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GEODETIC SURVEY COORDINATES TO
SUPPORT GLOBAL POSITIONING SYSTEM
TESTS AT YUMA PROVING GROUNDS ARIZONA

Defense Mapping Agency
Washington, D. C.

October 1975

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DEPARTMENT OF DEFENSE
DEFENSE MAPPING AGENCY
WASHINGTON, DC 20305

ABSTRACT

Geodetic and GEOCEIVER surveys were performed by Defense Mapping Agency personnel at Yuma Proving Grounds Arizona to support positioning requirements for Global Positioning System tests and evaluation. Geodetic field surveys began in November 1974 and ended in February 1975. GEOCEIVER surveys were conducted in March and April of 1975. Upon completion of these surveys, computations were made to determine Adjusted NAD 27 and WGS 72 geodetic coordinates for selected survey sites. Yuma local rectangular as well as Universal Transverse Mercator grid coordinates are also provided.

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CONTENTS

	<u>Page</u>
ABSTRACT	iii
ILLUSTRATIONS AND TABLES	vi
INTRODUCTION	1
DISCUSSION	1
1. Geodetic Surveys	1
2. GEOCEIVER Surveys	2
3. Universal Transverse Mercator Grid Coordinates	10
4. Yuma Local Rectangular Coordinates	10
5. Yuma Photogrammetric Data Base	20
SUMMARY	20
REFERENCES	25
APPENDIX A. REPORT ON THE 1975 PRECISE GEODETIC SURVEY YUMA PROVING GROUNDS ARIZONA	
APPENDIX B. DMAAC 75-5 GEOCEIVER SURVEYS FOR GLOBAL POSITIONING SYSTEM TESTS	
APPENDIX C. YUMA PHOTOGRAMMETRIC DATA BASE	

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ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
1	Yuma Test Station Sites	7
2	Relationship Between an Earth-centered and a Local Rectangular Coordinate System	19

TABLES

<u>Table</u>		
1	Adjusted NAD 27 Coordinates for Yuma Test Station Sites Derived from NAD 27 High Precision Traverse Coordinates	3
2	Legend for Identification of Yuma Test Station Sites	9
3	WGS 72 Coordinates for Yuma Test Station GEOCEIVER Sites	11
4	Adjusted NAD 27 to WGS 72 Datum Shifts Derived from Yuma Test Station GEOCEIVER Positions	11
5	WGS 72 Coordinates for Yuma Test Station Sites Derived from Four GEOCEIVER Positions	12
6	Universal Transverse Mercator Grid Coordinates for Yuma Test Station Sites Derived from Adjusted NAD 27 Coordinates	16
7	Coordinates for Yuma Test Station Sites Referenced to a Local Rectangular Coordinate System	21

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Geodetic and GEOCEIVER surveys were performed by Defense Mapping Agency personnel at Yuma Proving Grounds Arizona to support positioning requirements for Global Positioning System tests and evaluation. Geodetic field surveys began in November 1974 and ended in February 1975. GEOCEIVER surveys were conducted in March and April of 1975. Upon completion of these surveys, computations were made to determine Adjusted NAD 27 and WGS 72 geodetic coordinates for selected survey sites. Yuma local rectangular as well as Universal Transverse Mercator grid coordinates are also provided.		

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GEODETTIC SURVEY COORDINATES TO SUPPORT
GLOBAL POSITIONING SYSTEM TESTS AT
YUMA PROVING GROUNDS ARIZONA

INTRODUCTION

Precise geodetic positions for selected survey sites at U.S. Army Proving Grounds, Yuma, Arizona (YPG) are required to support Global Positioning Systems (GPS) tests and evaluation. Due to stringent positioning requirements, precise geodetic surveys as well as GEOCEIVER derived positions are required in order to provide not only accurate relative geodetic positions but also GEOCEIVER derived conversion parameters to obtain precise World Geodetic System 1972 (WGS 72) coordinates for the proposed test sites. The geodetic surveys were performed by personnel of the Defense Mapping Agency Topographic Center (DMATC) and the GEOCEIVER surveys by the Defense Mapping Agency Aerospace Center/Geodetic Survey Squadron (DMAAC/GSS). Pertinent information regarding both the geodetic and the GEOCEIVER surveys are included in this report as Appendices A and B, respectively. Appendix C describes the Yuma Photogrammetric Data Base from which additional positional data can be derived.

DISCUSSION

1. Geodetic Surveys

Geodetic surveys were required to supplement existing survey data in the YPG area. This survey included additional astronomic position and azimuth determinations, Geodimeter observations, measurements of horizontal directions and differential leveling. An adjustment of all of the available survey data was made holding

fixed the geodetic latitude (ϕ) and longitude (λ) of two stations, PGT 2 AMS 60 and PGT 3 AMS 60, to the National Geodetic Survey (NGS) Precise Geodimeter Traverse (PGT) North American Datum 1927 (NAD 27) coordinates. Since the original NAD 27 coordinates for these two stations are not identical to those derived through the PGT, the NAD 27 coordinates determined through the PGT will be referred to as Adjusted NAD 27 coordinates. A comparison of common horizontal control station coordinates indicates that a change of approximately 0"09 and -0"26 can be expected in geodetic latitude and longitude, respectively, in the sense old (NAD 27) minus new (Adjusted NAD 27). The Adjusted NAD 27 coordinates for 65 sites in the YPG area are tabulated in Table 1. Table 2 provides a legend for identifying the Yuma Test Station sites as portrayed in Figure 1.

The Circular Standard Error (CSE) for the horizontal positions of the Adjusted NAD 27 coordinates listed in Table 1 are based on the results of the adjustment of the survey data. Vertical position errors are not listed because they were not available for all sites. Table 3, Appendix A, lists the standard error of the geoidal separation as derived from the adjustment statistics for 17 of the YPG sites relative to the geoid height at PGT 2 AMS 60 which was held fixed. These geoidal separation errors represent the total vertical position error since leveling errors are considered to be negligible (less than 2 mm maximum standard error).

2. GEOCEIVER Surveys

In order to establish precise datum shifts for the conversion of the Yuma Test Station sites from Adjusted NAD 27 to WGS 72 four

Table 1

ADJUSTED NAD 27 COORDINATES FOR YUMA TEST STATION SITES
 DERIVED FROM NAD 27 HIGH PRECISION GEODIMETER TRAVERSE COORDINATES

Station Name	Latitude(ϕ)	Longitude(λ)	CSE** (m)	Elevation msl(m)	Geoid Height(m)
PGT 2 AMS 60*	32° 55' 37".944	-114° 18' 23".898	FIXED	265.197	-22.40
PGT 3 AMS 60*	33 14 21.672	-114 15 25.582	FIXED	549.600	-21.86
HILLTOP USCGS 49	33 6 15.377	-114 17 56.619	0.025	341.971	-22.12
MPS 25 DMATC 74	32 54 3.664	-114 22 54.423	0.010	170.056	-22.60
BENCHMARK USCGS 34	32 48 39.533	-114 22 35.601	0.022	89.040	-22.63
SITE 1 DMATC 74	32 52 3.372	-114 25 8.605	0.015	183.798	-22.68
SITE 2 DMATC 74	32 56 33.463	-114 25 26.547	0.012	152.732	-22.68
SITE 3 DMATC 74	32 56 5.456	-114 20 23.282	0.007	239.709	-22.48
SITE 6 DISC YPG	32 57 31.609	-114 21 11.179	0.010	201.434	-22.48
SITE 7 DISC YPG	33 1 24.889	-114 22 16.180	0.017	185.197	-22.44
SITE 8 DISC YPG	33 4 42.523	-114 21 20.124	0.022	229.158	-22.32
SITE 9 DISC YPG	33 7 35.771	-114 21 1.154	0.025	290.986	-22.22
SITE 10 DISC YPG	33 1 42.928	-114 24 23.647	0.017	144.614	-22.56
SITE 11 DISC YPG	33 1 9.447	-114 25 32.730	0.017	121.320	-22.63
SITE 12 DISC YPG	33 1 42.672	-114 27 35.853	0.018	107.795	-22.68
IR 21 DMATC 74	33 1 33.671	-114 25 49.465	0.017	118.797	-22.60

*HELD FIXED TO NAD 27 HIGH PRECISION GEODIMETER TRAVERSE COORDINATES

**CIRCULAR STANDARD ERROR OF THE ADJUSTED NAD 27 HORIZONTAL POSITIONS

Table 1 (Cont'd)

ADJUSTED NAD 27 COORDINATES FOR YUMA TEST STATION SITES
 DERIVED FROM NAD 27 HIGH PRECISION GEODIMETER TRAVERSE COORDINATES

Station Name	Latitude(ϕ)	Longitude(λ)	CSE** (m)	Elevation msl(m)	Geoid Height(m)
IR 22 DMATC 74	33° 2' 28".775	-114° 32' 43".745	0.024	328.510	-22.82
IR 22R TC 75	33 2 41.786	-114 32 30.797	0.024	288.440	-22.80
IR 23 DMATC 74	33 7 12.542	-114 21 20.524	0.024	279.040	-22.25
IR 24 DMATC 74	32 57 50.464	-114 21 24.792	0.011	201.348	-22.49
IRCC DMATC 74	33 1 2.390	-114 23 45.633	0.017	148.976	-22.50
CM 8 YPG	33 8 42.433	-114 22 8.002	0.027	270.742	-22.50
CM 1 YPG	33 5 34.296	-114 23 42.971	0.025	209.669	-22.50
SITE 5 1969 YPG	32 55 36.495	-114 18 24.076	0.001	259.326	-22.40
10012 DMATC 74	32 55 40.123	-114 18 18.658	0.001	267.989	-22.40
10010 DMATC 74	33 1 25.074	-114 22 13.078	0.017	189.652	-22.44
CAMERA SITE 4	32 54 5.169	-114 23 9.045	0.011	171.598	-22.60
LASER SITE 7	33 1 25.040	-114 22 12.611	0.017	193.562	-22.44
CT SITE 2	32 56 33.484	-114 25 26.622	0.012	154.354	-22.60
CT SITE 5	32 55 36.743	-114 18 24.228	0.002	261.008	-22.40
CT SITE 6	32 57 31.671	-114 21 11.101	0.010	203.126	-22.50
CT SITE 8	33 4 42.191	-114 21 19.929	0.022	230.942	-22.30

Table 1 (Cont'd)

ADJUSTED NAD 27 COORDINATES FOR YUMA TEST STATION SITES
 DERIVED FROM NAD 27 HIGH PRECISION GEODIMETER TRAVERSE COORDINATES

Station Name	Latitude (°)	Longitude (λ)	CSE** (m)	Elevation msl (m)	Geoid Height (m)
CT SITE 9	33° 7' 36.011	-114° 21' 1.279	0.025	292.554	-22.20
CT SITE 10	33 1 42.989	-114 24 23.463	0.017	146.266	-22.60
CT SITE 11	33 1 9.326	-114 25 32.719	0.017	123.582	-22.60
CT SITE 12	33 1 42.615	-114 27 35.962	0.018	109.438	-22.70
SITE 11 MON	33 1 10.007	-114 25 32.596	0.017	117.899	-22.60
LASER DISC SITE 12	33 1 43.248	-114 27 32.392	0.018	104.137	-22.68
LASER DISC SITE 9	33 7 36.467	-114 20 49.874	0.025	294.636	-22.22
LASER DISC SITE 7	33 1 24.943	-114 22 12.828	0.017	189.868	-22.44
10011 DMATC 74	33 1 43.443	-114 27 35.750	0.018	107.040	-22.68
TOP 0701	33 1 38.008	-114 22 10.510	0.018	184.855	-22.40
TOP 0702	33 6 49.038	-114 22 13.694	0.048	260.600	-22.20
TOP 0703	33 5 34.536	-114 23 43.001	0.041	211.187	-22.20
TOP 0704	33 8 26.721	-114 25 36.936	0.067	247.692	-22.20
TOP 0705	33 5 51.436	-114 27 9.592	0.056	194.465	-22.20
TOP 0706	33 1 58.510	-114 23 42.643	0.021	157.135	-22.60
TUF 0707	33 2 44.508	-114 26 12.797	0.036	131.367	-22.60

Table 1 (Cont'd)

ADJUSTED NAD 27 COORDINATES FOR YUMA TEST STATION SITES
 DERIVED FROM NAD 27 HIGH PRECISION GEODIMETER TRAVERSE COORDINATES

Station Name	Latitude(ϕ)	Longitude(λ)	CSE** (m)	Elevation msl(m)	Geoid Height(m)
TOP 0708	33° 2' 3".468	-114° 24' 58".922	0.027	135.796	-22.60
TOP 0709	32 56 36.639	-114 25 34.020	0.050	150.170	-22.70
TOP 0710	32 52 3.256	-114 25 8.486	0.080	185.566	-22.70
TOP 0711	33 1 1.669	-114 22 15.373	0.018	192.872	-22.40
PEF 0712	33 1 36.079	-114 21 20.359	0.019	297.683	-22.40
PEF 3	33 2 5.939	-114 22 24.820	0.019	189.648	-22.40
PEF SOCL	33 1 .446	-114 24 1.400	0.022	147.005	-22.50
PEF NOCL	33 4 55.060	-114 24 24.173	0.039	188.300	-22.40
TOP 1201	33 1 18.327	-114 28 7.976	0.024	108.411	-22.70
TOP 1202	33 1 44.897	-114 28 7.572	0.021	120.921	-22.70
TOP 1203	33 2 .754	-114 28 .869	0.022	120.594	-22.70
TOP 1204	33 2 11.362	-114 27 46.290	0.022	126.104	-22.70
TOP 1205	33 2 24.132	-114 27 36.334	0.024	125.079	-22.70
TOP 1206	33 2 27.357	-114 27 20.614	0.025	128.049	-22.70
TOP 1207	33 2 9.979	-114 27 2.642	0.023	115.842	-22.70
TOP 1208	33 1 51.269	-114 26 41.543	0.024	113.067	-22.70
TOP 1209	33 1 32.597	-114 26 53.441	0.022	107.471	-22.70

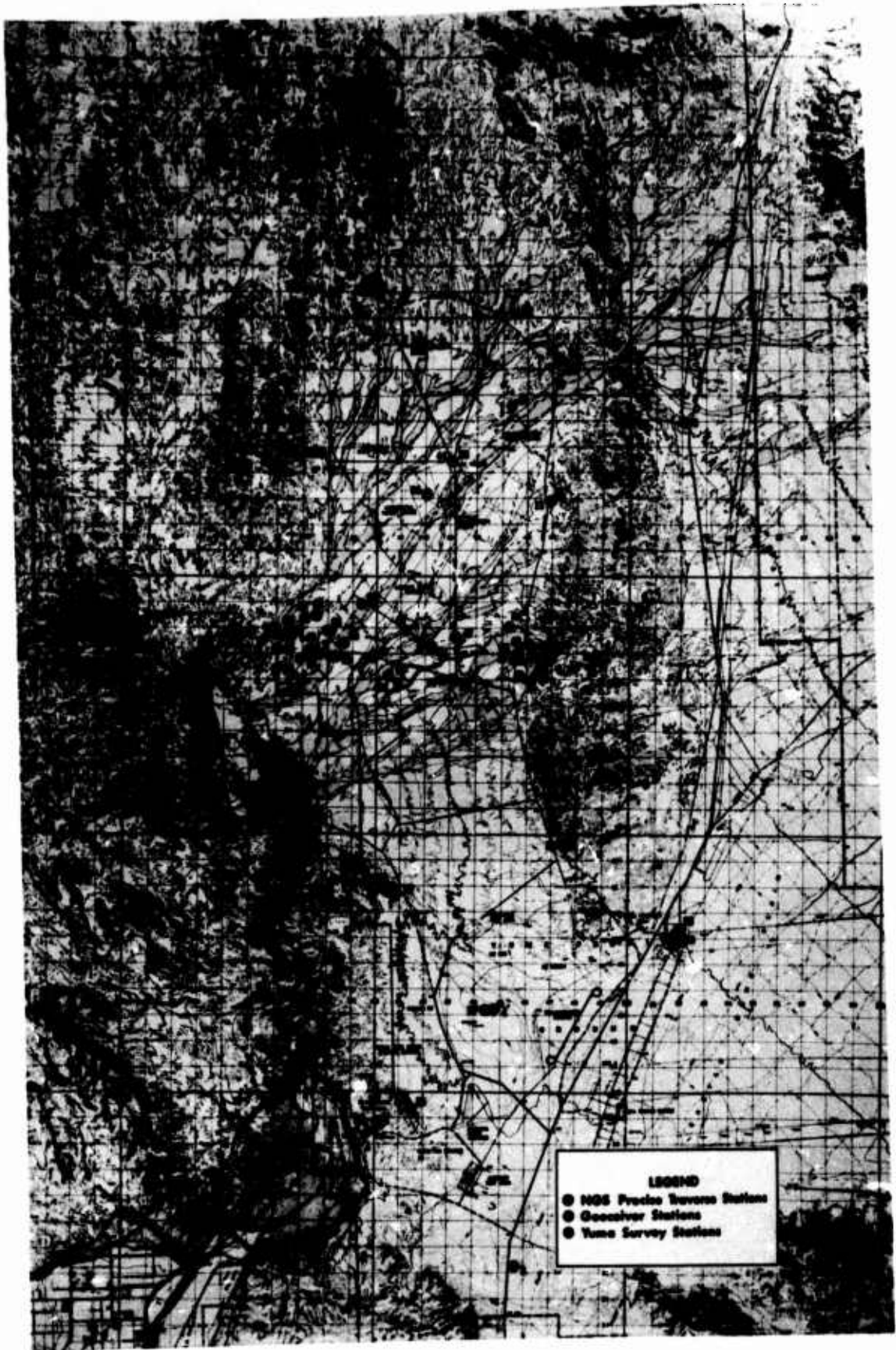


Figure 1. Yuma Test Station Sites

Table 2

LEGEND FOR IDENTIFICATION OF YUMA TEST STATION SITES

Station Number	Station Number	Station Number	Station Number	Station Number	Station Number		
PGT 2 AMS 60*	1	IR 22R TC 75	18	CT SITE 10	34	TOP 0709	50
PGT 3 AMS 60*	2	IR 23 DMATC 74	19	CT SITE 11	35	TOP 0710	51
HILLTOP USCGS 49	3	IR 24 DMATC 74	20	CT SITE 12	36	TOP 0711	52
MPS 25 DMATC 74	4	IRCC DMATC 74	21	SITE 11 MON	37	PEF 0712	53
BENCHMARK USCGS 34	5	CM 8 YPG	22	LASER DISC SITE 12	38	PEF T3	54
SITE 1 DMATC 74	6	CM 1 YPG	23	LASER DISC SITE 9	39	PEF SOCL	55
SITE 2 DMATC 74	7	SITE 5 1969 YPG	24	LASER DISC SITE 7	40	PEF NOCL	56
SITE 3 DMATC 74	8	10012 DMATC 74**	25	10011 DMATC 74**	41	TOP 1201	57
SITE 6 DISC YPG	9	10010 DMATC 74	26	TOP 0701	42	TOP 1202	58
SITE 7 D:SC YPG**	10	CAMERA SITE 4	27	TOP 0702	43	TOP 1203	59
SITE 8 DISC YPG	11	LASER SITE 7	28	TOP 0703	44	TOP 1204	60
SITE 9 DISC YPG**	12	CT SITE 2	29	TOP 0704	45	TOP 1205	61
SITE 10 DISC YPG	13	CT SITE 5	30	TOP 0705	46	TOP 1206	62
SITE 11 DISC YPG	14	CT SITE 6	31	TOP 0706	47	TOP 1207	63
SITE 12 DISC YPG	15	CT SITE 8	32	TOP 0707	48	TOP 1208	64
IR 21 DMATC 74	16	CT SITE 9	33	TOP 0708	49	TOP 1209	65
IR 22 DMATC 74	17						

*NGS PRECISE GEODIMETER TRAVERSE STATIONS

**GEOCEIVER STATIONS

survey sites were occupied and positioned using standard GEOCEIVER techniques. GEOCEIVER stations 10009, 10213, 10011, and 10012 were located at survey stations identified as SITE 9 DISC YPG, SITE 7 DISC YPG, 10011 DMATC 74, and 10012 DMATC 74, respectively. The days of observation, number of passes and the WGS 72 positions derived from the GEOCEIVER data are shown in Table 3. Mean rectangular coordinate shifts shown in Table 4, along with appropriate ellipsoid parameters differences, were applied to the Adjusted NAD 27 coordinates of Table 1 to obtain WGS 72 coordinates for the Yuma Test Station sites. The resulting WGS 72 coordinates are listed in Table 5. The CSE is not repeated in Table 5 because the conversion to WGS 72 coordinates does not affect the relative horizontal position accuracy of the stations. The standard deviations in Table 4 represent the standard error of the conversion shifts used to convert from Adjusted NAD 27 to WGS 72 coordinates.

3. Universal Transverse Mercator Grid Coordinates

Universal Transverse Mercator (UTM) grid coordinates were computed from the Adjusted NAD 27 coordinates listed in Table 1. These coordinates are listed in Table 6.

4. Yuma Local Rectangular Coordinates

The Yuma local rectangular coordinate system is defined to have its origin at the Yuma Test Station site identified by the name IRCC DMATC 74. The X and Y axes of this coordinate system are in the local horizontal plane with the X axis positive east and the Y axis positive north. The Z axis is coincident with the geodetic normal to the WGS

Table 3

WGS 72 COORDINATES*
FOR YUMA TEST STATION GEOCEIVER SITES

Station Number	Observation Days (1975)	Number of Passes	Geodetic Latitude (ϕ)	Geodetic Longitude (λ)	Geodetic Height (m)
10009	78 - 84	50	33° 7' 35" 849	-114° 2' 4" 236	255.773
10213	86 - 91	31	33 1 24.979	-114 22 19.235	150.477
10011	67 - 76	59	33 1 43.527	-114 27 38.821	69.896
10012	78 - 86	61	32 55 40.232	-114 18 21.731	231.560

*DERIVED BY CONVERTING IWL 9D GEOCEIVER COORDINATES TO WGS 72

Table 4

ADJUSTED NAD 27 TO WGS 72 DATUM SHIFTS
DERIVED FROM YUMA TEST STATION GEOCEIVER POSITIONS

Station Number	Latitude(m)	Longitude(m)	Height(m)	Rectangular Coordinate Shifts	
				$\Delta X(m)$	$\Delta Z(m)$
10009	2.4	-79.9	-13.0	-18.558	176.949
10213	2.8	-79.3	-12.3	-18.186	177.378
10011	2.6	-79.7	-13.5	-17.950	176.591
10012	3.4	-79.8	-14.0	-18.200	176.666
MEAN	2.8	-79.7	13.2	-18.223	176.896
STD. DEV.	0.4	0.3	0.7	0.3	0.4

Table 5

WGS 72 COORDINATES FOR YUMA TEST STATION SITES
DERIVED FROM FOUR GEOCEIVER POSITIONS

Station Name	Latitude (ϕ)	Longitude (λ)	Elevation msl (m)	Geoid Height (m)	Geodetic Height (m)
PGT 2 AMS 60	32° 55' 38".047	-114° 18' 26".959	265.197	-35.71	229.491
PGT 3 AMS 60	33 14 21.744	-114 15 28.649	549.600	-35.21	514.391
HILLTOP USCGS 49	33 6 15.462	-114 17 59.685	341.971	-35.43	306.545
MPS 25 DMATC 74	32 54 3.768	-114 22 57.489	170.056	-35.82	134.236
BENCHMARK USCGS 34	32 48 39.646	-114 22 38.664	89.040	-35.86	53.179
SITE 1 DMATC 74	32 52 3.478	-114 25 11.674	183.798	-35.86	147.940
SITE 2 DMATC 74	32 56 33.561	-114 25 29.619	152.732	-35.85	116.884
SITE 3 DMATC 74	32 56 5.557	-114 20 26.346	239.709	-35.75	203.962
SITE 6 DISC YPG	32 57 31.707	-114 21 14.245	201.434	-35.73	165.704
*SITE 7 DISC YPG	33 1 24.980	-114 22 19.250	185.197	-35.67	149.531
SITE 8 DISC YPG	33 4 42.609	-114 21 23.194	229.158	-35.56	193.597
*SITE 9 DISC YPG	33 7 35.852	-114 21 4.225	290.986	-35.47	255.521
SITE 10 DISC YPG	33 1 43.018	-114 24 26.720	144.614	-35.74	108.870
SITE 11 DISC YPG	33 1 9.538	-114 25 35.805	121.320	-35.79	85.528
SITE 12 DISC YPG	33 1 42.761	-114 27 38.931	107.795	-35.80	71.993
IR 21 DMATC 74	33 1 33.761	-114 25 52.540	118.797	-35.76	83.040

*GEOCEIVER SITE

Table 5 (Cont'd)
 WGS 72 COORDINATES FOR YUMA TEST STATION SITES
 DERIVED FROM FOUR GEOCEIVER POSITIONS

Station Name	Latitude(ϕ)	Longitude(λ)	Elevation msl(m)	Geoid Height(m)	Geodetic Height(m)
IR 22 DMATC 74	33° 2' 28".860	-114° 32' 46".831	328.510	-35.84	292.669
IR 22R TC 75	33 2 41.871	-114 32 33.883	288.440	-35.83	252.615
IR 23 DMATC 74	33 7 12.624	-114 21 23.596	279.040	-35.49	243.551
IR 24 DMATC 74	32 57 50.562	-114 21 27.858	201.348	-35.74	165.612
IRCC DMATC 74	33 1 2.481	-114 23 48.705	148.976	-35.70	113.279
CM 8 YPG	33 8 42.512	-114 22 11.076	270.742	-35.72	235.019
CM 1 YPG	33 5 34.380	-114 23 46.035	209.669	-35.69	173.974
SITE 5 1969 YPG	32 55 36.598	-114 18 27.137	259.326	-35.71	223.620
*10012 DMATC 74	32 55 40.226	-114 18 21.719	267.989	-35.71	232.281
10010 DMATC 74	33 1 25.165	-114 22 16.148	189.652	-35.67	153.985
CAMERA SITE 4	32 54 5.273	-114 23 12.112	171.598	-35.82	135.783
LASER SITE 7	33 1 25.131	-114 22 15.681	193.562	-35.67	157.895
CT SITE 2	32 56 33.582	-114 25 29.694	154.354	-35.77	118.586
CT SITE 5	32 55 36.846	-114 18 27.289	261.008	-35.71	225.302
CT SITE 6	32 57 31.769	-114 21 14.167	203.126	-35.75	167.376
CT SITE 8	33 4 42.277	-114 21 22.999	230.942	-35.54	195.401

*GEOCEIVER SITE

Table 5 (Cont'd)

WGS 72 COORDINATES FOR YUMA TEST STATION SITES
DERIVED FROM FOUR GEOCEIVER POSITIONS

Station Name	Latitude(ϕ)	Longitude(λ)	Elevation msl(m)	Geoid Height(m)	Geodetic Height(m)
CT SITE 9	33° 7' 36".092	-114° 21' 4".350	292.554	-35.45	257.109
CT SITE 10	33 1 43.079	-114 24 26.536	146.266	-35.78	110.482
CT SITE 11	33 1 9.417	-114 25 35.794	123.582	-35.76	87.820
CT SITE 12	33 1 42.704	-114 27 39.040	109.438	-35.82	73.616
SITE 11 MON	33 1 10.097	-114 25 35.671	117.899	-35.76	82.137
LASER DISC SITE 12	33 1 43.337	-114 27 35.470	104.137	-35.80	68.334
LASER DISC SITE 9	33 7 36.548	-114 20 52.945	294.636	-35.47	259.167
LASER DISC SITE 7	33 1 25.034	-114 22 15.898	189.868	-35.67	154.201
*10011 DMATC 74	33 1 43.532	-114 27 38.828	107.040	-35.80	71.238
TOP 0701	33 1 38.099	-114 22 13.580	184.855	-35.63	149.227
TOP 0702	33 6 49.120	-114 22 16.767	260.600	-35.42	225.178
TOP 0703	33 5 34.620	-114 23 46.075	211.187	-35.39	175.793
TOP 0704	33 8 26.799	-114 25 40.015	247.692	-35.36	212.336
TOP 0705	33 5 51.518	-114 27 12.672	194.465	-35.33	159.138
TOP 0706	33 1 58.600	-114 23 45.715	157.135	-35.80	121.338
TOP 0707	33 2 44.596	-114 26 15.873	131.367	-35.75	95.619

*GEOCEIVER SITE

Table 5 (Cont'd)
WGS 72 COORDINATES FOR YUMA TEST STATION SITES
DERIVED FROM FOUR GEOCEIVER POSITIONS

Station Name	Latitude(ϕ)	Longitude(λ)	Elevation msl(m)	Geoid Height(m)	Geodetic Height(m)
TOP 0708	33° 2' 3".557	-114° 25' 1".996	135.796	-35.77	100.023
TOP 0709	32 56 36.737	-114 25 37.092	150.170	-35.87	114.304
TOP 0710	32 52 3.362	-114 25 11.555	185.566	-35.88	149.688
TOP 0711	33 1 1.761	-114 22 18.443	192.872	-35.63	157.246
PEF 0712	33 1 36.170	-114 21 23.427	297.683	-35.64	262.039
PEF T3	33 2 6.029	-114 22 27.890	189.648	-35.62	154.025
PEF SOCL	33 1 .537	-114 24 4.472	147.005	-35.69	111.313
PEF NOCL	33 4 55.145	-114 24 27.248	188.300	-35.58	152.718
TOP 1201	33 1 18.416	-114 28 11.054	108.411	-35.81	72.599
TOP 1202	33 1 44.985	-114 28 10.651	120.921	-35.81	85.109
TOP 1203	33 2 .842	-114 28 3.948	120.594	-35.81	84.780
TOP 1204	33 2 11.450	-114 27 49.368	126.104	-35.82	90.286
TOP 1205	33 2 24.220	-114 27 39.412	125.079	-35.82	89.258
TOP 1206	33 2 27.445	-114 27 23.692	128.049	-35.83	92.223
TOP 1207	33 2 10.067	-114 27 5.719	115.842	-35.83	80.010
TOP 1208	33 1 51.358	-114 26 44.620	113.067	-35.84	77.228
TOP 1209	33 1 32.686	-114 26 56.518	107.471	-35.84	71.635

Table 6

UNIVERSAL TRANSVERSE MERCATOR GRID COORDINATES
FOR YUMA TEST STATION SITES DERIVED FROM
ADJUSTED NAD 27 COORDINATES
(ZONE 11, CENTRAL MERIDIAN 117° W)

Station Name	Northing (meters)	Easting (meters)	Station Name	Northing (meters)	Easting (meters)
PGT 2 AMS 60	3646245.378	751852.776	IR 22 DMATC 74	3658355.141	729217.314
PGT 3 AMS 60	3680985.103	755580.538	IR 22R TC 75	3658763.807	729543.894
HILLTOP USCGS 49	3665901.314	752056.775	IR 23 DMATC 74	3667527.619	746725.022
MPS 25 DMATC 74	3643163.728	744896.111	IR 24 DMATC 74	3650208.823	747050.237
BENCHMARK USCGS 34	3633190.652	745633.507	IRCC DMATC 74	3656030.198	743246.020
SITE 1 DMATC 74	3639372.024	741499.496	CM 8 YPG	3670265.939	745424.581
SITE 2 DMATC 74	3647681.020	740829.667	CM 1 YPG	3664408.467	743107.518
SITE 3 DMATC 74	3647014.106	748729.488	SITE 5 1969 YPG	3646200.620	751849.293
SITE 6 DISC YPG	3649636.847	747418.395	10012 DMATC 74	3646315.989	751987.207
SITE 7 DISC YPG	3656781.135	745550.467	10010 DMATC 74	3656788.849	745630.832
SITE 8 DISC YPG	3662906.192	746851.962	CAMERA SITE 4	3643200.660	744514.942
SITE 9 DISC YPG	3668255.932	747209.100	LASER SITE 7	3656788.105	745642.979
SITE 10 DISC YPG	3657254.632	742228.529	CT SITE 2	3647681.620	740827.703
SITE 11 DISC YPG	3656179.107	740460.972	CT SITE 5	3646208.159	751845.148
SITE 12 DISC YPG	3657124.868	737240.650	CT SITE 6	3649638.808	747420.373
IR 21 DMATC 74	3656914.727	740008.372	CT SITE 8	3662896.091	746857.277

Table 6 (Cont'd)

UNIVERSAL TRANSVERSE MERCATOR GRID COORDINATES
 FOR YUMA TEST STATION SITES DERIVED FROM
 ADJUSTED NAD 27 COORDINATES
 (ZONE 11, CENTRAL MERIDIAN 117° W)

Station Name	Northing (meters)	Easting (meters)	Station Name	Northing (meters)	Easting (meters)
CT SITE 9	3668263.244	747205.673	TOP 0709	3647774.113	740633.150
CT SITE 10	3657256.630	742233.258	TOP 0710	3639368.526	741502.678
CT SITE 11	3656175.386	740461.348	TOP 0711	3656066.323	745589.310
CT SITE 12	3657123.043	737237.864	PEF 0712	3657162.225	746990.553
SITE 11 MON	3656196.443	740464.027	PEF T3	3658040.150	745294.607
LASER DISC SITE 12	3657144.784	737330.039	PEF SOCL	3655960.177	742838.264
LASER DISC SITE 9	3668284.774	747500.975	PEF NOCL	3663173.243	742068.652
LASER DISC SITE 7	3656784.976	745637.422	TOP 1201	3656354.776	736425.080
10011 DMATC 74	3657149.684	737242.749	TOP 1202	3657173.542	736415.845
TOP 0701	3657188.975	745687.504	TOP 1203	3657666.226	736578.016
TOP 0702	3666768.836	745364.741	TOP 1204	3658002.147	736948.446
TOP 0703	3664415.835	743106.297	TOP 1205	3658401.785	737197.282
TOP 0704	3669647.346	740021.390	TOP 1206	3658511.009	737602.779
TOP 0705	3664804.856	737736.159	TOP 1207	3657986.969	738082.110
TOP 0706	3657760.992	743280.759	TOP 1208	3657423.889	738643.637
TOP 0707	3659082.160	739349.595	TOP 1209	3656841.171	738348.846
TOP 0708	3657864.839	741297.513			

72 ellipsoid at the origin point. This coordinate system is illustrated in Figure 2. The conversion from WGS 72 geodetic coordinates to Yuma local rectangular coordinates can be accomplished using the following equation:

$$\begin{bmatrix} X_i \\ Y_i \\ Z_i \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \sin \phi_0 & \cos \phi_0 \\ 0 & -\cos \phi_0 & \sin \phi_0 \end{bmatrix} \begin{bmatrix} -\sin \lambda_0 & \cos \lambda_0 & 0 \\ -\cos \lambda_0 & -\sin \lambda_0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_i - x_0 \\ y_i - y_0 \\ z_i - z_0 \end{bmatrix}$$

or conversely by the equation:

$$\begin{bmatrix} x_i \\ y_i \\ z_i \end{bmatrix} = \begin{bmatrix} -\sin \lambda_0 & -\cos \lambda_0 & 0 \\ \cos \lambda_0 & -\sin \lambda_0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \sin \phi_0 & -\cos \phi_0 \\ 0 & \cos \phi_0 & \sin \phi_0 \end{bmatrix} \begin{bmatrix} X_i \\ Y_i \\ Z_i \end{bmatrix} + \begin{bmatrix} x_0 \\ y_0 \\ z_0 \end{bmatrix}$$

where:

X_i, Y_i, Z_i = Yuma local rectangular coordinates for station i .

x_i, y_i, z_i = rectangular coordinates for station i in an earth-centered rectangular coordinate system (WGS 72).

x_0, y_0, z_0 = rectangular coordinates for the origin station (IRCC DMATC 74) in an earth-centered rectangular coordinate system (WGS 72).

ϕ_0, λ_0 = WGS 72 geodetic latitude and longitude, respectively, of the origin station (IRCC DMATC 74).

To obtain earth-centered rectangular coordinates (x, y, z) from geodetic coordinates - latitude (ϕ), longitude (λ), and geodetic height (H) the following equations may be used:

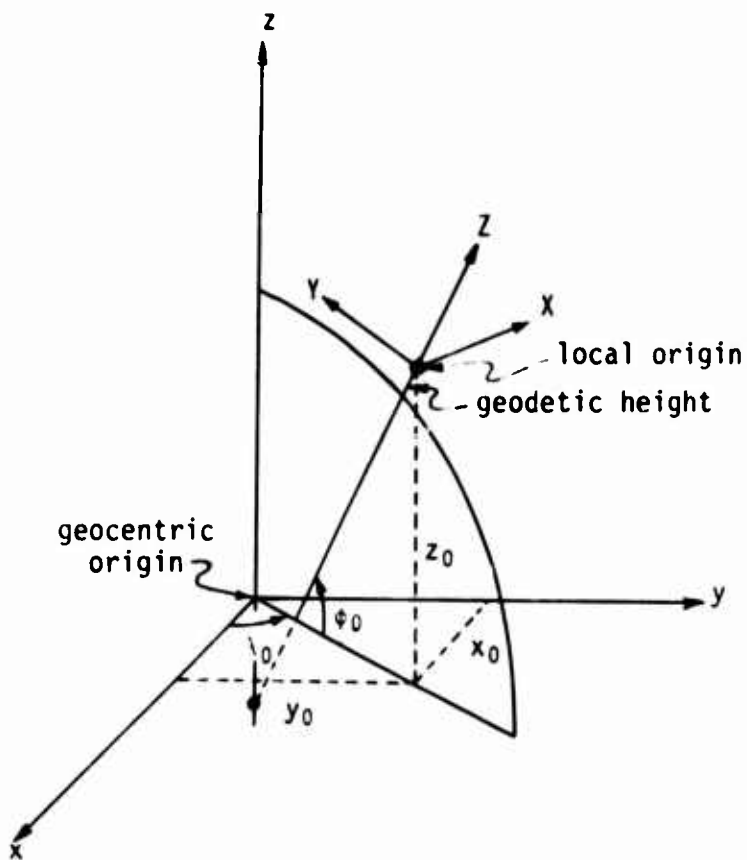


Figure 2. Relationship Between an Earth-centered and a Local Rectangular Coordinate System.

$$\begin{aligned}
 x &= (N + H) \cos \phi \cos \lambda \\
 y &= (N + H) \cos \phi \sin \lambda \\
 z &= [N (1 - e^2) + H] \sin \phi
 \end{aligned}$$

where:

$$N = a (1 - e^2 \sin^2 \phi)^{\frac{1}{2}}$$

a = semimajor axis of the reference ellipsoid

e = eccentricity of the reference ellipsoid

The Yuma local rectangular coordinates for the Yuma Test Station sites are listed in Table 7.

5. Yuma Photogrammetric Data Base

A Photogrammetric Data Base is available for deriving positional data in the YPG area. Technically, this data base provides a means by which any YPG point that can be photogrammetrically identified can also be positioned with respect to WGS 72 provided accuracy requirements are within those achievable, i.e., a CSE of about 1.5 meters and a vertical standard error of about 2 meters. In addition, anyone requesting that a point be positioned must provide an aerial photograph identifying the exact point to be positioned. The identification photograph should have sufficient detail to facilitate identification on the data base photography of the point to be positioned.

SUMMARY

The geodetic survey performed at YPG and the subsequent adjustment yielded very precise geodetic coordinates for the Yuma Test Station sites. These Adjusted NAD 27 coordinates provide

Table 7

COORDINATES FOR YUMA TEST STATION SITES
 REFERENCED TO A LOCAL RECTANGULAR COORDINATE SYSTEM

Station Name	X (meters)	Y (meters)	Z (meters)
PGT 2 AMS 60	8359.421	-9991.528	102.884
PGT 3 AMS 60	12946.927	24633.714	340.242
HILLTOP USCGS 49	9050.042	9646.666	179.530
MPS 25 DMATC 74	1331.037	-12899.291	7.726
BENCHMARK USCGS 34	1822.091	-22884.017	-101.566
SITE 1 DMATC 74	-2157.071	-16604.928	12.601
SITE 2 DMATC 74	-2621.390	-8284.335	-2.333
SITE 3 DMATC 74	5257.104	-9146.124	81.937
SITE 6 DISC YPG	4011.627	-6492.607	47.848
SITE 7 DISC YPG	2321.618	693.415	35.792
SITE 8 DISC YPG	3774.117	6782.419	75.583
SITE 9 DISC YPG	4263.833	12120.042	129.260
SITE 10 DISC YPG	-986.538	1248.890	-4.608
SITE 11 DISC YPG	-2779.663	217.800	-28.360
SITE 12 DISC YPG	-5974.628	1242.733	-44.203
IR 21 DMATC 74	-3213.757	964.178	-31.121
IR 22 DMATC 74	-13963.435	2671.119	163.560
IR 22R TC 75	-13626.815	3071.476	124.052
IR 23 DMATC 74	3761.944	11404.194	118.931
IR 24 DMATC 74	3657.855	-5911.871	48.535
*IRCC DMATC 74	0.000	0.000	0.000
CM 8 YPG	2530.308	14173.100	105.433
CM 1 YPG	69.240	8376.635	55.174
SITE 5 1969 YPG	8354.826	-10036.163	96.949
10012 DMATC 74	8495.509	-9924.287	105.600

*THIS STATION IS THE COORDINATE SYSTEM ORIGIN

Table 7 (Cont'd)

COORDINATES FOR YUMA TEST STATION SITES
REFERENCED TO A LOCAL RECTANGULAR COORDINATE SYSTEM

Station Name	X (meters)	Y (meters)	Z (meters)
10010 DMATC 74	2402.124	699.134	40.216
CAMERA SITE 4	951.000	-12852.974	9.435
LASER SITE 7	2414.246	698.090	44.121
CT SITE 2	-2623.338	-8283.689	-0.631
CT SITE 5	8350.873	-10028.529	98.648
CT SITE 6	4013.653	-6490.698	49.521
CT SITE 8	3779.180	6772.194	77.395
CT SITE 9	4260.590	12127.438	130.836
CT SITE 10	-981.763	1250.769	-2.996
CT SITE 11	-2779.380	214.073	-26.068
CT SITE 12	-5977.459	1240.979	-42.582
SITE 11 MON	-2776.179	235.020	-31.750
LASER DISC SITE 12	-5884.797	1260.423	-47.782
LASER DISC SITE 9	4556.238	12141.623	132.663
LASER DISC SITE 7	2408.613	695.100	40.430
10011 DMATC 74	-5971.940	1266.483	-44.960
TOP 0701	2468.669	1097.616	35.376
TOP 0702	2383.658	10679.608	102.480
TOP 0703	68.203	8384.032	56.983
TOP 0704	-2885.019	13689.054	83.661
TOP 0705	-5289.115	8906.028	37.427
TOP 0706	77.591	1728.886	7.823
TOP 0707	-3818.451	3146.640	-19.581
TOP 0708	-1901.870	1881.777	-13.818

Table 7 (Cont'd)

COORDINATES FOR YUMA TEST STATION SITES
 REFERENCED TO A LOCAL RECTANGULAR COORDINATE SYSTEM

Station Name	X (meters)	Y (meters)	Z (meters)
TOP 0709	-2815.483	-8186.435	-4.869
TOP 0710	-2153.978	-16608.507	14.341
TOP 0711	2342.735	-21.902	43.537
PEF 0712	3770.321	1038.620	147.562
PEF T3	2097.116	1957.989	40.100
PEF SOCL	-409.228	-59.881	-1.979
PEF NOCL	-999.644	7167.909	35.318
TOP 1201	-6808.777	493.273	-44.330
TOP 1202	-6797.764	1311.786	-31.924
TOP 1203	-6623.485	1800.179	-32.190
TOP 1204	-6244.936	2126.738	-26.403
TOP 1205	-5986.348	2519.987	-27.327
TOP 1206	-5578.394	2619.102	-24.033
TOP 1207	-5112.307	2083.473	-35.657
TOP 1208	-4565.076	1506.828	-37.862
TOP 1209	-4874.116	931.742	-43.573

relative horizontal and vertical positions with accuracies that are representative of the state-of-the-art in geodetic positioning. This relative positioning accuracy is maintained under transformations to other coordinate systems such as WGS 72 or the Yuma local rectangular coordinate system. The additional GEOCEIVER survey provided a means by which the local survey can be accurately related to WGS 72. The accepted accuracy for GEOCEIVER derived surveys [1] is 1.5 m in each coordinate at 90% confidence which is equivalent to a standard error of 0.8 m. This accuracy is not significantly different from the accuracy implied by the standard deviations from the mean of the limited sample of Table 4. These accuracy figures indicate that the WGS 72 coordinates for any and/or all of the Yuma Test Station sites have a standard error of approximately 1 m in each coordinate. The standard error of WGS 72 positions in the NAD 27 area with respect to the earth's center of mass is estimated to be 5 m in each component [2].

REFERENCES

1. DMA Report 0001; Report of the DOD Geceiver Test Program; Defense Mapping Agency, Washington, D.C.; July 1972. [Prepared by Applied Physics Laboratory, The Johns Hopkins University; Silver Spring, Maryland.]
2. World Geodetic System Committee; Department of Defense World Geodetic System 1972; Defense Mapping Agency; Washington, D.C.; May 1974. [Presented by Thomas O. Seppelin at the International Symposium of Problems Related to the Redefinition of North American Geodetic Networks, Fredericton, New Brunswick, Canada.]

REPORT ON THE 1975
PRECISE GEODETIC SURVEY
YUMA PROVING GROUNDS
ARIZONA

PURPOSE AND SCOPE

Defense Mapping Agency Topographic Center (DMATC) was directed by HQ DMA in November 1974 to perform the necessary geodetic survey at Yuma Proving Grounds (YPG) to support the upcoming Global Positioning System (GPS) inverted range tests. DMATC, in November 1974, coordinated project details with YPG personnel and performed reconnaissance on a tentative survey network which was accepted when a simulated adjustment indicated that the stringent accuracies required would be met. Figure 1 shows the horizontal and vertical networks but does not show the laser and cinetheodolite calibration lines. The scheme for laser and cinetheodolite calibration lines had not been finalized when these results were obtained. Those lines will be discussed in a supplemental report.

DMATC field parties began the field work on 21 November 1974 and terminated field operations on 18 February 1975. The following work was accomplished:

ASTRONOMIC POSITIONS	-	16 modified first order stations
DISTANCES	-	58 precise lengths
DIRECTIONS	-	122 first order directions
ASTRONOMIC AZIMUTHS	-	21 lines
SITES OCCUPIED	-	2 Transcontinental Traverse Stations
	-	25 Primary Network Stations
	-	2 Secondary Stations (CM-1, CM-8)
DIFFERENTIAL LEVELS		
SECOND ORDER	-	149 kilometers (see Table 4)

SPECIFICATIONS

Project specifications require relative errors, (1 sigma), of $1\text{ppm} \pm 2\text{cm}$ for the horizontal positioning. The vertical accuracy (ellipsoid elevations) requirement for the primary points is also $1\text{ppm}^* \pm 2\text{cm}$, (1 sigma). The azimuth and elevation angles of the laser and cinetheodolite calibration lines are to be within 3 arc seconds.

DESCRIPTION OF FIELD WORK

Astronomic Positions

Modified first order observations (one nights work) were made at

*The ratio of the relative vertical error to the distance between any two points in the net.

16 network stations. All equipment was calibrated prior to, and at intervals during the project to minimize any systematic errors. Two other astros (PGT 2 and PGT 3) previously observed by National Geodetic Survey (NGS) on the Transcontinental Traverse (TT) were accepted as given.

Precise longitudes were determined by observing the meridian transits of fundamental catalog (FK 4) stars using a Wild T-4 Universal Theodolite. Timing was from the digital printout of the Datametrics Electronic Timing System, which was set to coordinated Universal time (UTC). The largest standard deviation for any single longitude determination is 0".18 and the average of all the standard deviations is 0".14. (see Table 1)

Precise latitudes were determined by observing the zenith distances of fundamental catalog (FK 4) stars at the time of their meridian transits using a Wild T-4 Universal Theodolite. The largest standard deviation for any single latitude determination is 0".23 and the average of all standard deviations is 0".13. (see Table 1)

Horizontal Directions and Astronomic Azimuths

The horizontal survey was accomplished using the NGS specifications (as amended in this paragraph) for the super-precise TT. Because the network contains a large amount of redundancy (number of degrees of freedom) the specifications for directions and azimuths could be relaxed from two nights of observations to one night and still meet the accuracy requirement cited under specifications.

Astronomic azimuths were observed concurrently with the observations for horizontal directions at 21 of the 25 primary stations. Wild T-3 theodolites were used for the observations after tests had been performed which indicated that imperfections in the linearity of the vertical axis (trunnion irregularities) were not excessive. At least one set of 16 positions was made to all traverse stations and on Polaris. Additional observations were made in cases where acceptable closures appeared to be marginal. The largest standard deviation for any single azimuth determination is 0".62 and the average of all standard deviations is 0".40. (see Table 1)

Elevations

The spirit leveling (differential leveling), was accomplished to standard second order specifications. The allowable circuit misclosure is $8.4\text{mm} \times \sqrt{K}$. K is the length of the circuit in kilometers. Elevations were carried from bench marks to primary stations with the same accuracy.

Geodimeter Measurements

All distances greater than 2 kilometers were measured with laser geodimeters (model 4 and 8). Each line between stations consists of at least two sets of four measurements each. Each set contains two measurements with the reflectors eccentric forward and two measurements with the reflectors eccentric rearward. On lines where the elevations of the end points exceed 300 meters, zenith distances were measured on each end of the lines before and after each set of geodimeter measurements. The mean of the before and after zenith distances was used to compute a refractive index rate correction for each end of the line. At the time of each measurement a frequency count was taken which was used to compute a correction for the variation of frequencies. Meteorological data at each end of the line consisted of altimeter readings, wet and dry bulb temperatures, and the ambient temperature at the heights of 15 and 25 feet above the stations before and after each measurement. The geodimeters were calibrated before the project was started. The zero constant for each instrument was determined before and after the completion of the project. A summary of the measurements and instrument comparisons are given in table 2. On lines shorter than 2 kilometers (with one exception) the MA-100 Tellurometer was used. At least 2 sets of measurements were taken on each line.

COMPUTATION AND ADJUSTMENT

Computation of Geoid Heights

Deflections of the Vertical were obtained from preliminary geodetic positions and the astronomic positions. Geoid heights were computed at each network station by the method of least squares. The geoid height at station PGT 2 resulting from the NGS adjustment of the Transcontinental Traverse was held fixed. The small variation in geoid heights (less than one meter) precluded a need for an iteration of the geoid adjustment after the network adjustment. The adjusted geoid heights resulted in an average length correction to reduce from geoid to ellipsoid of 1 part in 284,000.

Horizontal Control Adjustment

The network was adjusted by the method of variation of coordinates. A series of adjustments were made to obtain optimum weights for the observations. The first adjustment was made with weights derived from the following a priori estimates of the standard deviations:

Directions : 0".6
Azimuths : 1".0
Lengths : 6mm + 1ppm

The standard deviation of an observation of unit weight (σ_0) for the adjustment was 1.21. This value was within the 95% confidence interval for chi-square (χ^2) but near the upper limit. A succession of adjustments were made using directions only, then directions and distances; and finally directions, distances, and azimuths. Weights were varied after each adjustment to yield a σ_0 approximating unity. A summary of each adjustment is given in the table below:

ADJ. NO.	σ (DIR)	σ (LENGTH)	σ (Z.)	σ_0	n-u	95% χ^2 INTERVAL
	1mm+	6mm+	1mm+			
1	0.6	1ppm	1.0	1.21	108	0.75-1.28
2	0.6			0.98	41	0.62-1.48
3	0.6	1		1.24	91	0.73-1.31
4	0.6	2		1.09	91	0.73-1.31
5	0.6	2	1.4	1.05	108	0.75-1.28
6	0.6	2	1.0	1.03	118	0.76-1.28

n-u = degrees of Freedom

The 1mm part of the direction and azimuth errors represent the uncertainty in instrument and target placement. The additional degrees of freedom shown with adjustment 6 results from the addition of several spur lines to the final adjustment. Relevant statistics from the final adjustment are given in tables 5 and 8. The Transcontinental Traverse positions of stations PGT 2 and PGT 3 were held fixed in the adjustment. The positions of the network are referenced to the North American 1927 Datum origin as transported through the Transcontinental Traverse. Comparison with NAD 1927 coordinates derived from triangulation are given in table 6.

Adjustment of Elevations

The leveling network was adjusted by the method of least squares using observation equations. The elevation of a recovered bench mark (1113 + 7208) in the southeast part of the net was held fixed in the adjustment. The standard error in an observation of unit weight was 1.4 millimeters. The maximum standard error in an adjusted elevation was 1.8 millimeters. Detail: and a diagram of the leveling net are given in table 4. Comparison of newly determined elevations with published elevations at recovered stations are given in table 7.

RESULTS

Figure 2 is a geoid profile of the surveyed area. The "flatness" of the geoid in the area (variation of one meter in 1000 square kilometers) will yield a high interpolation accuracy.

Figures 3 and 4 are contours of the astro-geodetic deflection of the vertical components.

Pages A-18 through A-51 contain the station description cards (DA form 1959) with Geodetic Coordinates, MSL Elevations, UTM grid coordinates, and YPG grid coordinates.

Pages A-52 through A-54 contain Geocentric Coordinates and Ellipsoidal Positions.

Pages A-55 through A-70 contain the astronomic position and azimuth results cards.

Pages A-71 through A-96 contain the level line descriptions.

Pages A-97 through A-99 contain a tabulation of elevations from the level line adjustment. Note that usable width of field necessitated abbreviation of some station designations.

Station IR 22 R replaces IR 22 as an inverted range station.

ANALYSIS

Specifications were met or exceeded in all cases. Table 8 gives the circular standard errors of the adjusted horizontal positions and corresponding values from the simulation. The high correlation between the simulation and adjustment justifies the specifications used in the field work. The largest positional error in the adjusted network is 0.027m at CM 8 YPG. This is less by a factor of 2.6 than the accuracy required (0.070m) at that station.

The error in Ellipsoid height is given by $\sigma_H = \sqrt{\sigma_N^2 + \sigma_h^2}$

Where: σ_N = Error in Geoid height
 σ_h = Error in leveling

Since the maximum error in leveling is less than 2mm its contribution to σ_H is negligible and $\sigma_H = \sigma_N$. The maximum value of σ_N is 0.028 meter at PGT 3. This compares with a required accuracy of 0.055 meter at that point. The following empirical formula yields the relative accuracy between any two points in the net:

$$\sigma_c = 0.0127(S)^{0.189}$$

Where: σ_c is the circular standard error in meters
 S^c is the distance between points in kilometers.

The results of the survey yields a basic framework for existing and future YPG control requirements.

TABLE 1

GPS-YPG 1975 PRECISE GEODETIC SURVEY

Standard Deviations of the 1975 DMATC Astronomic Position and Azimuth Determinations.

<u>Station</u>	<u>$\sigma\phi$</u>	<u>$\sigma\lambda$</u>	<u>$\sigma\alpha$</u>
HILLTOP USCGS 1949	0"14	0"11	0"62
BENCH MARK USCGS 1934	0.10	0.12	0.26
MPS 25 DMATC 1974	0.15	0.12	0.35
SITE 1 DMATC 1974	0.10	0.12	0.35
SITE 2 DMATC 1974	0.13	0.11	0.51
SITE 3 DMATC 1974	0.14	0.14	0.32
SITE 6 DISC YPG	0.12	0.18	0.41
SITE 7 DISC YPG	0.13	0.18	0.62
SITE 8 DISC YPG	0.12	0.16	0.44
SITE 9 DISC YPG	0.23	0.14	0.43
SITE 10 DISC YPG	0.13	0.16	0.47
SITE 11 DISC YPG	0.10	0.17	0.49
SITE 12 DISC YPG	0.12	0.10	0.35
IR 22 DMATC 1974	0.13	0.12	0.38
IR 23 DMATC 1974	0.13	0.18	0.25
IR 24 DMATC 1974	0.13	0.13	0.27

TABLE 2

GPS-YFG 1975 PRECISE GEODETIC SURVEY
 GEODIMETER MEASUREMENT SUMMARY AND COMPARISONS

Station From To	Adjusted Results length (meters)	sigma (meters)	Mean length minus first night's value (millimeters)	Model B Geodimeters		Model 4L Geodimeters	
				#60070-mean (millimeters)	#60011-mean (millimeters)	#236-mean (millimeters)	#304-mean (millimeters)
POT 2 HILLTOP	19649.465	.025	+12.6	-12.6			+12.7
POT 2 HILLTOP	7605.628	.029	-2.2	+2.2			+26.7 R
POT 3 HILLTOP	15463.615	.025	+3.5	-3.5			+3.9
POT 3 SITE 2	36411.496	.015	-24.5	+24.5			-24.4
MPS 25 SITE 1	5088.926	.010	-6.0	+6.0			-9.9
MPS 25 SITE 2	6075.971	.008	+10.8	+9.7			-10.8
MPS 25 SITE 6	6944.762	.008	+3.8	+3.8			-3.8
POT 2 BENCH MARK	14455.218	.019	+11.4	+40.5 R			+12.5
POT 2 SITE 1	7433.674	.015	+8.8	+8.9			-6.8
POT 2 SITE 1	12422.792	.011	-0.2	+0.2			-0.1
POT 2 SITE 2	11112.359	.009	+3.0	-0.9			+1.7
SITE 2 SITE 1	8333.306	.011	+4.4	+4.4			+4.4
SITE 2 SITE 6	6870.602	.008	+7.3	+7.3			+7.3
SITE 2 SITE 7	10248.367	.012	+4.0	+4.0			+4.0
SITE 2 IR 24	6712.325	.008	+1.8	+1.9			-1.8
POT 2 SITE 3	3215.394	.007	-5.6	+5.6			-5.5
SITE 3 MPS 25	5431.332	.011	+4.1	-4.1			+4.2
SITE 3 SITE 2	7925.246	.008	-6.3	-6.3			+6.3
SITE 3 SITE 6	2931.144	.007	-2.8	+2.8			-3.1
SITE 7 SITE 6	6259.646	.011	+5.2	+4.1			-5.2
SITE 9 SITE 7	11590.007	.012	-5.5	+5.5			+6.3
SITE 7 SITE 10	3354.386	.006	-0.6	-0.6			+0.6
SITE 7 SITE 11	5123.281	.006	-4.8	0.0			+43.5 R
SITE 7 INCC	2422.691	.006	-11.9	-13.0			+11.9
SITE 6 IR 23	4621.545	.008	-9.1	+9.1			-8.4
SITE 6 CM 1	4033.191	.010	+3.8	-3.8			+3.1
SITE 9 SITE 8	5359.737	.008	+0.9	-0.9			-0.9
SITE 9 SITE 12	14937.414	.013	-3.3	-2.7			+3.3
SITE 9 CM 8	2686.923	.008	-0.4	+0.4			-0.3
SITE 10 SITE 2	9672.196	.011	-9.5	+9.5			-9.4
SITE 11 SITE 10	2068.401	.004	+4.2				
SITE 12 POT 2	18211.361	.014	+10.4	+16.7			-6.9
SITE 12 SITE 2	10099.766	.012	+11.7	-11.7			+9.6
SITE 12 * SITE 7	(8314.278)		-6.7	-6.8			+6.7
SITE 12 * SITE 8	(11212.515)		-7.5	-7.4			+7.5
SITE 12 SITE 10	4988.041	.006	+1.9	-1.9			+1.8
SITE 12 SITE 11	3355.329	.006	-6.7	-6.8			+6.7
IR 21 SITE 12	2774.864	.006	+4.3	+3.1			-4.3
SITE 12 IR 24	11998.602	.013	+1.5	-0.7			-2.9
IR 21 IR 21	2245.311	.004	+1.1	+1.1			+3.9
IR 21 SITE 11	863.452	.004	+10.4				-2.4
IR 22 POT 3	34732.556	.028	-27.0	-27.0			+1.5
IR 22 SITE 8	18207.004	.015	-2.1	+2.1			+1.5
IR 22 SITE 9	20529.902	.016	+1.7	-1.7			+1.7
IR 22 SITE 12	8114.905	.011	+1.6	-1.6			+1.5
SITE 10 INCC	1591.493	.005	+1.4	+1.4			-1.4
SITE 11 INCC	2768.117	.005	-2.4				+2.4
IR 22R IR 22	522.888	.006	-3.8				-2.9
IR 22R SITE 9	20047.898	.016	+27.7	+27.7			-27.7
IR 22R SITE 12	7867.183	.011	+6.5	-6.5			+5.9
POT 2 POT 3	34925.400	FIXED	+8.3	-11.9			+2.4

*These two lines rejected in adjustment because of excessive residuals. Distances shown in parenthesis are from inverse of final positions.

TABLE 3

GPS-YPG 1975 PRECISE GEODETIC SURVEY
Geoidal Separation Adjustment Statistics

<u>Station</u>	<u>Geoidal Separation (meters)</u>	<u>Sigma (meters)</u>
PGT 2	-22.40	FIXED
PGT 3	-21.86	0.028
HILLTOP	-22.12	0.021
BENCH MARK	-22.63	0.017
MPS 25	-22.60	0.014
SITE 1	-22.68	0.014
SITE 2	-22.68	0.015
SITE 3	-22.48	0.019
SITE 6	-22.48	0.021
SITE 7	-22.44	0.021
SITE 8	-22.32	0.019
SITE 9	-22.22	0.018
SITE 10	-22.56	0.024
SITE 11	-22.63	0.013
SITE 12	-22.68	0.026
IR 22	-22.82	0.022
IR 23	-22.25	0.016
IR 24	-22.49	0.020

No. of Equations = 46
 Max. Residual = -0.071 meters
 Avg. Residual = 0.019 meters
 σ_0 = 0.031 meters

TABLE 4

GPS-YPG 1975 PRECISE GEODETIC SURVEY

Second Order Differential Levels Adjustment Statistics

No. of Fixed Marks	2
No. of Monumented Bench Marks	100
No. of Temporary Bench Marks	17
No. of Observations	156
No. of Kilometers	148.92
No. of Circuits	3 (Closures given below)
Maximum Correction to an Elevation	22.5mm
Average Correction to an Elevation	11.4mm
σ_0	1.4mm

Loop Closure 4.79mm
 A - Length of Loop 55.81km
 Allowable Error 62.75mm

Loop Closure -24.21mm
 B - Length of Loop 70.68km
 Allowable Error 70.62mm

Loop Closure 7.45mm
 C - Length of Loop 19.55km
 Allowable Error 37.14mm

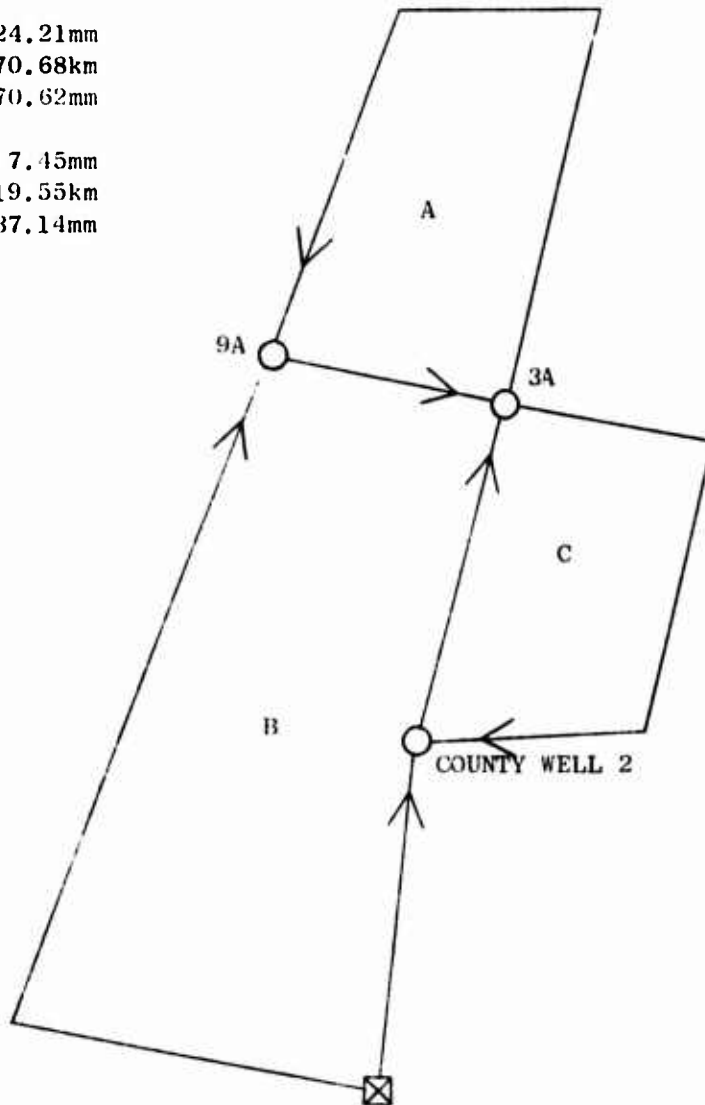


TABLE 5

GPS-YPG 1975 PRECISE GEODETIC SURVEY

Statistics on Computations

Number of Fixed Stations	2
Number of Adjustable Stations	27
Number of Observations	201
" " Directions	122
" " Measured Lengths	58
" " Observed Azimuths	21
Total Number of Triangles	41
Maximum Triangle Closure	2."95
Average Triangle Closure	1."02
Maximum Correction to Direction	2."07
" " " Length	1.4 ppm
" " " Azimuth	2."06
Standard Error in an Observation of Unit Weight (σ_0)	1.03

TABLE 6

GPS-YPG 1975 PRECISE GEODETIC SURVEY

Comparison at Common Horizontal Control Stations of Previously Established 1927 NAD Coordinates with the Values Resulting from this Survey.

<u>Station</u>	<u>$\Delta\phi(\text{Old-New})$</u>	<u>$\Delta\lambda(\text{Old-New})$</u>
HILLTOP USC&GS 1949	+0".0875	-0".2645
BENCH MARK USC&GS 1934	+0.0957	-0.2636
CM 1 YPG	+0.0911	-0.2609
CM 8 YPG	+0.0894	-0.2635
SITE 11 MONUMENT	+0.0934	-0.2617

TABLE 7

GPS-YPG 1975 PRECISE GEODETIC SURVEY

Previously Published Elevations Compared with this Survey's Results
at Common Points

<u>Station</u>	<u>Old (meters)</u>	<u>New (meters)</u>	<u>Old-New (millimeters)</u>
USE 1144+45.07	97.9789	97.9635	+ 15.4
USE 1160+00.0	102.5855	102.5751	+ 10.4
USE 1175+00.0	103.4485	103.4403	+ 8.2
USE 1190+00	106.9967	107.1788	-182.1
TR-28 USGS '34	267.3921	267.4097	- 17.6
TR-27 USGS '34	281.4998	281.5099	- 10.1
TBM 1018 USGS '34	310.2718	310.2559	+ 15.9
TR-25 USGS '34	298.8795	298.8710	+ 8.5
TR-40 USGS '34	257.1380	257.1210	+ 17.0
20-M USGS '25	173.7683	173.7757	- 7.4
24-M USGS '25	129.4015	129.3807	+ 20.8
23-M USGS '25	125.5843	125.6137	- 29.4

TABLE 8

GPS-YPG 1975 PRECISE GEODETIC SURVEY

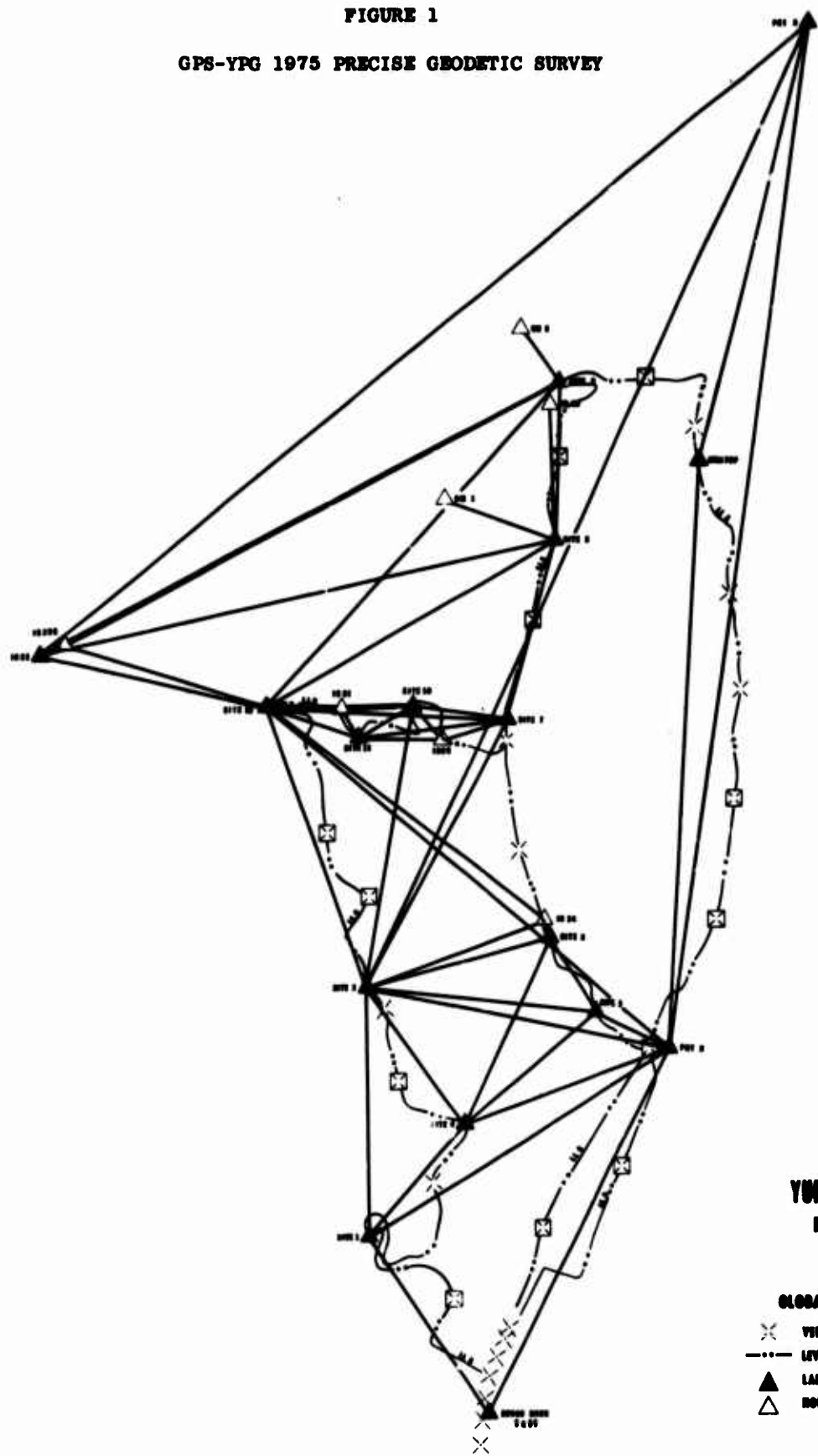
Comparison of Simulated and Final Adjusted Circular Standard Errors

Station	Arc Path (Km.)*	Simulated		Final	
		CSE**	PPM	CSE	PPM
PGT 2 AMS 60	17.46				
PGT 3 AMS 60	17.46				
HILLTOP USC&GS 49	32.94	.020	0.6	.025	0.8
MPS 25 DMATC 74	25.39			.010	0.4
BENCH MARK C&GS 34	31.91	.018	0.6	.022	0.7
SITE 1 DMATC 74	29.88	.013	0.4	.015	0.5
SITE 2 DMATC 74	28.57	.010	0.4	.012	0.4
SITE 3 DMATC 74	20.67	.006	0.3	.007	0.3
SITE 6 DISC YPG	23.63	.009	0.4	.010	0.4
SITE 7 DISC YPG	36.21	.015	0.4	.017	0.5
SITE 8 DISC YPG	42.45	.019	0.4	.022	0.5
SITE 9 DISC YPG	47.79	.022	0.5	.025	0.5
SITE 10 DISC YPG	32.83	.015	0.5	.017	0.5
SITE 11 DISC YPG	34.89	.015	0.4	.017	0.5
SITE 12 DISC YPG	35.68	.016	0.5	.018	0.5
IR 21 DMATC 74	38.45			.017	0.4
IR 22 DMATC 74	43.79			.024	0.5
IR 22R TC 75	43.55			.024	0.6
IR 23 DMATC 74	48.66			.024	0.5
IR 24 DMATC 74	24.31			.011	0.5
IRCC DMATC 74	34.42			.017	0.5
CM 8 YPG	50.48	.024	0.5	.027	0.5
CM 1 YPG	46.52	.024	0.5	.025	0.5
SITE 5 1969 YPG	17.50			.001	0.1
10012 DMATC 74	17.61			.001	0.1
10010 DMATC 74	36.21			.017	0.5
CAMERA SITE 4	25.77	.010	0.4	.011	0.4
SITE 11 MON	34.89			.017	0.5
10011 DMATC 74	35.68			.018	0.5

* arc path distance from the center of gravity of the fixed stations

**meters

FIGURE 1
GPS-YPG 1975 PRECISE GEODETIC SURVEY



YUMA PROVING GROUND
HORIZONTAL AND VERTICAL
CONTROL NET FOR THE
INVERTED RANGE

- GLOBAL POSITIONING SYSTEM TESTS**
- ✕ VERTICAL BENCH MARK
 - ⋯⋯⋯ LEVEL LINE ROUTING
 - ▲ LAPLACE AND HORIZONTAL CONTROL STATION
 - △ HORIZONTAL CONTROL STATION

FIGURE 2

GPS-YPG 1975 PRECISE GEODETIC SURVEY

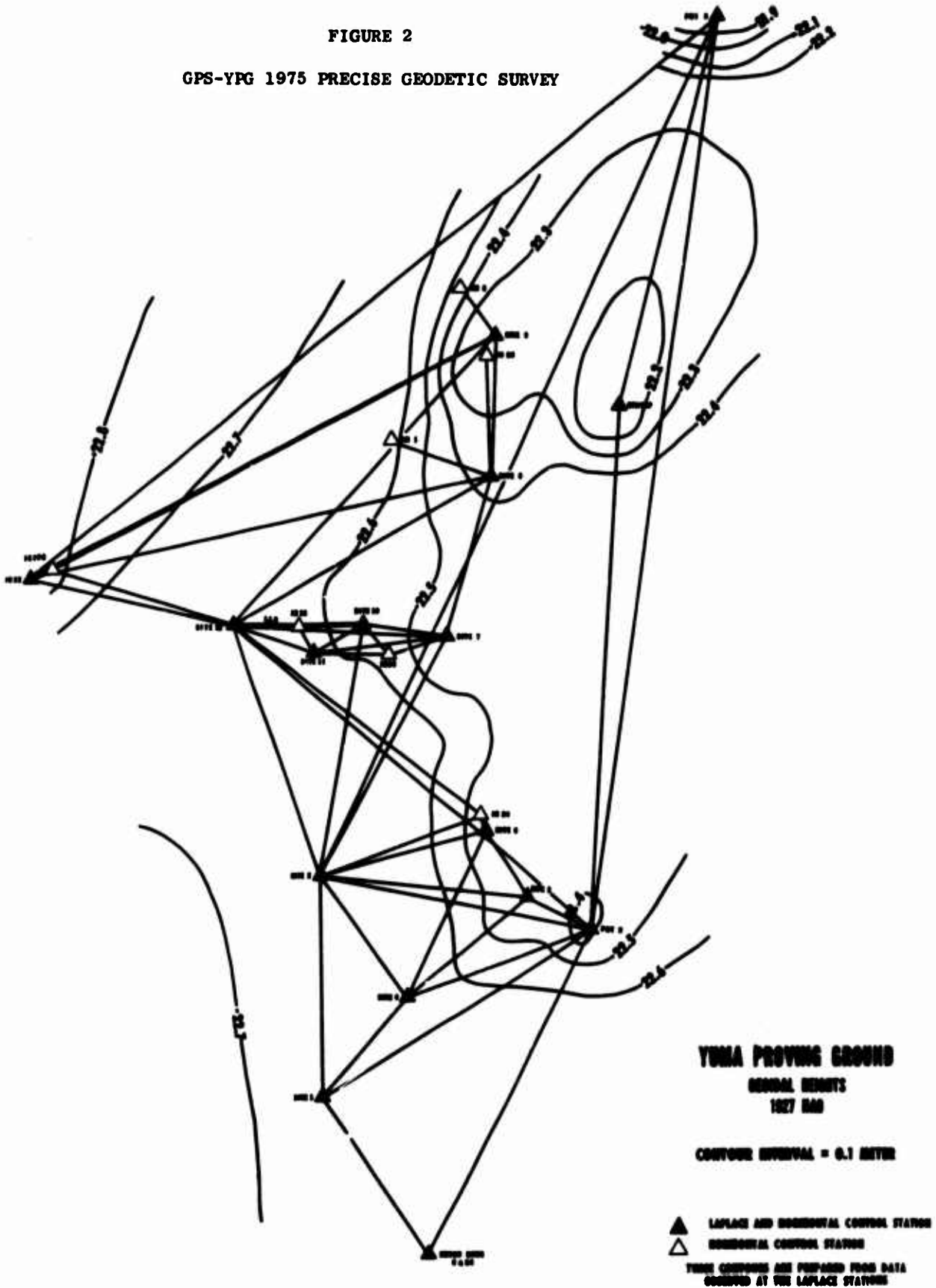
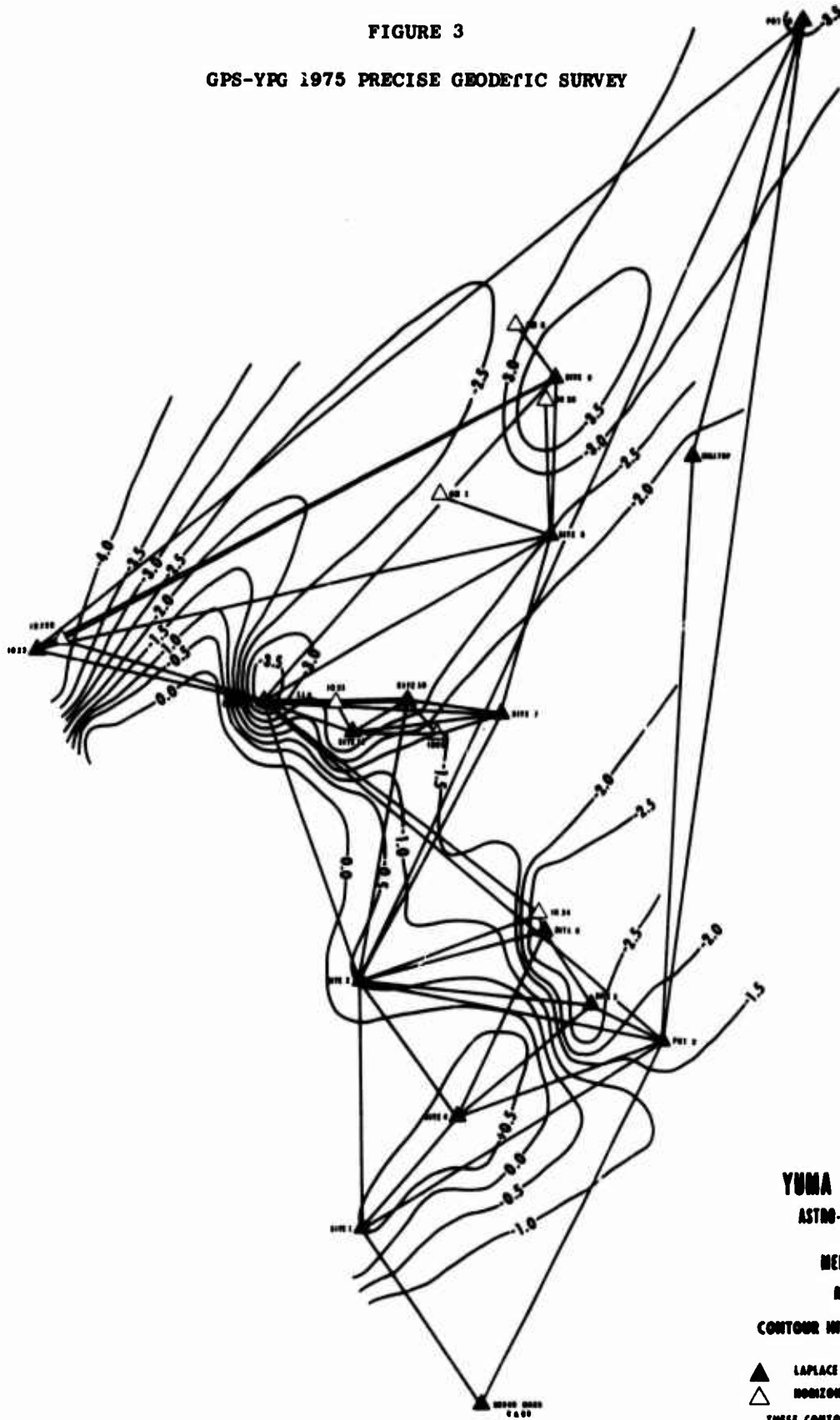


FIGURE 3
GPS-YFG 1975 PRECISE GEODETIC SURVEY



YUMA PROVING GROUND
ASTRO-GEODETIC DEFLECTIONS
1927 MAD
MERIDIAN COMPONENT

$$\Delta\sigma = \phi_1 - \phi_2$$

CONTOUR INTERVAL = 0.5 ARC SECOND

- ▲** LAPLACE AND HORIZONTAL CONTROL STATION
- △** HORIZONTAL CONTROL STATION

THESE CONTOURS ARE PREPARED FROM DATA OBSERVED AT THE LAPLACE STATIONS

FIGURE 4
GPS-YPG 1975 PRECISE GEODETIC SURVEY



YUMA PROVING GROUND
ASTRO-GEODETIC DEFLECTIONS
1927 MAD
PRIME VERTICAL COMPONENT (PVC)
 $PVC = (\lambda_A - \lambda_0) \cos \phi_0$
CONTOUR INTERVAL = 0.5 ARC SECOND

▲ LAPLACE AND HORIZONTAL CONTROL STATION
 △ HORIZONTAL CONTROL STATION
 THESE CONTOURS ARE PREPARED FROM DATA
 OBSERVED AT THE LAPLACE STATIONS

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION PGT NO. 2 AMS 1960	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK PGT NO. 2 ARMY MAP SERVICE 1960		AGENCY (CAST IN MARKS) CORPS OF ENGINEERS	
LATITUDE N 32° 55' 37" 9442		LONGITUDE W 114° 18' 23" 8977		ELEVATION 265.197	
(NORTHING)(EASTING) (M) 3 646 245.384		(EASTING)(NORTHING) (M) 751 852.783		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 38 002.874		(EASTING)(NORTHING) (M) 32 677.700		ESTABLISHED BY (AGENCY) DMATC	
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 32' 06.68"		TO THE GEODETTIC AZIMUTH	
TO OBTAIN		GRID AZ. (ADD)(SUB.)		TO THE GEODETTIC AZIMUTH	

OBJECT	AZIMUTH OR DIRECTION (GEODETTIC) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
HILLTOP USC&GS 1949	182° 03' 46.58	02° 04' 01.44	19649.465	
PGT NO. 2 RM 1	05 17 36.		19.815	
SITE 5 1969 YPG	05 56 11.57	185 56 11.48	44.896	
10012	243 45 24.27	63 45 27.12	151.787	
PGT NO. 2 RM 2	249 47 05.		9.918	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 0.5 mile east of U.S. Highway 95 and about 6.8 miles northeast of post headquarters. Permission to visit the station must be obtained through Headquarters, Yuma Proving Ground.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 3.1 miles to the junction with a road to the right leading into the Kofa Range Area; turn right and go east for 0.8 mile to a guard post, continue for 0.15 mile to a crossroad; turn left and go northerly for 4.5 miles to a gravel road left at a curve in the road just northeast of a low saddle; turn left onto the gravel road and go northerly, upgrade for 0.3 mile to a saddle and a crossroad; turn left and go southwest up a steep grade for 0.1 mile to a parking area, an astro dome, and the end of truck travel; from here walk north, up a path to the highest point of the hill and the station.

Station Mark: A Corps of Engineers, U.S. Army disc stamped: "PGT NO. 2 ARMY MAP SERVICE 1960" cemented in a drill hole in a boulder. A concrete pad, 3 feet x 3 feet, has been placed around the disc.

Reference Mark No. 1: A Corps of Engineers, U.S. Army disc stamped: "PGT NO. 2 RM 1 ARMY MAP SERVICE 1960" cemented in a drill hole in a boulder. It is located at a horizontal distance of 19.815 meters (65.01 ft.) south-southeast of the station and 3.4 meters lower in elevation.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION PGT NO. 2 AMS 1960	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK		AGENCY (CAST IN MARKS)	
LATITUDE		LONGITUDE		DATUM	
(NORTHING)(EASTING)	(FT) (M)	(EASTING)(NORTHING)	(FT) (M)	GRID AND ZONE	
(NORTHING)(EASTING)	(FT) (M)	(EASTING)(NORTHING)	(FT) (M)	GRID AND ZONE	
				ESTABLISHED BY (AGENCY)	
				DATE	ORDER

TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION		BACK AZIMUTH	GEOD. DISTANCE		GRID DISTANCE	
	(GEODETIC)(GRID)	(MAGNETIC)		(METERS)	(FEET)	(METERS)	(FEET)

Reference Mark No. 2: A Corps of Engineers, U.S. Army disc stamped: "PGT NO. 2 RM 2 ARMY MAP SERVICE 1960" cemented in a drill hole in a rock outcrop. It is located at a horizontal distance of 9.918 meters (32.54 feet) northeast of the station and 2.4 meters lower in elevation.



SKETCH

DA FORM 1959
1 OCT 64

REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
 For use of this form, see TM 5-237; the proponent agency is U.S. Continental Army Command.

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION PGT NO. 3 AMS 1960	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK PGT NO. 3 ARMY MAP SERVICE 1960		AGENCY (CAST IN MARKS) CORPS OF ENGINEERS	
LATITUDE N 33° 14' 21" 6720		LONGITUDE W 114° 15' 25" 5817		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 3 680 985.105 (M)		(EASTING)(NORTHING) (M) 755 580.544 (M)		GRID AND ZONE UTM 11	
(NORTHING)(EASTING) (M) 72 595.596 (M)		(EASTING)(NORTHING) (M) 37 477.558 (M)		GRID AND ZONE YPC**	
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 29' 44.52"		TO THE GEODETTIC AZIMUTH	
TO OBTAIN		GRID AZ. (ADD)(SUB.)		TO THE GEODETTIC AZIMUTH	

OBJECT	AZIMUTH OR DIRECTION (GEODETTIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 2	25° 23' 15".60	205° 17' 47".49	36411.496	
PGT NO. 2	07 37 21.98	187 35 44.64	34925.400	
HILLTOP	14 39 02.77	194 37 40.13	15483.815	
PGT NO. 3 RM 1	23 10 22.		5.291	
PGT NO. 3 RM 2	280 19 16.		8.388	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2800 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

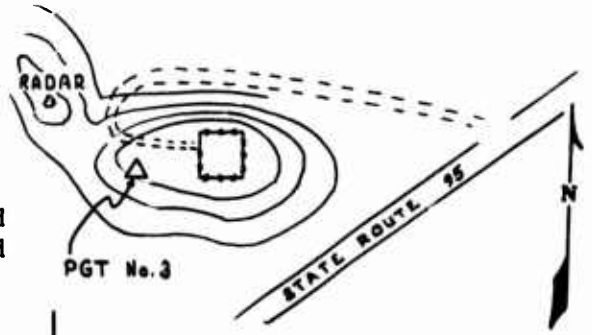
PGT NO. 3, AMS 1960 is a station on a precise geodimeter traverse and was established by an Army Map Service field survey party.

The station mark is a U.S. Army Corps of Engineers disk cemented in a drilled hole in a large rock about 3 feet in diameter and projecting about 1 foot above the ground. It is stamped "PGT NO. 3 ARMY MAP SERVICE 1960".

Station mark is located on a hill near a radar installation which is also on that hill. The station mark is 154 feet west of the southwest corner of a fence; 20 feet south of the centerline of a road; 30 miles south of Quartz site and 29 miles north of the Yuma Test Center.

To reach from the intersection of U.S. Routes 60 and 70 and State Route 95 at Quartz site, go south on State Route 95 for 29.3 miles to intersection with a road to the west (this road is between mile posts 74 and 75); turn right and go west up a winding road for 0.6 mile to a radar installation at top of the hill and site of the station. The station mark can also be reached from the intersection of State Route 95 and the main entrance road toward the Yuma Test Station by going north-northeast on Route 95 for 30.8 miles to intersection with road as mentioned in above description.

Reference Mark No. 1: A U.S. Army Corps of Engineers disk cemented in a drilled hole in a rock 5.291 meters south of the station mark and about 2 feet lower in elevation. It is stamped "PGT NO. 3 RM NO. 1 ARMY MAP SERVICE 1960".



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION PGT NO. 3 AMS 1960		
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK		AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)	
LATITUDE		LONGITUDE		DATUM	DATUM	
(NORTHING)(EASTING) (M)	(FT)	(EASTING)(NORTHING) (M)	(FT)	GRID AND ZONE	ESTABLISHED BY (AGENCY)	
(NORTHING)(EASTING) (M)	(FT)	(EASTING)(NORTHING) (M)	(FT)	GRID AND ZONE	DATE	ORDER

TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)		BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)		GRID DISTANCE (METERS) (FEET)	

Reference Mark No. 2: A U.S. Army Corps of Engineers disk cemented in a drilled hole in a rock 8.388 meters east of the station mark and about 3 feet lower in elevation. It is stamped "PGT NO. 3 RM NO. 2 ARMY MAP SERVICE 1960".

Azimuth Mark: A U.S. Army Corps of Engineers disk cemented in a drilled hole in an outcropping rock about 0.1 mile west-northwest of the station mark. It is stamped "RADAR 1957". To reach from the station mark go west-northwest for about 0.1 mile to the highest point of a rounded hill and site of station. Reported not found (Radar, 1957) in Sep. 1965 by AMS.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DYSC		STATION HILLTOP, USC&GS 1949, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK HILLTOP 1949		AGENCY (CAST IN MARKS) USC&GS	
LATITUDE N 33° 06' 15" 3769		LONGITUDE W 114° 17' 56" 6185		ELEVATION 341.971 (M)	
(NORTHING)(EASTING) (FEET) (M)		(EASTING)(NORTHING) (FEET) (M)		DATUM 1927 NAD*	
3 665 901.312 (M)		752 056.785 (M)		ESTABLISHED BY (AGENCY) DMATC	
(NORTHING)(EASTING) (FEET) (M)		(EASTING)(NORTHING) (FEET) (M)		DATE 1974	
57 634.921 (M)		33 488.937 (M)		ORDER SECOND	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 31' 26.63 TO THE GEODEIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODEIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODEIC)(MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
PGT NO. 3	194° 37' 40.13	14° 39' 02.77	15483.815	
PGT NO. 2	02 04 01.44	182 03 46.58	19649.465	
HILLTOP RM 2	135 03 26.		11.645	
HILLTOP RM 1	239 38 51.		7.910	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.

**Northing = Arizona West Zone -576 816.5768/3.2808 33333

Easting = Arizona West Zone -221 988.7058/3.2808 33333

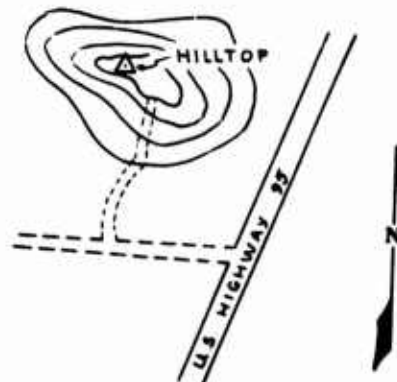
The station is located at the U.S. Army Yuma Proving Ground. It is about 0.5 mile west of U.S. Highway 95 and 19.0 miles north-northeast of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 20.4 miles to a road left; turn left and go west and north for 0.15 mile to a crossroad; turn left and go west for 0.2 mile to a track road left; turn left and go upgrade to the top of a small hill and the station site. The station is located at the west end of a cleared area.

Station Mark: A USC&GS disc stamped: "HILLTOP 1949" cemented in a drill hole in a large flat boulder.

Reference Mark No. 1: A USC&GS disc stamped: "HILLTOP NO. 1 1949" cemented in a drill hole in a boulder. It is located 7.910 meters (25.95 feet) north-northeast of the station.

Reference Mark No. 2: A USC&GS disc stamped: "HILLTOP NO. 2 1949" cemented in a drill hole in a boulder. It is located 11.645 meters (38.21 feet) north-northwest of the station.



SKETCH

DA FORM 1959
OCT 64

REPLACES DA FORMS 1959
AND 1960, 1 FEB 57, WHICH
ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION

For use of this form, see TM 5-237; the proponent
agency is U.S. Continental Army Command.

COUNTRY UNITED STATES	TYPE OF MARK DISC	STATION BENCH MARK USC&GS 1934, DMATC 1974
LOCALITY YUMA COUNTY, ARIZONA	STAMPING ON MARK BENCH MARK 1934	AGENCY (CAST IN MARKS) USC&GS
LATITUDE N 32° 48' 39" 5334	LONGITUDE W 114° 22' 35" 6009	ELEVATION (M) 89.040
(NORTHING)(EASTING) (M) 3 633 190.666	(EASTING)(NORTHING) (M) 745 633.507	DATUM 1927 NAD*
(NORTHING)(EASTING) (M) 25 150.895	(EASTING)(NORTHING) (M) 26 061.970	ESTABLISHED BY (AGENCY) DMATC
TO OBTAIN UTM (ZONE 11)	GRID AZIMUTH, ADD 178° 34'	DATE 1974
TO OBTAIN	GRID AZ. (ADD)(SUB.)	ORDER SECOND

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
PGT NO. 2	206° 53' 51.79	26° 56' 08.40	14455.218	
BENCH MARK RM 2	05 55 03.		30.430	
BENCH MARK RM 1	127 37 12.		20.411	
SITE 1	147 38 56.96	327 37 33.99	7433.874	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.

**Northing = Arizona West Zone -576 816.5768/3.2808 33333

Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 0.5 mile east of U.S. Highway 95 and about 2.5 miles southeast of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go east for 0.3 mile to the intersection with the power line road; turn right and go south for 0.7 mile to the station site. The station is located about 10 meters east of the power line.

Station Mark: A USC&GS disc stamped: "BENCH MARK 1934" set in the top of a concrete monument projecting 0.5 foot above the surface.

Reference Mark No. 1: A USC&GS disc stamped: "BENCH MARK NO. 1 1934" set in the top of a concrete monument projecting 0.3 foot above the surface. It is located about 21 meters west-northwest of the station.

Reference Mark No. 2: A USC&GS disc stamped: "BENCH MARK NO. 2 1934" set in the top of a concrete monument projecting 0.3 foot above the surface. It is located about 31 meters south of the station.



SKETCH

DA FORM 1959
1 OCT 64

REPLACES DA FORMS 1959
AND 1960, 1 FEB 57, WHICH
ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION

For use of this form, see TM 5-237; the proponent
agency is U.S. Continental Army Command.

A-23

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION MPS 25, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK MPS 25 1974 TOPO. CENTER		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 32° 54' 03" 6645		LONGITUDE W 114° 22' 54" 4232		ELEVATION 170.056	
(NORTHING)(EASTING) (M)		(EASTING)(NORTHING) (M)		DATUM 1927 NAD*	
3 643 163.743		744 896.105		DATUM 1929 MSL	
(NORTHING)(EASTING) (M)		(EASTING)(NORTHING) (M)		GRID AND ZONE UTM 11	
35 138.292		25 632.063		ESTABLISHED BY (AGENCY) DMATC	
				DATE 1974	
				ORDER SECOND	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 34' 37.58" TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
PGT NO. 2	247° 31' 52.48	67° 34' 19.48	7605.928	
MPS 25 RM 1	14 32 52.		36.246	
MPS 25 RM 2	57 19 35.		30.021	
CAMERA SITE 4	96 57 16.98	276 57 09.04	382.810	
SITE 3	226 17 49.70	46 19 11.84	5431.332	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.

**Northing = Arizona West Zone -576 816.5768/3.2808 33333

Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 3.0 miles west of U.S. Highway 95 and about 4.0 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; turn left and go west for 2.4 miles to a road fork, north, for 2.1 miles to the turnoff to Cibola Range Control; turn right continuing northerly for 0.7 mile to a gravel road right (Cibola Range Control is on the west side of the road); turn right and go east for 0.8 mile to a road fork; take the right fork and go east for 0.9 mile to the end of the road and the station site at the north side of a cleared area.

Station Mark: A Defense Mapping Agency disc stamped: "MPS 25 1974 TOPO CENTER" set in the top of a round concrete post, 12 inches in diameter and projecting 0.4 foot above ground.

Reference Mark No. 1: A Defense Mapping Agency disc stamped: "MPS 25 RM NO 1 1974 TOPO CENTER", set in a concrete block, 2 feet square and flush with the ground. It is located 36.246 meters (118.92 feet) south of the station.

Reference Mark No. 2: A YPG Geodetic Control disc stamped: "MPS 25 1971" set in a concrete post, 5 inches square and flush with the ground. It is located 30.021 meters (98.49 feet) southwest of the station.



SKETCH

DA FORM 1959
1 OCT 64

REPLACES DA FORMS 1889
AND 1890, 1 FEB 57, WHICH
ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent
agency is U.S. Continental Army Command.

COUNTRY	TYPE OF MARK	STATION	
UNITED STATES	DISC	SITE 1, DMATC 1974	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION
YUMA COUNTY, ARIZONA	SITE 1 1974 TOPO CENTER	DMA	183.798 (M)
LATITUDE	LONGITUDE	DATUM	DATUM
N 32° 52' 03" 3716	W 114° 25' 08" 6052	1927 NAD*	1929 MSL
(NORTHING)(EASTING) (M)	(EASTING)(NORTHING) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
3 639 372.011 (M)	741 499.489 (M)	UTM 11	DMATC
(NORTHING)(EASTING) (M)	(EASTING)(NORTHING) (M)	GRID AND ZONE	DATE
31 454.284 (M)	22 121.485 (M)	YPG**	1974
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 35' 55.12	TO THE GEODETTIC AZIMUTH
TO OBTAIN		GRID AZ. (ADD)(SUB.)	TO THE GEODETTIC AZIMUTH

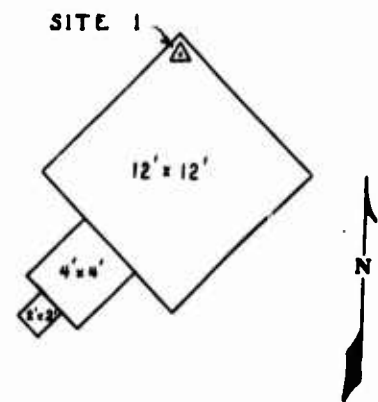
OBJECT	AZIMUTH OR DIRECTION (GEODETTIC)(MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
PGT NO. 2	237° 49' 22.98	57° 53' 02.79	12422.792	
SITE 2	176 47 37.96	356 47 28.22	8333.306	
MPS 25	223 15 21.04	43 16 33.89	5088.926	
BENCH MARK	327 37 33.99	147 38 56.96	7433.874	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 3.5 miles west of U.S. Highway 95 and about 2 miles northwest of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground, go west on Laguna Road for 1.45 miles to a side road right (Crotillo Road); turn right and go north for 1.15 miles to a fork; take the left fork, north and west, for 1.15 miles to a "Y" intersection; turn left and go 0.3 mile to a gravel road right; turn right and go northerly for 1.2 miles upgrade to a switchback to the left; turn left and continue up a steep grade for 0.1 mile to the top of the hill, an old camera astro dome site and the station. The station is located in the north corner of a concrete pad which projects 1.4 feet above ground.

Station Mark: A Defense Mapping Agency disc stamped: "SITE 1 1974 TOPOCENTER", and cemented in a drill hole.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION SITE 2, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK SITE 2 1974 TOPO CENTER		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 32° 56' 33" 4625		LONGITUDE W 114° 25' 26" 5470		ELEVATION (M) 152.732	
(NORTHING)(EASTING) (M) 3 647 681.006		(EASTING)(NORTHING) (M) 740 829.665		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 39 777.186		(EASTING)(NORTHING) (M) 21 708.218		ESTABLISHED BY (AGENCY) DMATC	
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 35' 54.68"		TO THE GEODETIC AZIMUTH	
TO OBTAIN		GRID AZ. (ADD)(SUB.)		TO THE GEODETIC AZIMUTH	
GRID AND ZONE UTM 11		DATE 1974		ORDER SECOND	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 35' 54.68" TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

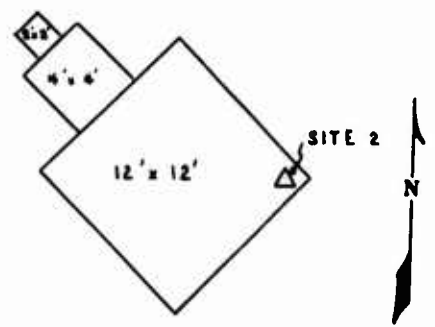
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
PGT NO. 3	205° 17' 47.49"	25° 23' 15.60"	36411.496	
SITE 12 DISC	160 35 39.72	340 34 29.32	10099.766	
SITE 7 DISC	208 49 17.72	28 51 01.35	10248.367	
IR 24	249 17 12.29	69 19 23.79	6712.325	
PGT NO. 2	278 49 17.46	98 53 07.25	11112.339	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 6.5 miles west of U.S. Highway 95 and about 7 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; turn left and go west for 2.4 miles to a road fork; take the right fork north, and go for 4.6 miles to a gravel road left; turn left and go for 0.5 mile to a GLO mark on the left; bear to the right, upgrade, and go easterly for 0.2 mile to the top of the hill and the site of an astro dome and the station. The station is located on the southeast corner of the concrete astro dome pad.

Station Mark: A Defense Mapping Agency disc stamped: "SITE 2 1974 TOPO CENTER", cemented in a drill hole.



SKETCH

COUNTRY	TYPE OF MARK	STATION		
UNITED STATES	DISC	SITE 3, DMATC 1974		
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION	
YUMA COUNTY, ARIZONA	SITE 3 1974 TOPO CENTER	DMA	239.709 (M)	
LATITUDE	LONGITUDE	DATUM	DATUM	
N 32° 56' 05" 4555	W 114° 20' 23" 2815	1927 NAD*	1929 MSL	
(NORTHING)(EASTING) (FT)	(EASTING)(NORTHING) (FT)	GRID AND ZONE	ESTABLISHED BY (AGENCY)	
3 647 014.091 (M)	748 729.498 (M)	UTM 11	DMATC	
(NORTHING)(EASTING) (FT)	(EASTING)(NORTHING) (FT)	GRID AND ZONE	DATE	ORDER
38 867.204 (M)	29 580.862 (M)	YPG**	1974	SECOND

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 33' 10.61 TO THE GEODETIC AZIMUTH

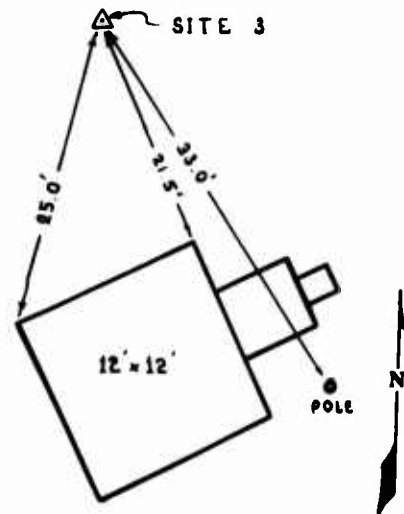
OBJECT	AZIMUTH OR DIRECTION		FROM SOUTH		GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)	
	(GEODETIC)	(MAGNETIC)	BACK	AZIMUTH		(METERS)	(FEET)
SITE 2	96° 16'	21.78	276° 13'	36.88	7925.248		
MPS 25	46 19	11.84	226 17	49.70	5431.332		
SITE 6 DISC	154 53	14.91	334 52	48.86	2931.164		
PGT NO. 2	285 16	25.73	105 17	30.63	3215.294		

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 3333
 Easting = Arizona West Zone -221 988.7058/3.2808 3333

The station is located at the U.S. Army Yuma Proving Ground. It is about 1.5 miles west of U.S. Highway 95 and about 7.5 miles northeast of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left and go west and north for 1.6 miles to a road left; turn left and go southwest, upgrade, for 0.4 miles to the top of the hill and the station site on the north side of an old astro dome concrete pad. The station is located 28.28 feet north of the center (cup tack in lead) of the concrete astro dome pad.

Station Mark: A Defense Mapping Agency disc stamped: "SITE 3 1974 TOPO CENTER", set in the top of a 1 foot square concrete post set flush with the ground.



SKETCH

COUNTRY UNITED STATES	TYPE OF MARK DISC	STATION CAMERA SITE 4, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA	STAMPING ON MARK CAMERA SITE 4 1974 TOPO CENTER	AGENCY (CAST IN MARKS) DMA	ELEVATION 171.598 (M)
LATITUDE N 32° 54' 05" 1689	LONGITUDE W 114° 23' 09" 0447	DATUM 1927 NAD*	DATUM 1929 MSL
(NORTHING)(EASTING) (M) 3 643 200.658	(EASTING)(NORTHING) (M) 744 514.949	GRID AND ZONE UTM 11	ESTABLISHED BY (AGENCY) DMATC
(NORTHING)(EASTING) (M) 35 186.918	(EASTING)(NORTHING) (M) 25 252.363	GRID AND ZONE YPG**	DATE 1974
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 34' 45.47 TO THE GEODETIC AZIMUTH	
TO OBTAIN		GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH	

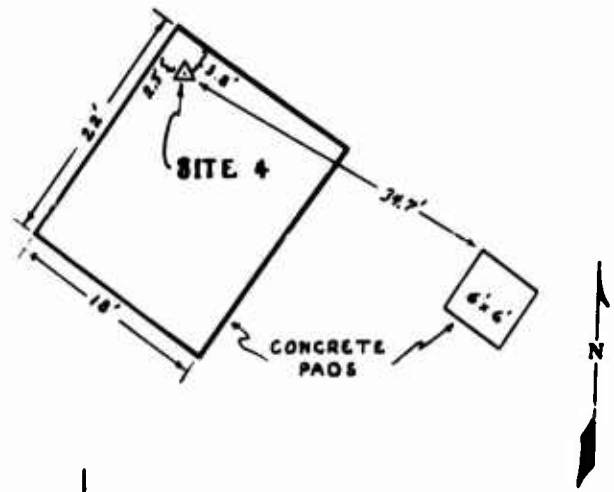
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
MPS 25	276° 57' 09".04	96° 57' 16".98	382.810	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 3.0 miles west of U.S. Highway 95 and about 4.0 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 and 2.7 miles to the junction with Martinez Lake Road to the left; turn left and go west for 2.4 miles to a road fork; take the right fork, north, for 2.1 miles to the turnoff to Cibola Range Control; turn right continuing northerly for 0.7 mile to a gravel road right (Cibola Range Control is on the west side of the road); turn right and go east for 0.8 mile to a road fork; take the right fork and go east for 0.65 mile to the station site on the left. The station is located on the north corner of a concrete pad which measures 18 feet by 22 feet.

Station Mark: A Defense Mapping Agency disc stamped: "CAMERA SITE 4 1974 TOPO CENTER" set in a drill hole.



SKETCH

COUNTRY	TYPE OF MARK	STATION		
UNITED STATES	DISC	SITE 5 1969 YPG, DMATC 1974		
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FEET) (M)	
YUMA COUNTY, ARIZONA	SITE 5 1969	YPG GEODETIC CONTROL	259.326 (M)	
LATITUDE	LONGITUDE	DATUM	DATUM	
N 32° 55' 36" 4946	W 114° 18' 24" 0764	1927 NAD*	1929 MSL	
(NORTHING)(EASTING) (FEET) (M)	(EASTING)(NORTHING) (FEET) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)	
3 646 200.608 (M)	751 849.281 (M)	UTM 11	DMATC	
(NORTHING)(EASTING) (FEET) (M)	(EASTING)(NORTHING) (FEET) (M)	GRID AND ZONE	DATE	ORDER
37 958.246 (M)	32 672.620 (M)	YPC**	1974	Second

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 32' 06.84 TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD(SUB.)) TO THE GEODETIC AZIMUTH

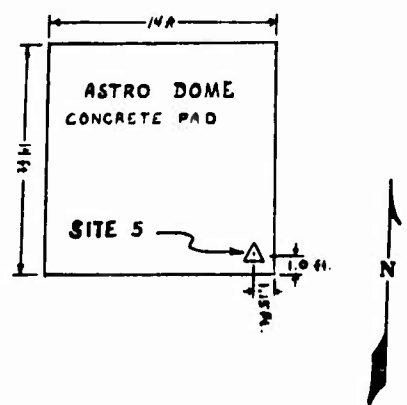
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
PGT NO. 2	185° 36' 11.48	05° 56' 11.57	44.896	
10012	231 33 10.99	51 33 13.93	179.759	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 0.5 mile east of U.S. Highway 95 and about 6.8 miles northeast of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right and go east for 1.1 miles to a crossroad; turn left and go north on W. 3rd Avenue for 4.6 miles to a sharp curve and gravel road left; turn left and go west and north, upgrade, for 0.4 mile to a road fork; take the left fork and go southwest for 0.15 mile to an astro dome and the station site. The station is located on the southeast corner of the concrete astro dome pad.

Station Mark: A YPG Geodetic Control disc stamped: "SITE 5 1969" cemented in a drill hole.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION SITE 6 DISC YPG, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK SITE 6 DISC		AGENCY (CAST IN MARKS) YPG GEODETIC CONTROL	
LATITUDE N 32° 57' 31" 6094		LONGITUDE W 114° 21' 11" 1787		ELEVATION 201.434 (M)	
(NORTHING)(EASTING) (FEET) (M) 3 649 636.859		(EASTING)(NORTHING) (FEET) (M) 747 418.401		DATUM 1927 NAD*	
(NORTHING)(EASTING) (FEET) (M) 41 528.150		(EASTING)(NORTHING) (FEET) (M) 28 351.797		DATUM 1929 MSL	
		GRID AND ZONE UTM 11		ESTABLISHED BY (AGENCY) DMATC	
		GRID AND ZONE YPG**		DATE 1974	
				ORDER Second	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 33' 33.35 TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

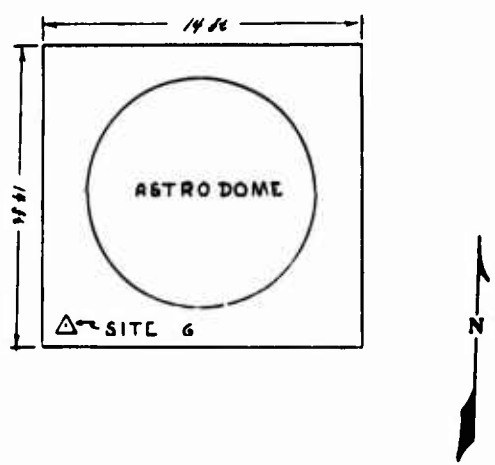
OBJECT	AZIMUTH OR DIRECTION (GEODETIC) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
MPS 25	22° 43' 42.03	202° 42' 45.91	6944.762	
SITE 2	74 54 25.13	254 52 06.23	6870.602	
SITE 12 DISC	127 47 05.08	307 43 35.60	12631.447	
SITE 6 MON. YPG	135 47 22.		21.805	
IR 24	148 40 20.63	328 40 13.22	679.983	
SITE 3	334 52 48.86	154 53 14.91	2931.164	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 3.5 miles west of U.S. Highway 95 and about 8.5 miles northeast of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground, go north on U.S. Highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left and go west and north for 3.75 miles to a road right; turn right and go east for 0.3 mile, upslope, to an astro dome and the station site. The station is located in the southwest corner of the concrete astro dome pad.

Station Mark: A YPG Geodetic Control disc stamped: "SITE 6 DISC", cemented in a drill hole.



SKETCH

COUNTRY	TYPE OF MARK	STATION	
UNITED STATES	DISC	SITE 7 DISC YPG, DMATC 1974	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (M)
YUMA COUNTY, ARIZONA	SITE 7 DISC	YPG GEODETIC CONTROL	185.197
LATITUDE	LONGITUDE	DATUM	DATUM
N 33° 01' 24" 8889	W 114° 22' 16" 1801	1927 NAD*	1929 MSL
(NORTHING)(EASTING) (FF)	(EASTING)(NORTHING) (FF)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
3 656 781.132 (M)	745 550.461 (M)	UTM 11	DMATC
(NORTHING)(EASTING) (FF)	(EASTING)(NORTHING) (FF)	GRID AND ZONE	DATE
48 724.020 (M)	26 706.084 (M)	YPG**	1974
			ORDER
			SECOND

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 33' 59.79 TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

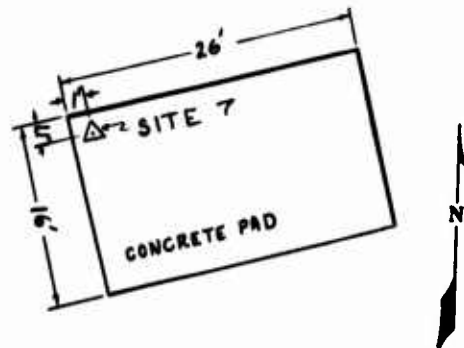
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 9 DISC	189° 39' 37.08	09° 40' 18.02	11 590.007	
IRCC	73 23 04.09	253 22 15.35	2 422.891	
SITE 8 DISC	193 25 50.61	13 26 21.18	6 259.648	
10010	265 56 40.77	85 56 42.46	80.721	
SITE 7 LASER DISC	268 54 21.92	88 54 23.75	87.006	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 5.2 miles west of U.S. Highway 95 and about 12.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground, go north on Highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left and go west and north on Middle Mtn. Road for 8.3 miles to an astro dome site on the left; turn left on access road and go west for 0.1 mile to the astro dome site and station. The station is located near the northwest corner of a 16-foot x 26-foot concrete pad that projects 0.3 foot above ground. It is 1.0 foot east of the west edge of pad and 1.1 feet south of the north edge of pad. The pad is the center one of three concrete pads.

Station Mark: A YPG Geodetic Control disc stamped: "SITE 7 DISC" and cemented in a drill hole.



SKETCH

COUNTRY	TYPE OF MARK	STATION		
UNITED STATES	DISC	SITE 8 DISC YPG, DMATC 1974		
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FEET) (M)	
YUMA COUNTY, ARIZONA	SITE 8 DISC	YPG GEODETIC CONTROL	229.158 (M)	
LATITUDE	LONGITUDE	DATUM	DATUM	
N 33° 04' 42" 5234	W 114° 21' 20" 1237	1927 NAD*	1929 MSL	
(NORTHING)(EASTING) (FEET) (M)	(EASTING)(NORTHING) (FEET) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)	
3 662 906.204 (M)	746 851.968 (M)	UTM 11	DMATC	
(NORTHING)(EASTING) (FEET) (M)	(EASTING)(NORTHING) (FEET) (M)	GRID AND ZONE	DATE	ORDER
54 803.612 (M)	28 195.945 (M)	YPG**	1974	SECOND
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 33' 21.54 TO THE GEODETIC AZIMUTH		
TO OBTAIN		GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH		

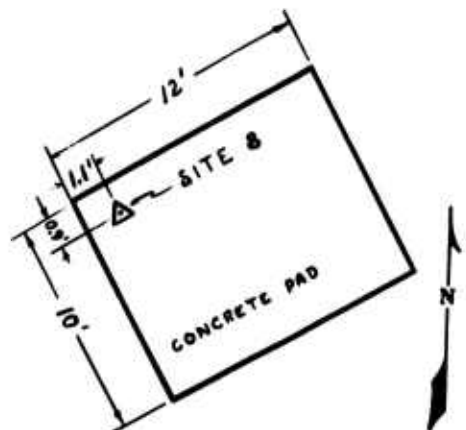
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 12 DISC	60° 24' 55.92	240° 21' 30.98	11 212.515	
IR 22	76 58 20.55	256 52 07.62	18 207.004	
CM 1	113 18 18.16	293 17 00.19	4 033.191	
IR 23	179 52 16.33	359 52 16.11	4 621.545	
SITE 9 DISC	185 15 50.94	05 16 01.30	5 359.737	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 3.5 miles west of U.S. Highway 95 and about 16.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left and go west and north on Middle Mtn. Road for 12.3 miles to a road to the right; turn right and go east, upgrade, for 0.15 mile to the top of small hill and the site of an astro dome and the station. The station is located near the west corner of a 10-foot x 12-foot concrete pad that projects 0.3 foot above ground. It is 0.9 foot south of the north edge of pad and 1.1 feet east of the west edge of the pad.

Station Mark: A YPG Geodetic Control disc stamped: "SITE 8 DISC" and cemented in a drill hole.



SKETCH

COUNTRY UNITED STATES	TYPE OF MARK DISC	STATION SITE 9 DISC YPG, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA	STAMPING ON MARK SITE 9 DISC	AGENCY (CAST IN MARKS) YPG GEODETIC CONTROL	ELEVATION (FF) 290.986 (M)
LATITUDE N 33° 07' 35" 7707	LONGITUDE W 114° 21' 01" 1541	DATUM 1927 NAD*	DATUM 1929 MSL
(NORTHING)(EASTING) (FF) 3 668 255.923 (M)	(EASTING)(NORTHING) (FF) 747 209.097 (M)	GRID AND ZONE UTM 11	ESTABLISHED BY (AGENCY) DMATC
(NORTHING)(EASTING) (FF) 60 137.669 (M)	(EASTING)(NORTHING) (FF) 28 718.473 (M)	GRID AND ZONE YPG**	DATE 1974
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 33' 04.46 TO THE GEODETIC AZIMUTH	
TO OBTAIN		GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH	

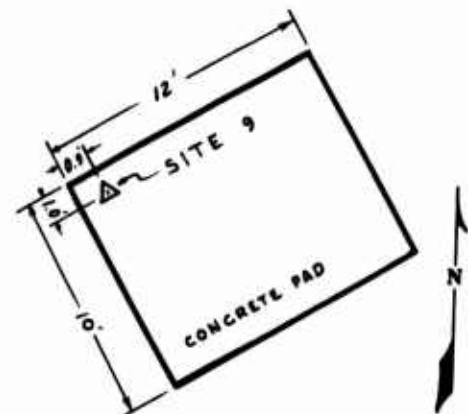
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
IR 22	62° 37' 23.92	242° 31' 00.40	20 529.902	
SITE 7 DISC	09 40 18.02	189 39 37.08	11 590.007	
IR 23	35 03 35.98	215 03 25.39	874.195	
SITE 12 DISC	43 17 34.68	223 13 59.26	14 937.414	
CM 8	139 51 00.04	319 50 23.50	2 686.923	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 4 miles west of U.S. Highway 95 and about 20 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground, go north on Highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left and go west and north on Middle Mtn. Road for 16.7 miles to an astro dome and site of station. The mark is located near the west corner of a 10-foot x 12-foot concrete pad that projects 0.3 foot above ground. It is 1.0 foot south of the north edge of pad, 0.9 foot east of the west edge of pad and 13.8 feet southeast of the northeast corner of the concrete pad for the astro dome.

Station Mark: A YPG Geodetic Control disc stamped: "SITE 9 DISC" and cemented in a drill hole.



SKETCH

DA FORM 1959
1 OCT 64

REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION

For use of this form, see TM 3-237; the proponent agency is U.S. Continental Army Command.

COUNTRY UNITED STATES	TYPE OF MARK DISC	STATION SITE 10 DISC YPG, DMATC 1974		
LOCALITY YUMA COUNTY, ARIZONA	STAMPING ON MARK SITE 10 DISC	AGENCY (CAST IN MARKS) YPG GEODETIC CONTROL	ELEVATION 144.614 (M)	
LATITUDE N 33° 01' 42" 9280	LONGITUDE W 114° 24' 23" 6468	DATUM 1927 NAD*	DATUM 1929 MSL	
(NORTHING)(EASTING) (M) 3 657 254.632	(EASTING)(NORTHING) (M) 742 228.532	GRID AND ZONE UTM 11	ESTABLISHED BY (AGENCY) DMATC	
(NORTHING)(EASTING) (M) 49 299.812	(EASTING)(NORTHING) (M) 23 401.563	GRID AND ZONE YPG **	DATE 1974	ORDER SECOND

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 35' 08.67" TO THE GEODETIC AZIMUTH
TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

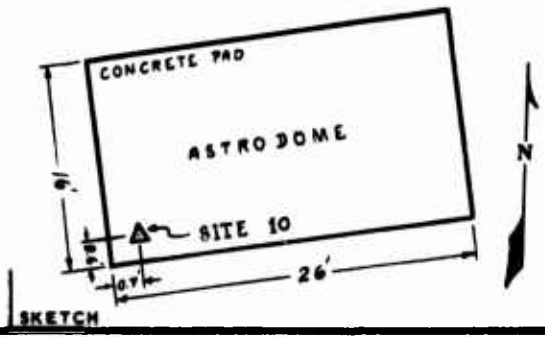
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)			FROM SOUTH BACK AZIMUTH			GEOD. DISTANCE (METERS) (FEET)		GRID DISTANCE (METERS) (FEET)	
	SITE 2	09°	43'	32".40	189°	42'	58".16	9 672.196		
SITE 11 DISC	60	05	38.51	240	05	00.86	2 068.401			
IR 21	82	42	36.12	262	41	49.34	2 245.311			
SITE 12 DISC	89	55	25.88	269	53	41.11	4 988.041			
SITE 7 DISC	279	31	34.81	99	32	44.28	3 354.386			
IRCC	321	41	16.38	141	41	37.09	1 591.493			

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 7 miles west of U.S. Highway 95 and about 13 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road), go north on U.S. Highway 95 for 7.4 miles to the junction with Middle Mtn. Rd. to the left; turn left on a gravel road and go north and west for 7.6 miles to a road left (Cibola Front Road); turn left and go west for 1.4 miles to a road right (Cheyenne Base Road); turn right and go west for 0.65 mile to an astro dome and the station site. The station is located in the southwest corner of the concrete astro dome pad.

Station Mark: A YPG Geodetic Control disc stamped: "SITE 10 DISC", cemented in a drill hole.



COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION SITE 11 DISC YPG, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK SITE 11 DISC		AGENCY (CAST IN MARKS) YPG GEODETIC CONTROL	
LATITUDE N 33° 01' 09".4467		LONGITUDE W 114° 25' 32".7295		ELEVATION 121.320 (M)	
(NORTHING)(EASTING) (PP)		(EASTING)(NORTHING) (PP)		DATUM 1927 NAD*	
3 656 179.097 (M)		740 460.982 (M)		ESTABLISHED BY (AGENCY) DMATC	
(NORTHING)(EASTING) (PP)		(EASTING)(NORTHING) (PP)		GRID AND ZONE UTM 11	
48 279.790 (M)		21 602.209 (M)		DATE 1974	
				ORDER SECOND	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 35' 47.64 TO THE GEODETIC AZIMUTH
TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

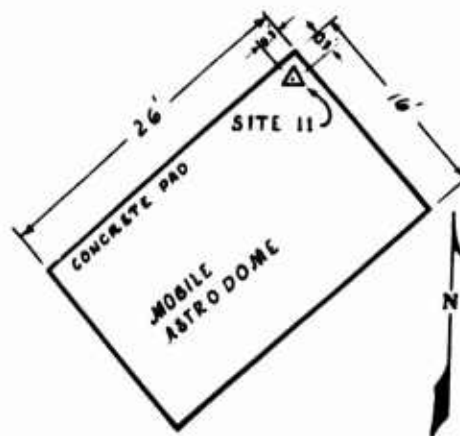
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 7 DISC	264° 39' 26".52	84° 41' 13".63	5 123.281	
SITE 12 DISC	107 46 12.74	287 45 05.64	3 355.329	
IR 21	149 48 05.24	329 47 56.12	863.452	
SITE 11 MON.	191 21 05.98	11 21 06.05	17.618	
SITE 10 DISC	240 05 00.86	60 05 38.51	2 068.401	
IRCC	274 27 49.19	94 28 47.55	2 788.117	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
**Northing = Arizona West Zone -576 816.5768/3.2808 33333
Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 8.5 miles west of U.S. Highway 95 and about 12.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 7.4 miles to the junction with Middle Mtn. Rd. to the left; turn left, on a gravel road, and go north and west for 7.6 miles to a road left (Cibola Front Road); turn left and go west for 3.1 miles to a gravel road left; turn left and go south for 0.35 mile to an astro dome and the station site. The station is located in the northwest corner of the concrete astro dome pad.

Station Mark: A YPG Geodetic Control disc stamped: "SITE 11 DISC", cemented in a drill hole.



SKETCH

COUNTRY UNITED STATES	TYPE OF MARK DISC	STATION SITE 12 DISC YPG, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA	STAMPING ON MARK SITE 12 DISC	AGENCY (CAST IN MARKS) YPG GEODETIC CONTROL	ELEVATION (FEET) (M) 107.795
LATITUDE N 33° 01' 42".6717	LONGITUDE W 114° 27' 35".8534	DATUM 1927 NAD*	DATUM 1929 MSL
(NORTHING)(EASTING) (FEET) (M) 3 657 124.857	(EASTING)(NORTHING) (FEET) (M) 737 240.640	GRID AND ZONE UTM 11	ESTABLISHED BY (AGENCY) DMATC
(NORTHING)(EASTING) (FEET) (M) 49 324.339	(EASTING)(NORTHING) (FEET) (M) 18 413.665	GRID AND ZONE YPG**	DATE 1974

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 36' 53.60" TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

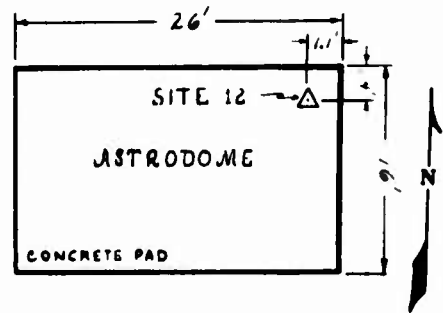
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
PGT NO. 2	308° 03' 10".02	128° 08' 10".46	18211.361	
IR 22	100 06 10.91	280 03 23.06	8114.905	
IR 22 R	103 24 22.93	283 21 42.14	7867.183	
10011	186 26 14.69	06 26 14.74	23.924	
IR 21	275 43 35.57	95 44 33.56	2774.864	
SITE 2	340 34 29.32	160 35 39.72	10099.766	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 10.5 miles west of U.S. Highway 95 and about 13.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on Highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; turn left and go west for 2.4 miles to a road fork; take the right fork and go north for 5.9 miles to a gravel road right (Cibola West Access Road); turn right and go northeast for 0.75 mile to the junction with Water Tank Road; bear left and continue north for 4.7 miles to a crossroad (Cibola Front Road); turn left and go west for 1.35 miles to an astro dome and the station site. The station is located on the northeast corner of the concrete astro dome pad.

Station Mark: A YPG Geodetic Control disc stamped "SITE 12 DISC", cemented in a drill hole.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION 10010, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK 10010 TOPO CENTER 1974		AGENCY (CAST IN MARKS) DMA	ELEVATION (M) 189.652
LATITUDE N 33° 01' 25".0742		LONGITUDE W 114° 22' 13".0776		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 3 656 788.855	(EASTING)(NORTHING) (M) 745 630.839	GRID AND ZONE UTM 11		ESTABLISHED BY (AGENCY) DMATC	
(NORTHING)(EASTING) (M) 48 729.252	(EASTING)(NORTHING) (M) 26 786.633	GRID AND ZONE YPC**		DATE 1975	ORDER SECOND

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 33' 58".09 TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

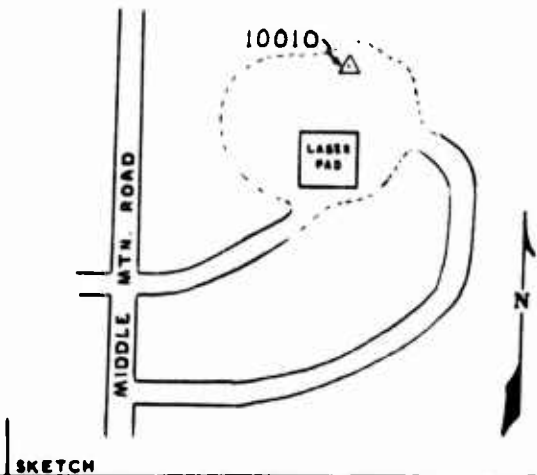
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	SITE 7 DISC	85° 56' 42".46	265° 56' 40".77	80.721

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 5.2 miles west of U.S. Highway 95 and about 12.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left and go west and north for 8.35 miles to the station site on the right side of the road atop a small hill. The station is located 5.58 feet north of the north edge of a concrete pad and 6.56 feet northeast of the northwest corner of the same concrete pad.

Station Mark: A Defense Mapping Agency disc stamped: "10010 TOPO CENTER 1974", set in the top of a round concrete post, 12 inches in diameter and projecting 0.1 foot above the surface. There is a sub-surface mark set in concrete 3 feet below the surface. It is a Defense Mapping Agency disc stamped the same as the surface mark.



DA FORM 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 67, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
 For use of this form, see TM 5-237; the proponent agency is U.S. Continental Army Command.

COUNTRY UNITED STATES	TYPE OF MARK DISC	STATION 10011, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA	STAMPING ON MARK 10011 1974 TOPO CENTER	AGENCY (CAST IN MARKS) DMA	ELEVATION 107.040 (M)
LATITUDE N 33° 01' 43" 4434	LONGITUDE W 114° 27' 35" 7500	DATUM 1927 NAD*	DATUM 1927 MSL
(NORTHING)(EASTING) 3 657 148.695 (M)	(EASTING)(NORTHING) 737 242.747 (M)	GRID AND ZONE UTM 11	ESTABLISHED BY (AGENCY) DMATC
(NORTHING)(EASTING) 49 348.094 (M)	(EASTING)(NORTHING) 18 416.508 (M)	GRID AND ZONE YPG**	DATE 1975
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 36' 53.5"	TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC OR MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 12 DISC	06° 26' 14.74"	186° 26' 14.69"	23.924	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 10.5 miles west of U.S. Highway 95 and about 13.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on Highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; turn left and go west for 2.4 miles to a road fork; take the right fork and go north for 5.9 miles to a gravel road right (Cibola West Access Road); turn right and go northeast for 0.75 mile to the junction with Water Tank Road; bear left and continue north for 4.7 miles to a crossroad (Cibola Front Road); turn left and go west for 1.35 miles to the SITE 12 astro dome and the station site. The station is located on the north side of a cleared area, 77.2 feet north of the northeast corner of the concrete astro dome pad, 78.56 feet north of SITE 12 DISC and 51.0 feet east-northeast of the east corner of a 10-foot x 12-foot concrete pad.

Station Mark: A Defense Mapping Agency disc stamped: "10010 1974 TOPO CENTER" set in the top of a round concrete post, 12 inches in diameter and projecting 0.3 foot above the surface of the ground. There is a sub-surface mark set in a drill hole in a rock buried in concrete 3 feet below the surface. It is stamped the same as the surface mark.



SKETCH

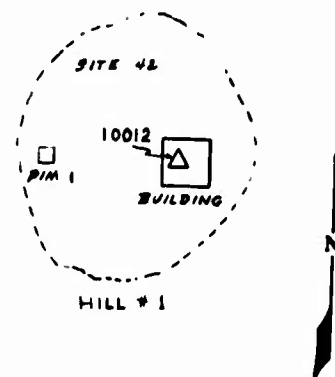
COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION 10012, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK 10012 1974 TOPO CENTER		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 32° 55' 40".1229		LONGITUDE W 114° 18' 18".6576		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 3 646 315.987 (M)		(EASTING)(NORTHING) (M) 751 987.215 (M)		GRID AND ZONE UTM 11	
(NORTHING)(EASTING) (M) 38 069.27C (M)		(EASTING)(NORTHING) (M) 32 814.188 (M)		GRID AND ZONE YPG**	
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 32'		03,74° TO THE GEODETIC AZIMUTH	
TO OBTAIN		GRID AZ. (ADD)(SUB.)		TO THE GEODETIC AZIMUTH	
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)	
SITE 5 1969 YPG	51° 33' 13".93	231° 33' 10".99	179.759		
PGT NO. 2	63 45 27.12	243 45 24.27	151.787		

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 0.5 mile east of U.S. Highway 95 and about 6.8 miles northeast of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right and go east for 1.1 miles to a crossroad; turn left and go north on W. 3rd Avenue for 4.6 miles to a sharp curve and gravel road left; turn left and go west and north, upgrade, for 0.4 mile to a road fork; take the right fork and go northeast for 0.1 mile to the top of the hill and a building. The station is located on top of the building, 13.3 feet southwest of the northeast corner of the building and 8.95 feet northwest of the southeast corner of the building.

Station Mark: A Defense Mapping Agency disc stamped:
 "10012 1974 TOPO CENTER" cemented in a drill hole.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION IR 21, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK IR 21 1974 TOPO CENTER		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 33° 01' 33".6712		LONGITUDE W 114° 25' 49".4647		ELEVATION (M) 118.797	
(NORTHING)(EASTING) (M) 3 656 914.735		(EASTING)(NORTHING) (M) 740 008.378		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 49 028.824		(EASTING)(NORTHING) (M) 21 172.708		GRID AND ZONE UTM 11	
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 35' 55".86		TO THE GEODETIC AZIMUTH	
TO OBTAIN		GRID AZ. (ADD/SUB.)		TO THE GEODETIC AZIMUTH	

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 10 DISC	262° 41' 49".34	82° 42' 36".12	2245.311	
IR 21 RM 2	07 24 31.		22.903	
SITE 12 DISC	95 44 33.56	275 43 35.57	2774.864	
IR 21 RM 1	272 13 53.		21.422	
SITE 11 DISC	329 47 56.12	149 48 05.24	863.452	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 8.5 miles west of U.S. Highway 95 and about 13.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on Highway 95 7.4 miles to the junction with Middle Mtn. Rd. to the left; turn left on a gravel road and go north and west for 7.6 miles to a road left (Cibola Front Road); turn left and go west for 3.5 miles to the station site on the right. The station is located 150 feet north of the centerline of Cibola Front Road and 4.0 feet west of a red and white witness post.

Station Mark: A Defense Mapping Agency disc stamped: "IR 21 TOPO CENTER 1974" set in the top of a round concrete post, 12 inches in diameter, projecting 0.1 foot above ground. There is a sub-surface mark set in a drill hole in a rock which is buried in concrete. The sub-surface mark is a Defense Mapping Agency disc stamped: "IR 21 TOPO CENTER 1974."

Reference Mark No. 1: A Defense Mapping Agency disc stamped: "IR 21 RM NO 1 1974 TOPO CENTER", set in the top of a round concrete post, 12 inches in diameter, projecting 0.2 foot above ground. It is located 21.422 meters (70.28 feet) northeast of the station.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK		STATION IR 21, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK		AGENCY (CAST IN MARKS)	
LATITUDE		LONGITUDE		DATUM	
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE		ESTABLISHED BY (AGENCY)	
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE		DATE	ORDER

TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)		BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)		GRID DISTANCE (METERS) (FEET)	

Reference Mark No. 2: A Defense Mapping Agency disc stamped: "IR 21 RM NO. 2 1974 TOPO CENTER" set in the top of a round concrete post, 12 inches in diameter, projecting 0.3 foot above ground. It is located 22.903 meters (75.14 feet) southeast of the station.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION IR 22, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK IR 22 1974 TOPO CENTER		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 33° 02' 28".7749		LONGITUDE W 114° 32' 43".7450		ELEVATION (FF) 328.510 (M)	
(NORTHING)(EASTING) (FF) 3 658 355.137 (M)		(EASTING)(NORTHING) (FF) 729 217.314 (M)		DATUM 1927 NAD*	
(NORTHING)(EASTING) (FF) 50 801.776 (M)		(EASTING)(NORTHING) (FF) 10 434.435 (M)		DATUM 1929 MSL	
		GRID AND ZONE UTM 11		ESTABLISHED BY (AGENCY) DMATC	
		GRID AND ZONE YPG**		DATE 1974	ORDER VA

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 39' 39".98 TO THE GEODETIC AZIMUTH
TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)		FROM SOUTH BACK AZIMUTH		GEOD. DISTANCE (METERS) (FEET)		GRID DISTANCE (METERS) (FEET)	
	PGT NO. 3	230°	42' 00".70	50°	51' 28".26	34732.558		
IR 22 RM 2	159	46 36.			5.236			
IR 22 R	219	58 04.27	39	58 11.33	522.988			
SITE 9 DISC	242	31 00.40	62	37 23.92	20529.902			
SITE 8 DISC	256	52 07.62	76	58 20.55	18207.004			
IR 22 RM 1	270	11 53.			5.962			
SITE 12 DISC	280	03 23.06	100	06 10.91	8114.905			

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
**Northing = Arizona West Zone -576 816.5768/3.2808 33333
Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located on a small top on a east-west ridge line, within the Imperial National Wildlife Refuge, about 6.6 miles northwest of Fishers Landing, 1.2 miles west of Yuma Wash., 0.6 mile north of the Colorado River and 0.1 mile south of the Yuma Proving Grounds Reservations Boundary.

The station is marked by a Defense Mapping Agency survey disk set in the top of a large concrete mass projecting 1 inch above ground. The disk is stamped: "IR 22 TOPO. CENTER 1974." It is on the highest point.

Reference Mark No. 1 is a Defense Mapping Agency survey disk grouted into a drilled hole in outcropping bedrock about 2 feet lower in elevation than the station and 5.962 meters east of the station mark. The disk is stamped: "IR 22 R.M. NO. 1 TOPO. CENTER 1974."

Reference Mark No. 2 is a Defense Mapping Agency survey disk grouted into a drilled hole in outcropping bedrock about 2 feet lower in elevation than the station and 5.236 meters north-northwest of the station mark. The disk is stamped: "IR 22 R.M. NO. 2 TOPO. CENTER 1974."

The station was reached by helicopter.

No azimuth mark was set for this station.



SKETCH

DA FORM 1959
1 OCT 64

REPLACES DA FORMS 1959
AND 1960, 1 FEB 57, WHICH
ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent
agency is U.S. Continental Army Command.

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION IR 22 R, DMATC 1975	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK IR 22 R		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 33° 02' 41" 7858		LONGITUDE W 114° 32' 30" 7974		ELEVATION 288.440 (M)	
LATITUDE N 33° 02' 41" 7858		LONGITUDE W 114° 32' 30" 7974		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 3 658 763.800		(EASTING)(NORTHING) (M) 729 543.882		GRID AND ZONE UTM 11	
(NORTHING)(EASTING) (M) 51 200.042		(EASTING)(NORTHING) (M) 10 773.406		GRID AND ZONE YPG**	
				ESTABLISHED BY (AGENCY) DMATC	
				DATE 1975	
				ORDER VA	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 39' 32.45 TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC) (MAGNETIC)		FROM SOUTH BACK AZIMUTH		GEOD. DISTANCE (METERS)	GRID DISTANCE (METERS)
	(M)	(M)	(M)	(M)	(FEET)	(FEET)
IR 22	39°	58' 11.33	219°	58' 04.27	522.988	
SITE 9 DISC	243	05 30.88	63	11 47.35	20047.898	
SITE 12 DISC	283	21 42.14	103	24 22.93	7867.183	
IR 22 R RM 1	232	44 34.			5.535	
IR 22 R RM 2	333	27 26.			3.981	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.

**Northing = Arizona West Zone -576 816.5768/3.2808 33333

Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is at the U.S. Army Yuma Proving Ground. It is near the southeast end of the Trigo Mountains about 7 miles northwest of Fishers Landing, about 1 mile west of Yuma Wash and about 0.8 mile north of the Colorado River.

The station was reached by helicopter.

Station Mark: A Defense Mapping Agency disc stamped: "IR 22 R" and set in the top of poured concrete, oval in shape. It is on the highest point, at the northeast end of a rocky ridge. It projects 0.2 foot above ground.

Reference Mark No. 1: A Defense Mapping Agency disc stamped: "IR 22 R RM 1 TOPO. CENTER 1975" and set in the top of poured concrete. It is 5.535 meters (18.16 ft.) northeast of the station and about 4 feet lower in elevation.

Reference Mark No. 2: A Defense Mapping Agency disc stamped: "IR 22 R RM 2 TOPO. CENTER 1975" and set in the top of poured concrete. It is 3.981 meters (13.06 ft.) southeast of the station and about 2 feet lower in elevation.

SKETCH



DA FORM 1959
1 OCT 64

REPLACES DA FORMS 1989
AND 1960, 1 FEB 57, WHICH
ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 3-237; the proponent
agency is U.S. Continental Army Command.

A-43

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION IR 24, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK IR 24 1974 TOPO. CENTER		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 32° 57' 50" 4644		LONGITUDE W 114° 21' 24" 7921		ELEVATION (M) 201.348	
(NORTHING)(EASTING) (M) 3 650 208.835		(EASTING)(NORTHING) (M) 747 050.233		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 42 110.997		(EASTING)(NORTHING) (M) 28 001.596		DATUM 1929 MSL	
		GRID AND ZONE UTM 11		ESTABLISHED BY (AGENCY) DMATC	
		GRID AND ZONE YPG**		DATE 1975	
				ORDER SECOND	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 33' 40.04 TO THE GEODETIC AZIMUTH
TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 12 DISC	126° 37' 29.69	306° 34' 07.62	11998.602	
IR 24 RM 1	15 38 37.		5.080	
SITE 2	69 19 23.79	249 17 12.29	6712.325	
IR 24 RM 2	270 42 15.		5.514	
SITE 6 DISC	328 40 13.22	148 40 20.63	679.983	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
**Northing = Arizona West Zone -576 816.5768/3.2808 33333
Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is on the highest point of a cone shaped hill about 8.7 miles north-northeast of post headquarters and about 4.0 miles west of the junction of U.S. Highway 95 and Castle Dome Road.

To reach the station from the intersection of Highway 95 and the main entrance road to the proving ground, go north on Highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left and go west and north for 4.1 miles to a dim trail on the right; turn right on dim trail and go east for 0.1 mile to the base of cone shaped hill and end of truck travel. From here pack uphill to highest point of hill and site of station.

Station Mark: A Defense Mapping Agency (Cast in Mark) disc stamped: "IR 24 TOPO. CENTER 1974" set in a mass of concrete, 2.5 feet in diameter that is flush with the ground.

Reference Mark No. 1: A Defense Mapping Agency disc stamped: "IR 24 RM 1 TOPO CENTER 1974" set in a mass of concrete that is flush with the ground. It is 5.08 meters (16.67 ft.) southwest of the station.

Reference Mark No. 2: A Defense Mapping Agency disc stamped: "IR 24 RM 2 TOPO CENTER 1974" set in a mass of concrete that is flush with the ground. It is 5.51 meters (18.09 ft.) southeast of the station.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK		STATION IR 24 DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK		AGENCY (CAST IN MARKS)	
LATITUDE		LONGITUDE		DATUM	
(NORTHING)(EASTING) (FT) (M)		(EASTING)(NORTHING) (FT) (M)		GRID AND ZONE	
(NORTHING)(EASTING) (FT) (M)		(EASTING)(NORTHING) (FT) (M)		GRID AND ZONE	
				ESTABLISHED BY (AGENCY)	
				DATE	
				ORDER	

TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE		GRID DISTANCE	
			(METERS)	(FEET)	(METERS)	(FEET)

Sub-Surface Mark: A Defense Mapping Agency disc stamped: "IR 24 TOPO. CENTER 1974" and cemented in a drill hole in rock buried in concrete 3 feet below ground surface.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION IRCC, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK IRCC 1974 TOPO CENTER		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 33° 01' 02" 3901		LONGITUDE W 114° 23' 45" 6330		ELEVATION (M) 148.976	
(NORTHING)(EASTING) (M) 3 656 030.203		(EASTING)(NORTHING) (M) 743 246.018		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 48 044.943		(EASTING)(NORTHING) (M) 24 380.362		DATUM 1929 MSL	
		GRID AND ZONE UTM 11		ESTABLISHED BY (AGENCY) DMATC	
		GRID AND ZONE YPG**		DATE 1975	
				ORDER SECOND	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 34' 49.47 TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC OR MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 7 DISC	253° 22' 15.35	73° 23' 04.09	2422.891	
IRCC RM 1	73 24 53.		24.153	
SITE 11 DISC	94 28 47.55	274 27 49.19	2788.117	
SITE 10 DISC	141 41 37.09	321 41 16.38	1591.493	
IRCC RM 2	163 20 13.		13.606	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 6.5 miles west of U.S. Highway 95 and about 12.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left on a gravel road and go north and west for 7.6 miles to a road left (Cibola Front Road); turn left and go west for 1.4 miles to a road right (Cheyenne Base Road) and the station site. The station is located 176.2 feet south of the centerline of Cibola Front Road and 120.0 feet west of the extended centerline of Cheyenne Base Road.

Station Mark: A Defense Mapping Agency disc stamped: "IRCC 1974 TOPO CENTER", set in the top of a round concrete post, 12 inches in diameter and projecting 0.2 foot above the ground. There is a sub-surface mark set in a drill hole in a rock which is buried in concrete, 3 feet below the surface mark. It is a Defense Mapping Agency disc stamped: "IRCC 1974 TOPO CENTER."

Reference Mark No. 1: A Defense Mapping Agency disc stamped: "IRCC RM 1 1974 TOPO CENTER", set in the top of a round concrete post, 12 inches in diameter and projecting 0.2 foot above the ground. It is 24.154 meters (79.24 feet) west of the station mark.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK		STATION IRCC, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK		AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
LATITUDE		LONGITUDE		DATUM	DATUM
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE		ESTABLISHED BY (AGENCY)	
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE		DATE	ORDER

TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)		BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)		GRID DISTANCE (METERS) (FEET)	

Reference Mark No. 2: A Defense Mapping Agency disc stamped: "IRCC RM NO. 2 1974 TOPO CENTER", set in the top of a round concrete post, 12 inches in diameter and projecting 0.3 foot above the ground. It is 13.607 meters (44.64 feet) north of the station mark.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK DISC		STATION IR 23, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK IR 23 1974 TOPO CENTER		AGENCY (CAST IN MARKS) DMA	
LATITUDE N 33° 07' 12" 5423		LONGITUDE W 114° 21' 20" 5244		DATUM 1927 NAD*	
(NORTHING)(EASTING) (M) 3 667 527.627		(EASTING)(NORTHING) (M) 746 725.010		GRID AND ZONE UTM 11	
(NORTHING)(EASTING) (M) 59 425.002		(EASTING)(NORTHING) (M) 28 212.231		GRID AND ZONE YPG**	
				ELEVATION (M) 279.040	
				DATUM 1929 MSL	
				ESTABLISHED BY (AGENCY) DMATC	
				DATE 1975	
				ORDER SECOND	

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 33' 15.96" TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 8 DISC	359° 52' 16.11	179° 52' 16.33	4 621.545	
IR 23 RM 2	120 39 49.		19.253	
IR 23 RM 1	211 50 17.		24.092	
SITE 9 DISC	215 03 25.39	35 03 35.98	874.195	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located at the U.S. Army Yuma Proving Ground. It is about 4.0 miles west of U.S. Highway 95 and about 19.5 miles north of post headquarters.

To reach the station from the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the proving ground go north on U.S. Highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; turn left and go west and north for 16.5 miles to YPG BM966 on the right and a dim trail to the left; turn left on dim trail and go south-southwest on the ridge line for 0.8 mile to the station site.

Station Mark: A Defense Mapping Agency disc stamped: "IR 23 1974 TOPO CENTER", set in the top of a round concrete post, 12 inches in diameter, flush with the ground. There is a sub-surface mark set in concrete 3 feet below the surface mark. It is a Defense Mapping Agency disc stamped: "IR 23 1974 TOPO CENTER".

Reference Mark No. 1: A Defense Mapping Agency disc stamped: "IR 23 RM 1 1974 TOPO CENTER", set in top of a 12-inch square concrete post, flush with the ground. It is located 24.09 meters (79.04 feet) northeast of the station mark.

Reference Mark No. 2: A Defense Mapping Agency disc stamped: "IR 23 RM 2 1974 TOPO CENTER", set in the top of a 12-inch square concrete post, flush with the ground. It is located 19.25 meters (63.156 feet) northwest of the station mark.



SKETCH

COUNTRY UNITED STATES		TYPE OF MARK		STATION SITE 11 MON YPG, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK		AGENCY (CAST IN MARKS)	ELEVATION 117.899 (M)
LATITUDE N 33° 01' 10"0074		LONGITUDE W 114° 25' 32"5959		DATUM 1927 NAD*	DATUM 1929 MSL
(NORTHING)(EASTING) 3 656 196.456 (M)	(EASTING)(NORTHING) 740 464.027 (M)	(EASTING)(NORTHING) 740 464.027 (M)	(EASTING)(NORTHING) 21 605.788 (M)	GRID AND ZONE UTM 11	ESTABLISHED BY (AGENCY) YPG
(NORTHING)(EASTING) 48 297.040 (M)	(EASTING)(NORTHING) 21 605.788 (M)	(EASTING)(NORTHING) 21 605.788 (M)	(EASTING)(NORTHING) 21 605.788 (M)	GRID AND ZONE YPG**	DATE

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 35' 47.55" TO THE GEODETIC AZIMUTH
 TO OBTAIN GRID AZ. (ADD)(SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION		FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE		GRID DISTANCE	
	(GEODETIC)	(MAGNETIC)		(METERS)	(FEET)	(METERS)	(FEET)
SITE 11 DISC	11°	21' 06.05"	191°	21' 05.98"	17.618		

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

Station description is not available at this time. It will be furnished at a later date.



SKETCH

DA FORM 1959
1 OCT 64

REPLACES DA FORMS 1959
AND 1960, 1 FEB 57, WHICH
ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
 For use of this form, see TM 5-237; the proponent
 agency is U.S. Continental Army Command.

COUNTRY UNITED STATES	TYPE OF MARK BRONZE DISK	STATION CM 1, YPG, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA	STAMPING ON MARK CON MON 1 ALT	AGENCY (CAST IN MARKS) YPG GEODETIC CONTROL	ELEVATION (M) 209.669
LATITUDE N 33° 05' 34" 2965	LONGITUDE W 114° 23' 42" 9606	DATUM 1927 NAD*	DATUM 1929 MSL
(NORTHING)(EASTING) (M) 3 664 408.483	(EASTING)(NORTHING) (M) 743 107.525	GRID AND ZONE UTM 11	ESTABLISHED BY (AGENCY) YPG
(NORTHING)(EASTING) (M) 56 420.556	(EASTING)(NORTHING) (M) 24 501.175	GRID AND ZONE YPG**	DATE

TO OBTAIN UTM (ZONE 11) GRID AZIMUTH, ADD 178° 34' 37.65" TO THE GEODETIC AZIMUTH
TO OBTAIN GRID AZ. (ADD|SUB.) TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 8 DISC	293° 17' 00.19	113° 18' 18.16	4033.191	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
**Northing = Arizona West Zone -576 816.5768/3.2808 33333
Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located on the Yuma Proving Grounds, U.S. Army Test and Evaluation Command. About 16 miles north-northeast of the Main Post area, 4.5 miles north-northeast of SITE 10, 2.5 miles west-northwest of SITE 8 and 275 feet east of the intersection of Cheyenne Base Road, West Target Road, Red Hill Road and East Target Road. On the top of a low reddish-brown hill.

To reach from the road intersection mentioned above go east on a track road, up-grade, for 0.05 mile to the top of hill and the station.

The station is marked by a YPG Geodetic Control survey disk set in the top of a 4-inch square concrete post projecting 1 inch above ground. It is 7.40 meters south of a 1 1/4 inch diameter steel pipe, 5 feet high, with a retro-directive prism attached to it (PATS 3).

No reference marks or azimuth mark were established for this station.



SKETCH

DA FORM 1959
1 OCT 64

REPLACES DA FORMS 1959
AND 1960, 1 FEB 67, WHICH
ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent
agency is U.S. Continental Army Command.

COUNTRY UNITED STATES		TYPE OF MARK BRONZE DISK		STATION CM 8, YPG, DMATC 1974	
LOCALITY YUMA COUNTY, ARIZONA		STAMPING ON MARK CM 8		AGENCY (CAST IN MARKS) YPG GEODETIC CONTROL	
LATITUDE N 33° 08' 42" 4326		LONGITUDE W 114° 22' 08" 0016		ELEVATION 270.742 (M)	
(NORTHING)(EASTING) (M)		(EASTING)(NORTHING) (M)		DATUM 1927 NAD*	
3 670 265.926 (M)		745 424.589 (M)		1929 MSL	
(NORTHING)(EASTING) (M)		(EASTING)(NORTHING) (M)		GRID AND ZONE UTM 11	
62 201.277 (M)		26 997.808 (M)		ESTABLISHED BY (AGENCY) YPG	
TO OBTAIN UTM (ZONE 11)		GRID AZIMUTH, ADD 178° 33' 38.49"		TO THE GEODETIC AZIMUTH	
TO OBTAIN		GRID AZ. (ADD)(SUB.)		TO THE GEODETIC AZIMUTH	

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	FROM SOUTH BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
SITE 9 DISC	319° 50' 23.50"	139° 51' 00.04"	2686.923	

*Ellipsoidal positions as carried into area through the Transcontinental Traverse.
 **Northing = Arizona West Zone -576 816.5768/3.2808 33333
 Easting = Arizona West Zone -221 988.7058/3.2808 33333

The station is located on the Yuma Proving Grounds, U.S. Army Test and Evaluation Command. About 20 miles north-northeast of the Main Post area, 1.5 miles north-northwest of SITE 9 and 0.3 mile northeast of the intersection of Target Boundary Road and East Target Road.

To reach from SITE 9 go west on Middle Mountain Road for 0.5 mile to the intersection with Target Boundary Road, turn right and go northerly on Target Boundary Road for 1.4 miles to a track road right (0.1 mile southeast of intersection of Target Boundary Road and East Target Road) turn right and follow track road along low ridge line for 0.5 mile to the station.

The station is marked by a YPG Geodetic Control survey disk set in the top of a 4-inch square concrete post projecting 3 inches above ground. It is 6.74 meters west-southwest of a 2 1/4-inch diameter steel pipe that is 4.5 feet high (LASER 9 NO 1).

No reference marks or azimuth mark were set for this station.



SKETCH

GPS-YPG 1975 PRECISE GEODETIC SURVEY

STATION NAME	LATITUDE LONGITUDE ELLIP. HT.	X Y Z	DX/DH DY/DH DZ/DH
PGT 2 AMS 60	32 55 37.94419N	-2205948.867	-.34550
	114 18 23.89766W	-4884126.332	-.76496
	242.797	3447134.828	.54357
PGT 3 AMS 60	33 14 21.67205N	-2194060.088	-.34361
	114 15 25.58169W	-4869020.123	-.76254
	527.740	3476297.628	.54814
HILLTOP USC+GS 49	33 6 15.37693N	-2200926.489	-.34470
	114 17 56.61854W	-4874724.916	-.76347
	319.851	3463643.322	.54616
MPS 25 DMATC 74	32 54 3.66447N	-2212971.184	-.34660
	114 22 54.42315W	-4882593.485	-.76473
	147.456	3444644.805	.54319
BENCH MARK C+GS 34	32 32 48 39.53344N	-2214733.372	-.34689
	114 22 35.60092W	-4887667.656	-.76554
	66.410	3436213.014	.54187
SITE 1 DMATC 74	32 52 3.37159N	-2216983.528	-.34723
	114 25 8.60523W	-4882995.319	-.76479
	161.118	3441540.255	.54270
SITE 2 DMATC 74	32 56 33.46254N	-2215528.488	-.34700
	114 25 26.54703W	-4878663.135	-.76411
	130.052	3448508.983	.54380
SITE 3 DMATC 74	32 56 5.45551N	-2208576.639	-.34591
	114 20 23.28152W	-4882409.392	-.76469
	217.229	3447832.282	.54369
SITE 6 DISC YPG	32 57 31.60938N	-2209101.865	-.34599
	114 21 11.17868W	-4880552.117	-.76440
	178.954	3450038.725	.54404
SITE 7 DISC YPG	33 1 24.88889N	-2209019.441	-.34598
	114 22 16.18015W	-4876278.877	-.76373
	162.757	3456057.660	.54498

GPS-YPG 1975 PRECISE GEODETIC SURVEY

STATION NAME	LATITUDE LONGITUDE ELLIP. HT.	X Y Z	DX/DH DY/DH DZ/DH
SITE 8 DISC YPG	33 4 42.52338N	-2206339.965	-.34556
	114 21 20.12366W	-4873887.627	-.76335
	206.838	3461185.012	.54579
SITE 9 DISC YPG	33 7 35.77071N	-2204711.243	-.34530
	114 21 1.15406W	-4871482.167	-.76297
	268.766	3465689.876	.54649
SITE 10 DISC YPG	33 1 42.92796N	-2211893.187	-.34643
	114 24 23.64681W	-4874605.934	-.76348
	122.054	3456501.407	.54506
SITE 11 DISC YPG	33 1 9.44669N	-2213750.024	-.34673
	114 25 32.72953W	-4874358.825	-.76344
	98.690	3455623.870	.54492
SITE 12 DISC YPG	33 1 42.67166N	-2216423.555	-.34715
	114 27 35.85335W	-4872518.407	-.76315
	85.115	3456474.653	.54506
IR 21 DMATC 74	33 1 33.67125N	-2213976.426	-.34676
	114 25 49.46472W	-4873807.011	-.76335
	96.197	3456248.227	.54502
IR 22 DMATC 74	33 2 28.77487N	-2223449.465	-.34823
	114 32 43.74496W	-4868658.422	-.76252
	305.190	3457785.592	.54524
IR 22R TC 75	33 2 41.78578N	-2223039.121	-.34817
	114 32 30.79741W	-4868578.625	-.76251
	265.640	3458099.756	.54530
10012 DMATC 74	32 55 40.12291N	-2205810.736	-.34548
	114 18 18.65761W	-4884151.257	-.76496
	245.589	3447192.682	.54358
10010 DMATC 74	33 1 25.07419N	-2208916.263	-.34597
	114 22 13.07765W	-4876312.473	-.76374
	166.952	3456064.732	.54498

GPS-YPG 1975 PRECISE GEODETIC SURVEY

STATION NAME	LATITUDE LONGITUDE ELLIP. HT.	X Y Z	DX/DH DY/DH DZ/DH
CAMERA SITE 4	32 54 5.16092N 114 23 9.04467W 148.998	-2213307.431 -4882414.852 3444684.555	-.34666 -.76470 .54320
SITE 11 MON	33 1 10.00740N 114 25 32.59592W 95.299	-2213741.798 -4874349.100 3455636.506	-.34672 -.76344 .54492
10011 DMATC 74	33 1 43.44337N 114 27 35.74999W 84.340	-2216415.479 -4872507.131 3456494.163	-.34714 -.76315 .54506
IR 23 DMATC 74	33 7 12.54226N 114 21 20.52440W 256.790	-2205325.845 -4871622.206 3465084.007	-.34540 -.76299 .54640
IR 24 DMATC 74	32 57 50.46439N 114 21 24.79206W 178.858	-2209293.605 -4880118.332 3450526.033	-.34602 -.76434 .54411
IRCC DMATC 74	33 1 2.39014N 114 23 45.63300W 126.476	-2211277.418 -4875636.685 3455456.732	-.34634 -.76364 .54489
CM 8 YPG	33 8 42.43258N 114 22 8.00163W 248.242	-2205819.617 -4869729.147 3467398.381	-.34547 -.76269 .54676
CM 1 YPG	33 5 34.29650N 114 23 42.96063W 187.169	-2209348.142 -4871550.621 3462510.643	-.34603 -.76299 .54600
SITE 5 1969 UPG	32 55 36.49461N 114 18 24.07638W 236.926	-2205961.063 -4884142.052 3447094.153	-.34550 -.76496 .54357

PROJECT		YPG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA		STATION			
AZIMUTH MARK		PGT 2 AMS 60		SITE 1, DMATC 74			
ELEVATION		265.20m		SOURCE		DMATC	
ELEVATION		183.80m		SOURCE		DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH-NORTH)	
		° ' "		° ' "		° ' "	
MEAN OBSERVED VALUE						237 49 17.79	
REDUCTION TO SEA LEVEL		S	0.03			- 0.02	
REDUCTION TO POLE		S	0.26	E	0.05	+ 0.12	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		N	0.07	W	0.01	0.00	
ASTRONOMIC RESULTS		N 32 52 03.83		W 114 25 14.25		237 49 18.21	
STD DEVIATION, RESULT UNIT		± .10 ± .22		± .12 ± .21		± .35 ± 1.36	
OBSERVATIONS ACCEPTED		5 GROUPS		3 SETS		15 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		1 POSITION	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		J. AUSTIN		J. AUSTIN		J. WHITE	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 41307	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11830	
DATES OBSERVED (LOCAL)		3,5 DEC. 74		5 DEC. 74		5 FEB. 75	
MEAN GREENWICH CIVIL DATE		4.87 DEC. 74		6.09 DEC. 74		6.11 FEB. 75	
COMPUTER AND ORGANIZATION		CSH DMATC		CSH DMATC		RAK DMATC	
CHECKER AND ORGANIZATION		DSP DMATC		DSP DMATC		CSH DMATC	
DATE COMPUTED		DEC. 74		DEC. 74		FEB. 75	
DATE CHECKED		DEC. 74		DEC. 74		FEB. 75	
INST SUPPORT (PIER, TRIPOD ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S):		WWV					
SOURCE OF CORRECTION TO TIME (UTI):		BIH CIRC. NO. D99					
UTI CORRECTION(S) TO SIGNAL:		-0 ^s .221					
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D99					
PROPAGATION DELAY:		APPLIED					
INSTRUMENT CONSTANTS							
DESCRIPTION		VIAL NO.		VALUE		DATE	
HORREBOW LEVEL (UPPER)		50		1.142		MAR. 74	
HORREBOW LEVEL (LOWER)							
HANGING LEVEL		749		1.212		MAR. 74	
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
(R 200) (M * S)				.0397		FEB. 74	
DEFLECTION DATA							
GEODETTIC LATITUDE		GEODETTIC LONGITUDE		DATUM		ORDER	
N 32° 52' 03.37		W 114° 25' 08.60		1927 NAD		1st DMATC	
DEFLECTION IN MERIDIAN (φ ₁ - φ ₂)		+0.46		DIFFERENCE IN LONGITUDE (λ ₁ - λ ₂)		+5.64	
PRIME VERTICAL DEFLECTION (λ ₁ - λ ₂) COS φ		+4.74		LAPLACE CORRECTION (λ ₁ - λ ₂) SIN φ ₀		+3.06	
LAPLACE AZIMUTH (α ₀)		237° 49' 21.27		α ₀ = α ₁ ; LAPLACE CORR N LATITUDES & W LONGITUDES POSITIVE			
COMPILED BY:		DATE		CHECKED BY:		DATE	
DSP		FEB. 75		CSH		FEB. 75	
REVISED BY:		DATE		REVISED BY:		DATE	
DSP		FEB. 75		DSP		JUNE 75	

PROJECT		YPG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA		STATION			
AZIMUTH MARK		PGT 3 AMS 60		SITE 2, DMATC 74			
ELEVATION		549.60m		SOURCE		DMATC	
ELEVATION		152.73m		SOURCE		DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH)	
		O I N		O I N		O I N	
MEAN OBSERVED VALUE						205 17 45.86	
REDUCTION TO SEA LEVEL		S 0.02				- 0.03	
REDUCTION TO POLE		S 0.26		E 0.06		+ 0.12	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		N 0.35		E 0.37		0.00	
ASTRONOMIC RESULTS		N 32 56 32.97		W 114 25 31.45		205 17 46.26	
STD DEVIATION, RESULT. UNIT		± .13 , ± .26		± .11 , ± .19		± .51 , ± 2.04	
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		16 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		0 POSITIONS	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		J. AUSTIN		J. AUSTIN		C. TAYLOR	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 52891	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11991	
DATES OBSERVED (LOCAL)		1 DEC 74		1 DEC 74		5 FEB 75	
MEAN GREENWICH CIVIL DATE		2.11 DEC 74		2.16 DEC 74		6.25 FEB 75	
COMPUTER AND ORGANIZATION		DSP DMATC		DSP DMATC		RAK DMATC	
CHECKER AND ORGANIZATION		CSH DMATC		CSH DMATC		CSH DMATC	
DATE COMPUTED		DEC 74		DEC 74		FEB 75	
DATE CHECKED		DEC 74		DEC 74		FEB 75	
INST SUPPORT (PIER, TRIPOD ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S): WWV				<p>A hand-drawn sketch showing the geodetic connection between two points. A vertical line represents the meridian. A point 'ASTRO' is marked on the meridian. A line connects 'ASTRO' to 'SITE 2'. The bearing from 'ASTRO' to 'SITE 2' is N 114° 25' 26.55" W. The distance is 14.42. A second vertical line is shown to the right of 'SITE 2', with a bearing of N 205° 17' 45.86" S from 'SITE 2' to this line. The distance is 17.46. The word 'ASTRO' is written below the first point, and 'SITE 2' is written to the right of the second point.</p>			
SOURCE OF CORRECTION TO TIME (UTI): BIH CIRC. NO. D98							
CORRECTION(S) TO SIGNAL: -0 ^s .212							
SOURCE OF POLAR COORDINATES: BIH CIRC. NO. D98							
PROPAGATION DELAY: APPLIED							
INSTRUMENT CONSTANTS							
DESCRIPTION		VIAL NO.		VALUE		DATE	
HORREBOW LEVEL (UPPER)		50		1.142		MAR 74	
HORREBOW LEVEL (LOWER)							
HANGING LEVEL		749		1.212		MAR 74	
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
(R 200) (M ° S)				.0397		FEB 74	
DEFLECTION DATA							
GEODETTIC LATITUDE		GEODETTIC LONGITUDE		DATUM		ORDER	
N 32° 56' 33.46"		W 114° 25' 26.55"		1927 NAD		1st DMATC	
DEFLECTION IN MERIDIAN (φ _s - φ _o)		-0.49		DIFFERENCE IN LONGITUDE (λ _s - λ _o)		+4.90	
PRIME VERTICAL DEFLECTION (λ _s - λ _o) COS φ _o		+4.11		LAPLACE CORRECTION (λ _s - λ _o) SIN φ _o		+2.66	
LAPLACE AZIMUTH (α _o)		205° 17' 48.92"		α _o = α _s ± LAPLACE CORR N LATITUDES & W LONGITUDES POSITIVE			
COMPILED BY:		DATE		CHECKED BY:		DATE	
DSP		FEB 75		CSH		FEB 75	
						REVISED BY:	
						DATE	
						DSP	
						JUN 75	

PROJECT		YPG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA					
AZIMUTH MARK		SITE 2 DMATC 74		STATION			
ELEVATION		152.73m		SOURCE		DMATC	
				ELEVATION		239.71m	
				SOURCE		DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from: SOUTH NORTH)	
		O I H		O I H		O I H	
MEAN OBSERVED VALUE						96 16 18.77	
REDUCTION TO SEA LEVEL		S	0.04			+ 0.00	
REDUCTION TO POLE		S	0.26	E	0.05	+ 0.10	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		N	0.27	E	0.09	0.00	
ASTRONOMIC RESULTS		N	32 56 02.85	W	114 20 31.15	96 16 19.19	
STD DEVIATION, RESULT UNIT		± .14 , ± .29		± .14 , ± .24		± .32 , ± 1.30	
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		17 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		0 POSITIONS	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		J. AUSTIN		J. AUSTIN		C. TAYLOR	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 52891	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		HAMILTON	
DATES OBSERVED (LOCAL)		10 DEC 74		10 DEC 74		31 JAN 75	
MEAN GREENWICH CIVIL DATE		11.06 DEC 74		11.11 DEC 74		1.08 FEB 75	
COMPUTER AND ORGANIZATION		DSP DMATC		DSP DMATC		RAK DMATC	
CHECKER AND ORGANIZATION		CSH DMATC		CSH DMATC		DSP DMATC	
DATE COMPUTED		DEC 74		DEC 74		DEC 74	
DATE CHECKED		DEC 74		DEC 74		FEB 75	
INST SUPPORT (PIER, TRIPOD ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S): WWV							
SOURCE OF CORRECTION TO TIME (UT1): BIH CIRC. NO. D99							
UT1 CORRECTION(S) TO SIGNAL: -0 ^s .238							
SOURCE OF POLAR COORDINATES: BIH CIRC. NO. D99							
PROPAGATION DELAY: APPLIED							
INSTRUMENT CONSTANTS							
DESCRIPTION		VIAL NO.	VALUE	DATE			
HORREBOW LEVEL (UPPER)		50	1.142	MAR 74			
HORREBOW LEVEL (LOWER)							
HANGING LEVEL		749	1.212	MAR 74			
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
(R 200) (M * S)			.0397	FEB 74			
DEFLECTION DATA							
GEODETIC LATITUDE		GEODETIC LONGITUDE		DATUM	ORDER	GEODETIC POSITION BY:	
N 32° 56' 05.46		W 114° 20' 23.28		1927 NAD	1st	DMATC	
DEFLECTION IN MERIDIAN (φ _s - φ _o)		-2.61		DIFFERENCE IN LONGITUDE (λ _s - λ _o)		+7.87	
PRIME VERTICAL DEFLECTION (λ _s - λ _o) COS φ		+6.61		LAPLACE CORRECTION (λ _s - λ _o) SIN φ _o		+4.28	
LAPLACE AZIMUTH (α _o)		96° 16' 23.47		α _o = α; LAPLACE CORR		N LATITUDES & W LONGITUDES POSITIVE	
COMPILED BY:		DATE	CHECKED BY:	DATE	REVISED BY:	DATE	
DSP		FEB 75	CSH	FEB 75	DSP	JUN 75	

PROJECT		YPG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA					
AZIMUTH MARK		MPS 25 DMATC 74		STATION		SITE 6 DISC YPG, DMATC 1974	
ELEVATION		170.06m		SOURCE		DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH)	
		° ' "		° ' "		° ' "	
MEAN OBSERVED VALUE						22 43 36.27	
REDUCTION TO SEA LEVEL		S 0.03				+ 0.01	
REDUCTION TO POLE		S 0.26		E 0.05		+ 0.10	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		N 0.09		E 0.08		0.00	
ASTRONOMIC RESULTS		N 32 57 28.63		W 114 21 21.10		22 43 36.71	
STD DEVIATION, RESULT UNIT		± .12 , ± .24		± .18 , ± .31		± .41 , ± 1.64	
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		15 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		1 POSITION	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		J. AUSTIN		J. AUSTIN		K. ZELLERS	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 41307	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11830	
DATES OBSERVED (LOCAL)		7 DEC 74		7 DEC 74		31 JAN 75	
MEAN GREENWICH CIVIL DATE		8.08 DEC 74		8.13 DEC 74		1.14 FEB 75	
COMPUTER AND ORGANIZATION		CSH DMATC		CSH DMATC		DSP DMATC	
CHECKER AND ORGANIZATION		DSP DMATC		DSP DMATC		CSH DMATC	
DATE COMPUTED		DEC 74		DEC 74		FEB 75	
DATE CHECKED		DEC 74		DEC 74		MAR 75	
INST SUPPORT (PIER TRIPOD ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S): WWV							
SOURCE OF CORRECTION TO TIME (UTI): BIH CIRC. NO. D99							
UTI CORRECTION(S) TO SIGNAL: -05230							
SOURCE OF POLAR COORDINATES: BIH CIRC. NO. D99							
PROPAGATION DELAY: APPLIED							
INSTRUMENT CONSTANTS							
DESCRIPTION		VIAL NO.	VALUE	DATE			
HORREBOW LEVEL (UPPER)		50	1.142	MAR 74			
HORREBOW LEVEL (LOWER)							
HANGING LEVEL		749	1.212	MAR 74			
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
IN 200 (M ' S)			.0397	FEB 74			
DEFLECTION DATA							
GEODETIC LATITUDE		GEODETIC LONGITUDE		DATUM	ORDER	GEODETIC POSITION BY:	
N 32° 57' 31.61		W 114° 21' 11.18		1927 NAD	1st	DMATC	
DEFLECTION IN MERIDIAN ($\phi_1 - \phi_2$)			-2.98	DIFFERENCE IN LONGITUDE ($\lambda_1 - \lambda_2$)		+9.92	
PRIME VERTICAL DEFLECTION ($\lambda_1 - \lambda_2$) COS ϕ			+8.32	LAPLACE CORRECTION ($\lambda_1 - \lambda_2$) SIN ϕ_1		+5.40	
LAPLACE AZIMUTH (α_1)			22° 43' 42.11	$\alpha_1 = \alpha_2$ LAPLACE CORR		N LATITUDES & W LONGITUDES POSITIVE	
COMPILED BY:		DATE	CHECKED BY:	DATE	REVISED BY:	DATE	
DSP		DEC 74	CSH	FEB 75	DSP	JUN 75	

PROJECT		YPG		ASTRONOMIC RESULTS							
LOCATION		ARIZONA									
AZIMUTH MARK		SITE 9 DISC YPG, DMATC 1974		STATION							
ELEVATION		290.99m		SOURCE		DMATC					
ELEVATION		185.80m		SOURCE		DMATC					
	LATITUDE		LONGITUDE		AZIMUTH (from SOUTH NORTH)						
	° ' "		° ' "		° ' "						
MEAN OBSERVED VALUE					189 39 30.21						
REDUCTION TO SEA LEVEL	S	0.03		-	0.01						
REDUCTION TO POLE	S	0.25		E	0.06						
DAILY ABERRATION				+	0.32						
ECCENTRIC REDUCTION	N	0.11		W	0.07						
ASTRONOMIC RESULTS	N	33 01	23.25	W	114 22	27.36	189 39 30.63				
STD DEVIATION RESULT UNIT	±	.13	±	.26	±	.18	±	.32			
RESERVATIONS ACCEPTED	4 GROUPS		3 SETS		15 POSITIONS						
RESERVATIONS REJECTED	0 GROUPS		0 SETS		1 POSITION						
METHOD OF DETERMINATION	STERNECK		MERIDIAN TRANSIT		DIRECTION						
OBSERVER	R. COURBIS		R. COURBIS		J. WHITE						
ORGANIZATION	DMATC		DMATC		DMATC						
INSTRUMENT	T-4 86967		T-4 86967		T-3 41307						
CHRONOMETER	DATAMETRICS 227		DATAMETRICS 227		2E-11830						
DATES OBSERVED (LOCAL)	25 NOV 74		25 NOV 74		3 FEB 75						
MEAN GREENWICH CIVIL DATE	26.08 NOV 74		26.14 NOV 74		4.25 FEB 75						
COMPUTER AND ORGANIZATION	DSP DMATC		DSP DMATC		DSP DMATC						
CHECKER AND ORGANIZATION	CSH DMATC		CSH DMATC		CSH DMATC						
DATE COMPUTED	DATE CHECKED	DEC 74	DEC 74	DEC 74	DEC 74	FEB 75	MAR 75				
INST SUPPORT (PIER, TRIPOD ETC)	TRIPOD		TRIPOD		TRIPOD						
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION							
SOURCE OF PRECISE TIME(S): WWV											
SOURCE OF CORRECTION TO TIME (UTI): BIH CIRC. NO. D98											
UTI CORRECTION(S) TO SIGNAL: -0 ^s .194											
SOURCE OF POLAR COORDINATES: BIH CIRC. NO. D98											
PROPAGATION DELAY: APPLIED											
INSTRUMENT CONSTANTS											
DESCRIPTION	VIAL NO.	VALUE	DATE								
MERIDIAN LEVEL (UPPER)	50	1.142	MAR 74								
MERIDIAN LEVEL (LOWER)											
HANGING LEVEL	749	1.212	MAR 74								
VERTICAL CIRCLE LEVEL											
AZIMUTH CROSS LEVEL											
(R 200) (M 5)		.0397	FEB 74								
DEFLECTION DATA											
GEODETIC LATITUDE	N 33° 01' 24.89		GEODETIC LONGITUDE	W 114° 22' 16.18		DATUM	1927 NAD	ORDER	1st	GEODETIC POSITION BY:	DMATC
DEFLECTION IN MERIDIAN (α ₁ - α ₂)			-1.64		DIFFERENCE IN LONGITUDE (λ ₁ - λ ₂)			+11.18			
PRIME VERTICAL DEFLECTION (λ ₁ - λ ₂) COS φ			+9.37		LAPLACE CORRECTION (λ ₁ - λ ₂) SIN φ ₀			+ 6.09			
LAPLACE AZIMUTH (μ ₀)			189° 39' 36.72		α = α ₁ ; LAPLACE CORR N LATITUDES & W LONGITUDES POSITIVE						
COMPILED BY:	DATE	CHECKED BY:	DATE	REVISED BY:	DATE						
DSP	FEB 75	CSH	FEB 75	DSP	JUN 75						


PROJECT		YPG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA					
AZIMUTH MARK		SITE 12 DISC YPG, DMATC 1974		STATION		SITE 8 DISC YPG, DMATC 1974	
ELEVATION		107.80m		SOURCE		DMATC	
ELEVATION		229.17m		SOURCE		DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH-NORTH)	
		D I H		D I H		D I H	
MEAN OBSERVED VALUE						60 24 49.44	
REDUCTION TO SEA LEVEL		S 0.04		E 0.06		+ 0.01	
REDUCTION TO POLE		S 0.25				+ 0.12	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		0.00		W 0.05		0.00	
ASTRONOMIC RESULTS		N 33 04 40.07		W 114 21 30.71		60 24 49.89	
TD DEVIATION, RESULT UNIT		± .12 , ± .24		± .16 , ± .27		± .44 , ± 1.81	
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		17 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		1 POSITION	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		J. AUSTIN		J. AUSTIN		H. WOODWORTH	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 41307	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11830	
DATES OBSERVED (LOCAL)		24 NOV 74		24 NOV 74		8 FEB 75	
MEAN GREENWICH CIVIL DATE		25.09 NOV 74		25.14 NOV 74		9.13 FEB 75	
COMPUTER AND ORGANIZATION		CSH DMATC		CSH DMATC		DSP DMATC	
CHECKER AND ORGANIZATION		DSP DMATC		DSP DMATC		CSH DMATC	
DATE COMPUTED		DEC 74		DEC 74		FEB 75	
DATE CHECKED		DEC 74		DEC 74		MAR 75	
INST SUPPORT (PIER, TRIPOD ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S):		WWV					
SOURCE OF CORRECTION TO TIME (UTI):		BIH CIRC. NO. D98					
UTI CORRECTION(S) TO SIGNAL:		-0 ^s 191					
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D98					
PROPAGATION DELAY:		APPLIED					
INSTRUMENT CONSTANTS							
DESCRIPTION		VIAL NO.		VALUE		DATE	
HORREBOW LEVEL (UPPER)		50		1.142		MAR 74	
HORREBOW LEVEL (LOWER)							
HANGING LEVEL		749		1.212		MAR 74	
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
(R 200) (M + S)				.0397		FEB 74	
DEFLECTION DATA							
GEODETIC LATITUDE		N 33° 04' 42.52		GEODETIC LONGITUDE		W 114° 21' 20.12	
DATE		FEB 75		DATUM		1927 NAD	
COMPILED BY:		DSP		ORDER		1st	
CHECKED BY:		CSH		GEODETIC POSITION BY:		DMATC	
DATE		FEB 75		DEFLECTION IN MERIDIAN (φ ₁ - φ ₂)		-2.45	
REVISOR:		DSP		DIFFERENCE IN LONGITUDE (λ ₁ - λ ₂)		+10.59	
DATE		JUN 75		PRIME VERTICAL DEFLECTION (λ ₁ - λ ₂) COS φ		+8.87	
LAPLACE CORRECTION		+5.78		LAPLACE AZIMUTH (α ₁)		60° 24' 55.67	
LAPLACE CORRECTION		+5.78		LAPLACE CORRECTION		α ₂ = α ₁ + LAPLACE CORR	
LAPLACE CORRECTION		+5.78		N LATITUDES & W LONGITUDES POSITIVE			

PROJECT		YPG		ASTRONOMIC RESULTS				
LOCATION		ARIZONA						
AZIMUTH MARK		IR 22 DMATC 74		STATION				
ELEVATION		328.51 m		SOURCE		DMATC		
ELEVATION		290.99 m		SOURCE		DMATC		
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH NORTH)		
		° ' "		° ' "		° ' "		
MEAN OBSERVED VALUE						62 37 17.07		
REDUCTION TO SEA LEVEL		S 0.05				+ 0.02		
REDUCTION TO POLE		S 0.25		E 0.06		+ 0.12		
DIURNAL ABERRATION						+ 0.32		
ECCENTRIC REDUCTION		0.00		W 0.05		0.00		
ASTRONOMIC RESULTS		N 33 07 31.77		W 114 21 09.75		62 37 17.53		
STD. DEVIATION, RESULT UNIT		± .23 , ± .46		± .14 , ± .25		± .43 , ± 1.73		
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		16 POSITIONS		
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		0 POSITIONS		
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION		
OBSERVER		R. COURBIS		R. COURBIS		J. WOLF		
ORGANIZATION		DMATC		DMATC		DMATC		
INSTRUMENT		T-4 86967		T-4 86967		T-3 41305		
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-12115		
DATES OBSERVED (LOCAL)		23 NOV 74		23 NOV 74		6 FEB 75		
MEAN GREENWICH CIVIL DATE		24.12 NOV 74		24.18 NOV 74		7.16 FEB 75		
COMPUTER AND ORGANIZATION		CSH DMATC		CSH DMATC		DSP DMATC		
CHECKER AND ORGANIZATION		DSP DMATC		DSP DMATC		CSH DMATC		
DATE COMPUTED		DEC 74		DEC 74		FEB 75		
DATE CHECKED		DEC 74		DEC 74		MAR 75		
INST. SUPPORT (PIER TRIPOD ETC)		TRIPOD		TRIPOD		TRIPOD		
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION				
SOURCE OF PRECISE TIME(S):				WWV				
SOURCE OF CORRECTION TO TIME (UTI):				BIH CIRC. NO. D98				
UT1 CORRECTION(S) TO SIGNAL:				-0 ^s 188				
SOURCE OF POLAR COORDINATES:				BIH CIRC. NO. D98				
PROPAGATION DELAY:				APPLIED				
INSTRUMENT CONSTANTS								
DESCRIPTION		VIAL NO.	VALUE					DATE
WIREBOW LEVEL (UPPER)		50	1.142					MAR 74
WIREBOW LEVEL (LOWER)								
HANGING LEVEL		749	1.212					MAR 74
VERTICAL SINGLE LEVEL								
AZIMUTH CROSS LEVEL								
IR 2001 IM S			.0397	FEB 74				
DEFLECTION DATA								
GEODETIC LATITUDE		N 33° 07' 35.77		GEODETIC LONGITUDE		W 114° 21' 01.15		
DATUM		1927 NAD		ORDER		1st		
GEODETIC POSITION BY:		DMATC						
DEFLECTION IN MERIDIAN (α - α')		-4.00		DIFFERENCE IN LONGITUDE (λ - λ')		+8.60		
PRIME VERTICAL DEFLECTION (λ - λ') COS α		+7.20		LAPLACE CORRECTION (λ - λ') SIN α		+4.70		
LAPLACE AZIMUTH (α')		62° 37' 22.23		α = α'; LAPLACE CORR N LATITUDES & W LONGITUDES POSITIVE				
COMPILED BY		DATE	CHECKED BY:	DATE	REVISED BY:	DATE		
DSP		FEB 75	CSH	FEB 75	DSP	JUN 75		


PROJECT		YPG		ASTRONOMIC RESULTS								
LOCATION		ARIZONA										
AZIMUTH MARK		SITE 2 DISC YPG, DMATC 1974		STATION		SITE 10 DISC YPG, DMATC 1974						
ELEVATION	152.73 m	SOURCE	DMATC <th>ELEVATION</th> <td>144.61 m</td> <th>SOURCE</th> <td>DMATC</td>	ELEVATION	144.61 m	SOURCE	DMATC					
	LATITUDE			LONGITUDE			AZIMUTH (from: SOUTH NORTH)					
	O	I	N	O	I	N	O	I	N			
MEAN OBSERVED VALUE							09	43	25.91			
REDUCTION TO SEA LEVEL	S		0.02						0.00			
REDUCTION TO POLE	S		0.25	E		0.06	+		0.10			
DIURNAL ABERRATION							+		0.32			
ECCENTRIC REDUCTION	S		0.08	W		0.04			0.00			
ASTRONOMIC RESULTS	N	33	01	40.25	W	114	24	30.99	09 43 26.34			
STD DEVIATION RESULT UNIT	±	.13	±	.25	±	.16	±	.28	± .47 ± 1.81			
OBSERVATIONS ACCEPTED	4 GROUPS			3 SETS			15 POSITIONS					
OBSERVATIONS REJECTED	0 GROUPS			0 SETS			1 POSITION					
METHOD OF DETERMINATION	STERNECK			MERIDIAN TRANSIT			DIRECTION					
OBSERVER	J. AUSTIN			J. AUSTIN			K. ZELIERS					
ORGANIZATION	DMATC			DMATC			DMATC					
INSTRUMENT	T-4 86967			T-4 86967			T-3 41307					
CHRONOMETER	DATAMETRICS 227			DATAMETRICS 227			2E-11830					
DATES OBSERVED (LOCAL)	22 NOV 74			22 NOV 74			1 FEB 75					
MEAN GREENWICH CIVIL DATE	23.09 NOV 74			23.15 NOV 74			2.10 FEB 75					
COMPUTER AND ORGANIZATION	CSH DMATC			CSH DMATC			DSP DMATC					
CHECKER AND ORGANIZATION	DSP DMATC			DSP DMATC			CSH DMATC					
DATE COMPUTED	DATE CHECKED	DEC 74	DEC 74	DEC 74	DEC 74	FEB 75	MAR 75					
INST. SUPPORT (PIER, TRIPOD, ETC)	TRIPOD			TRIPOD			TRIPOD					
TIME AND POLAR MOTION DATA					SKETCH OF GEODETIC CONNECTION							
SOURCE OF PRECISE TIME (S):		WWV										
SOURCE OF CORRECTION TO TIME (U):		BIH CIRC. NO. D98										
CORRECTION(S) TO SIGNAL:		-0 ^s .185										
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D98										
PROPAGATION DELAY:		APPLIED										
INSTRUMENT CONSTANTS												
DESCRIPTION	VIAL NO.	VALUE	DATE									
HORIZONTAL LEVEL (UPPER)	50	1.142	MAR 74									
HORIZONTAL LEVEL (LOWER)												
HANDING LEVEL	749	1.212	MAR 74									
VERTICAL LEVEL												
AIRY'S WIRE LEVEL												
OR 200 (M + S)		.0397	FEB 74									
DEFLECTION DATA												
GEODETIC LATITUDE	N 33° 01' 42.93		GEODETIC LONGITUDE	W 114° 24' 23.65		DATE	1927 NAD		ORDER	1st	GEODETIC POSITION BY:	DMATC
DEFLECTION IN MERIDIAN (φ ₁ - φ ₂)			-2.68			DIFFERENCE IN LONGITUDE (λ ₁ - λ ₂)			+7.34			
PRIME VERTICAL DEFLECTION (λ ₁ - λ ₂) COS φ			+6.15			LAPLACE CORRECTION (λ ₁ - λ ₂) SIN φ			+4.00			
LAPLACE AZIMUTH (α)			09° 43' 30.34			α = 0°; LAPLACE CORR			IN LATITUDES & W LONGITUDE - POSITIVE			
COMPILED BY:	DATE	CHECKED BY:	DATE	REVISED BY:	DATE							
DSP	FEB 75	CSH	FEB 75	DSP	JUN 75							

PROJECT YPG		ASTRONOMIC RESULTS						
LOCATION ARIZONA								
AZIMUTH MARK			STATION					
SITE 7 DISC YPG, DMATC 1974			SITE 11 DISC YPG, DMATC 1974					
ELEVATION	185.20 m	SOURCE	DMATC	ELEVATION	121.32 m	SOURCE	DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH NORTH)		
		D I N		D I N		D I N		
MEAN OBSERVED VALUE						264 39 21.91		
REDUCTION TO SEA LEVEL		S	0.02			0.00		
REDUCTION TO POLE		S	0.26	E	0.06	+	0.10	
DIURNAL ABERRATION						+	0.32	
ECCENTRIC REDUCTION		N	0.20	E	0.12	0.00		
ASTRONOMIC RESULTS		N 33 01 06.77		W 114 25 38.97		264 39 22.33		
STD DEVIATION RESULT, UNIT		± .10 , ± .19		± .17 , ± .29		± .49 , ± 2.23		
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		21 POSITIONS		
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		1 POSITION		
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION		
OBSERVER		J. AUSTIN		J. AUSTIN		G. TAYLOR		
ORGANIZATION		DMATC		DMATC		DMATC		
INSTRUMENT		T-4 86967		T-4 86967		T-3 52891		
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11991		
DATES OBSERVED (LOCAL)		26 NOV 74		26 NOV 74		25 JAN 75		
MEAN GREENWICH CIVIL DATE		27.08 NOV 74		27.14 NOV 74		26.18 JAN 75		
COMPUTER AND ORGANIZATION		DSP DMATC		DSP DMATC		DSP DMATC		
CHECKER AND ORGANIZATION		CSH DMATC		CSH DMATC		CSH DMATC		
DATE COMPUTED	DATE CHECKED	DEC 74	DEC 74	DEC 74	DEC 74	FEB 75	MAR 75	
INST. SUPPORT (PIER, TRIPOD, ETC)		TRIPOD		TRIPOD		TRIPOD		
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION				
SOURCE OF PRECISE TIME (S):		WWV						
SOURCE OF CORRECTION TO TIME (UT1):		BIH CIRC. NO. D98						
CORRECTION(S) TO SIGNAL:		-0.197						
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D98						
PROPAGATION OF AREA:		APPLIED						
INSTRUMENT CONSTANTS								
DESCRIPTION	VIAL NO.	VALUE	DATE					
HORREBOW LEVEL (UPPER)	50	1.142	MAR 74					
HORREBOW LEVEL (LOWER)								
HANGING LEVEL	749	1.212	MAR 74					
VERTICAL CIRCLE LEVEL								
AZIMUTH CROSS LEVEL								
(R 200) (M * S)		.0397	FEB 74					
DEFLECTION DATA								
GEODETIC LATITUDE		GEODETIC LONGITUDE		DATUM	ORDER	GEODETIC POSITION BY:		
N 33° 01' 09.45		W 114° 25' 32.73		1927 NAD	1st	DMATC		
DEFLECTION IN MERIDIAN (α ₀ - α ₀)			-2.68	DIFFERENCE IN LONGITUDE (λ ₀ - λ ₀)		+6.24		
PRIME VERTICAL DEFLECTION (λ ₀ - λ ₀) COS α ₀			+5.23	LAPLACE CORRECTION (λ ₀ - λ ₀) SIN α ₀		+3.40		
LAPLACE AZIMUTH (α ₀)			264° 39' 25.73	α ₀ = α ₀ LAPLACE CORR		N LATITUDES & W LONGITUDES POSITIVE		
COMPILED BY:	DATE	CHECKED BY:	DATE	REVISED BY:	DATE			
DSP	FEB 75	CSH	FEB 75	DSP	JUN 75			

PROJECT YPG				ASTRONOMIC RESULTS			
LOCATION ARIZONA				STATION			
AZIMUTH MARK PGT 2 AMS 60				SITE 12 DISC YPG, DMATC 1974			
ELEVATION 265.20 m		SOURCE DMATC		ELEVATION 107.80 m		SOURCE DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH NORTH)	
		D I M		D I M		D I M	
MEAN OBSERVED VALUE						308 03 06.78	
REDUCTION TO SEA LEVEL		S 0.02				- 0.02	
REDUCTION TO POLE		S 0.26		E 0.06		+ 0.12	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		S 0.36		E 0.36		0.00	
ASTRONOMIC RESULTS		N 33 01 39.11		E 114 27 40.22		308 03 07.20	
S. D. DEVIATION, RESULT, UNIT		± .12 , ± .23		± .10 , ± .17		± .35 , ± 1.41	
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		16 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		0 POSITIONS	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSITE		DIRECTION	
OBSERVER		R. COURBIS		R. COURBIS		R. CAMPBELL	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 41304	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-12467	
DATES OBSERVE (LOCAL)		27 NOV 74		27 NOV 74		6 FEB 75	
MEAN GREENWICH CIVIL DATE		28.08 NOV 74		28.14 NOV 74		7.19 FEB 75	
COMPUTER AND ORGANIZATION		DSP DMATC		DSP DMATC		DSP DMATC	
CHECKER AND ORGANIZATION		CSH DMATC		CSH DMATC		CSH DMATC	
DATE COMPUTED		DEC 74		DEC 74		MAR 75	
DATE CHECKED		DEC 74		DEC 74		MAR 75	
INST. SUPPORT (PIER, TRIPOD, ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S): WWV							
SOURCE OF CORRECTION TO TIME (UTI): BIH CIRC. NO. D98							
TIME CORRECTION(S) TO SIGNAL: -0 ^s 200							
SOURCE OF POLAR COORDINATES: BIH CIRC. NO. D98							
PROPAGATION DELAY: APPLIED							
INSTRUMENT CONSTANTS							
DESCRIPTION		VIAL NO.	VALUE	DATE			
HORREBOW LEVEL (UPPER)		50	1.142	MAR 74			
HORREBOW LEVEL (LOWER)							
HANGING LEVEL		749	1.212	MAR 74			
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
IR 2001 (M + S)			.0397	FEB 74			
DEFLECTION DATA							
GEODETIC LATITUDE		N 33° 01' 42" 67		GEODETIC LONGITUDE		W 114° 27' 35" 85	
DATUM		1927 NAD		ORDER		1st	
GEODETIC POSITION BY:		DMATC					
DEFLECTION IN MERIDIAN (α ₁ - α ₂)		-3.56		DIFFERENCE IN LONGITUDE (λ ₁ - λ ₂)		+4.37	
PRIME VERTICAL DEFLECTION (λ ₁ - λ ₂) COS α		+3.66		LAPLACE CORRECTION (λ ₁ - λ ₂) SIN α ₁		+2.38	
LAPLACE AZIMUTH (α ₁)		308° 03' 09" 58		α ₁ = α ₂ ; LAPLACE CORR IN LATITUDES & W LONGITUDES POSITIVE			
COMPILED BY:		DATE	CHECKED BY:	DATE	REVISED BY:	DATE	
DSP		FEB 75	CSH	FEB 75	DSP	JUN 75	

PROJECT		YPG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA					
AZIMUTH MARK		PGT 2 AMS 1960		STATION			
ELEVATION		265.20m		SOURCE		DMATC	
ELEVATION		89.04m		SOURCE		USCGS	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH)	
		° ' "		° ' "		° ' "	
MEAN OBSERVED VALUE						206 53 49.41	
REDUCTION TO SEA LEVEL		S 0.01				- 0.02	
REDUCTION TO POLE		S 0.26		E 0.05		+ 0.10	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		0.00		0.00		0.00	
ASTRONOMIC RESULTS		N 32 48 38.32		W 114 22 41.12		206 53 49.82	
SID. DEVIATION RESULT. UNIT		± .10 ± .21		± .12 ± .22		± .26 ± 1.00	
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		15 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		2 POSITIONS	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		R. COURBIS		R. COURBIS		C. TAYLOR	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 52891	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11991	
DATES OBSERVED (LOCAL)		9 DEC 74		9 DEC 74		31 JAN 75	
MEAN GREENWICH CIVIL DATE		10.07 DEC 74		10.12 DEC 74		1.24 FEB 75	
COMPUTER AND ORGANIZATION		CSH DMATC		CSH DMATC		DSP DMATC	
CHECKER AND ORGANIZATION		DSP DMATC		DSP DMATC		CSH DMATC	
DATE COMPUTED		DEC 74		DEC 74		FEB 75	
DATE CHECKED		DEC 74		DEC 74		MAR 75	
INST. SUPPORT (SER. TRIPOD, ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S): WWV				NO ECCENTRICITY			
SOURCE OF CORRECTION TO TIME (UT1): BIH CIRC. NO. D99							
L1 CORRECTION(S) TO SIGNAL: -0 ^s .235							
SOURCE OF POLAR COORDINATES: BIH CIRC. NO. D99							
PROPAGATION DELAY: APPLIED							
INSTRUMENT CONSTANTS							
DESCRIPTION	VIAL NO.	VALUE	DATE				
MORSEBOW LEVEL (UPPER)	50	1.142	MAR 74				
MORSEBOW LEVEL (LOWER)							
HANGING LEVEL	749	1.212	MAR 74				
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
(R 200) (M ± S)		.0397	FEB 74				
DEFLECTION DATA							
GEODETIC LATITUDE		GEODETIC LONGITUDE		DATUM		ORDER	
N 32° 48' 39.53		W 114 22' 35.60		1927 NAD		1st DMATC	
DEFLECTION IN MERIDIAN (α _s - α _c)				DIFFERENCE IN LONGITUDE (λ _s - λ _c)		+5.52	
PRIME VERTICAL DEFLECTION (λ _s - λ _c) COS φ		+4.64		LAPLACE CORRECTION (λ _s - λ _c) SIN φ _c		+2.99	
LAPLACE AZIMUTH (α _c)		206° 53' 52.81		α _s = α _c ± LAPLACE CORR		N LATITUDES & W LONGITUDES POSITIVE	
COMPILED BY:	DATE	CHECKED BY:	DATE	REVISED BY:	DATE		
DSP	FEB 75	CSH	FEB 75	DSP	JUN 75		

PROJECT		YPG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA					
AZIMUTH MARK		PGT 3 AMS 1960		STATION			
ELEVATION		549.60m		SOURCE		DMATC	
ELEVATION		341.97m		SOURCE		DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH - NORTH)	
		° ' "		° ' "		° ' "	
MEAN OBSERVED VALUE						194 37 35.52	
REDUCTION TO SEA LEVEL		S 0.05				- 0.02	
REDUCTION TO POLE		S 0.26		E 0.05		+ 0.13	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		0.00		0.00		0.00	
ASTRONOMIC RESULTS		N 33 06 13.48		W 114 18 02.80		194 37 35.95	
STD DEVIATION, RESULT UNIT		± .14 , ± .29		± .11 , ± .19		± .62 , ± 2.47	
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		16 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		0 POSITIONS	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		R. COURBIS		R. COURBIS		H. WOODWORTH	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 52891	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11991	
DATES OBSERVED (LOCAL)		6 DEC 74		6 DEC 74		10 FEB 75	
MEAN GREENWICH CIVIL DATE		7.08 DEC 74		7.13 DEC 74		11.12 FEB 75	
COMPUTER AND ORGANIZATION		DSP DMATC		DSP DMATC		DSP DMATC	
CHECKER AND ORGANIZATION		CSH DMATC		CSH DMATC		CSH DMATC	
DATE COMPUTED		DEC 74		DEC 74		FEB 75	
DATE CHECKED		DEC 74		DEC 74		MAR 75	
INST SUPPORT (PIER TRIPOD ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S):		WWV		NO ECCENTRICITY			
SOURCE OF CORRECTION TO TIME (UTI):		BIH CIRC. NO. D99					
UTI CORRECTION(S) TO SIGNAL:		-0 ^s .227					
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D99					
PROPAGATION DELAY:		APPLIED					
INSTRUMENT CONSTANTS							
DESCRIPTION	VIAL NO.	VALUE	DATE				
HORREBOW LEVEL (UPPER)	50	1.142	MAR 74				
HORREBOW LEVEL (LOWER)							
HANGING LEVEL	749	1.212	MAR 74				
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
(R 200) (M ± S)		.0397	FEB 74				
DEFLECTION DATA							
GEODETIC LATITUDE		N 33° 06' 15.38"		GEODETIC LONGITUDE		W 114° 17' 56.62"	
DATE		FEB 75		DATUM		1927 NAD	
ORDER		1st		GEODETIC POSITION BY:		DMATC	
DEFLECTION IN MERIDIAN (φ _s - φ ₀)		-1.90		DIFFERENCE IN LONGITUDE (λ _s - λ ₀)		+6.18	
PRIME VERTICAL DEFLECTION (λ _s - λ ₀) COS φ		+5.18		LAPLACE CORRECTION (λ _s - λ ₀) SIN φ ₀		+3.38	
LAPLACE AZIMUTH (α ₀)		194° 37' 39.33"		α _s = α ₀ , LAPLACE CORR		N LATITUDES & W LONGITUDES POSITIVE	
COMPILED BY:		DSP		DATE		FEB 75	
DATE		FEB 75		CHECKED BY:		CSH	
DATE		FEB 75		REVISED BY:		DSP	
DATE		FEB 75		DATE		JUN 75	

PROJECT		YPG		ASTRONOMIC RESULTS					
LOCATION		ARIZONA							
AZIMUTH MARK		PGT 2 AMS 60		STATION					
ELEVATION		265.20m		SOURCE		DMATC			
ELEVATION		170.06m		SOURCE		DMATC			
		LATITUDE		LONGITUDE		AZIMUTH (from: SOUTH)			
		° ' "		° ' "		° ' "			
MEAN OBSERVED VALUE						247 31 49.44			
REDUCTION TO SEA LEVEL		S 0.03				- 0.01			
REDUCTION TO POLE		S 0.26		E 0.05		+ 0.09			
DIURNAL ABERRATION						+ 0.32			
ECCENTRIC REDUCTION		0.00		0.00		0.00			
ASTRONOMIC RESULTS		N 32 54 04.40		W 114 22 59.50		247 31 49.84			
STD DEVIATION RESULT, UNIT		± .15 , ± .30		± .12 , ± .20		± .35 , ± 1.40			
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		16 POSITIONS			
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		0 POSITIONS			
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION			
OBSERVER		R. COURBIS		R. COURBIS		C. TAYLOR			
ORGANIZATION		DMATC		DMATC		DMATC			
INSTRUMENT		T-4 86967		T-4 86967		T-3 52891			
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11991			
DATES OBSERVED (LOCAL)		2 DEC 74		2 DEC 74		24 JAN 75			
MEAN GREENWICH CIVIL DATE		3.07 DEC 74		3.12 DEC 74		25.14 JAN 75			
COMPUTER AND ORGANIZATION		DSP DMATC		DSP DMATC		DSP DMATC			
CHECKER AND ORGANIZATION		CSH DMATC		CSH DMATC		CSH DMATC			
DATE COMPUTED		DEC 74		DEC 74		FEB 75			
DATE CHECKED		DEC 74		DEC 74		MAR 75			
INST. SUPPORT (PIER, TRIPOD, ETC)		TRIPOD		TRIPOD		TRIPOD			
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION					
SOURCE OF PRECISE TIME(S):		WWV		NO ECCENTRICITY					
SOURCE OF CORRECTION TO TIME (UTI):		BIH CIRC. NO. D99							
UTI CORRECTION(S) TO SIGNAL:		-0 ^s .215							
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D99							
PROPAGATION DELAY:		APPLIED							
INSTRUMENT CONSTANTS									
DESCRIPTION		VIAL NO.	VALUE					DATE	
HORREBOW LEVEL (UPPER)		50	1.142					MAR 74	
HORREBOW LEVEL (LOWER)									
HANGING LEVEL		749	1.212					MAR 74	
VERTICAL CIRCLE LEVEL									
AZIMUTH CROSS LEVEL									
(R/200) (M + S)			.0397	FEB 74					
DEFLECTION DATA									
GEODETIC LATITUDE		GEODETIC LONGITUDE		DATUM	ORDER	GEODETIC POSITION BY:			
N 32° 54' 03.66		W 114° 22' 54.42		1927 NAD	1st	DMATC			
DEFLECTION IN MERIDAN (φ _A - φ _C)		+0.74		DIFFERENCE IN LONGITUDE (λ _A - λ _C)		+5.08			
PRIME VERTICAL DEFLECTION (λ _A - λ _C) COS φ		+4.27		LAPLACE CORRECTION (λ _A - λ _C) SIN φ _C		+2.76			
LAPLACE AZIMUTH (α _C)		247 ° 31' 52.60		φ _C = α _C LAPLACE CORR N LATITUDES & W LONGITUDES POSITIVE					
COMPILED BY:		DATE	CHECKED BY:	DATE	REVISED BY:	DATE			
DSP		FEB 75	CSH	FEB 75	DSP	JUN 75			

PROJECT YPG		ASTRONOMIC RESULTS			
LOCATION ARIZONA		STATION			
AZIMUTH MARK PGT 3 AMS 1960		IR 22 DMATC 1974			
ELEVATION	549.60 m	SOURCE	DMATC	ELEVATION	328.51 m
		SOURCE		DMATC	
		LATITUDE		LONGITUDE	
		AZIMUTH (from SOUTH NORTH)			
MEAN OBSERVED VALUE					230 41 56.84
REDUCTION TO SEA LEVEL	S	0.05		-	0.04
REDUCTION TO POLE	S	0.26	E	0.05	+ 0.12
DIURNAL ABERRATION					+ 0.32
ECCENTRIC REDUCTION		0.00		0.00	0.00
ASTRONOMIC RESULTS	N 33 02 24.51	W 114 32 47.10			230 41 57.24
STD DEVIATION, RESULT UNIT	± .13 , ± .27	± .12 , ± .20			± .38 , ± 1.53
OBSERVATIONS ACCEPTED	4 GROUPS	3 SETS			16 POSITIONS
OBSERVATIONS REJECTED	0 GROUPS	0 SETS			0 POSITIONS
METHOD OF DETERMINATION	STERNECK	MERIDIAN TRANSIT			DIRECTION
OBSERVER	R. COURBIS	R. COURBIS			J. WHITE
ORGANIZATION	DMATC	DMATC			DMATC
INSTRUMENT	T-4 86967	T-4 86967			T-3 41307
CHRONOMETER	DATAMETRICS 227	DATAMETRICS 227			2E-11830
DATES OBSERVED (LOCAL)	12 DEC 74	12 DEC 74			6 FEB 75
MEAN GREENWICH CIVIL DATE	13.08 DEC 74	13.14 DEC 74			7.08 FEB 75
COMPUTER AND ORGANIZATION	CSH DMATC	CSH DMATC			DSP DMATC
CHECKER AND ORGANIZATION	DSP DMATC	DSP DMATC			CSH DMATC
DATE COMPUTED	DEC 74	DEC 74	DEC 74	DEC 74	MAR 75
DATE CHECKED	DEC 74	DEC 74	DEC 74	DEC 74	MAR 75
INST SUPPORT (PIER, TRIPOD ETC)	TRIPOD	TRIPOD			TRIPOD
TIME AND POLAR MOTION DATA			SKETCH OF GEODETIC CONNECTION		
SOURCE OF PRECISE TIME(S):		WWV			
SOURCE OF CORRECTION TO TIME (UTI):		BIH CIRC. NO. D99			
UTI CORRECTION(S) TO SIGNAL:		-0 ^s 244			
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D99			
PROPAGATION DELAY:		APPLIED			
NO ECCENTRICITY					
INSTRUMENT CONSTANTS					
DESCRIPTION	VIAL NO.	VALUE	DATE		
HORREBOW LEVEL (UPPER)	50	1.142	MAR 74		
HORREBOW LEVEL (LOWER)					
HANGING LEVEL	749	1.212	MAR 74		
VERTICAL CIRCLE LEVEL					
AZIMUTH CROSS LEVEL					
(R 200) (M ± S)		.0397	FEB 74		
DEFLECTION DATA					
GEODETIC LATITUDE	GEODETIC LONGITUDE	DATUM	ORDER	GEODETIC POSITION BY:	
N 33° 02' 28.77"	W 114° 32' 43.74"	1927 NAD	1st	DMATC	
DEFLECTION IN MERIDIAN ($\phi_s - \phi_o$)				DIFFERENCE IN LONGITUDE ($\lambda_s - \lambda_o$)	+3.36
PRIME VERTICAL DEFLECTION ($\lambda_s - \lambda_o$) COS ϕ				LAPLACE CORRECTION ($\lambda_s - \lambda_o$) SIN ϕ_o	+1.83
LAPLACE AZIMUTH (α_o)	230° 41' 59.07"			$\alpha_s = \alpha_o \mp$ LAPLACE CORR N LATITUDES & W LONGITUDES POSITIVE	
COMPILED BY:	DATE	CHECKED BY:	DATE	REVISED BY:	DATE
DSP	FEB 75	CSH	FEB 75	DSP	JUN 75

PROJECT		YPG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA		STATION			
AZIMUTH MARK		SITE 8 DISC YPG, DMATC 1974		IR 23 DMATC 74			
ELEVATION		229.16 m	SOURCE DMATC	ELEVATION	279.04 m	SOURCE DMATC	
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH NORTH)	
		°	'	°	'	°	'
MEAN OBSERVED VALUE						359	52 12.56
REDUCTION TO SEA LEVEL		S	0.04				0.00
REDUCTION TO POLE		S	0.26	E	0.05	+	0.10
DIURNAL ABERRATION						+	0.32
ECCENTRIC REDUCTION			0.00		0.00		0.00
ASTRONOMIC RESULTS		N	33 07 08.72	W	114 21 28.81		359 52 12.98
STD DEVIATION, RESULT UNIT		±	.13, ± .25	±	.18, ± .32	±	.25, ± 1.00
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		16 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		0 POSITIONS	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		J. AUSTIN		J. AUSTIN		C. TAYLOR	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 52891	
CHRONOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11991	
DATES OBSERVED (LOCAL)		13 DEC 74		13 DEC 74		1 FEB 75	
MEAN GREENWICH CIVIL DATE		14.08 DEC 74		14.12 DEC 74		2.09 FEB 75	
COMPUTER AND ORGANIZATION		CSH DMATC		CSH DMATC		DSP DMATC	
CHECKER AND ORGANIZATION		DSP DMATC		DSP DMATC		CSH DMATC	
DATE COMPUTED	DATE CHECKED	DEC 74	DEC 74	DEC 74	DEC 74	MAR 75	MAR 75
INST SUPPORT (PIER, TRIPOD ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S):		WWV		NO ECCENTRICITY			
SOURCE OF CORRECTION TO TIME (UTI):		BIH CIRC. NO. D99					
UTI CORRECTION(S) TO SIGNAL:		-0 ^s .246					
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D99					
PROPAGATION DELAY:		APPLIED					
INSTRUMENT CONSTANTS							
DESCRIPTION	VIAL NO.	VALUE	DATE				
HORREBOW LEVEL (UPPER)	50	1.142	MAR 74				
HORREBOW LEVEL (LOWER)							
HANGING LEVEL	749	1.212	MAR 74				
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
(R 200) (M + S)		.0397	FEB 74				
DEFLECTION DATA							
GEODETIC LATITUDE		GEODETIC LONGITUDE		DATUM		ORDER	
N 33° 07' 12" 54		W 114° 21' 20" 52		1927 NAD		1st DMATC	
DEFLECTION IN MERIDIAN ($\phi_A - \phi_G$)		-3.82		DIFFERENCE IN LONGITUDE ($\lambda_A - \lambda_G$)		+8.29	
PRIME VERTICAL DEFLECTION ($\lambda_A - \lambda_G$) COS ϕ		+6.94		LAPLACE CORRECTION ($\lambda_A - \lambda_G$) SIN ϕ_G		+4.53	
LAPLACE AZIMUTH (α_G)		359° 52' 17" 51		$\alpha_G = \alpha +$ LAPLACE CORR		N LATITUDES & W LONGITUDES POSITIVE	
COMPILED BY:	DATE	CHECKED BY:	DATE	REVISED BY:	DATE		
DSP	FEB 75	CSH	FEB 75	DSP	JUN 75		

PROJECT		YFG		ASTRONOMIC RESULTS			
LOCATION		ARIZONA					
AZIMUTH MARK		SITE 12 DISC YFG, DMATC 1971		STATION		IR 24, DMATC 74	
ELEVATION	107.80m	SOURCE	DMATC	ELEVATION	201.35m	SOURCE	DMATC
		LATITUDE		LONGITUDE		AZIMUTH (from SOUTH NORTH)	
		° ' "		° ' "		° ' "	
MEAN OBSERVED VALUE						126 37 23.20	
REDUCTION TO SEA LEVEL		S	0.03			- 0.01	
REDUCTION TO POLE		S	0.27	E	0.05	+ 0.10	
DIURNAL ABERRATION						+ 0.32	
ECCENTRIC REDUCTION		0.00		W	0.21	0.00	
ASTRONOMIC RESULTS		N 32 57 47.68		W 114 21 34.88		126 37 23.62	
STD. DEVIATION, RESULT, UNIT		± .13	, ± .26	± .13	, ± .23	± .27	, ± 1.06
OBSERVATIONS ACCEPTED		4 GROUPS		3 SETS		15 POSITIONS	
OBSERVATIONS REJECTED		0 GROUPS		0 SETS		1 POSITION	
METHOD OF DETERMINATION		STERNECK		MERIDIAN TRANSIT		DIRECTION	
OBSERVER		R. COURBIS		R. COURBIS		K. ZELLERS	
ORGANIZATION		DMATC		DMATC		DMATC	
INSTRUMENT		T-4 86967		T-4 86967		T-3 41307	
CHROMOMETER		DATAMETRICS 227		DATAMETRICS 227		2E-11830	
DATES OBSERVED (LOCAL)		14 DEC 74		14 DEC 74		31 JAN 75	
MEAN GREENWICH CIVIL DATE		15.06 DEC 74		15.12 DEC 74		1.07 FEB 75	
COMPUTER AND ORGANIZATION		DSP DMATC		DSP DMATC		DSP DMATC	
CHECKER AND ORGANIZATION		CSH DMATC		CSH DMATC		CSH DMATC	
DATE COMPUTED	DATE CHECKED	DEC 74	DEC 74	DEC 74	DEC 74	MAR 75	MAR 75
INST. SUPPORT (PIER, TRIPOD, ETC)		TRIPOD		TRIPOD		TRIPOD	
TIME AND POLAR MOTION DATA				SKETCH OF GEODETIC CONNECTION			
SOURCE OF PRECISE TIME(S):		WWV					
SOURCE OF CORRECTION TO TIME (UTI):		BIH CIRC. NO. D99					
CORRECTION(S) TO SIGNAL:		-0 ^s .219					
SOURCE OF POLAR COORDINATES:		BIH CIRC. NO. D99					
PROPAGATION DELAY:		APPLIED					
INSTRUMENT CONSTANTS							
DESCRIPTION	VIAL NO.	VALUE	DATE				
HORREBOW LEVEL (UPPER)	50	1.142	MAR 74				
HORREBOW LEVEL (LOWER)							
HANGING LEVEL	749	1.212	MAR 74				
VERTICAL CIRCLE LEVEL							
AZIMUTH CROSS LEVEL							
(R/200) (M.F.S)		.0397	FEB 74				
DEFLECTION DATA							
GEODETIC LATITUDE		GEODETIC LONGITUDE		DATUM	ORDER	GEODETIC POSITION BY:	
N 32° 57' 50.46		W 114° 21' 24.79		1927 NAD	1st	DMATC	
DEFLECTION IN MERIDIAN (α - α ₀)		-2.78		DIFFERENCE IN LONGITUDE (λ _a - λ ₀)		+10.09	
PRIME VERTICAL DEFLECTION (λ _a - λ ₀) COS α		+8.47		LAPLACE CORRECTION (λ _a - λ ₀) SIN α _c		+5.49	
LAPLACE AZIMUTH (α _c)		126° 37' 29.41		α ₀ = α ₁ LAPLACE CORR		N LATITUDES & W LONGITUDES POSITIVE	
COMPILED BY:	DATE	CHECKED BY:	DATE	REVISED BY:	DATE		
DSP	DEC 74	CSH	DEC 74	DSP	JUN 75		

DESCRIPTION OF BENCH MARKS

Level Line "A" - Yuma County, Arizona

1113+72.08 AHD 1957 - Located in the southeast corner of the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk set in the top of a concrete mass that is flush with the surface of the ground. It is stamped: "1113+72.08 1957 304.09". It is located 100 feet east of the centerline of highway 95, 5.0 feet east of telephone pole No. W-M B-1 1458 and 2.0 feet south-east of an AHD R/W post.

1130+61.77 AHD 1957 - 0.35 mile north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1130-61.77 1957" and set in the top of a round concrete post, 12-inches in diameter that projects 0.3 foot above ground. It is located 100 feet west of the centerline of the highway, 71.5 feet south of telephone pole No. W-M B-1 1337 and 2.0 feet south of an AHD R/W post.

1144+45.07 AHD 1957 - 0.6 mile north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1144-45.07 1957 321.73" and set in the top of a round concrete post, 12-inches in diameter that projects 0.2 foot above ground. It is located 100 feet east of the centerline of highway 95 and 1.9 feet south of an AHD R/W post.

1160+00.00 AHD 1957 - 0.9 mile north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1160+00.00 1957 336.88" and set in the top of a concrete post 12-inches in diameter that is flush with the ground. It is located 100 feet east of the centerline of highway 95 and 2.3 feet south of an AHD R/W post.

1175+00.0 AHD 1957 - 1.2 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1175+00.0 1957 339.69" and set in the top of a round concrete post, 12-inches in diameter that projects 0.1 foot above ground. It is located 100 feet east of the centerline of highway 95 and 2.0 feet south of an AHD R/W post.

1190+00 AHD 1957 - 1.5 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1190+00 1957 351.29" and set in the top of a round concrete post, 12-inches in diameter that projects 0.3 foot above ground. It is located 100 feet east of the centerline of highway 95 and 2.0 feet south of an AHD R/W post.

COUNTY WELL AZIMUTH MARK - 1.7 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is a standard USC&GS azimuth disk stamped: "COUNTY WELL 1949" and set in the top of a concrete post, 12-inches square that projects 0.3 foot above ground. It is located 70 feet west of the centerline of highway 95 and 19.0 feet east of a power pole.

1235+00.0 AHD 1957 - 2.4 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1235+00.00 1957" and set in the top of a round concrete post, 12-inches in diameter that projects 0.2 foot above ground. It is located 100 feet west of the centerline of highway 95 and 1.8 feet south of an AHD R/W post.

COUNTY WELL 2 - 2.7 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is a standard USC&GS triangulation station disk stamped: "COUNTY WELL 2 1957" and set in the top of a concrete post, 15-inches square that projects 0.2 foot above ground. It is located on the top of a small ridge above 500 feet north-northeast of the junction of highway 95 and the Martinez Lake Road. Also, it is 66 feet east of the centerline of highway 95 and about 180 feet south of a large wash.

1282+75.29 AHD 1957 - 3.3 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1282+75.29 388.52" and set in the top of a round concrete post, 6-inches in diameter that projects 0.3 foot above ground. It is located 100 feet east of the centerline of highway 95, 30 feet south of the centerline of Aberdeen Road and 4.3 feet north of an AHD R/W post.

BM 1A - 3.6 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is a Defense Mapping Agency disk stamped: "BM 1A 1974 TOPO CENTER" and set in the top of a round concrete post, 12-inches in diameter that projects 0.3 foot above ground. It is located 87 feet west of the centerline of highway 95 and 2.8 feet west of a metal witness post.

1380+00 AHD - 5.3 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1380+00 475.35" and set in the top of a round concrete post, 6-inches in diameter that projects 0.7 foot above ground. It is located 100 feet west of the centerline of highway 95 and 2.7 feet south of an AHD R/W disk.

1460+00 AHD - 6.8 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1460+00 544.27" and set in the top of a round concrete post, 6-inches in diameter that projects 0.7 foot above the ground. It is located 100 feet west of the centerline of highway 95, 375 feet north of a high pressure gas line junction point and 3.6 feet south of an AHD R/W post.

BM 3A - 7.6 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is a Defense Mapping Agency disk stamped: "BM 3A 1974 TOPO CENTER" and set in a round concrete post, 12-inches in diameter that projects 0.2 foot above ground. It is located 104 feet east of the centerline of highway 95, 5.1 feet south of an AHD R/W post and 3.5 feet west of a witness post.

1628+24.93 AHD - 9.4 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground. The mark is an Arizona Highway Department (AHD) disk stamped: "1628+24.93 678.62" and set in the top of a round concrete post, 6-inches in diameter that projects 0.3 foot above ground. It is located 100 feet west of the centerline of highway 95 and about 37 feet east of the centerline of a drain.

BM 4A - 10.4 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is a Defense Mapping Agency disk stamped: "BM 4A 1974 TOPO CENTER" and set in the top of a round concrete post, 12-inches diameter that projects 0.2 foot above the ground. It is located about 250 feet north of the apex formed by the junction of highway 95 and Castle Dome Road to the East. Also, it is 56 feet east of the centerline of highway 95, 57 feet northwest of the centerline of Castle Dome Road and 4.0 feet north of a metal witness post.

TBM 235 - 11.6 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is a chiseled square on the southeast corner of a 3-foot X 6-foot concrete slab. It is 106 feet west of the centerline of highway 95 and 41.1 feet southwest of the northwest corner of a shelter in the rest area.

BM 5A - 12.8 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is a Defense Mapping Agency disk stamped: "BM 5A 1974 TOPO CENTER" and set in the top of a round concrete post, 12-inches in diameter that projects 0.3 foot above ground. It is located 132 feet south-southwest of the intersecting centerlines of U.S. Highway 95 and a road to the east, 84 feet west of the centerline of highway 95 and 2.9 feet west of a witness post.

1839 USCE 1968 - 14.6 miles north on U.S. Highway 95 from the intersection of highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground. The mark is a Corps of Engineers, Los Angeles District Cap stamped: "1893 1969" and riveted to the top of a steel Re-Bar that projects 0.5 feet above ground. It is located about 300 feet east of the highway, 250 feet east of power line pole, 59 feet west of a dirt road and 5 feet west of a metal witness post.

TR 28 USGS 1934 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 14.6 miles to a power line crossing and road to the north; thence north on power line road for 0.9 mile to the mark on the right. It is a standard USGS disk stamped: "TR 28 877 1934" and set in the top of a concrete post, 8-inches square that projects 0.5 foot above ground. It is located 44.0 feet east of the centerline of road, 17.0 feet southwest of power line pole and 5.0 feet north of a witness post.

TBM 275 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 14.6 miles to a power line crossing and road to the north; thence north on power line road for 1.0 mile to a dim road fork; thence left on dim track and continue north for 0.3 mile to mark on the right. The mark is chiseled square in the top of a large boulder that projects 0.3 foot above ground. It is located 34 feet east of the centerline of a track road, 14 feet west of the centerline of a dirt road and 2.3 feet east of a witness post.

TR 27 USGS 1934 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 17.6 miles to mile post 62 and a road to the right; thence turn right and go east for 0.25 mile to a crossroad; thence turn right and go south for 0.2 mile to the mark on the left. The mark is a standard USGS BM disk stamped: "TR 27 924 1934" and set in the top of a concrete post, 8-inches square that projects 0.3 foot above ground. It is located 165 feet east of road and 3.3 feet east of a witness post.

TBM 288 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on Highway 95 for 19.1 miles to the mark on the right. The mark is a chiseled square on the top, at the east end of a steel culvert. It is 38.8 feet east of the centerline of highway 95.

TBM 1018 USGS 1934 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 20.4 miles to the mark on the west side of road on the top of a cut. The mark is a chiseled square on the northeast end of a large flat rock. It is located 140 feet west of the centerline of highway 95, 240 feet southwest of the intersecting centerlines of the highway and a road to the west-northwest and 38.1 feet southeast of an AHD R/W witness post.

HILLTOP USC&GS 1949 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 20.4 miles to a road intersecting from the west; thence left, west and north for 0.15 mile to a crossroad; thence left and go west for 0.2 mile to a track road to the left; thence left upgrade to the top of a small hill and the station at the west end of a cleared area. The mark is a standard USC&GS triangulation station disk stamped: "HILLTOP 1949" and cemented in a drill hole in a large flat boulder.

HILLTOP REFERENCE MARK NO. 1 - Located 7.910 meters (25.95 feet) north-northeast of Triangulation Station HILLTOP. It is a standard USC&GS reference mark stamped: "HILLTOP NO. 1 1949" and cemented in a drill hole in a boulder.

HILLTOP REFERENCE MARK NO. 2 - Located 11.645 meters (38.21 feet) northwest of Triangulation Station HILLTOP. It is a standard USC&GS reference mark stamped: "HILLTOP NO. 2 1949" and cemented in a drill hole in a boulder.

TR 25 USGS 1934 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 20.4 miles to road intersecting from the west; thence left going west and north for 0.15 mile to a crossroad; thence continue straight ahead going north for 0.65 mile to the mark on the left. The mark is a standard USGS BM disk stamped: "TR 25 980 1934" and set in the top of a concrete post, 8-inches square that projects 0.4 foot above ground. It is located 87 feet west of the centerline of road and 4.9 feet southwest of a 4" X 4" wooden witness post.

TBM 301 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 20.4 miles to intersection with road from the west; thence left going west and north for 0.15 mile to a crossroad; thence to straight ahead, continuing north for 1.2 miles to the mark on the left side of the road. The mark is a chiseled square in the top of a large boulder that projects 0.1 foot above ground. It is located 45 feet west of the centerline of north-south road, 25 feet south of the centerline of a dim track road to the west and 2.3 feet west of a witness post.

BM 6A - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 20.4 miles to a road intersecting from the west; thence left, going west and north for 0.15 miles to a crossroad; thence straight ahead, continuing north for 1.2 miles to a dim track road to the left; thence left, going west on track road for 1.2 miles to the mark on the right. The mark is a Defense Mapping Agency disk stamped: "BM 6A 1974 TOPO CENTER" and set in the top of a round concrete post, 12-inches in diameter that projects 0.3 foot above ground. It is located 30 feet north on the track road and 4.0 feet east of a metal fence post.

IR 23 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 16.5 miles to YPG BM 966 on the right and a dim trail road to the left; thence left on dim trail and go south-southwest along ridge for 0.8 mile to the mark. The mark is a Defense Mapping Agency disk stamped: "IR 23 1974 TOPO CENTER" and set in the top of a round concrete post, 12-inches in diameter that is flush with the ground.

IR 23 REFERENCE MARK NO. 1 - Located 24.09 meters (79.04 feet) northeast of the station mark. It is a Defense Mapping Agency disk stamped: "IR 23 RM 1 1974 TOPO CENTER" and set in the top of a concrete post, 12-inches square that is flush with the ground.

IR 23 REFERENCE MARK NO. 2 - Located 19.25 meters (63.16 feet) northwest of the station mark. It is a Defense Mapping Agency disk stamped: "IR 23 RM 2 1974 TOPO CENTER" and set in the top of a concrete post, 12-inches square that is flush with the ground.

SITE 9 DISC - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 16.7 miles to an astro dome and mark. The mark is a YPG Survey disk stamped: "SITE 9 DISC" and cemented in a drill hole at the west corner of a concrete pad which is southeast of the astro dome.

BM 966 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 16.5 miles to the mark on the right. The mark is a YPG Survey disk stamped: "BM 966" and set in the top of a concrete post, 5-inches square that projects 0.2 feet above ground. It is located 15 feet north of the centerline of the road.

TBM 264 - From the intersection of U. S. Highway 95 and the main entrance road to the U.S Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 16.2 miles to the mark on the right. The mark is a chiseled circle on the apex of a large boulder. It is located 38 feet east of the road, 3 feet east of a rock cairn and 2.5 feet west of a witness post.

TR 40 USGS 1934 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 14.6 miles to a dim jeep trail on the right; thence right on dim trail and go northeast for 0.85 mile to the mark on the right. The mark is a standard USGS BM disk stamped: "TR 40 1934" and set in the top of a concrete post, 8-inches square that projects 0.5 foot above ground. It is located 73 feet east of a jeep trail and 3.5 feet east of a rock cairn.

BM 7A - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 14.2 miles to the mark on the left. The mark is a Defense Mapping Agency disk stamped: "BM 7A 1974 TOPO CENTER" and set in the top of a round concrete post, 12-inches in diameter that projects 0.3 foot above ground. It is located 30 feet west of the centerline of the road, 4.3 feet west of power pole No. 2206 and 2.4 feet east of a witness post.

BM 239 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 13.8 miles to the mark on the right. The mark is a YPG Survey disk stamped: "BM 239" and set in the top of a concrete post, 5-inches square that projects 0.3 foot above ground. It is located 215 feet east of the centerline of the road and 3.0 feet south of a witness post.

TBM 225 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 12.9 miles to the mark on the left. The mark is a chiseled circle on the top of a large boulder that projects 0.2 foot above ground. It is located 38 feet west of the centerline of road, 12.0 feet south-east of a power pole and 2.7 feet west of a witness post.

SITE 8 DISC YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 12.3 miles to a road intersecting from the east; thence right, going east up-grade for 0.15 mile to the top of small hill and an astro dome. The mark is a Yuma Proving Ground Geodetic Control Survey disk stamped: "SITE 8 DISC" and cemented in a drill hole in the west corner of the northern most concrete pad.

BM 8A DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 10.9 miles to the mark on the left. The mark is a Defense Mapping Agency disk stamped: "BM 8A 1974 TOPO CENTER" and set in the top of a round concrete post, 12-inches in diameter that projects 0.5 foot above ground. It is located 32 feet west of the road, 4.3 feet west of a power pole and 3.0 feet east of a witness post.

OP MID YPG - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 10.6 miles to a track road intersecting from the east; thence right on track road, going east for 0.1 to top of small hill and the mark. The mark is a YPG Survey disk stamped: "OP MID" and set in the center of a shell casing which is flush with the ground. It is located 5 feet south-southeast of track road and 4.3 feet north of witness post.

TBM 189 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 9.7 miles to the mark on left. The mark is a chiseled circle on the top of a large boulder that projects 0.2 foot above ground. It is located 34 feet west of the centerline of road, 75 feet north of the centerline of a track road, 7.0 feet west of a power pole and 3.2 feet east of a witness post.

OP MOUNT YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 9.4 miles to a road intersecting from the west; thence left, going west uphill for about 0.05 mile to top of small hill and the mark. The mark is a YPG Survey disk stamped: "OP MOUNT" and set in the center of a shell casing which is flush with the surface of the ground. It is located 5.3 feet north-northwest of a witness post.

SITE 7 DISC YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 8.4 miles to an astro dome on the left and an access road to the west; thence left, west on access road for 0.1 mile to the astro dome. The mark is a YPG Survey disk stamped: "SITE 7 DISC" and cemented in a drill hole in the northwest corner of the astro dome's concrete pad. The mark is on the center one of three concrete pads.

SITE 7 MON YPG 1968 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 8.4 miles to the mark on the left. The mark is a YPG Survey disk stamped: "SITE 7 1968" and set in the top of a concrete post, 5-inches square that projects 0.3 foot above ground. The mark is 64 feet west of the centerline of the road.

GEOCEIVER STATION 10010 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 8.4 miles to the mark on the right, east side of the road. The mark is a Defense Mapping Agency disk stamped: "10010 TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter that projects 0.1 foot above ground. It is located on a small top 5.58 feet north on the north edge of a concrete slab and 6.56 feet northeast of the northwest corner of the slab.

BM 618 YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 7.9 miles to the mark on the right. The mark is a YPG Survey disk stamped: "BM 618" and set in the top of a concrete post, 5-inches square that projects 0.5 foot above ground. It is located 126 feet east of the centerline of road and 2.0 feet south of a witness post.

BM 9A DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 7.7 miles to the mark on the left. The mark is a Defense Mapping Agency disk stamped: "BM 9A 1974 TOPO CENTER" and cemented in a drill hole in the southwest corner of the entrance walk to a quonset hut. It is 50 feet west of the centerline of the road.

BM 561 YPG - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 7.1 miles to mark on the right. The mark is a YPG Survey disk stamped: "BM 561" and set in the top of a concrete post, 5-inches square that projects 0.2 foot above ground. It is located 25 feet east of the centerline of the road and 4.2 feet south of a witness post.

BM 563 YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 6.6 miles to the mark on the right. The mark is a YPG Survey disk stamped: "BM 563" and set in the top of a concrete post, 5-inches square that projects 0.3 foot above ground. It is located 25 feet east of the centerline of the road and 2.8 feet west of a witness post.

BM 20 M USGS 1925 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 5.8 miles to the mark on the right. The mark is a standard USGS Bench Mark disk stamped: "20 M 1925 570" and riveted to the top of an iron pipe, 2-inches in diameter that projects 1.1 feet above ground. It is located 14 feet east of the centerline of the road, 28 feet north of a trail road and 4.3 feet west of a witness post.

BM 587 YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 4.8 miles to the mark on the right. The mark is a YPG Survey disk stamped: "BM 587" and set in the top of a concrete post, 5-inches square that projects 0.2 foot above ground. It is located 51 feet east of the centerline of road and 3.4 feet west of a witness post.

IR 24 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 4.1 miles to a dim trail right; turn right on dim trail and go east for 0.1 mile to a cone shaped hill and end of truck travel. Pack uphill to the highest point and station site. The mark is Defense Mapping Agency disk stamped: "IR 24 TOPO CENTER 1974" set in the top of a round concrete mass, 2.5 feet in diameter that is flush with the ground.

IR 24 REFERENCE MARK NO. 1 - Located 5.08 meters (16.67 feet) southwest of the station mark. It is a Defense Mapping Agency disk stamped: "IR 24 RM 1 TOPO CENTER 1974" and set in the top of a mass of concrete that is flush with the ground.

IR 24 REFERENCE MARK NO. 2 - Located 5.51 meters (18.08 feet) southeast of the station mark. It is a Defense Mapping Agency disk stamped: "IR 24 RM 2 TOPO CENTER 1974" and set in the top of a mass of concrete that is flush with the ground.

SITE 6 DISC, YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road going west and north for 3.7 miles to a road intersecting from the right; turn right and go east upgrade for 0.3 mile to the astro dome and mark. The mark is a YPG Survey disk stamped: "SITE 6 DISC" cemented in a drill hole in the southwest corner of the concrete pad supporting the astro dome.

BM 560 YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road going west and north for 3.7 miles to the mark on the right. The mark is a YPG Survey disk stamped: "BM 560" and set in the top of a concrete post, 5-inches square that projects 0.3 foot above ground. The mark is located 4.0 feet west of a witness post, 31 feet east of the centerline of Middle Mtn. Road and 149 feet north of the centerline of road leading to Site 6.

BM 10A DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road going west and north for 2.8 miles to the mark on the left. The mark is a Defense Mapping Agency disk stamped: "BM 10A TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter that projects 0.4 foot above ground. It is located 52 feet west of the centerline of Middle Mtn. Road, and 3.5 feet south of a power pole with a telephone box.

SITE 3 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road going west and north for 1.6 miles to a road intersecting from the left; thence left southwest going upgrade for 0.4 mile to top of hill and mark at the north side of a concrete pad for an astro dome. The mark is a Defense Mapping Agency disk set in the top of a concrete post, 12-inches square that is flush with the ground. It is located 28.28 feet north of a cup tack set in a lead plug at the center of the concrete pad. (No information on stamping of mark.)

TBM 190 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road, going west and north for 1.5 miles to the mark on the left. The mark is a chiseled circle on the top of a large boulder of outcropping rock that projects about 1.5 feet. It is located 60 feet southwest of the centerline of Middle Mtn. Road and 209 feet southeast of the centerline of road leading to site 3.

Level Line "B" - Yuma County, Arizona

BM 2 USCE 1951 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go west-northwest on Laguna Road for 1.3 miles to the mark on the left side of the road. The mark is a Corps of Engineers disk stamped: "BM 2 1951 MSL" and set in the top of a concrete post, 5-inches square that projects 0.3 foot above ground. It is located 50 feet south of the centerline of Laguna Road.

1 MON. LONG. YPG 1970 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go west-northwest on Laguna Road for 1.4 miles to Ocotillo Road intersecting from the right; turn right and go north for 0.15 mile to the mark on the right. The mark is a YPG Survey disk stamped: "1 MON. LONG. 1970" and set in the top of a concrete post, 5-inches square that projects 0.3 foot above ground. It is located 140 feet east of the centerline of Ocotillo Road and 3.0 feet east of a witness post.

BM 1B DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go west-northwest on Laguna Road for 1.4 miles to Ocotillo Road intersecting from the right; turn right and go north on Ocotillo Road for 1.2 miles to road fork and building 2502. The mark is about 150 feet north of the apex of the road fork. It is a Defense Mapping Agency disk stamped: "BM 1B TOPO CENTER 1974" and set in the top of a round concrete post, 1 1/2-inches in diameter that projects 0.4 foot above ground. It is located 148 feet north-northwest of the northwest corner of building 2502, 62 feet east of the centerline of Ocotillo Road, 60 feet west of the centerline of a dirt road and 3.8 feet east of a metal witness post.

TBM 100 - From the intersection of U.S. Highway 95 and the main entrance road to U.S. Army Yuma Proving Ground, go west-northwest on Laguna Road for 1.4 miles to the intersection with Ocotillo Road from the right; turn right on Ocotillo Road and go 1.1 miles to road fork; take left fork and go northwest for 1.1 miles to a "Y" intersection; bear left and go west for 0.3 miles to a dirt road to the right and site of mark. The mark is a circle chiseled on the top of a large boulder that projects 0.5 foot above ground. It is located 49 feet north of the centerline of paved road, 74 feet west of the centerline of dirt road and 3.0 feet west of a witness post.

SITE 1 DMATC 1974 - From the intersection of U.S Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go west-northwest on Laguna Road for 1.4 miles to Ocotillo Road intersecting from the right; turn right and go north on Ocotillo Road for 1.1 miles to road fork; take left fork and go northwest for 1.1 miles to "Y" intersection; bear left and go west for 0.3 mile to a gravel road to the right; turn right and go north, upgrade, for 1.2 miles to a switch back to the left; turn left and go up a steep grade for 0.1 mile to the top of hill and site of an abandoned camera astro dome. The mark is a Defense Mapping Agency disk stamped: "SITE 1 TOPO CENTER 1974" and cemented in a drill hole in the north corner of the concrete pad. The pad is 1.4 feet higher than ground surface.

AIR YPG 1969 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go west on Laguna Road for 1.4 miles to Ocotillo Road intersecting from the right; turn right and go north on Ocotillo Road for 1.1 miles to road fork; take left fork and go northwest for 1.1 miles to a "Y" intersection; turn right and go north for 0.3 miles to a concrete pad on the right and site of station. The mark is a YPG Survey disk stamped; "AIR 1969" and cemented in a drill hole at the northeast corner of the concrete pad. It is located 140.5 feet northwest of the northwest corner of building S 3002, 25 feet east of the centerline of paved road and 3.5 feet northeast of the center of a man-hole cover.

BM 24M USGS 1925 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to junction with Martinez Lake Road to the left; thence left on Martinez Lake Road going northwest for 2.4 miles to road fork; take right fork and go for 0.35 mile to the mark on the right. The mark is a standard USGS bench mark disk stamped: "24M 1925 424" and cemented in a drill hole in a boulder that projects 0.4 foot above ground. It is located 40 feet west of old Martinez Lake Road and 3.7 feet east of a witness post.

FLATHILL USC&GS 1934 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to a road fork; take right fork for 0.2 mile to a power line crossing; turn right going north on power line road for 1.1 miles to the station on the left. The mark is a standard USC&GS triangulation station disk stamped: "FLATHILL 1934" and set in the top of a concrete post, 12-inches square, that projects 0.2 foot above ground. It is located on the top of a small hill about 100 feet west of the powerline.

BM 2B DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to a road fork; take right fork and go north for 2.1 miles to the turn-off to Cibola Range Headquarters and site of mark. The mark is a Defense Mapping Agency disk stamped: "BM 2B TOPO CENTER 1974" and set in a drill hole in the concrete base at the southeast corner of monument to "J.G. PHILLIPS". The monument is located in the southeast corner of the intersection, 85 feet southeast of the intersecting centerline of Martinez Lake Road and the road to Cibola Range Control and 98 feet south of the centerline of the road to Cibola Range Control.

CAMERA SITE 4 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez lake Road for 2.4 miles to a road fork; take right fork and go north for 2.1 miles to the turn-off to Cibola Range Control; thence right, continuing northerly for 0.7 mile to a road on the right (Cibola Range Control is on the west side of the road), turn right and go east for 0.65 mile to camera site 4 on the left. The mark is a Defense Mapping Agency disk stamped: "CAMERA SITE 4 TOPO CENTER 1974" cemented in a drill hole at the north corner of an 18 feet X 22 feet concrete pad.

MPS 25 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road; thence left on Martinez Lake Road for 2.4 miles to a road fork; take right fork going north for 2.1 miles to the turn-off to Cibola Range Control; turn right and continue northerly for 0.7 mile to a road on the right (Cibola Range Control is on the west side of the road); turn right and go east for 0.8 mile to a road fork; take right fork and continue east for 0.9 mile to the end of road and the mark at the north side of cleared area. The mark is a Defense Mapping Agency disk stamped: "MPS 25 TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.4 foot above ground.

MPS 25 DMATC 1974, REFERENCE MARK NO. 1 - Located 36.246 meters (118.92 ft.) south of the station. It is a Defense Mapping Agency disk stamped: "MPS 25 RM NO. 1 TOPO CENTER 1974" and cemented in a drill hole in a block of concrete, 2-foot square, that is flush with the ground.

MPS 25 DMATC 1974, REFERENCE MARK NO. 2 - Located 30.021 meters (98.49 ft.) southwest of the station. It is a YPG Survey disk stamped: "MPS 25 1971" and set in the top of a concrete post, 5-inches square, that is flush with the ground.

BM 961 USCE 1968 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to a road fork; take right fork and go north for 3.8 miles to mark on the left. The mark is a Corps of Engineers cap stamped: "USCE 961 LA DIST 1968" affixed to the top of a 1 1/2 inch pipe that projects 0.3 foot above ground. It is located 74 feet west of the centerline of Martinez Lake Road and 5.2 feet west of a metal witness post.

BM 23M USGS 1925 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to road fork, take left fork and continue on Martinez Lake Road for 4.1 miles to the station on the right side of road. The mark is a USGS disk stamped: "23M 1925 412" and cemented in a drill hole in a boulder that projects 0.4 foot. It is located 470 feet east of the centerline of Martinez Lake Road and 30 feet west of the old abandoned Martinez Lake Road.

T5S R21W S33 GLO 1946 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork going north for 4.6 miles to a gravel road to the left; turn left and go west for 0.5 mile to the mark on the left. The mark is a USGLO disk stamped: "T5S R21W S33 S5 S4 T6S R21W 1946" and riveted to the top of a 1 1/2 inch pipe that projects 0.5 foot above ground. It is located 21 feet west of the centerline of gravel road and 3.0 feet east of a witness post.

SITE 2 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork and go north for 4.6 miles to a gravel road to the left; turn left and go west for 0.5 mile to a GLO mark on the left; bear to the right, upgrade, and go east for 0.2 mile to the top of hill and site of an astro dome. The mark is a Defense Mapping Agency disk stamped: "SITE 2 TOPO CENTER 1974" and cemented in a drill hole at the southeast corner of concrete pad for astro dome.

TBM 82 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork and go north for 5.9 miles to a gravel road on the right (Cibola West Access Road) and site of mark. The mark is a railroad spike in the base of a telephone pole in the northwest corner of the intersection.

BM 3B DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork and go north for 5.9 miles to a gravel road to the right (Cibola West Access Road); turn right and go northeast for 0.75 mile to the junction with Water Tank Road and site of the mark on the left. The mark is a Defense Mapping Agency disk stamped: "BM 3B TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.2 foot above ground. It is located 41 feet west of Cibola Road and 3.0 feet northwest of a witness post.

BM 4B DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork and go north for 5.9 miles to a gravel road to the right (Cibola West Access Road); turn right and go northeast for 0.75 mile to the junction with Water Tank Road; bear left and go north for 2.0 miles to the mark on the left. The mark is a Defense Mapping Agency disk stamped: "BM 4B TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.3 foot above ground. It is located 74 feet west of the centerline of road and 3.2 feet east of a witness post.

BM 5B DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork and go north for 5.9 miles to a gravel road to the right (Cibola West Access Road), turn right and go northeast for 0.75 mile to the junction with Water Tank Road; bear left and go north for 4.0 miles to the mark on the left. The mark is a Defense Mapping Agency disk stamped: "BM 5B TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.3 foot above ground. It is located 74 feet west of the centerline of road and 2.8 feet east of a witness post.

SITE 12 DISC YPG - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork and go north for 5.9 miles to a gravel road to the right (Cibola West Access Road); turn right and go northeast for 0.75 mile to the junction with Water Tank Road; bear left and go north for 4.7 miles to a crossroad (Cibola Front Road); turn left and go west for 1.4 miles to the astro dome and site of mark. The mark is a YPG survey disk stamped: "SITE 12 DISC" and cemented in a drill hole at the northeast corner of the concrete pad for the astro dome.

10011 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork and go north for 5.9 miles to a gravel road to the right (Cibola West Access Road); turn right and go northeast for 0.75 mile to the junction with Water Tank Road; bear left and go north for 4.7 miles to a crossroad (Cibola Front Road); turn left and go west for 1.4 miles to the astro dome and site 12. The mark is on the north side of a cleared area. It is a Defense Mapping Agency disk stamped: "10011 TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.3 foot above ground. It is located 77.2 feet north of the northeast corner of the concrete pad for the astro dome, 78.56 feet north of Site 12 Disc and 51.0 feet east-northeast of the east corner of a 10-foot X 12-foot concrete pad.

SITE 12 LASER YPG 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 2.7 miles to the junction with Martinez Lake Road to the left; thence left on Martinez Lake Road for 2.4 miles to fork in road; take right fork and go north for 5.9 miles to a gravel road to the right (Cibola West Access Road); turn right and go northeast for 0.75 mile to the junction with Water Tank Road; bear left and go north for 4.7 miles to crossroads (Cibola Front Road); turn left and go west for 1.3 miles to concrete pad and mark on the right. The mark is a YPG Survey disk cemented in a drill hole at the east side of the concrete pad. It is located 80 feet north of Cibola Front Road. The disk is not stamped.

TR 44 USGS 1934 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.6 miles to a road to the left (Cibola Front Road); turn left and go west for 3.9 miles to crossroads; turn right on track road and go north for 0.45 mile to mark on the left. The mark is a USGS disk stamped: "TR 44 399 1934" and set in the top of a concrete post, 6-inches square, that projects 0.5 foot above ground. It is located 68 feet west of track road, 115 feet east of a drain and 3.7 feet east of a witness post.

BM 512 YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.6 miles to a road to the left (Cibola Front Road); turn left and go west for 0.65 mile to the mark on the left. The mark is a YPG Survey disk stamped: "BM 512" and set in the top of a concrete post, 5-inches square, that projects 0.1 foot above ground. It is located 45 feet south of the centerline of road and 2.8 feet north of a witness post.

BM 541 YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.6 miles to a road to the left (Cibola Front Road); turn left and go west for 0.25 mile to the mark on the left. The mark is a YPG Survey disk stamped: "BM 541" and set in the top of a concrete post, 5-inches square, that projects 0.2 foot above ground. It is located 38 feet south of the centerline of road and 3.5 feet east of a witness post.

SITE 11 DISC YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.5 miles to a road to the left (Cibola Front Road); turn left and go west for 3.1 miles to a gravel road to the left; turn left and go south for 0.35 mile to the astro dome and site of the mark. The mark is a YPG Survey disk stamped: "SITE 11 DISC" and cemented in a drill hole at the northwest corner of the concrete pad for the astro dome.

IR 21 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.6 miles to a road to the left (Cibola Front Road); turn left and go west for 3.5 miles to the mark on the right. The mark is a Defense Mapping Agency disk stamped: "IR 21 TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.1 foot above ground. It is located 150 feet north of the centerline of road and 4.0 feet west of a witness post.

IR 21 DMATC 1974 REFERENCE MARK NO. 1 - Is located 21.422 meters (70.28 ft.) northeast of the station. It is a Defense Mapping Agency disk stamped: "IR 21 RM NO. 1 TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.2 foot above ground.

IR 21 DMATC 1974 REFERENCE MARK NO. 2 - Is located 22.903 meters (75.14 ft.) southeast of the station. It is a Defense Mapping Agency disk stamped: "IR 21 RM NO. 2 TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter that, projects 0.3 foot above ground.

BM 485 YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.6 miles to a road to the left (Cibola Front Road); turn left and go west for 1.5 miles to the mark on the left. The mark is a YPG Survey disk stamped: "BM 485" and set in the top of a concrete post, 5-inches square, that projects 0.3 foot above ground. It is located 40 feet south of the centerline of road and 4.0 feet south of a witness post.

IRCC DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.6 miles to a road to the left (Cibola Front Road); turn left and go west for 1.4 miles to Cheyenne Base Road to the right. The mark is located 176 feet south of the centerline of Cibola Front Road and 120 feet west of the extended centerline of Cheyenne Base Road. The mark is a Defense Mapping Agency disk stamped: "IRCC TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.2 foot above ground.

IRCC DMATC 1974 REFERENCE MARK NO. 1 - Located 24.154 meters (79.25 ft.) west of the station. It is a Defense Mapping Agency disk stamped: "IRCC RM NO. 1 TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.2 foot above ground.

IRCC DMATC 1974 REFERENCE MARK NO. 2 - Located 13.607 meters (44.64 ft.) north of the station. It is a Defense Mapping Agency disk stamped: "IRCC RM NO. 2 TOPO CENTER 1974" and set in the top of a round concrete post, 12-inches in diameter, that projects 0.3 foot above the ground.

S2 MET YPG 1971 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.6 miles to a road to the left (Cibola Front Road); turn left and go west for 1.4 miles to Cheyenne Base Road to the right and site of mark. The mark is a YPG Survey disk stamped: "S2 MET 1971" and cemented in a drill hole in the center of a 5 foot square concrete pad. It is located 88 feet north of the centerline of Cibola Road, 29 feet east of the centerline of Cheyenne Base Road and 5.5 feet east of a witness post.

SITE 10 DISC YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 7.4 miles to the junction with Middle Mtn. Road to the left; thence left on Middle Mtn. Road for 7.6 miles to a road to the left (Cibola Front Road); turn left and go west for 1.4 miles to Cheyenne Base Road to the right; turn right and go north for 0.7 mile to a road to the left (Moving Target Road); turn left and go west for 0.65 mile to the astro dome and site of mark. The mark is a YPG Survey disk stamped: "SITE 10 DISC" and cemented in a drill hole at the southwest corner of the concrete pad for the astro dome.

SPUR LINE

1282+75.29 AHD - To reach from the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right (Entrance road to Kofa Firing Range) and the site of the mark. The mark is an AHD disk stamped: "1282+75.29 389 OE" and set in the top of a round concrete post, 6-inches in diameter, that projects 0.4 foot above ground. It is located 100 feet west of the centerline of the highway and 3.3 feet south of an AHD R/W marker.

TBM 124 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right and go east for 1.1 miles to crossroads; continue straight ahead, east for about 200 feet to the mark on the right. The mark is a chiseled square on the south end of a concrete headwall. It is located 64 feet south of the centerline of Aberdeen Road, 217 feet east of the centerline of W. 3rd Avenue and 43.3 feet northwest of the southwest corner of building No. S3519.

TBM 143 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right on Aberdeen Road and go east for 1.1 miles to crossroads; turn left and go north on W. 3rd. Avenue for 1.4 miles to building 3534 and the mark on the right. The mark is the eastern most bolt of three bolts set in a concrete pad on the east side of building 3534. The bolt is located 37 feet north of the centerline of 11th St., 6.65 feet east-northeast of the southeast corner of building 3534 and 2.5 feet west of the edge of the concrete pad.

BM 2A DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right on Aberdeen Road and go east for 1.1 miles to crossroads; turn left and go north on W. 3rd Avenue for 2.5 miles to 15th Street and site of mark. The mark is a Defense Mapping Agency disk stamped: "BM 2A TOPO CENTER 1974" and set in the top of a round concrete post, 10-inches in diameter that projects 0.2 foot above ground. It is located 63 feet east of the centerline of W. 3rd. Avenue, 48 feet south of the centerline of 15th Street and 22.0 feet southeast of a pole with telephone box.

BM 174 YPG - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right on Aberdeen Road and go east for 1.1 miles to crossroads; turn left and go north on W. 3rd Avenue for 3.2 miles to the mark on the right. The mark is a YPG Survey disk set in the top of a concrete post 5-inches square that projects 0.3 foot above ground. It is located about 300 feet west of the centerline of W. 3rd Avenue. Note: The mark is not stamped.

TBM 186 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right on Aberdeen Road and go east for 1.1 miles to the crossroads; turn left and go north on W. 3rd Avenue for 4.4 miles to the mark on the right. The mark is the south corner of a 3 1/2 feet X 4 1/2 feet concrete valve box for a water main. It is located 78 feet east of the centerline of W. 3rd Avenue.

SITE 5 YPG 1969 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right on Aberdeen Road and go east for 1.1 miles to crossroads; turn left and go north on W. 3rd Avenue for 4.5 miles to a sharp curve and a gravel road to the left; turn left and go west and north, upgrade, for 0.4 mile to fork in road; take left fork and go southwest for 0.15 mile to the astro dome and site of mark. The mark is a YPG Survey disk stamped: "SITE 5 1969" and cemented in a drill hole at the southeast corner of concrete pad for the astro dome.

PGT NO. 2 AMS 1960 - From the intersection of U.S. Highway 95 and the main entrance road to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right on Aberdeen Road and go east for 1.1 miles to crossroads; turn left and go north on W. 3rd Avenue for 4.5 miles to a sharp curve and a gravel road to the left; turn left and go west and north, upgrade for 0.4 mile to fork in road; take left fork and go southwest for 0.15 mile to the astro dome and parking area. The mark is on the highest part of hill north of astro dome. It is a Corps of Engineers U.S. Army disk stamped: "PGT NO. 2 ARMY MAP SERVICE 1960" and cemented in a drill hole in a boulder. A 3 foot square concrete pad has been placed around the disk.

PGT NO. 2 AMS 1960 REFERENCE MARK NO. 1 - Located at a horizontal distance of 19.815 meters (65.01 ft.) south-southeast of the station. The mark is a Corps of Engineers, U.S. Army disk stamped: "PGT NO. 2 RM 1 ARMY MAP SERVICE 1960" and cemented in a drill hole in a boulder.

PGT NO. 2 AMS 1960 REFERENCE MARK NO. 2 - Located at a horizontal distance of 9.918 meters (32.54 ft.) northeast of the station. The mark is a Corps of Engineers, U.S. Army disk stamped: "PGT NO. 2 ARMY MAP SERVICE 1960" and cemented in a drill hole in a boulder.

10012 DMATC 1974 - From the intersection of U.S. Highway 95 and the main entrance road (Laguna Road) to the U.S. Army Yuma Proving Ground, go north on highway 95 for 3.3 miles to the junction with Aberdeen Road to the right; turn right on Aberdeen Road and go east for 1.1 miles to crossroads; turn left and go north on W. 3rd Avenue for 4.5 miles to a sharp curve and a gravel road to the left; turn left and go west and north, upgrade, for 0.4 mile to fork in road; take right fork and go northeast for 0.1 mile to the top of hill and a building and the site of station. The mark is a Defense Mapping Agency disk stamped: "10012 TOPO CENTER 1974" and cemented in a drill hole on the roof of the building. It is located 13.3 feet southwest of the northeast corner of building and 8.95 feet northwest of the southeast corner of building.

BENCHMARK		HEIGHT (METERS)	CORRECTION (METERS)	ADJ HEIGHT (METERS)	JUNCTION
USE1113+7208	1	92.59560	.00000	92.59560	1
TR 62 GS34	117	78.67570	-.00000	78.67570	2
USE1160+0000	4	102.57390	.00112	102.57503	3
USE1175+0000	5	103.43848	.00112	103.43960	4
USE1190+0000	6	107.17706	.00098	107.17803	5
COUNTY WELL2	9	116.55762	.00340	116.56101	6
3-A DMATC 74	14	185.85707	.01086	185.86794	7
HILLTOP	26	341.94864	.02253	341.97117	8
RM 2 HILLTOP	28	341.52953	.02253	341.55206	9
TBM 264	32	264.67007	.01879	264.69486	10
966 YPG	33	294.46001	.01879	294.47880	11
SITE 9 DISC	35	290.96723	.01878	290.98601	12
SITE 7 MON	43	185.79474	.01470	185.80944	13
9-A DMATC 74	48	172.70327	.01435	172.71762	14
560 YPG	53	170.84825	.01275	170.86100	15
SITE 6 MON	55	201.08747	.01302	201.10048	16
TBM 190	57	189.49680	.01176	189.50856	17
SITE 3 DMATC	58	239.69720	.01175	239.70895	18
TBM 186	59	185.91437	.01038	185.92475	19
SITE 5	60	259.31511	.01047	259.32558	20
PGT2RM2 AMS	63	262.82789	.01010	262.83799	21
HAWT 8269	64	173.08967	.01038	173.10004	22
YPG DISK NS	65	173.97337	.01038	173.98375	23
BM 2 CE 1951	70	94.74852	.00075	94.74927	24
1 MON LONG	71	97.19950	.00075	97.20025	25
TBM 100	73	100.27770	.00231	100.28001	26
SITE 1	75	183.79629	.00214	183.79843	27
MPS 25 RM1TC	79	169.45335	.00417	169.45752	28
MPS 25 YPG	81	170.21068	.00417	170.21485	29
GLO 1946	87	119.83707	.00702	119.84409	30
SITE 2	88	152.72490	.00683	152.73174	31
SITE 12 YPG	93	107.78413	.01084	107.79497	32
TR 44 USGS	94	121.66055	.01169	121.67223	33
S2 MET YPG	97	150.04700	.01398	150.06098	34
BM 512 YPG	98	156.04376	.01398	156.05774	35
BM 541 YPG	99	164.77369	.01398	164.78768	36
SITE 12LASER	101	104.12575	.01099	104.13674	37
IR 21 RM 1	104	119.40225	.01169	119.41394	38
IRCC RM 1	108	148.86996	.01397	148.88393	39
IR 24 RM 2	111	200.64231	.01275	200.65507	40
IR 23 RM 1	114	278.77125	.01878	278.79003	41
GEO 10012	115	267.97884	.01046	267.98929	42
GEO 10010	116	189.63703	.01470	189.65173	43
TBM235TC75	118	71.57231	.00000	71.57231	44
IR 23 TC 74	112	279.02116	.01879	279.03994	
IRCC TC 74	105	148.96177	.01397	148.97574	
IR 21 TC 74	102	118.78561	.01169	118.79729	
IR 23 RM 2	113	278.61637	.01879	278.63516	
IR 24 TC 74	110	201.33534	.01275	201.34809	
IR 24 RM 1	109	200.52633	.01276	200.53908	
IRCC RM 2	107	149.08497	.01397	149.09894	
BM 485 YPG	106	147.83968	.01398	147.85365	
IR 21 RM 2	103	119.32557	.01169	119.33726	
GEO 10011	100	107.02946	.01099	107.04045	

SITE 10 YPG	96	144.60120	.01310	144.61430
SITE 11 YPG	95	121.30723	.01261	121.31984
BM 5B DMATC	92	104.73543	.01017	104.74561
BM 4B DMATC	91	89.16822	.00925	89.17747
BM 3B DMATC	90	92.54515	.00824	92.55339
TBM 82	89	82.29506	.00792	82.30298
23 M USGS	86	125.60525	.00641	125.61165
961 USCE 68	85	128.92292	.00616	128.92908
BM 2B DMATC	84	139.97383	.00532	139.97915
CAMERA SITE4	83	171.59351	.00427	171.59777
MPS 25 DMATC	82	170.05132	.00419	170.05552
MPS 25 RM2	80	169.83236	.00418	169.83654
FLATHILL	78	164.73791	.00369	164.74160
24 M USGS	77	129.37684	.00325	129.38009
AIR YPG 1969	76	111.65731	.00263	111.65994
UE 1 TBM 100	74	109.01527	.00215	109.01742
BM 1B	72	107.49221	.00139	107.49360
AHD1282+7529 WEST	69	118.42711	.00402	118.43113
TBM 124	68	124.11521	.00567	124.12088
TBM 143	67	142.61305	.00724	142.62029
BM 2A DMATC	66	157.13456	.00836	157.14292
PGT 2 AMS60	62	265.18661	.01010	265.19671
PGT2KM1 AMS	61	261.81435	.01010	261.82446
10-A DMATC74	56	167.36730	.01237	167.37966
SITE 6 DISC	54	201.42077	.01302	201.43379
587 YPG	52	178.78434	.01343	178.79777
20-M USGS 25	51	173.76120	.01373	173.77493
563 YPG	50	171.68247	.01408	171.69655
561 YPG	49	171.03325	.01438	171.04763
618 YPG	47	188.33500	.01454	188.34954
SITE 7 DISC	45	185.18242	.01472	185.19714
OP MOUNT YPG	44	203.00255	.01515	203.01770
TBM 189	43	189.18138	.01543	189.19680
OP MID YPG	42	199.34107	.01592	199.35699
8-A DMATC 74	41	196.97066	.01620	196.98686
SITE 8 DISC	40	229.14133	.01681	229.15814
TBM 225	39	225.17083	.01729	225.18813
239 YPG	38	238.73667	.01772	238.75438
7-A DMATC 74	37	241.76171	.01797	241.77968
TR-40 USGS34	36	257.10105	.01849	257.11953
U.E. 966 YPG	34	294.61767	.01879	294.63646
6-A DMATC 74	31	279.77996	.02002	279.79998
TBM 304	30	304.09167	.02096	304.11263
TR-25 USGS34	29	298.84730	.02181	298.86911
KM 1 HILLTOP	27	342.27480	.02254	342.29734
TBM1018 GS34	25	310.23193	.02227	310.25420
TBM 288	24	288.06996	.02165	288.09161
TR-27 USGS34	23	281.48776	.02067	281.50843
TBM 275	22	274.74497	.02031	274.76527
TR-28 USGS34	21	267.38946	.01885	267.40831
TBM 1839	20	269.08118	.01848	269.09966
5-A DMATC 74	19	248.18086	.01744	248.19830
TBM 235	18	235.05646	.01601	235.07247
MARKED TURN	17	229.15142	.01564	229.16706
4-A DMATC 74	16	220.93001	.01442	220.94443
AHD1628+2493	15	206.62582	.01299	206.63881
AHD1460+0000	13	165.72759	.00883	165.73642

AHD1380+0000	12	144.74574	.00675	144.75249
1-A DMATC 74	11	122.24429	.00469	122.24898
AHD1282+7529 EAST	10	118.29041	.00415	118.29456
USE1235+0000	8	109.52928	.00297	109.53225
CNTY WELL AZ	7	110.42322	.00209	110.42532
USE1144+4507	3	97.96276	.00071	97.96346
AHD1130+6177	2	95.52773	.00039	95.52812

DMAAC 75-5 GEOCEIVER SURVEYS
FOR GLOBAL POSITIONING SYSTEM TEST

1. Introduction: This project was accomplished by the Geodetic Satellite Branch to meet requirements established by SAMSO/YET letter, subject: Request for DMA Support, dated 25 October 1974. Five GPS stations were geocentrically positioned using GEOCEIVER data to permit the transformation of all stations used in the GPS test to the WGS-72 coordinate system. DMATC performed conventional surveys at the U. S. Army Yuma Proving Grounds, Arizona, to connect the four GEOCEIVER stations with the other stations in the area which will be used in the GPS test program. Defense Mapping Agency Aerospace Center Geodetic Survey Squadron (DMAAC GSS) performed a conventional survey at San Clemente Island, California, to connect one GEOCEIVER station with three other stations in the area which will be used in the GPS test. Required documentation and survey ties to local control were made at all stations as required by the Guidelines for Geodetic Satellite Programs, July 1972, Ref 1.
2. Reconnaissance: DMAAC GSS performed reconnaissance of the Yuma Proving Grounds stations in November 1974 and SAMSO performed reconnaissance of the San Clemente Island station in February 1975. This provided necessary information to deploy and support the GEOCEIVER teams. When Station Hilltop was replaced by Site 9, DMATC provided the necessary reconnaissance information for Site 9.
3. Requirements: Planning established that relative conventional survey tie accuracies between range tracking stations, local control, and GEOCEIVER

stations must meet the established survey requirements (one sigma) of one part in $10^6 \pm 2$ cm for distances and ± 3 arc seconds for azimuth and elevation angles.

3.1 Survey: Conventional surveys, GEOCEIVER surveys and related documentation are detailed in the project specifications.

3.2 New or Modified Computer Programs: No modifications were required to process, reduce or analyze this data.

3.3 Special Studies: No special studies were done relating to this project.

3.4 Changes in Data Processing Procedures: The data processing for this project was routine.

3.5 Changes in Quality Control Procedures: Quality control was routine as established for field and office control. No changes were required.

4. GEOCEIVER Survey Operations: The teams followed standard operating procedures as required by the Field Operations Manual Doppler Beacon Program but as excepted by the project specifications. The planning efforts of the Geodetic Satellite Survey Section (ODT) and team chiefs resulted in a smooth operation during deployment, operations and recovery of the team. No major problems were encountered.

4.1 Personnel, Equipment and Deployment: A summary of sites, team instruments and occupation data are given below:

<u>Station Number</u>	<u>Station Location</u>	<u>GEOCEIVER Number</u>	<u>Personnel</u>	<u>Occupation Dates</u>
10011	YPG, Arizona	0011	MSgt Green Sgt Boucher	7 Mar - 18 Mar 75
10012	YPG, Arizona	0012	MSgt Green Sgt Boucher	18 Mar - 27 Mar 75
10009	Site 9,	0035	Sgt Craviotto Sgt Thompson	17 Mar - 25 Mar 75
10213	Site 7,	0035	Sgt Craviotto Sgt Thompson	25 Mar - 9 Apr 75
10013	San Clemente,	0009	1Lt Grappo TSgt Martin Sgt Summerfield Sgt Lee	12 Mar - 26 Mar 75

5. Special Studies (Results): No special studies were done as a result of this project.

6. New or Modified Computer Program: No modification of program resulted from this project.

7. GEOCEIVER Data Processing: Table I contains a summary of satellite passes scheduled, executed, available for data reduction and missed.

TABLE I

Data Collection and Processing Statistics

<u>Sta. No.</u>	<u>Scheduled</u>	<u>Executed</u>	<u>Available for Reduction</u>	<u>Equipment Error</u>	<u>Operator Error</u>	<u>Other</u>
10009	58	52	52	0	3	3
10213	100*	54	54	0	0	46
10011	71	63	61	3	4	3
10012	71	66	66	2	2	1
10013	63	58	58	0	5	0

*This site had a conflicting 400 Mhz signal in the area which caused the loss of passes.

7.1 Quality Control: Upon receipt of the GEOCEIVER data tape, the Geodetic Satellite Data Processing Section initially checked the data. The data was then put onto magnetic tape and processed through the computer creating a library tape. Data failing to be assembled on the library tape were hand edited and corrected as necessary.

7.2 Computation: GEOCEIVER data reduction for this project was by the Geodetic Satellite Branch. Using the above library tape with precise ephemerides in the Naval Weapons Laboratory (NWL) Long Arc Computer Program to obtain geocentric coordinates of the survey marks occupied by the GEOCEIVER antenna.

8. Data Analysis and Final Results: During the analysis of the Long Arc Solutions, the final results were found to be excellent. Only ten passes were rejected because of poor quality. A slight problem was incurred in reducing the data for station 10213. Due to 400 Mhz frequency interference, 31 passes were collected with the antenna on a stand and 23 passes were collected without the stand. The group of 31 passes was adjudged to be the superior set in quality and this group was used in the final station coordinate computation.

TABLE II

Data Reduction Statistics

<u>Station Designation</u>	<u>GEOCEIVER Sta. No.</u>	<u>Passes Available for Reduction</u>	<u>Dates of Occupation</u>	<u>Passes in Solution</u>
Site 9 Disc	10009	52	18 Mar-25 Mar 75	60
Site 7 Disc	10213	54	27 Mar- 9 Apr 75	31
10011	10011	61	8 Mar-17 Mar 75	59
10012	10012	66	19 Mar-27 Mar 75	61
GEOCEIVER STA 10013	10013	58	13 Mar-21 Mar 75	54

9. Problems Encountered: The frequency interference at Yuma Proving Grounds Station 10213 added 20 mandays to the project and increased the cost considerably. Island to mainland transportation delays in returning the GSA vehicle from San Clemente added 18 mandays to the project. Station 10010 TOPO CENTER 1974 could not be occupied due to the frequency interference. However, when the GEOCEIVER was moved to Station 10213, Site 7 Disc, the interference was less intense and GEOCEIVER data was collected. This left a disc stamped as if it were a GEOCEIVER station. In fact, it is not.

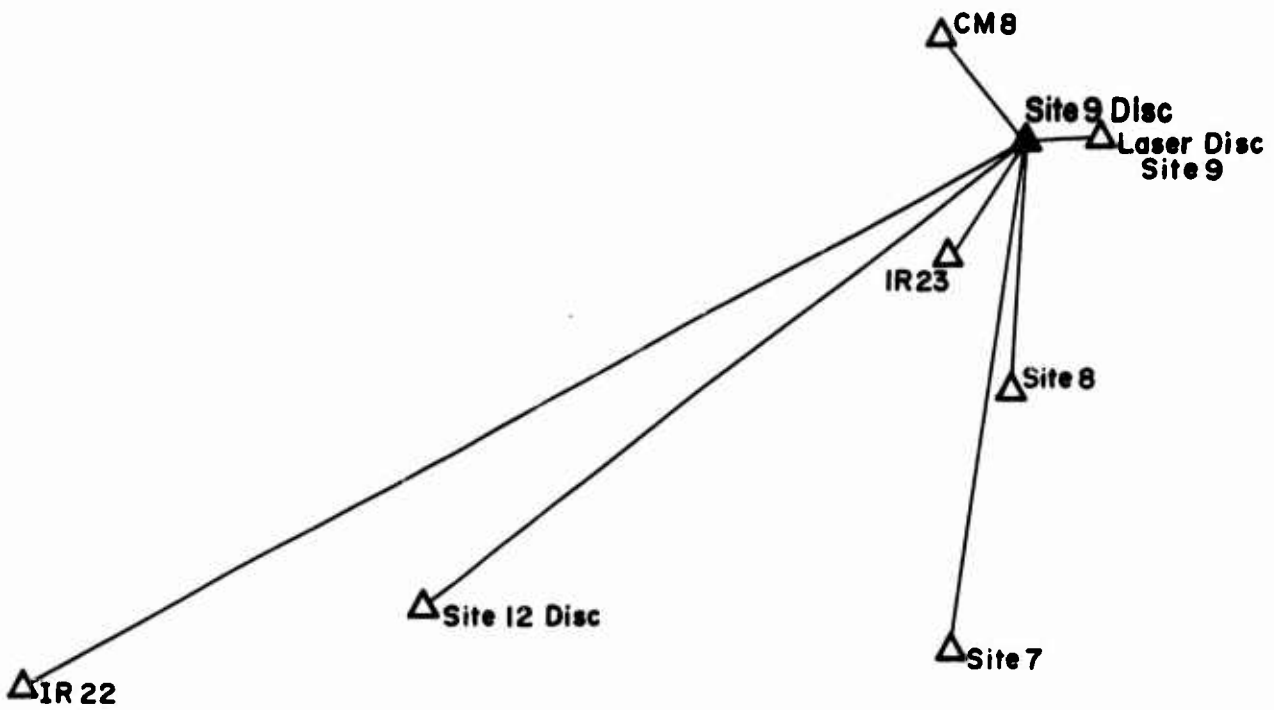
10. Recommendations: No recommendations are made as a result of this project.

REFERENCES

1. Guidelines for Geodetic Satellite Programs, Edition 4, Defense Mapping Agency, Topographic Center, Washington, D. C., July 1972.
2. Field Operations Manual Doppler Beacon Program, DMATM T-1-52220, Department of Defense, Defense Mapping Agency, Jan 1973.

SURVEY SKETCH

Project	Location	Survey
AC 75-5	Yuma Proving Grounds, AZ	Traverse



- ▲ - Geoceliver Station ■ - Picture Points ○ - New Station
- △ - Geodetic Station, RM's & BM's ≡ - Measured Distance

Prepared by	Date	Checked by	Date
Sidney M. Lounsberry	13 June 75	H. T. McGlone	19 Jun 75

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: SITE 9 DISC	STATE: Arizona	COUNTY: Yuma
CHIEF OF PARTY: Sgt Craviotto	YEAR: 1975	DESCRIBED BY: Capt Lounsberry

NOTE.*	HEIGHT OF TELESCOPE ABOVE STATION MARK	METERS.†	HEIGHT OF LIGHT ABOVE STATION MARK	METERS.	
	SURFACE-STATION MARK, UNDERGROUND-STATION MARK	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION			
	OBJECT	BEARING	DISTANCE		AZIMUTH FM NORTH
			FEET	METERS	" "
	Site 7 Disc			11590.013	189 40 18.01
	Site 12 Disc			14937.421	223 17 34.51

Detailed description:

GEOCIEVER STATION 10009 (Site 9 Disc) is located 33 miles northeast of Yuma, Arizona, and 39 miles south of Quartzite, Arizona, on the Yuma Proving Grounds.

To reach this station from the intersection of U. S. Highway 95 and Laguna Road, which is the main entrance road to the U. S. Army Test and Evaluation Command, Yuma Proving Grounds, proceed northeast on U. S. Highway 95 7.4 miles to the intersection with Middle Mountain Road (gravel) on the left (north). Proceed left (north and west) for 16.7 miles to the Astrodome and marker.

The Geociever station is a 0.05 meter brass disk cemented in a drill hole in the west corner of a 1.2 x 1.2 meter concrete pad which is southeast of the Astrodome. It is stamped: SITE 9 DISC.

No reference or azimuth marks were established.

*Refers to notes in manuals of triangulation and state publications of triangulation. †Direction-angle measured clockwise, referred to initial station. ‡To nearest meter only, when no trigonometric leveling is being done.

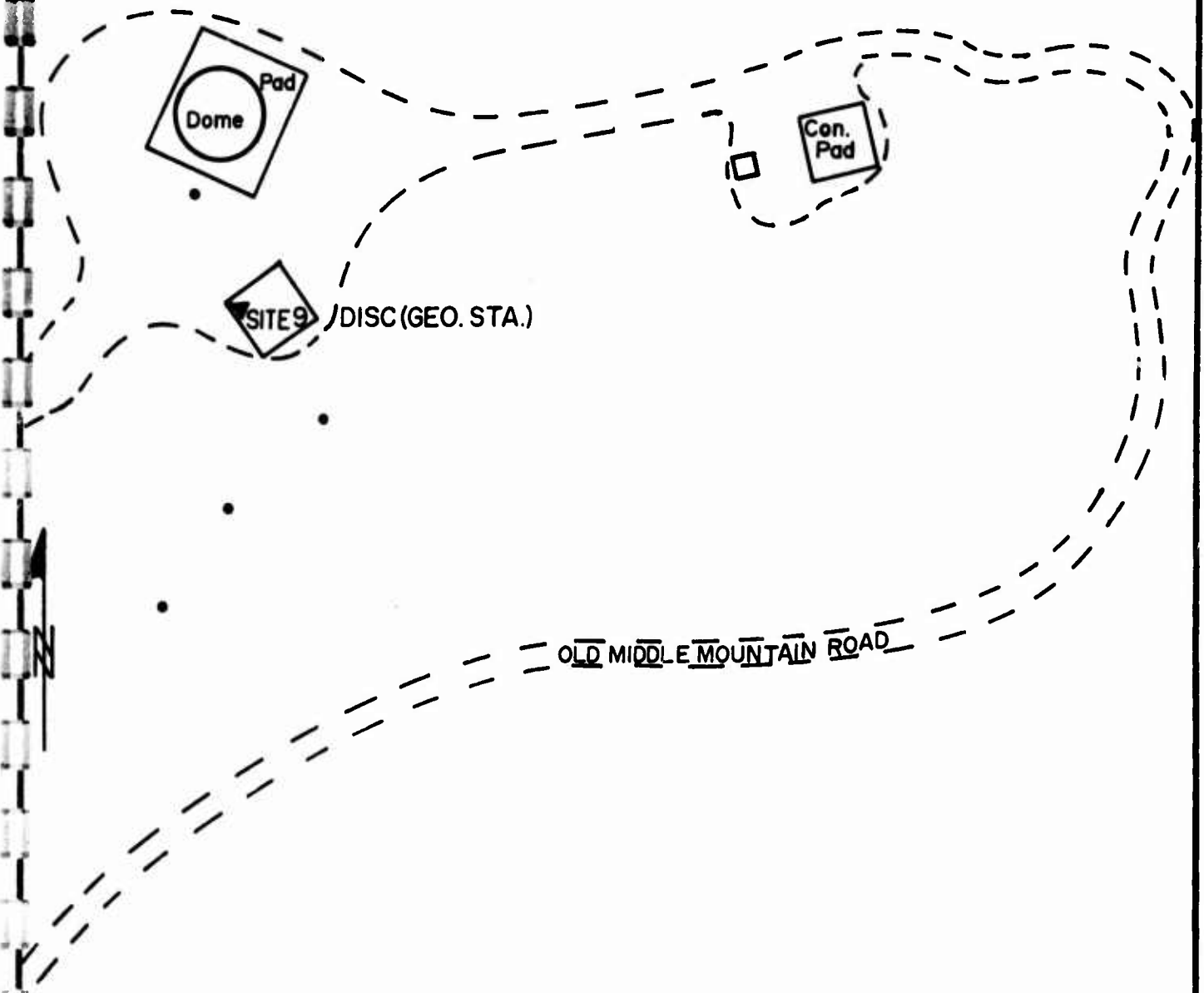
VICINITY SKETCH

Project

AC 75-5

Location

Yuma Proving Grounds, Arizona



- ▲ - Geociever Station ■ - Picture Points Δ - Geodetic Station, RM's & BM's
- - New Station ● - Power Poles ○ - Tanks X—X - Fence == - Roads

Prepared by

Sgt Cravotto

Date

19 Mar 1975

Checked by

Capt Lounsberry

Date

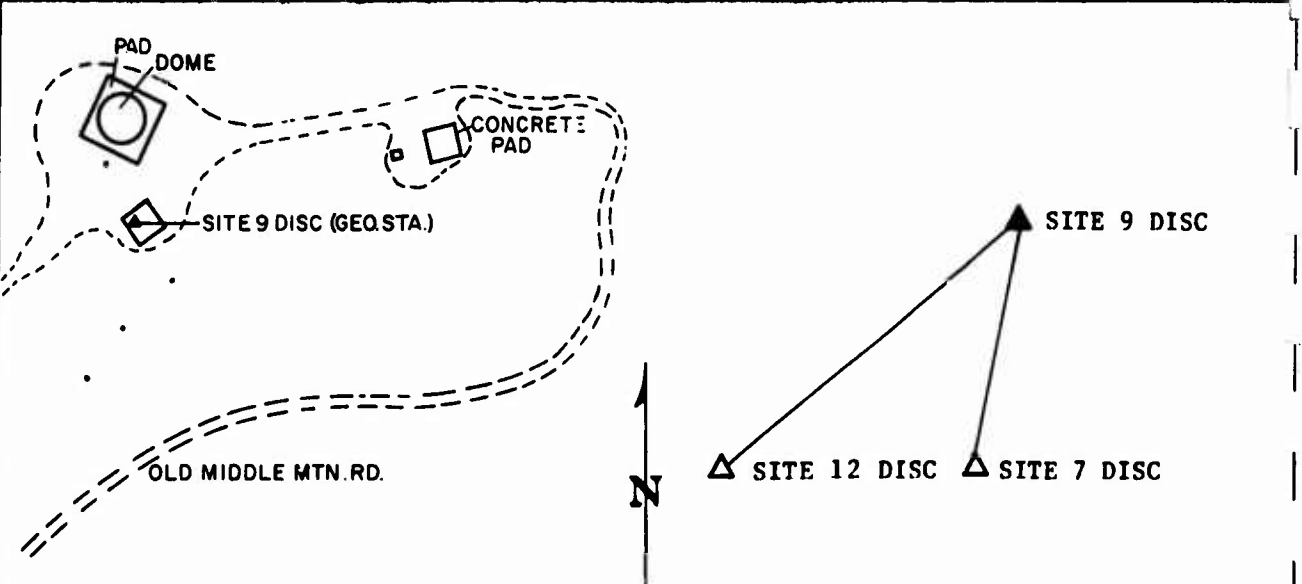
25 Apr 1975

GEODETIC SUMMARY

GEODETIC SATELLITE OBSERVATION STATION

LOCATION Yuma Proving Grounds, Arizona		EQUIPMENT GEOCEIVER 0035	STATION NO. 10009	OBSERVED BY (AGENCY) DMAAC/GSS	
TRACKING EQUIPMENT REFERENCE POINT Center of Red Ring on Antenna			PERIOD OF OCCUPATION 18 Mar 75 - 25 Mar 75		
TYPE OF STATION MARKER 2" Brass Disc		AGENCY (CAST IN MARK) None		STAMPING ON MARK SITE 9 DISC	
GEODETIC COORDINATES <small>(OF SATELLITE OBSN. STA.)</small>			GRID COORDINATES <small>(OF SATELLITE OBSN. STA.)</small>		
LATITUDE (°) N 33° 07' 35".771 ±		NORTHING 3668255.931 (M)	EASTING 747209.100 (M)	ZONE 11	GRID 11M
LONGITUDE (λ) W 114° 21' 01".154 ±		NORTHING (M)	EASTING (M)	ZONE (M)	GRID (M)
DATUM NAD 1927*	ELLIPSOID Clarke 1866	TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH			
SURVEYED BY (AGENCY) DMATC		TO OBTAIN GRID AZ. (ADD) (SUB.) TO THE GEODETIC AZIMUTH			
LOCATION OF SURVEY DATA DMATC		ELEVATION ESTABLISHED BY (AGENCY) DMATC		DATE Feb 75	ORDER 2nd
ELEVATION OF MARK ABOVE MBL (GEOID) 290.986 METERS ±	HEIGHT OF GEOID ABOVE ELLIPSOID -22.220 METERS ±	HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARKER 1.984 METERS			
HEIGHT OF REFERENCE POINT ABOVE ELLIPSOID 270.75 METERS	DATUM USED FOR GEOID HEIGHTS Meades Ranch N=0 NAD 1927*	PHOTOIDENTIFICATION BY AGENCY: WHERE FILED: None			

AZIMUTH (FROM STATION)		DISTANCE	
FROM	TO	AZIMUTH	DISTANCE
SITE 9 DISC	SITE 7 DISC	189° 40' 18".01	11590.013 m
SITE 9 DISC	SITE 12 DISC	223° 17' 34".51	14937.421 m



The precision figures listed are for the geodetic coordinates refer to the datum as defined by established control in the area.

PREPARED BY (AGENCY) DMAAC GSS	DATE 13 Jun 75	REVISED BY (AGENCY) B-10	DATE	REVISED BY (AGENCY)	DATE
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GEOCEIVER STATION 10009 (Site 9 Disc) is located 33 miles northeast of Yuma, Arizona, and 39 miles south of Quartzite, Arizona, on the Yuma Proving Grounds.

To reach this station from the intersection of U. S. Highway 95 and Laguna Road, which is the main entrance road to the U. S. Army Test and Evaluation Command, Yuma Proving Grounds, proceed northeast on U. S. Highway 95 7.4 miles to the intersection with Middle Mountain Road (gravel) on the left (north). Proceed left (north and west) for 16.7 miles to the Astrodome and marker.

The GEOCEIVER station is a 0.05 meter brass disc cemented in a drill hole in the west corner of a 1.2 x 1.2 meter concrete pad which is southeast of the Astrodome. It is stamped: SITE 9 DISC.

No reference or azimuth marks were established.

*NAD 27 Geodetic Coordinates and geoid height are based on values carried into the Yuma area through the Precise Geodimeter Traverse.

DOPPLER RECEIVER GEODETIC SUMMARY SHEET

STATION DESIGNATION	SITE 9 DISC	STATION NO	POSITIONAL DATA REFERRED TO	MODEL	GEOCEIVE..
LOCATION	Yuma Proving Grounds, AZ	10009	Center of Sta Mark	SN	#0035
ELEVATION OF MARK ABOVE MSL (GEOID)			HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION M		
250.981 METERS ±			1.904 METERS		

GEODETIC COORDINATES (SURVEY)

DATUM	ϕ	λ	h^*
NAD 1927*	N 33° 07' 35"771	W 114° 21' 01"154	268.766m
DATUM	ϕ	λ	h^*

ASTRONOMICAL COORDINATES

SOURCE	ϕ	λ
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DOPPLER DATA

DATUM	ϕ	λ	h^*
NWL 9D	N 33° 07' 35"871	W 114° 21' 04"496	251.267 m
DATUM	x	y	z
NWL 9D	-220.737.771 m	-4871330.645 m	3465869.695 m

REMARKS:

* h = HEIGHT ABOVE THE ELLIP: ϕ

Data is from satellites 65 and 77 from 18-25 Mar 1975. 52 passes were collected. 50 were used in the final solution.

The NWL precise ephemeris was held fixed in the station.

The standard errors of the solution are:

$$\sigma_{\phi} = 0.112 \text{ sec}$$

$$\sigma_{\lambda} = 0.056 \text{ sec}$$

$$\sigma_H = 0.898 \text{ m}$$

* NAD 27 Geodetic Coordinates and geoid height are based on values carried into the Yuma area through the Precise Geodimeter Traverse.

(If more space is required use reverse side)

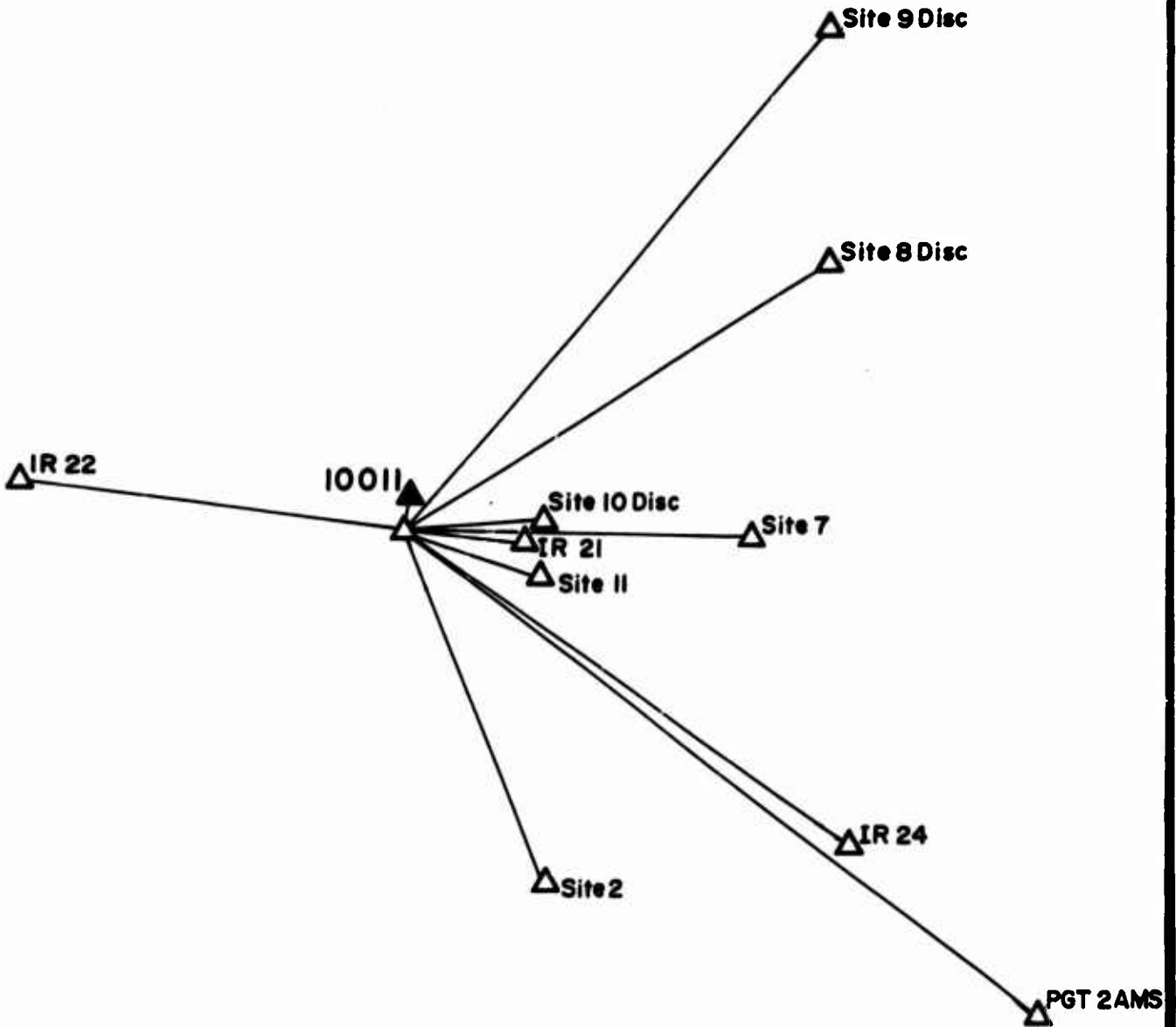
PREPARED BY:	DATE	CHECKED BY:	DATE
NOLLIE R. GOFF	30 Apr 75	Sidney M. Lounsberry	30 Apr 75
AGENCY:			
DMAAC GSS		DMAAC GSS	

SURVEY SKETCH

Project
AC 75-5

Location
Yuma Proving Ground's, AZ

Survey
Traverse



▲ - Geociever Station ■ - Picture Points ○ - New Station
 △ - Geodetic Station, RM's & BM's ≡ - Measured Distance

Prepared by
Sidney M. Lounsberry

Date
13 June 75

Checked by
H. T. McGlo...

Date
10 Jun 75

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: 10011 TOPO CENTER 1974	STATE: Arizona	COUNTY: Yuma
CHIEF OF PARTY: MSgt Green	YEAR: 1974	DESCRIBED BY: Capt Lounsberry

NOTE.*	HEIGHT OF TELESCOPE ABOVE STATION MARK METERS.†	HEIGHT OF LIGHT ABOVE STATION MARK METERS.			
	SURFACE-STATION MARK, UNDERGROUND-STATION MARK	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION			
	OBJECT	BEARING	DISTANCE		AZIMUTH FM NORTH
FEET			METERS		
	SITE 12 Disc			23.924	186 26 14.66

Detailed description:

Geoceliver Station 10011 is located 23 miles north-northeast of Yuma, Arizona, and 46 miles south-southwest of Quartzite, Arizona, on the Yuma Proving Grounds.

To reach this station from the intersection of U.S. Highway 95 and Laguna Road which is the main entrance road to the U.S. Army Test and Evaluation Command, Yuma Proving Grounds, proceed northeast along U.S. Highway 95 for 2.7 miles to the intersection with Lake Martinez Road. Turn northwest (left) and proceed for 2.8 miles to a reverse Y intersection with the other road coming from the Aviation Complex. Continue north for 5.85 miles to the intersection with West Cibola Access Drive. Turn northeast (right) and proceed on a gravel road for 0.75 mile to a Y intersection with Water Tank Road. Take the north (left) fork and proceed along West Cibola Access Drive for 5.35 miles to the intersection with Cibola Front Road. Turn west (left) and proceed for 1.4 miles to Site 12 and the end of the road.

The Geoceliver Station is a standard DMA brass disk set in the top of a 0.3 meter diameter, concrete post projecting 0.1 meter above the ground. It is stamped: 10011 TOPO. CENTER 1974. The mark is 23.9 meters north of Site 12 Disc (set on the northeast corner of the Astrodome pad) and 15.5 meters east-northeast of the east corner of a 3.0 x 3.6 meter concrete pad.

The subsurface mark is a standard DMA brass disk set in a drill hole in a rock buried in concrete 0.9 meter below the surface and stamped the same as the surface marker.

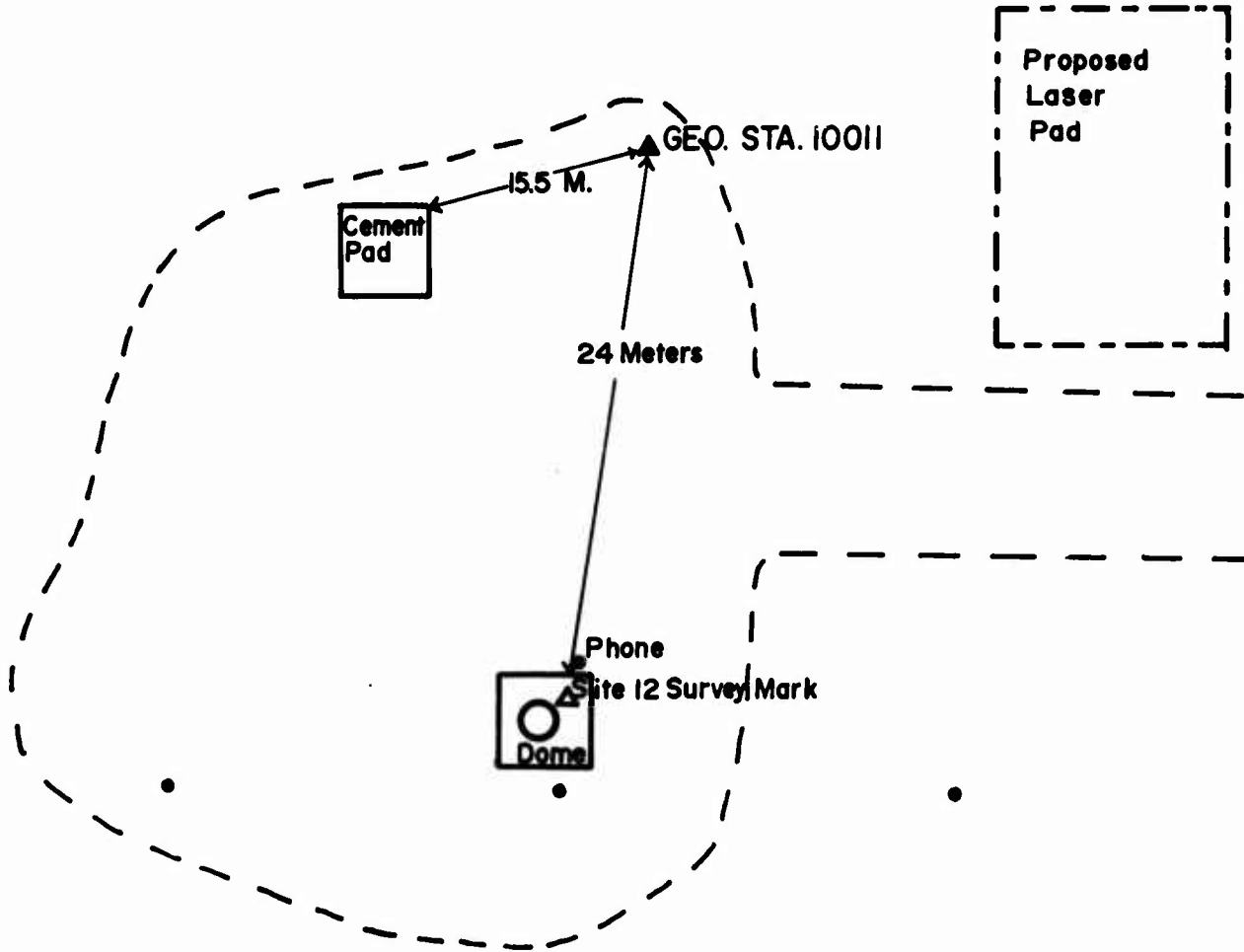
No reference or azimuth marks were established.

* Refers to notes in manuals of triangulation and state publications of triangulation. † Direction-angle measured clockwise, referred to initial station. ‡ To nearest meter only, when no trigonometric leveling is being done.

VICINITY SKETCH

Project
AC 75-5

Location
U. S. Army Proving Grounds, Yuma, Arizona



- ▲ - Geociever Station ■ - Picture Points △ - Geodetic Station, RM's & BM's
- - New Station ● - Power Poles ○ - Tanks X-X - Fence == - Roads

Prepared by
Capt Lounsberry

Date
3 Dec 1974

Checked by
MSgt Green

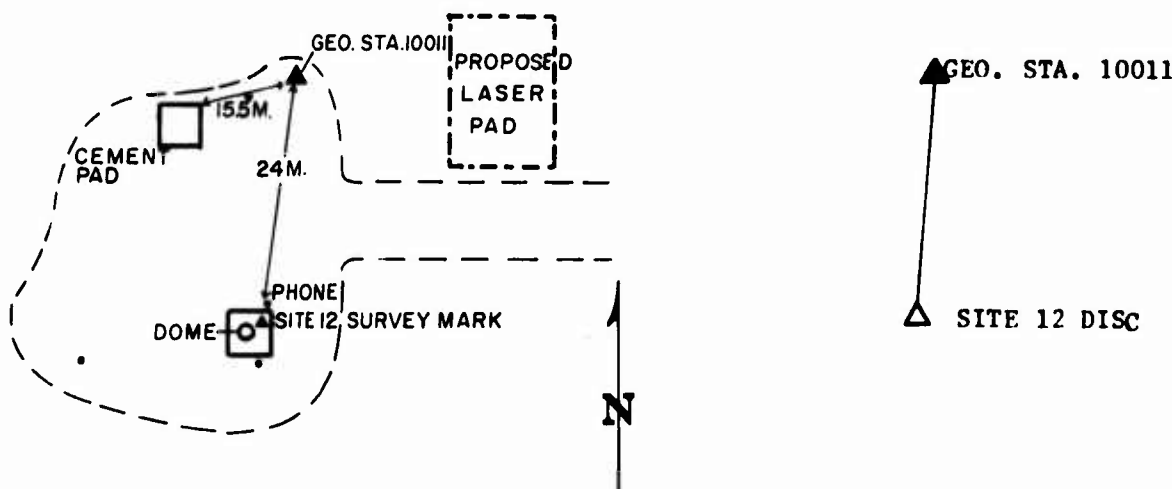
Date
7 Mar 1975

GEODETIC SUMMARY

GEODETIC SATELLITE OBSERVATION STATION

LOCATION Yuma Proving Grounds, Arizona		EQUIPMENT Geociever#0011	STATION NO. 10011	OBSERVED BY (AGENCY) DMAAC GSS	
TRACKING EQUIPMENT REFERENCE POINT Center of Red Ring on Antenna			PERIOD OF OCCUPATION 8 Mar 75 - 17 Mar 75		
TYPE OF STATION MARKER Brass Disk		AGENCY (CAST IN MARK) Defence Mapping Agency		STAMPING ON MARK 10011 Topo Center 1974	
GEODETIC COORDINATES <small>(OF SATELLITE OBSN. STA.)</small>			GRID COORDINATES <small>(OF SATELLITE OBSN. STA.)</small>		
LATITUDE (φ) N 33° 01' 43" 443 ±		NORTHING (M) 3 657 148.683 (M)	EASTING (M) 737 242.749 (M)	ZONE 11	GRID UTM
LONGITUDE (λ) W 114° 27' 35" 750 ±		NORTHING (FT) (M)	EASTING (FT) (M)	ZONE	GRID
DATUM NAD 1927*	ELLIPSOID Clark 1866	TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETIC AZIMUTH			
SURVEYED BY (AGENCY) DMATC		TO OBTAIN GRID AZ. (ADD) (SUB.) TO THE GEODETIC AZIMUTH			
LOCATION OF SURVEY DATA DMATC		ELEVATION ESTABLISHED BY (AGENCY) DMATC	DATE Feb 1975	ORDER 2nd	
ELEVATION OF MARK ABOVE MSL (GEOID) 107.040 METERS ±	HEIGHT OF GEOID ABOVE ELLIPSOID - 22.680 METERS ±	HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARKER 1.836 METERS			
HEIGHT OF REFERENCE POINT ABOVE ELLIPSOID 86.196 METERS	DATUM USED FOR GEOID HEIGHTS Meades Ranch N=0 NAD 1927*	PHOTOIDENTIFICATION BY AGENCY: WHERE FILED: None			

GEODETIC AZIMUTH <small>(FROM TO) North</small>			
FROM	TO	AZIMUTH	DISTANCE
Geociever Sta. 10011	Site 12 Disc	186° 26' 14" 66	23.924 m



SKETCH OF STATION SITE AND VICINITY SKETCH OF SURVEY (SHOW TIE TO LOCAL CONTROL)

The precision figures listed are for the geodetic coordinates refer to the datum as defined by established control in the area.

PREPARED BY (AGENCY)	DATE	REVISED BY (AGENCY)	DATE	REVISED BY (AGENCY)	DATE
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GEOCEIVER Station 10011 is located 23 miles north-northeast of Yuma, Arizona, and 46 miles south-southwest of Quartzite, Arizona, on the Yuma Proving Grounds.

To reach this station from the intersection of U. S. Highway 95 and Laguna Road (which is the main entrance road to the U. S. Army Test and Evaluation Command, Yuma Proving Grounds) proceed northeast along U. S. Highway 95 for 2.7 miles to the intersection with Lake Martinez Road.

Turn northwest (left) and proceed for 2.8 miles to a reverse Y intersection with the other road coming from Aviation Complex, Continue north for 5.85 miles to the intersection with West Cibola Access Drive. Turn northeast (right) and proceed on a gravel road for 0.75 mile to a Y intersection with Water Tank Road. Take the north (left) fork and proceed along West Cibola Access Drive for 5.35 miles to the intersection with Cibola Front Road. Turn west (left) and proceed for 1.4 miles to Site 12 and the end of the road.

The GEOCEIVER Station is a standard DMA brass disk set in the top of a 0.3 meter diameter concrete post projecting 0.1 meter above the ground. It is stamped: 10011 TOPO CENTER 1974. The mark is 23.9 meters north of Site 12 Disc (set on the northeast corner of the astrodome pad) and 15.5 meters east-northeast of the east corner of a 3.0 x 3.6 meter concrete pad.

The subsurface mark is a standard DMA brass disk set in a drill hole in a rock buried in concrete 0.9 meter below the surface and stamped the same as the surface marker.

No reference or azimuth marks were established.

*NAD 27 Geodetic Coordinates and geoid height are based on values carried into the Yuma area through the Precise Geodimeter Traverse.

DOPPLER RECEIVER GEODETIC SUMMARY SHEET

STATION DESIGNATION Yuma Proving Grounds, Arizona LOCATION	10011 TC 1974 10011	STATION NO 10011	POSITIONAL DATA REFERRED TO Center of Station Mark	MODEL Geoceiver SN # 0011
ELEVATION OF MARK ABOVE MSL (GEOID) 107.040 METERS ±		HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARK 1.836 METERS		

GEODETIC COORDINATES (SURVEY)

DATUM NAD 1927*	ϕ N 33° 01' 43"443	λ W 114° 27' 35"750	h^* 84.360m
DATUM	ϕ	λ	h^*

ASTRONOMICAL COORDINATES

SOURCE	ϕ	λ
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DOPPLER DATA

DATUM NWL 9D	ϕ N 33° 01' 43"549	λ W 114° 27' 39"081	h^* 65.388 m
DATUM NWL 9D	x -2216441.061 m	y -4872354.600 m	z 3456673.085 m

REMARKS:

* h = HEIGHT ABOVE THE ELLIPSOID

Data is from satellites 68 and 77 from 8-17 March, 1975.
61 passes were collected, 59 were used in the final solution.

The NWL precise ephemeris was held fixed in the solution.

The standard errors of the solution are:

$\sigma_{\phi} = 0.021$ sec

$\sigma_{\lambda} = 0.050$ sec

$\sigma_H = 0.861$ m

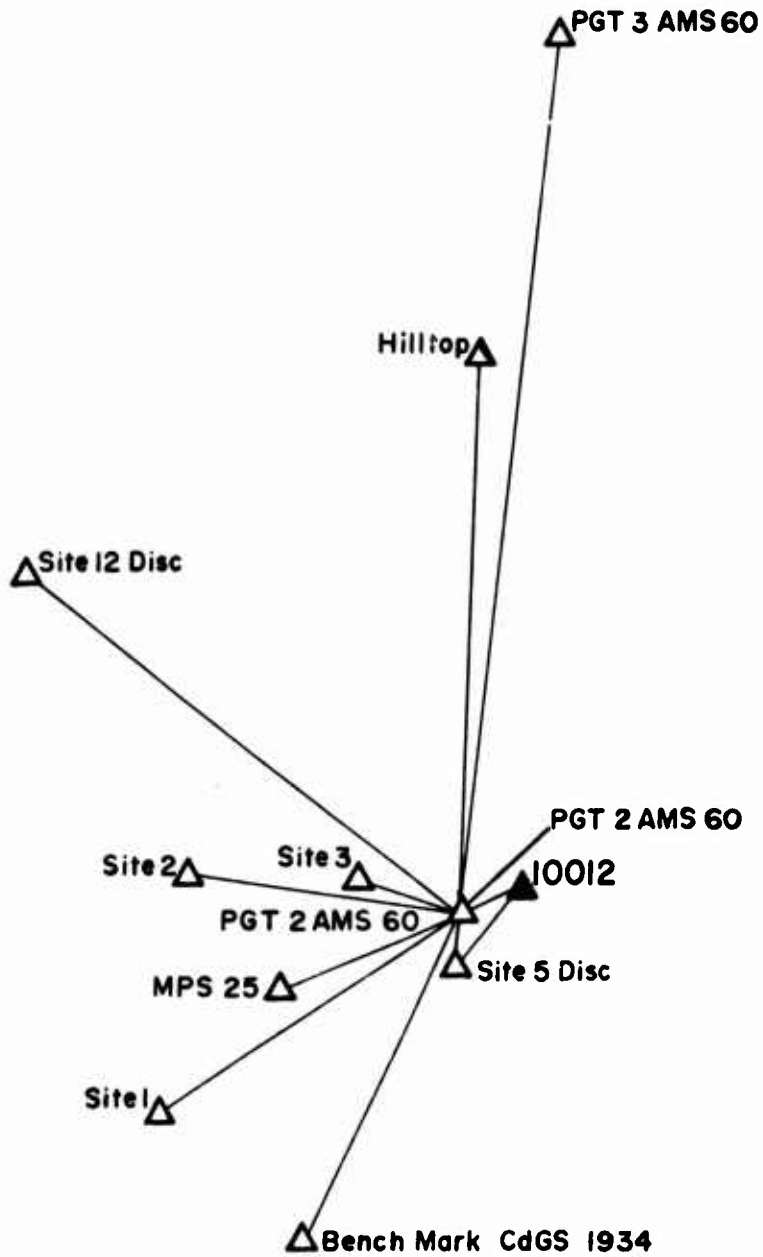
* NAD 27 Geodetic Coordinates and geoid height are based on values carried into the Yuma area through the Precise Geodimeter Traverse.

(If more space is required use reverse side.)

PREPARED BY: Nollie R. Goff	DATE 30 Apr 75	CHECKED BY: Sidney M. Lounsberry	DATE 30 Apr 75
AGENCY: DMAAC GSS		DMAAC GSS	

SURVEY SKETCH

Project AC 75-5	Location Yuma Proving Grounds, AZ	Survey Traverse
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- ▲ - Geodetic Station ■ - Picture Points ○ - New Station
- △ - Geodetic Station, RM's & BM's ≡ - Measured Distance

Prepared by Sidney M. Lounsberry	Date 13 June 75	Checked by H. T. McGlone	Date 19 Jun 75
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DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: 10012 TOPO CENTER 1974	STATE: Arizona	COUNTY: Yuma
CHIEF OF PARTY: MSgt Green	YEAR: 1974	DESCRIBED BY: Capt Lounsberry

NOTE.*	HEIGHT OF TELESCOPE ABOVE STATION MARK	METERS, †	HEIGHT OF LIGHT ABOVE STATION MARK	METERS		
	SURFACE-STATION MARK, UNDERGROUND-STATION MARK	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION				
	OBJECT	BEARING	DISTANCE		DIRECTION ‡	
			FEET	METERS		
	SITE 5 DISC PGT2AMS60		179.759	231	33	13.84
			151.787	243	45	27.03

Detailed description:

Geociever Station 10012 is located 24 miles northeast of Yuma, Arizona, and 51 miles south of Quartzsite, Arizona, on the Yuma Proving Grounds.

To reach this station from the intersection of U. S. Highway 95 and Laguna Road, which is the main entrance road to the U.S. Army Test and Evaluation Command, Yuma Proving Grounds, proceed northeast along U.S. Highway 95 for 3.25 miles to the intersection with Aberdeen Road. Turn east (right) along Aberdeen Road and proceed for 1 mile to the guardhouse and gate to the KOFA Range Area. Continue for 0.1 mile to the intersection with West Third Avenue. Turn north (left) and proceed along West Third Avenue for 4.5 miles to an intersection with the Site 5 Access Road. Turn northwesterly (left) and proceed along gravel road uphill for 0.45 mile to a saddle between the two peaks and a Y fork. Proceed along north (right) fork to the parking area at the top of the hill, west of a cement building. Proceed to the stairway on the north side of the building, and the station is on the center of the roof of the building.

The Geociever station is a standard DMA brass disk set in a drill hole and flush with the roof of a block building. It is stamped 10012 TOPO. CENTER 1974. The mark is 4.0 meters southwest of the northeast corner of the building and 2.7 meters northwest of the southeast corner of the building.

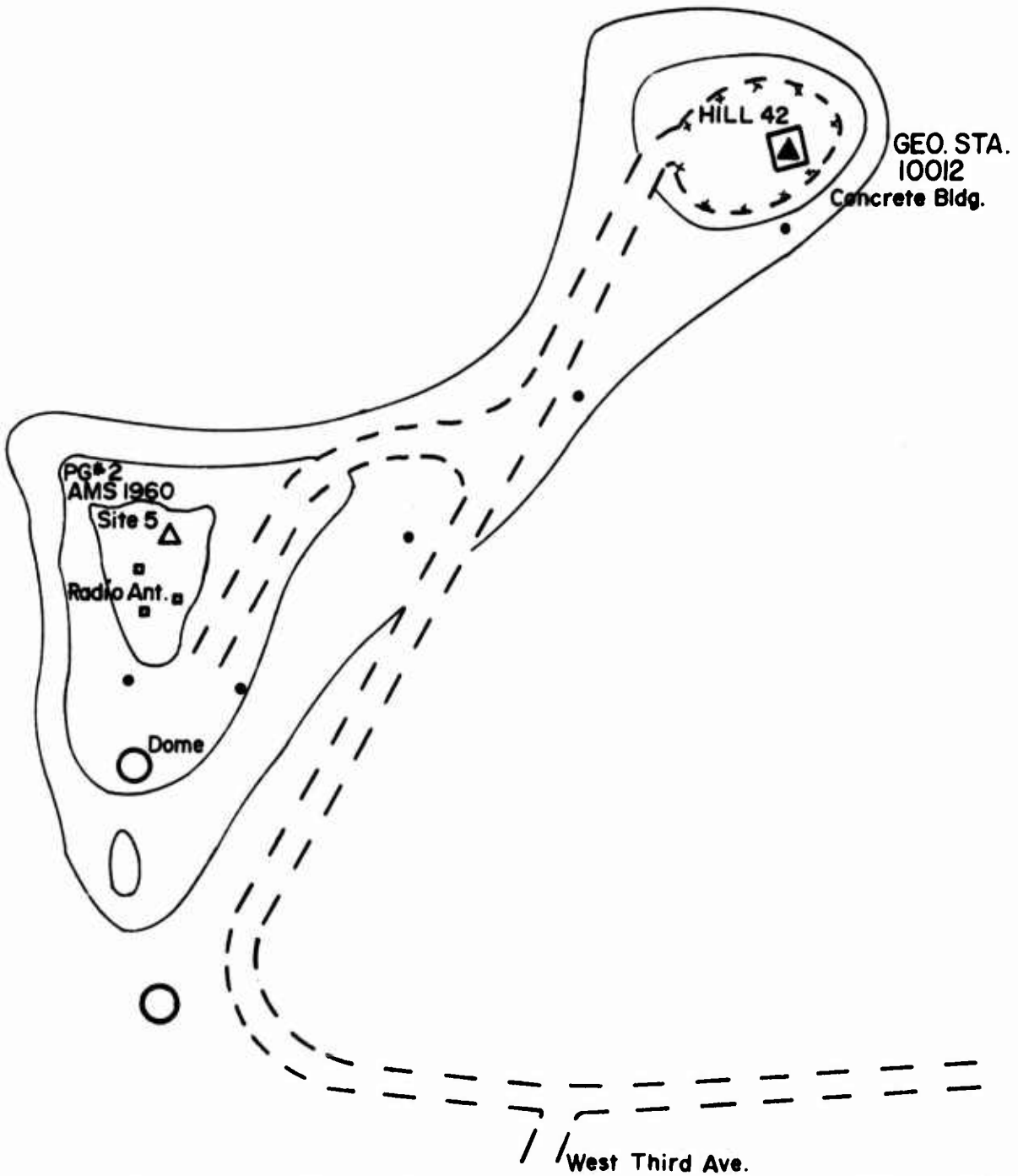
No reference or azimuth marks were established.

* Refers to notes in manuals of triangulation and state publications of triangulation. † Direction-angle measured clockwise, referred to initial station.
‡ To nearest meter only, when no trigonometric leveling is being done.

VICINITY SKETCH

Project
AC 75-5

Location
U. S. Army Proving Grounds, Yuma, Arizona



- ▲ - Geociever Stacion ■ - Picture Points / ▲ - Geodetic Station, RM's & BM's
- - New Station ● - Power Poles ○ - Tanks X-X - Fence == - Roads

Prepared by
Capt Lounsberry

Date
3 Dec 1974

Checked by
MSgt Green

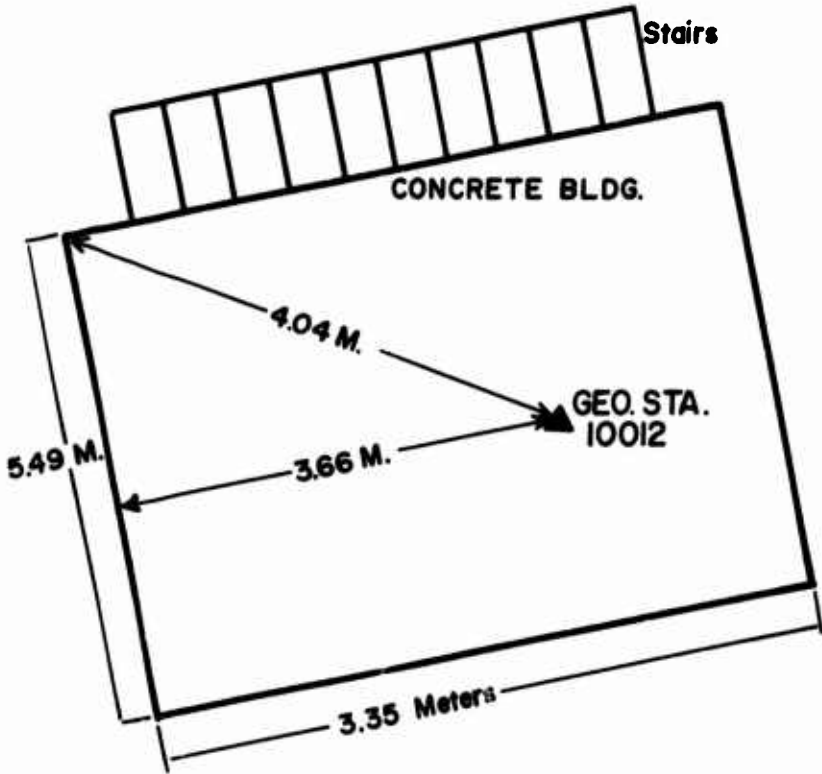
Date
19 Mar 1975

ROOF SKETCH

Project
AC 75-5

Location U. S. Army Proving
Grounds, Yuma, Arizona

Survey
N/A



▲ - Geodetic Station

■ - Picture Points

○ - New Station

△ - Geodetic Station, RM's & BM's



- Measured Distance

Prepared by
MSgt Green

Date
19 Mar 1975

Checked by
Capt Lounsberry

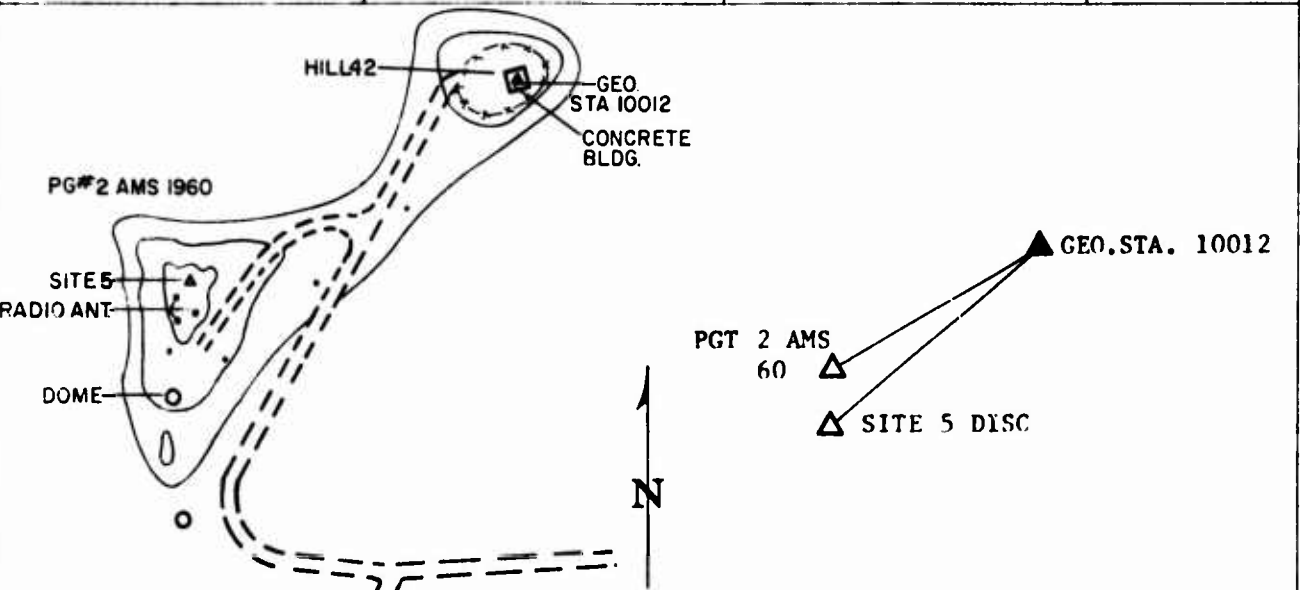
Date
25 Apr 1975

GEODETTIC SUMMARY

GEODETTIC SATELLITE OBSERVATION STATION

LOCATION Yuma Provin; Grounds, Arizona		EQUIPMENT GEOCEIVER 0012	STATION NO. 10012	OBSERVED BY (AGENCY) DMAAC GSS	
TRACKING EQUIPMENT REFERENCE POINT Center of Red Ring on Antenna			PERIOD OF OCCUPATION 19 Mar 75 - 27 Mar 75		
TYPE OF STATION MARKER Brass Disc		AGENCY (CAST IN MARK) Defence Mapping Agency		STAMPING ON MARK 10012 Topo Center 1974	
GEODETTIC COORDINATES <small>(OF SATELLITE OBSN. STA.)</small>			GRID COORDINATES <small>(OF SATELLITE OBSN. STA.)</small>		
LATITUDE (φ) N 32° 55' 40" 123 ±		NORTHING 3646315.989 (M)	EASTING 751987.207 (M)	ZONE 11	GRID UTM
LONGITUDE (λ) W 114° 15' 18" 658 ±		NORTHING (M)	EASTING (M)	ZONE (M)	GRID (M)
DATUM NAD 1927*	ELLIPSOID Clarke 1866	TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETTIC AZIMUTH			
SURVEYED BY (AGENCY) DMATC		TO OBTAIN GRID AZ. (ADD) (SUB.) TO THE GEODETTIC AZIMUTH			
LOCATION OF SURVEY DATA DMATC		ELEVATION ESTABLISHED BY (AGENCY) DMATC		DATE Feb 75	ORDER 2nd
ELEVATION OF MARK ABOVE MSL (GEOID) 267.989 METERS ±	HEIGHT OF GEOID ABOVE ELLIPSOID -22.400 METERS ±	HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARKER 1.910 METERS			
HEIGHT OF REFERENCE POINT ABOVE ELLIPSOID 247.499 METERS	DATUM USED FOR GEOID HEIGHTS Meades Ranch N=0 NAD 1927*	PHOTOIDENTIFICATION BY AGENCY: WHERE FILED: None			

GEODETTIC AZIMUTH <small>(FROM SURVEY)</small>		AZIMUTH		DISTANCE	
FROM	TO				
GEOCEIVER STA 10012	SITE 5 DISC	231° 33' 13" 84		179.759 r	
GEOCEIVER STA 10012	PGT2AMS 60	243° 45' 27" 03		151.787 m	



The precision figures listed are for the geodetic coordinates refer to the datum as defined by established control in the area.

PREPARED BY (AGENCY) DMAAC GSS	DATE 13 Jun 75	REVISED BY (AGENCY) B-23	DATE	REVISED BY (AGENCY)	DATE
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GEOCEIVER Station 10012 is located 24 miles northeast of Yuma, Arizona, and 51 miles south of Quartzsite, Arizona, on the Yuma Proving Grounds.

To reach this station from the intersection of U.S. Highway 95 and Laguna Road, which is the main entrance road to the U.S. Army Test and Evaluation Command, Yuma Proving Grounds, proceed northeast along U.S. Highway 95 for 3.25 miles to the intersection with Aberdeen road. Turn east (right) along Aberdeen Road and proceed for 1 mile to the guardhouse and gate to the KOFA Range Area. Continue for 0.1 mile to the intersection with West Third Avenue. Turn north (left) and proceed along West Third Avenue for 4.5 miles to an intersection with the Site 5 Access Road. Turn northwesterly (left) and proceed along gravel road uphill for 0.45 mile to a saddle between the two peaks and a Y fork. Proceed along north (right) fork to the parking area at the top of the hill, west of a cement building. Proceed to the stairway on the north side of the building, and the station is on the center of the roof of the building.

The GEOCEIVER station is a standard DMA brass disk set in a drill hole and flush with the roof of a block building. It is stamped 10012 TOPO. CENTER 1974. The mark is 4.0 meters southwest of the northeast corner of the building and 2.7 meters northwest of the southeast corner of the building.

No reference or azimuth marks were established.

*NAD 27 Geodetic Coordinates and geoid height are based on values carried into the Yuma area through the Precise Geodimeter Traverse.

DOPPLER RECEIVER GEODETIC SUMMARY SHEET

STATION DESIGNATION 10012 TC 1974	STATION NO 10012	POSITIONAL DATA REFERRED TO Center of Sta Mark	MODEL GEOCEIVER
LOCATION Yuma Proving Grounds, AZ		SN #0012	
ELEVATION OF MARK ABOVE MSL (GEOID) 267.989 METERS ±		HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARK 1.910 METERS	

GEODETIC COORDINATES (SURVEY)

DATUM NAD 1927*	ϕ N 32° 55' 40"123	λ W 114° 18' 18"658	h^* 245.589m
DATUM	ϕ	λ	h^*

ASTRONOMICAL COORDINATES

SOURCE	ϕ	λ
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DOPPLER DATA

DATUM NWL 9D	ϕ N 32° 55' 40"254	λ W 114° 18' 21"991	h^* 227.051 m
DATUM NWL 9D	X -2205836.924 m	Y -4883998.822 m	Z 3447372.218 m

REMARKS:

* h = HEIGHT ABOVE THE ELLIPSOID

Data is from satellites 77 and 68 from 19-27 Mar 1975. 66 passes were collected. 61 were used in the final solution.

The NWL precise ephemeris was held fixed in the solution.

The standard errors of the solution are:

$\sigma_{\phi} = 0.021 \text{ sec}$

$\sigma_{\lambda} = 0.050 \text{ sec}$

$\sigma_H = 0.830 \text{ m}$

* NAD 27 Geodetic Coordinates and geoid height are based on values carried into the Yuma area through the Precise Geodimeter Traverse.

(If more space is required use reverse side)

PREPARED BY: NOLLIE R. GOFF	DATE 30 Apr 75	CHECKED BY: Sidney M. Lounsberry DMAAC GSS	DATE 30 Apr 75
AGENCY: DMAAC GSS			

SURVEY SKETCH

Project

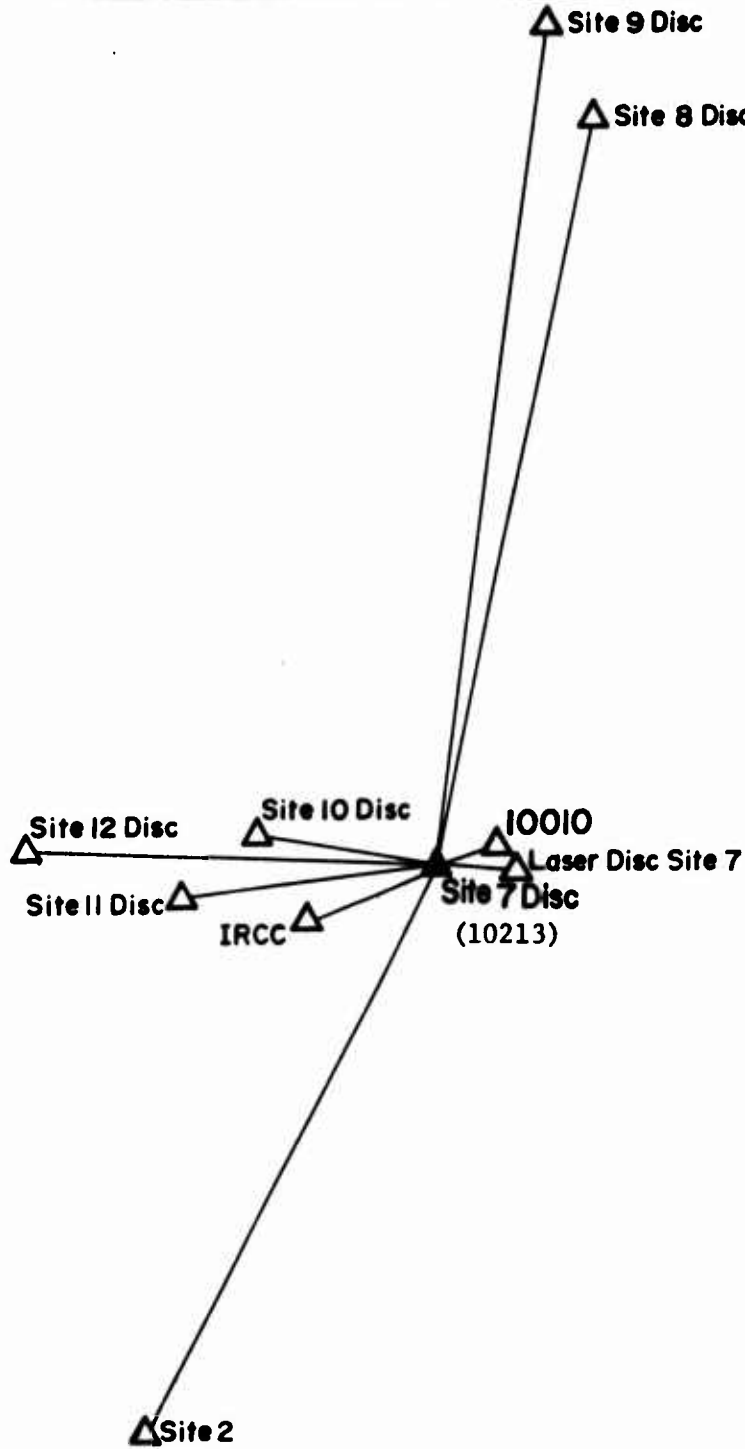
AC 75-5

LOCATION

Yuma Proving Grounds, AZ

SURVEY

Traverse



- ▲ - Geodetic Station
- - Picture Points
- - New Station
- △ - Geodetic Station, RM's & BM's
- ≡ - Measured Distance

Prepared by
Sidney M. Lounsberry

Date
13 Jun 75

Checked by
H. T. McGlone

Date
19 Jun 75

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: SITE 7 DISC	STATE: Arizona	COUNTY: Yuma
CHIEF OF PARTY: Sgt Craviotto	YEAR: 1974	DESCRIBED BY: Capt Lounsberry

NOTE.°	HEIGHT OF TELESCOPE ABOVE STATION MARK SURFACE-STATION MARK, UNDERGROUND-STATION MARK	METERS,†	HEIGHT OF LIGHT ABOVE STATION MARK DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION	METERS.
	OBJECT	BEARING	DISTANCE	AZIMUTH FM NORTH
			FEET	METERS
	Site 9 Disc			11590.013
	10010 DMATC 1974			80.721
	Laser Disc Site 7			87.006
	Site 12 Disc			8314.273
				9 39 37.06
				85 56 40.67
				88 54 21.91
				273 48 07.29

Site 7 Disc is located 27 miles northeast of Yuma, Arizona, and 45 miles south of Quartzite, Arizona, on the Yuma Proving Grounds.

To reach this station from the intersection of U. S. Highway 95 and Laguna Road, which is the main entrance road to the U.S. Army Test and Evaluation Command, Yuma Proving Grounds, proceed northeast along U.S. Highway 95 for 2.7 miles to the intersection with Lake Martinez Road. Turn northwest (left) and proceed for 2.8 miles to a reverse Y intersection with the other road coming from the Aviation Complex. Continue north for 5.85 miles to the intersection with West Cibola Access Drive. Turn northeast (right) on the gravel road and proceed for 0.75 mile to a Y intersection with Water Tank Road. Take the north (left) fork and proceed along West Cibola Access Drive for 5.35 miles to the intersection with Cibola Front Road. Turn east (right) and proceed for 4 miles to the intersection with Middle Mountain Road. Turn north (left) and proceed along Middle Mountain Road for 0.75 miles to the intersection with the Site 7 Access Road. Turn northwest (left) and proceed approximately 0.1 mile to the top of the hill and to the concrete pad.

The Geoceliver Station is a 0.05 meter brass disk cemented in a drill hole in the northwest corner of a 1.8 x 1.8 meter concrete pad. The mark is on the center of three concrete pads and 3.0 meters west of the Astrodome. It is stamped: SITE 7 DISC.

No references or azimuth marks were established.

°Refers to notes in manuals of triangulation and state publications of triangulation. †Direction-angle measured clockwise, referred to initial station. ‡To nearest meter only, when no trigonometric levelling is being done.

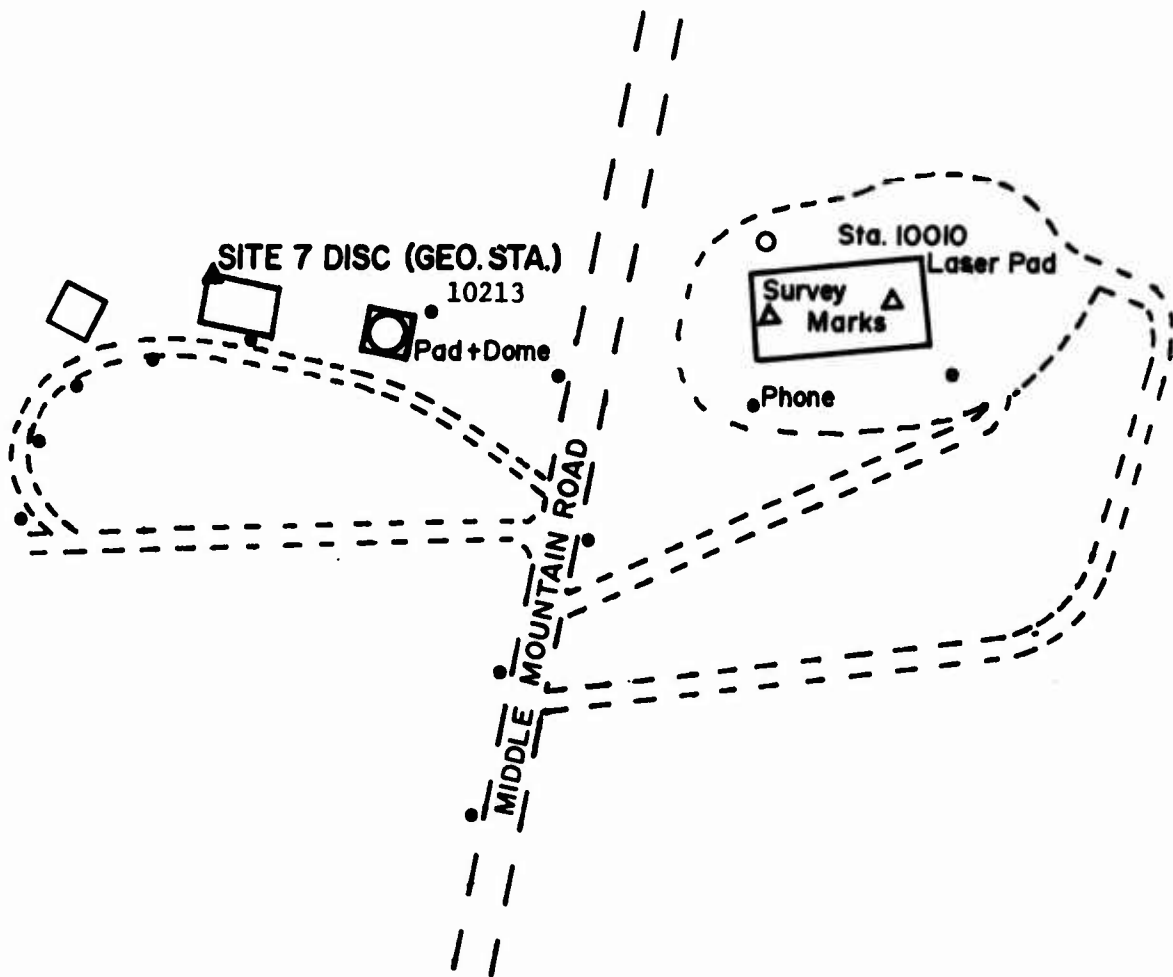
VICINITY SKETCH

Project

AC 75-5

Location

U. S. Army Proving Grounds, Yuma, Arizona



- ▲ - Geociever Station ■ - Picture Points △ - Geodetic Station, RM's & BM's
- - New Station ● - Power Poles ○ - Tanks X—X - Fence == - Roads

Prepared by
Capt Lounsberry

Date
3 Dec 1974

Checked by
Sgt Craviotto

Date
26 Mar 75

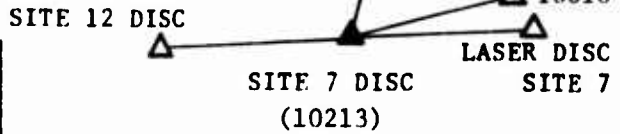
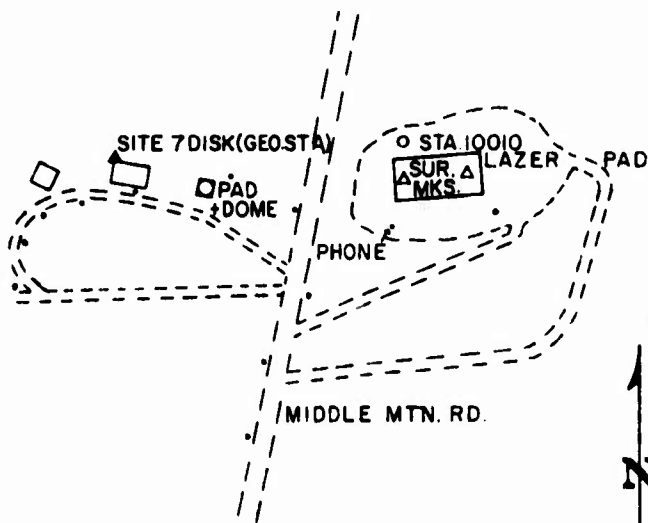
GEODETTIC SUMMARY

GEODETTIC SATELLITE OBSERVATION STATION

LOCATION Yuma Proving Ground, Arizona		EQUIPMENT GEOCEIVER 0035	STATION NO 10213	OBSERVED BY (AGENCY) DMAAC/GSS	
TRACKING EQUIPMENT REFERENCE POINT Center of Red Ring on Antenna			PERIOD OF OCCUPATION 27 March - 9 Apr 75		
TYPE OF STATION MARKER 2" Brass Disc		AGENCY (CAST IN MARK) None		STAMPING ON MARK Site 7 Disc	
GEODETTIC COORDINATES <small>(OF SATELLITE OBSN. STA.)</small>			GRID COORDINATES <small>(OF SATELLITE OBSN. STA.)</small>		
LATITUDE (φ) N 33° 01' 24"889 ±		NORTHING 3656781.135 <small>(M)</small>	EASTING 745550.467 <small>(M)</small>	ZONE	GRID UTM
LONGITUDE (λ) W 114° 22' 16"180 ±		NORTHING <small>(FT)</small>	EASTING <small>(FT)</small>	ZONE	GRID
DATUM NAD 1927*	ELLIPSOID Clark 1866	TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETTIC AZIMUTH			
SURVEYED BY (AGENCY) DMATC		TO OBTAIN GRID AZ. (ADD) (SUB.) TO THE GEODETTIC AZIMUTH			
LOCATION OF SURVEY DATA DMATC		ELEVATION ESTABLISHED BY (AGENCY) DMATC		DATE Feb 75	ORDER 2nd
ELEVATION OF MARK ABOVE MBL (GEOID) 185.197 METERS ±	HEIGHT OF GEOID ABOVE ELLIPSOID -22.440 METERS ±	HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARKER 3.170 METERS			
HEIGHT OF REFERENCE POINT ABOVE ELLIPSOID 165.927 METERS	DATUM USED FOR GEOID HEIGHTS Meades Ranch N=0 NAD 1927*	PHOTOIDENTIFICATION BY AGENCY: None WHERE FILED:			

GEODETTIC AZIMUTH (North)			
<small>MEASUREMENT (FROM)</small>			
FROM	TO	AZIMUTH	DISTANCE
Site 7 Disc	Site 9 Disc	9° 39' 37"06	11590.013 m
Site 7 Disc	10010 TOWER CENTER 1974	85° 56' 40"67	80.721 m
Site 7 Disc	Laser Disc Site 7	88° 54' 21"91	87.006 m
Site 7 Disc	Site 12 Disc	273° 48' 07"29	8314.273 m

* 3.170 Meters from 27 Mar 75 - 1 Apr 75



SKETCH OF STATION SITE AND VICINITY

SKETCH OF SURVEY (SHOW TIE TO LOCAL CONTROL)

The precision figures listed are for the geodetic coordinates refer to the datum as defined by established control in the area.

PREPARED BY (AGENCY)	DATE	REVISED BY (AGENCY)	DATE	REVISED BY (AGENCY)	DATE
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DMAAC GSS

13 Jun 75

B-29

GEOCEIVER STATION 10213 (Site 7 Disc) is located 27 miles northeast of Yuma, Arizona, and 45 miles south of Quartzite, Arizona, on the Yuma Proving Grounds.

To reach this station from the intersection of U.S. Highway 95 and Laguna Road, which is the main entrance road to the U.S. Army Test and Evaluation Command, Yuma Proving Grounds, proceed northeast along U.S. Highway 95 for 2.7 miles to the intersection with Lake Martinez Road. Turn northeast (left) and proceed for 2.8 miles to a reverse Y intersection with the other road coming from the Aviation Complex. Continue north for 5.85 miles to the intersection with West Cibola Access Drive. Turn northeast (right) on the gravel road and proceed for 0.75 mile to a Y intersection with Water Tank Road. Take the north (Left) fork and proceed along West Cibola Access Drive for 5.35 miles to the intersection with Cibola Front Road. Turn east (right) and proceed for 4 miles to the intersection with Middle Mountain Road. Turn north (left) and proceed along Middle Mountain Road for 0.75 miles to the intersection with the Site 7 Access Road. Turn northwest (left) and proceed approximately 0.1 mile to the top of the hill and to the concrete pad.

The GEOCEIVER Station is a 0.05 meter brass disk cemented in a drill hole in the northwest corner of a 1.8 x 1.8 meter concrete pad. The mark is on the center of three concrete pads and 3.0 meters west of the Astrodome. It is stamped: SITE 7 DISC.

No references or azimuth marks were established.

*NAD 27 Geodetic coordinates and geoid height are based on values carried into the Yuma area through the Precise Geodimeter Traverse.

DOPPLER RECEIVER GEODETIC SUMMARY SHEET

STATION DESIGNATION SITE 7 DISC	STATION NO 10213	POSITIONAL DATA REFERRED TO Center of Station Mark	MODEL Geoceiver
LOCATION Yuma Proving Grounds, AZ		SN #0035	
ELEVATION OF MARK ABOVE MSL (GEOID) 185.197 METERS ±		HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARK 3.170 METERS	

GEODETIC COORDINATES (SURVEY)

DATUM	φ	λ	h*
NAD 1927 *	N 33° 01' 24"889	W 114° 22' 16"180	162.757m
DATUM	φ	λ	h*

ASTRONOMICAL COORDINATES

SOURCE	φ	λ

DOPPLER DATA

DATUM	φ	λ	h*
NWL 9C	N 33° 01' 25"001	W 114° 22' 19"495	145.969 m
DATUM	X	Y	Z
NWL 9D	-2209045.585 m	-4876128.122 m	3456237.914 m

REMARKS:

* h = HEIGHT ABOVE THE ELLIPSOID

- Data is from satellites 77 and 68 from 27 March - 9 April 1975. 54 passes were collected. 31 were used in the final solution.
- The NWL precise ephemeris was held fixed in the solution.
- The standard errors of the solution are:
 - $\sigma_{\phi} = 0.031 \text{ sec}$
 - $\sigma_{\lambda} = 0.076 \text{ sec}$
 - $\sigma_H = 1.222 \text{ m}$

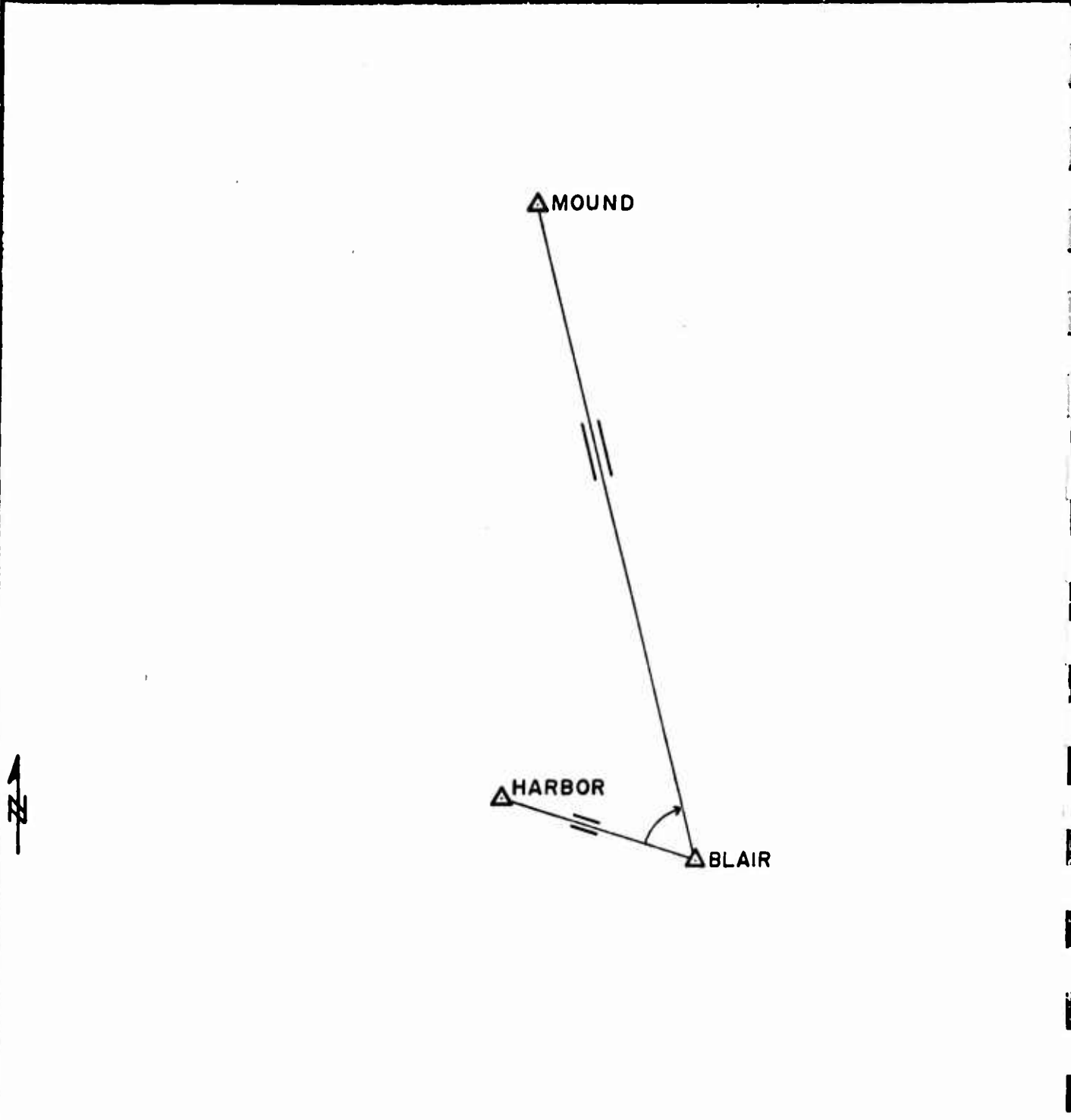
* NAD 27 Geodetic Coordinates and geoid height are based on values carried into the Precise Geodimeter Traverse.

(If more space is required use reverse side.)

PREPARED BY: NOLLIE R. GOFF	DATE 30 Apr 75	CHECKED BY: Capt Sidney M. Lounsberry	DATE 30 Apr 75
AGENCY: DMAAC GSS			

SURVEY SKETCH

Project DMAAC 75-5	Location San Clemente Island, California	Survey Traverse
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- ▲ - Geodetic Station
- - Picture Points
- - New Station
- △ - Geodetic Station, RM's & BM's
- ══ - Measured Distance

Prepared by Lt Grappo	Date 19 Mar 1975	Checked by TSgt Martin	Date 3 Apr 1975
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SURVEY SKETCH

Project

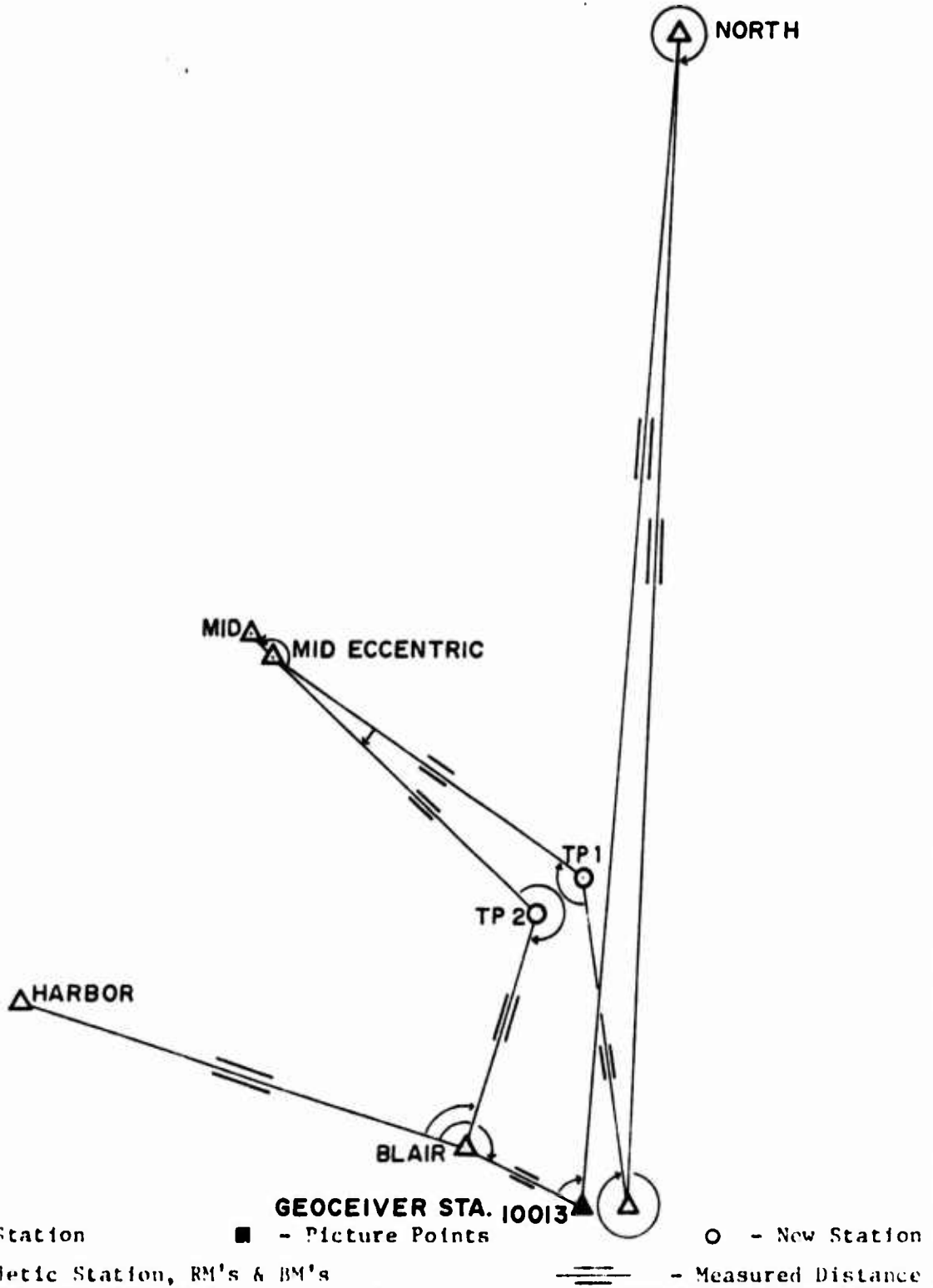
DMAAC 75-5

Location

San Clemente Island, California

Survey

Traverse



▲ - Geociever Station

■ - Picture Points

○ - New Station

△ - Geodetic Station, RM's & BM's

≡ - Measured Distance

Prepared by

Lt. Grappo

Date

20 Mar 1975

Checked by

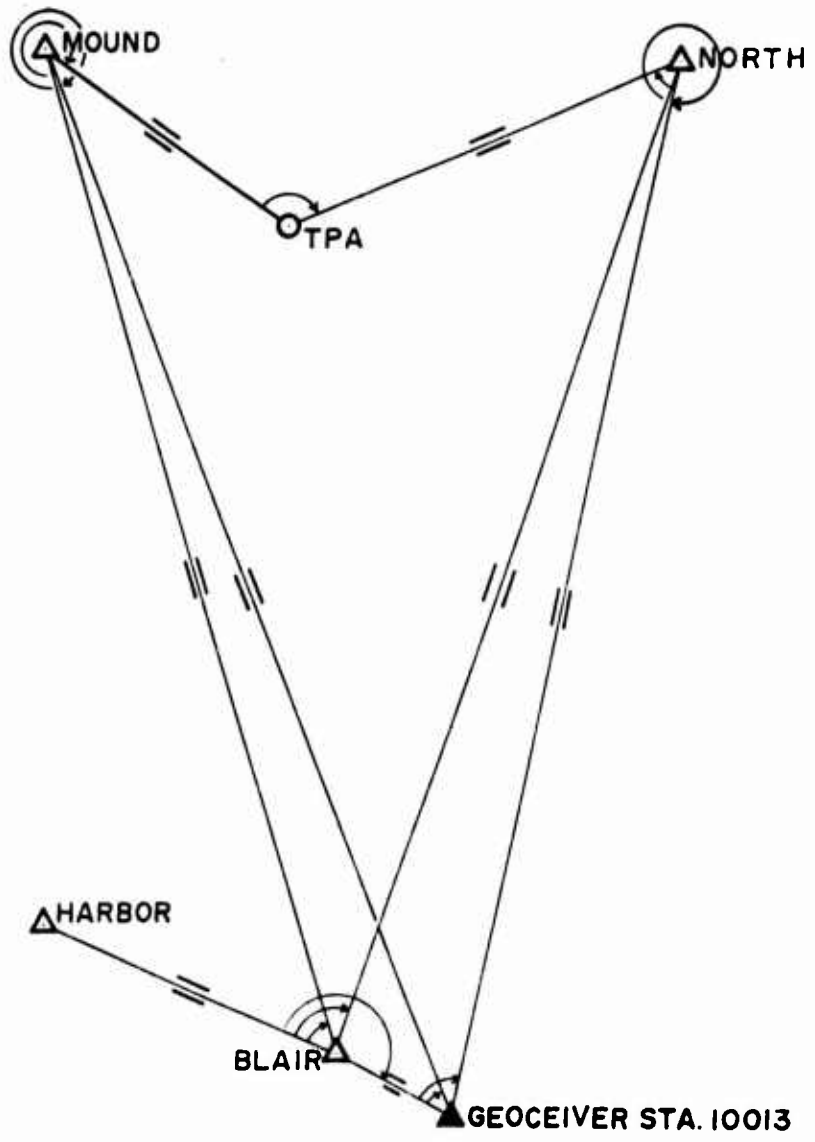
TSgt Martin

Date

3 Apr 1975

SURVEY SKETCH

Project DMAAC 75-5	Location San Clemente Island, California	Survey Traverse
-----------------------	---	--------------------



- ▲ - Geociever Station
- - Picture Points
- - New Station
- △ - Geodetic Station, BM's & BM's
- ══ - Measured Distance

Prepared by Lt Grappo	Date 20 Mar 1975	Checked by T Sgt Martin	Date 3 Apr 1975
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DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: GEOCEIVER STATION 10013	STATE: California	COUNTY: San Clemente Island
CHIEF OF PARTY: Lt. Grappo	YEAR: 1975	DESCRIBED BY: TSgt Martin

NOTE: *	HEIGHT OF TELESCOPE ABOVE STATION MARK	METERS, †	HEIGHT OF LIGHT ABOVE STATION MARK	METERS.	
	SURFACE-STATION MARK, UNDERGROUND-STATION MARK	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION			
	OBJECT	BEARING	DISTANCE		AZIMUTH IN NORTH
			FEET	METERS	
	NORTH	NW	3093.528	332 25 39.216	
	BLAIR	NW	341.473	287 08 56.767	
	MOUND	NW	2877.819	319 44 58.060	

The station is located on the eastern side of San Clemente Island which is approximately 58 air miles from San Diego, California. The island is reachable via commercial air from either San Diego or Long Beach.

To reach the station from the Operations Building at the Naval Undersea Center in Wilson Cove, drive southeast along the road for about one block. Cross the main road and proceed south along asphalt road for 0.25 miles to a small dirt road cutoff to the left (east). Proceed down this dirt road to the end of it at the FORACS Station South Building. Off to the right of the road by a meter is a concrete slab into which the station is embedded.

There are two stations on the concrete slab, the GEOCEIVER station being the southernmost of the two. It is a brass disk stamped GEOCEIVER STA 10013 1975 DMAAC GSS.

There are no reference marks.

* Refers to notes in manuals of triangulation and state publications of triangulation. † Direction-angle measured clockwise, referred to initial station.
 ‡ To nearest meter only, when no trigonometric leveline is being done.

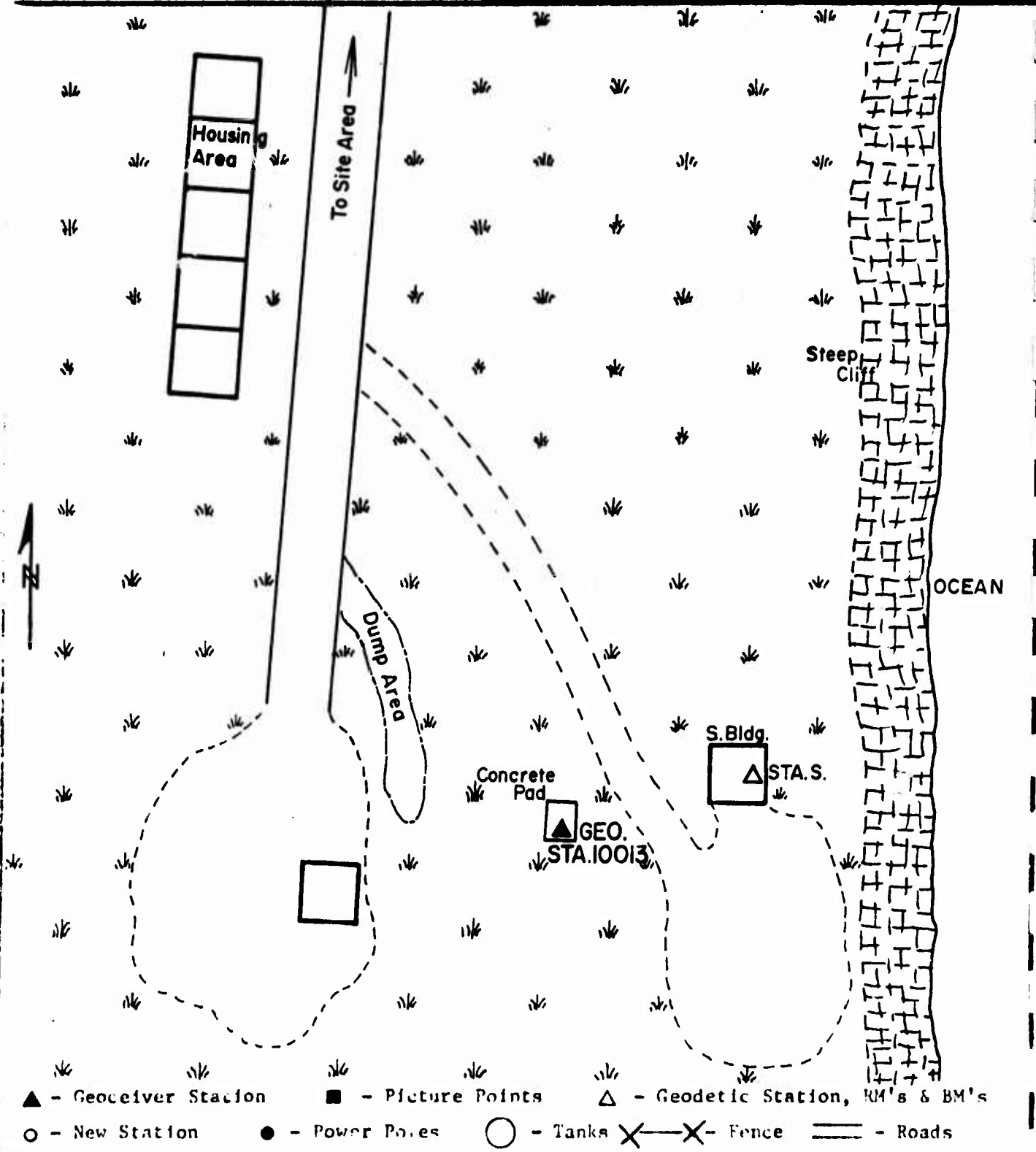
VICINITY SKETCH

Project

DMAAC 75-5

Location

San Clemente Island, California



- ▲ - Geociever Station
- - Picture Points
- △ - Geodetic Station, RM's & BM's
- - New Station
- - Power Poles
- - Tanks
- X-X - Fence
- == - Roads

Prepared by
Lt. Grappo

Date
20 Mar 1975

Checked by
TSgt Martin

Date
3 Apr 1975

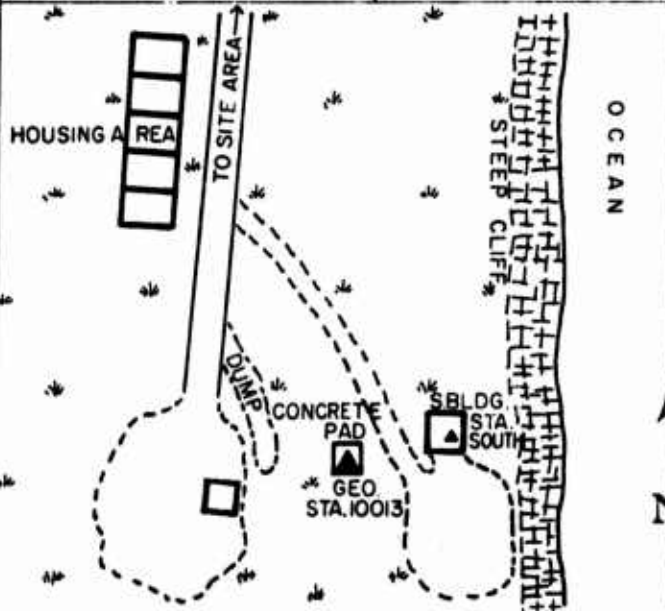
GEODETTIC SUMMARY

GEODETTIC SATELLITE OBSERVATION STATION

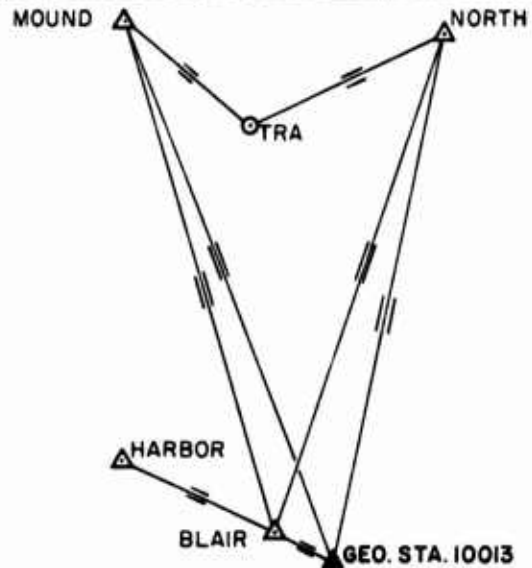
LOCATION San Clemente, Calif., CA		EQUIPMENT GEOCEIVER #008	STATION NO. 10013	OBSERVED BY (AGENCY) DMAAC/GSS	
TRACKING EQUIPMENT REFERENCE POINT Center of Red Ring on Antenna			PERIOD OF OCCUPATION 13 Mar 75 - 21 Mar 75		
TYPE OF STATION MARKER Brass Disk		AGENCY (CAST IN MARK) None		STAMPING ON MARK GEOCEIVER STA 10013 DMAAC/GSS 1975	
GEODETTIC COORDINATES (OF SATELLITE OBSN. STA.)			GRID COORDINATES (OF SATELLITE OBSN. STA.)		
LATITUDE (φ) N 32° 59' 55" 716 ±		NORTHING 3652027.576 (M)	EASTING 355411.783 (M)	ZONE 11	GRID UTM
LONGITUDE (λ) W 118° 32' 51" 574 ±		NORTHING (FT) (M)	EASTING (FT) (M)	ZONE	GRID
DATUM NAD 1927	ELLIPSOID Clarke 1866	TO OBTAIN GRID AZIMUTH, ADD TO THE GEODETTIC AZIMUTH			
SURVEYED BY (AGENCY) DMAAC GSS		TO OBTAIN GRID AZ. (ADD) (SUB.) TO THE GEODETTIC AZIMUTH			
LOCATION OF SURVEY DATA DMAAC GSS		ELEVATION ESTABLISHED BY (AGENCY) DMAAC/GSS		DATE Mar 75	ORDER VA
ELEVATION OF MARK ABOVE MSL (GEOID) 45.348 - METERS ±	HEIGHT OF GEOID ABOVE ELLIPSOID -30.000 METERS ±	HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARKER 1.917 METERS			
HEIGHT OF REFERENCE POINT ABOVE ELLIPSOID 17.265 METERS	DATUM USED FOR GEOID HEIGHTS NAD 1927		PHOTOIDENTIFICATION BY AGENCY: WHERE FILED: N/A		

GEODETTIC AZIMUTH
ASTRONOMIC (FROM ~~XXXX~~ North)

FROM	TO	AZIMUTH	DISTANCE
GEOCEIVER STA 10013	BLAIR	287° 08' 56" 77	341.473 m
GEOCEIVER STA 10013	MOUND	319° 44' 53.06	2877.819 m
GEOCEIVER STA 10013	NORTH	332° 25' 39.22	3093.528 m



SKETCH OF STATION SITE AND VICINITY



SKETCH OF SURVEY (SHOW TIE TO LOCAL CONTROL)

The precision figures listed are for the geodetic coordinates refer to the datum as defined by established control in the area.

PREPARED BY (AGENCY) DMAAC GSS	DATE 30 Apr 75	REVISED BY (AGENCY)	DATE	REVISED BY (AGENCY)	DATE
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DESCRIPTION (WITH BRIEF "TO REACH")

The station 's located on the eastern side of San Clemente Island which is approximately 58 air miles from San Diego, California. The island is reachable via commercial air from either San Diego or Long Beach.

To reach the station from the Operations Building at the Naval Undersea Center in Wilson Cove, drive southeast along the road for about one block. Cross the main road and proceed south along asphalt road for 0.25 miles to a small dirt road cutoff to the left (east). Proceed down this dirt road to the end of it at the FORACS Station South Building. Off to the right of the road by a meter is a concrete slab into which the station is embedded.

There are two stations on the concrete slab, the GEOCEIVER station being the southernmost of the two. It is a brass disk stamped GEOCEIVER STA 10013 1975 DMAAC GSS.

There are no reference marks.

DOPPLER RECEIVER GEODETIC SUMMARY SHEET

STATION DESIGNATION GEOCEIVER Sta 10013	STATION NO 10013	POSITIONAL DATA REFERRED TO Center of Station Mark	MODEL GEOCEIVER
LOCATION San Clemente Island, Calif.			SN # 008
ELEVATION OF MARK ABOVE MSL (GEOID) 45.348 METERS ±		HEIGHT OF TRACKING EQUIPMENT REF. PT. ABOVE STATION MARK 1.917 METERS	

GEODETIC COORDINATES (SURVEY)

DATUM NAD 1927	ϕ N 32° 59' 55" 716	λ W 118° 32' 51" 574	h^* 15.348 m
DATUM	ϕ	λ	h^*

ASTRONOMICAL COORDINATES

CE	ϕ	λ
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DOPPLER DATA

DATUM NWL-9D	ϕ N 32° 59' 55" 695	λ W 118° 32' 55" 642	h^* 2.537 m
DATUM NWL-9D	x -2 558 979.429 m	y - 4 703 498.070 m	z 3 453 852.653 m

REMARKS: * h = HEIGHT ABOVE THE ELLIPSOID

Data is from satellites 68 and 77 from 13-21 March 1975.
58 passes were collected, 54 passes were used in the final solution.
The NWL precise ephemeris was held fixed in the solution.

The standard errors of the final solution are:

- $\sigma_{\phi} = 0.022$ sec
- $\sigma_{\lambda} = 0.057$ sec
- $\sigma_H = 0.842$ m

(If more space is required use reverse side)

PREPARED BY: NOLLIE R. COFF DMAAC GSS	DATE 30 Apr 75	CHECKED BY: Sidney H. Lounsberry DMAAC GSS	DATE 30 Apr 75
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ADJUSTED NAD 27 COORDINATES FOR
SAN CLEMENTE ISLAND SURVEY SITES

Station Name	Latitude(ϕ)	Longitude(λ)	CSE** (m)	Elevation (m)	Geoid Height(m)
HARBOR*	32° 59' 54".064	-118° 33' 39".442	FIXED	195.60	-30.00
MOUND*	33 01 07.009	-118 34 03.217	FIXED	141.86	-30.00
BLAIR*	32 59 58.984	-118 33 04.143	FIXED	95.69	-30.00
GEO STA 10013	32 59 55.716	-118 32 51.574	0.010	45.35	-30.00
SOUTH	32 59 56.265	-118 32 51.318	0.025	42.32	-30.00
MID ECCENTRIC	33 00 26.790	-118 33 34.016	0.023	17.91	-30.00
NORTH	33 01 24.727	-118 33 46.747	0.016	9.13	-30.00
TP 1	33 00 13.273	-118 33 06.160	0.022	34.24	-30.00
TP 2	33 00 10.039	-118 33 06.458	0.012	46.87	-30.00
MID	33 00 26.947	-118 33 34.344	0.023	17.91	-30.00
TPA	33 00 50.030	-118 33 44.489	0.014	107.23	-30.00

*NAD 27 COORDINATES HELD FIXED

**CIRCULAR STANDARD ERROR OF THE ADJUSTED NAD 27 HORIZONTAL POSITIONS RELATIVE TO THE
FIXED STATIONS

WGS 72 COORDINATES FOR SAN CLEMENTE ISLAND
SURVEY SITES BASED ON GEOCEIVER DERIVED SHIFTS*

Station Name	Latitude(ϕ)	Longitude(λ)	Elevation msl(m)	Geoid Height(m)	Geodetic Height(m)
HARBOR	32° 59' 54".019	-118° 33' 43.249	195.60	-38.29	157.31
MOUND	33 01 06.962	-118 34 07.025	141.86	-38.28	103.58
BLAIR	32 59 58.939	-118 33 07.949	95.69	-38.31	57.38
GEO STA 10013	32 59 55.672	-118 32 55.380	45.35	-38.31	7.04
SOUTH	32 59 56.220	-118 32 55.124	42.32	-38.31	4.01
MID ECCENTRIC	33 00 26.744	-118 33 37.823	17.91	-38.30	-20.39
NORTH	33 01 24.679	-118 33 50.555	9.13	-38.29	-29.16
TP 1	33 00 13.228	-118 33 09.966	34.24	-38.30	- 4.06
TP 2	33 00 09.994	-118 33 10.264	46.87	-38.31	8.56
MID	33 00 26.901	-118 33 38.151	17.91	-38.30	-20.39
TPA	33 00 49.983	-118 33 48.297	107.23	-38.29	68.94

* ΔX , ΔY AND ΔZ SHIFTS AT GEOCEIVER STATION 10013 USED TO OBTAIN WGS 72 COORDINATES ARE -26.9, 157.3 AND 176.0 METERS, RESPECTIVELY.

YUMA PHOTOGRAMMETRIC DATA BASE

The Yuma Photogrammetric Data Base is referenced to WGS 72. Any positional data derived from it will also be on WGS 72 unless appropriate conversions are performed. The photographic source data consists of 18 exposures collected during three overflights on 19 July 1975. The approximate scale of the photography is 1:78,000. Cartographic source material consists of four United States Geological Survey (USGS) 15 minute quad sheets with a 1:62,500 scale - Red Hill, Red Bluff Mountain, Castle Dome and Laguna - and nine USGS 7.5 minute quad sheets with a 1:24,000 scale - Hidden Valley, Picacho SW, Picacho, Picacho Peak, Little Picacho Peak, Bard, Imperial Reservoir, Laguna Dam and Dome. Geodetic control is provided by 13 photo identifiable survey sites which served as primary control in the data base adjustment. These sites are those identified by numbers 3, 6-15, 24 and 27 in Figure 1 of this Report. An evaluation of the achievable accuracy for positions derived from the photogrammetric data base was made by comparing differences between the initial and the derived positions for the 13 geodetic points used for control. This evaluation yielded horizontal and vertical accuracies of 3 m at 90% assurance. This is equivalent to a horizontal Circular Standard Error of approximately 1.5 m and a vertical standard error of approximately 2 m. These accuracy figures do not include the uncertainty involved in relating the data base coordinates to WGS 72 or the uncertainty of

WGS 72 with respect to the earth's center of mass.

Data base exploitation requires that the requestor provide to DMAAC an approximate geographic coordinate for each point along with an aerial photograph identifying the exact point and/or points to be positioned. The identification photograph should have sufficient detail to facilitate point identification. DMAAC will provide the requestor the geodetic latitude, longitude and height of each point with respect to WGS 72. UTM coordinates can also be provided upon request.