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TRIANGULATION COMPUTATIONS

MARSHALL ISLANDS

ENIWETOK ATOLL

1948

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CONTENTS.

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TRIANGULATION

A scheme of first-order triangulation composed of check figures was executed along the eastern side of the atoll from a first-order base line on Runit Island. This scheme extends northward to Engebi Island and southward to Aniyaanii Island, and was executed for the the purpose of coordinating local surveys on the activated islands and to establish distances and azimuths between certain installations.

All observations were made at night, and standard procedure was followed throughout. The maximum triangle closure for the entire scheme was 02.41 seconds and the average 01.01 seconds. The maximum triangle closure in the base expansion figure was 01.10 seconds and the average 00.55 seconds.

With the exception of station REEF PHOTO TOWER, which could not be occupied because of excessive vibration, all stations were occupied. Traverse ties were made to the Zero and/or Photo towers on Engebi, Aomon, Runit, and Aniyaanii Islands.

In order to coordinate the triangulation of the U.S.S. BOWDITCH with the new survey, stations NORTH BASE USN, 1944 and SAND USN, 1944 were incorporated into the scheme.

BASE LINE

A first-order base line was measured on Runit Island between stations NORTH BASE USN, 1944 and newly established station RUNIT. The configuration of the island necessitated the adoption of a broken base consisting of four sections of varying lengths. First-order invar tapes were used, and standard procedure followed throughout.

The computed probable error of the final measurement is 1 part in 2,100,000.

This base line is shorter than the second-order base line measured on the same island by the U.S.S. BOWDITCH in 1944 due to the fact that a considerable portion of the sand spit extending off the south end of the island has washed away.

The base expansion figure was developed through station CORAL, a newly established station constructed in the same general area as station REEF USN, 1944, but not identical with that station. This is the most advantageous position at which the construction of a station suitable for observations was feasible.

The base expansion figure does not meet the specifications for first-order triangulation in that the R1 for the figure is larger than is generally allowed on first order triangulation. This is the only respect in which the triangulation fails to meet first-order specifications, and is largely compensated by the limited extent of the scheme.

SECRET

DATUM

No astronomic observations were made. The datum adopted was that established by the survey of the U.S.S. BOWDITCH in 1944, which is considered to meet all requirements of the present survey.

The probable errors of the elements of the datum as determined by the U.S.S. BOWDITCH are as follows:

Latitude	0".1
Longitude	0".1
Azimuth	0".7

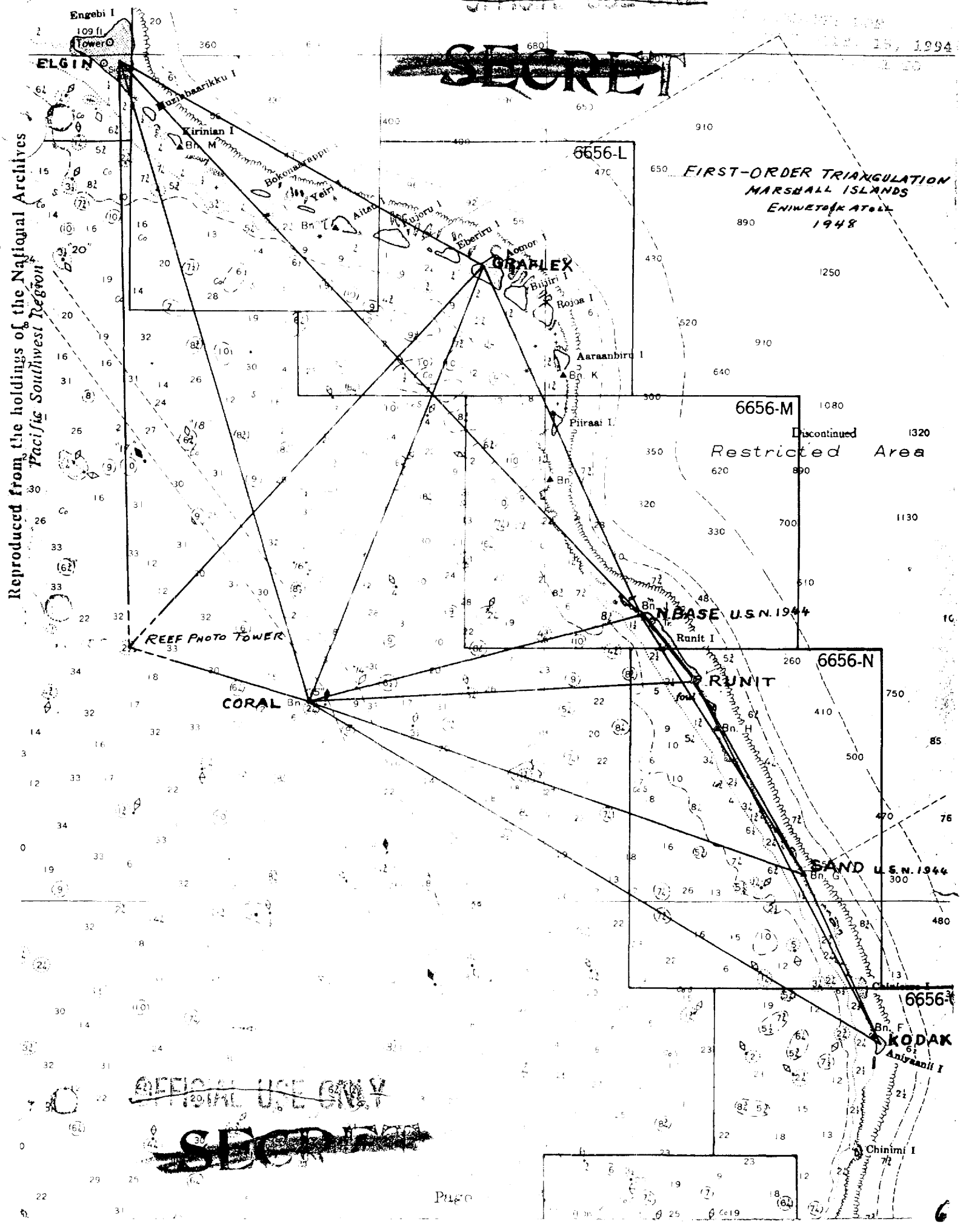
Although the original azimuth observations were made from station NORTH BASE USN 1944 to station SOUTH BASE USN 1944, a line which no longer exists, an examination of the correction obtained for the angle in the adjustment of the BOWDITCH triangulation shows that but little accuracy is lost by using the azimuth of the line NORTH BASE USN, 1944 to SAND USN, 1944. It was therefore considered that a reobservation for the purposes of the present survey was not justified.

In the computation of the new first-order scheme, the latitude and longitude of station NORTH BASE USN, 1944 and the forward azimuth of the line NORTH BASE USN, 1944 to SAND USN, 1944 have been held, and together with the elements of the Clarke spheroid of 1866 determine the datum used.

RECOMPUTATION OF USN STATIONS.

Since the introduction of a new base line into the scheme changes the length obtained for the line NORTH BASE USN, 1944 to SAND USN, 1944, a recomputation was made for stations of the BOWDITCH survey to the southward of the first-order scheme in order to make them consistent with the new scheme and available for use on the present project. This recomputation was made from the line NORTH BASE USN, 1944 -- SAND USN, 1944. The adjusted angles of the BOWDITCH surveys were used.

SECRET



DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 28-B
Ed. April 1940

FIELD COMPUTATION

GEOGRAPHIC POSITIONS

ENIWETOK ASTRONOMIC DATUM, 1944

Accession No. of Computation: _____

Locality ENIWETOK ATOLL — FIRST-order Triangulation. State MARSHALL ISLANDS

16—15034-1 U. S. GOVERNMENT PRINTING OFFICE

STATION	LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE		
						LOGARITHM (METERS)	METERS	FEET
NORTH BASE, U.S.N., 1944	11 33 23.265		327 56 52.40		SAND, U.S.N., 1944			
d. m.	162 21 09.890							
SAND, U.S.N., 1944	11 30 18.781		147 57 15.78	327 56 52.40	NORTH BASE, U.S.N., 1944	3.824 1995	6670.33	21,9[illegible]
d. m.	162 23 06.873							
CORAL	11 32 40.255		253 01 25.04	75 02 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	109 54 [illegible]	LAND, U.S.N. [illegible]	[illegible]	[illegible]	[illegible]
[illegible]								
	11 32 6.08[illegible]		[illegible]	[illegible]	CORAL	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	322 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
KUDAK	11 28 13.[illegible]		125 16 28.70	305 [illegible]	CORAL	4.108 3840	14407.35	47,268.1
	162 [illegible] 38.13[illegible]		54 00 12.79	333 59 49.43	RUNIT ZERO TOWER	3.908 2891	8096.35	26,562.8
GRAFFLE								
	[illegible] 37 [illegible]		[illegible]	[illegible]	NORTH BASE [illegible]	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	CORAL	[illegible]	[illegible]	[illegible]
ELGIN	[illegible]		[illegible]	[illegible]	GRAFFLE	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	CORAL	[illegible]	[illegible]	[illegible]
REEF PHOTO [illegible]	[illegible] 32 03 [illegible]		180 09 04.10	00 [illegible] 04.24	ELGIN	4.043 7715	12359.99	40,[illegible]
	162 14 54.051		285 39 19.13	105 [illegible] 47.12	CORAL	3.447 2442	4357.49	14,[illegible]
			266 31 08.64*	86° [illegible] 25.14*	RUNIT ZERO TOWER	4.[illegible] 2928*	15375.04	18,043.2
			223 24 17.41*	43 2 09.14*	AOMON ZERO TOWER	4.055 4317*	11361.40	37,279.1
			176 16 49.13*	356 [illegible] 43.40*	ENGEBI ZERO TOWER	4.123 5877	13291.92	43,608.6

[1] No check on this position.

Abbreviations used: d. = described; m. = marked; n. = not; r. = recovered; l. = lost; p. = probably. (Examples: n. d. = not described; p. l. = probably lost.)

* Derived by inverse Position Computation

DECLASSIFIED PER DOE
LETTER DATED JULY, 15, 1994
FROM ANTON SINISGALLI TO
DIANE S. NIXON

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26 B
Ed. April 1940

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FIELD COMPUTATION
GEOGRAPHIC POSITIONS

Accession No. of Computation:

Locality ENIWETOK ATOLL   ENIWETOK ASTRONOMIC 1944 ~~North American 1927~~ Datum   FIRST -order TRAVERSE ~~Triangulation~~   State MARSHALL ISLANDS

16—15634-1 U. S. GOVERNMENT PRINTING OFFICE

STATION	LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE LOGARITHM (METERS)	DISTANCE METERS	DISTANCE FEET
ANIYAANII PHOTO TOWER	11 28 18.619		143 52 48.38	323 52 48.30	KODAK	1.330 9208	21.425	70.292
[illegible]	162 [illegible] 52		[illegible] 58 51.18*	331 58 18.62*	RUNIT ZERO TOWER	[illegible] 0466*	10520.60	34,516.3
RUNIT ZERO TOWER	[illegible]		[illegible] 58 50.04	290 58 48.81	NORTH BASE [illegible]	[illegible] 945	[illegible]	654.906
[illegible]	[illegible]		[illegible]	[illegible] 41 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible] 58				
[illegible]	[illegible]		[illegible]	228 57 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	16[illegible]		[illegible]	[illegible] 54	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible] 39 17.84	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	30 04 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TRAVERSE STA [illegible]	[illegible] 3.295		26 11 41.20	30[illegible] 17 37.98	ADMON [illegible]	[illegible]	[illegible]	[illegible]
	162 [illegible] 41.578							

1 No check on this position.   Abbreviations used: d.=described; m.=marked; n.=not; r.=recovered; l.=lost; p.=probably. (Examples: n. d.=not described; p. l.=probably lost.)

* Derived By Inverse Position Computation

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FIELD COMPUTATION

GEOGRAPHIC POSITIONS

ENIWETOK ASTRONOMIC, 1994
~~North American 1927~~ Datum

Accession No. of Computation:

Locality ENIWETOK ATOLL — order ~~Triangulation~~ TRAVERSE — State MARSHALL ISLANDS

10—18034-1 U. S. GOVERNMENT PRINTING OFFICE

STATION	LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE		
						LOGARITHM (METERS)	METERS	FEET
TRAVERSE STA BILLIEI	11 [illegible] 00 162 [illegible]		[illegible] 00 [illegible]	306 17 41.20	TRAVERSE STA ANNON	2.380 3885	759.2[illegible]	2,490.994

[illegible] No check on this position. Abbreviations used: d = described; m = [illegible]marked; r = [illegible]; r = recovered; l = lost; p = probably. (Examples: n.d. = not described; p.l. = probably lost.

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SECRET

DIRECTIONS

Station CORAL *State* Marshall Islands (Eniwetok Atoll)

Chief of party R.L.Pfe *Date* 2-17- *Computed by* M.G.

Observer G.R.Stro de *Instrument* [illegible] *Checked by* JRS

OBSERVED STATION	Observed direction	Sea level reduction	Corrected direction with zero initial	Adjusted direction
	° ′ ″	″	° ′ ″	° ′ ″
ELGIN	[illegible]		0 00 00.00	
GRAFLEX	[illegible]			
N.BASE U.S.N. 1944	[illegible]			
RUNIT	[illegible]			
SAND U.S.N. 1944	[illegible]			
KODAK	[illegible]			
REEF PHOTO TOWER	[illegible]			

No eccentricit[illegible] of [illegible] tion.

Observations m[illegible] f[illegible]

Recorded in volumes [illegible]

NOTE: No reference [illegible]

USE ONLY

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[illegible]

/0

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
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~~SECRET~~

Station ELGIN Note Marshall [illegible] (Enwetok Atoll)

Chief of party R. L. Pfau Date 2-19-48 *Computed by* G.R.S.

Observer G.R.S. *Instrument* [illegible] *Checked by* R.L.P.

OBSERVED STATION	[illegible]	[illegible]	Corrected direction with zero initial	Adjusted direction*
			° ′ ″	° ′ ″
GRAFLEX	[illegible]	[illegible]	0 00 00.00	
N. BASE U.S.N. 1944	[illegible]	[illegible]		
CORAL	[illegible]	[illegible]		
REEF PHOTO TOWER	[illegible]	[illegible]		
ENGEBI ZERO TOWER	[illegible]	[illegible]		

No eccentricity of lights or instrument at this station.

Observations made from a [illegible] foot steel tower.

Observations recorded in volume 4.

NOTE: No reference marks were established at this station.

~~SECRET~~

* These columns are for office use and should be left blank in the field.

[illegible]

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DEPARTMENT OF COMMERCE
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LIST OF DIRECTIONS

Station GRAFLEX | State [illegible] (Eniwetok Atoll)

Chief of party R.L.Platt | Date [illegible] | Computed by M.G.

Observer G.R.Stroce | Instrument [illegible] | Checked by MHJ

OBSERVED STATION	Observed direction	Eccentricity correction*	Corrected direction with zero initial	Adjusted direction*
	° ′ ″	″	° ′ ″	° ′ ″
N.BASE U.S.N. 194	[illegible]		0 00 00.00	
CORAL	[illegible]			
REEF PHOTO TOWER	[illegible]		47 49 24.02	
ELGIN	[illegible]			
Aomon Zero Tower Horizontal [illegible]	[illegible]			
Aomon Photo Tower Ebr				
Hor. Dist. [illegible]	[illegible]			

No eccentricity of light [illegible]

Observations made from [illegible] steel tower.

Recorded in volume 3.

NOTE: No reference [illegible]

* Observations reduced [illegible]

* Record of [illegible]

These columns are for office use [illegible]

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 24-A
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L[illegible] OBSERVATIONS

Station ....AODAK *Said* Marshal Islands

Chief of party R.L.Pfau *Date* 8-13-45 *Computed by* M.G.

Observer G.R.Strode *Instrument* G3[illegible]5 *Checked by* HRS

11—6503

OBSERVED STATION	[illegible]	[illegible]	[illegible]	Corrected direction with zero station	Adjusted direction*
				° ′ ″	° ′ ″
CORAL	[illegible]			00 00.00	
UNIT	[illegible]				
AND USN 1944	[illegible]				
R.M.No.1 NE Hor.					
Dist. 57.398ft					
17.495meters	[illegible]				
*Aniyaanii photo tower					
SE Hor. Dist. 21.428m	[illegible]				
R.M.No.2 SSE Hor.					
Dist. 110.819ft.					
33.776 meters	[illegible]				

No eccentricity of [illegible]

Observations made from [illegible]

Recorded in volume 1.

*Distance to the Aniyaanii photo tower was measured with [illegible] steel tape G3661 with tension of [illegible]

~~SECRET~~

*These columns are for office use and should be left blank in the field

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SECRET

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Form 24 A
Rev. Oct., 1932

LIST OF DIRECTIONS

Station N. BASE U.S.N. [illegible] *Date* [illegible]

Chief of party R.L. [illegible] *Computed by* M.G.

Observer G.R.Strode *Instrument* [illegible] *Checked by* [illegible]

U. S. GOVERNMENT PRINTING OFFICE: 1933 — 11—2503

OBSERVED STATION	Observed direction	Sea level reduction	Corrected direction with zero initial	Adjusted direction*
	° ′ ″	″	° ′ ″	° ′ ″
RUNIT	[illegible]		0 00 00.00	
SAND U.S.N. 1944	[illegible]			
CORAL	[illegible]			
EIGIN	[illegible]			
GR FLEX	[illegible]			
RUNIT PHOTO TOWER Hor. Dist. 40.164 m *	[illegible]			
RUNIT ZERO TOWER Hor. Dist. 199.613 m *	[illegible]			

No eccentricity of [illegible] Instrument [illegible]

Observations made from [illegible]

Recorded in volume [illegible]

NOTE: No reference [illegible]

* Record of observation [illegible]

† Record of measurement [illegible]

SECRET

* These columns are for office use and [illegible] not filled in the field

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DEPARTMENT OF COMMERCE
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SECRET

LIST OF DIRECTIONS

Station RUNIT *Atoll* Marshall Islands (Kwajalein Atoll)

Chief of party R. L. Pfau *Date* 1-31-44-2-1 *Computed by* G.R.S.

Observer G.R.S. & J.C.H. *Instrument* Gurley 3-inch *Checked by*

OBSERVED STATION	Mean direction	Reduction	Mean direction with initial	Adjusted direction*
	° ′ ″		° ′ ″	° ′ ″
SAND U.S.N. 1944	[illegible]	[illegible]	00 00 00.00	
KODAK	[illegible]	[illegible]	[illegible]	
CORAL	[illegible]	[illegible]	[illegible]	
N. BASE U.S.N. 1944	[illegible]	[illegible]	[illegible]	

Reference mark No. 1
41.075 feet, 12.520 meters [illegible]

Reference mark No. 2
48.062 feet, 14.650 meters [illegible]

No eccentricity of light or instrument at this station.
Observations made from [illegible]
Observations recorded in [illegible] and 2 and in
Horizontal angles volume [illegible]
NOTE: Reference mark [illegible] of instrument H-334.

SECRET

* These columns are for office use and should be left blank by [illegible]

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 24A
Rev. Oct., 1932

LIST OF DIRECTIONS

Station SAND U.S.N. 1944 *State* Marshall Islands (Enjwetok Atoll)

Chief of party R.A.Pfeil *Date* 2-14-44 *Computed by* M.G.

Observer G.R.Strode *Instrument* G.T.1 *Checked by* HRS

11—9543

OBSERVED STATION	Observed direction	Sea level reduction*	Corrected direction with zero initial	Adjusted direction*
	° ′ ″	″	° ′ ″	° ′ ″
KODAK	0 00 00.00		0 00 00.00	
CORAL	[illegible]			
N BASE U.S.N. 1944	[illegible]			
RUNIT	[illegible]			

No eccentricity of [illegible] on instrument [illegible] station.

Observations made from [illegible] wood tower.

Recorded in volume 1.

NOTE: No reference m[illegible] this station.

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 382
Ed. June 1929

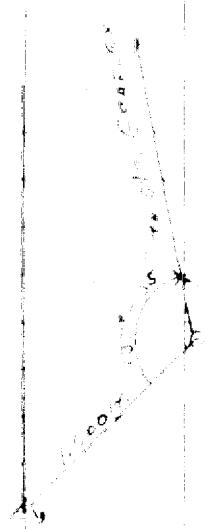
Eccentric Light at Station

REEF PHOTO TOWER

d = 1.500 *meters*

16—19440

STATION			LOGARITHM OF REDUCTION IN SECONDS	REDUCTION =
Center				
Graflex	13	7 35	26187	+19.28



Eccentricity of photo at Reef Photo Tower is determined on Photo Theodolite Graflex ONLY. Eccentricity for Graflex at other stations

~~SECRET~~

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 470
Ed. Oct. 1, 1

ABSTRACT OF DIRECTIONS

Station 108 A Computed [illegible] Date 2-17-48

Observer [illegible] Checked by [illegible] Inst. No. 6335

POSITION NO.	STATIONS OBSERVED								
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	KOA A R	REEF PHOTO TOWER	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	° ′	° ′	° ′
	IN FIELD 0° 00″	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	137 44	302 31	
							"	"	"
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Sum,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Mean,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Cor. for eca.,									
Direction,									

DO NOT WRITE IN THIS MARGIN

~~SECRET~~

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 470
Ed. Oct. 1944

SECRET

ABSTRACT OF DIRECTIONS

Station ELGIN Date 2-19-48

Observer G.R. Strode Inst. No. 6335

U. S. GOVERNMENT PRINTING OFFICE: 1944 11—4089

POSITION NO.	STATION DESCRIPTIONS			
	GRAFLEX			
	(INITIAL 0° 00')			
1	0.00			
2	0.00			
3	0.00			
4	0.00			
5	0.00			
6	0.00			
7	0.00			
8	0.00			
9	0.00			
10	0.00			
11	0.00			
12	0.00			
13	0.00			
14	0.00			
15	0.00			
16	0.00			
Sum,				
Mean,				
Cor. for ecc.,				
Direction,				

SECRET

DEPARTMENT OF COMMERCE
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Ed. Oct. 1932

SECRET

ABSTRACT OF DIRECTIONS

Station GRAFTON Computed by [illegible] Date 2-18-48

Observer G. H. Swain Checked by [illegible] Inst. No. G 335

U. S. GOVERNMENT PRINTING OFFICE 1931 11—4080

POSITION NO.	STATIONS OBSERVED					
	N BASE			W BASE	AOMON PHOTO TOWER	
	S.N. 12 '48 (INITIAL)			SW 1944		
	0° 0'			° '	° '	° '
				00 00	263 34	
1	0.00				120	
2	0.00					
3	0.00					
4	0.00					
5	0.00				175	
6	0.00					
7	0.00					
8	0.00					
9	0.00				158	
10	0.0					
11	0.0					
12	0.0					
13	0.0					
14	0.0					
15	0.0					
16	0.0					
Sum,					653	
Mean,					81	
Cor. for ecc.						
Direction,					81	

DO NOT WRITE IN THIS MARGIN

SECRET

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 470
Ed. Oct., 1932.

ABSTRACT OF DIRECTIONS

Station MODA Computed by [illegible] Date [illegible]

Observer G. R. STROZ Record by [illegible] Inst. No. [illegible]

U. S. GOVERNMENT PRINTING OFFICE: 1932 11—4680

POSITION NO.		STATION
	CORAL	[illegible]
	(INITIAL) 0° 00′	[illegible]
1	0.00	
2	0.00	
3	0.00	
4	0.00	
5	0.00	
6	0.00	
7	0.00	
8	0.00	
9	0.00	
10	0.00	
11	0.00	
12	0.00	
13	0.00	
14	0.00	
15	0.00	
16	0.00	
Sum.		
Mean,		
Cor. for ecc.,		
Direction,		

DO NOT WRITE IN THIS MARGIN

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 470

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ABSTRACT OF DIRECTIONS

Station [illegible] Computed [illegible] Date 2-13-48

Observer E. C. SIMMS Checked by [illegible] Inst. No. G 335

POSITION NO.	STATION OCCUPIED					
	SAN [illegible]					
	INITIAL 0° 00'					
1	0.00					
2	0.00					
3	0.00					
4	0.00					
5	0.00					
6	0.00					
7	0.00					
8	0.00					
9	0.00					
10	0.00					
11	0.00					
12	0.00					
13	0.00					
14	0.00					
15	0.00					
16	0.00					
Sum,						
Mean,						
Cor. for ecc.,						
Direction,						

DO NOT WRITE IN THIS MARGIN

SECRET

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
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Ed. Oct., 1932

ABSTRACT OF DIRECTIONS

State

Station N. BASE CSN 194 Computed by MC Date 2-6-48

Observer G. R. Strode Checked by SAR Inst. No. 6335

POSITION NO.	RUNIT	STATIONS USED								
	(INITIAL) 0° 00"							°	'	"
1	0.00									
2	0.00									
3	0.00									
4	0.00									
5	0.00									
6	0.00									
7	0.00									
8	0.00									
9	0.00									
10	0.00									
11	0.00									
12	0.00									
13	0.00									
14	0.00									
15	0.00									
16	0.00									
Sum,										
Mean,										
Cor. for cent.,										
Direction,										

DEPARTMENT OF COMMERCE
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ABSTRACT OF DIRECTIONS

Station RUNIT Computed [illegible] Date 2-15-48

Observer G.R. Strock Checked to [illegible] Inst. No. 6235

U. S. GOVERNMENT PRINTING OFFICE, 1934 11—6089

POSITION NO.					
	SAND				
	USN 1944				
	(INITIAL)				
	0° 00'	66 12 19 36			0 ' 0 " 0 "
1	0.00				
2	0.0				
3	0.0				
4	0.0				
5	0.0				
6	0.0				
7	0.0				
8	0.00				
9	0.00				
10	0.00				
11	0.00				
12	0.00				
13	0.00				
14	0.00				
15	0.00				
16	0.00				
Sum,					
Mean,					
Cor. for sec.,					
Direction,					

DO NOT WRITE IN THIS MARGIN

SECRET

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 470
Ed. Oct. 1 ...

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N 175 05
175 20

ABSTRACT OF DIRECTIONS

State ...

Station SANL ... Computed by ... Date 2-14-48

Observer G.R. Strode Checked by ... Inst. No. E 233

U. S. GOVERNMENT PRINTING OFFICE 1941 11—4039

STATION ...

POSITION NO.	(INITIAL) 0° 00"	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "
1	0.00						
2	0.00						
3	0.00						
4	0.00						
5	0.00						
6	0.00						
7	0.00						
8	0.00						
9	0.00						
10	0.00						
11	0.00						
12	0.00						
13	0.00						
14	0.00						
15	0.00						
16	0.00						
Sum,							
Mean,							
Cor. for ecc.,							
Direction,							

SECRET

DO NOT WRITE IN THIS MARGIN

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
FORM 25

COMPUTATION OF TRIANGLES

Marshall Islands Eniwetok Atoll

STATION	OBSERVED ANGLE	CORRECTION	CORRECTED ANGLE	WEIGHT	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3					2591.9689m	3 413 6298
1 Coral				1.02	0950	0 564 9132
2 N. Base				1.01	55.76	9 966 3991
3 Reef				1.02	54.74	9 896 2271
1-3						3 944 9421
1-2						3 874 7701
				0.05	00 00	
2-3						3.874 7701
1 Sand				1.04	1169	0.202 1920
2 Coral				1.04	27.87	9 747 8359
3 N. Base				1.04	20.44	9 980 3895
1-3						3.824 7980
1-2						4 057 3516
				0.12	00.00	
2-3						3.944 9421
1 Sand				1.03	27.13	0.173 2968
2 Coral				1.03	18.33	9 495 1219
3 Reef				1.03	10.54	9 939 1108
1-3						3. 613 3608
1-2						4. 057 3497
				0.08	00.00	
2-3						3. 413 6298
1 Sand				1.00	19.55	1 245 7478
2 N. Base				1.00	9.492	8 953 9174
3 Reef				1.01	05.53	9 165 3757
1-3						3. 613 2922
1-2						3. 824 7533
				0.01	00.00	

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 25
Ed. Nov. 1946

COMPUTATION OF TRIANGLES

State: .....

STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						3.944 9421
1 Kodak	33 03 44.89	-0.80	44.09	0.05	44.04	0.263 1657
2 Coral	30 05 33.60	-0.80	32.80	0.05	32.75	9.700 1813
3 Runit	116 50 44.08	-0.81	43.27	0.06	43.21	9.950 4762
1-3						3.908 2891
1-2						4.158 5840
	02.57	-2.41		0.16	00.00	
2-3						4.057 3497
1 Kodak	35 55 36.07	-0.61	35.46	0.03	35.43	0.231 5490
2 Coral	11 52 14.87	-0.61	14.26	0.03	14.23	9.313 2373
3 Sand, U.S.N.	132 12 10.97	-0.60	10.37	0.03	10.34	9.869 6879
1-3						3.602 1320
1-2						4.158 5826
	01.91	-1.82			00.00	
2-3						3.613 3608
1 Kodak	02 51 51.18	-0.17	51.01	0.00	51.01	1.301 3048
2 Runit	02 47 26.84	-0.17	26.67	0.00	26.67	8.687 4052
3 Sand, U.S.N.	174 20 42.50	-0.17	42.33	0.01	42.32	8.993 3778
1-3						3.602 0468
1-2						3.908 2624
	00.52	-0.51			00.00	
2-3						
1						
2						
3						
1-3						
1-2						

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 25
Ed. Nov. 1946

COMPUTATION OF TRIANGLES

State: Marshall Islands ~ Eniwetok Atoll

	STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3						3.874 7701
	1 Graflex	45 59 53.24	-0.43	52.81	0.05	52.76	0.143 0806
	2 N. Base, USN	80 21 39.08	-0.42	38.66	0.06	38.60	9.993 8247
	3 Coral	53 38 29.12	-0.43	28.69	0.05	28.64	9.905 9691
	1-3						4.011 6754
	1-2						3.923 8198
		01.44	-1.28			00.00	
	2-3						4.011 6754
	1 Elgin	46 07 16.82	+0.16	16.98	0.08	16.90	0.142 1794
	2 Graflex	95 38 14.34	+0.16	14.50	0.07	14.43	9.997 8945
	3 Coral	38 14 28.59	+0.16	28.75	0.08	28.67	9.791 6729
	1-3						4.151 7493
	1-2						3.945 5277
		59.75	+0.48		0.23	00.00	
	2-3						3.874 7701
	1 Elgin	27 26 12.84	+0.34	13.18	0.09	13.09	0.336 5134
	2 N. Base, USN	60 40 48.70	+0.34	49.04	0.09	48.95	9.940 4670
	3 Coral	91 52 57.71	+0.34	58.05	0.09	57.96	9.999 7655
	1-3						4.151 7505
	1-2						4.211 0490
		59.25	+1.02		0.27	00.00	
	2-3						4.211 0490
	1 Graflex	141 38 07.58	-0.64	06.98	0.04	06.94	0.207 1425
	2 N. Base, USN	19 40 50.38	-0.65	49.77	0.04	49.73	9.527 3392
	3 Elgin	18 41 03.98	-0.65	03.37	0.04	03.33	9.505 6285
	1-3						3.945 5307
	1-2						3.923 8200
		01.94	-1.82		0.12	00.00	

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
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COMPUTATION OF TRIANGLES

State: Marshall Islands ~ Eniwetok Atoll

STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						4.011 6754
1 Reef Photo tower	(62 27 20.26)	0.00	20.26	0.04	20.22	0.052 2464
2 Graflex	21 49 30.78	0.00	30.78	0.04	30.74	9.570 2816
3 Coral	95 43 09.07	0.00	09.07	0.03	09.04	9.997 8328
1-3						3.634 2034
1-2						4061 7546
	00.11	0.00		0.11	00.00	
2-3						3.945 5277
1 Reef Photo tower	(43 02 55.95)	0.00	55.95	0.08	55.87	0.165 8199
2 Elgin	63 08 20.74	0.00	20.74	0.08	20.66	9.950 4165
3 Graflex	73 48 43.56	0.00	43.56	0.09	43.47	9.982 4306
1-3						4.061 7644
1-2						4.093 7782
	00.25			0.25	00.00	
2-3						4.151 7505
1 Reef Photo tower	(105 30 15.73)	0.00	15.73	0.05	15.68	0.016 0986
2 Elgin	11 01 03.92	0.00	03.92	0.04	03.88	9.466 3751
3 Coral	51 28 40.48	0.00	40.48	0.04	40.44	9.925 9224
1-3						3.634 2242
1-2						4.093 7715
	00.13			0.13	00.00	
2-3						
1						
2						
3						
1-3						
1-2						

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

			°	′	″				°	′	″
α	2	to 3	255	01	25.04	α	3	to 2	75		12.88
2d ∠		&	+15	48	09.52	3d ∠			-112	14	55.77
α	2	to 1	270	49	34.56	α		to 1	322	47	17.11
Δα			+	00	58.14	Δα			+	00	10.36
			180	00	00.00				180	00	00.00
α′	1	to 2	90	50	32 70	α′	1	to 3	142	47	27 47
		First Angle of Triangle	51	56	54.76						
			42	47	27.46						

	°	′	″				°	′	″
φ	11 32 22	2		φ	11 33 23.265	3 N Base USN	λ	162	21 09.890
Δφ	- 00 07		Δλ	+	04 50.690	Δφ	- 01 01.185		Δλ	+	00 51.731
φ′	11 32 16.080	1 RUNIT	λ′	162	22 01.621	φ′	11 32 16.080	1 RUNIT	λ′	162	22 01.621

Logarithms			Logs			Logarithms			Logs			Logarithms	
s	3.777 1721	(1)	+ 04.1345	½	9.699	½(φ+φ′)	11 32 18.17	s	3.413 6298	(1)	+ 67 1835	½	9.699	½(φ+φ′)	11 32 49.67
+ cos α	8.128 7276	(2)	+ 0.0404	s′		Logarithms		+ cos α	9.110 1336	(2)	+ 0.0013	s²		Logarithms	
B	7.906 0997	Sum	+ 04.1749	K		s	3.777 1721	B	8.523 4970	Sum	+ 67.8348	K		s	3.413 6298
(1) -h	3.5547			E		(−) sin α	9.999 3548	(1) -h	1.827 2626	(3)	+ 0.0000	E		sin α	9.781 5865
s²	7.554 88	4		5		A	3.509 6678	s²	6.827 26	(4)	0.0000	(5)		A	3.509 6678
sin² α	7.779 91	5		3	0.477	sec φ′	0.008 8657	sin² α	9.563 17	(5)		3	0.477	sec φ′	0.008 8657
C	0.11668	(6)		cos² α		Sum	2.463 4304	C	0.11737	(6)	+	cos² α		Sum	1.713 7498
(2)=K	8.06047	(7)		(6)		Arc—sin corr.	0	(2)=K	7.10780	(7)	+	(6)		Arc—sin corr.	0
(½s)²	1.2327	−Δφ	+ 04.1749	(colog) E		− Δλ	2.463 4304	(½s)²	3.6545	−Δφ	+ 67.1848	(colog) E		− Δλ	1.713 7498
D	1.9845	Δφ/2		A²arc²1″/3	5.912	sin½(φ+φ′)	9.301 0828	D	1.9851	Δφ/2		A²arc²1″/3	5.912	sin½(φ+φ′)	9.301 4075
(3)	3.2172			sec²φ		sec Δφ/2	0	(3)	5.6396			sec²φ		sec Δφ/2	0
−h	0.6164			(7)		(approx.) −Δα	1.764 5132	−h	1.8273			(7)		(approx.) −Δα	1.015 1573
s² sin² α	7.8898					do	-58.145	s² sin² α	6.3904					do	10.355
E	5.6635	Arc—sin corr.				(8)	0	E	5.6636	Arc—sin corr.				(8)	0
(4)	4.1697	for s	− 1	(Δλ)³	7.390	−Δα	-58.145	(4)	3.8813	for s	− 0	(Δλ)³	5.141	, −Δα	− 10.355
		for Δλ	+ 1	F	7.575					for Δλ	+ 0	F	7.135		
		Total	0	(8)	4.965	− Δλ	-290.690			Total	0	(8)	2.276	− Δλ	− 51.7309

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U. S. GOVERNMENT PRINTING OFFICE : 1941 — O - 305152

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

			°	′	″				°	′	″
α	2	to 3	270	49	34.56	α	3	to 2	90	50	32.70
2d ∠		&	+30	05	32.80	3d ∠		&	−116	50	43.27
α	2	to 1	300	55	07.36	α	3	to 1	333	59	49.43
Δα			+	01	21.34	Δα			+	00	23.36
			180	00	00.00				180	00	00.00
α′	1	to 2	120	56	28.70	α′	1	to 3	154	00	12.79
		First Angle of Triangle	33	03	44.09						
	°	′	″		180	00	12.79		°	′	″

φ	11	32	20.255	2 CORAL	λ	162	17	10.931	φ	11	32	16.080	3 RUNIT	λ	162	23	01.621
Δφ		04	00.780		Δλ	+	06	41.804	Δφ	−	03	56.838		Δλ	+	01	57.114
φ′	11	28	19.475	1 KODAK	λ′	162	23	52.735	φ′	11	28	23.242	1 KODAK	λ′	162	24	58.735

	Logarithms				Logs
s	4.158 5840	(1)	+ 240.9851	½	9.699
+ cos α	9.710 8123	(2)	+ 0.0796	s²	
B	8.512 4491	Sum	+ 240.9847	K	
(1)=h	2.381 8460	(3)	+ 0.0006	E	
s²	8.317 6816	(4)	− 0.0002	(5)	
sin² α	7.8666 [illegible]	(5)		3	0.477
C	[illegible]	(6)		cos² α	
(2)=K	8.7000 [illegible]	(7)		(6)	
(½δφ)²	4.7638	−Δφ	+ 240.9851	(colog) E	
D	1.9845	Δφ/2		A²arc²1″/3	5.912
(3)	6.7483			sec²φ	
−h	2.3818			(7)	
s² sin² α	8.1840				
E	5.6635	Arc−sin corr.			
(4)	6.2293	for s	− 3.5	(Δλ)²	7.832
		for Δλ	+ 2.8	F	7.575
		Total	−0.7	(8)	5.407

	Logarithms			
½(φ+φ′)	11 32 19.15			
s	4.158 5840			
(−) sin α	9.933 4352			
A′	8.509 6684			
sec φ′	0.008 7642			
Sum	6.6 [illegible]			
Arc−sin corr.	1			
−Δλ	2.610 4517			
sin½(φ+φ′)	9.299 8596			
sec Δφ/2 (approx.)	1			
−Δα	1.9103114			
do	− 81.342			
(8)	0			
−Δα	− 81.342			
−Δλ	− 4[illegible]			

	Logarithms				Logs
s	3.908 2891	(1)	+ 236.8308	½	9.699
+ cos α	9.953 6493	(2)	+ 0.0066	s²	
B	8.512 4998	Sum	+ 236.8374	K	
(1)=h	2.374 4382	(3)	+ 0.0005	E	
s²	7.816 58	(4)	− 0.0000	(5)	
sin² α	9.283 [illegible]	(5)		3	0.477
C	0.116 [illegible]	(6)		cos² α	
(2)=K	7.811 01	(7)		(6)	
(½δφ)²	4.7489	−Δφ	+ 236.8379	(colog) E	
D	1.9845	Δφ/2		A²arc²1″/3	5.912
(3)	6.7334			sec²φ	
−h	2.3744			(7)	
s² sin² α	7.1004				
E	5.6635	Arc−sin corr.			
(4)	5.1383	for s	− 1.1	(Δλ)²	6.206
		for Δλ	+ 0.2	F	7.575
		Total	− 0.7	(8)	3.781

	Logarithms
½(φ+φ′)	11 30 [illegible]
s	3.908 2891
(−) sin α	9.6[illegible]
A′	8.[illegible]
sec φ′	0.008 7642
Sum	2.0[illegible]
Arc−sin corr.	[illegible]
− Δλ	2.06[illegible]
sin½(φ+φ′)	9.299 8380
sec Δφ/2 (approx.)	1
−Δα	1.3684473
do	− 23.358
(8)	0
−Δα	− 23.358
−Δλ	− 117.1141

U. S. GOVERNMENT PRINTING OFFICE : 1941 — O - 305152

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

			°	′	″				°	′	″
α	2	to 3				α	3	to 2			
2d ∠		&	+			3d ∠		&			
α	2	to 1	327	56	52.40 ✓	α	3	to 1			
$\Delta\alpha$			+	00	23.38 ✓	$\Delta\alpha$	NOTE: Position of N. Base USN 1944 and				
			180	00	00.00		Azimuth N. Base USN to Sand USN 1944 has been Held fixed in these computations		180	00	00.00
α'	1	to 2	147	57	15.78 ✓	α'	1	to 3			

ϕ	[illegible]		162	21	09.890 ✓	ϕ	3				
$\Delta\lambda$	− 03 04 284		+	01	56.983 ✓	$\Delta\phi$					$\Delta\lambda$
λ'	11 30 18 981 ✓	[illegible]	162	23	06.873 ✓	ϕ'	1				λ'

Logarithms				Logs		Logarithms				Logs	Logarithms
s	3.824 1980	(1)	+ .84 2768	$\frac{1}{2}$	0.699	$\frac{1}{2}(\phi+\phi')$	11 31 51.128	s	(1)	$\frac{1}{2}$	0.699	$\frac{1}{2}(\phi+\phi')$
+ $\cos\alpha$	9.918 1734 ✓	(2)	+ 0.0066	s^2		Logarithms		$\cos\alpha$	(2)	s^2		Logarithms
B	δ [illegible]			h		−	9.924 1980	B	Sum	K		s
s^2=h	2.265 4198	(3)	+ 0.0003	L		$\sin\alpha$	9.724 8412 ✓	(1) −h	(3) +	E		$\sin\alpha$
s^2	7.649 60	(4)	0000	(5)		A	8.509 6681	s^2	(4)	(5)		A′
$\sin^2\alpha$	9.449 68 ✓	(5)		3	0.477	sec ϕ'	0.008 8154	$\sin^2\alpha$	(5) −	3	0.477	sec ϕ'
C	0.717 37 ✓	(6)	+	$\cos^2\alpha$		Sum	2.068 1227	C	(6) +	$\cos^2\alpha$		Sum
(2)=K	7.816 65 ✓	(7)	+	(6)		Arc−sin corr.	−1	(2)=K	(7) +	(6)		Arc−sin corr.
$\left(\frac{s^2}{\delta\phi}\right)^2$	4.53 09 ✓	$-\Delta\phi$	+184.2837 ✓	(colog) E		$-\Delta\lambda$	2.068 1226 ✓	$(\delta\phi)^2$	$-\Delta\phi$	(colog) E		$\Delta\lambda$
D	1.9851 ✓	$\frac{\Delta\phi}{2}$		$\frac{A^2 arc^2 1''}{3}$	$\bar{5}.912$	$\sin\frac{1}{2}(\phi+\phi')$	9.300 8038 ✓	D	$\frac{\Delta\phi}{2}$	$\frac{A^2 arc^2 1''}{3}$	$\bar{5}.912$	$\sin\frac{1}{2}(\phi+\phi')$
(3)	6.5160 ✓			$\sec^2\phi$		$\sec\frac{\Delta\phi}{2}$	0 ✓	(3)		$\sec^2\phi$		$\sec\frac{\Delta\phi}{2}$
−h	2.2655 ✓			(7)		(approx.) $-\Delta\alpha$	1.368 9264 ✓	−h		(7)		(approx.) $-\Delta\alpha$
$s^2\sin^2\alpha$	7.0993 ✓					do	− 23.384 ✓	$s^2\sin^2\alpha$				do
E	5.6636 ✓	Arc−sin corr.				(8)	0 ✓	E	Arc−sin corr.			(8)
(4)	5.0284 ✓	for s	− 1 ✓	$(\Delta\lambda)^2$	6.204 ✓	$-\Delta\alpha$	−23.384 ✓	(4)	for s −	$(\Delta\lambda)^2$		$-\Delta\alpha$
		for $\Delta\lambda$	+ 0 ✓	F	7.576 ✓				for $\Delta\lambda$ +	F		
		Total	− 1 ✓	(8)	3 4.780 ✓	$-\Delta\lambda$	−116.9830 ✓		Total	(8)		$\Delta\lambda$

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POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

α	2	to 3	324	56	52.40	α	3		147	57	15.78
2d ∠		&	+107	05	20.48	3d ∠			-38	53	11.73
α	2	to 1	75	02	12.88	α	3	to 1	109	04	04.05
Δα			-	00	47.84	Δα			-	01	11.10
			180	00	00.00				180	00	00.00
α'	1	to 2	255	01	25.04	α'	1	to 3	289	02	52.95
		First Angle of Triangle	34 / 269	01 / 02	27.91 / 52.95						

	°	′	″				°	′	″			°	′	″
φ	11	33	23.265	2 N Base, USN	λ	162	21	09.890	φ	11	30	18.981	3 Sand USN	λ	162	23	06.873
Δφ		01	03.010		Δλ	-	00	58.751	Δφ		02	01.274		Δλ	-	00	55.942
φ'					λ'	162	21	10.139	φ'	11	32	20.255	1 CORAL	λ'	162	22	10.931

Logarithms				Logs	Logarithms				Logs	Logarithms	
s	3.874 [illegible]	1	[illegible]	9.699	½(φ−φ')	11 32 51.76	s	4.057 3516	(1)	-121.33[illegible]	½	9.699	½(φ+φ')	11 31 17.6[illegible]	s	4.057 3516
+ cos α	9.471 [illegible]	(2)	0.0274	s²			(−) cos α	9.514 133[illegible]	(2)	+ 0.0604	s²				+ sin α	9.975 492[illegible]
B	8.[illegible]	Sum	+ 63.0099	K			B	8.512 5007	Sum	-121.27[illegible]	K				A'	8.509 6677
h	1.799 [illegible]	3	[illegible]	E			(1)=h	2.083 9864	(3)	+ 0.0001	E				sec φ'	0.008 8675
s²	7.749 [illegible]	4		A			s²	8.114 70	(4)	+ [illegible]	(5)				Sum	2.551 3793
sec φ	[illegible]	5					sin² α	9.750 78	(5)		3	0.477			Arc−sin corr	
		6		cos² α			Sum	[illegible]	(6)		cos² α					
(2)=K	8.736 [illegible]	7		(6)			Arc−sin corr	0	(7)	+	(6)				−Δλ	2551 3793
(Δφ/2)²	9.5984	−Δφ/2	+ 63.0099	(colog) E / A²arc²1″/3	5.912		−Δλ	2.378 3239	(2)=K	8.781 03	(7)				sin½(φ+φ')	9.300 4785
D	1.9851			sec²φ			sin½(φ+φ')	9.301 4290	(δφ/2)²	4.1680	−Δφ	-121.27[illegible]			sec Δφ/2	0
(3)	5.5835			(7)			sec Δφ/2	0	D	1.9833	Δφ/2				(approx.) −Δα	1.851 8578
−h	1.7992						(approx.) −Δα	1.679 7529	(3)	6.1513					do	+ 71.098
s² sin² α	7.7196						do	+ 47.836	−h	2.0840					(8)	0
E	5.6636	Arc−sin corr.					(8)	0	s² sin² α	8.0657					−Δα	+ 71.098
(4)	5.1824	for s	− 1	(Δλ)³	7.135		−Δα	+ 47.836	E	5.6632	Arc−sin corr.					
		for Δλ	+ 1	F	7.576				(4)	5.8129	for s	− 2	(Δλ)³	7.654		
		Total	±0	(8)	4.711		−Δλ	+ 238.9593			for Δλ	+ 2	F	7.567		
											Total	0	(8)	5.221	−Δλ	4355.942[illegible]

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			°	′	″				°	′	″
α	2	to 3	75	02	12.88	α	3	to 2	255	01	25.04
2d ∠		&	+80	21	38.66	3d ∠		&	-53	38	28.69
α	2	to 1	155	23	51.54	α	3	to 1	201	22	56.35
Δα			−	00	23.17	Δα			+	00	24.82
			180	00	00.00				180	00	00.00
α′	1	to 2	335	23	28.37	α′	1	to 3	21	23	21.17
			45	59	52.81						

First Angle of Triangle

φ		N Base				λ			φ				λ		
Δφ						Δλ			Δφ				Δλ		
φ′		GRAFLEX				λ			φ		GRAFLEX		λ		

	Logarithms				Logs		Logarithms				Logs		Logarithms
s	3.923 8198	(1)	− 238.3062	½	9.699	½(φ+φ′)	11 35 27.41	s	4.011 6754	(1)	− 311.3174	½	9.699	½(φ+φ′)	11 34 55.91
cos α	9.958 6685	(2)	+ 0.0064	s²			Logarithms	cos α	9.969 0283	(2)	+ 0.0023	s²			Logarithms
B		Sum		K		s		B		Sum		K		s	
(1)−h	2.374 9873	(3)	+ 0.0006	E		sin α		(1)−h	2.493 2034	(3)	+ 0.0001	E		sin α	
sin²α	9.238 85	(5)		3	0.477	sec φ′	0.001 6018	sin²α	9.123 61	(5)		3	0.477	sec φ′	0.001 6018
C	0.717 37	(6)	+	cos²α		Sum	2.061 9138	C	0.116 68	(6)	+	cos²α		Sum	2.092 1482
(2)=K	7.803 86	(7)	+	(6)		Arc−sin corr.	−1	(2)=K	7.863 64	(7)	+	(6)		Arc−sin corr.	−2
(δφ)²	4.7900	−Δφ/2	−238.2992	(colog) E / A²arc²1″/3	5.912	− Δλ	2.061 9137	(δφ)²	4.9864	−Δφ/2	− 311.3092	(colog) E / A²arc²1″/3	5.912	− Δλ	2.092 1480
D	1.7851			sec²φ		sin½(φ+φ′)	9.303 0300	D	1.9845			sec²φ		sin½(φ+φ′)	9.302 7065
(3)	6.7751			(7)		sec Δφ/2	1	(3)	6.9709			(7)		sec Δφ/2	1
−h	2.3950					(approx.) −Δα	1.364 9438	−h	2.4932					(approx.) −Δα	1.394 8546
s² sin²α	7.0865					do	"	s² sin²α	7.1470					do	"
E	5.6636	Arc−sin corr.				(8)	"	E	5.6635	Arc−sin corr.				(8)	"
(4)	5.1451	for s	− 1.3	(Δλ)²	6.186	−Δα	+ 23.171	(4)	5.3037	for s	− 1.9	(Δλ)²	6.276	−Δα	− 24.823
		for Δλ	+ 0.2	F	7.576					for Δλ	+ 0.2	F	7.575		
		Total	− 1.1	(8)	3.762	− Δλ	+ 115.3224			Total	− 1.7	(8)	3.851	− Δλ	− 123.6369

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POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

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			°	′	″				°	′	″
α	2	to 3	21	23	21.18	α	3	to 2	201	22	56.35
2d ∠		&	+95	38	14.50	3d ∠		&	−38	14	28.75
α	2	to 1	117	01	35.68	α	3	to 1	163	08	27.60
Δα			−	00	52.36	Δα			−	00	27.31
			180	00	00.00				180	00	00.00
α′	1	to 2	297	00	43.32	α′	1	to 3	343	08	00.29
			46	07	16.98						
		First Angle of Triangle	343	08	00.30						
φ	11 31 [illegible] 564	2 GRAFLEX λ	162	19	14.568	φ	11 32 20.255	3 CORAL λ	162	17	10.931
Δφ	[illegible]	Δλ		[illegible]	[illegible]	Δφ	[illegible]	Δλ		02	15.799
φ′	[illegible]	λ′		[illegible]	[illegible]	φ′	[illegible]	λ′		[illegible]	[illegible]

Station 2 (left computation):

							Logarithms
s	[illegible]	(1)	[illegible]		9.699	s	[illegible]
cos α	[illegible]	(2)	[illegible]	s²			
B	8.5[illegible] 4970	Sum	[illegible]	K		s	3.948 5[illegible]
(1)·h	[illegible] 4666	3		I		sin α	9.[illegible]
s²	[illegible]	4				A′	[illegible]
sin² α	[illegible]	5		3	0.477	sec φ′	[illegible]
	[illegible]	6		cos² α		Sum	[illegible]
(2)=K	[illegible]	7		6		Arc-sin corr	
(δφ)²	4.2507	−Δφ	[illegible] 7242	(colog) E		−Δλ	2.414 0308
D	1.9876	Δφ/2		$\frac{A^2 \text{arc}^2 1''}{3}$	$\bar{5}.912$	sin ½(φ+φ′)	9.307 9695
(3)	6.2185			sec² φ		sec Δφ/2	0
−h	2.115 5			(7)		(approx.) −Δα	1.719 0003
s² sin² α	7.790 6					do	+52.360
E	$\bar{\bar{5}}$.6643	Arc−sin corr.				(8)	0.000
(4)	5.5704	for s	−1.4	(Δλ)³	7.242	−Δα	+52.360
		for Δλ	+1.1	F	$\bar{\bar{7}}$.578		
		Total	−0.3	(8)	[illegible].820	−Δλ	+259.4364

Station 3 (right computation):

							Logarithms
s	[illegible]	(1)	[illegible]		9.699	s	[illegible]
cos α	9.980 9[illegible]	(2)	1.[illegible]	s²			
B	8.512 4997	Sum	−441.7351	K		s	4.151 [illegible]
(1)·h	2.645 [illegible]706	(3)	+ [illegible]	E		sin α	9.462 [illegible]
s²	8.[illegible]	4		5		A′	8.50[illegible]
sin² α	[illegible]	5	−	3	0.477	sec φ′	[illegible]
	[illegible]	6		cos² α		Sum	[illegible]
(2)=K	7.748 [illegible]	7	+	(6)		Arc-sin corr	
(δφ)²	5.2103	−Δφ	−441.[illegible]	(colog) E		−Δλ	2.132 8980
D	1.9845	Δφ/2		$\frac{A^2 \text{arc}^2 1''}{3}$	$\bar{5}.912$	sin ½(φ+φ′)	9.303 3758
(3)	7.2748			sec² φ		sec Δφ/2	2
−h	2.6452			(7)		(approx.) −Δα	1.436 2740
s² sin² α	7.2284					do	+27.307
E	$\bar{\bar{5}}$.6535	Arc−sin corr.				(8)	0.000
(4)	5.5271	for s	−3.6	(Δλ)³	6.399	−Δα	+27.307
		for Δλ	+0.3	F	$\bar{\bar{7}}$.575		
		Total	−3.3	(8)	$\bar{3}$.974	−Δλ	+135.7994

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			°	′	″				°	′	″
α	2	to 3	343	08	00.30	α	3	to 2	163	08	27.60
2d ∠		&	+17	01	03.92	3d ∠		&	-57	28	40.48
α	2	to 1	000	09	04.22	α	3	to 1	105	39	47.12
$\Delta\alpha$			-	00	00.22	$\Delta\alpha$			-	00	27.39
			180	00	00.00				180	00	00.00
			80	09	04.00	α'	1	to 3	285	39	19.73

Logarithms

					Logs										Logs
					0.000										0.000
$\sin^2\alpha$				3	0.477	sec ϕ		$\sin^2\alpha$		(5)		3	0.477	sec ϕ'	
C			(6)	+		Sum	0.033 6717	C	0.116 68	(6)	+	$\cos^2\alpha$		Sum	2.136 3413
(2)—K			(7)	+		Arc—sin corr.		(2)—K	7.952 46	(7)	+	(6)		Arc—sin corr.	
$(\delta\phi)^2$	5.2125	$-\Delta\phi$	+405.8721	(colog) E		$-\Delta\lambda$	0.033 6714	$(\delta\phi)^2$	3.1561	$-\Delta\phi$	-37.8401	(colog) E		$-\Delta\lambda$	2.136 3413
D	1.9889	$\frac{\Delta\phi}{2}$		$\frac{A^2 arc^2 1''}{3}$	5.912	$\sin\frac{1}{2}(\phi+\phi')$	9.303 5699	D	1.9845	$\frac{\Delta\phi}{2}$		$\frac{A^2 arc^2 1''}{3}$	5.912	$\sin\frac{1}{2}(\phi+\phi')$	9.301 2994
(3)	7.2014			$\sec^2\phi$		sec $\frac{\Delta\phi}{2}$		(3)	5.1406			$\sec^2\phi$		sec $\frac{\Delta\phi}{2}$	
−h	2.6063			(7)		(approx.) $-\Delta\alpha$	9.337 2415	−h	1.5781			(7)		(approx.) $-\Delta\alpha$	1.437 6407
$s^2\sin^2\alpha$	3.0302					do	+0.217	$s^2\sin^2\alpha$	7.2356					do	+27.393
E	5.6646	Arc—sin corr.				(8)	0	E	5.6635	Arc—sin corr.				(8)	0
(4)	1.3011	for s	-2.8	$(\Delta\lambda)^2$		$-\Delta\alpha$	+0.217	(4)	4.4772	for s	-0.3	$(\Delta\lambda)^2$	6.409	$-\Delta\alpha$	+27.393
		for $\Delta\lambda$	+ 0	F	7.580					for $\Delta\lambda$	+0.4	F	7.575		
		Total	-2.8	(8)		$-\Delta\lambda$	+1.0806			Total	+0.1	(8)	3.984	$-\Delta\lambda$	+136.8804

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POSITION COMPUTATION, ~~THIRD~~ TRAVERSE ORDER ~~TRIANGULATION~~

— CHECK COMPUTATION —

			°	′	″				°	′	″
α	Δ KODAK	to Δ CORAL	120	56	28.70	α	3	to 2			
2d ∠		&	+202	56	19.60	3d ∠		&			
α	2	to 1	323	52	48.30	α	3	to 1	143	52	48.38
Δα			+	00	00.08	Δα			−	00	00.08
			180	00	00.0				180	00	00.0
α	1	to 2	143	52	48.38	α	1	to 3	143	[illegible]	[illegible]
				00	00.41						
			162	23	59.382				162	23	58.73

	1.330 9208		½(φ+φ′)	11 28 18.96		1.330 9208		½(φ+φ′)	11 28 18.96
Sin ½	[illegible]		Sec φ	0.008 7640	Sin²			Sec φ′	0.008 7642
C	0.7408		−Δλ	9.6198202	−00.4161	C		Δλ	9.6198202 +00.4161
	[illegible]	2d term	Sin ½(φ+φ′)	9.2986084			2d term	Sin ½(φ+φ′)	9.2986084
h²	9.5014		−Δα	8.9184286	−00.083	h²		−Δα	8.9184286 +00.083
D	1.9821					D			
	1.4835	3d term	+ 0.0000				3d term	+	
		−Δφ	+00.563				−Δφ	−00.5633	

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POSITION COMPUTATION, FIRST ORDER TRAVERSE

CHECK COMPUTATION

		°	′	″			°	′	″
α	N Base, USN to Δ Runit	322	47	17.11	α 3 to 2				
2d α	&	328	11	31.70	3d α &				
α	2 to 1	290	58	48.81	α 3 to 1		[illegible]	58	[illegible]
Δα		+	00	01.23	Δα			00	[illegible]

		°	′	″		°	′	″
11 33 23.265	N Base, USN	162	21	09.890	11 33 20.939	3 Runit Zero Tower	162	21 [illegible]
Δφ		+	00	[illegible]	+ 00 02.326			00 [illegible]
11 33 [illegible]	3 Runit Zero Tower	162	21	16.041	11 33 23.265	1 Base USN	162	21 [illegible]

Logarithms / Values in seconds

	0.366 [illegible]			Sin	[illegible] 2043			0.366 6389	1st term	Sin	[illegible] 2083
	[illegible]			A	8.509 6676			4.600 39		A	8.509 6675
Sin	[illegible]			Sec φ′	0.008 8936		Sin²	9.940 42		Sec φ	0.008 8946
C	0.717 [illegible]			−Δλ	0.788 9650	−06.1513	C	0.717 33		−Δλ	0.788 9649 +06.1513
	5.258 [illegible]	2d term	+0.0000	Sin½(φ+φ′)	9.301 7416			5.258 14	2d term +0.0000	Sin½(φ+φ′)	9.301 7416
h²	0.723 [illegible]			−Δα	0.090 7066	−01.232	h²			−Δα	0.090 7065 +01.23[illegible]
D	1.9851						D				
	2.7184	3d term	+0.0000						3d term +		
		−Δφ	+2.3261						−Δφ −02.3662		

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POSITION COMPUTATION, ~~THIRD~~ FIRST-ORDER ~~TRIANGULATION~~ TRAVERSE

			°	′	″				°	′	″
							— CHECK COMPUTATION —				
α	N. Base, USN	to Δ RUNIT	322	47	17.11	α	3	to 2			
2d Δ		&	+298	54	07.00 ✓	3d Δ		&	—		
α	2	to 1	261	41	24.11	α	3	to 1	81	41	24 37
Δα			+	00	00.26	Δα			—	00	00.26
			180	00	00.0				180	00	00.0
α	1	to 2	81	41	24 37	α	1	to 3	261	41	24 11

First Angle of Triangle

Logarithms	Values in seconds
1.603 8402	
2d term	+
3d term	+ 0.0000
	+ 00.1889

	Logarithms	Values in seconds
	1.603 8402	
Cos α	9.59 9600	
B	8.512 4992	
Sin ½(φ+θ)	9.301 2546	
D		
2d term	+	
3d term	+	
−Δφ	+00.1889	

	Logarithms	Values in seconds
	1.603 8402	
Sin α	9.7	
Sin ½(φ+θ)	9.301 2546	
Δα	9.7	

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POSITION COMPUTATION, ~~THIRD~~ FIRST-ORDER ~~TRIANGULATION~~ TRAVERSE

α	R Δ GRAFLEX	to R Δ ELGIN	117	01	35.68	α	R Δ GRAFLEX	to Δ ELGIN			
			297	41	54.9			&			
			31	43	30 58				211	19	21.78
									+	00	00 60
									211	19	22.38
									+	00	02.954
									62	19	45.43

					B	8 512 777					
			Sin α	9.720 8580							
			N	8 509 6669							
			sec α	0.008 9998	s^2	0.673 0304			N	8 509 6667	
			− Δλ	0.470 3424		+ 461 64			sec α	0.008 9998	
Sin²α	9.441 71			+02.9535	Sin²α	9.441 71			− Δλ	0.470 3423	−02.9535
C	0.720 00		Sin½(φ+φ')	9.304 2786	C	0.719 97			Sin½(φ+φ')	9.304 2784	
	7.622 56	2d term	−Δα	9.774 6208		4 6233 2	2d term	+ 0 0000	−Δα	9.774 6207	−00.595
l^2	1.3461			+00.595	l^2	1.3461					
D	1.9876				D	1.9876					
	3 3337	3d term	+ 0 0000			3 3337	3d term	+ 0.000 0			
		Δλ	+04.7101				−Δφ	−04.7101			

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POSITION COMPUTATION, ~~THIRD~~ FIRST-ORDER ~~TRIANGULATION~~ Traverse

			°	′	″				°	′	″
								Check computation:			
α	# GRAFLEX	to # N. BASE, USN	335	23	28.37 ✓	α	3.	to 2			
± L		&	+263	34	11.8− ✓	3d ℓ		&	−		
α	2	to 1	238	57	40.17	α	3	to 1	58	57	40.31
Δα			+	00	00.14	Δα			−	00	00.14
			180	00	00.0				180	00	00.0
	1	to 2	58	57	40.31	α	1	to 3	238	57	40.17

First Angle Traverse

11 37 31.564 2 Graflex 62 9 14.568 + 57 Above Check

+ 00 00.420 + 00 00.154 − 00 00.420 + 00 00.154

11 37 31.784 1 Romer Photo Tower 62 19 13.272 + 11 37 31.564 1 Graflex 13 59 14.568

Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds	
s	1.398 917		½	11 37 31.77		s	1.398 917	½ 11 37 31.77
Sin 2	1.324 76		Log	9.317 3285		Log		Logarithms
M	8.512 4910			1.378 7111			8.0	1.378 7111
	1.942 3			4 4 8885				
ε''	2.797 87			8.857 6609				2.797 87
Sin²α	9.865 78		Sin α	9.807 0020		Sin α		Sin α 9.807 0020
ℓ'	0.720 00		− Δλ	9.850 4691	− 00.7087	ℓ'		− Δλ 9.850 4691 + 00.7087
	3.383 60	2d term 2.0000	Sin ½(φ+φ')	9.304 5047				2d term Sin ½(φ+φ') 9.304 5047
h''	9.2426		− Δα	9.154 7738	− 00.143	h''		− Δα 9.154 7738 + 00.143
D	1.9876					D		
	1.2351	3d term +0.0000						3d term +
		Δφ −00.4205						− Δφ + 00.4205

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POSITION COMPUTATION, ~~THIRD~~ First -ORDER ~~TRIANGULATION~~ Traverse

CHECK COMPUTATION

			°	′	″				°	′	″
α	2 △ ELGIN	to 1 △ GRAFLEX	297	00	43.32	α	3	to 2			
		&	-196	38	34.52	3d		&			
α	2	to 1	133	39	17.84	α	3	to 1	313	39	11.86
				00	05.98	Δα			+	00	05.98
			180	00	00.0				180	00	00.0
α	1	[illegible]	[illegible]	[illegible]	[illegible]	α	1	to 3	[illegible]	[illegible]	[illegible]
φ	[illegible]	2 ELGIN	[illegible]	[illegible]	[illegible]	φ	[illegible]	[illegible]	3 Zero Zero Tower	[illegible]	[illegible]
Δφ	[illegible]	[illegible]	Δλ	00	29.552	Δλ	[illegible]	[illegible]	[illegible]	00	29.552
φ′	[illegible]	Zero Tower	λ′	14	25.580	φ′	[illegible]	4.988 1 ELGIN	[illegible]	17	[illegible]

s	[illegible]			[illegible]	[illegible]		s	[illegible]				[illegible]	
h	[illegible]	1st term	[illegible]	[illegible]	[illegible]		h	[illegible]	1st term	[illegible]	Sin α	9.[illegible]	
s²	6.184 82			A′	8.509 6665		s²	[illegible]			A′	8.509 6665	
Sin²α	9.718 89			Sec φ′	0.009 0705		Sin²α	[illegible]			Sec φ′	0.009 0584	
C	0.721 39			−Δλ	1.470 5900	+29.5522	C	0.721 70			−Δλ	1.470 5899	−29.5522
	6.625 10	2d term	+0.0004	Sin½(φ+φ′)	9.305 7769			6.625 43	2d term	+0.0004	Sin½(φ+φ′)	9.305 7769	
h²	2.8879			−Δα	0.776 3669	+05.975	h²	2.8879			−Δα	0.776 3668	−05.975
D	1.9889						D	1.9891					
	4.8768	3d term	+0.0000					4.8770	3d term	+0.0000			
		−Δφ	−27.7936						−Δφ	+27.7935			

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POSITION COMPUTATION; ~~THIRD~~ FIRST-ORDER ~~TRIANGULATION~~ TRAVERSE

Check Computation

		°	′	″				°	′	″
1	N. Base USN to B RUNIT	322	47	17.11 ✗	α	3	to 2			
	&	+344	17	02.5 — * ✓	3d ∠		&	—		
2	to 1	307	04	19.61 ✗	α	3	to 1	127	04	21.64
		+	00	02.03 ✓	Δα	* Corrected ✗ from B.L. Loop Comp.		—	00	02.03
		180	00	00.0				180	00	00.0
1	to 2	127	04	2 64 ✓	α	1	to 3	307	04	19.61

Logarithms	Values in seconds		Logarithms	Values in seconds
2.581 3323 ✗	20.00 ~~24.50~~	s	2.584 3323	
	Values in seconds	Cos α	7.180 1930	Logarithms
		b	8.312 4993	
				9.701 4348 30
	1.005 8914 ✓	Sin²		0.008 8946
	1.004 8275 - 10.1118 ✓	C	0.111 28	1.004 8274 + 10.1118
	Sin 9° 30′ 7720 7663 ✓			Sin 9° 30′ 7720 7200
	0.306 ~~59 38~~ 5475 - 2.026	h²		0.306 6474 + 02.026
		D		
	3d term +.00000		3d term +	
	Δα +07.5339		−Δφ −07.5340	

* Not a permanent station

VRMS.

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POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

		°	′	″		Check		°	′	″
α	2 [illegible]	[illegible]	04	21.67 x		3	to 2			
	3	196	03	38.5 * x	3		&			
		[illegible]	08	00.14 x	α	3	to 1	143	08	04.90
Δα		+	00	04.76	Δα	*Corrected α from Base line [illegible] Comp.		−	00	04.76
								180	00	00.0

[illegible]	[illegible]		[illegible]	62	[illegible]	20.003	φ	32	44.486	3 TRAVERSE RUNIT	162	[illegible]	12.[illegible]
	− 00	31.245	[illegible]	+	00	23.757	Δφ	− 00	31.244	[illegible]	−	00	23.759
			(TRAVERSE Sta. RUNIT) **	162	21	43.761	φ	33	15.730	1 4(A)	162	21	20.002

						Logarithms	Values		33 00 [illegible]
	[illegible]			B	[illegible]	1st term	[illegible]	Sin α	9.[illegible]8 [illegible]049
	[illegible]		A′	8.509 6677	s²	6.[illegible]833		A′	8.509 6676
	[illegible]			[illegible]	Sin² α	[illegible]		Sec φ′	0.008 8914
C	[illegible]		−Δλ	1.375 8264 −23.7589	C	0.71695		−Δλ	1.375 8265 +23.7587
	6.431 84	2d term +0.0003	Sin½(φ+φ′)	9.301 5151		6.43149	2d term +0.0003	Sin½(φ+φ′)	9.301 5151
h²	2.9895		Δα	0.677 3415 −04.757	h²	2.9876		−Δα	0.677 3416 +04.757
D	1.2851				D	1.9848			
	4.9746	3d term +0.0000				4.9744	3d term +		
		−Δφ +31.2446					−Δφ −31.2445		

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** This is a permanent station Marked with a standard U.S.C+G.S. Triangulation Disk Stamped "TRAVERSE sta. RUNIT"

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POSITION COMPUTATION, ~~THIRD~~ FIRST-ORDER TRAVERSE ~~TRIANGULATION~~

		°	′	″				°	′	″
	* Aomori Zero Tower to * A GRAFLEX	211	43	29.98	α	3	to 2			
	&	-94	34	08.0-	31		&			
2	to 1	3	9	21.98	α	3	to 1	126	11	41.20
		1	00	03.23	Δα			-	00	03.22
		180	00	00.0				180	00	00.0
1	to 2					1	to 3			

CHECK COMPUTATION →

Logarithms	Logarithms	Logarithms	Logarithms	
Sin 3.8126	8.9947	Sin 7.8220	Sec 0.0000	
C 9.2796	1.4031552 15.7645	C 0.1184	−Δλ 1.2031553 +15.9645	
6.0885	Sin 9.3041951	3d term +0.0001	Sin α+Δα 9.3041951	
h² 2.1257	−Δα 0.5073503 −03.216	h²	−Δα 0.5073504 +03.216	
D 1.9876		D		
4.1135	3d term +		3d term +	
	+Δφ +11.0593		−Δφ −11.0594	

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* This point is central with stake Aomori 12 of the Gamma Line three tape traverse.

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POSITION COMPUTATION, THIRD-ORDER ~~TRIANGULATION~~ TRAVERSE

← CHECK COMPUTATION

			°	′	″				°	′	″
α	2 Trav Sta Aaman	to 3 Aaman Dee Trav	126	17	41.20	α	3	to 2			
2d α		&	+180	00	00	3d α		&			
α	2	to 1	306	17	41.20	α	3	to 1	126	17	45.27
Δα			+	00	04.07	Δα				00	04.07
			180	00	00				180	00	00

φ	32	15.125	2 Trav Sta Aaman	λ	162	19	27.078	φ 32	00.667	3 Trav Sta Biijiri	λ 162 19 47.779
Δφ				Δλ	+	00	20.201	Δφ	4.628	1592.565 m	Δλ 00 20.20
φ′			Trav Sta	λ′	162	19	47			Trav Sta Aaman	

s				A′	8.509 6670	s				A′	8.509 6670
Sin² α					2.008 7883	Sin² α	7.812			Sec φ′	0.008 9947
C	0.7187			−Δλ	1.305 3696	−20.2008	C	0.71969		−Δλ	1.305 3694 +20.2005
	6.293 27	2d term	+0.0002	Sin ½(φ+φ′)	9.304 0611			6.293 11	2d term +0.0002	Sin ½(φ+φ′)	9.304 0611
h²	2.3303			−Δα	0.609 4301	−4.069	h²	2.3303		−Δα	0.609 4305 +4.067
D	1.9815						D	1.9873			
	4.3178	3d term	+14.6275					4.3176	3d term +		
		−Δφ	+14.6275						−Δφ −14.6279		

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* This point is identical with stake Biijiri II of the Gamma Line, Invar Traverse

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DEPARTMENT OF COMMERCE
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Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

"CHECK ON INVERSE COMPUTATION"

			°	′	″				°	′	″
α	2	to 3				α	3	to 2			
3d ∠		&	+			3d ∠		&	−		
α	2	to 1	331	58	18.62	α	3	to 1			
Δα			+	00	32.56	Δα					
			180	00	00.00				180	00	00.00
α	1	to 2	151	58	[illegible]	α	1	to 3			
		First Angle of Triangle									
φ	[illegible]	[illegible] Tower	62	[illegible]	[illegible]	φ		3			
Δφ	[illegible]			02	[illegible]	Δφ					
φ′	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	φ′		1			

	Logarithms		Logs				Logarithms		Logs		Logarithms
s	4.022 0406	[illegible]	[illegible]	[illegible]		s					
cos α	[illegible]	(2) [illegible]	s²	Logarithms		cos α		(2)	s²		Logarithms
B	[illegible]	Sum [illegible]	K	s	4.022 0406	B		Sum	K		
h	[illegible]					h		3			
						s²		4			
				sec		sin² α		5			sec φ′
			cos² α	Sum	[illegible]	C		6	cos² α		Sum
(2)=K	[illegible]	(7) +	(6)	Arc−sin corr.		(2)=K		(7) +	(6)		Arc−sin corr.
(δφ)²	[illegible]	Δφ [illegible]	(colog) E	Δλ	[illegible]	(δφ)²		Δφ	(colog) E		Δλ
D	[illegible]	$\frac{\Delta\phi}{2}$	$\frac{A^2 arc^2 1''}{3}$	$\bar{5}.912$	sin ½(φ+φ′)	7.500 [illegible]	D	$\frac{\Delta\phi}{2}$	$\frac{A^2 arc^2 1''}{3}$	$\bar{5}.912$	sin ½(φ+φ′)
(3)	6.7458		sec² φ	sec $\frac{\Delta\phi}{2}$		(3)			sec² φ		sec $\frac{\Delta\phi}{2}$
−h	3.4804		(7)	(approx.) Δα	1.512 6541	−h			(7)		(approx.) −Δα
s² sin² α	7.3881			do	− 32.558″	s² sin² α					do
E	5.6636	Arc−sin corr.		(8)	—	E		Arc−sin corr.			(8)
(4)	5.5321	for s −	(Δλ)²	−Δα	− 32.558″	(4)		for s −	(Δλ)²		−Δα
		for Δλ +	F					for Δλ +	F		
		Total	(8)	−Δλ	−163.1111″			Total	(8)		Δλ

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COMPUTATION

in which log $\Delta\alpha_1$ = log [illegible] correction for arc to sin*; and log s = log s_1 + correction for arc to sin*

1.			162 23 59.152 E
2.			162 21 16.041 E
$\Delta\phi$			+ 02 43.111
$\frac{\Delta\phi}{2}$			+ 01 21.556
$\phi_m\left(=\phi_1+\frac{\Delta\phi}{2}\right)$			
$\Delta\phi$ (secs.)			+ 163.111

log $\Delta\alpha$		log $\Delta\phi$	2.212 4833 P
correction for sin			0
log $\Delta\phi$			2.212 4833
log cos $\frac{\Delta\alpha}{2}$		log cos $\frac{\Delta\alpha}{2}$	9.991 1714
colog B_m		colog A	1.790 3320
log s cos $\left(\alpha+\frac{\alpha}{2}\right)$		log s sin $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	3.693 9867 P
		log s cos $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	3.967 8802 P
log $\Delta\alpha$		log tan $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.726 1065
log sin ϕ_m			151 58 34.90
log sec $\frac{\Delta\phi}{2}$		log sin $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.671 9461
		log cos $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.945 8396
log a		log s	4.012 0406
a		correction for sin	0
b			4.012 0406
$\Delta\alpha$ (secs.)			
$\frac{\Delta\alpha}{2}$			
$\alpha+\frac{\Delta\alpha}{2}$			
α (1 to 2)			
$\Delta\alpha$			
180			
α' (2 to 1)			

For [illegible] use of this form for correction of [illegible]

VERIFICATION ONLY

NOTE. For log [illegible] or $\Delta\alpha$ or $\Delta\lambda$ [illegible] and all terms below the heavy line except those printed in white [illegible] use underscored values and retain to 7 decimal places.

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16—31070-1

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in which log [illegible] for [illegible] and log s = log s_1 +

correction for arc to [illegible]

1. ϕ	[illegible]	[illegible]	[illegible] 2 [illegible] 1.202
2. ϕ'	[illegible]	[illegible]	[illegible] 58.592
$\Delta\phi$ (2 - 1)	[illegible]		1 00 59.794
$\Delta\phi$ / 2			
$\phi_m\left(\phi + \frac{\Delta\phi}{2}\right)$	[illegible]		
$\Delta\phi$ (secs.)			1 119.588
log $\Delta\phi$	3 [illegible]		2.077 6876
cor. arc to sin			0
log $\Delta\phi_1$	2 3 [illegible]		2 077 6876
log cos $\frac{\Delta\lambda}{2}$		log cos	9 999 0528
colog B_m	1 9 [illegible]	+ log A	1 490 3328
log $s_1 \cos\left(\alpha + \frac{\Delta\alpha}{2}\right)$	3 8 [illegible]	log s_1 sin $\left(\alpha + \frac{\Delta\alpha}{2}\right)$	3 054 0732 P
		log s_1 cos $\left(\alpha + \frac{\Delta\alpha}{2}\right)$	3 873 8225 P
log $\Delta\lambda$	2 [illegible]	Log tan $\left(\alpha + \frac{\Delta\alpha}{2}\right)$	9 [illegible] 2507
log sin ϕ_m	9 [illegible]		157 09 07.36
log sec $\frac{\Delta\phi}{2}$	[illegible]	log sin $\left(\alpha + \frac{\Delta\alpha}{2}\right)$	9 629 4710
log a	[illegible]	Log cos $\left(\alpha + \frac{\Delta\alpha}{2}\right)$	9 954 2204
a	[illegible]		3 977 6624
b	[illegible]		c
$\Delta\alpha$ (secs.)	[illegible]		[illegible]
$-\frac{\Delta\alpha}{2}$	[illegible]		
$\alpha + \frac{\Delta\alpha}{2}$	[illegible]		[illegible] on the back of this form for correction of
α (1 to 2)	[illegible]		
$\Delta\alpha$	[illegible]		
	180		
α' (2 to 1)	[illegible]		[illegible]

NOTE. For log [illegible] except those printed for whole or half parts, [illegible] or those underscored, [illegible] 7 decimal places.

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

° ' " CHECK ON INVERSE COMPUTATION

α	2	to 3				α	3	to 2			
$2^d\angle$		&	+			$3^d\angle$		&			
α	2	to 1	334	08	55.35	α	3	to 1			
$\Delta\alpha$			+	00	24.03	$\Delta\alpha$					
			180	00	00.00				180	00	00.00
α'	1	to 2	154	09	19.38	α'	1	to 3			

ϕ	11	31	26.5	1			20	19	11.614	ϕ				
$\Delta\phi$	−	02	02.7	1			+	01	59.588	$\Delta\phi$				
ϕ'	11	33	29.2	1			20	21	11.202	ϕ'				

	Logarithms			Logs		Logarithms		Logarithms		Logs	
s	39.7 6622			5.000		$\frac{1}{2}(\phi+\phi')$	11 35 25.15	s			5.000	
$\cos\alpha$	9							$\cos\alpha$				
B	8	Sum						B	Sum			
(1) − h	6.38							(1) − h				
s^3	1.8					A		s^3				
$\sin^3\alpha$	9.77	(5)		3	0.477	sec ϕ	0.0 8947	$\sin^3\alpha$	(5)	3	0.477	sec ϕ
C	0.39 96	(6)	+	$\cos^2\alpha$		Sum	2.077 6811	C	(6) +	$\cos^2\alpha$		Sum
(2)=K	7.838 21	(7)	+	(6)		Arc−sin corr.	2.077 6	(2)=K	7	(6)		Arc−sin corr.
$(\frac{\delta\phi}{2})^2$	4.1726	$-\frac{\Delta\phi}{2}$	+2.43	(colog) E $\frac{A^2 arc^2 1''}{3}$	$\bar{5}.912$	$-\Delta\lambda$	2.077 6811	$(\delta\phi)^2$	$-\frac{\Delta\phi}{2}$	(colog) E $\frac{A^2 arc^2 1''}{3}$	$\bar{5}.912$	$\Delta\lambda$
D	1.9876					$\sin\frac{1}{2}(\phi+\phi')$	9.303 4433 0067	D				$\sin\frac{1}{2}(\phi+\phi')$
(3)	6.7602			$\sec^2\phi$		$\sec\frac{\Delta\phi}{2}$	0	(3)		$\sec^2\phi$		$\sec\frac{\Delta\phi}{2}$
−h	2.3863			(7)		(approx.) $-\Delta\alpha$	1.380 6944 "	−h		(7)		(approx.) $-\Delta\alpha$
$s^3\sin^3\alpha$	7.1182					do	"	$s^3\sin^3\alpha$				do
E	5.6642	Arc−sin corr.				(8)	"	E	Arc−sin corr.			(8)
(4)	5.4687	for s −		$(\Delta\lambda)^3$		$-\Delta\alpha$	− 24.027	(4)	for s −	$(\Delta\lambda)^3$		$-\Delta\alpha$
		for $\Delta\lambda$ +		F					for $\Delta\lambda$ +	F		
		Total		(8)		$-\Delta\lambda$	−119.5880		Total	(8)		$\Delta\lambda$

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[redacted] COMPUTATION

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in which log $\Delta\lambda_1$=log (λ' − λ) corrected for arc to sin*; and log s = log s_1 + correction for arc to sin*.

NAME OF STATION

1. ϕ			62 19 15.277 ✓
2. ϕ'			62 14 25.580 ✓
$\Delta\phi$ (=ϕ'−ϕ)			+ 04 49.697 ✓
$\frac{\Delta\phi}{2}$			+ 02 24.848 ✓
$\phi_m\left(=\phi+\frac{\Delta\phi}{2}\right)$			
$\Delta\phi$ (secs.)	7157.118		+ 289.697 ✓
log $\Delta\phi$	2.178	log	2.461 9440 ✓
cor. arc − sin			0
log $\Delta\phi_1$	2.178		2.461 9440 ✓
log cos $\frac{\Delta\lambda}{2}$	9.999	log	9.990 9636 ✓
colog B_m	1.487 5026	colog λ	1.490 3334 ✓
log $\left\{s_1 \cos\left(\alpha+\frac{\Delta\alpha}{2}\right)\right\}$	3.685	log $\left\{s \sin\left(\alpha+\frac{\Delta\alpha}{2}\right)\right\}$	3.943 2410 ✓ p
		log $\left\{s \cos\left(\alpha+\frac{\Delta\alpha}{2}\right)\right\}$	3.685 6050 ✓ 7
log $\Delta\lambda$	2.461 9440	log tan $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.957 6360 ✓
log sin ϕ_m	9.205		118 55 20.77
log sec $\frac{\Delta\phi}{2}$		log sin $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.942 1447
log a		log cos $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.684 5087
a		log s	4.001 0963
b			+ c
$-\Delta\alpha$ **(secs.)**			4.001 c963
$-\frac{\Delta\alpha}{2}$			
$\alpha+\frac{\Delta\alpha}{2}$	118 55	[illegible] on the back of this form for correction of	
α **(1 to 2)**	118		
$\Delta\alpha$			
	180	~~OFFICIAL USE ONLY~~	
α' **(2 to 1)**	298 54 51.47		

NOTE.—For log s up to 4.0 and for $\Delta\phi$ or $\Delta\lambda$ (or both) up to 3° omit all terms below the heavy line except those printed (in whole or in part) in heavy type or those underscored, if using logarithms to 7 decimal places.

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

CHECK ON INVERSE COMPUTATION

			°	′	″				°	′	″
α	2	to 3				α	3	to 2			
2d ∠		&	+			3d ∠		&	−		
α	2	to 1	298	54	51.47	α	3	to 1			
Δα			+	00	58.49	Δα					
			180	00	00.00				180	00	00.00
α′	1	to 2	118	55	49.96	α′	1	to 3			

First Angle of Triangle

			°	′	″				°	′	″
φ	[illegible]	[illegible]	162	[illegible]	25.580	φ		3	λ		
Δφ	[illegible]	Δλ	1	04	49.697	Δφ			Δλ		
φ′	[illegible]	[illegible] λ′	162	19	15.277	φ′		1	λ′		

	Logarithms			Logs					Logarithms			Logs	
s	[illegible]		½	$\bar{9}$.699	½(φ+φ′)	11° 38′ 7.88″	s		(1)		½	$\bar{9}$.699	½(φ+φ′)
cos α	[illegible]					Logarithms	cos α		(2)	+	s²		Logarithms
B	[illegible]					[illegible]	B		Sum		K		
(1) = h	[illegible]				sin α	[illegible]	sin α		3	+	E		sin α
s²	[illegible]				A′	[illegible]	s²		4		(5)		A′
sin² α	[illegible]	5	3	0.477	sec φ	[illegible]	sin² α		(5)		3	0.477	sec φ′
C	[illegible]	(6) +	cos² α		Sum	2.4619439	C		(6)	+	cos² α		Sum
(2) = K	8.60825	(7) +	(6)		Arc sin corr.	0	(2) = K		(7)	+	(6)		Arc—sin corr.
(δφ)²	[illegible]	−Δφ +157.9978	(colog) E		−Δλ	2.4619439	(δφ)²		−Δφ		(colog) E		Δλ
D	[illegible]	Δφ/2	$A^2 arc^2 1''$ / 3	$\bar{5}$.912	sin ½(φ+φ′)	9.3051135	D		Δφ/2		$A^2 arc^2 1''$ / 3	$\bar{5}$.912	sin ½(φ+φ′)
(3)	6.3857		sec² φ		sec Δφ/2	0	(3)				sec² φ		sec Δφ/2
−h	2.1980		(7)		(approx.) −Δα	1.7610574	−h				(7)		(approx.) −Δα
s² sin² α	7.8866				do	−58.487″	s² sin² α						do
E	5.6646	Arc—sin corr.			(8)	″ –	E		Arc—sin corr.				(8)
(4)	5.7492	for s −1.8	(Δλ)³		−Δα	−58.487″	(4)		for s −		(Δλ)³		−Δα
		for Δλ +1.4	F						for Δλ +		F		
		Total −0.4	(8)		−Δλ	−289.6969″			Total		(8)		Δλ

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INVERSE POSITION COMPUTATION

in which log $\Delta\lambda_1$ = log ($\lambda' - \lambda$) [illegible] for arc to sin*; and log s = log s_1 + correction for arc to sin*

NAME OF AREA

1. ϕ	[illegible]	[illegible]	162 14 54.051 E
2. ϕ'	[illegible]	[illegible]	162 21 16.041 E
$\Delta\phi$ ($= \phi' - \phi$)			- 06 21.990
$\frac{\Delta\phi}{2}$			- 03 10.995
$\phi_m\left(= \phi + \frac{\Delta\phi}{2}\right)$	[illegible]		
$\Delta\phi$ (secs.)	- 2.844		- 381.990

log $\Delta\phi$	1.358 [illegible]	log	2.582 0520 n
cor. arc = sin			0
log $\Delta\phi_1$	1.358 [illegible]		2.582 0520
log cos $\frac{\Delta\lambda}{2}$	9.999 [illegible]	log cos	9.991 [illegible]
colog B_m	1.487 [illegible]	**colog** V	1.490 3324
log $\left\{s_1 \cos\left(\alpha - \frac{\Delta\alpha}{2}\right)\right\}$	2.846 [illegible]	(+ positive) log $\left\{s \sin\left(\frac{\Delta\alpha}{2}\right)\right\}$	4.063 4957 n
		log $\left\{s \cos\left(\frac{\Delta\alpha}{2}\right)\right\}$	2.846 2727 n
log $\Delta\lambda$	2.582 [illegible]	log [illegible]	2.712 2230
log sin ϕ_m	9.301 [illegible]	[illegible]	266 31 46.89
log sec $\frac{\Delta\phi}{2}$	0.000 [illegible]	log sin $\left(\frac{\Delta\alpha}{2}\right)$	4.999 2029
		log cos $\left(\frac{\Delta\alpha}{2}\right)$	2.846 9798
log a	1.883 [illegible]	log	4.062 4928
a	[illegible]		0
b	[illegible]		4.062 4928
$-\Delta\alpha$ (**secs.**)	[illegible]		
$-\frac{\Delta\alpha}{2}$	[illegible]		
$\alpha + \frac{\Delta\alpha}{2}$	266 31 46.8	[illegible]	
α (1 to 2)	266 31 [illegible]		
$\frac{\Delta\alpha}{}$	[illegible]		
180			
α′ (2 to 1)	[illegible]		

NOTE. - For logs up to 4 [illegible] for finding s_1 [illegible] below the heavy line except those printed in whole or in part in [illegible] or those underscored, if using logarithms to 7 decimal places

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

°CHECK ON INVERSE COMPUTATION

						°	′	″						°	′	″
α	2	to 3				α	3	to 2							
2d ∠		&	+			3d ∠		&	−						
α	2	to 1	266	31	08.64	α	3	to 1							
$\Delta\alpha$			+	01	16.50	$\Delta\alpha$									
			180	00	00.00								180	00	00.00
α'	1	to 2	86	32	25.14	α'	1	to 3							

First angle of triangle

						°	′	″						°	′	″
ϕ	11	32	58.095	2 CLEAR [illegible] LOCAL	λ	162	14	54.051	ϕ				λ			
$\Delta\phi$	+	00	32.044		$\Delta\lambda$	+	06	21.714	$\Delta\phi$				$\Delta\lambda$			
ϕ'	11	33	20.139	1 RUNIT ZERO CONER	λ'	162	21	16.341	ϕ'				λ'			

Logarithms					Logarithms				Logarithms					Logarithms	
s	4.064 2928	(1)		Logs 0.000	$\frac{1}{2}(\phi+\phi')$	11 33 09.52	s		(1)		$\frac{1}{2}$	9.699	$\frac{1}{2}(\phi+\phi')$		
(−) cos α		(2)					cos α		(2)		s^2				
B		Sum			s	4064 2928	B		Sum		K		s		
(1)−h	1.360 0981	3			(−) sin α	9.999 1786	(1)−h		3		E		sin α		
s^2	8.128 59	(4)		(5)	A′	8.507 6675	s^2		(4)		(5)		A′		
$\sin^2\alpha$	9.928 40	(5)		3 0.477	sec φ′	0.008 8936	$\sin^2\alpha$		(5)	−	3	0.477	sec φ′		
C	0.1710	(6)	+	$\cos^2\alpha$	Sum	2.582 0519	C		(6)	+	$\cos^2\alpha$		Sum		
(2)=K	8.84449	(7)	+	(6)	Arc−sin corr.	0	(2)=K		(7)	+	(6)		Arc−sin corr.		
$(\frac{\delta\phi}{2})^2$	2.7202	$-\Delta\phi$	32.044	(colog) E	− Δλ	2.582 0519	$(\delta\phi)^2$		$-\Delta\phi$		(colog) E		Δλ		
D	1.9849	$\frac{\Delta\phi}{2}$		$\frac{A^2 arc^2 1''}{3}$ 5.912	$\sin\frac{1}{2}(\phi+\phi')$	9.301 6120	D		$\frac{\Delta\phi}{2}$		$\frac{A^2 arc^2 1''}{3}$	5.912	$\sin\frac{1}{2}(\phi+\phi')$		
(3)	4.7051			$\sec^2\phi$	$\sec\frac{\Delta\phi}{2}$	0	(3)				$\sec^2\phi$		$\sec\frac{\Delta\phi}{2}$		
−h	1.3601			(7)	(approx.) $-\Delta\alpha$	1.883 6639	−h				(7)		(approx.) $-\Delta\alpha$		
$s^2\sin^2\alpha$	8.1270				do	"	$s^2\sin^2\alpha$						do		"
E	5.6636	Arc−sin corr.			(8)	"	E		Arc−sin corr.				(8)		"
(4)	5.1507	for s −		$(\Delta\lambda)^2$	$-\Delta\alpha$	−76.500	(4)		for s −		$(\Delta\lambda)^2$		$-\Delta\alpha$		"
		for Δλ +		F		"			for Δλ +		F				
		Total		(8)	− Δλ	−381.9899			Total		(8)		Δλ		"

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REDUCTION OF OBSERVATION

$$s_1 \sin\left(\alpha + \frac{\Delta\alpha}{2}\right) = \frac{\Delta\lambda_1 \cos\phi_m}{A_m}$$

$$s_1 \cos\left(\alpha + \frac{\Delta\alpha}{2}\right) = -\Delta\phi_1 \cos\frac{\Delta\lambda}{2}$$

$$B_m$$

$$\alpha \quad \Delta\lambda \sin\phi_m \sec\frac{\Delta\phi}{2} = \Delta\alpha$$

in which log $\Delta\lambda_1$ = log $(\lambda' - \lambda)$ − corr [illegible]; log [illegible] correction for arc to sin*; and log s = log s_1 + correction for arc to sin*.

NAME OF STATION

1. ϕ	11 °	[illegible] '	28.095 "	REESE PEAK TOWER	λ	162 °	14 ' 54.051 " E
2. ϕ'	11 °	3 '	26.854 "	AGNEW ZERO TOWER	λ	162 °	19 ' 11.614 " E
$\Delta\phi$ $(=\phi' - \phi)$		− [illegible]					− 04 ' 17.563 "
$\frac{\Delta\phi}{2}$		− [illegible]					− 02 ' 08.782 "
$\phi_m \left(= \phi + \frac{\Delta\phi}{2}\right)$	11 °	33 '	47 "				
$\Delta\phi$ (secs.)		+ 2068.759					− 257.563

log $\Delta\phi$	2.429 [illegible]		log	2.410 8818 η
cor. arc − sin			[illegible]	− 0
log $\Delta\phi_1$	2.429 [illegible]		[illegible]	2.410 8818
log cos $\frac{\Delta\lambda}{2}$	9.999 [illegible]		log cos [illegible]	9.991 0583
colog B_m	1.487 [illegible]		**colog** A	1.490 3327
log $\left\{s_1 \cos\left(\alpha + \frac{\Delta\alpha}{2}\right)\right\}$	3.916 [illegible]	(opposite in sign to $\Delta\alpha$)	**log** $\left\{s \sin\left(\alpha + \frac{\Delta\alpha}{2}\right)\right\}$	3.892 2728 η
			log $\left\{s \cos\left(\alpha + \frac{\Delta\alpha}{2}\right)\right\}$	3.916 8647 η
log $\Delta\lambda$	2.410 [illegible]	log $\Delta\lambda$ [illegible] 233	log tan $\left(\alpha + \frac{\Delta\alpha}{2}\right)$	9.975 4081
log sin ϕ_m	9.302 [illegible]	[illegible] 7577	$\alpha + \frac{\Delta\alpha}{2}$	223 ° 22 ' 43.27 "
log sec $\frac{\Delta\phi}{2}$	[illegible]	log [illegible] 8 [illegible]	log sin $\left(\alpha + \frac{\Delta\alpha}{2}\right)$	9.836 8411
			log cos $\left(\alpha + \frac{\Delta\alpha}{2}\right)$	9.861 4330
log a	1.713 [illegible]		log s	4.055 4317
a	[illegible]		[illegible] sin	− 0
b	[illegible]		[illegible]	4.055 4317
$-\Delta\alpha$ **(secs.)**	[illegible]			
$-\frac{\Delta\alpha}{2}$	[illegible]			
$\alpha + \frac{\Delta\alpha}{2}$	223 ° [illegible] '	[illegible] "		
α **(1 to 2)**	223 ° [illegible] '	[illegible] "		
$\Delta\alpha$	[illegible]			
	180			
α' **(2 to 1)**	43 ° 23 '	09.14 "		

[illegible] section on the back of this form for correction of

NOTE.—For log s up to 4.0 and for $\Delta\phi$ or $\Delta\lambda$ (or both) [illegible] omit all terms below the heavy line except those printed (in whole or in part) in heavy type or those underscored, if using logarithms to 7 decimal places.

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 96—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

"CHECK ON INVERSE COMPUTATION

α	2	to 3				α	3	to 2			
$2^d\angle$		&	+			$3^d\angle$		&	−		
α	2	to 1	223	22	17.41	α	3	to 1			
$\Delta\alpha$			+	00	51.73	$\Delta\alpha$					
			180	00	00.00				180	00	00.00
α'	1	to 2	43	23	09.14	α'	1	to 3			

First Angle of Triangle

ϕ	11	35	38.795	2 KEEL PHOTO TOWER	λ	162	14	54.051	ϕ		3	λ			
$\Delta\phi$	+	1	58.952		$\Delta\lambda$	+	04	17.562	$\Delta\phi$			$\Delta\lambda$			
ϕ'	11	37	37.747	1 AGUAN ZERO TOWER	λ'	162	19	11.613	ϕ'		1	λ'			

	Logarithms				Logs		° ′ ″	Logarithms					Logs		° ′ ″
s	4.055 4317	(1)	− 268.7915	$\frac{1}{3}$	9.699	$\frac{1}{2}(\phi+\phi')$	11 35 12.47	s		(1)		$\frac{1}{2}$	9.699	$\frac{1}{2}(\phi+\phi')$	
$\cos\alpha$	1.8461 7844	(2)	+ 0.0317	s^2			Logarithms	$\cos\alpha$		(2)	+	s^2			Logarithms
B		Sum		K		s	4.055 4317	B		Sum		K		s	
(1)=h	2.4294 55	(3)	+ 0.0000 7	E		$\sin\alpha$	9.8368 8400	(1)=h		3)	+	E			
s^2	8.1108 86	(4)	− 0.0000 1	(5)		A′	8.5313 00667	s^2		(4)		(5)		A′	
$\sin^2\alpha$	9.6735 7	(5)	−	3	0.477	sec ϕ'	0.0089998	$\sin^2\alpha$		(5)	−	3	0.477	sec ϕ'	
C	0.7710	(6)	+	$\cos^2\alpha$		Sum	2.4108819	C		(6)	+	$\cos^2\alpha$		Sum	
(2)=K	8.5015 3	(7)	+	(6)		Arc—sin corr.		(2)=K		(7)	+	(6)		Arc—sin corr.	
$(\frac{\Delta\phi}{2})^2$	4.8588	$-\Delta\phi$	−268.7592	(colog) E		$\Delta\lambda$	2.4108818′	$(\delta\phi)^2$		$-\Delta\phi$		(colog) E		$\Delta\lambda$	
D	1.9849	$\frac{\Delta\phi}{2}$		$A^2\text{arc}^2 1''$ / 3	5.912	$\sin\frac{1}{2}(\phi+\phi')$	9.3028765	D		$\frac{\Delta\phi}{2}$		$A^2\text{arc}^2 1''$ / 3	5.912	$\sin\frac{1}{2}(\phi+\phi')$	
(3)	6.8437			$\sec^2\phi$		sec $\frac{\Delta\phi}{2}$	1	(3)				$\sec^2\phi$		sec $\frac{\Delta\phi}{2}$	
−h	2.4294			(7)		(approx.) $-\Delta\alpha$	1.7137584	−h				(7)		(approx.) $-\Delta\alpha$	
$s^2\sin^2\alpha$	7.7844					do	51.73	$s^2\sin^2\alpha$						do	
E	5.6636	Arc—sin corr.				(8)		E		Arc—sin corr.				(8)	
(4)	5.8774	for s	− 2.3	$(\Delta\lambda)^2$		$-\Delta\alpha$	− 51.73	(4)		for s	−	$(\Delta\lambda)^2$		$-\Delta\alpha$	
		for $\Delta\lambda$	+ 1.1	F						for $\Delta\lambda$	+	F			
		Total	− 1.2	(8)		$-\Delta\lambda$	− 257.5620			Total		(8)		$\Delta\lambda$	

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 662
Rev. Sept 1942

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INVERSE POSITION COMPUTATION

$s_1 \sin\left(\alpha + \frac{\Delta\alpha}{2}\right) = \Delta\lambda_1 \cos\phi_m$

$s_1 \cos\left(\alpha + \frac{\Delta\alpha}{2}\right) = \Delta\phi_1$

$\Delta\alpha = \Delta\lambda \sin\phi_m \sec\frac{\Delta\phi}{2} = F\,\Delta\lambda$

in which $\log \Delta\lambda_1 = \log(\lambda' - \lambda)$ − correction for arc to sin*; $\log \Delta\phi_1 = \log(\phi' - \phi)$ − correction for arc to sin*; and $\log s = \log s_1 +$ correction for arc to sin*.

NAME OF STATION

1. ϕ	11	32	38.095	REEF PHOTO TOWER	162	14	54.051	E
2. ϕ'	11	40	09.782	ENGEB ZERO TOWER	162	14	25.580	E
$\Delta\phi$ $(=\phi' - \phi)$	+	07	31.687				+ 28.471	
$\frac{\Delta\phi}{2}$	+	03	35.844				+14.235	
$\phi_m\left(=\phi + \frac{\Delta\phi}{2}\right)$	11	36	3.938					
$\Delta\phi$ (secs.)			+ 431.687				+ 28.471	

log $\Delta\phi$	2.635 1694		**log**	1.454 4027	
cor. arc−sin				0	
log $\Delta\phi_1$	2.635 1694			1.454 4027	
log $\cos\frac{\Delta\lambda}{2}$			**log cos**	9.991 0231	
colog B_m	1.487 5025		**colog** A	1.490 3330	
log $\{s_1 \cos(\alpha + \frac{\Delta\alpha}{2})\}$	4.122 6715	(opposite in sign to $\Delta\alpha$)	**log** $s \sin(\alpha + \frac{\Delta\alpha}{2})$	2.935 7588	e
			log $s \cos(\alpha + \frac{\Delta\alpha}{2})$	4.122 6715	n
log $\Delta\lambda$	1.454 4027	4.363	**log tan** $\frac{\Delta\alpha}{2}$	8.813 0873	
log sin ϕ_m	9.303 7124	9.576	$\frac{\Delta\alpha}{2}$	176 16	46.27
log sec $\frac{\Delta\phi}{2}$		9.439	**log sin** $\frac{\alpha}{2}$	8.812 1711	
log a	0.758 1818		log cos $\frac{\alpha}{2}$	9.999 0838	
a	+ 05.748		log	4.123 5877	
b				0	
$-\Delta\alpha$ **(secs.)**	+ 02.874			4.123 5877	
$-\frac{\Delta\alpha}{2}$	+ 01.437				
$\alpha + \frac{\Delta\alpha}{2}$	176 16 46.27				
α (1 to 2)	176 16 44.833				
$\Delta\alpha$	02.874				
	180				
α′ (2 to 1)	356 6 43.40				

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NOTE.—For log s up to 4.0 and for $\Delta\phi$ or $\Delta\lambda$ (or both) up to 3 omit all terms below the heavy line except those printed (in whole or in part) in heavy type or those underscored. Use logs to not more than 7 decimal places.

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, FIRST-ORDER TRIANGULATION

"CHECK ON" INVERSE COMPUTATION

α	2	to 3				α	3	to 2				°	′	″
2d ∠		&	+			3d ∠		&	−					
α	2	to 1	176	16	49.13	α	3	to 1						
$\Delta\alpha$			−	00	05.73	$\Delta\alpha$								
			180	00	00.00							180	00	00.00
α'	1		356	16	43.40	α'	1	to 3						

First Order Triangle

	11 32 58.96	2	Left Hand Tower	λ	162	14	54.051	ϕ			8	λ					
	+ 57 [illegible]			$\Delta\lambda$	−	00	28.771	$\Delta\phi$				$\Delta\lambda$					
	11 [illegible] 07.18	1	Center Tower	λ'	162	14	25.280	ϕ'			1	λ'					

	Logarithms			Logs		° ′ ″		Logarithms				Logs		° ′ ″
	[illegible]	1	[illegible]	9.699	$\frac{1}{2}(\phi+\phi')$	11 36 33.94	s		(1)		$\frac{1}{2}$	9.699	$\frac{1}{2}(\phi+\phi')$	
	[illegible]	2	[illegible]			Logarithms	$\cos\alpha$		(2)	+	s^2			Logarithms
		Sum			s	4 123 5817	B		Sum		K		s	
(1)	[illegible]	3			$\sin\alpha$	8 812 [illegible]	(1) = D		(3)	+	E		$\sin\alpha$	
s^2	8 [illegible]	4			A′	2 509 6665	s^2		(4)		(5)		A′	
$\sin^2\alpha$	[illegible]	(5)	3	0.477	sec ϕ'	0.009 0705	$\sin^2\alpha$		(5)	−	3^n	0.477	sec ϕ'	
C	[illegible]	(6)	$\cos^2\alpha$		Sum	1.454 4032	C		(6)	+	$\cos^2\alpha$		Sum	
(2)=K	6.588 44	(7)	(6)		Arc−sin corr.	−3	(2)=K		(7)	+	(6)		Arc−sin corr.	
$(\delta\phi)^2$	5.270 3	$-\Delta\phi$	− 431.0870	(colog) E	$-\Delta\lambda$	1.454 4029	$(\delta\phi)^2$		$-\Delta\phi$		(colog) E		$\Delta\lambda$	
D	1 9849	$\frac{\Delta\phi}{2}$		$\frac{A^2 arc^2 1''}{3}$ 5.912	$\sin\frac{1}{2}(\phi+\phi')$	9.303 7124	D		$\frac{\Delta\phi}{2}$		$\frac{A^2 arc^2 1''}{3}$	5.912	$\sin\frac{1}{2}(\phi+\phi')$	
(3)	7.2552			$\sec^2\phi$	sec $\frac{\Delta\phi}{2}$	2-	(3)				$\sec^2\phi$		sec $\frac{\Delta\phi}{2}$	
−h	2.6351			(7)	(approx.) $-\Delta\alpha$	0.758 1155	−h				(7)		(approx.) $-\Delta\alpha$	
$s^2\sin^2\alpha$	5.8713				do	+ 05.729	$s^2\sin^2\alpha$						do	
E	5.6636	Arc−sin corr.			(8)	0.00	E		Arc−sin corr.				(8)	
(4)	4.6700	for s	− 3.2	$(\Delta\lambda)^2$	$-\Delta\alpha$	+ 05.729	(4)		for s	−	$(\Delta\lambda)^2$		$-\Delta\alpha$	
		for $\Delta\lambda$	+ 0	F					for $\Delta\lambda$	+	F			
		Total	− 3.2	(8)	$-\Delta\lambda$	+28.4710			Total		(8)		$\Delta\lambda$	

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DEPARTMENT OF COMMERCE
U.S. COAST AND GEODETIC SURVEY
FORM 28-11

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GEOGRAPHIC POSITIONS

North American 1927 Datum

DESCRIPTION	LATITUDE (φ) AND LONGITUDE (λ)	FROM STATION	AZIMUTH	TO STATION	DISTANCE (Spheroidal) Meters	DISTANCE Feet
REEF U.S.N. TWR	32 9 30.0					
	162 7 18.05					
			25 59 10 28.678	SAN DIEGO BASE 2	3,875.409	
			295 59 10 28.678	SAN DIEGO	3,851.382	
			42 30 42 03.332	REEF U.S.N.	4,875.409	
			180 00 00 00.000	SAN DIEGO	3,875.409	

~~SECRET ONLY~~

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 25
F. L. S. 334

COMPUTATION OF TRIANGLES

State

U. S. GOVERNMENT PRINTING OFFICE 16—80064-2

	ADJUSTED	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3					3 824 7980 ✓
1 Peel			.03	05.98	0 251 +848 ✓
2 [illegible] Bas			.04	16.09	9 980 9554 ✓
3 Sand			.03	5793	9 993 1263 ✓
1-3					4 057 1382 ✓
1-2					3 875 4091 ✓
			0.10	0000	
2-3					4 057 1382
1 [illegible]			.09	1356	0 140 9749 ✓
2 Peel			.09	5154	9 742 8155 ✓
3 Sand			.09	4490	9 993 1739 ✓
1-3					3 940 9286 ✓
1-2					4 191 2870 ✓
			0.25	0000	
2-3					4 191 2870
1 [illegible]			.24	2853	0 153 7422 ✓
2 Peel			.24	5410	9 905 6860 ✓
3 [illegible]			.24	5537	9 995 5719 ✓
1-3					4 250 7152 ✓
1-2					4 340 6011 ✓
			0.72	0000	
2-3					4 250 7152
1 Pier [illegible]			.07	3617	0 039 0510 ✓
2 [illegible]			.08	5439	9 571 6653 ✓
3 [illegible]			.08	5944	9 843 0745 ✓
1-3					3 896 4315 ✓
1-2					4 132 8407 ✓
		0.23	0.23	0000	

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 25
Ed. Nov. 1946

COMPUTATION OF TRIANGLES

STATION	Adjusted ANGLE		SPHER. EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3					4.250 7152
1 STEEL USN	[illegible]	[illegible]	[illegible]	50.43	0.000 1653
2 LANTANA USN	[illegible]	[illegible]	[illegible]	44.45	8.985 1647
3 LILAC USN	[illegible]	[illegible]	[illegible]	94.60	9.996 6319
1-3					3.236 0452
1-2					4.247 5124
	0.028		0.028	0.000	
2-3					
1					
2					
3					
1-3					
1-2					
2-3					
1					
2					
3					
1-3					
1-2					
2-3					
1					
2					
3					
1-3					
1-2					

36A

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, SECOND-ORDER TRIANGULATION

			°	′	″				°	′	″
α	2	to 3	240	38	43.70	α	3	to 2	60	40	24.82
2d ∠		& •	+05	32	44.98	3d ∠		&	-82	52	24.65
α	2	to 1	246	11	28.68	α	3	to 1	337	48	00.17
-Δα			+	01	45.30	Δα			+		24.35
			180	00	00.00				180	00	00.00
α′	1	to 2	66	13	1398	α′	1	to 3			

First Angle of Triangle

φ			62	13	20.696	φ					
Δφ				02		Δφ					
φ′			162	22	44.3	φ′				162	

	Logarithms			Logs			Logarithms			Logs	
	4247 5.29	1		0.699	½(φ+φ′)	81 22 44.3		3 336 1452	1		
cos α		2					cos α		2		
b		Sum					b		Sum		
									4		
sin² α		(5)		3 0.477	sec ²		sin² α		(5)	3 0.477	sec φ′
C		(6)	+	cos² α	Sum		C	0 11235	(6)	+ cos² α	Sum
(2)=K		(7)	+	(6)	Arc—sin corr.		(2)=K	6.337 06	(7)	+ (6)	Arc—sin corr.
$\frac{h}{(\Delta\phi)^2}$		-Δφ	-232.1202	(colog) E	Δλ	2.727 2276	$\frac{h}{(\Delta\phi)^2}$	3 4302	-Δφ	51 8920 (colog) E	Δλ
D		$\frac{\Delta\phi}{2}$	116.08	$\frac{A^2 \text{arc}^2 1''}{3}$ 5.912	$\sin\frac{1}{2}(\phi+\phi')$	9.245 1842	D	1.98105	$\frac{\Delta\phi}{2}$	$\frac{A^2 \text{arc}^2 1''}{3}$ 5.912	$\sin\frac{1}{2}(\phi+\phi')$
(3)	6.7096			sec²φ	sec $\frac{\Delta\phi}{2}$		(3)	5.4107		sec²φ	sec $\frac{\Delta\phi}{2}$
-h-	2.3661			(7)	(approx.) -Δα-	2.022 4118	-h-	1.7151		(7)	(approx.) -Δα-
s² sin² α	8.4178				do	105.2960	s² sin² α	5.6267			do
E	5.6619	Arc—sin corr.			(8)		E	5.6626	Arc—sin corr.		(8)
(4)+	6.4458	for s	- 5.5	(Δλ)² 8.182	-Δα-	105.2960	(4)	3.0044	for s	- — (Δλ)² 3.995	-Δα-
		for Δλ	+ 4.8	F 7.569					for Δλ	+ — F 7.576	
		Total	- 0.7	(8) 5.751	-Δλ-	533.6146			Total	(8) 1.571	-Δλ-

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, SECOND-ORDER TRIANGULATION

~~OFFICIAL USE ONLY~~

			°	′	″				°	′	″
α	2	to 3	327	56	52.40	α	3	to 2	147	57	15.78
2d ∠		&	106	53	16.13	3d ∠		&	-39	01	37.96
α	2	to 1	74	50	08.53	α	3	to 1	108	55	37.82
Δα				-	47.86	Δα				01	11.12
			180	00	00.00				180	00	00.00
α′	1	to 2	254	02	26.67	α′	1	to 3	288	54	26.70

First Angle of Triangle

Logarithms

s	3.870 4091	(1)	[illegible]	log	0.699	s	[illegible]	(1)	[illegible]	log	[illegible]
cos α	[illegible]	(2)	[illegible]			cos α	[illegible]	(2)	[illegible]		
B	[illegible]	Sum	[illegible]	E		B	[illegible]	Sum	[illegible]	E	
(1)=h	[illegible]	(3)	[illegible]	F		(1)=h	2.080 6743	(3)	[illegible]	F	
s²	[illegible]	(4)		(5)		s²	[illegible]	(4)		(5)	
						sin² α	[illegible]				
		(6)		cos²		Sum	2.[illegible]	C	[illegible]	(6)	
(2)=K	[illegible]	(7)	+	(6)		(2)=K	8.78[illegible]	(7)	+	(6)	
$(\frac{h}{\Delta\phi})^2$	36.11	$-\frac{\Delta\phi}{2}$	[illegible]	(colog) E		$(\frac{h}{\Delta\phi})^2$	4.1613	$-\frac{\Delta\phi}{2}$	[illegible]	(colog) E	
D	1.4851			$\frac{A^2 \text{arc}^2 1''}{3}$	5.912	D	1.4833			$\frac{A^2 \text{arc}^2 1''}{3}$	5.912
(3)	5.5762			sec²φ		(3)	6.1446			sec²φ	
−h	8055			(7)		−h	-2.0807			(7)	
s² sin² α	7200					s² sin² α	8.0660				
E	5.0636	Arc−sin corr.				E	5.6632	Arc−sin corr.			
(4)	5.1891	for s − 1	$(\Delta\lambda)^2$	7.136		(4)	5.8099	for s − 1.8	$(\Delta\lambda)^2$	7.655	
		for Δλ + 1	F	7.516				for Δλ + 2.2	F	7.574	
		Total 0	(8)	4.712				Total + 0.4	(8)	5.229	

Logarithms

s	3.875 4091	(1)	[illegible]	log	0.699	s	[illegible]	(1)	[illegible]	log	[illegible]
sin α′	9.986 [illegible]	(2)	[illegible]			cos α	[illegible]	(2)	[illegible]		
A	[illegible]	Sum	[illegible]	E		B	[illegible]	Sum	[illegible]	E	
		(3)	[illegible]	F		(1)=h	2.080 6743	(3)	[illegible]	F	
		(4)		(5)		s²	[illegible]	(4)		(5)	
						sin² α	[illegible]				
		(6)		cos²		Sum	2.[illegible]	C	[illegible]	(6)	
Sum	2.[illegible]					(2)=K	8.78[illegible]	(7)	+	(6)	
Arc−sin corr.						$(\frac{h}{\Delta\phi})^2$	4.1613	$-\frac{\Delta\phi}{2}$	[illegible]	(colog) E	
Δλ	2.378 5521					D	1.4833			$\frac{A^2 \text{arc}^2 1''}{3}$	5.912
$\sin\frac{1}{2}(\phi+\phi')$	9.301 [illegible]					(3)	6.1446			sec²φ	
$\sec\frac{\Delta\phi}{2}$						−h	-2.0807			(7)	
(approx.) −Δα	1.679 9764					s² sin² α	8.0660				
do	47.8604					E	5.6632	Arc−sin corr.			
(8)	0.0000					(4)	5.8099	for s − 1.8	$(\Delta\lambda)^2$	7.655	
−Δα	47.8604							for Δλ + 2.2	F	7.574	
−Δλ	239.0849							Total + 0.4	(8)	5.229	

Logarithms

s	4.[illegible] 3842	(1)	[illegible]	log	[illegible]	s	[illegible]	(1)	[illegible]	log	[illegible]
sin α	9.[illegible] 4.16	(2)	[illegible]			cos α	[illegible]	(2)	[illegible]		
A	[illegible]	Sum	[illegible]	E		B	[illegible]	Sum	[illegible]	E	
		(3)	[illegible]	F		(1)=h	2.080 6743	(3)	[illegible]	F	
		(4)		(5)		s²	[illegible]	(4)		(5)	
						sin² α	[illegible]				
sec φ	[illegible] 76					Sum	2.[illegible]	C	[illegible]	(6)	
Sum	[illegible] 5327					(2)=K	8.78[illegible]	(7)	+	(6)	
Arc−sin corr.	2					$(\frac{h}{\Delta\phi})^2$	4.1613	$-\frac{\Delta\phi}{2}$	[illegible]	(colog) E	
Δλ	2.355 5327					D	1.4833			$\frac{A^2 \text{arc}^2 1''}{3}$	5.912
$\sin\frac{1}{2}(\phi+\phi')$	9.300 [illegible] 37					(3)	6.1446			sec²φ	
$\sec\frac{\Delta\phi}{2}$						−h	-2.0807			(7)	
(approx.) −Δα	1.852 0064					s² sin² α	8.0660				
do	71.1224					E	5.6632	Arc−sin corr.			
(8)						(4)	5.8099	for s − 1.8	$(\Delta\lambda)^2$	7.655	
−Δα	71.1224							for Δλ + 2.2	F	7.574	
−Δλ	356.0678							Total + 0.4	(8)	5.229	

U. S. GOVERNMENT PRINTING OFFICE : 1941—O-[illegible]

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 26—Rev. Apr. 11, 1930

POSITION COMPUTATION, ~~FIRST~~ SECOND-ORDER TRIANGULATION

			°	′	″				°	′	″
α	2	to 3	288	54	26.69	α	3	to 2	108	55	37.82
2d ∠		&	+33	34	51.62	3d ∠		&	100	07	54.99
α	2	to 1	322	29	18.31	α	3	to 1	008	47	42.83
Δα			[illegible]	01	02.12	Δα			−		8.75
			180	00	00.00				180	00	00.00
α′	1	to 2	[illegible]	[illegible]	[illegible]	α′	1	to 3	[illegible]	[illegible]	[illegible]

Third angle of Triangle

			°	′	″		°	′	″			°	′	″
φ	[illegible]	2	[illegible]	[illegible]	[illegible]	φ	[illegible]	[illegible]	[illegible]	3		[illegible]	[illegible]	[illegible]
−Δλ	[illegible]		Δλ	05	12.042	−Δφ		04	40.734		−Δλ			44.026
λ	[illegible]	1	λ	162	22	22.841	φ′	11	25	38.247	1	λ′	[illegible]	22.841

Logarithms					Logs		Logarithms		Logarithms				Logs		Logarithms
s	[illegible]	(1)	[illegible]	½	5.699	½(φ+φ′)	[illegible]	s	3.740 7286	(1)	[illegible]	½	5.699	½(φ+φ′)	[illegible]
cos α	[illegible]	(2)		s²				cos α	9.994 8630	(2)	+	s²			
B	[illegible]	Sum		h		s	[illegible]	B	8.[illegible]2 5007	Sum		h		s	[illegible]
(1)=h	[illegible]	(3)		E		sin α	[illegible]	(1)=h	2.448 2923	(3)	+	E		sin α	[illegible]
s²	[illegible]	(4)		(5)		A′	8.509 6689	s²	7.88186	(4)		(5)		A′	8.507 6689
sin² α	[illegible]	(5)		3	0.477	sec φ′	0.008 6955	sin² α	8.36883	(5)	−	3	0.477	sec φ′	0.008 6955
C	[illegible]	(6)		cos² α		Sum	2.494 2130	C	0.71537	(6)	+	cos² α		Sum	1.643 7106
(2)=K	8.66830	(7)	+	(6)		Arc−sin corr.	0.000 0003	(2)=K	6.96606	(7)	+	(6)		Arc−sin corr.	0.000 0001
(δφ)²	5.2063	−Δφ	401.2344	(colog) E		Δλ	2.494 2133	(δφ)²	4.8966	−Δφ	280.7340	(colog) E		Δλ	1.643 7105
D	1.8845	Δφ/2	[illegible]	$\frac{A^2 \text{arc}^2 1''}{3}$	$\bar{5}$.912	sin ½(φ+φ′)	9.299 0214	D	1.9833	Δφ/2	140.37	$\frac{A^2 \text{arc}^2 1''}{3}$	$\bar{5}$.912	sin ½(φ+φ′)	9.298 397[illegible]
(3)	7.1909			sec² φ		sec Δφ/2	0.000 0002	(3)	6.8799			sec² φ		sec Δφ/2	0.000 0001
−h	2.6032			(7)		(approx.) −Δα	1.793 2349	−h	2.4483			(7)		(approx.) −Δα	0.942 1077
s² sin² α	7.9517					do	62.1205″	s² sin² α	6.2507					do	8.7520″
E	5.6635					(8)		E	5.6632					(8)	—
(4)	6.2184					−Δα	62.1205″	(4)	4.3622					−Δα	8.7520″
						−Δλ	312.0417″							−Δλ	44.0261″

Arc−sin corr.				Arc−sin corr.			
for s	− 4.3	(Δλ)²	7.483	for s	− 1.3	(Δλ)²	4.931
for Δλ	+ 1.7	F	7.575	for Δλ	+ 0.0	F	7.574
Total	− 2.6	(8)	5.058	Total	− 1.3	(8)	2.505

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 96—Rev. Apr. 11, 1930

POSITION COMPUTATION, ~~FIRST~~ SECOND-ORDER TRIANGULATION

~~OFFICIAL USE ONLY~~

			°	′	″				°	′	″
α	2	to 3	322	29	18.31	α	3	to 2	142	30	20.43
3d ∠		&	+53	35	26.33	3d ∠		&	-81	49	55.61
α	2	to 1	16	04	44.64	α	3	to 1	60	40	24.82
Δα			−		39.70	Δα				01	41.12
			180	00	00.00				180	00	00.00
α′	1	to 2	196	04	04.94	α′	1	to 3	240	38	43.70
			44	34	38.76						

First Angle of Triangle

	°	′	″			°	′	″			°	′	″		
φ		39	23.24	2					φ						
Δφ			25.49						Δφ						
φ′	11	20	24.85	1					φ′						

Logarithms				Logs	Logarithms				Logarithms				
a	4340 6011	(1)	+ 665255	9.699									
cos α	9.782 6693	(2)	+		sin (φ′+φ)				cos α				
B	8.512 4991	Sum	665.144 7		a	4.340 6011			B		Sum		
(1)=h	2.835 10	(3)	+		sin α				(1)=h				
s		4			s				s				
sin² α		5			sec φ				sin² α				
		6			Sum								
(2)=K	8.2827	7		6	Arc sin corr				(2)=K				
$\left(\frac{b}{2\Delta\phi}\right)^2$	5.6715	$\frac{-\Delta\phi}{\frac{\Delta\phi}{2}}$	665.144	$\frac{(\cos\alpha)\ E}{A^2 \text{arc}^2 1''}$	Δλ				$\left(\frac{b}{2\Delta\phi}\right)^2$		$\frac{-\Delta\phi}{\frac{\Delta\phi}{2}}$		$\frac{(\cos\alpha)\ E}{A^2 \text{arc}^2 1''}$
D	1.9842		342.5	3 5.912	sin ½(φ+φ)				D				
(3)	7.6560			sec²φ	sec $\frac{\Delta\phi}{2}$	0.000 0006			(3)	6.8864			sec²φ
−h	2.8358			(7)	(approx.) −Δα	1.598 8150			−h	2.4532			(7)
s² sin² α	7.5660				do				s² sin² α				
E	5.6635	Arc−sin corr.			(8)				E		Arc−sin corr.		
(4)−	6.0653	for s	− 8.5	$(\Delta\lambda)^5$		−Δα	39.7022		(4)−	6.4981	for s		$(\Delta\lambda)^5$		
		for Δλ	+ .7	F	7.5755						for Δλ		F		
		Total	− 7.8	(8)		−Δλ	200.1049				Total		(8)		Δλ

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
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POSITION COMPUTATION, SECOND-ORDER TRIANGULATION

			°	′	″				°	′	″
α	2	to 3	240	38	43.70	α	3	to 2	60	40	24.82
2d ∠		&	+21	53	54.47	3d ∠		&	-44	09	57.52
α	2	to 1	262	32	38.17	α	3	to 1	16	30	25.30
Δα			+	01	27.44	Δα			−		13.46
			180	00	00.00				180	00	00.00

Logarithms

						sec φ′	0.0052993	sin² α					sec φ′	
						Sum							Sum	
(2)=K	8.9427546					Arc−sin corr.	0.	(2)=K	7.3422				Arc−sin corr.	0.0001
$\left(\frac{\Delta\phi}{2}\right)^2$		$-\frac{\Delta\phi}{2}$		(colog) E / $\frac{A^2 \text{arc}^2 1''}{3}$	5.912	Δλ	2,64742.18″	$\left(\frac{h}{\Delta\phi}\right)^2$		$-\frac{\Delta\phi}{2}$		(colog) E / $\frac{A^2 \text{arc}^2 1''}{3}$	5.912	Δλ
D						$\sin\frac{1}{2}(\phi+\phi')$	9.2742682	D						$\sin\frac{1}{2}(\phi+\phi')$
(3)				sec²φ		sec $\frac{\Delta\phi}{2}$		(3)				sec²φ		sec $\frac{\Delta\phi}{2}$
+h				(7)		(approx.) $-\Delta\alpha-$	1.9416900	−h				(7)		(approx.) $-\Delta\alpha+$
s² sin² α						do	87.4359″	s² sin² α						do
E						(8)	0.0000	E						(8)
(4)+		Arc−sin corr. for s		(Δλ)²		$-\Delta\alpha-$	87.4359	(4)		Arc−sin corr. for s		(Δλ)²		$-\Delta\alpha+$
		for Δλ		F						for Δλ		F		
		Total		(8)		$-\Delta\lambda-$	444.0397			Total		(8)		$-\Delta\lambda+$

			°	′	″				°	′	″
α	2	to 3				α	3	to 2			
2d ∠		&				3d ∠		&			
α	2	to 1				α	3	to 1			
Δα						Δα					
			180	00	00.00				180	00	00.00

Logarithms

						sec φ′		sin² α					sec φ′	
						Sum							Sum	
(2)=K						Arc−sin corr.		(2)=K					Arc−sin corr.	
$\left(\frac{\Delta\phi}{2}\right)^2$		$-\frac{\Delta\phi}{2}$		(colog) E / $\frac{A^2 \text{arc}^2 1''}{3}$	5.912	Δλ		$\left(\frac{h}{\Delta\phi}\right)^2$		$-\frac{\Delta\phi}{2}$		(colog) E / $\frac{A^2 \text{arc}^2 1''}{3}$	5.912	Δλ
D						$\sin\frac{1}{2}(\phi+\phi')$		D						$\sin\frac{1}{2}(\phi+\phi')$
(3)				sec²φ		sec $\frac{\Delta\phi}{2}$		(3)				sec²φ		sec $\frac{\Delta\phi}{2}$
+h				(7)		(approx.) $-\Delta\alpha-$		−h				(7)		(approx.) $-\Delta\alpha+$
s² sin² α						do		s² sin² α						do
E						(8)		E						(8)
(4)+		Arc−sin corr. for s		(Δλ)²		$-\Delta\alpha-$		(4)		Arc−sin corr. for s		(Δλ)²		$-\Delta\alpha+$
		for Δλ		F						for Δλ		F		
		Total		(8)		$-\Delta\lambda-$				Total		(8)		$-\Delta\lambda+$

U. S. GOVERNMENT PRINTING OFFICE : 1941 — O - 305152

N.H.O. 89

GEOGRAPHIC POSITIONS

Locality KWAJALEIN, Marshall Islands — 2nd order triangulation Astro *Datum.* — *Scale* Pacific Ocean — USS BOWDITCH - 1944 — Archive No. 305697/1

STATIONS	LATITUDE	Seconds in Meters	LONGITUDE	Seconds in Meters	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE Meters	LOGARITHMS
PETUNIA	08 38 09.362	1823.957	162 09 40.138	1215.740	239 34 23.79	59 34 48.57	SAGE	4305.72	3.634 0460
					243 33 46.69	63 34 28.48	ZINNIA	6990.82	3.844 5280
					270 33 20.46	90 34 32.30	ASTER	10,777.10	4.032 5004
					59 34 48.57	239 34 23.79	PETUNIA	4305.72	3.634 0459
					[illegible]	[illegible]	ZINNIA	2712.13	3.433 3102
					[illegible]	107 56 45.39	ASTER	7424.24	3.870 8519
					291 10 00.03	[illegible]	CAMELLIA	11,271.60	4.052 9852
					325 30 39.85	145 31 43.84	KEKE	[illegible]	[illegible]
ZINNIA	[illegible]	[illegible]	[illegible]	[illegible]	63 34 28.48	243 33 46.69	PETUNIA	6990.82	3.844 5280
					69 54 58.90	249 54 41.89	SAGE	2712.13	3.433 3102
					[illegible]	[illegible]	ASTER	5545.29	3.743 9238
ASTER	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PETUNIA	777.10	4.032 5004
					[illegible]	[illegible]	SAGE	7424.24	3.870 8519
					[illegible]	[illegible]	ZINNIA	5545.29	3.743 9238
					[illegible]	[illegible]	CAMELLIA	3881.83	3.589 0367
					346 43 32.85	166 43 51.92	KEKE	2,519.30	3.401 5728
CAMELLIA	11 37 57.805	1776.116	162 17 29.721	900.279	03 09 27.99	183 09 24.19	KEKE	10,615.70	4.017 6901
					111 10 10.10	291 10 00.03	SAGE	11,271.60	4.052 9852
					117 22 47.25	297 22 24.29	ASTER	3881.83	3.589 0358
					302 57 25.15	122 57 58.18	GARDENIA	5922.17	3.772 4806
					321 39 33.90	141 40 18.15	NORTH BASE	10,753.90	4.031 5685
GARDENIA	11 36 12.938	397.533	162 20 13.749	416.526	37 41 02.45	217 40 25.76	KEKE	9069.22	3.957 5698
					122 57 58.18	302 57 25.15	CAMELLIA	5922.17	3.772 4806
					341 55 44.00	161 55 55.27	NORTH BASE	5483.79	3.739 0812

FINAL VALUES — GEOGRAPHIC POSITIONS

ENIWETOK, Marshall Islands — 2nd order triangulation — Astro — *Datum* — *State* Pacific Ocean — USS BOWDITCH - 1944 — Archive No. 305697/1

STATIONS	LATITUDE	LONGITUDE	AZIMUTH	BACK AZIMUTH	DISTANCES	DESCRIPTIONS
ENIWETOK ASTRO PIER	11 33 29.480	162 10.250	310.575			
			238 44 37.63	58 44 37.70	ENIWETOK ASTRO PIER	12.767		
			324 59 32.56	145 59 43.57	SOUTH BASE	2981.42		
			327 56 52.60	147 57 15.77	SAND	6680.87	3.826	8331
			74 50 08.53	254 49 20.67	REEF	7506.61	3.875	4441
			141 40 18.15	321 39 33.90	CAMELLIA	10,753.90	4.031	5685
			161 55 55.27	341 55 44.00	GARDENIA	5483.79	3.739	3812
			129 [illegible] 31.44	149 [illegible] 44.01	SAND	[illegible]	[illegible]	[illegible]
			157 23 58.31	337 22 01.87	LILAC	[illegible]	[illegible]	[illegible]
			[illegible] 50.06	[illegible]	REEF	[illegible]	[illegible]	[illegible]
			145 59 43.57	325 59 52.56	NORTH BASE	2981.42	[illegible]	[illegible]
			145 31 45.84	325 30 39.85	SAGE	17,555.80	4.244	6200
			166 43 51.92	346 43 32.85	ASTER	12,519.30	4.097	5798
			183 09 24.19	03 09 27.99	CAMELLIA	10,415.70	4.017	6901
			217 40 25.76	37 41 02.45	GARDENIA	9069.22	3.957	5698
			254 49 20.67	74 50 08.53	NORTH BASE	7506.61	3.875	4441
			273 14 52.17	93 15 50.99	SOUTH BASE	8927.19	3.950	7152
			288 54 26.68	108 55 37.81	SAND	11,407.00	4.057	1732
			322 29 18.30	142 30 20.43	LILAC	15,535.40	4.191	3221
			16 04 44.63	196 04 04.93	LANTANA	21,909.70	4.340	6362

FINAL VALUES — GEOGRAPHIC POSITIONS

Locality KWAJALEIN, Marshall Islands — 2nd. order triangulation — ASTRO *Datum.* — *State* Pacific Ocean — USS HOWDITCH - 1944 — Archive No. 305697/1

STATIONS	LATITUDE	Seconds in Meters	LONGITUDE	Seconds in Meters	AZIMUTH	BACK AZIMUTH	TO STATIONS	DISTANCE Meters		
BAND	11 30 18.966	582.749	162 23 06.881	208.596	08 47 42.82	188 47 34.07	LILAC	8728.98	3.940	9636
					44 13 17.84	224 09 [illegible].65	LANTANA	24,196.90	4.383	7598
					108 [illegible] [illegible].83	[illegible] [illegible].68	HOOF	[illegible].407.00	[illegible]	1733
					147 [illegible] [illegible].7	[illegible] [illegible].46	SOUTH BASE	6,80[illegible].87	[illegible]	3331
					149 [illegible] [illegible].01	[illegible] [illegible].[illegible]	SOUTH BASE	[illegible],[illegible]4.00	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PRIVILEGE	7268.86	[illegible]	4665
					50 40 24.82	240 48 43.69	LANTANA	17,813.50	4.250	7502
					[illegible] [illegible] [illegible].43	[illegible] [illegible] [illegible]	HOOF	[illegible],535.40	[illegible]	3221
					177 22 01.87	357 23 56.31	SOUTH BASE	[illegible],830.00	[illegible]	9854
					188 47 34.07	08 47 42.82	BAND	8728.98	[illegible]	9636
					[illegible] [illegible] [illegible]	[illegible] [illegible] [illegible]	STEEL	1722.19	[illegible]	0804
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	HOOF	[illegible],[illegible]9.20	[illegible]	6362
					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					[illegible] [illegible] [illegible].64	[illegible] [illegible] [illegible].82	LILAC	7813.50	[illegible]	7502
					246 11 28.67	66 13 13.97	STEEL	[illegible],682.70	[illegible]	[illegible]
					264 32 38.16	84 34 [illegible].60	PRIVILEGE	[illegible],579.20	[illegible]	[illegible]
STEEL	[illegible] 24 26 [illegible] 1422.998	162 [illegible] 14 [illegible]19	1343.530	26 48 36.39	206 48 18.70	PRIVILEGE	6022.03	[illegible].779	7427	
					66 13 13.97	246 11 28.67	LANTANA	17,682.70	4.247	5474
					157 48 04.42	337 48 00.17	LILAC	1722.19	3.236	0804
PRIVILEGE	11 21 51.383	1578.743	162 21 14.736	446.800	82 34 05.60	262 32 38.16	LANTANA	13,579.20	4.132	8757
					196 30 11.84	16 30 25.30	LILAC	7268.86	3.861	4665
					206 48 18.70	26 48 36.39	STEEL	6022.03	3.779	7427

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 525
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DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: EL[illegible]
STATE: [illegible]rshall Islands COUNTY: Eniwetok Atoll
CHIEF OF PARTY: R. L. F[illegible]
YEAR: 19[illegible]8 LOCALITY: Engebi Island

Surface-station mark, No. [illegible]
Underground-station mark, No. [illegible]
Reference mark, No. [illegible]
Reference mark, No. [illegible]
Azimuth mark, No. [illegible]
Witness mark, No. [illegible]
Height of light above station mark, [illegible] meters.†
Height of telescope above station mark, [illegible] meters.†

DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND

DISTANCE	DIRECTION	AZIMUTH
	° ′ ″	° ′ ″

Detailed description: The station is located on Engebi Island, approximately 700 feet north of the south end of the island, [illegible]00 feet east of the seaward side, 300 feet west of the lagoon side, and 45 feet south of the southeast corner of a small quonset hut. The disk is a standard USC&GS station disk set in a [illegible] inch concrete mark that projects 2 inches above the surface of the ground and is stamped ELGIN.

Described by G.R.S.

Marked by G.A.J.

NOTE.—The initial direction [illegible] scheme station

† Refers to pages 108 and 109, Special Publication No. 120, or to pages 112 and 113, Special Publication No. 145. ... 11—8761
The nearest meter only, when no trigonometric leveling is being done.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 525
Rev. Oct., 1932

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: GRAFLE[illegible]
STATE: Marshall Islands COUNTY: Eniwetok Atoll
CHIEF OF PARTY: R. L. P[illegible]au
YEAR: 1948 LOCALITY: Aomon Island

Surface-station mark, No. [illegible]
Underground-station mark, No. [illegible]
Reference mark, No. [illegible]
Reference mark, No. [illegible]
Azimuth mark, No. [illegible]
Witness mark, No. [illegible]
Height of light above station mark, [illegible] meters.
Height of telescope above station mark, 19 meters.†

DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND

DISTANCE	DIRECTION	AZIMUTH
	° ′ ″	° ′ ″

Detailed description: The station is located on the north end of Aomon Island, about 500 feet west of the east shoreline of the island, 2[illegible]5 feet south of the north shoreline, and 75 west of the northwest leg of the photo-tower. The disk is a standard USC&GS station disk set in a 12 by 12 inch concrete mark that projects 6 inches above the surface of the ground and is stamped GRAFLE.

No reference marks were established at this station.

Described by G.R.S.

Marked by G.A.J.

NOTE.—The initial direction [illegible] scheme station

† Refers to pages 108 and 109, Special Publication No. 120, or to pages 112 and 113, Special Publication No. 145. ... 11—8761
The nearest meter only, when no trigonometric leveling is being done.

M.D.

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DEPARTMENT OF COMMERCE
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Form 525
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DESCRIPTION OF TRIANGULATION STATION

STATE Marshall Islands COUNTY Eniwetok Atoll
YEAR 1948 LOCALITY Eniwetok Lagoon

NAME OF STATION: CORAL
CHIEF OF PARTY: R. L. Pfau

		DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND		
		OBJECT	DISTANCE	DIRECTION	AZIMUTH
Surface-station mark,	Note,*				
Underground-station mark	Note,*				
Reference mark,	Note,*				
Reference mark,	Note,*				
Azimuth mark,	Note,*				
Witness mark,	Note,*				
Height of light above station mark	meters				
Height of telescope above station mark	meters				

Detailed description: The station is located atop a circular concrete cell that is 15 feet in diameter, about 2 miles east-southeast of the reef [illegible] tower, about 5 miles west of Runit Island, and 0.15 mile west of buoy No. 15. The [illegible] is a standard USC&GS station disk set in the center of the structure, about [illegible] feet above the high water mark, stamped CORAL, and is surrounded by a sheet met[illegible] projects 10 feet out of the water.

Described by G.R.S. Marked by G.A.J.

NOTE.—The initial direction must be to main scheme station

* Refers to pages 108 and 109, Special Publication No. 120, or to pages 112 and 113, Special Publication No. 145 11—5761
* To nearest [illegible] when no trigonometric leveling is being done.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
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DESCRIPTION OF TRIANGULATION STATION

STATE: Marshall Islands COUNTY: Eniwetok Atoll
YEAR: 1948 LOCALITY: Eniwetok Lagoon

NAME OF STATION: REEF PHOTO TOWER
CHIEF OF PARTY: R. L. Pfau

		DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND			
		OBJECT	DISTANCE	DIRECTION	AZIMUTH
Surface-station mark,	Note,*				
Underground-station mark,	Note,*				
Reference mark,	Note,*				
Reference mark,	Note,*				
Azimuth mark,	Note,*	This is an intersection station.			
Witness mark,	Note,*				
Height of light above station mark	meters				
Height of telescope above station mark	meters.*				

Detailed description: The station is a 4 leg steel structure constructed atop 4 steel piles encased in concrete ~~pilings~~ located on a reef that is approximately 7 statute miles south of Engebi, 7 miles west of the northend of Runit Island, and 7 miles west northwest of station CORAL.

Directions were observed on a temporary point established at the intersection of the diagonals of the opposite legs of the tower and this point was marked on a wood deck that was constructed about 5 feet above the high water mark. No permanent mark was set and the station was not occupied due to the [illegible] present.

Described by G.R.S. Marked by

NOTE.—The initial direction must be to main scheme station

* Refers to pages 108 and 109, Special Publication No. 120, or to pages 112 and 113, Special Publication No. 145 11—5761
* To nearest [illegible] when no trigonometric leveling is being done.

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DESCRIPTION OF STATION

NAME OF STATION: KODAK
STATE: Marshall Islands COUNTY: Eniwetok Atoll
CHIEF OF PARTY: R. L. Pfau YEAR: 1945 LOCALITY: Aniyaanii Island

Surface-station mark,	Note
Underground-station mark,	Note
Reference mark,	No. 1 Note*
Reference mark,	No. Note*
Azimuth mark,	Note*
Witness mark,	Note*
Height of light above station mark	feet
Height of telescope above station mark	feet

DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND

MARK	DISTANCE	DIRECTION	AZIMUTH
	meters	° ′ ″	° ′ ″
Control		0 00 00.0	
Reference mark No. 1	17.495	113 01 16	
Aniyaanii photo tower	21.425	202 56 19.6	
Reference mark No.	33.777	224 07 02	

Detailed description: The station is located about [illegible] feet south of the end of vegetation in a small clearing on the lagoon side of Aniyaanii Island, 80 feet south of the north edge of the clearing, 125 feet west of the high-water mark on the lagoon beach, and 75.5 feet north of the northwest leg of the photo tower. The disk is a standard USC&GS station disk set in a 12 by 12 inch concrete mark flush with the ground and is stamped KODAK.

Reference mark No. [illegible] is 47.700 feet east of the station, 74 feet north-northeast of the northeast leg ~~of the northeast leg~~ of the photo tower, and 25 feet west of the east edge of the clearing. The disk is a standard USC&GS reference disk set in a 12 by 12 inch concrete mark that is flush with the surface of the ground and is stamped KODAK MK 1.

Described by J.H.J. Marked by G.A.J.

*NOTE.—The initial direction [illegible]

† Refers to pages 108 and 109, Special Publication No. 120, or to pages [illegible] 1-2 and 1-3, Special Publication No. 145.
‡ To nearest meter only, when no trigonometric leveling is being done.

11—5761

MJD

Station: KODAK [illegible] Islands County: Eniwetok Atoll
Chief: R. L. Pfau Year: 1945 Locality: Aniyaanii Island

Reference mark No. [illegible] is 10.819 feet south-southeast of the station, 37 feet north of the south edge of the clearing, and 35 feet southwest of the southwest leg of the photo tower. The disk is a standard USC&GS reference disk set in a 12 by 12 inch concrete mark that is flush with the surface of the ground and is stamped KODAK MK 11.

The Aniyaanii photo tower is 21.425 meters southeast of the station. The tower is a 4-leg steel structure 75 feet in height. Distance and direction were taken from a stake with a nail in the center to the center of the tower.

M.D.

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DEPARTMENT OF COMMERCE
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DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: RUNIT

STATE: Marshall Islands COUNTY: Eniwetok Atoll

CHIEF OF PARTY: R. L. Pfau

YEAR: 1948 LOCALITY: Runit Island

Surface-station mark,		Note,*	1
Underground-station mark,		Note,*	7
Reference mark,	No. 1	Note,*	1
Reference mark,	No. 2	Note,*	1
Azimuth mark,		Note,*	
Witness mark,		Note,*	

Height of light above station mark 6 meters.
Height of telescope above station mark 6 meters.

DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND

OBJECT	DISTANCE	DIRECTION	AZIMUTH
		° ′ ″	° ′ ″
SAID U.S.N. 1948	meters	0 ° 00′ 00.0	
Reference mark No. 1	12.520	180 12 25	
Reference mark No. 2	48.550	278 37 39	

Detailed description: The station is located approximately 250 feet north of the south end of Runit Island, 60 feet east of the high water mark on the lagoon side of the island, and 130 feet west of the high water mark on the seaward side. The disk is a standard USC&GS station disk set in a 12 by 12 inch concrete mark that projects 2 inches above the ground, and is stamped RUNIT.

Reference mark No. 1 is 41.075 feet north-northwest of the station, 60 feet east of the high water mark of the lagoon, and 2 feet south of the southwest corner of the southernmost quonset hut on Runit Island. The disk is a standard USC&GS reference disk set in a 12 by 12 inch concrete mark that is flush with the ground and is stamped RUNIT.

Reference mark No. 2 is 48.0[illegible] feet east of the station, 90 feet west of the high water mark on the seaward side of the island, and 4[illegible] feet south of a quonset hut. The disk is a standard USC&GS disk set in a 12 by 12 inch concrete mark that is flush with the surface of the ground, and is stamped RUNIT.

Described by G.R.S.

Marked by G.A.J.

NOTE.—The initial direction must be to main scheme station

* Refers to pages 108 and 109, Special Publication No. 120, or to pages 112 and 113, Special Publication No. 145. ... 11—5761

† To nearest meter only when the trigonometric leveling is being done.

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DESCRIPTION OF TRAVERSE STATION

NAME OF STATION: ACMON TRAVERSE ST[illegible]

STATE: Marshall Islands COUNTY: Eniwetok Atoll

CHIEF OF PARTY: R. L. Pfau

YEAR: 1948 LOCALITY: Acmon

Surface-station mark,		Note *	1a
Underground-station mark,		Note *	
Reference mark,		Note *	
Reference mark,		Note *	
Azimuth mark,		Note *	
Witness mark,		Note *	

Height of light above station mark meters
Height of telescope above station mark meters

DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND

OBJECT	DISTANCE	DIRECTION	AZIMUTH
		° ′ ″	° ′ ″

Detailed description: The station is located [illegible] the southwestern corner of Acmon Island, about 500 feet northeast of the southwest corner of the island, [illegible] feet northwest of the northwest corner of the causeway, and 130 feet east of the high-water mark of the lagoon. The disk is a standard USC&GS triangulation disk [illegible] concrete mark that projects 2 inches and is stamped ACMON TRAVERSE [illegible]

Described by G.R.S.

Marked by [illegible]

NOTE.—The initial direction must be to [illegible]

* Refers to pages 108 and 109, Special Publication No. 120, or to pages 112 and 113, Special Publication No. 145. ... 11—5761

† To nearest meter only when the trigonometric leveling is being done.

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SECRET DESCRIPTION OF STATION

NAME OF STATION: BIJIRI TRAVERSE STA. STATE Marshall Islands COUNTY: Eniwetok Atoll
CHIEF OF PARTY: Ralph L. Pfau YEAR 1948. LOCALITY: Biijiri Island

		DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND		
		DISTANCE	DIRECTION	AZIMUTH
			° ′ ″	° ′ ″
Surface-station mark,	Note 1			
Underground-station mark,	None			
Reference mark,	None			
Reference mark,	None			
Azimuth mark,	None			
Witness mark,	None			
Height of light above station mark		Meters.		
Height of telescope above station mark		Meters.		

Detailed description: The station is located in the northwestern corner of Biijiri Island, about 550 feet northeast of the southwestern end of the island, 180 feet north of the south end of the island, and 11 feet west of the high water mark of the lagoon. The disk is a standard USC&GS triangulation disk set in a 6-inch cndb concrete mark that projects 2 inches and is stamped BIJIRI TRAVERSE STA.

Described by G.A.J. Marked by G.A.J.

NOTE.--The initial direction ... pages 108 and 109, Special Publication No. 120, or to pages ... Special Publication No. 145. ... when no trigonometric leveling is being done. ... 11—5761

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DESCRIPTION OF STATION

NAME OF STATION: RUNIT TRAVERSE STA. STATE Marshall Islands COUNTY: Eniwetok Atoll
CHIEF OF PARTY: R. L. Pfau YEAR 1948 LOCALITY Runit Island

		DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND		
		DISTANCE	DIRECTION	AZIMUTH
			° ′ ″	° ′ ″
Surface-station mark,	Note 1			
Underground-station mark,	None			
Reference mark,	None			
Reference mark,	None			
Azimuth mark	None			
Witness mark,	None			
Height of light above station mark		Meters.		
Height of telescope above station mark		Meters.		

Detailed description: The station ... central part of Runit Island, about 1200 feet northeast ... larger sections of the island, 221 feet west of the ... side of the island, and 121 feet east of a pontoon, ... of the island. The disk is a standard USC&GS disk set ... projects 1 inch above the ground and is stamped ...

Described by ... Marked by G.A.J.

NOTE ... Publication No. 120, or to pages ... No. 14 ... 11—5761
... when no trigonometric leveling is being done.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 526

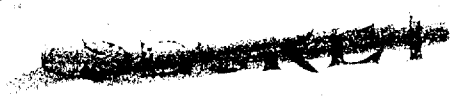
RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION SOUTH BASE STATE MARSHALL ISLANDS COUNTY ENIWETOK ATOLL
ESTABLISHED BY U.S.S. BOWDITCH [illegible] 1944
RECOVERED BY* R.L.Pfau [illegible] 19[illegible]

Detailed statement as to the witness [illegible] This station has been destroyed

J.C.H.



* Name of chief [illegible] should be entered [illegible] recovery note.

U. S. GOVERNMENT PRINTING [illegible] 16—26438-1

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 526

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION ENIWETOK ASTRO STATE MARSHALL ISLANDS COUNTY ENIWETOK ATOLL
ESTABLISHED BY U.S.S. BOWDITCH [illegible] 1944
RECOVERED BY* R.L.Pfau [illegible] 19[illegible]

Detailed statement as to the witness [illegible] This station has been destroyed

J.C.H.

* Name of chief [illegible] should be entered [illegible] recovery note.

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 526

RECOVERY NOTE — TRIANGULATION STATION

R

NAME OF STATION [illegible] Is. Is. COUNTY Eniwetok Atoll
ESTABLISHED BY [illegible] 1944
RECOVERED BY* R. L. [illegible] 1948

Detailed statement as to the [illegible] description [illegible] was recovered and found to be in good condition. A complete description follows:

The station is located on the third [illegible] island south of Runit Island, about 450 feet south of the [illegible] the island and [illegible] feet east of the high-water mark on the lagoon beach. The disk is a standard USN triangulation survey disk set in an 8 by 8 inch concrete [illegible] projects [illegible] above the surface of the ground and is not stamped.

No reference [illegible] established at this station.

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* Name of [illegible] who should sign his name at the end of the recovery note.

Gordon M. Steele

16—26488-1

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 526

RECOVERY NOTE — TRIANGULATION STATION

R

NAME OF STATION NORTH [illegible] 1944 [illegible] Marshall Islands COUNTY Eniwetok Atoll
ESTABLISHED BY [illegible] 1944 [illegible] Runit Island
RECOVERED BY* R. L. [illegible] 1948

Detailed statement as to the [illegible] description. The [illegible] was recovered and found to be in good condition. A complete description follows:

The station is located on the north end of Runit Island, 180 feet southeast of the north tip of the [illegible] island, 120 feet west of the northwest leg of the photo tower, and 35 feet east of the high-water mark on the lagoon side of the island. The disk is a standard USN triangulation [illegible] disk set in an 8 by 8 inch concrete mark that projects [illegible] above the surface of the ground. There is no stamping on the disk.

No reference [illegible] were established at this station.

SECRET

* Name of [illegible] who should sign his name at the end of the recovery note.

Gordon M. Steele

16—26488-1

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~~SECRET~~

IV B

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~~SECRET~~

SECRET

CONTENTS

SECRET

SECRET

TRIANGULATION

A scheme of first-order triangulation, composed of check figures was executed [illegible] from a first-order base line on Eniwetok Island. This scheme extends northward to Engebi Island and southward to Aniyaan Island. [illegible] was executed for the the purpose of coordinating local datums for the activated islands and to establish control [illegible] between certain installations.

All observations were made by the [illegible] standard procedure was followed throughout. The maximum triangle closure for the entire scheme was 0'.[illegible] seconds and the average [illegible] seconds. The maximum triangle closure in the base quadrilateral was 01.10 seconds and the average [illegible] seconds.

With the exception of stations [illegible] on Aomon, which could not be occupied because of excessive [illegible] all stations were occupied. Traverse ties were made to the [illegible] control towers on Engebi, Aomon, Runit, and Aniyaan Islands.

In order to [illegible] of the U.S.S. BOWDITCH with the new survey stations [illegible], 1944 and SHIP USN, 1944 were incorporated into the scheme.

BASE LINE

A first-order base line was established on Runit Island between stations NAN [illegible], 1944 and the newly established station RUNIT. The configuration of the base net required the adoption of a broken base consisting of four sections of varying lengths. First-order inver ters were used, and the [illegible] followed throughout.

The computed probable error in the base measurement is 1 part in 2,101,000.

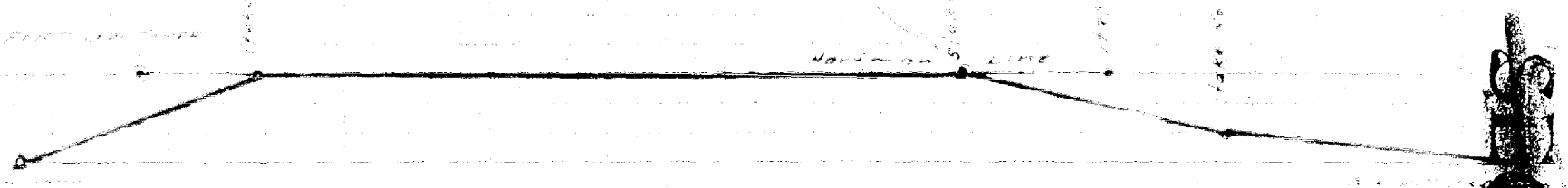
This base line is shorter than the second-order base line measured on the same island by the U.S.S. BOWDITCH in 1944, due to the fact that a considerable portion of the reef extending off the south end of the island was washed away.

The base [illegible] through station CORAL, a newly established station [illegible] in the same general area as station [illegible], but not coincident with that station. This is the most favorable location [illegible] for the construction of a station suitable for observations [illegible].

The base quadrilateral [illegible] with the specifications for first-order triangulation in that the [illegible] for the figure is larger than is generally allowed [illegible] station. This is the only [illegible] in which the [illegible] first-order specifications, due to [illegible] extent of the scheme.

SECRET

BASE LINE
(No Scale)



The Hartman line was staked out first, using [illegible] Stake Numbers thru Stake No 33
The portion of this Line from stake No 4 thru stake No 28 was also used as a section of the Triangulation Base line and stakes 4 & 28 of the Hartman Line were designated 4(A) and 28(B) to indicate that they were angle stations in the Base line. Following the same system of designation angle station "C" of the base line was designated 9(C), 9 being the stake No ~ The designations were used in all record book & computations.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 589
Rev. April 1935

[redacted]

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COMPUTATION OF *Runit I* BASE LINE

					Uncorrected length			Cor-		(Folding space)	-rections			Reduced length	Adopted length		
											Sag		Sea level				
											Meters	Meters	Meters	Meters	Meters		
									+0.0003		5.9[illegible]						
	1-28-48	B	933	1	1/1	5.50	33.4	+0.0048	-0.0405		0.0832	-0.0415		580.9923		±1.4	1.46
		B	933	2	1/2	25	[illegible]	+0.00[illegible]3	0.0018								
		B	3661	2	-		30.4	+0.0007	+0.0003		5.9968						

P.E. entire measurement = 1.245 mm
= 1:2,100,[illegible]

DECLASSIFIED PER DOE
LETTER DATED JULY 15,
FROM ANTON SINISCALLI T
DIANE S. NIXON

[redacted]

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OBSERVED

N.B		
A		
B		
C		
RUNIT		
Σ		

NB-RUNIT	2.017 0913	+104.0139	
	9.992 590		
NB - A	2.584 323		
	9.983 4532		
	2.567 7855		369.6456
A - B	0.858 5066	+ 7.2195	
	3.079 3440		
	3.079 626		
B - C	9.999 9921		
	3.079 1547		1199.9266
	1.939 8407	+ 87.0644	
C - RUNIT	9.286 404		
	2.653 2003		
	1.991 1150		
RUNIT - N.B	2.644 9153		441.4843
	0.987 3814	+ 9.7136	
	3.223 2100		
	2.764 7714		
	9.999 9393		
	2.764 1107		580.9124
	Σ	-0.0164	2591.9689
		Log =	3.4136298

SECRET

✓RSB

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U. S. COAST AND GEODETIC SURVEY
Form 685

SECRET

ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

(Result I)

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	[illegible]	MEAN ELEVATION	REMARKS
	Meters	[illegible]	[illegible]	[illegible]	Meters	
Mark N. Base USN 1944 Bench						
N. Base USN 1944	0	[illegible]	[illegible]	[illegible]	[illegible]	
N. Base Set up	> 784	[illegible]	[illegible]	[illegible]	[illegible]	
1	50	[illegible]	[illegible]	[illegible]	[illegible]	
2	50	[illegible]	[illegible]	[illegible]	[illegible]	
2 + 25	25	[illegible]	[illegible]	[illegible]	[illegible]	
3	50	[illegible]	[illegible]	[illegible]	[illegible]	
4	50	[illegible]	[illegible]	[illegible]	[illegible]	
5	50	[illegible]	[illegible]	[illegible]	[illegible]	
6	50	[illegible]	[illegible]	[illegible]	[illegible]	
4(A)	50	[illegible]	[illegible]	[illegible]	[illegible]	

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11—8196

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Form 685

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ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DIFFERENCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	Meters	Meters	Meters	Meters	
4 (A)						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28 (B)						

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 635

ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	[illegible]	MEAN ELEVATION	REMARKS
	Meters	[illegible]	[illegible]	[illegible]	[illegible]	
28 (B)						
1	[illegible]	[illegible]	[illegible]			
2	[illegible]	[illegible]	[illegible]			
3	[illegible]	[illegible]	[illegible]			
4	[illegible]	[illegible]	[illegible]			
5	[illegible]	[illegible]	[illegible]			
6	[illegible]	[illegible]	[illegible]			
7	[illegible]	[illegible]	[illegible]			
8	[illegible]	[illegible]	[illegible]			
9 (C)	[illegible]	[illegible]	[illegible]			

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 635

~~SECRET~~

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ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	Meters		Meters	Meters	
9 (C)						
1						
2						
3						
4						
5						
6						
6+25						
7						
8						
9						
10						
11						
Bench Δ Run						
Mark Δ Run						

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11—6134 GOVERNMENT PRINTING OFFICE

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 24A
Rev. Oct., 1932

SECRET

SECTION

Station NORTH BASE, U.S.N. 1944 Kwajalein Atoll Marshall Is. Triangulation

Chief of party Ralph L. Pfau Date 20 January 1944 Computed by R.L.P.

Observer G.R. Strode Instrument 4" Repeater T-2 #37 Checked by R.L.P.

11—9503

OBSERVED STATION	Observed direction	Eccentric correction	Reduced direction	Corrected direction with zero initial	Adjusted direction*
	° ' "	° ' "	° ' "	° ' "	° ' "
4 (A)	[illegible]			00.00	
RUNIT, U.S.C.&G.S. 1944	[illegible]			[illegible]	

No [illegible] of [illegible]

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* These columns are for office use and should be left blank [illegible]

[illegible]

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LIST OF DIRECTIONS

Station 4 (A) State Marshall Islands, Eniwetok Atoll

Chief of party Ralph [illegible] Date 2[illegible] Computed by R.L.P.

Observer G.R. Stroop Instrument [illegible] H-334 Checked by R.L.P.

=MAP

OBSERVED STATION	Observed direction	Reduction	Corrected direction with zero initial	Adjusted direction*
	° ′ ″	″	° ′ ″	′ ″
28 (B)	[illegible]		0 00 00.00	
North Base [illegible]	[illegible]			

* These columns are for office use and should [illegible]

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DEPARTMENT OF COMMERCE
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Station 28(B) Kole Marshall Is. Ennuen Atoll

Chief of party Ralph L. Pfau Date 29 June 1945

Computed by R.L.P.

Observer [illegible]

R 26

Adjusted direction*

N BASE

(2)

(3)

13

~~SECRET~~

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 24-A
Rev. Oct., 1932

Station 28(B) Site Marshall Is. [illegible] Atoll

Chief of party Ralph L. Pfau Date 29 Jan [illegible] Computed by R.L.P.

Observer G.R. Strode Instrument 7" Repeate[illegible] No. 314 Checked by R.L.P.

11-9503

OBSERVED STATION	Reduced direction	Eccentricity correction	Reduction to center	Corrected direction with zero initial	Adjusted direction*
29 (C)	[illegible]			[illegible] (0.00)	
24 (A)	[illegible]				

[illegible]

* These columns are for office use and should be left blank [illegible]

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Form 24-A
Rev. Oct., 1932

LIST OF DIRECTIONS

Station 9 (C) State Marshall Is. Eniwetok Atoll

Chief of party Ralph [illegible] Date 29 [illegible] 1948 Computed by R.L.P.

Observer G.R. Stroke Instrument [illegible] #H-334 Checked by R.L.G.

OBSERVED STATION	Observed direction	Sea level reduction*	Corrected direction with zero initial	Adjusted direction*
	° ′ ″	″	° ′ ″	° ′ ″
Runit, USC&GS [illegible]	[illegible]		0 00 00.00	
28 (B)	[illegible]			

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Form 24-A
Rev. Oct., 1932

SECRET

LIST OF DIRECTIONS

Station RUNIT U.S.C&GS 1944 State Marshall Is - Eniwetok Atoll

Chief of party Ralph L. Pfau Date 2nd June 1944 Computed by R.L.P.

Observer G.R. Strode Instrument T Repeater # ~ 234 Checked by R.L.P.

=498

11-8508

OBSERVED STATION	Observed direction	Eccentricity correction	Sea level reduction	Corrected direction with zero initial	Adjusted direction*
	° ' "	° ' "	° ' "	° ' "	° ' "
North Base, U.S.N. 1944	[illegible]			00 00 00.00	
9 C&GS	[illegible]				

No [illegible] of [illegible]

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[illegible]

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards

Certificate

for

[illegible] METER IRON NICKEL [illegible]

[illegible] Expansion [illegible]

NBS No. [illegible]

submitted by

U.S.C. & G.S. No. 921

United States Coast [illegible] Geodetic Survey
Washington [illegible]

This tape has been compared with the standards of the United States under a horizontal tension of 15 kilograms. The interval (0 to 50 meters) has the following lengths at 25 °C. under the conditions given below:

Supported at the 0-, 12.5-, [illegible], 37.5-, and 50-meter points [illegible] meters

Supported at the 0-, 12.5-, [illegible], 37.5-, and 50-meter points, with the 12.5- and 37.5-meter points 6 inches above the plane of the 0- and 50-meter supports [illegible] meters

Thermometers weighing 45 grams were attached at points 1 meter inside the terminal marks.

These comparisons were made on the section of the lines near the [illegible] edge of the tape marked with a small "a" or "y" or dots near the graduation.

The values for the lengths are not in error by more than [illegible] part in 1,500,000, the probable error does not exceed 1 part in 1,500,000.

The values for the lengths were obtained from measurements made [illegible] °C., and in reducing to 25 °C. the thermal expansion of +0.055 millimeter per 50 meters per degree centigrade was used.

The weight per meter of this tape previously determined is [illegible] grams.

For the Director,

[illegible]
Lewis V. Judson
Chief, Length Section [illegible]
Metrology Division.

XEB-EAD:ec 2.1/1144-39
Test completed October [illegible], 1939

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards

Certificate

for

[illegible] METER IRON NICKEL ALLOY TAPE

[illegible] Expansion Coefficient

NBS No. 1168

submitted by

United States Coast & Geodetic Survey,
Washington, D. C.

This tape has been compared with the standards of the United States under a horizontal tension of [illegible] kilograms. The interval (0 to 50 meters) has the following lengths at 25 °C. under the conditions given below:

Supported at the 0-, [illegible], 37.5-, and 50-meter points 49.99748 meters.

Supported at the 0-, [illegible], 37.5-, and 50-meter points, with the 12.5- and 37.5-meter points 6 inches above the plane of the 0- and 50-meter supports 49.99712 meters.

Thermometers weighing [illegible] grams were attached at points 1 meter inside the terminal marks.

These comparisons were made on the section of the lines near the end on the edge of the tape marked with a small "a" or "y" or dots near the graduation.

The values for the lengths are not in error by more than 1 part in 500,000, the probable error does not exceed 1 part in 1,500,000.

The values for the lengths were obtained from measurements made at 22.6 °C., and in reducing to 25 °C. the thermal expansion of +0.055 millimeter per 50 meters per degree centigrade was used.

The weight per meter of this tape previously determined is 45.6 grams.

For the Director,

[illegible]
Lewis V. Judson
Chief, Length Section [illegible]
Metrology Division.

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards

Certificate

for

[illegible] METER IRON NICKEL ALLOY TAPE

[illegible] Expansion Coefficient

NBS No. 324

submitted by

United States Coast & Geodetic Survey
Washington, D. C.

This tape has been compared with the standards of the United States under a horizontal tension of 15 kilograms. The interval (0 to 50 meters) has the following lengths at 25 °C. under the conditions given below:

Supported at the 0-, 12.5-, [illegible], 37.5-, and 50-meter points [illegible] meters

Supported at the 0-, 12.5-, [illegible], 37.5-, and 50-meter points, with the 12.5- and 37.5-meter points 6 inches above the plane of the 0- and 50-meter supports [illegible] meters

Thermometers weighing [illegible] grams were attached at points 1 meter inside the terminal marks.

These comparisons were made on the section of the lines near the end on the edge of the tape marked with a small "a" or "y" or dots near the graduation.

The values for the lengths are not in error by more than [illegible] part in 1,500,000, the probable error does not exceed 1 part in 1,500,000.

The values for the lengths were obtained from measurements made at [illegible] °C. and in reducing to 25 °C. the thermal expansion of +0.052 millimeter per 50 meters per degree centigrade was used.

The weight per meter of this tape previously determined is [illegible] grams.

For the Director,

[illegible]
Lewis V. Judson
Chief, Length Section [illegible]
Metrology Division.

[illegible]
Test completed [illegible]

Form 578
1-41-2

SECRET

U. S. DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards

Certificate

FOR

50-Meter Steel Tape

NBS No. 8305

RECEIVED OCT 6 1947

Maker's Identification Mark
The Lufkin Rule Co.
U.S.C.& G.S. No. 3661

SUBMITTED BY

United States Coast & Geodetic Survey,
Washington, D. C.

This tape has been compared with the standards of the United States. It complies with the specifications for a standard tape, and the intervals indicated have the following lengths at 68° Fahrenheit (20° centigrade) under the conditions given below:

Supported throughout in horizontal position on surfaces

Tension 4 1/2 pounds

Interval	Length
(0 to 1 meter)	1.0001 meters
(0 to 2 meters)	2.0004 "
(0 to 3 meters)	3.0003 "
(0 to 4 meters)	4.0003 "
(0 to 5 meters)	5.0004 "
(0 to 6 meters)	6.0000 "
(0 to 7 meters)	7.0007 "
(0 to 8 meters)	8.0009 "
(0 to 9 meters)	9.0010 "
(0 to 10 meters)	10.0008 "
(0 to 11 meters)	11.0011 "
(0 to 12 meters)	12.0008 "
(0 to 13 meters)	13.0012 "
(0 to 14 meters)	14.0015 "
(0 to 15 meters)	15.0017 "
(0 to 16 meters)	16.0006 meters
(0 to 17 meters)	17.0010 "
(0 to 18 meters)	18.0007 "
(0 to 19 meters)	19.0009 "
(0 to 20 meters)	20.0008 "
(0 to 21 meters)	21.0007 "
(0 to 22 meters)	22.0008 "
(0 to 23 meters)	23.0010 "
(0 to 24 meters)	24.0010 "
(0 to 25 meters)	25.0008 "
(0 to 26 meters)	26.0012 "
(0 to 27 meters)	27.0008 "
(0 to 28 meters)	28.0012 "
(0 to 29 meters)	29.0015 "
(0 to 30 meters)	30.0017 "

Test No. 2.1/113718

SECRET

The comparisons of this tape with the United States Coast and Geodetic Survey standard were made at a temperature of 24.9°Centigrade and in reducing to 68° Fahrenheit (20° centigrade) the coefficient of expansion of steel has been assumed to be 0.00000645 per degree Fahrenheit (0.0000116 per degree centigrade).

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6/6

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Tape Certificate Continued ..... NBS No. 8305

When supported as indicated below:

Tension 5 kilograms

Points of Support	Interval	Length
0 and 5 meters	(0 to 5 meters)	5.0003 meters
0 and 10 meters	(0 to 10 meters)	10.0002 "
0 and 15 meters	(0 to 15 meters)	14.9997 "
0 and 20 meters	(0 to 20 meters)	19.9989 "
0 and 25 meters	(0 to 25 meters)	24.9971 "
0 and 30 meters	(0 to 30 meters)	29.9953 "

The above values for the lengths are not in error by more than 0.0002 meter.

The comparison of this tape with the Bench Standards were made at the center of the ends of the lines farthest from the observer when the zero of the tape was at his left hand.

The weight per meter of this tape was found to be 12.0 grams.

By the direction,

Lewis V. Judson,
Chief, Length Section,
Metrology Division

Test No. 2.1/113718
Test completed: Sept. 25, 1947

~~SECRET~~

Page 2

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SECRET

V A. GENERAL METHOD ADOPTED FOR ESTABLISHMENT OF CONTROL FOR TOPOGRAPHY OF ALL ISLANDS.

The general method adopted for establishing stakes on all islands consisted of the precise measurement of one line, using a first-order traverse to establish a standard base line procedure, and the establishment of other points by normal or chord off-sets from this line.

Since tape ends were not established on the stakes for the forward and backward measurements, the tape ends of the forward measurements of the line were semi-permanently marked on the stakes to be used, and the proportional correction applied to differences determined in the forward measurement of the magnitude and sign to make the resulting total length of line equal to the mean of the forward and backward measurements.

In all cases, one of the edges (Martian, Gamma or Timing) radiating from the zero base was selected for precise measurement. Which of the three lines was selected was dictated by local conditions on each island.

Although the Martian line was the most economical line to measure, since the greatest number of stations could be established by direct set-ups on each base line stake, and necessitated the least amount of pre-computing, it was possible to measure this line on only one of the islands.

SECRET

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~~SECRET~~

Since t[illegible] between the AEC lines on [illegible] used was well adapted to th[illegible] necessity for the measur[illegible] the posibility of a syste[illegible] been present in the direct me[illegible] with interior tapes and methods.

~~SECRET~~

~~OFFICIAL USE ONLY~~

On Engebi Island, the [illegible] by standard base line procedure was the Zero Tower [illegible] triangulation station ELGIN line. This was the only [illegible] the AEC lines which was not obstructed at the time. [illegible] error of the measurement was [illegible]

The timing station is located [illegible] line, and the timing station stake was established by [illegible] from stake No. 23 of the line.

The Gamma A and Gamma B station stakes were established by chord off-sets from the Zero [illegible] Elgin line.

Stakes for the blast footings [illegible] including the footing at 3900 feet from Zero were established by chord off-sets from the Zero Tower - Elgin line. The blast footing stakes at 4200 and 4800 feet from Zero were established by prolonging the line beyond the 3900 foot stake. Distances beyond the 3900 foot stake were established by use of a 300 foot steel tape.

The centerline for the Sr. [illegible] was selected so as to run diagonally across the [illegible], thus affording a clear line of sight. From the Zero Tower a traverse was run along the centerline, ~~and~~ stakes set flush with the runway surface at the required distances from Zero, and chord off-set stakes set on either edge of the runway.

Measurements were made with a 300 foot steel tape.

The orientation of the centerline was determined by an observed angle at the Zero Tower between the Bu. Y&D centerline and triangulation station [illegible].

A line of reference rods was set in front of each line of Bu. Y&D units and two measurements made to each of two marked points on each unit.

The 3000 foot north bound station on the Bu. Y&D was selected as meeting the centerline of the U. S. units. With the instrument set over this point and oriented back to Zero a traverse was run back to the Zero and stakes set at the required intervals.

A 300 foot steel tape was used for these measurements. The azimuth of the centerline as established by previously computed Bu. Y&D control.

The O.C.E. building stake at 1000 feet from Zero was established by direct measurement of angle and distance from the Zero Tower to offset mark.

The most northerly O.C.E. building stakes at 1000 and 2500 feet from Zero were established by short off-sets from the Bu. Y&D centerline. The corresponding southwesterly stakes at these distances were established by equal off-sets from the northeasterly stakes. A 300 foot steel tape was used for these measurements.

40 f

Four reference [illegible] each of the C.C.E. buildings, with the exception of the large "J" structure at 2500 feet from [illegible] measurements made to drill holes in eight [illegible] project horizontally from the building. Four of these holes are on the front face of the building (two near the base and two near the top), and four are similarly located on the back of the buildings.

All reference measurements to the C.C.E. buildings and to Bu. Y&D units [illegible] were made with steel tape No. [illegible] 3674. [illegible] was left in the area for use in making [illegible] measurements.

In order to further tie in the C.C.E. buildings with reference to points which will not be destroyed, a traverse line was run from the Zero Tower to the 2500 foot stake of the Bu. Y&D center line, thence to each of the reference stakes set near each of the C.C.E. buildings, and back to the Zero Tower. The traverse stakes were in turn tied in to the reference stakes at each building. This line was measured with a 300 foot steel tape.

Range pole No. 1 was located at a normal off-set from the Zero Tower - [illegible] line. Range poles No. 2 and No. 3 were similarly located, but were later moved. Range pole No. 3 was moved 40 feet northeastward [illegible] normal to the original line of poles. Range pole No. 2 was moved 20 feet northeastward [illegible] normal to the original line of poles. Thus the poles are still on a straight line, but the line is no longer parallel to the Zero - Timing Station line.

6-1

The site of [redacted], as selected by Dr. Clark of [redacted] was located by [redacted] angle and distance from [redacted].

The winch [redacted] was located by [redacted] angle and distance from triangulation [redacted].

The tank [redacted] was located by [redacted] angle and distance from the center [redacted] position of range pole No. 3.

A line of levels was run every [redacted] feet was run along the [redacted] for a distance of 500 feet [redacted]. This line is tied in to triangulation station [redacted] and other points in the vicinity of [redacted].

Since the [illegible] Island to Rojoa Island, [illegible] of obstructions, it was selected [illegible] by standard base line procedure.

This line [illegible] land, making it necessary to carry the [illegible] by triangulation.

This was [illegible] short auxiliary base line - [illegible] standard base line procedure- [illegible]

The probable [illegible] line, including sections determined by triangulation does not exceede 1 part in 850,000. The probable error is computed in this manner because in its computation it is necessary to use the two determinations of distance [illegible] each water gap one of which distance is determined from a mathematically stronger figure than the other. [illegible] the distance determined from the stronger figure is used as the distance across the gap, the second determination being used as a check only.

Gamma stations [illegible] located by set ups or set backs from stations of the [illegible] line. Gamma A was set at 213[illegible] feet from Aomon, since it was the maximum distance obtainable on Aomon [illegible]

SECRET

The blast fo[illegible] stakes were [illegible]sured by chord off-sets from the measured Gamma line.

The **Timing** Station stake was [illegible] by chord off-set from the 6[illegible] from Blast [illegible] stake.

The range pole stakes were originally set by off-sets from the Zero Tower - Timing Station line at the positions specified in the AE drawings. Range pole No. 1 was set in the specified position, but range pole No. 2 and No. 3 were not set in accordance with the drawings. This change was made by the resident engineer because range pole No. 3 fell in front of the wind [illegible] which [illegible] spotted in by eye prior to the arrival of the survey party on the Island.

The positions of range poles [illegible] No. 3 as actually set were determined by the [illegible] les and distances from stakes of the Reduced Gamma [illegible] The poles as set are on a straight line, but the line is not parallel to the Zero Tower - Timing Station line.

Stakes for the [illegible] by the [illegible] units at each specified distance from zero were originally set by chord off-sets from the Gamma line. However, [illegible] Starting this report Lieut. Com[illegible] Rehearing, USN, advises that all of these stakes have been destroyed or removed. The section of computations relating to the [illegible] Yoda or Aomon, Biijiri and Mejatto Islands [illegible] significance, and should be disregarded.

SECRET

The wind [illegible], part soil [illegible] rock revetment which were in the pr[illegible] construction. The survey party arrived on the isl[illegible] and took [illegible] measured angles and distances from [illegible] to the [illegible] ran a line.

The Photo to[illegible] was located [illegible] turned angle and distance from triangulati[illegible] station Gu[illegible].

The causeway [illegible] established by offset from the [illegible] line [illegible], purpose of orienting the AEC installati[illegible] to the [illegible] being the only line available [illegible] line the [illegible] required.

One causeway [illegible] set above high water line on Aomon I[illegible] other [illegible]. The distance between these s[illegible] determi[illegible] triangulation from an auxiliary base [illegible] measured with [illegible] steel tape. Additional bent [illegible] piles [illegible] were later set on both Aomon and Biijiri Islands.

A bench [illegible] established [illegible] and [illegible] the [illegible] which [illegible] upon an assumed elevation [illegible] for the high water line on the beach. This [illegible] an elevation of 7.00 feet for the Aomon bench mark. A [illegible] mark was established on Biijiri I., and connected by [illegible] to the bench mark on Aomon I.

Pile cut-off [illegible] elevations were determined by leveling from these [illegible], and [illegible] the centerline and pile line stakes.

[redacted]

[illegible] lines [illegible] [illegible] intervals [illegible] profile.

Pre-grading [illegible] elevations [illegible] Biijiri Islands, [illegible] Gamma [illegible] as a centerline. Rod readings were [illegible] the centerline, and side shots [illegible] 100 feet [illegible] and at breaks in grade for a distance of 100 feet [illegible] the centerline. These side shots were [illegible] intervals along the centerline, [illegible] lines [illegible] to the centerline.

[redacted]

On Munit [illegible] of the [illegible] were unobstructed and available [illegible] Hartman line was selected as the [illegible] because it was the most economical [illegible] on the standpoint of establishing [illegible] and because it was so situated that [illegible] could be used as one section of the triangulation [illegible] base line.

The Hartman [illegible] three sections. The first section extends from the [illegible] station mark to stake 4(A). The [illegible] section, [illegible] one section of the first-order base line extends from stake 4(A) to stake 28(B). The third section extends from stake 28(B) to stake 33. Stake 28(B) was [illegible] by a standard USC&GS triangulation [illegible] concrete post and stamped "[illegible]".

The Hartman [illegible] to stake 33 has a computed probable error of [illegible],878,000. The probable error of the triangulation [illegible] which was measured between [illegible] 1944 and newly established [illegible] is directly under the section titled "BASE [illegible]".

The bluff [illegible] were located by [illegible] or set backs from [illegible] of the Hartman [illegible] measurement.

The Timing [illegible] from the Hartman Line.

The Gamma [illegible] off-sets from the Hartman Line.

The 1000 foot [illegible] off-set from the 1000 foot point on the [illegible] station line.

The range pole [illegible] from the Hartman line to the point of intersection and thence to the range pole station by [illegible] case the chord angle and distance [illegible] off-set from the 1500 foot point on the [illegible] station line to range pole station No. 2. The range pole [illegible] parallel to the [illegible] line.

The winch [illegible] by an observed angle and distance from station No. 10 of the [illegible] line. From this data the distance [illegible] Timing Tower was computed.

The tank [illegible] by an observed angle and distance from station No. 5 on the [illegible] section of the first-order [illegible] line.

The Photo Tower was located by an observed angle and distance from triangulation station [illegible] 1944.

Page [illegible]

A standard USGS triangulation disk stamped "TRAVERSE STA RUNIT" and set in a concrete post was established as a permanent mark for the ground base line (Lake 28, B).

Pre-grading cross sections were run on Runit Island using the optical line of sight method. Rod readings were taken every 50 feet along the centerline, and side shots taken at all significant breaks in grade for a distance of 500 feet out from the centerline. These side shots were taken 100 feet apart along the centerline, and also at right angles to the centerline.

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ENGEBI ISLAND

LOCATION OF STRUCTURES FROM ZERO TOWER

STRUCTURE	DISTANCE FROM ZERO	AZIMUTH FROM ZERO
Timing Station	3900 ft	323 39 12
Blast Footing	1200 ft	316 27 53
" "	1380 ft	" " "
" "	1800 ft	" " "
" "	2100 ft	" " "
" "	2400 ft	" " "
" "	2700 ft	" " "
" "	3000 ft	" " "
" "	3300 ft	" " "
" "	3600 ft	" " "
" "	3900 ft	" " "
" "	4200 ft	" " "
" "	4800 ft	" " "
Blast Building	4700 ft	314 45 43
Gamma A Station	2250 ft	314 01 41
" B "	4900 ft	" " "
Ionization Sta.	3000 ft	314 24 17
Ctr. of Line of Cube Bu Y&D	3050 ft	262 28 22
" " "	3400 ft	" " "
" " "	2200 ft	" " "
" " "	2600 ft	" " "
" " "	4000 ft	" " "
" " "	3800 ft	" " "

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STRUCTURE	DISTANCE FROM ZERO	AZIMUTH FROM ZERO *
O.C.E. Type A	[illegible]	289 22 42
" " A	[illegible]	281 33 51
" " B	[illegible]	287 00 33
" " B	[illegible]	279 44 01
" " C	[illegible]	283 14 31
Range Pole # 1	[illegible]	304 18 05
" " # 2	Distant from Pole #1 [illegible] ft.	Az from Pole #1 312 53 22
" " # 3	[illegible]	" " " " " "
Tank Revetment	[illegible] # [illegible]	#3 ~~348 56 22~~ 346 29 19
Winch Base	4411 [illegible]	311 02 32
Bu S Stakes	2210 [illegible]	257 02 48
" " "	2300 [illegible]	" " "
" " "	2410	" " "
" " "	2500 [illegible]	" " "
" " "	2600 [illegible]	" " "
" " "	2700 [illegible]	" " "
" " "	2800 [illegible]	" " "
" " "	2900 [illegible]	" " "
" " "	3000 [illegible]	" " "

* Except where [illegible] otherwise

[illegible]

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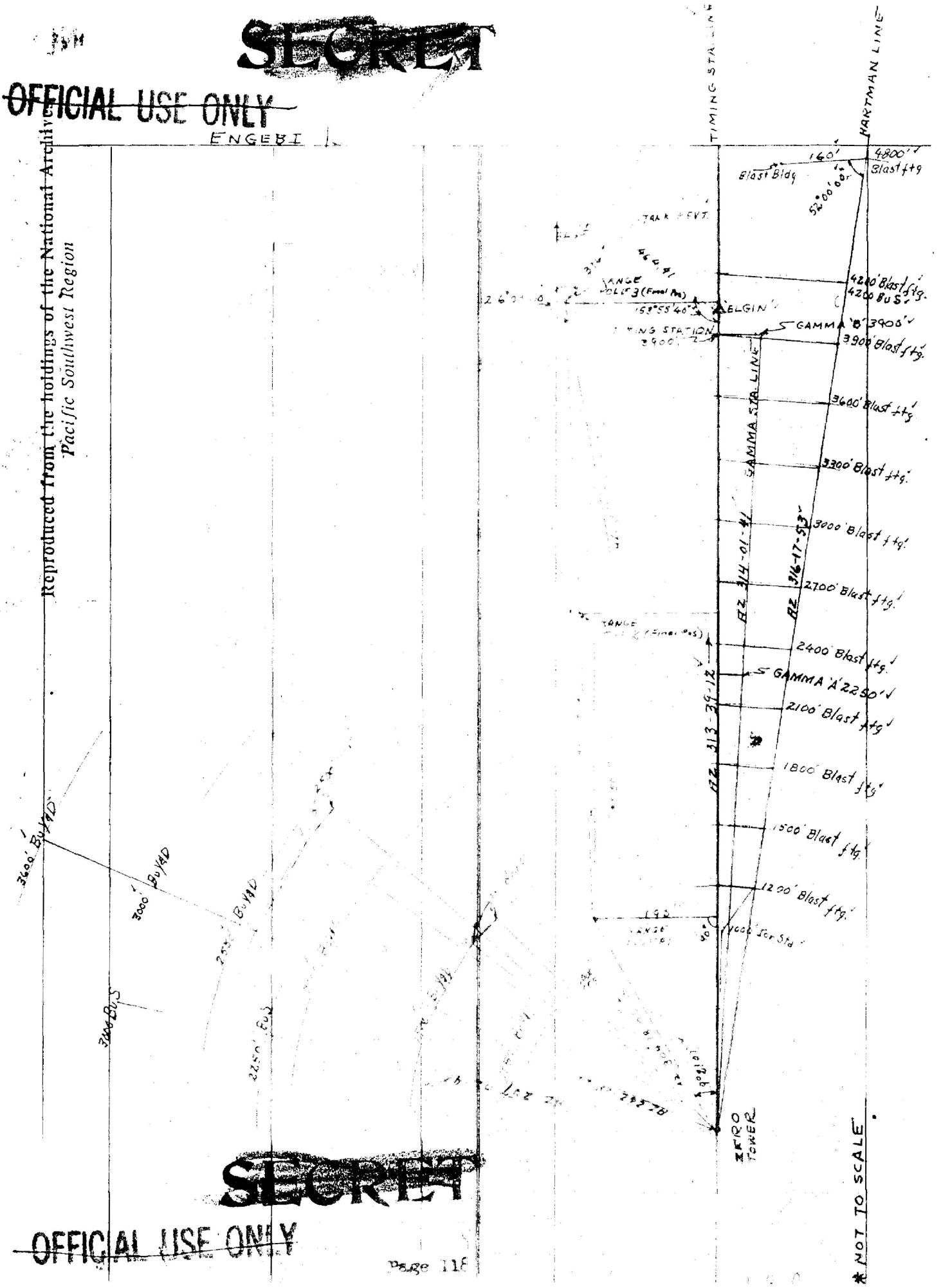

SE[illegible]

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COMPUTATIONS OF TRAVERSE BETWEEN

ENGEBI ZERO TOWER AND TRIANGULATION

STATION ELGIN

DISTANCES TO STAKES OF THE ABOVE

LINE USED IN ESTABLISHING OTHER

POINTS

SE[illegible]

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Form 568
Rev. April 1935

COMPUTATION OF TRAVERSE ~~BASE~~ LINE

ENGEBI

SECTION	DATE	DIR. OF MEAS	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH: Tape Length	UNCORRECTED LENGTH: Meters	TEMP	COR: Tape	COR: Tape and Catenary	REDUCTIONS: Set up Set-back	REDUCTIONS: Inclination	REDUCTIONS: Sea level	REDUCED LENGTH	ADOPTED LENGTH	v	vv
								Meters	Meters	Meters	Meters	Meters	Meters	Meters	mm	mm
Bench ENGEBI ZERO	11-16-41	F	72	3					-0.0816							
To		F	72	2					-0.0017							
Bench A ENGEBI		F	72	1					+0.0000							

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Rev. April 1935

[redacted]

COMPUTATION OF ENGEBI TRAVERSE BASE LINE

File: ~~OFFICIAL USE ONLY~~

SECTION	DATE	DIR. OF MEAS	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH: Tape Lengths	UNCORRECTED LENGTH: Meters	TEMP	COR.: Temp. Meters	COR.: Tape and Catenary Meters	REDUCTIONS: Set-up Set back Meters	REDUCTIONS: Inclination Meters	REDUCTIONS: Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH* Meters	DISTANCE (m) (cm) FROM ENGEBI ZERO: TOWER — FEET —
Bench From ENGEBI ZERO To															
Stake No 7	2 16 47	E	921						-0.0238	0.0000	-0.0004				
[illegible]	[illegible]	[illegible]	921						-0.0306	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]						[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	E	921		8	400	29.5	+0.0044	-0.0412	[illegible]	[illegible]				
			921			200	30.0	+0.0021	-0.0021						
		F	3661	2-T			29.0	+0.0013	±0.0000						

[redacted]

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[redacted]

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COMPUTATION OF TRAVERSE ENGEBI BASE LINE

SECTION	DATE	DIR. OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH: Tape Lengths	UNCORRECTED LENGTH: Meters	TEMP.	COR. RECTIONS: Temp. Meters	COR. RECTIONS: Tape and Catenary Meters	COR. RECTIONS: Setup Set back Meters	COR. RECTIONS: Inclination Meters	COR. RECTIONS: Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH** Meters	DISTANCE (m) FROM ENGEBI 2 SITE	DISTANCE (m) ENGEBI TOWER
FROM ENGEBI 2 SITE TO [illegible]																

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[redacted]

72

72

72

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 635

ABSOLUTE LEVELS AND COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Km	[illegible]	[illegible]	Meters	Meters	
Mark ENGEBI ZERO				[illegible] (assumed)		
Bench ENGEBI ZERO	[illegible]	[illegible]	[illegible]	[illegible]		
1	[illegible]	[illegible]	[illegible]	[illegible]		
2	[illegible]	[illegible]	[illegible]	[illegible]		
3	[illegible]	[illegible]	[illegible]	[illegible]		
4	[illegible]	[illegible]	[illegible]	[illegible]		
5	[illegible]	[illegible]	[illegible]	[illegible]		
6	[illegible]	[illegible]	[illegible]	[illegible]		
7	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 2.4 mm
8	[illegible]	[illegible]	[illegible]	[illegible]		
9	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 4.2 mm
10	[illegible]	[illegible]	[illegible]	[illegible]		
11	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 7.4 mm
12	[illegible]	[illegible]	[illegible]	[illegible]		
13	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 10.6 mm
13 + 25	[illegible]	[illegible]	[illegible]	[illegible]		
13+25 Setup	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 11.3 mm
14	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 11.7 mm
15	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 11.7 mm
16	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 11.8 mm
17	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 11.9 mm
18	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 12.0 mm
19	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 12.1 mm
20	[illegible]	[illegible]	[illegible]	[illegible]		
21	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 12.3 mm
22	[illegible]	[illegible]	[illegible]	[illegible]		
23	[illegible]	[illegible]	[illegible]	[illegible]		Σ Crn = 20.0 mm
Bench ALGIN	[illegible]	[illegible]	[illegible]	[illegible]		
Mark ALGIN	[illegible]	[illegible]	[illegible]	[illegible]		

Page 1.

SECRET

ABSTRACT OF WYE LEVELING -- ENGEB ZERO - Δ ELGIN TRAVERSE 12/16/47

FROM Mark	To Bench	Diff in Elevation Plus or Minus	Running	MEAN
ENGEB I ZERO	ENGEB I ZERO			
Bench ENGEB I ZERO	1			
1	2			
2	3			
3	4			
4	5			
5	6			
6	7			
7	8			
8	9			
9	10			
10	11			
11	12			
12	13			
13	13 + 25			
13 + 25	13 + 25 Set up			
13 + 25 Set up	14			
14	15			
15	16			
16	17			
17	18			
18	19			
19	20			
20	21			
21	22			
22	23			
23	Bench Δ ELGIN			
Bench Δ ELGIN	Mark Δ ELGIN			
MARK Δ ELGIN	Water line at 1500 hrs			

SECRET

79 A

MEAN TEMPERATURES OF FULL TAPE LENGTHS (INVAR) — ENGEBI ZERO TOWER — Δ ELGIN

~SEC.~ STAKE Nos.	FND Thermo °C
Bench Engebi	
Zero — 1	28
1 — 2	28.5
2 — 3	29.3
3 — 4	29.5
4 — 5	29.2
5 — 6	29.5
6 — 7	29.6
7 — 8	29.5
8 — 9	29.5
9 — 10	29.3
10 — 11	29.3
11 — 12	29.1
12 — 13	30.1
13 — 14	29.7
14 — 15	29.6
15 — 16	29.3
16 — 17	29.1
17 — 18	31.0
18 — 19	30.3
19 — 20	29.5
20 — 21	29.8
21 — 22	30.1
22 — 23	29.7
23 - Bench Δ Elgin	29.1

COMPUTATIONS OF [illegible] SETBACKS
AND OFFSETS FROM [illegible]MING STATION
LINE FOR USE IN ESTABLISHING OTHER
POINTS

SECRET

COMPUTATION OF SET UPS [illegible] OF THE ZERO TOWER - Δ ELGIN (TIMING LINE) TRAVERSE TO PROPER DISTANCES FOR ESTABLISHING OTHER POINTS BY CHORD OFFSETS

OBJECT TO BE ESTABLISHED	DIST. FROM ZERO TOWER Feet	DIST. FROM ZERO TOWER Meters	Closest Sta.	Dist. Zero Tower to Closest Sta.	SET UP from Closest Sta. [illegible]	SET UP from Closest Sta. Feet	SET BACK from Closest Sta. Meters	SET BACK from Closest Sta. Feet
Hartman Sta.	1200'	365.76	[illegible]	[illegible]	[illegible]	[illegible]	———	———
Hartman Sta.	1500'	457.20	[illegible]	450.000	[illegible]	[illegible]	———	———
Hartman Sta.	1800'	548.64	[illegible]	550.00			[illegible]	4.459'
Hartman Sta.	2100'	640.08	[illegible]	650.00			9.9368	32.601'
Hartman Sta.	2400'	731.52	[illegible]	[illegible]			5.5950	18.356'
Hartman Sta.	2700'	822.96	[illegible]	[illegible]	[illegible]	[illegible]	———	———
Hartman Sta.	3000'	914.40	[illegible]	[illegible]	[illegible]	[illegible]	———	———
Hartman Sta.	3300'	1005.84	[illegible]	[illegible]	[illegible]	[illegible]	———	———
Hartman Sta.	3600'	1097.28	[illegible]	[illegible]	[illegible]	[illegible]	———	———
Timing Sta. Gamma "B" Hartman Sta.	3900'	[illegible]	[illegible]	1152.08	[illegible]	[illegible]	———	———

COMPUTATION OF "SET UPS" AND SET BACKS FROM [illegible] THE ZERO TOWER - Δ ELGIN TRAVERSE TO PROPER DISTANCE FOR ESTABLISHING [illegible] POINTS BY NORMAL OFFSETS

Object to Be Established	Distance from Zero Tower Ft.	Distance required on Z-T Line Ft.	Closest Stake No.	Dist. Zero to Closest Stake Ft.	Set Up Ft.	Set Back Ft.	Length of Normal offset Ft.
Range Pole #1	1200	1184.31	[illegible]	1148.347	[illegible]	[illegible]	195.0'
GAMMA "A"	2250'	2249.95	[illegible]	2254.324		[illegible]	14.71
*Range Pole #2	—	2684.[illegible]	[illegible]	2746.426		2.310'	196.0
*Range Pole #3	—	4187.[illegible]	[illegible]	4058.75[illegible]	[illegible]		195.0'

(A bracket beside Range Poles #2 and #3 is marked *.)

* Poles No. 2 + No 3 were [illegible] because range pole #3 fell on line between [illegible] by [illegible] AEC, and Zero Tower. [illegible] Pole #2 [illegible] the original pole line. Pole #2 was [illegible] original pole line. This [illegible] parallel to the Zero Tower Timing [illegible] line.

SECRET

Engebi Island

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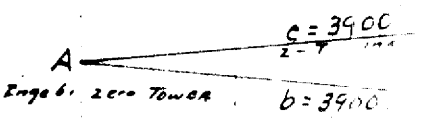
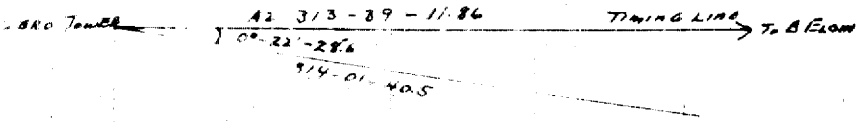
∠ Zero-Time to γB

"COMPUTATION OF CHORD & B" to Chord offset from 3900' point on Zero-Time Line to Gamma "B"



a = 25.5'
b = 3900.'
c = 3900.0'
2S = 7825.5'
S = 3912.7'

S-a = 3887.25'
S-b = 12.7'
S-c = 12.7'



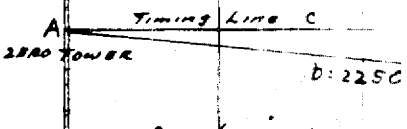
log S-a = 3.589 6425'
" S-b = 1.105 5 0.'
" S-c = 1.105 5 0.0 ✓
5.800 6629'
log S = 3.592 482.'
2.208 180 8'
log r = 1.104 090 4'

$\tan \frac{1}{2}A = \frac{r}{S-a}$

log r = 1.104 090 4'
log (S-a) = 3.589 6425
log tan ½A = 7.514 4477'
½A = 0° 11' 14".3
A = 0° 22' 28.6"

COMPUTATION OF Prop. Dist. Timing Line to Gamma Normal offset from Z-T line to Gamma A at 2250' from ZERO Tower

Dist Z T Line to γA



A = 0°-22'-28.6 (from ... Timing)

a = b sin A ✓
log 2250 = 3.352 1825 ✓
log Sin = 7.815 4549 ✓
log a = 167 6374 ✓
a = 14.71 ✓

c = b Cos A ✓
log 2250 = 3.352 1825
log Cos A = 9.999 99 ✓
log c = 3.352 1748
c = 2249.96 ✓

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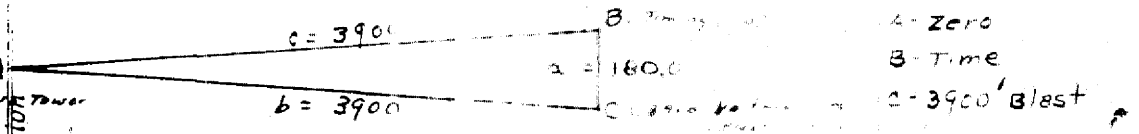
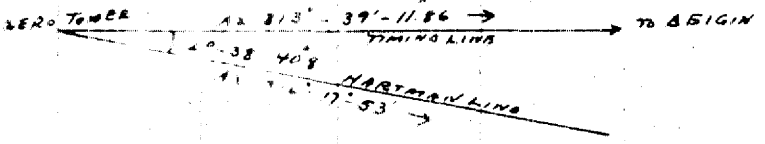
∠ Zero-Time Line to Blast Line

COMP. OF Chord ∠B for chords from ZERO TIME TOWER To Hartman stations (Blast readings)



a =	180 ✓
b =	3900 ✓
c =	3900 ✓
2S =	7980 ✓
S =	3990 ✓
S-a =	3810 ✓
S-b =	90 ✓
S-c =	90 ✓



log (S-a) =	3.580 9250 ✓
" (S-b) =	1.954 2425 ✓
" (S-c) =	1.954 2425 ✓
	7.489 4100 ✓
log S =	3.600 9729 ✓
	3.888 4371 ✓
log r =	1.944 2186 ✓

$\tan \frac{1}{2}A = \frac{r}{S-a}$

log r =	1.944 2186 ✓
log (S-a) =	3.580 9250 ✓
log tan ½A =	8.363 2936 ✓
½A =	1° 19' 20.4"
A =	2° 38' 40"8

check: $\cos A = \frac{b^2+c^2-a^2}{2bc}$

b^2 =	15210000
c^2 =	15210000
b^2+c^2 =	30420000 = 2bc
a^2 =	32400
	30387600

$\tan \frac{1}{2}B \quad \frac{S-b}{S} = \tan \frac{1}{2}C$

log r	1.944 2186 ✓
log (S-b)	1.954 2425 ✓
log tan ½B	9.989 9761 ✓
½B =	44° 20' 19"8 ✓
B =	88° 40' 39"6 ✓
A =	2 38 40.8
C =	88 40 39.6
	180 00 00.0

✓ R I P.

log 30387600 =	7.482 6964
log 30420000 =	7.483 1592
log Cos A =	9.999 5372
A =	2° 38' 41"

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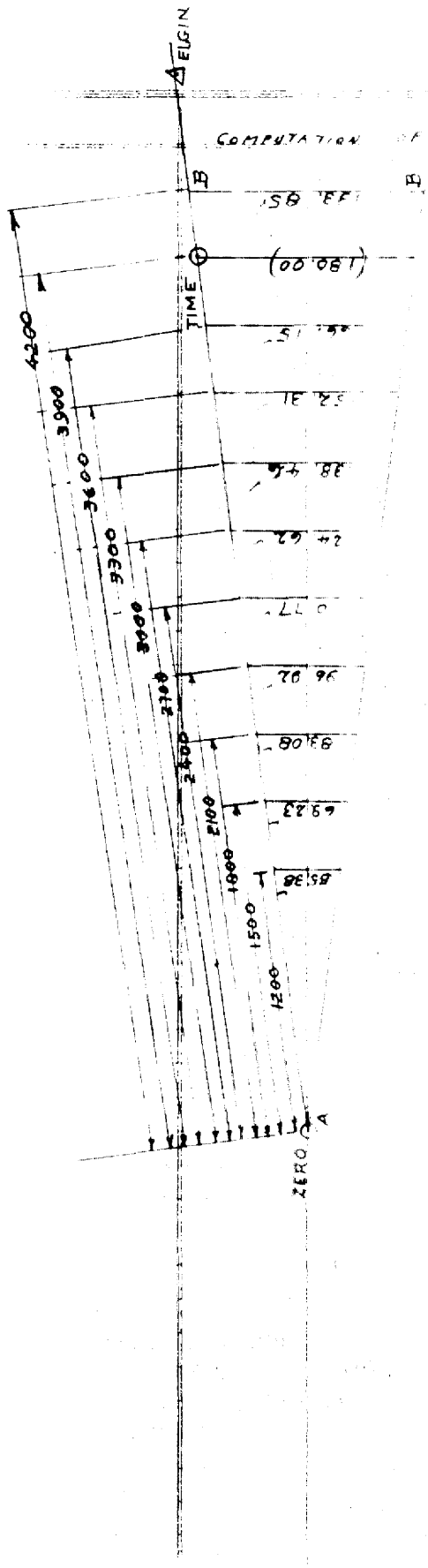
100 yd. Blast Stations



COMPUTATION OF CHORD DISTANCES FOR Hartman Stations From Z-T Line

$a = \frac{b \sin A}{\sin B}$

∠A 38' 40.8" ✓
∠B 44° 40' 39.6" ✓

log 2700 = 3.431 3638 ✓
log Sin A = 8.664 0941 ✓
2.095 4579 ✓
log Sin B = 9.999 8843 ✓
2.095 5736 ✓
1. dist. = 124.62 ✓

log 3000 = 3.477 1213 ✓
log Sin A = 8.664 0941 ✓
2.141 2154 ✓
log Sin B = 9.999 8843 ✓
2.141 3311 ✓
7. dist. = 138.46 ✓

log 3300 = 3.518 5139 ✓
log Sin A = 8.664 0941 ✓
2.182 6080 ✓
log Sin B = 9.999 8843 ✓
2.182 7237 ✓
8. dist = 152.31 ✓

log 3600 = 3.556 3025 ✓
log Sin A = 8.664 0941 ✓
2.220 3966 ✓
log Sin B = 9.999 8843 ✓
2.220 5123 ✓
9. dist = 166.15 ✓

log 4200 3.623 2493 ✓
log Sin A = 8.664 0941 ✓
2.287 3434 ✓
log Sin B = 9.999 8843 ✓
2.287 4591 ✓
11. dist 193.85 ✓

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TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Cal. longe... sub... $\tan\frac{1}{2}(A_p-B_p)=\cot\frac{1}{2}C_p\tan\frac{1}{2}(A_p+B_p)$: $\left.c=\frac{a\sin C_p}{\sin A_p}\right]^*$

Comp of Dist. from 2nd Tower To Near face of 1000 ionization Station.

C_s			Log a		Log m
Sph. excess / 3			Log b		Log sin C_s
C_p	10°	3	Log tan ϕ	5.4	Log a
C_p	5°		$(45°+\phi)$	26	Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$	8...		ϕ	26	Log sph. ex.
(A_p-B_p)	3...		Log tan ϕ	9.738	Sph. excess
Sum $=A_p$	16...		Log tan $\frac{1}{2}(A_p+B_p)$	1.46	
Diff $=B_p$	...		Log tan $\frac{1}{2}(A_p-B_p)$	9.284	
C_p	10			(Sketch)	

Log a 3.0...
Log sin C_p 9.2...
Colog sin A_p 0.66...
Log c 3.0...

$C=$ 1000.0...

(1000' Sta. front face)
A
b = 178.6 ft
B
(1175' on Blast line)
C

CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3.000 0147
	1	2-39-...			0.732 8291
	2	1-53-36			9.519 0254
	3	16)-26-44			9.337 941
	1-3			1175...	2.251 8692
	1-2			1000.00	3.070 0379
		180-00-...			
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

*The subscripts ... upon this form refer to spherical and plane angles respectively.

Page 1...

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Pole # from Z-T Line

Comp of Dist out [illegible] TOWER along [illegible] for Normal offset to Range pole #1 (8200' from 2)

B Range pole #1

c = 120°

a = 45

A = [illegible]
ZERO TOWER

Sin [illegible]

log 145 = 2.2[illegible] 0346
log 200 = .079 18/2
log Sin = 9.[illegible] 2534
A = 9° 2[illegible] 07"

b = c Cos A

log 200 = 3.[illegible] 18/2
log Cos = 9.9[illegible] 2097
log b = 3.0[illegible] 3909

b = 1[illegible] Dist o[illegible] Line for Normal offset to pole #1
500.00 spa[illegible] between Poles (Pole line // to 2-T Line.)
2684 11 Dis o[illegible] for Normal offset to pole #2 *
1100.00
4 84 11 [illegible] for Normal offset to pole #3 *

* [illegible] #3 later moved — pole #3 moved Northerly
[illegible] L to original line of poles
[illegible] moved Northerly 20.0 on line L to original
[illegible] poles — Thus poles are still on a straight
[illegible] line is no longer // to 2-T Line.
[illegible] next sheet for Range Poles
[illegible] #2 as re-set

A2 304 18-05 [illegible]
9[illegible]
A2 = 31[illegible]

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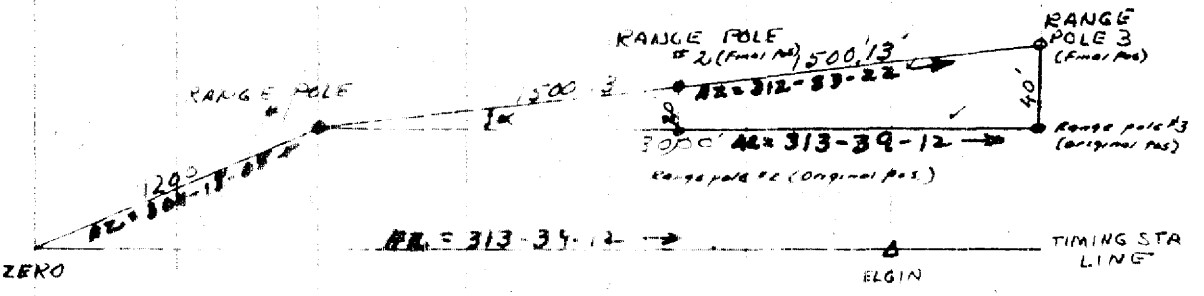
RANGE POLES ENGEBI

Distances & Azimuth - Range Poles, after Poles #2 & #3 were re-set.

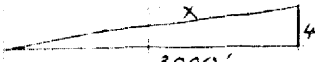


Log 40 1.6020 6000

4000 3.4771 2125

Log Tan α 9.1249 3221

α 4° 46' 55"



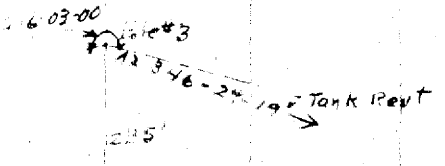
$X^2 = \overline{3000^2 + 40^2}$

Log X^2: 6.9543197

X: 3.4771598

X = 3000.27 FT.

Azimuth [illegible] 312° 53' 22"



Log .33 [illegible]

4184 [illegible]

Log Tan β 9.4162

β 1° 15' 55"

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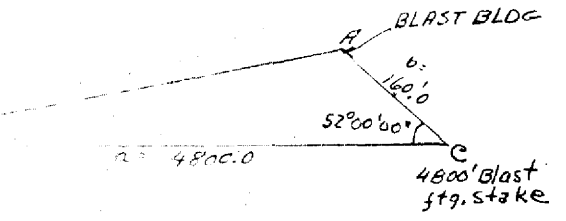
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b} = \tan(45° - \phi) \quad \tan \phi \tan \tfrac{1}{2}(A_p + B_p) \qquad c = \frac{a \sin C_p}{\sin A_p}\right]^*$

C_s		2412	Log m
$\frac{\text{Sph. excess}}{3}$		1200	Log sin C_s
C_p		1212	Log a
$\frac{1}{2}\,C_p$		21".0	Log b
$90° - \frac{1}{2}C_p = \frac{1}{2}(A_p - B_p)$		2210	Log sph. ex.
$\frac{1}{2}\,(A_p - B_p)$		6361	Sph. excess
Sum $= A_p$		81 82	
Diff $= B_p$		8543	
C_p		(Sketch)	

Log a	
Log sin C_p	9 89c
Colog sin A_p	0 2 9 4
Log c	



CHECK COMPUTATION

No.	STA	STA	Spherical Excess	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3.672 3918
	1				0.103 4679
	2				8.428 2637
	3				9.905 3815
	1-3			160 0	2.204 1234
	1-2			4800 0	3.681 2412
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

*The subscripts s and p on this form refer to spherical and plane respectively.

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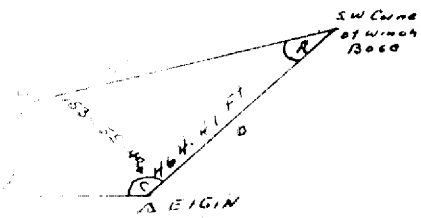
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Call longer side a) $\tan\frac{1}{2}(A_p+B_p)$ $\left.c=\frac{a\sin C_p}{\sin A_p}\right]$*

C_s		Log m
Sph. excess / 3		Log sin C_s
C_p		Log a
$\frac{1}{2}C_p$		Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$		Log sph. ex.
$\frac{1}{2}(A_p-B_p)$		Sph. excess
Sum $=A_p$		
Diff $=B_p$		
C_p	(Sketch)	

Log a
Log sin C_p
Colog sin A_p
Log c



CHECK COMPUTATION

No.	STATION	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3			3.651 3315
	1			0.357 0374
	2			9.600 6235
	3			8.658 5293
	1-3			3.608 3924
	1-2			2.666 8982
	2-3			
	1			
	2			
	3			
	1-3			
	1-2			

Winch Base (S.W. Corner)

to BEGIN

*The subscripts s and p in the formulas refer to spherical and plane angles respectively.

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COMPUTATIONS AND MEASUREMENTS

REQUIRED FOR LOCATING AN

CHECKING THE Bu Y&D STRUCTURES

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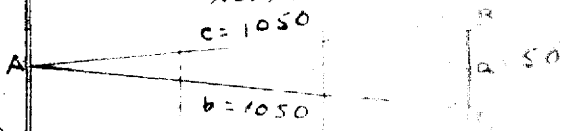
ENGR-I 2- Buoys to chord or edge Runway.

COMPUTATION For Chord offset stake on N side of runway



a:	50
b:	1050
c:	1050
2S:	2150
S:	1075
S-a:	1025
S-b:	25
S-c:	25
log (S-a):	3.010 7239
log (S-b):	1.397 9400
log (S-c):	1.397 9400
	5.806 6039
log S:	3.031 4085
	2.775 1954
log r:	1.387 5977

log r =	1.387 5977
log (S-a):	3.010 7239
log tan ½A:	8.376 8738
½A:	1° 21' 57"
A:	2° 43' 54"

log r =	1.387 5977
log (S-b):	1.397 9400
log tan ½B:	9.989 6577
½B:	44° 19' 04"
B:	88 38 08

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ENGEBI I
12-23-47

ENGEBI 2- Buoys & [illegible] on edge of Runway.
COMPUTATION For Chord offset stakes [illegible] sides of runway

a =	288	a =	148
b =	500	b =	1500
c =	1500	c =	1500
2S =	3288	S =	3148
S =	1644	S =	1574
S-a =	1356	S-a =	1426
S-b =	144	S-b =	74
S-c =	144	S-c =	74
log (S-a)	3.132 2597	log (S-a)	3.154 1195
log (S-b)	2.158 3625	log (S-b)	1.869 2317
log (S-c)	2.158 3625	log (S-c)	1.869 2317
	7.448 9847		6.892 5829
log S =	3.215 5018	log S =	3.197 0047
	4.233 4829		3.695 5782
log r =	2.116 7415	log r =	8477891
log r =	2.116 5415	log r =	847 7891
log (S-a) =	3.132 2597	log (S-a) =	3 154 1195
log tan ½A =	8.984 2818	log tan ½A =	8.693 2696
½A =	5° 30	½A =	2° 49 35.8
A =	11° 01	A =	5° 39 19.6
log r =	2.116	log r =	1.847 7891
log (S-b) =	2.158 3625	log (S-b) =	1.869 2317
log tan ½B =	9.958	log tan ½B =	.978 5574
½B =	42° 14' 44.	½B =	43° 35 10.1
B =	84 29 28	B =	87° 10 20.2

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COMPUTATION For Choice of Set-Stakes [illegible] sides of runway [illegible] Kahului

NORTH

a	224	
b	[illegible]	
c	2160	
2S	4384	4924
S	2192	2462
S-a	1968	2238
S-b	132	112
S-c	32	302
log (S-a)	3.2941	3.3498
log (S-b)	2.1206	2.0492
log (S-c)	1.5051	2.4800
	6.9198	7.8790
log S	3.3429	3.3914
	3.5769	4.4876
log r	2.0933	2.0260
log r	2.0933	2.0260
log (S-a)	3.2941	3.2984
log tan ½A	8.7992	8.7276
½A	3° 36	3° 03 26.0
A	7° 12	6° 06 52.0
log r	2.0933	2.0260
log (S-b)	2.1206	2.0492
log tan ½B	9.9727	9.9768
½B	43°	43° 28 17.0
B	86° 23	86° 56 34.0

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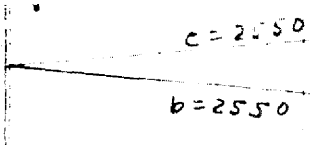
ENGEBI Is. Bm. 1 & 2 ℄ to Chords on edge Runway
COMPUTATION FOR Chord offset stakes on N & S sides of Runway

SOUTH

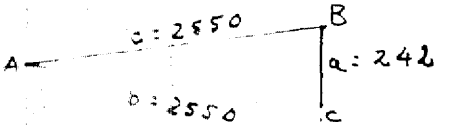


a =	222
b =	2550
c =	2550
2S =	5322
S =	2661
S-a =	2439
S-b =	111
S-c =	111
Log (S-a) =	3.387 2118
Log (S-b) =	2.045 3230
Log (S-c) =	2.045 3230
	7.477 8578
½ S	3.425 0449
	4.052 8129
Log r =	2.026 4005

Log r =	2.026 4005
Log (S-a) =	3.387 2118
Log tan ½ A	8.639 1947
½ A =	2° 29' 11.1"
A =	4° 58' 22.2"

Log r =	2.026 4005
Log (S-b) =	2.045 3230
Log tan ½ B =	9.981 1087
½ B =	43° 45' 09.2"
B =	87° 30' 18.4"

NORTH



a =	242
b =	2550
c =	2550
2S =	5342
S =	2671
S-a =	2429
S-b =	121
S-c =	121
Log (S-a) =	3.385 4275
Log (S-b) =	2.082 7854
Log (S-c) =	2.082 7854
	7.550 9983
Log S	3.426 6739
	4.124 3244
Log r =	2.062 1622

Log r =	2.062 1622
Log (S-a) =	3.385 4275
Log tan ½ A	8.676 7347
½ A =	2° 43' 11.1"
A =	5° 26' 22.2"

Log r =	2.062 1622
Log (S-b) =	2.082 7854
Log tan ½ B =	9.979 3768
½ B =	43° 38' 24.4"
B =	87° 16' 48.8"

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ENGER!

Comp for Chord off ... stake ... point on Edge of Runway
... face of Runway.

SOUTH

... = 3000'

... = 3...'

a = 246

b = 3000'

c = 3000'

2S = ...46

S = 3...

S-a = 287...

S-b = 12...

S-c = 12...

Log (S-a) = 3.458 ...

Log (s-b) = 2.089 ...

Log (s-c) = 2.089 ...

7.636 ...

Log S = 3.494 ...

4.147 ...

Log r = 2.072 ...

tan ½A = r/(S-a)

Log r = 2.072 08...

Log (s-a) = 3.458 93...

Log tan ½A 8.613 14...

½A = 2°-2...

A = 4°-4...

tan ½B = r/(S-b) = tan ...

Log r = 2.072 08...

Log S-b = 2.089 90...

tan ½B 9.982 18...

½B = 43°-4...

87-...

NORTH

... = 3000

Q 284

b = 3000

B — Chord stake on N side of runway

C = 3000 point on Bu.Y.L.D. ℄

284

... 00

3 00

... 84

... 42

... 158

... 142

... 142

3 456 0622

2 152 2883

2 152 2883

1 760 6388

3 497 2062

426.3 4326

... 7163

... 7163

3 456 0622

... 6541

... 48 46.8

... 23 43.6

... 7163

... 152 2883

... 4280

... 38 36.6

... 17 13.2

* This Chord Stake Later used as 3000' ℄ Stake of Bu.S. Line.

Bu.S. ℄

A2 25 - 02 - 48

5° - 25 - 34

BU YLD ℄

42 2 - 1 - 28 - 22

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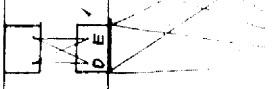
U.S.C.&G.S. Tape #3774

NOTE - The measurements are from the E.D.M. to the tape and not from the zero mark to the true distance. ADD 0.4 ft. to the following

1050' CUBES

A-B 27467 'true distance

B-C 26835 'true distance



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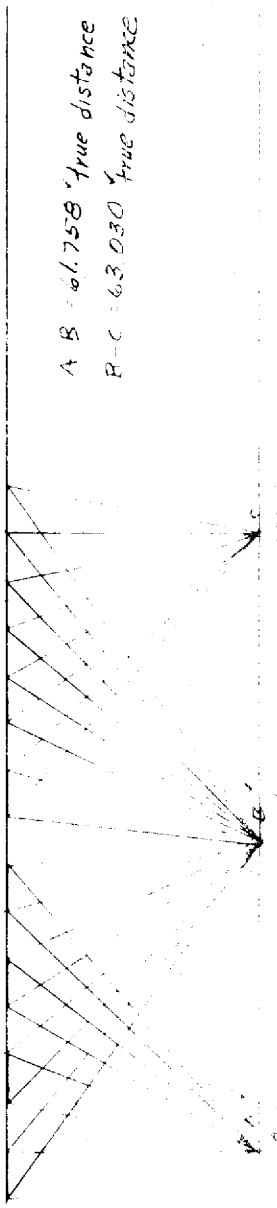
NOTE - [illegible]
from the [illegible]
from the [illegible]
ADD [illegible]

Projection 3714

1500' CUBES

A-B = 61.758 True distance
B-C = 43.030 True distance



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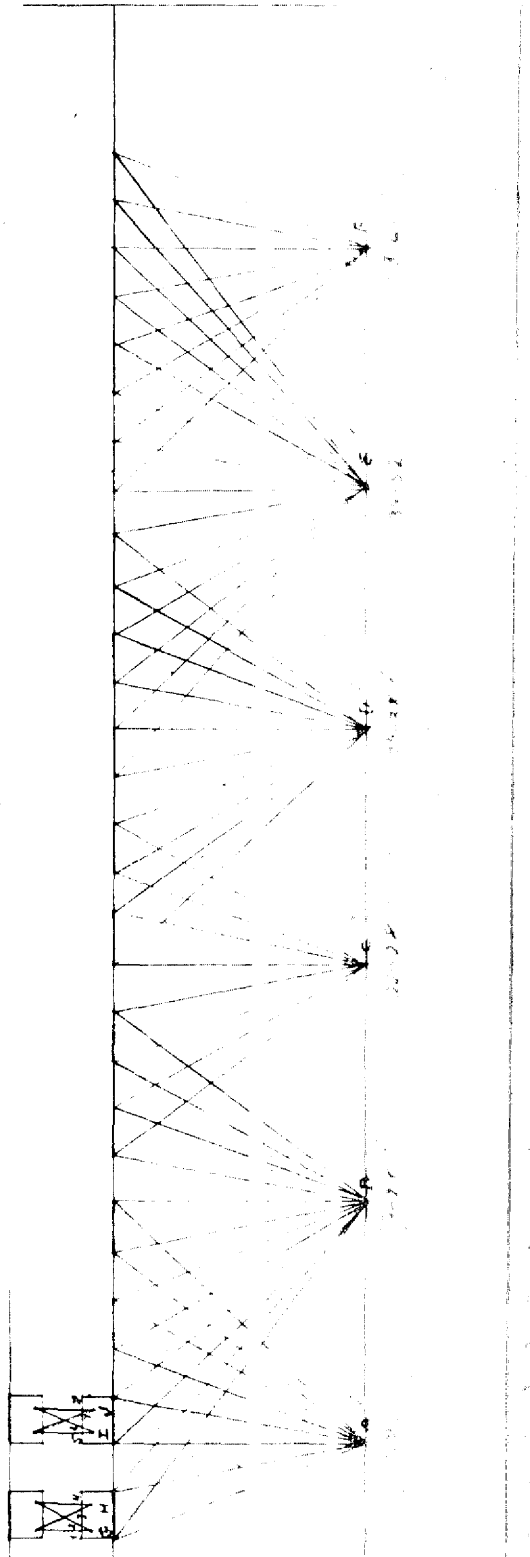
U.S.C.&G.S. Tape #3774

NOTE— These measurements
from the ENS
from the
ADD 0.4

2100' CUBES



		2.3	I'
		20.6	5'
		22.9	6'
		16.7	J'
		34.7	7'
		37.8	8'

		6.04'
		6.57'
		6.80'
		5.82'

A-B' = 49.950' true dist
B-C' = 49.980' " "
C-D' = 49.945' " "
D-E' = 50.013' " "
E-F' = 47.950' " "

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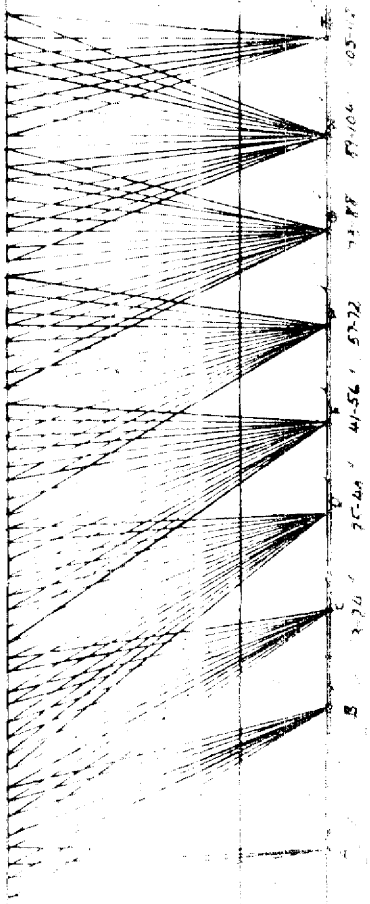
2550 CUBES



2550 RADIUS
LINE OF BU YAD
CUBES

A B	50.030' true dist.
B C	50.118' " "
C D	49.975' " "
D E	49.933' " "
E F	49.990' "
F G	49.840'
G H	50.145'
H I	50.042'

USE AGS Tape #3774

NOTE – [illegible] measurements [illegible] from the E[illegible] of the base of [illegible] from the [illegible] for the [illegible] ADD [illegible]

SECRET

2550' CUBES

A		33	[illegible]	[illegible]	[illegible]	-503
1	19.65	34	[illegible]	66	22.88	50[illegible]
2	20.65	35	[illegible]	69	[illegible]	40.34
3	23.58	36	[illegible]	70	[illegible]	[illegible]
4	25.72	37	[illegible]	[illegible]	[illegible]	
B		38	[illegible]	72	[illegible]	-56
5	56.11	39	[illegible]	[illegible]	[illegible]	-099
6	53.24	40	[illegible]	[illegible]	[illegible]	32.31
7	41.57	5	[illegible]	75	[illegible]	[illegible]
8	39.31	41	[illegible]	[illegible]	[illegible]	[illegible]
9	29.30	42	[illegible]	[illegible]	[illegible]	[illegible]
10	26.92	43	[illegible]	[illegible]	[illegible]	2133
11	20.80	44	[illegible]	[illegible]	[illegible]	2246
12	19.99	45	[illegible]	[illegible]	[illegible]	
C		46	[illegible]	[illegible]	[illegible]	
13	74.62	47	[illegible]	[illegible]	[illegible]	
14	71.25	48	[illegible]	[illegible]	[illegible]	
15	60.84	49	[illegible]	[illegible]	[illegible]	
16	57.56	50	[illegible]	[illegible]	[illegible]	
17	47.57	51	[illegible]	[illegible]	[illegible]	
18	44.53	52	[illegible]	[illegible]	[illegible]	
19	35.21	53	[illegible]	[illegible]	[illegible]	
20	32.51	54	[illegible]	[illegible]	[illegible]	
21	24.61	55	[illegible]	[illegible]		
22	22.50	56	[illegible]	[illegible]		
23	19.72	F	[illegible]	[illegible]	[illegible]	
24	20.40	57	[illegible]	[illegible]	[illegible]	
D		58	[illegible]	[illegible]	[illegible]	
25	95.12	59	[illegible]	[illegible]	[illegible]	
26	91.75	60	[illegible]	[illegible]	[illegible]	
27	81.30	61	[illegible]	[illegible]	[illegible]	
28	77.97	62	[illegible]	[illegible]	[illegible]	
29	67.42	63	[illegible]	[illegible]	[illegible]	
30	63.39	64	[illegible]	[illegible]	[illegible]	
31	53.19	65	[illegible]	[illegible]	[illegible]	
32	49.42	66	[illegible]	[illegible]	[illegible]	

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USCAGS TAPE # 3774

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SECRET

55

SECRET

NOTE – [illegible] measureme[illegible] from the E[illegible] [illegible] tape [illegible] from the [illegible] for true [illegible] ADD 0.4 [illegible] the [illegible]

U.S.C.&G.S. Tape # 3774

3000' CUBES.

2'			2524	I	
[illegible]	24		[illegible]299'	5'	5.91'
3	[illegible]		[illegible]75'	6'	6.71'
3'	[illegible]		[illegible]34'	J'	
4'	[illegible]		[illegible]360'	7'	6.69'
[illegible]	[illegible]		[illegible]42'	8'	5.99'
[illegible]	[illegible]				
[illegible]	[illegible]		[illegible]68'		
[illegible]	[illegible]		[illegible]489'		
[illegible]			[illegible]463		
[illegible]	[illegible]		[illegible]45		
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]		[illegible]565'		
[illegible]	[illegible]		[illegible]057'		
[illegible]	[illegible]		[illegible]83'		
16	2315		2231'		
[illegible]	30[illegible]		[illegible]464'		
[illegible]	34[illegible]		[illegible]98'		
19'	43[illegible]		[illegible]		
[illegible]	[illegible]				
			[illegible]		
[illegible]	2232		[illegible]96'		
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]		[illegible]422		
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]		[illegible]		
	[illegible]				
			[illegible]		
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]				
31'	[illegible]		[illegible]		
[illegible]	[illegible]		[illegible]89'		

A-B – 50.005 [illegible]
B-C – 49.930
C-D – 49.99[illegible]
D-E – 50.185
E-F – 49.92[illegible]

SAME AS SKETCH FOR 2100' CUBES.

SECRET

NOTE: [illegible] measurements [illegible]
from the E[illegible] of the tape [illegible]
from the zero mark. For true [illegible]
ADD 0.4 [illegible] to the following

U.S.C.&G.S. Tape # 3774

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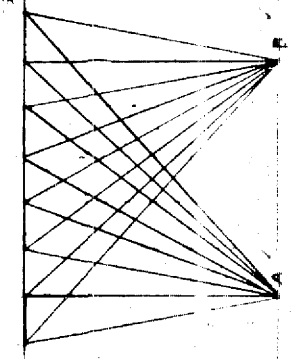
3600' CUBES

~~SECRET~~

	31.96'
	[illegible]
	30.10'
	33.12'
	30.38'
	35.17'
	48.10'
	52.15'
	163.10'
	57.19'
	47.19'
	42.38'
	32.17'
	28.32'
	20.98'
	20.64'



A-[illegible] 1.5 PBC from d.f.

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~~SECRET~~

~~OFFICIAL USE ONLY~~

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

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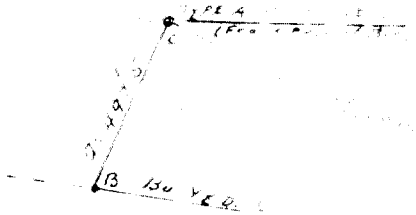
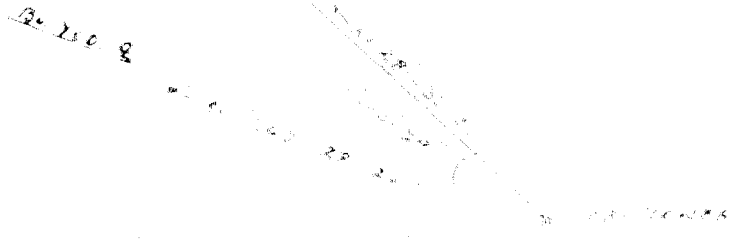
COMPUTATION OF [illegible] on Bu Yds & to OCE Rdg. TYPE A
(1500' from ZERO)



[illegible]

[illegible]



DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 665
Ed. Dec. 1929

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TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Call longer side a) $\tan\phi=(\quad-\quad)\tan\frac{1}{2}(A_p+B_p)$: $\left.c=\frac{a\sin C_p}{\sin A_p}\right]$*

COMP. OF Dist from ZERO + 2 from OCE BLDG A for OCE BLDG type stake set By 18th Engrs. 41
(Stak originally Set By USCGS (Geo Mon. Rod, Out of Top of Flat Top Rock 20 by 18th Engrs)

C_s		Log m
$\frac{\text{Sph. excess}}{3}$		Log sin C_s
C_p		Log a
$\frac{1}{2}C_p$		Log b
$90°-\frac{1}{2}C_p-\frac{1}{2}(A_p+B_p)$		Log sph. ex.
$\frac{1}{2}(A_p-B_p)$		Sph. excess
Sum $=A_p$		
Diff $=B_p$		
C_p		

(Sketch)

OCE Type A
142.5
OCE Type B
A (Front Face of Bldg.

Log a	
Log sin C_p	
Colog sin A_p	
Log c	

CHECK COMPUTATION

No.	STATIONS	OBSERVED ANGLES	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				
	2-3			Type "A" OCE Bldg stake (1500' from 2)	
	1				
	2				
	3				
	1-3			Type "B" OCE BLDG STK (1500' from 2)	
	1-2				

SECRET

*The sin sections [illegible] and angle respectively

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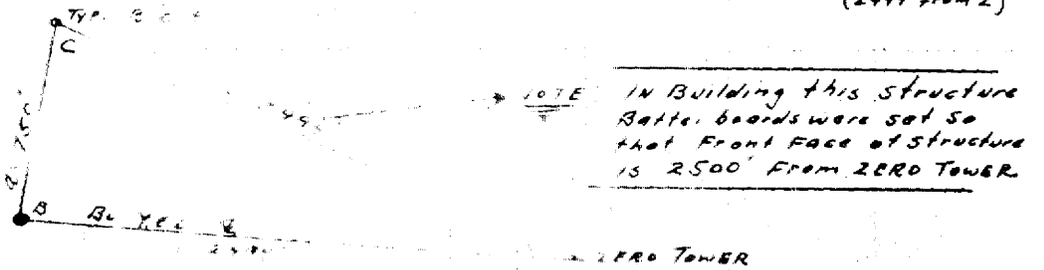
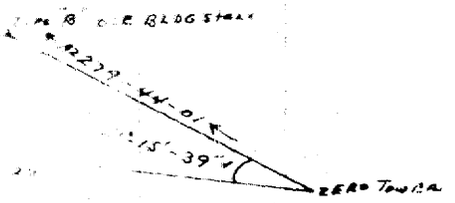
COMPUTATION OF ∠ "B" for CHORD OFFSET from 2499 point on LAID Ø TO O.C.E BLDG. TYPE B (2499' from Z)



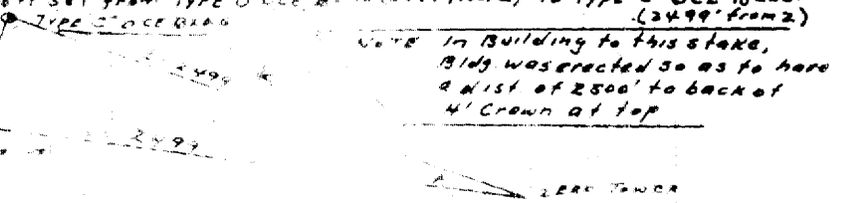
NOTE IN Building this Structure Batter boards were set so that Front Face of Structure is 2500' From ZERO Tower.

a = 750.0
b = 2499'
c = 2499
2S = 5748
S = 2874



Log (S-a) =	3.327 1545	Log r =	2 508 3652
Log (S-b) =	2.574 0313	Log (S-b)	2.574 0313
Log (S-c) =	2.574 0313	Log cos ½B	9.934 3339
Σ	8.475 217	½A	40 41 05.3
Log S	3.458 4868	B	81 22 10.6
	5.016 7303	C	81 22 10.6
Log r =	2.508 3652	A	17 15 39.0
		Σ	180 00 00.2

COMPUTATION OF ∠ "B" for Chord off set from TYPE B O.C.E Bldg. (2499 from Z) To TYPE "C" O.C.E BLDG. (2499' from Z)



NOTE In Building to this stake, Bldg was erected so as to have a list of 2500' to back of 4' Crown at top

a = 153'
b = 2499'
c = 2499'
2S = 5151
S = 2575.5
(S-a) = 2422
(S-b) = 76.5
(S-c) = 76.5

Log (S-a) =	3.384 2638		1870 3625
Log (S-b) =	1.883 6614	Log (S-b)	1.883 6614
Log (S-c) =	1.883 6614	Log cos ½B	9.986 7011
	7.151 5866	½A	44°-07' 22.4
Log S =	3.410 8616	B	88 14 44.8
	3.740 7250	C	88 14 44.8
Log r =	1.870 3625	A	3 30 30.4
		Σ	180 00 00.0

ENGR. I

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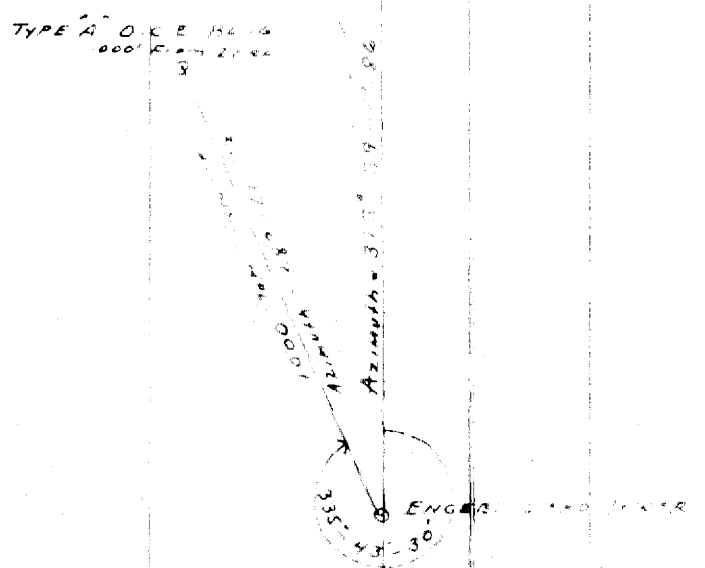
SKETCH SHOWING LOCATION OF TYPE A [illegible] BLDG (1000 From ZERO TOWER)



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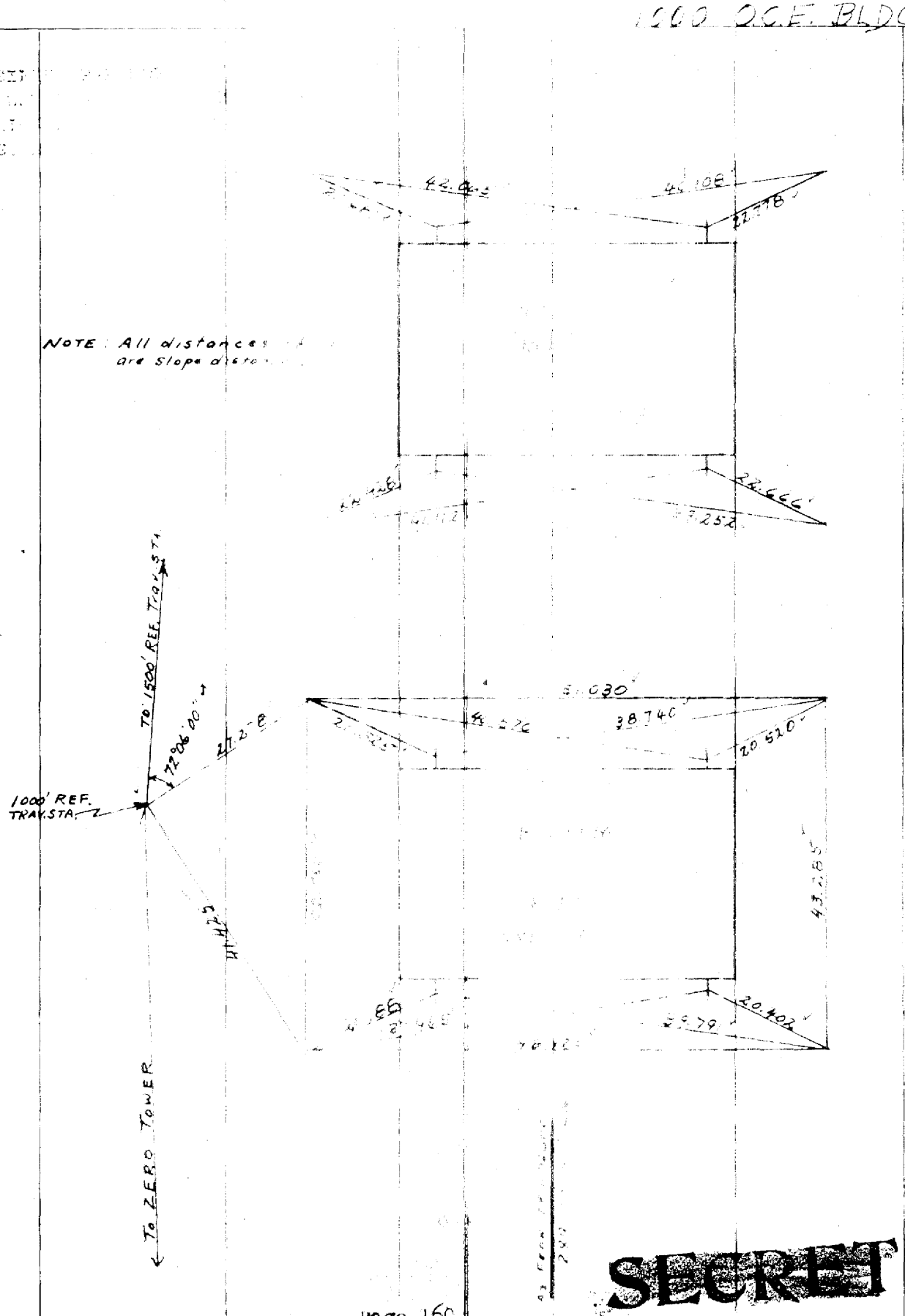
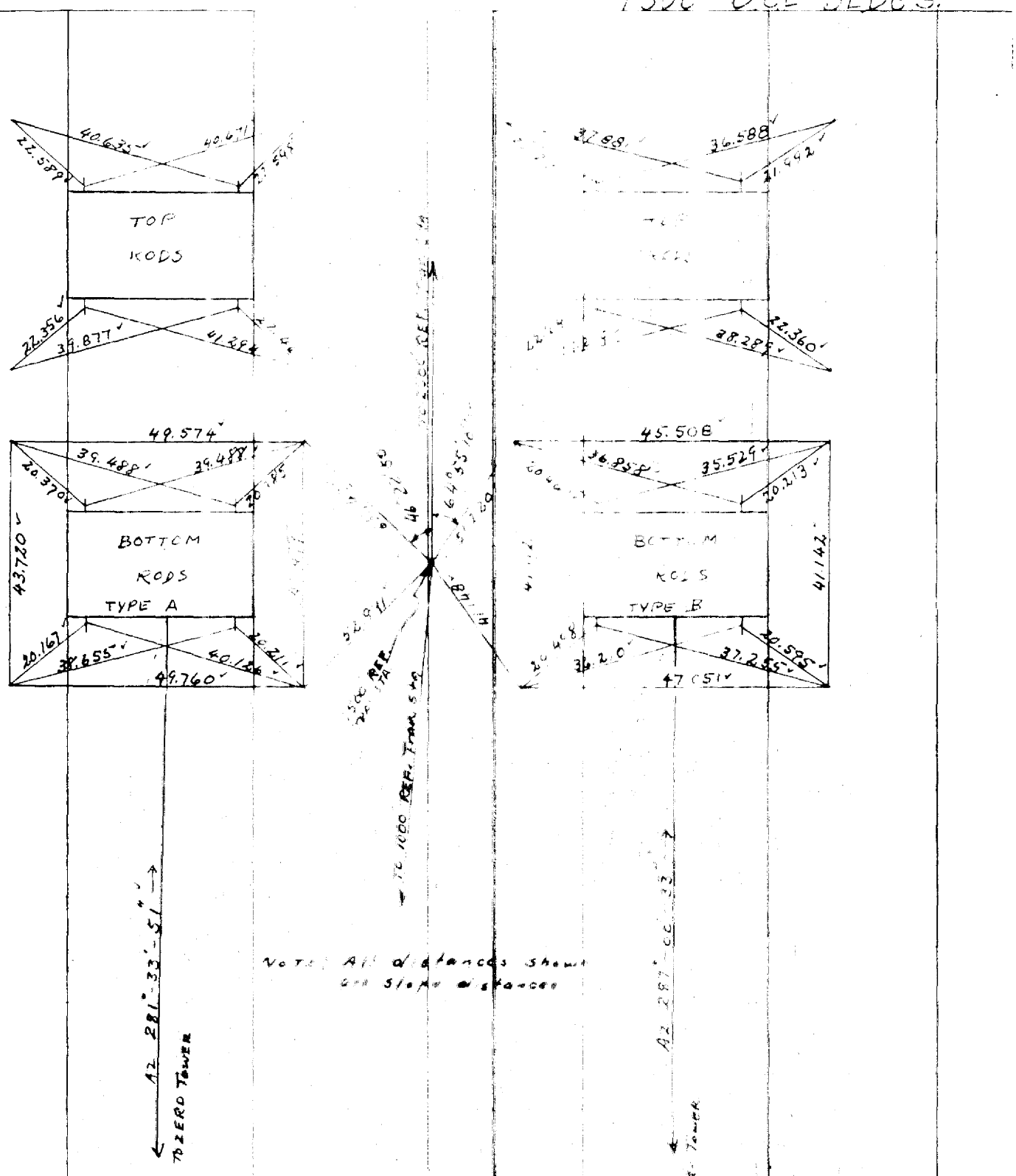
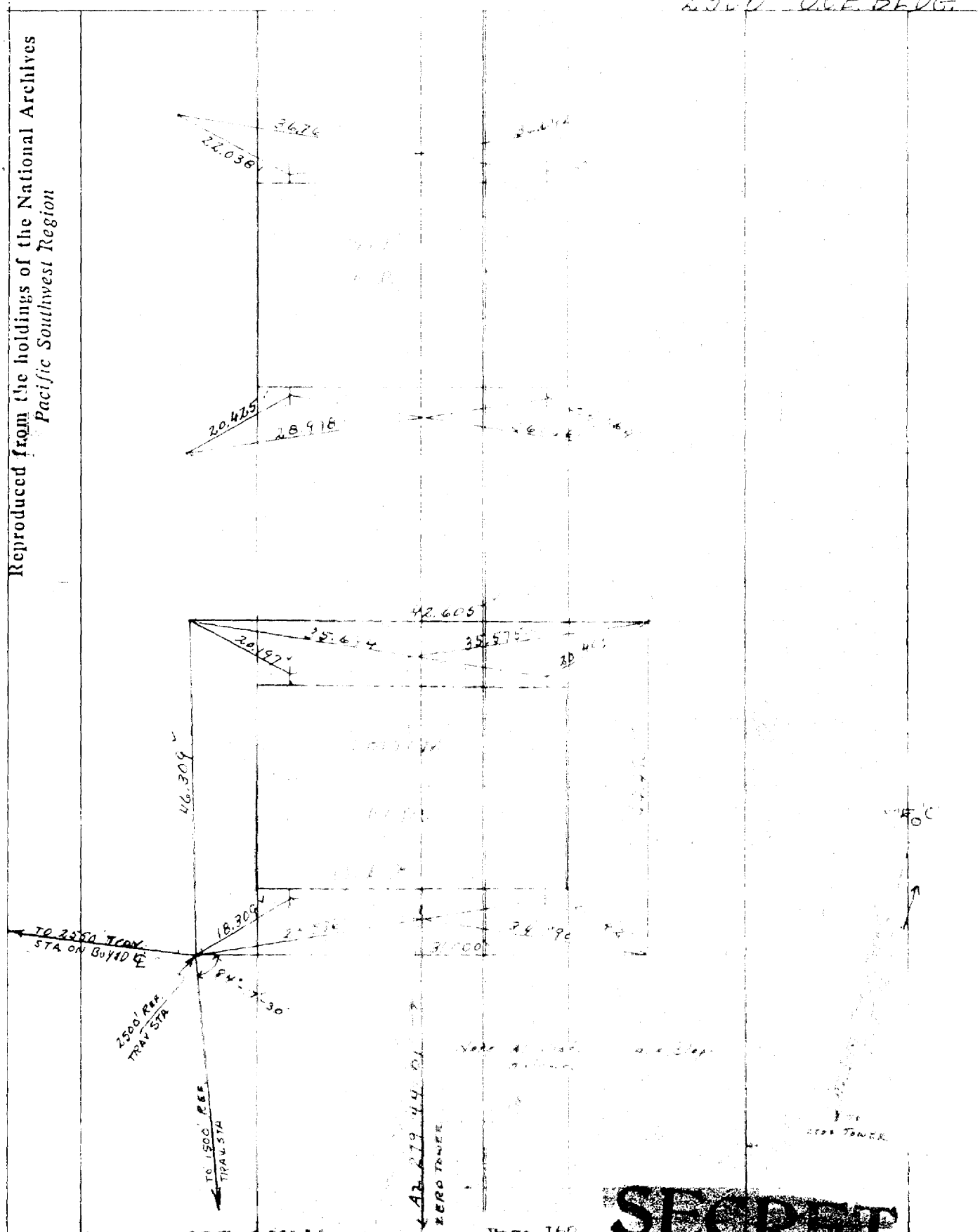


1506 O.C.E. BLDGS.





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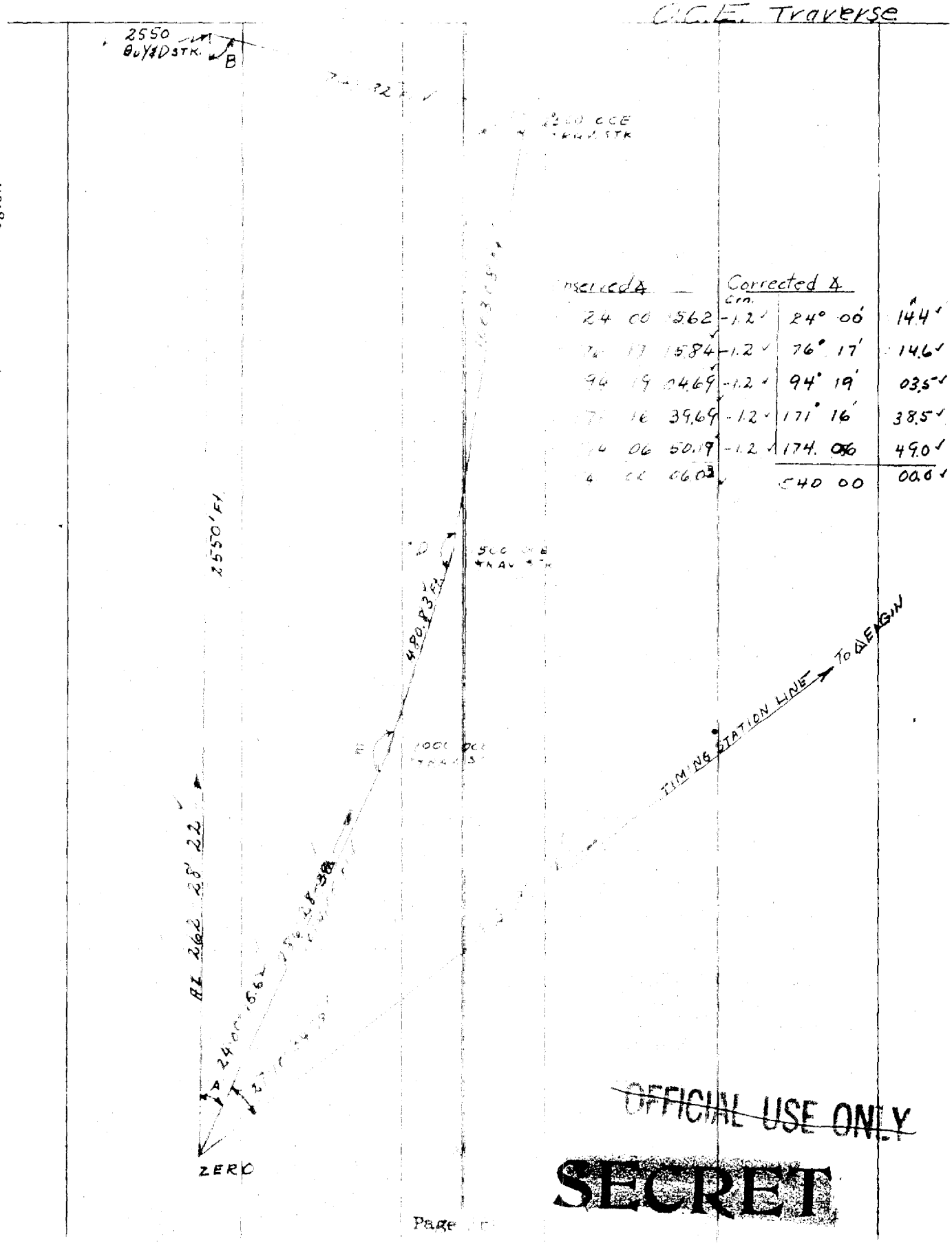
C.C.E. Traverse



Measured Δ			Corrected Δ	
			cor.	
24	00	15.62 -1.2	24° 00'	14.4
76	17	15.84 -1.2	76° 17'	14.6
94	19	04.69 -1.2	94° 19'	03.5
171	16	39.69 -1.2	171° 16'	38.5
174	06	50.19 -1.2	174. 06	49.0
4	00	06.03	540 00	00.0

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~~DEPT STATE TODAY~~

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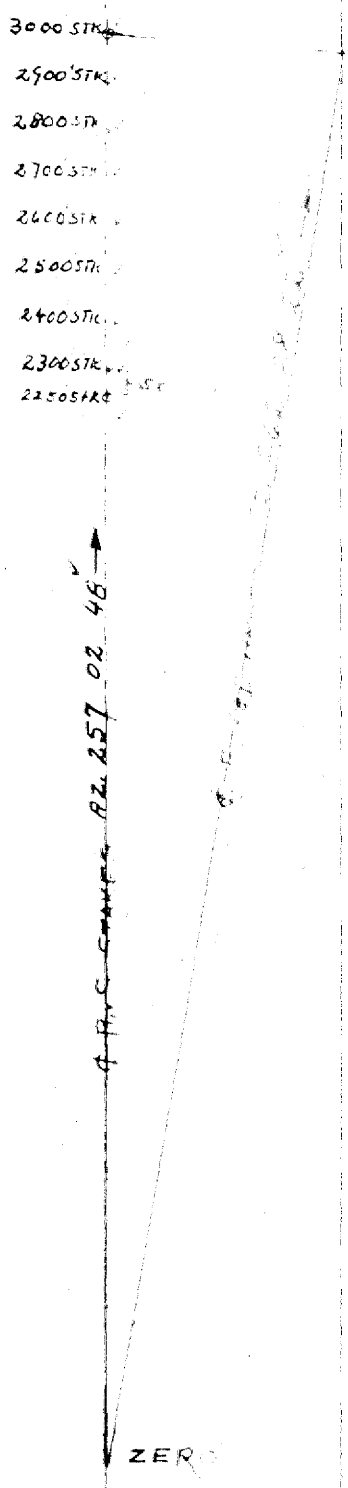
BUS LINE



...the 3100' E stake of the
... the 3000 Chord stake
... the N side of the runway
... the Bu Y&D Line. (Computation
... Bu Y&D Section of Engebi Comps)
... this 3000' Chord stake.
... sighting rods were set at
... intervals on line to
... Line as indicated
... below.

... the Bu Ship point
... the 4200' blast

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ZERO TOWER

el. 6.850 ELGIN

el. 7.483 GEM HSE x in conc. floor

corner conc. mk

el. 6.698 TIMINGSTA

ELEVATIONS FOR ... ERLY 5' ON EXTEND ... ZERO ELGIN LINE

* Assumed Elevation

el. 6.79 510' back from Zero on zero Elgin line

el. 7.00 ZERO TOWER

el. 3.78 end paving

el. -0.82 Zero-Elgin line extended 495'

3.78 — end of oiled area

2.47 ** solid, coral

0.76

0.04 "

-0.82 "

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ACROSS - BOLLARD - ROSCOE

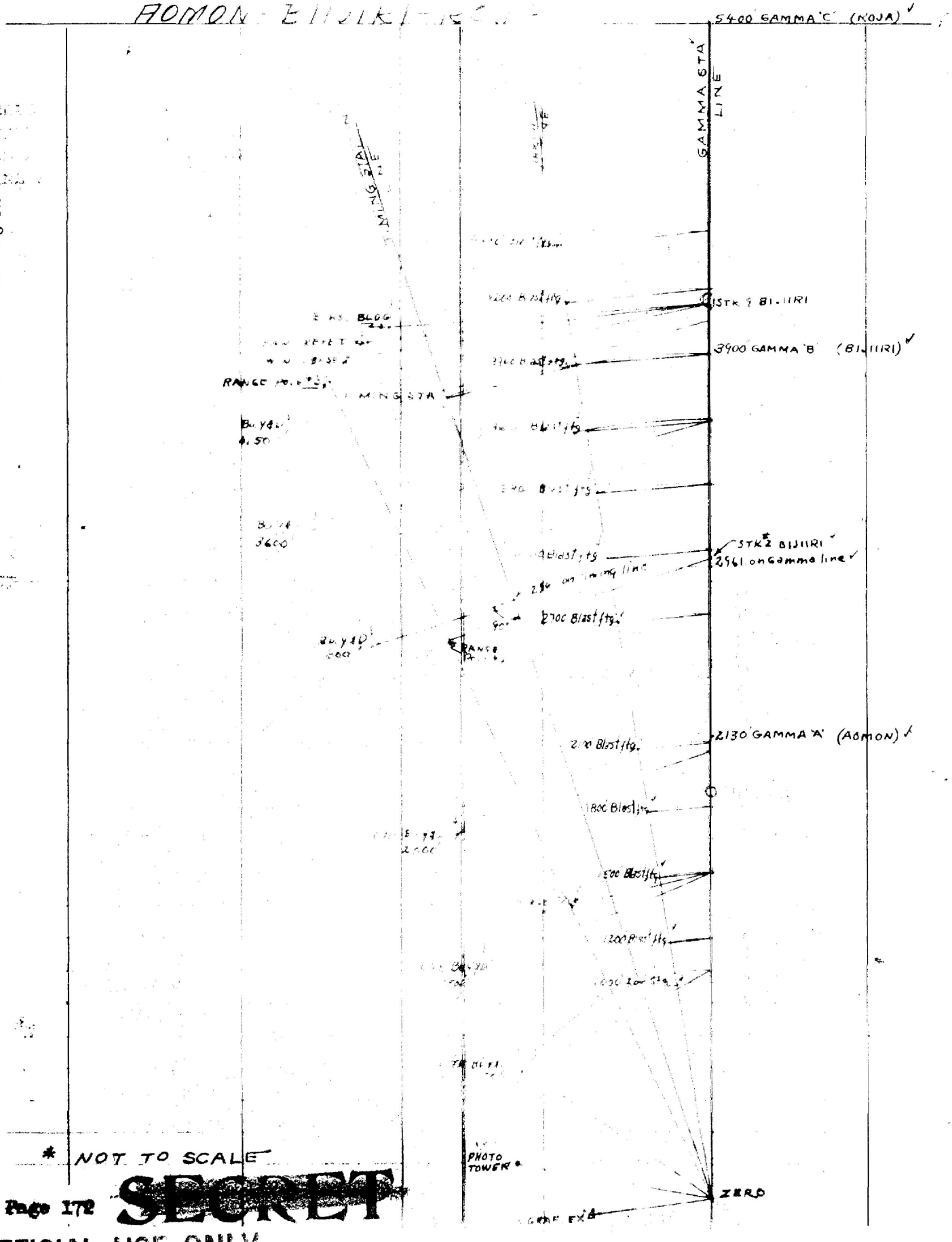
Location of Structures from the Zero Tower

STRUCTURE	DISTANCE FROM ZERO	AZIMUTH FROM ZERO
Gamma Station A	2160 ft.	306 17 38
" " B	5900 "	" " "
" " C	5450 "	" " "
Blast Footings	1200 "	304 05 24
" "	1500 "	" " "
" "	1800 "	" " "
" "	2100 "	" " "
~~" "~~	~~2400~~ "	~~" " "~~
" "	2700 "	" " "
" "	3000 "	" " "
" "	3300 "	" " "
" "	3600 "	" " "
" "	3900 "	" " "
" "	4200 "	" " "
" "	4450 "	" " "
Blast Building	4300 "	301 59 27
Timing Station	5900 "	301 53 10
Center one of line of Bu Y&D conc. cubes	1080 "	275 08 07 *
" "	1500 "	285 53 41 *
" "	2000 "	287 39 13 *
" "	3000 "	~~287 05 13~~ 292° 40' 45"
" "	3600 "	294 20 08 *
" "	4050 "	295 14 31 *
Ion. Station	1000 "	272 13 24
Range Pole #1	1500 "	294 15 57
" " #2	3848 "	297 45 02
" " #3	6192 "	298 50 19
Triang. Sta. Gradlex	850.000 ft.	271 49 30
Photo Tower	650.465 "	269 57 02
Tank Revetment	4278 "	300 57 32
Winch Base	4240 "	303 37 12

* Since preparing this Table, Lieut. Comdr. [illegible] has reported that all of these stakes have been removed and that the location of Buried Units will be determined by [illegible]

GEOGRAPHIC POSITIONS

STRUCTURE	LATITUDE	LONGITUDE
Zero Tower	11 37 [illegible]	162 19 11.614
Photo Tower	11 37 [illegible]	162 19 15.277
Traverse Station Aomon	11 37 [illegible]	162 19 27.578
Traverse Station Bjiiri	11 37 [illegible]	162 19 47.779
Triangulation Station Graflex	11 37 [illegible]	162 19 14.568



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COMPUTATIONS OF SETUPS, SETBACKS AND OFFSETS FROM THE GAMMA STATION LINE FOR USE IN ESTABLISHING OTHER POINTS

~~SECRET~~

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SECRET

Aoman, Bujiri y Rojoa Is.

COMPUTATION OF "SET UPS" AND "SET BACKS" FROM STAKES OF THE GAMMA LINE TRAVERSE TO PROPER DISTANCES FOR FOR ESTABLISHMENT OF OTHER POINTS BY CHORD OFFSETS

OBJECT TO BE ESTABLISHED	DIST. FROM ZERO TOWER FEET	METERS	CLOSEST STAKE TO ZERO TOWER	DIST. ZERO TOWER TO CLOSEST STK METERS	SET UP From Closest Stk ft.	SET BACK from Closest Stk m.	SET BACK from Closest Stk Ft.
Ion STA	1,200	365.76					
Bu. YED	1050	320.					
Hartman Sta.	1200	365					
Hartman Sta Range Flag #1	1500	457.					
Hartman Sta	800	518				1.3743	4.509
Bu YED	2050*	624.84					
Hartman Sta	2100	640.					
GAMMA A	2,130	649.				1.1773	2.550
Hartman Sta	1,000	304.8					
Hartman Sta	3000	914.4					
Hartman Sta	3300	005.8				3.3985	11.150
Hartman Sta	12,000	097.28				11.9532	39.216
~~Bu. G~~	~~3250~~	143.0					
TIMING STA. GAMMA 'B' Hartman Sta	3400	188				20.5380	67.382
HARTMAN STA	4200	280					
Bu. YED	4050	234				24.8152	81.415
Hartman Sta.	4500	371.					
GAMMA C	5400	645					

* This stake fell at high [illegible] line to zero tower [illegible]

"Aomon & Billiri Is..."

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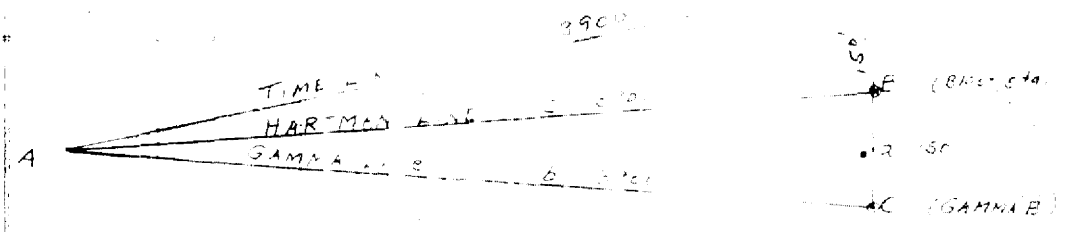
COMPUTATION OF Δ FOR 150 Chord offset from 3900' Point on GAMMA LINE TO 3900' Hartman sta.

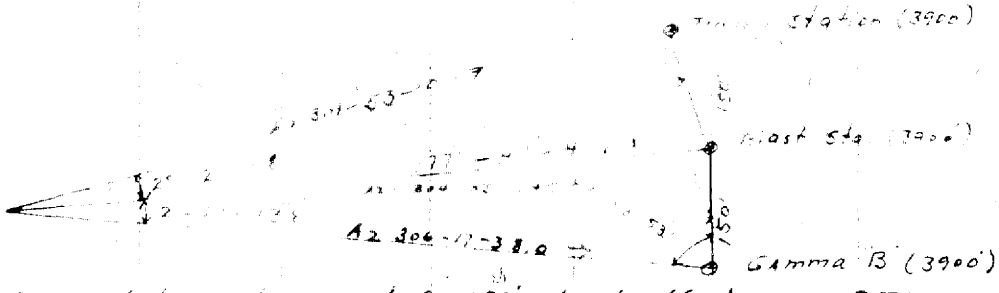


a = 150
b = 3900
c = 3900
2S = 7950
S = 3975

S-a = 3825
S-b = 75
S-c = 75

Log (S-a) 3.582 [illegible]
Log (S-b) 1.875 [illegible]
Log (S-c) 1.875 [illegible]
7 7.332 [illegible]
Log S = 3.599 [illegible]
3 733 [illegible]
Log r = 1.866 [illegible]

[illegible] = 1.866 7084
log (S-b) 1.875 0613
secant ½B 9.991 6471
½B = 44° 26' 56.55
B 88 53 53.1
C = 88 53 53.1
A 2° 12' 13.81
180 00 00.0



Timing station stake set by 150' chord offset from 3900 Hartman Sta. stake as shown in above sketch.

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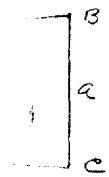
SECRET

98

Aomon + Bijiri Is.

SECRET

CHORD DIST ... AZIMUTH LINE 1 Hartman Line



Aomon Zero

A

A = 2° - 12' - 19"
B = 88° - 53' - 53"
C = 88° - 53' - 53"
180° 00' 00"

... DIST GAMMA LINE TO HARTMAN LINE

Log 1200	3.079 18	Log 1500	3	Log 1800	3.255 2725
Log Sin A	8.584 94	Log Sin A	8	Log Sin A	8.584 9491
Σ	1.664 13	Σ	3	Σ	1.840 2216
Log Sin B	9.999 91	Log Sin B	9	Log Sin B	9.999 9197
Log Dist	1.664 22	Log Dist	1	Log Dist	1.840 3019
Dist	46.54	Dist	6	Dist	69.231 ✓

Log 2100	3.322 2	Log 2700	3	Log 3000	3.477 1213 *
Log Sin A	8.584 94	Log Sin A	8	Log Sin A	8.584 9491 ✓
Σ	1.907 168	Σ	2	Σ	2.062 0704
Log Sin B	9.999 919	Log Sin B	9	Log Sin B	9.999 9197
Log Dist	1.907 248	Log Dist	2	Log Dist	2.062 1507
Dist	80.770	Dist	1	Dist	115.385 ✓

Log 3300	3.518 5	Log 3600	3	Log 4500 *	3.653 2125 ✓
Log Sin A	8.584 94	Log Sin A	8	Log Sin A	8.584 9491
Σ	2.103 46	Σ	2	Σ	2.238 1616
Log Sin B	9.999 9	Log Sin B	9	Log Sin B	9.999 9197
Log Dist	2.103 54	Log Dist	2	Log Dist	1.238 2419
Dist	126.92	Dist	1	Dist	173.078 ✓

(Dist ... Gamma Line)

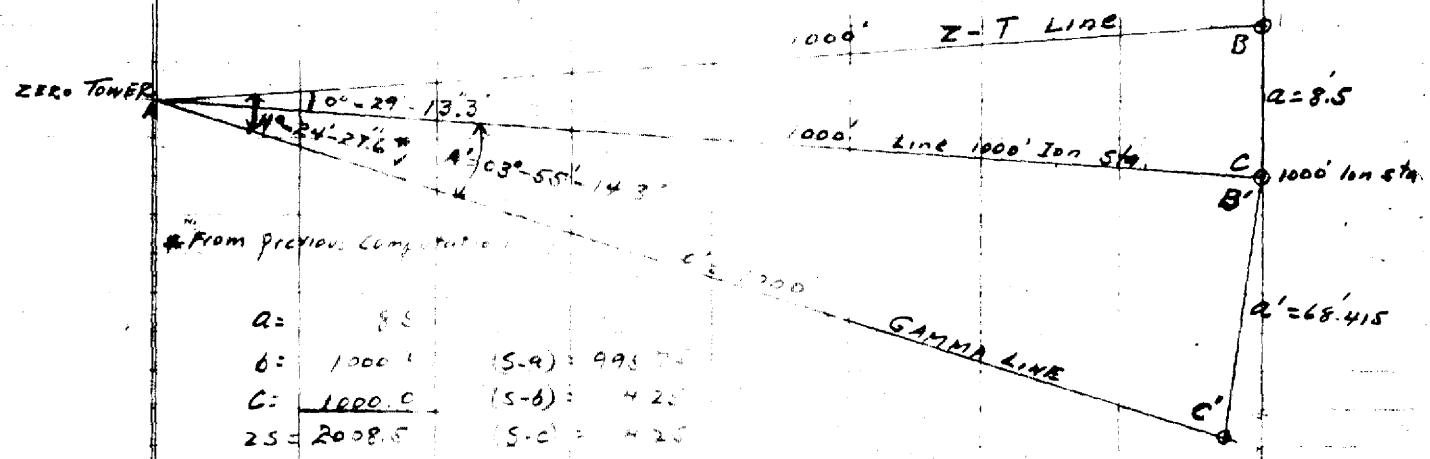
		Log 4200	3.623 2493
		Log Sin A	8.584 9491
3900'	Blast Star ... 150 ...	Σ	2.208 1984
	Gamma Line)	Log Sin B	9.999 9197
		Log Dist	2.208 2787
		Dist	161.540

* This stake was set back 60.0 Towards Zero Tower by Island Constr. giving a distance from Zero Tower of 4450 Feet.

SECRET

98A

Comp of Chord dist & ∠C' for Chord offset from GAMMA LINE to 1000' Ionization Sta



a = 8.5
b = 1000' (S-a) = 995.75
C = 1000.0 (S-b) = 4.25
2S = 2008.5 (S-c) = 4.25
S = 1004.25

Log(S-a)	2.998 1563	Log 2	0.026 5432	Log r =	0.626 5432
Log(S-b)	0.628 3889	Log(S-a)	2.998 1503	Log(S-b) =	0.628 3889
Log(S-C)	0.628 3889	Log tan ½A	7.628 3929	Log tan ½B	9.998 1543
Σ	4.254 9281	½A =	0°-14'-36.63"	½B =	44°-52'-41.72"
Log S =	3.001 8418	A =	0°-29'-13.3"	B =	89°-45'-23.4"
	1.253 0863			C =	89-45-23.4
Log r =	0.026 5432			A =	0°-29'-13.3"
					180 00 00.1

A' = (03-55-14.3"
B' = (88-02-22.8)"
C' 88-02-22.8"

$a' = \frac{b \sin A'}{\sin B}$

Log 1000 =	3.000 0000
Log Sin A° =	8.834 8952
Σ	1.834 8952
Log Sin B' =	9.999 7458
Log a' = Dist' =	1.835 1494
a =	68.415' FI

= Chord dist from 1000' point on GAMMA LINE To center of front of 1000' Ion Station Nearest Zero Tower.

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Aomon Island

Comp of chord Δs + offsets for location of Range pole #1

ZERO TOWER A — TIME LINE — GAMMA LINE — C = 1500

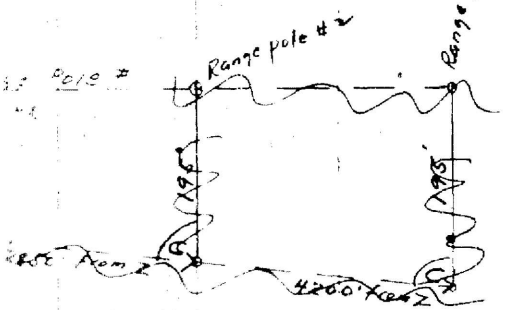
A = 4° - 24 - 27 ←
B = (87 - 47 - 46 ←
C = (87 - 47 - 46 ←

$$a = \frac{b \sin A}{\sin B}$$

Range poles 2 & 3 were set as shown by ... computations. However, Range poles #2 & 3 were set in different positions by the Island Commander. — Measurements were ... to actual positions of poles #2 & 3 ... poles as shown on ... (2 sides Hind & Comp)

Log 1500 =	3.176 09 3	Log 2850	Log 4200 3.623 2493
Log sin A	8.885 6577	Log sin A 8.885 6	Log sin A 8.885 6577
Σ	2.061 7490	Σ 2.34 5	Σ 2.508 9070
Log sin B	9.999 6786	Log sin B 9.999 6	Log sin B 9.999 6786
Log Dist	2.062 0704	Log Dist 2.34 8	Log Dist 2509 2284
Dist	115.364	Dist 2.9 9	Dist 323.019

(Checked by B = 14' 4)



ZERO TOWER A — (7° 21' 48.3 — 15 — 53.0

a =	195'		
b =	1500'		
c =	1500'		
2S =	3195'		
S =	1597.5'		
Log (S-A) =	3.146 902		Log A = 1.960 7356
Log (S-b)	1.989 004		Log (S-b) 1.989 0046
Log (S-c) =	1.989 004		Log ½B 9.971 7310
Σ	3.124 912		A = 43 - 08 - 11.67
Log S =	3.203 440		B = 86° - 16' 23.3
	2.921 472		C = 86 16 23 3
Log r =	1.960 7350		A = 7 27 13.3
			179° 59.9

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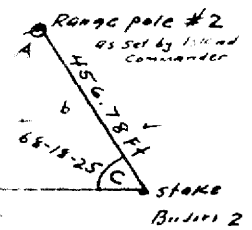
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Call origin ... $\tan\phi\tan\frac{1}{2}(A_p+B_p)$ $\left.c=\frac{a\sin C_p}{\sin A_p}\right]$*

(A)

C_s		Log	6.5 0 4	Log m
Sph. excess / 3		Log	6 5 9 0 7 1	Log sin C_s
C_p	68 - 18 -	Log	4 9 4 3 3	Log a
$\frac{1}{2}C_p$	34 - 09 -		18.39	Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$	55 -		8 3 9	Log sph. ex.
$\frac{1}{2}(A_p-B_p)$	-	Log	6.5 9396	Sph. excess —
Sum $=A_p$	103 06 58.4	Log	1 6 8 5 0 6 0	
Diff $=B_p$	08 34 [illegible]	Log	1 2 4 4 5 6	
C_p	68 18 2[illegible]		(Sketch)	
	180 00 [illegible]			
Log a	3.474 6 [illegible]			
Log sin C_p	9 9 6 8 [illegible]			
Colog sin A_p	[illegible]			
Log c	3.454 2 [illegible]			

c = 2845.9'



CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3.454 2296
	1 C			68-18-25	0 031 9014
	2 B			34 36 2	9.173 5756
	3 A			06 [illegible]	9.988 5194
	1-3			[illegible]	2.659 7066
	1-2			[illegible]	3.474 6504
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

*The sub-scripts s and p denote spherical and plane angles respectively

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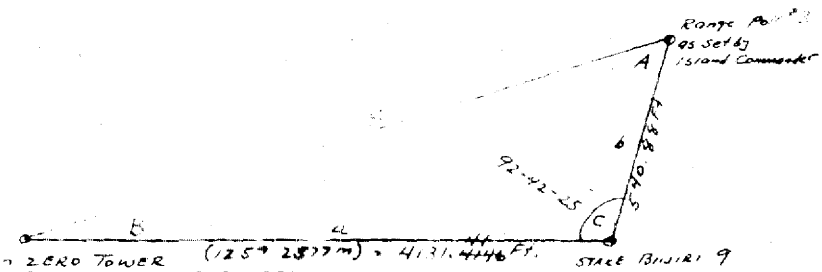
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Call longer side a) $\tan\frac{1}{2}(A_p-B_p)$ $\tan\frac{1}{2}(A_p+B_p)$; $\left.c=\frac{a\sin C_p}{\sin A_p}\right]$*

C_s		Log a	Log m
Sph. excess / 3		Log b	Log sin C_s
C_p	92 - 42 - 25	Log tan 45° + ϕ	Log a
$\frac{1}{2}C_p$	46 - 21 - 12.5	$(45°+\phi)$	Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$	43 - 38 - 47.5	ϕ	Log sph. ex.
$\frac{1}{2}(A_p-B_p)$	36 - 14 - 59.8	Log tan ϕ	Sph excess —
Sum $=A_p$	79 - 53 - 47.3	Log tan $\frac{1}{2}(A_p+B_p)$	
Diff $=B_p$	07 - 24 - 47.2	Log tan $\frac{1}{2}(A_p-B_p)$	
C_p	92 - 42 - 25		(Sketch)
	180 - 00 - 00		

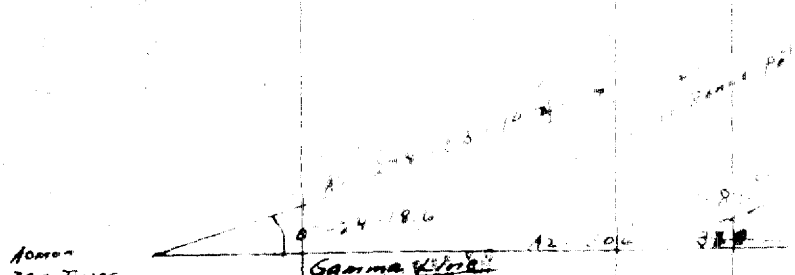
Log a	3.616	0983
Log sin C_p	9.999	4910
Colog sin A_p	0.006	7946
Log c	3.622	3945

$c = 4191.74$



CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3.622 3945
	1	C		92-42-25.9	0 000 5030
	2	B		07 24 18.6	9 110 2024
	3	A		79 53 16.4	9 993 2008
	1-3			540.88	2.733 0999
	1-2			4191.41	3.616 0983
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				



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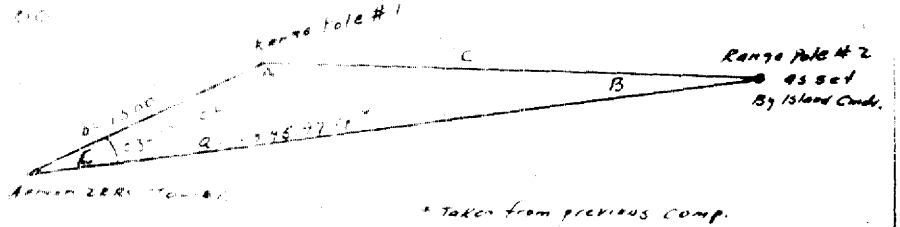
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Cal. long. side a): tan ϕ (Cal. long. side b): $\tan\phi \tan\frac{1}{2}(A_p+B_p)$: $\left.c=\frac{a \sin C_p}{\sin A_p}\right]$* (C)

C_s		Log	4.54 .296 ✓	Log m
Sph. excess / 3		Log	.96 .913 ✓	Log sin C_s
C_p	03-17-04.7	Log tan	0.278 1383 ✓	Log a
$\frac{1}{2}$ C_p	01 38 32.35 ✓		62 12 28.76 ✓	Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$	88 21 27.65		7 12 28.76 ✓	Log sph. ex.
$\frac{1}{2}$ (A_p-B_p)	54 42 [illegible]76	Log tan	9.490 9475 ✓	Sph. excess —
Sum $=A_p$	143 [illegible]	Log tan	B_s 1542 5461 ✓	
Diff $=B_p$	03 [illegible] 89	Log tan	B_p 033 4936 ✓	
C_p	03 17 04.70		(Sketch)	

Log a	3.454 [illegible]	
Log sin C_p	8.758 [illegible]	
Colog sin A_p	0.918 [illegible]	
Log c	3.130 [illegible]	



* Taken from previous comp.

C = 135.17 ±

CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3.130 7086
	1 C			03 17 04.70	1.241 8730
	2 A			173 04 06 41	9.081 6480
	3 B			03 38 47.89	8.803 5097
	1-3			2845.97	3.454 2296
	1-2			1500.00	3.176 0913
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

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TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\frac{a}{b}=\tan(45°+\phi)$ (Call longer side a ... $\tan\frac{1}{2}(A_p-B_p)$; $c=\frac{a\sin C_p}{\sin A_p}$]* (5)

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Southwest Pacific Region

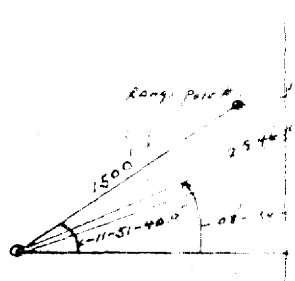
C_s				Log m
$\frac{\text{Sph. excess}}{3}$				Log sin C_s
C_p	04 27 22 3	log tan (45° + ϕ)	0.4 3032	Log a
C_p	02 13 41.13	45 + ϕ	37 54	Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$	87 46 18 85		37.54	Log sph. ex.
$\frac{1}{2}(A_p-B_p)$	85 17 48 0	log tan ϕ	1.1 7 788	Sph. excess
Sum $=A_p$	173 04 07.5	log tan $\frac{1}{2}(A_p+B_p)$	1.09 9696	
Diff $=B_p$	02 28 30.5	log tan $\frac{1}{2}(A_p-B_p)$	8.6 35 32	*From previous comp.
	04 27 22		Sketch	
	180 00 00			

Log a 3.622 3945
Log sin C_p 8.890 4030
Colog sin A_p 0.918 3718
Log c 3.431 1699

$c=$ 2698.80 ✓ ft.

CHECK COMPUTATION

No.	STATION	SPECIFIED ANGLE	CORRECTION	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3.431 1699
	1 C			04 27 22.30	1.109 5964
	2 A			173 04 07.65	9.081 6282
	3 B			02 28 30.15	8.635 3248
	1-3			4191.74	3.622 3945
	1-2			2500.0	3.176 0911
	2-3				
	1				
	2				
	3				
	1-3				
	1-2 Aomon Zero Tower			GAMMA LINE	



*The subscripts s and p on the form refer to spherical and plane

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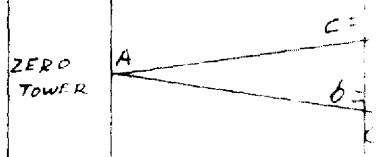
CHORD 4 — DISTANCE BASED [illegible] from Zero Tower. 14

[illegible] for use of 7 BuRED Cubes



a=	564
b=	1050
c=	1050
2S	2664
S	1332

Log(s-a)	2.885 36.2		Log a =	2.330 6776
Log(s-b)	2 450 2491		Log -b):	2.450 2491
Log(s-c)	2. 450 2491		½B	9.880 4285
Σ	7.785 8594		½B	37-12 -37.30
Log S	3.124 5042		B	74 25 -146
	4.661 3552		C=	74 25 -146
Log a	2 3306776		A:	31 09 308
				180-00-000

[illegible] (STAKE)

Aomon ZERO TOWER ∠ [illegible]

* Light [illegible] Marking [illegible]

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Page [illegible]

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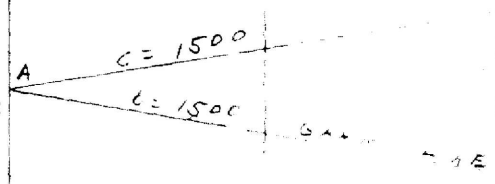
CHORD A-1 Dist Temp - Bu YED = 1500 from ZERO TOWER

Cubes



a=	600
b=	1500
c=	1500
2S=	3600
S=	1800

Log (s-a)	3. 079 1812	Log r	2.389 0756
Log (s-b)	2. 477 1213	Log (s-a)	3.079 1812
Log (s-c)	2. 477 1213	Log tan ½ A	9.309 [illegible]
Σ	8.033 4238	½ A	[illegible]
Log S	3 255 2725	A	23 04 26
	4.778 1513		
Log r	2.389 0756		

Log r =	2.389 0756
Log (s-c) =	2.477 1213
Log tan ½ B =	9.9 11 9543
½ B =	39 13 53.47
B	78 27 46.9
C	78 27 46.9
A	23 04 26.1
	179 59 59.9

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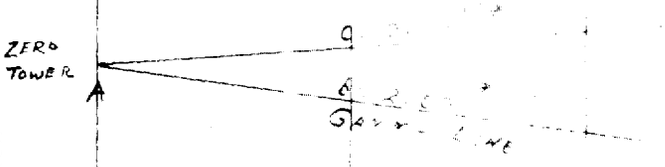
Computation of Chord & Dist. Bu Y&D ~2050 From ZERO TOWER *



Center line of 21 Bu Y&D. Curve

a = 664'
b = 2050'
c = 2050'
2S = 4764'
S = 2382'

Log(S-a)	3.235 0232	2.450 1788	Log r = 2.450 1788
Log(S-b)	2.521 138	3.235 0232	Log (S-b) = 2.521 1381
Log(S-c)	2.521 138	9.215 154	log for 2B = 9.929 0407
Σ	8.277 299	9-19-12.6	B = 40 20 23.70
Log S =	3.376 9418	8' 38 25	B = 80 40 47.4
	4.900 357		C = 80 40 47.4
Log r =	2.450 1788		A = 18 38 25
			180 00 000

* Note: Stake set as computed above fell off high part of Island. Stake was set [illegible] on line to ZERO TOWER giving Radius of 2000 Ft from Zero Tower. Stake set at this point.

[illegible] Rose from Zero
[illegible] as to control one of
[illegible] 2000' from Zero

* Note: Lent Cmdr Erickson CEC USN reports his stake as having been removed or destroyed

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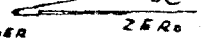
~~Annex I~~

Comp for Normal offset [illegible] 80 = 3000' from Zero Tower *

accurate to of 21 Bo Y80 units.



$X^2 = 3000^2$

$= 9,000,000$

$\log X^2$

$\log$

X

$\tan \alpha = \frac{480}{2961.35}$

$\log 480$ 2.681

$\log 2961.35$ 3.471 489

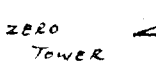
$\sin \alpha = \frac{480}{3000}$

$\log 480$ 2.681

$\log 3000$ 3.477

292-40

297-00



~~LINE~~ TIMING STA. LINE

* Lieut Cmdr. Crumpo [illegible] USN Reports This Stake as having been removed or destroyed

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COMPUTATION OF CROSS △ DIST. Co. 150 ~ 3600' From ZERO TOWER*

ZERO TOWER

A

C = 36

a =	750'		
b =	3600'		
c =	3600'		
2S =	7950'		
S =	3975'		
Log(S-a)	3.508 5297	Log r	2.528 6276
Log(S-b)	2 574 0313	Log(S-b) =	2. 574 0313
Log(S-c)	2.574 0313	Log tan ½B =	9.954 5963
Σ	8656 5923	½B =	42 00 37.52
Log S =	3.599 3371	B =	84 01 150
	5.057 2552	C =	84 01 150
Log r =	2.528 6276	A =	11 57 29.9
			179 59 59.9

* Stake for Center one of 3 Bu Yeo units

GAMMA LINE

* Last Chance Canyon, Calif. reports this stake as having been removed by Natural

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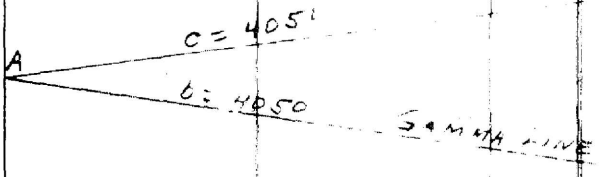
COMP. OF CHORD A × DIS BEARD – 4050 from ZERO TOWER



780
4050
4050
8880
4440

Log(S-a)	3.563 4811	Log 2	2.549 1136
Log(S-b)	2.591 0646	Log (S-b)	2.591 0646
Log(S-c)	2.591 0646	Log tan ½ A	9.958 0490
Σ	8.745 6103	½ A	42-14-13.30
Log S	3.647 3830	B	84 28 26.6
	5.098 2273	C	84 28 26.6
Log r	2.549 1136	A	11 03 06.7
			179 59 59.9

* STAKE IN CENTER ONE OF SURVEYED UNITS.

ZERO TOWER

SAMMA LINE

* Last Cmdr. Confirmed [illegible] report this stake as [illegible]

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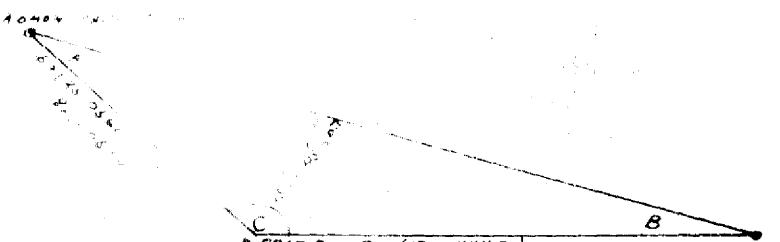
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\quad$ (Call [illegible] $\tan \phi \tan \frac{1}{2}(A_p+B_p)$; $\quad c=\frac{a \sin C_p}{\sin A_p}\right]^*$

C_s		Log	Log m
$\frac{\text{Sph. excess}}{3}$		Log	Log sin C_s
C_p		Log tan	Log a
$\frac{1}{2}C_p$		45° + c	Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$		ϕ	Log sph. ex.
$\frac{1}{2}(A_p-B_p)$		Log	Sph. excess
Sum $=A_p$		Log tan	
Diff $=B_p$		Log tan	
C_p			(Sketch)

Log a	2.746 [illegible]
Log sin C_p	9.660 [illegible]
Colog sin A_p	0.391 [illegible]
Log c	2.801 [illegible]

$C = 632.43$ Ft

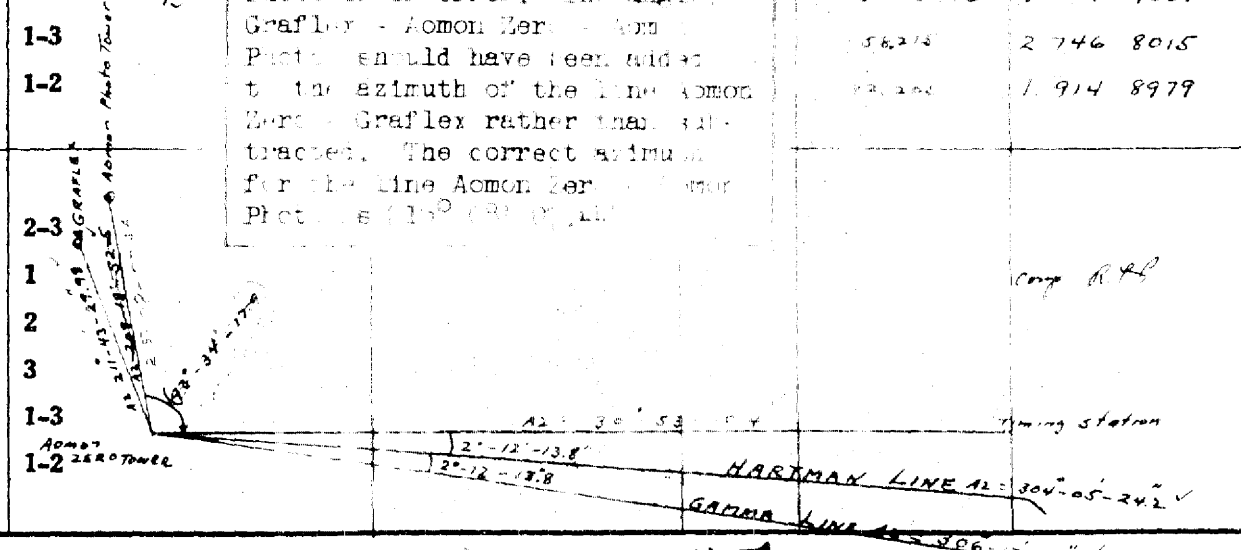


CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				2.801 0095
	1	C		15° 45' 50"	0 339 4615
	2	A		23 49 3.84	9 606 3305
	3	B		0° 24' 32.40"	8 774 4269
	1-3			558.215	2 746 8015
	1-2			[illegible]	1 914 8979

NOTE

The azimuth shown on this page for the line Aomon Zero - Aomon Photo is in error. The angle Graflex - Aomon Zero - Aomon Photo should have been added to the azimuth of the line Aomon Zero - Graflex rather than subtracted. The correct azimuth for the line Aomon Zero - Aomon Photo is [illegible]



*The subscripts s and p on this form refer to spherical and plane angles respectively.

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Basis I

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Form 665
Ed. Dec. 1929

TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\frac{a}{b}$ = tan $(45° + \phi)$ (Call longer side a) tan $\frac{1}{2}(A_p - B_p)$: $c = \left[\frac{a \sin C_p}{\sin A_p}\right]^*$

C_s			Log m
Sph. excess / 3			Log sin C_s
C_p	1 7	Log tan $(45° + \phi)$	Log a
$\frac{1}{2}C_p$	5 9	$45° + \phi$	Log b
$90° - \frac{1}{2}C_p = \frac{1}{2}(A_p + B_p)$	3		Log sph. ex. 3 6 7
$\frac{1}{2}(A_p - B_p)$	2	Log tan ϕ	Sph. excess
Sum $= A_p$	5 8 3	Log tan $\frac{1}{2}(A_p + B_p)$	
Diff $= B_p$	0 4 1	Log tan $\frac{1}{2}(A_p - B_p)$	
	1 1 7	(Sketch)	

Log a 3.616 09
Log sin C_p 9.949
Colog sin A_p 0.068 7266
Log c 3.634 3672

4308.91'

Cor. NW 4+9.

CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3 634 3672
	1	C			0 050 4517
	2	B			8 875 2404
	3	A			9 731 2734
	1-3				3 660 0653
	1-2				3 684 0983
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

Azimuth Zero

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*The subscripts s and p on this form refer to spherical and plane angles, respectively.

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Bijuri I

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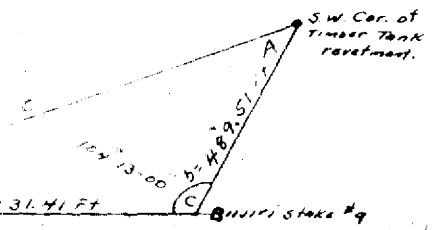
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b} = \tan (45° - \phi) \quad \text{Cot} \quad \tan \phi \tan \tfrac{1}{2}(A_p + B_p) \quad c = \frac{a \sin C_p}{\sin A_p}\right]^*$

C_s	3.616 0983	Log m
$\frac{\text{Sph. excess}}{3}$	2.689 7616	Log sin C_s
C_p	3.926 3367	Log a
$\frac{1}{2} C_p$	4 34"1	Log b
$90° - \frac{1}{2}C_p = \frac{1}{2}(A_p + B_p)$	14 34.1	Log sph. ex.
$\frac{1}{2}(A_p - B_p)$	9.896 5994	Sph. excess
Sum $= A_p$	9.891 1165	
Diff $= B_p$	9.787 1159	
C_p	(Sketch)	

Log c	
Log sin C_p	9.986 [illegible]
Colog sin A_p	0.028 [illegible]
Log c	3.631 [illegible]



CHECK COMPUTATION

No.	STATION	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3			3.631 2435
	1			0.013 5087
	2			9.971 3461
	3			9.045 0165
	1-3			3.616 0983
	1-2			2.689 7627
	2-3			
	1			
	2			
	3			
	1-3			
	1-2			

GAMMALING

*The subscript [illegible] on this [illegible] angles respectively.

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Bill Sect. I

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U. S. COAST AND GEODETIC SURVEY
Form 665
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TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

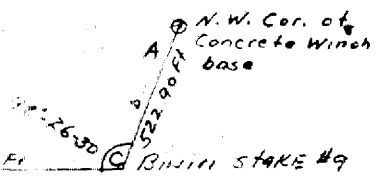
Archives

$\frac{a}{b}=\tan(45°+\phi)$ (Call longer side a) $\tan\frac{1}{2}(A_p-B_p)=\frac{a-b}{a+b}\tan\frac{1}{2}(A_p+B_p)$ $c=\frac{a\sin C_p}{\sin A_p}$]*

Reproduced from the holdings of the National Archives Pacific Southwest Region

C_p		Log			Log m
Sph. excess / 3		Log			Log sin C_e
$\frac{1}{2}C_p$		Log [illegible]			Log a
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$					Log b
$\frac{1}{2}(A_p-B_p)$		Log [illegible]			Log sph. ex.
Sum $=A_p$		Log [illegible]			Sph. excess
Diff $=B_p$		Log [illegible]			
C_p				(Sketch)	

Log a
Log sin C_p
Colog sin A_p
Log c



CHECK COMPUTATION

No.	STATION	OBSERVED ANGLE	REDUCTIONS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3.627 3495
	1	C			0.164 7309
	2	A			9.784 0179
	3	B			0.086 3367
	1-3				3.616 0983
	1-2				2.718 4 7
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

Atomic 2540 TOWER

GAMMA LINE

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*The subscripts s and p on this form refer to [illegible] respectively.

Page

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[illegible] FOR RELEASE
[illegible] CIRCULATION [illegible]
[illegible] QUARTERLY [illegible]
[illegible] DOWN.

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U. S. COAST AND GEODETIC SURVEY
Form 568
Revised 1935

[redacted]

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COMPUTATION OF [illegible] — Aerial Photo Tower TRAVERSE BASE LINE

Fold in here

U. S. GOVERNMENT PRINTING OFFICE 16-7536

SECTION	DATE	DIR OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH		TEMP.	C O R R E C T I O N S					REDUCED LENGTH	ADOPTED LENGTH	(x)	(xx)
					Tape Lengths	Meters		Temp.	Tape and Catenary	Slope or Set-back	Inclination	Sea level				
								Meters	Meters	Meters	Meters	Meters	Meters	Meters	mm	mm
Base [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

[redacted]

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 635

ABSTRACT OF [illegible] LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Mar	[illegible]	[illegible]	Mar	Meters	
Bench Δ GRAFLEX						
Bench AOMON PHOTO TOWER	2 [illegible]	[illegible]	[illegible]			

109 v 8 83

11—6126

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COMMUNICATIONS FOR TRANSMISSION BETWEEN
TRIANGULATION STATION [illegible] AND
AOMORI [illegible]

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U. S. COAST AND GEODETIC SURVEY
Form 849
Rev. April 1935

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COMPUTATION OF A GRAFLEX - ADAMS TEST TAPE TRAVERSE ~~BASE~~ LINE

Field Book

SECTION	DATE	DIR. OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH		TEMP	COR-		REDUCTIONS			REDUCED LENGTH	ADOPTED LENGTH	(xx)	(yy)
					Tape Lengths	Meters	°C	Temp Meters	Tape and Catenary Meters	Set-up Set back Meters	Inclination Meters	Sea level Meters	Meters	Meters	mm	mm
Base A																
1 Graflex			92													
			927													
4 Base A			164													

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U. S. COAST AND GEODETIC SURVEY
Form 635

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ARSTRAND LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	Meters	Meters	Meters	Meters	
Mark Δ Graflex						
Bench Δ Graflex						
1						
2						
3						
4						
Bench Aomon Zero Town						
Mark Aomon Zero Town						

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11—8134

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COMMUTATION OF AUTHORIZED [illegible]

ROJOA ISLAND AND DISTANT [illegible]

STATE #1 [illegible]

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Form 526
Rev. April 1936

[redacted]

COMPUTATION OF AUXILIARY BASE LINE

For determining distance across Runway II
To Point "C" By Triangulation

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Field No.

SECTION	DATE	DIR. OF MEAS.	T/FF NO.	TAPE SUPPORT	UNCORRECTED LENGTH: Tape Lengths	UNCORRECTED LENGTH: Meters	TEMP °C	COR: Temp Meters	COR: Tape and Calibration Meters	REDUCTIONS: Set up Set back Meters	REDUCTIONS: Inclination Meters	REDUCTIONS: Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH Meters	(illegible) Feet	(illegible) Feet
To Point C																
To																
Point "C"							280									

Page

[redacted]

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U. S. COAST AND GEODETIC SURVEY
Form 635

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ABSTRACT OF LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	[redacted] feet	[redacted]	Meters	Meters	
Rojoa '0						
BL 1	[redacted]	[redacted]	[redacted]	[redacted]		
BL 2	[redacted]	[redacted]	[redacted]	[redacted]		
BL 3	[redacted]	[redacted]	[redacted]	[redacted]		

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U. S. COAST AND GEODETIC SURVEY
Form 24A
Rev. Oct., 1932

Station BIJIRI II State Marshall Islands (Enewetak Atoll)

Chief of party Ralph L. Ptan Date 7 February 944 Computed by R.L.P.

Observer G.R. Strode Instrument H 3[illegible] Checked by R.L.P.

11—9503

OBSERVED STATION		Observed direction	Eccentric correction	Reduction	Corrected direction with zero initial	Adjusted direction*
		° ′ ″	″	″	° ′ ″	° ′ ″
ReSeA	"O"	0 00 00.00			0 00 00.00	
ReSeA	BL 3	3[illegible]				
ReSeA	BL 2	3[illegible]				

*These columns are for office use and should be left blank in the field

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Form 24-A
Rev. Oct., 1932

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Station ROJOA RL 3 State MARSHALL IS (Enewetak Atoll)

Chief of party Ralph L. Platt Date 7 February 1948 Computed by R.L.P.

Observer G.R. Strode Instrument [illegible] Checked by R.H.P.

U. S. GOVERNMENT PRINTING OFFICE 11—9503

OBSERVED STATION	Observed direction	Correction to reduce to sea level	Sea level reduction*	Corrected direction with zero initial	Adjusted direction*
	° ′ ″		″	° ′ ″	° ′ ″
ROJOA "O"	[illegible]			0 00 00.00	
BIJIRI II	[illegible]				

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U. S. COAST AND GEODETIC SURVEY
Form 24A
Rev. Oct., 1932

SECRET

Station Rojoa R 4 2 State Marshall Islands (Kwajalein Atoll)

Chief of party Ralph L Ptak Date 2 Feb 1944 Computed by R.L.P.

Observer G.R. Stroade Instrument [illegible] Checked by R.L.P.

11—9503

OBSERVED STATION	Observed direction	Eccentric correction	Reduced direction	Corrected direction with zero initial	Adjusted direction*
	° ′ ″			° ′ ″	° ′ ″
Rojoa "O"	[illegible] 00 00			000 00 00.00	
Bijire 11	[illegible]				

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Page [illegible]

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Station ROJOA 0 State Marshall Islands (Kwajalein Atoll)

Chief of party Ralph L. Tuck Date [illegible] Computed by R.A.P.

Observer G.R. Strode Instrument [illegible] Checked by .....

U. S. GOVERNMENT PRINTING OFFICE: 1936 11—9813

OBSERVED STATION	Observed direction	Correction to reduce to sea level	Corrected direction with zero initial	Adjusted direction*
	° ′ ″	″	° ′ ″	° ′ ″
BIJIRU 11	0 00 00.00		0 00 00.00	
ROJOA BL 2	[illegible]			
ROJOA BL 3	[illegible]			

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Form 25
Ed. Nov. 1946

COMPUTATION OF TRIANGLES

MARSHALL

U. S. GOVERNMENT PRINTING OFFICE 16—0215

STATION	OBSERVED ANGLE	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3				49.9936 m	2.176 0727
1 Bluff				644	0.278 2108
Obsy Δ 2 Rojoa BLS				16.5	9.942 7447
Ref for dist. 3 Rojoa	84 53 28			38.1	9.999 3954
1-3				49.4757 m	2 397 0282
1-2					2.453 6789
2-3				49.9956 m	1.999 98~~17~~09 ✓
1 Bluff				24.9	0.421 9443
Check Δ 2 Rojoa BLS				56.2	9.975 0983
3 Rojoa	36			38.9	9.999 3954
1-3				49.4757	2.397 02~~48~~55
1-2					2.421 32~~14~~06
2-3					
1					
2					
3					
1-3					
1-2					
2-3					
1					
2					
3					
1-3					
1-2					

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COORDINATES OF AUXILIARY BASE LINE
AOLON ISLAND AND ITS AMOE AOLON STAKE
#1 TO AOJIKI STAKE #2

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 588
Rev. April 1955

[redacted]

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COMPUTATION OF AUXILIARY BASE LINE

(For determination of grid scale factor)

Auxiliary to Baseline "C"

SECTION	DATE	DIR. OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH		TEMP	CORRECTIONS				REDUCED LENGTH	ADOPTED LENGTH	(+)	(++)
					Tape Length	Meters		Temp	Tape and Catenary	Set-up Setback	Inclination	Sea level				
								Meters	Meters	Meters	Meters	Meters	Meters	mm	mm
Azimuth 14	12-5-58	F	72	B	2	100	71.5	+0.0168	-0.0168	-0.0075	-0.0001		99.9893	99.9890		
To																
13-2		F	72	B	1	00	71.5	+0.0168	-0.0168	-0.0075	-0.0001		99.9893	99.9890		

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 685

ABSTRACT OF WY LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	Meters	Meters	Meters	Meters	
Aomen 12						
BL 1						
BL 2						
BL 2+25						

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 24 A
Rev. Oct., 1933

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Station Aomon "2" State Marshall Is. (Kwajalein Atoll Aomon)

Chief of party Ralph L. Pfau Date 5 February 1943 Computed by R.L.P.

Observer G.R. Strode Instrument 7" Kern No. 10 Checked by RLP

11—9503

OBSERVED STATION	Observed direction	Number of readings	Mean of readings	Corrected direction with zero initial	Adjusted direction*
	° ′ ″			° ′ ″	° ′ ″
Ujiri "0"	[illegible]			00 00.00	
RL 2	244 [illegible]				
RL 2+25	244 [illegible]				

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Station BL 2 State Marshall Is (Eniwetok Atoll Aomon I.

Chief of party Ralph L Pfau Date 5 February 1948 Computed by R.L.P.

Observer C. R. Strode Instrument 7" Repeater Checked by R.L.P.

11—9503

OBSERVED STATION	Observed direction	Eccentricity to	Sea level reduction*	Corrected direction with zero initial	Adjusted direction*
	'		'	° ' "	' "
Biijiri "C	0 00 00.00			0 00 00.00	
Aomon 12	6 49 27				

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U. S. COAST AND GEODETIC SURVEY
Form 24A
Rev. Oct., 1932

Station BL 2 +25 State MARSHALL Is. (ENIWETOK Atoll) (Aomon I.)

Chief of party Ralph L. Pfau Date 5 February 1948 Computed by R.L.P.

Observer G.R. Strode Instrument 7" Repeater Checked by R.L.P.

11—9503

OBSERVED STATION	Observed direction	Eccentric reduction	Spherical reduction	Corrected direction with zero initial	Adjusted direction*
	° ' "	"	"	° ' "	° ' "
Bijiri "0"	0 00 00.00			0 00 00.00	
Aomon "12"	[illegible]				

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Station Bijiri 0 State Marshall Is. (Enjuetok Atoll) (Bijiri I)

Chief of party Ralph L. Pratt Date 5 February 1948 Computed by R.L.P.

Observer G.R. Strode Instrument T-2 Theodolite Checked by R.L.P.

11—9503

OBSERVED STATION	Mean of direct and reversed readings	Reduction to initial	Sum (mean) reduction*	Corrected direction with zero initial	Adjusted direction*
	° ′ ″		″	° ′ ″	′ ″
Aomon "12"	0 00 00.00			0 00 00.00	
BL 2	[illegible]				
BL 2 +25	[illegible]				

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Form 25
Ed. Nov. 1946

COMPUTATION OF TRIANGLES

State: Marshall Is [illegible]

U. S. GOVERNMENT PRINTING OFFICE 16—50265-1

	STATION	OBSERVED ANGLE	SPHE. EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3			24 9886m	2 096 8704
	1 Bilgiri 2	[illegible]		765	0.326 7454
Legt Triangle	2 Aomon 12	[illegible]		453	9 993 5996
(Sea dist.)	3 BL 2+25	[illegible]		8.2 / 000	9 896 9563
	1-3	[illegible]			2 417 2154
	1-2			209 2050m	2 320 5721
	2-3			99 4890m	1 999 9522
	1 Bilgiri 2	[illegible]		529	0.398 7540
Check Triangle	2 Aomon 12	[illegible]		540	9 993 5964
	3 BL 2	[illegible]		3.1 / 000	9 921 8751
	1-3	[illegible]			2 392 3026
	1-2			209 2095m	2 320 5813
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

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DISTAN[illegible] STAKES [illegible] GAGE

STATION [illegible] TRAVERSE [illegible] OFFSETS

TO ESTABLISH OTHER [illegible]

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 589
Rev. April 1935

[redacted]

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COMPUTATION OF TRAVERSE GAMMA ~~BASE~~ LINE Aomon 2

(Azimuth 45)

SECTION	DATE	DIR. OF MEAS	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH: Tape Lengths	UNCORRECTED LENGTH: Meters	TEMP.	COR: Tension Meters	COR: Tape and Catenary Meters	REDUCTIONS: Set up Correction Meters	REDUCTIONS: Inclination Meters	REDUCTIONS: Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH Meters	ΔN mm	ΔE mm
Aomon ZERO Tower To																
4																

[redacted]

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U. S. COAST AND GEODETIC SURVEY
Form 588
Rev. April 1935

[redacted]

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COMPUTATION OF ~ TRAVERSE ~ GAMMA BASE LINE ~ BIJIRI I

Asmara Zero Tower – Asmara 12 = 600.0164m
Asmara 12 – Bijiri 6" = 209.2050m
Asmara Zero Tower – Bijiri 6" = 809.2214m

SECTION	DATE	DIR. OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH — Tape Lengths	UNCORRECTED LENGTH — Meters	TEMP.	COR — Temp. Meters	COR — Tape and Catenary Meters	REDUCTIONS — Set-up Set-back Meters	REDUCTIONS — Inclination Meters	REDUCTIONS — Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH Meters	DISTANCE — Meters	DISTANCE — Feet
F. Gam Bijiri 6 To										± 0.0014	(-)0.0004			49.04	809.	2191

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U. S. COAST AND GEODETIC SURVEY
Form 685

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ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	~~ELEVATION~~	MEAN ELEVATION	REMARKS
	Meters	~~Meters~~ feet	m	~~Meters~~	Meters	
Mark Aamon Zero Tower				Σ		
Bench Aamon Zero Tower		+2.244		0.0		
1		-0.566		0.3		
2		-0.906		0.9		
3		+0.026		0.9		
4		+0.129		0.9		
5		+0.632		1.5		
6		+0.066		1.6		
7		-0.220		1.3		
8		-0.313		1.4		
9		-0.410		1.5		
10		-0.274		1.5		
11		-0.912		1.2		
12		+0.424		1.3		
13		+0.156	-0.0	2.3		
		Σ	-0.0			
					Corr. R.X.P	
					+ R.X.C	

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Form 635

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ABSTRACT OF WYE LEVELS AND COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters		m	Meters	Meters	
Bissel "O"						
1	[illegible]	[illegible]	[illegible]			
2	[illegible]	[illegible]	[illegible]			
3	[illegible]	[illegible]	[illegible]			
4	[illegible]	[illegible]	[illegible]			
5	[illegible]	[illegible]	[illegible]			
6	[illegible]	[illegible]	0.2			
7	[illegible]	[illegible]	0.3			
8	[illegible]	[illegible]	0.4			
9	[illegible]	[illegible]	[illegible]			
10	[illegible]	[illegible]	[illegible]			
11	[illegible]	[illegible]	2.2			
			0.7			

SECRET

11—6184

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MEAN TEMPERATURE - Gamma Line Traverse

Points Birdied To				
				35.6 To stk #1'
1-2				34.9 to stk #2'
2-3				
3-4				34.6 to stk #4
4-5				
5-6				34.0 to stk #6'
6-7				
				33.8 to stk #8'
8-9				33.7 to stk #9'
9-10				
10-11				33.3 To stk #11

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MEAN TEMPERATURE ... Traverse

SECTION ... TOWER ...

Point.	Two Thermometers		
ANEMOMETER TOWER - 1			
1-2			
2-3			
3-4			
4-5			
5-6			65.2
		5	
6-7			66.6
		2	
7-8			
8-9			67.1
		5	
9-10			
10-11			65.6
		5	
11-12			64.2
		7	
12-13			63.4
		5	

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COMPUTATIONS OF THE [illegible] STATION

LINE [illegible]

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Form 8419
Rev. April 1938

[redacted]

COMPUTATION OF [redacted] BASE LINE TRAVERSE

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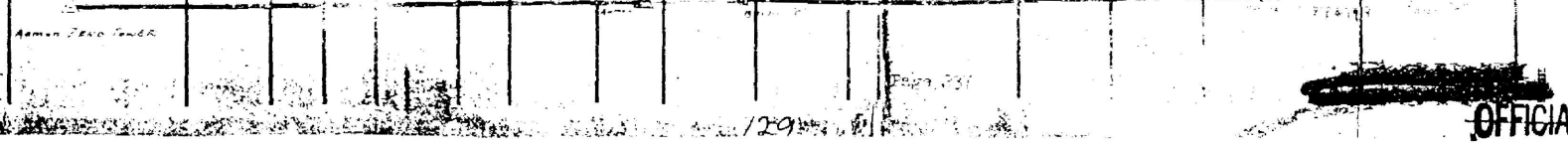
Field Book No.

SECTION	DATE	DIR. OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH		TEMP.	CORRECTIONS				REDUCED LENGTH	ADOPTED LENGTH	DISTANCE FROM
					Tape and Meters	Meters		Slope Meters	Tape and Meters	Slope Meters	Inclination Meters	Sea Level Meters	Meters	Meters	ADMON ZERO TOWER METERS
BENCH ADMON ZERO TOWER														



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U. S. COAST AND GEODETIC SURVEY
Form 635

ABSTRACT OF ~~W.Y. LEVELS~~
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	Meters	m	Meters	Meters	
Mark Aomon Zero Tower						
Bench Aomon Zero Tower						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 685

SECRET

ABSTRACT OF LEVELS AND COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	Meters	m.m.	Meters	Meters	
BIJIRI O						
1	50					
2	50					
3	50					
4	50					
5	50					
6	50					
7	50					
8	50					
9	50					
10	50					
11	50					

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Location of Structures on Runit Island from Zero Tower

STRUCTURE	DISTANCE FROM ZERO	AZIMUTH FROM ZERO
Blast Footing	1200 ft	323 08 00
" "	1500 ft	" " "
" "	1800 ft	" " "
" "	2100 ft	" " "
" "	2400 ft	" " "
" "	2700 ft	" " "
" "	3000 ft	" " "
" "	3300 ft	" " "
" "	3600 ft	" " "
" "	3900 ft	" " "
" "	4200 ft	" " "
Blast Building	8250 ft	" " "
Gamma Station A	2150 ft	323 19 31
" " B	3000 ft	" " "
" " C	5400 ft	" " "
Timing Station	2600 ft	323 31 02
Ion. Station	1000 ft	323 00 15
Winch Base	3400 ft	323 08 58
Tank Revetment	3100 ft	324 54 25

STRUCTURE	DISTANCE FROM ZERO	AZIMUTH FROM ZERO
Photo Tower	[illegible] ft.	117 47 20
Triang. Sta. North Base	[illegible]	110 58 50
Range Pole #1	[illegible]	316 44 28
" " #2 [illegible] from #1	[illegible]	Az. from #1 321 31 02
" " #3 [illegible]	[illegible]	" " " "

[redacted]

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[illegible] UNIT ISLAND

STRUCTURE	LATITUDE	LONGITUDE
Triangulation Station North Base	[illegible] 38 [illegible]	182 21 09.890
Triangulation Station Runit	[illegible] 38 [illegible]	182 22 01.621
Zero Tower	[illegible] 38 [illegible]	182 21 16.041
Photo Tower	[illegible] 38 [illegible]	182 21 11.202
Traverse Station Runit	[illegible] 38 [illegible]	182 21 43.761

[redacted]

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COMPUTATION OF HARTMAN LINE TRAVERSE

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U. S. COAST AND GEODETIC SURVEY
Form 529
Rev. April 1935

[redacted]

COMPUTATION OF TRAVERSE HARTMAN BASE LINE

(RUNIT ISLAND)

SECTION	DATE	DIR OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH: Tape Length	UNCORRECTED LENGTH: Meters	TEMP °C	COR-RECTIONS: Temp Meters	COR-RECTIONS: Tape and Catenary Meters	COR-RECTIONS: Set-up Set-back Meters	COR-RECTIONS: Inclination Meters	COR-RECTIONS: Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH Meters	∆Y mm	(yy) mm
Bench, RUNIT ZERO TOWER	1-26-48	F	927	3	4	200	22.8	+0.0077	-0.0101	+0.0176	-0.0027	--	[illegible]	[illegible]		
4 (A)	1-27-48	B	927	3	4	200	22.4	+0.0085	-0.0147	+0.0244	-0.0042	--	[illegible]			

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Form 589
Rev. April 1935

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COMPUTATION OF TRAVERSE HARTMAN BASE LINE

(RUNIT ISLAND)

Distance Runit Zero Tower to 4(A) = 200.0015 m

SECTION	DATE	DIR. OF MEAS	TAPE NO	TAPE SUPPORT	UNCORRECTED LENGTH Tape Lengths	UNCORRECTED LENGTH Meters	TEMP	CORRECTIONS Temp. Meters	Tape and Catenary Meters	Set-up Set-back Meters	Inclination Meters	Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH Meters	(+) Distance From Runit Zero T. Meters	(−)
4(A) To																
Stake No. 6	1 27 48	F	921	3	2	[illegible]	[illegible]	[illegible]	[illegible]0068	±0.0000	[illegible]	[illegible]	[illegible]	[illegible]	300.	0006
Stake No. [illegible]	[illegible] 48	F	921	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	±0.0000	[illegible]	—	[illegible]	[illegible]	[illegible]	9963
Stake No. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stake No. 28(B)	[illegible]	F	[illegible]	3	24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Stake No. 28(B)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			

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✓ by [illegible]

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 568
Rev. April 1932

[redacted]

COMPUTATION OF TRAVERSE HARTMAN ~~BASE~~ LINE (RUNIT ISLAND)

DISTANCES
RUNIT ZERO TOWER – 4(A) 200.0075 m'
4(A) TO 28(B) 1199.9485 m'
Σ 1399.9560 m'

SECTION	DATE	DIR. OF MEAS	TAPE NO	TAPE SUPPORT	UNCORRECTED LENGTH Tape Length	UNCORRECTED LENGTH Meters	TEMP °C	COR Temp Meters	COR Tape and Catenary Meters	COR Setup Setback Meters	COR Inclination Meters	COR Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH Meters	(x) DISTANCE FROM RUNIT ZERO TOWER Meters	(y) DISTANCE FROM RUNIT ZERO TOWER Meters
FROM 28(B) TO:																
STAKE No 41	[illegible]	A	42	[illegible]	[illegible]	[illegible]	28.4	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	1404.9435	[illegible]
STAKE No 42	[illegible]	[illegible]	42	[illegible]	[illegible]	[illegible]	28.4	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]

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U. S. COAST AND GEODETIC SURVEY
Form 635

ABSTRACT OF LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

(RUNIT I)

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	feet	mm	Meters m m	Meters	
28 (B)						
29	50	0.59				
30	50	1.79				
31	50	0.10				
32	50	0.48				
33	50	0.45	-0.2			
		Σ				

10 RC

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U. S. COAST AND GEODETIC SURVEY
Form 685

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ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

RUNIT 15

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters				Meters	
MARK RUNIT ZERO TOWER BENCH RUNIT ZERO TOWER	0		0			
1	50					
2	50					
3	50					
4 (A)	50		0			

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Department of Commerce
U. S. Coast and Geodetic Survey
Form 635

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LEVELS

COMPUTATION OF INCLINATION CORRECTIONS

(RUNIT I)

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	~~ELEVATION~~	MEAN ELEVATION	REMARKS
	Meters	~~Meters or~~ feet	mm	Meters mm	Meters	
4 (A)				Σ + Crns.		
5	50	+ 0 04	[illegible]	0 0		
6	50	- 0 62	[illegible]	0.4		
7	50	+ 1 04	[illegible]	1 4		
8	50	+ 0.44	[illegible]	[illegible] 6		
9	50	+ 0.54		[illegible] 9		
10	50	- 0.04	[illegible]	[illegible]		
11	50	[illegible] 0 40		2 [illegible]		
12	50	- [illegible] 6	[illegible]	3 2		
13	50	- 0 [illegible] 6	[illegible]	3 2		
14	50	- 0 [illegible] 0		3 2		
15	50	+ [illegible]. 38	[illegible]	5 0		
16	50	+ 0 79	[illegible]	5 6		
17	50	- 0.58	[illegible]	5 9		
18	50	+ 0.50	[illegible]	6 [illegible]		
19	50	+ 0.95	[illegible]	6.9		
20	50	+ 0.42	[illegible]	[illegible]		
21	50	- 0 18	[illegible]	[illegible]		
22	50	- 0 54		[illegible] 4		
23	50	- 0 [illegible]		[illegible] 9		
24	50	- 0 3[illegible]		8 [illegible]		
25	50	- 0. 40		[illegible]		
26	[illegible]	- 0 9[illegible]		[illegible] 9		
27	[illegible]	+ 0. 3[illegible]		9 [illegible]		
28 (B)	[illegible]	- 0. 34	[illegible]	9 [illegible]		
		[illegible]	[illegible]			

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MEAN TEMPERATURE COMPUTATIO

(RUNIT ISLAND)

HARTMAN LINE TRAVERSE

SECTION 4(A) – 28 (B) FORWARD MEAS

STAKE	FWD. Therm	Rear Therm	Σ	
4A-5	26.9			
5-6	27.0	26.6	53.6	
			10 3	Mean 26.8 To stake No 6
6-7	27.1	26	53.8	
			16 1	Mean 26 To stake No
7-8	27.1	26.5	53.6	
8-9	26.9	26	53.6	
			26 8 2	Mean 26 To stake No 9
9-10	27.1		54.1	
10-11	26.9		53.9	
			370.3	Mean 26 To stake No 11
11-12	27.1		54.2	
12-13	27.1	27.5	54.6	
			48 5	Mean To stake No 13
13-14	27.2		54.3	
			539 4	Mean 27 To stake No 14
14-15	27.0	27.5	54.5	
			593.9	Mean To stake No 15
15-16	27.1	27.2	54.3	
			648.2	Mean To stake No 16
16-17	27.0		54	
17-18	27.0		54.2	
			56.5	To stake No 18
18-19	26.9		53.9	
19-20	27.2		54.7	
			865	To stake No 20
20-21	27.1		54.3	
21-22	27.0		54.0	
			53.4	To stake No 22
22-23	27.1		54.1	
23-24	27.4		55.7	
			193	take No 24
24-25	27.7		55.4	
25-26	27.6		55.4	
			276	To stake No 26
26-27	27.9		55.9	
27-28(B)	27.4		55.4	
			309.5	To stake No. 28

SECRET

MEAN TEMPERATURE COMPUTATION (RUNIT I)

~HARTMAN LINE TRAVERSE~

SECTION 28(B) – 33 ~ FORWARD MEAS.

STAKE	FWD THERM	REAR THERM	Σ
28(B) - 29	28.0	8.9	56.9
29 - 30	27.8	8.5	56.3
30 - 31	28.0	8.0	56.5
		8.2	169.7 ÷ 3 = 56.6 To Stake No. 31
31 - 32	28.8	8.0	58.8
		8.2	228.5 ÷ 8 = 28.6 To Stake No. 32
32 - 33	29.0	8.1	60.1
			288.6 ÷ 10 = 28.9 To Stake No. 33

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COMPUTATION OF SETUPS, SETBACKS AND OFFSETS
FROM SHOTS OF THE HARTMAN LINE TRAVERSE
TO ESTABLISHMENT OF OTHER POINTS

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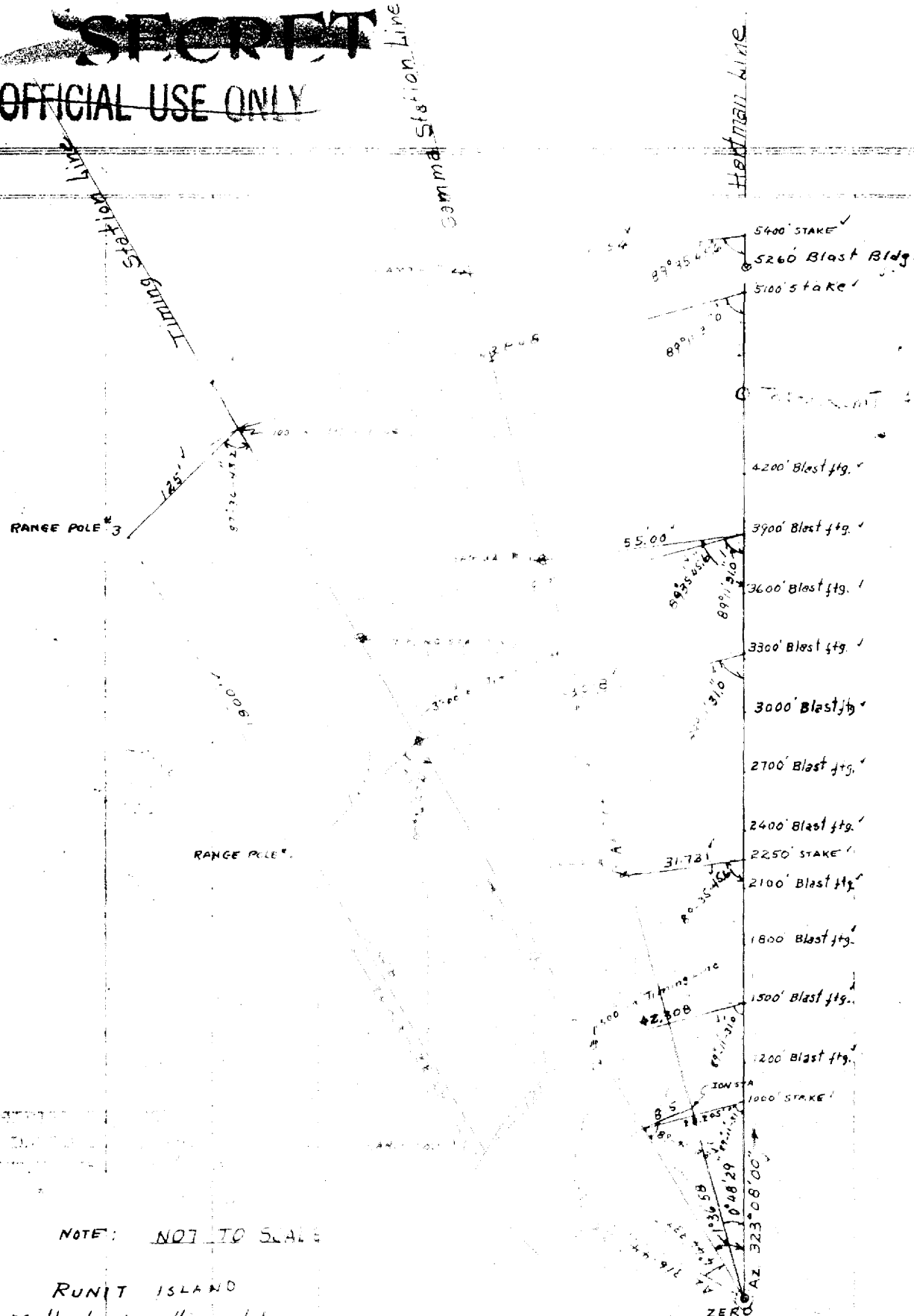

NOTE: NOT TO SCALE

RUNIT ISLAND
Method of setting stakes
by offset from
HARTMAN TRAVERSE LINE

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RUNIT I

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Computation "Set up" and "Set Backs" [illegible] of the HARTMAN LINE Traverse
To proper distances for establishment [illegible] points by Chord offsets.

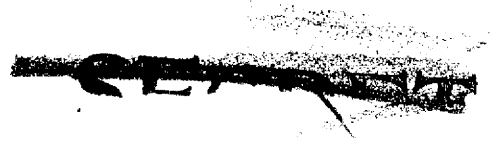
OBJECT TO BE ESTABLISHED	DIST. FROM ZERO TOWER Feet	Meters	BEST STAKE No.	DIST. PER CHORD OFFSET Feet	SET UP FROM CLOSEST STK. Ft.	SET BACK FROM CLOSEST STK. m	Ft.
Ionization Sta.	1000	[illegible]	[illegible]	[illegible]	[illegible] 748'	———	———
Hartman Sta. & Range Pole #1	1500	[illegible]	[illegible]	[illegible]	[illegible] 2.524'	———	———
Hartman Sta.	1800	[illegible]	[illegible]	[illegible]	———	3679'	4.488'
Hartman Sta.	2100	[illegible]	[illegible]	[illegible]	———	9.9199'	32.546'
Gamma A	2250	[illegible]	[illegible]	[illegible]	———	14.2225'	46.662'
Hartman Sta.	2400	[illegible]	[illegible]	[illegible]	———	18.4973'	60.687'
Hartman Sta.	2700	[illegible]	[illegible]	[illegible]	35.84'	———	———
Hartman Sta.	3000	[illegible]	[illegible]	[illegible]	37.224'	———	———
Hartman Sta. & Range Pole #2	3300	[illegible]	[illegible]	[illegible]	19.231'	———	———
Hartman Sta. TIMING STA.	3600	[illegible]	[illegible]	[illegible]	———	2.6915'	8.830'
GAMMA B	3900	[illegible]	[illegible]	[illegible]	———	11.2442'	36.890'
HARTMAN Sta.	4200	[illegible]	[illegible]	[illegible]	———	19.7868'	64.917'
Hartman Sta. & Range Pole #3	5100	[illegible]	[illegible]	[illegible]	4.894'	———	———
Gamma C	5400	[illegible]	[illegible]	[illegible]	———	4.0344'	13.236'
Hartman Sta.	1200	[illegible]	[illegible]	[illegible]	[illegible] 1720'	———	———

Blast Bldg ~ Set 10.88 [illegible] Range Pole #3 = 5260.0' from zero Tower [illegible] Blast Bldg [illegible] original location to the [illegible]

~~SECRET~~

[illegible] ANEV [illegible] 1/4 E

UNIT I



CHORD 4 For offset from HARTMAN LINE [illegible] to 3900' stake for Timing Station.

A = 1°36'58"

a: 110
b: 3900
c: 3900
2S: [illegible]
S: [illegible]

UNIT ZERO TOWER
a: Timing Sta stake.
b: Stake on Hartman Line

S-a	3845
S-b	55
S-c	55

log (S-a)	3.584 896
log (S-b)	1.740 362
log (S-c)	1.740 362
	7.065 621
log S	3.597 146
	3.468 475
log r	1.734 237

log r	1.734 237
log (S-a)	3.584 896
log tan ½A	8.149 34[illegible]
½A	0-4[illegible]
A	[illegible]

log r	1.734 237
log (S-b)	1.740 362
log tan ½B	9.99[illegible]
½B	44-[illegible]
B=C	89-[illegible]

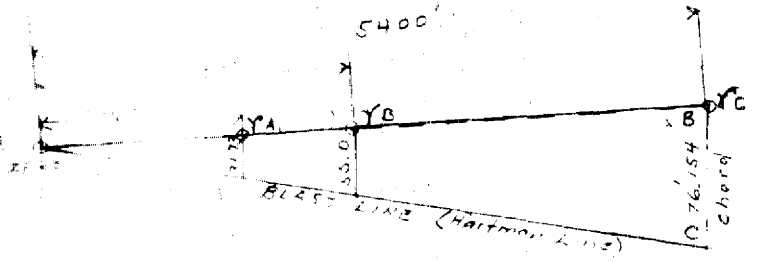
SECRET

RUNIT

~~SECRET~~ ~~OFFICIAL USE ONLY~~

CHORD ∠ + Distances for offsets from Hartman Line Traverse to GAMMA A, B, + C

B 3900 Stake for Gamma sta B"



a = 55.1
b = 3 [illegible]
c = 3900
2S = 7855
S = 3927.5

S-a = 3872.5
S-b = 27.5
S-c = 27.5

Log S-a = 3.587 [illegible]
" S-b = 1.439 [illegible]
" S-c = 1.439 [illegible]
Σ 6.466 [illegible]
Log S 3.594 [illegible]
2.872 [illegible]
Log r = 1.436 [illegible]

Tan ½ A = $\frac{r}{S-a}$

Log r = 1.436 [illegible]
Log S-a = 3.587 [illegible]
Log tan ½ A = 7.848 [illegible]
½ A = 0° - 24 [illegible]
A = 0° - 48 [illegible]

Log r = 1.436 [illegible]
Log S-b = 1.439 [illegible]
Log tan ½ B = 9.996 [illegible]
½ B = 44° - 4 [illegible]
B = C = 89 - 35 - 4 [illegible]

∠ A = 0° 48 - 28.9
∠ B = 89° - 35' - 45.6
∠ C = 89° - 35 - 45.6
180° 00 00

Δ = 6 Sin A = Chord dist ~ Blast line to Gamma
Sin A

Log 2.5C 3.352 1825
Log Sin A = 8.149 2893 ✓
Σ 1.501 4718
Log Sin B 9.999 9892
Log dist 1.501 4826
dist = 31.731 Ft. ✓ GAMMA "A"

Log 5400 3.732 3938
Log Sin A 8.149 2893
Σ 1.881 6831
Log Sin B 9.999 9892
Log Dist 1.881 6939
dist = 76.154 Ft. ✓ GAMMA "C"

(B + C may checked by similar Δ)

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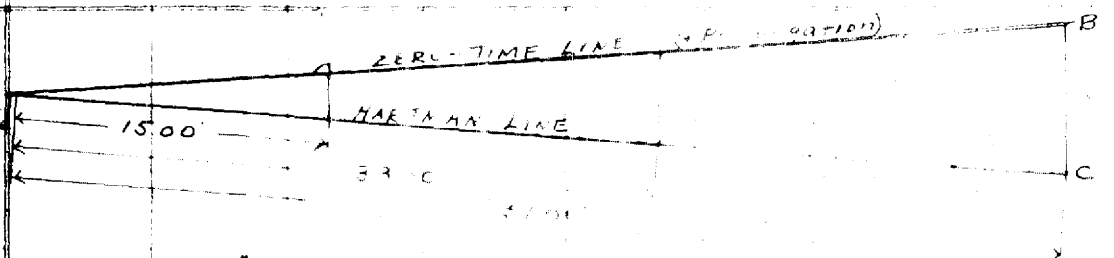
UNIT I

CHORD OFF SETS FROM Hartman Line To ... LINE (For use in setting Range Poles)

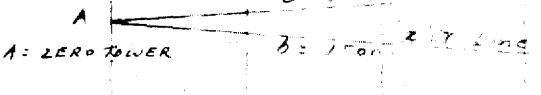


A = 1°-36'-58.0"
B = 89°-N'-31.0" } From ... Computation
C = 89°-N-31.0

$a = \frac{b \sin A}{\sin B}$ = Chord d ... to ... Line ...

Log 1500 =	3.176 0913	Log 3300 =	Log 5200 = 3.707 5702
Log Sin A =	8.450 2910	Log Sin A = 8.450 2910	Log Sin A = 8.450 2910
Σ	1.626 38[illegible]		Σ 2.1578612
Log Sin B	9.999 9568	Log Sin 89° [illegible]	Log Sin B 9.999 9568
Log dist =	1.626 42[illegible]	Log dist = [illegible]	Log dist 2.157 9044
Dist =	42.308 Feet	93.078 Feet	Dist = 143.848 Feet

(Distance ... Chord ... A)



... pole No. ...

a =	125.0	[illegible]	
b =	1500.0	[illegible]	62.5
c =	1500.0		62.5
2S =	3125.0		
S =	1562.5		

Log (S-a) =	3.157 60[illegible]	[illegible]	Log r = 1.777 7740
Log (S-b) =	1.795 88[illegible]	Log (S-c) = 3.1[illegible]	Log (S-b) = 1.795 8800
Log (S-c) =	1.795 8800	Log tan ½ B [illegible]	Log tan ½ B 9.981 8940
Σ	6.749 34[illegible]	½ B = [illegible]	½ B = 43°-48-21.6
Log S =	3.193 8200	A = [illegible]	B = 87°-36-43.2
	3.555 5[illegible]		C = 87° 36 43.2
Log r =	1.777 7[illegible]40		A = 04° 46' 33.7
			Σ 180° 00' 00.1

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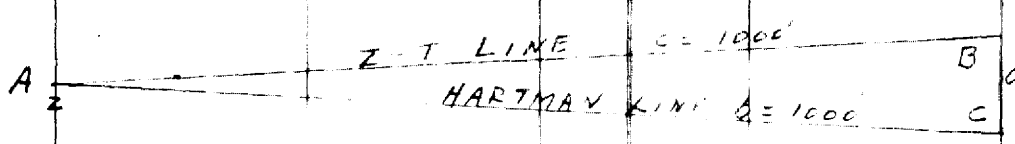
CHORD L + Dist. from 1000' pt on HARTMAN LINE TRAVERSE To 1000' point on Zero-Timing station Line

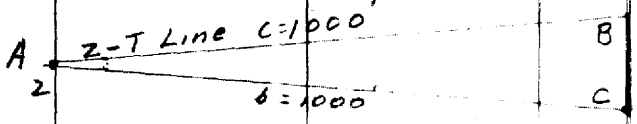


A = 1°-36'-58.0"
B = 89°-11'-31.0" > From previous computation
C = 89°-11'-31.0"

$a = \frac{b \sin A}{\sin B}$ Chord dist Hartman Line to Timo Line

Log 1000 = 3.000 0000
Log Sin A = 8.450 2910
Σ = 1.450 2910
Log Sin B = 9.999 9568
Log Dist = 1.450 3342
Dist = 28.205' (Checked by Similar Δ

CHORD L + Dist From 1000' point on Zero-Timing stn Line to 1000' stake for Ionization Structure.



a = 8.5 s-a 995.75
b = 1000.0 s-b = 4.25
C = 1000.0 s-c = 4.25
2S = 2008.5
S = 1004.25

Log (s-a) = 2.998 1503
Log (s-b) = 0.628 3889
Log (s-c) = 0.628 3889
Σ 4.254 928
Log S = 3.001 844
1.253 0816
Log r = 0.626 5432

Log r = 0.626 5432
Log (s-a) 2.998 1503
Log tan ½A 7.628 3929
½A 0°-14'-36.63
A 0°-29'-13.3

Log r = 0.626 5432
Log (s-b) = 0.628 3889
Log tan ½B = 9.998 1543
½B = 44-52-41.72
B = 89-45-23.4
C = 89-45-23.4
A = 0-29-13.3
180 00 00.1

Chord dist is Computed to Center of Face of 7'x7' structure nearest Zero Tower

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Form 665
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TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

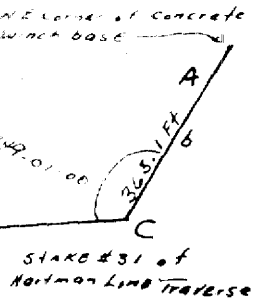
$\left[\frac{a}{b} = \tan(45° + \phi)\right.$ (Call longer side a) $\tan \frac{1}{2}(A_p - B_p) = \tan \phi \tan \frac{1}{2}(A_p + B_p)$; $\left. c = \frac{a \sin C_p}{\sin A_p}\right]$*

C_s		Log a	Log m
$\frac{\text{Sph. excess}}{3}$		Log b	Log sin C_s
C_p	149 01 00	Log tan $\frac{1}{2}(A_p + B_p)$	Log a
$\frac{1}{2} C_p$	74 30 30	$\frac{1}{2}(A_p + B_p)$	Log b
$90° - \frac{1}{2} C_p = \frac{1}{2}(A_p + B_p)$	15 29 30	ϕ	Log sph. ex.
$\frac{1}{2}(A_p - B_p)$	13 30 28.56	Log tan ϕ	Sph. excess 0.0
Sum $= A_p$	28 59 58.56	Log tan $\frac{1}{2}(A_p + B_p)$	
Diff $= B_p$	01 59 01.74	Log tan $\frac{1}{2}(A_p - B_p)$	
C_p	149 01 00		
	180 00 00		

Log a 3.706 2995
Log sin C_p 9.711 6290
Colog sin A_p 0.314 4354
Log c 3.732 3639

c = 5399.65 Ft

(Sketch)



CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				3.732 3639
	1 C			149 01 00	0.288 3710
	2 B			01 59 01.74	8.539 2920
	3 A			28 59 58.26	9.685 5647
	1-3			63.1	2.560 0269
	1-2			5085.1	3.706 2996
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

*The subscripts s and p on this form refer to spherical and plane angles respectively

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COMPUTATION FOR DETERMINING DISTANCE AND AZIMUTH

BETWEEN ZERO TOWER AND PHOTO TOWER

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U. S. COAST AND GEODETIC SURVEY
Form 665
Ed. Dec. 1929

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RUN I

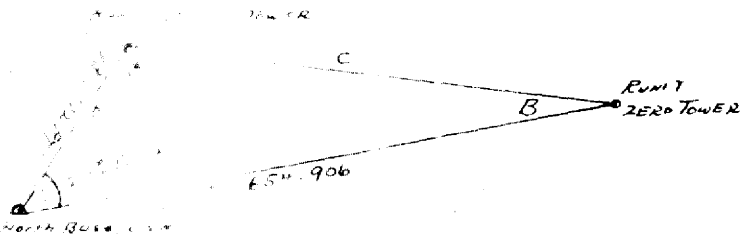
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Call longer side a) $\tan\phi=\tan\frac{1}{2}(A_p+B_p)\tan\frac{1}{2}(A_p-B_p)$: $\left.c=\frac{a\sin C_p}{\sin A_p}\right]$*

C_s	Log		Log m
$\frac{\text{Sph. excess}}{3}$	Log	8237	Log sin C_s
C_p	Log tan 45	10 00000	Log a
$\frac{1}{2}C_p$	ϕ	24 82	Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p-B_p)$		24 82	Log sph. ex.
$\frac{1}{2}(A_p-B_p)$		8 60	Sph. excess
Sum $=A_p$			
Diff $=B_p$			
C_p		(Sketch)	

Log a	2.816 1790
Log sin C_p	9.689 5524
Colog sin A_p	0.229 7860
Log c	2.735 4514

$C = 543.82$ Ft



CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3				2.735 4514
	1	C		25° 247	0 310 4841
	2	A		48 29 0537	9 770 2435
	3	B		66 49 2953	9 073 8891
	1-3			65° 906	2.816 1790
	1-2			90 000	2 119 8246
	2-3				
	1				
	2			RUN I ZERO TOWER	
	3				
	1-3				
	1-2				

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*The subscripts s and p in the formulas refer to spherical and plane angles respectively

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COMPUTATION OF TRAVERSE BETWEEN TRIANGULATION STATION NORTH BASE AND PHOTO TOWER

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 568
Rev. April 1935

[redacted] COMPUTATION OF TRAVERSE BASE LINE

(RUNIT ISLAND)

SECTION	DATE	DIR OF MEAS	TAPE NO	TAPE SUPPORT	UNCORRECTED LENGTH		TEMP	FOR		REDUCTIONS			REDUCED LENGTH	ADOPTED LENGTH		
					Tape Lengths	Meters		Temp.	Tape and Catenary	Sag or Set back	Inclination	Sea level				
								Meters	Meters	Meters	Meters	Meters	Meters	Meters	mm	mm
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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U. S. COAST AND GEODETIC SURVEY
Form 635

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ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	[redacted] feet	mm	Meters	Meters	
Mark N. Base, U S N.						
Bench N. Base, U S N	0 "	+ 1.348 "	c			
/	50 "	- 0.31[illegible] "	c			
Bench Runit Photo Tower	" 83.[illegible]	c 00[illegible] "	c			
Mark Runit Photo Tower	0 "	398 "	c			
		Σ	c			

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COMPUTATION OF TRAVERSE BETWEEN TRIANGULATION STATION NORTH BASE AND ZERO TOWER

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 599
Rev. April 1938

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COMPUTATION OF N Base. USN – Run 1 ZERO Temp TRAVERSE [redacted] BASE LINE

(RUNIT 8)

SECTION	DATE	DIR. OF MEAS.	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH		TEMP	COR		RECTIONS			REDUCED LENGTH	ADOPTED LENGTH	(v)	(vv)
					Tape Length	Meters		Temp	Tape and Catenary	Set-up Set-back	Inclination	Sea level				
							°C	Meters	Meters	Meters	Meters	Meters	Meters	Meters	mm	mm
Base N Base USN 4444	2-1-48	F	921	3	4	2[illegible]	28.1	+0.0001	-0.0101	+0.0233	-0.0014		199.6155	199.6156		
To Base Run 1 ZERO Temp		F	366	2	-	-	28.4	+0.0000	+0.0000	-0.3940						
							28.1	+0.0009	-0.0136	+0.0233	-0.0014					

[redacted]

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U. S. COAST AND GEODETIC SURVEY
Form 686

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ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

(RUNIT I)

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	Meters or feet	cm	Meters	Meters	
Mark N. Base, USN						
Bench N. Base, USN	0	+1.347	0.0			
1	50	+0.517	0.3			
2	50	+0.151	0.2			
3	50	+0.545	0.3			
4	50	+0.846	0.4			
Bench RUNIT ZERO	0.3940	-3.014	0.0			
Mark RUNIT ZERO	0	-1.870	0.0			
		Σ	1.4			

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[redacted]

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COMPUTATION FOR DETERMINING TANK REVETMENT LOCATION

[redacted]

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U. S. COAST AND GEODETIC SURVEY
Form 589
Rev. April 1935

[redacted]

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COMPUTATION OF 28(B) to SHL #5 Portion of 28(B) Tr. (E) Sec. 11 BASE LINE

For comp. of Pos. of Tank Treatment, Unit I.

SECTION	DATE	DIR. OF MEAS	TAPE NO.	TAPE SUPPORT	UNCORRECTED LENGTH: Tape Lengths	UNCORRECTED LENGTH: Meters	TEMP.	COR: Temp. Meters	COR: Tape and Catenary Meters	REDUCTIONS: Set-up Set-back Meters	REDUCTIONS: Inclination Meters	REDUCTIONS: Sea level Meters	REDUCED LENGTH Meters	ADOPTED LENGTH Meters	(x) mm	(yy) mm
28(B) To																
State No 5	7-28-48	E	92		5				-.126					250.013		
														1821.384		

[redacted]

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U. S. COAST AND GEODETIC SURVEY
Form 685

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ABSTRACT OF WYE LEVELS
AND
COMPUTATION OF INCLINATION CORRECTIONS

POINT	DISTANCE	MEAN DIFFERENCE OF ELEVATION	INCLINATION CORRECTION	ELEVATION	MEAN ELEVATION	REMARKS
	Meters	*Meters or feet*	*mm.*	*Meters*	*Meters*	
28 (13)						
1	50 "	−0.25 "	00 "			
2	50 "	−1 60 "	2.4 "			
3	50 "	−0 35 "	0 "			
4	50 "	−0 60 "	0.9 "			
5	50 "	+0 22 "	0 0 "			
			28			

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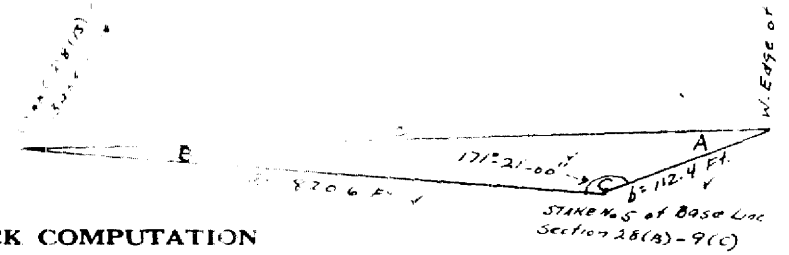
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Call longer side a) $\tan\frac{1}{2}(A_p-B_p)=\tan\phi\tan\frac{1}{2}(A_p+B_p)$: $\left.c=\frac{a\sin C_p}{\sin A_p}\right]^*$

C_s		Log a	4 3315	Log m	
Sph. excess / 3		Log b	7663	Log sin C_s	
C_p	171 21 00	Log tan 45 c	9.365 2	Log a	
$\frac{1}{2}C_p$	85 40 30	$(45°+\phi)$	2 02 03	Log b	
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p+B_p)$	04 19 30	ϕ	2 02 03	Log sph. ex.	
$\frac{1}{2}(A_p-B_p)$	03 17 04 01	Log tan ϕ	9.880 2943	Sph. excess	—
Sum $=A_p$	07 36 28 03	Log tan $\frac{1}{2}(A_p+B_p)$	9.472 6895		
Diff $=B_p$	01 02 24 97	Log tan $\frac{1}{2}(A_p-B_p)$	8.358 9638		
C_p	171 21 00		(Sketch)		
	180 00 00 03				

Log a	2.914	1315
Log sin C_p	9.177	2425
Colog sin A_p	0.877	9856
Log c	2.969	3576



$C = 931.88$ Ft.

CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3			93.9 Ft	2.969 3576
	1 C			171 21 00	0.822 7575
	2 B			01 02 21.97	8.258 6513
	3 A			07 36 38.03	9.122 0164
	1-3				2 050 7664
	1-2				2 914 1315
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				

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Form 665
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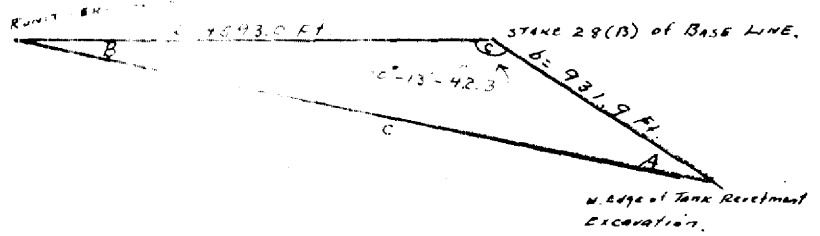
TRIANGLE COMPUTATION USING TWO SIDES AND INCLUDED ANGLE

$\left[\frac{a}{b}=\tan(45°+\phi)\right.$ (Cot. half incl. angle a) $\tan \phi = \cot \frac{1}{2}(A_p+B_p)\tan \frac{1}{2}(A_p+B_p)$; $\left. c=\frac{a \sin C_p}{\sin A_p}\right]^*$

C_p		Log	Log m
$\frac{\text{Sph. excess}}{3}$		Log	Log sin C_s
C_p		Log tan	Log a
$\frac{1}{2}C_p$			Log b
$90°-\frac{1}{2}C_p=\frac{1}{2}(A_p-B_p)$			Log sph. ex.
$\frac{1}{2}(A_p-B_p)$		Log tan	Sph. excess —
Sum $=A_p$		Log sin B_1	
Diff $=B_p$		Log sin B_1	
C_p			

(Sketch)

* Taken from previous comp.

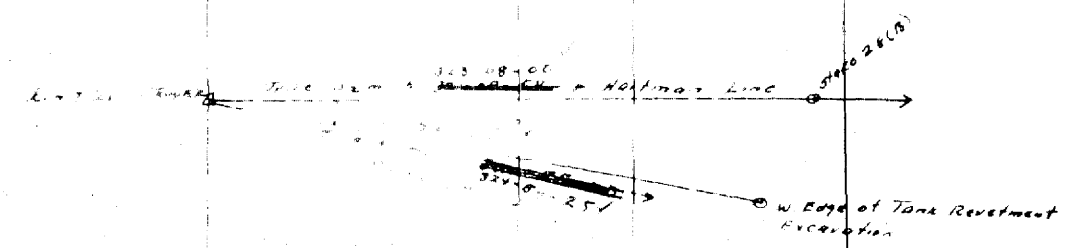


Log a	3.622 0964
Log sin C_p	9.229
Colog sin A_p	0.856
Log c	3.708

C = 5109.7 Ft

CHECK COMPUTATION

No.	STATION	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3			5109.7 Ft.	3.708 3927
	1 C			170 13 42.3	0.770 2651
	2 A			59 52 21	9.143 4386
	3 B			01 46 25.49	8.490 6997
	1-3				3.622 0964
	1-2				2.969 3575
	2-3				
	1				
	2				
	3				
	1-3				
	1-2				



*The subscripts s and p in this form refer to spherical and plane angles respectively.

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