.29
	(14,104)	-226.49	(14,303)	-223.29	(14,304)	-.32	(15,105)	-2.12	(15,304)	-36.93
	(15,305)	9.97	(16,106)	2.53	(16,305)	-57.68	(21,201)	-91.03	(22,201)	4.14
	(22,202)	-66.02	(22,401)	11.04	(23,202)	-12.41	(23,203)	-53.94	(23,402)	6.77
	(24,203)	-53.94	(24,204)	-12.41	(24,403)	6.77	(25,204)	-66.02	(25,205)	4.14
	(25,404)	11.04	(26,205)	-91.03	(31,301)	-13.69	(31,501)	-26.72	(32,302)	-20.14
	(32,501)	10.48	(32,502)	-10.91	(33,303)	-22.48	(33,502)	2.00	(33,503)	2.00
	(34,304)	-20.14	(34,503)	-10.91	(34,504)	10.48	(35,305)	-13.69	(35,504)	-26.72
	(41,401)	-86.70	(42,401)	-6.03	(42,402)	-57.86	(42,601)	8.14	(43,402)	-28.79
	(43,403)	-28.79	(43,602)	9.11	(44,403)	-57.86	(44,404)	-6.03	(44,603)	8.14
	(45,404)	-86.70	(51,501)	-34.27	(52,502)	-39.92	(53,503)	-39.92	(54,504)	-34.27
	(61,601)	-56.88	(62,601)	4.88	(62,602)	-20.24	(63,602)	-20.24	(63,603)	4.88
	(64,603)	-56.88	(							
BOTTOM STRUTS										
	(101,102)	-1.34	(101,201)	11.48	(101,301)	5.07	(102,103)	10.70	(102,201)	-1.26
	(102,202)	12.67	(102,301)	11.89	(102,302)	11.12	(103,104)	-209.26	(103,202)	6.51
	(103,203)	7.02	(103,302)	14.30	(103,303)	-222.52	(104,105)	10.70	(104,203)	7.02
	(104,204)	5.51	(104,303)	-222.52	(104,304)	14.30	(105,106)	-1.34	(105,204)	12.67
	(105,205)	-1.26	(105,304)	11.12	(105,305)	11.89	(106,205)	11.48	(106,305)	5.07
	(201,202)	4.22	(201,401)	8.07	(202,203)	12.76	(202,401)	-9.90	(202,402)	5.19
	(203,204)	12.76	(203,402)	-15.76	(203,403)	-15.76	(204,205)	4.22	(204,403)	5.19
	(204,404)	-9.90	(205,404)	8.07	(301,302)	6.14	(301,501)	12.93	(302,303)	-131.45
	(302,501)	9.43	(302,502)	14.22	(303,304)	-131.45	(303,502)	12.96	(303,503)	12.96
	(304,305)	6.14	(304,503)	14.22	(304,504)	9.43	(305,504)	12.93	(401,402)	7.44
	(401,601)	-3.44	(402,403)	11.56	(402,601)	-20.48	(402,602)	-10.45	(403,404)	7.44
	(403,602)	-10.45	(403,603)	-20.48	(404,603)	-3.44	(501,502)	10.89	(502,503)	14.88
	(503,504)	10.89	(601,602)	8.01	(602,603)	8.01	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 2:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	25.38	(2, 11)	49.40	(2, 21)	72.60	(3, 4)	33.48	(3, 11)	36.58
(3, 12)	21.29	(3, 21)	3.56	(3, 22)	30.20	(4, 5)	37.92	(4, 12)	35.72
(4, 13)	28.10	(4, 22)	12.95	(4, 23)	26.48	(5, 6)	37.92	(5, 13)	15.61
(5, 14)	15.61	(5, 23)	20.68	(5, 24)	20.68	(6, 7)	33.48	(6, 14)	28.10
(6, 15)	35.72	(6, 24)	26.48	(6, 25)	12.95	(7, 8)	25.38	(7, 15)	21.29
(7, 16)	36.58	(7, 25)	30.20	(7, 26)	3.56	(8, 16)	49.40	(8, 26)	72.60
(11, 12)	31.14	(11, 31)	63.86	(12, 13)	37.61	(12, 31)	39.10	(12, 32)	33.36
(13, 14)	-253.33	(13, 32)	36.98	(13, 33)	-202.81	(14, 15)	37.61	(14, 33)	-202.81
(14, 34)	36.98	(15, 16)	31.14	(15, 34)	33.36	(15, 35)	39.10	(16, 35)	63.86
(21, 22)	27.50	(21, 41)	63.86	(22, 23)	34.14	(22, 41)	-7.22	(22, 42)	17.53
(23, 24)	36.57	(23, 42)	2.62	(23, 43)	10.98	(24, 25)	34.14	(24, 43)	10.98
(24, 44)	2.62	(25, 26)	27.50	(25, 44)	17.53	(25, 45)	-7.22	(26, 45)	63.86
(31, 32)	35.48	(31, 51)	72.60	(32, 33)	-149.53	(32, 51)	39.88	(32, 52)	39.35
(33, 34)	-149.53	(33, 52)	-2.41	(33, 53)	-2.41	(34, 35)	35.48	(34, 53)	39.35
(34, 54)	39.88	(35, 54)	72.60	(41, 42)	27.82	(41, 61)	49.40	(42, 43)	32.56
(42, 61)	-19.65	(42, 62)	-1.12	(43, 44)	32.56	(43, 62)	-9.74	(43, 63)	-9.74
(44, 45)	27.82	(44, 63)	-1.12	(44, 64)	-19.65	(45, 64)	49.40	(51, 52)	53.98
(52, 53)	56.07	(53, 54)	53.98	(61, 62)	74.01	(62, 63)	76.19	(63, 64)	74.01

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,101)	-50.97	(3,101)	32.80	(3,102)	-35.34	(3,201)	35.59	(4,102)	23.05
(4,103)	-14.02	(4,202)	37.01	(5,103)	5.62	(5,104)	5.62	(5,203)	37.35
(6,104)	-14.02	(6,105)	23.05	(6,204)	37.01	(7,105)	-35.34	(7,106)	32.80
(7,205)	35.59	(8,106)	-50.97	(11,101)	36.63	(11,301)	-32.73	(12,102)	36.64
(12,301)	31.54	(12,302)	-14.81	(13,103)	-1.77	(13,302)	20.20	(13,303)	-254.30
(14,104)	-1.77	(14,303)	-254.30	(14,304)	20.20	(15,105)	36.64	(15,304)	-14.81
(15,305)	31.54	(16,106)	36.63	(16,305)	-32.73	(21,201)	-48.99	(22,201)	26.27
(22,202)	-29.51	(22,401)	30.61	(23,202)	12.73	(23,203)	-7.06	(23,402)	32.71
(24,203)	-7.06	(24,204)	12.73	(24,403)	32.71	(25,204)	-29.51	(25,205)	26.27
(25,404)	30.61	(26,205)	-48.99	(31,301)	33.44	(31,501)	-7.67	(32,302)	31.63
(32,501)	31.31	(32,502)	7.38	(33,303)	-192.19	(33,502)	-124.51	(33,503)	-124.51
(34,304)	31.63	(34,503)	7.38	(34,504)	31.31	(35,305)	33.44	(35,504)	-7.67
(41,401)	-41.89	(42,401)	17.25	(42,402)	-20.31	(42,601)	20.20	(43,402)	.90
(43,403)	.90	(43,602)	21.90	(44,403)	-20.31	(44,404)	17.25	(44,603)	20.20
(45,404)	-41.89	(51,501)	26.22	(52,502)	24.34	(53,503)	24.34	(54,504)	26.22
(61,601)	9.25	(62,601)	52.13	(62,602)	31.86	(63,602)	31.86	(63,603)	52.13
(64,603)	9.25	(							

BOTTOM STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	27.90	(101,201)	32.60	(101,301)	19.85	(102,103)	36.00	(102,201)	10.77
(102,202)	30.64	(102,301)	37.41	(102,302)	27.88	(103,104)	37.74	(103,202)	20.08
(103,203)	26.78	(103,302)	36.50	(103,303)	-55.67	(104,105)	36.00	(104,203)	26.78
(104,204)	20.08	(104,303)	-55.67	(104,304)	36.50	(105,106)	27.90	(105,204)	30.64
(105,205)	10.77	(105,304)	27.88	(105,305)	37.41	(106,205)	32.60	(106,305)	19.85
(201,202)	30.06	(201,401)	22.42	(202,203)	35.82	(202,401)	-.14	(202,402)	17.55
(203,204)	35.82	(203,402)	10.01	(203,403)	10.01	(204,205)	30.06	(204,403)	17.55
(204,404)	-.14	(205,404)	22.42	(301,302)	33.97	(301,501)	33.44	(302,303)	-217.33
(302,501)	39.71	(302,502)	37.59	(303,304)	-217.33	(303,502)	-168.53	(303,503)	-168.53
(304,305)	33.97	(304,503)	37.59	(304,504)	39.71	(305,504)	33.44	(401,402)	29.76
(401,601)	5.55	(402,403)	32.72	(402,601)	-12.82	(402,602)	-2.32	(403,404)	29.76
(403,602)	-2.32	(403,603)	-12.82	(404,603)	5.55	(501,502)	37.95	(502,503)	-77.21
(503,504)	37.95	(601,602)	75.53	(602,603)	75.53	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 3:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	24.82	(2, 11)	3.39	(2, 21)	62.25	(3, 4)	30.97	(3, 11)	26.65
	(3, 12)	1.73	(3, 21)	-21.78	(3, 22)	13.46	(4, 5)	34.60	(4, 12)	23.53
	(4, 13)	11.01	(4, 22)	-10.40	(4, 23)	7.57	(5, 6)	34.60	(5, 13)	18.38
	(5, 14)	18.36	(5, 23)	-.47	(5, 24)	-.47	(6, 7)	30.97	(6, 14)	11.01
	(6, 15)	23.53	(6, 24)	7.57	(6, 25)	-10.40	(7, 8)	24.82	(7, 15)	1.73
	(7, 16)	26.65	(7, 25)	13.46	(7, 26)	-21.78	(8, 16)	3.39	(8, 26)	62.25
	(11, 12)	31.23	(11, 31)	48.07	(12, 13)	36.04	(12, 31)	32.92	(12, 32)	19.82
	(13, 14)	36.74	(13, 32)	30.46	(13, 33)	-24.36	(14, 15)	36.04	(14, 33)	-24.36
	(14, 34)	30.46	(15, 16)	31.23	(15, 34)	19.82	(15, 35)	32.92	(16, 35)	48.07
	(21, 22)	22.78	(21, 41)	48.02	(22, 23)	28.05	(22, 41)	-36.75	(22, 42)	-7.18
	(23, 24)	29.98	(23, 42)	-25.46	(23, 43)	-15.43	(24, 25)	28.05	(24, 43)	-15.43
	(24, 44)	-25.46	(25, 26)	22.78	(25, 44)	-7.18	(25, 45)	-36.75	(26, 45)	48.02
	(31, 32)	35.65	(31, 51)	62.25	(32, 33)	-222.77	(32, 51)	36.84	(32, 52)	31.61
	(33, 34)	-222.77	(33, 52)	-194.17	(33, 53)	-194.17	(34, 35)	35.65	(34, 53)	31.61
	(34, 54)	36.84	(35, 54)	62.25	(41, 42)	16.14	(41, 61)	28.51	(42, 43)	20.12
	(42, 61)	-55.79	(42, 62)	-36.05	(43, 44)	20.12	(43, 62)	-45.32	(43, 63)	-45.32
	(44, 45)	16.14	(44, 63)	-36.05	(44, 64)	-55.79	(45, 64)	28.51	(51, 52)	38.56
	(52, 53)	-137.77	(53, 54)	38.56	(61, 62)	74.70	(62, 63)	76.19	(63, 64)	74.70
DIAGONAL STRUTS										
	(2,101)	-40.88	(3,101)	25.83	(3,102)	-32.45	(3,201)	23.42	(4,102)	16.03
	(4,103)	-16.66	(4,202)	27.33	(5,103)	1.07	(5,104)	1.07	(5,203)	28.57
	(6,104)	-16.66	(6,105)	16.03	(6,204)	27.33	(7,105)	-32.45	(7,106)	25.83
	(7,205)	23.42	(8,106)	-40.88	(11,101)	31.26	(11,301)	-35.52	(12,102)	34.33
	(12,301)	24.59	(12,302)	-21.98	(13,103)	35.92	(13,302)	11.94	(13,303)	-11.59
	(14,104)	35.92	(14,303)	-11.59	(14,304)	11.94	(15,105)	34.33	(15,304)	-21.98
	(15,305)	24.59	(16,106)	31.26	(16,305)	-35.52	(21,201)	-37.98	(22,201)	16.77
	(22,202)	-25.86	(22,401)	8.40	(23,202)	5.63	(23,203)	-9.73	(23,402)	12.21
	(24,203)	-9.73	(24,204)	5.63	(24,403)	12.21	(25,204)	-25.86	(25,205)	16.77
	(25,404)	8.40	(26,205)	-37.98	(31,301)	36.64	(31,501)	-19.20	(32,302)	37.17
	(32,501)	23.00	(32,502)	-4.64	(33,303)	-23.62	(33,502)	-215.66	(33,503)	-215.66
	(34,304)	37.17	(34,503)	-4.64	(34,504)	23.00	(35,305)	36.64	(35,504)	-19.20
	(41,401)	-19.03	(42,401)	.83	(42,402)	-25.20	(42,601)	-17.98	(43,402)	-10.64
	(43,403)	-10.64	(43,602)	-15.35	(44,403)	-25.20	(44,404)	.83	(44,603)	-17.98
	(45,404)	-19.03	(51,501)	36.20	(52,502)	-183.37	(53,503)	-183.37	(54,504)	36.20
	(61,601)	26.73	(62,601)	55.37	(62,602)	41.23	(63,602)	41.23	(63,603)	55.37
	(64,603)	26.73	(							
BOTTOM STRUTS										
	(101,102)	25.90	(101,201)	16.71	(101,301)	-.42	(102,103)	32.32	(102,201)	-14.08
	(102,202)	13.13	(102,301)	27.43	(102,302)	10.53	(103,104)	34.69	(103,202)	-2.12
	(103,203)	6.99	(103,302)	24.33	(103,303)	18.75	(104,105)	32.32	(104,203)	6.99
	(104,204)	-2.12	(104,303)	18.75	(104,304)	24.33	(105,106)	25.90	(105,204)	13.13
	(105,205)	-14.08	(105,304)	10.53	(105,305)	27.43	(106,205)	16.71	(106,305)	-.42
	(201,202)	22.39	(201,401)	-4.66	(202,203)	27.16	(202,401)	-31.72	(202,402)	-10.66
	(203,204)	27.16	(203,402)	-19.69	(203,403)	-19.69	(204,205)	22.39	(204,403)	-10.66
	(204,404)	-31.72	(205,404)	-4.66	(301,302)	33.13	(301,501)	20.24	(302,303)	33.13
	(302,501)	34.17	(302,502)	27.17	(303,304)	33.13	(303,502)	-89.70	(303,503)	-89.70
	(304,305)	33.13	(304,503)	27.17	(304,504)	34.17	(305,504)	20.24	(401,402)	6.84
	(401,601)	23.45	(402,403)	9.49	(402,601)	-2.27	(402,602)	11.86	(403,404)	6.84
	(403,602)	11.86	(403,603)	-2.27	(404,603)	23.45	(501,502)	37.51	(502,503)	-204.79
	(503,504)	37.51	(601,602)	75.76	(602,603)	75.76	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   6 BAY   32.99 FT. DIA.

TIME 4:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	18.68	(2, 11)	-35.63	(2, 21)	45.64	(3, 4)	23.42	(3, 11)	7.39
	(3, 12)	-24.16	(3, 21)	-52.32	(3, 22)	-15.00	(4, 5)	25.76	(4, 12)	2.61
	(4, 13)	-13.45	(4, 22)	-41.15	(4, 23)	-21.78	(5, 6)	25.76	(5, 13)	-4.50
	(5, 14)	-4.50	(5, 23)	-30.69	(5, 24)	-30.69	(6, 7)	23.42	(6, 14)	-13.45
	(6, 15)	2.61	(6, 24)	-21.78	(6, 25)	-41.15	(7, 8)	18.68	(7, 15)	-24.16
	(7, 16)	7.39	(7, 25)	-15.00	(7, 26)	-52.32	(8, 16)	-35.63	(8, 26)	45.64
	(11, 12)	28.60	(11, 31)	-10.67	(12, 13)	31.93	(12, 31)	18.56	(12, 32)	-.78
	(13, 14)	33.09	(13, 32)	14.12	(13, 33)	7.57	(14, 15)	31.93	(14, 33)	7.57
	(14, 34)	14.12	(15, 16)	28.60	(15, 34)	-.78	(15, 35)	18.56	(16, 35)	-10.67
	(21, 22)	5.18	(21, 41)	27.09	(22, 23)	9.94	(22, 41)	-77.85	(22, 42)	-52.11
	(23, 24)	11.65	(23, 42)	-68.02	(23, 43)	-59.15	(24, 25)	9.94	(24, 43)	-59.15
	(24, 44)	-68.02	(25, 26)	5.18	(25, 44)	-52.11	(25, 45)	-77.85	(26, 45)	27.09
	(31, 32)	34.17	(31, 51)	11.02	(32, 33)	34.39	(32, 51)	26.00	(32, 52)	16.51
	(33, 34)	34.39	(33, 52)	-28.26	(33, 53)	-28.26	(34, 35)	34.17	(34, 53)	16.51
	(34, 54)	26.00	(35, 54)	11.02	(41, 42)	-42.05	(41, 61)	5.56	(42, 43)	-37.01
	(42, 61)	-147.83	(42, 62)	-138.83	(43, 44)	-37.01	(43, 62)	-142.23	(43, 63)	-142.23
	(44, 45)	-42.05	(44, 63)	-138.83	(44, 64)	-147.83	(45, 64)	5.56	(51, 52)	37.43
	(52, 53)	-219.16	(53, 54)	37.43	(61, 62)	75.41	(62, 63)	76.19	(63, 64)	75.41
DIAGONAL STRUTS										
	(2,101)	3.30	(3,101)	11.62	(3,102)	-25.60	(3,201)	-8.48	(4,102)	4.58
	(4,103)	-16.95	(4,202)	-1.71	(5,103)	-6.51	(5,104)	-6.51	(5,203)	.57
	(6,104)	-16.95	(6,105)	4.58	(6,204)	-1.71	(7,105)	-25.60	(7,106)	11.62
	(7,205)	-8.48	(8,106)	3.30	(11,101)	13.55	(11,301)	-26.70	(12,102)	19.80
	(12,301)	15.25	(12,302)	-20.48	(13,103)	22.25	(13,302)	4.09	(13,303)	-8.98
	(14,104)	22.25	(14,303)	-8.98	(14,304)	4.09	(15,105)	19.80	(15,304)	-20.48
	(15,305)	15.25	(16,106)	13.55	(16,305)	-26.70	(21,201)	31.91	(22,201)	-18.37
	(22,202)	-41.07	(22,401)	-89.34	(23,202)	-22.98	(23,203)	-31.26	(23,402)	-84.70
	(24,203)	-31.26	(24,204)	-22.98	(24,403)	-84.70	(25,204)	-41.07	(25,205)	-18.37
	(25,404)	-89.34	(26,205)	31.91	(31,301)	29.56	(31,501)	-22.17	(32,302)	32.30
	(32,501)	13.03	(32,502)	-12.37	(33,303)	32.98	(33,502)	-5.55	(33,503)	-5.55
	(34,304)	32.30	(34,503)	-12.37	(34,504)	13.03	(35,305)	29.56	(35,504)	-22.17
	(41,401)	40.22	(42,401)	52.39	(42,402)	35.39	(42,601)	14.90	(43,402)	43.98
	(43,403)	43.98	(43,602)	17.46	(44,403)	35.39	(44,404)	52.39	(44,603)	14.90
	(45,404)	40.22	(51,501)	36.20	(52,502)	-30.30	(53,503)	-30.30	(54,504)	36.20
	(61,601)	46.34	(62,601)	61.17	(62,602)	53.62	(63,602)	53.62	(63,603)	61.17
	(64,603)	46.34	(							
BOTTOM STRUTS										
	(101,102)	14.40	(101,201)	31.31	(101,301)	-28.60	(102,103)	19.95	(102,201)	-54.44
	(102,202)	-25.60	(102,301)	6.25	(102,302)	-15.66	(103,104)	19.73	(103,202)	-41.27
	(103,203)	-31.40	(103,302)	1.84	(103,303)	-5.69	(104,105)	19.95	(104,203)	-31.40
	(104,204)	-41.27	(104,303)	-5.69	(104,304)	1.84	(105,106)	14.40	(105,204)	-25.60
	(105,205)	-54.44	(105,304)	-15.66	(105,305)	6.25	(106,205)	31.31	(106,305)	-28.60
	(201,202)	-45.80	(201,401)	26.65	(202,203)	-36.28	(202,401)	-34.08	(202,402)	-7.86
	(203,204)	-36.28	(203,402)	-20.27	(203,403)	-20.27	(204,205)	-45.80	(204,403)	-7.86
	(204,404)	-34.06	(205,404)	26.65	(301,302)	28.98	(301,501)	-.43	(302,303)	31.89
	(302,501)	-19.91	(302,502)	8.84	(303,304)	31.89	(303,502)	15.23	(303,503)	15.23
	(304,305)	28.98	(304,503)	8.84	(304,504)	19.91	(305,504)	-.43	(401,402)	75.00
	(401,601)	7.11	(402,403)	75.95	(402,601)	-11.76	(402,602)	-2.63	(403,404)	75.00
	(403,602)	-2.63	(403,603)	-11.76	(404,603)	7.11	(501,502)	35.34	(502,503)	32.06
	(503,504)	35.34	(601,602)	75.97	(602,603)	75.97	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 5:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	-14.30	(2, 11)	-66.37	(2, 21)	23.99	(3, 4)	-18.02	(3, 11)	-29.34
	(3, 12)	-57.42	(3, 21)	-119.52	(3, 22)	-94.15	(4, 5)	-17.71	(4, 12)	-32.64
	(4, 13)	-47.56	(4, 22)	-119.62	(4, 23)	-109.77	(5, 6)	-17.71	(5, 13)	-38.96
	(5, 14)	-38.96	(5, 23)	-113.77	(5, 24)	-113.77	(6, 7)	-18.02	(6, 14)	-47.56
	(6, 15)	-32.64	(6, 24)	-109.77	(6, 25)	-119.62	(7, 8)	-14.30	(7, 15)	-57.42
	(7, 16)	-29.34	(7, 25)	-94.15	(7, 26)	-119.52	(8, 16)	-66.37	(8, 26)	23.99
	(11, 12)	16.37	(11, 31)	-38.18	(12, 13)	19.32	(12, 31)	-6.58	(12, 32)	-28.30
	(13, 14)	20.77	(13, 32)	-11.97	(13, 33)	-19.33	(14, 15)	19.32	(14, 33)	-19.33
	(14, 34)	-11.97	(15, 16)	16.37	(15, 34)	-28.30	(15, 35)	-6.58	(16, 35)	-38.18
	(21, 22)	-70.80	(21, 41)	5.63	(22, 23)	-61.85	(22, 41)	-42.45	(22, 42)	-28.96
	(23, 24)	-60.64	(23, 42)	-40.70	(23, 43)	-36.11	(24, 25)	-61.85	(24, 43)	-36.11
	(24, 44)	-40.70	(25, 26)	-70.80	(25, 44)	-28.96	(25, 45)	-42.45	(26, 45)	5.63
	(31, 32)	28.29	(31, 51)	-15.11	(32, 33)	29.82	(32, 51)	5.94	(32, 52)	-6.48
	(33, 34)	29.82	(33, 52)	.62	(33, 53)	.62	(34, 35)	28.29	(34, 53)	-6.48
	(34, 54)	5.94	(35, 54)	-15.11	(41, 42)	74.73	(41, 61)	-8.72	(42, 43)	75.24
	(42, 61)	-12.29	(42, 62)	-13.90	(43, 44)	75.24	(43, 62)	-14.46	(43, 63)	-14.46
	(44, 45)	74.73	(44, 63)	-13.90	(44, 64)	-12.29	(45, 64)	-8.72	(51, 52)	33.79
	(52, 53)	33.47	(53, 54)	33.79	(61, 62)	75.94	(62, 63)	76.19	(63, 64)	75.94
DIAGONAL STRUTS										
	(2,101)	47.56	(3,101)	-28.04	(3,102)	-47.84	(3,201)	17.76	(4,102)	-47.09
	(4,103)	-56.53	(4,202)	23.60	(5,103)	-52.05	(5,104)	-52.05	(5,203)	26.07
	(6,104)	-56.53	(6,105)	-47.09	(6,204)	23.60	(7,105)	-47.84	(7,106)	-28.04
	(7,205)	17.76	(8,106)	47.56	(11,101)	-39.52	(11,301)	-28.33	(12,102)	-37.83
	(12,301)	-6.93	(12,302)	-23.30	(13,103)	-40.00	(13,302)	-11.01	(13,303)	-16.45
	(14,104)	-40.00	(14,303)	-16.45	(14,304)	-11.01	(15,105)	-37.83	(15,304)	-23.30
	(15,305)	-6.93	(16,106)	-39.52	(16,305)	-28.33	(21,201)	53.59	(22,201)	66.09
	(22,202)	53.26	(22,401)	3.98	(23,202)	60.75	(23,203)	56.10	(23,402)	8.63
	(24,203)	56.10	(24,204)	60.75	(24,403)	8.63	(25,204)	53.26	(25,205)	66.09
	(25,404)	3.98	(26,205)	53.59	(31,301)	6.33	(31,501)	-18.28	(32,302)	11.51
	(32,501)	1.31	(32,502)	-14.80	(33,303)	13.29	(33,502)	-7.52	(33,503)	-7.52
	(34,304)	11.51	(34,503)	-14.80	(34,504)	1.31	(35,305)	6.33	(35,504)	-18.28
	(41,401)	58.75	(42,401)	67.36	(42,402)	60.80	(42,601)	-29.95	(43,402)	63.83
	(43,403)	63.83	(43,602)	-28.34	(44,403)	60.80	(44,404)	67.36	(44,603)	-29.95
	(45,404)	58.75	(51,501)	24.07	(52,502)	26.37	(53,503)	26.37	(54,504)	24.07
	(61,601)	62.10	(82,601)	67.43	(62,602)	64.76	(63,602)	64.76	(63,603)	67.43
	(64,603)	62.10	(							
BOTTOM STRUTS										
	(101,102)	64.45	(101,201)	22.86	(101,301)	-107.23	(102,103)	63.89	(102,201)	-14.03
	(102,202)	11.47	(102,301)	-80.49	(102,302)	-101.91	(103,104)	62.90	(103,202)	-6.79
	(103,203)	2.16	(103,302)	-89.64	(103,303)	-93.62	(104,105)	63.89	(104,203)	2.16
	(104,204)	-6.79	(104,303)	-93.62	(104,304)	-89.64	(105,106)	64.45	(105,204)	11.47
	(105,205)	-14.03	(105,304)	-101.91	(105,305)	-80.49	(106,205)	22.86	(106,305)	-107.23
	(201,202)	75.38	(201,401)	5.62	(202,203)	76.06	(202,401)	-10.63	(202,402)	-1.69
	(203,204)	76.06	(203,402)	-7.21	(203,403)	-7.21	(204,205)	75.38	(204,403)	-1.69
	(204,404)	-10.63	(205,404)	5.62	(301,302)	4.01	(301,501)	-31.51	(302,303)	10.16
	(302,501)	-8.85	(302,502)	-21.29	(303,304)	10.16	(303,502)	-12.97	(303,503)	-12.97
	(304,305)	4.01	(304,503)	-21.29	(304,504)	-8.85	(305,504)	-31.51	(401,402)	75.89
	(401,601)	-5.78	(402,403)	76.20	(402,601)	-7.26	(402,602)	-7.69	(403,404)	75.89
	(403,602)	-7.69	(403,603)	-7.26	(404,603)	-5.78	(501,502)	27.76	(502,503)	28.82
	(503,504)	27.76	(601,602)	76.13	(602,603)	76.13	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 6:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	66.41	(2, 11)	-128.49	(2, 21)	1.58	(3, 4)	64.62	(3, 11)	-117.03
	(3, 12)	-140.31	(3, 21)	-3.11	(3, 22)	-7.90	(4, 5)	63.71	(4, 12)	-135.89
	(4, 13)	-140.93	(4, 22)	-8.87	(4, 23)	-11.66	(5, 6)	63.71	(5, 13)	-138.09
	(5, 14)	-138.09	(5, 23)	-11.97	(5, 24)	-11.97	(6, 7)	64.62	(6, 14)	-140.93
	(6, 15)	-135.89	(6, 24)	-11.66	(6, 25)	-8.87	(7, 8)	66.41	(7, 15)	-140.31
	(7, 16)	-117.03	(7, 25)	-7.90	(7, 26)	-3.11	(8, 16)	-128.49	(8, 26)	1.58
	(11, 12)	-98.03	(11, 31)	-79.66	(12, 13)	-105.18	(12, 31)	-89.74	(12, 32)	-107.58
	(13, 14)	-102.93	(13, 32)	-97.92	(13, 33)	-102.02	(14, 15)	-105.18	(14, 33)	-102.02
	(14, 34)	-97.92	(15, 16)	-98.03	(15, 34)	-107.58	(15, 35)	-89.74	(16, 35)	-79.66
	(21, 22)	76.05	(21, 41)	-7.46	(22, 23)	76.14	(22, 41)	8.17	(22, 42)	-7.58
	(23, 24)	76.18	(23, 42)	1.19	(23, 43)	-4.42	(24, 25)	76.14	(24, 43)	-4.42
	(24, 44)	1.19	(25, 26)	76.05	(25, 44)	-7.58	(25, 45)	8.17	(26, 45)	-7.46
	(31, 32)	-36.56	(31, 51)	-48.19	(32, 33)	-33.95	(32, 51)	-49.55	(32, 52)	-59.68
	(33, 34)	-33.95	(33, 52)	-52.99	(33, 53)	-52.99	(34, 35)	-36.56	(34, 53)	-59.68
	(34, 54)	-49.55	(35, 54)	-48.19	(41, 42)	76.13	(41, 61)	-4.34	(42, 43)	76.19
	(42, 61)	15.63	(42, 62)	1.44	(43, 44)	76.19	(43, 62)	8.35	(43, 63)	8.35
	(44, 45)	76.13	(44, 63)	1.44	(44, 64)	15.63	(45, 64)	-4.34	(51, 52)	20.50
	(52, 53)	20.97	(53, 54)	20.50	(61, 62)	76.17	(62, 63)	76.19	(63, 64)	76.17
DIAGONAL STRUTS										
	(2,101)	64.42	(3,101)	66.16	(3,102)	61.82	(3,201)	-10.15	(4,102)	63.21
	(4,103)	60.73	(4,202)	-3.15	(5,103)	61.23	(5,104)	61.23	(5,203)	-1.07
	(6,104)	60.73	(6,105)	63.21	(6,204)	-3.15	(7,105)	61.82	(7,106)	66.16
	(7,205)	-10.15	(8,106)	64.42	(11,101)	10.55	(11,301)	45.77	(12,102)	20.28
	(12,301)	43.23	(12,302)	37.71	(13,103)	24.39	(13,302)	38.54	(13,303)	36.06
	(14,104)	24.39	(14,303)	36.06	(14,304)	38.54	(15,105)	20.28	(15,304)	37.71
	(15,305)	43.23	(16,106)	10.55	(16,305)	45.77	(21,201)	68.08	(22,201)	69.28
	(22,202)	67.22	(22,401)	-42.81	(23,202)	68.00	(23,203)	67.31	(23,402)	-41.28
	(24,203)	67.31	(24,204)	68.00	(24,403)	-41.28	(25,204)	67.22	(25,205)	69.28
	(25,404)	-42.81	(26,205)	68.08	(31,301)	-83.80	(31,501)	-70.62	(32,302)	-90.94
	(32,501)	-73.57	(32,502)	-76.74	(33,303)	-88.34	(33,502)	-74.57	(33,503)	-74.57
	(34,304)	-90.94	(34,503)	-76.74	(34,504)	-73.57	(35,305)	-83.80	(35,504)	-70.62
	(41,401)	70.51	(42,401)	71.46	(42,402)	70.75	(42,601)	-90.11	(43,402)	71.08
	(43,403)	71.08	(43,602)	-101.81	(44,403)	70.75	(44,404)	71.46	(44,603)	-90.11
	(45,404)	70.51	(51,501)	-39.74	(52,502)	-37.93	(53,503)	-37.93	(54,504)	-39.74
	(61,601)	71.98	(62,601)	72.57	(62,602)	72.44	(63,602)	72.44	(63,603)	72.57
	(64,603)	71.98	(							
BOTTOM STRUTS										
	(101,102)	76.02	(101,201)	-.66	(101,301)	-8.51	(102,103)	76.15	(102,201)	-3.13
	(102,202)	-5.12	(102,301)	6.62	(102,302)	-7.84	(103,104)	76.20	(103,202)	-6.42
	(103,203)	-7.13	(103,302)	.40	(103,303)	-4.65	(104,105)	76.15	(104,203)	-7.13
	(104,204)	-6.42	(104,303)	-4.65	(104,304)	.40	(105,106)	76.02	(105,204)	-5.12
	(105,205)	-3.13	(105,304)	-7.84	(105,305)	6.62	(106,205)	-.66	(106,305)	-8.51
	(201,202)	76.11	(201,401)	-7.43	(202,203)	76.19	(202,401)	4.96	(202,402)	-5.60
	(203,204)	76.19	(203,402)	-1.21	(203,403)	-1.21	(204,205)	76.11	(204,403)	-5.60
	(204,404)	4.96	(205,404)	-7.43	(301,302)	74.96	(301,501)	-46.13	(302,303)	74.98
	(302,501)	-25.33	(302,502)	-42.35	(303,304)	74.98	(303,502)	-34.73	(303,503)	-34.73
	(304,305)	74.96	(304,503)	-42.35	(304,504)	-25.33	(305,504)	-46.13	(401,402)	76.17
	(401,601)	-.68	(402,403)	76.20	(402,601)	14.18	(402,602)	6.34	(403,404)	76.17
	(403,602)	6.34	(403,603)	14.18	(404,603)	-.68	(501,502)	-72.22	(502,503)	-70.50
	(503,504)	-72.22	(601,602)	76.19	(602,603)	76.19	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 7:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	75.34	(2, 11)	16.18	(2, 21)	-9.53	(3, 4)	75.84	(3, 11)	-10.07
(3, 12)	6.91	(3, 21)	25.67	(3, 22)	-6.48	(4, 5)	76.16	(4, 12)	-10.46
(4, 13)	-1.31	(4, 22)	16.73	(4, 23)	-.46	(5, 6)	76.16	(5, 13)	-7.40
(5, 14)	-7.40	(5, 23)	7.67	(5, 24)	7.67	(6, 7)	75.84	(6, 14)	-1.31
(6, 15)	-10.46	(6, 24)	-.46	(6, 25)	16.73	(7, 8)	75.34	(7, 15)	6.91
(7, 16)	-10.07	(7, 25)	-6.48	(7, 26)	25.67	(8, 16)	16.18	(8, 26)	-9.53
(11, 12)	74.87	(11, 31)	-33.93	(12, 13)	75.28	(12, 31)	-41.85	(12, 32)	-42.68
(13, 14)	75.46	(13, 32)	-45.04	(13, 33)	-45.36	(14, 15)	75.28	(14, 33)	-45.36
(14, 34)	-45.04	(15, 16)	74.87	(15, 34)	-42.68	(15, 35)	-41.85	(16, 35)	-33.93
(21, 22)	75.61	(21, 41)	-.47	(22, 23)	76.03	(22, 41)	33.93	(22, 42)	7.64
(23, 24)	76.20	(23, 42)	25.68	(23, 43)	16.71	(24, 25)	76.03	(24, 43)	16.71
(24, 44)	25.68	(25, 26)	75.61	(25, 44)	7.64	(25, 45)	33.93	(26, 45)	-.47
(31, 32)	-106.77	(31, 51)	-148.74	(32, 33)	-114.56	(32, 51)	-140.85	(32, 52)	-144.42
(33, 34)	-114.56	(33, 52)	-141.27	(33, 53)	-141.27	(34, 35)	-106.77	(34, 53)	-144.42
(34, 54)	-140.85	(35, 54)	-148.74	(41, 42)	75.83	(41, 61)	16.71	(42, 43)	76.15
(42, 61)	41.16	(42, 62)	25.66	(43, 44)	76.15	(43, 62)	33.92	(43, 63)	33.92
(44, 45)	75.83	(44, 63)	25.66	(44, 64)	41.16	(45, 64)	16.71	(51, 52)	-68.50
(52, 53)	-66.88	(53, 54)	-68.50	(61, 62)	76.02	(62, 63)	76.19	(63, 64)	76.02

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,1(1))	73.48	(3,101)	67.89	(3,102)	72.24	(3,201)	-56.25	(4,102)	68.51
(4,103)	70.82	(4,202)	-56.41	(5,103)	69.52	(5,104)	69.52	(5,203)	-57.32
(6,104)	70.82	(6,105)	68.51	(6,204)	-56.41	(7,105)	72.24	(7,106)	67.89
(7,205)	-56.25	(8,106)	73.48	(11,101)	-30.06	(11,301)	68.55	(12,102)	-20.18
(12,301)	60.89	(12,302)	65.50	(13,103)	-15.88	(13,302)	61.35	(13,303)	63.03
(14,104)	-15.88	(14,303)	63.03	(14,304)	61.35	(15,105)	-20.18	(15,304)	65.50
(15,305)	60.89	(16,106)	-30.06	(16,305)	68.55	(21,201)	74.83	(22,201)	72.21
(22,202)	74.58	(22,401)	-88.94	(23,202)	73.19	(23,203)	73.95	(23,402)	-112.77
(24,203)	73.95	(24,204)	73.19	(24,403)	-112.77	(25,204)	74.58	(25,205)	72.21
(25,404)	-88.94	(26,205)	74.83	(31,301)	1.78	(31,501)	57.20	(32,302)	9.14
(32,501)	47.95	(32,502)	52.38	(33,303)	11.34	(33,502)	48.88	(33,503)	48.88
(34,304)	9.14	(34,503)	52.38	(34,504)	47.95	(35,305)	1.78	(35,504)	57.20
(41,401)	75.67	(42,401)	74.59	(42,402)	75.56	(42,601)	-105.28	(43,402)	75.28
(43,403)	75.28	(43,602)	-155.79	(44,403)	75.56	(44,404)	74.59	(44,603)	-105.28
(45,404)	75.67	(51,501)	-3.34	(52,502)	1.97	(53,503)	1.97	(54,504)	-3.34
(61,601)	75.81	(62,601)	75.58	(62,602)	75.82	(63,602)	75.82	(63,603)	75.58
(64,6(3))	75.81	(							

BOTTOM STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	75.74	(101,201)	-13.23	(101,301)	7.91	(102,103)	76.07	(102,201)	18.53
(102,202)	-8.47	(102,301)	-14.06	(102,302)	-.55	(103,104)	76.20	(103,202)	8.87
(103,203)	-.56	(103,302)	-12.50	(103,303)	-7.69	(104,105)	76.07	(104,203)	-.56
(104,204)	8.87	(104,303)	-7.69	(104,304)	-12.50	(105,106)	75.74	(105,204)	-8.47
(105,205)	18.53	(105,304)	-.55	(105,305)	-14.06	(106,205)	-13.23	(106,305)	7.91
(201,202)	75.86	(201,401)	-.49	(202,203)	76.16	(202,401)	29.15	(202,402)	9.27
(203,204)	76.16	(203,402)	19.52	(203,403)	19.52	(204,205)	75.86	(204,403)	9.27
(204,404)	29.15	(205,404)	-.49	(301,302)	75.97	(301,501)	-6.46	(302,303)	76.17
(307,501)	-9.61	(302,502)	-10.07	(303,304)	76.17	(303,502)	-11.20	(303,503)	-11.20
(304,305)	75.97	(304,503)	-10.07	(304,504)	-9.81	(305,504)	-6.46	(401,402)	75.99
(401,601)	19.54	(402,403)	76.20	(402,601)	38.47	(402,602)	29.53	(403,404)	75.99
(403,602)	29.53	(403,603)	38.47	(404,603)	19.54	(501,502)	75.98	(502,503)	76.07
(503,504)	75.98	(601,602)	76.13	(602,603)	76.13	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 8:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	72.80	(2, 11)	40.22	(2, 21)	-1.02	(3, 4)	74.80	(3, 11)	-9.93
(3, 12)	30.79	(3, 21)	48.36	(3, 22)	9.33	(4, 5)	76.03	(4, 12)	-1.10
(4, 13)	20.25	(4, 22)	40.22	(4, 23)	20.31	(5, 6)	76.03	(5, 13)	9.37
(5, 14)	9.37	(5, 23)	30.79	(5, 24)	30.79	(6, 7)	74.80	(6, 14)	20.25
(6, 15)	-1.10	(6, 24)	20.31	(6, 25)	40.22	(7, 8)	72.80	(7, 15)	30.79
(7, 16)	-9.93	(7, 25)	9.33	(7, 26)	48.36	(8, 16)	40.22	(8, 26)	-1.02
(11, 12)	73.86	(11, 31)	20.23	(12, 13)	75.55	(12, 31)	-16.51	(12, 32)	9.28
(13, 14)	76.20	(13, 32)	-10.11	(13, 33)	-1.23	(14, 15)	75.55	(14, 33)	-1.23
(14, 34)	-10.11	(15, 16)	73.86	(15, 34)	9.28	(15, 35)	-16.51	(16, 35)	20.23
(21, 22)	73.86	(21, 41)	20.35	(22, 23)	75.55	(22, 41)	55.06	(22, 42)	30.84
(23, 24)	76.20	(23, 42)	48.37	(23, 43)	40.27	(24, 25)	75.55	(24, 43)	40.27
(24, 44)	48.37	(25, 26)	73.86	(25, 44)	30.84	(25, 45)	55.06	(26, 45)	20.35
(31, 32)	74.76	(31, 51)	-6.63	(32, 33)	75.99	(32, 51)	-26.90	(32, 52)	-16.51
(33, 34)	75.99	(33, 52)	-23.25	(33, 53)	-23.25	(34, 35)	74.76	(34, 53)	-16.51
(34, 54)	-26.90	(35, 54)	-6.63	(41, 42)	74.80	(41, 61)	40.26	(42, 43)	76.03
(42, 61)	60.34	(42, 62)	48.28	(43, 44)	76.03	(43, 62)	54.97	(43, 63)	54.97
(44, 45)	74.80	(44, 63)	48.28	(44, 64)	60.34	(45, 64)	40.26	(51, 52)	65.14
(52, 53)	66.00	(53, 54)	65.14	(61, 62)	75.55	(62, 63)	76.19	(63, 64)	75.55

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,101)	75.59	(3,101)	70.48	(3,102)	75.67	(3,201)	-81.66	(4,102)	72.91
(4,103)	75.41	(4,202)	-115.47	(5,103)	74.53	(5,104)	74.53	(5,203)	-150.92
(6,104)	75.41	(6,105)	72.91	(6,204)	-115.47	(7,105)	75.67	(7,106)	70.48
(7,205)	-81.66	(8,106)	75.59	(11,101)	-73.83	(11,301)	74.94	(12,102)	-75.90
(12,301)	65.83	(12,302)	73.47	(13,103)	-79.61	(13,302)	68.79	(13,303)	71.36
(14,104)	-79.61	(14,303)	71.36	(14,304)	68.79	(15,105)	-75.90	(15,304)	73.47
(15,305)	65.83	(16,106)	-73.83	(16,305)	74.94	(21,201)	74.79	(22,201)	74.62
(22,202)	75.32	(22,401)	-71.07	(23,202)	75.74	(23,203)	75.82	(23,402)	-122.24
(24,203)	75.82	(24,204)	75.74	(24,403)	-122.24	(25,204)	75.32	(25,205)	74.62
(25,404)	-71.07	(26,205)	74.79	(31,301)	-46.82	(31,501)	69.89	(32,302)	-39.77
(32,501)	57.46	(32,502)	65.93	(33,303)	-37.80	(33,502)	61.68	(33,503)	61.68
(34,304)	-39.77	(34,503)	65.93	(34,504)	57.46	(35,305)	-46.82	(35,504)	69.89
(41,401)	73.52	(42,401)	76.00	(42,402)	74.53	(42,601)	-37.36	(43,402)	75.61
(43,403)	75.61	(43,602)	-57.31	(44,403)	74.53	(44,404)	76.00	(44,603)	-37.36
(45,404)	73.52	(51,501)	-18.37	(52,502)	-12.95	(53,503)	-12.95	(54,504)	-18.37
(61,601)	72.98	(62,601)	75.71	(62,602)	74.28	(63,602)	74.28	(63,603)	75.71
(64,603)	72.98	(							

BOTTOM STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	74.08	(101,201)	-4.56	(101,301)	31.52	(102,103)	75.61	(102,201)	41.92
(102,202)	7.93	(102,301)	-15.48	(102,302)	20.29	(103,104)	76.20	(103,202)	31.93
(103,203)	20.38	(103,302)	-4.33	(103,303)	8.05	(104,105)	75.61	(104,203)	20.38
(104,204)	31.93	(104,303)	8.05	(104,304)	-4.33	(105,106)	74.08	(105,204)	7.93
(105,205)	41.92	(105,304)	20.29	(105,305)	-15.48	(106,205)	-4.56	(106,305)	31.52
(201,202)	74.75	(201,401)	20.33	(202,203)	76.02	(202,401)	50.83	(202,402)	31.95
(203,204)	76.02	(203,402)	42.24	(203,403)	42.24	(204,205)	74.75	(204,403)	31.95
(204,404)	50.83	(205,404)	20.33	(301,302)	75.06	(301,501)	8.76	(302,303)	76.06
(302,501)	-22.72	(302,502)	-2.93	(303,304)	76.06	(303,502)	-13.90	(303,503)	-13.90
(304,305)	75.06	(304,503)	-2.93	(304,504)	-22.72	(305,504)	8.76	(401,402)	75.42
(401,601)	42.04	(402,403)	76.20	(402,601)	58.00	(402,602)	50.81	(403,404)	75.42
(403,602)	50.81	(403,603)	58.00	(404,603)	42.04	(501,502)	75.70	(502,503)	76.20
(503,504)	75.70	(601,602)	75.96	(602,603)	75.96	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   6 BAY   32.99 FT. DIA.

TIME 9:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	69.14	(2, 11)	58.75	(2, 21)	21.46	(3, 4)	73.33	(3, 11)	9.66
(3, 12)	51.57	(3, 21)	64.41	(3, 22)	32.77	(4, 5)	75.86	(4, 12)	21.55
(4, 13)	42.89	(4, 22)	58.76	(4, 23)	42.84	(5, 6)	75.86	(5, 13)	32.80
(5, 14)	32.80	(5, 23)	51.57	(5, 24)	51.57	(6, 7)	73.33	(6, 14)	42.89
(6, 15)	21.55	(6, 24)	42.84	(6, 25)	58.76	(7, 8)	69.14	(7, 15)	51.57
(7, 16)	9.66	(7, 25)	32.77	(7, 26)	64.41	(8, 16)	58.75	(8, 26)	21.46
(11, 12)	71.37	(11, 31)	42.83	(12, 13)	74.87	(12, 31)	-2.03	(12, 32)	32.70
(13, 14)	76.20	(13, 32)	9.65	(13, 33)	21.56	(14, 15)	74.87	(14, 33)	21.56
(14, 34)	9.65	(15, 16)	71.37	(15, 34)	32.70	(15, 35)	-2.03	(16, 35)	42.83
(21, 22)	71.37	(21, 41)	42.82	(22, 23)	74.87	(22, 41)	68.68	(22, 42)	51.56
(23, 24)	76.20	(23, 42)	64.42	(23, 43)	58.76	(24, 25)	74.87	(24, 43)	58.76
(24, 44)	64.42	(25, 26)	71.37	(25, 44)	51.56	(25, 45)	68.68	(26, 45)	42.82
(31, 32)	73.33	(31, 51)	21.46	(32, 33)	75.86	(32, 51)	-12.96	(32, 52)	9.71
(33, 34)	75.86	(33, 52)	-2.10	(33, 53)	-2.10	(34, 35)	73.33	(34, 53)	9.71
(34, 54)	-12.96	(35, 54)	21.46	(41, 42)	73.33	(41, 61)	58.74	(42, 43)	75.86
(42, 61)	71.77	(42, 62)	64.46	(43, 44)	75.86	(43, 62)	68.72	(43, 63)	68.72
(44, 45)	73.33	(44, 63)	64.46	(44, 64)	71.77	(45, 64)	58.74	(51, 52)	74.86
(52, 53)	76.19	(53, 54)	74.86	(61, 62)	74.87	(62, 63)	76.19	(63, 64)	74.87

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,101)	70.15	(3,101)	73.13	(3,102)	72.91	(3,201)	-41.53	(4,102)	75.63
(4,103)	74.88	(4,202)	-81.06	(5,103)	75.99	(5,104)	75.99	(5,203)	-115.94
(6,104)	74.88	(6,105)	75.63	(6,204)	-81.06	(7,105)	72.91	(7,106)	73.13
(7,205)	-41.53	(8,106)	70.15	(11,101)	-66.76	(11,301)	75.02	(12,102)	-100.99
(12,301)	70.76	(12,302)	75.93	(13,103)	-144.34	(13,302)	74.04	(13,303)	75.68
(14,104)	-144.34	(14,303)	75.68	(14,304)	74.04	(15,105)	-100.99	(15,304)	75.93
(15,305)	70.76	(16,106)	-66.76	(16,305)	75.02	(21,201)	67.21	(22,201)	75.99
(22,202)	70.20	(22,401)	-12.76	(23,202)	75.53	(23,203)	73.22	(23,402)	-34.83
(24,203)	73.22	(24,204)	75.53	(24,403)	-34.83	(25,204)	70.20	(25,205)	75.99
(25,404)	-12.76	(26,205)	67.21	(31,301)	-96.83	(31,501)	75.40	(32,302)	-107.15
(32,501)	65.49	(32,502)	73.51	(33,303)	-117.32	(33,502)	70.18	(33,503)	70.18
(34,304)	-107.15	(34,503)	73.51	(34,504)	65.49	(35,305)	-96.83	(35,504)	75.40
(41,401)	65.06	(42,401)	75.52	(42,402)	68.33	(42,601)	15.15	(43,402)	72.37
(43,403)	72.37	(43,602)	7.91	(44,403)	68.33	(44,404)	75.52	(44,603)	15.15
(45,404)	65.06	(51,501)	-80.70	(52,502)	-76.05	(53,503)	-76.05	(54,504)	-80.70
(61,601)	64.34	(62,601)	73.24	(62,602)	68.41	(63,602)	68.41	(63,603)	73.24
(64,603)	64.34	(							

BOTTOM STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	71.31	(101,201)	19.07	(101,301)	52.32	(102,103)	74.87	(102,201)	60.12
(102,202)	31.65	(102,301)	4.84	(102,302)	42.94	(103,104)	76.20	(103,202)	52.42
(103,203)	42.86	(103,302)	18.78	(103,303)	31.62	(104,105)	74.87	(104,203)	42.86
(104,204)	52.42	(104,303)	31.62	(104,304)	18.78	(105,106)	71.31	(105,204)	31.65
(105,205)	60.12	(105,304)	42.94	(105,305)	4.84	(106,205)	19.07	(106,305)	52.32
(201,202)	73.05	(201,401)	42.83	(202,203)	75.83	(202,401)	66.05	(202,402)	52.30
(203,204)	75.83	(203,402)	60.07	(203,403)	60.07	(204,205)	73.05	(204,403)	52.30
(204,404)	66.05	(205,404)	42.83	(301,302)	73.52	(301,501)	31.90	(302,303)	75.88
(302,501)	-9.46	(302,502)	19.19	(303,304)	75.88	(303,502)	5.15	(303,503)	5.15
(304,305)	73.52	(304,503)	19.19	(304,504)	-9.46	(305,504)	31.90	(401,402)	74.60
(401,601)	59.78	(402,403)	76.20	(402,601)	70.27	(402,602)	65.81	(403,404)	74.60
(403,602)	65.81	(403,603)	70.27	(404,603)	59.78	(501,502)	75.02	(502,503)	76.20
(503,504)	75.02	(601,602)	75.75	(602,603)	75.75	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 10:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(2, 3)	65.12	(2, 11)	70.91	(2, 21)	44.43	(3, 4)	71.77	(3, 11)	34.34
	(3, 12)	66.57	(3, 21)	73.82	(3, 22)	53.20	(4, 5)	75.68	(4, 12)	44.34
	(4, 13)	60.64	(4, 22)	70.91	(4, 23)	60.68	(5, 6)	75.68	(5, 13)	53.23
	(5, 14)	53.23	(5, 23)	66.57	(5, 24)	66.57	(6, 7)	71.77	(6, 14)	60.64
	(6, 15)	44.34	(6, 24)	60.68	(6, 25)	70.91	(7, 8)	65.12	(7, 15)	66.57
	(7, 16)	34.34	(7, 25)	53.20	(7, 26)	73.82	(8, 16)	70.91	(8, 26)	44.43
	(11, 12)	68.69	(11, 31)	60.68	(12, 13)	74.16	(12, 31)	23.29	(12, 32)	53.25
	(13, 14)	76.20	(13, 32)	34.34	(13, 33)	44.35	(14, 15)	74.16	(14, 33)	44.35
	(14, 34)	34.34	(15, 16)	68.69	(15, 34)	53.25	(15, 35)	23.29	(16, 35)	60.68
	(21, 22)	68.69	(21, 41)	60.71	(22, 23)	74.16	(22, 41)	75.42	(22, 42)	66.59
	(23, 24)	76.20	(23, 42)	73.82	(23, 43)	70.93	(24, 25)	74.16	(24, 43)	70.93
	(24, 44)	73.82	(25, 26)	68.69	(25, 44)	66.59	(25, 45)	75.42	(26, 45)	60.71
	(31, 32)	71.77	(31, 51)	44.39	(32, 33)	75.68	(32, 51)	11.72	(32, 52)	34.26
	(33, 34)	75.68	(33, 52)	23.43	(33, 53)	23.43	(34, 35)	71.77	(34, 53)	34.26
	(34, 54)	11.72	(35, 54)	44.39	(41, 42)	71.77	(41, 61)	70.93	(42, 43)	75.68
	(42, 61)	75.84	(42, 62)	73.70	(43, 44)	75.68	(43, 62)	75.31	(43, 63)	75.31
	(44, 45)	71.77	(44, 63)	73.70	(44, 64)	75.84	(45, 64)	70.93	(51, 52)	74.16
	(52, 53)	76.19	(53, 54)	74.16	(61, 62)	74.15	(62, 63)	76.19	(63, 64)	74.15
DIAGONAL STRUTS										
	(2,101)	57.85	(3,101)	75.15	(3,102)	63.24	(3,201)	8.00	(4,102)	75.88
	(4,103)	68.67	(4,202)	-11.34	(5,103)	73.28	(5,104)	73.28	(5,203)	-21.46
	(6,104)	68.67	(6,105)	75.88	(6,204)	-11.34	(7,105)	63.24	(7,106)	75.15
	(7,205)	8.00	(8,106)	57.85	(11,101)	-16.08	(11,301)	68.08	(12,102)	-44.95
	(12,301)	74.37	(12,302)	72.17	(13,103)	-74.83	(13,302)	75.97	(13,303)	74.99
	(14,104)	-74.83	(14,303)	74.99	(14,304)	75.97	(15,105)	-44.95	(15,304)	72.17
	(15,305)	74.37	(16,106)	-16.08	(16,305)	68.08	(21,201)	52.96	(22,201)	75.89
	(22,202)	58.96	(22,401)	29.05	(23,202)	72.33	(23,203)	65.93	(23,402)	18.77
	(24,203)	65.93	(24,204)	72.33	(24,403)	18.77	(25,204)	58.96	(25,205)	75.89
	(25,404)	29.05	(26,205)	52.96	(31,301)	-76.67	(31,501)	74.84	(32,302)	-114.88
	(32,501)	71.85	(32,502)	75.89	(33,303)	-150.03	(33,502)	75.02	(33,503)	75.02
	(34,304)	-114.88	(34,503)	75.89	(34,504)	71.85	(35,305)	-76.67	(35,504)	74.84
	(41,401)	49.68	(42,401)	73.10	(42,402)	56.91	(42,601)	47.22	(43,402)	65.70
	(43,403)	65.70	(43,602)	43.43	(44,403)	56.91	(44,404)	73.10	(44,603)	47.22
	(45,404)	49.68	(51,501)	-129.13	(52,502)	-147.20	(53,503)	-147.20	(54,504)	-129.13
	(61,601)	49.72	(62,601)	68.32	(62,602)	58.49	(63,602)	58.49	(63,603)	68.32
	(64,603)	49.72	(							
BOTTOM STRUTS										
	(101,102)	68.14	(101,201)	43.03	(101,301)	66.89	(102,103)	74.04	(102,201)	71.44
	(102,202)	52.56	(102,301)	31.33	(102,302)	60.52	(103,104)	76.20	(103,202)	66.93
	(103,203)	60.58	(103,302)	42.45	(103,303)	52.30	(104,105)	74.04	(104,203)	60.58
	(104,204)	66.93	(104,303)	52.30	(104,304)	42.45	(105,106)	68.14	(105,204)	52.56
	(105,205)	71.44	(105,304)	60.52	(105,305)	31.33	(106,205)	43.03	(106,305)	66.89
	(201,202)	71.17	(201,401)	60.68	(202,203)	75.61	(202,401)	74.31	(202,402)	66.83
	(203,204)	75.61	(203,402)	71.42	(203,403)	71.42	(204,205)	71.17	(204,403)	66.83
	(204,404)	74.31	(205,404)	60.68	(301,302)	71.75	(301,501)	52.36	(302,303)	75.68
	(302,501)	17.80	(302,502)	42.37	(303,304)	75.68	(303,502)	30.67	(303,503)	30.67
	(304,305)	71.75	(304,503)	42.37	(304,504)	17.80	(305,504)	52.36	(401,402)	73.74
	(401,601)	71.35	(402,403)	76.20	(402,601)	75.76	(402,602)	74.31	(403,404)	73.74
	(403,602)	74.31	(403,603)	75.76	(404,603)	71.35	(501,502)	74.24	(502,503)	76.20
	(503,504)	74.24	(601,602)	75.53	(602,603)	75.53	(			

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 6 BAY 32.99 FT. DIA.

TIME 11:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2, 3)	61.87	(2, 11)	75.64	(2, 21)	61.64	(3, 4)	70.55	(3, 11)	54.74
(3, 12)	74.34	(3, 21)	75.62	(3, 22)	67.35	(4, 5)	75.54	(4, 12)	61.70
(4, 13)	71.60	(4, 22)	75.64	(4, 23)	71.58	(5, 6)	75.54	(5, 13)	67.37
(5, 14)	67.37	(5, 23)	74.34	(5, 24)	74.34	(6, 7)	70.55	(6, 14)	71.60
(6, 15)	61.70	(6, 24)	71.58	(6, 25)	75.64	(7, 8)	61.87	(7, 15)	74.34
(7, 16)	54.74	(7, 25)	67.35	(7, 26)	75.62	(8, 16)	75.64	(8, 26)	61.64
(11, 12)	66.56	(11, 31)	71.57	(12, 13)	73.61	(12, 31)	46.84	(12, 32)	67.33
(13, 14)	76.20	(13, 32)	54.74	(13, 33)	61.71	(14, 15)	73.61	(14, 33)	61.71
(14, 34)	54.74	(15, 16)	66.56	(15, 34)	67.33	(15, 35)	46.84	(16, 35)	71.57
(21, 22)	66.56	(21, 41)	71.56	(22, 23)	73.61	(22, 41)	74.47	(22, 42)	74.34
(23, 24)	76.20	(23, 42)	75.63	(23, 43)	75.65	(24, 25)	73.61	(24, 43)	75.65
(24, 44)	75.63	(25, 26)	66.56	(25, 44)	74.34	(25, 45)	74.47	(26, 45)	71.56
(31, 32)	70.54	(31, 51)	61.66	(32, 33)	75.54	(32, 51)	38.09	(32, 52)	54.78
(33, 34)	75.54	(33, 52)	46.78	(33, 53)	46.78	(34, 35)	70.54	(34, 53)	54.78
(34, 54)	38.09	(35, 54)	61.66	(41, 42)	70.55	(41, 61)	75.64	(42, 43)	75.54
(42, 61)	72.45	(42, 62)	75.68	(43, 44)	75.54	(43, 62)	74.52	(43, 63)	74.52
(44, 45)	70.55	(44, 63)	75.68	(44, 64)	72.45	(45, 64)	75.64	(51, 52)	73.60
(52, 53)	76.19	(53, 54)	73.60	(61, 62)	73.61	(62, 63)	76.19	(63, 64)	73.61

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(2,101)	38.66	(3,101)	76.12	(3,102)	48.00	(3,201)	41.33	(4,102)	73.91
(4,103)	57.89	(4,202)	30.81	(5,103)	67.20	(5,104)	67.20	(5,203)	26.21
(6,104)	57.89	(6,105)	73.91	(6,204)	30.81	(7,105)	48.00	(7,106)	76.12
(7,205)	41.33	(8,106)	38.66	(11,101)	25.25	(11,301)	55.26	(12,102)	9.51
(12,301)	76.08	(12,302)	63.18	(13,103)	-2.48	(13,302)	74.66	(13,303)	69.92
(14,104)	-2.48	(14,303)	69.92	(14,304)	74.66	(15,105)	9.51	(15,304)	63.18
(15,305)	76.08	(16,106)	25.25	(16,305)	55.26	(21,201)	32.18	(22,201)	74.50
(22,202)	42.80	(22,401)	55.12	(23,202)	66.91	(23,203)	55.38	(23,402)	49.54
(24,203)	55.38	(24,204)	66.91	(24,403)	49.54	(25,204)	42.80	(25,205)	74.50
(25,404)	55.12	(26,205)	32.18	(31,301)	-13.55	(31,501)	68.75	(32,302)	-33.88
(32,501)	75.53	(32,502)	73.30	(33,303)	-44.56	(33,502)	75.78	(33,503)	75.78
(34,304)	-33.88	(34,503)	73.30	(34,504)	75.53	(35,305)	-13.55	(35,504)	68.75
(41,401)	29.27	(42,401)	69.40	(42,402)	42.19	(42,601)	66.11	(43,402)	57.05
(43,403)	57.05	(43,602)	64.22	(44,403)	42.19	(44,404)	69.40	(44,603)	66.11
(45,404)	29.27	(51,501)	-63.90	(52,502)	-85.06	(53,503)	-85.06	(54,504)	-63.90
(61,601)	31.33	(62,601)	62.21	(62,602)	46.56	(63,602)	46.56	(63,603)	62.21
(64,603)	31.33	(							

BOTTOM STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(101,102)	65.47	(101,201)	61.00	(101,301)	74.68	(102,103)	73.36	(102,201)	75.90
(102,202)	67.11	(102,301)	53.14	(102,302)	71.72	(103,104)	76.20	(103,202)	74.62
(103,203)	71.67	(103,302)	60.75	(103,303)	66.99	(104,105)	73.36	(104,203)	71.67
(104,204)	74.62	(104,303)	66.99	(104,304)	60.75	(105,106)	65.47	(105,204)	67.11
(105,205)	75.90	(105,304)	71.72	(105,305)	53.14	(106,205)	61.00	(106,305)	74.68
(201,202)	69.66	(201,401)	71.58	(202,203)	75.44	(202,401)	75.47	(202,402)	74.53
(203,204)	75.44	(203,402)	75.81	(203,403)	75.81	(204,205)	69.66	(204,403)	74.53
(204,404)	75.47	(205,404)	71.58	(301,302)	70.23	(301,501)	66.90	(302,303)	75.51
(302,501)	43.44	(302,502)	60.44	(303,304)	75.51	(303,502)	52.50	(303,503)	52.50
(304,305)	70.23	(304,503)	60.44	(304,504)	43.44	(305,504)	66.90	(401,402)	73.09
(401,601)	75.72	(402,403)	76.20	(402,601)	73.77	(402,602)	75.48	(403,404)	73.09
(403,602)	75.48	(403,603)	73.77	(404,603)	75.72	(501,502)	73.56	(502,503)	76.20
(503,504)	73.56	(601,602)	75.37	(602,603)	75.37	(				

D.4 TUBULAR ELEMENT TEMPERATURE LISTINGS, 70.0 FT. ANTENNA

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA. [COATING $\alpha_S = \epsilon = .25$]

TIME - NOON

SURFACE STRUTS

[TITANIUM O.D. = 2.0" t = 0.018"]

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	59.11	(1, 10)	73.64	(1, 20)	70.77	(2, 3)	66.85	(2, 10)	67.66
(2, 11)	75.14	(2, 20)	71.38	(2, 21)	73.17	(3, 4)	72.66	(3, 11)	70.82
(3, 12)	75.89	(3, 21)	73.55	(3, 22)	74.86	(4, 5)	75.80	(4, 12)	73.25
(4, 13)	75.83	(4, 22)	75.05	(4, 23)	75.74	(5, 6)	75.80	(5, 13)	74.96
(5, 14)	74.96	(5, 23)	75.80	(5, 24)	75.80	(6, 7)	72.66	(6, 14)	75.83
(6, 15)	73.25	(6, 24)	75.74	(6, 25)	75.05	(7, 8)	66.85	(7, 15)	75.89
(7, 16)	70.82	(7, 25)	74.86	(7, 26)	73.55	(8, 9)	59.11	(8, 16)	75.14
(8, 17)	67.66	(8, 26)	73.17	(8, 27)	71.38	(9, 17)	73.64	(9, 27)	70.77
(10, 11)	63.19	(10, 30)	75.89	(11, 12)	70.05	(11, 30)	63.91	(11, 31)	75.84
(12, 13)	74.60	(12, 31)	67.67	(12, 32)	74.97	(13, 14)	76.20	(13, 32)	70.82
(13, 33)	73.28	(14, 15)	74.60	(14, 33)	73.28	(14, 34)	70.82	(15, 16)	70.05
(15, 34)	74.97	(15, 35)	67.67	(16, 17)	63.19	(16, 35)	75.84	(16, 36)	63.91
(17, 36)	75.89	(20, 21)	63.17	(20, 40)	74.91	(21, 22)	70.04	(21, 40)	68.69
(21, 41)	75.80	(22, 23)	74.60	(22, 41)	71.45	(22, 42)	75.85	(23, 24)	76.20
(23, 42)	73.61	(23, 43)	75.11	(24, 25)	74.60	(24, 43)	75.11	(24, 44)	73.61
(25, 26)	70.04	(25, 44)	75.85	(25, 45)	71.45	(26, 27)	63.17	(26, 45)	75.80
(26, 46)	68.69	(27, 46)	74.91	(30, 31)	66.86	(30, 50)	74.91	(31, 32)	72.66
(31, 50)	59.59	(31, 51)	73.24	(32, 33)	75.80	(32, 51)	63.87	(32, 52)	70.79
(33, 34)	75.80	(33, 52)	67.63	(33, 53)	67.63	(34, 35)	72.66	(34, 53)	70.79
(34, 54)	63.87	(35, 36)	66.86	(35, 54)	73.24	(35, 55)	59.59	(36, 55)	74.91
(40, 41)	66.86	(40, 60)	75.83	(41, 42)	72.66	(41, 60)	65.50	(41, 61)	75.15
(42, 43)	75.80	(42, 61)	68.73	(42, 62)	73.66	(43, 44)	75.80	(43, 62)	71.48
(43, 63)	71.48	(44, 45)	72.66	(44, 63)	73.66	(44, 64)	68.73	(45, 46)	66.86
(45, 64)	75.15	(45, 65)	65.50	(46, 65)	75.83	(50, 51)	70.04	(50, 70)	70.71
(51, 52)	74.60	(51, 70)	54.77	(51, 71)	67.53	(52, 53)	76.20	(52, 71)	59.48
(52, 72)	63.82	(53, 54)	74.60	(53, 72)	63.82	(53, 73)	59.48	(54, 55)	70.04
(54, 73)	67.53	(54, 74)	54.77	(55, 74)	70.71	(60, 61)	70.04	(60, 80)	73.59
(61, 62)	74.60	(61, 80)	61.85	(61, 81)	71.43	(62, 63)	76.20	(62, 81)	65.45
(62, 82)	68.68	(63, 64)	74.60	(63, 82)	68.68	(63, 83)	65.45	(64, 65)	70.04
(64, 83)	71.43	(64, 84)	61.85	(65, 84)	73.59	(70, 71)	72.65	(71, 72)	75.79
(72, 73)	75.79	(73, 74)	72.65	(80, 81)	72.65	(81, 82)	75.79	(82, 83)	75.79
(83, 84)	72.65								

DIAGONAL STRUTS

[TITANIUM O.D. = 1.5" t = 0.015"]

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	-2.30	(2,100)	74.48	(2,101)	9.46	(2,200)	54.44	(3,101)	69.11
(3,102)	22.50	(3,201)	47.87	(4,102)	60.46	(4,103)	36.05	(4,202)	42.75
(5,103)	49.09	(5,104)	49.09	(5,203)	40.76	(6,104)	36.05	(6,105)	60.46
(6,204)	42.75	(7,105)	22.50	(7,106)	69.11	(7,205)	47.87	(8,106)	9.46
(8,107)	74.48	(8,206)	54.44	(9,107)	-2.30	(10,100)	45.53	(10,300)	17.64
(11,101)	36.89	(11,300)	73.81	(11,301)	28.87	(12,102)	28.92	(12,301)	68.53
(12,302)	40.15	(13,103)	23.91	(13,302)	60.72	(13,303)	51.04	(14,104)	23.91
(14,303)	51.04	(14,304)	60.72	(15,105)	28.92	(15,304)	40.15	(15,305)	68.53
(16,106)	36.89	(16,305)	28.87	(16,306)	73.81	(17,107)	45.53	(17,306)	17.64
(20,200)	-9.15	(21,200)	70.89	(21,201)	4.05	(21,400)	61.99	(22,201)	62.31
(22,202)	19.39	(22,401)	57.75	(23,202)	50.17	(23,203)	35.36	(23,402)	55.05
(24,203)	35.36	(24,204)	50.17	(24,403)	55.05	(25,204)	19.39	(25,205)	62.31

(25,404)	57.75	(26,205)	4.05	(26,206)	70.89	(26,405)	61.99	(27,206)	-9.15
(30,300)	24.67	(30,500)	36.95	(31,301)	14.12	(31,500)	73.87	(31,501)	46.39
(32,302)	5.44	(32,501)	69.41	(32,502)	55.23	(33,303)	1.76	(33,502)	63.04
(33,503)	63.04	(34,304)	5.44	(34,503)	55.23	(34,504)	69.41	(35,305)	14.12
(35,504)	46.39	(35,505)	73.87	(36,306)	24.67	(36,505)	36.95	(40,400)	-12.71
(41,400)	65.64	(41,401)	3.15	(41,600)	68.30	(42,401)	53.92	(42,402)	20.91
(42,601)	65.85	(43,402)	38.55	(43,403)	38.55	(43,602)	64.88	(44,403)	20.91
(44,404)	53.92	(44,603)	65.85	(45,404)	3.15	(45,405)	65.64	(45,604)	68.30
(46,405)	-12.71	(50,500)	-1.33	(50,700)	53.37	(51,501)	-13.68	(51,700)	74.68
(51,701)	60.53	(52,502)	-22.36	(52,701)	71.42	(52,702)	66.61	(53,503)	-22.36
(53,702)	66.61	(53,703)	71.42	(54,504)	-13.68	(54,703)	60.53	(54,704)	74.68
(55,505)	-1.33	(55,704)	53.37	(60,600)	-11.60	(61,600)	59.02	(61,601)	6.75
(61,800)	72.70	(62,601)	44.32	(62,602)	26.25	(62,801)	71.63	(63,602)	26.25
(63,603)	44.32	(63,802)	71.63	(64,603)	6.75	(64,604)	59.02	(64,803)	72.70
(65,604)	-11.60	(70,700)	-31.72	(71,701)	-44.07	(72,702)	-49.45	(73,703)	-44.07
(74,704)	-31.72	(80,800)	-6.18	(81,800)	51.20	(81,801)	13.88	(82,801)	33.90
(82,802)	33.90	(83,802)	13.88	(83,803)	51.20	(84,803)	-6.18	(	

BOTTOM STRUTS

TITANIUM
O.D. = 2.0"
t = 0.018"

(100,101)	61.93	(100,200)	70.69	(100,300)	74.88	(101,102)	69.52	(101,200)	73.24
(101,201)	73.20	(101,300)	67.28	(101,301)	75.85	(102,103)	74.47	(102,201)	75.01
(102,202)	74.93	(102,301)	70.49	(102,302)	75.82	(103,104)	76.20	(103,202)	75.88
(103,203)	75.85	(103,302)	73.06	(103,303)	74.88	(104,105)	74.47	(104,203)	75.85
(104,204)	75.88	(104,303)	74.88	(104,304)	73.06	(105,106)	69.52	(105,204)	74.93
(105,205)	75.01	(105,304)	75.82	(105,305)	70.49	(106,107)	61.93	(106,205)	73.20
(106,206)	73.24	(106,305)	75.85	(106,306)	67.28	(107,206)	70.69	(107,306)	74.88
(200,201)	65.84	(200,400)	74.91	(201,202)	72.28	(201,400)	70.81	(201,401)	75.76
(202,203)	75.75	(202,401)	73.25	(202,402)	75.79	(203,204)	75.75	(203,402)	74.95
(203,403)	74.95	(204,205)	72.28	(204,403)	75.79	(204,404)	73.25	(205,206)	65.84
(205,404)	75.76	(205,405)	70.81	(206,405)	74.91	(300,301)	66.22	(300,500)	75.76
(301,302)	72.45	(301,500)	62.97	(301,501)	74.81	(302,303)	75.77	(302,501)	66.91
(302,502)	72.95	(303,304)	75.77	(303,502)	70.28	(303,503)	70.28	(304,305)	72.45
(304,503)	72.95	(304,504)	66.91	(305,306)	66.22	(305,504)	74.81	(305,505)	62.97
(306,505)	75.76	(400,401)	69.28	(400,600)	75.81	(401,402)	74.40	(401,600)	67.70
(401,601)	75.01	(402,403)	76.20	(402,601)	70.90	(402,602)	73.38	(403,404)	74.40
(403,602)	73.38	(403,603)	70.90	(404,405)	69.28	(404,603)	75.01	(404,604)	67.70
(405,604)	75.81	(500,501)	69.80	(500,700)	72.90	(501,502)	74.55	(501,700)	57.94
(501,701)	70.15	(502,503)	76.20	(502,701)	62.53	(502,702)	66.64	(503,504)	74.55
(503,702)	66.64	(503,703)	62.53	(504,505)	69.80	(504,703)	70.15	(504,704)	57.94
(505,704)	72.90	(600,601)	72.18	(600,800)	73.54	(601,602)	75.74	(601,800)	64.28
(601,801)	71.20	(602,603)	75.74	(602,801)	68.08	(602,802)	68.08	(603,604)	72.18
(603,802)	71.20	(603,803)	64.28	(604,803)	73.54	(700,701)	72.60	(701,702)	75.79
(702,703)	75.79	(703,704)	72.60	(800,801)	74.37	(801,802)	76.19	(802,803)	74.37

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 1:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	59.90	(1, 10)	64.48	(1, 20)	75.61	(2, 3)	67.27	(2, 10)	74.79
(2, 11)	68.25	(2, 20)	60.08	(2, 21)	75.73	(3, 4)	72.81	(3, 11)	75.62
(3, 12)	71.31	(3, 21)	64.48	(3, 22)	75.06	(4, 5)	75.81	(4, 12)	75.73
(4, 13)	73.59	(4, 22)	68.26	(4, 23)	73.59	(5, 6)	75.81	(5, 13)	75.06
(5, 14)	75.06	(5, 23)	71.31	(5, 24)	71.31	(6, 7)	72.81	(6, 14)	73.59
(6, 15)	75.73	(6, 24)	73.59	(6, 25)	68.26	(7, 8)	67.27	(7, 15)	71.31
(7, 16)	75.62	(7, 25)	75.06	(7, 26)	64.48	(8, 9)	59.90	(8, 16)	68.25
(8, 17)	74.79	(8, 26)	75.73	(8, 27)	60.08	(9, 17)	64.48	(9, 27)	75.61
(10, 11)	63.76	(10, 30)	71.31	(11, 12)	70.32	(11, 30)	73.34	(11, 31)	73.59
(12, 13)	74.67	(12, 31)	74.80	(12, 32)	75.06	(13, 14)	76.20	(13, 32)	75.62
(13, 33)	75.73	(14, 15)	74.67	(14, 33)	75.73	(14, 34)	75.62	(15, 16)	70.32
(15, 34)	75.06	(15, 35)	74.80	(16, 17)	63.76	(16, 35)	73.59	(16, 36)	73.34
(17, 36)	71.31	(20, 21)	63.76	(20, 40)	75.06	(21, 22)	70.32	(21, 40)	55.16
(21, 41)	73.59	(22, 23)	74.67	(22, 41)	60.08	(22, 42)	71.31	(23, 24)	76.20
(23, 42)	64.49	(23, 43)	68.26	(24, 25)	74.67	(24, 43)	68.26	(24, 44)	64.49
(25, 26)	70.32	(25, 44)	71.31	(25, 45)	60.08	(26, 27)	63.76	(26, 45)	73.59
(26, 46)	55.16	(27, 46)	75.06	(30, 31)	67.27	(30, 50)	75.06	(31, 32)	72.81
(31, 50)	71.34	(31, 51)	75.73	(32, 33)	75.81	(32, 51)	73.34	(32, 52)	75.62
(33, 34)	75.81	(33, 52)	74.80	(33, 53)	74.80	(34, 35)	72.81	(34, 53)	75.62
(34, 54)	73.34	(35, 36)	67.27	(35, 54)	75.73	(35, 55)	71.34	(36, 55)	75.06
(40, 41)	67.27	(40, 60)	71.31	(41, 42)	72.81	(41, 60)	49.81	(41, 61)	68.25
(42, 43)	75.81	(42, 61)	55.16	(42, 62)	64.48	(43, 44)	75.81	(43, 62)	60.08
(43, 63)	60.08	(44, 45)	72.81	(44, 63)	64.48	(44, 64)	55.16	(45, 46)	67.27
(45, 64)	68.25	(45, 65)	49.81	(46, 65)	71.31	(50, 51)	70.31	(50, 70)	75.61
(51, 52)	74.67	(51, 70)	68.89	(51, 71)	74.79	(52, 53)	76.20	(52, 71)	71.34
(52, 72)	73.34	(53, 54)	74.67	(53, 72)	73.34	(53, 73)	71.34	(54, 55)	70.31
(54, 73)	74.79	(54, 74)	68.89	(55, 74)	75.61	(60, 61)	70.31	(60, 80)	64.48
(61, 62)	74.67	(61, 80)	44.14	(61, 81)	60.08	(62, 63)	76.20	(62, 81)	49.81
(62, 82)	55.16	(63, 64)	74.67	(63, 82)	55.16	(63, 83)	49.81	(64, 65)	70.31
(64, 83)	60.08	(64, 84)	44.14	(65, 84)	64.48	(70, 71)	72.81	(71, 72)	75.81
(72, 73)	75.81	(73, 74)	72.81	(80, 81)	72.81	(81, 82)	75.81	(82, 83)	75.81
(83, 84)	72.81	(.							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	-32.67	(2,100)	72.18	(2,101)	-16.92	(2,200)	69.44	(3,101)	64.38
(3,102)	1.25	(3,201)	66.29	(4,102)	52.72	(4,103)	20.01	(4,202)	63.79
(5,103)	37.63	(5,104)	37.63	(5,203)	62.82	(6,104)	20.01	(6,105)	52.72
(6,204)	63.79	(7,105)	1.25	(7,106)	64.38	(7,205)	66.29	(8,106)	-16.92
(8,107)	72.18	(8,206)	69.44	(9,107)	-32.67	(10,100)	64.49	(10,300)	-10.62
(11,101)	59.80	(11,300)	70.16	(11,301)	4.98	(12,102)	55.66	(12,301)	61.88
(12,302)	21.11	(13,103)	53.16	(13,302)	50.51	(13,303)	36.64	(14,104)	53.16
(14,303)	36.64	(14,304)	50.51	(15,105)	55.66	(15,304)	21.11	(15,305)	61.88
(16,106)	59.80	(16,305)	4.98	(16,306)	70.16	(17,107)	64.49	(17,306)	-10.62
(20,200)	-35.75	(21,200)	67.96	(21,201)	-17.44	(21,400)	73.12	(22,201)	57.23
(22,202)	3.26	(22,401)	71.38	(23,202)	42.32	(23,203)	23.88	(23,402)	70.23
(24,203)	23.88	(24,204)	42.32	(24,403)	70.23	(25,204)	3.26	(25,205)	57.23
(25,404)	71.38	(26,205)	-17.44	(26,206)	67.96	(26,405)	73.12	(27,206)	-35.75

(30,300)	52.36	(30,500)	13.01	(31,301)	46.57	(31,500)	69.14	(31,501)	26.58
(32,302)	42.27	(32,501)	61.41	(32,502)	39.59	(33,303)	40.66	(33,502)	51.39
(33,503)	51.39	(34,304)	42.27	(34,503)	39.59	(34,504)	61.41	(35,305)	46.57
(35,504)	26.58	(35,505)	69.14	(36,306)	52.36	(36,505)	13.01	(40,400)	-32.78
(41,400)	62.57	(41,401)	-11.91	(41,600)	75.26	(42,401)	49.09	(42,402)	10.40
(42,601)	74.64	(43,402)	31.37	(43,403)	31.37	(43,602)	74.36	(44,403)	10.40
(44,404)	49.09	(44,603)	74.64	(45,404)	-11.91	(45,405)	62.57	(45,604)	75.26
(46,405)	-32.78	(50,500)	37.17	(50,700)	34.61	(51,501)	31.22	(51,700)	69.58
(51,701)	45.30	(52,502)	27.76	(52,701)	63.11	(52,702)	54.90	(53,503)	27.76
(53,702)	54.90	(53,703)	63.11	(54,504)	31.22	(54,703)	45.30	(54,704)	69.58
(55,505)	37.17	(55,704)	34.61	(60,600)	-24.76	(61,600)	56.17	(61,601)	-2.15
(61,800)	75.56	(62,601)	40.25	(62,602)	20.34	(62,801)	75.66	(63,602)	20.34
(63,603)	40.25	(63,802)	75.66	(64,603)	-2.15	(64,604)	56.17	(64,803)	75.56
(65,604)	-24.76	(70,700)	20.94	(71,701)	15.92	(72,702)	14.09	(73,703)	15.92
(74,704)	20.94	(80,800)	-13.85	(81,800)	48.80	(81,801)	9.29	(82,801)	30.79
(82,802)	30.79	(83,802)	9.29	(83,803)	48.80	(84,803)	-13.85	(	

BOTTOM STRUTS

(100,101)	62.23	(100,200)	75.60	(100,300)	67.76	(101,102)	69.65	(101,200)	63.64
(101,201)	75.73	(101,300)	74.71	(101,301)	71.13	(102,103)	74.51	(102,201)	67.85
(102,202)	75.08	(102,301)	75.57	(102,302)	73.59	(103,104)	76.20	(103,202)	71.18
(103,203)	73.59	(103,302)	75.74	(103,303)	75.11	(104,105)	74.51	(104,203)	73.59
(104,204)	71.18	(104,303)	75.11	(104,304)	75.74	(105,106)	69.65	(105,204)	75.08
(105,205)	67.85	(105,304)	73.59	(105,305)	75.57	(106,107)	62.23	(106,205)	75.73
(106,206)	63.64	(106,305)	71.13	(106,306)	74.71	(107,206)	75.60	(107,306)	67.76
(200,201)	66.11	(200,400)	75.06	(201,202)	72.40	(201,400)	58.89	(201,401)	73.59
(202,203)	75.77	(202,401)	63.85	(202,402)	71.25	(203,204)	75.77	(203,402)	68.00
(203,403)	68.00	(204,205)	72.40	(204,403)	71.25	(204,404)	63.85	(205,206)	66.11
(205,404)	73.59	(205,405)	58.89	(206,405)	75.06	(300,301)	66.37	(300,500)	73.59
(301,302)	72.51	(301,500)	73.04	(301,501)	75.13	(302,303)	75.78	(302,501)	74.58
(302,502)	75.75	(303,304)	75.78	(303,502)	75.53	(303,503)	75.53	(304,305)	72.51
(304,503)	75.75	(304,504)	74.58	(305,306)	66.37	(305,504)	75.13	(305,505)	73.04
(306,505)	73.59	(400,401)	69.54	(400,600)	71.31	(401,402)	74.47	(401,600)	53.70
(401,601)	68.18	(402,403)	76.20	(402,601)	59.31	(402,602)	64.18	(403,404)	74.47
(403,602)	64.18	(403,603)	59.31	(404,405)	69.54	(404,603)	68.18	(404,604)	53.70
(405,604)	71.31	(500,501)	69.88	(500,700)	75.76	(501,502)	74.56	(501,700)	70.64
(501,701)	75.51	(502,503)	76.20	(502,701)	72.81	(502,702)	74.48	(503,504)	74.56
(503,702)	74.48	(503,703)	72.81	(504,505)	69.88	(504,703)	75.51	(504,704)	70.64
(505,704)	75.76	(600,601)	72.38	(600,800)	64.44	(601,602)	75.76	(601,800)	48.20
(601,801)	59.81	(602,603)	75.76	(602,801)	54.36	(602,802)	54.36	(603,604)	72.38
(603,802)	59.81	(603,803)	48.20	(604,803)	64.44	(700,701)	72.63	(701,702)	75.79
(702,703)	75.79	(703,704)	72.63	(800,801)	74.48	(801,802)	76.19	(802,803)	74.48

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 2:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(1, 2)	62.87	(1, 10)	49.00	(1, 20)	73.63	(2, 3)	68.84	(2, 10)	75.00
	(2, 11)	54.99	(2, 20)	42.44	(2, 21)	71.51	(3, 4)	73.39	(3, 11)	73.64
	(3, 12)	60.30	(3, 21)	49.01	(3, 22)	68.60	(4, 5)	75.88	(4, 12)	71.52
	(4, 13)	64.85	(4, 22)	55.00	(4, 23)	64.85	(5, 6)	75.88	(5, 13)	68.60
	(5, 14)	68.60	(5, 23)	60.30	(5, 24)	60.30	(6, 7)	73.39	(6, 14)	64.85
	(6, 15)	71.52	(6, 24)	64.85	(6, 25)	55.00	(7, 8)	68.84	(7, 15)	60.30
	(7, 16)	73.64	(7, 25)	68.60	(7, 26)	49.01	(8, 9)	62.87	(8, 16)	54.99
	(8, 17)	75.00	(8, 26)	71.51	(8, 27)	42.44	(9, 17)	49.00	(9, 27)	73.63
	(10, 11)	65.99	(10, 30)	60.30	(11, 12)	71.34	(11, 30)	75.68	(11, 31)	64.85
	(12, 13)	74.93	(12, 31)	75.00	(12, 32)	68.60	(13, 14)	76.20	(13, 32)	73.64
	(13, 33)	71.52	(14, 15)	74.93	(14, 33)	71.52	(14, 34)	73.64	(15, 16)	71.34
	(15, 34)	68.60	(15, 35)	75.00	(16, 17)	65.99	(16, 35)	64.85	(16, 36)	75.68
	(17, 36)	60.30	(20, 21)	65.99	(20, 40)	68.59	(21, 22)	71.34	(21, 40)	35.43
	(21, 41)	64.85	(22, 23)	74.93	(22, 41)	42.45	(22, 42)	60.30	(23, 24)	76.20
	(23, 42)	49.01	(23, 43)	55.00	(24, 25)	74.93	(24, 43)	55.00	(24, 44)	49.01
	(25, 26)	71.34	(25, 44)	60.30	(25, 45)	42.45	(26, 27)	65.99	(26, 45)	64.85
	(26, 46)	35.43	(27, 46)	68.59	(30, 31)	68.84	(30, 50)	68.59	(31, 32)	73.39
	(31, 50)	75.76	(31, 51)	71.51	(32, 33)	75.88	(32, 51)	75.68	(32, 52)	73.64
	(33, 34)	75.88	(33, 52)	75.00	(33, 53)	75.00	(34, 35)	73.39	(34, 53)	73.64
	(34, 54)	75.68	(35, 36)	68.84	(35, 54)	71.51	(35, 55)	75.76	(36, 55)	68.59
	(40, 41)	68.84	(40, 60)	60.30	(41, 42)	73.39	(41, 60)	28.08	(41, 61)	54.99
	(42, 43)	75.88	(42, 61)	35.43	(42, 62)	49.01	(43, 44)	75.88	(43, 62)	42.45
	(43, 63)	42.45	(44, 45)	73.39	(44, 63)	49.01	(44, 64)	35.43	(45, 46)	68.84
	(45, 64)	54.99	(45, 65)	28.08	(46, 65)	60.30	(50, 51)	71.33	(50, 70)	73.63
	(51, 52)	74.93	(51, 70)	75.32	(51, 71)	75.00	(52, 53)	76.20	(52, 71)	75.76
	(52, 72)	75.68	(53, 54)	74.93	(53, 72)	75.68	(53, 73)	75.76	(54, 55)	71.33
	(54, 73)	75.00	(54, 74)	75.32	(55, 74)	73.63	(60, 61)	71.33	(60, 80)	49.00
	(61, 62)	74.93	(61, 80)	20.51	(61, 81)	42.44	(62, 63)	76.20	(62, 81)	28.08
	(62, 82)	35.43	(63, 64)	74.93	(63, 82)	35.43	(63, 83)	28.08	(64, 65)	71.33
	(64, 83)	42.44	(64, 84)	20.51	(65, 84)	49.00	(70, 71)	73.39	(71, 72)	75.87
	(72, 73)	75.87	(73, 74)	73.39	(80, 81)	73.39	(81, 82)	75.87	(82, 83)	75.87
	(83, 84)	73.39	(							
DIAGONAL STRUTS										
	(1,100)	-40.70	(2,100)	69.54	(2,101)	-27.43	(2,200)	75.61	(3,101)	60.17
	(3,102)	-9.12	(3,201)	74.90	(4,102)	46.95	(4,103)	10.97	(4,202)	74.16
	(5,103)	30.24	(5,104)	30.24	(5,203)	73.84	(6,104)	10.97	(6,105)	46.95
	(6,204)	74.16	(7,105)	-9.12	(7,106)	60.17	(7,205)	74.90	(8,106)	-27.43
	(8,107)	69.54	(8,206)	75.61	(9,107)	-40.70	(10,100)	74.20	(10,300)	-29.01
	(11,101)	72.40	(11,300)	65.74	(11,301)	-12.57	(12,102)	70.63	(12,301)	55.12
	(12,302)	6.03	(13,103)	69.53	(13,302)	41.19	(13,303)	24.49	(14,104)	69.53
	(14,303)	24.49	(14,304)	41.19	(15,105)	70.63	(15,304)	6.03	(15,305)	55.12
	(16,106)	72.40	(16,305)	-12.57	(16,306)	65.74	(17,107)	74.20	(17,306)	-29.01
	(20,200)	-34.52	(21,200)	65.61	(21,201)	-19.08	(21,400)	75.56	(22,201)	54.22
	(22,202)	.32	(22,401)	75.77	(23,202)	38.94	(23,203)	20.48	(23,402)	75.73
	(24,203)	20.48	(24,204)	38.94	(24,403)	75.73	(25,204)	.32	(25,205)	54.22
	(25,404)	75.77	(26,205)	-19.08	(26,206)	65.61	(26,405)	75.56	(27,206)	-34.52

(30,300)	68.73	(30,500)	-8.92	(31,301)	65.83	(31,500)	62.75	(31,501)	7.31
(32,302)	63.67	(32,501)	52.07	(32,502)	23.65	(33,303)	62.86	(33,502)	38.85
(33,503)	38.85	(34,304)	63.67	(34,503)	23.65	(34,504)	52.07	(35,305)	65.83
(35,504)	7.31	(35,505)	62.75	(36,306)	68.73	(36,505)	-8.92	(40,400)	-23.95
(41,400)	61.13	(41,401)	-6.83	(41,600)	73.72	(42,401)	48.13	(42,402)	12.61
(42,601)	74.52	(43,402)	31.59	(43,403)	31.59	(43,602)	74.75	(44,403)	12.61
(44,404)	48.13	(44,603)	74.52	(45,404)	-6.83	(45,405)	61.13	(45,604)	73.72
(46,405)	-23.95	(50,500)	60 [illegible] 5	(50,700)	14.03	(51,501)	57.23	(51,700)	61.71
(51,701)	27.73	(52,502)	[illegible]	(52,701)	52.09	(52,702)	40.62	(53,503)	55.40

(53,702)	40.62	(53,7[illegible])	52.09	(54,504)	57.23	(54,703)	27.73	(54,704)	61.71
(55,505)	60.45	([illegible],704)	14.03	(60,600)	-11.76	(61,600)	56.15	(61,601)	6.23
(61,800)	[illegible].73	(62,601)	41.97	(62,602)	24.86	(62,801)	70.73	(63,602)	24.86
(63,603)	41.97	(63,802)	70.73	(64,603)	6.23	(64,604)	56.15	(64,803)	69.73
(65,604)	-11.76	(70,700)	51.08	(71,701)	48.31	(72,702)	47.33	(73,703)	48.31
(74,704)	51.08	(80,800)	.05	(81,800)	50.55	(81,801)	18.15	(82,801)	35.49
(82,802)	35.49	(83,802)	18.15	(83,803)	50.55	(84,803)	.05	(	

BOTTOM STRUTS

(100,101)	64.42	(100,200)	73.60	(100,300)	54.12	(101,102)	70.64	(101,200)	47.69
(101,201)	71.53	(101,300)	75.02	(101,301)	59.97	(102,103)	74.76	(102,201)	54.34
(102,202)	68.64	(102,301)	73.72	(102,302)	64.85	(103,104)	76.20	(103,202)	60.09
(103,203)	64.85	(103,302)	71.67	(103,303)	68.74	(104,105)	74.76	(104,203)	64.85
(104,204)	60.09	(104,303)	68.74	(104,304)	71.67	(105,106)	70.64	(105,204)	68.64
(105,205)	54.34	(105,304)	64.85	(105,305)	73.72	(106,107)	64.42	(106,205)	71.53
(106,206)	47.69	(106,305)	59.97	(106,306)	75.02	(107,206)	73.60	(107,306)	54.12
(200,201)	67.74	(200,400)	68.56	(201,202)	72.99	(201,400)	40.80	(201,401)	64.85
(202,203)	75.83	(202,401)	48.15	(202,402)	60.24	(203,204)	75.83	(203,402)	54.66
(203,403)	54.66	(204,205)	72.99	(204,403)	60.24	(204,404)	48.15	(205,206)	67.74
(205,404)	64.85	(205,405)	40.80	(206,405)	68.56	(300,301)	67.83	(300,500)	64.85
(301,302)	73.03	(301,500)	75.71	(301,501)	68.81	(302,303)	75.84	(302,501)	75.13
(302,502)	71.80	(303,304)	75.84	(303,502)	73.87	(303,503)	73.87	(304,305)	73.03
(304,503)	71.80	(304,504)	75.13	(305,306)	67.83	(305,504)	68.81	(305,505)	75.71
(306,505)	64.85	(400,401)	70.66	(400,600)	60.35	(401,402)	74.76	(401,600)	33.66
(401,601)	55.00	(402,403)	76.20	(402,601)	41.59	(402,602)	48.74	(403,404)	74.76
(403,602)	48.74	(403,603)	41.59	(404,405)	70.66	(404,603)	55.00	(404,604)	33.66
(405,604)	60.35	(500,501)	70.77	(500,700)	71.89	(501,502)	74.79	(501,700)	75.68
(501,701)	73.98	(502,503)	76.20	(502,701)	75.75	(502,702)	75.23	(503,504)	74.79
(503,702)	75.23	(503,703)	75.75	(504,505)	70.77	(504,703)	73.98	(504,704)	75.68
(505,704)	71.88	(600,601)	73.05	(600,800)	49.17	(601,602)	75.84	(601,800)	26.46
(601,801)	42.40	(602,603)	75.84	(602,801)	34.80	(602,802)	34.80	(603,604)	73.05
(603,802)	42.40	(603,803)	26.46	(604,803)	49.17	(700,701)	73.12	(701,702)	75.84
(702,703)	75.84	(703,704)	73.12	(800,801)	74.79	(801,802)	76.19	(802,803)	74.79

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 3:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	67.10	(1, 10)	28.30	(1, 20)	64.72	(2, 3)	71.12	(2, 10)	68.11
(2, 11)	36.04	(2, 20)	20.19	(2, 21)	60.55	(3, 4)	74.25	(3, 11)	64.73
(3, 12)	43.24	(3, 21)	28.30	(3, 22)	55.57	(4, 5)	75.98	(4, 12)	60.55
(4, 13)	49.78	(4, 22)	36.04	(4, 23)	49.78	(5, 6)	75.98	(5, 13)	55.57
(5, 14)	55.57	(5, 23)	43.24	(5, 24)	43.24	(6, 7)	74.25	(6, 14)	49.78
(6, 15)	60.55	(6, 24)	49.78	(6, 25)	36.04	(7, 8)	71.12	(7, 15)	43.24
(7, 16)	64.73	(7, 25)	55.57	(7, 26)	28.30	(8, 9)	67.10	(8, 16)	36.04
(8, 17)	68.11	(8, 26)	60.55	(8, 27)	20.19	(9, 17)	28.30	(9, 27)	64.72
(10, 11)	69.19	(10, 30)	43.24	(11, 12)	72.83	(11, 30)	70.75	(11, 31)	49.78
(12, 13)	75.31	(12, 31)	68.11	(12, 32)	55.57	(13, 14)	76.20	(13, 32)	64.73
(13, 33)	60.55	(14, 15)	75.31	(14, 33)	60.55	(14, 34)	64.73	(15, 16)	72.83
(15, 34)	55.57	(15, 35)	68.11	(16, 17)	69.19	(16, 35)	49.78	(16, 36)	70.75
(17, 36)	43.24	(20, 21)	69.19	(20, 40)	55.56	(21, 22)	72.83	(21, 40)	11.87
(21, 41)	49.78	(22, 23)	75.31	(22, 41)	20.19	(22, 42)	43.24	(23, 24)	76.20
(23, 42)	28.31	(23, 43)	36.04	(24, 25)	75.31	(24, 43)	36.04	(24, 44)	28.31
(25, 26)	72.83	(25, 44)	43.24	(25, 45)	20.19	(26, 27)	69.19	(26, 45)	49.78
(26, 46)	11.87	(27, 46)	55.56	(30, 31)	71.12	(30, 50)	55.56	(31, 32)	74.25
(31, 50)	72.73	(31, 51)	60.55	(32, 33)	75.97	(32, 51)	70.76	(32, 52)	64.73
(33, 34)	75.97	(33, 52)	68.11	(33, 53)	68.11	(34, 35)	74.25	(34, 53)	64.73
(34, 54)	70.76	(35, 36)	71.12	(35, 54)	60.55	(35, 55)	72.73	(36, 55)	55.56
(40, 41)	71.12	(40, 60)	43.24	(41, 42)	74.25	(41, 60)	3.54	(41, 61)	36.04
(42, 43)	75.97	(42, 61)	11.87	(42, 62)	28.30	(43, 44)	75.97	(43, 62)	20.19
(43, 63)	20.19	(44, 45)	74.25	(44, 63)	28.30	(44, 64)	11.87	(45, 46)	71.12
(45, 64)	36.04	(45, 65)	3.54	(46, 65)	43.24	(50, 51)	72.82	(50, 70)	64.72
(51, 52)	75.31	(51, 70)	74.13	(51, 71)	68.11	(52, 53)	76.20	(52, 71)	72.73
(52, 72)	70.75	(53, 54)	75.31	(53, 72)	70.75	(53, 73)	72.73	(54, 55)	72.82
(54, 73)	68.11	(54, 74)	74.13	(55, 74)	64.72	(60, 61)	72.82	(60, 80)	28.30
(61, 62)	75.31	(61, 80)	-4.62	(61, 81)	20.19	(62, 63)	76.20	(62, 81)	3.54
(62, 82)	11.87	(63, 64)	75.31	(63, 82)	11.87	(63, 83)	3.54	(64, 65)	72.82
(64, 83)	20.19	(64, 84)	-4.62	(65, 84)	28.30	(70, 71)	74.24	(71, 72)	75.97
(72, 73)	75.97	(73, 74)	74.24	(80, 81)	74.24	(81, 82)	75.97	(82, 83)	75.97
(83, 84)	74.24	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	-14.90	(2,100)	67.30	(2,101)	-10.23	(2,200)	72.97	(3,101)	57.91
(3,102)	.53	(3,201)	74.25	(4,102)	45.53	(4,103)	15.10	(4,202)	74.83
(5,103)	30.82	(5,104)	30.82	(5,203)	74.99	(6,104)	15.10	(6,105)	45.53
(6,204)	74.83	(7,105)	.53	(7,106)	57.91	(7,205)	74.25	(8,106)	-10.23
(8,107)	67.30	(8,206)	72.97	(9,107)	-14.90	(10,100)	74.99	(10,300)	-19.78
(11,101)	75.53	(11,300)	61.72	(11,301)	-10.19	(12,102)	75.56	(12,301)	50.42
(12,302)	4.18	(13,103)	75.45	(13,302)	36.41	(13,303)	20.49	(14,104)	75.45
(14,303)	20.49	(14,304)	36.41	(15,105)	75.56	(15,304)	4.18	(15,305)	50.42
(16,106)	75.53	(16,305)	-10.19	(16,306)	61.72	(17,107)	74.99	(17,306)	-19.78
(20,200)	-4.63	(21,200)	64.63	(21,201)	2.32	(21,400)	69.17	(22,201)	54.54
(22,202)	13.81	(22,401)	70.93	(23,202)	41.92	(23,203)	27.76	(23,402)	71.74
(24,203)	27.76	(24,204)	41.92	(24,403)	71.74	(25,204)	13.81	(25,205)	54.54
(25,404)	70.93	(26,205)	2.32	(26,206)	64.63	(26,405)	69.17	(27,206)	-4.63

(30,300)	75.29	(30,500)	-14.92	(31,301)	74.57	(31,500)	56.23	(31,501)	-1.64
(32,302)	73.89	(32,501)	44.04	(32,502)	13.95	(33,303)	73.62	(33,502)	29.66
(33,503)	29.66	(34,304)	73.89	(34,503)	13.95	(34,504)	44.04	(35,305)	74.57
(35,504)	-1.64	(35,505)	56.23	(36,306)	75.29	(36,505)	-14.92	(40,400)	6.29
(41,400)	61.93	(41,401)	15.02	(41,600)	63.18	(42,401)	51.64	(42,402)	26.67
(42,601)	65.08	(43,402)	39.47	(43,403)	39.47	(43,602)	65.69	(44,403)	26.67
(44,404)	51.64	(44,603)	65.08	(45,404)	15.02	(45,405)	61.93	(45,604)	63.18
(46,405)	6.29	(50,500)	72.53	(50,700)	-.38	(51,501)	71.18	(51,700)	52.58
(51,701)	13.34	(52,502)	70.38	(52,701)	40.80	(52,702)	27.48	(53,503)	70.38

(53,702)	27.48	(53,703)	40.80	(54,504)	71.18	(54,703)	13.34	(54,704)	52.58
(55,505)	72.53	(55,704)	-.38	(60,600)	16.36	(61,600)	59.12	(61,601)	26.21
(61,800)	54.57	(62,601)	48.94	(62,602)	37.55	(62,801)	56.22	(63,602)	37.55
(63,603)	48.94	(63,802)	56.22	(64,603)	26.21	(64,604)	59.12	(64,803)	54.57
(65,604)	16.36	(70,700)	68.15	(71,701)	66.78	(72,702)	66.29	(73,703)	66.78
(74,704)	68.15	(80,800)	24.89	(81,800)	55.96	(81,801)	35.27	(82,801)	45.98
(82,802)	45.98	(83,802)	35.27	(83,803)	55.96	(84,803)	24.89	(	

BOTTOM STRUTS

(100,101)	67.85	(100,200)	64.54	(100,300)	34.77	(101,102)	72.22	(101,200)	26.59
(101,201)	60.47	(101,300)	68.07	(101,301)	42.76	(102,103)	75.16	(102,201)	35.22
(102,202)	55.59	(102,301)	64.82	(102,302)	49.78	(103,104)	76.20	(103,202)	42.99
(103,203)	49.78	(103,302)	60.77	(103,303)	55.78	(104,105)	75.16	(104,203)	49.78
(104,204)	42.99	(104,303)	55.78	(104,304)	60.77	(105,106)	72.22	(105,204)	55.59
(105,205)	35.22	(105,304)	49.78	(105,305)	64.82	(106,107)	67.85	(106,205)	60.47
(106,206)	26.59	(106,305)	42.76	(106,306)	68.07	(107,206)	64.54	(107,306)	34.77
(200,201)	70.23	(200,400)	55.45	(201,202)	73.92	(201,400)	18.35	(201,401)	49.78
(202,203)	75.94	(202,401)	27.43	(202,402)	43.24	(203,204)	75.94	(203,402)	35.78
(203,403)	35.78	(204,205)	73.92	(204,403)	43.24	(204,404)	27.43	(205,206)	70.23
(205,404)	49.78	(205,405)	18.35	(206,405)	55.45	(300,301)	70.18	(300,500)	49.78
(301,302)	73.90	(301,500)	70.93	(301,501)	55.93	(302,303)	75.94	(302,501)	68.44
(302,502)	61.06	(303,304)	75.94	(303,502)	65.20	(303,503)	65.20	(304,305)	73.90
(304,503)	61.06	(304,504)	68.44	(305,306)	70.18	(305,504)	55.93	(305,505)	70.93
(306,505)	49.78	(400,401)	72.32	(400,600)	43.41	(401,402)	75.19	(401,600)	10.37
(401,601)	36.29	(402,403)	76.20	(402,601)	19.66	(402,602)	28.36	(403,404)	75.19
(403,602)	28.36	(403,603)	19.66	(404,405)	72.32	(404,603)	36.29	(404,604)	10.37
(405,604)	43.41	(500,501)	72.25	(500,700)	61.27	(501,502)	75.17	(501,700)	73.08
(501,701)	65.50	(502,503)	76.20	(502,701)	71.28	(502,702)	68.80	(503,504)	75.17
(503,702)	68.80	(503,703)	71.28	(504,505)	72.25	(504,703)	65.50	(504,704)	73.08
(505,704)	61.27	(600,601)	74.02	(600,800)	28.96	(601,602)	75.95	(601,800)	2.87
(601,801)	20.83	(602,603)	75.95	(602,801)	12.09	(602,802)	12.09	(603,604)	74.02
(603,802)	20.83	(603,803)	2.87	(604,803)	28.96	(700,701)	73.95	(701,702)	75.94
(702,703)	75.94	(703,704)	73.95	(800,801)	75.24	(801,802)	76.19	(802,803)	75.24

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 4:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	71.39	(1, 10)	5.83	(1, 20)	49.36	(2, 3)	73.48	(2, 10)	54.53
(2, 11)	13.82	(2, 20)	-1.84	(2, 21)	43.44	(3, 4)	75.14	(3, 11)	49.36
(3, 12)	21.82	(3, 21)	5.84	(3, 22)	36.81	(4, 5)	76.08	(4, 12)	43.44
(4, 13)	29.55	(4, 22)	13.83	(4, 23)	29.55	(5, 6)	76.08	(5, 13)	36.81
(5, 14)	36.81	(5, 23)	21.82	(5, 24)	21.82	(6, 7)	75.14	(6, 14)	29.55
(6, 15)	43.44	(6, 24)	29.55	(6, 25)	13.83	(7, 8)	73.48	(7, 15)	21.82
(7, 16)	49.36	(7, 25)	36.81	(7, 26)	5.84	(8, 9)	71.39	(8, 16)	13.82
(8, 17)	54.53	(8, 26)	43.44	(8, 27)	-1.84	(9, 17)	5.83	(9, 27)	49.36
(10, 11)	72.47	(10, 30)	21.81	(11, 12)	74.38	(11, 30)	58.96	(11, 31)	29.55
(12, 13)	75.72	(12, 31)	54.53	(12, 32)	36.81	(13, 14)	76.20	(13, 32)	49.36
(13, 33)	43.44	(14, 15)	75.72	(14, 33)	43.44	(14, 34)	49.36	(15, 16)	74.38
(15, 34)	36.81	(15, 35)	54.53	(16, 17)	72.47	(16, 35)	29.55	(16, 36)	58.96
(17, 36)	21.81	(20, 21)	72.47	(20, 40)	36.80	(21, 22)	74.38	(21, 40)	-8.90
(21, 41)	29.55	(22, 23)	75.72	(22, 41)	-1.84	(22, 42)	21.82	(23, 24)	76.20
(23, 42)	5.84	(23, 43)	13.83	(24, 25)	75.72	(24, 43)	13.83	(24, 44)	5.84
(25, 26)	74.38	(25, 44)	21.82	(25, 45)	-1.84	(26, 27)	72.47	(26, 45)	29.55
(26, 46)	-8.90	(27, 46)	36.80	(30, 31)	73.48	(30, 50)	36.80	(31, 32)	75.14
(31, 50)	62.68	(31, 51)	43.44	(32, 33)	76.08	(32, 51)	58.96	(32, 52)	49.36
(33, 34)	76.08	(33, 52)	54.53	(33, 53)	54.53	(34, 35)	75.14	(34, 53)	49.36
(34, 54)	58.96	(35, 36)	73.48	(35, 54)	43.44	(35, 55)	62.68	(36, 55)	36.80
(40, 41)	73.48	(40, 60)	21.81	(41, 42)	75.14	(41, 60)	-15.05	(41, 61)	13.82
(42, 43)	76.08	(42, 61)	-8.90	(42, 62)	5.84	(43, 44)	76.08	(43, 62)	-1.84
(43, 63)	-1.84	(44, 45)	75.14	(44, 63)	5.84	(44, 64)	-8.90	(45, 46)	73.48
(45, 64)	13.82	(45, 65)	-15.05	(46, 65)	21.81	(50, 51)	74.38	(50, 70)	49.36
(51, 52)	75.72	(51, 70)	65.76	(51, 71)	54.53	(52, 53)	76.20	(52, 71)	62.68
(52, 72)	58.96	(53, 54)	75.72	(53, 72)	58.96	(53, 73)	62.68	(54, 55)	74.38
(54, 73)	54.53	(54, 74)	65.76	(55, 74)	49.36	(60, 61)	74.38	(60, 80)	5.83
(61, 62)	75.72	(61, 80)	-20.10	(61, 81)	-1.84	(62, 63)	76.20	(62, 81)	-15.05
(62, 82)	-8.90	(63, 64)	75.72	(63, 82)	-8.90	(63, 83)	-15.05	(64, 65)	74.38
(64, 83)	-1.84	(64, 84)	-20.10	(65, 84)	5.83	(70, 71)	75.14	(71, 72)	76.07
(72, 73)	76.07	(73, 74)	75.14	(80, 81)	75.14	(81, 82)	76.07	(82, 83)	76.07
(83, 84)	75.14	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	20.38	(2,100)	66.05	(2,101)	19.76	(2,200)	62.01	(3,101)	58.24
(3,102)	23.04	(3,201)	64.98	(4,102)	48.94	(4,103)	29.87	(4,202)	66.63
(5,103)	39.03	(5,104)	39.03	(5,203)	67.16	(6,104)	29.87	(6,105)	48.94
(6,204)	66.63	(7,105)	23.04	(7,106)	58.24	(7,205)	64.98	(8,106)	19.76
(8,107)	66.05	(8,206)	62.01	(9,107)	20.38	(10,100)	67.56	(10,300)	9.37
(11,101)	70.17	(11,300)	59.23	(11,301)	10.99	(12,102)	71.67	(12,301)	49.34
(12,302)	17.26	(13,103)	72.35	(13,302)	38.20	(13,303)	26.95	(14,104)	72.35
(14,303)	26.95	(14,304)	38.20	(15,105)	71.67	(15,304)	17.26	(15,305)	49.34
(16,106)	70.17	(16,305)	10.99	(16,306)	59.23	(17,107)	67.56	(17,306)	9.37
(20,200)	28.66	(21,200)	65.25	(21,201)	30.24	(21,400)	54.16	(22,201)	58.00
(22,202)	34.76	(22,401)	57.16	(23,202)	49.81	(23,203)	41.65	(23,402)	58.60
(24,203)	41.65	(24,204)	49.81	(24,403)	58.60	(25,204)	34.76	(25,205)	58.00
(25,404)	57.16	(26,205)	30.24	(26,206)	65.25	(26,405)	54.16	(27,206)	28.66

(30,300)	73.30	(30,500)	1.09	(31,301)	74.40	(31,500)	51.40	(31,501)	6.43
(32,302)	74.90	(32,501)	40.02	(32,502)	15.98	(33,303)	75.03	(33,502)	27.78
(33,503)	27.78	(34,304)	74.90	(34,503)	15.98	(34,504)	40.02	(35,305)	74.40
(35,504)	6.43	(35,505)	51.40	(36,306)	73.30	(36,505)	1.09	(40,400)	36.33
(41,400)	64.63	(41,401)	39.56	(41,600)	43.48	(42,401)	58.16	(42,402)	44.75
(42,601)	46.14	(43,402)	51.24	(43,403)	51.24	(43,602)	47.00	(44,403)	44.75
(44,404)	58.16	(44,603)	46.14	(45,404)	39.56	(45,405)	64.63	(45,604)	43.48
(46,405)	36.33	(50,500)	75.48	(50,700)	.59	(51,501)	75.61	(51,700)	44.48
(51,701)	9.25	(52,502)	75.60	(52,701)	32.70	(52,702)	20.53	(53,503)	75.60
(53,702)	20.53	(53,703)	32.70	(54,504)	75.61	(54,703)	9.25	(54,704)	44.48
(55,505)	75.48	(55,704)	.59	(60,600)	42.87	(61,600)	63.98	(61,601)	47.13
(61,800)	29.35	(62,601)	58.30	(62,602)	52.47	(62,801)	31.30	(63,602)	52.47
(63,603)	58.30	(63,802)	31.30	(64,603)	47.13	(64,604)	63.98	(64,803)	29.35
(65,604)	42.87	(70,700)	75.30	(71,701)	74.99	(72,702)	74.87	(73,703)	74.99
(74,704)	75.30	(80,800)	48.02	(81,800)	63.04	(81,801)	52.82	(82,801)	57.97
(82,802)	57.97	(83,802)	52.82	(83,803)	63.04	(84,803)	48.02	(	

BOTTOM STRUTS

(100,101)	71.53	(100,200)	48.85	(100,300)	12.24	(101,102)	73.94	(101,200)	4.04
(101,201)	43.13	(101,300)	54.23	(101,301)	21.24	(102,103)	75.60	(102,201)	13.03
(102,202)	36.72	(102,301)	49.30	(102,302)	29.55	(103,104)	76.20	(103,202)	21.61
(103,203)	29.55	(103,302)	43.60	(103,303)	37.03	(104,105)	75.60	(104,203)	29.55
(104,204)	21.61	(104,303)	37.03	(104,304)	43.60	(105,106)	73.94	(105,204)	36.72
(105,205)	13.03	(105,304)	29.55	(105,305)	49.30	(106,107)	71.53	(106,205)	43.13
(106,206)	4.04	(106,305)	21.24	(106,306)	54.23	(107,206)	48.85	(107,306)	12.24
(200,201)	72.89	(200,400)	36.53	(201,202)	74.93	(201,400)	-3.18	(201,401)	29.55
(202,203)	76.05	(202,401)	5.40	(202,402)	21.99	(203,204)	76.05	(203,402)	13.89
(203,403)	13.89	(204,205)	74.93	(204,403)	21.99	(204,404)	5.40	(205,206)	72.89
(205,404)	29.55	(205,405)	-3.18	(206,405)	36.53	(300,301)	72.76	(300,500)	29.55
(301,302)	74.87	(301,500)	59.06	(301,501)	37.30	(302,303)	76.05	(302,501)	54.90
(302,502)	44.11	(303,304)	76.05	(303,502)	49.95	(303,503)	49.95	(304,305)	74.87
(304,503)	44.11	(304,504)	54.90	(305,306)	72.76	(305,504)	37.30	(305,505)	59.06
(306,505)	29.55	(400,401)	74.08	(400,600)	22.21	(401,402)	75.64	(401,600)	-9.00
(401,601)	14.57	(402,403)	76.20	(402,601)	-1.27	(402,602)	6.68	(403,404)	75.64
(403,602)	6.68	(403,603)	-1.27	(404,405)	74.08	(404,603)	14.57	(404,604)	-9.00
(405,604)	22.21	(500,501)	73.92	(500,700)	44.53	(501,502)	75.60	(501,700)	63.24
(501,701)	50.53	(502,503)	76.20	(502,701)	59.79	(502,702)	55.60	(503,504)	75.60
(503,702)	55.60	(503,703)	59.79	(504,505)	73.92	(504,703)	50.53	(504,704)	63.24
(505,704)	44.53	(600,601)	75.03	(600,800)	7.38	(601,602)	76.06	(601,800)	-13.31
(601,801)	.14	(602,603)	76.06	(602,801)	-6.83	(602,802)	-6.83	(603,604)	75.03
(603,802)	.14	(603,803)	-13.31	(604,803)	7.38	(700,701)	74.89	(701,702)	76.05
(702,703)	76.05	(703,704)	74.89	(800,801)	75.69	(801,802)	76.19	(802,803)	75.69

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 5:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	74.55	(1, 10)	-8.61	(1, 20)	28.73	(2, 3)	75.26	(2, 10)	34.98
(2, 11)	-4.04	(2, 20)	-11.71	(2, 21)	22.04	(3, 4)	75.83	(3, 11)	28.73
(3, 12)	1.69	(3, 21)	-8.60	(3, 22)	15.11	(4, 5)	76.16	(4, 12)	22.05
(4, 13)	8.21	(4, 22)	-4.03	(4, 23)	8.21	(5, 6)	76.16	(5, 13)	15.11
(5, 14)	15.11	(5, 23)	1.70	(5, 24)	1.70	(6, 7)	75.83	(6, 14)	8.21
(6, 15)	22.05	(6, 24)	8.21	(6, 25)	-4.03	(7, 8)	75.26	(7, 15)	1.69
(7, 16)	28.73	(7, 25)	15.11	(7, 26)	-8.60	(8, 9)	74.55	(8, 16)	-4.04
(8, 17)	34.98	(8, 26)	22.04	(8, 27)	-11.71	(9, 17)	-8.61	(9, 27)	28.73
(10, 11)	74.91	(10, 30)	1.68	(11, 12)	75.57	(11, 30)	40.66	(11, 31)	8.20
(12, 13)	76.03	(12, 31)	34.98	(12, 32)	15.11	(13, 14)	76.20	(13, 32)	28.74
(13, 33)	22.05	(14, 15)	76.03	(14, 33)	22.05	(14, 34)	28.74	(15, 16)	75.57
(15, 34)	15.11	(15, 35)	34.98	(16, 17)	74.91	(16, 35)	8.20	(16, 36)	40.66
(17, 36)	1.68	(20, 21)	74.91	(20, 40)	15.10	(21, 22)	75.57	(21, 40)	-13.24
(21, 41)	8.20	(22, 23)	76.03	(22, 41)	-11.71	(22, 42)	1.69	(23, 24)	76.20
(23, 42)	-8.60	(23, 43)	-4.03	(24, 25)	76.03	(24, 43)	-4.03	(24, 44)	-8.60
(25, 26)	75.57	(25, 44)	1.69	(25, 45)	-11.71	(26, 27)	74.91	(26, 45)	8.20
(26, 46)	-13.24	(27, 46)	15.10	(30, 31)	75.26	(30, 50)	15.10	(31, 32)	75.83
(31, 50)	45.74	(31, 51)	22.04	(32, 33)	76.16	(32, 51)	40.67	(32, 52)	28.73
(33, 34)	76.16	(33, 52)	34.98	(33, 53)	34.98	(34, 35)	75.83	(34, 53)	28.73
(34, 54)	40.67	(35, 36)	75.26	(35, 54)	22.04	(35, 55)	45.74	(36, 55)	15.10
(40, 41)	75.26	(40, 60)	1.45	(41, 42)	75.83	(41, 60)	-13.42	(41, 61)	-4.30
(42, 43)	76.16	(42, 61)	-13.47	(42, 62)	-8.88	(43, 44)	76.16	(43, 62)	-11.98
(43, 63)	-11.98	(44, 45)	75.83	(44, 63)	-8.88	(44, 64)	-13.47	(45, 46)	75.26
(45, 64)	-4.30	(45, 65)	-13.42	(46, 65)	1.45	(50, 51)	75.57	(50, 70)	28.73
(51, 52)	76.03	(51, 70)	50.21	(51, 71)	34.98	(52, 53)	76.20	(52, 71)	45.74
(52, 72)	40.66	(53, 54)	76.03	(53, 72)	40.66	(53, 73)	45.74	(54, 55)	75.57
(54, 73)	34.98	(54, 74)	50.21	(55, 74)	28.73	(60, 61)	22.71	(60, 80)	-80.76
(61, 62)	23.06	(61, 80)	-86.07	(61, 81)	-82.88	(62, 63)	23.18	(62, 81)	-85.61
(62, 82)	-64.55	(63, 64)	23.06	(63, 82)	-84.55	(63, 83)	-85.61	(64, 65)	22.71
(64, 83)	-82.88	(64, 84)	-86.07	(65, 84)	-80.76	(70, 71)	75.83	(71, 72)	76.15
(72, 73)	76.15	(73, 74)	75.83	(80, 81)	-71.25	(81, 82)	-70.19	(82, 83)	-70.19
(83, 84)	-71.25	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	47.58	(2,100)	66.25	(2,101)	45.68	(2,200)	42.06	(3,101)	61.18
(3,102)	45.57	(3,201)	46.30	(4,102)	55.91	(4,103)	47.43	(4,202)	48.69
(5,103)	51.08	(5,104)	51.08	(5,203)	49.47	(6,104)	47.43	(6,105)	55.91
(6,204)	48.69	(7,105)	45.57	(7,106)	61.18	(7,205)	46.30	(8,106)	45.68
(8,107)	66.25	(8,206)	42.06	(9,107)	47.58	(10,100)	51.37	(10,300)	37.91
(11,101)	55.76	(11,300)	59.22	(11,301)	36.16	(12,102)	58.45	(12,301)	52.54
(12,302)	37.03	(13,103)	59.73	(13,302)	45.99	(13,303)	40.51	(14,104)	59.73
(14,303)	40.51	(14,304)	45.99	(15,105)	58.45	(15,304)	37.03	(15,305)	52.54
(16,106)	55.76	(16,305)	36.16	(16,306)	59.22	(17,107)	51.37	(17,306)	37.91
(20,200)	53.07	(21,200)	67.34	(21,201)	52.76	(21,400)	29.66	(22,201)	63.40
(22,202)	53.80	(22,401)	33.30	(23,202)	59.50	(23,203)	56.14	(23,402)	35.04
(24,203)	56.14	(24,204)	59.50	(24,403)	35.04	(25,204)	53.80	(25,205)	63.40
(25,404)	33.30	(26,205)	52.76	(26,206)	67.34	(26,405)	29.66	(27,206)	53.07

(30,300)	62.40	(30,500)	26.78	(31,301)	65.06	(31,500)	50.18	(31,501)	26.25
(32,302)	66.52	(32,501)	42.12	(32,502)	29.07	(33,303)	66.99	(33,502)	34.71
(33,503)	34.71	(34,304)	66.52	(34,503)	29.07	(34,504)	42.12	(35,305)	65.06
(35,504)	26.25	(35,505)	50.18	(36,306)	62.40	(36,505)	26.78	(40,400)	57.81
(41,400)	68.39	(41,401)	58.62	(41,600)	13.40	(42,401)	65.45	(42,402)	60.28
(42,601)	15.98	(43,402)	62.64	(43,403)	62.64	(43,602)	16.80	(44,403)	60.28
(44,404)	65.45	(44,603)	15.98	(45,404)	58.62	(45,405)	68.39	(45,604)	13.40
(46,405)	57.81	(50,500)	69.27	(50,700)	17.27	(51,501)	70.66	(51,700)	40.59
(51,701)	19.06	(52,502)	71.29	(52,701)	31.82	(52,702)	24.25	(53,503)	71.29
(53,702)	24.25	(53,703)	31.82	(54,504)	70.66	(54,703)	19.06	(54,704)	40.59
(55,505)	69.27	(55,704)	17.27	(60,600)	61.59	(61,600)	69.19	(61,601)	63.05
(61,800)	-7.78	(62,601)	67.00	(62,602)	64.90	(62,801)	-6.66	(63,602)	64.90
(63,603)	67.00	(63,802)	-6.66	(64,603)	63.05	(64,604)	69.19	(64,803)	-7.78
(65,604)	61.59	(70,700)	72.96	(71,701)	73.56	(72,702)	73.74	(73,703)	73.56
(74,704)	72.96	(80,800)	64.46	(81,800)	69.63	(81,801)	66.18	(82,801)	67.93
(82,802)	67.93	(83,802)	66.18	(83,803)	69.63	(84,803)	64.46	(	

BOTTOM STRUTS

(100,101)	74.42	(100,200)	27.65	(100,300)	-5.53	(101,102)	75.33	(101,200)	-9.69
(101,201)	21.30	(101,300)	34.10	(101,301)	1.17	(102,103)	75.97	(102,201)	-4.38
(102,202)	14.80	(102,301)	28.23	(102,302)	8.21	(103,104)	76.20	(103,202)	1.71
(103,203)	8.21	(103,302)	21.93	(103,303)	15.22	(104,105)	75.97	(104,203)	8.21
(104,204)	1.71	(104,303)	15.22	(104,304)	21.93	(105,106)	75.33	(105,204)	14.80
(105,205)	-4.38	(105,304)	8.21	(105,305)	28.23	(106,107)	74.42	(106,205)	21.30
(106,206)	-9.69	(106,305)	1.17	(106,306)	34.10	(107,206)	27.65	(107,306)	-5.53
(200,201)	74.97	(200,400)	14.57	(201,202)	75.73	(201,400)	-11.51	(201,401)	8.21
(202,203)	76.15	(202,401)	-7.96	(202,402)	2.19	(203,204)	76.15	(203,402)	-3.29
(203,403)	-3.29	(204,205)	75.73	(204,403)	2.19	(204,404)	-7.96	(205,206)	74.97
(205,404)	8.21	(205,405)	-11.51	(206,405)	14.57	(300,301)	74.85	(300,500)	8.20
(301,302)	75.67	(301,500)	40.36	(301,501)	15.65	(302,303)	76.14	(302,501)	35.08
(302,502)	22.71	(303,304)	76.14	(303,502)	29.21	(303,503)	29.21	(304,305)	75.67
(304,503)	22.71	(304,504)	35.08	(305,306)	74.85	(305,504)	15.65	(305,505)	40.36
(306,505)	8.20	(400,401)	75.44	(400,600)	2.40	(401,402)	76.00	(401,600)	-11.10
(401,601)	-2.58	(402,403)	76.20	(402,601)	-9.46	(402,602)	-6.58	(403,404)	76.00
(403,602)	-6.58	(403,603)	-9.46	(404,405)	75.44	(404,603)	-2.58	(404,604)	-11.10
(405,604)	2.40	(500,501)	75.29	(500,700)	23.42	(501,502)	75.96	(501,700)	46.20
(501,701)	30.18	(502,503)	76.20	(502,701)	41.54	(502,702)	36.22	(503,504)	75.96
(503,702)	36.22	(503,703)	41.54	(504,505)	75.29	(504,703)	30.18	(504,704)	46.20
(505,704)	23.42	(600,601)	75.80	(600,800)	-6.03	(601,602)	76.15	(601,800)	-8.99
(601,801)	-8.27	(602,603)	76.15	(602,801)	-9.22	(602,802)	-9.22	(603,604)	75.80
(603,802)	-8.27	(603,803)	-8.99	(604,803)	-6.03	(700,701)	75.67	(701,702)	76.13
(702,703)	76.13	(703,704)	75.67	(800,801)	76.03	(801,802)	76.19	(802,803)	76.03

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 6:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	76.00	(1, 10)	-4.50	(1, 20)	6.23	(2, 3)	76.08	(2, 10)	11.77
(2, 11)	-6.66	(2, 20)	-.96	(2, 21)	1.16	(3, 4)	76.16	(3, 11)	6.23
(3, 12)	-7.16	(3, 21)	-4.49	(3, 22)	-3.03	(4, 5)	76.20	(4, 12)	1.16
(4, 13)	-5.90	(4, 22)	-6.65	(4, 23)	-5.90	(5, 6)	76.20	(5, 13)	-3.02
(5, 14)	-3.02	(5, 23)	-7.16	(5, 24)	-7.16	(6, 7)	76.16	(6, 14)	-5.90
(6, 15)	1.16	(6, 24)	-5.90	(6, 25)	-6.65	(7, 8)	76.08	(7, 15)	-7.16
(7, 16)	6.23	(7, 25)	-3.03	(7, 26)	-4.49	(8, 9)	76.00	(8, 16)	-6.66
(8, 17)	11.77	(8, 26)	1.16	(8, 27)	-.96	(9, 17)	-4.50	(9, 27)	6.23
(10, 11)	76.04	(10, 30)	-7.17	(11, 12)	76.12	(11, 30)	17.43	(11, 31)	-5.91
(12, 13)	76.18	(12, 31)	11.78	(12, 32)	-3.03	(13, 14)	76.20	(13, 32)	6.24
(13, 33)	1.16	(14, 15)	76.18	(14, 33)	1.16	(14, 34)	6.24	(15, 16)	76.12
(15, 34)	-3.03	(15, 35)	11.78	(16, 17)	76.04	(16, 35)	-5.91	(16, 36)	17.43
(17, 36)	-7.17	(20, 21)	25.96	(20, 40)	-80.91	(21, 22)	26.03	(21, 40)	-83.03
(21, 41)	-82.50	(22, 23)	26.08	(22, 41)	-83.78	(22, 42)	-83.68	(23, 24)	26.10
(23, 42)	-84.21	(23, 43)	-84.20	(24, 25)	26.08	(24, 43)	-84.20	(24, 44)	-84.21
(25, 26)	26.03	(25, 44)	-83.68	(25, 45)	-83.78	(26, 27)	25.96	(26, 45)	-82.50
(26, 46)	-83.03	(27, 46)	-80.91	(30, 31)	76.08	(30, 50)	-3.03	(31, 32)	76.15
(31, 50)	22.95	(31, 51)	1.16	(32, 33)	76.19	(32, 51)	17.43	(32, 52)	6.23
(33, 34)	76.19	(33, 52)	11.78	(33, 53)	11.78	(34, 35)	76.15	(34, 53)	6.23
(34, 54)	17.43	(35, 36)	76.08	(35, 54)	1.16	(35, 55)	22.95	(36, 55)	-3.03
(40, 41)	-76.10	(40, 60)	-115.84	(41, 42)	-73.68	(41, 60)	-111.96	(41, 61)	-114.44
(42, 43)	-72.26	(42, 61)	-111.69	(42, 62)	-113.08	(43, 44)	-72.26	(43, 62)	-112.09
(43, 63)	-112.09	(44, 45)	-73.68	(44, 63)	-113.08	(44, 64)	-111.69	(45, 46)	-76.10
(45, 64)	-114.44	(45, 65)	-111.96	(46, 65)	-115.84	(50, 51)	76.12	(50, 70)	6.23
(51, 52)	76.18	(51, 70)	28.15	(51, 71)	11.77	(52, 53)	76.20	(52, 71)	22.95
(52, 72)	17.43	(53, 54)	76.18	(53, 72)	17.43	(53, 73)	22.95	(54, 55)	76.12
(54, 73)	11.77	(54, 74)	28.15	(55, 74)	6.23	(60, 61)	-67.61	(60, 80)	-111.59
(61, 62)	-64.64	(61, 80)	-101.63	(61, 81)	-108.10	(62, 63)	-63.55	(62, 81)	-102.81
(62, 82)	-105.06	(63, 64)	-64.64	(63, 82)	-105.06	(63, 83)	-102.81	(64, 65)	-67.61
(64, 83)	-108.10	(64, 84)	-101.63	(65, 84)	-111.59	(70, 71)	76.15	(71, 72)	76.19
(72, 73)	76.19	(73, 74)	76.15	(80, 81)	-43.27	(81, 82)	-41.54	(82, 83)	-41.54
(83, 84)	-43.27	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	65.42	(2,100)	67.78	(2,101)	63.75	(2,200)	12.59	(3,101)	65.69
(3,102)	62.67	(3,201)	17.27	(4,102)	63.95	(4,103)	62.33	(4,202)	19.83
(5,103)	62.78	(5,104)	62.78	(5,203)	20.64	(6,104)	62.33	(6,105)	63.95
(6,204)	19.83	(7,105)	62.67	(7,106)	65.69	(7,205)	17.27	(8,106)	63.75
(8,107)	67.78	(8,206)	12.59	(9,107)	65.42	(10,100)	26.09	(10,300)	58.87
(11,101)	31.84	(11,300)	61.63	(11,301)	56.57	(12,102)	35.35	(12,301)	58.67
(12,302)	55.29	(13,103)	37.01	(13,302)	56.43	(13,303)	55.24	(14,104)	37.01
(14,303)	55.24	(14,304)	56.43	(15,105)	35.35	(15,304)	55.29	(15,305)	58.67
(16,106)	31.84	(16,305)	56.57	(16,306)	61.63	(17,107)	26.09	(17,306)	58.87
(20,200)	68.47	(21,200)	70.24	(21,201)	67.79	(21,400)	-5.14	(22,201)	69.09
(22,202)	67.52	(22,401)	-2.37	(23,202)	68.21	(23,203)	67.67	(23,402)	-1.18
(24,203)	67.67	(24,204)	68.21	(24,403)	-1.18	(25,204)	67.52	(25,205)	69.09
(25,404)	-2.37	(26,205)	67.79	(26,206)	70.24	(26,405)	-5.14	(27,206)	68.47

(30,300)	42.44	(30,500)	49.76	(31,301)	46.44	(31,500)	52.95	(31,501)	47.12
(32,302)	48.69	(32,501)	49.29	(32,502)	46.10	(33,303)	49.41	(33,502)	46.88
(33,503)	46.88	(34,304)	48.69	(34,503)	46.10	(34,504)	49.29	(35,305)	46.44
(35,504)	47.12	(35,505)	52.95	(36,306)	42.44	(36,505)	49.76	(40,400)	70.85
(41,400)	72.15	(41,401)	70.79	(41,600)	-46.78	(42,401)	71.62	(42,402)	70.92
(42,601)	-46.62	(43,402)	71.20	(43,403)	71.20	(43,602)	-48.05	(44,403)	70.92
(44,404)	71.62	(44,603)	-46.62	(45,404)	70.79	(45,405)	72.15	(45,604)	-46.78
(46,405)	70.85	(50,500)	54.07	(50,700)	38.97	(51,501)	56.60	(51,700)	42.46
(51,701)	36.60	(52,502)	57.79	(52,701)	38.55	(52,702)	36.47	(53,503)	57.79

(53,702)	36.47	(53,703)	38.55	(54,504)	56.60	(54,703)	36.60	(54,704)	42.46
(55,505)	54.07	(55,704)	38.97	(60,600)	-45.63	(61,600)	-45.84	(61,601)	-46.25
(61,800)	-120.75	(62,601)	-45.94	(62,602)	-44.68	(62,801)	-121.65	(63,602)	-44.68
(63,603)	-45.94	(63,802)	-121.65	(64,603)	-46.25	(64,604)	-45.84	(64,803)	-120.75
(65,604)	-45.63	(70,700)	61.66	(71,701)	63.10	(72,702)	63.56	(73,703)	63.10
(74,704)	61.66	(80,800)	-54.99	(81,800)	-53.12	(81,801)	-51.95	(82,801)	-51.93
(82,802)	-51.93	(83,802)	-51.95	(83,803)	-53.12	(84,803)	-54.99	(	

BOTTOM STRUTS

(100,101)	75.94	(100,200)	4.24	(100,300)	-7.36	(101,102)	76.07	(101,200)	-4.23
(101,201)	-.25	(101,300)	9.85	(101,301)	-7.34	(102,103)	76.17	(102,201)	-6.17
(102,202)	-3.70	(102,301)	4.87	(102,302)	-5.90	(103,104)	76.20	(103,202)	-6.74
(103,203)	-5.90	(103,302)	.45	(103,303)	-3.22	(104,105)	76.17	(104,203)	-5.90
(104,204)	-6.74	(104,303)	-3.22	(104,304)	.45	(105,106)	76.07	(105,204)	-3.70
(105,205)	-6.17	(105,304)	-5.90	(105,305)	4.87	(106,107)	75.94	(106,205)	-.25
(106,206)	-4.23	(106,305)	-7.34	(106,306)	9.85	(107,206)	4.24	(107,306)	-7.36
(200,201)	76.03	(200,400)	-3.89	(201,202)	76.14	(201,400)	.79	(201,401)	-5.90
(202,203)	76.19	(202,401)	-2.74	(202,402)	-6.31	(203,204)	76.19	(203,402)	-5.19
(203,403)	-5.19	(204,205)	76.14	(204,403)	-6.31	(204,404)	-2.74	(205,206)	76.03
(205,404)	-5.90	(205,405)	.79	(206,405)	-3.89	(300,301)	75.99	(300,500)	-5.91
(301,302)	76.12	(301,500)	16.17	(301,501)	-2.65	(302,303)	76.19	(302,501)	11.10
(302,502)	1.48	(303,304)	76.19	(303,502)	6.15	(303,503)	6.15	(304,305)	76.12
(304,503)	1.48	(304,504)	11.10	(305,306)	75.99	(305,504)	-2.65	(305,505)	16.17
(306,505)	-5.91	(400,401)	76.10	(400,600)	-6.20	(401,402)	76.17	(401,600)	6.86
(401,601)	-4.74	(402,403)	76.20	(402,601)	2.20	(402,602)	-1.80	(403,404)	76.17
(403,602)	-1.80	(403,603)	2.20	(404,405)	76.10	(404,603)	-4.74	(404,604)	6.86
(405,604)	-6.20	(500,501)	76.05	(500,700)	2.53	(501,502)	76.16	(501,700)	22.76
(501,701)	7.58	(502,503)	76.20	(502,701)	17.85	(502,702)	12.75	(503,504)	76.16
(503,702)	12.75	(503,703)	17.85	(504,505)	76.05	(504,703)	7.58	(504,704)	22.76
(505,704)	2.53	(600,601)	76.15	(600,800)	-45.08	(601,602)	76.19	(601,800)	-35.96
(601,801)	-42.27	(602,603)	76.19	(602,801)	-39.13	(602,802)	-39.13	(603,604)	76.15
(603,802)	-42.27	(603,803)	-35.96	(604,803)	-45.08	(700,701)	76.11	(701,702)	76.18
(702,703)	76.18	(703,704)	76.11	(800,801)	-36.50	(801,802)	-35.42	(802,803)	-36.50

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 7:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	-45.11	(1, 10)	16.01	(1, 20)	-90.58	(2, 3)	-50.73	(2, 10)	-77.39
(2, 11)	-72.05	(2, 20)	-69.33	(2, 21)	-91.85	(3, 4)	-73.97	(3, 11)	-80.91
(3, 12)	-78.89	(3, 21)	-88.49	(3, 22)	-106.12	(4, 5)	-72.93	(4, 12)	-81.33
(4, 13)	-80.31	(4, 22)	-99.65	(4, 23)	-103.66	(5, 6)	-72.93	(5, 13)	-81.19
(5, 14)	-81.19	(5, 23)	-101.39	(5, 24)	-101.39	(6, 7)	-73.97	(6, 14)	-80.31
(6, 15)	-81.33	(6, 24)	-103.66	(6, 25)	-99.65	(7, 8)	-50.73	(7, 15)	-78.89
(7, 16)	-80.91	(7, 25)	-106.12	(7, 26)	-88.49	(8, 9)	-45.11	(8, 16)	-72.05
(8, 17)	-77.39	(8, 26)	-91.85	(8, 27)	-69.33	(9, 17)	16.01	(9, 27)	-90.58
(10, 11)	33.18	(10, 30)	3.23	(11, 12)	33.38	(11, 30)	-4.99	(11, 31)	-2.15
(12, 13)	33.52	(12, 31)	-7.52	(12, 32)	-6.06	(13, 14)	33.58	(13, 32)	-8.72
(13, 33)	-8.28	(14, 15)	33.52	(14, 33)	-8.28	(14, 34)	-8.72	(15, 16)	33.38
(15, 34)	-6.06	(15, 35)	-7.52	(16, 17)	33.18	(16, 35)	-2.15	(16, 36)	-4.99
(17, 36)	3.23	(20, 21)	-14.05	(20, 40)	-75.18	(21, 22)	-40.20	(21, 40)	-49.72
(21, 41)	-81.42	(22, 23)	-38.56	(22, 41)	-68.02	(22, 42)	-81.75	(23, 24)	-37.57
(23, 42)	-71.57	(23, 43)	-76.29	(24, 25)	-38.56	(24, 43)	-76.29	(24, 44)	-71.57
(25, 26)	-40.20	(25, 44)	-81.75	(25, 45)	-68.02	(26, 27)	-14.05	(26, 45)	-81.42
(26, 46)	-49.72	(27, 46)	-75.18	(30, 31)	75.71	(30, 50)	-5.88	(31, 32)	76.01
(31, 50)	-1.31	(31, 51)	-8.06	(32, 33)	76.18	(32, 51)	-4.75	(32, 52)	-8.47
(33, 34)	76.18	(33, 52)	-7.26	(33, 53)	-7.26	(34, 35)	76.01	(34, 53)	-8.47
(34, 54)	-4.75	(35, 36)	75.71	(35, 54)	-8.06	(35, 55)	-1.31	(36, 55)	-5.88
(40, 41)	5.78	(40, 60)	-56.00	(41, 42)	-.34	(41, 60)	-30.49	(41, 61)	-57.16
(42, 43)	1.20	(42, 61)	-38.18	(42, 62)	-49.91	(43, 44)	1.20	(43, 62)	-43.45
(43, 63)	-43.45	(44, 45)	-.34	(44, 63)	-49.91	(44, 64)	-38.18	(45, 46)	5.78
(45, 64)	-57.16	(45, 65)	-30.49	(46, 65)	-56.00	(50, 51)	75.87	(50, 70)	-8.48
(51, 52)	76.11	(51, 70)	2.70	(51, 71)	-7.27	(52, 53)	76.20	(52, 71)	-1.31
(52, 72)	-4.75	(53, 54)	76.11	(53, 72)	-4.75	(53, 73)	-1.31	(54, 55)	75.87
(54, 73)	-7.27	(54, 74)	2.70	(55, 74)	-8.48	(60, 61)	19.17	(60, 80)	-36.09
(61, 62)	20.63	(61, 80)	-13.35	(61, 81)	-30.31	(62, 63)	21.13	(62; 81)	-17.83
(62, 82)	-23.52	(63, 64)	20.63	(63, 82)	-23.52	(63, 83)	-17.83	(64, 65)	19.17
(64, 83)	-30.31	(64, 84)	-13.35	(65, 84)	-36.09	(70, 71)	76.00	(71, 72)	76.17
(72, 73)	76.17	(73, 74)	76.00	(80, 81)	28.88	(81, 82)	29.57	(82, 83)	29.57
(83, 84)	28.88	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	74.16	(2,100)	70.21	(2,101)	73.46	(2,200)	-33.11	(3,101)	70.38
(3,102)	72.68	(3,201)	-35.48	(4,102)	70.76	(4,103)	71.95	(4,202)	-34.71
(5,103)	71.30	(5,104)	71.30	(5,203)	-34.54	(6,104)	71.95	(6,105)	70.76
(6,204)	-34.71	(7,105)	72.68	(7,106)	70.38	(7,205)	-35.48	(8,106)	73.46
(8,107)	70.21	(8,206)	-33.11	(9,107)	74.16	(10,100)	-8.24	(10,300)	71.15
(11,101)	-2.69	(11,300)	65.68	(11,301)	69.56	(12,102)	.44	(12,301)	65.65
(12,302)	68.10	(13,103)	1.84	(13,302)	66.07	(13,303)	66.91	(14,104)	1.84
(14,303)	66.91	(14,304)	66.07	(15,105)	.44	(15,304)	68.10	(15,305)	65.65
(16,106)	-2.69	(16,305)	69.56	(16,306)	65.68	(17,107)	-8.24	(17,306)	71.15
(20,200)	-17.75	(21,200)	-18.87	(21,201)	-30.01	(21,400)	-102.09	(22,201)	-41.33
(22,202)	-41.05	(22,401)	-110.09	(23,202)	-40.30	(23,203)	-40.14	(23,402)	-111.28
(24,203)	-40.14	(24,204)	-40.30	(24,403)	-111.28	(25,204)	-41.05	(25,205)	-41.33
(25,404)	-110.09	(26,205)	-30.01	(26,206)	-18.87	(26,405)	-102.09	(27,206)	-17.75

(30,300)	12.34	(30,500)	65.57	(31,301)	17.10	(31,500)	58.73	(31,501)	63.04
(32,302)	19.72	(32,501)	58.68	(32,502)	60.93	(33,303)	20.55	(33,502)	59.43
(33,503)	59.43	(34,304)	19.72	(34,503)	60.93	(34,504)	58.68	(35,305)	17.10
(35,504)	63.04	(35,505)	58.73	(36,306)	12.34	(36,505)	65.57	(40,400)	-3.70
(41,400)	-12.23	(41,401)	-19.94	(41,600)	-123.23	(42,401)	-18.55	(42,402)	-17.74
(42,601)	-134.33	(43,402)	-17.16	(43,403)	-17.16	(43,602)	-141.39	(44,403)	-17.74
(44,404)	-18.55	(44,603)	-134.33	(45,404)	-19.94	(45,405)	-12.23	(45,604)	-123.23
(46,405)	-3.70	(50,500)	28.69	(50,700)	57.26	(51,501)	32.14	(51,700)	49.48
(51,701)	53.88	(52,502)	33.78	(52,701)	49.79	(52,702)	51.30	(53,503)	33.78

(53,702)	51.30	(53,703)	49.79	(54,504)	32.14	(54,703)	53.88	(54,704)	49.48
(55,505)	28.69	(55,704)	57.26	(60,600)	14.90	(61,600)	12.58	(61,601)	13.14
(61,800)	-138.15	(62,601)	14.00	(62,602)	14.24	(62,801)	-166.06	(63,602)	14.24
(63,603)	14.00	(63,802)	-166.06	(64,603)	13.14	(64,604)	12.58	(64,803)	-138.15
(65,604)	14.90	(70,700)	40.34	(71,701)	42.56	(72,702)	43.28	(73,703)	42.56
(74,704)	40.34	(80,800)	26.18	(81,800)	27.23	(81,801)	27.20	(82,801)	27.61
(82,802)	27.61	(83,802)	27.20	(83,803)	27.23	(84,803)	26.18	(	

BOTTOM STRUTS

(100,101)	75.69	(100,200)	-11.33	(100,300)	9.60	(101,102)	75.95	(101,200)	17.11
(101,201)	-10.00	(101,300)	-10.61	(101,301)	3.47	(102,103)	76.13	(102,201)	10.42
(102,202)	-6.80	(102,301)	-10.93	(102,302)	-2.00	(103,104)	76.20	(103,202)	3.91
(103,203)	-2.00	(103,302)	-9.51	(103,303)	-6.44	(104,105)	76.13	(104,203)	-2.00
(104,204)	3.91	(104,303)	-6.44	(104,304)	-9.51	(105,106)	75.95	(105,204)	-6.80
(105,205)	10.42	(105,304)	-2.00	(105,305)	-10.93	(106,107)	75.69	(106,205)	-10.00
(106,206)	17.11	(106,305)	3.47	(106,306)	-10.61	(107,206)	-11.33	(107,306)	9.60
(200,201)	75.79	(200,400)	-34.60	(201,202)	76.04	(201,400)	-11.87	(201,401)	-33.29
(202,203)	76.18	(202,401)	-18.84	(202,402)	-28.81	(203,204)	76.18	(203,402)	-23.84
(203,403)	-23.84	(204,205)	76.04	(204,403)	-28.81	(204,404)	-18.84	(205,206)	75.79
(205,404)	-33.29	(205,405)	-11.87	(206,405)	-34.60	(300,301)	75.87	(300,500)	-2.01
(301,302)	76.07	(301,500)	-7.76	(301,501)	-5.90	(302,303)	76.18	(302,501)	-9.40
(302,502)	-8.50	(303,304)	76.18	(303,502)	-9.67	(303,503)	-9.67	(304,305)	76.07
(304,503)	-8.50	(304,504)	-9.40	(305,306)	75.87	(305,504)	-5.90	(305,505)	-7.76
(306,505)	-2.01	(400,401)	-18.61	(400,600)	-62.93	(401,402)	-25.29	(401,600)	-51.88
(401,601)	-65.22	(402,403)	-23.63	(402,601)	-54.89	(402,602)	-59.34	(403,404)	-25.29
(403,602)	-59.34	(403,603)	-54.89	(404,405)	-18.61	(404,603)	-65.22	(404,604)	-51.88
(405,604)	-62.93	(500,501)	75.99	(500,700)	-7.33	(501,502)	76.14	(501,700)	-3.16
(501,701)	-8.00	(502,503)	76.20	(502,701)	-5.75	(502,702)	-7.42	(503,504)	76.14
(503,702)	-7.42	(503,703)	-5.75	(504,505)	75.99	(504,703)	-8.00	(504,704)	-3.16
(505,704)	-7.33	(600,601)	-2.26	(600,800)	-46.48	(601,602)	-.41	(601,800)	-27.58
(601,801)	-38.66	(602,603)	-.41	(602,801)	-32.25	(602,802)	-32.25	(603,604)	-2.26
(603,802)	-38.66	(603,803)	-27.58	(604,803)	-46.48	(700,701)	76.08	(701,702)	76.18
(702,703)	76.18	(703,704)	76.08	(800,801)	19.89	(801,802)	20.55	(802,803)	19.89

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 8:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	6.20	(1, 10)	39.91	(1, 20)	-60.90	(2, 3)	10.05	(2, 10)	-77.58
(2, 11)	-40.28	(2, 20)	-13.06	(2, 21)	-53.30	(3, 4)	11.14	(3, 11)	-72.63
(3, 12)	-48.18	(3, 21)	-18.54	(3, 22)	-47.18	(4, 5)	12.92	(4, 12)	-66.92
(4, 13)	-53.45	(4, 22)	-24.57	(4, 23)	-38.71	(5, 6)	12.92	(5, 13)	-59.86
(5, 14)	-59.86	(5, 23)	-31.04	(5, 24)	-31.04	(6, 7)	11.14	(6, 14)	-53.45
(6, 15)	-66.92	(6, 24)	-38.71	(6, 25)	-24.57	(7, 8)	10.05	(7, 15)	-48.18
(7, 16)	-72.63	(7, 25)	-47.18	(7, 26)	-18.54	(8, 9)	6.20	(8, 16)	-40.28
(8, 17)	-77.58	(8, 26)	-53.30	(8, 27)	-13.06	(9, 17)	39.91	(9, 27)	-60.90
(10, 11)	-14.85	(10, 30)	25.49	(11, 12)	-11.64	(11, 30)	-92.67	(11, 31)	-70.53
(12, 13)	-8.42	(12, 31)	-93.16	(12, 32)	-74.72	(13, 14)	-7.31	(13, 32)	-88.48
(13, 33)	-78.59	(14, 15)	-8.42	(14, 33)	-78.59	(14, 34)	-88.48	(15, 16)	-11.64
(15, 34)	-74.72	(15, 35)	-93.16	(16, 17)	-14.85	(16, 35)	-70.53	(16, 36)	-92.67
(17, 36)	25.49	(20, 21)	20.95	(20, 40)	-38.16	(21, 22)	22.83	(21, 40)	2.05
(21, 41)	-30.37	(22, 23)	24.82	(22, 41)	-2.70	(22, 42)	-22.30	(23, 24)	25.54
(23, 42)	-7.90	(23, 43)	-14.49	(24, 25)	24.82	(24, 43)	-14.49	(24, 44)	-7.90
(25, 26)	22.83	(25, 44)	-22.30	(25, 45)	-2.70	(26, 27)	20.95	(26, 45)	-30.37
(26, 46)	2.05	(27, 46)	-38.16	(30, 31)	-41.51	(30, 50)	9.60	(31, 32)	-37.17
(31, 50)	-89.31	(31, 51)	-80.62	(32, 33)	-34.90	(32, 51)	-88.13	(32, 52)	-84.69
(33, 34)	-34.90	(33, 52)	-86.41	(33, 53)	-86.41	(34, 35)	-37.17	(34, 53)	-84.69
(34, 54)	-88.13	(35, 36)	-41.51	(35, 54)	-80.62	(35, 55)	-89.31	(36, 55)	9.60
(40, 41)	28.59	(40, 60)	2.92	(41, 42)	30.60	(41, 60)	12.06	(41, 61)	-9.97
(42, 43)	31.77	(42, 61)	8.35	(42, 62)	-2.64	(43, 44)	31.77	(43, 62)	3.49
(43, 63)	3.49	(44, 45)	30.60	(44, 63)	-2.64	(44, 64)	8.35	(45, 46)	28.59
(45, 64)	-9.97	(45, 65)	12.06	(46, 65)	2.92	(50, 51)	-7.49	(50, 70)	-4.77
(51, 52)	-7.08	(51, 70)	-17.56	(51, 71)	-10.29	(52, 53)	-6.93	(52, 71)	-16.69
(52, 72)	-14.30	(53, 54)	-7.08	(53, 72)	-14.30	(53, 73)	-16.69	(54, 55)	-7.49
(54, 73)	-10.29	(54, 74)	-17.56	(55, 74)	-4.77	(60, 61)	33.14	(60, 80)	35.64
(61, 62)	34.64	(61, 80)	19.18	(61, 81)	6.05	(62, 63)	35.17	(62, 81)	15.91
(62, 82)	11.55	(63, 64)	34.64	(63, 82)	11.55	(63, 83)	15.91	(64, 65)	33.14
(64, 83)	6.05	(64, 84)	19.18	(65, 84)	35.64	(70, 71)	75.44	(71, 72)	76.11
(72, 73)	76.11	(73, 74)	75.44	(80, 81)	36.07	(81, 82)	33.71	(82, 83)	33.71
(83, 84)	36.07	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	74.92	(2,100)	4.16	(2,101)	-2.86	(2,200)	-114.08	(3,101)	-1.75
(3,102)	.02	(3,201)	-117.07	(4,102)	1.10	(4,103)	2.38	(4,202)	-124.33
(5,103)	2.68	(5,104)	2.68	(5,203)	-128.43	(6,104)	2.38	(6,105)	1.10
(6,204)	-124.33	(7,105)	.02	(7,106)	-1.75	(7,205)	-117.07	(8,106)	-2.86
(8,107)	4.16	(8,206)	-114.08	(9,107)	74.92	(10,100)	-46.53	(10,300)	75.68
(11,101)	-111.62	(11,300)	59.53	(11,301)	-18.26	(12,102)	-113.17	(12,301)	-22.77
(12,302)	-17.80	(13,103)	-115.09	(13,302)	-20.35	(13,303)	-16.79	(14,104)	-115.09
(14,303)	-16.79	(14,304)	-20.35	(15,105)	-113.17	(15,304)	-17.80	(15,305)	-22.77
(16,106)	-111.62	(16,305)	-18.26	(16,306)	59.53	(17,107)	-46.53	(17,306)	75.68
(20,200)	13.77	(21,200)	16.58	(21,201)	16.98	(21,400)	-110.91	(22,201)	18.13
(22,202)	18.22	(22,401)	-131.64	(23,202)	19.55	(23,203)	19.55	(23,402)	-157.09
(24,203)	19.55	(24,204)	19.55	(24,403)	-157.09	(25,204)	18.22	(25,205)	18.13
(25,404)	-131.64	(26,205)	16.98	(26,206)	16.58	(26,405)	-110.91	(27,206)	13.77

(30,300)	-28.51	(30,500)	74.18	(31,301)	-50.94	(31,500)	65.55	(31,501)	72.81
(32,302)	-49.39	(32,501)	67.44	(32,502)	71.17	(33,303)	-49.18	(33,502)	69.35
(33,503)	69.35	(34,304)	-49.39	(34,503)	71.17	(34,504)	67.44	(35,305)	-50.94
(35,504)	72.81	(35,505)	65.55	(36,306)	-28.51	(36,505)	74.18	(40,400)	24.32
(41,400)	28.23	(41,401)	26.02	(41,600)	-110.88	(42,401)	28.87	(42,402)	27.73
(42,601)	-142.65	(43,402)	28.75	(43,403)	28.75	(43,602)	-171.27	(44,403)	27.73
(44,404)	28.87	(44,603)	-142.65	(45,404)	26.02	(45,405)	28.23	(45,604)	-110.88
(46,405)	24.32	(50,500)	-8.66	(50,700)	69.72	(51,501)	-4.87	(51,700)	58.78
(51,701)	67.02	(52,502)	-3.11	(52,701)	61.39	(52,702)	64.19	(53,503)	-3.11

(53,702)	64.19	(53,703)	61.39	(54,504)	-4.87	(54,703)	67.02	(54,704)	58.78
(55,505)	-8.66	(55,704)	69.72	(60,600)	28.50	(61,600)	33.15	(61,601)	30.26
(61,800)	-99.50	(62,601)	32.84	(62,602)	31.75	(62,801)	-130.48	(63,602)	31.75
(63,603)	32.84	(63,802)	-130.48	(64,603)	30.26	(64,604)	33.15	(64,803)	-99.50
(65,604)	28.50	(70,700)	7.34	(71,701)	10.25	(72,702)	11.19	(73,703)	10.25
(74,704)	7.34	(80,800)	30.65	(81,800)	34.95	(81,801)	32.14	(82,801)	33.70
(82,802)	33.70	(83,802)	32.14	(83,803)	34.95	(84,803)	30.65	(	

BOTTOM STRUTS

(100,101)	73.79	(100,200)	-7.57	(100,300)	33.60	(101,102)	-5.19	(101,200)	-23.68
(101,201)	-60.11	(101,300)	-14.34	(101,301)	.22	(102,103)	-2.30	(102,201)	-32.88
(102,202)	-51.78	(102,301)	-42.73	(102,302)	-23.81	(103,104)	-1.16	(103,202)	-37.65
(103,203)	-44.72	(103,302)	-36.59	(103,303)	-29.53	(104,105)	-2.30	(104,203)	-44.72
(104,204)	-37.65	(104,303)	-29.53	(104,304)	-36.59	(105,106)	-5.19	(105,204)	-51.78
(105,205)	-32.88	(105,304)	-23.81	(105,305)	-42.73	(106,107)	73.79	(106,205)	-60.11
(106,206)	-23.68	(106,305)	.22	(106,306)	-14.34	(107,206)	-7.57	(107,306)	33.60
(200,201)	6.91	(200,400)	-46.34	(201,202)	10.00	(201,400)	-10.36	(201,401)	-39.55
(202,203)	11.90	(202,401)	-17.24	(202,402)	-30.45	(203,204)	11.90	(203,402)	-22.86
(203,403)	-22.86	(204,205)	10.00	(204,403)	-30.45	(204,404)	-17.24	(205,206)	6.91
(205,404)	-39.55	(205,405)	-10.36	(206,405)	-46.34	(300,301)	74.55	(300,500)	17.58
(301,302)	75.56	(301,500)	-19.06	(301,501)	9.22	(302,303)	76.13	(302,501)	-13.77
(302,502)	.89	(303,304)	76.13	(303,502)	-6.95	(303,503)	-6.95	(304,305)	75.56
(304,503)	.89	(304,504)	-13.77	(305,306)	74.55	(305,504)	9.22	(305,505)	-19.06
(306,505)	17.58	(400,401)	21.25	(400,600)	-21.79	(401,402)	23.55	(401,600)	4.46
(401,601)	-13.63	(402,403)	24.42	(402,601)	.13	(402,602)	-5.91	(403,404)	23.55
(403,602)	-5.91	(403,603)	.13	(404,405)	21.25	(404,603)	-13.63	(404,604)	4.46
(405,604)	-21.79	(500,501)	75.15	(500,700)	1.76	(501,502)	75.92	(501,700)	-21.17
(501,701)	-5.65	(502,503)	76.20	(502,701)	-17.48	(502,702)	-12.20	(503,504)	75.92
(503,702)	-12.20	(503,703)	-17.48	(504,505)	75.15	(504,703)	-5.65	(504,704)	-21.17
(505,704)	1.76	(600,601)	30.55	(600,800)	-1.50	(601,602)	31.94	(601,800)	15.52
(601,801)	5.60	(602,603)	31.94	(602,801)	11.30	(602,802)	11.30	(603,604)	30.55
(603,802)	5.60	(603,803)	15.52	(604,803)	-1.50	(700,701)	75.61	(701,702)	76.13
(702,703)	76.13	(703,704)	75.61	(800,801)	35.05	(801,802)	35.70	(802,803)	35.05

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 9:00 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	22.04	(1, 10)	58.76	(1, 20)	4.76	(2, 3)	26.64	(2, 10)	-41.18
(2, 11)	4.55	(2, 20)	18.11	(2, 21)	-18.45	(3, 4)	29.96	(3, 11)	-31.46
(3, 12)	-.34	(3, 21)	15.32	(3, 22)	-9.38	(4, 5)	31.84	(4, 12)	-22.12
(4, 13)	-6.25	(4, 22)	11.18	(4, 23)	-1.22	(5, 6)	31.84	(5, 13)	-13.57
(5, 14)	-13.57	(5, 23)	5.67	(5, 24)	5.67	(6, 7)	29.96	(6, 14)	-6.25
(6, 15)	-22.12	(6, 24)	-1.22	(6, 25)	11.18	(7, 8)	26.64	(7, 15)	-.34
(7, 16)	-31.46	(7, 25)	-9.38	(7, 26)	15.32	(8, 9)	22.04	(8, 16)	4.55
(8, 17)	-41.18	(8, 26)	-18.45	(8, 27)	18.11	(9, 17)	58.76	(9, 27)	4.76
(10, 11)	17.84	(10, 30)	47.43	(11, 12)	22.33	(11, 30)	-56.81	(11, 31)	-16.23
(12, 13)	25.30	(12, 31)	-47.86	(12, 32)	-22.09	(13, 14)	26.35	(13, 32)	-38.54
(13, 33)	-29.38	(14, 15)	25.30	(14, 33)	-29.38	(14, 34)	-38.54	(15, 16)	22.33
(15, 34)	-22.09	(15, 35)	-47.86	(16, 17)	17.84	(16, 35)	-16.23	(16, 36)	-56.81
(17, 36)	47.43	(20, 21)	28.28	(20, 40)	30.13	(21, 22)	32.05	(21, 40)	25.44
(21, 41)	.62	(22, 23)	34.60	(22, 41)	22.86	(22, 42)	8.09	(23, 24)	35.51
(23, 42)	19.23	(23, 43)	14.31	(24, 25)	34.60	(24, 43)	14.31	(24, 44)	19.23
(25, 26)	32.05	(25, 44)	8.09	(25, 45)	22.86	(26, 27)	28.28	(26, 45)	.62
(26, 46)	25.44	(27, 46)	30.13	(30, 31)	9.04	(30, 50)	32.70	(31, 32)	13.41
(31, 50)	-74.65	(31, 51)	-44.31	(32, 33)	15.75	(32, 51)	-66.44	(32, 52)	-51.12
(33, 34)	15.75	(33, 52)	-58.43	(33, 53)	-58.43	(34, 35)	13.41	(34, 53)	-51.12
(34, 54)	-66.44	(35, 36)	9.04	(35, 54)	-44.31	(35, 55)	-74.65	(36, 55)	32.70
(40, 41)	32.59	(40, 60)	47.00	(41, 42)	35.64	(41, 60)	30.56	(41, 61)	15.51
(42, 43)	37.33	(42, 61)	28.41	(42, 62)	21.00	(43, 44)	37.33	(43, 62)	25.29
(43, 63)	25.29	(44, 45)	35.64	(44, 63)	21.00	(44, 64)	28.41	(45, 46)	32.59
(45, 64)	15.51	(45, 65)	30.56	(46, 65)	47.00	(50, 51)	-7.94	(50, 70)	15.55
(51, 52)	-4.07	(51, 70)	-88.54	(51, 71)	-71.77	(52, 53)	-2.78	(52, 71)	-82.73
(52, 72)	-77.02	(53, 54)	-4.07	(53, 72)	-77.02	(53, 73)	-82.73	(54, 55)	-7.94
(54, 73)	-71.77	(54, 74)	-88.54	(55, 74)	15.55	(60, 61)	35.70	(60, 80)	58.73
(61, 62)	38.06	(61, 80)	34.16	(61, 81)	26.19	(62, 63)	-48.29	(62, 81)	32.47
(62, 82)	-116.12	(63, 64)	38.06	(63, 82)	-116.12	(63, 83)	32.47	(64, 65)	35.70
(64, 83)	26.19	(64, 84)	34.16	(65, 84)	58.73	(70, 71)	74.61	(71, 72)	76.01
(72, 73)	76.01	(73, 74)	74.61	(80, 81)	37.91	(81, 82)	-146.37	(82, 83)	-146.37
(83, 84)	37.91	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	67.48	(2,100)	25.46	(2,101)	21.53	(2,200)	-93.29	(3,101)	27.81
(3,102)	24.90	(3,201)	-116.04	(4,102)	29.06	(4,103)	27.37	(4,202)	-145.07
(5,103)	28.84	(5,104)	28.84	(5,203)	-171.77	(6,104)	27.37	(6,105)	29.06
(6,204)	-145.07	(7,105)	24.90	(7,106)	27.81	(7,205)	-116.04	(8,106)	21.53
(8,107)	25.46	(8,206)	-93.29	(9,107)	67.48	(10,100)	-59.64	(10,300)	72.29
(11,101)	-119.50	(11,300)	16.55	(11,301)	16.69	(12,102)	-137.10	(12,301)	18.62
(12,302)	19.30	(13,103)	-156.37	(13,302)	20.37	(13,303)	20.60	(14,104)	-156.37
(14,303)	20.60	(14,304)	20.37	(15,105)	-137.10	(15,304)	19.30	(15,305)	18.62
(16,106)	-119.50	(16,305)	16.69	(16,306)	16.55	(17,107)	-59.64	(17,306)	72.29
(20,200)	21.29	(21,200)	32.35	(21,201)	24.76	(21,400)	-78.51	(22,201)	32.97
(22,202)	27.70	(22,401)	-106.42	(23,202)	32.25	(23,203)	30.37	(23,402)	-138.02
(24,203)	30.37	(24,204)	32.25	(24,403)	-138.02	(25,204)	27.70	(25,205)	32.97
(25,404)	-106.42	(26,205)	24.76	(26,206)	32.35	(26,405)	-78.51	(27,206)	21.29

(30,300)	-68.75	(30,500)	75.26	(31,301)	-125.64	(31,500)	6.68	(31,501)	5.12
(32,302)	-130.48	(32,501)	3.70	(32,502)	6.14	(33,303)	-134.67	(33,502)	5.79
(33,503)	5.79	(34,304)	-130.48	(34,503)	6.14	(34,504)	3.70	(35,305)	-125.64
(35,504)	5.12	(35,505)	6.68	(36,306)	-68.75	(36,505)	75.26	(40,400)	22.20
(41,400)	35.13	(41,401)	25.35	(41,600)	-60.40	(42,401)	34.05	(42,402)	28.57
(42,601)	-83.71	(43,402)	31.64	(43,403)	31.64	(43,602)	-99.78	(44,403)	28.57
(44,404)	34.05	(44,603)	-83.71	(45,404)	25.35	(45,405)	35.13	(45,604)	-60.40
(46,405)	22.20	(50,500)	-58.11	(50,700)	75.32	(51,501)	-101.48	(51,700)	67.46
(51,701)	74.44	(52,502)	-99.45	(52,701)	70.38	(52,702)	72.71	(53,503)	-99.45

(53,702)	72.71	(53,703)	70.38	(54,504)	-101.48	(54,703)	74.44	(54,704)	67.46
(55,505)	-58.11	(55,704)	75.32	(60,600)	22.40	(61,600)	35.37	(61,601)	25.37
(61,800)	-39.10	(62,601)	32.57	(62,602)	15.99	(62,801)	-52.35	(63,602)	15.99
(63,603)	32.57	(63,802)	-52.35	(64,603)	25.37	(64,604)	35.37	(64,803)	-39.10
(65,604)	22.40	(70,700)	-40.57	(71,701)	-37.80	(72,702)	-36.94	(73,703)	-37.80
(74,704)	-40.57	(80,800)	22.67	(81,800)	34.08	(81,801)	25.98	(82,801)	-140.62
(82,802)	-140.62	(83,802)	25.98	(83,803)	34.08	(84,803)	22.67	(	

BOTTOM STRUTS

(100,101)	20.87	(100,200)	-29.36	(100,300)	54.12	(101,102)	20.79	(101,200)	10.20
(101,201)	-24.16	(101,300)	-36.84	(101,301)	-9.11	(102,103)	23.93	(102,201)	6.38
(102,202)	-14.30	(102,301)	-40.86	(102,302)	-15.43	(103,104)	25.05	(103,202)	1.20
(103,203)	-5.78	(103,302)	-31.09	(103,303)	-22.28	(104,105)	23.93	(104,203)	-5.78
(104,204)	1.20	(104,303)	-22.28	(104,304)	-31.09	(105,106)	20.79	(105,204)	-14.30
(105,205)	6.38	(105,304)	-15.43	(105,305)	-40.86	(106,107)	20.87	(106,205)	-24.16
(106,206)	10.20	(106,305)	-9.11	(106,306)	-36.84	(107,206)	-29.36	(107,306)	54.12
(200,201)	26.23	(200,400)	-10.66	(201,202)	29.94	(201,400)	20.75	(201,401)	-1.78
(202,203)	31.97	(202,401)	17.33	(202,402)	6.14	(203,204)	31.97	(203,402)	12.55
(203,403)	12.55	(204,205)	29.94	(204,403)	6.14	(204,404)	17.33	(205,206)	26.23
(205,404)	-1.78	(205,405)	20.75	(206,405)	-10.66	(300,301)	22.26	(300,500)	40.46
(301,302)	10.90	(301,500)	-35.37	(301,501)	-27.75	(302,303)	13.16	(302,501)	-51.64
(302,502)	-33.92	(303,304)	13.16	(303,502)	-41.42	(303,503)	-41.42	(304,305)	10.90
(304,503)	-33.92	(304,504)	-51.64	(305,306)	22.26	(305,504)	-27.75	(305,505)	-35.37
(306,505)	40.46	(400,401)	32.19	(400,600)	8.01	(401,402)	35.00	(401,600)	27.95
(401,601)	15.12	(402,403)	36.01	(402,601)	25.10	(402,602)	20.83	(403,404)	35.00
(403,602)	20.83	(403,603)	25.10	(404,405)	32.19	(404,603)	15.12	(404,604)	27.95
(405,604)	8.01	(500,501)	48.26	(500,700)	23.56	(501,502)	23.92	(501,700)	-15.70
(501,701)	13.97	(502,503)	24.73	(502,701)	-6.10	(502,702)	3.95	(503,504)	23.92
(503,702)	3.95	(503,703)	-6.10	(504,505)	48.26	(504,703)	13.97	(504,704)	-15.70
(505,704)	23.56	(600,601)	35.87	(600,800)	21.50	(601,602)	37.81	(601,800)	32.57
(601,801)	26.43	(602,603)	37.81	(602,801)	-39.36	(602,802)	-39.36	(603,604)	35.87
(603,802)	26.43	(603,803)	32.57	(604,803)	21.50	(700,701)	74.80	(701,702)	76.03
(702,703)	76.03	(703,704)	74.80	(800,801)	38.27	(801,802)	-100.95	(802,803)	38.27

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 10:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(1, 2)	24.35	(1, 10)	70.86	(1, 20)	39.16	(2, 3)	30.24	(2, 10)	-9.36
	(2, 11)	26.23	(2, 20)	32.85	(2, 21)	8.14	(3, 4)	34.78	(3, 11)	-.44
	(3, 12)	23.60	(3, 21)	31.69	(3, 22)	15.21	(4, 5)	37.24	(4, 12)	7.44
	(4, 13)	19.53	(4, 22)	29.46	(4, 23)	21.23	(5, 6)	37.24	(5, 13)	14.13
	(5, 14)	14.13	(5, 23)	25.98	(5, 24)	25.98	(6, 7)	34.78	(6, 14)	19.53
	(6, 15)	7.44	(6, 24)	21.23	(6, 25)	29.46	(7, 8)	30.24	(7, 15)	23.60
	(7, 16)	-.44	(7, 25)	15.21	(7, 26)	31.69	(8, 9)	24.35	(8, 16)	26.23
	(8, 17)	-9.36	(8, 26)	8.14	(8, 27)	32.85	(9, 17)	70.86	(9, 27)	39.16
	(10, 11)	25.08	(10, 30)	63.90	(11, 12)	30.51	(11, 30)	-19.90	(11, 31)	15.52
	(12, 13)	34.14	(12, 31)	-10.72	(12, 32)	10.84	(13, 14)	35.43	(13, 32)	-2.36
	(13, 33)	4.90	(14, 15)	34.14	(14, 33)	4.90	(14, 34)	-2.36	(15, 16)	30.51
	(15, 34)	10.84	(15, 35)	-10.72	(16, 17)	25.08	(16, 35)	15.52	(16, 36)	-19.90
	(17, 36)	63.90	(20, 21)	29.04	(20, 40)	53.26	(21, 22)	34.23	(21, 40)	36.22
	(21, 41)	21.72	(22, 23)	37.73	(22, 41)	35.64	(22, 42)	26.98	(23, 24)	38.97
	(23, 42)	33.92	(23, 43)	22.06	(24, 25)	37.73	(24, 43)	22.06	(24, 44)	33.92
	(25, 26)	34.23	(25, 44)	26.98	(25, 45)	35.64	(26, 27)	29.04	(26, 45)	21.72
	(26, 46)	36.22	(27, 46)	53.26	(30, 31)	24.49	(30, 50)	53.37	(31, 32)	29.23
	(31, 50)	-32.43	(31, 51)	-.28	(32, 33)	31.80	(32, 51)	-22.94	(32, 52)	-6.69
	(33, 34)	31.80	(33, 52)	-14.28	(33, 53)	-14.28	(34, 35)	29.23	(34, 53)	-6.69
	(34, 54)	-22.94	(35, 36)	24.49	(35, 54)	-.28	(35, 55)	-32.43	(36, 55)	53.37
	(40, 41)	32.83	(40, 60)	63.90	(41, 42)	37.20	(41, 60)	38.35	(41, 61)	31.21
	(42, 43)	-86.16	(42, 61)	38.11	(42, 62)	34.59	(43, 44)	-86.16	(43, 62)	-136.82
	(43, 63)	-136.82	(44, 45)	37.20	(44, 63)	34.59	(44, 64)	38.11	(45, 46)	32.83
	(45, 64)	31.21	(45, 65)	38.35	(46, 65)	63.90	(50, 51)	21.95	(50, 70)	39.48
	(51, 52)	25.84	(51, 70)	-46.75	(51, 71)	-21.45	(52, 53)	27.21	(52, 71)	-37.55
	(52, 72)	-29.03	(53, 54)	25.84	(53, 72)	-29.03	(53, 73)	-37.55	(54, 55)	21.95
	(54, 73)	-21.45	(54, 74)	-46.75	(55, 74)	39.48	(60, 61)	35.82	(60, 80)	70.84
	(61, 62)	39.19	(61, 80)	39.48	(61, 81)	36.96	(62, 63)	-163.28	(62, 81)	39.48
	(62, 82)	-23.47	(63, 64)	39.19	(63, 82)	-23.47	(63, 83)	39.48	(64, 65)	35.82
	(64, 83)	36.96	(64, 84)	39.48	(65, 84)	70.84	(70, 71)	73.70	(71, 72)	75.91
	(72, 73)	75.91	(73, 74)	73.70	(80, 81)	72.69	(81, 82)	67.78	(82, 83)	67.78
	(83, 84)	72.69	(							
DIAGONAL STRUTS										
	(1,100)	52.11	(2,100)	34.35	(2,101)	17.61	(2,200)	-48.40	(3,101)	35.29
	(3,102)	22.64	(3,201)	-68.72	(4,102)	34.12	(4,103)	27.34	(4,202)	-92.16
	(5,103)	31.32	(5,104)	31.32	(5,203)	-108.45	(6,104)	27.34	(6,105)	34.12
	(6,204)	-92.16	(7,105)	22.64	(7,106)	35.29	(7,205)	-68.72	(8,106)	17.61
	(8,107)	34.35	(8,206)	-48.40	(9,107)	52.11	(10,100)	-27.37	(10,300)	61.45
	(11,101)	-88.52	(11,300)	32.08	(11,301)	23.51	(12,102)	-115.33	(12,301)	33.32
	(12,302)	27.66	(13,103)	-145.03	(13,302)	32.84	(13,303)	30.86	(14,104)	-145.03
	(14,303)	30.86	(14,304)	32.84	(15,105)	-115.33	(15,304)	27.66	(15,305)	33.32
	(16,106)	-88.52	(16,305)	23.51	(16,306)	32.08	(17,107)	-27.37	(17,306)	61.45
	(20,200)	10.31	(21,200)	36.45	(21,201)	15.48	(21,400)	-30.33	(22,201)	34.93
	(22,202)	20.99	(22,401)	-46.35	(23,202)	31.37	(23,203)	26.46	(23,402)	-60.51
	(24,203)	26.46	(24,204)	31.37	(24,403)	-60.51	(25,204)	20.99	(25,205)	34.93
	(25,404)	-46.35	(26,205)	15.48	(26,206)	36.45	(26,405)	-30.33	(27,206)	10.31

(30,300)	-65.94	(30,500)	69.36	(31,301)	-126.67	(31,500)	27.84	(31,501)	25.75
(32,302)	-151.13	(32,501)	29.46	(32,502)	28.37	(33,303)	-173.37	(33,502)	29.66
(33,503)	29.66	(34,304)	-151.13	(34,503)	28.37	(34,504)	29.46	(35,305)	-126.67
(35,504)	25.75	(35,505)	27.84	(36,306)	-65.94	(36,505)	69.36	(40,400)	8.23
(41,400)	35.92	(41,401)	13.53	(41,600)	-13.54	(42,401)	31.90	(42,402)	19.68
(42,601)	-23.50	(43,402)	-54.71	(43,403)	-54.71	(43,602)	-155.06	(44,403)	19.68
(44,404)	31.90	(44,603)	-23.50	(45,404)	13.53	(45,405)	35.92	(45,604)	-13.54
(46,405)	8.23	(50,500)	-94.65	(50,700)	74.44	(51,501)	-142.90	(51,700)	21.59
(51,701)	24.27	(52,502)	-157.32	(52,701)	24.07	(52,702)	24.94	(53,503)	-157.32
(53,702)	24.94	(53,703)	24.07	(54,504)	-142.90	(54,703)	24.27	(54,704)	21.59
(55,505)	-94.65	(55,704)	74.44	(60,600)	6.75	(61,600)	33.28	(61,601)	12.56
(61,800)	1.40	(62,601)	27.10	(62,602)	-163.31	(62,801)	-3.67	(63,602)	-163.31
(63,603)	27.10	(63,802)	-3.67	(64,603)	12.56	(64,604)	33.28	(64,803)	1.40
(65,604)	6.75	(70,700)	-102.10	(71,701)	-108.68	(72,702)	-112.13	(73,703)	-108.68
(74,704)	-102.10	(80,800)	6.62	(81,800)	29.30	(81,801)	13.35	(82,801)	-.37
(82,802)	-.37	(83,802)	13.35	(83,803)	29.30	(84,803)	6.62	(	

BOTTOM STRUTS

(100,101)	25.17	(100,200)	-2.02	(100,300)	68.21	(101,102)	30.74	(101,200)	30.04
(101,201)	6.27	(101,300)	-12.37	(101,301)	20.78	(102,103)	34.53	(102,201)	28.11
(102,202)	13.79	(102,301)	-3.97	(102,302)	16.78	(103,104)	35.87	(103,202)	24.80
(103,203)	20.01	(103,302)	4.33	(103,303)	11.31	(104,105)	34.53	(104,203)	20.01
(104,204)	24.80	(104,303)	11.31	(104,304)	4.33	(105,106)	30.74	(105,204)	13.79
(105,205)	28.11	(105,304)	16.78	(105,305)	-3.97	(106,107)	25.17	(106,205)	6.27
(106,206)	30.04	(106,305)	20.78	(106,306)	-12.37	(107,206)	-2.02	(107,306)	68.21
(200,201)	30.26	(200,400)	14.45	(201,202)	35.09	(201,400)	34.79	(201,401)	21.23
(202,203)	37.75	(202,401)	33.48	(202,402)	26.67	(203,204)	37.75	(203,402)	30.77
(203,403)	30.77	(204,205)	35.09	(204,403)	26.67	(204,404)	33.48	(205,206)	30.26
(205,404)	21.23	(205,405)	34.79	(206,405)	14.45	(300,301)	25.02	(300,500)	59.08
(301,302)	29.26	(301,500)	-24.30	(301,501)	5.92	(302,303)	31.86	(302,501)	-16.57
(302,502)	-.12	(303,304)	31.86	(303,502)	-7.62	(303,503)	-7.62	(304,305)	29.26
(304,503)	-.12	(304,504)	-16.57	(305,306)	25.02	(305,504)	5.92	(305,505)	-24.30
(306,505)	59.08	(400,401)	34.16	(400,600)	26.75	(401,402)	38.03	(401,600)	37.71
(401,601)	31.26	(402,403)	36.08	(402,601)	36.80	(402,602)	-83.03	(403,404)	38.03
(403,602)	-83.03	(403,603)	36.80	(404,405)	34.16	(404,603)	31.26	(404,604)	37.71
(405,604)	26.75	(500,501)	22.71	(500,700)	46.04	(501,502)	25.57	(501,700)	-31.58
(501,701)	-6.52	(502,503)	26.88	(502,701)	-21.99	(502,702)	-13.64	(503,504)	25.57
(503,702)	-13.64	(503,703)	-21.99	(504,505)	22.71	(504,703)	-6.52	(504,704)	-31.58
(505,704)	46.04	(600,601)	37.12	(600,800)	34.66	(601,602)	39.83	(601,800)	39.47
(601,801)	37.38	(602,603)	39.83	(602,801)	-132.94	(602,802)	-132.94	(603,604)	37.12
(603,802)	37.38	(603,803)	39.47	(604,803)	34.66	(700,701)	73.86	(701,702)	75.93
(702,703)	75.93	(703,704)	73.86	(800,801)	39.16	(801,802)	-9.89	(802,803)	39.16

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 11:00 PM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(1, 2)	23.60	(1, 10)	75.63	(1, 20)	58.49	(2, 3)	30.94	(2, 10)	14.73
	(2, 11)	36.62	(2, 20)	37.82	(2, 21)	26.12	(3, 4)	36.48	(3, 11)	21.03
	(3, 12)	35.71	(3, 21)	38.69	(3, 22)	31.06	(4, 5)	39.48	(4, 12)	26.41
	(4, 13)	33.80	(4, 22)	38.52	(4, 23)	34.73	(5, 6)	39.48	(5, 13)	30.70
	(5, 14)	30.70	(5, 23)	-1.70	(5, 24)	-1.70	(6, 7)	36.48	(6, 14)	33.80
	(6, 15)	26.41	(6, 24)	34.73	(6, 25)	38.52	(7, 8)	30.94	(7, 15)	35.71
	(7, 16)	21.03	(7, 25)	31.06	(7, 26)	38.69	(8, 9)	23.60	(8, 16)	36.62
	(8, 17)	14.73	(8, 26)	26.12	(8, 27)	37.82	(9, 17)	75.63	(9, 27)	58.49
	(10, 11)	26.42	(10, 30)	73.24	(11, 12)	33.00	(11, 30)	7.86	(11, 31)	31.76
	(12, 13)	37.38	(12, 31)	14.81	(12, 32)	29.30	(13, 14)	38.92	(13, 32)	20.75
	(13, 33)	25.61	(14, 15)	37.38	(14, 33)	25.61	(14, 34)	20.75	(15, 16)	33.00
	(15, 34)	29.30	(15, 35)	14.81	(16, 17)	26.42	(16, 35)	31.76	(16, 36)	7.86
	(17, 36)	73.24	(20, 21)	28.09	(20, 40)	67.60	(21, 22)	34.59	(21, 40)	38.43
	(21, 41)	34.22	(22, 23)	38.92	(22, 41)	39.55	(22, 42)	37.24	(23, 24)	-100.38
	(23, 42)	39.84	(23, 43)	-148.28	(24, 25)	38.92	(24, 43)	-148.28	(24, 44)	39.84
	(25, 26)	34.59	(25, 44)	37.24	(25, 45)	39.55	(26, 27)	28.09	(26, 45)	34.22
	(26, 46)	38.43	(27, 46)	67.60	(30, 31)	28.53	(30, 50)	67.51	(31, 32)	34.15
	(31, 50)	.05	(31, 51)	23.22	(32, 33)	37.18	(32, 51)	7.31	(32, 52)	18.99
	(33, 34)	37.18	(33, 52)	13.66	(33, 53)	13.66	(34, 35)	34.15	(34, 53)	18.99
	(34, 54)	7.31	(35, 36)	28.53	(35, 54)	23.22	(35, 55)	.05	(36, 55)	67.51
	(40, 41)	31.90	(40, 60)	73.22	(41, 42)	37.35	(41, 60)	38.05	(41, 61)	38.74
	(42, 43)	-100.58	(42, 61)	39.49	(42, 62)	39.98	(43, 44)	-100.58	(43, 62)	2.43
	(43, 63)	2.43	(44, 45)	37.35	(44, 63)	39.98	(44, 64)	39.49	(45, 46)	31.90
	(45, 64)	38.74	(45, 65)	38.05	(46, 65)	73.22	(50, 51)	29.68	(50, 70)	58.46
	(51, 52)	34.09	(51, 70)	-8.78	(51, 71)	11.16	(52, 53)	35.64	(52, 71)	-1.26
	(52, 72)	5.42	(53, 54)	34.09	(53, 72)	5.42	(53, 73)	-1.26	(54, 55)	29.68
	(54, 73)	11.16	(54, 74)	-8.78	(55, 74)	58.46	(60, 61)	34.95	(60, 80)	75.64
	(61, 62)	39.20	(61, 80)	36.86	(61, 81)	39.95	(62, 63)	33.55	(62, 81)	38.64
	(62, 82)	38.47	(63, 64)	39.20	(63, 82)	38.47	(63, 83)	38.64	(64, 65)	34.95
	(64, 83)	39.95	(64, 84)	36.86	(65, 84)	75.64	(70, 71)	72.99	(71, 72)	75.83
	(72, 73)	75.83	(73, 74)	72.99	(80, 81)	72.99	(81, 82)	75.77	(82, 83)	75.77
	(83, 84)	72.99	(							
DIAGONAL STRUTS										
	(1,100)	28.58	(2,100)	37.41	(2,101)	1.85	(2,200)	-8.27	(3,101)	35.95
	(3,102)	9.97	(3,201)	-19.18	(4,102)	31.89	(4,103)	18.11	(4,202)	-29.29
	(5,103)	25.69	(5,104)	25.69	(5,203)	-34.07	(6,104)	18.11	(6,105)	31.89
	(6,204)	-29.29	(7,105)	9.97	(7,106)	35.95	(7,205)	-19.18	(8,106)	1.85
	(8,107)	37.41	(8,206)	-8.27	(9,107)	28.58	(10,100)	14.65	(10,300)	43.00
	(11,101)	-36.84	(11,300)	36.74	(11,301)	13.94	(12,102)	-52.46	(12,301)	35.57
	(12,302)	20.95	(13,103)	-66.12	(13,302)	32.25	(13,303)	27.20	(14,104)	-66.12
	(14,303)	27.20	(14,304)	32.25	(15,105)	-52.46	(15,304)	20.95	(15,305)	35.57
	(16,106)	-36.84	(16,305)	13.94	(16,306)	36.74	(17,107)	14.65	(17,306)	43.00
	(20,200)	-10.72	(21,200)	36.66	(21,201)	-2.43	(21,400)	4.46	(22,201)	32.33
	(22,202)	6.72	(22,401)	-2.85	(23,202)	25.27	(23,203)	-82.07	(23,402)	-8.01
	(24,203)	-82.07	(24,204)	25.27	(24,403)	-8.01	(25,204)	6.72	(25,205)	32.33
	(25,404)	-2.85	(26,205)	-2.43	(26,206)	36.66	(26,405)	4.46	(27,206)	-10.72

(30,300)	-18.35	(30,500)	56.35	(31,301)	-75.61	(31,500)	35.80	(31,501)	23.90
(32,302)	-96.07	(32,501)	35.32	(32,502)	29.05	(33,303)	-109.43	(33,502)	32.95
(33,503)	32.95	(34,304)	-96.07	(34,503)	29.05	(34,504)	35.32	(35,305)	-75.61
(35,504)	23.90	(35,505)	35.80	(36,306)	-18.35	(36,505)	56.35	(40,400)	.-14.26
(41,400)	33.65	(41,401)	-5.25	(41,600)	15.34	(42,401)	26.41	(42,402)	5.44
(42,601)	10.80	(43,402)	-176.45	(43,403)	-176.45	(43,602)	-52.44	(44,403)	5.44
(44,404)	26.41	(44,603)	10.80	(45,404)	-5.25	(45,405)	33.65	(45,604)	15.34
(46,405)	-14.26	(50,500)	-59.72	(50,700)	66.90	(51,501)	-117.57	(51,700)	34.04
(51,701)	29.87	(52,502)	-136.71	(52,701)	34.25	(52,702)	32.80	(53,503)	-136.71

(53,702)	32.80	(53,703)	34.25	(54,504)	-117.57	(54,703)	29.87	(54,704)	34.04
(55,505)	-59.72	(55,704)	66.90	(60,600)	-15.93	(61,600)	28.85	(61,601)	-5.37
(61,800)	24.49	(62,601)	18.92	(62,602)	-6.21	(62,801)	22.22	(63,602)	-6.21
(63,603)	18.92	(63,802)	22.22	(64,603)	-5.37	(64,604)	28.85	(64,803)	24.49
(65,604)	-15.93	(70,700)	-101.99	(71,701)	-136.20	(72,702)	-151.31	(73,703)	-136.20
(74,704)	-101.99	(80,800)	-14.82	(81,800)	22.69	(81,801)	-2.80	(82,801)	10.24
(82,802)	10.24	(83,802)	-2.80	(83,803)	22.69	(84,803)	-14.82	(	

BOTTOM STRUTS

(100,101)	26.02	(100,200)	19.88	(100,300)	67.78	(101,102)	33.05	(101,200)	37.75
(101,201)	25.88	(101,300)	13.39	(101,301)	34.61	(102,103)	37.72	(102,201)	37.91
(102,202)	30.75	(102,301)	19.87	(102,302)	32.86	(103,104)	39.36	(103,202)	36.83
(103,203)	34.46	(103,302)	25.41	(103,303)	29.79	(104,105)	37.72	(104,203)	34.46
(104,204)	36.83	(104,303)	29.79	(104,304)	25.41	(105,106)	33.05	(105,204)	30.75
(105,205)	37.91	(105,304)	32.86	(105,305)	19.87	(106,107)	26.02	(106,205)	25.88
(106,206)	37.75	(106,305)	34.61	(106,306)	13.39	(107,206)	19.88	(107,306)	67.78
(200,201)	30.44	(200,400)	30.26	(201,202)	36.49	(201,400)	38.88	(201,401)	34.30
(202,203)	39.77	(202,401)	39.51	(202,402)	37.29	(203,204)	39.77	(203,402)	-103.98
(203,403)	-103.98	(204,205)	36.49	(204,403)	37.29	(204,404)	39.51	(205,206)	30.44
(205,404)	34.30	(205,405)	38.88	(206,405)	30.26	(300,301)	28.65	(300,500)	71.00
(301,302)	34.51	(301,500)	5.45	(301,501)	27.49	(302,303)	37.65	(302,501)	12.48
(302,502)	23.72	(303,304)	37.65	(303,502)	18.68	(303,503)	18.68	(304,305)	34.51
(304,503)	23.72	(304,504)	12.48	(305,306)	28.65	(305,504)	27.49	(305,505)	5.45
(306,505)	71.00	(400,401)	34.10	(400,600)	36.67	(401,402)	38.92	(401,600)	38.93
(401,601)	39.05	(402,403)	-145.98	(402,601)	40.09	(402,602)	-56.54	(403,404)	38.92
(403,602)	-56.54	(403,603)	40.09	(404,405)	34.10	(404,603)	39.05	(404,604)	38.93
(405,604)	36.67	(500,501)	30.12	(500,700)	62.99	(501,502)	34.56	(501,700)	-3.79
(501,701)	16.15	(502,503)	36.11	(502,701)	3.84	(502,702)	10.54	(503,504)	34.56
(503,702)	10.54	(503,703)	3.84	(504,505)	30.12	(504,703)	16.15	(504,704)	-3.79
(505,704)	62.99	(600,601)	36.91	(600,800)	39.46	(601,602)	40.27	(601,800)	37.89
(601,801)	39.99	(602,603)	40.27	(602,801)	34.25	(602,802)	34.25	(603,604)	36.91
(603,802)	39.99	(603,803)	37.89	(604,803)	39.46	(700,701)	33.78	(701,702)	37.00
(702,703)	37.00	(703,704)	33.78	(800,801)	38.85	(801,802)	39.60	(802,803)	38.85

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 11:25 PM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	23.15	(1, 10)	75.71	(1, 20)	64.63	(2, 3)	30.95	(2, 10)	22.23
(2, 11)	38.30	(2, 20)	37.60	(2, 21)	31.46	(3, 4)	36.81	(3, 11)	27.63
(3, 12)	38.49	(3, 21)	39.14	(3, 22)	35.25	(4, 5)	32.16	(4, 12)	32.04
(4, 13)	37.50	(4, 22)	39.88	(4, 23)	37.94	(5, 6)	32.16	(5, 13)	35.35
(5, 14)	35.35	(5, 23)	-94.99	(5, 24)	-94.99	(6, 7)	36.81	(6, 14)	37.50
(6, 15)	32.04	(6, 24)	37.94	(6, 25)	39.88	(7, 8)	30.95	(7, 15)	38.49
(7, 16)	27.63	(7, 25)	35.25	(7, 26)	39.14	(8, 9)	23.15	(8, 16)	38.30
(8, 17)	22.23	(8, 26)	31.46	(8, 27)	37.60	(9, 17)	75.71	(9, 27)	64.63
(10, 11)	26.58	(10, 30)	75.27	(11, 12)	33.53	(11, 30)	16.87	(11, 31)	35.79
(12, 13)	38.13	(12, 31)	22.62	(12, 32)	34.12	(13, 14)	39.75	(13, 32)	27.52
(13, 33)	31.38	(14, 15)	38.13	(14, 33)	31.38	(14, 34)	27.52	(15, 16)	33.53
(15, 34)	34.12	(15, 35)	22.62	(16, 17)	26.58	(16, 35)	35.79	(16, 36)	16.87
(17, 36)	75.27	(20, 21)	27.62	(20, 40)	71.51	(21, 22)	34.51	(21, 40)	37.01
(21, 41)	37.38	(22, 23)	39.07	(22, 41)	39.02	(22, 42)	39.37	(23, 24)	-143.56
(23, 42)	40.17	(23, 43)	-100.31	(24, 25)	39.07	(24, 43)	-100.31	(24, 44)	40.17
(25, 26)	34.51	(25, 44)	39.37	(25, 45)	39.02	(26, 27)	27.62	(26, 45)	37.38
(26, 46)	37.01	(27, 46)	71.51	(30, 31)	29.32	(30, 50)	71.56	(31, 32)	35.20
(31, 50)	10.64	(31, 51)	29.79	(32, 33)	38.37	(32, 51)	16.84	(32, 52)	26.50
(33, 34)	38.37	(33, 52)	22.16	(33, 53)	22.16	(34, 35)	35.20	(34, 53)	26.50
(34, 54)	16.84	(35, 36)	29.32	(35, 54)	29.79	(35, 55)	10.64	(36, 55)	71.56
(40, 41)	31.41	(40, 60)	75.31	(41, 42)	37.19	(41, 60)	35.59	(41, 61)	39.79
(42, 43)	3.94	(42, 61)	37.95	(42, 62)	40.14	(43, 44)	3.94	(43, 62)	32.05
(43, 63)	32.05	(44, 45)	37.19	(44, 63)	40.14	(44, 64)	37.95	(45, 46)	31.41
(45, 64)	39.79	(45, 65)	35.59	(46, 65)	75.31	(50, 51)	31.20	(50, 70)	64.59
(51, 52)	35.81	(51, 70)	3.39	(51, 71)	20.22	(52, 53)	37.43	(52, 71)	9.83
(52, 72)	15.47	(53, 54)	35.81	(53, 72)	15.47	(53, 73)	9.83	(54, 55)	31.20
(54, 73)	20.22	(54, 74)	3.39	(55, 74)	64.59	(60, 61)	34.43	(60, 80)	75.70
(61, 62)	38.94	(61, 80)	33.39	(61, 81)	38.87	(62, 63)	39.22	(62, 81)	35.93
(62, 82)	37.64	(63, 64)	38.94	(63, 82)	37.64	(63, 83)	35.93	(64, 65)	34.43
(64, 83)	38.87	(64, 84)	33.39	(65, 84)	75.70	(70, 71)	72.79	(71, 72)	75.81
(72, 73)	75.81	(73, 74)	72.79	(80, 81)	72.79	(81, 82)	75.80	(82, 83)	75.80
(83, 84)	72.79	(							

DIAGONAL STRUTS

(1,100)	3.49	(2,100)	37.65	(2,101)	-7.23	(2,200)	4.38	(3,101)	35.19
(3,102)	2.62	(3,201)	-3.82	(4,102)	29.76	(4,103)	12.57	(4,202)	-10.89
(5,103)	21.94	(5,104)	21.94	(5,203)	-99.47	(6,104)	12.57	(6,105)	29.76
(6,204)	-10.89	(7,105)	2.62	(7,106)	35.19	(7,205)	-3.82	(8,106)	-7.23
(8,107)	37.65	(8,206)	4.38	(9,107)	3.49	(10,100)	13.93	(10,300)	25.90
(11,101)	-18.79	(11,300)	37.29	(11,301)	7.45	(12,102)	-29.97	(12,301)	34.99
(12,302)	15.96	(13,103)	-38.59	(13,302)	30.31	(13,303)	23.77	(14,104)	-38.59
(14,303)	23.77	(14,304)	30.31	(15,105)	-29.97	(15,304)	15.96	(15,305)	34.99
(16,106)	-18.79	(16,305)	7.45	(16,306)	37.29	(17,107)	13.93	(17,306)	25.90
(20,200)	-21.91	(21,200)	35.97	(21,201)	-11.91	(21,400)	14.81	(22,201)	30.49
(22,202)	-.69	(22,401)	9.38	(23,202)	21.86	(23,203)	-140.62	(23,402)	5.74
(24,203)	-140.62	(24,204)	21.86	(24,403)	5.74	(25,204)	-.69	(25,205)	30.49
(25,404)	9.38	(26,205)	-11.91	(26,206)	35.97	(26,405)	14.81	(27,206)	-21.91

(30,300)	-4.67	(30,500)	42.20	(31,301)	-50.39	(31,500)	36.92	(31,501)	19.87
(32,302)	-65.08	(32,501)	35.19	(32,502)	26.33	(33,303)	-73.47	(33,502)	31.55
(33,503)	31.55	(34,304)	-65.08	(34,503)	26.33	(34,504)	35.19	(35,305)	-50.39
(35,504)	19.87	(35,505)	36.92	(36,306)	-4.67	(36,505)	42.20	(40,400)	-25.57
(41,400)	32.21	(41,401)	-14.37	(41,600)	23.72	(42,401)	23.62	(42,402)	-1.31
(42,601)	20.46	(43,402)	-45.56	(43,403)	-45.56	(43,602)	6.65	(44,403)	-1.31
(44,404)	23.62	(44,603)	20.46	(45,404)	-14.37	(45,405)	32.21	(45,604)	23.72
(46,405)	-25.57	(50,500)	-36.95	(50,700)	47.75	(51,501)	-88.99	(51,700)	36.23
(51,701)	28.75	(52,502)	-104.08	(52,701)	35.37	(52,702)	32.81	(53,503)	-104.08

(53,702)	32.81	(53,703)	35.37	(54,504)	-88.99	(54,703)	28.75	(54,704)	36.23
(55,505)	-36.95	(55,704)	47.75	(60,600)	-26.63	(61,600)	26.68	(61,601)	-13.59
(61,800)	30.58	(62,601)	15.23	(62,602)	-1.45	(62,801)	29.04	(63,602)	-1.45
(63,603)	15.23	(63,802)	29.04	(64,603)	-13.59	(64,604)	·26.68	(64,803)	30.58
(65,604)	-26.63	(70,700)	-79.44	(71,701)	-118.09	(72,702)	-129.49	(73,703)	-118.09
(74,704)	-79.44	(80,800)	-24.35	(81,800)	19.79	(81,801)	-9.63	(82,801)	5.89
(82,802)	5.89	(83,802)	-9.63	(83,803)	19.79	(84,803)	-24.35	(	

BOTTOM STRUTS

(100,101)	25.87	(100,200)	26.48	(100,300)	42.84	(101,102)	33.41	(101,200)	38.24
(101,201)	31.32	(101,300)	21.58	(101,301)	37.65	(102,103)	38.37	(102,201)	39.32
(102,202)	35.14	(102,301)	27.00	(102,302)	36.85	(103,104)	40.11	(103,202)	39.20
(103,203)	-3.25	(103,302)	31.46	(103,303)	34.79	(104,105)	38.37	(104,203)	-3.25
(104,204)	39.20	(104,303)	34.79	(104,304)	31.46	(105,106)	33.41	(105,204)	35.14
(105,205)	39.32	(105,304)	36.85	(105,305)	27.00	(106,107)	25.87	(106,205)	31.32
(106,206)	38.24	(106,305)	37.65	(106,306)	21.58	(107,206)	26.48	(107,306)	42.84
(200,201)	30.21	(200,400)	34.43	(201,202)	36.66	(201,400)	38.25	(201,401)	37.58
(202,203)	40.14	(202,401)	39.89	(202,402)	39.59	(203,204)	40.14	(203,402)	-145.71
(203,403)	-145.71	(204,205)	36.66	(204,403)	39.59	(204,404)	39.89	(205,206)	30.21
(205,404)	37.58	(205,405)	38.25	(206,405)	34.43	(300,301)	29.26	(300,500)	42.18
(301,302)	35.45	(301,500)	15.17	(301,501)	33.04	(302,303)	38.77	(302,501)	21.24
(302,502)	30.28	(303,304)	38.77	(303,502)	26.30	(303,503)	26.30	(304,305)	35.45
(304,503)	30.28	(304,504)	21.24	(305,306)	29.26	(305,504)	33.04	(305,505)	15.17
(306,505)	42.18	(400,401)	33.82	(400,600)	38.67	(401,402)	38.94	(401,600)	37.04
(401,601)	39.94	(402,403)	-50.18	(402,601)	39.11	(402,602)	17.86	(403,404)	38.94
(403,602)	17.86	(403,603)	39.11	(404,405)	33.82	(404,603)	39.94	(404,604)	37.04
(405,604)	38.67	(500,501)	31.53	(500,700)	36.58	(501,502)	36.22	(501,700)	7.69
(501,701)	24.36	(502,503)	37.87	(502,701)	14.16	(502,702)	19.77	(503,504)	36.22
(503,702)	19.77	(503,703)	14.16	(504,505)	31.53	(504,703)	24.36	(504,704)	7.69
(505,704)	36.58	(600,601)	36.58	(600,800)	39.45	(601,602)	40.13	(601,800)	35.17
(601,801)	39.07	(602,603)	40.13	(602,801)	36.63	(602,802)	36.63	(603,604)	36.58
(603,802)	39.07	(603,803)	35.17	(604,803)	39.45	(700,701)	33.29	(701,702)	36.49
(702,703)	36.49	(703,704)	33.29	(800,801)	38.42	(801,802)	40.05	(802,803)	38.42

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 12:00 PM (MIDNIGHT)

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	-107.71	(1, 10)	-94.76	(1, 20)	-97.19	(2, 3)	-105.52	(2, 10)	-107.89
(2, 11)	-103.54	(2, 20)	-103.76	(2, 21)	-105.34	(3, 4)	-103.94	(3, 11)	-106.38
(3, 12)	-103.48	(3, 21)	-103.34	(3, 22)	-104.32	(4, 5)	-105.45	(4, 12)	-105.18
(4, 13)	-103.73	(4, 22)	-103.13	(4, 23)	-103.62	(5, 6)	-105.45	(5, 13)	-104.29
(5, 14)	-104.29	(5, 23)	-152.63	(5, 24)	-152.63	(6, 7)	-103.94	(6, 14)	-103.73
(6, 15)	-105.18	(6, 24)	-103.62	(6, 25)	-103.13	(7, 8)	-105.52	(7, 15)	-103.48
(7, 16)	-106.38	(7, 25)	-104.32	(7, 26)	-103.34	(8, 9)	-107.71	(8, 16)	-103.54
(8, 17)	-107.89	(8, 26)	-105.34	(8, 27)	-103.76	(9, 17)	-94.76	(9, 27)	-97.19
(10, 11)	-106.73	(10, 30)	-94.84	(11, 12)	-104.82	(11, 30)	-109.43	(11, 31)	-104.18
(12, 13)	-103.58	(12, 31)	-107.78	(12, 32)	-104.62	(13, 14)	-103.15	(13, 32)	-106.40
(13, 33)	-105.35	(14, 15)	-103.58	(14, 33)	-105.35	(14, 34)	-106.40	(15, 16)	-104.82
(15, 34)	-104.62	(15, 35)	-107.78	(16, 17)	-106.73	(16, 35)	-104.18	(16, 36)	-109.43
(17, 36)	-94.84	(20, 21)	-106.45	(20, 40)	-95.64	(21, 22)	-104.56	(21, 40)	-103.93
(21, 41)	-103.77	(22, 23)	-103.34	(22, 41)	-103.38	(22, 42)	-103.26	(23, 24)	-179.38
(23, 42)	-103.07	(23, 43)	-154.67	(24, 25)	-103.34	(24, 43)	-154.67	(24, 44)	-103.07
(25, 26)	-104.56	(25, 44)	-103.26	(25, 45)	-103.38	(26, 27)	-106.45	(26, 45)	-103.77
(26, 46)	-103.93	(27, 46)	-95.64	(30, 31)	-105.97	(30, 50)	-95.63	(31, 32)	-104.36
(31, 50)	-111.27	(31, 51)	-105.78	(32, 33)	-103.51	(32, 51)	-109.44	(32, 52)	-106.69
(33, 34)	-103.51	(33, 52)	-107.90	(33, 53)	-107.90	(34, 35)	-104.36	(34, 53)	-106.69
(34, 54)	-109.44	(35, 36)	-105.97	(35, 54)	-105.78	(35, 55)	-111.27	(36, 55)	-95.63
(40, 41)	-105.40	(40, 60)	-94.83	(41, 42)	-103.84	(41, 60)	-104.32	(41, 61)	-103.16
(42, 43)	-113.14	(42, 61)	-103.68	(42, 62)	-103.08	(43, 44)	-113.14	(43, 62)	-105.19
(43, 63)	-105.19	(44, 45)	-103.84	(44, 63)	-103.08	(44, 64)	-103.68	(45, 46)	-105.40
(45, 64)	-103.16	(45, 65)	-104.32	(46, 65)	-94.83	(50, 51)	-105.44	(50, 70)	-97.20
(51, 52)	-104.19	(51, 70)	-113.49	(51, 71)	-108.46	(52, 53)	-103.76	(52, 71)	-111.51
(52, 72)	-109.83	(53, 54)	-104.19	(53, 72)	-109.83	(53, 73)	-111.51	(54, 55)	-105.44
(54, 73)	-108.46	(54, 74)	-113.49	(55, 74)	-97.20	(60, 61)	-104.58	(60, 80)	-94.76
(61, 62)	-103.38	(61, 80)	-104.92	(61, 81)	-103.43	(62, 63)	-103.30	(62, 81)	-104.23
(62, 82)	-103.76	(63, 64)	-103.38	(63, 82)	-103.76	(63, 83)	-104.23	(64, 65)	-104.58
(64, 83)	-103.43	(64, 84)	-104.92	(65, 84)	-94.76	(70, 71)	-95.39	(71, 72)	-94.72
(72, 73)	-94.72	(73, 74)	-95.39	(80, 81)	-95.39	(81, 82)	-94.72	(82, 83)	-94.72
(83, 84)	-95.39	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	-126.35	(2,100)	-117.55	(2,101)	-129.18	(2,200)	-125.68	(3,101)	-118.13
(3,102)	-126.40	(3,201)	-127.93	(4,102)	-119.42	(4,103)	-123.73	(4,202)	-129.94
(5,103)	-93.73	(5,104)	-93.73	(5,203)	-162.66	(6,104)	-123.73	(6,105)	-119.42
(6,204)	-129.94	(7,105)	-126.40	(7,106)	-118.13	(7,205)	-127.93	(8,106)	-129.18
(8,107)	-117.55	(8,206)	-125.68	(9,107)	-126.35	(10,100)	-123.32	(10,300)	-120.65
(11,101)	-132.30	(11,300)	-117.63	(11,301)	-125.09	(12,102)	-135.78	(12,301)	-118.18
(12,302)	-122.86	(13,103)	-138.60	(13,302)	-119.29	(13,303)	-120.89	(14,104)	-138.60
(14,303)	-120.89	(14,304)	-119.29	(15,105)	-135.78	(15,304)	-122.86	(15,305)	-118.18
(16,106)	-132.30	(16,305)	-125.09	(16,306)	-117.63	(17,107)	-123.32	(17,306)	-120.65
(20,200)	-133.59	(21,200)	-117.95	(21,201)	-130.54	(21,400)	-122.96	(22,201)	-119.24
(22,202)	-127.30	(22,401)	-124.36	(23,202)	-121.34	(23,203)	-183.49	(23,402)	-125.31
(24,203)	-183.49	(24,204)	-121.34	(24,403)	-125.31	(25,204)	-127.30	(25,205)	-119.24
(25,404)	-124.36	(26,205)	-130.54	(26,206)	-117.95	(26,405)	-122.96	(27,206)	-133.59

(30,300)	-128.35	(30,500)	-116.87	(31,301)	-142.72	(31,500)	-117.71	(31,501)	-121.86
(32,302)	-148.16	(32,501)	-118.13	(32,502)	-120.26	(33,303)	-151.46	(33,502)	-118.99
(33,503)	-118.99	(34,304)	-148.16	(34,503)	-120.26	(34,504)	-118.13	(35,305)	-142.72
(35,504)	-121.86	(35,505)	-117.71	(36,306)	-128.35	(36,505)	-116.87	(40,400)	-134.73
(41,400)	-118.83	(41,401)	-131.26	(41,600)	-120.76	(42,401)	-120.90	(42,402)	-127.46
(42,601)	-121.55	(43,402)	-140.84	(43,403)	-140.84	(43,602)	-124.99	(44,403)	-127.46
(44,404)	-120.90	(44,603)	-121.55	(45,404)	-131.26	(45,405)	-118.83	(45,604)	-120.76
(46,405)	-134.73	(50,500)	-138.25	(50,700)	-115.59	(51,501)	-158.01	(51,700)	-117.86
(51,701)	-119.66	(52,502)	-164.81	(52,701)	-118.08	(52,702)	-118.69	(53,503)	-164.81

(53,702)	-118.69	(53,703)	-118.08	(54,504)	-158.01	(54,703)	-119.66	(54,704)	-117.86
(55,505)	-138.25	(55,704)	-115.59	(60,600)	-135.05	(61,600)	-120.15	(61,601)	-131.01
(61,800)	-119.13	(62,601)	-123.00	(62,602)	-127.46	(62,801)	-119.49	(63,602)	-127.46
(63,603)	-123.00	(63,802)	-119.49	(64,603)	-131.01	(64,604)	-120.15	(64,803)	-119.13
(65,604)	-135.05	(70,700)	-154.10	(71,701)	-171.69	(72,702)	-177.54	(73,703)	-171.69
(74,704)	-154.10	(80,800)	-134.31	(81,800)	-121.84	(81,801)	-129.82	(82,801)	-125.46
(82,802)	-125.46	(83,802)	-129.82	(83,803)	-121.84	(84,803)	-134.31	(	

BOTTOM STRUTS

(100,101)	-106.93	(100,200)	-106.70	(100,300)	-102.40	(101,102)	-104.85	(101,200)	-103.58
(101,201)	-105.37	(101,300)	-108.07	(101,301)	-103.70	(102,103)	-103.52	(102,201)	-103.28
(102,202)	-104.35	(102,301)	-106.55	(102,302)	-103.90	(103,104)	-103.06	(103,202)	-103.30
(103,203)	-115.77	(103,302)	-105.33	(103,303)	-104.44	(104,105)	-103.52	(104,203)	-115.77
(104,204)	-103.30	(104,303)	-104.44	(104,304)	-105.33	(105,106)	-104.85	(105,204)	-104.35
(105,205)	-103.28	(105,304)	-103.90	(105,305)	-106.55	(106,107)	-106.93	(106,205)	-105.37
(106,206)	-103.58	(106,305)	-103.70	(106,306)	-108.07	(107,206)	-106.70	(107,306)	-102.40
(200,201)	-105.73	(200,400)	-104.55	(201,202)	-103.98	(201,400)	-103.59	(201,401)	-103.72
(202,203)	-103.06	(202,401)	-103.15	(202,402)	-103.20	(203,204)	-103.06	(203,402)	-180.71
(203,403)	-180.71	(204,205)	-103.98	(204,403)	-103.20	(204,404)	-103.15	(205,206)	-105.73
(205,404)	-103.72	(205,405)	-103.59	(206,405)	-104.55	(300,301)	-105.98	(300,500)	-102.56
(301,302)	-104.29	(301,500)	-109.92	(301,501)	-104.91	(302,303)	-103.41	(302,501)	-108.17
(302,502)	-105.65	(303,304)	-103.41	(303,502)	-106.74	(303,503)	-106.74	(304,305)	-104.29
(304,503)	-105.65	(304,504)	-108.17	(305,306)	-105.98	(305,504)	-104.91	(305,505)	-109.92
(306,505)	-102.56	(400,401)	-104.75	(400,600)	-103.44	(401,402)	-103.38	(401,600)	-103.92
(401,601)	-103.12	(402,403)	-132.09	(402,601)	-103.36	(402,602)	-109.06	(403,404)	-103.38
(403,602)	-109.06	(403,603)	-103.36	(404,405)	-104.75	(404,603)	-103.12	(404,604)	-103.92
(405,604)	-103.44	(500,501)	-105.35	(500,700)	-104.01	(501,502)	-104.08	(501,700)	-112.16
(501,701)	-107.28	(502,503)	-103.64	(502,701)	-110.22	(502,702)	-108.59	(503,504)	-104.08
(503,702)	-108.59	(503,703)	-110.22	(504,505)	-105.35	(504,703)	-107.28	(504,704)	-112.16
(505,704)	-104.01	(600,601)	-104.01	(600,800)	-103.27	(601,602)	-103.07	(601,800)	-104.44
(601,801)	-103.38	(602,603)	-103.07	(602,801)	-104.03	(602,802)	-104.03	(603,604)	-104.01
(603,802)	-103.38	(603,803)	-104.44	(604,803)	-103.27	(700,701)	-104.87	(701,702)	-104.01
(702,703)	-104.01	(703,704)	-104.87	(800,801)	-103.52	(801,802)	-103.09	(802,803)	-103.52

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 00:35 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	-159.23	(1, 10)	-152.56	(1, 20)	-153.76	(2, 3)	-158.04	(2, 10)	-159.26
(2, 11)	-156.96	(2, 20)	-157.11	(2, 21)	-157.89	(3, 4)	-157.17	(3, 11)	-158.44
(3, 12)	-156.92	(3, 21)	-156.87	(3, 22)	-157.35	(4, 5)	-157.93	(4, 12)	-157.80
(4, 13)	-157.04	(4, 22)	-156.75	(4, 23)	-156.98	(5, 6)	-157.93	(5, 13)	-157.33
(5, 14)	-157.33	(5, 23)	-184.99	(5, 24)	-184.99	(6, 7)	-157.17	(6, 14)	-157.04
(6, 15)	-157.80	(6, 24)	-156.98	(6, 25)	-156.75	(7, 8)	-158.04	(7, 15)	-156.92
(7, 16)	-158.44	(7, 25)	-157.35	(7, 26)	-156.87	(8, 9)	-159.23	(8, 16)	-156.96
(8, 17)	-159.26	(8, 26)	-157.89	(8, 27)	-157.11	(9, 17)	-152.56	(9, 27)	-153.76
(10, 11)	-158.70	(10, 30)	-152.57	(11, 12)	-157.65	(11, 30)	-160.09	(11, 31)	-157.28
(12, 13)	-156.98	(12, 31)	-159.19	(12, 32)	-157.51	(13, 14)	-156.75	(13, 32)	-158.45
(13, 33)	-157.89	(14, 15)	-156.98	(14, 33)	-157.89	(14, 34)	-158.45	(15, 16)	-157.65
(15, 34)	-157.51	(15, 35)	-159.19	(16, 17)	-158.70	(16, 35)	-157.28	(16, 36)	-160.09
(17, 36)	-152.57	(20, 21)	-158.55	(20, 40)	-152.97	(21, 22)	-157.52	(21, 40)	-157.22
(21, 41)	-157.07	(22, 23)	-156.85	(22, 41)	-156.91	(22, 42)	-156.80	(23, 24)	-202.69
(23, 42)	-156.73	(23, 43)	-186.29	(24, 25)	-156.85	(24, 43)	-186.29	(24, 44)	-156.73
(25, 26)	-157.52	(25, 44)	-156.80	(25, 45)	-156.91	(26, 27)	-158.55	(26, 45)	-157.07
(26, 46)	-157.22	(27, 46)	-152.97	(30, 31)	-158.27	(30, 50)	-152.96	(31, 32)	-157.40
(31, 50)	-161.09	(31, 51)	-158.12	(32, 33)	-156.94	(32, 51)	-160.09	(32, 52)	-158.60
(33, 34)	-156.94	(33, 52)	-159.26	(33, 53)	-159.26	(34, 35)	-157.40	(34, 53)	-158.60
(34, 54)	-160.09	(35, 36)	-158.27	(35, 54)	-158.12	(35, 55)	-161.09	(36, 55)	-152.96
(40, 41)	-157.98	(40, 60)	-152.56	(41, 42)	-157.13	(41, 60)	-157.44	(41, 61)	-156.77
(42, 43)	-161.99	(42, 61)	-157.09	(42, 62)	-156.74	(43, 44)	-161.99	(43, 62)	-157.84
(43, 63)	-157.84	(44, 45)	-157.13	(44, 63)	-156.74	(44, 64)	-157.09	(45, 46)	-157.98
(45, 64)	-156.77	(45, 65)	-157.44	(46, 65)	-152.56	(50, 51)	-157.98	(50, 70)	-153.77
(51, 52)	-157.30	(51, 70)	-162.30	(51, 71)	-159.55	(52, 53)	-157.06	(52, 71)	-161.22
(52, 72)	-160.30	(53, 54)	-157.30	(53, 72)	-160.30	(53, 73)	-161.22	(54, 55)	-157.98
(54, 73)	-159.55	(54, 74)	-162.30	(55, 74)	-153.77	(60, 61)	-157.54	(60, 80)	-152.56
(61, 62)	-156.88	(61, 80)	-157.78	(61, 81)	-156.94	(62, 63)	-156.83	(62, 81)	-157.40
(62, 82)	-157.13	(63, 64)	-156.88	(63, 82)	-157.13	(63, 83)	-157.40	(64, 65)	-157.54
(64, 83)	-156.94	(64, 84)	-157.78	(65, 84)	-152.56	(70, 71)	-152.87	(71, 72)	-152.51
(72, 73)	-152.51	(73, 74)	-152.87	(80, 81)	-152.87	(81, 82)	-152.51	(82, 83)	-152.51
(83, 84)	-152.87	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	-176.10	(2,100)	-171.08	(2,101)	-177.50	(2,200)	-175.32	(3,101)	-171.41
(3,102)	-175.96	(3,201)	-176.52	(4,102)	-172.12	(4,103)	-174.49	(4,202)	-177.60
(5,103)	-160.08	(5,104)	-160.08	(5,203)	-196.19	(6,104)	-174.49	(6,105)	-172.12
(6,204)	-177.60	(7,105)	-175.96	(7,106)	-171.41	(7,205)	-176.52	(8,106)	-177.50
(8,107)	-171.08	(8,206)	-175.32	(9,107)	-176.10	(10,100)	-174.17	(10,300)	-173.06
(11,101)	-178.90	(11,300)	-171.12	(11,301)	-175.25	(12,102)	-180.81	(12,301)	-171.43
(12,302)	-174.02	(13,103)	-182.37	(13,302)	-172.05	(13,303)	-172.93	(14,104)	-182.37
(14,303)	-172.93	(14,304)	-172.05	(15,105)	-180.81	(15,304)	-174.02	(15,305)	-171.43
(16,106)	-178.90	(16,305)	-175.25	(16,306)	-171.12	(17,107)	-174.17	(17,306)	-173.06
(20,200)	-179.95	(21,200)	-171.30	(21,201)	-178.25	(21,400)	-173.87	(22,201)	-172.01
(22,202)	-176.44	(22,401)	-174.61	(23,202)	-173.16	(23,203)	-209.53	(23,402)	-175.11
(24,203)	-209.53	(24,204)	-173.16	(24,403)	-175.11	(25,204)	-176.44	(25,205)	-172.01

(25,404)	-174.61	(26,205)	-178.25	(26,206)	-171.30	(26,405)	-173.87	(27,206)	-179.95
(30,300)	-176.89	(30,500)	-171.04	(31,301)	-184.72	(31,500)	-171.16	(31,501)	-173.47
(32,302)	-187.83	(32,501)	-171.41	(32,502)	-172.59	(33,303)	-189.75	(33,502)	-171.89
(33,503)	-171.89	(34,304)	-187.83	(34,503)	-172.59	(34,504)	-171.41	(35,305)	-184.72
(35,504)	-173.47	(35,505)	-171.16	(36,306)	-176.89	(36,505)	-171.04	(40,400)	-180.58
(41,400)	-171.78	(41,401)	-178.62	(41,600)	-172.71	(42,401)	-172.91	(42,402)	-176.51
(42,601)	-173.12	(43,402)	-183.58	(43,403)	-183.58	(43,602)	-174.89	(44,403)	-176.51
(44,404)	-172.91	(44,603)	-173.12	(45,404)	-178.62	(45,405)	-171.78	(45,604)	-172.71
(46,405)	-180.58	(50,500)	-182.33	(50,700)	-170.29	(51,501)	-193.68	(51,700)	-171.23
(51,701)	-172.26	(52,502)	-197.83	(52,701)	-171.37	(52,702)	-171.71	(53,503)	-197.83

(53,702)	-171.71	(53,703)	-171.37	(54,504)	-193.68	(54,703)	-172.26	(54,704)	-171.23
(55,505)	-182.33	(55,704)	-170.29	(60,600)	-180.74	(61,600)	-172.50	(61,601)	-178.46
(61,800)	-171.87	(62,601)	-174.05	(62,602)	-176.48	(62,801)	-172.05	(63,602)	-176.48
(63,603)	-174.05	(63,802)	-172.05	(64,603)	-178.46	(64,604)	-172.50	(64,803)	-171.87
(65,604)	-180.74	(70,700)	-191.44	(71,701)	-202.21	(72,702)	-205.97	(73,703)	-202.21
(74,704)	-191.44	(80,800)	-180.31	(81,800)	-173.42	(81,801)	-177.79	(82,801)	-175.39
(82,802)	-175.39	(83,802)	-177.79	(83,803)	-173.42	(84,803)	-180.31	(	

BOTTOM STRUTS

(100,101)	-158.81	(100,200)	-158.62	(100,300)	-156.39	(101,102)	-157.67	(101,200)	-157.00
(101,201)	-157.91	(101,300)	-159.35	(101,301)	-157.04	(102,103)	-156.95	(102,201)	-156.82
(102,202)	-157.36	(102,301)	-158.53	(102,302)	-157.13	(103,104)	-156.70	(103,202)	-156.82
(103,203)	-163.40	(103,302)	-157.88	(103,303)	-157.41	(104,105)	-156.95	(104,203)	-163.40
(104,204)	-156.82	(104,303)	-157.41	(104,304)	-157.88	(105,106)	-157.67	(105,204)	-157.36
(105,205)	-156.82	(105,304)	-157.13	(105,305)	-158.53	(106,107)	-158.81	(106,205)	-157.91
(106,206)	-157.00	(106,305)	-157.04	(106,306)	-159.35	(107,206)	-158.62	(107,306)	-156.39
(200,201)	-158.15	(200,400)	-157.48	(201,202)	-157.20	(201,400)	-157.02	(201,401)	-157.04
(202,203)	-156.70	(202,401)	-156.77	(202,402)	-156.77	(203,204)	-156.70	(203,402)	-203.62
(203,403)	-203.62	(204,205)	-157.20	(204,403)	-156.77	(204,404)	-156.77	(205,206)	-158.15
(205,404)	-157.04	(205,405)	-157.02	(206,405)	-157.48	(300,301)	-158.29	(300,500)	-156.45
(301,302)	-157.36	(301,500)	-160.35	(301,501)	-157.66	(302,303)	-156.88	(302,501)	-159.40
(302,502)	-158.05	(303,304)	-156.88	(303,502)	-158.63	(303,503)	-158.63	(304,305)	-157.36
(304,503)	-158.05	(304,504)	-159.40	(305,306)	-158.29	(305,504)	-157.66	(305,505)	-160.35
(306,505)	-156.45	(400,401)	-157.62	(400,600)	-156.91	(401,402)	-156.88	(401,600)	-157.22
(401,601)	-156.75	(402,403)	-172.57	(402,601)	-156.90	(402,602)	-159.85	(403,404)	-156.88
(403,602)	-159.85	(403,603)	-156.90	(404,405)	-157.62	(404,603)	-156.75	(404,604)	-157.22
(405,604)	-156.91	(500,501)	-157.93	(500,700)	-157.21	(501,502)	-157.24	(501,700)	-161.57
(501,701)	-158.92	(502,503)	-157.00	(502,701)	-160.51	(502,702)	-159.62	(503,504)	-157.24
(503,702)	-159.62	(503,703)	-160.51	(504,505)	-157.93	(504,703)	-158.92	(504,704)	-161.57
(505,704)	-157.21	(600,601)	-157.22	(600,800)	-156.84	(601,602)	-156.71	(601,800)	-157.51
(601,801)	-156.91	(602,603)	-156.71	(602,801)	-157.27	(602,802)	-157.27	(603,604)	-157.22
(603,802)	-156.91	(603,803)	-157.51	(604,803)	-156.84	(700,701)	-157.67	(701,702)	-157.20
(702,703)	-157.20	(703,704)	-157.67	(800,801)	-156.96	(801,802)	-156.73	(802,803)	-156.96

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 1:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	-38.70	(1, 10)	10.31	(1, 20)	23.73	(2, 3)	-29.77	(2, 10)	-23.12
(2, 11)	-28.43	(2, 20)	-37.83	(2, 21)	-21.60	(3, 4)	-22.97	(3, 11)	-20.90
(3, 12)	-24.41	(3, 21)	-32.30	(3, 22)	-21.18	(4, 5)	-25.21	(4, 12)	-19.84
(4, 13)	-21.58	(4, 22)	-27.71	(4, 23)	-22.06	(5, 6)	-25.21	(5, 13)	-180.68
(5, 14)	-180.68	(5, 23)	-38.28	(5, 24)	-38.28	(6, 7)	-22.97	(6, 14)	-21.58
(6, 15)	-19.84	(6, 24)	-22.06	(6, 25)	-27.71	(7, 8)	-29.77	(7, 15)	-24.41
(7, 16)	-20.90	(7, 25)	-21.18	(7, 26)	-32.30	(8, 9)	-38.70	(8, 16)	-28.43
(8, 17)	-23.12	(8, 26)	-21.60	(8, 27)	-37.83	(9, 17)	10.31	(9, 27)	23.73
(10, 11)	-33.70	(10, 30)	18.68	(11, 12)	-25.72	(11, 30)	-24.16	(11, 31)	-22.35
(12, 13)	-20.37	(12, 31)	-21.46	(12, 32)	-20.24	(13, 14)	-180.26	(13, 32)	-19.83
(13, 33)	-123.28	(14, 15)	-20.37	(14, 33)	-123.28	(14, 34)	-19.83	(15, 16)	-25.72
(15, 34)	-20.24	(15, 35)	-21.46	(16, 17)	-33.70	(16, 35)	-22.35	(16, 36)	-24.16
(17, 36)	18.68	(20, 21)	-34.70	(20, 40)	23.22	(21, 22)	-26.71	(21, 40)	-43.04
(21, 41)	-23.88	(22, 23)	-21.35	(22, 41)	-37.19	(22, 42)	-25.41	(23, 24)	-42.79
(23, 42)	-32.18	(23, 43)	-42.66	(24, 25)	-21.35	(24, 43)	-42.66	(24, 44)	-32.18
(25, 26)	-26.71	(25, 44)	-25.41	(25, 45)	-37.19	(26, 27)	-34.70	(26, 45)	-23.88
(26, 46)	-43.04	(27, 46)	23.22	(30, 31)	-29.42	(30, 50)	23.22	(31, 32)	-22.67
(31, 50)	-26.23	(31, 51)	-20.15	(32, 33)	-18.97	(32, 51)	-23.14	(32, 52)	-19.99
(33, 34)	-18.97	(33, 52)	-21.02	(33, 53)	-21.02	(34, 35)	-22.67	(34, 53)	-19.99
(34, 54)	-23.14	(35, 36)	-29.42	(35, 54)	-20.15	(35, 55)	-26.23	(36, 55)	23.22
(40, 41)	-31.46	(40, 60)	18.68	(41, 42)	-24.69	(41, 60)	-49.01	(41, 61)	-30.04
(42, 43)	-23.45	(42, 61)	-43.00	(42, 62)	-33.35	(43, 44)	-23.45	(43, 62)	-38.21
(43, 63)	-38.21	(44, 45)	-24.69	(44, 63)	-33.35	(44, 64)	-43.00	(45, 46)	-31.46
(45, 64)	-30.04	(45, 65)	-49.01	(46, 65)	18.68	(50, 51)	-25.98	(50, 70)	23.73
(51, 52)	-20.69	(51, 70)	-29.20	(51, 71)	-21.75	(52, 53)	-18.82	(52, 71)	-25.83
(52, 72)	-23.31	(53, 54)	-20.69	(53, 72)	-23.31	(53, 73)	-25.83	(54, 55)	-25.98
(54, 73)	-21.75	(54, 74)	-29.20	(55, 74)	23.73	(60, 61)	-29.16	(60, 80)	10.31
(61, 62)	-23.86	(61, 80)	-55.58	(61, 81)	-39.55	(62, 63)	-22.06	(62, 81)	-49.58
(62, 82)	-44.19	(63, 64)	-23.86	(63, 82)	-44.19	(63, 83)	-49.58	(64, 65)	-29.16
(64, 83)	-39.55	(64, 84)	-55.58	(65, 84)	10.31	(70, 71)	20.56	(71, 72)	24.32
(72, 73)	24.32	(73, 74)	20.56	(80, 81)	20.56	(81, 82)	24.32	(82, 83)	24.32
(83, 84)	20.56	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	-118.55	(2,100)	-15.76	(2,101)	-106.02	(2,200)	-20.58	(3,101)	-23.32
(3,102)	-88.67	(3,201)	-23.44	(4,102)	-35.47	(4,103)	-69.83	(4,202)	-25.92
(5,103)	-82.04	(5,104)	-82.04	(5,203)	-35.21	(6,104)	-69.83	(6,105)	-35.47
(6,204)	-25.92	(7,105)	-88.67	(7,106)	-23.32	(7,205)	-23.44	(8,106)	-106.02
(8,107)	-15.76	(8,206)	-20.58	(9,107)	-118.55	(10,100)	-25.55	(10,300)	-98.65
(11,101)	-31.38	(11,300)	-16.95	(11,301)	-85.15	(12,102)	-35.80	(12,301)	-25.26
(12,302)	-68.57	(13,103)	-38.71	(13,302)	-37.28	(13,303)	-195.54	(14,104)	-38.71
(14,303)	-195.54	(14,304)	-37.28	(15,105)	-35.80	(15,304)	-68.57	(15,305)	-25.26
(16,106)	-31.38	(16,305)	-85.15	(16,306)	-16.95	(17,107)	-25.55	(17,306)	-98.65
(20,200)	-122.62	(21,200)	-20.66	(21,201)	-106.53	(21,400)	-16.29	(22,201)	-31.61
(22,202)	-87.08	(22,401)	-17.59	(23,202)	-47.31	(23,203)	-85.26	(23,402)	-18.58
(24,203)	-85.26	(24,204)	-47.31	(24,403)	-18.58	(25,204)	-87.08	(25,205)	-31.61
(25,404)	-17.59	(26,205)	-106.53	(26,206)	-20.66	(26,405)	-16.29	(27,206)	-122.62

(30,300)	-38.65	(30,500)	-75.89	(31,301)	-47.27	(31,500)	-17.50	(31,501)	-63.19
(32,302)	-52.57	(32,501)	-25.42	(32,502)	-49.06	(33,303)	-113.65	(33,502)	-36.19
(33,503)	-36.19	(34,304)	-52.57	(34,503)	-49.06	(34,504)	-25.42	(35,305)	-47.27
(35,504)	-63.19	(35,505)	-17.50	(36,306)	-38.65	(36,505)	-75.89	(40,400)	-120.38
(41,400)	-27.32	(41,401)	-102.12	(41,600)	-14.29	(42,401)	-41.36	(42,402)	-81.01
(42,601)	-14.43	(43,402)	-64.31	(43,403)	-64.31	(43,602)	-15.19	(44,403)	-81.01
(44,404)	-41.36	(44,603)	-14.43	(45,404)	-102.12	(45,405)	-27.32	(45,604)	-14.29
(46,405)	-120.38	(50,500)	-56.03	(50,700)	-54.10	(51,501)	-66.90	(51,700)	-16.88
(51,701)	-43.37	(52,502)	-72.09	(52,701)	-23.61	(52,702)	-32.60	(53,503)	-72.09

(53,702)	-32.60	(53,703)	-23.61	(54,504)	-66.90	(54,703)	-43.37	(54,704)	-16.88
(55,505)	-56.03	(55,704)	-54.10	(60,600)	-114.43	(61,600)	-35.53	(61,601)	-94.25
(61,800)	-14.97	(62,601)	-52.14	(62,602)	-72.69	(62,801)	-14.47	(63,602)	-72.69
(63,603)	-52.14	(63,802)	-14.47	(64,603)	-94.25	(64,604)	-35.53	(64,803)	-14.97
(65,604)	-114.43	(70,700)	-75.99	(71,701)	-86.09	(72,702)	-89.75	(73,703)	-86.09
(74,704)	-75.99	(80,800)	-74.64	(81,800)	-.09	(81,801)	-48.64	(82,801)	-23.00
(82,802)	-23.00	(83,802)	-48.64	(83,803)	-.09	(84,803)	-74.64	(	

BOTTOM STRUTS

(100,101)	-35.79	(100,200)	-22.78	(100,300)	-29.36	(101,102)	-26.80	(101,200)	-33.78
(101,201)	-21.17	(101,300)	-22.81	(101,301)	-25.09	(102,103)	-20.81	(102,201)	-28.45
(102,202)	-20.80	(102,301)	-20.61	(102,302)	-21.80	(103,104)	-100.75	(103,202)	-24.42
(103,203)	-24.88	(103,302)	-19.60	(103,303)	-180.74	(104,105)	-20.81	(104,203)	-24.88
(104,204)	-24.42	(104,303)	-180.74	(104,304)	-19.60	(105,106)	-26.80	(105,204)	-20.80
(105,205)	-28.45	(105,304)	-21.80	(105,305)	-20.61	(106,107)	-35.79	(106,205)	-21.17
(106,206)	-33.78	(106,305)	-25.09	(106,306)	-22.81	(107,206)	-22.78	(107,306)	-29.36
(200,201)	-31.76	(200,400)	-23.17	(201,202)	-24.07	(201,400)	-38.88	(201,401)	-23.47
(202,203)	-19.89	(202,401)	-33.01	(202,402)	-25.18	(203,204)	-19.89	(203,402)	-52.92
(203,403)	-52.92	(204,205)	-24.07	(204,403)	-25.18	(204,404)	-33.01	(205,206)	-31.76
(205,404)	-23.47	(205,405)	-38.88	(206,405)	-23.17	(300,301)	-30.53	(300,500)	-22.57
(301,302)	-23.04	(301,500)	-24.24	(301,501)	-20.60	(302,303)	-19.00	(302,501)	-21.53
(302,502)	-19.56	(303,304)	-19.00	(303,502)	-19.68	(303,503)	-19.68	(304,305)	-23.04
(304,503)	-19.56	(304,504)	-21.53	(305,306)	-30.53	(305,504)	-20.60	(305,505)	-24.24
(306,505)	-22.57	(400,401)	-28.65	(400,600)	-27.52	(401,402)	-22.58	(401,600)	-44.83
(401,601)	-29.82	(402,403)	-27.84	(402,601)	-38.60	(402,602)	-35.02	(403,404)	-22.58
(403,602)	-35.02	(403,603)	-38.60	(404,405)	-28.65	(404,603)	-29.82	(404,604)	-44.83
(405,604)	-27.52	(500,501)	-26.36	(500,700)	-20.22	(501,502)	-20.64	(501,700)	-26.97
(501,701)	-20.58	(502,503)	-18.63	(502,701)	-23.82	(502,702)	-21.64	(503,504)	-20.64
(503,702)	-21.64	(503,703)	-23.82	(504,505)	-26.36	(504,703)	-20.58	(504,704)	-26.97
(505,704)	-20.22	(600,601)	-26.68	(600,800)	-35.60	(601,602)	-22.52	(601,800)	-51.42
(601,801)	-39.68	(602,603)	-22.52	(602,801)	-45.07	(602,802)	-45.07	(603,604)	-26.68
(603,802)	-39.68	(603,803)	-51.42	(604,803)	-35.60	(700,701)	-23.38	(701,702)	-19.54
(702,703)	-19.54	(703,704)	-23.38	(800,801)	21.06	(801,802)	23.20	(802,803)	21.06

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 2:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	22.25	(1, 10)	48.32	(1, 20)	73.26	(2, 3)	29.28	(2, 10)	35.18
(2, 11)	17.46	(2, 20)	3.96	(2, 21)	31.43	(3, 4)	34.54	(3, 11)	35.05
(3, 12)	23.23	(3, 21)	11.15	(3, 22)	29.71	(4, 5)	37.24	(4, 12)	33.84
(4, 13)	27.93	(4, 22)	17.45	(4, 23)	26.80	(5, 6)	37.24	(5, 13)	19.75
(5, 14)	19.75	(5, 23)	22.25	(5, 24)	22.25	(6, 7)	34.54	(6, 14)	27.93
(6, 15)	33.84	(6, 24)	26.80	(6, 25)	17.45	(7, 8)	29.28	(7, 15)	23.23
(7, 16)	35.05	(7, 25)	29.71	(7, 26)	11.15	(8, 9)	22.25	(8, 16)	17.46
(8, 17)	35.18	(8, 26)	31.43	(8, 27)	3.96	(9, 17)	48.32	(9, 27)	73.26
(10, 11)	27.00	(10, 30)	59.79	(11, 12)	33.17	(11, 30)	37.10	(11, 31)	27.85
(12, 13)	37.26	(12, 31)	37.39	(12, 32)	31.92	(13, 14)	-37.10	(13, 32)	36.67
(13, 33)	-188.23	(14, 15)	37.26	(14, 33)	-188.23	(14, 34)	36.67	(15, 16)	33.17
(15, 34)	31.92	(15, 35)	37.39	(16, 17)	27.00	(16, 35)	27.85	(16, 36)	37.10
(17, 36)	59.79	(20, 21)	24.40	(20, 40)	68.18	(21, 22)	30.69	(21, 40)	-3.70
(21, 41)	24.16	(22, 23)	34.85	(22, 41)	3.80	(22, 42)	20.74	(23, 24)	35.69
(23, 42)	10.47	(23, 43)	15.63	(24, 25)	34.85	(24, 43)	15.63	(24, 44)	10.47
(25, 26)	30.69	(25, 44)	20.74	(25, 45)	3.80	(26, 27)	24.40	(26, 45)	24.16
(26, 46)	-3.70	(27, 46)	68.18	(30, 31)	30.95	(.30, 50)	68.18	(31, 32)	36.11
(31, 50)	37.95	(31, 51)	34.75	(32, 33)	-138.58	(32, 51)	38.59	(32, 52)	37.06
(33, 34)	-138.58	(33, 52)	-82.80	(33, 53)	-82.80	(34, 35)	36.11	(34, 53)	37.06
(34, 54)	38.59	(35, 36)	30.95	(35, 54)	34.75	(35, 55)	37.95	(36, 55)	68.18
(40, 41)	25.66	(40, 60)	59.79	(41, 42)	31.01	(41, 60)	-12.26	(41, 61)	13.23
(42, 43)	33.83	(42, 61)	-4.60	(42, 62)	8.28	(43, 44)	33.83	(43, 62)	2.27
(43, 63)	2.27	(44, 45)	31.01	(44, 63)	8.28	(44, 64)	-4.60	(45, 46)	25.66
(45, 64)	13.23	(45, 65)	-12.26	(46, 65)	59.79	(50, 51)	34.10	(50, 70)	73.26
(51, 52)	38.10	(51, 70)	37.90	(51, 71)	38.23	(52, 53)	36.12	(52, 71)	38.84
(52, 72)	38.98	(53, 54)	38.10	(53, 72)	38.98	(53, 73)	38.84	(54, 55)	34.10
(54, 73)	38.23	(54, 74)	37.90	(55, 74)	73.26	(60, 61)	25.75	(60, 80)	48.32
(61, 62)	29.96	(61, 80)	-21.71	(61, 81)	-.96	(62, 63)	31.44	(62, 81)	-14.07
(62, 82)	-7.11	(63, 64)	29.96	(63, 82)	-7.11	(63, 83)	-14.07	(64, 65)	25.75
(64, 83)	-.96	(64, 84)	-21.71	(65, 84)	48.32	(70, 71)	72.95	(71, 72)	75.48
(72, 73)	75.48	(73, 74)	72.95	(80, 81)	72.95	(81, 82)	75.48	(82, 83)	75.48
(83, 84)	72.95	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	-78.30	(2,100)	30.10	(2,101)	-63.50	(2,200)	34.98	(3,101)	22.44
(3,102)	-44.13	(3,201)	35.29	(4,102)	10.67	(4,103)	-23.78	(4,202)	35.19
(5,103)	-5.96	(5,104)	-5.96	(5,203)	34.99	(6,104)	-23.78	(6,105)	10.67
(6,204)	35.19	(7,105)	-44.13	(7,106)	22.44	(7,205)	35.29	(8,106)	-63.50
(8,107)	30.10	(8,206)	34.98	(9,107)	-78.30	(10,100)	34.29	(10,300)	-63.53
(11,101)	33.59	(11,300)	28.32	(11,301)	-46.30	(12,102)	32.62	(12,301)	19.21
(12,302)	-27.43	(13,103)	31.92	(13,302)	6.52	(13,303)	-108.05	(14,104)	31.92
(14,303)	-108.05	(14,304)	6.52	(15,105)	32.62	(15,304)	-27.43	(15,305)	19.21
(16,106)	33.59	(16,305)	-46.30	(16,306)	28.32	(17,107)	34.29	(17,306)	-63.53
(20,200)	-74.08	(21,200)	25.33	(21,201)	-56.89	(21,400)	33.74	(22,201)	15.60
(22,202)	-36.46	(22,401)	34.80	(23,202)	1.61	(23,203)	-17.03	(23,402)	35.21
(24,203)	-17.03	(24,204)	1.61	(24,403)	35.21	(25,204)	-36.46	(25,205)	15.60
(25,404)	34.80	(26,205)	-56.89	(26,206)	25.33	(26,405)	33.74	(27,206)	-74.08

(30,300)	30.32	(30,500)	-41.89	(31,301)	28.27	(31,500)	26.71	(31,501)	-25.52
(32,302)	26.63	(32,501)	17.31	(32,502)	-9.43	(33,303)	-193.45	(33,502)	-141.55
(33,503)	-141.55	(34,304)	26.63	(34,503)	-9.43	(34,504)	17.31	(35,305)	28.27
(35,504)	-25.52	(35,505)	26.71	(36,306)	30.32	(36,505)	-41.89	(40,400)	-65.45
(41,400)	19.37	(41,401)	-46.70	(41,600)	30.09	(42,401)	7.90	(42,402)	-26.47
(42,601)	31.54	(43,402)	-7.82	(43,403)	-7.82	(43,602)	31.99	(44,403)	-26.47
(44,404)	7.90	(44,603)	31.54	(45,404)	-46.70	(45,405)	19.37	(45,604)	30.09
(46,405)	-65.45	(50,500)	22.99	(50,700)	-18.81	(51,501)	20.27	(51,700)	26.46
(51,701)	-5.28	(52,502)	18.69	(52,701)	17.85	(52,702)	7.13	(53,503)	18.69

(53,702)	7.13	(53,703)	17.85	(54,504)	20.27	(54,703)	-5.28	(54,704)	26.46
(55,505)	22.99	(55,704)	-18.81	(60,600)	-55.62	(61,600)	12.05	(61,601)	-36.33
(61,800)	23.53	(62,601)	-.81	(62,602)	-17.34	(62,801)	24.94	(63,602)	-17.34
(63,603)	-.81	(63,802)	24.94	(64,603)	-36.33	(64,604)	12.05	(64,803)	23.53
(65,604)	-55.62	(70,700)	13.95	(71,701)	11.36	(72,702)	10.42	(73,703)	11.36
(74,704)	13.95	(80,800)	-1.95	(81,800)	50.27	(81,801)	17.10	(82,801)	34.97
(82,802)	34.97	(83,802)	17.10	(83,803)	50.27	(84,803)	-1.95	(	

BOTTOM STRUTS

(100,101)	24.20	(100,200)	32.33	(100,300)	15.95	(101,102)	31.43	(101,200)	9.21
(101,201)	31.76	(101,300)	35.63	(101,301)	22.50	(102,103)	36.17	(102,201)	16.44
(102,202)	30.01	(102,301)	35.52	(102,302)	27.79	(103,104)	35.18	(103,202)	22.38
(103,203)	26.84	(103,302)	34.26	(103,303)	3.31	(104,105)	36.17	(104,203)	26.84
(104,204)	22.38	(104,303)	3.31	(104,304)	34.26	(105,106)	31.43	(105,204)	30.01
(105,205)	16.44	(105,304)	27.79	(105,305)	35.52	(106,107)	24.20	(106,205)	31.76
(106,206)	9.21	(106,305)	22.50	(106,306)	35.63	(107,206)	32.33	(107,306)	15.95
(200,201)	26.37	(200,400)	26.49	(201,202)	32.52	(201,400)	1.48	(201,401)	24.26
(202,203)	35.81	(202,401)	9.21	(202,402)	20.69	(203,204)	35.81	(203,402)	14.75
(203,403)	14.75	(204,205)	32.52	(204,403)	20.69	(204,404)	9.21	(205,206)	26.37
(205,404)	24.26	(205,405)	1.48	(206,405)	26.49	(300,301)	29.28	(300,500)	27.39
(301,302)	35.22	(301,500)	37.54	(301,501)	31.89	(302,303)	38.40	(302,501)	37.83
(302,502)	35.12	(303,304)	38.40	(303,502)	-153.61	(303,503)	-153.61	(304,305)	35.22
(304,503)	35.12	(304,504)	37.83	(305,306)	29.28	(305,504)	31.89	(305,505)	37.54
(306,505)	27.39	(400,401)	27.40	(400,600)	16.94	(401,402)	32.21	(401,600)	-7.19
(401,601)	12.99	(402,403)	33.70	(402,601)	.86	(402,602)	7.57	(403,404)	32.21
(403,602)	7.57	(403,603)	.86	(404,405)	27.40	(404,603)	12.99	(404,604)	-7.19
(405,604)	16.94	(500,501)	33.26	(500,700)	34.77	(501,502)	37.77	(501,700)	38.18
(501,701)	37.23	(502,503)	-105.76	(502,701)	38.84	(502,702)	-25.96	(503,504)	37.77
(503,702)	-25.96	(503,703)	38.84	(504,505)	33.26	(504,703)	37.23	(504,704)	38.18
(505,704)	34.77	(600,601)	26.89	(600,800)	3.77	(601,602)	30.18	(601,800)	-16.77
(601,801)	-1.74	(602,603)	30.18	(602,801)	-8.63	(602,802)	-8.63	(603,604)	26.89
(603,802)	-1.74	(603,803)	-16.77	(604,803)	3.77	(700,701)	36.14	(701,702)	39.14
(702,703)	39.14	(703,704)	36.14	(800,801)	74.37	(801,802)	75.79	(802,803)	74.37

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 3:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	24.00	(1, 10)	28.27	(1, 20)	64.69	(2, 3)	29.16	(2, 10)	27.31
(2, 11)	-.70	(2, 20)	-17.85	(2, 21)	18.60	(3, 4)	33.06	(3, 11)	25.47
(3, 12)	6.66	(3, 21)	-9.45	(3, 22)	15.27	(4, 5)	35.16	(4, 12)	22.51
(4, 13)	13.07	(4, 22)	-1.76	(4, 23)	10.74	(5, 6)	35.16	(5, 13)	18.08
(5, 14)	18.08	(5, 23)	5.01	(5, 24)	5.01	(6, 7)	33.06	(6, 14)	13.07
(6, 15)	22.51	(6, 24)	10.74	(6, 25)	-1.76	(7, 8)	29.16	(7, 15)	6.66
(7, 16)	25.47	(7, 25)	15.27	(7, 26)	-9.45	(8, 9)	24.00	(8, 16)	-.70
(8, 17)	27.31	(8, 26)	18.60	(8, 27)	-17.85	(9, 17)	28.27	(9, 27)	64.69
(10, 11)	29.03	(10, 30)	43.21	(11, 12)	33.50	(11, 30)	32.11	(11, 31)	13.77
(12, 13)	36.50	(12, 31)	30.62	(12, 32)	19.64	(13, 14)	35.93	(13, 32)	28.08
(13, 33)	12.91	(14, 15)	36.50	(14, 33)	12.91	(14, 34)	28.08	(15, 16)	33.50
(15, 34)	19.64	(15, 35)	30.62	(16, 17)	29.03	(16, 35)	13.77	(16, 36)	32.11
(17, 36)	43.21	(20, 21)	23.22	(20, 40)	55.53	(21, 22)	27.98	(21, 40)	-27.91
(21, 41)	5.96	(22, 23)	31.15	(22, 41)	-19.49	(22, 42)	1.18	(23, 24)	32.25
(23, 42)	-11.70	(23, 43)	-4.76	(24, 25)	31.15	(24, 43)	-4.76	(24, 44)	-11.70
(25, 26)	27.98	(25, 44)	1.18	(25, 45)	-19.49	(26, 27)	23.22	(26, 45)	5.96
(26, 46)	-27.91	(27, 46)	55.53	(30, 31)	32.93	(30, 50)	55.53	(31, 32)	36.63
(31, 50)	35.50	(31, 51)	24.94	(32, 33)	-4.57	(32, 51)	34.35	(32, 52)	29.12
(33, 34)	-4.57	(33, 52)	-118.05	(33, 53)	-118.05	(34, 35)	36.63	(34, 53)	29.12
(34, 54)	34.35	(35, 36)	32.93	(35, 54)	24.94	(35, 55)	35.50	(36, 55)	55.53
(40, 41)	20.59	(40, 60)	43.21	(41, 42)	24.77	(41, 60)	-39.39	(41, 61)	-10.86
(42, 43)	27.03	(42, 61)	-31.20	(42, 62)	-16.73	(43, 44)	27.03	(43, 62)	-23.58
(43, 63)	-23.58	(44, 45)	24.77	(44, 63)	-16.73	(44, 64)	-31.20	(45, 46)	20.59
(45, 64)	-10.86	(45, 65)	-39.39	(46, 65)	43.21	(50, 51)	35.91	(50, 70)	64.69
(51, 52)	38.76	(51, 70)	37.78	(51, 71)	32.66	(52, 53)	-145.98	(52, 71)	36.94
(52, 72)	-103.09	(53, 54)	38.76	(53, 72)	-103.09	(53, 73)	36.94	(54, 55)	35.91
(54, 73)	32.66	(54, 74)	37.78	(55, 74)	64.69	(60, 61)	14.68	(60, 80)	28.27
(61, 62)	18.11	(61, 80)	-53.19	(61, 81)	-32.08	(62, 63)	19.32	(62, 81)	-45.53
(62, 82)	-38.43	(63, 64)	18.11	(63, 82)	-38.43	(63, 83)	-45.53	(64, 65)	14.68
(64, 83)	-32.08	(64, 84)	-53.19	(65, 84)	28.27	(70, 71)	50.00	(71, 72)	-5.38
(72, 73)	-5.38	(73, 74)	50.00	(80, 81)	74.24	(81, 82)	75.97	(82, 83)	75.97
(83, 84)	74.24	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	-54.32	(2,100)	24.14	(2,101)	-47.82	(2,200)	27.88	(3,101)	16.94
(3,102)	-36.14	(3,201)	30.35	(4,102)	6.46	(4,103)	-21.64	(4,202)	31.72
(5,103)	-6.85	(5,104)	-6.85	(5,203)	32.15	(6,104)	-21.64	(6,105)	6.46
(6,204)	31.72	(7,105)	-36.14	(7,106)	16.94	(7,205)	30.35	(8,106)	-47.82
(8,107)	24.14	(8,206)	27.88	(9,107)	-54.32	(10,100)	32.20	(10,300)	-54.46
(11,101)	34.00	(11,300)	22.48	(11,301)	-43.93	(12,102)	34.95	(12,301)	13.08
(12,302)	-29.55	(13,103)	35.33	(13,302)	.69	(13,303)	-18.14	(14,104)	35.33
(14,303)	-18.14	(14,304)	.69	(15,105)	34.95	(15,304)	-29.55	(15,305)	13.08
(16,106)	34.00	(16,305)	-43.93	(16,306)	22.48	(17,107)	32.20	(17,306)	-54.46
(20,200)	-19.80	(21,200)	18.28	(21,201)	-39.32	(21,400)	20.26	(22,201)	10.45
(22,202)	-27.09	(22,401)	23.10	(23,202)	-.39	(23,203)	-13.45	(23,402)	24.48
(24,203)	-13.45	(24,204)	-.39	(24,403)	24.48	(25,204)	-27.09	(25,205)	10.45
(25,404)	23.10	(26,205)	-39.32	(26,206)	18.28	(26,405)	20.26	(27,206)	-19.80

(30,300)	35.20	(30,500)	-46.79	(31,301)	35.49	(31,500)	19.67	(31,501)	-33.50
(32,302)	35.46	(32,501)	9.10	(32,502)	-18.54	(33,303)	28.86	(33,502)	-52.11
(33,503)	-52.11	(34,304)	35.46	(34,503)	-18.54	(34,504)	9.10	(35,305)	35.49
(35,504)	-33.50	(35,505)	19.67	(36,306)	35.20	(36,505)	-46.79	(40,400)	.10
(41,400)	9.93	(41,401)	-32.86	(41,600)	7.44	(42,401)	1.91	(42,402)	-20.80
(42,601)	10.24	(43,402)	-8.69	(43,403)	-8.69	(43,602)	11.17	(44,403)	-20.80
(44,404)	1.91	(44,603)	10.24	(45,404)	-32.86	(45,405)	9.93	(45,604)	7.44
(46,405)	.10	(50,500)	34.38	(50,700)	-31.48	(51,501)	33.78	(51,700)	17.72
(51,701)	-18.23	(52,502)	33.37	(52,701)	7.28	(52,702)	-154.86	(53,503)	33.37

(53,702)	-154.86	(53,703)	7.28	(54,504)	33.78	(54,703)	-18.23	(54,704)	17.72
(55,505)	34.38	(55,704)	-31.48	(60,600)	13.09	(61,600)	-4.34	(61,601)	-33.40
(61,800)	41.54	(62,601)	-12.15	(62,602)	-22.19	(62,801)	43.98	(63,602)	-22.19
(63,603)	-12.15	(63,802)	43.98	(64,603)	-33.40	(64,604)	-4.34	(64,803)	41.54
(65,604)	13.09	(70,700)	31.32	(71,701)	30.45	(72,702)	-107.13	(73,703)	30.45
(74,704)	31.32	(80,800)	24.88	(81,800)	55.95	(81,801)	35.26	(82,801)	45.97
(82,802)	45.97	(83,802)	35.26	(83,803)	55.95	(84,803)	24.88	(	

BOTTOM STRUTS

(100,101)	24.44	(100,200)	19.97	(100,300)	-2.99	(101,102)	29.98	(101,200)	-12.64
(101,201)	17.94	(101,300)	27.33	(101,301)	5.42	(102,103)	33.67	(102,201)	-3.75
(102,202)	14.74	(102,301)	25.63	(102,302)	12.59	(103,104)	35.00	(103,202)	3.89
(103,203)	10.08	(103,302)	22.70	(103,303)	17.58	(104,105)	33.67	(104,203)	10.08
(104,204)	3.89	(104,303)	17.58	(104,304)	22.70	(105,106)	29.98	(105,204)	14.74
(105,205)	-3.75	(105,304)	12.59	(105,305)	25.63	(106,107)	24.44	(106,205)	17.94
(106,206)	-12.64	(106,305)	5.42	(106,306)	27.33	(107,206)	19.97	(107,306)	-2.99
(200,201)	22.82	(200,400)	27.71	(201,202)	27.70	(201,400)	-23.93	(201,401)	3.93
(202,203)	30.34	(202,401)	-14.87	(202,402)	-.78	(203,204)	30.34	(203,402)	-7.10
(203,403)	-7.10	(204,205)	27.70	(204,403)	-.78	(204,404)	-14.87	(205,206)	22.82
(205,404)	3.93	(205,405)	-23.93	(206,405)	27.71	(300,301)	30.23	(300,500)	13.15
(301,302)	34.74	(301,500)	32.61	(301,501)	19.64	(302,303)	37.19	(302,501)	31.20
(302,502)	24.81	(303,304)	37.19	(303,502)	14.09	(303,503)	14.09	(304,305)	34.74
(304,503)	24.81	(304,504)	31.20	(305,306)	30.23	(305,504)	19.64	(305,505)	32.61
(306,505)	13.15	(400,401)	17.38	(400,600)	32.40	(401,402)	21.40	(401,600)	-38.70
(401,601)	-16.70	(402,403)	22.81	(402,601)	-29.92	(402,602)	-22.50	(403,404)	21.40
(403,602)	-22.50	(403,603)	-29.92	(404,405)	17.38	(404,603)	-16.70	(404,604)	-38.70
(405,604)	32.40	(500,501)	34.42	(500,700)	25.28	(501,502)	37.82	(501,700)	36.20
(501,701)	29.73	(502,503)	-21.14	(502,701)	35.10	(502,702)	-148.89	(503,504)	37.82
(503,702)	-148.89	(503,703)	35.10	(504,505)	34.42	(504,703)	29.73	(504,704)	36.20
(505,704)	25.28	(600,601)	21.79	(600,800)	26.88	(601,602)	24.56	(601,800)	-.36
(601,801)	18.47	(602,603)	24.56	(602,801)	9.35	(602,802)	9.35	(603,604)	21.79
(603,802)	18.47	(603,803)	-.36	(604,803)	26.88	(700,701)	37.36	(701,702)	39.61
(702,703)	39.61	(703,704)	37.36	(800,801)	75.23	(801,802)	76.19	(802,803)	75.23

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 4:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	18.89	(1, 10)	-25.96	(1, 20)	49.36	(2, 3)	22.84	(2, 10)	8.85
(2, 11)	-26.05	(2, 20)	-46.08	(2, 21)	-6.27	(3, 4)	25.79	(3, 11)	5.84
(3, 12)	-17.85	(3, 21)	-37.75	(3, 22)	-10.40	(4, 5)	27.43	(4, 12)	1.62
(4, 13)	-10.35	(4, 22)	-29.71	(4, 23)	-15.77	(5, 6)	27.43	(5, 13)	-3.79
(5, 14)	-3.79	(5, 23)	-22.28	(5, 24)	-22.28	(6, 7)	25.79	(6, 14)	-10.35
(6, 15)	1.62	(6, 24)	-15.77	(6, 25)	-29.71	(7, 8)	22.84	(7, 15)	-17.85
(7, 16)	5.84	(7, 25)	-10.40	(7, 26)	-37.75	(8, 9)	18.89	(8, 16)	-26.05
(8, 17)	8.85	(8, 26)	-6.27	(8, 27)	-46.08	(9, 17)	-25.96	(9, 27)	49.36
(10, 11)	26.54	(10, 30)	4.21	(11, 12)	29.71	(11, 30)	17.48	(11, 31)	-8.11
(12, 13)	31.82	(12, 31)	14.59	(12, 32)	-.86	(13, 14)	32.39	(13, 32)	10.58
(13, 33)	5.03	(14, 15)	31.82	(14, 33)	5.03	(14, 34)	10.58	(15, 16)	29.71
(15, 34)	-.86	(15, 35)	14.59	(16, 17)	26.54	(16, 35)	-8.11	(16, 36)	17.48
(17, 36)	4.21	(20, 21)	11.05	(20, 40)	36.80	(21, 22)	15.06	(21, 40)	-60.90
(21, 41)	-27.83	(22, 23)	17.69	(22, 41)	-53.10	(22, 42)	-32.58	(23, 24)	18.61
(23, 42)	-45.62	(23, 43)	-38.50	(24, 25)	17.69	(24, 43)	-38.50	(24, 44)	-45.62
(25, 26)	15.06	(25, 44)	-32.58	(25, 45)	-53.10	(26, 27)	11.05	(26, 45)	-27.83
(26, 46)	-60.90	(27, 46)	36.80	(30, 31)	31.55	(30, 50)	36.80	(31, 32)	34.05
(31, 50)	23.79	(31, 51)	6.94	(32, 33)	34.51	(32, 51)	21.15	(32, 52)	12.74
(33, 34)	34.51	(33, 52)	11.51	(33, 53)	11.51	(34, 35)	34.05	(34, 53)	12.74
(34, 54)	21.15	(35, 36)	31.55	(35, 54)	6.94	(35, 55)	23.79	(36, 55)	36.80
(40, 41)	-6.32	(40, 60)	21.79	(41, 42)	-2.20	(41, 60)	-85.33	(41, 61)	-62.74
(42, 43)	.01	(42, 61)	-78.41	(42, 62)	-66.80	(43, 44)	.01	(43, 62)	-72.11
(43, 63)	-72.11	(44, 45)	-2.20	(44, 63)	-66.80	(44, 64)	-78.41	(45, 46)	-6.32
(45, 64)	-62.74	(45, 65)	-85.33	(46, 65)	21.79	(50, 51)	34.97	(50, 70)	49.36
(51, 52)	36.82	(51, 70)	28.47	(51, 71)	18.63	(52, 53)	17.76	(52, 71)	26.13
(52, 72)	-54.16	(53, 54)	36.82	(53, 72)	-54.16	(53, 73)	26.13	(54, 55)	34.97
(54, 73)	18.63	(54, 74)	28.47	(55, 74)	49.36	(60, 61)	-56.40	(60, 80)	5.78
(61, 62)	-52.15	(61, 80)	-111.42	(61, 81)	-94.23	(62, 63)	-50.73	(62, 81)	-102.81
(62, 82)	-98.17	(63, 64)	-52.15	(63, 82)	-98.17	(63, 83)	-102.81	(64, 65)	-56.40
(64, 83)	-94.23	(64, 84)	-111.42	(65, 84)	5.78	(70, 71)	37.49	(71, 72)	-153.38
(72, 73)	-153.38	(73, 74)	37.49	(80, 81)	75.14	(81, 82)	76.07	(82, 83)	76.07
(83, 84)	75.14	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	19.28	(2,100)	11.17	(2,101)	-30.86	(2,200)	2.80	(3,101)	6.44
(3,102)	-25.55	(3,201)	7.66	(4,102)	-.51	(4,103)	-17.84	(4,202)	10.61
(5,103)	-9.14	(5,104)	-9.14	(5,203)	11.60	(6,104)	-17.84	(6,105)	-.51
(6,204)	10.61	(7,105)	-25.55	(7,106)	6.44	(7,205)	7.66	(8,106)	-30.86
(8,107)	11.17	(8,206)	2.80	(9,107)	19.28	(10,100)	16.93	(10,300)	-34.27
(11,101)	21.20	(11,300)	13.87	(11,301)	-30.71	(12,102)	23.94	(12,301)	6.20
(12,302)	-23.41	(13,103)	25.29	(13,302)	-3.31	(13,303)	-13.97	(14,104)	25.29
(14,303)	-13.97	(14,304)	-3.31	(15,105)	23.94	(15,304)	-23.41	(15,305)	6.20
(16,106)	21.20	(16,305)	-30.71	(16,306)	13.87	(17,107)	16.93	(17,306)	-34.27
(20,200)	28.39	(21,200)	-4.68	(21,201)	-34.92	(21,400)	-28.46	(22,201)	-8.12
(22,202)	-28.19	(22,401)	-24.54	(23,202)	-13.65	(23,203)	-20.71	(23,402)	-21.69
(24,203)	-20.71	(24,204)	-13.65	(24,403)	-21.69	(25,204)	-28.19	(25,205)	-8.12
(25,404)	-24.54	(26,205)	-34.92	(26,206)	-4.68	(26,405)	-28.46	(27,206)	28.39

(30,300)	28.54	(30,500)	-36.62	(31,301)	30.84	(31,500)	11.42	(31,501)	-30.21
(32,302)	32.11	(32,501)	1.76	(32,502)	-20.47	(33,303)	32.26	(33,502)	-10.74
(33,503)	-10.74	(34,304)	32.11	(34,503)	-20.47	(34,504)	1.76	(35,305)	30.84
(35,504)	-30.21	(35,505)	11.42	(36,306)	28.54	(36,505)	-36.62	(40,400)	36.26
(41,400)	1.00	(41,401)	-78.97	(41,600)	15.74	(42,401)	-63.44	(42,402)	-71.72
(42,601)	7.71	(43,402)	-66.32	(43,403)	-66.32	(43,602)	9.15	(44,403)	-71.72
(44,404)	-63.44	(44,603)	7.71	(45,404)	-78.97	(45,405)	1.00	(45,604)	15.74
(46,405)	36.26	(50,500)	34.24	(50,700)	-33.62	(51,501)	35.20	(51,700)	7.83
(51,701)	-24.69	(52,502)	35.62	(52,701)	-2.59	(52,702)	-39.57	(53,503)	35.62

(53,702)	-39.57	(53,703)	-2.59	(54,504)	35.20	(54,703)	-24.69	(54,704)	7.83
(55,505)	34.24	(55,704)	-33.62	(60,600)	42.78	(61,600)	60.05	(61,601)	41.99
(61,800)	29.21	(62,601)	54.02	(62,602)	47.96	(62,801)	31.18	(63,602)	47.96
(63,603)	54.02	(63,802)	31.18	(64,603)	41.99	(64,604)	60.05	(64,803)	29.21
(65,604)	42.78	(70,700)	36.28	(71,701)	36.52	(72,702)	-32.52	(73,703)	36.52
(74,704)	36.28	(80,800)	47.98	(81,800)	63.03	(81,801)	52.78	(82,801)	57.94
(82,802)	57.94	(83,802)	52.78	(83,803)	63.03	(84,803)	47.98	(	

BOTTOM STRUTS

(100,101)	13.78	(100,200)	47.45	(100,300)	-31.03	(101,102)	18.63	(101,200)	-48.18
(101,201)	-14.85	(101,300)	6.15	(101,301)	-21.34	(102,103)	21.90	(102,201)	-38.11
(102,202)	-17.75	(102,301)	3.74	(102,302)	-12.77	(103,104)	21.84	(103,202)	-29.51
(103,203)	-22.63	(103,302)	-.14	(103,303)	-5.56	(104,105)	21.90	(104,203)	-22.63
(104,204)	-29.51	(104,303)	-5.56	(104,304)	-.14	(105,106)	18.63	(105,204)	-17.75
(105,205)	-38.11	(105,304)	-12.77	(105,305)	3.74	(106,107)	13.78	(106,205)	-14.85
(106,206)	-48.18	(106,305)	-21.34	(106,306)	6.15	(107,206)	47.45	(107,306)	-31.03
(200,201)	-13.19	(200,400)	36.10	(201,202)	-6.48	(201,400)	-44.49	(201,401)	-53.55
(202,203)	-2.97	(202,401)	-75.57	(202,402)	-61.92	(203,204)	-2.97	(203,402)	-68.57
(203,403)	-68.57	(204,205)	-6.48	(204,403)	-61.92	(204,404)	-75.57	(205,206)	-13.19
(205,404)	-53.55	(205,405)	-44.49	(206,405)	36.10	(300,301)	25.63	(300,500)	-9.57
(301,302)	29.12	(301,500)	17.22	(301,501)	-1.46	(302,303)	31.02	(302,501)	14.60
(302,502)	5.32	(303,304)	31.02	(303,502)	10.13	(303,503)	10.13	(304,305)	29.12
(304,503)	5.32	(304,504)	14.60	(305,306)	25.63	(305,504)	-1.46	(305,505)	17.22
(306,505)	-9.57	(400,401)	57.06	(400,600)	21.97	(401,402)	46.62	(401,600)	-20.33
(401,601)	5.50	(402,403)	43.97	(402,601)	-11.56	(402,602)	-3.29	(403,404)	46.62
(403,602)	-3.29	(403,603)	-11.56	(404,405)	57.06	(404,603)	5.50	(404,604)	-20.33
(405,604)	21.97	(500,501)	32.00	(500,700)	7.34	(501,502)	34.45	(501,700)	24.52
(501,701)	13.50	(502,503)	34.01	(502,701)	22.03	(502,702)	10.43	(503,504)	34.45
(503,702)	10.43	(503,703)	22.03	(504,505)	32.00	(504,703)	13.50	(504,704)	24.52
(505,704)	7.34	(600,601)	74.61	(600,800)	7.48	(601,602)	75.67	(601,800)	-13.21
(601,801)	.26	(602,603)	75.67	(602,801)	-6.71	(602,802)	-6.71	(603,604)	74.61
(603,802)	.26	(603,803)	-13.21	(604,803)	7.48	(700,701)	35.79	(701,702)	37.33
(702,703)	37.33	(703,704)	35.79	(800,801)	75.70	(801,802)	76.19	(802,803)	75.70

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 5:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS	(1, 2)	-9.14	(1, 10)	-63.50	(1, 20)	28.71	(2, 3)	-4.42	(2, 10)	-26.83
	(2, 11)	-57.73	(2, 20)	-96.03	(2, 21)	-62.53	(3, 4)	-8.87	(3, 11)	-28.85
	(3, 12)	-50.00	(3, 21)	-85.95	(3, 22)	-75.67	(4, 5)	-7.37	(4, 12)	-32.12
	(4, 13)	-43.31	(4, 22)	-87.47	(4, 23)	-78.45	(5, 6)	-7.37	(5, 13)	-37.53
	(5, 14)	-37.53	(5, 23)	-82.48	(5, 24)	-82.48	(6, 7)	-8.87	(6, 14)	-43.31
	(6, 15)	-32.12	(6, 24)	-78.45	(6, 25)	-87.47	(7, 8)	-4.42	(7, 15)	-50.00
	(7, 16)	-28.85	(7, 25)	-75.67	(7, 26)	-85.95	(8, 9)	-9.14	(8, 16)	-57.73
	(8, 17)	-26.83	(8, 26)	-62.53	(8, 27)	-96.03	(9, 17)	-63.50	(9, 27)	28.71
	(10, 11)	13.01	(10, 30)	-41.55	(11, 12)	16.22	(11, 30)	-8.44	(11, 31)	-35.65
	(12, 13)	18.07	(12, 31)	-11.82	(12, 32)	-28.51	(13, 14)	19.43	(13, 32)	-16.36
	(13, 33)	-21.93	(14, 15)	18.07	(14, 33)	-21.93	(14, 34)	-16.36	(15, 16)	16.22
	(15, 34)	-28.51	(15, 35)	-11.82	(16, 17)	13.01	(16, 35)	-35.65	(16, 36)	-8.44
	(17, 36)	-41.55	(20, 21)	-77.69	(20, 40)	15.10	(21, 22)	-82.49	(21, 40)	-94.44
	(21, 41)	-70.78	(22, 23)	-80.09	(22, 41)	-90.64	(22, 42)	-75.67	(23, 24)	-79.18
	(23, 42)	-86.46	(23, 43)	-79.81	(24, 25)	-80.09	(24, 43)	-79.81	(24, 44)	-86.46
	(25, 26)	-82.49	(25, 44)	-75.67	(25, 45)	-90.64	(26, 27)	-77.69	(26, 45)	-70.78
	(26, 46)	-94.44	(27, 46)	15.10	(30, 31)	24.45	(30, 50)	-21.59	(31, 32)	26.32
	(31, 50)	2.63	(31, 51)	-17.73	(32, 33)	27.32	(32, 51)	-.94	(32, 52)	-11.20
	(33, 34)	27.32	(33, 52)	-5.73	(33, 53)	-5.73	(34, 35)	26.32	(34, 53)	-11.20
	(34, 54)	-.94	(35, 36)	24.45	(35, 54)	-17.73	(35, 55)	2.63	(36, 55)	-21.59
	(40, 41)	41.37	(40, 60)	1.72	(41, 42)	43.27	(41, 60)	-38.92	(41, 61)	-27.33
	(42, 43)	44.20	(42, 61)	-38.04	(42, 62)	-32.24	(43, 44)	44.20	(43, 62)	-35.81
	(43, 63)	-35.81	(44, 45)	43.27	(44, 63)	-32.24	(44, 64)	-38.04	(45, 46)	41.37
	(45, 64)	-27.33	(45, 65)	-38.92	(46, 65)	1.72	(50, 51)	30.51	(50, 70)	2.22
	(51, 52)	31.73	(51, 70)	10.40	(51, 71)	-2.86	(52, 53)	31.77	(52, 71)	6.93
	(52, 72)	-.62	(53, 54)	31.73	(53, 72)	-.62	(53, 73)	6.93	(54, 55)	30.51
	(54, 73)	-2.86	(54, 74)	10.40	(55, 74)	2.22	(60, 61)	71.23	(60, 80)	-8.54
	(61, 62)	71.85	(61, 80)	-19.25	(61, 81)	-17.84	(62, 63)	72.06	(62, 81)	-19.95
	(62, 82)	-19.67	(63, 64)	71.85	(63, 82)	-19.67	(63, 83)	-19.95	(64, 65)	71.23
	(64, 83)	-17.84	(64, 84)	-19.25	(65, 84)	-8.54	(70, 71)	34.16	(71, 72)	27.82
	(72, 73)	27.82	(73, 74)	34.16	(80, 81)	75.83	(81, 82)	76.15	(82, 83)	76.15
	(83, 84)	75.83	(							
DIAGONAL STRUTS	(1,100)	47.61	(2,100)	29.85	(2,101)	-51.84	(2,200)	31.58	(3,101)	-36.68
	(3,102)	-55.39	(3,201)	15.35	(4,102)	-51.88	(4,103)	-58.13	(4,202)	18.50
	(5,103)	-57.55	(5,104)	-57.55	(5,203)	19.77	(6,104)	-58.13	(6,105)	-51.88
	(6,204)	18.50	(7,105)	-55.39	(7,106)	-36.68	(7,205)	15.35	(8,106)	-51.84
	(8,107)	29.85	(8,206)	31.58	(9,107)	47.61	(10,100)	-40.74	(10,300)	-40.62
	(11,101)	-30.77	(11,300)	-8.88	(11,301)	-32.34	(12,102)	-40.04	(12,301)	-12.12
	(12,302)	-25.58	(13,103)	-37.29	(13,302)	-16.33	(13,303)	-21.50	(14,104)	-37.29
	(14,303)	-21.50	(14,304)	-16.33	(15,105)	-40.04	(15,304)	-25.58	(15,305)	-12.12
	(16,106)	-30.77	(16,305)	-32.34	(16,306)	-8.88	(17,107)	-40.74	(17,306)	-40.62
	(20,200)	53.08	(21,200)	64.73	(21,201)	41.66	(21,400)	28.28	(22,201)	54.20
	(22,202)	43.67	(22,401)	29.61	(23,202)	50.05	(23,203)	46.22	(23,402)	31.58
	(24,203)	46.22	(24,204)	50.05	(24,403)	31.58	(25,204)	43.67	(25,205)	54.20
	(25,404)	29.61	(26,205)	41.66	(26,206)	64.73	(26,405)	28.28	(27,206)	53.08

(30,300)	2.05	(30,500)	-24.03	(31,301)	7.26	(31,500)	-.34	(31,501)	-22.34
(32,302)	10.39	(32,501)	-6.33	(32,502)	-18.34	(33,303)	12.18	(33,502)	-12.64
(33,503)	-12.64	(34,304)	10.39	(34,503)	-18.34	(34,504)	-6.33	(35,305)	7.26
(35,504)	-22.34	(35,505)	-.34	(36,306)	2.05	(36,505)	-24.03	(40,400)	57.80
(41,400)	68.14	(41,401)	57.59	(41,600)	13.10	(42,401)	64.62	(42,402)	59.25
(42,601)	15.56	(43,402)	61.72	(43,403)	61.72	(43,602)	16.40	(44,403)	59.25
(44,404)	64.62	(44,603)	15.56	(45,404)	57.59	(45,405)	68.14	(45,604)	13.10
(46,405)	57.80	(50,500)	20.55	(50,700)	-24.63	(51,501)	23.06	(51,700)	-1.61
(51,701)	-21.66	(52,502)	24.29	(52,701)	-9.09	(52,702)	-17.04	(53,503)	24.29

(53,702)	-17.04	(53,703)	-9.09	(54,504)	23.06	(54,703)	-21.66	(54,704)	-1.61
(55,505)	20.55	(55,704)	-24.63	(60,600)	61.69	(61,600)	69.18	(61,601)	63.05
(61,800)	-7.76	(62,601)	66.99	(62,602)	64.90	(62,801)	-6.65	(63,602)	64.90
(63,603)	66.99	(63,802)	-6.65	(64,603)	63.05	(64,604)	69.18	(64,803)	-7.76
(65,604)	61.69	(70,700)	29.33	(71,701)	30.57	(72,702)	30.42	(73,703)	30.57
(74,704)	29.33	(80,800)	64.43	(81,800)	69.61	(81,801)	66.18	(82,801)	67.92
(82,802)	67.92	(83,802)	66.18	(83,803)	69.61	(84,803)	64.43	(	

BOTTOM STRUTS

(100,101)	67.47	(100,200)	27.61	(100,300)	-34.40	(101,102)	48.37	(101,200)	-17.13
(101,201)	7.99	(101,300)	-38.55	(101,301)	-66.17	(102,103)	49.34	(102,201)	-20.52
(102,202)	-.24	(102,301)	-45.47	(102,302)	-61.39	(103,104)	46.59	(103,202)	-14.85
(103,203)	-7.46	(103,302)	-55.48	(103,303)	-60.42	(104,105)	49.34	(104,203)	-7.46
(104,204)	-14.85	(104,303)	-60.42	(104,304)	-55.48	(105,106)	48.37	(105,204)	-.24
(105,205)	-20.52	(105,304)	-61.39	(105,305)	-45.47	(106,107)	67.47	(106,205)	7.99
(106,206)	-17.13	(106,305)	-66.17	(106,306)	-38.55	(107,206)	27.61	(107,306)	-34.40
(200,201)	74.16	(200,400)	14.46	(201,202)	72.76	(201,400)	-13.75	(201,401)	5.21
(202,203)	73.14	(202,401)	-12.57	(202,402)	-1.37	(203,204)	73.14	(203,402)	-7.37
(203,403)	-7.37	(204,205)	72.76	(204,403)	-1.37	(204,404)	-12.57	(205,206)	74.16
(205,404)	5.21	(205,405)	-13.75	(206,405)	14.46	(300,301)	-8.58	(300,500)	-47.66
(301,302)	-14.71	(301,500)	-18.81	(301,501)	-35.23	(302,303)	-10.96	(302,501)	-18.11
(302,502)	-27.84	(303,304)	-10.96	(303,502)	-21.47	(303,503)	-21.47	(304,305)	-14.71
(304,503)	-27.84	(304,504)	-18.11	(305,306)	-8.58	(305,504)	-35.23	(305,505)	-18.81
(306,505)	-47.66	(400,401)	75.34	(400,600)	2.42	(401,402)	75.79	(401,600)	-11.80
(401,601)	-3.00	(402,403)	75.97	(402,601)	-10.05	(402,602)	-7.11	(403,404)	75.79
(403,602)	-7.11	(403,603)	-10.05	(404,405)	75.34	(404,603)	-3.00	(404,604)	-11.80
(405,604)	2.42	(500,501)	19.78	(500,700)	-18.91	(501,502)	22.11	(501,700)	1.58
(501,701)	-11.83	(502,503)	22.93	(502,701)	-1.56	(502,702)	-6.10	(503,504)	22.11
(503,702)	-6.10	(503,703)	-1.56	(504,505)	19.78	(504,703)	-11.83	(504,704)	1.58
(505,704)	-18.91	(600,601)	75.80	(600,800)	-6.24	(601,602)	76.15	(601,800)	-9.13
(601,801)	-8.47	(602,603)	76.15	(602,801)	-9.40	(602,802)	-9.40	(603,604)	75.80
(603,802)	-8.47	(603,803)	-9.13	(604,803)	-6.24	(700,701)	29.97	(701,702)	31.09
(702,703)	31.09	(703,704)	29.97	(800,801)	76.03	(801,802)	76.19	(802,803)	76.03

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 6:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	45.39	(1, 10)	-88.97	(1, 20)	6.17	(2, 3)	44.35	(2, 10)	-68.33
(2, 11)	-89.62	(2, 20)	-21.94	(2, 21)	-17.73	(3, 4)	41.08	(3, 11)	-82.39
(3, 12)	-97.27	(3, 21)	-24.79	(3, 22)	-23.03	(4, 5)	41.43	(4, 12)	-89.44
(4, 13)	-94.82	(4, 22)	-27.70	(4, 23)	-26.23	(5, 6)	41.43	(5, 13)	-90.71
(5, 14)	-90.71	(5, 23)	-27.83	(5, 24)	-27.83	(6, 7)	41.08	(6, 14)	-94.82
(6, 15)	-89.44	(6, 24)	-26.23	(6, 25)	-27.70	(7, 8)	44.35	(7, 15)	-97.27
(7, 16)	-82.39	(7, 25)	-23.03	(7, 26)	-24.79	(8, 9)	45.39	(8, 16)	-89.62
(8, 17)	-68.33	(8, 26)	-17.73	(8, 27)	-21.94	(9, 17)	-88.97	(9, 27)	6.17
(10, 11)	-84.14	(10, 30)	-87.49	(11, 12)	-104.80	(11, 30)	-82.84	(11, 31)	-106.52
(12, 13)	-102.57	(12, 31)	-98.30	(12, 32)	-106.08	(13, 14)	-101.70	(13, 32)	-99.63
(13, 33)	-102.34	(14, 15)	-102.57	(14, 33)	-102.34	(14, 34)	-99.63	(15, 16)	-104.80
(15, 34)	-106.08	(15, 35)	-98.30	(16, 17)	-84.14	(16, 35)	-106.52	(16, 36)	-82.84
(17, 36)	-87.49	(20, 21)	73.37	(20, 40)	-3.12	(21, 22)	73.35	(21, 40)	-1.43
(21, 41)	-9.94	(22, 23)	73.47	(22, 41)	-5.96	(22, 42)	-11.50	(23, 24)	73.51
(23, 42)	-9.38	(23, 43)	-11.20	(24, 25)	73.47	(24, 43)	-11.20	(24, 44)	-9.38
(25, 26)	73.35	(25, 44)	-11.50	(25, 45)	-5.96	(26, 27)	73.37	(26, 45)	-9.94
(26, 46)	-1.43	(27, 46)	-3.12	(30, 31)	-35.45	(30, 50)	-57.42	(31, 32)	-45.41
(31, 50)	-53.49	(31, 51)	-73.76	(32, 33)	-43.90	(32, 51)	-61.66	(32, 52)	-68.90
(33, 34)	-43.90	(33, 52)	-64.79	(33, 53)	-64.79	(34, 35)	-45.41	(34, 53)	-68.90
(34, 54)	-61.66	(35, 36)	-35.45	(35, 54)	-73.76	(35, 55)	-53.49	(36, 55)	-57.42
(40, 41)	75.84	(40, 60)	-7.26	(41, 42)	75.92	(41, 60)	7.35	(41, 61)	-7.86
(42, 43)	75.97	(42, 61)	2.26	(42, 62)	-5.76	(43, 44)	75.97	(43, 62)	-2.25
(43, 63)	-2.25	(44, 45)	75.92	(44, 63)	-5.76	(44, 64)	2.26	(45, 46)	75.84
(45, 64)	-7.86	(45, 65)	7.35	(46, 65)	-7.26	(50, 51)	-11.97	(50, 70)	-37.62
(51, 52)	-10.41	(51, 70)	-30.60	(51, 71)	-42.89	(52, 53)	-9.87	(52, 71)	-33.80
(52, 72)	-38.06	(53, 54)	-10.41	(53, 72)	-38.06	(53, 73)	-33.80	(54, 55)	-11.97
(54, 73)	-42.89	(54, 74)	-30.60	(55, 74)	-37.62	(60, 61)	76.08	(60, 80)	-4.57
(61, 62)	76.15	(61, 80)	13.52	(61, 81)	-1.34	(62, 63)	76.17	(62, 81)	8.26
(62, 82)	3.18	(63, 64)	76.15	(63, 82)	3.18	(63, 83)	8.26	(64, 65)	76.08
(64, 83)	-1.34	(64, 84)	13.52	(65, 84)	-4.57	(70, 71)	22.86	(71, 72)	23.31
(72, 73)	23.31	(73, 74)	22.86	(80, 81)	76.15	(81, 82)	76.19	(82, 83)	76.19
(83, 84)	76.15	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	65.35	(2,100)	67.67	(2,101)	63.02	(2,200)	12.48	(3,101)	65.22
(3,102)	61.88	(3,201)	16.94	(4,102)	63.30	(4,103)	61.54	(4,202)	19.64
(5,103)	62.03	(5,104)	62.03	(5,203)	20.46	(6,104)	61.54	(6,105)	63.30
(6,204)	19.64	(7,105)	61.88	(7,106)	65.22	(7,205)	16.94	(8,106)	63.02
(8,107)	67.67	(8,206)	12.48	(9,107)	65.35	(10,100)	25.10	(10,300)	48.99
(11,101)	28.87	(11,300)	52.61	(11,301)	45.91	(12,102)	32.30	(12,301)	47.12
(12,302)	42.97	(13,103)	33.99	(13,302)	43.98	(13,303)	41.84	(14,104)	33.99
(14,303)	41.84	(14,304)	43.98	(15,105)	32.30	(15,304)	42.97	(15,305)	47.12
(16,106)	28.87	(16,305)	45.91	(16,306)	52.61	(17,107)	25.10	(17,306)	48.99
(20,200)	68.44	(21,200)	70.23	(21,201)	67.74	(21,400)	-5.16	(22,201)	69.06
(22,202)	67.47	(22,401)	-2.47	(23,202)	68.17	(23,203)	67.62	(23,402)	-1.33
(24,203)	67.62	(24,204)	68.17	(24,403)	-1.33	(25,204)	67.47	(25,205)	69.06
(25,404)	-2.47	(26,205)	67.74	(26,206)	70.23	(26,405)	-5.16	(27,206)	68.44

(30,300)	9.95	(30,500)	-72.64	(31,301)	2.95	(31,500)	-87.70	(31,501)	-96.20
(32,302)	3.73	(32,501)	-95.23	(32,502)	-97.47	(33,303)	5.02	(33,502)	-95.72
(33,503)	-95.72	(34,304)	3.73	(34,503)	-97.47	(34,504)	-95.23	(35,305)	2.95
(35,504)	-96.20	(35,505)	-87.70	(36,306)	9.95	(36,505)	-72.64	(40,400)	70.84
(41,400)	72.15	(41,401)	70.77	(41,600)	-28.17	(42,401)	71.60	(42,402)	70.90
(42,601)	-28.52	(43,402)	71.19	(43,403)	71.19	(43,602)	-28.81	(44,403)	70.90
(44,404)	71.60	(44,603)	-28.52	(45,404)	70.77	(45,405)	72.15	(45,604)	-28.17
(46,405)	70.84	(50,500)	-58.09	(50,700)	-48.86	(51,501)	-66.44	(51,700)	-51.34
(51,701)	-56.00	(52,502)	-61.83	(52,701)	-52.87	(52,702)	-54.59	(53,503)	-61.83

(53,702)	-54.59	(53,703)	-52.87	(54,504)	-66.44	(54,703)	-56.00	(54,704)	-51.34
(55,505)	-58.09	(55,704)	-48.86	(60,600)	72.43	(61,600)	73.44	(61,601)	72.72
(61,800)	-58.40	(62,601)	73.21	(62,602)	72.98	(62,801)	-63.47	(63,602)	72.98
(63,603)	73.21	(63,802)	-63.47	(64,603)	72.72	(64,604)	73.44	(64,803)	-58.40
(65,604)	72.43	(70,700)	-18.43	(71,701)	-17.33	(72,702)	-16.43	(73,703)	-17.33
(74,704)	-18.43	(80,800)	73.51	(81,800)	74.19	(81,801)	73.84	(82,801)	74.07
(82,802)	74.07	(83,802)	73.84	(83,803)	74.19	(84,803)	73.51	(	

BOTTOM STRUTS

(100,101)	75.89	(100,200)	4.22	(100,300)	-8.86	(101,102)	75.88	(101,200)	-4.49
(101,201)	-.64	(101,300)	7.61	(101,301)	-11.00	(102,103)	75.98	(102,201)	-7.02
(102,202)	-4.26	(102,301)	2.37	(102,302)	-9.31	(103,104)	75.99	(103,202)	-7.56
(103,203)	-6.60	(103,302)	-2.60	(103,303)	-6.62	(104,105)	75.98	(104,203)	-6.60
(104,204)	-7.56	(104,303)	-6.62	(104,304)	-2.60	(105,106)	75.88	(105,204)	-4.26
(105,205)	-7.02	(105,304)	-9.31	(105,305)	2.37	(106,107)	75.89	(106,205)	-.64
(106,206)	-4.49	(106,305)	-11.00	(106,306)	7.61	(107,206)	4.22	(107,306)	-8.86
(200,201)	76.02	(200,400)	-3.67	(201,202)	76.11	(201,400)	.63	(201,401)	-6.10
(202,203)	76.17	(202,401)	-3.01	(202,402)	-6.53	(203,204)	76.17	(203,402)	-5.42
(203,403)	-5.42	(204,205)	76.11	(204,403)	-6.53	(204,404)	-3.01	(205,206)	76.02
(205,404)	-6.10	(205,405)	.63	(206,405)	-3.67	(300,301)	73.63	(300,500)	-23.62
(301,302)	73.00	(301,500)	-.57	(301,501)	-23.57	(302,303)	73.05	(302,501)	-9.11
(302,502)	-19.43	(303,304)	73.05	(303,502)	-14.10	(303,503)	-14.10	(304,305)	73.00
(304,503)	-19.43	(304,504)	-9.11	(305,306)	73.63	(305,504)	-23.57	(305,505)	-.57
(306,505)	-23.62	(400,401)	76.09	(400,600)	-6.27	(401,402)	76.17	(401,600)	6.87
(401,601)	-4.65	(402,403)	76.20	(402,601)	2.23	(402,602)	-1.73	(403,404)	76.17
(403,602)	-1.73	(403,603)	2.23	(404,405)	76.09	(404,603)	-4.65	(404,604)	6.87
(405,604)	-6.27	(500,501)	31.33	(500,700)	-94.55	(501,502)	29.88	(501,700)	-88.06
(501,701)	-94.62	(502,503)	25.88	(502,701)	-93.02	(502,702)	-94.50	(503,504)	29.88
(503,702)	-94.50	(503,703)	-93.02	(504,505)	31.33	(504,703)	-94.62	(504,704)	-88.06
(505,704)	-94.55	(600,601)	76.14	(600,800)	-1.53	(601,602)	76.19	(601,800)	13.19
(601,801)	2.80	(602,603)	76.19	(602,801)	7.86	(602,802)	7.86	(603,604)	76.14
(603,802)	2.80	(603,803)	13.19	(604,803)	-1.53	(700,701)	-35.19	(701,702)	-32.95
(702,703)	-32.95	(703,704)	-35.19	(800,801)	76.18	(801,802)	76.19	(802,803)	76.18

9

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 7:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS	(1, 2)	75.16	(1, 10)	11.88	(1, 20)	-8.41	(2, 3)	75.51	(2, 10)	-11.40
	(2, 11)	4.95	(2, 20)	21.91	(2, 21)	-8.97	(3, 4)	75.76	(3, 11)	-13.57
	(3, 12)	-2.08	(3, 21)	15.22	(3, 22)	-6.85	(4, 5)	75.93	(4, 12)	-13.58
	(4, 13)	-7.46	(4, 22)	8.49	(4, 23)	-2.99	(5, 6)	75.93	(5, 13)	-11.31
	(5, 14)	-11.31	(5, 23)	2.27	(5, 24)	2.27	(6, 7)	75.76	(6, 14)	-7.46
	(6, 15)	-13.58	(6, 24)	-2.99	(6, 25)	8.49	(7, 8)	75.51	(7, 15)	-2.08
	(7, 16)	-13.57	(7, 25)	-6.85	(7, 26)	15.22	(8, 9)	75.16	(8, 16)	4.95
	(8, 17)	-11.40	(8, 26)	-8.97	(8, 27)	21.91	(9, 17)	11.88	(9, 27)	-8.41
	(10, 11)	72.62	(10, 30)	-20.20	(11, 12)	72.17	(11, 30)	-29.29	(11, 31)	-28.56
	(12, 13)	72.48	(12, 31)	-35.23	(12, 32)	-33.91	(13, 14)	72.85	(13, 32)	-36.38
	(13, 33)	-35.96	(14, 15)	72.48	(14, 33)	-35.96	(14, 34)	-36.38	(15, 16)	72.17
	(15, 34)	-33.91	(15, 35)	-35.23	(16, 17)	72.62	(16, 35)	-28.56	(16, 36)	-29.29
	(17, 36)	-20.20	(20, 21)	75.52	(20, 40)	-5.80	(21, 22)	75.85	(21, 40)	28.86
	(21, 41)	-2.33	(22, 23)	76.09	(22, 41)	22.58	(22, 42)	3.02	(23, 24)	76.18
	(23, 42)	15.90	(23, 43)	9.25	(24, 25)	76.09	(24, 43)	9.25	(24, 44)	15.90
	(25, 26)	75.85	(25, 44)	3.02	(25, 45)	22.58	(26, 27)	75.52	(26, 45)	-2.33
	(26, 46)	28.86	(27, 46)	-5.80	(30, 31)	34.67	(30, 50)	-105.49	(31, 32)	32.52
	(31, 50)	-102.71	(31, 51)	-109.80	(32, 33)	33.23	(32, 51)	-105.53	(32, 52)	-108.36
	(33, 34)	33.23	(33, 52)	-106.84	(33, 53)	-106.84	(34, 35)	32.52	(34, 53)	-108.36
	(34, 54)	-105.53	(35, 36)	34.67	(35, 54)	-109.80	(35, 55)	-102.71	(36, 55)	-105.49
	(40, 41)	75.71	(40, 60)	3.29	(41, 42)	76.01	(41, 60)	34.86	(41, 61)	9.39
	(42, 43)	76.18	(42, 61)	28.99	(42, 62)	16.01	(43, 44)	76.18	(43, 62)	22.64
	(43, 63)	22.64	(44, 45)	76.01	(44, 63)	16.01	(44, 64)	28.99	(45, 46)	75.71
	(45, 64)	9.39	(45, 65)	34.86	(46, 65)	3.29	(50, 51)	-110.40	(50, 70)	-118.75
	(51, 52)	-107.79	(51, 70)	-110.89	(51, 71)	-116.51	(52, 53)	-106.60	(52, 71)	-111.60
	(52, 72)	-113.51	(53, 54)	-107.79	(53, 72)	-113.51	(53, 73)	-111.60	(54, 55)	-110.40
	(54, 73)	-116.51	(54, 74)	-110.89	(55, 74)	-118.75	(60, 61)	75.88	(60, 80)	16.05
	(61, 62)	76.11	(61, 80)	40.16	(61, 81)	22.66	(62, 63)	76.20	(62, 81)	34.87
	(62, 82)	29.01	(63, 64)	76.11	(63, 82)	29.01	(63, 83)	34.87	(64, 65)	75.88
	(64, 83)	22.66	(64, 84)	40.16	(65, 84)	16.05	(70, 71)	-56.16	(71, 72)	-54.39
	(72, 73)	-54.39	(73, 74)	-56.16	(80, 81)	76.00	(81, 82)	76.17	(82, 83)	76.17
	(83, 84)	76.00	(							
DIAGONAL STRUTS	(1,100)	74.22	(2,100)	70.21	(2,101)	73.53	(2,200)	-25.30	(3,101)	70.39
	(3,102)	72.76	(3,201)	-23.37	(4,102)	70.79	(4,103)	72.01	(4,202)	-23.04
	(5,103)	71.36	(5,104)	71.36	(5,203)	-23.00	(6,104)	72.01	(6,105)	70.79
	(6,204)	-23.04	(7,105)	72.76	(7,106)	70.39	(7,205)	-23.37	(8,106)	73.53
	(8,107)	70.21	(8,206)	-25.30	(9,107)	74.22	(10,100)	-8.35	(10,300)	71.17
	(11,101)	-2.78	(11,300)	65.65	(11,301)	69.61	(12,102)	.22	(12,301)	65.61
	(12,302)	68.10	(13,103)	1.62	(13,302)	66.04	(13,303)	66.92	(14,104)	1.62
	(14,303)	66.92	(14,304)	66.04	(15,105)	.22	(15,304)	68.10	(15,305)	65.61
	(16,106)	-2.78	(16,305)	69.61	(16,306)	65.65	(17,107)	-8.35	(17,306)	71.17
	(20,200)	75.09	(21,200)	73.11	(21,201)	74.80	(21,400)	-47.00	(22,201)	73.50
	(22,202)	74.53	(22,401)	-51.63	(23,202)	73.89	(23,203)	74.23	(23,402)	-54.90
	(24,203)	74.23	(24,204)	73.89	(24,403)	-54.90	(25,204)	74.53	(25,205)	73.50
	(25,404)	-51.63	(26,205)	74.80	(26,206)	73.11	(26,405)	-47.00	(27,206)	75.09

(30,300)	11.87	(30,500)	64.83	(31,301)	16.68	(31,500)	57.71	(31,501)	61.98
(32,302)	19.31	(32,501)	57.55	(32,502)	59.80	(33,303)	20.09	(33,502)	58.30
(33,503)	58.30	(34,304)	19.31	(34,503)	59.80	(34,504)	57.55	(35,305)	16.68
(35,504)	61.98	(35,505)	57.71	(36,306)	11.87	(36,505)	64.83	(40,400)	75.46
(41,400)	74.87	(41,401)	75.49	(41,600)	-72.56	(42,401)	75.21	(42,402)	75.48
(42,601)	-88.69	(43,402)	75.41	(43,403)	75.41	(43,602)	-98.60	(44,403)	75.48
(44,404)	75.21	(44,603)	-88.69	(45,404)	75.49	(45,405)	74.87	(45,604)	-72.56
(46,405)	75.46	(50,500)	23.92	(50,700)	38.53	(51,501)	26.74	(51,700)	29.89
(51,701)	34.78	(52,502)	28.54	(52,701)	29.71	(52,702)	31.39	(53,503)	28.54

(53,702)	31.39	(53,703)	29.71	(54,504)	26.74	(54,703)	34.78	(54,704)	29.89
(55,505)	23.92	(55,704)	38.53	(60,600)	75.63	(61,600)	75.74	(61,601)	75.65
(61,800)	-97.31	(62,601)	75.84	(62,602)	75.77	(62,801)	-131.28	(63,602)	75.77
(63,603)	75.84	(63,802)	-131.28	(64,603)	75.65	(64,604)	75.74	(64,803)	-97.31
(65,604)	75.63	(70,700)	-20.02	(71,701)	-16.41	(72,702)	-18.14	(73,703)	-16.41
(74,704)	-20.02	(80,800)	75.46	(81,800)	75.97	(81,801)	75.63	(82,801)	75.84
(82,802)	75.84	(83,802)	75.63	(83,803)	75.97	(84,803)	75.46	(	

BOTTOM STRUTS

(100,101)	75.68	(100,200)	-11.23	(100,300)	9.52	(101,102)	75.95	(101,200)	17.08
(101,201)	-9.98	(101,300)	-10.96	(101,301)	3.21	(102,103)	76.13	(102,201)	10.44
(102,202)	-6.74	(102,301)	-11.32	(102,302)	-2.25	(103,104)	76.20	(103,202)	3.94
(103,203)	-1.95	(103,302)	-9.87	(103,303)	-6.73	(104,105)	76.13	(104,203)	-1.95
(104,204)	3.94	(104,303)	-6.73	(104,304)	-9.87	(105,106)	75.95	(105,204)	-6.74
(105,205)	10.44	(105,304)	-2.25	(105,305)	-11.32	(106,107)	75.68	(106,205)	-9.98
(106,206)	17.08	(106,305)	3.21	(106,306)	-10.96	(107,206)	-11.23	(107,306)	9.52
(200,201)	75.77	(200,400)	-7.03	(201,202)	76.04	(201,400)	24.76	(201,401)	-1.97
(202,203)	76.18	(202,401)	17.98	(202,402)	4.15	(203,204)	76.18	(203,402)	10.98
(203,403)	10.98	(204,205)	76.04	(204,403)	4.15	(204,404)	17.98	(205,206)	75.77
(205,404)	-1.97	(205,405)	24.76	(206,405)	-7.03	(300,301)	75.85	(300,500)	-2.97
(301,302)	76.05	(301,500)	-8.60	(301,501)	-7.07	(302,303)	76.16	(302,501)	-10.44
(302,502)	-9.67	(303,304)	76.16	(303,502)	-10.79	(303,503)	-10.79	(304,305)	76.05
(304,503)	-9.67	(304,504)	-10.44	(305,306)	75.85	(305,504)	-7.07	(305,505)	-8.60
(306,505)	-2.97	(400,401)	75.88	(400,600)	4.13	(401,402)	76.11	(401,600)	31.91
(401,601)	11.04	(402,403)	76.20	(402,601)	25.37	(402,602)	18.30	(403,404)	76.11
(403,602)	18.30	(403,603)	25.37	(404,405)	75.88	(404,603)	11.04	(404,604)	31.91
(405,604)	4.13	(500,501)	75.66	(500,700)	-13.36	(501,502)	75.80	(501,700)	-8.56
(501,701)	-14.14	(502,503)	75.82	(502,701)	-11.67	(502,702)	-13.58	(503,504)	75.80
(503,702)	-13.58	(503,703)	-11.67	(504,505)	75.66	(504,703)	-14.14	(504,704)	-8.56
(505,704)	-13.36	(600,601)	75.98	(600,800)	18.11	(601,602)	76.17	(601,800)	38.33
(601,801)	25.35	(602,603)	76.17	(602,801)	32.18	(602,802)	32.18	(603,604)	75.98
(603,802)	25.35	(603,803)	38.33	(604,803)	18.11	(700,701)	70.46	(701,702)	70.72
(702,703)	70.72	(703,704)	70.46	(800,801)	76.07	(801,802)	76.19	(802,803)	76.07

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 8:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	72.80	(1, 10)	39.79	(1, 20)	-4.85	(2, 3)	74.26	(2, 10)	-10.61
(2, 11)	32.86	(2, 20)	46.06	(2, 21)	1.95	(3, 4)	75.44	(3, 11)	-5.10
(3, 12)	25.23	(3, 21)	39.90	(3, 22)	9.55	(4, 5)	76.11	(4, 12)	1.61
(4, 13)	17.27	(4, 22)	32.99	(4, 23)	17.54	(5, 6)	76.11	(5, 13)	9.33
(5, 14)	9.33	(5, 23)	25.47	(5, 24)	25.47	(6, 7)	75.44	(6, 14)	17.27
(6, 15)	1.61	(6, 24)	17.54	(6, 25)	32.99	(7, 8)	74.26	(7, 15)	25.23
(7, 16)	-5.10	(7, 25)	9.55	(7, 26)	39.90	(8, 9)	72.80	(8, 16)	32.86
(8, 17)	-10.61	(8, 26)	1.95	(8, 27)	46.06	(9, 17)	39.79	(9, 27)	-4.85
(10, 11)	73.54	(10, 30)	24.65	(11, 12)	74.89	(11, 30)	-15.60	(11, 31)	16.46
(12, 13)	75.83	(12, 31)	-11.85	(12, 32)	8.31	(13, 14)	76.18	(13, 32)	-6.28
(13, 33)	.58	(14, 15)	75.83	(14, 33)	.58	(14, 34)	-6.28	(15, 16)	74.89
(15, 34)	8.31	(15, 35)	-11.85	(16, 17)	73.54	(16, 35)	16.46	(16, 36)	-15.60
(17, 36)	24.65	(20, 21)	73.56	(20, 40)	9.57	(21, 22)	74.91	(21, 40)	51.37
(21, 41)	17.60	(22, 23)	75.86	(22, 41)	45.95	(22, 42)	25.43	(23, 24)	76.20
(23, 42)	39.81	(23, 43)	32.93	(24, 25)	75.86	(24, 43)	32.93	(24, 44)	39.81
(25, 26)	74.91	(25, 44)	25.43	(25, 45)	45.95	(26, 27)	73.56	(26, 45)	17.60
(26, 46)	51.37	(27, 46)	9.57	(30, 31)	73.98	(30, 50)	3.87	(31, 32)	75.12
(31, 50)	-23.79	(31, 51)	-4.48	(32, 33)	75.80	(32, 51)	-21.49	(32, 52)	-11.56
(33, 34)	75.80	(33, 52)	-17.33	(33, 53)	-17.33	(34, 35)	75.12	(34, 53)	-11.56
(34, 54)	-21.49	(35, 36)	73.98	(35, 54)	-4.48	(35, 55)	-23.79	(36, 55)	3.87
(40, 41)	74.28	(40, 60)	25.49	(41, 42)	75.45	(41, 60)	56.01	(41, 61)	33.00
(42, 43)	76.11	(42, 61)	51.42	(42, 62)	39.90	(43, 44)	76.11	(43, 62)	46.05
(43, 63)	46.05	(44, 45)	75.45	(44, 63)	39.90	(44, 64)	51.42	(45, 46)	74.28
(45, 64)	33.00	(45, 65)	56.01	(46, 65)	25.49	(50, 51)	70.98	(50, 70)	-32.27
(51, 52)	72.05	(51, 70)	-46.06	(51, 71)	-38.21	(52, 53)	72.45	(52, 71)	-44.92
(52, 72)	-42.31	(53, 54)	72.05	(53, 72)	-42.31	(53, 73)	-44.92	(54, 55)	70.98
(54, 73)	-38.21	(54, 74)	-46.06	(55, 74)	-32.27	(60, 61)	74.90	(60, 80)	39.93
(61, 62)	75.85	(61, 80)	59.96	(61, 81)	46.08	(62, 63)	76.20	(62, 81)	56.06
(62, 82)	51.45	(63, 64)	75.85	(63, 82)	51.45	(63, 83)	56.06	(64, 65)	74.90
(64, 83)	46.08	(64, 84)	59.96	(65, 84)	39.93	(70, 71)	39.54	(71, 72)	40.73
(72, 73)	40.73	(73, 74)	39.54	(80, 81)	75.44	(81, 82)	76.11	(82, 83)	76.11
(83, 84)	75.44	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	74.83	(2,100)	72.83	(2,101)	75.31	(2,200)	-59.98	(3,101)	74.05
(3,102)	75.60	(3,201)	-71.31	(4,102)	74.92	(4,103)	75.66	(4,202)	-83.26
(5,103)	75.45	(5,104)	75.45	(5,203)	-89.32	(6,104)	75.66	(6,105)	74.92
(6,204)	-83.26	(7,105)	75.60	(7,106)	74.05	(7,205)	-71.31	(8,106)	75.31
(8,107)	72.83	(8,206)	-59.98	(9,107)	74.83	(10,100)	-46.13	(10,300)	75.58
(11,101)	-47.21	(11,300)	70.14	(11,301)	75.33	(12,102)	-48.94	(12,301)	71.61
(12,302)	74.79	(13,103)	-50.60	(13,302)	72.90	(13,303)	73.97	(14,104)	-50.60
(14,303)	73.97	(14,304)	72.90	(15,105)	-48.94	(15,304)	74.79	(15,305)	71.61
(16,106)	-47.21	(16,305)	75.33	(16,306)	70.14	(17,107)	-46.13	(17,306)	75.58
(20,200)	73.80	(21,200)	75.22	(21,201)	74.53	(21,400)	-70.34	(22,201)	75.83
(22,202)	75.15	(22,401)	-96.39	(23,202)	75.94	(23,203)	75.66	(23,402)	-129.83
(24,203)	75.66	(24,204)	75.94	(24,403)	-129.83	(25,204)	75.15	(25,205)	75.83
(25,404)	-96.39	(26,205)	74.53	(26,206)	75.22	(26,405)	-70.34	(27,206)	73.80

(30,300)	-28.20	(30,500)	74.19	(31,301)	-25.10	(31,500)	65.55	(31,501)	72.83
(32,302)	-23.58	(32,501)	67.44	(32,502)	71.18	(33,303)	-22.99	(33,502)	69.36
(33,503)	69.36	(34,304)	-23.58	(34,503)	71.18	(34,504)	67.44	(35,305)	-25.10
(35,504)	72.83	(35,505)	65.55	(36,306)	-28.20	(36,505)	74.19	(40,400)	72.46
(41,400)	76.07	(41,401)	73.26	(41,600)	-73.72	(42,401)	75.81	(42,402)	74.15
(42,601)	-111.00	(43,402)	75.08	(43,403)	75.08	(43,602)	-146.25	(44,403)	74.15
(44,404)	75.81	(44,603)	-111.00	(45,404)	73.26	(45,405)	76.07	(45,604)	-73.72
(46,405)	72.46	(50,500)	-8.77	(50,700)	69.63	(51,501)	-4.92	(51,700)	58.64
(51,701)	66.92	(52,502)	-3.17	(52,701)	61.25	(52,702)	64.08	(53,503)	-3.17

(53,702)	64.08	(53,703)	61.25	(54,504)	-4.92	(54,703)	66.92	(54,704)	58.64
(55,505)	-8.77	(55,704)	69.63	(60,600)	71.04	(61,600)	75.67	(61,601)	71.97
(61,800)	-62.06	(62,601)	74.57	(62,602)	73.20	(62,801)	-93.91	(63,602)	73.20
(63,603)	74.57	(63,802)	-93.91	(64,603)	71.97	(64,604)	75.67	(64,803)	-62.06
(65,604)	71.04	(70,700)	6.57	(71,701)	9.55	(72,702)	10.30	(73,703)	9.55
(74,704)	6.57	(80,800)	70.13	(81,800)	74.58	(81,801)	71.20	(82,801)	72.83
(82,802)	72.83	(83,802)	71.20	(83,803)	74.58	(84,803)	70.13	(	

BOTTOM STRUTS

(100,101)	73.79	(100,200)	-7.66	(100,300)	33.59	(101,102)	75.03	(101,200)	41.03
(101,201)	.20	(101,300)	-14.18	(101,301)	25.90	(102,103)	75.89	(102,201)	34.00
(102,202)	8.75	(102,301)	-7.57	(102,302)	17.53	(103,104)	76.20	(103,202)	26.11
(103,203)	17.57	(103,302)	.31	(103,303)	8.90	(104,105)	75.89	(104,203)	17.57
(104,204)	26.11	(104,303)	8.90	(104,304)	.31	(105,106)	75.03	(105,204)	8.75
(105,205)	34.00	(105,304)	17.53	(105,305)	-7.57	(106,107)	73.79	(106,205)	.20
(106,206)	41.03	(106,305)	25.90	(106,306)	-14.18	(107,206)	-7.66	(107,306)	33.59
(200,201)	74.30	(200,400)	8.91	(201,202)	75.45	(201,400)	47.75	(201,401)	17.56
(202,203)	76.11	(202,401)	41.45	(202,402)	26.16	(203,204)	76.11	(203,402)	34.21
(203,403)	34.21	(204,205)	75.45	(204,403)	26.16	(204,404)	41.45	(205,206)	74.30
(205,404)	17.56	(205,405)	47.75	(206,405)	8.91	(300,301)	74.55	(300,500)	17.57
(301,302)	75.57	(301,500)	-18.93	(301,501)	9.23	(302,303)	76.13	(302,501)	-13.65
(302,502)	.94	(303,304)	76.13	(303,502)	-6.85	(303,503)	-6.85	(304,305)	75.57
(304,503)	.94	(304,504)	-13.65	(305,306)	74.55	(305,504)	9.23	(305,505)	-18.93
(306,505)	17.57	(400,401)	74.81	(400,600)	26.05	(401,402)	75.83	(401,600)	53.42
(401,601)	34.08	(402,403)	76.20	(402,601)	47.90	(402,602)	41.42	(403,404)	75.83
(403,602)	41.42	(403,603)	47.90	(404,405)	74.81	(404,603)	34.08	(404,604)	53.42
(405,604)	26.05	(500,501)	75.15	(500,700)	1.44	(501,502)	75.92	(501,700)	-21.52
(501,701)	-6.00	(502,503)	76.20	(502,701)	-17.83	(502,702)	-12.54	(503,504)	75.92
(503,702)	-12.54	(503,703)	-17.83	(504,505)	75.15	(504,703)	-6.00	(504,704)	-21.52
(505,704)	1.44	(600,601)	75.32	(600,800)	41.13	(601,602)	76.09	(601,800)	58.12
(601,801)	47.65	(602,603)	76.09	(602,801)	53.33	(602,802)	53.33	(603,604)	75.32
(603,802)	47.65	(603,803)	58.12	(604,803)	41.13	(700,701)	75.56	(701,702)	76.09
(702,703)	76.09	(703,704)	75.56	(800,801)	75.76	(801,802)	76.19	(802,803)	75.76

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS   8 BAY   70.0 FT. DIA.

TIME 9:00 AM

	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
SURFACE STRUTS										
	(1, 2)	68.93	(1, 10)	58.76	(1, 20)	15.59	(2, 3)	72.10	(2, 10)	6.75
	(2, 11)	53.55	(2, 20)	63.11	(2, 21)	24.35	(3, 4)	74.61	(3, 11)	15.59
	(3, 12)	47.49	(3, 21)	58.76	(3, 22)	32.71	(4, 5)	76.02	(4, 12)	24.42
	(4, 13)	40.53	(4, 22)	53.55	(4, 23)	40.47	(5, 6)	76.02	(5, 13)	32.71
	(5, 14)	32.71	(5, 23)	47.44	(5, 24)	47.44	(6, 7)	74.61	(6, 14)	40.53
	(6, 15)	24.42	(6, 24)	40.47	(6, 25)	53.55	(7, 8)	72.10	(7, 15)	47.49
	(7, 16)	15.59	(7, 25)	32.71	(7, 26)	58.76	(8, 9)	68.93	(8, 16)	53.55
	(8, 17)	6.75	(8, 26)	24.35	(8, 27)	63.11	(9, 17)	58.76	(9, 27)	15.59
	(10, 11)	70.56	(10, 30)	47.52	(11, 12)	73.46	(11, 30)	-1.97	(11, 31)	40.54
	(12, 13)	75.48	(12, 31)	6.70	(12, 32)	32.77	(13, 14)	76.20	(13, 32)	15.59
	(13, 33)	24.37	(14, 15)	75.48	(14, 33)	24.37	(14, 34)	15.59	(15, 16)	73.46
	(15, 34)	32.77	(15, 35)	6.70	(16, 17)	70.56	(16, 35)	40.54	(16, 36)	-1.97
	(17, 36)	47.52	(20, 21)	70.56	(20, 40)	32.72	(21, 22)	73.46	(21, 40)	66.72
	(21, 41)	40.49	(22, 23)	75.47	(22, 41)	63.24	(22, 42)	47.56	(23, 24)	76.20
	(23, 42)	58.89	(23, 43)	53.67	(24, 25)	75.47	(24, 43)	53.67	(24, 44)	58.89
	(25, 26)	73.46	(25, 44)	47.56	(25, 45)	63.24	(26, 27)	70.56	(26, 45)	40.49
	(26, 46)	66.72	(27, 46)	32.72	(30, 31)	72.08	(30, 50)	32.62	(31, 32)	74.60
	(31, 50)	-10.43	(31, 51)	24.10	(32, 33)	76.01	(32, 51)	-2.37	(32, 52)	15.26
	(33, 34)	76.01	(33, 52)	6.30	(33, 53)	6.30	(34, 35)	74.60	(34, 53)	15.26
	(34, 54)	-2.37	(35, 36)	72.08	(35, 54)	24.10	(35, 55)	-10.43	(36, 55)	32.62
	(40, 41)	72.09	(40, 60)	47.44	(41, 42)	74.61	(41, 60)	69.47	(41, 61)	53.56
	(42, 43)	76.01	(42, 61)	66.66	(42, 62)	58.78	(43, 44)	76.01	(43, 62)	63.13
	(43, 63)	63.13	(44, 45)	74.61	(44, 63)	58.78	(44, 64)	66.66	(45, 46)	72.09
	(45, 64)	53.56	(45, 65)	69.47	(46, 65)	47.44	(50, 51)	73.43	(50, 70)	14.42
	(51, 52)	75.45	(51, 70)	-18.77	(51, 71)	5.43	(52, 53)	76.17	(52, 71)	-11.55
	(52, 72)	-3.42	(53, 54)	75.45	(53, 72)	-3.42	(53, 73)	-11.55	(54, 55)	73.43
	(54, 73)	5.43	(54, 74)	-18.77	(55, 74)	14.42	(60, 61)	73.46	(60, 80)	58.75
	(61, 62)	75.47	(61, 80)	71.56	(61, 81)	63.10	(62, 63)	76.20	(62, 81)	69.42
	(62, 82)	66.63	(63, 64)	75.47	(63, 82)	66.63	(63, 83)	69.42	(64, 65)	73.46
	(64, 83)	63.10	(64, 84)	71.56	(65, 84)	58.75	(70, 71)	74.34	(71, 72)	75.75
	(72, 73)	75.75	(73, 74)	74.34	(80, 81)	74.60	(81, 82)	76.01	(82, 83)	76.01
	(83, 84)	74.60	(							
DIAGONAL STRUTS										
	(1,100)	67.54	(2,100)	74.94	(2,101)	69.86	(2,200)	-53.07	(3,101)	75.95
	(3,102)	71.84	(3,201)	-81.70	(4,102)	75.92	(4,103)	73.62	(4,202)	-116.69
	(5,103)	75.05	(5,104)	75.05	(5,203)	-142.67	(6,104)	73.62	(6,105)	75.92
	(6,204)	-116.69	(7,105)	71.84	(7,106)	75.95	(7,205)	-81.70	(8,106)	69.86
	(8,107)	74.94	(8,206)	-53.07	(9,107)	67.54	(10,100)	-59.63	(10,300)	72.35
	(11,101)	-77.56	(11,300)	73.79	(11,301)	73.94	(12,102)	-99.26	(12,301)	75.23
	(12,302)	75.12	(13,103)	-119.69	(13,302)	75.87	(13,303)	75.79	(14,104)	-119.69
	(14,303)	75.79	(14,304)	75.87	(15,105)	-99.26	(15,304)	75.12	(15,305)	75.23
	(16,106)	-77.56	(16,305)	73.94	(16,306)	73.79	(17,107)	-59.63	(17,306)	72.35
	(20,200)	64.51	(21,200)	76.11	(21,201)	66.74	(21,400)	-41.30	(22,201)	75.52
	(22,202)	69.15	(22,401)	-71.97	(23,202)	73.90	(23,203)	71.62	(23,402)	-107.09
	(24,203)	71.62	(24,204)	73.90	(24,403)	-107.09	(25,204)	69.15	(25,205)	75.52
	(25,404)	-71.97	(26,205)	66.74	(26,206)	76.11	(26,405)	-41.30	(27,206)	64.51

(30,300)	-69.20	(30,500)	75.23	(31,301)	-77.40	(31,500)	71.39	(31,501)	75.70
(32,302)	-85.61	(32,501)	73.44	(32,502)	75.57	(33,303)	-89.63	(33,502)	74.83
(33,503)	74.83	(34,304)	-85.61	(34,503)	75.57	(34,504)	73.44	(35,305)	-77.40
(35,504)	75.70	(35,505)	71.39	(36,306)	-69.20	(36,505)	75.23	(40,400)	61.57
(41,400)	75.36	(41,401)	63.95	(41,600)	-23.53	(42,401)	73.21	(42,402)	66.87
(42,601)	-46.94	(43,402)	70.15	(43,403)	70.15	(43,602)	-62.43	(44,403)	66.87
(44,404)	73.21	(44,603)	-46.94	(45,404)	63.95	(45,405)	75.36	(45,604)	-23.53
(46,405)	61.57	(50,500)	-58.53	(50,700)	75.30	(51,501)	-58.24	(51,700)	67.39
(51,701)	74.25	(52,502)	-58.36	(52,701)	70.26	(52,702)	72.56	(53,503)	-58.36

(53,702)	72.56	(53,703)	70.26	(54,504)	-58.24	(54,703)	74.25	(54,704)	67.39
(55,505)	-58.53	(55,704)	75.30	(60,600)	59.36	(61,600)	73.30	(61,601)	61.94
(61,800)	-2.87	(62,601)	69.67	(62,602)	65.58	(62,801)	-15.18	(63,602)	65.58
(63,603)	69.67	(63,802)	-15.18	(64,603)	61.94	(64,604)	73.30	(64,803)	-2.87
(65,604)	59.36	(70,700)	-40.79	(71,701)	-38.02	(72,702)	-36.97	(73,703)	-38.02
(74,704)	-40.79	(80,800)	58.07	(81,800)	70.40	(81,801)	61.31	(82,801)	65.74
(82,802)	65.74	(83,802)	61.31	(83,803)	70.40	(84,803)	58.07	(	

BOTTOM STRUTS

(100,101)	70.63	(100,200)	13.75	(100,300)	54.13	(101,102)	73.51	(101,200)	59.72
(101,201)	23.19	(101,300)	3.48	(101,301)	47.87	(102,103)	75.49	(102,201)	54.29
(102,202)	32.17	(102,301)	13.38	(102,302)	40.56	(103,104)	76.20	(103,202)	47.89
(103,203)	40.48	(103,302)	23.06	(103,303)	32.27	(104,105)	75.49	(104,203)	40.48
(104,204)	47.89	(104,303)	32.27	(104,304)	23.06	(105,106)	73.51	(105,204)	32.17
(105,205)	54.29	(105,304)	40.56	(105,305)	13.38	(106,107)	70.63	(106,205)	23.19
(106,206)	59.72	(106,305)	47.87	(106,306)	3.48	(107,206)	13.75	(107,306)	54.13
(200,201)	71.95	(200,400)	32.29	(201,202)	74.55	(201,400)	64.18	(201,401)	40.47
(202,203)	76.01	(202,401)	59.75	(202,402)	47.85	(203,204)	76.01	(203,402)	54.30
(203,403)	54.30	(204,205)	74.55	(204,403)	47.85	(204,404)	59.75	(205,206)	71.95
(205,404)	40.47	(205,405)	64.18	(206,405)	32.29	(300,301)	72.33	(300,500)	40.47
(301,302)	74.71	(301,500)	-6.52	(301,501)	32.25	(302,303)	76.03	(302,501)	3.28
(302,502)	23.13	(303,304)	76.03	(303,502)	13.39	(303,503)	13.39	(304,305)	74.71
(304,503)	23.13	(304,504)	3.28	(305,306)	72.33	(305,504)	32.25	(305,505)	-6.52
(306,505)	40.47	(400,401)	73.21	(400,600)	47.73	(401,402)	75.40	(401,600)	67.82
(401,601)	54.16	(402,403)	76.20	(402,601)	64.22	(402,602)	59.67	(403,404)	75.40
(403,602)	59.67	(403,603)	64.22	(404,405)	73.21	(404,603)	54.16	(404,604)	67.82
(405,604)	47.73	(500,501)	73.72	(500,700)	23.56	(501,502)	75.55	(501,700)	-15.65
(501,701)	13.97	(502,503)	76.20	(502,701)	-6.10	(502,702)	3.96	(503,504)	75.55
(503,702)	3.96	(503,703)	-6.10	(504,505)	73.72	(504,703)	13.97	(504,704)	-15.65
(505,704)	23.56	(600,601)	74.37	(600,800)	59.48	(601,602)	75.99	(601,800)	70.63
(601,801)	64.05	(602,603)	75.99	(602,801)	67.77	(602,802)	67.77	(603,604)	74.37
(603,802)	64.05	(603,803)	70.63	(604,803)	59.48	(700,701)	74.80	(701,702)	76.03
(702,703)	76.03	(703,704)	74.80	(800,801)	75.32	(801,802)	76.19	(802,803)	75.32

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 10:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	64.56	(1, 10)	70.88	(1, 20)	39.51	(2, 3)	69.71	(2, 10)	31.52
(2, 11)	67.82	(2, 20)	73.12	(2, 21)	46.82	(3, 4)	73.71	(3, 11)	39.50
(3, 12)	63.87	(3, 21)	70.89	(3, 22)	53.38	(4, 5)	75.91	(4, 12)	46.75
(4, 13)	59.04	(4, 22)	67.84	(4, 23)	59.10	(5, 6)	75.91	(5, 13)	53.38
(5, 14)	53.38	(5, 23)	63.92	(5, 24)	63.92	(6, 7)	73.71	(6, 14)	59.04
(6, 15)	46.75	(6, 24)	59.10	(6, 25)	67.84	(7, 8)	69.71	(7, 15)	63.87
(7, 16)	39.50	(7, 25)	53.38	(7, 26)	70.89	(8, 9)	64.56	(8, 16)	67.82
(8, 17)	31.52	(8, 26)	46.82	(8, 27)	73.12	(9, 17)	70.88	(9, 27)	39.51
(10, 11)	67.23	(10, 30)	63.82	(11, 12)	71.90	(11, 30)	23.04	(11, 31)	58.98
(12, 13)	75.07	(12, 31)	31.45	(12, 32)	53.29	(13, 14)	76.20	(13, 32)	39.42
(13, 33)	46.74	(14, 15)	75.07	(14, 33)	46.74	(14, 34)	39.42	(15, 16)	71.90
(15, 34)	53.29	(15, 35)	31.45	(16, 17)	67.23	(16, 35)	58.98	(16, 36)	23.04
(17, 36)	63.82	(20, 21)	67.23	(20, 40)	53.40	(21, 22)	71.90	(21, 40)	74.50
(21, 41)	59.01	(22, 23)	75.07	(22, 41)	72.98	(22, 42)	63.78	(23, 24)	76.20
(23, 42)	70.75	(23, 43)	67.70	(24, 25)	75.07	(24, 43)	67.70	(24, 44)	70.75
(25, 26)	71.90	(25, 44)	63.78	(25, 45)	72.98	(26, 27)	67.23	(26, 45)	59.01
(26, 46)	74.50	(27, 46)	53.40	(30, 31)	69.71	(30, 50)	53.27	(31, 32)	73.71
(31, 50)	14.27	(31, 51)	46.76	(32, 33)	75.91	(32, 51)	23.04	(32, 52)	39.45
(33, 34)	75.91	(33, 52)	31.48	(33, 53)	31.48	(34, 35)	73.71	(34, 53)	39.45
(34, 54)	23.04	(35, 36)	69.71	(35, 54)	46.76	(35, 55)	14.27	(36, 55)	53.27
(40, 41)	69.70	(40, 60)	63.94	(41, 42)	73.71	(41, 60)	75.40	(41, 61)	67.78
(42, 43)	75.91	(42, 61)	74.56	(42, 62)	70.83	(43, 44)	75.91	(43, 62)	73.06
(43, 63)	73.06	(44, 45)	73.71	(44, 63)	70.83	(44, 64)	74.56	(45, 46)	69.70
(45, 64)	67.78	(45, 65)	75.40	(46, 65)	63.94	(50, 51)	71.90	(50, 70)	39.46
(51, 52)	75.07	(51, 70)	5.17	(51, 71)	31.41	(52, 53)	76.20	(52, 71)	14.11
(52, 72)	23.04	(53, 54)	75.07	(53, 72)	23.04	(53, 73)	14.11	(54, 55)	71.90
(54, 73)	31.41	(54, 74)	5.17	(55, 74)	39.46	(60, 61)	71.90	(60, 80)	70.91
(61, 62)	75.07	(61, 80)	75.80	(61, 81)	73.14	(62, 63)	76.20	(62, 81)	75.50
(62, 82)	74.64	(63, 64)	75.07	(63, 82)	74.64	(63, 83)	75.50	(64, 65)	71.90
(64, 83)	73.14	(64, 84)	75.80	(65, 84)	70.91	(70, 71)	73.71	(71, 72)	75.91
(72, 73)	75.91	(73, 74)	73.71	(80, 81)	73.70	(81, 82)	75.91	(82, 83)	75.91
(83, 84)	73.70	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	52.04	(2,100)	76.03	(2,101)	56.49	(2,200)	-10.52	(3,101)	75.57
(3,102)	61.06	(3,201)	-32.27	(4,102)	73.37	(4,103)	65.59	(4,202)	-56.62
(5,103)	69.86	(5,104)	69.86	(5,203)	-71.49	(6,104)	65.59	(6,105)	73.37
(6,204)	-56.62	(7,105)	61.06	(7,106)	75.57	(7,205)	-32.27	(8,106)	56.49
(8,107)	76.03	(8,206)	-10.52	(9,107)	52.04	(10,100)	-27.40	(10,300)	61.36
(11,101)	-51.38	(11,300)	75.81	(11,301)	65.42	(12,102)	-81.44	(12,301)	75.86
(12,302)	69.01	(13,103)	-112.10	(13,302)	74.53	(13,303)	72.14	(14,104)	-112.10
(14,303)	72.14	(14,304)	74.53	(15,105)	-81.44	(15,304)	69.01	(15,305)	75.86
(16,106)	-51.38	(16,305)	65.42	(16,306)	75.81	(17,107)	-27.40	(17,306)	61.36
(20,200)	47.22	(21,200)	75.51	(21,201)	51.82	(21,400)	6.09	(22,201)	72.77
(22,202)	57.05	(22,401)	-10.20	(23,202)	68.25	(23,203)	62.73	(23,402)	-23.57
(24,203)	62.73	(24,204)	68.25	(24,403)	-23.57	(25,204)	57.05	(25,205)	72.77
(25,404)	-10.20	(26,205)	51.82	(26,206)	75.51	(26,405)	6.09	(27,206)	47.22

(30,300)	-66.19	(30,500)	69.42	(31,301)	-92.52	(31,500)	75.15	(31,501)	72.23
(32,302)	-122.65	(32,501)	75.98	(32,502)	74.34	(33,303)	-142.70	(33,502)	75.65
(33,503)	75.65	(34,304)	-122.65	(34,503)	74.34	(34,504)	75.98	(35,305)	-92.52
(35,504)	72.23	(35,505)	75.15	(36,306)	-66.19	(36,505)	69.42	(40,400)	43.02
(41,400)	73.03	(41,401)	48.01	(41,600)	21.99	(42,401)	67.92	(42,402)	54.28
(42,601)	11.86	(43,402)	61.29	(43,403)	61.29	(43,602)	7.36	(44,403)	54.28
(44,404)	67.92	(44,603)	11.86	(45,404)	48.01	(45,405)	73.03	(45,604)	21.99
(46,405)	43.02	(50,500)	-94.35	(50,700)	74.47	(51,501)	-112.51	(51,700)	73.47
(51,701)	75.64	(52,502)	-136.78	(52,701)	75.22	(52,702)	75.91	(53,503)	-136.78

(53,702)	75.91	(53,703)	75.22	(54,504)	-112.51	(54,703)	75.64	(54,704)	73.47
(55,505)	-94.35	(55,704)	74.47	(60,600)	40.14	(61,600)	69.01	(61,601)	45.99
(61,800)	36.55	(62,601)	61.78	(62,602)	53.59	(62,801)	31.23	(63,602)	53.59
(63,603)	61.78	(63,802)	31.23	(64,603)	45.99	(64,604)	69.01	(64,803)	36.55
(65,604)	40.14	(70,700)	-100.98	(71,701)	-107.70	(72,702)	-112.25	(73,703)	-107.70
(74,704)	-100.98	(80,800)	39.36	(81,800)	64.07	(81,801)	46.40	(82,801)	55.23
(82,802)	55.23	(83,802)	46.40	(83,803)	64.07	(84,803)	39.36	(	

BOTTOM STRUTS

(100,101)	66.95	(100,200)	38.57	(100,300)	68.18	(101,102)	71.78	(101,200)	71.26
(101,201)	46.18	(101,300)	29.68	(101,301)	64.08	(102,103)	75.04	(102,201)	68.24
(102,202)	53.05	(102,301)	38.05	(102,302)	58.97	(103,104)	76.20	(103,202)	64.17
(103,203)	59.08	(103,302)	45.85	(103,303)	52.90	(104,105)	75.04	(104,203)	59.08
(104,204)	64.17	(104,303)	52.90	(104,304)	45.85	(105,106)	71.78	(105,204)	53.05
(105,205)	68.24	(105,304)	58.97	(105,305)	38.05	(106,107)	66.95	(106,205)	46.18
(106,206)	71.26	(106,305)	64.08	(106,306)	29.68	(107,206)	38.57	(107,306)	68.18
(200,201)	69.27	(200,400)	53.10	(201,202)	73.55	(201,400)	73.59	(201,401)	59.10
(202,203)	75.89	(202,401)	71.39	(202,402)	64.14	(203,204)	75.89	(203,402)	68.24
(203,403)	68.24	(204,205)	73.55	(204,403)	64.14	(204,404)	71.39	(205,206)	69.27
(205,404)	59.10	(205,405)	73.59	(206,405)	53.10	(300,301)	69.75	(300,500)	59.03
(301,302)	73.74	(301,500)	19.87	(301,501)	52.96	(302,303)	75.92	(302,501)	29.18
(302,502)	45.87	(303,304)	75.92	(303,502)	37.92	(303,503)	37.92	(304,305)	73.74
(304,503)	45.87	(304,504)	29.18	(305,306)	69.75	(305,504)	52.96	(305,505)	19.87
(306,505)	59.03	(400,401)	71.45	(400,600)	64.05	(401,402)	74.95	(401,600)	74.92
(401,601)	68.05	(402,403)	76.20	(402,601)	73.49	(402,602)	71.21	(403,404)	74.95
(403,602)	71.21	(403,603)	73.49	(404,405)	71.45	(404,603)	68.05	(404,604)	74.92
(405,604)	64.05	(500,501)	72.07	(500,700)	46.05	(501,502)	75.12	(501,700)	9.66
(501,701)	38.04	(502,503)	76.20	(502,701)	19.62	(502,702)	29.15	(503,504)	75.12
(503,702)	29.15	(503,703)	19.62	(504,505)	72.07	(504,703)	38.04	(504,704)	9.66
(505,704)	46.05	(600,601)	73.35	(600,800)	71.03	(601,602)	75.87	(601,800)	75.54
(601,801)	73.32	(602,603)	75.87	(602,801)	74.81	(602,802)	74.81	(603,604)	73.35
(603,802)	73.32	(603,803)	75.54	(604,803)	71.03	(700,701)	73.87	(701,702)	75.93
(702,703)	75.93	(703,704)	73.87	(800,801)	74.86	(801,802)	76.19	(802,803)	74.86

LARGE ERECTABLE ANTENNA FOR SPACE APPLICATIONS 8 BAY 70.0 FT. DIA.

TIME 11:00 AM

SURFACE STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1, 2)	60.91	(1, 10)	75.59	(1, 20)	58.45	(2, 3)	67.78	(2, 10)	52.83
(2, 11)	74.81	(2, 20)	75.68	(2, 21)	63.39	(3, 4)	72.99	(3, 11)	58.45
(3, 12)	73.24	(3, 21)	75.62	(3, 22)	67.50	(4, 5)	75.83	(4, 12)	63.40
(4, 13)	70.81	(4, 22)	74.83	(4, 23)	70.80	(5, 6)	75.83	(5, 13)	67.48
(5, 14)	67.48	(5, 23)	73.24	(5, 24)	73.24	(6, 7)	72.99	(6, 14)	70.81
(6, 15)	63.40	(6, 24)	70.80	(6, 25)	74.83	(7, 8)	67.78	(7, 15)	73.24
(7, 16)	58.45	(7, 25)	67.50	(7, 26)	75.62	(8, 9)	60.91	(8, 16)	74.81
(8, 17)	52.83	(8, 26)	63.39	(8, 27)	75.68	(9, 17)	75.59	(9, 27)	58.45
(10, 11)	64.52	(10, 30)	73.32	(11, 12)	70.64	(11, 30)	46.66	(11, 31)	70.89
(12, 13)	74.75	(12, 31)	52.95	(12, 32)	67.60	(13, 14)	76.20	(13, 32)	58.57
(13, 33)	63.47	(14, 15)	74.75	(14, 33)	63.47	(14, 34)	58.57	(15, 16)	70.64
(15, 34)	67.60	(15, 35)	52.95	(16, 17)	64.52	(16, 35)	70.89	(16, 36)	46.66
(17, 36)	73.32	(20, 21)	64.52	(20, 40)	67.49	(21, 22)	70.65	(21, 40)	75.19
(21, 41)	70.89	(22, 23)	74.75	(22, 41)	75.77	(22, 42)	73.35	(23, 24)	76.20
(23, 42)	75.73	(23, 43)	74.94	(24, 25)	74.75	(24, 43)	74.94	(24, 44)	75.73
(25, 26)	70.65	(25, 44)	73.35	(25, 45)	75.77	(26, 27)	64.52	(26, 45)	70.89
(26, 46)	75.19	(27, 46)	67.49	(30, 31)	67.79	(30, 50)	67.61	(31, 32)	73.00
(31, 50)	39.92	(31, 51)	63.45	(32, 33)	75.83	(32, 51)	46.67	(32, 52)	58.53
(33, 34)	75.83	(33, 52)	52.90	(33, 53)	52.90	(34, 35)	73.00	(34, 53)	58.53
(34, 54)	46.67	(35, 36)	67.79	(35, 54)	63.45	(35, 55)	39.92	(36, 55)	67.61
(40, 41)	67.80	(40, 60)	73.22	(41, 42)	73.00	(41, 60)	73.98	(41, 61)	74.86
(42, 43)	75.83	(42, 61)	75.12	(42, 62)	75.65	(43, 44)	75.83	(43, 62)	75.71
(43, 63)	75.71	(44, 45)	73.00	(44, 63)	75.65	(44, 64)	75.12	(45, 46)	67.80
(45, 64)	74.86	(45, 65)	73.98	(46, 65)	73.22	(50, 51)	70.65	(50, 70)	58.46
(51, 52)	74.75	(51, 70)	32.82	(51, 71)	52.90	(52, 53)	76.20	(52, 71)	39.95
(52, 72)	46.65	(53, 54)	74.75	(53, 72)	46.65	(53, 73)	39.95	(54, 55)	70.65
(54, 73)	52.90	(54, 74)	32.82	(55, 74)	58.46	(60, 61)	70.64	(60, 80)	75.60
(61, 62)	74.75	(61, 80)	72.32	(61, 81)	75.65	(62, 63)	76.20	(62, 81)	73.92
(62, 82)	75.06	(63, 64)	74.75	(63, 82)	75.06	(63, 83)	73.92	(64, 65)	70.64
(64, 83)	75.65	(64, 84)	72.32	(65, 84)	75.60	(70, 71)	72.99	(71, 72)	75.83
(72, 73)	75.83	(73, 74)	72.99	(80, 81)	73.00	(81, 82)	75.83	(82, 83)	75.83
(83, 84)	73.00	(							

DIAGONAL STRUTS

IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.	IDENT.	TEMP.
(1,100)	28.57	(2,100)	75.87	(2,101)	36.17	(2,200)	28.15	(3,101)	73.18
(3,102)	44.17	(3,201)	16.40	(4,102)	67.94	(4,103)	52.59	(4,202)	6.28
(5,103)	60.78	(5,104)	60.78	(5,203)	1.76	(6,104)	52.59	(6,105)	67.94
(6,204)	6.28	(7,105)	44.17	(7,106)	73.18	(7,205)	16.40	(8,106)	36.17
(8,107)	75.87	(8,206)	28.15	(9,107)	28.57	(10,100)	14.67	(10,300)	43.05
(11,101)	-.49	(11,300)	75.82	(11,301)	50.10	(12,102)	-16.28	(12,301)	73.53
(12,302)	57.14	(13,103)	-28.87	(13,302)	69.30	(13,303)	63.64	(14,104)	-28.87
(14,303)	63.64	(14,304)	69.30	(15,105)	-16.28	(15,304)	57.14	(15,305)	73.53
(16,106)	-.49	(16,305)	50.10	(16,306)	75.82	(17,107)	14.67	(17,306)	43.05
(20,200)	22.13	(21,200)	73.66	(21,201)	30.21	(21,400)	40.30	(22,201)	68.03
(22,202)	39.67	(22,401)	32.09	(23,202)	59.79	(23,203)	49.92	(23,402)	26.67
(24,203)	49.92	(24,204)	59.79	(24,403)	26.67	(25,204)	39.67	(25,205)	68.03
(25,404)	32.09	(26,205)	30.21	(26,206)	73.66	(26,405)	40.30	(27,206)	22.13

(30,300)	-18.16	(30,500)	56.28	(31,301)	-38.81	(31,500)	75.94	(31,501)	62.16
(32,302)	-59.89	(32,501)	74.48	(32,502)	67.28	(33,303)	-71.64	(33,502)	71.48
(33,503)	71.48	(34,304)	-59.89	(34,503)	67.28	(34,504)	74.48	(35,305)	-38.81
(35,504)	62.16	(35,505)	75.94	(36,306)	-18.16	(36,505)	56.28	(40,400)	17.28
(41,400)	69.51	(41,401)	26.59	(41,600)	50.97	(42,401)	60.97	(42,402)	37.89
(42,601)	45.78	(43,402)	49.94	(43,403)	49.94	(43,602)	43.75	(44,403)	37.89
(44,404)	60.97	(44,603)	45.78	(45,404)	26.59	(45,405)	69.51	(45,604)	50.97
(46,405)	17.28	(50,500)	-59.72	(50,700)	66.83	(51,501)	-84.12	(51,700)	75.91
(51,701)	70.77	(52,502)	-108.21	(52,701)	75.47	(52,702)	73.68	(53,503)	-108.21

(53,702)	73.68	(53,703)	75.47	(54,504)	-84.12	(54,703)	70.77	(54,704)	75.91
(55,505)	-59.72	(55,704)	66.83	(60,600)	15.07	(61,600)	63.85	(61,601)	26.14
(61,800)	60.07	(62,601)	52.59	(62,602)	39.33	(62,801)	57.39	(63,602)	39.33
(63,603)	52.59	(63,802)	57.39	(64,603)	26.14	(64,604)	63.85	(64,803)	60.07
(65,604)	15.07	(70,700)	-101.82	(71,701)	-122.95	(72,702)	-134.36	(73,703)	-122.95
(74,704)	-101.82	(80,800)	16.16	(81,800)	57.06	(81,801)	29.05	(82,801)	43.57
(82,802)	43.57	(83,802)	29.05	(83,803)	57.06	(84,803)	16.16	(	

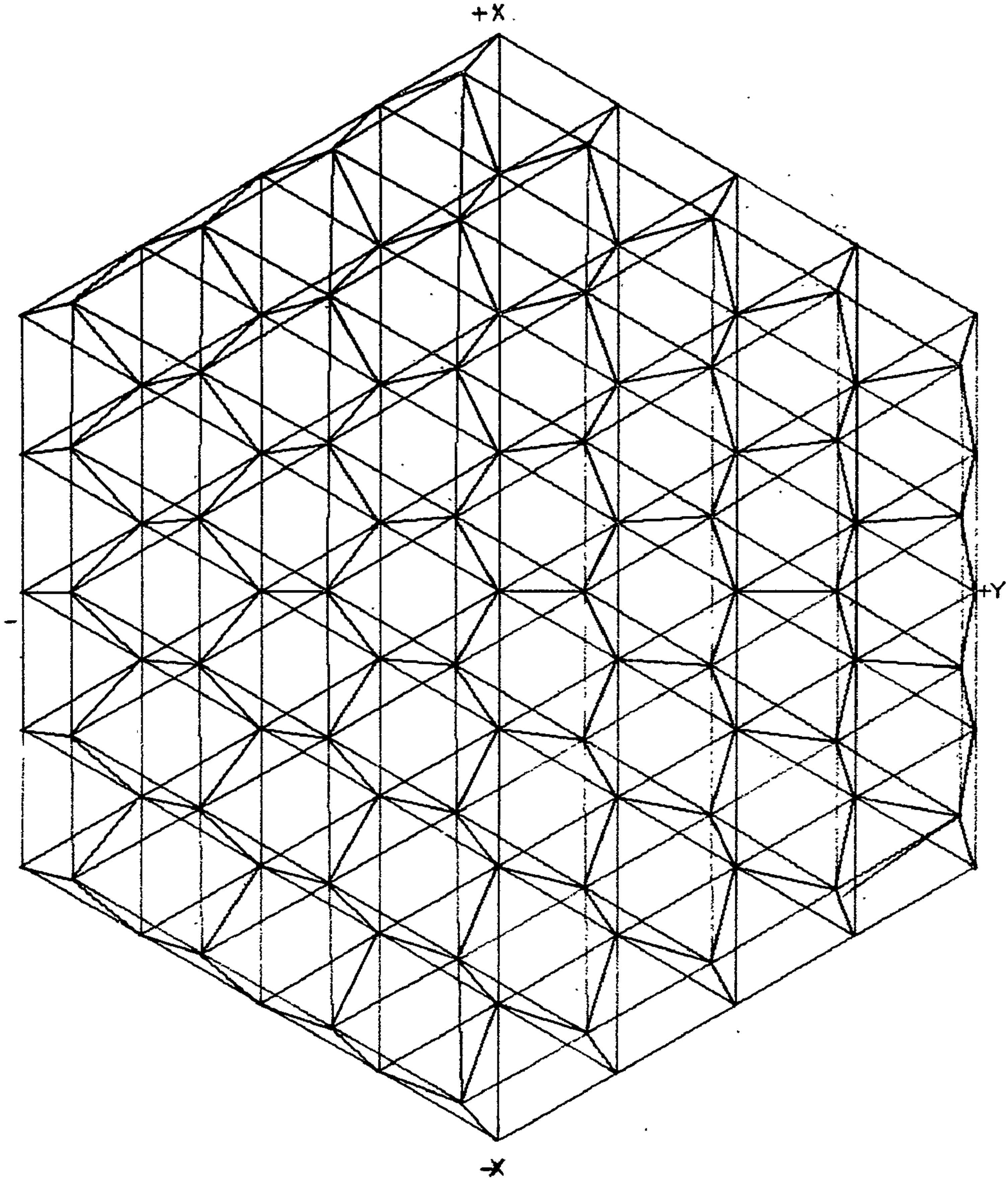
BOTTOM STRUTS

(100,101)	63.77	(100,200)	58.05	(100,300)	74.99	(101,102)	70.33	(101,200)	75.81
(101,201)	63.11	(101,300)	52.01	(101,301)	73.47	(102,103)	74.67	(102,201)	74.98
(102,202)	67.36	(102,301)	57.88	(102,302)	70.93	(103,104)	76.20	(103,202)	73.35
(103,203)	70.80	(103,302)	63.04	(103,303)	67.45	(104,105)	74.67	(104,203)	70.80
(104,204)	73.35	(104,303)	67.45	(104,304)	63.04	(105,106)	70.33	(105,204)	67.36
(105,205)	74.98	(105,304)	70.93	(105,305)	57.88	(106,107)	63.77	(106,205)	63.11
(106,206)	75.81	(106,305)	73.47	(106,306)	52.01	(107,206)	58.05	(107,306)	74.99
(200,201)	67.03	(200,400)	67.52	(201,202)	72.71	(201,400)	75.56	(201,401)	70.79
(202,203)	75.80	(202,401)	75.68	(202,402)	73.32	(203,204)	75.80	(203,402)	74.95
(203,403)	74.95	(204,205)	72.71	(204,403)	73.32	(204,404)	75.68	(205,206)	67.03
(205,404)	70.79	(205,405)	75.56	(206,405)	67.52	(300,301)	67.53	(300,500)	70.84
(301,302)	72.92	(301,500)	44.98	(301,501)	67.32	(302,303)	75.83	(302,501)	51.50
(302,502)	62.85	(303,304)	75.83	(303,502)	57.55	(303,503)	57.55	(304,305)	72.92
(304,503)	62.85	(304,504)	51.50	(305,306)	67.53	(305,504)	67.32	(305,505)	44.98
(306,505)	70.84	(400,401)	70.00	(400,600)	73.27	(401,402)	74.58	(401,600)	74.81
(401,601)	74.94	(402,403)	76.20	(402,601)	75.65	(402,602)	75.72	(403,404)	74.58
(403,602)	75.72	(403,603)	75.65	(404,405)	70.00	(404,603)	74.94	(404,604)	74.81
(405,604)	73.27	(500,501)	70.64	(500,700)	62.81	(501,502)	74.76	(501,700)	37.01
(501,701)	57.42	(502,503)	76.20	(502,701)	44.37	(502,702)	51.23	(503,504)	74.76
(503,702)	51.23	(503,703)	44.37	(504,505)	70.64	(504,703)	57.42	(504,704)	37.01
(505,704)	62.81	(600,601)	72.55	(600,800)	75.76	(601,602)	75.78	(601,800)	73.50
(601,801)	75.75	(602,603)	75.78	(602,801)	74.98	(602,802)	74.98	(603,604)	72.55
(603,802)	75.75	(603,803)	73.50	(604,803)	75.76	(700,701)	73.06	(701,702)	75.84
(702,703)	75.84	(703,704)	73.06	(800,801)	74.52	(801,802)	76.19	(802,803)	74.52

D.5 EIGHT BAY ANTENNA PERSPECTIVE PLOTS

Each antenna perspective plot in this section is labeled with its orbital position assuming the reader is viewing the antenna from the position of the sun. By turning the plots upside down and changing the sign of the X axis, the following additional orbital positions are obtained.

Labeled Orbital Position	Upside Down
Noon	Midnight
2:00 p.m.	2:00 a.m.
3:00 p.m.	3:00 a.m.
4:00 p.m.	4:00 a.m.
5:00 p.m.	5:00 a.m.
6:00 p.m.	6:00 a.m.
7:00 p.m.	7:00 a.m.
8:00 p.m.	8:00 a.m.
9:00 p.m.	9:00 a.m.
10:00 p.m.	10:00 a.m.



ORBITAL POSITION - NOON

D-100

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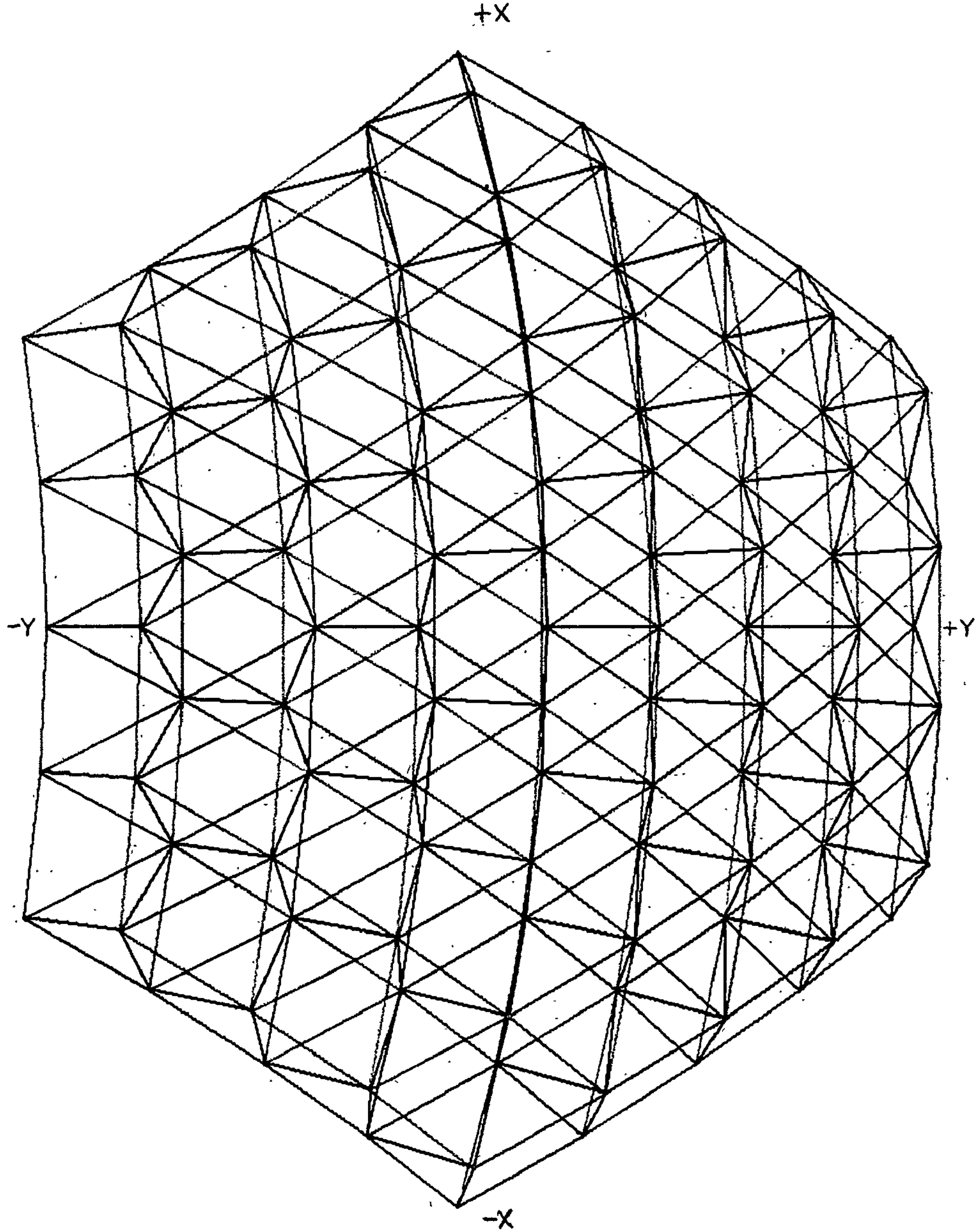
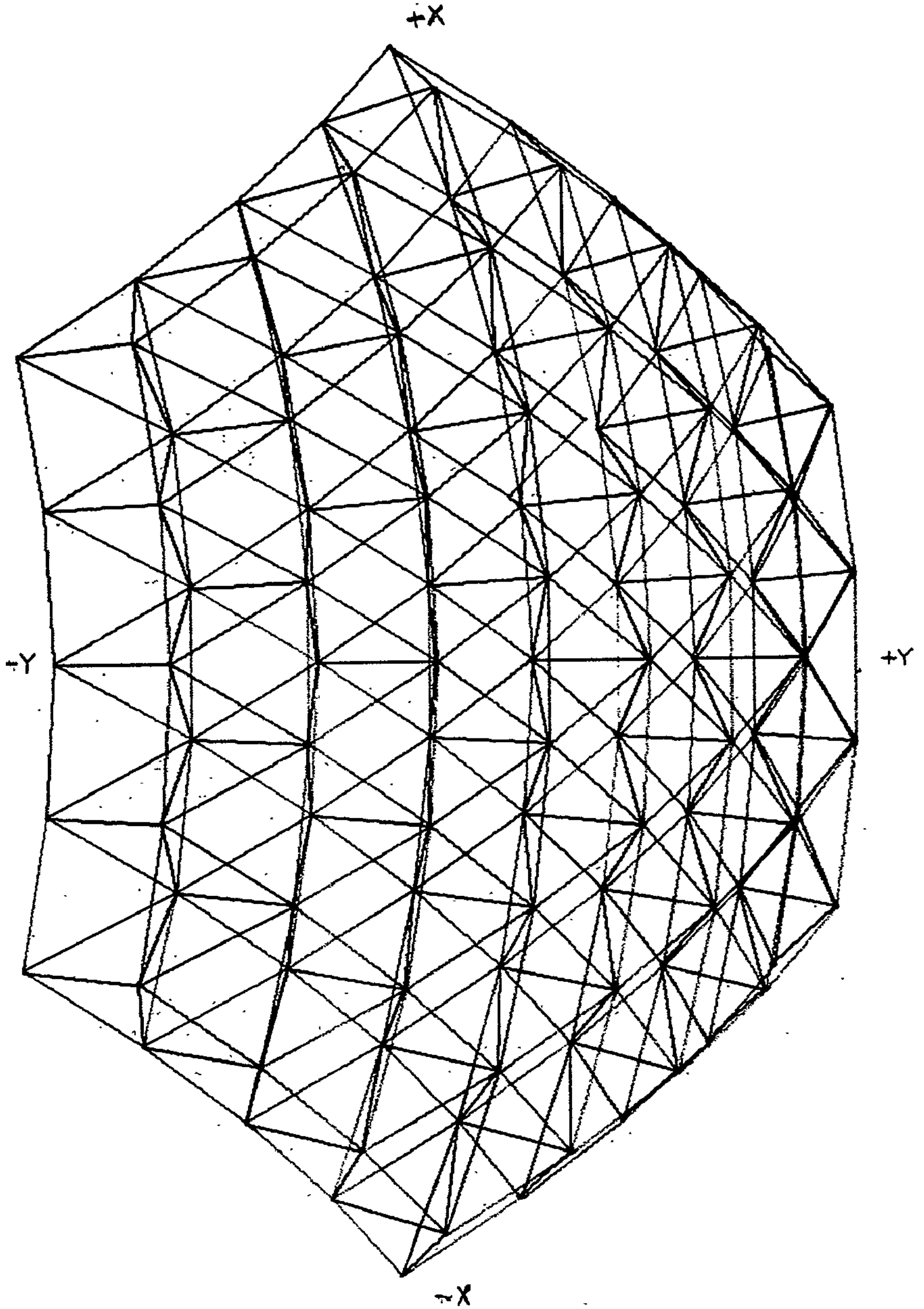
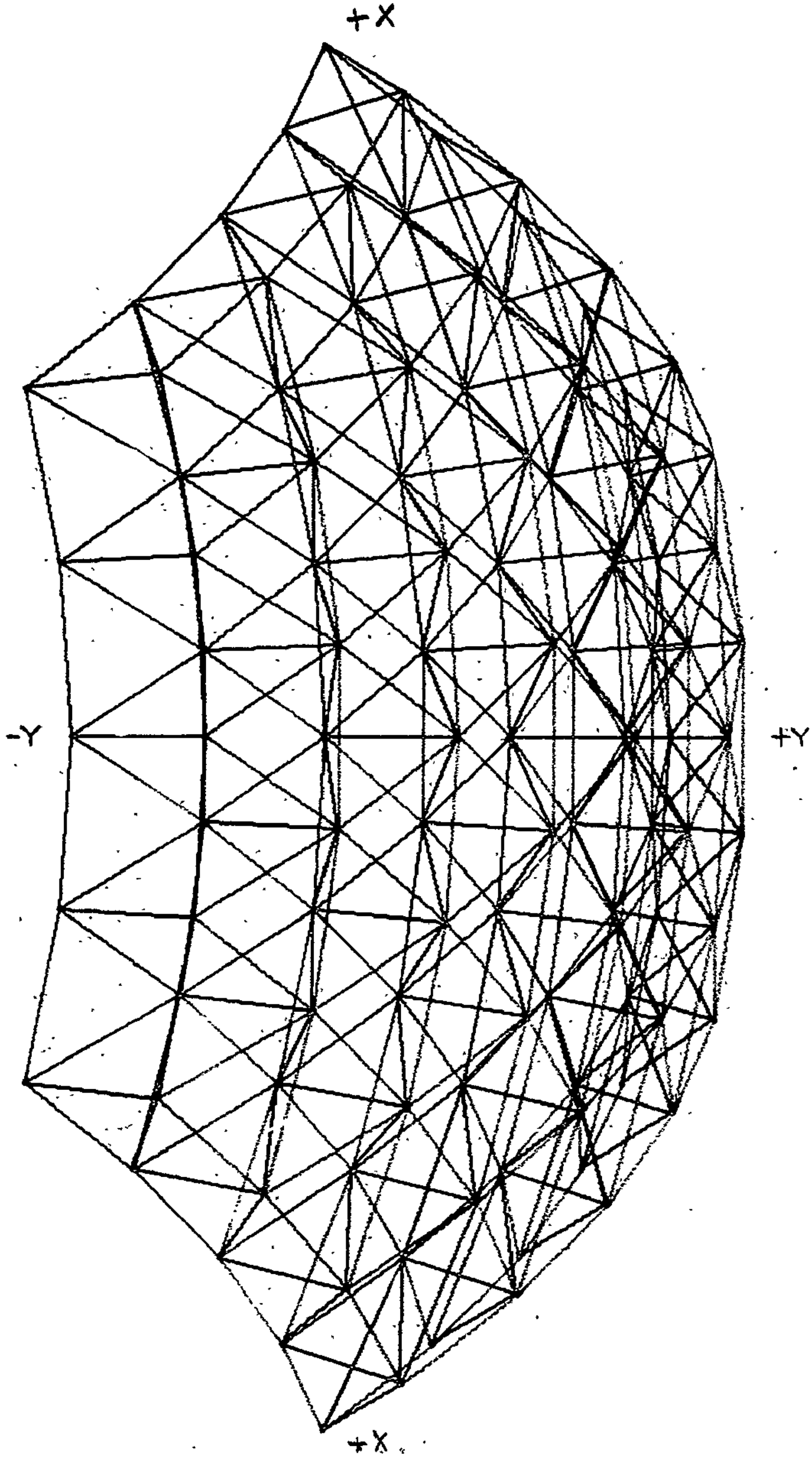


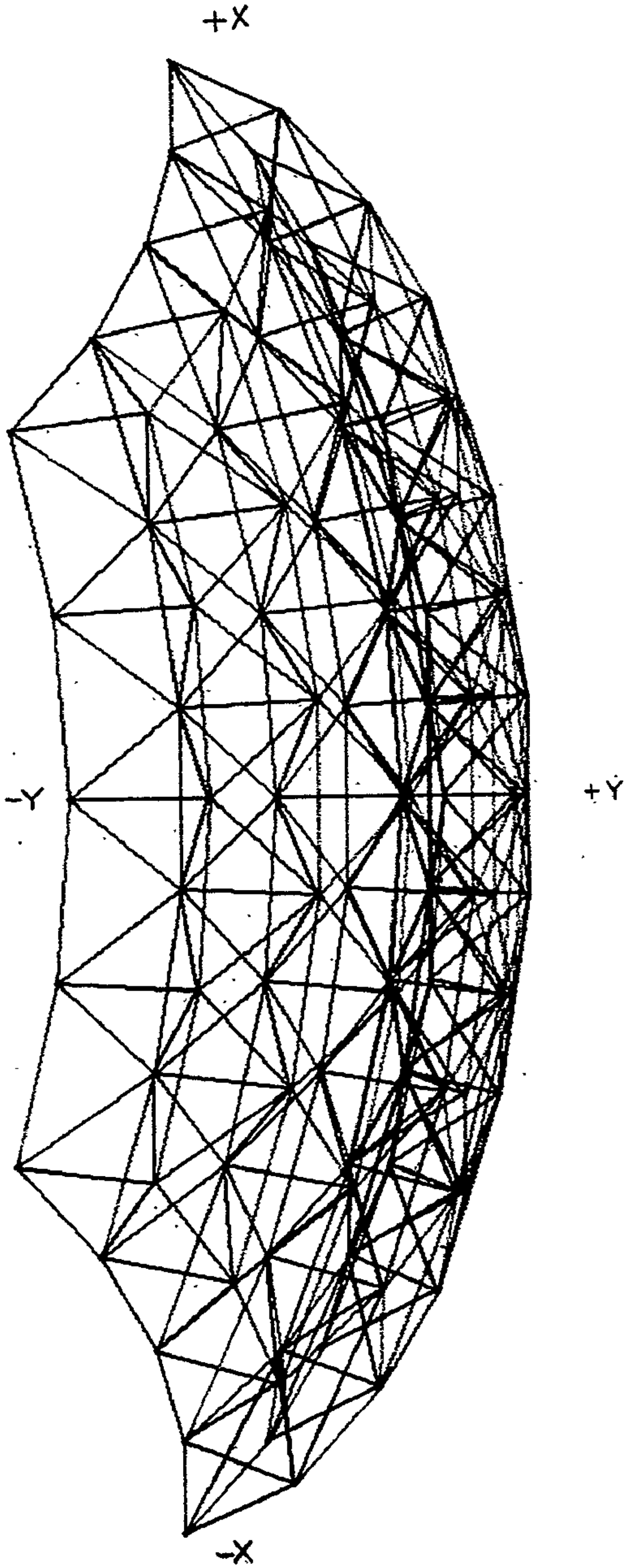
ORBITAL POSITION - 2:00 PM



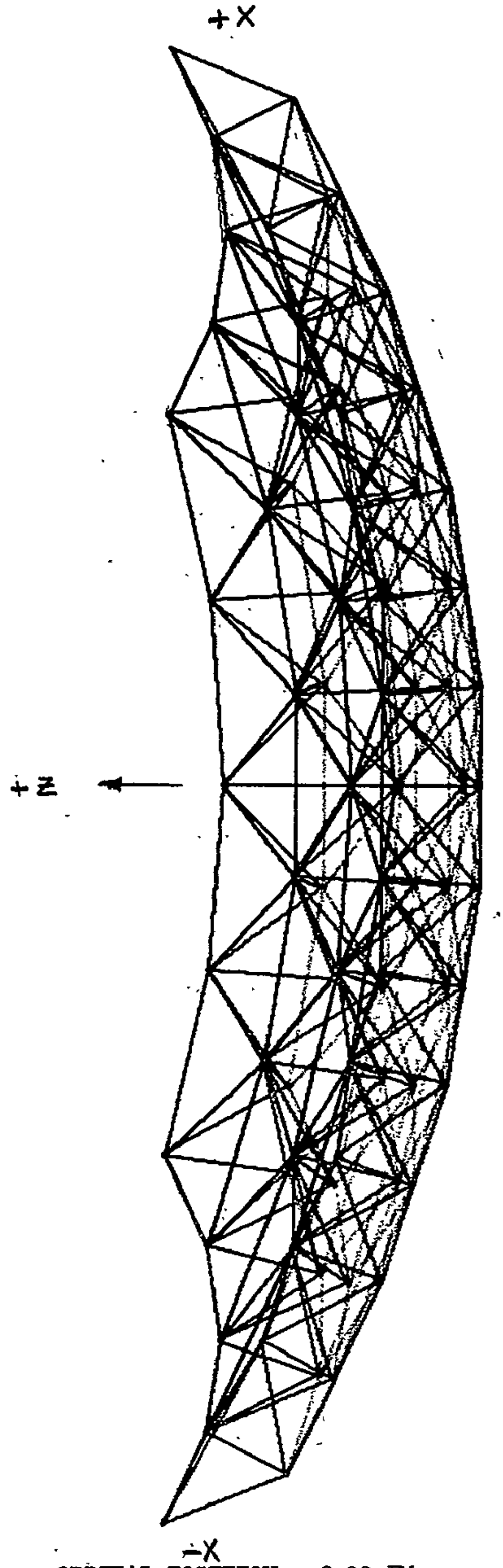
ORBITAL POSITION - 3:00 PM



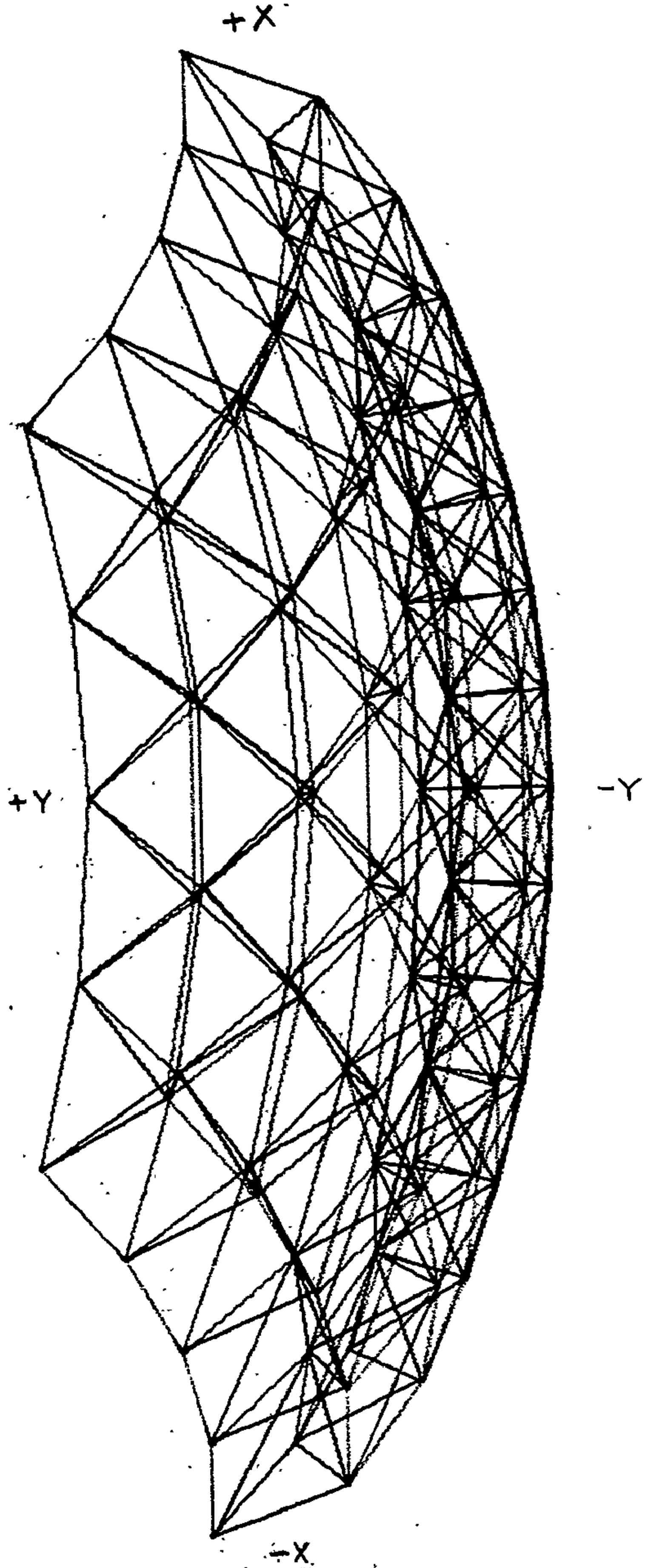
ORBITAL POSITION - 4:00 PM



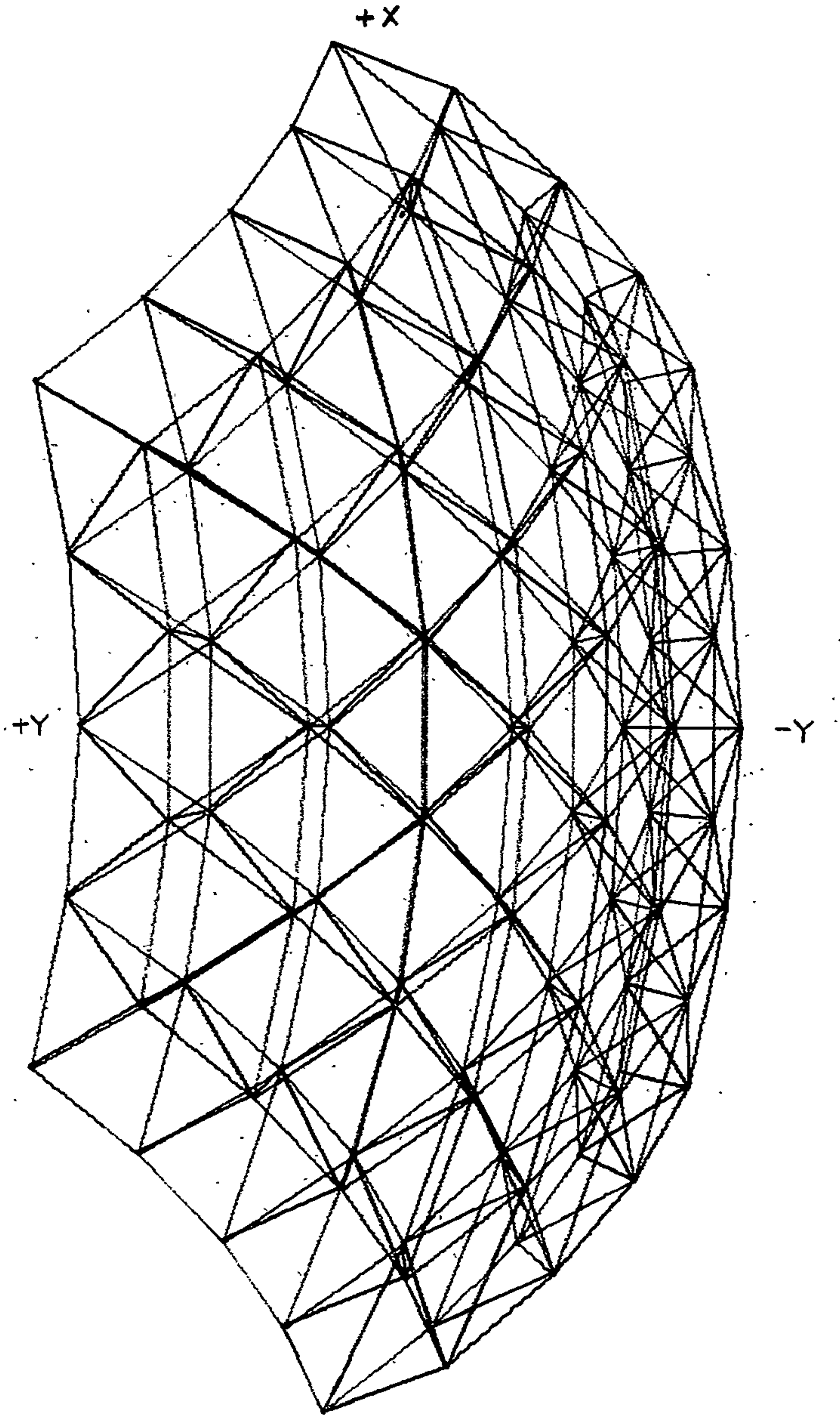
ORBITAL POSITION - 5:00 PM



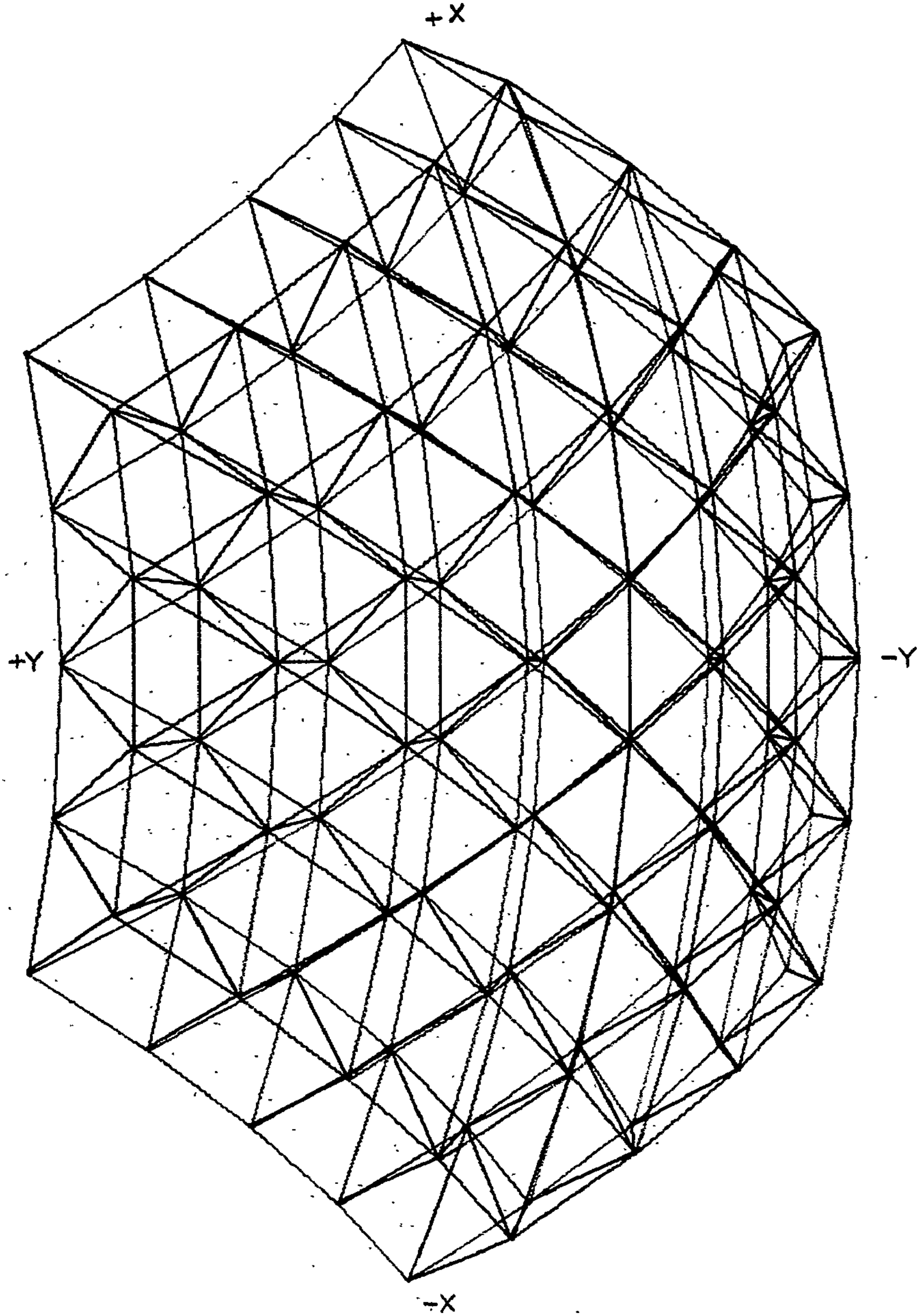
ORBITAL POSITION - 6:00 PM



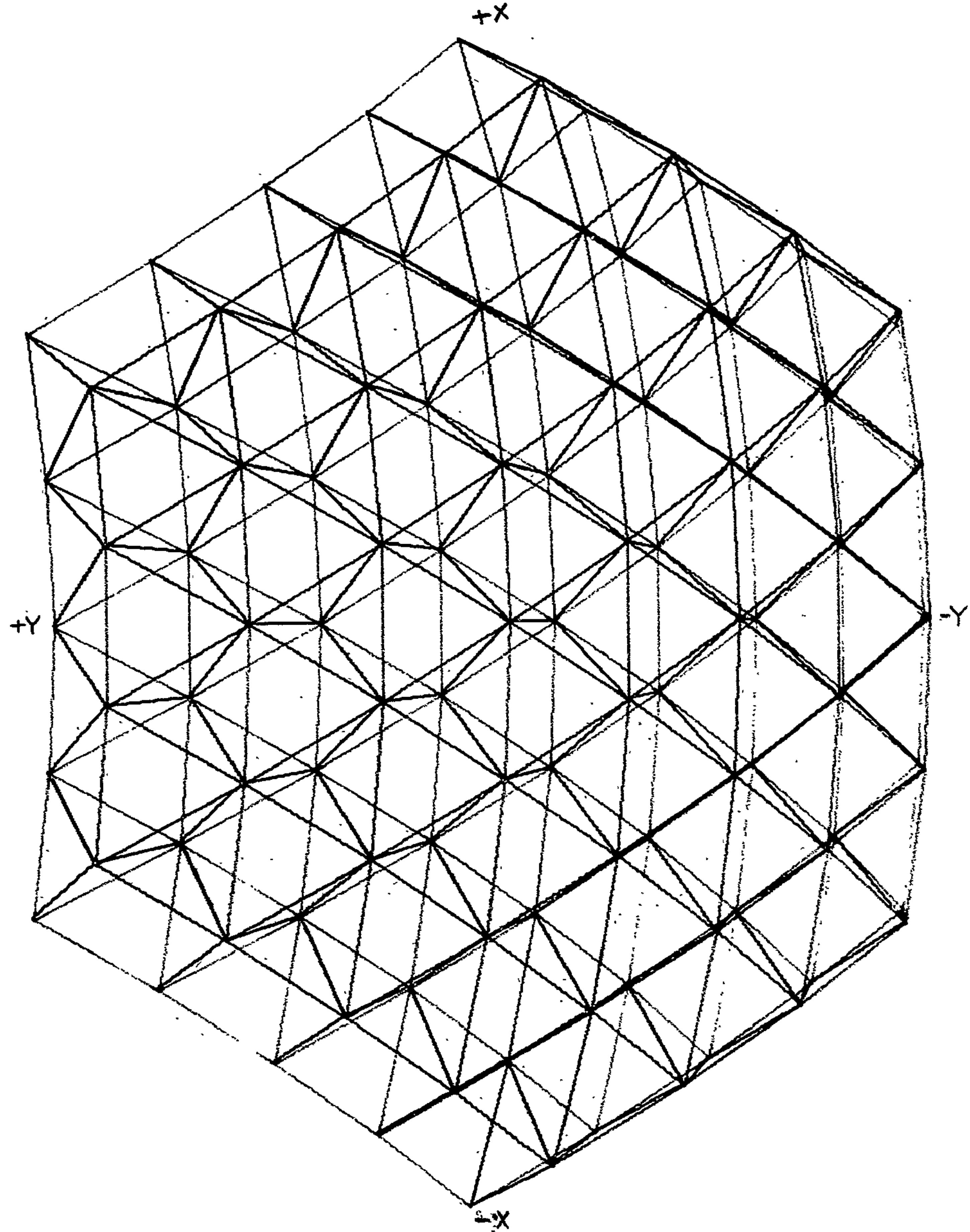
ORBITAL POSITION - 7:00 PM



ORBITAL POSITION - 8:00 PM



ORBITAL POSITION - 9:00 PM



ORBITAL POSITION - 10:00 PM

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GENERAL DYNAMICS

Convair Division