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R

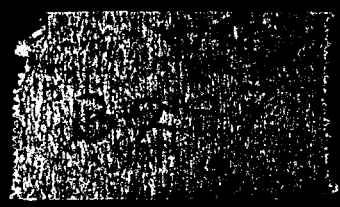
1951-1952 HORIZONTAL CONTROL SURVEY
1955 EXPANSION
ENIWETOK ATOLL

6

20022/

MARCH 1st

J/S No 4



FOR DESCRIPTIONS, RECOVERIES & TAPE CERTIFICATES, SEE J/S 4.

HORIZONTAL CONTROL

The horizontal control scheme has been expanded until it now includes the entire Atoll. It consists of a primary network of second order triangulation supplemented with third order stations at locations of lesser importance. The few remaining islands which have not been included in the scheme can be located by single triangles from existing controls.

PREVIOUS SURVEYS

Some features of previous surveys were utilized in establishing the scheme. The earliest survey from which records are available was completed in 1944 by the U.S.S. BOWDITCH to control the hydrographic mapping of the Atoll. As this survey was of third order accuracy and most of the stations were not on project islands it was not adaptable to requirements of this project. However, the geographic position of station North Base on Runit Island and the azimuth of the line North Base-Sand became the origin of position and azimuth for the later surveys.

A survey was completed in 1947-48 by the JOINT TASK FORCE SEVEN consisting of a limited scheme covering the eastern portion of the Atoll. The scheme was stated to be of first order accuracy but it was only because of its limited extent that it could be considered of such high order. As the south end of the original base line had been destroyed a new base line, North Base-Runit, was established and the azimuth of the line was computed from its relation to the line North Base-Sand. Expansion of this scheme involved re-occupation of all of its existing stations and it became obvious that

to meet project requirements, a substantially new and stronger scheme was necessary which could be expanded as required.

1949-50 HORIZONTAL CONTROL SURVEY

This survey was designed to meet the requirements of Operation Greenhouse and adaptable to future expansion. It consisted of sixteen stations covering the Eastern portion of the Atoll from Bogallua island to Eniwetok island and included five stations of the previous surveys. As it was determined that Station North Base had been disturbed it was necessary to measure a new base line North Base #2-Runit to second order accuracy. The network expanding from this base line was executed to second order specifications and procedure of the U. S. Coast and Geodetic Survey. The geographical position of Station Runit and the azimuth of the line Runit-Coral, as determined by the previous survey, were adopted as the origin of position and azimuth.

1951 EXPANSION

An expansion of the survey was necessary to meet additional requirements which could not be anticipated earlier. Several additional islands were located by local triangulation and photo tower and zero locations were determined. Local control traverses were established on all project islands. The accuracy of these controls depended on their uses and were generally of third order. The zero lines and some traverses for location of instrumentation were established to first order traverse specifications.

An independent plane coordinate grid was established at each of the zero areas for location of instrumentation. While satisfactory results were obtained it brought out the desirability for an overall Atoll grid.

1952 EXPANSION AND ADJUSTMENT

Requirements for Operation Ivy resulted in the expansion of the scheme to include the entire Atoll. Some stations of the earlier surveys had been destroyed and additional stations were required. Fifteen stations were established, replaced or more precise values determined. As the expansion permitted closing the survey around the Atoll to the Runit base line a check on the previous work was obtained. The closing error of the survey before adjustment was determined as approximately 1:25000. An additional check was obtained by inclusion of the zero line traverse in the Flora-Gene area. This indicated a closing error of approximately 1:70000 before adjustment of the adjacent quadrangle. In order that the values of a station would remain the same independent of the direction of computation through the net an adjustment has been applied to the triangulation figures. This consists of a side equation adjustment which resulted in slight changes in the values previously reported but of little consequence in computations made to date.

PLANE COORDINATE SYSTEM (IVY GRID)

A plane coordinate system has been established which is common to all stations. The origin of coordinates is a plane through triangulation Station Coral with assumed values of N 100,000. East 100,000, at this station. A true meridian through this station was used as the basis of bearings and was determined by computing through the base expansion figure from the adopted azimuth of the Runit base line. The horizontal control network as it now exists should meet

all future requirements with a minimum of field work. Sufficient controls are available to replace destroyed stations and establish required new stations. A new station can be located by forming a strong triangle with any two of the adjusted primary stations.

PRECISE ALIGNMENT

An unusual feature of the survey program was the alignment requirement of the 203 series stations. This included measurement of a zero line to a linear tolerance of not to exceed 1:25000 and establishing a 9000 foot line of sight to a tolerance of plus or minus one quarter inch. Vertical control for this alignment was accomplished by establishing a series of bench marks by precise differential leveling and applying a correction for curvature of the earth. Horizontal control stations were established by night operations with precise equipment and procedures developed to produce the required accuracy. The alignment of the stations was accomplished by offset measurements from these controls to a pre-established working point on each station.

LIST OF HORIZONTAL CONTROL STATIONS - OCTOBER 1952

ISLAND	IVY CODE	STA. NAME	ORDER	REMARKS
Bogallua	Alice	Boga #1	2nd	Destroyed 1951
"	"	Boga #2 - RM-1	2nd	
Bogombogo	Belle	Bogom	3rd	
Ruchi	Clara	Ruchi	"	
Cochiti	Daisy	Cochiti	"	Traverse Sta.
Santildefenso	Edna	Santil	"	" "
Elugelab	Flora	RP-X	2nd	
Teiteirpuuchi	Gene	Teiteir	"	
Bogairikk	Helen	--	-	None
Bogon	Irene	Bogon	3rd	
"	"	RP-Y	2nd	
W. of Engebi	Noah	Noah	3rd	Traverse Sta.
Engebi	Janet	Engebi (Elgin)	2nd	Re-estab JTF-7 Sta.
Muzinbaarikku	Kate	Muzin Pl #1	3rd	
Kirinian	Lucy	Kirinian	"	
Bokonaarappu	Mary	Bokon	2nd	
Yeiri	Nancy	Yeiri	3rd	
Aitsu	Olive	Aitsu	"	
Rujoru	Pearl	Rujoru	"	
Eberiru	Ruby	V Zero	2nd	Destroyed 1951
Aomon	Sally	Aomon	"	Re-estab JTF-7 Sta.
Biijiri	Tilda	Biijiri	3rd	Traverse Sta.
Rojoa	Ursula	Jake	"	" "
Aaraanbiru	Vera	Lucy	"	

LIST OF HORIZONTAL CONTROL STATIONS CONTINUED

ISLAND	IVY CODE	STA. NAME	ORDER	REMARKS
Piiraai	Wilma	Piiraai	2nd	
Runit	Yvonne	H.Base #2	"	Destroyed 1951
"	"	" #3	"	
"	"	Runit	"	Adopted JTF-7 Sta.
So. of Runit	Zona	Loc. M	"	Traverse Sta.
" "	--	Reef	"	
" "	--	Islet	"	
Lagoon				
" Photo Tower	Mack	Photo	"	Re-estab JTF-7 Sta.
" Tri. Sta.	Oscar	Coral	"	" " "
" " "	--	Pinnacle	"	Destroyed 1951
Chinieero	Alvin	--		None
Aniyaanii	Bruce	Aniyaanii (Kodak)	"	Re-estab JTF-7 Sta.
Chinimi	Clyde	--		None
Jieroru	--	Lilac	3rd	Re-estab Bowditch Sta.
Japtan	David	Japtan		
Parry	Elmer	Parry	2nd	Destroyed 1951
"	"	Ivy	"	
Eniwetok	Fred	Eniwetok (Privilege)	"	Re-estab Bowditch Sta.
Igurin	Glen	Lantana		USS BOWDITCH Sta.
Mui	Henry	--	-	None
Pokon	Irwin	--	-	"
Ribaion	James	--	-	"
Giriinien	Keith	--	-	"
Rigili	Leroy	Rigili #1	3rd	Destroyed 1951
"	"	" #2	2nd	

VERTICAL CONTROL

There has been no requirement for an overall vertical control network and such a network would involve extensive observations over a considerable period of time. Bench marks for vertical control have been established independently at each of the project areas from tidal observations and the accuracy is considered consistent with project requirements. A check was obtained of the datum established by this method at Eniwetok island when a tide gage was operated at this location for several months during Operation Greenhouse by the U. S. Coast and Geodetic Survey. A differential of 0.14 foot was determined which would be of no consequence in the tidal relation to project structures.

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J/S ENGINEERING CORRESPONDENCE AND REPORTS

Folder Title 1951-1952 ~~Horizontal~~ Control Survey
1955 Expansion Eniwetok Atoll March 1st J/S No. 4.

Box No.

199679 (#1089) A16429 326-65AG170

STATIONS	COORDINATES	
	NORTH	EAST
AITSU	134,162.9	105,130.1
AOMON	129,741.5	113,980.0
BOGA #2	136,932.8	92,601.6
CORAL	100,000.0	100,000.0
ENGEBI	146,827.9	88,506.2
ENIWETOK	38,618.3	124,250.7
IVY	82,534.1	132,481.9
JAPTAN	89,804.8	136,874.9
LILAC	89,482.0	131,019.3
N. BABE #3	106,364.6	125,755.9
PIIRAAI	119,601.0	117,354.5
RIGILI #2	71,860.6	32,190.0
RP-X	147,658.8	87,475.1
RP-Y	150,320.6	76,704.7
RUCHI	143,872.6	61,078.6
RUJORU	132,714.7	107,327.3
RUNIT	99,883.5	126,697.5
SAND	87,781.7	139,398.3
TEITEIR	148,250.6	76,998.3
YEIRI	138,047.8	100,867.0

LEGEND

A TRUE MERIDIAN THROUGH STATION CORAL WAS USED AS THE BASIS OF BEARINGS.

THE ORIGIN OF PLANE COORDINATES (N100,000 E100,000) WAS TAKEN AT STATION CORAL

EXISTING

SECOND ORDER

THIRD ORDER

THIRD ORDER STATION

ENIWETOK ATOLL, M.I.
PLANE COORDINATES, IVY GRID
952 EXPANSION OF HORIZONTAL CONTROL
SCALE 1:100,000

U.S. ATOMIC ENERGY COMMISSION
SANTA FE OPERATIONS OFFICE

HOLMES & NARVER
INCORPORATED
ENGINEERS—CONSTRUCTORS
820 S. Figueroa St., Los Angeles 17, Calif.

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Folder Title 1951-1952 ~~H~~orizontal Control Survey
1955 Expansion Eniwetok Atoll March 1st J/S No. 4.

Box No.

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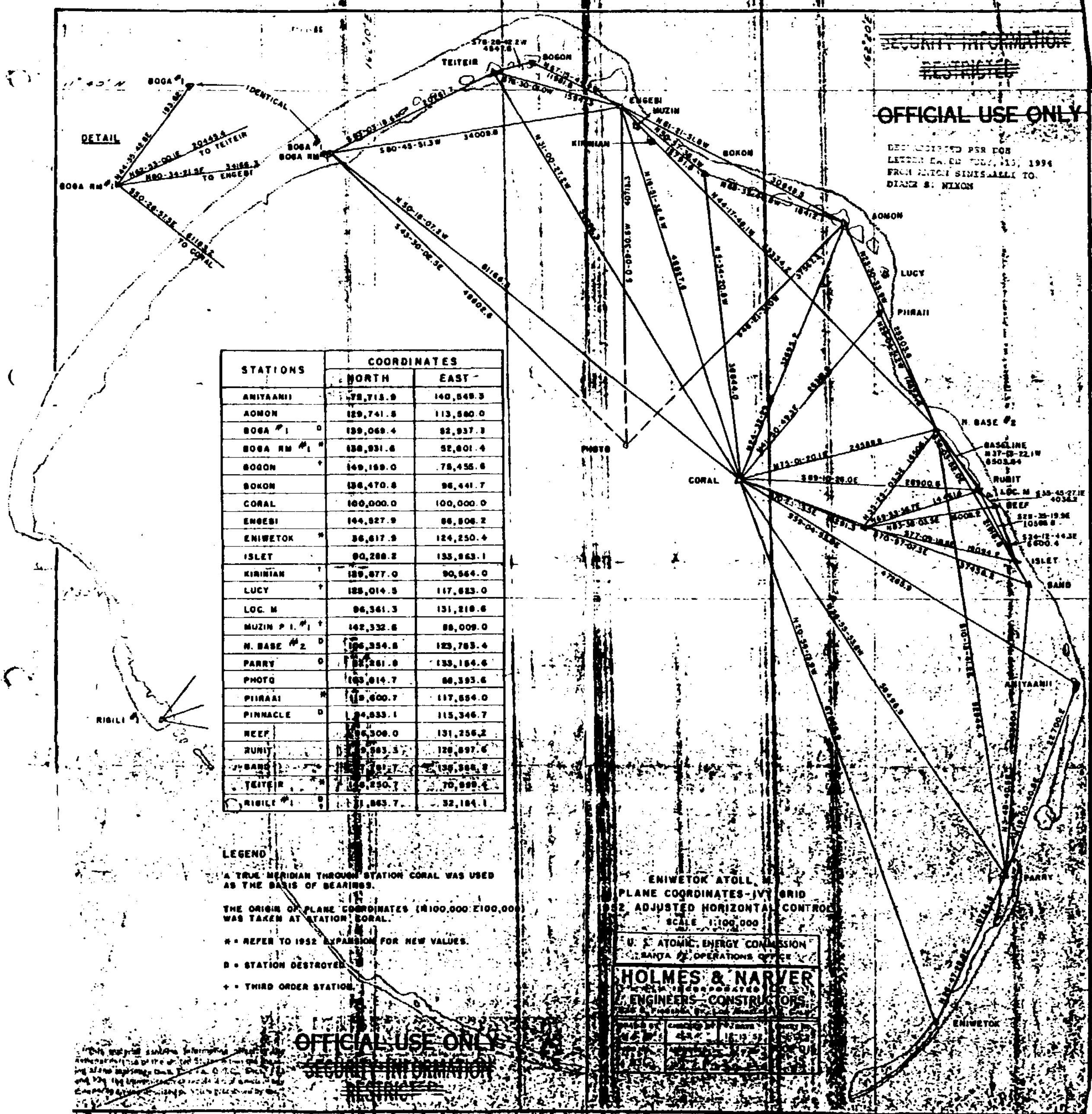

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LETTER DATED JULY 13, 1994
FROM ... TO
DIANE S. NIXON

STATIONS		COORDINATES NORTH	COORDINATES EAST
ANITAANII		78,715.9	140,549.3
AOMON		129,741.5	113,580.0
BOGA #1	D	139,069.4	52,937.3
BOGA RM #1	*	138,931.6	52,601.4
BOGON	+	149,169.0	78,455.6
BOKON		136,470.8	96,441.7
CORAL		100,000.0	100,000.0
ENGEBI		144,827.9	86,806.2
ENIWETOK	*	36,617.9	124,250.4
ISLET		90,288.2	135,863.1
KIRINIAN	+	139,877.0	90,564.0
LUCY	+	128,014.5	117,623.0
LOC. M		96,361.3	131,218.6
MUZIN P.I. #1	+	142,332.6	88,009.0
N. BASE #2	D	106,354.8	123,783.4
PARRY	D	[illegible],261.8	133,164.6
PHOTO		103,014.7	80,393.6
PIIRAAI	*	119,600.7	117,654.0
PINNACLE	D	[illegible]4,833.1	115,346.7
REEF		[illegible]6,308.0	131,256.2
RUNIT		[illegible]9,983.5	120,897.6
SAND		[illegible]	135,368.8
TEITEIR	*	1[illegible]6,250.7	70,889.4
RIGILI #1	D	[illegible]1,863.7	32,184.1

LEGEND

A TRUE MERIDIAN THROUGH STATION CORAL WAS USED AS THE BASIS OF BEARINGS.

THE ORIGIN OF PLANE COORDINATES (N100,000 E100,000) WAS TAKEN AT STATION CORAL.

* = REFER TO 1952 EXPANSION FOR NEW VALUES.

D = STATION DESTROYED.

+ = THIRD ORDER STATION.

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ENIWETOK ATOLL, M.I.
PLANE COORDINATES-IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL
SCALE 1:100,000

U. S. ATOMIC ENERGY COMMISSION
SANTA FE OPERATIONS OFFICE

HOLMES & NARVER
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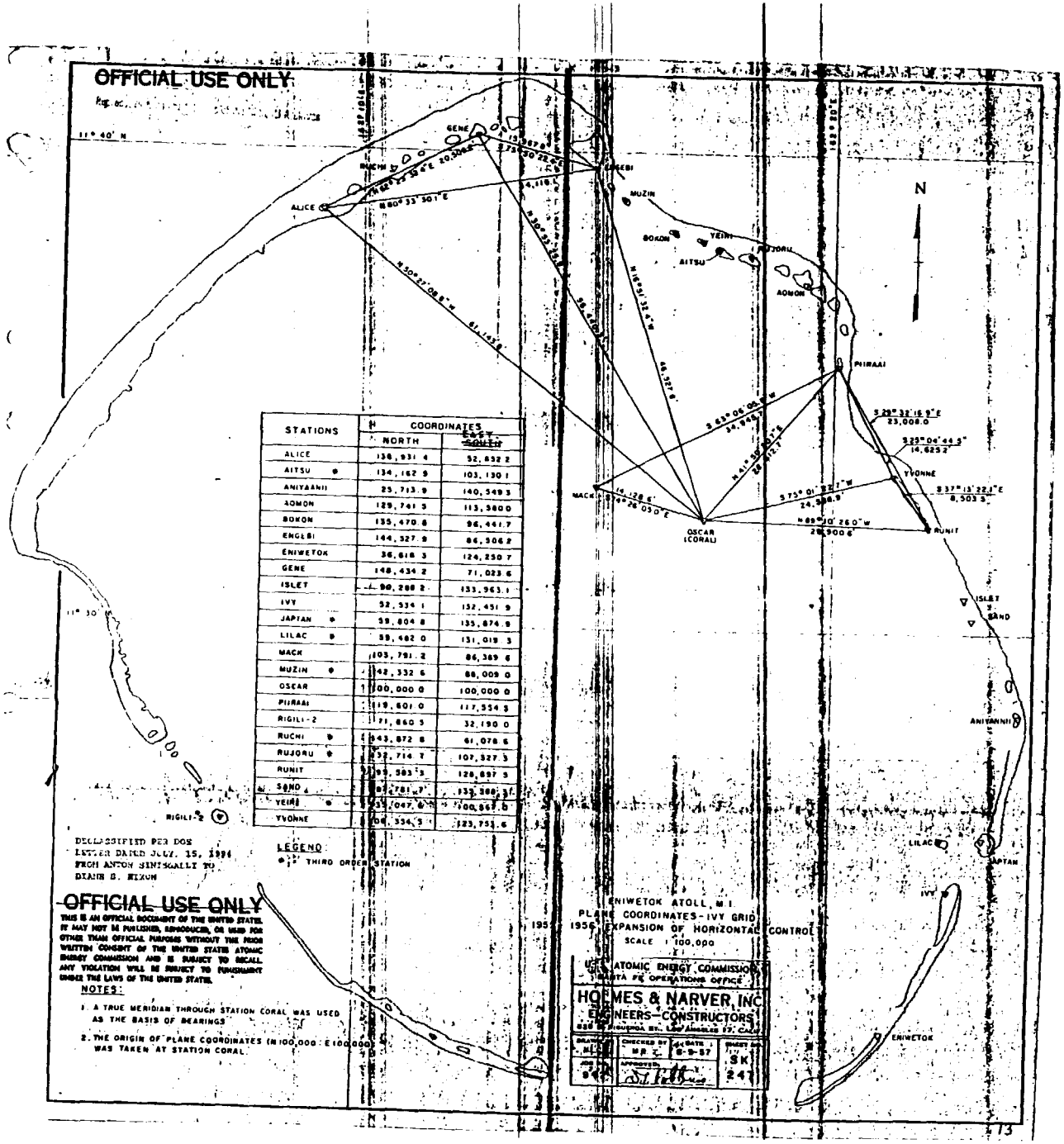
Box No.

199679 (#1089) A16429 326-65AG170

405220 p. 13



STATIONS	COORDINATES	
	NORTH	EAST ~~SOUTH~~
ALICE	138,931 4	52,852 2
AITSU ⊕	134,162 9	103,130 1
ANIYAANII	25,713 9	140,549 3
AOMON	129,741 3	113,580 0
BOKON	135,470 8	96,461 7
ENGEBI	144,327 9	86,306 2
ENIWETOK	36,818 3	124,250 7
GENE	148,434 2	71,023 6
ISLET	90,288 2	153,963 1
IVY	32,534 1	152,451 9
JAPTAN ⊕	59,804 8	135,874 9
LILAC ⊕	88,482 0	131,018 3
MACK	103,791 2	86,389 6
MUZIN ⊕	142,332 6	88,009 0
OSCAR	100,000 0	100,000 0
PIIRAAI	119,601 0	117,534 3
RIGILI-2	71,860 3	32,190 0
RUCHI ⊕	143,872 8	61,078 6
RUJORU ⊕	132,714 7	107,327 3
RUNIT	99,583 3	128,897 3
SAND	88,781 7	135,388 3
YEIRI ⊕	135,047 6	100,867 5
YVONNE	108,534 3	123,751 6

LEGEND
⊕ THIRD ORDER STATION

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

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NOTES:
1. A TRUE MERIDIAN THROUGH STATION CORAL WAS USED AS THE BASIS OF BEARINGS
2. THE ORIGIN OF PLANE COORDINATES (N 100,000 : E 100,000) WAS TAKEN AT STATION CORAL

ENIWETOK ATOLL, M I
PLANE COORDINATES - IVY GRID
1956 EXPANSION OF HORIZONTAL CONTROL
SCALE : 1" = 100,000

U.S. ATOMIC ENERGY COMMISSION
SANTA FE OPERATIONS OFFICE
HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS
CHECKED BY MR C. DATE 6-9-57 DRAWING NO. SK 241

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVY GRID
1952 EXPANSION OF HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE Nov. 1952
JOB NO. 831 LOCATION Eniwetok Atoll, M.I.

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral to									100,000.0		100,000.0		1
2	Boga #2	N 50-28-55.6W	61183.4	63631911	77142595	38932.2			47198.5	138,932.2		52,801.6		2
3	RP-X	N 34-18-42.1W	57699.5	82598326	56369465	47658.8			32524.9	147,658.8		67,475.1		3
4	Teiteir	N 31-00-27.8W	56295.3	85709788	51515360	48250.6			29000.7	148,250.6		70,999.3		4
5	Engebi	N 16-51-32.4W	46527.6	95702136	29001744	44527.9			13493.8	144,527.9		86,506.2		5
6	Yeiri	N 0-55-36.7E	35052.2	99986916	01617608	35047.6		567.0		135,047.6		100,567.0		6
7	Aitsu	N 5-14-06.2E	34306.0	99582876	09124188	34162.9		3130.1		134,162.9		103,130.1		7
8	Rujoru	N 12-37-28.0E	33525.2	97582361	21855958	32714.7		7327.3		132,714.7		107,327.3		8
9	Aomon	N 24-32-29.4E	32695.2	90966067	41535223	29741.5		13580.0		129,741.5		113,580.0		9
10	Pliraai	N 41-50-50.7E	26312.7	74492414	66714918	19601.0		17554.5		119,601.0		117,554.5		10
11	N.Base #3	N 75-01-26.3E	24589.1	25841489	96603403	6354.2		23753.9		106,354.2		123,753.9		11
12	Runit	S 89-10-26.0E	28900.6	01141786	99989606		416.7	28897.5		99,583.3		128,897.5		12
13	Sand	S 70-57-07.3E	37438.2	32635970	94524565		12218.3	35388.3		87,781.7		135,388.3		13
14	Ivy	S 34-21-35.7E	57499.0	82550854	56438963		47465.9	32451.9		52,534.1		132,451.9		14
15	Eniwetok	S 20-56-15.2E	67862.7	93397044	35735027		63381.7	24250.7		36,618.3		124,250.7		15
16	Rigili #2	S 67-27-45.6W	73416.9	38328534	92362999		28139.6		67810.0	71,860.4		32,190.0		16
17														17
18	Boga #2 to									138,932.2		52,801.6		18
19	Ruchi	N 59-09-59.8E	9639.5	51254333	85866136	4940.6		8277.0		143,872.8		61,078.6		19
20	Engebi	N 80-34-24.7E	34166.0	16378117	98649659	5595.7		33704.6		144,527.9		86,506.2		20
21	Rigili #2	S 17-04-57.0W	70167.4	95588278	29374838		67071.8		20611.6	71,860.4		32,190.0		21
22														22
23	RP-X to									147,658.8		67,475.1		23
24	RP-Y	N 73-54-47.5E	9605.76	27709339	96084309	2661.7		9229.6		150,320.5		76,704.7		24
25														25
26	Engebi to									144,527.9		86,506.2		26
27	Ruchi	S 88-31-27.0W	25436.0	02575530	99966828		655.1		25427.6	143,872.8		61,078.6		27
28	RP-X	N 80-39-28.0W	19286.9	16233101	98673636	3130.9			19031.1	147,658.8		67,475.1		28
29	Teiteir	N 76-30-03.1W	15947.5	23343075	97237343	3722.7			15506.9	148,250.6		70,999.3		29
30	RP-Y	N 59-25-02.9W	11385.2	50877891	86089721	5792.6			9801.5	150,320.5		76,704.7		30

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVY GRID
1952 EXPANSION OF HORIZONTAL CONTROL

CALC. BY R.L.P. CHECKED BY L.S.H. DATE Nov. 1952 JOB NO. 831 LOCATION Eniwetok Atoll, M.I.

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Teiteir to									148250.6		70999.3		1
2	RP-X	S 89-28-04.5W	3573.5	16560464	98619303		591.8		3524.2	147658.8		67475.1		2
3	RP-Y	N 70-03-33.6E	6069.3	34104685	94004630	2069.9		5705.4		150320.5		76704.7		3
4														4
5	Aomon to	N 67-49-00.7W	14053.2	37756831	92598174	5306.1			13013.0	129741.5		113580.0		5
6	Yeiri	N 67-03.59.7W	11346.7	38966115	92095830	4421.4			10449.9	135047.6		100567.0		6
7	Aitsu	N 64-34-08.6W	6923.6	42942295	90310350	2973.2			6252.7	134162.9		103130.1		7
8	Rujoru									132714.7		107327.3		8
9														9
10	Pliraai to	S 29-32-16.9E	23008.0	87002868	49300112		2001.7	11343.0		119601.0		117554.5		10
11	Runit	S 25-04-45.7E	14625.7	90572155	42387319		1321.8	6199.4		99583.3		128897.5		11
12	N. Base #3									106354.2		123753.9		12
13														13
14	N. Base #3	S 37-13-21.0E	8503.0	796292h3	62491186		6770.9	5143.6		106354.2		123753.9		14
15	Runit									99583.3		128897.5		15
16														16
17	Sand to	S 0-59-46.9E	27981.1	99984880	01738891		27975.9	486.6		87781.7		135388.3		17
18	Japtan	S 4-45-44.1W	35369.7	99654778	08302127		35241.6		2936.4	59804.8		135874.9		18
19	Ivy	S 8-46-34.3W	28634.9	98829186	15257523		28299.7		4369.0	52534.1		132451.9		19
20	Lilac	S 12-16-51.3W	52361.6	97711647	21270495		51163.4		11137.6	59482.0		131019.3		20
21	Eniwetok									36618.3		124250.7		21
22														22
23	Ivy to	N 11-39-00.7W	7094.1	97939871	20193601	6948.1			1432.6	52534.1		132451.9		23
24	Lilac	N 25-12-38.0E	8036.2	90474860	42594598	7270.7		3423.0		59482.0		131019.3		24
25	Japtan									59804.8		135874.9		25
26														26
27	Eniwetok to	N 69-03-08.8W	98575.8	35751327	93390806	35242.1			92060.7	36618.3		124250.7		27
28	Rigili #2	N 27-15-40.4E	17904.5	88892744	45804803	15915.8		8201.2		71860.4		32190.0		28
29	Ivy									52534.1		132451.9		29
30														30

HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVI GRID &
1952 ADJUSTED HORIZONTAL CONTROL

CALC BY R.B.S. DATE Nov. 1952
CHECKED BY L.S.H.

JOB NO. 831 LOCATION Eniwetok Atoll, M.I.

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral to									100,000.0		100,000.0		1
2	Boga RM #1 *	N 50-28-57.5W	61183.2	63631200	77143181	38931.6			47198.6	138,931.6 *		52,801.4 *		2
D 3	Boga #1	N 50-18-07.2W	61166.3	63874096	76942185	39069.4			47062.7	139,069.4		52,937.3		3
4	Teiteir	N 31-00-27.2W	56295.3	85709938	51515110	48250.7			29000.6	148,250.7		70,999.4		4
5	Engebi	N 16-51-32.1W	46527.6	95702136	29001744	44527.9			13493.8	144,527.9		86,506.2		5
6	Bokon	N 5-34-20.8W	36644.0	99527421	09710425	36470.8			3558.3	136,470.8		96,441.7		6
7	Aomon	N 24-32-29.4E	32695.2	90966067	41535223	29741.5		13580.0		129,741.5		113,580.0		7
8	Piiraai *	N 41-50-49.3E	26312.2	74492867	66714412	19600.7		17554.0 *		119,600.7 *		117,554.0 *		8
D 9	N.Base #2	N 75-01-20.1E	24588.8	25844392	96602626	6354.8		23753.4		106,354.8		123,753.4		9
10	Runit	S 89-10-26.0E	28900.6	01141786	99989606		415.7	28897.6		99,583.3		128,897.6		10
D 11	Pinnacle	S 70-23-33.5E	16291.3	33557262	94201434		5466.9	15346.7		94,533.1		115,346.7		11
12	Sand	S 70-57-07.3E	37438.2	32635970	94524565		12215.3	35388.3		87,781.7		135,388.3		12
13	Aniyaanii	S 59-04-53.0E	47265.9	51381995	85789805		24286.1	40549.3		75,713.9		140,549.3		13
14	Parry	S 35-55-53.8E	56498.9	80971801	58681918		45748.1	33154.6		54,251.9		133,154.6		14
15	Eniwetok *	S 20-56-13.9E	67862.9	93397269	35734438		63382.1	24250.4		36,617.9 *		124,250.4 *		15
16														16
17														17
18	Boga RM #1 to	N 44-35-42.8E	193.62	71208459	70209368	137.8		135.9		138,931.6 *		52,801.4 *		18
D 19	Boga #1	N 62-53-00.1E	20445.4	45580341	89008047	9319.1		18198.0		139,069.4		52,937.3		19
20	Teiteir *	N 80-34-21.5E	34166.3	16379707	98649406	5596.3		33704.8		148,250.7 *		70,999.4 *		20
21	Engebi *									144,527.9		86,506.2		21
22														22
D 23	Boga #1 to	S 43-30-02.5E	48602.6	72536603	68836337		35254.7	33456.3		139,069.4		52,937.3		23
24	Photo	N 63-03-18.6E	20261.7	45313239	89144323	9181.3		18062.1		103,814.7		86,393.6		24
25	Teiteir	N 80-45-51.3E	34009.8	16049709	98703631	5458.5		33568.9		148,250.7		70,999.4		25
26	Engebi									144,527.9		86,506.2		26
27														27
28	Teiteir to	N 78-28-42.2E	4547.8	19973753	97984943	908.3		4456.2		148,250.7		70,999.4		28
29	Bogon	S 76-30-01.0E	15947.3	23344065	97237105		3722	15506.8		149,159.0		75,455.6		29
30	Engebi									144,527.9		86,506.2		30
31														31

ENGINEERS - CONSTRUCTION

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.S
CHECKED BY L.S.H. DATE: Nov. 1952
JOB NO. 831 LOCATION Eniwetok Atoll, M. I.

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Engebi to									144527.9		86,506.2		1
2	Bogon	N 67-15-44.4W	11981.8	.38651244	.92228419	4631.1			11050.6	149,159.0		75,455.6		2
3	Aomon	S 61-21-31.8E	30848.5	.47932256	.87763881		14786.4	27073.8		129,741.5		113,580.0		3
4	Bokon	S 50-57-36.4E	12791.8	.62986128	.77670764		8057.1	9935.5		136,470.8		96,441.7		4
D 5	N. Base #2	S 44-17-48.1E	53334.2	.71573302	.69837380		38173.1	37247.2		106,354.8		123,753.4		5
6	Photo	S 0- 09-30.6W	40713.3	.99999617	.00276634		40713.2		112.6	103,814.7		86,393.6		6
D 7	E Zero	N 46-10-34.9W	4133.985	.69244090	.72147460	2862.5			2982.6	147,390.4		83,523.6		7
8														8
9	Aomon to									129,741.5		113,580.0		9
10	Bokon	N 68-33-45.8W	18412.1	.36548247	.93081823	6729.3			17138.3	136,470.8		96,441.7		10
D 11	N. Base #2	S 23-30-33.9E	25503.6	.91699452	.39889979		23386.7	10173.4		106,354.8		123,753.4		11
12	Photo	S 46-21-31.0W	37567.3	.69014249	.72367351		25925.8		27186.4	103,814.7		86,393.6		12
D 13	V Zero	N 56-01-33.8W	4140.9	.55881583	.82929178	2314.0			3434.0	132,055.5		110,146.0		13
14														14
D 15	N. Base #2 to									106,354.8		123,753.4		15
16	Piiraai	N 25-04-51.2W	14624.8	.90571024	.42389735	13245.9			6199.4	119,600.7	*	117,554.0	*	16
17	Runit	S 37-13-22.1E	8503.84	.79628921	.60491612		6771.5	5144.2		99,583.3		128,897.6		17
18	Sand	S 32-03-52.0E	21916.5	.84745152	.53087279		18573.1	11634.9		87,781.7		135,388.3		18
D 19	Parry	S 10-13-41.2E	52944.4	.98410861	.17756759		52102.9	9401.2		54,251.9	*	133,154.6	*	19
D 20	Pinnacle	S 35-25-03.3W	14506.1	.81494999	.57953129		11821.7		8406.7	94,533.1		115,346.7		20
D 21	C Zero	S 72-40-16.9E	591.3	.29785206	.95461204		176.1	564.5		106,178.7		124,317.9		21
22														22
23	Runit to									99,583.3		128,897.6		23
24	Reef	S 35-45-27.1E	4036.2	.81149722	.58435629		3275.8	2358.6		96,308.0		131,256.2		24
25	Islet	S 28-35-19.9E	10585.8	.87807370	.47852116		9295.1	5065.5		90,288.2		133,963.1		25
D 26	Pinnacle	S 69-33-36.7W	14461.4	.34922313	.93703959		5050.2		13550.9	94,533.1		115,346.7		26
27														27
28	Reef to									96,308.0		131,256.2		28
29	Islet	S 24-12-44.3E	6600.4	.91203205	.41011893		6019.8	2706.9		90,288.2		133,963.1		29
D 30	Pinnacle	S 83-38-03.5W	16008.2	.11087390	.99383448		1774.9		15909.5	94,533.1		115,346.7		30

D = Station Destroyed * = Refer to 1952 Expansion for new values

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

TRAVERSE COMPUTATIONS

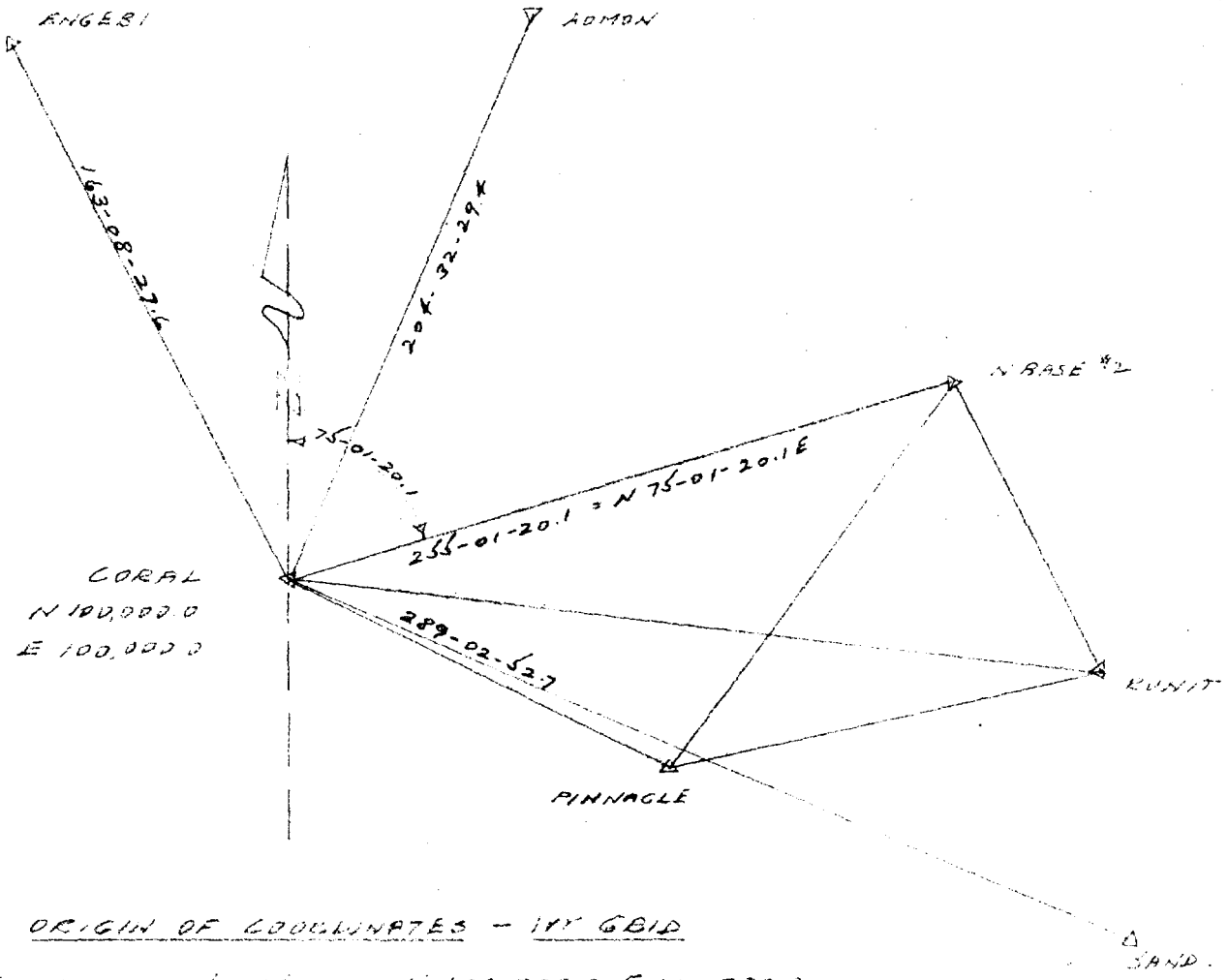
PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.E.B. DATE
CHECKED BY L.S.R. DATE Nov. 1952

JOB NO. 831 LOCATION Eniwetok Atoll, M.I.

		STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
D	1	Pinnacle to									94,533.1		115,346.7		1
	2	Islet	S 77-05-18.8E	19,094.2	22231053	97497591		4244.9	18616.4		90,288.2		133,963.1		2
	3														3
D	4	Parry to									54,251.9		133,154.6		4
	5	Sand	N 3-48-40.5E	33604.1	99778844	06649882	33529.8		2233.7		87,781.7		135,388.3		5
	6	Aniyaanii	N 19-00-40.5E	22700.2	94545463	32575380	21462.0		7394.7		75,713.9		140,549.3		6
	7														7
	8	Eniwetok to									36,617.9	*	124,250.4	*	8
D	9	Parry	N 26-47-28.8E	19754.5	89265401	45074260	17634.0		8904.2		54,251.9		133,154.6		9
	10														10
	11	Muzin to									142,332.6		88,009.0		11
	12	Engebi	N 34-23-41.3W	2660.4	82516472	56489220	2195.3			1502.8	144,527.9		86,506.2		12
D	13	E Zero	N 41-34-03.0W	6760.2	74817457	66350193	5057.8			4485.4	147,390.4		83,523.6		13
	14														14
	15	Kirinian to									139,877.0		90,564.0		15
	16	Engebi	N 41-06-13.3W	6172.3	75352100	65742384	4650.9			4057.8	144,527.9		86,506.2		16
	17	Bokon	S 59-54-27.6E	6793.3	50139399	86521852		3406.2	5877.7		136,470.8		96,441.7		17
	18	Coral	S 13-18-46.5E	40978.2	97312699	23026912		39877.0	9436.0		100,000.0		100,000.0		18
	19														19
	20	Lucy to									125,014.4		117,623.0		20
	21	Aomon	N 40-32-21.8W	6220.2	75995931	64997079	4727.1			4043.0	129,741.5		113,580.0		21
D	22	V Zero	N 46-43-10.6W	10270.5	68556921	72800746	7041.1			7477.0	132,055.5		110,146.0		22
	23														23
	24	Loc. M to									96,361.3		131,218.6		24
	25	Reef	S 35-06-13.3E	65.27	81811264	57505801		53.3	37.5		96,308.0		131,256.2		25
D	26	C Zero	N 35-06-13.3W	12000.0	81811264	57505801	9817.4			6900.7	106,178.7		124,317.9		26
	27														27
	28	Rigili #1 to									71,863.7		32,181.1		28
	29	N. Base #2	N 69-21-37.0E	9784.9	35249052	93581538	3449.09		9156.9.25		106,354.8		123,753.4		29
	30	Engebi	N 36-46-51.3E	90724.7	80093084	59875687	72664.21		54322.04		144,527.9		86,506.2		30

BY ARA DATE Feb 1961 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1
CHKD. BY [illegible] DATE [illegible] ORIGIN OF COORDINATES - IVY GRID JOB NO. 231
IVY GRID



ORIGIN OF COORDINATES - IVY GRID

An assumed value of N 100,000.0 E 100,000.0 was taken at station Coral

A true meridian through this station was based on the adjusted forward azimuth of the line Coral - N Base #2 as determined by the 1961 adjustment.

Due to the limited extent of the scheme only control established by the plane grid was used in the traverse computations.

(NOTE: The following is an excerpt from letter SEN-137, dated 13 February 1952, from D. T. Robbins, Chief Engineer, H&N, to Manager, A.E.C., Albuquerque, N.M.)

The relation between local grids used for the "Greenhouse" computations and the new Atoll grid is as follows. This is based on the difference in bearings of the zero lines as computed from the two systems, and gives the relation of structure 6A to zero at each of the three locations.

Location Janet	Sta. Zero	Sta. 6A
"Greenhouse" coordinates	N 5,051.77 E 945.73	N 2,307.86 E 3,821.76
"Ivy" "	N 147,390.40 E 83,523.60	N 144,637.95 E 86,391.46
"Greenhouse" bearing	Zero to Sta. 6A	S 46° 20' 48"E
"Ivy" "	" " " "	S 46° 10' 35"E
	Difference	0° 10' 13"

Location Ruby	Sta. Zero	Sta. 6A
"Greenhouse" coordinates	N 11,148.91 E 3,153.21	N 7,939.90 E 8,311.49
"Ivy" "	N 132,055.50 E 110,146.00	N 128,847.06 E 115,304.64
"Greenhouse" bearing	Zero to Sta. 6A	S 58° 06' 50"E
"Ivy" "	" " " "	S 58° 07' 13"E
	Difference	0° 00' 23"

Location Yvonne	Sta. Zero	Sta. 6A
"Greenhouse" coordinates	N 15,058.71 E 953.33	N 11,947.10 E 3,426.89
"Ivy" "	N 106,178.70 E 124,317.80	N 103,067.64 E 126,792.05
"Greenhouse" Bearing	Zero to Sta. 6A	S 38° 28' 58"E
"Ivy" "	" " " "	S 38° 29' 44"E
	Difference	0° 00' ~~46"~~ 58"

To determine the location of any structure based on the "Ivy" coordinate system, apply the difference in bearings between grids at the particular location to the "Greenhouse" bearing. From the adjusted bearing and the given distance from zero to a structure compute the difference in coordinates to be applied to the "Ivy" coordinates of zero.

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

JOB NO. 831

GEOGRAPHIC POSITIONS

1952 ... BY ... RAD ... CONTROL

LOCALITY ENIWETOK ATOLL, M. I. DATUM ENIWETOK ASTRONOMIC - 1944 SECOND ORDER TRIANGULATION

STATION	LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE LOGARITHM METERS	DISTANCE METERS	DISTANCE FEET
Coral	N 11-32-20.254		129-51-04.4	309-29-29.0	Boga #2	4.2706496	18648.74	61185.4
	E 162-17-10.944		148-59-32.2	328-58-33.4	Teiteir	4.2344880	17159.84	56295.3
			163-08-27.6	343-08-00.2	Engebi (Elgin)	4.1517265	14181.84	46527.6
			180-55-36.7	0-55-37.8	Yeiri	4.0287311	10686.98	35062.2
			185-14-06.1	5-14-12.4	Aitsu	4.0193859	10456.46	34306.0
			192-37-28.0	12-37-42.8	Bujoru	4.0093871	10218.50	33525.2
			204-32-29.4	24-32-56.8	Aomon	3.9985000	9965.52	32695.2
			221-50-50.7	41-51-26.1	Piiraai	3.9041614	8020.13	26312.7
			255-01-26.3	75-02-14.1	N. Base #3	3.8747685	7494.77	24589.1
			270-49-34.0	90-50-32.2	Runit	3.9449227	8808.92	28900.5
			289-02-52.7	109-04-03.8	Sand	4.0573309	11411.19	37438.2
			325-38-24.3	145-39-29.2	Ivy	4.2436761	17625.78	57809.0
			339-03-44.8	159-04-33.2	Eniwetok	4.3156468	20684.59	67862.7
			67-27-45.5	247-25-29.6	Rigili #2	4.3496120	22377.52	73416.9
Boga #2	N 11-38-43.355		281-57-14.0	101-57-33.1	Ruchi	3.4880710	2938.13	9639.5
	E 162-09-15.997		260-32-49.1	80-33-57.5	Engebi	4.0176101	10413.82	34165.0
			17-03-22.1	197-02-40.6	Rigili #2	4.3301613	21387.07	70167.4
Ruchi (+)	N 11-38-26.544		252-36-05.9	72-36-55.2	Engebi	3.8594648	7252.31	25436.0
	E 162-10-50.892							
RP-X	N 11-40-12.980		260-26-58.4	80-27-05.6	Teiteir	3.0371076	1089.20	3573.5
	E 162-11-43.625		253-53-41.4	73-54-00.2	RP-Y	3.4665470	2927.84	9605.76
Teiteir	N 11-40-18.861		260-02-34.7	80-02-45.3	RP-Y	3.2671653	1849.93	6093.3
	E 162-12-19.089		283-28-58.0	103-29-29.6	Engebi	3.6857087	4860.61	15947.5

... Order station.

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

GEOGRAPHIC POSITIONS

1952 EXPANSION OF HORIZONTAL CONTROL

JOB NO. 851

LOCALITY ENIWETOK ATOLL, M. I. DATUM ENIWETOK ASTRONOMIC - 1944 SECOND ORDER TRIANGULATION

STATION	LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE		
						LOGARITHM METERS	METERS	FEET
RP-Y	N 11-40-89.409		300-34-09.8	120-34-29.8	Engebi	3.5403592	3470.22	11385.2
	E 162-13-16.502							
Engebi ✓	N 11-39-41.964		313-08-00.2	133-08-27.6	Coral	4.1517265	14181.64	46527.5
	E 162-14-55.151							
Yeiri (+)	N 11-38-07.928		292-11-00.4	112-11-26.8	Aomon	3.6517906	4283.42	14055.2
	E 162-17-16.850							
Aiteu (+)	N 11-37-59.151		292-55-06.5	112-56-27.7	Aomon	3.5388853	3456.48	11346.7
	E 162-17-42.440							
Rujoru (+)	N 11-37-44.783		296-26-06.2	116-26-18.8	Aomon	3.3243483	2110.32	6923.6
	E 162-18-24.872							
Aomon	N 11-37-15.283		24-32-56.8	204-32-29.4	Coral	3.9985000	9965.52	32695.2
	E 162-19-27.554							
Piiraai	N 11-36-34.682		334-55-49.6	154-56-02.1	N. Base #3	3.6491323	4457.92	14625.7
	E 162-20-07.567							
N. Base #3	N 11-33-23.262		322-47-26.8	142-47-37.2	Runit	3.4135881	2591.72	8503.0
	E 162-21-09.898							
Runit ✓	N 11-32-16.080		90-50-32.2	270-49-34.0	Coral	3.9449227	8808.92	28900.6
	E 162-22-01.621							
Sand	N 11-30-18.986		359-01-24.0	179-01-24.9	Japtan	3.9308808	8528.66	27981.1
	E 162-23-06.870		4-46-55.0	184-46-49.1	Ivy	4.0323473	10780.71	35369.7
			8-47-45.2	188-47-38.5	Lilac	3.9409113	8727.93	28634.9

(+) Control point established on

ENGINEERS-CONSTRUCTORS

GEOGRAPHIC POSITIONS

JOB NO. 831

1952 EXPANSION OF HORIZONTAL CONTROL

LOCALITY ENIWETOK ATOLL, M. I. DATUM ENIWETOK ASTRONOMIC - 1944 SECOND ORDER TRIANGULATION

STATION	LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE LOGARITHM METERS	DISTANCE METERS	DISTANCE FEET
Japtan (+)	N 11-25-41.449		25-13-49.8	205-13-48.0	Ivy	3.3890668	2449.44	8036.2
	E 162-23-11.664							
Lilao (+)	N 11-25-36.264		348-22-01.5	168-22-04.3	Ivy	3.8343139	6862.20	7094.1
	E 162-22-22.842							
Ivy	N 11-24-29.334		27-16-45.2	207-16-29.9	Eniwetok	3.7329778	5457.30	17904.8
	E 162-23-37.224							
Eniwetok	N 11-21-51.459		110-57-39.0	290-54-38.8	Rigili #2	4.4777861	30045.96	98575.8
	E 162-21-14.730							
Rigili #2	N 11-27-40.883		197-02-40.8	17-03-22.1	Boge #2	4.3301513	21387.07	70167.4
	E 162-25-49.036							

(+) = Third Order Station

HOLMES & NARVER, INC.
ENGINEERS-CONTRACTORS

GEOGRAPHIC POSITIONS

1952 ADJUSTED HORIZONTAL CONTROL

JOB NO. 831

LOCALITY ENIWETOK ATOLL, M. I. DATUM ENIWETOK ASTRONOMIC - 1944 SECOND ORDER TRIANGULATION

STATION		LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	AZIMUTH	TO STATION	DISTANCE		
							LOGARITHM METERS	METERS	FEET
Coral		N 11-32-20.254		129-41-52.7	[illegible]-40-17.5	Boga #1	4.2705281	18643.53	61166.3
		E 162-17-10.944		129-31-02.4	[illegible]-29-26.9	Boga RM #1	4.2706480	18648.68	61183.2
				148-59-32.7	[illegible]-58-34.0	Teiteir	4.2344880	17158.84	56295.3
				153-08-27.6	[illegible]-08-00.2	Engebi	4.1517267	14181.64	46527.6
				174-25-39.2	[illegible]-25-31.9	Bokon	4.0480186	11169.11	36644.0
				204-32-29.4	[illegible]-32-56.8	Aomon	3.9985000	9965.52	32695.2
				221-50-49.3	[illegible]-51-24.7	Pilirai	3.9041728	8019.97	26312.2
				256-01-20.1	[illegible]-02-07.9	N. Base #2	3.8747531	7494.68	24588.3
				270-49-34.9	[illegible]-50-32.2	Aonit	3.9449227	8808.92	28900.6
				289-02-52.7	[illegible]-04-03.8	Sand	4.0573309	11411.19	37438.2
				299-36-25.5	[illegible]-36-57.4	Pinnacle	3.6959717	4965.60	16291.3
				300-56-07.1	[illegible]-56-28.4	Aliysenii	4.1585639	14406.68	47265.9
				324-04-06.3	[illegible]-05-12.6	Parry	4.2360659	17220.90	56498.9
				339-03-40.3	[illegible]-04-34.6	Eniwetok	4.3156450	20684.65	67862.9
Boga RM #1	(+)	N 11-38-46.350		260-32-45.8	[illegible]-33-54.3	Engebi	4.0176138	10413.91	34166.3
		E 162-09-15.995							
Boga #1	(+)	N 11-38-47.717		260-44-15.9	[illegible]-45-24.1	Engebi	4.0158200	10366.21	34009.8
		E 162-09-17.362		316-28-22.2	[illegible]-29-29.9	Photo	4.1706752	14814.10	48602.6
Teiteir	(+)	N 11-40-10.662		258-27-43.4	[illegible]-27-52.5	Bogon	3.1418165	1386.17	4547.8
		E 162-12-19.091		293-29-00.2	[illegible]-29-31.7	Engebi	3.6867033	4860.75	15947.3
Bogon	(+)	N 11-40-27.384		292-43-25.9	[illegible]-43-48.3	Engebi	3.5625318	3652.08	11981.8
		E 162-13-03.934							
Engebi		N 11-39-41.964		298-38-00.7	[illegible]-38-55.7	Aomon	3.9732496	9402.64	30848.5
		E 162-14-55.151		309-01-56.1	[illegible]-02-16.3	Bokon	3.5909476	3896.95	12791.8

(D) - Station destroyed (+) - Refer to 1952 Expansion for new values. (t) - Third Order station.

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

JOB NO. 831

GEOGRAPHIC POSITIONS

1952 ADJUSTED HORIZONTAL CONTROL

LOCALITY ENIWETOK ATOLL, M. I. DATUM ENIWETOK ASTRONOMIC - 1944 SECOND ORDER TRIANGULATION

STATION	LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE LOGARITHM METERS	DISTANCE METERS	DISTANCE FEET
Bokon	N 11-38-22.046		291-26-06.9	111-26-41.7	Aomon	3.7491192	5612.02	18412.1
	E 162-16-35.159							
Aomon	N 11-37-15.283		336-29-53.5	156-30-14.0	N. Base #2	3.8906172	7773.51	25503.6
	E 162-19-27.584		46-21-58.4	226-21-03.6	Photo	4.0588260	11450.54	37567.3
Piiraai	N 11-35-34.679		334-55-44.2	154-55-56.7	N. Base #2	3.6491059	4457.65	14624.6
	E 162-20-07.552							
N. Base #2 (D)	N 11-33-23.267		322-47-28.7	142-47-36.1	Runit	3.4136308	2591.9749	8503.84
	E 162-21-09.593		327-56-55.7	147-57-19.1	Sand	3.8247869	6680.16	21916.5
Runit	N 11-32-16.080		324-15-31.1	144-15-35.8	Reef	3.0899898	1230.24	4036.2
	E 162-22-01.621		331-25-38.3	151-25-48.5	Islet	3.5087397	3226.56	10586.8
Pinnacle (D)	N 11-31-25.010		249-34-07.6	69-34-34.9	Runit	3.6442258	4407.84	14461.4
	E 162-19-45.307							
Reef	N 11-31-43.581		335-48-18.6	155-48-24.1	Islet	3.3035870	2011.81	6600.4
	E 162-22-25.335							
Islet	N 11-30-43.956		102-51-49.8	282-51-12.1	Pinnacle	3.7649170	5819.92	19094.2
	E 162-22-52.543							
Sand	N 11-30-18.986		3-49-51.5	183-49-47.0	Parry	4.0104083	10242.55	33604.1
	E 162-23-06.870							
Aniyaanil	N 11-28-19.253		19-02-01.8	199-01-47.0	Parry	3.8400452	6919.03	22700.2
	E 162-23-58.730							

(D) = Station destroyed. (*) = Refer to 1952 Expansion for new values. (T) = Third Order station.

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

JOB NO. 831

GEOGRAPHIC POSITIONS

1952 ADJUSTED HORIZONTAL CONTROL

LOCALITY ENIWETOK ATOLL, M. I. DATUM ENIWETOK ASTRONOMIC - 1944 SPHEROID ORDER TRIANGULATION

STATION	LATITUDE AND LONGITUDE	SECONDS IN METERS	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE LOGARITHM METERS	DISTANCE METERS	DISTANCE FEET
Parry (D)	N 11-24-46.373		26-48-35.1	206-46-17.4	Eniwetok	3.7796816	6021.13	19754.5
	E 162-22-44.295							
Eniwetok (*)	N 11-21-51.466		159-04-34.6	339-03-46.3	Coral	4.3156450	20684.65	67862.9
	E 162-21-14.726							
Mugin	N 11-30-20.189		145-35-54.3	325-35-51.3	Engebi	2.9089619	810.59	2660.4
	E 162-15-10.277		138-25-32.6	318-25-23.5	E-Zero	3.3139747	2060.51	6760.2
Kirinian (+)	N 11-38-55.831		138-53-27.5	318-53-19.2	Engebi	3.2744627	1881.32	6172.3
	E 162-15-35.991		300-05-13.2	120-05-25.1	Rokon	3.3180962	2070.80	6793.3
Lucy (+)	N 11-36-28.384		139-28-15.8	319-28-05.6	Aomon	3.2778200	1898.92	6220.2
	E 162-20-08.256		133-17-25.0	313-17-03.8	V-Zero	3.4956067	3130.45	10270.5
Photo	N 11-32-58.088		180-09-03.1	0-09-03.3	Engebi	4.0937522	12409.44	40713.3
	E 162-14-54.072							
Rigili #1 (D) (+)	N 11-27-40.914		216-44-34.6	36-46-24.0	Engebi	4.4417415	27662.94	90724.7
	E 162-08-48.977		249-19-20.6	69-22-24.3	N. Base #2	4.4746754	29824.65	97849.7
	The following refer to "Greenhouse" stations							
E-Zero (D)	N 11-40-10.356		313-48-51.6	133-48-57.7	Engebi	3.1003843	1260.04	4133.985
	E 162-14-28.132							
V-Zero (D)	N 11-37-38.242		303-58-48.6	123-58-53.6	Aomon	3.1011110	1262.15	4140.9
	E 162-18-53.034							
C-Zero (D)	N 11-33-21.519		187-20-32.0	267-20-30.9	N. Base #2	2.2558030	180.22	591.27
	E 162-21-15.570							

(D) = Station destroyed (*) = Refer to 1952 Expansion for new values (+) = Third Order station.

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Pacific Southwest Region

BENCH MARKS

SITE	STATION	ELEV	FIELD BOOK	PAGE	DATE	DESCRIPTION		REMARKS
ALICE	BOGA #2	8.675	20	21	1-10-50	H&N DISC, CONC. MON.	F.S. 516	CLOSED CIRCUIT FROM STA. BOGA (STA. BOGA, TIDE OBSERVATIONS)
BELLE	P.I. "A"	8.06	148	22	10-12-51	COPPER PIPE, LEAD & TACK, CONC. MON.	F.S. 522	RUN FROM BOGA #2
	P.I. "E"	8.16	151	25	11-14-51	H&N DISC, CONC. MON.	F.S. 537	CLOSED CIRCUIT FROM P.I. "A"
CLARA	P.I. "R"	6.57	157	2	2-15-52	H&N DISC. CONC. MON.	F.S. 550	CLOSED CIRCUIT FROM P.I. "E"
	RUCHI	9.72	157	16	2-20-52	ALUM. PIPE & CAP, CONC. MON.	F.S. 550	CLOSED CIRCUIT FROM P.I. "R"
DAISY	PYNE	7.80	157	16	2-20-52	ALUM. PIPE & CAP, CONC. MON.	F.S. 554	CLOSED CIRCUIT FROM P.I. "R"
	CHITI	8.39	157	16	2-20-52	ALUM. PIPE & CAP, CONC. MON.	F.S. 554	CLOSED CIRCUIT FROM P.I. "R"
EDNA	SAM	6.87	158	5	2-26-52	ALUM. PIPE & CAP, CONC. MON	F.S. 555	CLOSED CIRCUIT FROM CHITI
		(8.86	158	5	2-26-52	ALUM. PIPE & CAP,	F.S. 555	CLOSED CIRCUIT FROM CHITI
	PONSO	(8.53	158	7	2-27-52	CONC. MON.	F.S. 555	CLOSED CIRCUIT FROM ELUG
FLORA	R.P. "X"	8.965	164	17	5-8-52	ALUM. PIPE & CAP, CONC. MON.		CLOSED CIRCUIT FROM ELUG
	ELUG	8.115	152	5	11-20-51	H&N DISC, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
	ELAB	10.09	152	5	11-20-51	H&N DISC, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
GENE	PUCCHI	9.215	152	20	12-3-51	H&N DISC, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
	INTER "X"	8.07	152	20	12-3-51	H&N DISC, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
	TENT POLE T	6.81	155	12	2-1-52	ALUM. PIPE & CAP, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
	TEITEIR	8.545	158	20	3-1-52	H&N DISC, CONC. MON.	F.S. 543	TIDE OBSERVATIONS
HELEN	BOGAIR	6.51	152	20	12-3-51	ALUM. PIPE & CAP, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
	RIKK	5.29	152	20	12-3-51	ALUM. PIPE & CAP, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
IRENE	JIM	6.59	156	26	2-14-52	ALUM. PIPE & CAP, CONC. MON.	F.S. 543	CIRCUIT NOGOB TO BOGON
	NOGOB	5.75	152	20	12-3-51	ALUM. PIPE & CAP, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
	BOGON	7.15	152	20	12-3-51	H&N DISC, CONC. MON.	F.S. 543	CLOSED CIRCUIT FROM TEITEIR
	MART	10.99	156	26	2-14-52	ALUM. PIPE & CAP,	F.S. 543	CIRCUIT NOGOB TO BOGON
JANET	ENGEBI	10.08	10	18	5-14-59	U.S.C.&G.S., CONC. MON.	F.S. 73	TIDE OBSERVATIONS
	LADEDA	9.76	43	14	6-2-50	H&N DISC, CONC. MON.	F.S. 73	CLOSED CIRCUIT FROM ENGEBI
	T.A.K.	9.39	69	23	9-13-50	NAIL IN CONC. MON.	F.S. 73	CLOSED CIRCUIT FROM ENGEBI
	R.P. 4	9.09	168	7	4-28-52	20MM SHELL IN CONC. MON.	F.S. 73	CLOSED CIRCUIT FROM ENGEBI
	R.P. 3	9.86	168	27	5-3-52	H&N DISC, CONC. MON.	F.S. 73	CIRCUIT, TANKS TO R.P. 4

~~OFFICIAL USE ONLY~~

~~SECURITY CLASSIFICATION~~

BENCH MARKS

SITE	STATION	ELEV	FIELD BOOK	PAGE	DATE	DESCRIPTION	REMARKS
FRED	B.M. 53-J	11.78	LIST OF VALID BENCHES			S.W. COR SLAB BLDG. #84	
	B.M. 53-K	15.67	LIST OF VALID BENCHES			S.E. COR. OF W. STEP BLDG. #90	
	P.I. #6	8.55	203	19	4-21-53	STANDARD H&N DISC IN CONC.	
	P.I. #8	10.49	208	19	4-21-53	STANDARD H&N DISC IN CONC.	
	P.I. #10	15.33	203	19	4-21-53	STANDARD H&N DISC IN CONC.	
	P.I. #12	11.81	204	17	6-1-53	STANDARD H&N DISC IN CONC.	
	P.I. #15	12.01	203	19	4-21-53	STANDARD H&N DISC IN CONC.	
	P.I. #17	12.16	203	19	4-21-53	STANDARD H&N DISC IN CONC.	
	P.I. #20	9.59	203	19	4-21-53	STANDARD H&N DISC IN CONC.	
	P.I. "B"	9.66	203	19	4-21-53	STANDARD H&N DISC IN CONC.	
	P.I. "E"	14.76	203	19	4-21-53	USN DISC IN TRUNCATED CONC PYRAMID	
	P.I. "F"	15.92	203	19	4-21-53	CONC. MON.	
	ENIWETOK	11.48	LIST OF VALID BENCHES			NAVY MON. NR. BLDG. #1	
	USC & GS #3	10.90	LIST OF VALID BANCHES			USC & GS DISC IN CONC. MON.	
	PANSY	10.40	LIST OF VALID BENCHES			STANDARD H&N DISC IN CONC.	
	VIOLET	12.25	LIST OF VALID BENCHES			STANDARD H&N DISC IN CONC.	
	ROSE	11.61	LIST OF VALID BENCHES			STANDARD H&N DISC IN CONC.	

NOTE: STANDARD H&N DISC IN CONCRETE IS A 2 5/8" DIA BRASS DISC SET IN A CONCRETE MONUMENT FROM 6 TO 8 INCHES BELOW GROUND ELEVATION, WITH NAME OR NUMBER DESIGNATION STAMPED ON ITS FACE.

REFERENCE TO "LIST OF VALID BENCHES" REFERS TO LIST ASSEMBLED, ADJUSTED AND REPRODUCED FROM VARIOUS LEVEL CIRCUITS ON SITE FRED.

BENCH MARKS

SITE	STATION	ELEV	FIELD BOOK	PAGE	DATE	DESCRIPTION	REMARKS
KATE	MUZIN	6.40	28	27	3-30-50	CONC. MON.	TIDE OBSERVATIONS
	P.I. "A"	8.72	141	28	6-31-51	STANDARD H&N DISC. IN CONC.	CLOSED CIRCUIT FROM MUZIN
LUCY	BEACON "M"	8.60	37	7	4-12-50	USN CONC. MON	TIDE OBSERVATIONS
	R.P. "A"	6.71	142	5	6-15-51	STANDARD H&N DISC IN CONC.	CLOSED CIRCUIT FROM BN "M"
	R.P. "B"	7.09	142	5	6-15-51	STANDARD H&N DISC IN CONC.	CLOSED CIRCUIT FROM BN. "M"
MARY	BOKON	10.40	31	6	3-27-50	CONC. MON.	TIDE OBSERVATIONS
	MATT	9.53	159	10	4-3-52	CONC. MON.	CLOSED CIRCUIT FROM BOKON
	ROOK						
NANCY	NICK	10.54	159	10	4-3-52	CONC. MON.	CIRCUIT BOKON TO RUJURO
	YEIRI	9.96	159	10	4-3-52	CONC. MON.	CIRCUIT BOKON TO RUJURO
	JON	10.955	207	25	11-14-53	ALUM. BOLT IN CONC. MON.	CIRCUIT FROM YIERI
OLIVE	OMAR	11.57	159	21	4-3-52	CONC. MON.	CIRCUIT BOKON TO RUJURO
	AITSU	10.05	159	21	4-3-52	CONC. MON.	CIRCUIT BOKON TO RUJURO
	EATON	13.51	207	22	11-13-53	CONC. MON.	CLOSED CIRCUIT FROM AITSU
	EVY	9.29	207	22	11-13-53	Bolt in Conc Mon.	CLOSED CIRCUIT FROM AITSU
PEARL	PAUL	9.73	159	8	4-7-52	CONC. MON.	CIRCUIT BOKON TO RUJURO
	RUJURO	10.90	159	9	3-21-52	CONC. MON.	CLOSED CIRCUIT FROM BOKON
	TENT POLE "J"	9.33	207	24	11-14-53	CONC. MON.	CLOSED CIRCUIT FROM RUJURO
	TENT POLE "K"	13.88	207	24	11-14-53	CONC. MON.	CLOSED CIRCUIT FROM RUJURO
	TENT POLE "L"	11.62	207	24	11-14-53	CONC. MON.	CLOSED CIRCUIT FROM RUJURO
RUBY	RUBY	8.87	212	26	11-7-53	STANDARD H&N DISC IN CONC.	
SALLY	AOMON	8.41	202	11	5-12-53	U.S.C. & G.S. BRASS DISC IN CONC.	DISTURBED ABOUT 5-1-53
	DUKE	6.10	202	12	5-12-53	STANDARD H&N DISC IN CONC.	CIRCUIT SALLY-URSULA
	DAN	12.40	202	12	5-12-53	STANDARD H&N DISC IN CONC.	CIRCUIT SALLY-URSULA
TILDA	JACK	7.18	202	11	5-12-53	STANDARD H&N DISC IN CONC.	CIRCUIT SALLY-URSULA
	JEAN	8.78	202	11	5-12-53	STANDARD H&N DISC IN CONC.	CIRCUIT SALLY-URSULA
	IOWA	7.95	202	11	5-12-53	STANDARD H&N DISC IN CONC.	CIRCUIT SALLY-URSULA
URSULA	KATE	8.66	202	11	5-12-53	STANDARD H&N DISC IN CONC.	CIRCUIT SALLY-URSULA
	R.P. KATE	8.33	202	11	5-12-53	STANDARD H&N DISC IN CONC.	CIRCUIT SALLY-URSULA
	UTAH	8.34	202	11	5-12-53	STANDARD H&N DISC IN CONC.	CIRCUIT SALLY-URSULA
	LUKE	10.94	207	20	11-11-53	6" CENTER PUNCHED BOLT IN CONC.	CLOSED CIRCUIT FROM KATE
VERA	LUCY	8.44	33	2	12-( )-50	STANDARD H&N DISC. IN CONC.	TIDE OBSERVATIONS
	BEACON "K"	12.22	33	2	12-( )-50	USN DISC IN CONC.	CLOSED CIRCUIT FROM LUCY
WILMA	PIIRAAI	8.80	24	22	1-20-50	CONC. MON.	TIDE OBSERVATIONS
	STA. 60	9.88	124	18	3-9-51	✓ CHISELED IN SE FTG OF NE TOWER	CLOSED CIRCUIT FROM PIRAAI
	STA. 62	9.55	124	18	3-19-51	✓ CHISELED IN SE FTG SW	CLOSED CIRCUIT FROM PIRAAI
YVONNE	#59	4.26	104	16	5-23-51	NOT AVAILABLE	C.C. FROM TRAVERSE RUNIT
	USC&GS NO BASE	6.60	104	16	5-23-51	U.S.C. & G.S. CONC. MON.	CC. FROM TRAVERSE RUNIT
	#26 (L&T)	23.40	104	16	5-23-51	NOT AVAILABLE	C.C. FROM TRAVERSE RUNIT

BENCH MARKS

SITE	STATION	ELEV	FIELD BOOK	PAGE	DATE	DESCRIPTION	REMARKS
YVONNE	TRAVERSE RUNIT	12.95	5	2	3-16-49	U.S.C. & G.S. MON.	TIDE OBSERVATIONS
	SOUTH BASE	8.33	134	15	6-16-51	U.S.C. & G.S. MON.	C.C. FROM TRAVERSE RUNIT ALSO CALLED RUNIT
ZONA	TOWER FTGS	6.67	73	20	11-29-50	NOT AVAILABLE	C.C. FROM RUNIT
	WINCH BASE	6.64	73	20	11-29-50	NOT AVAILABLE	C.C. FROM RUNIT
ALVIN							
BRUCE	ANIYAANII	9.60	165	14	4-17-52		TIDE OBSERVATIONS
	BESS	8.70	165	18	4-19-52		C.C FROM ANIYAANII
	BYRL	9.07			4-19-52		C.C. FROM ANIYAANII
CLYDE							
DAVID	PIER	9.00	85	12	12-9-50	PILE CUTOFF - BASE OF PIER	FROM M.H. INVERT GRADES
	BLDG. 48	10.17	32	3	3-14-50	BOOSTER PUMP STATION	NO SOURCE GIVEN
ELMER	ASH	9.86	F.S. 578			STANDARD H&N DISC IN CONC.	
	PARRY	8.63	F.S.578			STANDARD H&N DISC IN CONC.	
	MAGNETIC	12.12	F.S.578			STANDARD H&N DISC IN CONC.	
	"H"	13.24	F.S. 578			STANDARD H&N DISC IN CONC.	
	"L"	11.07	F.S.578			STANDARD H&N DISC IN CONC.	
	"M"	17.97	F.S.578			STANDARD H&N DISC IN CONC.	
	P.I. #25	10.84	F.S.578			STANDARD H&N DISC IN CONC.	
	P.I. #26	9.77	F.S.578			STANDARD H&N DISC IN CONC.	
FRED	ENIWET "A"	15.03	LIST OF VALID BENCHES			USC & GS MON. 220' N OF NE COR.	AIRSTRIP
	ENIWET "B"	10.83	LIST OF VALID BENCHES			USC & GS MON. NO. BLDG. 117A & B	
	ENIWET "C"	13.85	LIST OF VALID BENCHES			USC & GS MON. ACCR. RD FR BLDG 6	
	B.M. #4	12.02	LIST OF VALID BENCHES			CONC. MON. 93' SW USC & GS #2	
	B.M. #6	10.27	LIST OF VALID BENCHES			CONC. MON. NO. SIDE CHAPEL	
	B.M. #7	11.65	LIST OF VALID BENCHES			CONC. PYRAMID ACROSS FR WOODS FIELD	STAMPED H&N TULIP
	B.M. 53-A	10.87	LIST OF VALID BENCHES			N.W. COR. SLAB BLDG. #7	
	B.M. 53-B	11.17	LIST OF VALID BENCHES			N.E. COR. DOOR SLAB BLDG. #15	DECLASSIFIED PER DOE
	B.M. 53-C	12.33	LIST OF VALID BENCHES			N.E. COR. SLAB BLDG. #50	LETTER DATED JULY, 15, 1994
	B.M. 53-D	13.82	LIST OF VALID BENCHES			TOP FIRE HYD. OPP. WHSE #37	FROM ANTON SINISGALLI TO
	B.M. 53-F	11.32	LIST OF VALID BENCHES			S.W. COR. CENTER SLAB BLDG. #56	DIANE S. NIXON
	B.M. 53-H	19.84	LIST OF VALID BENCHES			TOP FIRE HYD. #16 OPP. BLDG #160	
	B.M. 53-I	17.21	LIST OF VALID BENCHES			TOP FIRE HYD. #17 83' N. OPP. BLDG. #156	
LEROY	RIGILI	9.11	159	4	2-21-52	50 Cal shell in Cone Mon	Tide Observations

HOLMES & NARVER ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

COMPUTED BY _____ CHECKED BY _____ DATE 10-27-52

PLANE COORDINATES - IVY GRID
1952 EXPANSION OF HORIZONTAL CONTROL

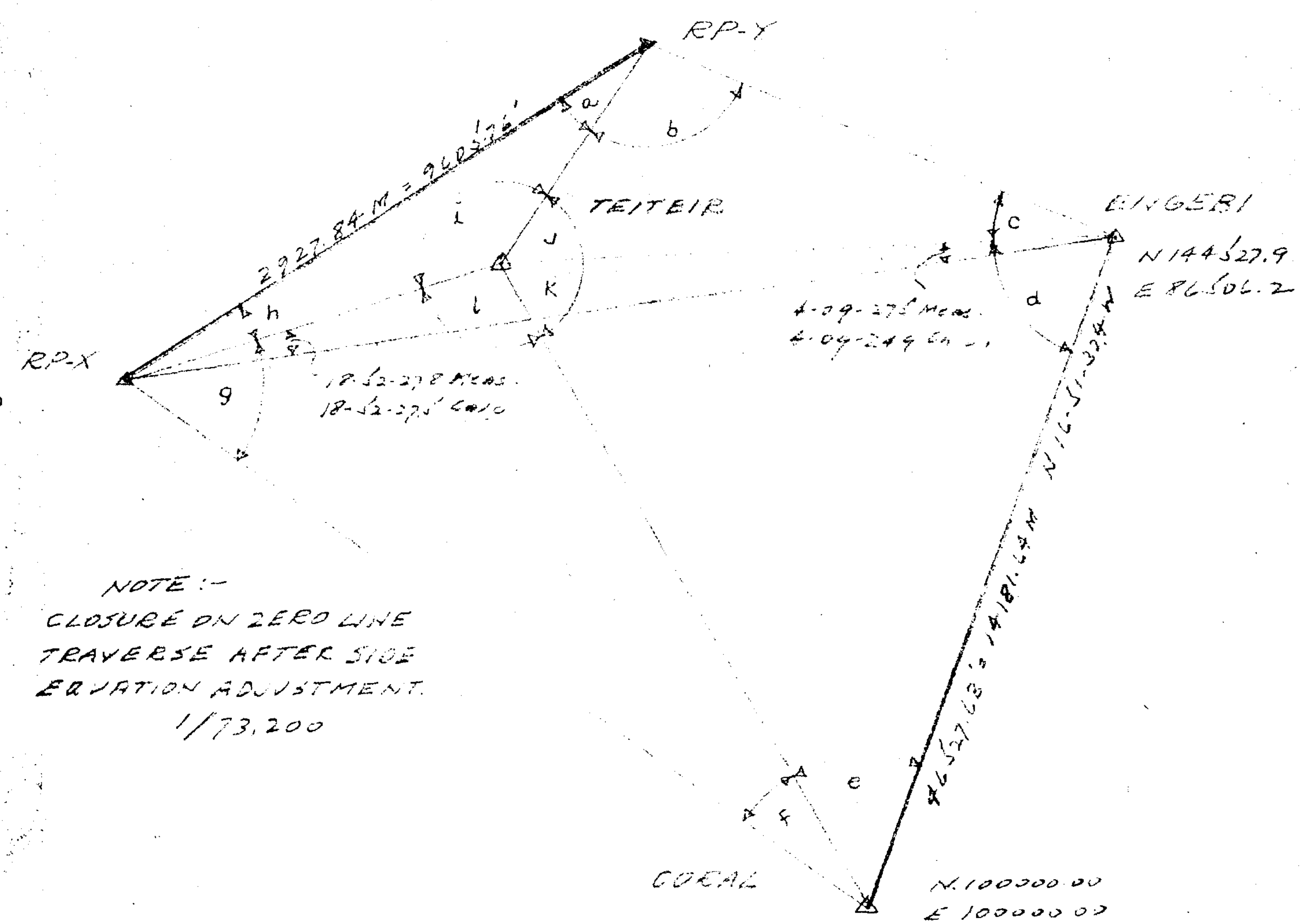
JOB NO. 831 LOCATION RP-X, RP-Y, Teitoir

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Corel									100,000.00		100,000.00		1
2	Engebi	N 16-51-32.4W	46527.63	.95702136	.29001744	44527.936			13493.824	144,527.94		86,506.18		2
3	RP-Y	N 59-03-[illegible].9E	11385.19	.50477091	.86319721	5792.545			9801.478	150,320.48		76,704.70		3
4	RP-X	S 73-51-47.5W	9605.76	.27709339	.96081309		2661.71		9229.628	147,658.79		67,475.07		4
5	Corel	S 84-[illegible]-28.1	57657.17	.82598326	.56369465		4765[illegible]	32524.083		99,999.99		99,999.95		5
6														6
7														7
8	Engebi									144,527.94		86,506.18		8
9	Teitoir	N 76-39-[illegible].17	15947.47	.23243075	.97237343	3722.630			15506.896	148,250.57		70,999.28		9
10	RP-X	S 80-26-4.5W	3573.55	.16560464	.98619303		591[illegible]		3524.210	147,658.77		67,475.07		10
11														11
12	Teitoir									148,250.57		70,999.28		12
13	RP-Y	N 7[illegible]-00-35.6E	6000.29	.34101635	.94004630	2069.[illegible]12		5705.414		150,320.48		76,704.69		13
14														14
15	Engebi									144,527.94		86,506.18		15
16	RP-X	N [illegible]-[illegible]-25.0W	19270.17	.16233101	.98673636	3130.657			19031.[illegible]56	147,658.797		67,475.12		16
17														17
18	Corel									100,000.00		100,000.00		18
19	Teitoir	N 31-00-27.8W	56995.28	.85709788	.51515360	48250.565			29000.716	148,250.57		70,999.28		19
20														20
21														21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY A.R.B. DATE 7-2-52 SUBJECT TRIANGULATION 1952 EXPANSION SHEET NO. 1 OF 3

CHKD. BY [illegible] DATE JOB NO. 831

TEITEIR, RP-X, RP-Y



	MEAS ∢	GEO. COND	TRIG. COND. SIDE EQ.	(1) LENGTH EQ.	(2)	(3)
a	3-51-13.5	13.4	13.9	13.9	13.9	13.9
b	129-28-36.1	37.4	36.7	36.7	36.6	36.5
c	17-05-01.1	59.3	59.8	00.0	00.1	00.2
d	120-21-30.7	29.8	29.5	29.3	29.3	29.3
e	14-08-55.9	54.5	55.0	55.2	55.3	55.4
f	3-18-13.4	14.8	14.3	14.3	14.3	14.3
g	25-13-11.9	12.9	13.4	13.4	13.4	13.4
h	6-53-18.0	17.9	17.4	17.2	17.1	17.0
i	[illegible]-28.4	28.7		28.9	29.0	29.1
j	53-22-24.1	23.3		23.3	23.3	23.3
k	[illegible]-32.2	31.7		31.1	31.4	31.3
l	[illegible]-28-20.4	32.3		32.3	32.3	32.3

Side Eq. Sin a · Sin c · Sin e · Sin g / Sin b · Sin d · Sin f · Sin h = 1

Log. Sin a	8.8314203	3.2	Log Sin b	9.8875494	17.3
c	9.4679912	[illegible]	d	9.9359[illegible]	[illegible]
e	9.388[illegible]	[illegible]	f	8.760[illegible]	[illegible]
g	9.6[illegible]	[illegible]	h	9.[illegible]	[illegible]
	7.641[illegible]	[illegible]		7.641[illegible]24	[illegible]
				63.20	[illegible]
				[illegible]	[illegible]

[illegible] / 105.17 = 0.54"

BY AEE DATE 7-2-62 SUBJECT TRIANGULATION ADJ. SHEET NO. 2 OF 3
CHKD. BY ASA DATE 12-17-62 1962 EXPANSION JOB NO. 831
TEITER 2DX-RPY

Length Eq. $\frac{1}{2}\sin a \cdot \sin c \cdot \sin e = \frac{1}{2}\sin b \cdot \sin d \cdot \sin f$

(1)

	4.1517268				3.4665477	
Log Sin e	9.3881683	83.6	Log Sin b		9.8531913	20.7
c	9.4679947	46.6	d		9.8887.5506	17.3
i	9.2568799	114.6	f		9.0524876	183.1
	2.2647727	244.8			2.2647777	221.1
					222	266.8
					90	487.9

90 / 487.9 = 0.18"

4652.60	Sin 19-08-51.2	Sin 120-21-29.2
Sin 45-29-35.5	15947.39	5629.5.2.8
15942.39	Sin 17-05-00.0	Sin 33-26-23.3
Sin 129-28-36.7	6069.25	11385.14
6069.25	Sin 109-35-28.9	Sin 3-51-13.9
Sin 6-33-17.2	9605.66	3573.50
5629.5.23	Sin 3-18-14.3	Sin 111-28-32.3
Sin 45-12-13.4	3573.50	57699.42

9605.66 = 9605.76 Mews.

---

(2)

	4.1517268				3.4665477	
Log Sin e	9.3881100	83.6	Log Sin b		9.8531913	20.7
c	9.4679910	46.6	d		9.8887.5506	17.3
i	9.2568799	114.6	f		9.0524876	183.1
	2.2647727	244.8			2.2647777	221.1
					227	266.8
					45	487.9

45 / 487.9 = 0.09 (+0.10)

4652.7.60	Sin 19-08-51.3	Sin 120-21-29.3
Sin 45-29-35.4	15947.42	5629.5.22
15942.42	Sin 17-05-00.1	Sin 33-26-23.3
Sin 129-28-36.6	6069.27	11385.16
6069.27	Sin 109-35-29.0	Sin 3-51-13.9
Sin 6-33-17.1	9605.47	3573.54
5629.5.22	Sin 3-18-14.3	Sin 111-28-32.3
Sin 45-12-13.4	3573.50	57699.40

9605.747 = 9605.76 Mews.

BY ARB DATE 7-2-X SUBJECT TRIANGULATION ADJ. SHEET NO. 3 OF 3
CHKD. BY LSH DATE 10-17-X 1952 EXPANSION JOB NO. 831
TEHIPITE, ERX, RRX.

(3)

		4.1517268			3.4664477	
Log Sin	w	9.8881708	83.6		9.9953151	20.7
	c	9.4479967	68.6		9.8872508	17.3
	i	9.2568788	114.6		9.6374858	183.1
		2.2849731	266.8		2.2644774	221.1
					31	266.8
					23	4879

23/4879 = 0.047 (±0.10')

4627.63	Sim 14-08-51.4	Sim 120-21-29.3
Sim 45-29-35.8	15947.47	5629.28
15947.42	Sim 17-05-00.2	Sim 33-20-23.3
Sim 29-28-36.5	6069.29	11385.19
6069.29	Sim 169-35-21.1	Sim 3-51-13.7
Sim 6-38-17.0	960.76	3573.51
5629.28	Sim 3-18-14.3	Sim 111-28-22.3
Sim 44-18-13.4	3573.10	57699.47

960.76 Calc. = 960.76 Meas.

COMPUTATION OF TRIANGLES

COMPUTED BY L.S.H. CHECKED BY L.S.H. DATE Oct. 1952

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3							4.1517265
1	Teiteir	45-29-36.2	- 0.8	35.4	0.1	35.3	0.1468091
2	Engebi	120-21-30.7	- 1.3	29.4	0.1	29.3	9.9359520
3	Coral	14-08-55.4	0.0	55.4	0.0	55.4	9.3881717
1-3		02.3				17158.83	4.2344876
1-2						4860.79	3.6867073
2-3							3.6867073
1	RP-Y	129-28-39.1	- 2.6	36.5	0.0	36.5	0.1124491
2	Engebi	17-05-01.1	- 0.9	00.2	0.0	00.2	9.4679974
3	Teiteir	33-26-24.5	- 1.2	23.3	0.0	23.3	9.7411994
1-3		04.7				1849.92	3.2671538
1-2						3470.21	3.5403558
2-3							3.2671538
1	RP-X	6-33-18.0	- 1.0	17.0	0.0	17.0	0.9425161
2	RP-Y	3-51-13.6	+ 0.4	13.9	0.0	13.9	8.8274459
3	Teiteir	169-35-28.4	+ 0.7	29.1	0.0	29.1	9.2568777
1-3		59.9				1089.22	3.0371158
1-2						2927.84	3.4665476
2-3							4.2344876
1	RP-X	65-13-11.9	+ 1.5	13.4	0.0	13.4	0.0419492
2	Teiteir	111-28-30.9	+ 1.4	32.3	0.0	32.3	9.9687506
3	Coral	3-18-13.8	+ 0.5	14.3	0.0	14.3	8.7606731
1-3		56.6				17586.82	4.2451874
1-2						1089.21	3.0371099

JOB Nº 651

ϵ = 0.2

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

					°	'	"						°	'	"
α	2	Engebi	to 3	Coral	343	08	00.2	α	3	Coral	to 2	Engebi	163	08	27.6
2d $\angle$			8		+ 120	21	29.4	3d $\angle$			8		- 14	08	55.4
α	2	Engebi	to 1	Teiteir	103	29	29.6	α	3	Coral	to 1	Teiteir	148	59	32.2
$\Delta\alpha$						-	31.6	$\Delta\alpha$						-	55.7
					180	00	00.0						180	00	00.0
α'	1	Teiteir	to 2	Engebi	283	28	58.0	α'	1	Teiteir	to 3	Coral	328	58	33.8/4

FIRST ANGLE OF TRIANGLE 45-29-35.4

	°	'	"			°	'	"		°	'	"			°	'	"
ϕ	11	39	41.964	2	Engebi	λ	162	14	55.151	ϕ	11	32	20.254	3	Coral	λ	162	17	10.044
$\Delta\phi$		+	36.896			$\Delta\lambda$	-	2	36.062	$\Delta\phi$	+	7	58.607			$\Delta\lambda$	-	4	51.855
ϕ'	11	40	18.860/1	1	Teiteir	λ'	162	12	19.089	ϕ'	11	40	18.861	1	Teiteir	λ'	162	12	19.089

	Logarithms	Values in seconds					Logarithms	Values in seconds			Logarithms	Values in seconds
s	3.6867087		$\frac{1}{2}(\phi+\phi')$	11 40 00.412	s	3.6867087		Cos α	9.9330304		$\frac{1}{2}(\phi+\phi')$	11 36 14.557
Cos α	9.3679186				Cos α	9.9873469		B	8.5124997			
B	8.5124960		s	3.6867087	A'	8.5096665		h	2.6800181	1st term -478.6500	s	4.2344880
h	1.8671233	1st term -36.9082	Sin α	9.9873469	Sec ϕ'	0.0090745		s^2	8.46898		Sin α	9.7119867
s^2	7.37342		A'	8.5096665	$\Delta\lambda$	2.1932966	156.0618	$\sin^2\alpha$	9.42387		A'	8.5096677
$\sin^2\alpha$	9.97569		Sec ϕ'	0.0090745	$\sin\frac{1}{2}(\phi-\phi')$	9.3058231		C	0.71669		Sec ϕ'	0.0090745
C	0.72139		$\Delta\lambda$	2.1932966	$-\Delta\alpha$	1.4991197	31.559		8.60954	2d term + 0.0407	$\Delta\lambda$	2.4651669
	8.07050	2d term + 0.0118	$\sin\frac{1}{2}(\phi-\phi')$	9.3058231				h^2	5.3600		$\sin\frac{1}{2}(\phi-\phi')$	9.3035137
h^2	3.1342		$-\Delta\alpha$	1.4991197				D	1.9845		$-\Delta\alpha$	1.7386908
D	1.9888								7.3445	3d term + 0.0022		
	5.1230	3d term + 0.0000								$-\Delta\phi$ -478.6071		
		$-\Delta\phi$ -36.8964										

ϵ = 0.0

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY I.S.H. DATE Nov. 1952

α	2	RP-Y	to 3	Teiteir	70	02	46.3	α	3	Teiteir	to 2	RP-Y	250	02	34.7
$\delta\angle$			8		+ 3	51	13.9	$\delta\angle$			8		- 169	35	29.1
α	2	RP-Y	to 1	RP-X	73	54	00.2	α	3	Teiteir	to 1	RP-X	80	27	05.6
$\Delta\alpha$						-	18.8	$\Delta\alpha$						-	07.2
					180	00	00.0						180	00	00.0
α'	1	RP-X	to 2	RP-Y	253	53	41.4	α'	1	RP-X	to 3	Teiteir	260	26	58.4

FIRST ANGLE OF TRIANGLE 6-33-17.0

ϕ	11	40	39.409	2	RP-Y	λ	162	13	16.502	ϕ	11	40	18.861	3	Teiteir	λ	162	12	19.089
$\Delta\phi$		-	26.429			$\Delta\lambda$	-	1	32.877	$\Delta\phi$		-	05.881			$\Delta\lambda$	-		35.464
ϕ'	11	40	12.980	1	RP-X	λ'	162	11	43.625	ϕ'	11	40	12.980	1	RP-X	λ'	162	11	43.625

	Logarithms	Values in seconds			Logarithms	Values in seconds			Logarithms	Values in seconds			Logarithms	Values in seconds	
				$\frac{1}{2}(\phi+\phi')$	11 40 26.195			$\frac{1}{2}(\phi+\phi')$	11 40 15.921			$\frac{1}{2}(\phi+\phi')$	11 40 15.921		
s	3.4665470			s	3.4665470			s	3.0371076			s	3.0371076		
Cos α	9.4429714			Cos α	9.4429714			Cos α	9.2197979			Sin α	9.9339411		
b	8.5124955			b	8.5124955			b	8.5124956			Δ'	8.5096864		
h	1.4220139	1st term	+26.4249	Sin α	9.9826237			h	0.7694011	1st term	+5.8803	Sec ϕ'	0.0090718		
s^2	6.93311			Δ'	8.5096864			s^2	6.07422			$-\Delta\lambda$	1.5497809	+35.4639	
$\sin^2\alpha$	9.96525			Sec ϕ'	0.0090718			$\sin^2\alpha$	9.86758			$\sin\frac{1}{2}(\phi+\phi')$	9.3059812		
c	0.72201			$-\Delta\lambda$	1.9679089	92.8771		C	0.72179			$-\Delta\alpha$	0.8557651	+7.174	
	7.62037	2d term	+0.0042	$\sin\frac{1}{2}(\phi+\phi')$	9.3060859				6.66389	2d term	+0.0005				
n^2	2.8440			$-\Delta\alpha$	1.2739948	18.793		n^2	1.5388						
D	1.9894							D	1.9892						
	4.9334	3d term	+0.0000						3.5280	3d term	+0.0000				
		$-\Delta\phi$	+26.4291							$-\Delta\phi$	+5.8805				

JOB Nº 831

ϵ = 0.0

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

				°	'	"						°	'	"
α	2 Engebi	to 3	Teiteir	103	29	29.6	α	3 Teiteir	to 2	Engebi		283	28	58.0
$2^d\angle$		8		+ 17	05	00.2	$3^d\angle$		8			- 33	26	23.3
α	2 Engebi	to 1	RP-Y	120	34	29.8	α	3 Teiteir	to 1	RP-Y		250	02	34.7
$\Delta\alpha$					-	20.0	$\Delta\alpha$						+	11.6
				180	00	00.0						180	00	00.0
α'	1 RP-Y	to 2	Engebi	300	34	09.8	α'	1 RP-Y	to 3	Teiteir		70	02	46.3

FIRST ANGLE OF TRIANGLE 129-28-36.5

	°	'	"			°	'	"			°	'	"			°	'	"
ϕ	11	39	41.964	2	Engebi	λ	162	14	55.151	ϕ	11	40	18.861	3	Teiteir	λ	162	12	19.089
$\Delta\phi$		+	57.445			$\Delta\lambda$	-	1	38.649	$\Delta\phi$		+	20.648			$\Delta\lambda$		+	57.413
ϕ'	11	40	39.409	1	RP-Y	λ'	162	13	16.502	ϕ'	11	40	39.409	1	RP-Y	λ'	162	13	16.502

	Logarithms	Values in seconds	
s	3.5403572		
Cos α	9.7064318		
B	8.5124960		
h	1.7592850	1st term	-57.4493
s^2	7.08071		
$\sin^2\alpha$	9.86997		
C	0.72139		
	7.66207	2d term	+0.0046
h^2	3.5186		
D	1.9908		
	5.5094	3d term	+0.0000
		$-\Delta\phi$	-57.4447

	°	'	"	Logarithms	Values in seconds	
$\frac{1}{2}(\phi+\phi')$	11	40	10.686			
s				3.5403592		
Sin α				9.9349852		
A'				8.5096665		
Sec ϕ'				0.0090834		
$\Delta\lambda$				1.9940943	98.6494	
$\sin\frac{1}{2}(\phi+\phi')$				9.3059279		
$-\Delta\alpha$				1.3000222	19.954	

	Logarithms	Values in seconds	
s	3.2671553		
Cos α	9.5331557		
B	8.5124956		
h	1.3128066	1st term	-20.5498
s^2	6.53431		
$\sin^2\alpha$	9.94621		
C	0.72179		
	7.20231	2d term	+ 0.0016
h^2	2.6256		
D	1.9892		
	4.6148	3d term	+ 0.0000
		$-\Delta\phi$	-20.5482

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	40	29.135		
s				3.2671553	
Sin α				9.9731042	
A'				8.5096664	
Sec ϕ'				0.0090834	
$\Delta\lambda$				1.7590093	57.4129
$\sin\frac{1}{2}(\phi+\phi')$				9.3061159	
$-\Delta\alpha$				1.0651252	11.618

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HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

CALC. BY LSH
CHECKED BY _____ DATE 10-28-52

JOB NO. 831 LOCATION Rigili #2 Boga #2

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST
1									
2	Eniwetok								
3	Rigili #2	N 69-03-08.8W	98575.78	35761327	93390806	35242.149			92060.715
4	Boga #2	N 17-04-57.0E	70167.37	95588278	29374838	67071.781		20611.551	
5	Engebi	N 80-34-24.7E	24166.00	16378117	98649859	5595.747		33704.641	
6									
7									
8									
9									
10	Coral	S 67-27-45.6W	73416.86	38328534	92362999		28139.606		67810.013
11	Rigili #2								
12									
13									
14	Coral	N 60-28-55.6W	61183.40	63631911	77142595	38932.167			47198.462
15	Boga #2								
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

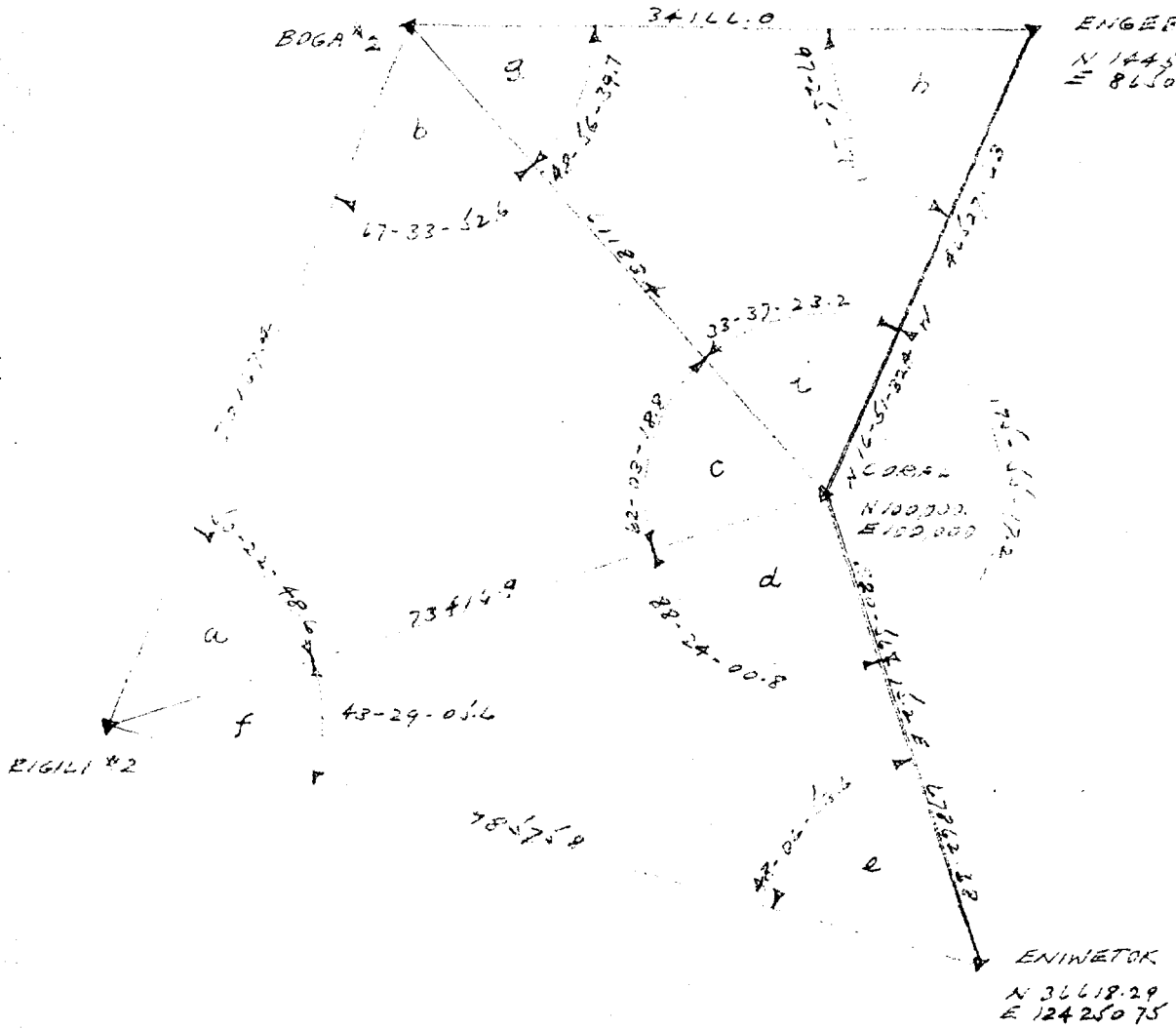
PLANE COORDINATES - IVY GRID
1952 EXPANSION OF HORIZONTAL CONTROL

COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
				1
36618.29		124250.75		2
71860.44		32190.04		3
138932.22		52801.59		4
144527.97	(.94)	86506.23	(.18)	5
				6
				7
				8
				9
100000.00		100000.00		10
71860.39	(.44)	32189.99	(.04)	11
				12
				13
100000.00		100000.00		14
138932.17	(.22)	52801.54	(.59)	15
				16
				17
				18
				19
				20
				21
				22
				23
				24
				25
				26
				27
				28
				29
				30

BY ARB DATE July 19 5x SUBJECT TRIANGULATION ARC. SHEET NO. 1 OF 2

CHKD. BY ARB DATE Nov 19 5x 1952 EXPANSION JOB NO. 831

BOGA #2 - EIGILI



	OBS. ∠	GEO. COND 180° sum Δ	GEO. COND i+c-d=42.8"	TRIG. COND (1)	TRIG. COND (2)
a	53-22-52.8	50.9	53.2	48.8	48.2
b	47-33-52.6	51.7	51.0	52.4	52.6
c	18-03-19.3	17.4	18.8	18.8	18.8
	05.6				
d	88-24-00.8	59.4	00.8	00.8	00.8
e	48 02 - 17.4	55.9	55.2	53.8	53.2
f	43-29-06.1	04.7	04.0	05.4	05.6
	24.2				
g	42-56-41.9	42.1	41.8	39.9	39.7
h	87-25-56.3	56.2	55.6	56.9	57.1
i	33-37-23.2	21.7	23.2	23.2	23.2
	59.4				

Corr. - Stars N 16-51-32.4 W

Corr. - Stars S 79-57-07.8 E

54-05-34.9

- 54-25.1

= 53-40-59.8

BY A.R.B. DATE July 1952 SUBJECT TRIANGULATION ADJ. SHEET NO. 2 OF 2

CHKD. BY L.S.H. DATE Nov 1952 1952 EXPANSION JOB NO. 831

BOGA #2 - DIGILI

Trig Cond (Engebi - Coral) (Sin h) (Sin b) (Sin f) = 1
(Eniwetok - Coral) (Sin e) (Sin a) (Sin g)

(1) Log 14181.14 4.1517218 Log 20684.59 4.3156469
" Sin h 9.9963810 02.7 " Sin e 9.8718590 18.9
" " b 9.9658166 08.7 " " a 9.8866585 17.4
" " f [illegible] 22.2 " " g 9.8274158 18.3
3.9510[illegible] 33.6 3.9515812 54.6
[illegible]72 33.6
130 88.2

130/88.2 = 1.47"

67862.68 / Sin 43-29-05.4 — Sin 48-06-53.8 (73416.95) — Sin 88-24-00.8 (98575.88)

46527.13 / Sin 48-56-39.9 — Sin 97-25-56.9 (61183.3[illegible]) — Sin 33-37-23.2 (34165.97)

61183.3594 / Sin 56-22-48.8 — Sin 67-33-52.4 (73416.72) — Sin 62-03-18.8 (70167.26)

(2) Log 14181.64 4.1517268 Log 20684.59 4.3156469
" Sin h 9.9963356 02.7 " Sin e 9.8718563 18.9
" " b 9.9658177 08.7 " " a 9.8866561 17.4
" " f 9.8276909 22.2 " " g 9.8274132 18.3
3.9515710 33.6 3.9515725 54.6
710 33.6
15 88.2

15/88.2 = 0.17"

67862.68 / Sin 43-29-05.6 — Sin 48-06-53.6 (73416.81) — Sin 88-24-00.8 (98575.78)

46527.63 / Sin 48-56-39.7 — Sin 97-25-57.1 (61183.40) — Sin 33-37-23.2 (34166.00)

61183.4030 / Sin 56-22-48.6 — Sin 67-33-52.6 (73416.86) — Sin 62-03-18.8 (70167.37)

Coral - Digili #2 73416.9

COMPUTATION OF TRIANGLES

COMPUTED BY L.S.H. CHECKED BY L.S.H. DATE Oct. 1962

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3							4.1517265
1	Boga #2	48-56-41.9	- 2.0	39.9	0.2	39.7	0.1228871
2	Engebi	97-25-56.0	+ 1.3	57.3	0.2	57.1	9.9963356
3	Coral	33-37-21.5	+ 1.7	23.2	0.0	23.2	9.7432960
1-3		59.4				18648.73	4.2706492
1-2						10413.81	4.0176096
2-3							4.2706492
1	Rigili #2	50-22-52.8	- 3.8	49.0	0.4	48.6	0.1133443
2	Boga #2	67-33-53.5	- 0.4	53.1	0.5	52.6	9.9658179
3	Coral	62-03-19.3	- 0.5	18.8	0.0	18.8	9.9461573
1-3		05.6				22377.49	4.3498114
1-2						21387.04	4.3301508
2-3							4.3156469
1	Rigili #2	43-29-06.1	+ 0.1	06.2	0.6	05.6	0.1623085
2	Coral	88-24-00.8	0.0	00.8	0.0	00.8	9.9998307
3	Eniwetok	48-06-57.4	- 3.2	54.2	0.6	53.6	9.8718560
1-3		04.3				30045.96	4.4777861
1-2						22377.49	4.3498114
2-3							
1							
2							
3							
1-3							
1-2							

JOB Nº 831

ϵ = 0.4

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

					°	'	"							°	'	"
α	2	Engebi	to 3	Coral	343	08	00.2	α	3	Coral	to 2	Engebi		163	08	27.6
3d $\angle$			8		+ 97	25	57.3	3d $\angle$			8			- 33	37	23.2
α	2	Engebi	to 1	Boga #2	80	33	57.5	α	3	Coral	to 1	Boga #2		129	31	04.4
$\Delta\alpha$					-	1	08.5	$\Delta\alpha$						-	1	35.4
					180	00	00.0							180	00	00.0
α'	1	Boga #2	to 2	Engebi	260	32	49.$\frac{1}{2}$	α'	1	Boga #2	to 3	Coral		309	29	29.0

FIRST ANGLE OF TRIANGLE 48-56-39.9

	°	'	"			°	'	"			°	'	"			°	'	"
ϕ	11	39	41.964	2 Engebi	λ	162	14	55.151	ϕ	11	32	20.254	3 Coral	λ	162	17	10.944
$\Delta\phi$		-	55.610		$\Delta\lambda$	-	5	39.154	$\Delta\phi$		+ 6	26.101		$\Delta\lambda$	-	7	54.947
ϕ'	11	38	46.35$\frac{5}{4}$	1 Boga #2	λ'	162	09	15.997	ϕ'	11	38	46.355	1 Boga #2	λ'	162	09	15.997

	Logarithms	Values in seconds		
	4.0176101			
Cos α	9.8146104			
B	8.5124964			
h	1.7447159	1st term	+ 55.5541	
s^2	8.03522			
$\sin^2\alpha$	9.98817			
C	0.72204			
	8.74543	2d term	+ 0.0556	
h^2	3.4894			
D	1.9894			
	5.4788	3d term	+ 0.0000	
		$-\Delta\phi$	+55.6097	

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	39	14.159		
s				4.0176101	
Sin α				9.9940861	
A'				8.5096665	
Sec ϕ'				0.0090343	
$-\Delta\lambda$				2.5303970	+339.1541
$\sin\frac{1}{2}(\phi+\phi')$				9.3053512	
$-\Delta\alpha$				1.8357482	+68.509

	Logarithms	Values in seconds		
s	4.2706495			
Cos α	9.8036750			
B	8.5124997			
h	2.5868242	1st term	-386.2106	
s^2	8.54130			
$\sin^2\alpha$	9.77459			
C	0.71669			
	9.03258	2d term	+ 0.1078	
h^2	5.1736			
D	1.9845			
	7.1581	3d term	+ 0.0014	
		$-\Delta\phi$	-386.1014	

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	35	33.306		
s				4.2706495	
Sin α				9.8872941	
A'				8.5096677	
Sec ϕ'				0.0090343	
$-\Delta\lambda$				2.5766456	+474.9478
$\sin\frac{1}{2}(\phi+\phi')$				9.3030904	
$-\Delta\alpha$				1.9797360	+ 95.441

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S-8

JOB Nº 831

ϵ = 0.9

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

					°	'	"							°	'	"
α	2	Boga #2	to 3	Coral	309	29	29.0	α	3	Corel	to 2	Boga #2		129	31	04.4
2d ∠			8		+ 67	33	53.1	3d ∠			8			- 62	03	18.8
α		Boga #2	to 1	Rigili #2	17	03	22.1	α	3	Coral	to 1	Rigili #2		67	27	45.6
$\Delta\alpha$					—	0	41.5	$\Delta\alpha$						—	2	16.0
					180	00	00.0							180	00	00.0
α'	1	Rigili #2	to 2	Boga #2	197	02	40.6	α'	1	Rigili #2	to 3	Coral		247	25	29.6

FIRST ANGLE OF TRIANGLE 50-22-49.0

	°	'	"			°	'	"		°	'	"			°	'	"
ϕ	11	38	46.355	2	Boga #2	λ	162	09	15.997	ϕ	11	32	20.254	3	Coral	λ	162	17	10.944
$\Delta\phi$	—	11	05.472			$\Delta\lambda$	—	3	26.962	$\Delta\phi$	—	4	39.371			$\Delta\lambda$	—	11	21.908
ϕ'	11	27	40.883	1	Rigili #2	λ'	162	05	49.035	ϕ'	11	27	40.883	1	Rigili #2	λ'	162	05	49.036

	Logarithms	Values in seconds			Logarithms	Values in seconds		Logarithms	Values in seconds			Logarithms	Values in seconds
	4.3301513			$\frac{1}{2}(\phi+\phi')$ 11 33 13.619			s	4.3498120			$\frac{1}{2}(\phi+\phi')$ 11 30 00.569		
Cos α	9.9804660				Logarithms	Values in seconds	Cos λ	9.5835223				Logarithms	Values in seconds
b	8.5124964			s	4.3301513		B	8.5124997			s	4.3498120	
h	2.8231137	1st term	+665.4474	Sin α	9.4673248		h	2.4458340	1st term	+279.1477	Sin α	9.9654982	
s^2	8.69930			A'	8.5096667		s^2	8.69962			A'	8.5096677	
$\sin^2\alpha$	8.93465			Sec ϕ'	0.0087478		$\sin^2\alpha$	9.93100			Sec ϕ'	0.0087478	
c	0.72055			$-\Delta\lambda$	2.3158906	+206.9620	C	0.71669			$-\Delta\lambda$	2.8337257	+681.9078
	8.31550	2d term	+ 0.0207	$\sin\frac{1}{2}(\phi+\phi')$	9.3016543			9.34731	2d term	+ 0.2225	$\sin\frac{1}{2}(\phi+\phi')$	9.2996612	
n^2	5.6462			$-\Delta\alpha$	1.6175449	+41.452	n^2	4.8917			$-\Delta\alpha$	2.1333869	+135.955
D	1.9684						D	1.9845					
	7.9340	3d term	+ 0.0043					6.8762	3d term	+ 0.0008			
		$-\Delta\phi$	+665.4724						$-\Delta\phi$	+279.3710			

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JOB Nº 831

$\epsilon = 1.2$

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

α	2	Coral	to 3	Eniwetok	339	03	44.8	α	3	Eniwetok	to 2	Coral	159	04	33.2
$2^d\angle$			8		+ 88	24	00.8	$3^d\angle$			8		- 48	06	54.2
α	2	Coral	to 1	Rigili #2	67	27	45.6	α	3	Eniwetok	to 1	Rigili #2	110	57	39.0
$\Delta\alpha$					-	2	16.0	$\Delta\alpha$					-	3	03.2
					180	00	00.0						180	00	00.0
α'	1	Rigili #2	to 2	Coral	247	25	29.6	α'	1	Rigili #2	to 3	Eniwetok	290	54	36.8

FIRST ANGLE OF TRIANGLE 43 - 29 - 06.2

ϕ	11	32	20.254	2	Coral	λ	162	17	10.944	ϕ	11	21	51.469	3	Eniwetok	λ	162	21	14.730
$\Delta\phi$	-	4	39.371			$\Delta\lambda$	-	11	21.908	$\Delta\phi$		+ 5	49.416			$\Delta\lambda$	-	15	25.697
ϕ'	11	27	40.883	1	Rigili #2	λ'	162	05	49.036	ϕ'	11	27	40.885	1	Rigili #2	λ'	162	05	49.033

	Logarithms	Values in seconds																
s	4.3498120																	
Cos α	9.5835223																	
b	8.5124997																	
h	2.4458340	1st term	+279.1477															
s^2	8.69962																	
$\sin^2\alpha$	9.93100																	
C	0.71669																	
	9.34731	2d term	+ 0.2225															
h^2	4.8917																	
D	1.9845																	
	6.8762	3d term	+ 0.0008															
		$-\Delta\phi$	+279.3710															

	°	'	"
$\frac{1}{2}(\phi+\phi')$	11	30	00.569

	Logarithms	Values in seconds
s	4.3498120	
Sin α	9.9654980	
A'	8.5096677	
Sec ϕ'	0.0087478	
$-\Delta\lambda$	2.8337265	+681.9075
$\sin\frac{1}{2}(\phi+\phi')$	9.2996612	
$-\Delta\alpha$	2.1333867	+135.952

	Logarithms	Values in seconds		
s	4.4777861			
Cos α	9.5535550			
B	8.5125050			
h	2.5438461	1st term	-349.8212	
s^2	8.95557			
$\sin^2\alpha$	9.94053			
C	0.70988			
	9.60598	2d term	+ 0.4036	
h^2	5.0877			
D	1.9782			
	7.0659	3d term	+ 0.0012	
		$-\Delta\phi$	-349.4164	

	°	'	"
$\frac{1}{2}(\phi+\phi')$	11	24	46.177

	Logarithms	Values in seconds
s	4.4777861	
Sin α	9.9702656	
A'	8.5096695	
Sec ϕ'	0.0087478	
$\Delta\lambda$	2.9664690	+925.6974
$\sin\frac{1}{2}(\phi+\phi')$	9.2963948	
$-\Delta\alpha$	2.2628638	+183.174

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HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

TRAVERSE COMPUTATIONS

CALC. BY LSH
CHECKED BY _____ DATE 10-28-52

JOB NO. 831 LOCATION Ivy, Eniwetok

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST
1	Coral								
2	Sand	S 70-57-07.5E	37438.21	32635970	94524565		12218.323	35388.305	
3	Ivy	S 4-45-44.1W	35369.70	99654778	08302127		35247.600		2936.437
4	Eniwetok	S 27-15-40.4W	17904.49	88892744	45804803		15915.792		8201.116
5	Coral	N 20-56-15.2W	67862.68	93397044	35735027	63381.737			24250.747
6									
7									
8	Coral								
9	Ivy	S 34-21-35.7E	57499.05	82550854	56438965		47465.957	32451.868	
10									
11									
12	Sand								
13	Eniwetok	S 12-16-51.3W	52361.65	97711647	21270495		51165.431		11137.582
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

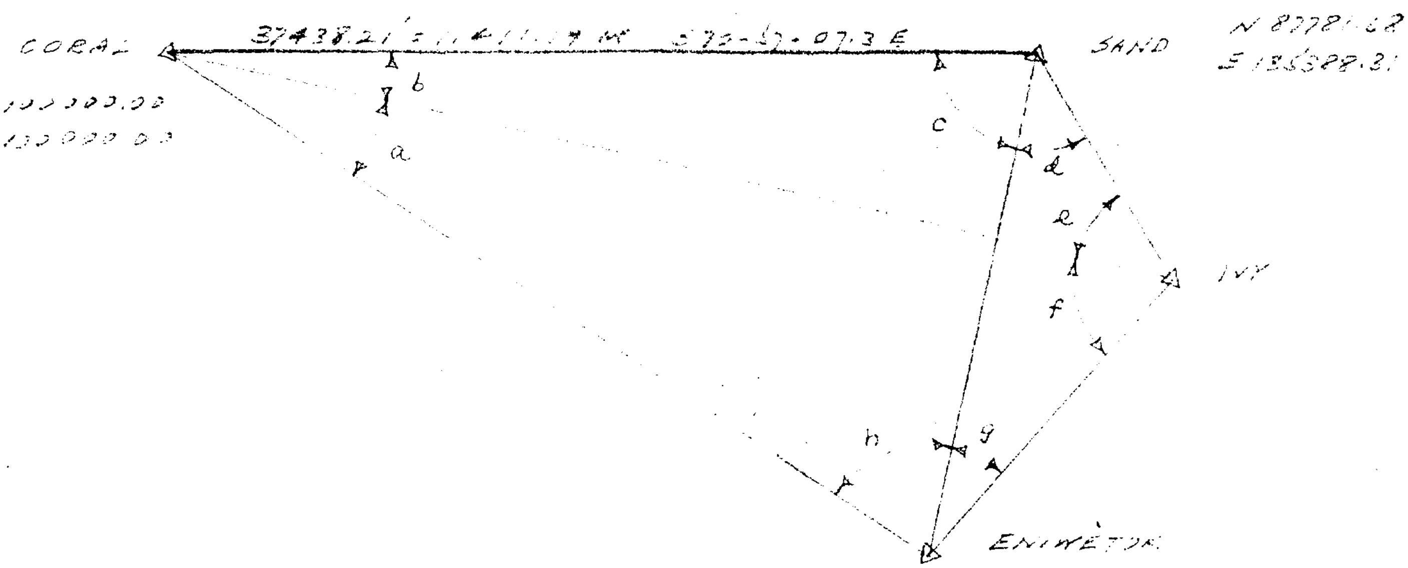
PLANE COORDINATES - IVY GRID
1952 EXPANSION OF HORIZONTAL CONTROL

COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
100000.00		100000.00		1
87781.68		135388.31		2
52534.08		132451.87		3
36618.29		124250.75		4
100000.02		100000.00		5
				6
				7
100000.00		100000.00		8
52534.04		132451.87		9
				10
				11
87781.68		135388.31		12
36618.25		124250.73		13
				14
				15
				16
				17
				18
				19
				20
				21
				22
				23
				24
				25
				26
				27
				28
				29
				30

BY LSH DATE 10-14-52 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1

CHKD. BY LSH DATE 1952 EXPANSION JOB NO. 231

IVY - ENIWETOK



	MEAS ∡	GEO. COND A	GEO. COND B	TRIG. COND SIDE EQ.	
a	12-25-19.3	19.45	19.2	20.5	
b	36-35-33.1	33.25	32.9	31.6	
c	96-46-00.2	00.35	00.1	01.2	
d	7-31-08.2	08.35	08.5	07.2	
e	39-07-18.1	18.25	18.5	19.8	
f	118-22-44.7	44.85	45.2	43.9	
g	14-58-47.3	47.45	47.8	49.1	
h	33-13-07.9	08.05	07.8	06.5	
	57.8				

Side Equation = $\frac{\text{Sin a} \cdot \text{Sin c} \cdot \text{Sin e} \cdot \text{Sin g}}{\text{Sin b} \cdot \text{Sin d} \cdot \text{Sin f} \cdot \text{Sin h}} = 1$

Log. Sin a	9.3327132	88.2	Log Sin b	9.7753333	28.4
c	9.9970642	02.5	d	9.1167918	15.4
e	9.8000095	25.9	f	9.9443943	11.4
g	9.4128308	78.7	h	9.7386524	32.8
	8.5731154	195.3		8.5751718	23.4
				1154	195.3
				564	426.7

564 / 426.7 = 1.32"

37438.21	Sin 50-00-52.1	Sin 96-46-01.4
Sin 33-13-06.5	52361.61	49582.68
52361.61	Sin 7-31-07.2	Sin 14-58-48.4
Sin 129-30-03.7	17904.52	35369.68
37438.21	Sin [illegible]	Sin 36-35-31.6
Sin [illegible]	17499.05	35369.70
17499.05	Sin 12-25-20.5	Sin 118-22-43.7
Sin 48-12-55.6	17904.49	49582.67

Coral - Eniwetok 35369.68

COMPUTATION OF TRIANGLES

COMPUTED BY L.S.H. CHECKED BY L.S.H. DATE Oct. 1952

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3							4.0573309
1	Eniwetok	33-13-07.9	- 1.2	06.7	0.2	06.5	0.2613518
2	Coral	50-00-52.4	- 0.2	52.2	0.1	52.1	9.8843460
3	Sand	96-46-00.2	+ 1.4	01.6	0.2	01.4	9.9969639
1-3		00.5				15959.85	4.2030287
1-2						20684.58	4.3156466
2-3							4.0573309
1	Ivy	39-07-18.1	+ 1.8	19.9	0.1	19.8	0.1999871
2	Coral	36-35-33.1	- 1.5	31.6	0.0	31.6	9.7753296
3	Sand	104-17-08.4	+ 0.4	08.8	0.2	08.6	9.9863584
1-3		59.6				10780.72	4.0326476
1-2						17525.74	4.2436764
2-3							4.2436764
1	Eniwetok	48-11-55.2	+ 0.5	55.7	0.1	55.6	0.1275747
2	Coral	13-25-19.3	+ 1.2	20.5	0.0	20.5	9.3657267
3	Ivy	118-22-44.7	- 0.7	44.0	0.1	43.9	9.9443958
1-3		59.2				5457.30	3.7369777
1-2						20684.59	4.3156469
2-3							4.2030287
1	Ivy	157-30-02.8	+ 0.9	03.7	0.0	03.7	0.4171792
2	Eniwetok	14-58-47.3	+ 1.8	49.1	0.0	49.1	9.4124387
3	Sand	7-31-08.2	- 1.0	07.2	0.0	07.2	9.1167711
1-3		58.3				10780.89	4.0326466
1-2						5457.31	3.7369790

JOB Nº 831

$\epsilon = 0.2$

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

α	2	Coral	to 3	Ivy	325	38	24.3	α	3	Ivy	to 2	Coral	145	39	29.2
$2^d\angle$			8		+ 13	25	20.5	$3^d\angle$			8		- 118	22	44.0
α		Coral	to 1	Eniwetok	339	03	44.8	α	3	Ivy	to 1	Eniwetok	27	16	45.2
$\Delta\alpha$						+	48.4	$\Delta\alpha$						-	16.2
					180	00	00.0						180	00	00.0
α'	1	Eniwetok	to 2	Coral	159	04	33.2	α'	1	Eniwetok	to 3	Ivy	207	16	29.0 28.9

FIRST ANGLE OF TRIANGLE 48-11-55.7

ϕ	11	32	20.254	2	Coral	λ	162	17	10.944	ϕ	11	24	29.334	3	Ivy	λ	162	22	37.224
$\Delta\phi$	—	10	28.785			$\Delta\lambda$	+	4	03.786	$\Delta\phi$	—	2	37.865			$\Delta\lambda$	—	1	22.494
ϕ'	11	21	51.469	1	Eniwetok	λ'	162	21	14730	ϕ'	11	21	51.469	1	Eniwetok	λ'	162	21	14.730

	Logarithms	Values in seconds						Logarithms	Values in seconds				Logarithms	Values in seconds
s	4.3156469			$\frac{1}{2}(\phi+\phi')$	11 27 05.862		s	3.7369778			$\frac{1}{2}(\phi+\phi')$	11 23 10.402	
Cos α	9.9703331				Logarithms	Values in seconds	Cos α	9.9487960					Logarithms	Values in seconds
b	8.5124997			s	4.3156469		b	8.5125037			s	3.7369778		
h	2.7984797	1st term	628.7525	Sin α	9.5530941		h	2.1982775	1st term	+157.8620	Sin α	9.6611757		
s^2	8.63129			A'	8.5096677		s^2	7.47396			A'	8.5096691		
$\sin^2\alpha$	9.10619			Sec ϕ'	0.0085993		$\sin^2\alpha$	9.32235			Sec ϕ'	0.0085993		
C	0.71669			$-\Delta\lambda$	2.3870080	-243.7856	C	0.71161			$-\Delta\lambda$	1.9164219		82.4939
	8.45417	2d term	+ 0.0285	$\sin\frac{1}{2}(\phi+\phi')$	9.2978493			7.50792	2d term	+ 0.0032	$\sin\frac{1}{2}(\phi+\phi')$	9.2943947		
h^2	5.5970			$-\Delta\alpha$	1.6848573	- 48.401	h^2	4.3966			$-\Delta\alpha$	1.2108166		16.249
D	1.9845						D	1.9798						
	7.5815	3d term	+ 0.0038					6.3764	3d term	+ 0.0002				
		$-\Delta\phi$	+628.7848						$-\Delta\phi$	157.8654				

S-8

JOB Nº 831

ϵ = 0.3

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952.

	2	Coral	to 3	Sand	289	02	52.7		3	Sand	to 2	Coral	109	04	03.8
3rd ∠			8		+ 36	35	31.6	3rd ∠			8		- 104	17	08.8
α		Coral	to 1	Ivy	325	38	24.3	α	2	Sand	to 1	Ivy	4	46	55.0
$\Delta\alpha$						+ 1	04.9	$\Delta\alpha$							- 05.9
					180	00	00.0						180	00	00.0
α'	1	Ivy	to 2	Coral	145	39	29.2	α'	1	Ivy	to 3	Sand	184	46	49.1

FIRST ANGLE OF TRIANGLE 39-07-19.9

ϕ	11	32	20.254	2 Coral	λ	162	17	10.944	ϕ	11	30	18.986	3 Sand	λ	162	23	06.870
$\Delta\phi$	—	7	50.919		$\Delta\lambda$		+ 5	26.279	$\Delta\phi$	—	5	49.652		$\Delta\lambda$		—	29.646
ϕ'	11	24	29.334	1 Ivy	λ'	162	22	37.223	ϕ'	11	24	29.334	1 Ivy	λ'	162	22	37.224

Logarithms	Values in seconds			Logarithms	Values in seconds			Logarithms	Values in seconds		
4.2436761			$\frac{1}{2}(\phi+\phi')$	11 28 24.794		s	4.0326473			$\frac{1}{2}(\phi+\phi')$	11 27 34.160
9.9167216				Logarithms	Values in seconds	Cos λ	9.9984867				Logarithms	Values in seconds
8.5124997			s	4.2436761		S	8.5125007			s	4.0326473	
2.6728974	1st term	470.8661	Sin α	9.7515791		h	2.5436337	1st term	349.6502	Sin α	8.9209776	
8.48735			A'	8.5096677		s^2	8.06529			A'	8.5096681	
9.50316			Sec ϕ'	0.0086662		$\sin^2\alpha$	7.84196			Sec ϕ'	0.0086662	
0.71669			$\Delta\lambda$	2.5135891	+326.2790	C	0.71538			$-\Delta\lambda$	1.4719592	+29.6455
8.70720	2d term	+ 0.0510	Sin $\frac{1}{2}(\phi+\phi')$	9.2986688			6.62263	2d term	+ 0.0004	Sin $\frac{1}{2}(\phi+\phi')$	9.2981433	
6.3458			$-\Delta\alpha$	1.8122579	−64.901	n^2	5.0873			$-\Delta\alpha$	0.7701025	+ 5.890
1.9845						D	1.9883					
7.3303	3d term	+ 0.0021					7.0756	3d term	+ 0.0012			
	$-\Delta\phi$	+470.9192						$-\Delta\phi$	349.6518			

S-8

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

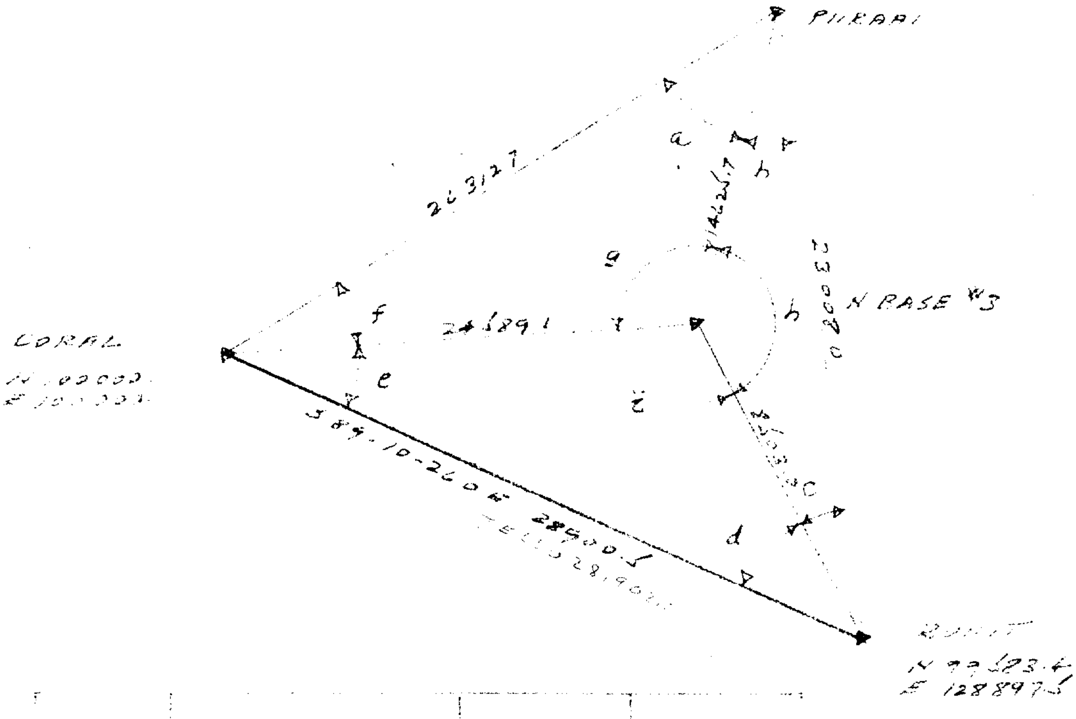
TRAVERSE COMPUTATIONS

CALC. BY ARB
CHECKED BY LSH
DATE 10-28-52
JOB NO. 831
LOCATION N. Base #3, Piiraai

PLANE COORDINATES - IVY GRID
1952 EXPANSION OF HORIZONTAL CONTROL

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral									100000.00		100000.00		1
2	Runit	S 89-10-26.0E	28900.5	01441786	99989606		416.683	28897.496		99583.32		128897.50		2
3	Piiraai	N 29-32-16.9W	23008.04	87002868	49300112	20017.655			11342.989	119600.97		117554.51		3
4	Coral	S 41-50-50.7W	26512.71	74492414	66714918		19600.973		17554.503	100000.00		100000.00		4
5														5
6														6
7	Coral									100000.00		100000.00		7
8	N. Base #3	N 75-01-26.3E	24589.12	25841489	96603403	6354.195		23753.927		106354.20		123753.93		8
9	Runit	S 37-13-21.0E	8503.00	79629243	60491186		6770.875	5143.566		99583.32		128897.49		9
10														10
11														11
12	Piiraai	S 25-04-45.7E	14625.66	90572155	42387319		13246.775	6199.425		119600.97		117554.51		12
13	N. Base #3									106354.20		123753.94		13
14														14
15														15
16														16
17														17
18														18
19														19
20														20
21														21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY ARB DATE July 1952 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1
CHKD. BY ESH DATE Nov 1952 1952 EXPANSION JOB NO. 831
N BASE #3, PIIRAAI



	OBS. ∡	GEO. COND	TRIG. COND
a	66-55-37.8	37.7	36.4
b	4-27-29.9	29.9	31.2
c	7-41-04.6	05.4	04.1
d	51-57-04.9	03.7	05.0
e	15-48-10.3	09.0	07.7
f	33-10-34.4	34.3	35.6
g	79-53-48.1	48.0	48.0
h	167-51-23.6	24.7	24.7
i	112-14-48.2	47.3	47.3

Trig Cond. (Side equation) $= \frac{\sin a \cdot \sin c \cdot \sin e}{\sin b \cdot \sin d \cdot \sin f} = 1$

Log Sin. a 9.9637912 9.0 Log Sin b 8.8906089 271
c 9.1262089 1561 d 9.8962419 165
e 9.4350831 744 f 9.7381584 322
8.5250832 2394 8.5250092 3189
0092 319.7
740 5592 740/55.92 = 13"

$\frac{28900.5}{\sin 71-23-07.6}$ Sin 59-38-09.1 (26312.71) Sin 48-58-43.3 (23008.04)

$\frac{28900.5}{\sin 112-14-47.3}$ Sin 51-57-05.0 (24589.12) Sin 15-48-07.7 (8203.00)

$\frac{24589.1209}{\sin 66-55-36.4}$ Sin 79-53-48.0 (26312.71) Sin 33-10-35.6 (14625.72)

60

JOB Nº 831

HOLMES & NARVER INC., ENGINEERS

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 7-7-52

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3							3.9449227
1	N. Base #3	112-14-48.3	- 1.0	47.3	0.0	47.3	0.0335937
2	Runit	51-57-04.9	+ 0.1	05.0	0.0	05.0	9.8962440
3	Coral	15-48-10.3	- 2.6	07.7	0.0	07.7	9.4350734
1-3		03.5				7494.81	3.8747604
1-2						2591.73	3.4135898
2-3							3.8747605
1	Piiraai	66-55-37.8	- 1.3	36.5	0.1	36.4	0.0362099
2	N. Base #3	79-53-48.1	- 0.1	48.0	0.0	48.0	9.9932126
3	Coral	33-10-34.4	+ 1.2	35.6	0.0	35.6	9.7381626
1-3		00.3				8020.16	3.9041830
1-2						4457.93	3.6491330
2-3							3.9449227
1	Piiraai	71-23-06.8	+ 0.9	07.7	0.1	07.6	0.0233349
2	Runit	59-38-09.5	- 0.4	09.1	0.0	09.1	9.9359254
3	Coral	48-58-44.7	- 1.4	43.3	0.0	43.3	9.8776394
1-3		01.0				8020.16	3.9041830
1-2						7012.89	3.8458970
2-3							
1							
2							
3							
1-3							
1-2							

JOB Nº 831

ϵ = 0.0

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

					°	'	"						°	'	"
α	2	Runit	to 3	Coral	90	50	32.2	α	3	Coral	to 2	Runit	270	49	34.0
$2^d\angle$			&		+ 51	57	05.0	$3^d\angle$			&		− 15	48	07.7
α	2	Runit	to 1	N.Base #3	142	47	37.2	α	3	Coral	to 1	N.Base #3	255	01	26.3
$\Delta\alpha$						−	10.4	$\Delta\alpha$						+	47.8
					180	00	00.0						180	00	00.0
α'	1	N.Base #3	to 2	Runit	322	47	26.8	α'	1	N.Base #3	to 3	Coral	75	02	14.1

FIRST ANGLE OF TRIANGLE

	°	'	"			°	'	"			°	'	"			°	'	"
ϕ	11	32	16.080	2	Runit	λ	162	22	01.621	ϕ	11	32	20.254	3	Coral	λ	162	17	10.944
$\Delta\phi$		+ 1	07.181			$\Delta\lambda$		−	51.723	$\Delta\phi$		+ 1	03.007			$\Delta\lambda$	+	3	58.953
ϕ'	11	33	23.262	1	N.Base #3	λ'	162	21	09.898	ϕ'	11	33	23.261	1	N.Base #3	λ'	162	21	09.897

Logarithms	Values in seconds			°	'	"	Logarithms	Values in seconds			Logarithms	Values in seconds
3.4135881			$\frac{1}{2}(\phi+\phi')$	11	32	49.670	s 3.8747583			$\frac{1}{2}(\phi+\phi')$	11 32 51.557	
9.9011656				Logarithms		Values in seconds	Cos α 9.4123175				Logarithms	Values in seconds
8.5124998			s	3.4135881			B 8.5124997			s	3.8747583	
1.8272535	1st term	−67.1821	Sin α	9.7815307			h 1.7995755	1st term	−63.0341	Sin α	9.9849025	
6.82718			A'	8.5096680			s^2 7.74952			A'	8.5096677	
Sin α 9.56306			Sec ϕ'	0.0088946			Sin$^2\alpha$ 9.97199			Sec ϕ'	0.0088946	
0.71664			$-\Delta\lambda$	1.7136814		+51.7227	C 0.71669			$-\Delta\lambda$	2.3783131	− 238.9534
7.10688	2d term	+ 0.0013	Sin$\frac{1}{2}(\phi+\phi')$	9.3014075			8.43820	2d term	+ 0.0274	Sin$\frac{1}{2}(\phi+\phi')$	9.3014269	
3.6545			$-\Delta\alpha$	1.0150889		+10.354	h^2 3.5992			$-\Delta\alpha$	1.6797400	− 47.834
1.9845							D 1.9845					
5.6390	3d term	+ 0.0000					5.5837	3d term	+ 0.0000			
	$-\Delta\phi$	−67.1808						$-\Delta\phi$	−63.0067			

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JOB No 831

ϵ = 0.1

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

α	2	N. Base #3 to 3	Coral	75	02	14.1	α	3	Coral	to 2	N. Base #3	255	01	26.3
$2^d\angle$		8		+ 79	53	48.0	$3^d\angle$			8		− 33	10	35.6
α	2	N. Base #3 to 1	Piiraai	154	56	02.1	α	3	Coral	to 1	Piiraai	221	50	50.7
$\Delta\alpha$					−	12.5	$\Delta\alpha$					+		35.4
				180	00	00.0						180	00	00.0
α'	1	Piiraai to 2	N.Base #3	334	55	49.6	α'	1	Piiraai	to 3	Coral	41	51	26.1

FIRST ANGLE OF TRIANGLE 66-55-36.5

ϕ	11	33	23.262	2	N. Base #3	λ	162	21	09.898	ϕ	11	32	20.254	3	Coral	λ	162	17	10.944
$\Delta\phi$		+ 2	11.421			$\Delta\lambda$	−	1	02.341	$\Delta\phi$		+ 3	14.428			$\Delta\lambda$		+ 2	56.613
ϕ'	11	35	34.683	1	Piiraai	λ'	162	20	07.557	ϕ'	11	35	34.682	1	Piiraai	λ'	162	20	07.557

	Logarithms	Values in seconds	
s	3.6491323		
Cos α	9.9570418		
b	8.5124992		
h	2.1186733	1st term	131.4236
s^2	7.29826		
$\sin^2\alpha$	9.25404		
C	0.71736		
	7.26966	2d term	+ 0.0019
h^2	4.2374		
D	1.9851		
	6.2225	3d term	+ 0.0002
		$-\Delta\phi$	−131.4215

		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11 34 28.972		
s		3.6491323	
Sin α		9.6270209	
A'		8.5096676	
Sec ϕ'		0.0089513	
$-\Delta\lambda$		1.7947721	+62.3408
$\sin\frac{1}{2}(\phi+\phi')$		9.3024296	
$-\Delta\alpha$		1.0972017	+12.508

	Logarithms	Values in seconds	
s	3.9041814		
Cos λ	9.8721121		
b	8.5124997		
h	2.2887932	1st term	194.4434
s^2	7.80836		
$\sin^2\alpha$	9.64845		
C	0.71669		
	8.17350	2d term	+ 0.0149
h^2	4.5776		
D	1.9845		
	6.5621	3d term	+ 0.0004
		$-\Delta\phi$	−194.4281

		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11 33 37.468		
s		3.9041814	
Sin α		9.8242229	
A'		8.5096677	
Sec ϕ'		0.0089513	
$-\Delta\lambda$		2.2470233	−176.6133
$\sin\frac{1}{2}(\phi+\phi')$		9.3018998	
$-\Delta\alpha$		1.5489231	− 35.393

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HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

CALC. BY ARB
CHECKED BY LSH DATE 10-28-52

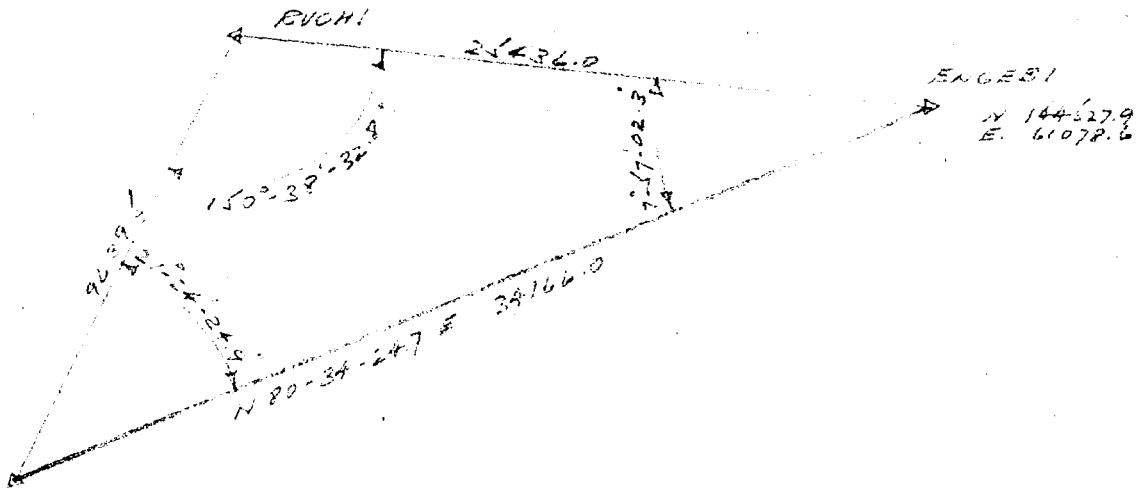
	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST
1	Engebi								
2		S 88-31-27.0W	25436.02	02575530	99966828		655.112		25427.582
3	Ruchi	S 59-09-59.8W	9639.49	51254333	85866136		4940.656		8277.058
4	Boga #2								
5									
6	Coral								
7		N 12-37-28.0E	33525.23	97582361	21855958	32714.711		7327.260	
8	Rujoru	S 64-34-08.6E	6923.64	42942295	90310350		2973.170	6252.764	
9	Aomon								
10									
11	Coral								
12		N 5-14-06.2E	34306.02	99582876	09124188	34162.921		3130.146	
13	Aitsu	S 67-03-59.7E	11346.74	38966115	92095830		4421.584	10449.874	
14	Aomon								
15									
16	Coral								
17		N 0-55-36.7E	35052.17	99986916	01617808	35047.584		567.007	
18	Yeiri	S 67-49-00.7E	14053.21	37756831	92598174		5306.047	13013.016	
19	Aomon								
20									
21	Rujoru								
22		N 70-57-46.9W	4439.94	32617822	94530829	1448.21			4197.11
23	Aitsu	N 70-57-28.9W	2711.51	32626071	94527982	884.66			2563.14
24	Yeiri								
25									
26									
27									
28									
29									
30									

PLANE COORDINATES - IVY GRID
1952 EXPANSION OF HORIZONTAL CONTROL

JOB NO. 831 LOCATION Ruchi, Rujoru, Aitsu, Yeiri

COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
144527.94		88506.18		1
143872.83		81078.60		2
138932.17	(.17)	52801.54	(.54)	3
				4
				5
100000.00		100000.00		6
132714.71		107327.26		7
129741.54		113580.02		8
				9
				10
100000.00		100000.00		11
134162.92		103130.15		12
129741.54		113580.02		13
				14
				15
100000.00		100000.00		16
135047.58		100567.01		17
129741.54		113580.02		18
				19
				20
132714.71		107327.26		21
134162.92		103130.15		22
135047.58		100567.01		23
				24
				25
				26
				27
				28
				29
				30

BY AFR DATE July 1952 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1
CHKD. BY LSH DATE Nov. 1952 1952 EXPANSION JOB NO. 831
EUCH



SQUAW
N 1[illegible]
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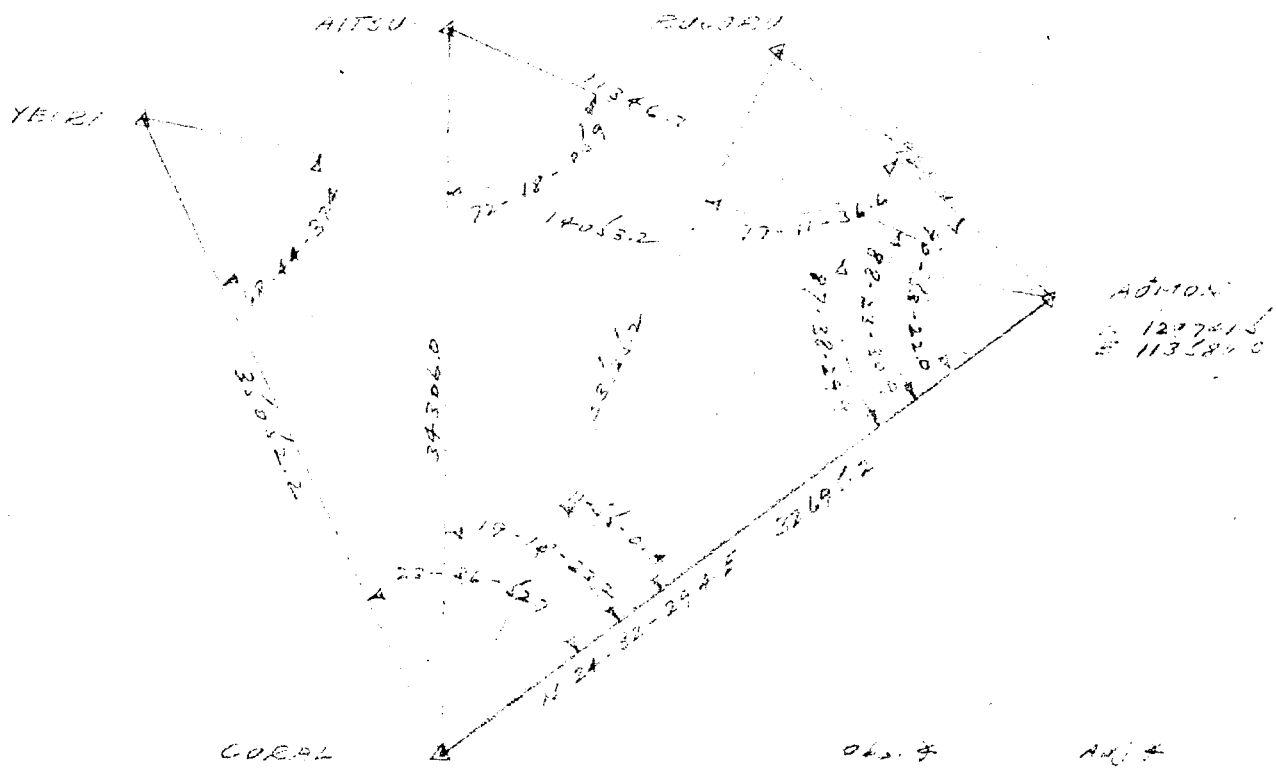
OBS. ∠	ADJ. ∠
150-38-33.1	150-38-32.8
7-57-02.6	7-57-02.3
21-24-25.2	21-24-24.9
00.9	

34.61.00
Sin 150-38-32.8

Sin 21-24-24.9
(24436.02)

Sin 7-57-02.3
(9839.44)

BY ARG DATE Sept, 19?? SUBJECT TRIANGULATION ADJ.
CHKD. BY - DATE 1942 FIELDWORK
SHEET NO. 1 OF 1
JOB NO. 821
YEIRI-AITSU-BUNDEN-ADMON-CORAL



CORAL
N 100 803.0
E 139 055.0

	Obs. ∠	Adj ∠
Bundn	77-11-36.6	36.6
Admon	90-13-22.0	22.0
Coral	11-34-02.4	01.4
	52.4	

	Obs. ∠	Adj ∠
Yeiri	72-18-09.8	09.9
Admon	88-28-31.8	30.9
Coral	19-18-24.1	23.2
	02.7	

	Obs. ∠	Adj ∠
Yeiri	28-44-38.6	37.4
Admon	81-28-33.6	29.9
Coral	23-36-53.4	52.7
	02.1	

32 495.2
Sin 77-11-36.6
(6923.04)

Sin 11-34-04.4
(6923.04)

Sin 90-13-22.0
(38126.23)

32 495.2
Sin 72-18-09.8
(31846.32)

Sin 19-18-24.2
(31846.32)

Sin 88-28-30.9
(34306.02)

38 126.2
Sin 28-46-52.7
(34306.02)

Sin 28-46-52.7
(38126.2 ?)

Sin 81-28-29.8
(38126.2 ?)

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 7-7-52

	STATION	OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM	
2-3							4.0176101	
1	Ruchi	150-36-33.1	- 0.3	32.8	0.0	32.8	0.3095751	
2	Engebi	7-57-02.6	- 0.3	02.3	0.0	02.3	9.1408848	RUCHI
3	Boga #2	21-24-25.2	- 0.3	24.9	0.0	24.9	9.5622800	
		00.9						
1-3						2938.12	3.4680700	
1-2						7752.92	3.8894652	
2-3							3.9985000	
1	Rujoru	77-11-35.4	+ 1.2	36.6	0.0	36.6	0.0109400	
2	Aomon	90-53-20.8	+ 1.2	22.0	0.0	22.0	9.9999477	RUJORU
3	Coral	11- 55-00.2	+ 1.2	01.4	0.0	01.4	9.3149105	
		56.4						
1-3						10218.51	4.0093877	
1-2						2110.33	3.3243505	
2-3							3.9985000	
1	Aitsu	72-18-06.8	- 0.9	05.9	0.0	05.9	0.0210575	
2	Aomon	88-23-31.8	- 0.9	30.9	0.0	30.9	9.9998289	AITSU
3	Coral	19-18-24.1	- 0.8	23.3	0.1	23.2	9.5193298	
		02.7						
1-3						10456.50	4.0193863	
1-2						3458.49	3.5388872	
2-3							3.9985000	
1	Yeiri	68-44-38.1	- 0.7	37.4	0.0	37.4	0.0305889	
2	Aomon	87-38-30.6	- 0.6	30.0	0.1	29.9	9.9996320	YEIRI
3	Coral	23-36-53.4	- 0.7	52.7	0.0	52.7	9.6026927	
		02.1						
1-3						10683.93	4.0287309	
1-2						4283.43	3.6317916	

JOB Nº 831

ϵ = 0.0

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

α	2	Boga #2	to 3	Engebi	260	32	49.1	α	3	Engebi	to 2	Boga #2	80	33	57.5
$\Delta^d\angle$		8			+ 21	24	24.9	$3^d\angle$		8			− 7	57	02.3
α	2	Boga #2	to 1	Ruchi	281	57	14.0	α	3	Engebi	to 1	Ruchi	72	36	55.2
$\Delta\alpha$						+	18.2	$\Delta\alpha$						−	49.3
					180	00	00.0						180	00	00.0
α'	1	Ruchi	to 2	Boga #2	101	57	33.$\frac{9}{1}$	α'	1	Ruchi	to 3	Engebi	252	36	05.9

FIRST ANGLE OF TRIANGLE 150-38-32.8

ϕ	11	38	46.355	2	Boga #2	λ	162	09	15.997	ϕ	11	39	41.964	3	Engebi	λ	162	14	55.151
$\Delta\phi$		−	19.810			$\Delta\lambda$	+	1	34.395	$\Delta\phi$		− 1	15.420			$\Delta\lambda$		− 4	04.259
ϕ'	11	38	26.54$\frac{5}{4}$	1	Ruchi	λ'	162	10	50.892	ϕ'	11	38	26.544	1	Ruchi	λ'	162	10	50.892

	Logarithms	Values in seconds		
s	3.4680710			
Cos α	9.3162313			
b	8.5124964			
n	1.2967987	1st term	+19.8061	
n^2	6.93614			
$\sin^2\alpha$	9.98096			
C	0.72055			
	7.63765	2d term	+0.0043	
b^2	2.5936			
D	1.9884			
	4.5820	3d term	+0.0000	
		$-\Delta\phi$	+19.8104	

$\frac{1}{2}(\phi+\phi')$	11	38	36.450	
	Logarithms		Values in seconds	
s	3.4680710			
Sin α	9.9904785			
A'	8.5096667			
Sec ϕ'	0.0090256			
$-\Delta\lambda$	1.9772418		−94.8947	
$\sin\frac{1}{2}(\phi+\phi')$	9.3049661			
$-\Delta\alpha$	1.2822079		−19.152	

	Logarithms	Values in seconds	
s	3.8694648		
Cos α	9.4753594		
B	8.5124954		
h	1.8773196	1st term	+75.3910
s^2	7.77893		
$\sin^2\alpha$	9.95939		
C	0.72204		
	8.46036	2d term	+ 0.0289
n^2	3.7546		
D	1.9894		
	5.7440	3d term	+ 0.0001
		$-\Delta\phi$	+75.4200

$\frac{1}{2}(\phi+\phi')$	11	39	04.254	
	Logarithms		Values in seconds	
s	3.8894648			
Sin α	9.9796941			
A'	8.5096665			
Sec ϕ'	0.0090256			
$-\Delta\lambda$	2.3878510		+244.2592	
$\sin\frac{1}{2}(\phi+\phi')$	9.3052501			
$-\Delta\alpha$	1.6931011		+49.329	

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JOB Nº 831

ϵ = 0.0

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

α	2	Aomon	to 3	Coral	24	32	56.8	α	3	Coral	to 2	Aomon	204	32	29.4
2d $\angle$			8		+ 90	53	22.0	3d $\angle$			8		- 11	55	01.4
α	2	Aomon	to 1	Rujoru	115	26	18.8	α	3	Coral	to 1	Rujoru	192	37	28.0
$\Delta\alpha$						-	12.7	$\Delta\alpha$						+	14.8
					180	00	00.0						180	00	00.0
α'	1	Rujoru	to 2	Aomon	295	26	06.1	α'	1	Rujoru	to 3	Coral	12	37	42.8

FIRST ANGLE OF TRIANGLE 77-11-36.6

ϕ	11	37	15.283	2 Aomon	λ	162	19	27.584	ϕ	11	32	20.254	3 Coral	λ	162	17	10.944
$\Delta\phi$		+	29.500		$\Delta\lambda$	-	1	02.912	$\Delta\phi$		+ 5	24.629		$\Delta\lambda$		+ 1	13.728
ϕ'	11	37	44.783	1 Rujoru	λ'	162	18	24.672	ϕ'	11	37	44.783	1 Rujoru	λ'	162	18	24.672

	Logarithms	Values in seconds			
s	3.3243483				
Cos α	9.6330065				
B	8.5124972				
n	1.4698520	1st term	-29.5020		
s^2	6.64870				
$\sin^2\alpha$	9.91142				
C	0.71982				
	7.27994	2d term	+ 0.0019		
n^2	2.9397				
D	1.9875				
	4.9272	3d term	+ 0.0000		
		$-\Delta\phi$	-29.5001		

		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11 37 30.033		
s		3.3243483	
Sin α		9.9557101	
A'		8.5096669	
Sec ϕ'		0.0090075	
$-\Delta\lambda$		1.7987328	+62.9119
$\sin\frac{1}{2}(\phi+\phi')$		9.3042868	
$-\Delta\alpha$		1.1030196	+12.677

	Logarithms	Values in seconds	
s	4.0093871		
Cos α	9.9893713		
B	8.5124998		
h	2.5112582	1st term	-324.5325
s^2	8.01877		
$\sin^2\alpha$	8.67914		
C	0.71669		
	7.41460	2d term	+ 0.0026
n^2	5.0225		
D	1.9845		
	7.0070	3d term	+ 0.0010
		$-\Delta\phi$	-324.5289

		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11 35 02.518		
s		4.0093871	
Sin α		9.3395699	
A'		8.5096677	
Sec ϕ'		0.0090075	
$-\Delta\lambda$		1.8676322	-73.7280
$\sin\frac{1}{2}(\phi+\phi')$		9.3027743	
$-\Delta\alpha$		1.1704065	-14.805

JOB Nº 831

ϵ = 0.1

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952.

					°	′	″						°	′	″
α	2	Aomon	to 3	Coral	24	32	56.8	α	3	Coral	to 2	Aomon	204	32	29.4
$\angle^d \angle$			8		+ 88	23	- 30.9	$3^d\angle$			8		- 19	18	23.3
α	2	Aomon	to 1	Aitsu	112	56	27.7	α	3	Coral	to 1	Aitsu	185	14	06.1
$\Delta\alpha$						—	21.1	$\Delta\alpha$						+	06.3
					180	00	00.0						180	00	00.0
α'	1	Aitsu	to 2	Aomon	292	56	06.6	α'	1	Aitsu	to 3	Coral	5	14	12.4

FIRST ANGLE OF TRIANGLE 72-18-05.9

	°	′	″			°	′	″			°	′	″			°	′	″
ϕ	11	37	15.283	2	Aomon	λ	162	19	27.584	ϕ	11	32	20.254	3	Coral	λ	162	17	10.944
$\Delta\phi$		+	43.869			$\Delta\lambda$	—	1	45.143	$\Delta\phi$	+	5	38.897			$\Delta\lambda$		+	31.496
ϕ'	11	37	59.152	1	Aitsu	λ'	162	17	42.441	ϕ'	11	37	59.151	1	Aitsu	λ'	162	17	42.440

	Logarithms	Values in seconds						Logarithms	Values in seconds				Logarithms	Values in seconds
s	3.5388853			$\frac{1}{2}(\phi+\phi')$	11 ° 37 ′ 37.218 ″		s	4.0193859			$\frac{1}{2}(\phi+\phi')$	11 ° 35 ′ 09.702 ″	
Cos α	9.5908234				Logarithms	Values in seconds	Cos α	9.9981847					Logarithms	Values in seconds
B	8.5124972			s	3.5388853		B	8.5124998			s	4.0193859		
h	1.6422059	1st term	-43.8739	Sin α	9.9642156		h	2.5300704	1st term	−338.8990	Sin α	8.9601919		
s^2	7.07777			A′	8.5096669		s^2	8.03878			A′	8.5096677		
$\sin^2\alpha$	9.92843			Sec ϕ'	0.0090138		$\sin^2\alpha$	7.92038			Sec ϕ'	0.0090138		
C	0.71982			$-\Delta\lambda$	2.0217816	+105.1433	C	0.71669			$-\Delta\lambda$	1.4982593	-31.4963	
	7.72602	2d term	+ 0.0053	$\sin\frac{1}{2}(\phi-\phi')$	9.3033604			6.67585	2d term	+ 0.0066	$\sin\frac{1}{2}(\phi+\phi')$	9.3028481		
n^2	3.2844			$-\Delta\alpha$	1.3251420	+21.142	n^2	5.0601			$-\Delta\alpha$	0.8011074	- 6.326	
D	1.9875						D	1.9845						
	5.2719	3d term	+ 0.0000					7.0446	3d term	+ 0.0011				
		$-\Delta\phi$	-43.8686						$-\Delta\phi$	338.8974				

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JOB Nº 831

ϵ = 0.1

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

α	2	Aomon	to 3	Coral	24	32	56.8	α	3	Coral	to 2	Aomon	204	32	29.4
$3^d\angle$			8		+ 87	38	30.0	$3^d\angle$			8		− 23	36	52.7
α	2	Aomon	to 1	Yeiri	112	11	26.8	α	3	Coral	to 1	Yeiri	180	55	36.7
$\Delta\alpha$						−	26.4	$\Delta\alpha$							+ 01.1
					180	00	00.0						180	00	00.0
α'	1	Yeiri	to 2	Aomon	292	11	00.4	α'	1	Yeiri	to 3	Coral	0	55	37.8

FIRST ANGLE OF TRIANGLE 68-44-37.4

ϕ	11	37	15.283	2	Aomon	λ	162	19	27.584	ϕ	11	32	20.254	3	Coral	λ	162	17	10.944
$\Delta\phi$		+	52.645			$\Delta\lambda$	−	2	10.934	$\Delta\phi$		+ 5	47.674			$\Delta\lambda$		+	05.705
ϕ'	11	38	07.928	1	Yeiri	λ'	162	17	16.650	ϕ'	11	38	07.928	1	Yeiri	λ'	162	17	16.649

	Logarithms	Values in seconds			Logarithms	Values in seconds			Logarithms	Values in seconds			Logarithms	Values in seconds
s	3.6317906		$\frac{1}{2}(\phi+\phi')$	11 37 41.605	s	4.0287311		$\frac{1}{2}(\phi+\phi')$	11 35 14.091					
$\cos\alpha$	9.5771375				$\cos\lambda$	9.9999432								
b	8.5124972		s	3.6317906	b	8.5124998		s	4.0287311					
h	1.7214253	1st term	$\sin\alpha$	9.9665788	h	2.5411741	1st term	$\sin\alpha$	8.2088733					
h^2	7.26358		A'	8.5096669	h^2	8.05746		A'	8.5096677					
$\sin^2\alpha$	9.93316		Sec ϕ'	0.0090176	$\sin^2\alpha$	6.41775		Sec ϕ'	0.0090176					
	0.71982		$-\Delta\lambda$	2.1170539	C	0.71669		$-\Delta\lambda$	0.7562897	−5.7054				
	7.91656	2d term + 0.0083	$\sin\frac{1}{2}(\phi+\phi')$	9.3044053		5.19190	2d term + 0.0000	$\sin\frac{1}{2}(\phi+\phi')$	9.3028930					
n^2	3.4429		$-\Delta\alpha$	1.4214592	n^2	5.0823		$-\Delta\alpha$	0.0591827	−1.146				
D	1.9875				D	1.9845								
	5.4304	3d term + 0.0000				7.0668	3d term + 0.0012							
		$-\Delta\phi$ −52.6450					$-\Delta\phi$ −347.6743							

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVY GRID
1952 EXPANSION OF HORIZONTAL CONTROL

CALC. BY L.S.H.
CHECKED BY ______ DATE 11-12-52
JOB NO. 831 LOCATION Japtan, Lilac

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Sand									67781.68		135388.31		1
		S 0-59-48.9E	27981.1	99984830	.01738391		27976.869	486.561						
2	Japtan									59804.81		135874.87		2
		S 25-12-3?.0W	8036.2	90478660	42597598		7270.741		3422.987					
3	Ivy									52534.07		132451.88		3
		N 11-39-00.7W	7094.1	97939871	20193601	6947.952			1432.554					
4	Lilac									59482.02		131019.33		4
		N 8-44-34.3E	28634.9	98829166	15257923	28299.639		4368.976						
5	Sand									87781.66		~~135588.31~~		5
6												135,388.31		6
7	Lilac									59482.02		131019.33		7
		N 86-11-17.2E	4866.3	06633532	99779735	322.810		4855.581						
8	Japtan									59804.83		135874.91		8
9														9
10														10
11														11
12														12
13														13
14														14
15														15
16														16
17														17
18														18
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21														21
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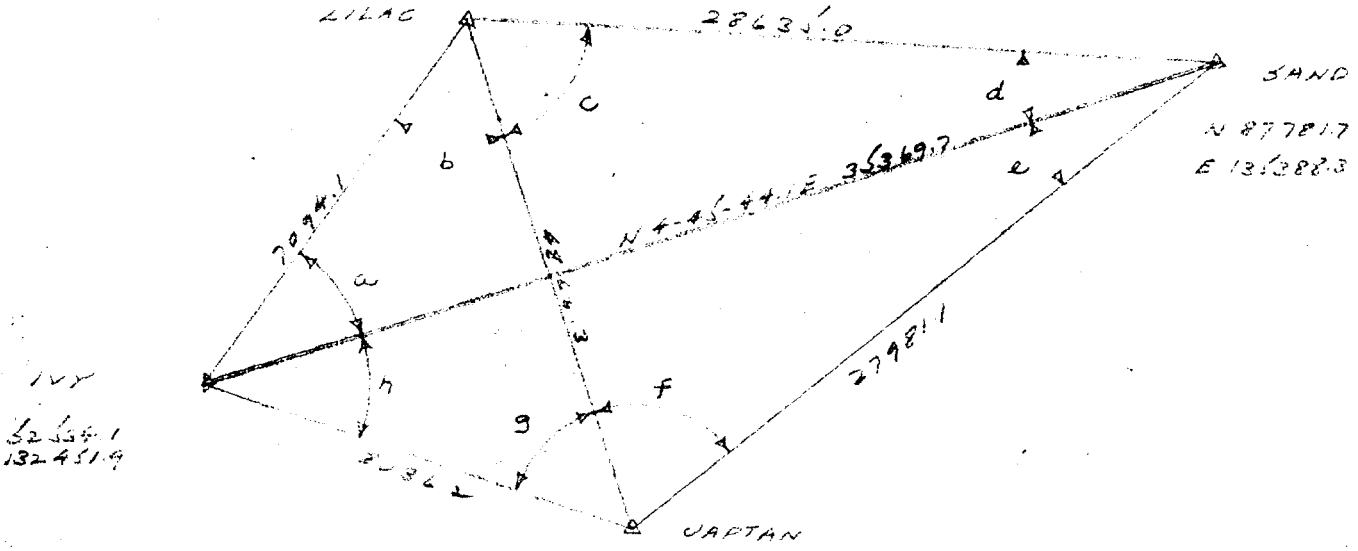
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY L.S.H. DATE
CHKD. BY L.S.H. DATE Nov. 1947

SUBJECT TRIANGULATION AUW
1942 EXPANSION

SHEET NO. 1 OF 1
JOB NO. 831
LILAC - JAPTAN



	Obs. ∠	Geo. Cond.		Trig. Cond.
a	16-24-43.3	43.9	45.3	44.8
b	82-09-09.5	10.1	11.6	12.1
c	77-25-12.3	12.9	13.4	12.9
d	4-00-48.8	49.3	49.7	50.2
e	5-45-32.4	32.9	31.5	31.0
f	92-48-26.3	26.9	25.4	25.9
g	60-59-09.5	10.1	09.7	09.2
h	20-22-53.3	53.9	53.4	53.9
	55.4			

Side Eq. $\frac{\sin a \cdot \sin c \cdot \sin e \cdot \sin g}{\sin b \cdot \sin d \cdot \sin f \cdot \sin h} = 1$

Log Sin a	9.4510985	21.5		Log Sin b	9.9959144	2.9	
" " c	9.9894473	4.7		" d	8.8410784	300.5	
" " e	9.0014741	2088		" f	9.9994286	1.0	
" " g	9.9417605	11.7		" h	9.5432333	54.1	
	8.3837804	296.7			8.3832447	360.9	
	44.2	360.9					
	3.7	63.2					

357 / 63.6 = 0.54"

3369.7	Sin 16-24-44.2	Sin 4-00-50.2
Sin 159-34-24.0	(28634.95)	(2094.01)
3369.7	Sin 20-22-53.9	Sin 5-45-31.4
Sin 153-47-35.1	(2798.06)	(283.12)
28634.95	Sin 9-44-21.2	Sin 77-25-12.9
Sin 92-48-25.9	(4866.26)	(2798.11)
8036.22	Sin 36-51-38.7	Sin 60-59-09.5
Sin 82-09-27	(4866.27)	(7369.84)

HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

JOB Nº 831

COMPUTATION OF TRIANGLES

COMPUTED BY L.S.H. CHECKED BY L.S.H. DATE Nov. 1952

STATION	OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM	
2-3						4.0326473	
1 Japtan	153-47-35.8	- 0.7	35.1	0.0	35.1	0.3549871	
2 Ivy	20-26-53.3	+ 0.6	53.9	0.0	53.9	9.5432759	JAPTAN
3 Sand	5-45-32.4	- 1.4	31.0	0.0	31.0	9.0014637	
1-3	01.5				8526.65	3.9308803	
1-2					2449.45	3.3890681	
2-3						4.0326473	
1 Lilac	159-34-21.8	+ 3.2	25.0	0.0	25.0	0.4571700	
2 Sand	4-00-48.8	+ 1.4	50.2	0.0	50.2	8.8450934	LILAC
3 Ivy	16-24-43.3	+ 1.5	44.8	0.0	44.8	9.4510950	
1-3	53.9				2162.27	3.3349107	
1-2					8727.95	3.9409123	
2-3							
1							
2							
3							
1-3							
1-2							
2-3							
1							
2							
3							
1-3							
1-2							

JOB No 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952.

α	2	Sand	to 3	Ivy	4	46	55.0	α	3	Ivy	to 2	Sand	184	46	49.1
3d $\angle$			8		+ 4	00	50.2	3d $\angle$			8		- 16	24	44.8
α	2	Sand	to 1	Lilac	8	47	45.2	α	3	Ivy	to 1	Lilac	168	22	04.3
$\Delta\alpha$						-	08.8	$\Delta\alpha$						-	02.8
					180	00	00.0						180	00	00.0
α'	1	Lilac	to 2	Sand	188	47	36.4 5/	α'	1	Lilac	to 3	Ivy	348	22	01.5

FIRST ANGLE OF TRIANGLE 159-34-25.0

ϕ	11	30	18.986 2	Sand	λ	162	23	06.970	ϕ	11	24	29.334 3	Ivy	λ	162	22	37.224
$\Delta\phi$	-	4	40.721		$\Delta\lambda$		-	44.028	$\Delta\phi$	+	1	08.930		$\Delta\lambda$		-	14.382
ϕ'	11	25	38.264 1/	Lilac	λ'	162	22	22.842	ϕ'	11	25	38.264	1 Lilac	λ'	162	22	22.842

	Logarithms	Values in seconds						Logarithms	Values in seconds			Logarithms	Values in seconds
	3.9409113			$\frac{1}{2}(\phi+\phi')$	11 27 58.626			s 3.3349139			$\frac{1}{2}(\phi+\phi')$	11 25 03.799	
Cos α	9.9948621				Logarithms	Values in seconds		Cos α 9.9909877				Logarithms	Values in seconds
B	8.5125007			s	3.9409113			B 8.5125037			s	3.3349139	
h	2.4482741	1st term	+280.7205	Sin α	9.1844499			h 1.9384053	1st term	68.9295	Sin α	9.3045495	
s^2	7.88182			A'	8.5096681			s^2 6.66983			A'	8.5096691	
$\sin^2\alpha$	8.36890			Sec ϕ'	0.0086955			$\sin^2\alpha$ 8.60910			Sec ϕ'	0.0086955	
C	0.71538			$-\Delta\lambda$	1.6437248	+44.0276		C 0.71161			$-\Delta\lambda$	1.1578280	+14.3823
	6.98810	2d term	+ 0.0009	$\sin\frac{1}{2}(\phi+\phi')$	9.2983973			5.99054	2d term	+ 0.0000	$\sin\frac{1}{2}(\phi+\phi')$	9.2965786	
n^2	4.8965			$-\Delta\alpha$	0.9421221	+8.752		n^2 3.6768			$-\Delta\alpha$	0.4544066	+ 2.847
D	1.9833							D 1.9798					
	2.8848	3d term	+ 0.0000					5.6566	3d term	+ 0.0000			
		$-\Delta\phi$	+280.7214						$-\Delta\phi$	- 68.9295			

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HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE 11-3-52

JOB NO. 831 LOCATION Coral, Pinnacle

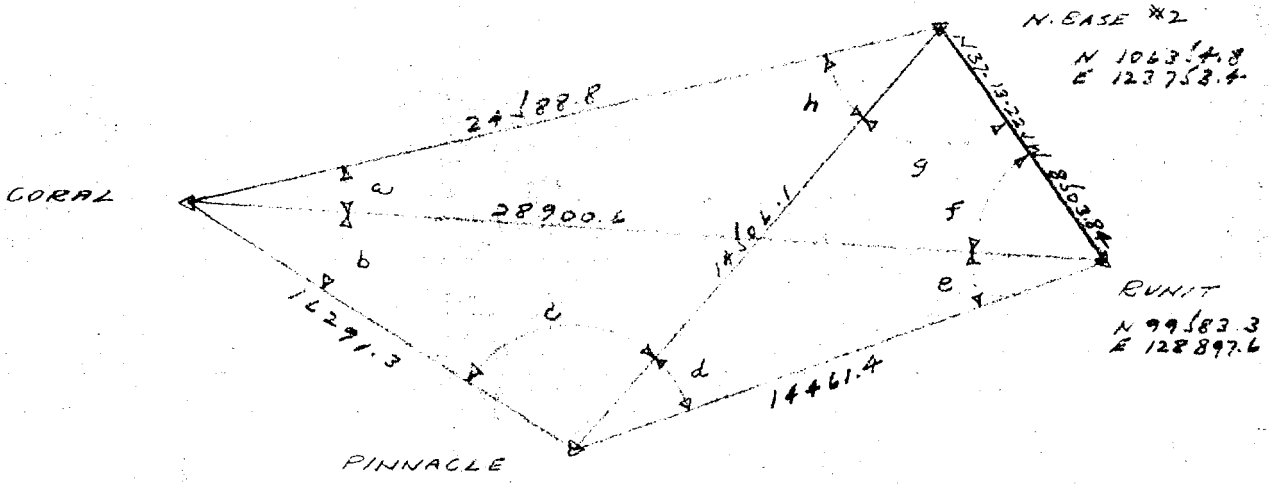
	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral									100,000.00		100,000.00		1
2	N. Base #2	N 75-01-20.1E	24588.81	25844392	96602626	6354.828		23753.436		106,354.83		123,753.436		2
3	Runit	S 37-13-22.1E	8503.84	79628921	60491612		6771.516	5144.110		99,583.31		128,897.55		3
4	Pinnacle	S 69-33-36.7W	14461.36	34922313	93703959		5050.241		13550.867	94,533.07		115,346.68		4
5	Coral	N 70-23-33.5W	16291.34	33557262	94201434	5466.928			15346.676	100,000.00		100,000.00		5
6														6
7														7
8	Coral									100,000.00		100,000.00		8
9	Runit	S 89-10-26.0E	28900.56	.01441786	99989606		416.684	28897.556		99,583.32		128,897.556		9
10														10
11														11
12	N. Base									106,354.83		123,753.436		12
13	Pinnacle	S 35-25-03.3W	14506.11	81494999	57953129		11821.754		8406.745	94,533.07		115,346.68		13
14														14
15														15
16														16
17														17
18														18
19														19
20														20
21														21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY A.R.B. DATE July 15 19
CHKD. BY L.S.H. DATE Nov. 19 19

SUBJECT TRIANGULATION ADJ
1952 ADJUSTMENT

SHEET NO. 1 OF 1
JOB NO. 831
CORAL - PINNACLE

N. BASE #2
N 1063 14.8
E 12378.4



	OBS. ∠	GEO. COND.		TRIG. COND.
a	15-48-14.6	14.4	14.2	13.9
b	18-46-52.6	52.3	52.2	52.5
c	105-48-37.3	37.1	37.1	36.8
d	34-08-33.1	32.9	33.1	33.4
e	21-15-57.7	57.4	57.6	57.3
f	51-57-03.8	03.6	03.6	03.9
g	72-38-25.8	25.6	25.7	25.4
h	39-36-17.0	16.7	16.5	16.8
	01.9			

Side Eq. $\frac{\sin a \cdot \sin g \cdot \sin e \cdot \sin c}{\sin b \cdot \sin h \cdot \sin f \cdot \sin d} = 1$

Log. Sin. a	9.4351218	74.4	Log. Sin. b	9.5077945	41.9
" " g	9.9797438	6.6	" " h	9.8044704	25.4
" " e	9.5595455	54.1	" " f	9.8962417	16.5
" " c	9.9832513	6.0	" " d	9.7491590	31.1
	8.9576724	141.1		8.9576655	134.9
	55	134.9			
	69	276.0		69/276 = 0.25"	

8503.84
Sin 15-48-13.9

Sin 112-14-42.2
(28900.56)

Sin 51-57-03.9
(24388.82)

28900.56
Sin 139-57-10.2

Sin. 18-46-52.5
(14461.32)

Sin 21-15-57.3
(16291.35)

8503.84
Sin 34-08-33.4

Sin 73-13-01.2
(14506.11)

Sin 72-38-25.4
(14461.35)

14506.11
Sin 34-35-06.4

Sin. 39-36-16.8
(16291.34)

Sin 105-48-36.8
(24388.81)

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.M. DATE 12-11-51

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						2591.9749	3.4136308
1	Pinnacle	34-08-33.1	+0.3	33.4	0.0	33.4	0.2508401
2	North Base #2	72-38-25.8	-0.4	25.4	0.0	25.4	9.9797536
3	Runit	73-13-01.5	-0.3	01.2	0.0	01.2	9.9810958
1-3						4407.83	3.6442245
1-2						4421.47	3.6455667
2-3						4421.47	3.6455667
1	Coral	34-35-07.2	-0.8	06.4	0.0	06.4	0.2459348
2	North Base #2	39-36-17.0	-0.2	16.8	0.0	16.8	9.8044712
3	Pinnacle	105-48-37.3	-0.4	36.9	0.1	36.8	9.9832515
1-3						4965.61	3.6959727
1-2						7494.68	3.8747530
2-3						2591.9749	3.4136308
1	Coral	15-48-14.6	-0.7	13.9	0.0	13.9	0.5648804
2	North Base #2	112-14-42.8	-0.6	42.2	0.0	42.2	9.9664107
3	Runit	51-57-03.8	-0.1	03.9	0.0	03.9	9.8962422
1-3						8808.90	3.9449219
1-2						7494.68	3.8747534
2-3						8808.90	3.9449219
1	Pinnacle	139-57-10.4	-0.2	10.2	0.0	10.2	0.1915065
2	Coral	18-46-52.6	-0.1	52.5	0.0	52.5	9.5977964
3	Runit	21-15-57.7	-0.4	57.3	0.0	57.3	9.5536439
1-3						4407.83	3.6442351
1-2						4965.61	3.6959726

JOB Nº 831

ϵ = 0.0"

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

			°	'	"
α	2 North Base #2 to 3 Runit	*	322	47	25.7
2d ∠	8	+	112	14	42.2
α	2 North Base #2 to 1 Coral		75	02	07.9
$\Delta\alpha$		−			47.8
			180	00	00.0
α'	1 Coral to 2 North Base #2		255	01	20.1

			°	'	"
α	3 Runit to 2 North Base #2	*	142	47	36.1
3d ∠	8	−	51	57	03.9
α	3 Runit to 1 Coral		90	50	32.2
$\Delta\alpha$					58.1
			180	00	00.0
α'	1 Coral to 3 Runit		270	49	34.1

FIRST ANGLE OF TRIANGLE 15-48-13.9

		°	'	"			°	'	"
ϕ	2 North Base #2	*11	33	23.267	λ	*162	21	09.893
$\Delta\phi$		−		63.013	$\Delta\lambda$	−	03	58.949
ϕ'	1 Coral	11	32	20.254	λ'	162	17	10.944

	Logarithms	Values in seconds		
s	3.8747534			
Cos α	9.4119900	+		
B	8.5124993			
h	1.7992427	1st term	+62.9858	
s^2	7.750			
$\sin^2\alpha$	9.970			
C	.717			
	8.437	2d term	+ .0274	
h^2	3.60			
D	1.98			
	5.58	3d term	+ .0000	
		$-\Delta\phi$	+63.0132	

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	32	51.761		
s				3.8747534	
Sin α				9.9850158+	
A'				8.5096677	
Sec ϕ'				0.0088675	
$\Delta\lambda$				2.3783044	+238.9484
$\sin\frac{1}{2}(\phi+\phi')$				9.3014291	
$-\Delta\alpha$				1.6797335	+47.83

	Logarithms	Values in seconds	
s	3.9449219		
Cos α	8.1673170_n		
B	8.5124998		
h	0.6247387_n	1st term	−4.2144
s^2	7.890		
$\sin^2\alpha$	0.000		
C	.717		
	8.607	2d term	+ .0405
h^2	1.25		
D	1.98		
	3.23	3d term	+ .0000
		$-\Delta\phi$	−4.1739

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	32	18.167		
s				3.9449219	
Sin α				9.9999531 +	
A'				8.5096677	
Sec ϕ'				0.0088675	
$-\Delta\lambda$				2.4634102	+290.6767
$\sin\frac{1}{2}(\phi+\phi')$				9.3010826	
$-\Delta\alpha$				1.7644928	+58.14

NOTE: The figures indicated with * were accepted from the 1949-50 Horizontal Control Survey.

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JOB Nº 831

ϵ = 0.0"

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND. ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

				°	'	"
α	2 Coral	to 3	Runit	270	49	34.0
$2^d\angle$		&		+ 18	46	52.5
α	2 Coral	to 1	Pinnacle	289	36	26.5
$\Delta\alpha$						30.9
				180	00	00.0
α'	1 Pinnacle	to 2	Coral	109	36	57.4

				°	'	"
α	3 Runit	to 2	Coral	90	50	32.2
$3^d\angle$		&		- 21	15	57.3
α	3 Runit	to 1	Pinnacle	69	34	34.9
$\Delta\alpha$				—		27.3
				180	00	00.0
α'	1 Pinnacle	to 3	Runit	249	34	07.6

FIRST ANGLE OF TRIANGLE 139-57-10.2

	°	'	"			°	'	"
ϕ	11	32	20.254	2 Coral	λ	162	17	10.944
$\Delta\phi$	-		54.244		$\Delta\lambda$	+	02	34.363
ϕ'	11	31	26.010	1 Pinnacle	λ'	162	19	45.307

	Logarithms	Values in seconds	
s	3.6959725		
Cos α	9.5257871+		
B	8.5124997		
h	1.7342593	1st term	+54.2325"
s^2	7.392		
$\sin^2\alpha$	9.948		
C	.717		
	8.057	2d term	+ .0114
h^2	3.47		
D	1.98		
	5.45	3d term	+ .0000
		$-\Delta\phi$	+ 54.2439

	°	'	"
$\frac{1}{2}(\phi+\phi')$	11	31	53.132

	Logarithms	Values in seconds
s	3.6959725	
Sin α	9.9740575$_n$	
A'	8.5096679	
Sec ϕ'	0.0088442	
$-\Delta\lambda$	2.1885421	-154.3626"
$\sin\frac{1}{2}(\phi+\phi')$	9.3008244	
$-\Delta\alpha$	1.4893665	- 30.86

	Logarithms	Values in seconds	
s	3.6442251		
Cos α	9.5427741+		
B	8.5124998		
h	1.6994990	1st term	+50.0609"
s^2	7.288		
$\sin^2\alpha$	9.944		
C	.717		
	7.949	2d term	+ .0089
h^2	3.40		
D	1.98		
	5.38	3d term	+ .0000
		$-\Delta\phi$	50.0698

	°	'	"
$\frac{1}{2}(\phi+\phi')$	11	31	51.045

	Logarithms	Values in seconds
s	3.6442251	
Sin α	9.9718036+	
A'	8.5096679	
Sec ϕ'	0.0088442	
$-\Delta\lambda$	2.1345408	+136.3141"
$\sin\frac{1}{2}(\phi+\phi')$	9.3008029	
$-\Delta\alpha$	1.4353437	+ 27.25

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE 11-3-52

JOB NO. 831 LOCATION Sand, Parry

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral									100,000.00		100,000.00		1
2	N. Base #2	N 75-01-20.1E	24588.81	25844392	96602626	6354.828		23753.436		106,354.83		123,753.44		2
3	Sand	S 32-03-52.0E	21916.46	84745152	53087279		18573.137	11634.852		87,781.69		135,388.29		3
4	Parry	S 3-48-40.5W	33604.15	99778844	06646982		33529.832		2233.662	54,251.86		133,154.63		4
5	Coral	N 35-55-53.8W	56498.87	80971801	58661918	45748.15			33154.621	100,000.00		100,000.00		5
6														6
7														7
8	Coral									100,000.00		100,000.00		8
9	Sand	S 70-57-07.3E	37438.18	32635970	94524565		12218.313	35388.277		87,781.69		135,388.28		9
10														10
11														11
12	N. Base #2									106,354.83		123,753.44		12
13	Parry	S 10-13-41.2E	52944.35	98410861	17756759		52102.991	9401.201		54,251.84		133,154.64		13
14														14
15		NOTE - Refer to 1952 Expansion for new values at Sta. Parry												15
16														16
17														17
18														18
19														19
20														20
21														21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

S-2D

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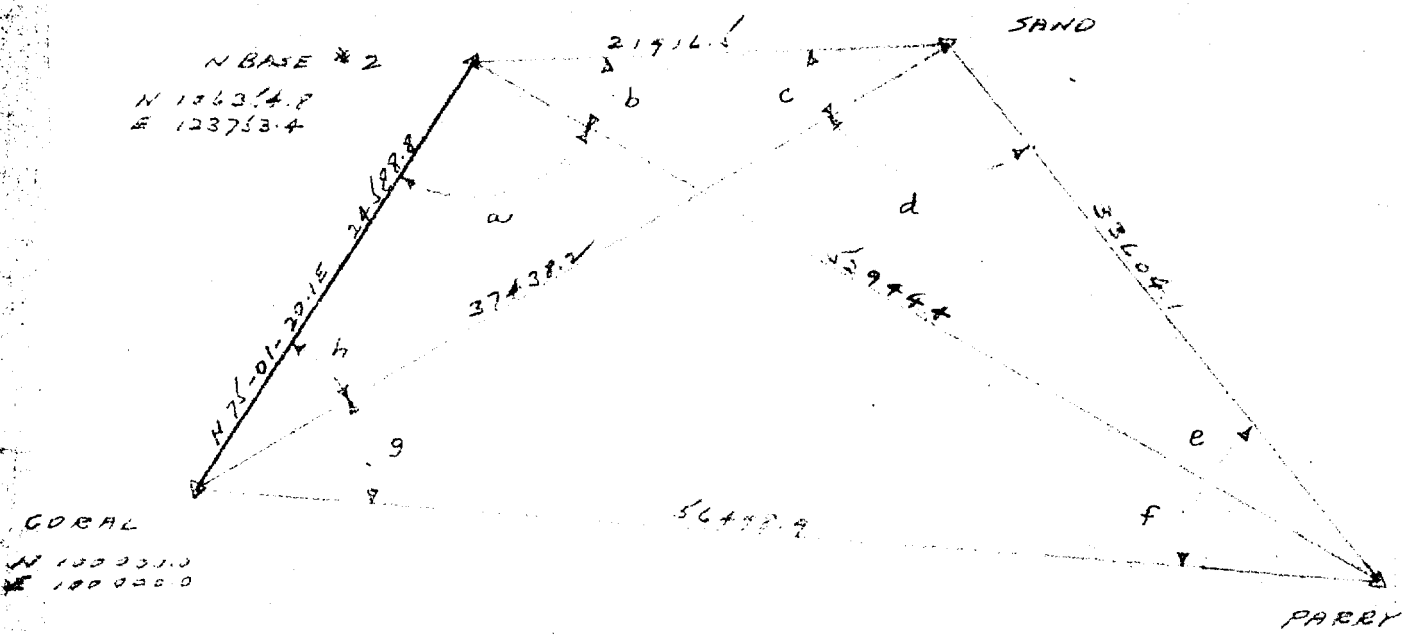
BY ARB DATE July 19SY SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1
CHKD. BY LSH DATE NOV 19SY 1952 ADJUSTMENT JOB NO. 831
PARRY, SAND



	OBS. ∠	GEO. COND		TRIG. COND.
a	85-15-00.3	00.3	00.9	01.3
b	21-50-10.6	10.6	11.2	10.8
c	38-53-14.2	14.3	14.9	15.3
d	105-14-13.1	13.1	12.6	12.2
e	14-02-21.8	21.8	21.3	21.7
f	25-42-13.5	13.6	13.0	12.6
g	35-01-13.8	13.8	13.1	13.5
h	34-01-32.5	32.5	33.0	32.6

Sine Eq $\frac{\sin a \cdot \sin c \cdot \sin e \cdot \sin g}{\sin b \cdot \sin d \cdot \sin f \cdot \sin h} = 1$

Log Sin a	9.9985068	1.7	Log Sin b	9.5704943	52.5
" " c	9.7978163	26.1	" " d	9.9844580	1.7
" " e	9.3848667	84.2	" " f	9.6372053	43.7
" " g	9.7588110	38.0	" " h	9.5485518	31.7
	8.9400000	142.0		8.9400000	133.1
				500	1420
				102	273.1

24588.8 / Sin 38-53-15.3
Sin 102-05-12.1 (37438.18)
Sin 34-01-32.6 (21916.46)

30438.18 / Sin 34-44-34.3
Sin 25-01-13.5 (33604.15)
Sin 105-14-12.2 (56498.87)

102/273.1 = 0.37"

24588.8 / Sin 25-42-12.6
Sin 69-02-42.1 (52944.35)
Sin 85-15-01.3 (56498.88)

52944.35 / Sin 14-02-21.8
Sin 21-50-10.8 (33604.15)
Sin 14-02-21.7 (21916.48)

COMPUTATION OF TRIANGLES

COMPUTED BY A.P.B. CHECKED BY LSH DATE 12-11-51

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						7494.68	3.8747531
1	Sand	38-53-14.2	+1.1	15.3	0.0	15.3	0.2021926
2	Coral	34-01-32.5	+0.1	32.6	0.0	32.6	9.7478506
3	North Base #2	107-05-10.9	+1.3	12.2	0.1	12.1	9.9603948
1-3						6656.15	3.8247863
1-2						11411.13	4.0573305
2-3						11411.18	4.0573305
1	Parry	39-44-35.3	-0.9	34.4	0.1	34.3	0.1942659
2	Coral	35-01-13.8	-0.2	13.6	0.1	13.5	9.7568122
3	Sand	105-14-13.1	-0.8	12.3	0.1	12.2	9.9844590
1-3						10242.56	4.0104086
1-2						17220.88	4.2360854
2-3						7494.68	3.8747531
1	Parry	28-42-13.5	-0.8	12.7	0.1	12.6	0.3627965
2	Coral	60-02-46.3	-0.1	46.2	0.1	46.1	9.9702858
3	North Base #2	93-15-00.3	+1.1	01.4	0.1	01.3	9.9985061
1-3						16137.47	4.2078354
1-2						17220.89	4.2360557
2-3						16137.47	4.2078354
1	Sand	144-07-27.3	+0.3	27.6	0.1	27.5	0.2320911
2	Parry	14-02-21.8	-0.1	21.7	0.0	21.7	9.3648701
3	North Base #2	21-50-10.6	+0.2	10.8	0.0	10.8	9.5704922
1-3						6656.15	3.8247863
1-2						10242.56	4.0104087

JOB Nº 831

$\epsilon = 0.1$

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

			°	'	"				°	'	"
α	2 Coral to 3 North Base #2		255	01	20.1	α	3 North Base #2 to 2 Coral		75	02	07.9
$2^d\angle$	8		+ 34	01	32.6	$3^d\angle$	8		−107	05	12.2
α	2 Coral to 1 Sand		289	02	52.7	α	3 North Base #2 to 1 Sand		327	56	55.7
$\Delta\alpha$			+	01	11.1	$\Delta\alpha$			+		23.4
			180	00	00.0				180	00	00.0
α'	1 Sand to 2 Coral		109	04	03.8	α'	1 Sand to 3 North Base #2		147	57	19.1

FIRST ANGLE OF TRIANGLE 38-53-15.3

	°	'	"			°	'	"		°	'	"		°	'	"
ϕ	11	32	20.254	2 Coral	λ	162	17	10.944	ϕ	11	33	23.267	3 North Base #2	λ	162	21	09.893
$\Delta\phi$	−	02	01.268		$\Delta\lambda$	+	05	55.926	$\Delta\phi$	−	03	04.281		$\Delta\lambda$	+	01	56.977
ϕ'	11	30	18.986	1 Sand	λ'	162	23	06.870	ϕ'	11	30	18.986	1 Sand	λ'	162	23	06.870

	Logarithms	Values in seconds			
s	4.0573308				
Cos α	9.5136965	+			
B	8.5124997				
h	2.0835270	1st term	+121".2068		
s^2	8.115				
$\sin^2\alpha$	9.951				
C	.717				
	8.783	2d term	+ .0607		
n^2	4.17				
D	1.98				
	6.15	3d term	+ .0001		
		$-\Delta\phi$	+121.2676		

	°	'	"			
$\frac{1}{2}(\phi+\phi')$	11	31	19.620			
		Logarithms		Values in seconds		
s		4.0573308				
Sin α		9.9755447$_n$				
A′		8.5096681				
Sec ϕ'		0.0088155				
$\Delta\lambda$		2.5513591		−355".9255		
$\sin\frac{1}{2}(\phi+\phi')$		9.3004785				
$-\Delta\alpha$		1.8518376		− 71.09		

	Logarithms	Values in seconds		
s	3.8247865			
Cos α	9.9281777+			
B	8.5124992			
h	2.2654634	1st term	+184".2737	
s^2	7.650			
$\sin^2\alpha$	9.450			
C	.717			
	7.817	2d term	+ .0066	
n^2	4.53			
D	1.98			
	6.51	3d term	+ .0003	
		$-\Delta\phi$	+184.2806	

	°	'	"		
$\frac{1}{2}(\phi+\phi')$	11	31	51.127		
		Logarithms		Values in seconds	
s		3.8247865			
Sin α		9.7248301$_n$			
A′		8.5096681			
Sec ϕ'		0.0088155			
$\Delta\lambda$		2.0681002		−116".9769	
$\sin\frac{1}{2}(\phi+\phi')$		9.3008037			
$-\Delta\alpha$		1.3689039		− 23.38	

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JOB Nº 831

ϵ = 0.3"

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

					°	'	"								°	'	"	
α	2	Coral	to 3	Sand	289	02	52.7	α	3	Sand	to 2	Coral	109	04	08.8	
$2^d\angle$			8.		+ 35	01	13.6	$3^d\angle$			8		-105	14	12.3	
α	2	Coral	to 1	Parry	324	04	06.3	α	3	Sand	to 1	Parry	3	49	51.5	
$\Delta\alpha$					+	01	06.3	$\Delta\alpha$							04.5	
					180	00	00.0						180	00	00.0	
α'	1	Parry	to 2	Coral	144	05	12.6	α'	1	Parry	to 3	Sand	183	49	47.0	

FIRST ANGLE OF TRIANGLE 39-44-34.4

		°	'	"			°	'	"			°	'	"			°	'	"
ϕ	11	32	20.254	2	Coral	λ	162	17	10.944	ϕ	11	30	18.986	3	Sand	λ	162	23	06.870
$\Delta\phi$	-	07	33.881			$\Delta\lambda$	+	05	33.351	$\Delta\phi$	-	05	32.613			$\Delta\lambda$	-		22.574
ϕ'	11	24	46.373	1	Parry	λ'	162	22	44.295	ϕ'	11	24	46.373	1	Parry	λ'	162	22	44.295

	Logarithms	Values in seconds					Logarithms	Values in seconds				Logarithms	Values in seconds
				°	'	"							
s	4.2360552		$\frac{1}{2}(\phi+\phi')$	11	28	33.314	s	4.0104089		$\frac{1}{2}(\phi+\phi')$	11	27	32.680
Cos α	9.9083339+				Logarithms	Values in seconds	Cos α	9.9990285+				Logarithms	Values in seconds
B	8.5124997		s		4.2360552		B	8.5125007		s		4.0104089	
h	2.6568888	1st term	+453.8254	Sin α		9.7685040$_n$	h	2.5219381	1st term	+332.6121	Sin α		8.8248627+
s^2	8.472			A'		8.5096690	s^2	8.021			A'		8.5096690
$\sin^2\alpha$	9.537			Sec ϕ'		0.0086735	$\sin^2\alpha$	7.650			Sec ϕ'		0.0086735
C	.717			$\Delta\lambda$		2.5229017	-333.3509	C	.715			$\Delta\lambda$		1.3536141	+22.5743
	8.726	2d term	+ .0532	$\sin\frac{1}{2}(\phi+\phi')$		9.2987573			6.386	2d term	+ .0002	$\sin\frac{1}{2}(\phi+\phi')$		9.2981279	
h^2	5.31			$-\Delta\alpha$		1.8216590	- 66.32	h^2	5.04			$-\Delta\alpha$		.6517420	+ 4.48
D	1.98							D	1.98						
	7.29	3d term	+ .0020						7.02	3d term	+ .0010				
		$-\Delta\phi$	453.8806							$-\Delta\phi$	+332.6133				

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HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

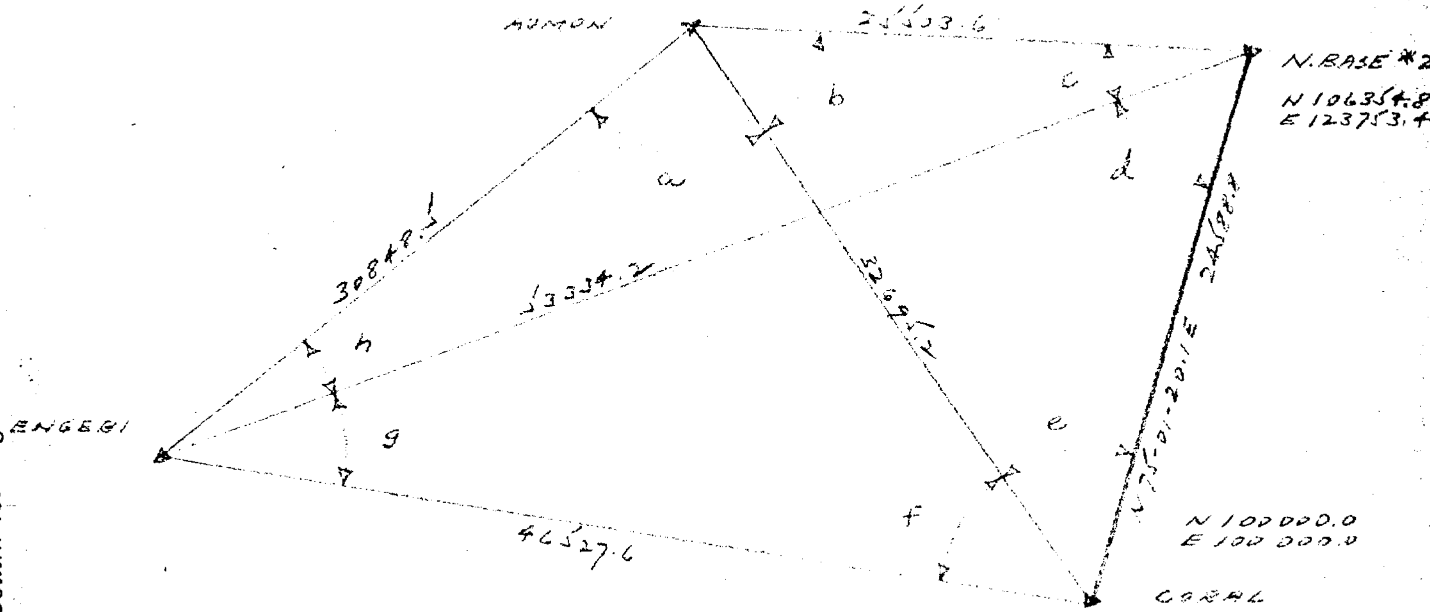
PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE 11-3-52

JOB NO. 831 LOCATION Aomon, Engebi

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral									100,000.00		100,000.00		1
2	N. Base #2	N 75-01-20.1E	24588.81	25844392	96602626	6354.828		23753.436		106,354.83		123,753.44		2
3	Aomon	N 23-30-33.9W	25503.65	91699452	39889979	23386.707			10173.401	129,741.54		113,580.03		3
4	Engebi	N 61-21-31.8W	30848.50	47932256	87763881	14786.382			27073.811	144,527.92		86,506.19		4
5	Coral	S 16-51-32.4E	46527.60	95702136	29001744		44527.907	13493.815		100,000.01		100,000.01		5
6														6
7														7
8	Coral									100,000.00		100,000.00		8
9	Aomon	N 24-32-29.4E	32695.20	90966067	41535223	29741.538		13580.024		129,741.54		11,358.02		9
10														10
11														11
12	N. Base #2									106,354.83		123,753.44		12
13	Engebi	N 44-17-48.1W	53334.23	71573302	69837380	38173.070			37247.229	144,527.90		86,506.21		13
14														14
15														15
16														16
17														17
18														18
19														19
20														20
21														21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY A.R.B. DATE July 1954 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1
CHKD. BY HM DATE Nov. 1954 1952 ADJUSTMENT JOB NO. 831
AOMON - ENGEBI



	OBS ∡	GEO. COND		TRIG. COND.
a	94-05-58.5	58.8	58.5	58.8
b	48-03-03.6	04.0	03.6	03.3
c	20-47-14.0	14.3	13.9	14.2
d	60-40-51.5	51.8	52.1	51.8
e	50-28-49.9	50.2	50.4	50.7
f	41-24-01.4	01.7	02.1	01.8
g	27-26-14.7	15.0	15.4	15.7
h	17-03-43.9	44.2	44.0	43.7
	57.5			

Side Eq. $\frac{\text{Sin } a \cdot \text{Sin } c \cdot \text{Sin } e \cdot \text{Sin } g}{\text{Sin } b \cdot \text{Sin } d \cdot \text{Sin } f \cdot \text{Sin } h} = 1$

Log Sin a	9.9988274	0.1	Log Sin b	9.8714212	18.9
c	9.5501036	55.5	d	9.9404707	11.9
e	9.8872812	17.4	f	9.8204113	23.9
g	9.6634959	40.5	h	9.4674750	68.6
	9.0997721	113.5		9.0997782	123.3
				7721	113.5
				61	236.8

61/236.8 = 0.26"

$\frac{24588.8}{\text{Sin } 48\text{-}03\text{-}03.3}$ Sin 81-28-02.0 (32695.20) Sin 50-28-50.7 (25503.6)

$\frac{32695.20}{\text{Sin } 44\text{-}29\text{-}19.4}$ Sin 41-24-01.8 (30848.50) Sin 94-05-58.8 (46527.6)

$\frac{24588.8}{\text{Sin } 27\text{-}26\text{-}15.7}$ Sin 91-52-52.5 (53334.23) Sin 60-40-51.8 (46527.6)

$\frac{53334.23}{\text{Sin } 142\text{-}09\text{-}02.1}$ Sin 20-47-14.2 (30848.51) Sin 17-03-43.7 (25503.6)

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 12-11-51

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						7494.68	3.8747531
1	Aomon	48-03-03.6	-0.3	03.3	0.0	03.3	0.1285794
2	North Base #2	81-28-05.5	+0.6	06.1	0.1	06.0	9.9951673
3	Coral	50-28-49.9	+0.8	50.7	0.0	50.7	9.8872858
1-3						9965.52	3.9984998
1-2						7773.53	3.8906183
2-3						9965.52	3.9984998
1	Engebi	44-29-58.6	+0.9	59.5	0.1	59.4	0.1543396
2	Aomon	94-05-58.5	+0.4	58.9	0.1	58.8	9.9988873
3	Coral	41-24-01.4	+0.4	01.8	0.0	01.8	9.8204106
1-3						14181.64	4.1517266
1-2						9402.64	3.9732499
2-3						7494.68	3.8747531
1	Engebi	27-26-14.7	+1.1	15.8	0.1	15.7	0.3365028
2	North Base #2	60-40-51.5	+0.4	51.9	0.1	51.8	9.9404704
3	Coral	91-52-51.3	+1.3	52.6	0.1	52.5	9.9997658
1-3						14181.63	4.1517263
1-2						16256.30	4.2110217
2-3						16256.31	4.2110217
1	Aomon	142-09-02.1	+0.1	02.2	0.1	02.1	0.2121229
2	North Base #2	20-47-14.0	+0.2	14.2	0.0	14.2	9.5501052
3	Engebi	17-03-43.9	-0.2	43.7	0.0	43.7	9.4674729
1-3						9402.64	3.9732498
1-2						7773.52	3.8906175

JOB Nº 831

$\epsilon = 0.1$

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

		°	'	"
α	2 North Base #2 to 3 Coral	75	02	07.9
$2^d\angle$	8	+ 81	28	06.1
α	2 North Base #2 to 1 Aomon	156	30	14.0
$\Delta\alpha$				20.5
		180	00	00.0
α'	1 Aomon to 2 North Base #2	336	29	53.5

		°	'	"
α	3 Coral to 2 North Base #2	255	01	20.1
$3^d\angle$	8	− 50	28	50.7
α	3 Coral to 1 Aomon	204	32	29.4
$\Delta\alpha$			+	27.4
		180	00	00.0
α'	1 Aomon to 3 Coral	24	32	56.8

FIRST ANGLE OF TRIANGLE 48-03-03.3

	°	'	"			°	'	"
ϕ	11	33	23.267 2 North Base #2	λ	162	21	09.893
$\Delta\phi$	+	03	52.016	$\Delta\lambda$	−	01	42.309
ϕ'	11	37	15.283 1 Aomon	λ'	162	19	27.584

	°	'	"			°	'	"
ϕ	11	32	20.254 3 Coral	λ	162	17	10.944
$\Delta\phi$	+	04	55.029	$\Delta\lambda$	+	02	16.640
ϕ'	11	37	15.283 1 Aomon	λ'	162	19	27.584

	Logarithms	Values in seconds	
s	3.8906184		
Cos α	9.9624106$_n$		
B	8.5124997		
h	2.3655287$_n$	1st term	−232.0218
s^2	7.781		
$\sin^2\alpha$	9.201		
C	.717		
	7.699	2d term	+ .0050
h^2	4.73		
D	1.98		
	6.71	3d term	+ .0005
		$-\Delta\phi$	−232.0163

	°	'	"
$\frac{1}{2}(\phi+\phi')$	11	35	19.275

	Logarithms	Values in seconds
s	3.8906184	
Sin α	9.6006319 +	
A′	8.5096669	
Sec ϕ'	0.0089948	
$-\Delta\lambda$	2.0099120	+102.3086
$\sin\frac{1}{2}(\phi+\phi')$	9.3029465	
$-\Delta\alpha$	1.3128585	+ 20.55

	Logarithms	Values in seconds	
s	3.9985000		
Cos α	9.9588794$_n$		
B	8.5124997		
h	2.4698791$_n$	1st term	−295.0388
s^2	7.997		
$\sin^2\alpha$	9.237		
C	.717		
	7.951	2d term	+ .0089
h^2	4.94		
D	1.98		
	6.92	3d term	+ .0008
		$-\Delta\phi$	−295.0291

	°	'	"
$\frac{1}{2}(\phi+\phi')$	11	34	47.768

	Logarithms	Values in seconds
s	3.9985000	
Sin α	9.6184165$_n$	
A′	8.5096669	
Sec ϕ'	0.0089948	
$\Delta\lambda$	2.1355782	−136.6401
$\sin\frac{1}{2}(\phi+\phi')$	9.3026229	
$-\Delta\alpha$	1.4382011	− 27.43

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JOB Nº 831

$\epsilon = 0.2''$

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY _____ DATE _____

			°	'	"								°	'	"
α	2 Aomon	to 3 Coral	24	32	56.8	α	3 Coral	to 2 Aomon	204	32	29.4
$2^d\angle$		8	+ 94	05	58.9	$3^d\angle$		8	- 41	24	01.8
α	2 Aomon	to 1 Engebi	118	38	55.7	α	3 Coral	to 1 Engebi	163	08	27.6
$\Delta\alpha$				-	55.0	$\Delta\alpha$			-		27.3
			180	00	00.0				180	00	00.0
α'	1 Engebi	to 2 Aomon	298	38	00.7	α'	1 Engebi	to 3 Coral	343	08	00.$\frac{2}{8}$

FIRST ANGLE OF TRIANGLE 44-29-59.5

	°	'	"		°	'	"		°	'	"		°	'	"
ϕ	11	37	15.2832 Aomon	λ	162	19	27.584	ϕ	11	32	20.254 3 Coral	λ	162	17	10.944
$\Delta\phi$	+	02	26.681	$\Delta\lambda$	-	04	32.433	$\Delta\phi$	+	07	21.710	$\Delta\lambda$	-	02	15.793
ϕ'	11	39	41.964 1 Engebi	λ'	162	14	55.151	ϕ'	11	39	41.964 1 Engebi	λ'	162	14	55.151

	Logarithms	Values in seconds													
s	3.9732501														
Cos α	9.6807338_n														
B	8.5124972														
h	2.1664811_n	1st term	146.7172												
ϕ^2	7.946														
$\sin^2\alpha$	9.887														
C	.720														
	8.553	2d term	+ .0357												
h^2	4.33														
D	1.99														
	6.32	3d term	+ .0002												
		$-\Delta\phi$	-146.6813												

	°	'	"		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	38	28.623			
s					3.9732501	
Sin α					9.9432841	+
A'					8.5096665	
Sec ϕ'					0.0090584	
$\Delta\lambda$					2.4352591	+272.4326
$\sin\frac{1}{2}(\phi+\phi')$					9.3048790	
$-\Delta\alpha$					1.7401381	+ 54.97

	Logarithms	Values in seconds													
s	4.1517268_n														
Cos α	9.9809217_n														
B	8.5124997														
h	2.6451482_n	1st term	-441.7211												
s^2	8.303														
$\sin^2\alpha$	8.925														
C	.717														
	7.945	2d term	+ .0088												
h^2	5.29														
D	1.98														
	7.27	3d term	+ .0019												
		$-\Delta\phi$	-441.7104												

	°	'	"		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	36	01.109			
s					4.1517268	
Sin α					9.4624241	+
A'					8.5096665	
Sec ϕ'					0.0090584	
$\Delta\lambda$					2.1328758	+135.7925
$\sin\frac{1}{2}(\phi+\phi')$					9.3033758	
$-\Delta\alpha$					1.4362516	+ 27.31

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JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

α	2	Bokon	to 3	Aomon	291	26	06.9	α	3	to 2							
$2^d\angle$			8		-162	23	50.6	$3^d\angle$		8		-					
α	2	Bokon	to 1	Engebi	129	02	16.3	α	3	to 1							
$\Delta\alpha$					-		20.2	$\Delta\alpha$									
					180	00	00.0					180	00	00.0			
α'	1	Engebi	to 2	Bokon	309	01	56.1	α'	1	to 3							

FIRST ANGLE OF TRIANGLE

ϕ	11	38	22.046	2	Bokon	λ	162	16	35.139	ϕ				3	λ			
$\Delta\phi$	+	01	19.918			$\Delta\lambda$	-	01	39.987	$\Delta\phi$					$\Delta\lambda$			
ϕ'	11	39	41.964	1	Engebi	λ'	162	14	55.152	ϕ'				1	λ'			

	Logarithms	Values in seconds							Logarithms	Values in seconds						
s	3.5909475			$\frac{1}{2}(\phi+\phi')$	11	39	02.005		s				$\frac{1}{2}(\phi+\phi')$			
Cos α	9.7992260$_n$				Logarithms	Values in seconds			Cos α					Logarithms	Values in seconds	
B	8.5124967			s	3.5909475				B				s			
h	1.9026702	1st term	-79.9227	Sin α	9.8902700+				h		1st term		Sin α			
s^2	7.182			A'	8.5096665				s^2				A'			
$\sin^2\alpha$	9.781			Sec ϕ'	0.0090584				$\sin^2\alpha$				Sec ϕ'			
C	.720			$\Delta\lambda$	1.9999424	+99.987			C				$\Delta\lambda$			
	7.683	2d term	+ .0048	$\sin\frac{1}{2}(\phi+\phi')$	9.3052271						2d term	+	$\sin\frac{1}{2}(\phi+\phi')$			
h^2	3.81			$-\Delta\alpha$	1.3051695	+20.19			h^2				$-\Delta\alpha$			
D	1.99								D							
	5.80	3d term	+ .0001								3d term	+				
		$-\Delta\phi$	-79.9178								$-\Delta\phi$					

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HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVI GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE 11-3-52

JOB NO. 831 LOCATION Teiteir, Boga #1, Boga RM #1

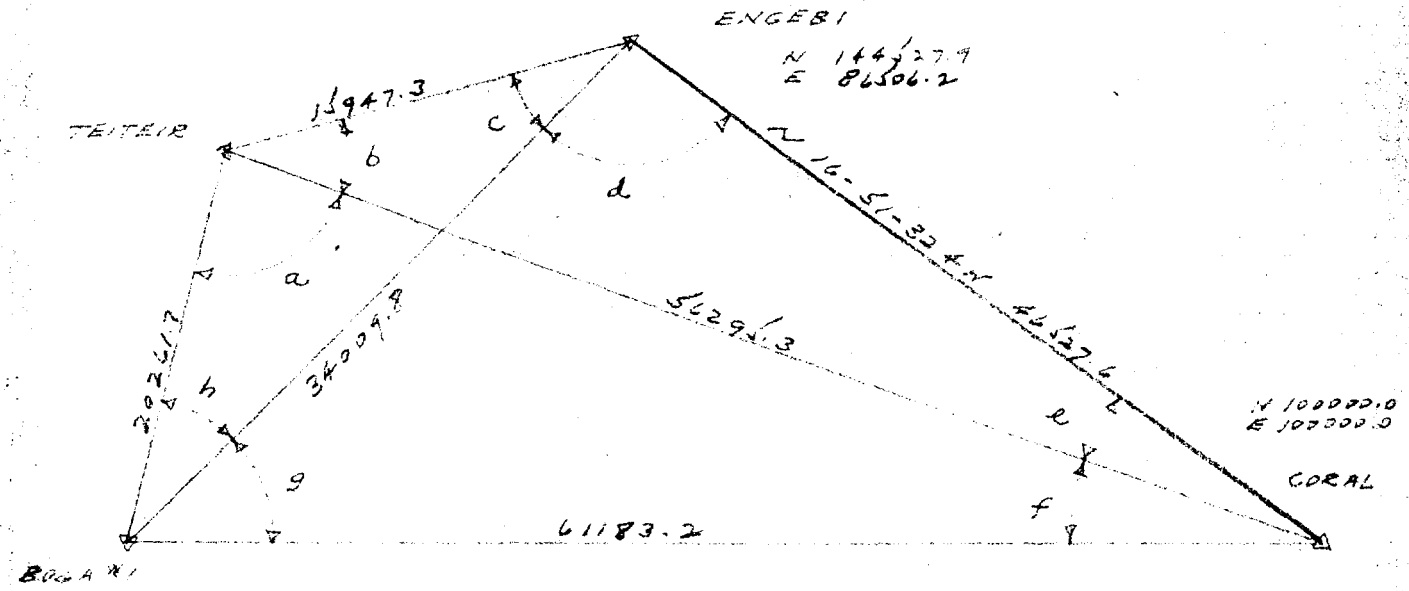
	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral									100,000.00		100,000.00		1
2	Engebi	N 16-51-32.4W	46527.60	95702136	29001744	44527.907			13493.815	144,527.91		86,506.18		2
3	Teiteir	N 76-30-01.0W	15947.35	23344065	97237105	3722.760			15506.741	148,250.67		70,999.44		3
4	Boga #1	S 63-03-18.6W	20261.69	45313239	89144323		9181.228		18062.146	139,069.44		52,937.30		4
5	Coral	S 50-18-07.2E	61166.32	63874096	76942185		39062.434	47062.703		100,000.00		100,000.00		5
6														6
7														7
8	Coral									100,000.00		100,000.00		8
9	Teiteir	N 31-00-27.2W	56295.31	85709938	51515110	48250.675			29000.591	148,250.67		70,999.41		9
10														10
11														11
12	Engebi									144,527.91		86,506.18		12
13	Boga #1	S 80-45-51.3W	34009.78	16019709	98703631		5458.471		33568.888	139,069.44		52,937.30		13
14														14
15	Boga #1									139,069.44		52,937.30		15
16	Boga RM #1	S 44-35-42.8W	193.62	71208459	70209368		137.874		135.939	138,931.57		52,801.36		16
17														17
18	Coral									100,000.00		100,000.00		18
19	Boga RM #1	N 50-28-57.5W	61183.17	63631200	77143181	38931.585			47198.644	138,931.59		52,801.36		19
20	Teiteir	N 62-53-00.1E	20445.43	45580341	89008047	9319.097		18198.078		148,250.68		70,999.43		20
21														21
22	Boga RM #1									138,931.57		52601.36		22
23	Engebi	N 80-34-21.5E	34166.27	16379707	98649406	5596.335		33704.822		144,527.91		86,506.18		23
24														24
25														25
26														26
27														27
28	•													28
29														29
30														30

NOTE - Refer to 1952 Expansion for new values at Boga RM #1 = Boga #2

BY A.C.B. DATE Feb 17 '42 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1

CHKD. BY L.S.H. DATE Nov 19 '42 1942 ADJUSTMENT JOB NO. 831

TEITEIR, BOGA #1



	OBS. ∠	GEO. COND		TRIG. COND
a	94-03-47.5		47.2	45.8
b	45-29-31.6		22.4	33.8
c	22-44-08.2		09.1	07.7
d	97-37-22.0		22.3	23.7
e	14-08-56.9		56.2	54.8
f	19-17-39.4		38.6	40.0
g	48-56-03.7		02.9	01.5
h	17-42-31.6		31.3	32.7
	360.0			

Sine Eq

Log. Sin a	9.9989071	01.1	Log. Sin b	9.8531849	20.7
" " c	9.5871308	50.4	d	9.9961449	2.8
" " e	9.3881284	83.6	f	9.5190617	60.1
" " g	9.8515614	18.3	h	9.4831277	15.9
	8.8515614	153.2		8.8515188	149.5
	5188	199.5			
	436	301.7		436/301.7 = 1.4"	

46527.6
Sin 48-56-01.5

Sin 22-26-34.8
(34009.78)

Sin 97-37-23.7
(61166.32)

34009.78
Sin 139-33-19.2

Sin 22-44-07.7
(20261.69)

Sin 17-42-32.7
(15947.35)

46527.6
Sin 45-29-33.8

Sin 120-21-31.4
(56294.31)

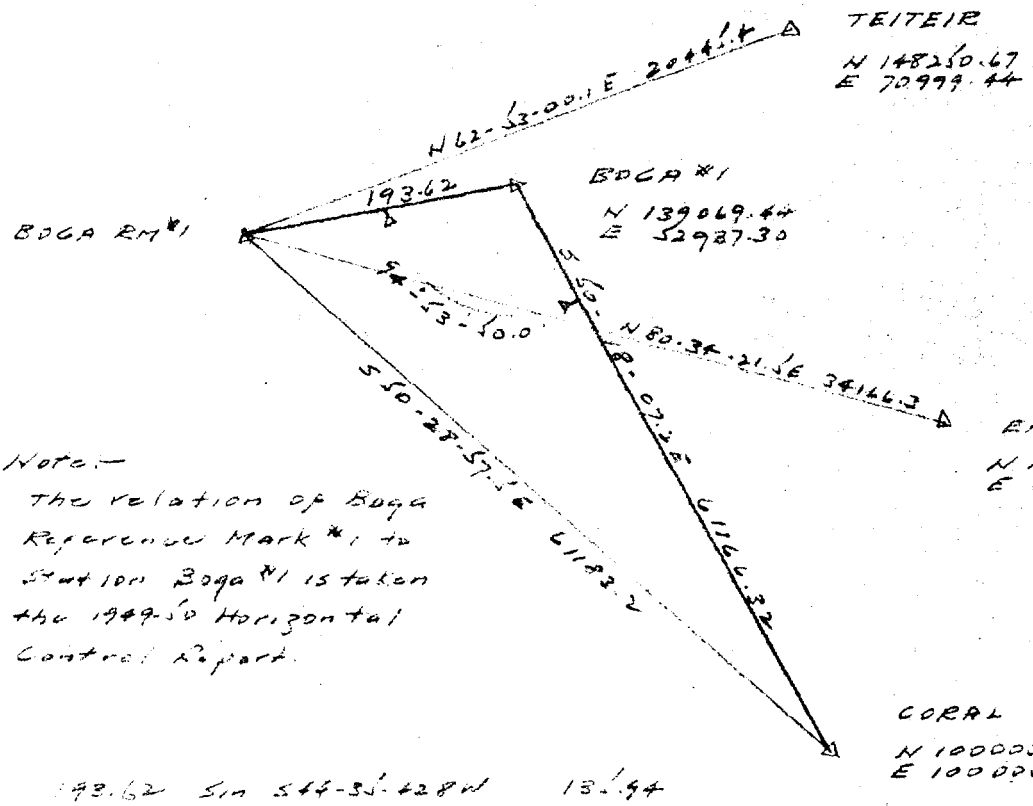
Sin 14-08-54.8
(15947.39)

56294.31
Sin 66-38-34.2

Sin 19-17-40.0
(20261.68)

Sin 94-03-45.8
(61166.35)

BY T.R.S DATE Feb 19[illegible] SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1
CHKD. BY S.M. DATE Mar 19[illegible] 1952 ADJUSTMENT JOB NO. 831
BOGA RM #1



Note:—
The relation of Boga Reference Mark #1 to Station Boga #1 is taken the 1949-50 Horizontal Control Report.

193.62 Sin S44-32-42.8W 13.194
Cos - 137.87

Boga #1 N 139069.44 E 52937.30
137.87 13.194
Boga RM #1 N 138931.57 E 52801.36

Boga RM #1 N 138931.57 E 52801.36
Teitier N 148250.67 E 70999.44
9319.10 18198.08

9319.10 = .51209248 = Tan. 27-06-59.9
18198.08
Cos 27-06-59.9 = 20445.43 N 62-53-00.1E

Boga RM #1 N 138931.57 E 52801.36
Engebi N 144527.91 E 86506.18
5596.34 33704.82

5596.34 = .16603475 = Tan. 9-28-38.1
33704.82
Cos 9-28-38.1 = 34166.27 N 80-34-21.1E

Boga RM #1 N 138931.57 E 52801.36
Coral N 100000.00 E 100000.00
38931.57 47198.64

38931.57 = .82484512 = Tan. 39-31-02.1
47198.64
Cos 39-31-02.1 = 61183.17 S 50-28-57.1E

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 12-11-51

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						14181.64	4.1517266
1	Boga #1	48-56-03.7	-2.1	01.6	0.1	01.5	0.1226572
2	Engebi	97-37-22.0	+1.9	23.9	0.2	23.7	9.9961446
3	Coral	33-26-35.3	-0.4	34.9	0.1	34.8	9.7412361
1-3						18643.54	4.2705284
1-2						10366.21	4.0156199
2-3						14181.64	4.1517266
1	Teiteir	45-29-31.6	+2.2	33.8	0.0	33.8	0.1468121
2	Engebi	120-21-30.3	+1.2	31.5	0.1	31.4	9.9359494
3	Coral	14-08-55.9	-1.0	54.9	0.1	54.8	9.3881666
1-3						17158.85	4.2344881
1-2						4860.77	3.6867053
2-3						17158.85	4.2344881
1	Boga #1	66-38-35.3	-1.0	34.3	0.1	34.2	0.0371330
2	Teiteir	94-03-47.5	-1.6	45.9	0.1	45.8	9.9989073
3	Coral	19-17-39.4	+0.7	40.1	0.1	40.0	9.5190701
1-3						18643.54	4.2705284
1-2						6175.77	3.7906912
2-3						10366.21	4.0156199
1	Teiteir	139-33-19.1	+0.5	19.6	0.0	19.6	0.1879481
2	Engebi	22-44-08.3	-0.6	07.7	0.0	07.7	9.5871238
3	Boga #1	17-42-31.6	+1.1	32.7	0.0	32.7	9.4831365
1-3						6175.78	3.7906918
1-2						4860.76	3.6867045

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 2-13-52

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3							4.1517267
1	Boga RM #1	48-56-	-	41.1	0.1	41.0	0.1225847
2	Engebi	97-25-	-	54.1	0.2	53.9	9.9963364
3	Coral	33-37-	-	25.2	0.1	25.1	9.7433021
1-3						18648.67	4.2706478
1-2						10403.90	4.0176135

NOTE - Refer to 1952 Expansion for new values

BOGA RM #1

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	

JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

$\epsilon = 0.2''$

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb.1952

				°	'	"							°	'	"	
α	2 Engebi	to 3	Coral	343	08	00.2	α	3 Coral	to 2	Engebi	163	08	27.6	
$2^d\angle$		8		+ 120	21	31.5	$3^d\angle$		8		- 14	08	54.9	
α	2 Engebi	to 1	Teiteir	103	29	31.7	α	3 Coral	to 1	Teiteir	148	59	32.7	
$\Delta\alpha$				-		31.6	$\Delta\alpha$				-		58.7	
				180	00	00.0					180	00	00.0	
α'	1 Teiteir	to 2	Engebi	283	29	00.1	α'	1 Teiteir	to 3	Coral	328	58	34.0	

FIRST ANGLE OF TRIANGLE 45-29-33.8

	°	'	"			°	'	"		°	'	"			°	'	"
ϕ	11	39	41.964	2 Engebi	λ	162	14	55.151	ϕ	11	32	20.254	3 Coral	λ	162	17	10.944
$\Delta\phi$	+		36.898		$\Delta\lambda$	-	02	36.060	$\Delta\phi$	+	07	58.608		$\Delta\lambda$	-	04	51.853
ϕ'	11	40	18.862	1 Teiteir	λ'	162	12	19.091	ϕ'	11	40	18.862	1 Teiteir	λ'	162	12	19.091

	Logarithms	Values in seconds		
s	3.6867054			
Cos α	9.3679379$_n$			
B	8.5124960			
h	1.5671393	1st term	−36.9096	
g^2	7.373			
$\sin^2\alpha$	9.976			
C	.721			
	8.070	2d term	+ .0118	
h^2	3.13			
D	1.99			
	5.12	3d term	+ .0000	
		$-\Delta\phi$	−36.8978	

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	40	00.413		
s				3.6867054	
Sin α				9.9878457 +	
A'				8.5096664	
Sec ϕ'				0.0090744	
$\Delta\lambda$				2.1932919	+156.0601
$\sin\frac{1}{2}(\phi+\phi')$				9.3058231	
$-\Delta\alpha$				1.4991150	+31.56

	Logarithms	Values in seconds	
s	4.2344881		
Cos α	9.9330310$_n$		
B	8.5124997		
h	2.6800188	1st term	−478.6508
s^2	8.469		
$\sin^2\alpha$	9.424		
C	.717		
	8.610	2d term	+ .0407
h^2	5.36		
D	1.98		
	7.34	3d term	+ .0022
		$-\Delta\phi$	−478.6079

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	36	19.558		
s				4.2344881	
Sin α				9.7119349 +	
A'				8.5096664	
Sec ϕ'				0.0090744	
$\Delta\lambda$				2.4651638	+291.8528
$\sin\frac{1}{2}(\phi+\phi')$				9.3035650	
$-\Delta\alpha$				1.7687288	+ 58.71

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JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952.

					°	'	"							°	'	"	
α	2	Engebi	to 3.	Coral	343	08	00.2	α	3	Coral	to 2	Engebi	163	08	27.6		
$2^d\angle$			8		+ 97	37	23.9	$3^d\angle$			8		- 33	26	34.9		
α	2	Engebi	to 1	Boga #1	80	45	24.1	α	3	Coral	to 1	Boga #1	129	41	52.7		
$\Delta\alpha$						- 1	08.2	$\Delta\alpha$						- 1	35.2		
					180	00	00.0						180	00	00.0		
α'	1	Boga #1	to 2	Engebi	260	44	15.9	α'	1	Boga #1	to 3	Coral	309	40	17.5		

FIRST ANGLE OF TRIANGLE 48-56-01.6

	°	'	"			°	'	"		°	'	"			°	'	"		
ϕ	11	39	41.964	2	Engebi	λ	162	14	55.151	ϕ	11	32	20.254	3	Coral	λ	162	17	10.944
$\Delta\phi$		-	54.247			$\Delta\lambda$		- 5	37.789	$\Delta\phi$		+ 6	27.463			$\Delta\lambda$		- 7	53.582
ϕ'	11	38	47.717	1	Boga #1	λ'	162	09	17.362	ϕ'	11	38	47.717	1	Boga #1	λ'	162	09	17.362

	Logarithms	Values in seconds																	
s	4.0156200																		
Cos α	9.2058179																		
B	8.5124960																		
h	1.7339339	1st term	+54.1918																
g^2	8.03124																		
$\sin^2\alpha$	9.98865																		
C	0.72139																		
	8.74128	2d term	+0.0551																
h^2	3.4679																		
D	1.9888																		
	5.4567	3d term	+0.0000																
		$-\Delta\phi$	54.2469																

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	39	14.840		
s				4.0156200	
Sin α				9.9943239	
A'				8.5096665	
Sec ϕ'				0.0090346	
$\Delta\lambda$				2.5286450	+337.7887
$\sin\frac{1}{2}(\phi+\phi')$				9.3053582	
$-\Delta\alpha$				1.8340032	+ 68.2

	Logarithms	Values in seconds																	
s	4.2705281																		
Cos α	9.8053245																		
B	8.5124997																		
h	2.5883523	1st term	-387.5719																
s^2	8.54106																		
$\sin^2\alpha$	9.77233																		
C	0.71669																		
	9.03008	2d term	+ 0.1072																
h^2	5.1767																		
D	1.9845																		
	7.1612	3d term	+ 0.0014																
		$-\Delta\phi$	387.4633																

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	35	33.986		
s				4.2705281	
Sin α				9.8861647	
A'				8.5096677	
Sec ϕ'				0.0090346	
$-\Delta\lambda$				2.6753951	+473.5819
$\sin\frac{1}{2}(\phi+\phi')$				9.3030974	
$-\Delta\alpha$				1.9784925	+ 95.2

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HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

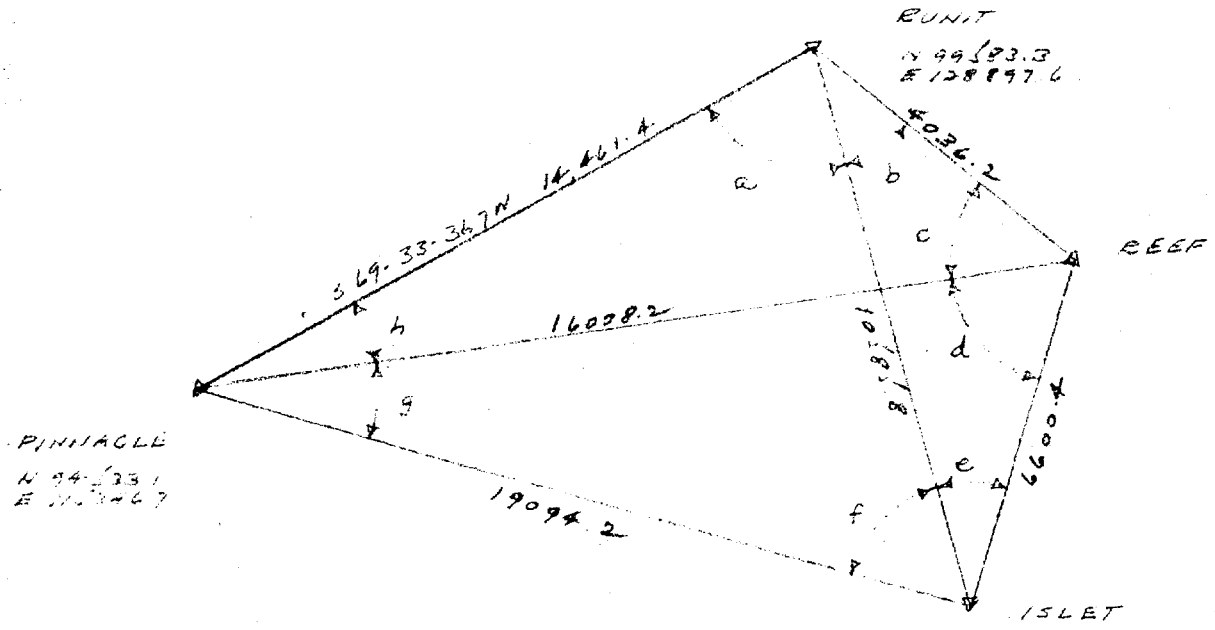
PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE 11-4-52

JOB NO. 831 LOCATION Islet, Reef

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Runit									99583.31		128897.55		1
2	Pinnacle	S 69-33-36.7W	14461.36	34922313	93703959		5050.241		13550.867	94533.07		115346.68		2
3	Islet	S 77-09-18.8E	19094.23	22231053	97497591		4244.848	18616.414		90288.22		133963.10		3
4	Reef	N 24-12-44.3W	6600.36	91203205	41011893	6019.740			2706.933	96307.96		131256.16		4
5	Runit	N 35-45-27.1W	4036.20	81149722	58435629	3275.365			2358.579	99583.33		128897.58		5
6														6
7														7
8	Pinnacle									94533.07		115346.68		8
9	Reef	N 83-38-03.5E	16008.18	11087390	99383448	1774.889		15909.481		96307.96		131256.16		9
10														10
11														11
12	Runit									99583.31		128897.55		12
13	Islet	S 28-35-19.9E	10585.76	87807370	47852116		9295.077	5065.510		90288.23		133963.06		13
14														14
15														15
16														16
17														17
18														18
19														19
20														20
21														21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY A.R.B DATE Mar 15 '72 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1
CHKD. BY A.S.H. DATE Mar 15 '72 1972 ADJUSTMENT JOB NO. 831
REEF, ISLET



a	98-08-56.6
b	7-10-07.2
c	60-36-29.4
d	107-50-47.8
e	4-22-35.6
f	48-33-58.9
g	19-12-37.7
h	14-04-26.8
	00.0

Side Eq. $\frac{\sin a \cdot \sin c \cdot \sin e \cdot \sin g}{\sin b \cdot \sin d \cdot \sin f \cdot \sin h} = 1$

Log Sin a	9.9951926	3.0	Log Sin b	9.0961821	167.4
" " c	9.9401596	11.9	" " d	9.9978825	6.9
" " e	8.8825874	27.5	" " f	9.8749006	18.6
" " g	9.5172477	10.4	" " h	9.3859220	84.0
	8.3356873			8.3356870	

No correction

14461.4 / Sin 60-36-29.4 — Sin 105-19-03.8 (16008.18) — Sin 14-04-26.8 (4036.20)

16008.18 / Sin 52-56-34.5 — Sin 19-12-37.7 (6600.36) — Sin 107-50-47.8 (19094.23)

14461.4 / Sin 48-33-58.9 — Sin 35-17-04.5 (10581.71) — Sin 98-08-56.6 (19094.23)

10581.71 / Sin 128-27-17.2 — Sin 7-10-07.2 (6600.36) — Sin 4-22-35.6 (4036.20)

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 1-8-52

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						4407.84	3.6442258
1	Islet	48-33-58.9	0.0	58.9	0.0	58.9	0.1250994
2	Pinnacle	33-17-04.5	0.0	04.5	0.0	04.5	9.7394124
3	Runit	98-08-56.6	0.0	56.6	0.0	56.6	9.9955926
1-3						3226.54	3.5087376
1-2						5819.93	3.7649177
2-3						4407.84	3.6442258
1	Reef	60-36-	-	29.4	0.0	29.4	0.0598404
2	Pinnacle	14-04-	-	26.8	0.0	26.8	9.3859220
3	Runit	105-19-	-	03.8	0.0	03.8	9.9842913
1-3						1230.24	3.0899882
1-2						4879.29	3.6883575
2-3						4879.29	3.6883575
1	Islet	52-56-	-	34.5	0.0	34.5	0.0979778
2	Pinnacle	19-12-	-	37.7	0.0	37.7	9.5172477
3	Reef	107-50-	-	47.8	0.0	47.8	9.9785825
1-3						2011.79	3.3035830
1-2						5819.93	3.7649178
2-3						3226.54	3.5087376
1	Reef	168-27-	-	17.2	0.0	17.2	0.6986633
2	Islet	4-22-	-	35.6	0.0	35.6	8.8825874
3	Runit	7-10-	-	07.2	0.0	07.2	9.0961821
1-3						1230.24	3.0899883
1-2						2011.79	3.3035830

JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

				°	'	"
α	2 Islet	to 3	Runit	151	25	48.5
2d ∠		&		+ 4	22	35.6
α	2 Islet	to 1	Reef	155	48	24.1
Δ α					−	05.4
				180	00	00.0
α′	1 Reef	to 2	Islet	335	48	18.6

				°	'	"
α	3 Runit	to 2	Islet	331	25	38.3
3d ∠		&		− 7	10	07.2
α	3 Runit	to 1	Reef	324	15	31.1
Δ α						04.7
				180	00	00.0
α′	1 Reef	to 3	Runit	144	15	35.8

FIRST ANGLE OF TRIANGLE 168-27-17.2

	°	'	"			°	'	"
φ	11	30	43.856	2 Islet	λ	162	22	52.543
Δ φ	+		59.725		Δ λ	−		27.208
φ′	11	31	43.581	1 Reef	λ′	162	22	25.335

	°	'	"			°	'	"
φ	11	32	16.080	3 Runit	λ	162	22	01.621
Δ φ		−	32.499		Δ λ		+	23.714
φ′	11	31	43.581	1 Reef	λ′	162	22	25.335

	Logarithms	Values in seconds	
s	3.3035815		
Cos α	9.9600749	n	
B	8.5125005		
h	1.7761569	1st term	-59.7251
s^2	6.607		
$\sin^2 \alpha$	9.225		
C	.716		
	6.548	2d term	+ .0004
h^2	3.55		
D	1.98		
	5.53	3d term	+ .0000
		−Δφ	-59.7247

	°	'	"	Logarithms	Values in seconds
½(φ+φ′)	11	31	13.718		
s				3.3035815	
Sin α				9.6125894+	
A′				8.5096679	
Sec φ′				0.0088517	
Δ λ				1.4346905	+27.2076
$\sin \frac{1}{2}(\phi+\phi')$				9.3003791	
−Δ α				0.7350696	+5.43

	Logarithms	Values in seconds	
s	3.0899868		
Cos α	9.9093753+		
B	8.5124997		
h	1.5118618	1st term	+32.4984
s^2	6.180		
$\sin^2 \alpha$	9.533		
C	.717		
	6.430	2d term	+ .0003
h^2	3.02		
D	1.98		
	5.00	3d term	+ .0000
		−Δφ	+32.4987

	°	'	"	Logarithms	Values in seconds
½(φ+φ′)	11	31	59.830		
s				3.0899868	
Sin α				9.7665075_n	
A′				8.5096679	
Sec φ′				0.0088517	
−Δ λ				1.3750139	-23.7145
$\sin \frac{1}{2}(\phi+\phi')$				9.3008935	
−Δ α				0.6759074	- 4.74

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JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

			°	'	"
α	2 Pinnacle to 3 Runit		249	34	07.6
2d ∠	&		+ 33	17	04.5
α	2 Pinnacle to 1 Islet		282	51	12.1
Δ α					+ 37.4
			180	00	00.0
α'	1 Islet to 2 Pinnacle		102	51	49.7

			°	'	"
α	3 Runit to 2 Pinnacle		429 69	34	34.9
3d ∠	&		− 98	08	56.6
α	3 Runit to 1 Islet		331	25	38.3
Δ α				+	10.2
			180	00	00.0
α'	1 Islet to 3 Runit		151	25	48.5

FIRST ANGLE OF TRIANGLE 48-33-58.9

	°	'	"			°	'	"
φ	11	31	26.010	2 Pinnacle	λ	162	19	45.307
Δ φ	−		42.154		Δ λ	+	03	07.236
φ'	11	30	43.856	1 Islet	λ'	162	22	52.543

	°	'	"			°	'	"
φ	11	32	16.080	3 Runit	λ	162	22	01.621
Δ φ	−	01	32.224		Δ λ		+	50.922
φ'	11	30	43.856	1 Islet	λ'	162	22	52.543

	Logarithms	Values in seconds		
s	3.7649163			
Cos α	9.3472462+			
B	8.5125002			
h	1.6246627	1st term	+ 42.1369	
s²	7.530			
Sin² α	9.978			
C	.716			
	8.224	2d term	+ .0168	
h²	3.25			
D	1.98			
	5.23	3d term	+ .0000	
		− Δ φ	+ 42.1537	

	°	'	"	Logarithms	Values in seconds
½(φ+φ')	11	31	04.933		
s				3.7649163	
Sin α				9.9889790n	
A'				8.5096680	
Sec φ'				0.0088261	
− Δ λ				2.2723894	−187.2360
Sin ½(φ+φ')				9.3003268	
− Δ α				1.5727162	−37.39

	Logarithms	Values in seconds		
s	3.5087363			
Cos α	9.9436989			
B	8.5124998			
h	1.9648350	1st term	+ 92.2221	
s²	7.017			
Sin² α	9.359			
C	.716			
	7.092	2d term	+ .0012	
h²	3.93			
D	1.98			
	5.91	3d term	+ .0001	
		− Δ φ	+ 92.2234	

	°	'	"	Logarithms	Values in seconds
½(φ+φ')	11	31	29.968		
s				3.5087363	
Sin α				9.6796762n	
A'				8.5096680	
Sec φ'				0.0088261	
− Δ λ				1.7069066	50.9221
Sin ½(φ+φ')				9.3005854	
− Δ α				1.0074920	−10.17

S-8

HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

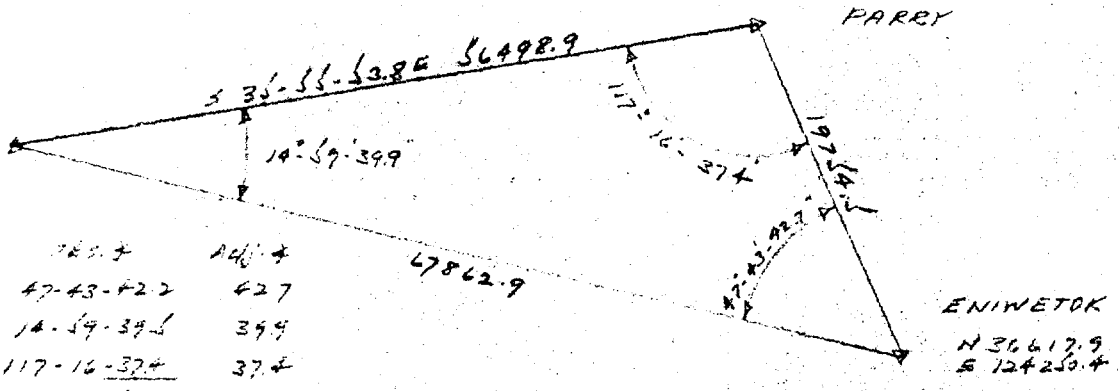
PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE 11-5-52

JOB NO. 831 LOCATION Eniwetok, Piiraai, Aniyaanii

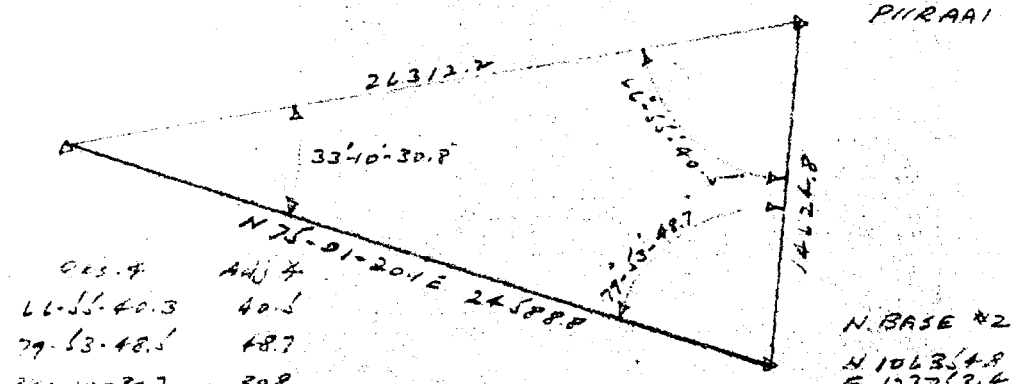
	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral									100,000.00		100,000.00		1
2	Parry	S 35-55-53.8E	56498.87	80971801	58681918		45746.153	33154.621		54,251.85		133,154.62		2
3	Eniwetok	S 26-47-28.8W	19754.51	89265401	45074260		17633.943		8904.197	36,617.90		124,250.42		3
4	Coral	N 20-56-13.9W	67862.90	93397269	35734438	63382.095			24250.426	100,000.00		100,000.00		4
5														5
6														6
7														7
8	Coral									100,000.00		100,000.00		8
9	N. Base #2	N 75-01-20.1E	24588.81	25844392	96602626	6354.828		23753.436	6199.427	106,354.83		123,753.44		9
10	Piiraai	N 25-04-51.2W	14624.83	90571024	42389735	13245.858			17554.009	119,600.69		117,554.01		10
11	Coral	S 41-50-49.3W	26312.17	74492867	66714412		19600.690			100,000.00		100,000.00		11
12														12
13														13
14														14
15	Coral									100,000.00		100,000.00		15
16	Aniyaanii	S 59-04-53.0E	47265.87	51381995	85789805	24286.147	40549.298			75,713.85		140,549.30		16
17	Parry	S 19-00-40.5W	22700.20	94545463	32575380	21462.009			7394.676	54,251.84		133,154.62		17
18														18
19														19
20		NOTE - Refer to 1952 Expansion for new values at Sta. Parry,												20
21		Piiraai and Eniwetok.												21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY ARB DATE MAR 15 SY SUBJECT TRIANGULATION ADJ SHEET NO. 1 OF 6
CHKD. BY LSH DATE NOV 19 SY 1952 ADJUSTMENT JOB NO. 831
ENIWETOK, PIIRAAI, ANIYAANII



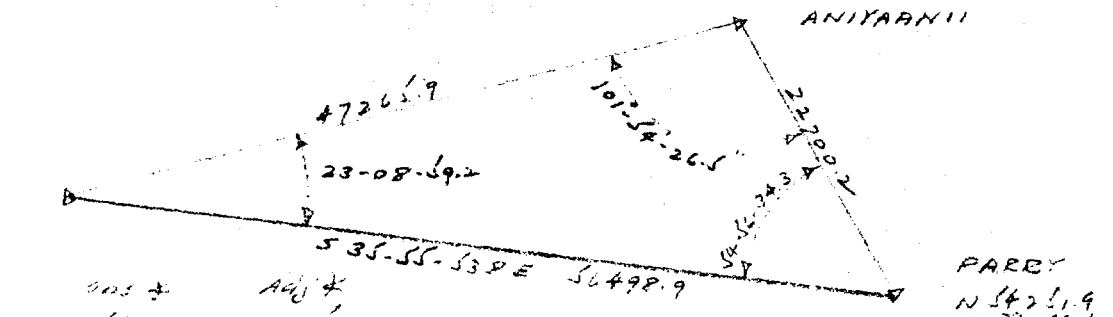
	Obs. ∠	Adj ∠
Eniwetok	47-43-42.2	42.7
Coral	14-59-39.5	39.9
Parry	117-16-37.4	37.4
		59.1

SL498.82 Sin 47-43-42.7 Sin 14-59-39.9 (19754.51) Sin 117-16-37.4 (47862.90)



	Obs. ∠	Adj ∠
Piiraai	66-55-40.3	40.5
N. Base #2	79-53-48.5	48.7
Coral	33-10-30.7	30.8
		59.5

24588.81 Sin 66-55-40.5 Sin 79-53-48.7 (26312.17) Sin 33-10-30.8 (14624.83)



	Obs. ∠	Adj ∠
Aniyaanii	101-54-26.6	26.5
Parry	54-56-34.4	34.3
Coral	23-08-59.2	59.2
		00.2

SL498.82 Sin 101-54-26.5 Sin 54-56-34.3 (47265.87) Sin 23-08-59.2 (22700.20)

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 1-8-52

STATION	OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM	
2-3					17220.89	4.2360559	
1 Eniwetok	47-43-42.2	+ 0.5	42.7	0.0	42.7	0.1307882	
2 Coral	14-59-39.5	+ 0.5	40.0	0.1	39.9	9.4128382	ENIWETOK
3 Parry	117-16-37.4	+ 0.1	37.5	0.1	37.4	9.9488045	
1-3					6021.19	3.7796823	
1-2					20684.67	4.3156486	
NOTE -	Refer to 1952 Expansion		for new	values			
2-3					7494.68	3.8747530	
1 Piiraai	66-55-40.3	+ 0.2	40.5	0.0	40.5	0.0362062	
2 North Base #2	79-53-48.5	+ 0.3	48.8	0.1	48.7	9.9932129	PIIRAAI
3 Coral	33-10-30.7	+ 0.1	30.8	0.0	30.8	9.7381472	
1-3					8019.96	3.9041721	
1-2					4457.65	3.6491064	
NOTE -	Refer to 1952 Expansion		for new	values			
2-3					17220.89	4.2360559	
1 Aniyaanii	101-54-26.6	0.0	26.6	0.1	26.5	0.0094470	
2 Parry	54-56-34.4	0.0	34.4	0.1	34.3	9.9130610	ANIYAANII
3 Coral	23-08-59.2	0.0	59.2	0.0	59.2	9.5945429	
1-3					14406.68	4.1585639	
1-2					6919.04	3.8400458	
2-3							
1							
2							
3							
1-3							
1-2							

JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

						°	'	"								°	'	"	
α	2	Coral	to 3	Parry		324	04	06.3	α	3	Parry	to 2	Coral			144	05	12.6	
$2^d\angle$			8			+ 14	59	40.0	$3^d\angle$			8				- 117	16	37.5	
α	2	Coral	to 1	Eniwetok		339	03	46.3	α	3	Parry	to 1	Eniwetok			26	48	35.1	
$\Delta\alpha$						+		48.4	$\Delta\alpha$							-		17.7	
						180	00	00.0								180	00	00.0	
α'	1	Eniwetok	to 2	Coral		159	04	34.7	α'	1	Eniwetok	to 3	Parry			206	48	17.4	

FIRST ANGLE OF TRIANGLE 47-43-42.7

	°	'	"				°	'	"		°	'	"				°	'	"
ϕ	11	32	20.254	2	Coral	λ	162	17	10.944	ϕ	11	24	46.373	3	Parry	λ	162	22	44.295
$\Delta\phi$	-	10	28.788			$\Delta\lambda$	+	04	03.782	$\Delta\phi$	-	02	54.907			$\Delta\lambda$	-	01	29.569
ϕ'	11	21	51.466	1	Eniwetok	λ'	162	21	14.726	ϕ'	11	21	51.466	1	Eniwetok	λ'	162	21	14.726

	Logarithms	Values in seconds																	
s	4.3156477																		
Cos α	9.9703343+																		
B	8.5124997																		
h	2.7984817	1st term	628.7554																
s^2	8.631																		
$\sin^2\alpha$	9.106																		
C	.717																		
	8.454	2d term	+ .0285																
n^2	5.60																		
D	1.98																		
	7.58	3d term	+ .0038																
		$-\Delta\phi$	+ 628.7877																

						°	'	"											
$\frac{1}{2}(\phi+\phi')$						11	27	05.860											
			Logarithms	Values in seconds															
s			4.3156477																
Sin α			9.5530859$_n$																
A'			8.5096695																
Sec ϕ'			0.0085993																
$\Delta\lambda$			2.3870024	−243.7824															
$\sin\frac{1}{2}(\phi+\phi')$			9.2978492																
$-\Delta\alpha$			1.6848516	− 48.40															

	Logarithms	Values in seconds																	
s	3.7796815																		
Cos α	9.9506126 +																		
B	8.5125035																		
h	2.2427976	1st term	+174.9031																
s^2	7.559																		
$\sin^2\alpha$	9.308																		
C	.712																		
	7.579	2d term	+ .0038																
n^2	4.49																		
D	1.98																		
	6.47	3d term	+ .0003																
		$-\Delta\phi$	+174.9072																

						°	'	"											
$\frac{1}{2}(\phi+\phi')$						11	23	18.919											
			Logarithms	Values in seconds															
s			3.7796815																
Sin α			9.6542049+																
A'			8.5096695																
Sec ϕ'			0.0085993																
$\Delta\lambda$			1.9521552	+89.5685															
$\sin\frac{1}{2}(\phi+\phi')$			9.2954837																
$-\Delta\alpha$			1.2476389	+17.69															

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JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

		°	'	"
∝	2 North Base #2 to 3 Coral	75	02	07.9
2d ∠	8	+ 79	53	48.8
∝	2 North Base #2 to 1 Piiraai	154	55	56.7
Δ ∝			−	12.5
		180	00	00.0
∝'	1 Piiraai to 2 North Base #2	334	55	44.2

		°	'	"
∝	3 Coral to 2 North Base #2	255	01	20.1
3d ∠	8	− 33	10	30.8
∝	3 Coral to 1 Piiraai	221	50	49.3
Δ ∝			+	35.4
		180	00	00.0
∝'	1 Piiraai to 3 Coral	41	51	24.7

FIRST ANGLE OF TRIANGLE 66-55-40.5

	°	'	"		°	'	"
φ	11	33	23.267	2 North Base #2	λ	162	21	09.893
Δ φ	+	02	11.412		Δ λ	−	01	02.341
φ'	11	35	34.679	1 Piiraai	λ'	162	20	07.552

	°	'	"		°	'	"
φ	11	32	20.254	3 Coral	λ	162	17	10.944
Δ φ	+	03	14.425		Δ λ	+	02	56.608
φ'	11	35	34.679	1 Piiraai	λ'	162	20	07.552

	Logarithms	Values in seconds	
s	3.6491067		
Cos ∝	9.9570365$_n$		
B	8.5124992		
h	2.1186424$_n$	1st term	−131.4142
s^2	7.298		
$\sin^2 \alpha$	9.254		
C	.717		
	7.269	2d term	+ .0019
h^2	4.24		
D	1.98		
	6.22	3d term	+ .0002
		−Δ φ	−131.4121

	°	'	"	Logarithms	Values in seconds
½(φ+φ')	11	34	28.973		
s				3.6491067	
Sin ∝				9.6270453+	
A'				8.5096672	
Sec φ'				0.0089513	
Δ λ				1.7947705	+62.3405
$\sin \frac{1}{2}(\phi+\phi')$				9.3024296	
−Δ ∝				1.0972001	+12.51

	Logarithms	Values in seconds	
s	3.9041724		
Cos ∝	9.8721147$_n$		
B	8.5124997		
h	2.2887868$_n$	1st term	−194.4405
s^2	7.808		
$\sin^2 \alpha$	9.648		
C	.717		
	8.173	2d term	+ .0149
h^2	4.58		
D	1.98		
	6.56	3d term	+ .0004
		−Δ φ	−194.4252

	°	'	"	Logarithms	Values in seconds
½(φ+φ')	11	33	57.466		
s				3.9041724	
Sin ∝				9.8242197$_n$	
A'				8.5096672	
Sec φ'				0.0089513	
Δ λ				2.2470106	−176.6081
$\sin \frac{1}{2}(\phi+\phi')$				9.3021056	
−Δ ∝				1.5491162	−35.41

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JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

				°	'	"								°	'	"			
α	2	Parry	to 3 Coral	144	05	12.6	α	3	Coral	to 2	Parry	324	04	06.3					
$2^d\angle$			8	+ 54	56	34.4	$3^d\angle$			8		− 23	08	59.2					
α	2	Parry	to 1 Aniyaanii	199	01	47.0	α	3	Coral	to 1	Aniyaanii	300	55	07.1					
$\Delta\alpha$					+	14.8	$\Delta\alpha$						+ 01	21.3					
				180	00	00.0						180	00	00.0					
α'	1	Aniyaanii	to 2 Parry	19	02	01.8	α'	1	Aniyaanii	to 3	Coral	120	56	28.4					

FIRST ANGLE OF TRIANGLE 101-54-26.6

		°	'	"			°	'	"			°	'	"			°	'	"
ϕ	11	24	46.373	2	Parry	λ	162	22	44.295	ϕ	11	32	20.254	3	Coral	λ	162	17	10.944
$\Delta\phi$	+	03	32.880			$\Delta\lambda$	+	01	14.435	$\Delta\phi$	−	04	01.001			$\Delta\lambda$	+	06	47.786
ϕ'	11	28	19.253	1	Aniyaanii	λ'	162	23	58.730	ϕ'	11	28	19.253	1	Aniyaanii	λ'	162	23	58.730

	Logarithms	Values in seconds																	
s	3.8400452																		
Cos α	9.9755924$_n$																		
B	8.5126035																		
h	2.3281411$_n$	1st term	−212.8830																
s^2	7.680																		
$\sin^2\alpha$	9.027																		
C	.712																		
	7.419	2d term	+ .0026																
h^2	4.66																		
D	1.98																		
	6.64	3d term	+ .0004																
		$-\Delta\phi$	− 212.8800																

		°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$		11	26	32.813		
s					3.8400452	
Sin α					9.5132957$_n$	
A′					8.5096684	
Sec ϕ'					0.0087642	
$-\Delta\lambda$					1.8717735	−74.4344
$\sin\frac{1}{2}(\phi+\phi')$					9.2975056	
$-\Delta\alpha$					1.1692791	−14.77

	Logarithms	Values in seconds																	
s	4.1685632																		
Cos α	9.7108113+																		
B	8.5124997																		
h	2.3818742+	1st term	+240.9207																
s^2	8.317																		
$\sin^2\alpha$	9.867																		
C	.717																		
	8.901	2d term	+ .0796																
h^2	4.76																		
D	1.98																		
	6.74	3d term	+ .0005																
		$-\Delta\phi$	+ 241.0008																

		°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$		11	30	19.754		
s					4.1685632	
Sin α					9.9334356$_n$	
A′					8.5096684	
Sec ϕ'					0.0087642	
$-\Delta\lambda$					2.6104319	−407.7856
$\sin\frac{1}{2}(\phi+\phi')$					9.2998597	
$-\Delta\alpha$					1.9102911	− 81.34

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HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE 11-5-52

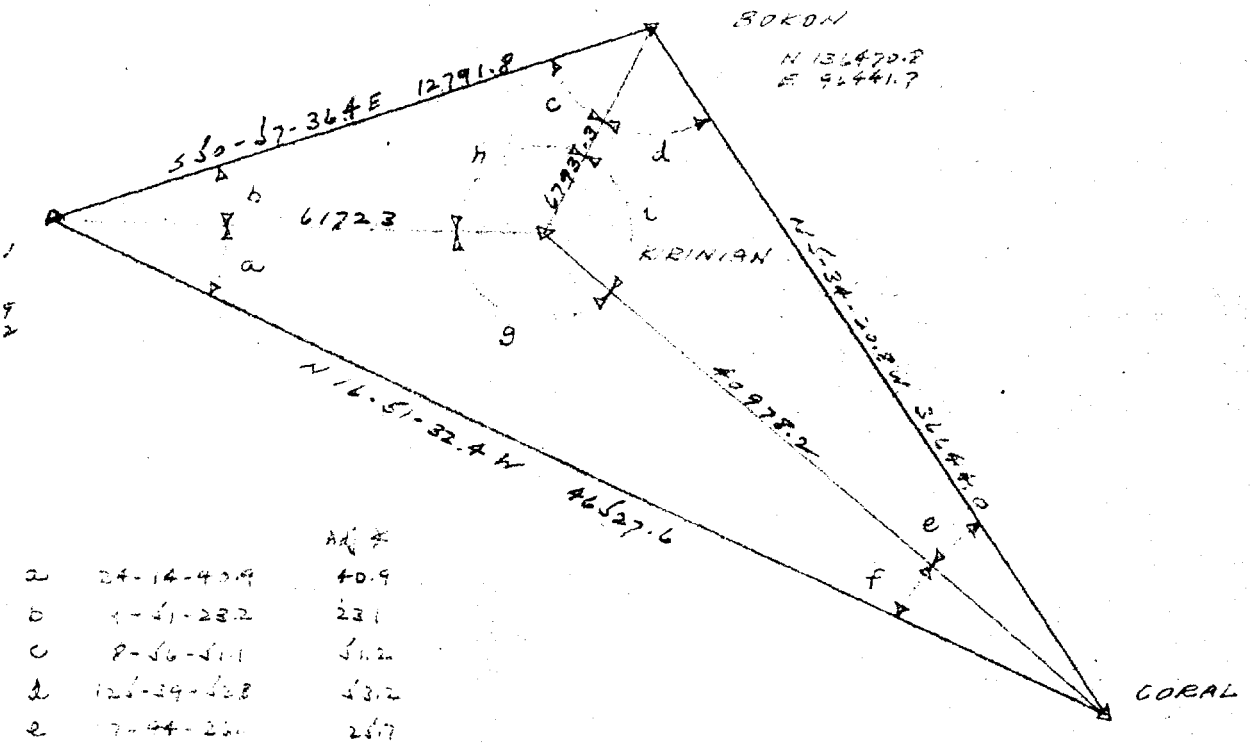
JOB NO. 831 LOCATION Bokon, Kirinian

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Coral									100,000.00		100,000.00		1
2	Bokon	N 5-34-20.8W	36644.00	99527421	09710425	36470.828			3558.288	136,470.83		96,441.71		2
3	Aomon	S 68-33-45.8E	18412.10	36548247	93081823		6729.300	17138.318		129,741.53		113,580.03		3
4														4
5														5
6	Bokon									136,470.83		96,441.71		6
7	Engebi	N 50-57-36.4W	12791.84	62986128	77670764	8057.085			9935.520	144,527.91		86,506.19		7
8														8
9														9
10														10
11														11
12	Coral									100,000.00		100,000.00		12
13	Kirinian	N 13-18-46.5W	40978.18	97312699	23026912	39876.973			9436.009	139,876.97		90,563.99		13
14	Bokon	S 59-54-27.6E	6793.34	50139399	86521852		3406.14	5877.724		136,470.83		96,441.71		14
15														15
16														16
17	Kirinian									139,876.97		90,563.99		17
18	Engebi	N 41-06-13.3W	6172.29	75352100	65742384	4650.950			4057.811	144,527.92		86,506.18		18
19														19
20														20
21														21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY AMB DATE Mar 1957 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1

CHKD. BY JSH DATE Mar 1957 1952 ADJUSTMENT JOB NO. 231

KIRINIAN



		Adj ∠
a	24-14-40.9	40.9
b	1-51-23.2	23.1
c	8-56-51.1	51.2
d	125-39-53.8	53.2
e	7-44-26.0	26.7
f	2-22-45.9	45.9
g	152-12-33.2	33.2
h	161-11-45.7	45.7
i	46-35-41.1	41.1

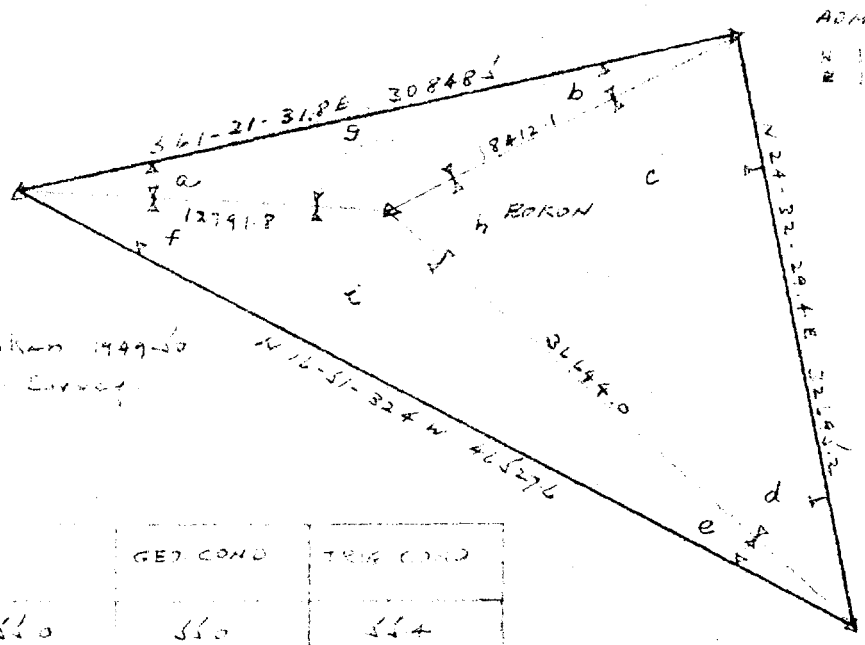
Side Eq $\frac{\sin a \cdot \sin c \cdot \sin \omega}{\sin b \cdot \sin d \cdot \sin f} = 1$

Log Sin ω	9.2138553	46.8	Log Sin f	9.2334523	121.2
" " c	9.1918151	133.7	" " d	9.9097924	15.2
" " e	9.1293229	15.9	" " f	9.7913490	340.0
	7.9345933	32.4		7.9345937	476.4
				933	32.4
				4	811.8

No correction.

32444.0	Sin 125-39-53.2	Sin 7-44-26.7
Sin 46-35-41.1	(40978.18)	(6793.34)
46527.60	Sin 24-14-40.9	Sin 2-22-45.9
Sin 152-12-33.2	(40978.17)	(6172.29)
12791.84	Sin 1-51-23.1	Sin 8-56-51.2
Sin 161-11-45.7	(6793.33)	(6172.28)

BY A.K.B. DATE Mar 1949 SUBJECT TRIANGULATION ARC SHEET NO. 1 OF 1
CHKD. BY L.S.H. DATE 10/19/49 1942 ADJUSTMENT JOB NO. 231
BOKON



Note
Angles c, d, h taken 1949-50
Horizontal Control Survey

		GEO COND	TRIG COND
a	10-23-55.0	55.0	55.4
b	7 12-14.4	14.4	14.0
c	86-53-44.1	44.4	44.8
d	30-06-50.7	50.6	50.2
e	21-17-10.7	11.2	10.6
f	34-06-04.1	04.4	04.0
	179-59-59.0	00.0	00.0
g	102-23-50.9	50.6	
h	62-47-24.7	25.0	
ℓ	134-36-43.7	44.4	
	299-59-59.1	00.0	

Side Eq. $\frac{\sin a \cdot \sin c \cdot \sin e}{\sin f \cdot \sin b \cdot \sin d} = 1$

Log Sin a	9.2546419	114.8
" " c	9.9999626	1.0
" " e	9.29 -202	105.4
	8.5474483	221.3

Log Sin f	9.7482970	31.1
" " b	9.0983542	166.2
" " d	9.2004640	36.3
	8.5474672	233.9
	4483	221.3
	189	45.2

189/45.2 = 0.4"

32 47 20	Sin 86-53-44.8	Sin 30-06-50.2
Sin 129-25.0	(26-44.01)	(184-2.09)
46 32 ?0	Sin 11-17-11.0	Sin 34-06-04.0
Sin 134-32-44.4	(279.85)	(36+43.99)
30848.1	Sin 10-23-55.4	Sin 7-12-14.0
Sin 162-23-50.6	(42527.76)	(12791.83)

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 2-12-52

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM	
2-3							3.9985000	
1	Bokon	62-59-24.7	+ 0.3	25.0	0.0	25.0	0.0501566	
2	Aomon	86-53-44.1	+ 0.8	44.9	0.1	44.8	9.9993623	BOKON
3	Coral	30-06-50.7	− 0.5	50.2	0.0	50.2	9.7004625	
1-3						11169.12	4.0480189	
1-2						5612.02	3.7491191	
2-3							3.5909476	
1	Kirinian	161-11-	-	45.7	0.0	45.7	0.4916974	
2	Engebi	9-51-	-	23.1	0.0	23.1	9.2334533	KIRINIAN
3	Bokon	8-56-	-	51.2	0.0	51.2	9.1918151	
1-3						2070.61	3.3160983	
1-2						1881.33	3.2744601	
2-3								
1								
2								
3								
1-3								
1-2								
2-3								
1								
2								
3								
1-3								
1-2								

JOB Nº 831

$\epsilon = 0.1$

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

					°	'	"									°	'	"	
α	2	Aomon	to 3	Coral	24	32	56.8	α	3	Coral	to 2	Aomon	204	32	29.4				
$2^d\angle$			8		+ 86	53	44.9	$3^d\angle$			8		− 30	06	50.2				
α	2	Aomon	to 1	Bokon	111	26	41.7	α	3	Coral	to 1	Bokon	174	25	39.2				
$\Delta\alpha$					−		34.8	$\Delta\alpha$					—		07.2				
					180	00	00.0						180	00	00.0				
α'	1	Bokon	to 2	Aomon	291	26	06.9	α'	1	Bokon	to 3	Coral	354	25	32.9				1.9

FIRST ANGLE OF TRIANGLE 62-59-25.0

	°	'	"			°	'	"			°	'	"			°	'	"	
ϕ	11	37	15.283	2	Aomon	λ	162	19	27.584	ϕ	11	32	20.254	3	Coral	λ	162	17	10.944
$\Delta\phi$	+	01	06.763			$\Delta\lambda$	−	02	52.445	$\Delta\phi$	+	06	01.792			$\Delta\lambda$	-		35.805
ϕ'	11	38	22.046	1	Bokon	λ'	162	16	35.139	ϕ'	11	38	22.046	1	Bokon	λ'	162	16	35.139

	Logarithms	Values in seconds		
s	3.7491191			
Cos α	9.8630140$_n$			
B	8.5124972			
h	1.8246303	1st term	−66.7775	
s^2	7.498			
$\sin^2\alpha$	9.938			
C	.720			
	8.156	2d term	+ .0143	
n^2	3.65			
D	1.99			
	5.64	3d term	+ .0000	
		$-\Delta\phi$	−66.7632	

	°	'	"		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	37	48.665			
s					3.7491191	
Sin α					9.9688421	+
A'					8.5096667	
Sec ϕ'					0.0090237	
$\Delta\lambda$					2.2366516	+172.4454
$\sin\frac{1}{2}(\phi+\phi')$					9.3044775	
$-\Delta\alpha$					1.5411291	+ 34.76

	Logarithms	Values in seconds		
s	4.0480189			
Cos α	9.9979427$_n$			
B	8.5124997			
h	2.5584613	1st term	−361.7939	
s^2	8.096			
$\sin^2\alpha$	7.974			
C	.717			
	6.787	2d term	+ .0006	
h^2	5.12			
D	1.98			
	7.10	3d term	+ .0013	
		$-\Delta\phi$	−361.7920	

	°	'	"		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	35	21.150			
s					4.0480189	
Sin α					8.9872382	+
A'					8.5096667	
Sec ϕ'					0.0090237	
$\Delta\lambda$					1.5539475	+35.8053
$\sin\frac{1}{2}(\phi+\phi')$					9.3029657	
$-\Delta\alpha$					.8569132	+ 7.19

S-8

JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION · SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

						°	'	"							°	'	"	
α	2	Engebi	to 3	Bokon		309	01	56.1	α	3	Bokon	to 2	Engebi		129	02	16.3	
∠			8			+ 9	51	23.1	∠			8			− 8	56	51.2	
α	2	Engebi	to 1	Kirinian		318	53	19.2	α	3	Bokon	to 1	Kirinian		120	05	25.1	
Δα							+	8.3	Δα							−	11.9	
						180	00	00.0							180	00	00.0	
α′	1	Kirinian	to 2	Engebi		138	53	27.5	α′	1	Kirinian	to 3	Bokon		300	05	13.2	

FIRST ANGLE OF TRIANGLE 161-11-45.7

	°	'	"				°	'	"		°	'	"				°	'	"
φ	11	39	41.964	2	Engebi	λ	162	14	55.151	φ	11	38	22.046	3	Bokon	λ	162	16	35.139
Δφ	−		46.133			Δλ		+	40.840	Δφ	+		33.785			Δλ	−		59.148
φ′	11	38	55.831	1	Kirinian	λ′	162	15	35.991	φ′	11	38	55.831	1	Kirinian	λ′	162	15	35.991

	Logarithms	Values in seconds																
s	3.2744627																	
Cos α	9.8770450																	
B	8.5124960																	
h	1.6640037	1st term	46.1321															
s²	6.549																	
Sin² α	9.636																	
C	.721																	
	6.906	2d term	+ .0008															
h²	3.33																	
D	1.99																	
	5.32	3d term	+ .0000															
		−Δφ	46.1329															

	°	'	"		Logarithms	Values in seconds
½(φ+φ′)	11	39	18.898			
s				3.2744627		
Sin α				9.8179116n		
A′				8.5096666		
Sec φ′				0.0090384		
Δλ				1.6110793	−40.8394	
Sin½(φ+φ′)				9.3053995		
−Δα				.9164788	− 8.25	

	Logarithms	Values in seconds	
s	3.3160962		
Cos α	9.7001535n		
B	8.5124966		
h	1.5287463	1st term	−33.7867
s²	6.632		
Sin² α	9.874		
C	.721		
	7.227	2d term	+ .0017
h²	3.06		
D	1.99		
	5.05	3d term	+ .0000
		−Δφ	−33.7850

	°	'	"	Logarithms	Values in seconds
½(φ+φ′)	11	38	38.938		
s				3.3160962	
Sin α				9.9371347 +	
A′				8.5096666	
Sec φ′				0.0090384	
Δλ				1.7719359	+59.1474
Sin½(φ+φ′)				9.3049914	
−Δα				1.0769273	+11.94

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HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

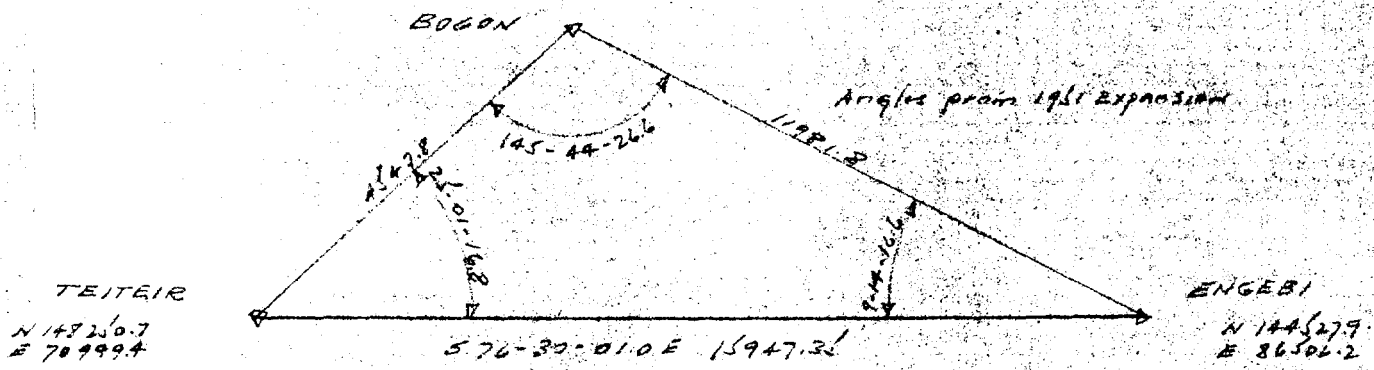
TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVI GRID
1952 ADJUSTED HORIZONTAL CONTROL

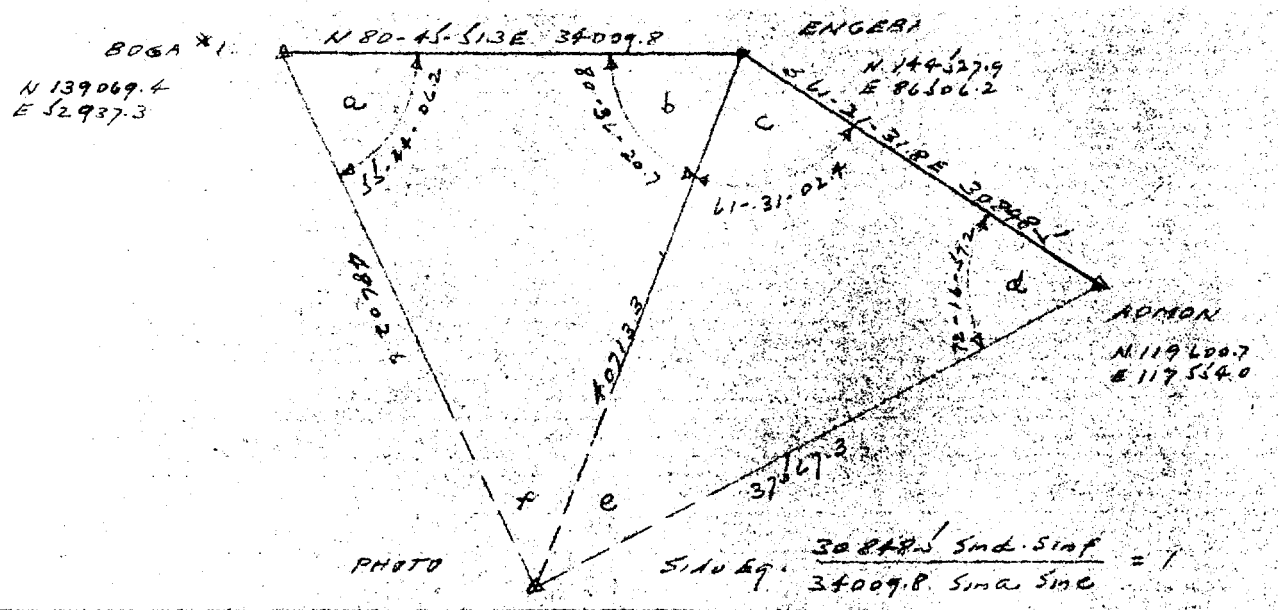
CALC. BY A.R.B.
CHECKED BY L.S.H. DATE 11-6-52
JOB NO. 831 LOCATION Photo, Bogon, Muzin

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1														1
2	Engebi									144527.90		86506.19		2
3	Bogon	N 67-15-44.4W	11981.79	386512hh	92228h19	4631.111			11050.615	149159.01		75455.58		3
4	Teiteir	S 78-28-42.2W	4547.76	19973753	9798h943		908.358		4456.120	148250.65		70999.45		4
5														5
6														6
7														7
8	Engebi									144527.90		86506.19		8
9	Photo	S 0-09-30.6W	40713.33	99999617	00276634		40713.174		112.627	103814.73		86393.56		9
10	Aomon	N 46-21-31.0E	37567.31	69011249	72367351	25926.797		27186.467		129741.52		113580.03		10
11														11
12														12
13	Photo									103814.73		86393.56		13
14	Boga #1	N 43-30-02.5W	48602.65	72536603	68836337	35254.711			33456.284	136069.44		52937.28		14
15														15
16														16
17	Engebi									144527.90		86506.19		17
18	PI #1 Muzin	S 34-23-41.3E	2660.39	82516472	56489220		2195.260	1502.834		142332.65		88009.02		18
19	E Zero	N 41-34-03.0W	6760.20	74817457	66350193	5057.810			4485.406	147390.45		83523.62		19
20														20
21														21
22														22
23														23
24														24
25														25
26														26
27														27
28														28
29														29
30														30

BY AKC DATE Jan 1947 SUBJECT TRIANGULATION ADV. SHEET NO. 1 OF 1
CHKD. BY [illegible] DATE Nov 1947 1952 ADJUSTMENT JOB NO. 831
BOGON, PHOTO



15947.3' / Sin 145-44-26.6 Sin 24-01-16.8 (11984.79) Sin 9-14-16.6 (4547.76)



PHOTO

Solve Eq. $\frac{30848.5' \sin d \cdot \sin f}{34009.8 \sin a \sin e} = 1$

		GEO. COND.	TRIG COND.
a	55-44-07.7	07.7	06.2
b	80-36-19.5'	20.7	20.7
c	61-31-01.1	02.4	02.4
d	76-16-55.7	55.7	57.2
e	46-12 - } NOT MEAS.	01.9	00.4
f	43-39 - } NOT MEAS.	31.9	33.1

Log Sin d	9.9788954	6.8
- - f	9.8390769	22.1
- 30848.5	4.4892340	
	+3072063	
Log Sin a	9.9172150	14.3
- - e	9.8583948	20.2
- 34009.8	4.5315041	
	+3072159	63.4
	063	
	96	

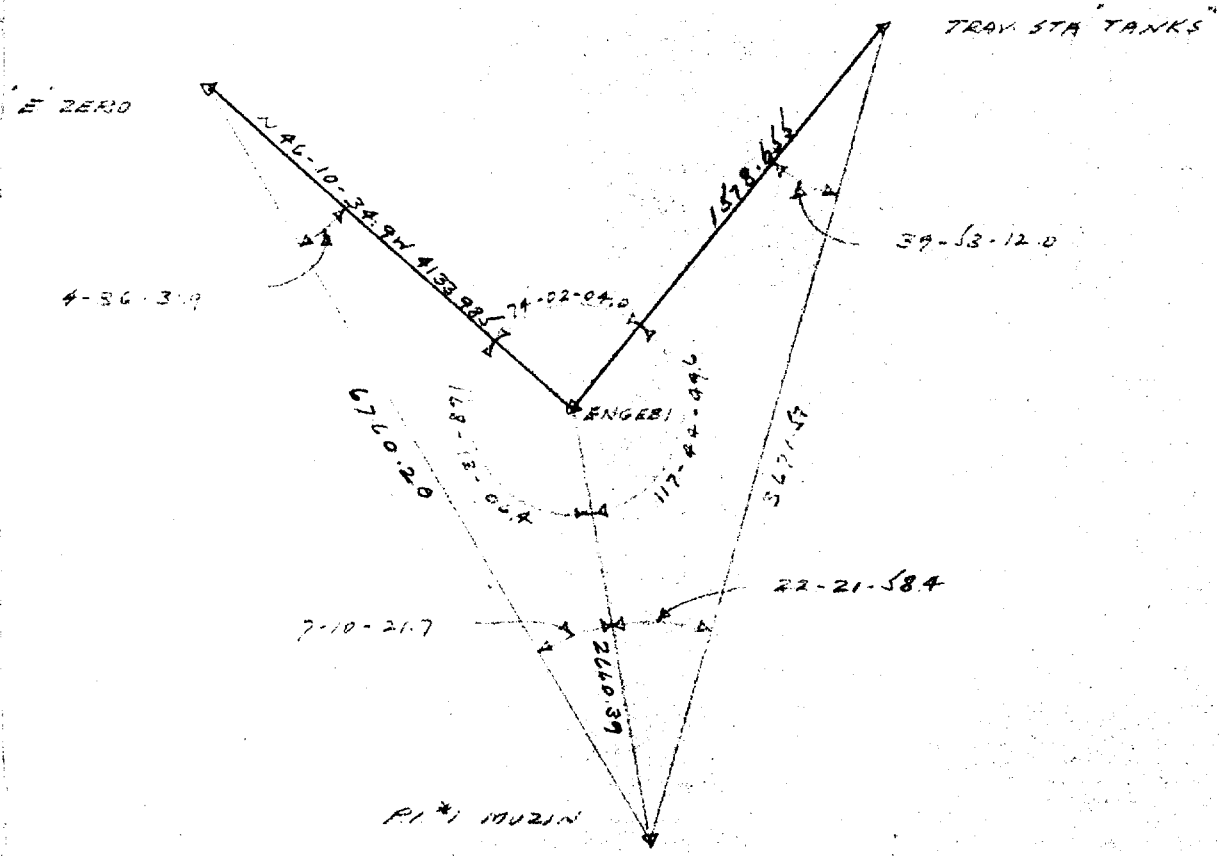
96/63.4 = .01.5"

34009.8' / Sin 43-39-33.1 Sin 55-44-06.2 (40713.33) Sin 80-36-20.7 (48602.45-)

30848.5' / Sin 46-12-00.4 Sin 61-31-02.4 (37567.31) Sin 76-16-57.7 (40713.34)

BY ARB DATE MAR 27 SUBJECT TRIANGULATION ADJ SHEET NO. 1 OF 1
CHKD. BY LSH DATE MAR 27 1952 ADJUSTMENT JOB NO. 231
PT #1 MUZIN

NOTE - Basic data copied from F.S. 76



4133.985'	Sin 4-36-31.9	Sin 168-13-06.4
Sin 7-10-21.7	(2660.40)	(6760.20)
1578.665'	Sin 39-53-12.0	Sin 117-44-49.6
Sin 22-21-58.4	(2660.39)	(3671.57)

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 1-3-52

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM	
2-3							3.6867033	
1	Bogon	145-44-	-	26.6	0.0	26.6	0.2495389	
2	Engebi	9-14-	-	16.6	0.0	16.6	9.2055694	
3	Teiteir	25-01-	-	16.8	0.0	16.8	9.6262949	BOGON
1-3						1386.15	3.1418116	
1-2						3652.05	3.5625371	
2-3							3.9732496	
1	Photo	46-12-03.1	-2.6	00.5	0.1	00.4	0.1416063	
2	Engebi	61-31-01.2	+1.4	02.5	0.1	02.4	9.9439698	
3	Aomon	72-16-55.7	+1.6	57.3	0.1	57.2	9.9788964	PHOTO
1-3						11450.53	4.0588257	
1-2						12409.44	4.0937523	
2-3							4.0156200	
1	Photo	43-39-32.8	+ 0.4	33.2	0.1	33.1	0.1609198	
2	Boga #1	55-44-07.7	-1.4	06.3	0.1	06.2	9.9172129	
3	Engebi	80-36-19.5	+1.3	20.8	0.1	20.7	9.9941361	PHOTO
1-3						12409.44	4.0937527	
1-2						14814.12	4.1706759	
2-3							3.1003843	
1	Muzin	7-10-	-	21.7	0.0	21.7	0.9035753	
2	E-Zero	4-36-	-	31.9	0.0	31.9	8.9049973	
3	Engebi	168-13-	-	06.4	0.0	06.4	9.3100152	MUZIN
1-3						810.98	2.9089569	
1-2						2060.51	3.3139748	

JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

			°	'	"
α	2 Engebi	to 3 Teiteir	103	29	31.7
2d ∠		&	+ 9	14	16.6
α	2 Engebi	to 1 Bogon	112	43	48.3
Δα			-		22.5
			180	00	00.0
α'	1 Bogon	to 2 Engebi	292	43	25.8

			°	'	"
α	3 Teiteir	to 2 Engebi	283	29	00.2
3d ∠		&	- 25	01	16.8
α	3 Teiteir	to 1 Bogon	258	27	43.4
Δα			+		09.1
			180	00	00.0
α'	1 Bogon	to 3 Teiteir	78	27	52.5

FIRST ANGLE OF TRIANGLE 145-44-26.8

	°	'	"			°	'	"
φ	11	39	41.964	2 Engebi	λ	162	14	55.151
Δφ		+	45.920		Δλ	-	01	51.217
φ'	11	40	27.884	1 Bogon	λ'	162	13	03.934

	°	'	"			°	'	"
φ	11	40	18.862	3 Teiteir	λ	162	12	19.091
Δφ		+	09.022		Δλ	+		44.843
φ'	11	40	27.884	1 Bogon	λ'	162	13	03.934

	Logarithms	Values in seconds		
s	3.5625392			
Cos α	9.5870268n			
B	8.5124960			
h	1.6620620	1st term	-45.9264	
s²	7.125			
Sin² α	9.930			
C	.721			
	7.776	2d term	+ .0060	
h²	3.32			
D	1.99			
	5.31	3d term	+ .0000	
		-Δφ	-45.9204	

	°	'	"	Logarithms	Values in seconds
½(φ+φ')	11	40	04.924		
s				3.5625392	
Sin α				9.9648888 +	
A'				8.5096664	
Sec φ'				0.0090784	
-Δλ				2.0461728	+111.2174
Sin½(φ+φ')				9.3058691	
-Δα				1.3520419	+ 22.49

	Logarithms	Values in seconds		
s	3.1418137			
Cos α	9.3010666n			
B	8.5124956			
h	0.9563759	1st term	-9.0235	
s²	6.284			
Sin² α	9.982			
C	.721			
	6.987	2d term	+ .0010	
h²	1.910			
D	1.99			
	3.90	3d term	+ .0000	
		-Δφ	-9.0225	

	°	'	"	Logarithms	Values in seconds
½(φ+φ')	11	40	23.373		
s				3.1418137	
Sin α				9.9911341n	
A'				8.5096664	
Sec φ'				0.0090784	
-Δλ				1.6516926	-44.8428
Sin½(φ+φ')				9.3060572	
-Δα				0.9577498	- 9.07

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JOB Nº 831

ϵ = 0.0

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952

				°	'	"								°	'	"	
α	2 E-Zero	to 3	Engebi	313	48	51.6	α	3 Engebi	to 2	E-Zero	133	48	57.7				
$2^d\angle$		8		+ 4	36	31.9	$3^d\angle$		8		- 168	13	06.4				
α	2 E-Zero	to 1	Muzin	318	25	23.5	α	3 Engebi	to 1	Muzin	325 / 34	35 / 24	51.8 / 08.7				
$\Delta\alpha$						+ 9.1	$\Delta\alpha$				+		3.1				
				180	00	00.0					180	00	00.0				
α'	1 Muzin	to 2	E-Zero	138	25	32.6	α'	1 Muzin	to 3	Engebi	145	35	54.4 / 3				

FIRST ANGLE OF TRIANGLE 7-10-21.7

	°	'	"			°	'	"		°	'	"			°	'	"
ϕ	11	40	10.356	2 E-Zero	λ	162	14	25.132	ϕ	11	39	41.964	3 Engebi	λ	162	14	55.151
$\Delta\phi$		-	50.167		$\Delta\lambda$		+	45.145	$\Delta\phi$		-	21.775		$\Delta\lambda$		+	15.126
ϕ'	11	39	20.189	1 Muzin	λ'	162	15	10.277	ϕ'	11	39	20.189	1 Muzin	λ'	262	15	10.277

	Logarithms	Values in seconds															
s	3.3139747																
Cos α	9.8739404																
B	8.5124957																
h	1.7004108	1st term	+50.1661														
s^2	6.62795																
$\sin^2\alpha$	9.64384																
C	0.72170																
	6.99349	2d term	+ 0.0010														
h^2	3.4008																
D	1.9891																
	5.3899	3d term	+ 0.0000														
		$-\Delta\phi$	+50.1671														

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	39	45.273		
s				3.3139747	
Sin α				9.8219217	
A'				8.5096664	
Sec ϕ'				0.0090489	
$-\Delta\lambda$				1.6546117	-45.1452
$\sin\frac{1}{2}(\phi+\phi')$				9.3056687	
$-\Delta\alpha$				0.9602804	- 9.13

	Logarithms	Values in seconds															
s	2.9089619																
Cos α	9.9165015																
B	8.5124955																
h	1.3379589	1st term	+21.7750														
s^2	5.81792																
$\sin^2\alpha$	9.50410																
C	0.72204																
	6.04406	2d term	+ 0.0001														
h^2	2.6759																
D	1.9894																
	4.6653	3d term	+ 0.0000														
		$-\Delta\phi$	+21.7751														

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	39	31.076		
s				2.9089619	
Sin α				9.7520499	
A'				8.5096665	
Sec ϕ'				0.0090489	
$-\Delta\lambda$				1.1797272	-15.1261
$\sin\frac{1}{2}(\phi+\phi')$				9.3055239	
$-\Delta\alpha$				0.4852511	- 3.06

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JOB № 831

ε = 0.3

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L.S.H. DATE Nov. 1952.

		°	'	"			°	'	"
α	2 Boga #1 to 3 Engebi	260	44	15.9	α	3 Engebi to 2 Boga #1	80	45	24.1
2d ∠	a	+ 55	44	06.3	3d ∠	a	− 80	36	20.8
α	2 Boga #1 to 1 Photo	316	28	22.2	α	3 Engebi to 1 Photo	0	09	03.3
Δα		+	1	07.7	Δα			−	00.2
		180	00	00.0			180	00	00.0
α'	1 Photo to 2 Boga #1	136	29	29.9	α'	1 Photo to 3 Engebi	180	09	03.1

FIRST ANGLE OF TRIANGLE 43-39-33.2

	°	'	"			°	'	"		°	'	"			°	'	"
φ	11	38	47.717	2 Boga #1	λ	162	09	17.362	φ	11	39	41.964	3 Engebi	λ	162	14	55.15
Δφ		− 5	49.629		Δλ	+	5	36.709	Δφ	−	6	43.876		Δλ		−	01.07
φ'	11	32	58.088	1 Photo	λ'	162	14	54.071	φ'	11	32	58.088	1 Photo	λ'	162	14	54.07

	Logarithms	Values in seconds			Logarithms	Values in seconds
s	4.1706752			$\frac{1}{2}(\phi+\phi')$	11° 35' 52.903"	
Cos α	9.8603667				Logarithms	Values in seconds
B	8.5124964			s	4.1706752	
n	2.5436383	1st term	+349.5733"	Sin α	9.8380290	
s²	8.34135			A'	8.5096666	
Sin² α	9.67606			Sec φ'	0.0088837	
C	0.72082			−Δλ	2.5272545	−336.7087"
	8.73823	2d term	+ 0.0547	$\sin\frac{1}{2}(\phi+\phi')$	9.3032916	
n²	5.0871			−Δα	1.8305461	−67.69
D	1.9884					
	7.0755	3d term	+ 0.0012			
		−Δφ	+349.6292			

	Logarithms	Values in seconds			Logarithms	Values in seconds
s	4.0937522			$\frac{1}{2}(\phi+\phi')$	11° 36' 20.02"	
Cos α	9.9999985				Logarithms	Values in seconds
B	8.5124960			s	4.0937522	
h	2.6062467	1st term	+403.8748"	Sin α	7.4206028	
s²	8.18750			A'	8.5096665	
Sin² α	4.84121			Sec φ'	0.0088837	
C	0.72139			−Δλ	0.0329052	−1.0787"
	3.75010	2d term	+ 0.0000	$\sin\frac{1}{2}(\phi+\phi')$	9.3035698	
h²	5.2125			−Δα	9.3364750	−0.22
D	1.9888					
	7.2013	3d term	+ 0.0016			
		−Δφ	403.8764			

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JOB Nº 831

$\epsilon = 0.3$

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

						°	′	″							°	′	″
α	2	Aomon	to 3	Engebi		118	38	55.7	α	3	to 2						
$2^d\angle$			8			−72	16	57.3	$3^d\angle$		8				−		
α	2	Aomon	to 1	Photo		46	21	58.4	α	3	to 1						
$\Delta\alpha$						−		54.9	$\Delta\alpha$								
						180	00	00.0							180	00	00.0
α'	1	Photo	to 2	Aomon		226	21	03.5	α'	1	to 3						

FIRST ANGLE OF TRIANGLE

	°	′	″				°	′	″		°	′	″				°	′	″	
ϕ	11	37	15.283	2	Aomon	λ	162	19	27.584	ϕ				3		λ				
$\Delta\phi$	−	04	17.196			$\Delta\lambda$	−	04	33.511	$\Delta\phi$						$\Delta\lambda$				
ϕ'	11	32	58.087	1	Photo	λ'	162	14	54.073	ϕ'				1		λ'				

	Logarithms	Values in seconds			°	′	″	2		Logarithms	Values in seconds			°	′	″
s	4.0588262			$\frac{1}{2}(\phi+\phi')$	11	35	06.686		s				$\frac{1}{2}(\phi+\phi')$			
Cos α	9.8388783	+			Logarithms		Values in seconds		Cos α					Logarithms		Values in seconds
B	8.5124972			s	4.0588262				B				s			
h	2.4102017	1st term	+257.1590	Sin α	9.8595977+				h		1st term		Sin α			
s^2	8.118			A′	8.5096676				s^2				A′			
$\sin^2\alpha$	9.719			Sec ϕ'	0.0088838				$\sin^2\alpha$				Sec ϕ'			
C	.720			$\Delta\lambda$	2.4369753		+273.5113		C				$\Delta\lambda$			
	8.557	2d term	+ .0361	$\sin\frac{1}{2}(\phi+\phi')$	9.3028172						2d term	+	$\sin\frac{1}{2}(\phi+\phi')$			
h^2	4.82			$-\Delta\alpha$	1.7397925		+ 54.93		h^2				$-\Delta\alpha$			
D	1.99								D							
	6.81	3d term	+ .0006								3d term	+				
		$-\Delta\phi$	+257.1957								$-\Delta\phi$					

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HOLMES & NARVER, INC.
ENGINEERS—CONSTRUCTORS

TRAVERSE COMPUTATIONS

CALC. BY L.S.H.
CHECKED BY _____ DATE 11-6-52

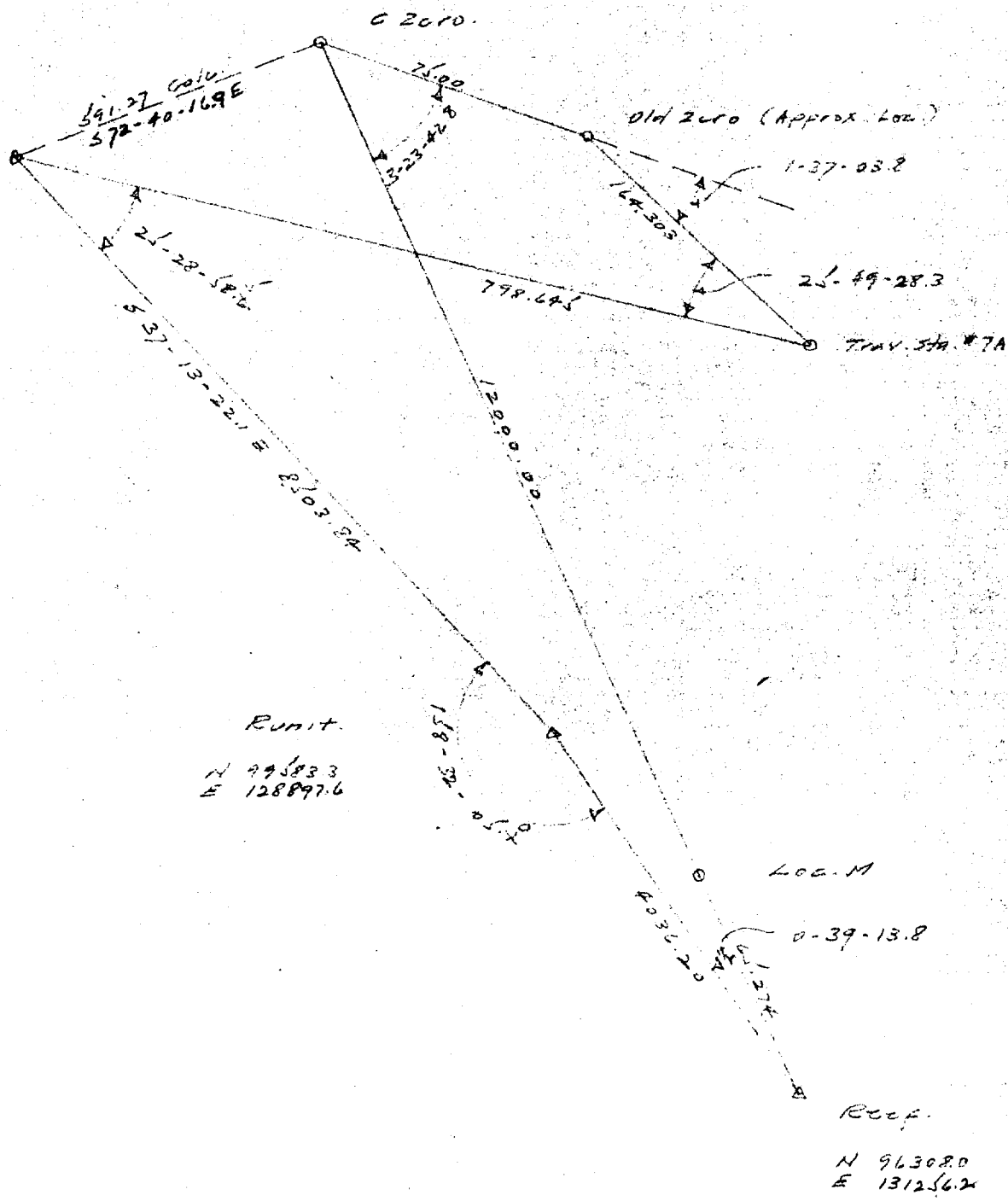
JOB NO. 831 LOCATION C, E, V Zeros, Loc. M, Lucy

PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

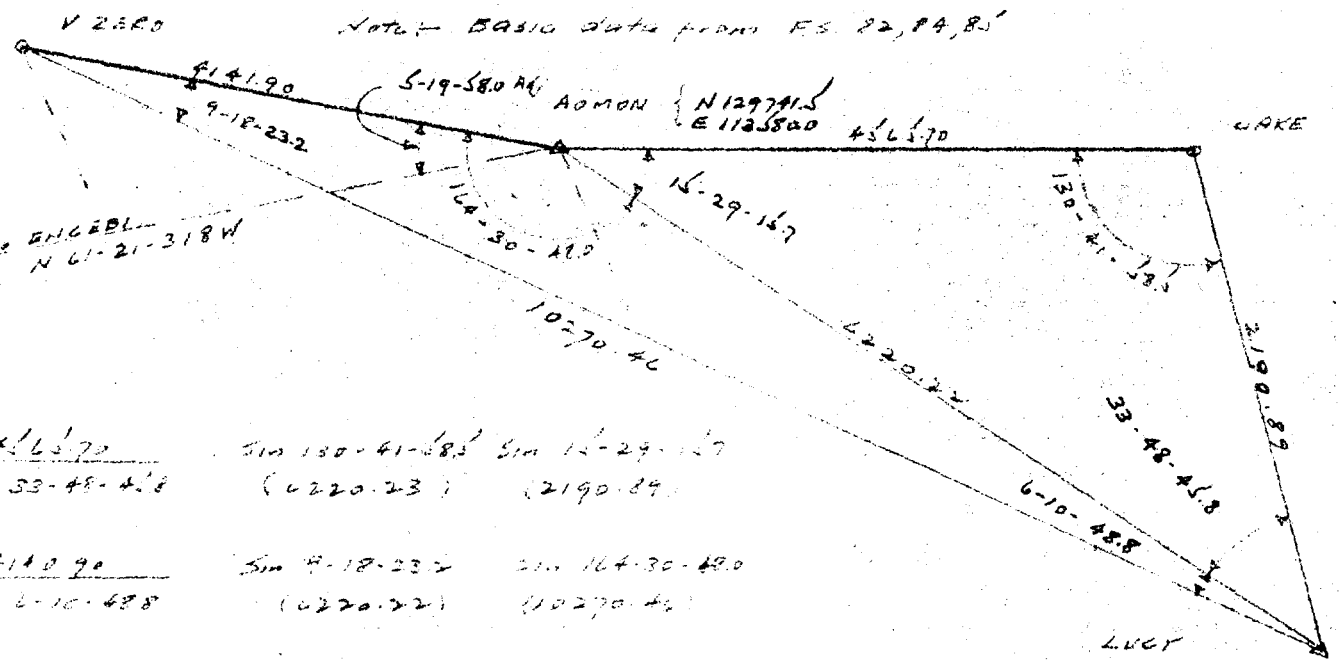
	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	N. Base #2									106354.83		123753.44		1
2	Runit	S 37-13-22.1E	8503.84	79628921	60491612		6771.516	5144.110		99583.31		128897.56		2
3	Reef	S 35-45-27.1E	4036.20	81149722	58435629		3276.365	2358.579		96307.95		131256.13		3
4	Loc. M.	N 35-06-13.3W	65.274	81811264	57505801	53.401			37.536	96361.35		131218.59		4
5	C Zero	N 35-06-13.3W	12000.00	81811264	57505801	9817.362			6900.696	106178.70		124317.90		5
6	Old Zero	S 38-29-56.1E	75.00	78261993	62249984		58.696	46.687		106120.01		124364.58		6
7	Trav. Sta. 7A	S 36-52-52.3E	164.303	79988169	60015820		131.423	98.608		105988.58		124465.19		7
8	N. Base #2	N 62-42-20.6W	798.645	46856080	88866303	366.227			709.726	106354.81		123753.47		8
9														9
10	N. Base #2									106354.83		123753.44		10
11	C Zero	S 72-40-16.9E	591.266	29785206	95461204		176.110	564.430		106178.72		124317.87		11
12														12
13														13
14	Coral									100000.00		100000.00		14
15	E Zero	N 19-10-16.3W	50172.96	94454159	32839181	47390.447			16476.389	147390.45		83523.61		15
16	Engebi	S 46-10-34.9E	4133.985	69244090	72147460		2862.540	2982.565		144527.91		86506.18		16
17														17
18	Aomon	N 56-01-33.8W	4140.90	55881583	82929178	2314.000			3434.014	129741.54		113580.03		18
19	V Zero									132055.54		110146.02		19
20														20
21	Aomon	S 56-01-37.5E	4565.70	55880096	82930180		2551.318	3786.345		129741.54		113580.03		21
22	Jaku	S 6-43-36.0E	2190.887	99311624	11713297		2175.805	256.625		127190.22		117366.37		22
23	Lucy	N 40-32-21.8W	6220.232	75995931	64997079	4727.123			4042.969	125014.42		117623.00		23
24	Aomon									129741.54		113580.03		24
25														25
26	Lucy	N 46-43-10.6W	10270.472	68556921	72800746	7041.119			7476.980	125014.42		117623.00		26
27	V Zero									132055.54		110146.02		27
28														28
29														29
30														30

BY R.C.B. DATE MAR 1954 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1
CHKD. BY L.S.M. DATE Nov 1954 1952 ADJUSTMENT JOB NO. 231
C ZERO, LOC M

Note.- Basic data copied from FS.#74



BY ARA DATE May 19 SUBJECT TRIANGULATION ADJ SHEET NO. 1 OF 1
CHKD. BY ESH DATE May 19 1951 ADJUSTMENT JOB NO. 831
E 2550, V 2660, ANGX



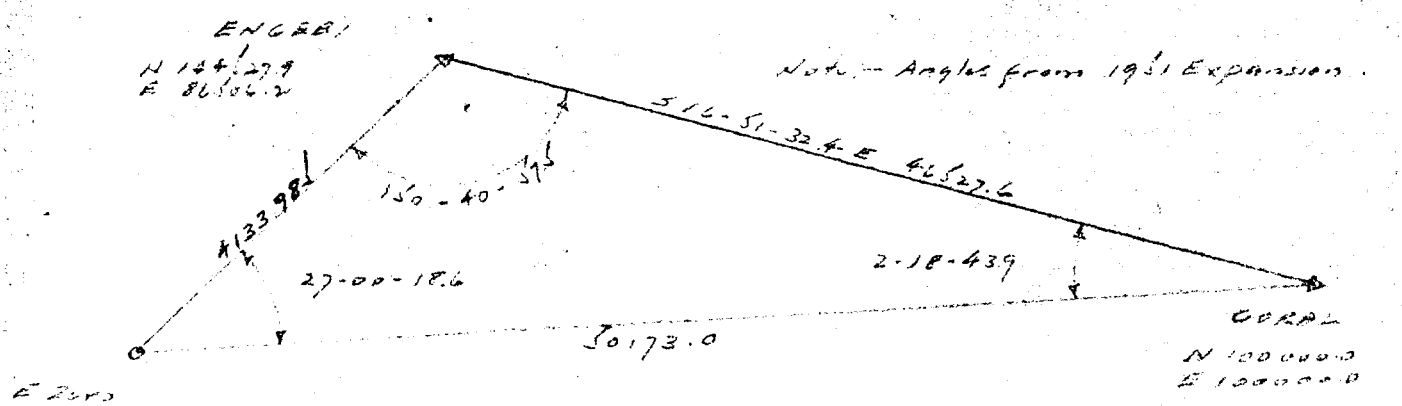
45 L 5.70 Sin 130-41-58.5 Sin 15-29-15.7
Sin 33-48-45.8 (4220.23) (2190.89)

41 L 0.90 Sin 9-18-23.2 Sin 164-30-49.0
Sin 6-10-45.8 (4220.22) (10270.4)

V 2660 N 132 055.54 E 110,46 02
Corr N 100000.00 E 100000.00
N 32 055.54 E 10146.02

10146.02 = .3165378 = Tan 17-33-419
32 055.54
32 055.54
Corr 17-33-419 = 33422.90

Coral - V 2660 = N 17-33-47.9 E 10146.0



46 L 27.2 Sin 2-18-43.9 = 1871.131
Cos " " = 46489.719

41 30 24" Sin 27-00-18.6 = 1817.127
Cos " " = 3683.238

46489.719
3683.238
50172.957

COMPUTATION OF TRIANGLES

COMPUTED BY A.R.B. CHECKED BY L.S.H. DATE 2-12-52

	STATION	OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM	
2-3							4.1517267	
1	B-Zero	27-00-	-	18.6	0.0	18.6	0.3428764	
2	Engebi	150-40-	-	57.5	0.0	57.5	9.6898828	B-ZERO
3	Coral	2-18-	-	43.9	0.0	43.9	8.6057839	
1-3						15292.76	4.1844859	
1-2						1260.05	3.1003870	
2-3							3.9986000	
1	V-Zero	73-35-	-	21.7	0.0	21.7	0.0180630	
2	Aomon	99-25-	-	56.8	0.0	56.8	9.9940881	V-ZERO
3	Coral	6-58-	-	41.5	0.0	41.5	9.0845462	
1-3						10248.28	4.0106511	
1-2						1262.14	3.1011092	
2-3							3.8747531	
1	C-Zero	31-35-	-	05.2	0.0	05.2	0.2808690	
2	Coral	0-43-	-	17.8	0.0	17.8	8.1001684	C-ZERO
3	N. Base #2	212-18-	-	23.0	0.0	23.0	9.7279043	
1-3						180.21	2.2557895	
1-2						7647.60	3.8835254	
2-3							3.1011110	
1	Lucy	6-10-	-	48.8	0.0	48.8	0.9679610	
2	V-Zero	9-18-	-	23.2	0.0	23.2	9.2087498	LUCY
3	Aomon	164-30-	-	48.0	0.0	48.0	9.4265342	
1-3						1895.93	3.2778218	
1-2						3130.44	3.4956062	

JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Nov. 1952

				°	'	"					°	'	"
α	2 V-Zero	to 3	Aomon	303	58	46.6	α	3 Aomon	to 2	V-Zero	123	58	53.6
$3^d\angle$		8		+ 9	18	23.2	$3^d\angle$		8		-164	30	48.0
α	2 V-Zero	to 1	Lucy	313	17	09.8	α	3 Aomon	to 1	Lucy	319 / 40	28 / 31	05.6 / 54.4
$\Delta\alpha$				+		15.2	$\Delta\alpha$					+	08.2
				180	00	00.0					180	00	00.0
α'	1 Lucy	to 2	V-Zero	133	17	25.0	α'	1 Lucy	to 3	Aomon	139	28	13.8

FIRST ANGLE OF TRIANGLE 6-10-48.8

	°	'	"			°	'	"			°	'	"
ϕ	11	37	38.242	2 V-Zero	λ	162	18	53.034	ϕ	11 37 15.282	3 Aomon	λ	162	19	27.58
$\Delta\phi$		- 1	09.858		$\Delta\lambda$		+ 1	15.222	$\Delta\phi$		- 46.899	$\Delta\lambda$		+	40.67
ϕ'	11	36	28.384	1 Lucy	λ'	162	20	08.256	ϕ'	11 36 28.383	1 Lucy	λ'	162	20	08.25

	Logarithms	Values in seconds			°	'	"			Logarithms	Values in seconds			°	'	"
c	3.4956067			$\frac{1}{2}(\phi+\phi')$	11	37	03.313		s	3.2778200			$\frac{1}{2}(\phi+\phi')$	11	36	51.83
Cos α	9.8360970				Logarithms		Values in seconds		Cos α	9.8808397				Logarithms		Values seconds
B	8.5124970			s	3.4956067				B	8.5124972			s	3.2778200		
h	1.8442007	1st term	+69.8555	Sin α	9.8620954				h	1.6711569	1st term	+46.8983	Sin α	9.8128263		
s^2	6.99121			A'	8.5096669				s^2	6.55564			A'	8.5096670		
$\sin^2\alpha$	9.72419			Sec ϕ'	0.0089744				$\sin^2\alpha$	9.62565			Sec ϕ'	0.0089744		
C	0.72009			$-\Delta\lambda$	1.8763434		-75.2217		C	0.71984			$-\Delta\lambda$	1.6092877		-40.671
	7.43549	2d term	+ 0.0027	$\sin\frac{1}{2}(\phi+\phi')$	9.3040133					6.90113	2d term	+ 0.0008	$\sin\frac{1}{2}(\phi+\phi')$	9.3038957		
h^2	4.3404			$-\Delta\alpha$	1.1803567		-15.15		h^2	3.3423			$-\Delta\alpha$	0.9131834		-8.19
D	1.9877								D	1.9874						
	6.3281	3d term	+ 0.0002							6.3297	3d term	+ 0.0000				
		$-\Delta\phi$	+69.8584								$-\Delta\phi$	+46.8991				

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JOB No 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

			°	'	"				°	'	"
α	2 N. Base #2 to 3 Coral		75	02	07.9	α	3 to 2				
$2^d\angle$	8		+212	18	23.0	$3^d\angle$	8		-		
α	2 N. Base #2 to 1 C-Zero		287	20	30.9	α	3 to 1				
$\Delta\alpha$				+	1.1	$\Delta\alpha$					
			180	00	00.0				180	00	00.0
α'	1 C-Zero to 2 N. Base #2		107	20	32.0	α'	1 to 3				

FIRST ANGLE OF TRIANGLE

	°	'	"			°	'	"		°	'	"		°	'	"
ϕ	11	33	23.267	2 N. Base #2	λ	162	21	09.893	ϕ				3	λ			
$\Delta\phi$		-	01.748		$\Delta\lambda$		+	05.677	$\Delta\phi$					$\Delta\lambda$			
ϕ'	11	33	21.519	1 C-Zero	λ'	162	21	15.570	ϕ'				1	λ'			

	Logarithms	Values in seconds			°	'	"		Logarithms	Values in seconds		°	'	"		Logarithms	Values in seconds
s	2.2558030			$\frac{1}{2}(\phi+\phi')$	11	33	22.393	s				$\frac{1}{2}(\phi+\phi')$					
Cos α	9.4743230				Logarithms	Values in seconds		Cos α									
B	8.5124992			s	2.2558030			B				s					
h	0.2426252	1st term	+1.7483"	Sin α	9.9797955n			h		1st term	"	Sin α					
s^2	4.512			A'	8.5096676			s^2				A'					
$\sin^2\alpha$	9.960			Sec ϕ'	0.0088939			$\sin^2\alpha$				Sec ϕ'			"		
C	.717			$\Delta\lambda$	0.7541600	-5.6775		C				$\Delta\lambda$					
	5.189	2d term	+ .0000	$\sin\frac{1}{2}(\phi+\phi')$	9.3017446					2d term	+	$\sin\frac{1}{2}(\phi+\phi')$					
h^2	.49			$-\Delta\alpha$	0.0559046	-1.14		h^2				$-\Delta\alpha$					
D	1.98							D									
	2.47	3d term	+ .0000							3d term	+						
		$-\Delta\phi$	+ 1.7483							$-\Delta\phi$							

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JOB № 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

			°	'	"				°	'	"
α	2 Engebi to 3 Coral		343	08	00.2	α	3 to 2				
2d ∠	8		+150	40	57.5	3d ∠	8		−		
α	2 Engebi to 1 E-Zero		133	48	57.7	α	3 to 1				
Δα			−		6.1	Δα					
			180	00	00.0				180	00	00.0
α'	1 E-Zero to 2 Engebi		313	48	51.~~7~~ 6	α'	1 to 3				

FIRST ANGLE OF TRIANGLE

	°	'	"			°	'	"		°	'	"			°	'	"
φ	11	39	41.964	2 Engebi	λ	162	14	55.151	φ				3	λ			
Δφ		+	28.392		Δλ	−		30.019	Δφ					Δλ			
φ'	11	40	10.356	1 E-Zero	λ'	162	14	25.132	φ'				1	λ'			

	Logarithms	Values in seconds					
s	3.1003843			½(φ+φ')	11° 39' 56.160"		
Cos α	9.8403228n				Logarithms	Values in seconds	
B	8.5124960			s	3.1003843		
h	1.4532031	1st term	−28.3925"	Sin α	9.8582762		
s²	6.201			A'	8.5096665		
Sin² α	9.717			Sec φ'	0.0090708		
C	.721			Δλ	1.4773978	30.0191"	
	6.639	2d term	+ .0004	Sin ½(φ+φ')	9.3057797		
h²	2.91			−Δα	0.7831775	6.07	
D	1.99						
	4.90	3d term	+ .0000				
		−Δφ	−28.3921				

	Logarithms	Values in seconds					
s				½(φ+φ')			
Cos α					Logarithms	Values in seconds	
B				s			
h		1st term	"	Sin α			
s²				A'			
Sin² α				Sec φ'			
C				Δλ		"	
		2d term	+	Sin ½(φ+φ')			
h²				−Δα			
D							
		3d term	+				
		−Δφ					

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JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

					°	'	"						°	'	"
α	2	Aomon	to 3	Coral	24	32	56.8	α	3	to 2					
$2^d\angle$			8		+99	25	56.8	$3^d\angle$		8		−			
α	2	Aomon	to 1	V-Zero	123	58	53.6	α	3	to 1					
$\Delta\alpha$					−		7.0	$\Delta\alpha$							
					180	00	00.0						180	00	00.0
α'	1	V-Zero	to 2	Aomon	303	58	46.6	α'	1	to 3					

FIRST ANGLE OF TRIANGLE

	°	'	"			°	'	"		°	'	"		°	'	"
ϕ	11	37	15.285	2	Aomon	λ	162	19	27.584	ϕ			3	λ		
$\Delta\phi$		+	22.959			$\Delta\lambda$	−		34.550	$\Delta\phi$				$\Delta\lambda$		
ϕ'	11	37	38.242	1	V-Zero	λ'	162	18	53.034	ϕ'			1	λ'		

	Logarithms	Values in seconds		
s	3.1011110			
Cos α	9.7473543$_n$			
B	8.5124972			
h	1.3609625	1st term	−22.9595	
s^2	6.202			
$\sin^2\alpha$	9.837			
C	.720			
	6.759	2d term	+ .0006	
h^2	2.72			
D	1.99			
	4.71	3d term	+ .0000	
		$-\Delta\phi$	−22.9589	

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	37	26.763		
s				3.1011110	
Sin α				9.9186685+	
A'				8.5096669	
Sec ϕ'				0.0090047	
$\Delta\lambda$				1.6384511	+34.5502
$\sin\frac{1}{2}(\phi+\phi')$				9.3042534	
$-\Delta\alpha$				0.8427045	+ 6.96

	Logarithms	Values in seconds	
s			
Cos α			
B			
h		1st term	"
s^2			
$\sin^2\alpha$			
C			
		2d term	+
h^2			
D			
		3d term	+
		$-\Delta\phi$	

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$					
s					
Sin α					
A'					
Sec ϕ'					
$\Delta\lambda$					"
$\sin\frac{1}{2}(\phi+\phi')$					
$-\Delta\alpha$					

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HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

TRAVERSE COMPUTATIONS

PLANE COORDINATES - IVY GRID
1952 ADJUSTED HORIZONTAL CONTROL

CALC. BY A.R.B.
CHECKED BY L.S.H. DATE Nov. 1952

JOB NO. 831 LOCATION Rigili #1

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE NORTH	LATITUDE SOUTH	DEPARTURE EAST	DEPARTURE WEST	COORDINATES NORTH	COORDINATES SOUTH	COORDINATES EAST	COORDINATES WEST	
1	Engebi									144527.9		86506.2		1
2	N. Base #2	S 44-17-47.[illegible]	[illegible]4.22	71873370	[illegible]77333		3817[illegible].10	37247.20		106354.8		123753.4		2
3	Rigili #1	S 69-21-37.[illegible]	97[illegible]0.7	35249052	93581538		3449[illegible].09		91569.25	71863.7		32184.1		3
4	Engebi	N 20-43- 1.35	5073[illegible].7	90093084	43375567	72664.21		54322.04		144527.9		86506.2		4
5														5
6														6
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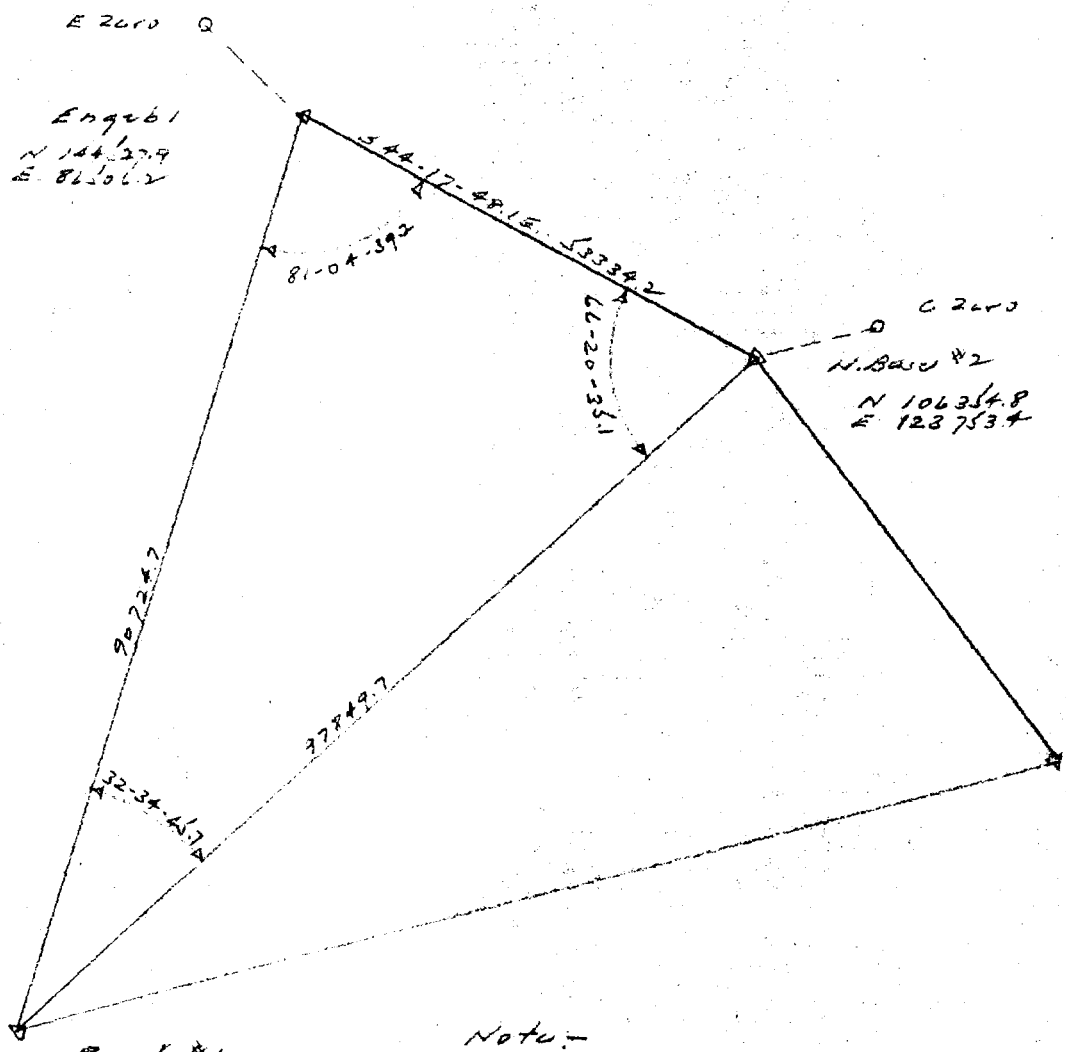
29														29
30														30

14R

BY ABB DATE MAY 1957 SUBJECT TRIANGULATION ADJ. SHEET NO. 1 OF 1

CHKD. BY LSA DATE NOV 1957 1957 ADJUSTMENT JOB NO. 831

EIGILI #1



Note:-

The data available from Fs. #92 is insufficient for a complete adjustment. As the survey satisfied the accuracy requirements for this station the adjusted positions of stations Engubi and N. Base #2 were used and the angles per Fs #92.

HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS

JOB No 831

COMPUTATION OF TRIANGLES

COMPUTED BY L.S.H. CHECKED BY L.S.H. DATE Nov. 1952

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						16256.33	4.2110225
1	Rigili #1	32-34--	-	46.0	0.3	46.7 *	0.2688407
2	Engebi	81-04--	-	39.6	0.4	39.2 *	9.9947127
3	N. Base #2	66-20--	-	35.5	0.4	35.1 *	9.9618787
1-3						29824.65	4.4745759
1-2						27652.94	4.4417419

* = Data from Field Sketch #92

RIGILI #1

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	

JOB Nº 831

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY A.R.B. DATE Feb. 1952

			°	'	"				°	'	"
∝	2 Engebi	to 3 N. Base #2	315	41	44.4	∝	3 N. Base #2	to 2 Engebi	135	42	59.8
$2^d\angle$		8	+ 81	04	39.6 *	$3^d\angle$		8	- 66	20	35.5 *
∝	2 Engebi	to 1 Rigili #1	36	46	24.0	∝	3 N. Base #2	to 1 Rigili #1	69	22	24.3
Δ∝			-	01	49.4	Δ∝			-	03	03.7
			180	00	00.0				180	00	00.0
∝'	1 Rigili #1	to 2 Engebi	216	44	34.6	∝'	1 Rigili #1	to 3 N. Base #2	249	19	20.6

FIRST ANGLE OF TRIANGLE 32-34-46.0 *

	°	'	"		°	'	"		°	'	"		°	'	"
ϕ	11	39	41.964	2 Engebi	λ	162	14	55.151	ϕ	11	33	23.267	3 N. Base #2	λ	162	21	09.893
Δϕ	-	12	01.050		Δλ	-	09	06.174	Δϕ	-	05	42.353		Δλ	-	15	20.915
ϕ'	11	27	40.914	1 Rigili #1	λ'	162	05	48.977	ϕ'	11	27	40.914	1 Rigili #1	λ'	162	05	48.978

	Logarithms	Values in seconds															
s	4.4417415	*															
Cos ∝	9.9036380																
b	8.5124960																
h	2.8573755	1st term	+720.9008														
s^2	8.883																
$\sin^2\alpha$	9.554																
C	.721																
	9.158	2d term	+ .1439														
n^2	5.72																
D	1.99																
	7.71	3d term	+ .0051														
		-Δϕ	+721.0498														

	°	'	"		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	33	41.439			
Cos ∝					9.5468830	
B					8.5124992	
h					2.5339576	
s^2					8.949	
$\sin^2\alpha$					9.942	
C					.717	
					9.608	
n^2					5.07	
D					1.98	
					7.05	

	Logarithms	Values in seconds															
s	4.4745754	*															
		1st term	+341.9461														
		2d term	+ .4056														
		3d term	+ .0011														
		-Δϕ	+ 342.3528														

	°	'	"		Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	30	32.091			
s					4.4745754	
Sin ∝					9.9712277	
A'					8.5096685	
Sec ϕ'					0.0087478	
-Δλ					2.9642194	+920.9147
$\sin\frac{1}{2}(\phi+\phi')$					9.2999873	
-Δ∝					2.2642067	+183.74

162

* = Data from Field Sketch #92

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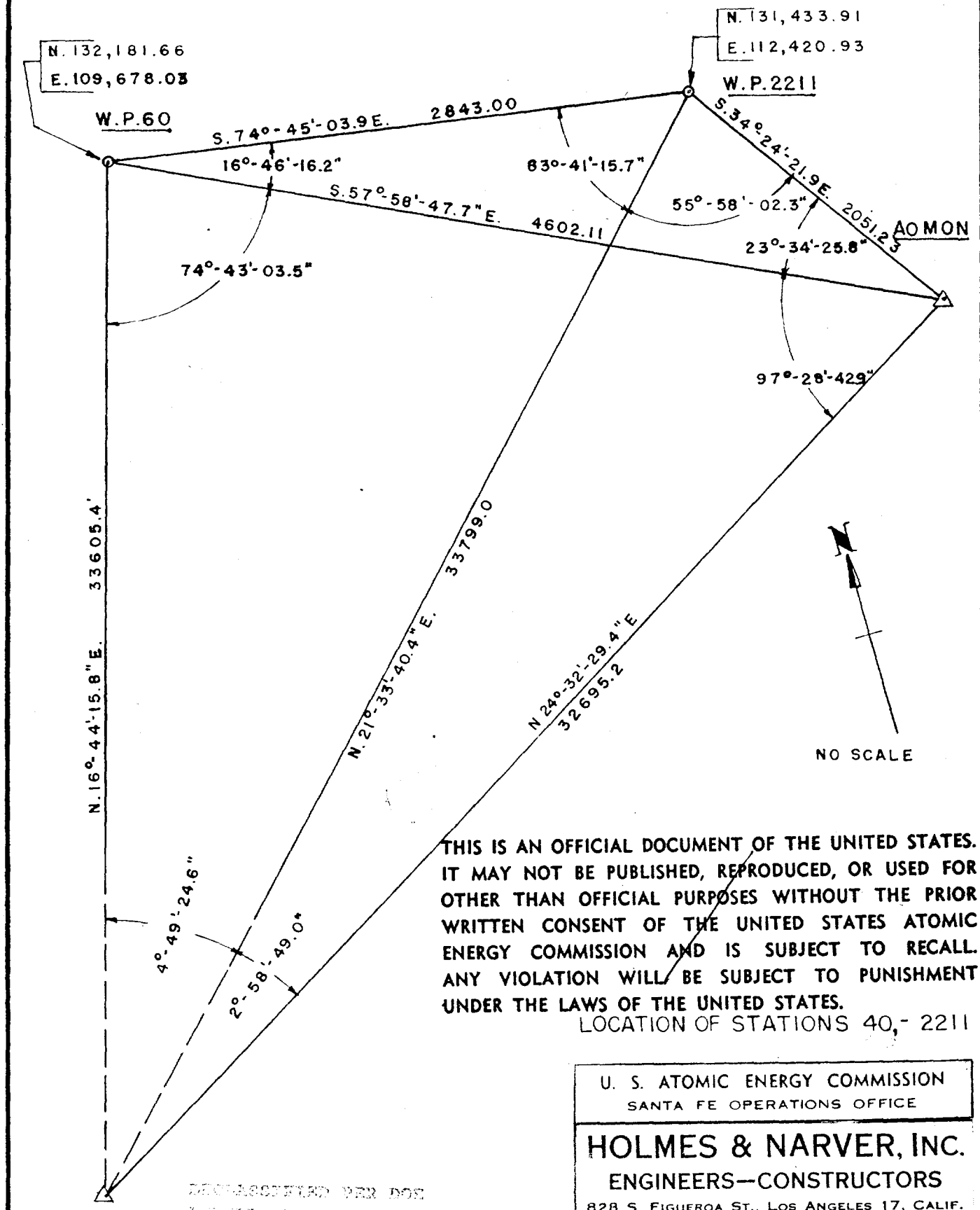


LOCATION OF STATIONS 40,- 2211

U. S. ATOMIC ENERGY COMMISSION
SANTA FE OPERATIONS OFFICE

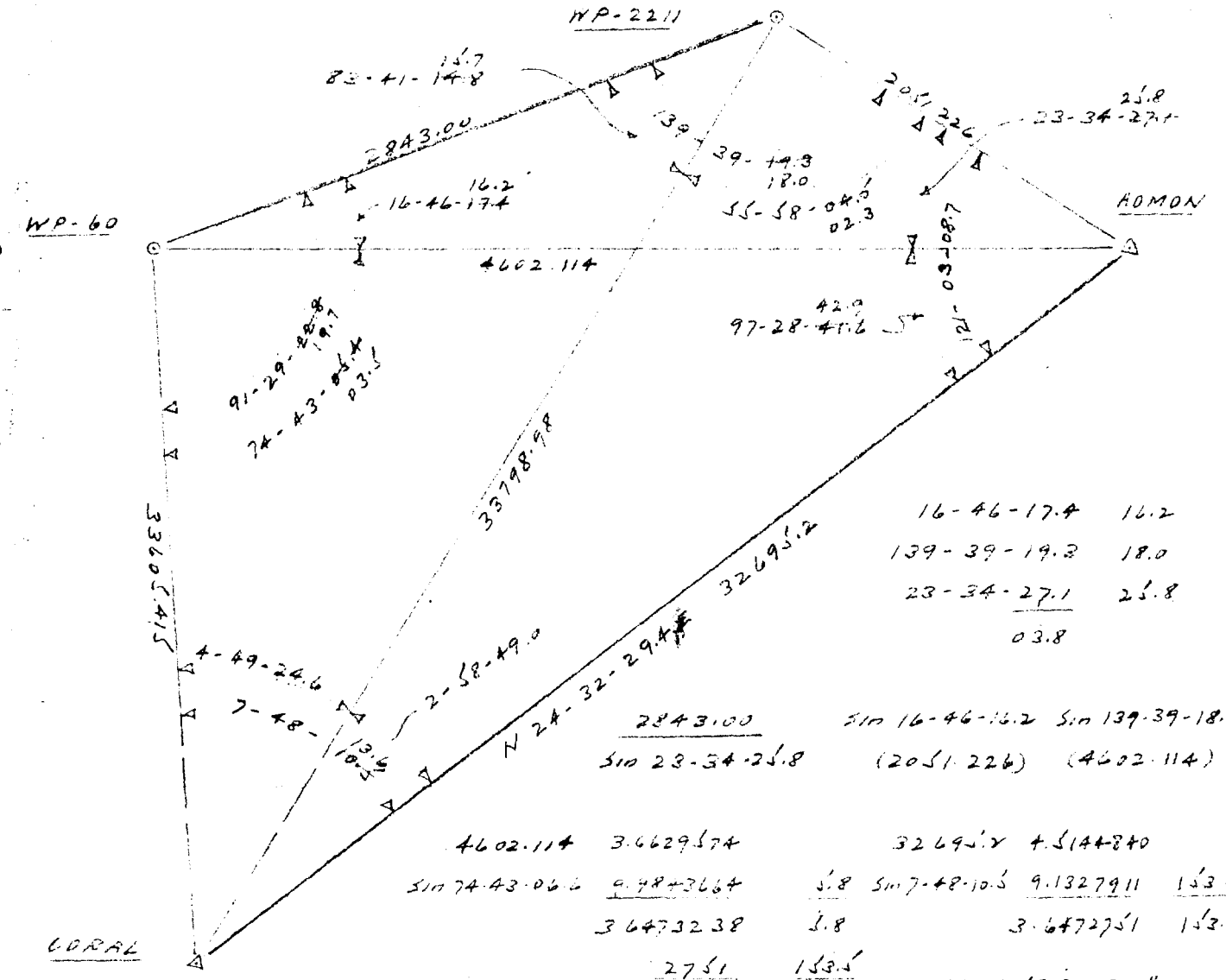
HOLMES & NARVER, INC.
ENGINEERS—CONSTRUCTORS
828 S. FIGUEROA ST., LOS ANGELES 17, CALIF.

DRAWN BY	CHECKED BY	DATE	SHEET NO.
L S H		10-15-53	7209 FO 17
JOB NO. 884	APPROVED		

~~OFFICIAL USE ONLY~~

HOLMES & NARVER, INC.
ENGINEERS · CONSTRUCTORS
LOS ANGELES, CALIFORNIA

JOB NO. 644
SHEET 1 OF 4
TITLE SITE RUBY-SALLY LOCATION OF STA. 60 AND 2211
BY LSH DATE 12-53



16-46-17.4	16.2	
139-39-19.3	18.0	
23-34-27.1	25.8	
	03.8	

2843.00
Sin 23-34-25.8

Sin 16-46-16.2 (2051.226)

Sin 139-39-18.0 (4602.114)

4602.114 3.6629574
Sin 74-43-06.6 9.9837664
3647232.38
2751
487

3269.52 4.5144840
.5 Sin 7-48-10.5 9.1327911 153.5
3.6472751 153.5
153.5
159.3

487/159.3 = 3.1"

3269.52
Sin 74-43-03.5

Sin 7-48-13.6 (4602.121)

Sin 97-28-42.9 (3360.415)

3360.415
Sin 83-41-15.7

Sin 4-49-24.6 (2842.999)

Sin 91-29-19.7 (33798.98)

3269.52
Sin 15-58-02.3

Sin 121-03-08.7 (33798.985)

Sin 2-58-49.0 (2051.23)

FORM T

HOLMES & NARVER INC. - ENGINEERS - CONSTRUCTORS

TRAVERSE SITE RUBY-SALLY
LOCATION OF STA 60-2211

CALC. BY LSH DATE 10-12
CHKD. BY ____ DATE ____
JOB NO. 884
SHEET NO. 2 OF 4

~~OFFICIAL USE ONLY~~

DECLASSIFIED PER DOE ... 15, 1994 ...

	STATION	BEARING	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	CO-ORDINATES NORTH	CO-ORDINATES EAST	
1										1
2	CORAL							100,000.00	100,000.00	2
3	WP-60	N16-44-15.8E	33605.41	95763310	28799016	N32181.658	E9678.029	132,181.66	109,678.03	3
4	WP-2211	S74-45-03.9E	2843.00	26301387	96479229	S747.748	E2742.904	131,433.91	112,420.93	4
5	AOMON	S34-24-21.9E	2051.23	82505350	56505461	S1692.371	E1159.055	129,741.54	113,579.99	5
6										6
7										7
8	CORAL							100,000.00	100,000.00	8
9	WP-2211	N21-33-40.4E	33798.99	93002562	36749519	N31433.920	E12420.966	131,433.92	112,420.97	9
10										10
11										11
12	WP-60							132,181.66	109,678.03	12
13	AOMON	S57-58-47.7E	4602.11	53021649	84786230	S2440.115	E3901.956	129,741.54	113,579.99	13
14										14
15										15
16										16
17										17
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27										27
28										28

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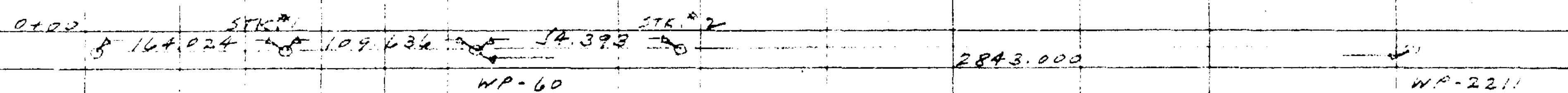
HOLMES & NARVER INC.-ENGINEERS CONSTRUCTORS

COMPUTATION OF SITE RUBY-SALLY BASE LINE

~~OFFICIAL USE ONLY~~

CALC. BY: MR CHKD BY: LSH DATE: 9-53 JOB NO. 884 LOCATION ENIWETOK ATOLL M.I.

SECTION	DATE	DIR OF MEAS	TAPE NO	SUP-PORT	UNCORR. LENGTH NO	UNCORR. LENGTH METERS	TEMP "C"	CORRECTIONS TEMP. METERS	SET-UP SET-BACK METERS	INCLINATION METERS	SEA LEVEL METERS	REDUCED LENGTH METERS	ADOPTED LENGTH METERS-FEET
0+00 TO	8-1-53	F	8172		10	49.99913		+.0025	-.0300	-.0189		499.9446	499.9440
STK *10	8-1	B	8187		10	49.99874		+.0032	-.0279	-.0189		499.9434	
STK. *10	8-1	F	8187		9	49.99874		+.0025	+.0311	-.0060		450.0159	450.0160
STK *19	8-1	B	8193		9	49.99923		+.0030	+.0263	-.0060		450.0161	
											TOTAL	METERS	949.9600
												FEET	3116.660



156

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

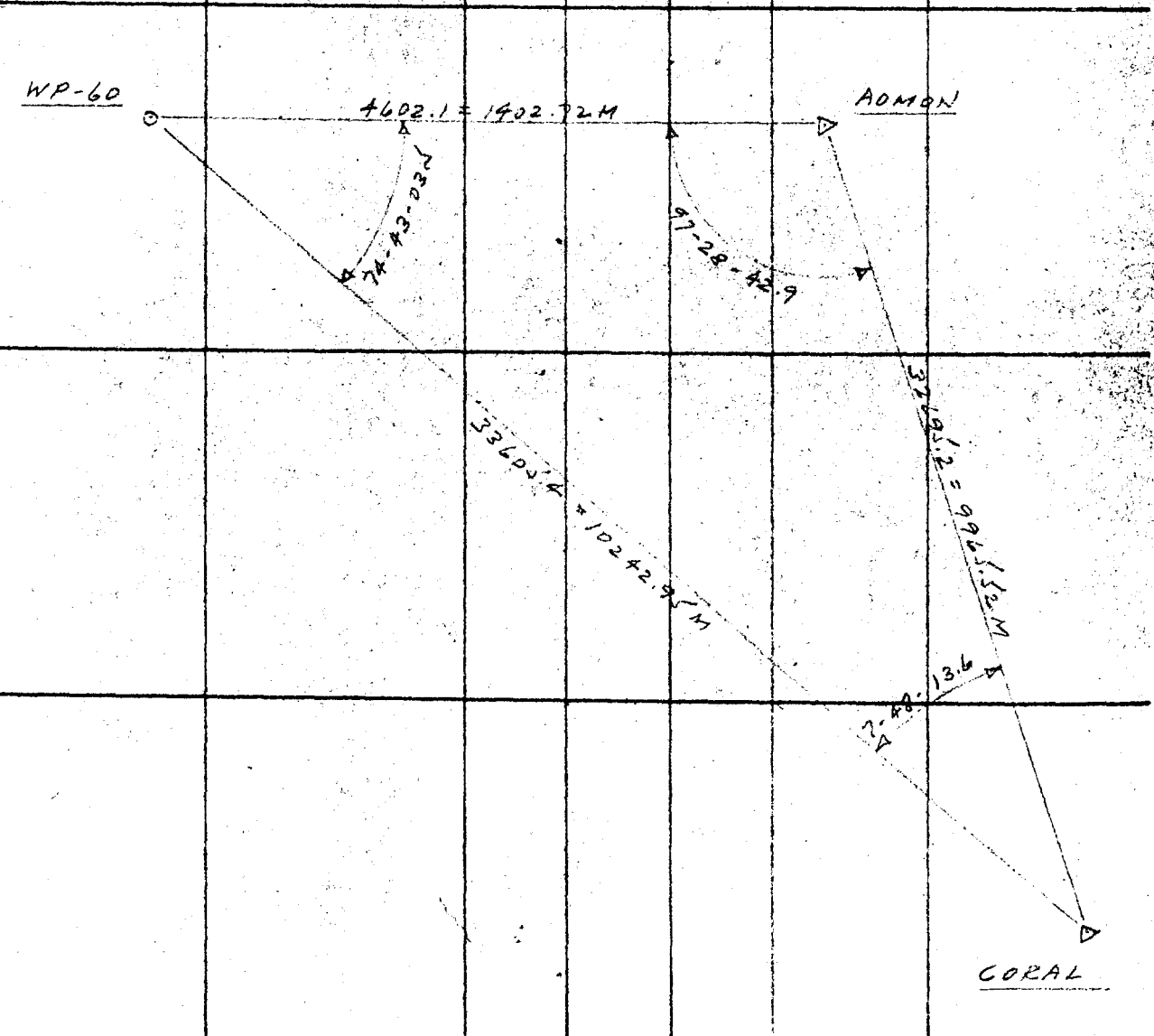
JOB No 284

~~OFFICIAL USE ONLY~~

COMPUTATION OF TRIANGLES

COMPUTED BY LSH CHECKED BY _____ DATE 12-53

STATION	OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						3.9985000
1 WP-60	74-43-03.5	—	03.5	0.0	03.5	0.0156353
2 AOMON	97-28-42.9	—	42.9	0.0	42.9	9.9962899
3 CORAL	7-48-13.6	—	13.6	0.0	13.6	9.1328387
1-3					10242.95	4.0104252
1-2					1402.73	3.1469740



JOB No. 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 10-63

		°	'	"
α	2 AOMON to 3 CORAL	24	32	56.8
2d ∠	8	+ 97	28	42.9
α	2 AOMON to 1 HP-60	122	01	39.7
Δα				
		180	00	00.0
α'	1 HP-60 to 2 AOMON	302	01	31.8

		°	'	"
α	3 CORAL to 2 AOMON	204	32	29.4
3d ∠	8	- 7	48	13.6
α	3 CORAL to 1 HP-60	196	44	15.8
Δα		+	0	19.5
		180	00	00.0
α'	1 HP-60 to 3 CORAL	16	44	25.3

FIRST ANGLE OF TRIANGLE 74-43-03.5

	°	'	"			°	'	"
φ	11	37	15.283	2 AOMON	λ	162	19	27.584
Δφ	+	0	24.210		Δλ	-	0	39.268
φ'	11	37	39.493	1 HP-60	λ'	162	18	48.316

	°	'	"			°	'	"
φ	11	32	28.254	3 CORAL	λ	162	19	10.944
Δφ	+	5	19.239		Δλ	+	1	37.381
φ'	11	37	39.493	1 HP-60	λ'	162	18	48.325

	Logarithms	Values in seconds
s	3.1469710	
Cos α	9.7245451	
B	8.5124992	
h	1.3840137	1st term -242.111
s²	6.2939420	
Sin² α	9.8516318	
C	0.7198414	
	6.8703732	2d term +.0009
h²	2.7674	
D	1.9927	
	4.7581	3d term +.0000
		-Δφ +24.2102

	°	'	"
½(φ+φ')	11-37-27.388		

	Logarithms	Values in seconds
s	3.1469710	
Sin α	9.9282892	
A'	8.5096469	
Sec φ'	0.0009001	
Δλ	1.5939223	-39.268
Sin ½(φ+φ')	9.3042598	
-Δα	0.8981921	+ 7.910

	Logarithms	Values in seconds
s	4.0104251	
Cos α	9.9811992	
B	8.5124997	
h	2.5041240	1st term -319.2449
s²	8.0208502	
Sin² α	8.9187	
C	0.7166	
	2.6163	2d term +.0045
h²	5.0082	
D	1.9845	
	1.9927	3d term +.0010
		-Δφ +319.2394

	°	'	"
½(φ+φ')	11-34-19.874		

	Logarithms	Values in seconds
s	4.0104251	
Sin α	9.9819790	
A'	8.5096469	
Sec φ'	0.0009001	
Δλ	1.5884762	+ 97.381
Sin ½(φ+φ')	9.3027472	
-Δα	1.2912234	- 19.548

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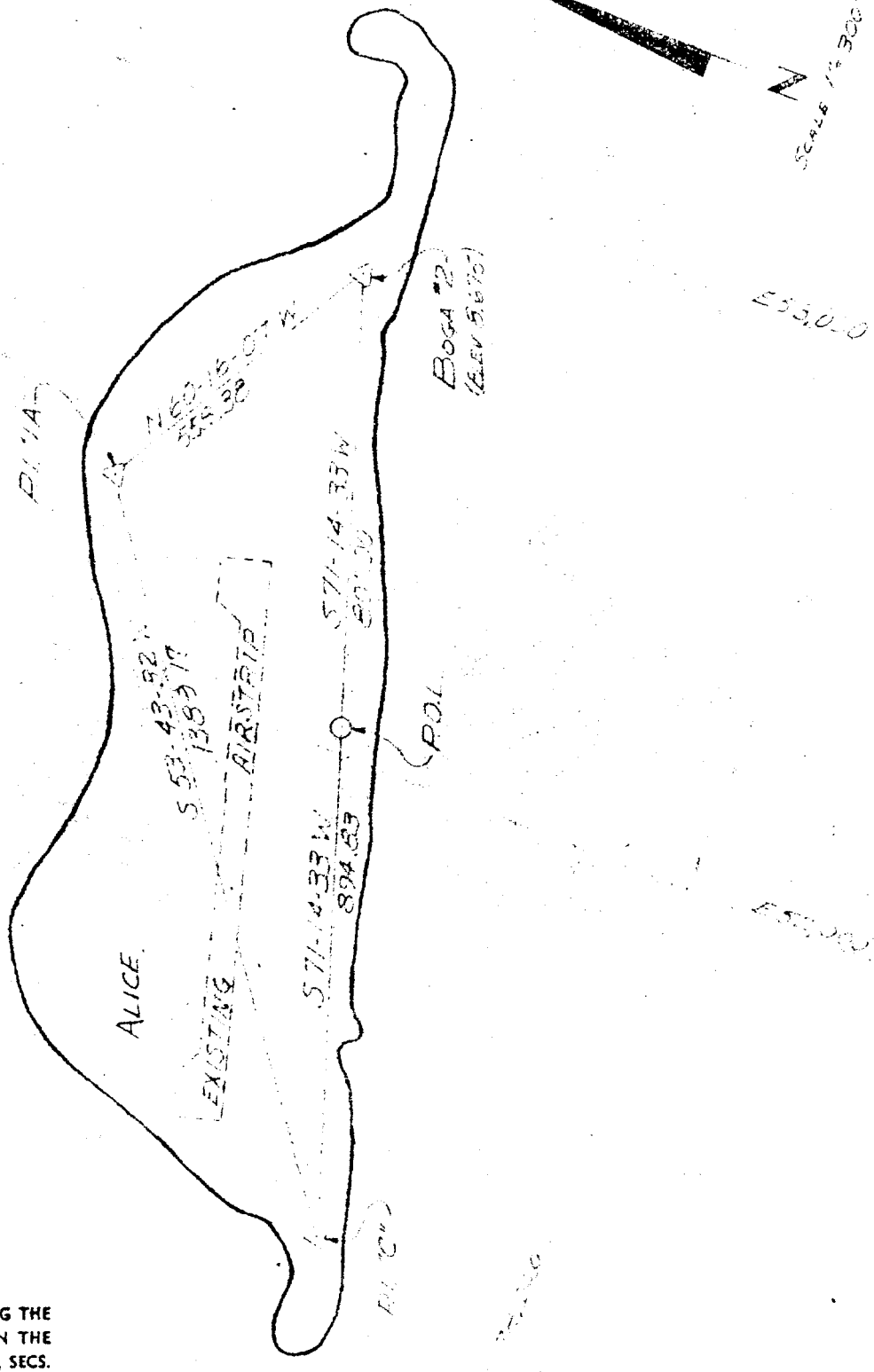
GENERAL CONTROL LAYOUT

SITE ALICE



BOGA #2 N 38 930.17
E 51 801.54

BOGA #1 N 39 209.99
E 52 [illegible]

BOGA #3 N 38 387.8
E 51 196.23

10-19-55
ES

GENERAL CONTROL LOCATION
SITE BELLE

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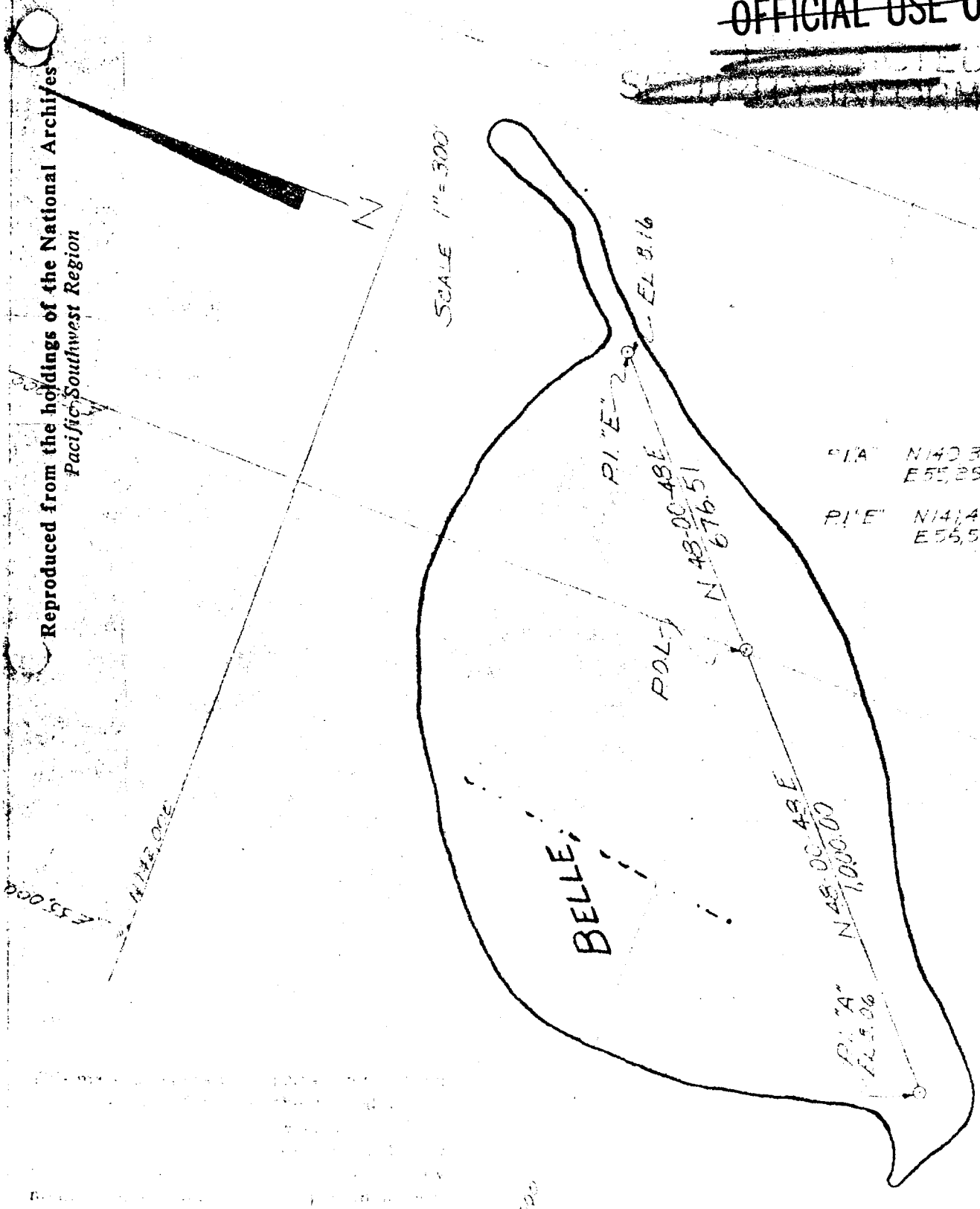
[redacted] SECURITY INFORMATION



P.I. "A" N 140 329.99
E 55,256.51

P.I. "E" N 141,451.50
E 55,502.66

[redacted] SECURITY INFORMATION

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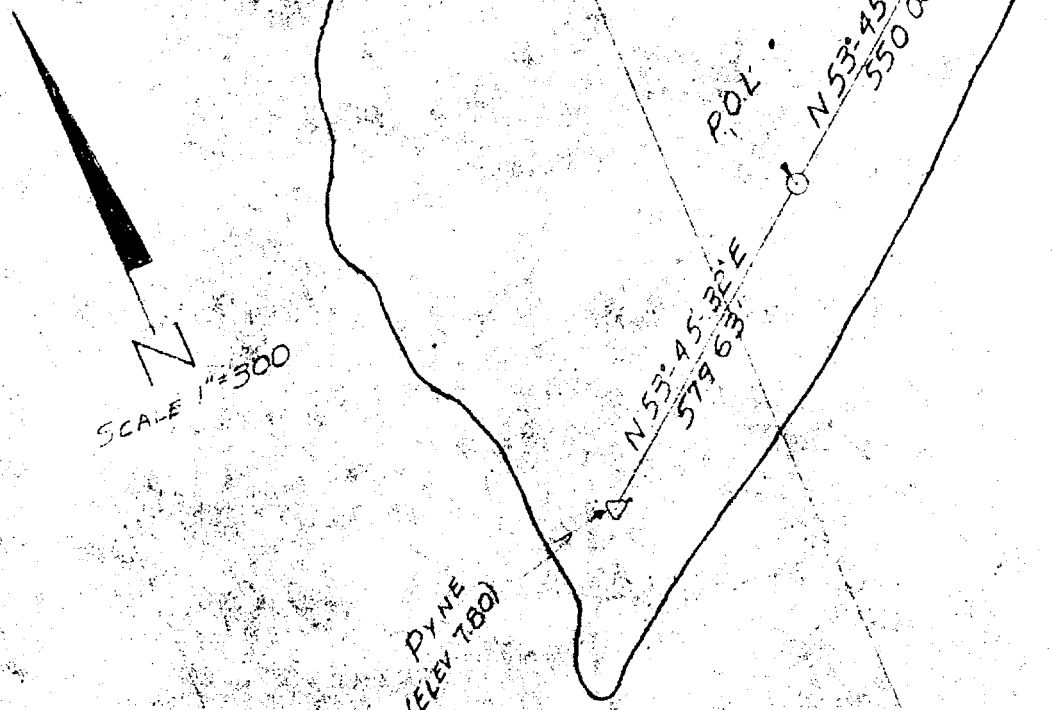
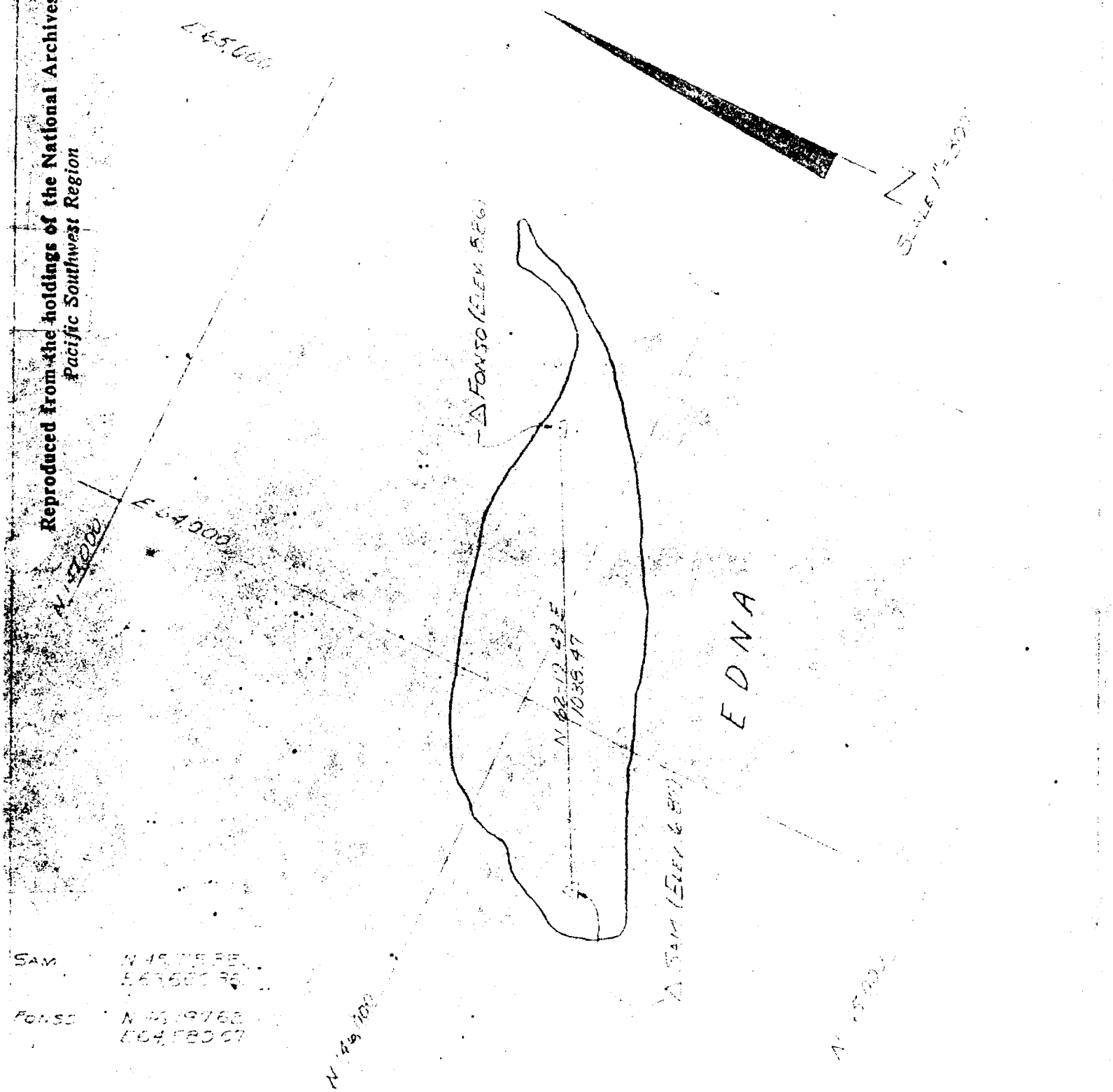
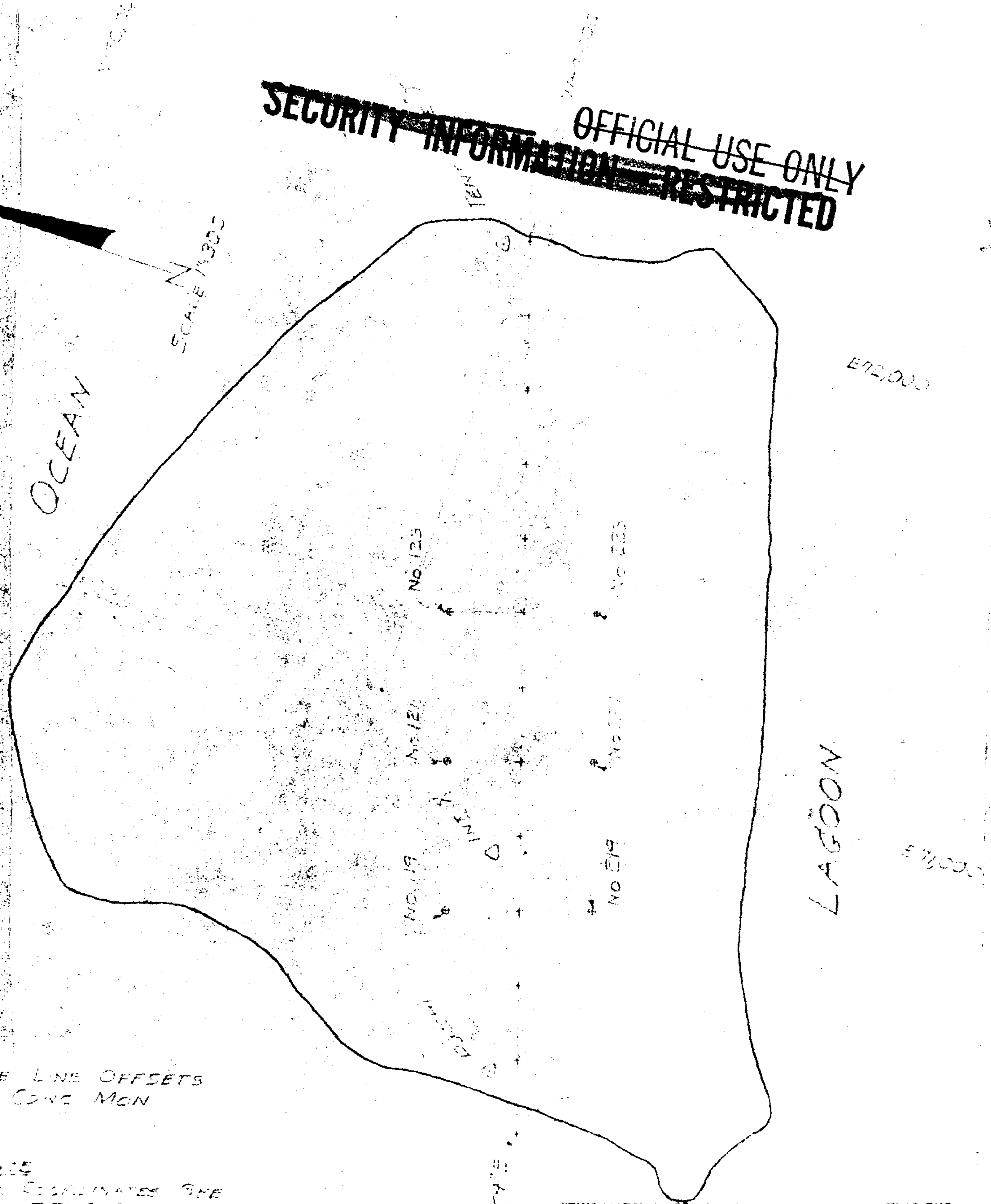


10-22-23
E.S.

GENERAL CONTROL LAYOUT
SITE EDNA



"THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS. TITLE 18, U.S.C., SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW."



NOTES:
BASE LINE OFFSETS
ARE CONC MON

REFERENCE
FOR COORDINATES SEE
DWG FS 569, SHT 2

"THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS. TITLE 18, U.S.C., SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW."

SITE GENL

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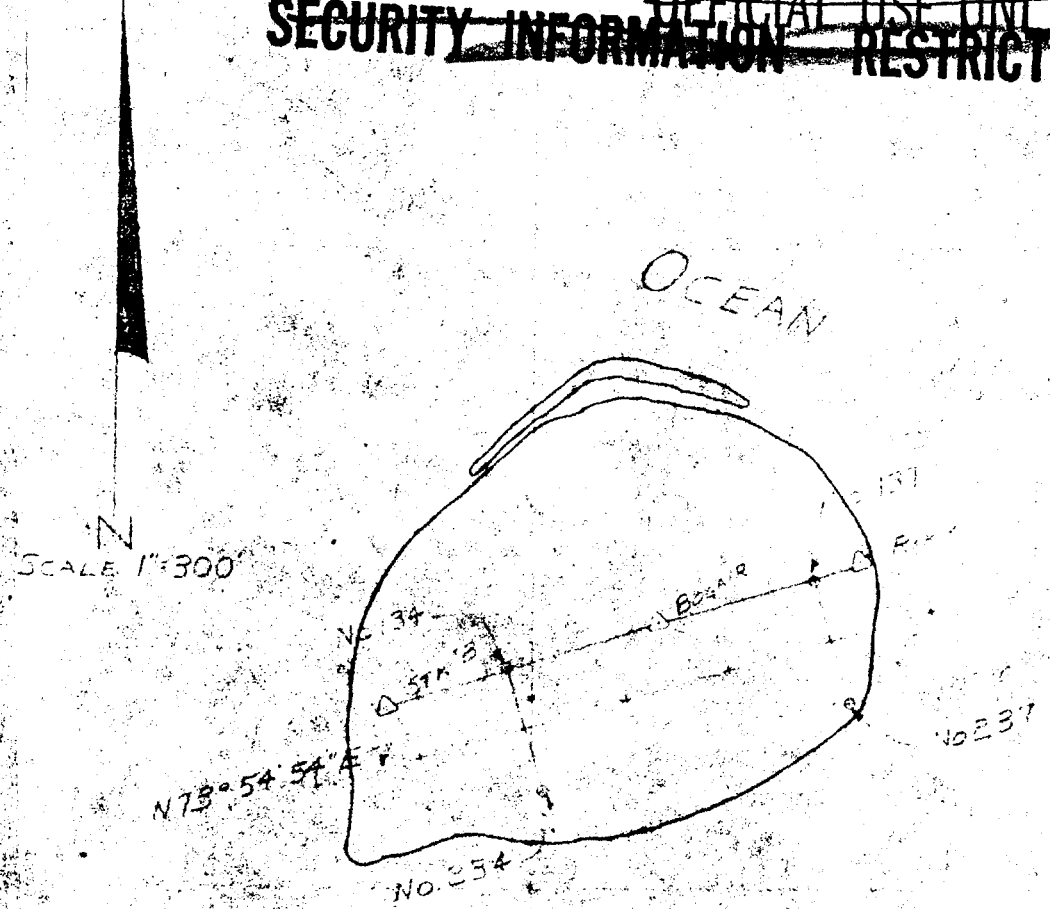
SECURITY INFORMATION — RESTRICTED

~~SECURITY INFORMATION~~ ~~OFFICIAL USE ONLY~~ ~~RESTRICTED~~



DATA

BASE LINE OFFSETS ARE CONCRETE

REFERENCE

FOR COORDINATES SEE DWG. NO. 559

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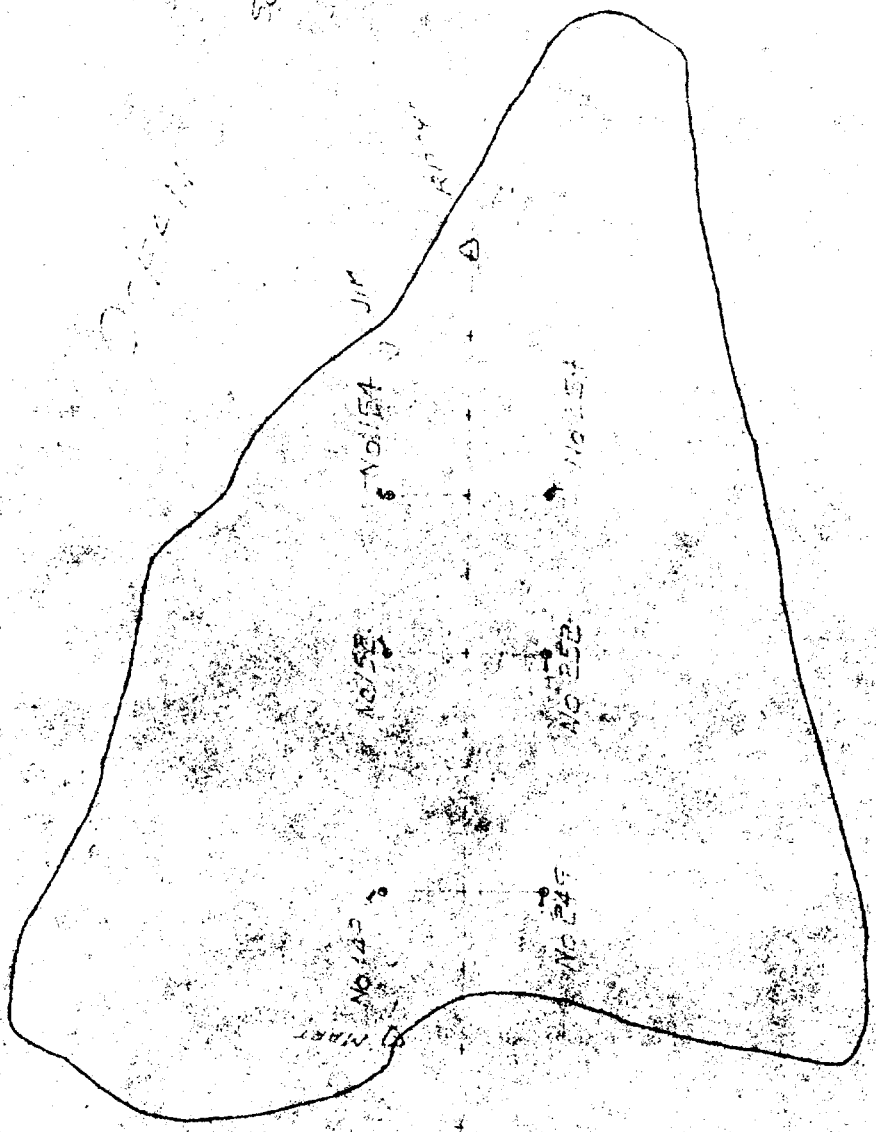
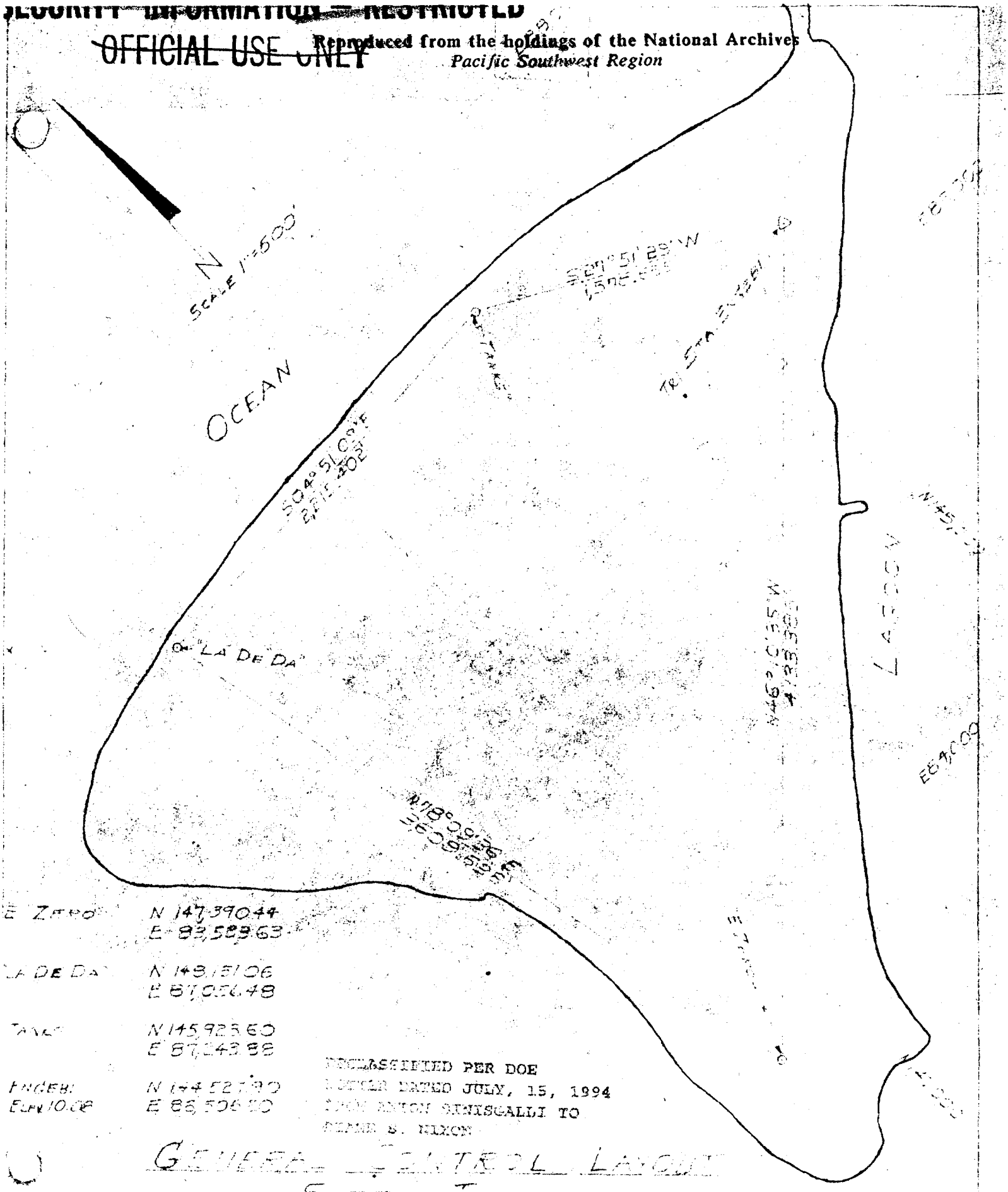


NOTES:
FACILITIE OFFSETS
ANY CONFIGN

REFERENCE:
FOR ELEVATIONS
SEE DWG #SL-E?

DECLASSIFIED PER DOE
LTR OF DATED JULY 15, 1994
DECLASSIFICATION SPECIALIST TO
DIANE S. NIXON

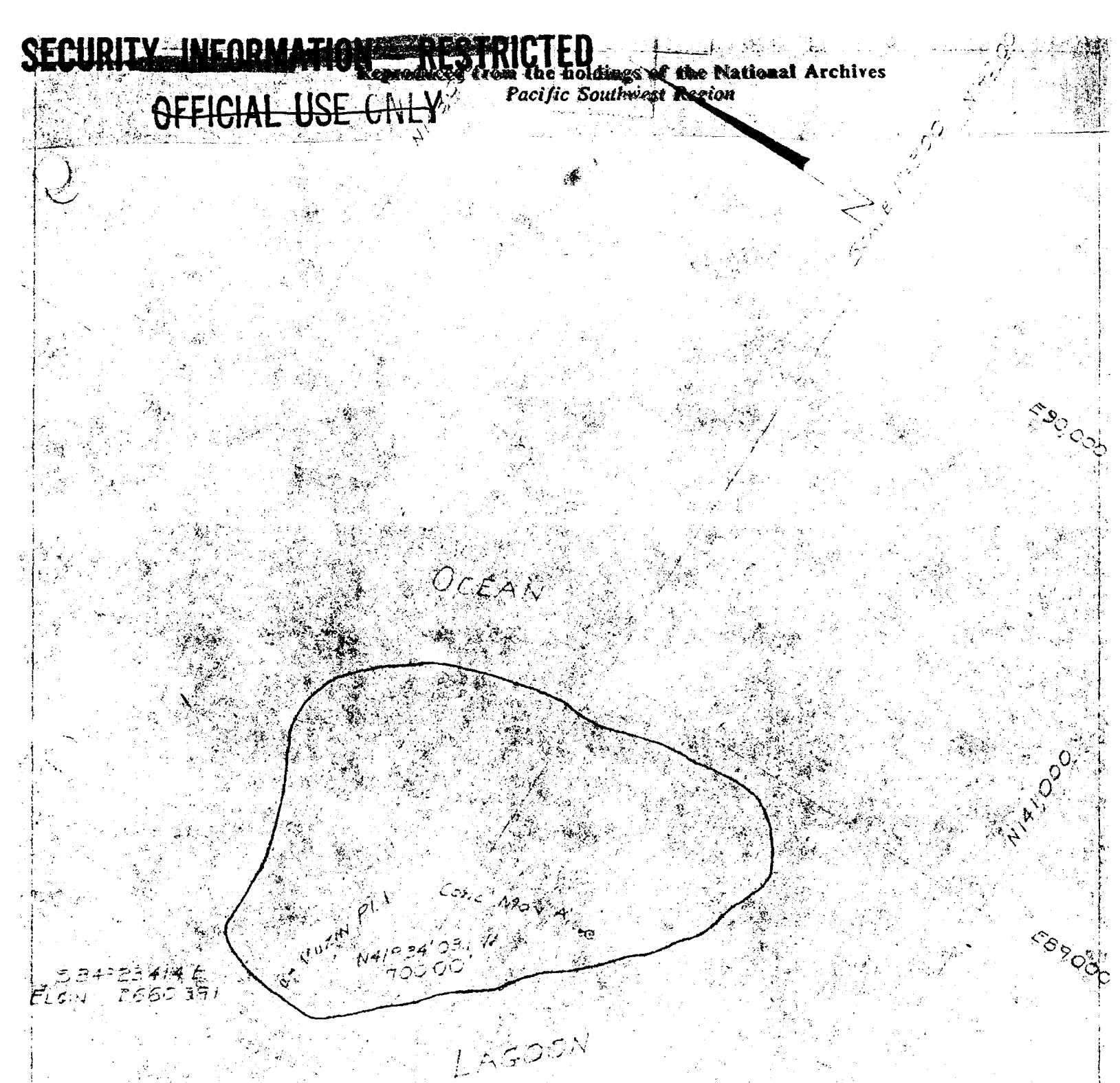
GENERAL CONTROL LAYOUT
SITE IRENE



E ZERO	N 147 390 44 E 88,588 63	
LA DE DA	N 148,151 06 E 87,056.48	
TANK	N 145 925 60 E 87,243 88	
ENGEBI ELAN 10.08	N 144 521 90 E 86,506 50	

DECLASSIFIED PER DOE
LETTER DATED JULY, 15, 1994
FROM ANTON SINISCALLI TO
RICHARD B. NIXON

GENERAL CONTROL LAYOUT
SITE JANET



MUZIN PI. N 141,232.64
E 89,009.04

CONIC MERC A N 141,528.92
E 88,473.49

GENERAL CONTROL LAYOUT
SITE MATE

~~SECURITY INFORMATION - RESTRICTED~~

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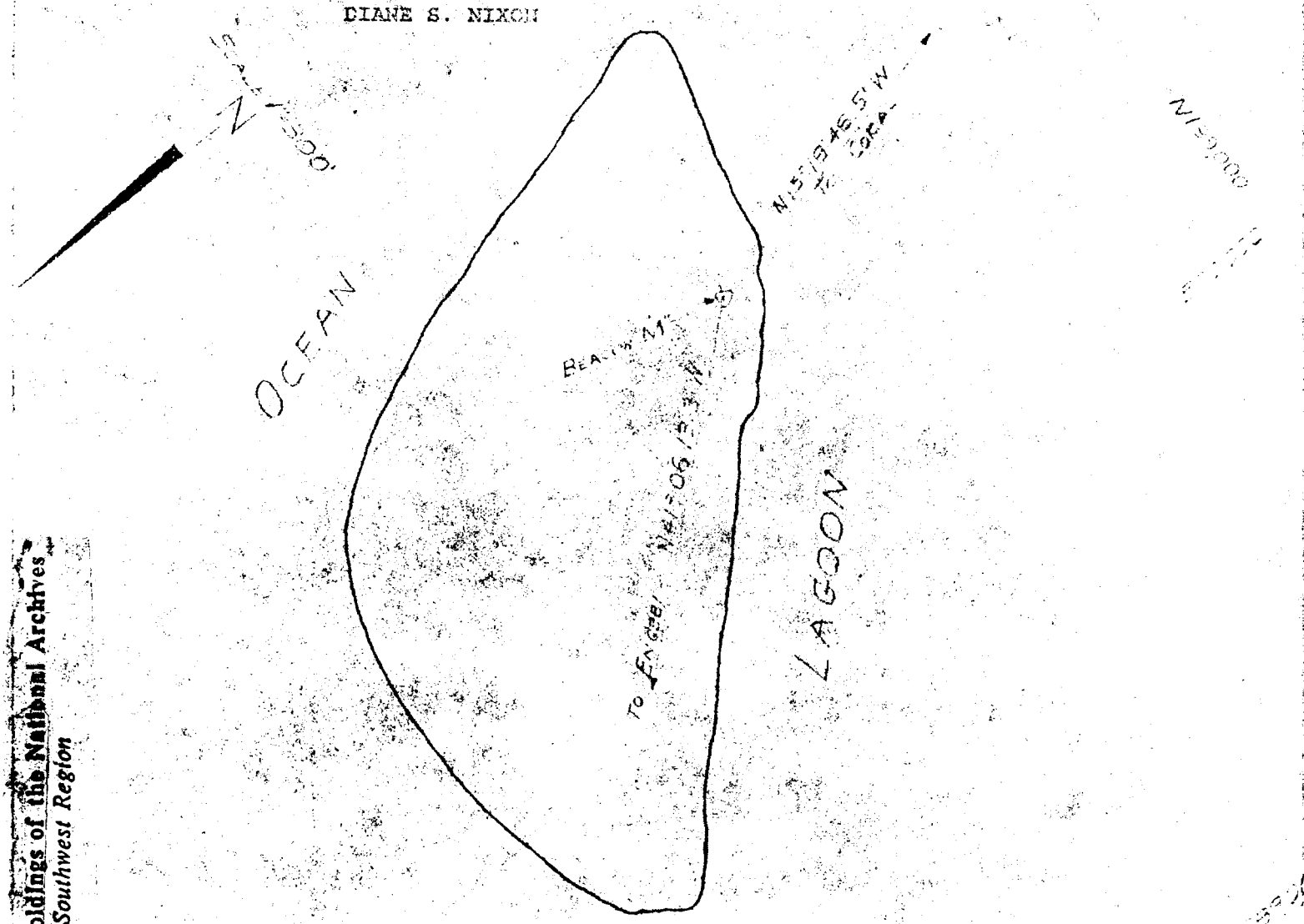
DECLASSIFIED PER DOE
LETTER DATED JULY. 15, 1994
FROM ANTON SIENICALLI TO
DIANE S. NIXON



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GENERAL CONTROL LAYOUT
SITE INDEX

~~SECURITY INFORMATION - RESTRICTED~~

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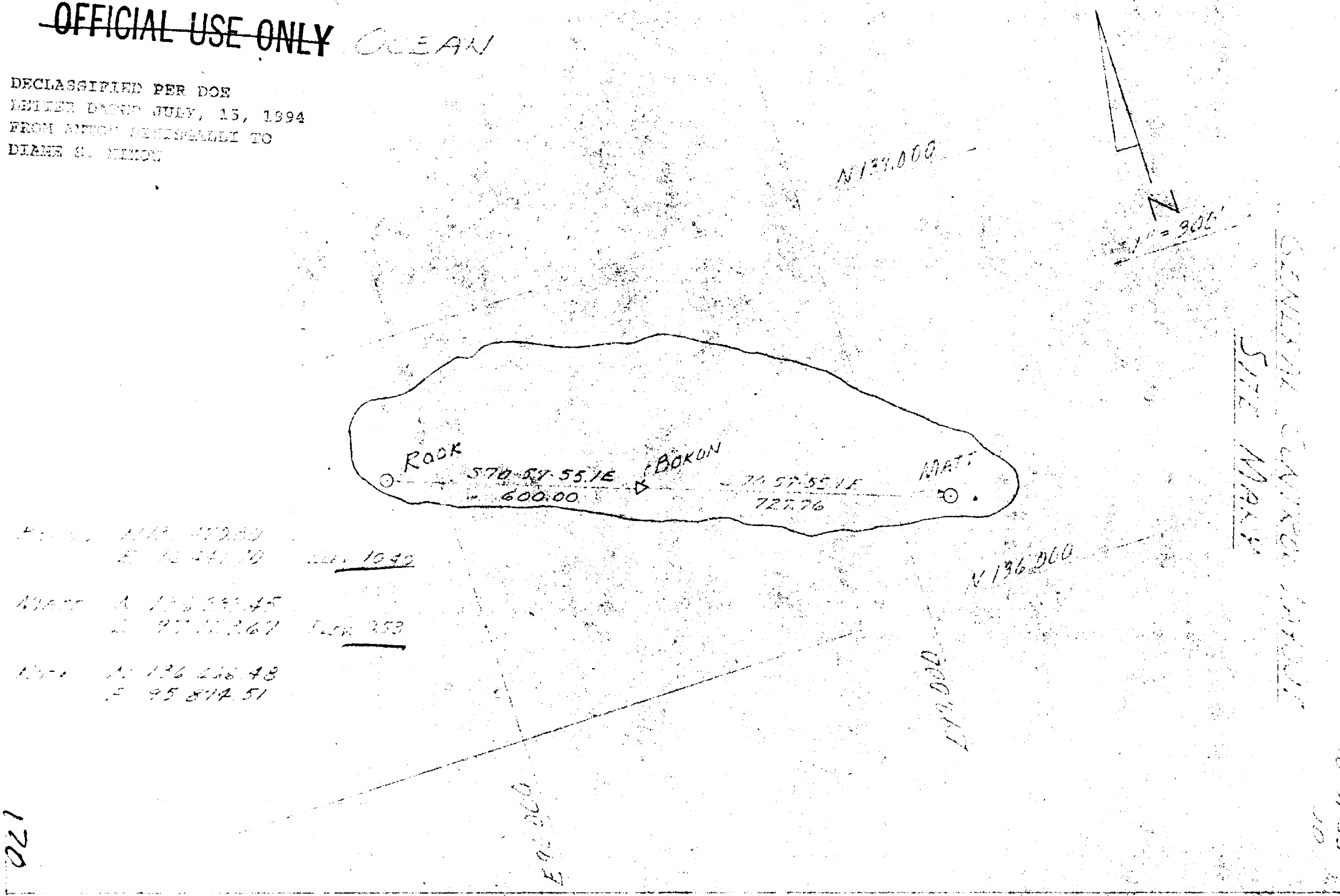
~~OFFICIAL USE ONLY~~ CLEAN

DECLASSIFIED PER DOE
LETTER DATED JULY, 15, 1994
FROM [illegible] TO
DIANE S. [illegible]



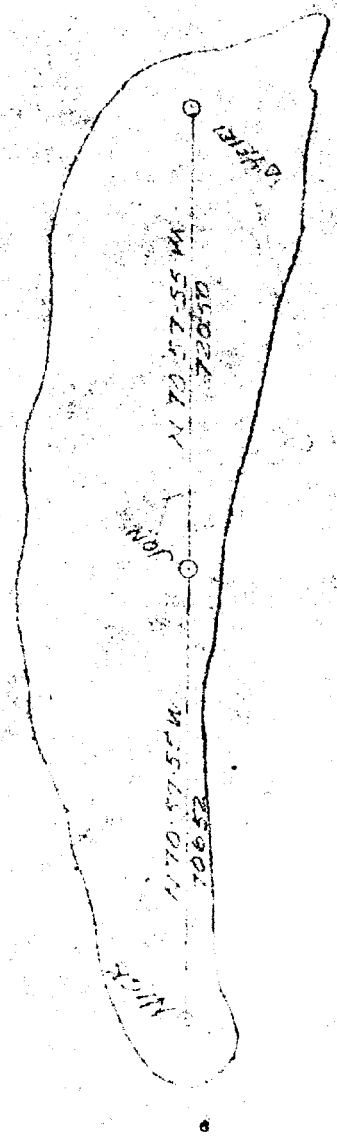
170

11-3-53

GENERAL CONTROL LAYOUT
SITE NANCY

N 135 000

E 101 000



SCALE 1:300

E 99 000

N 135 000

N 135 147.53
E 100 561.01

N 135 282.55
E 99 895.91

N 135 512.77
E 99 210.02

~~SECURITY INFORMATION — RESTRICTED~~

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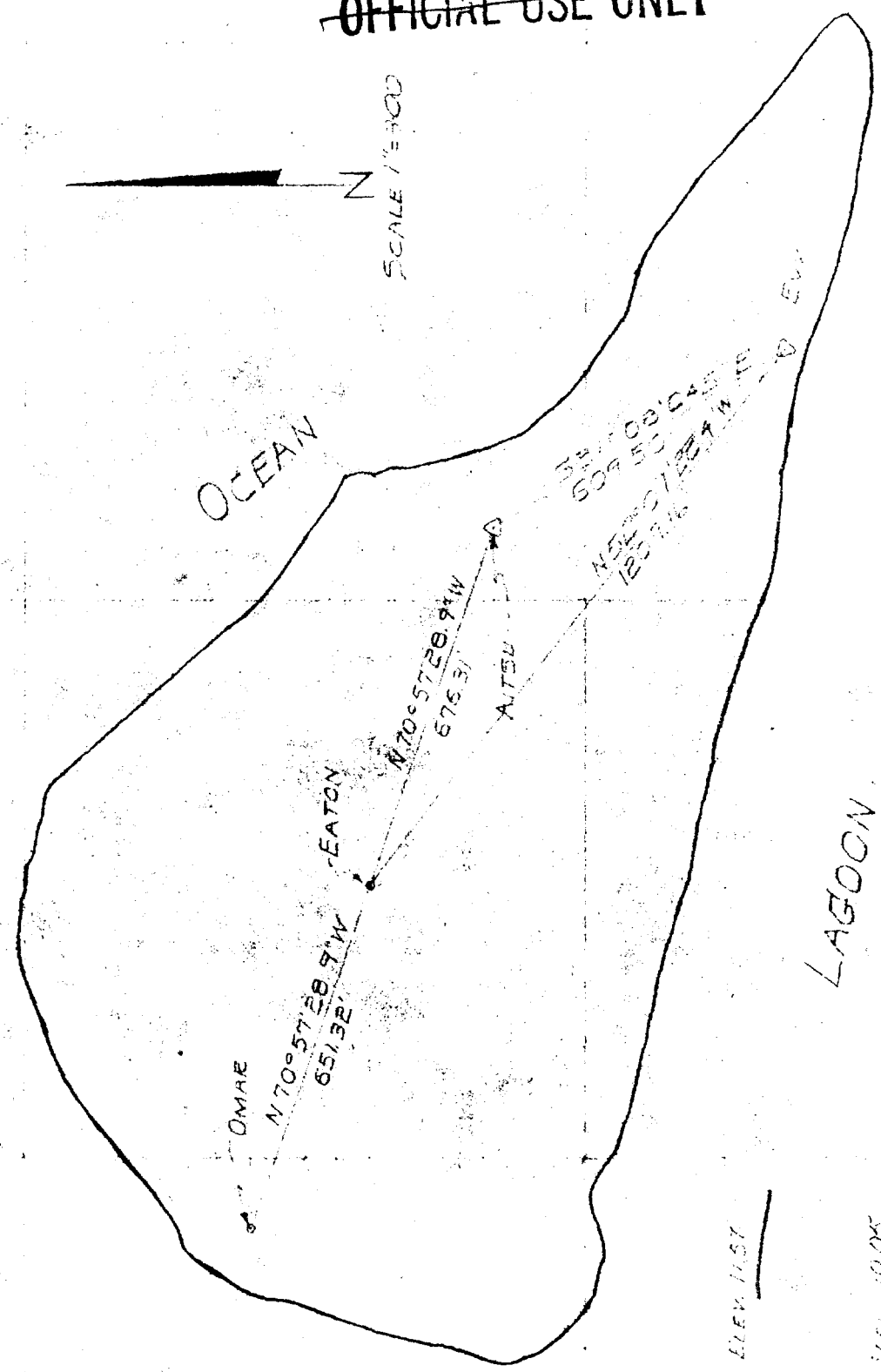

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"THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW."

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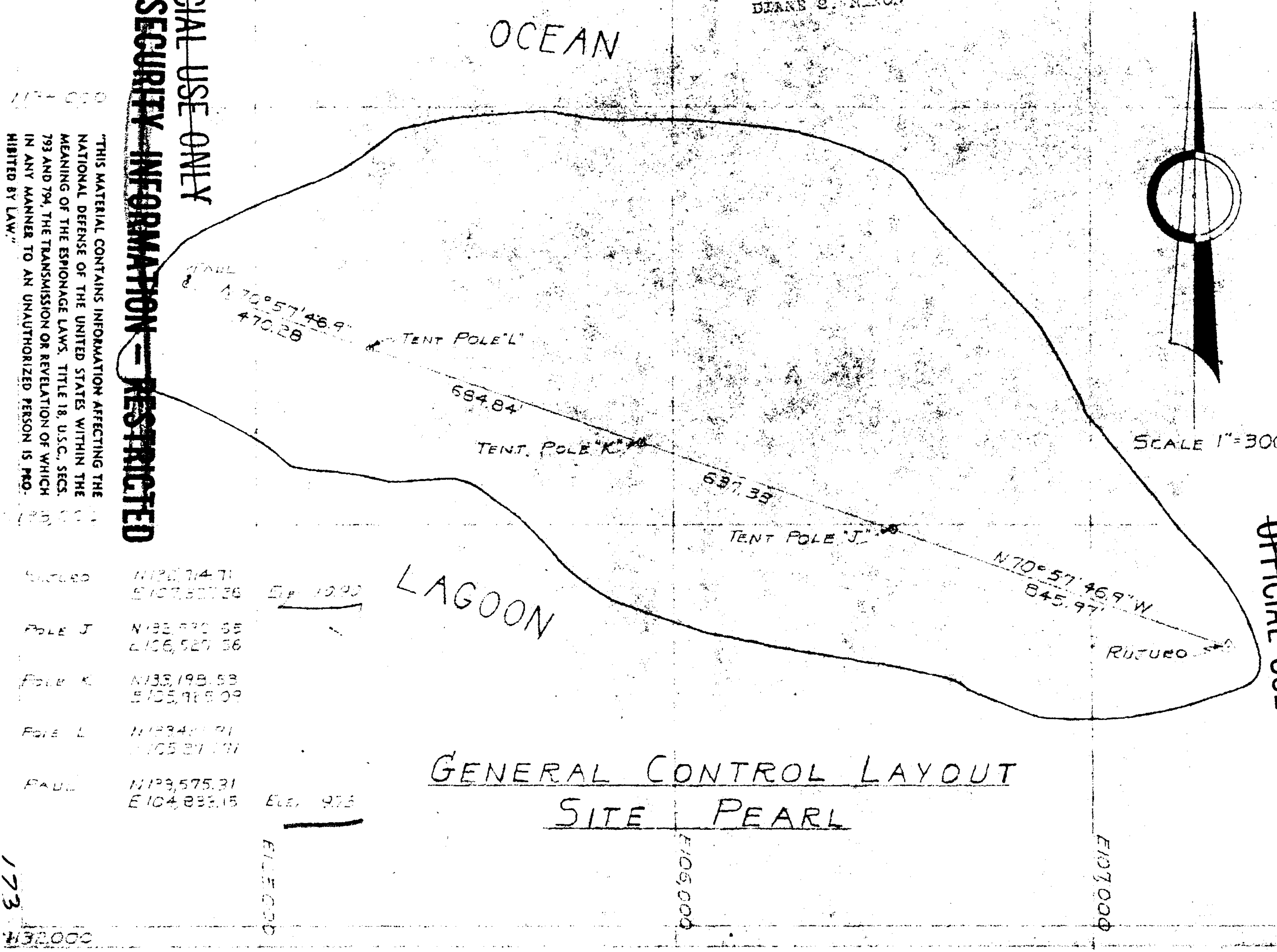

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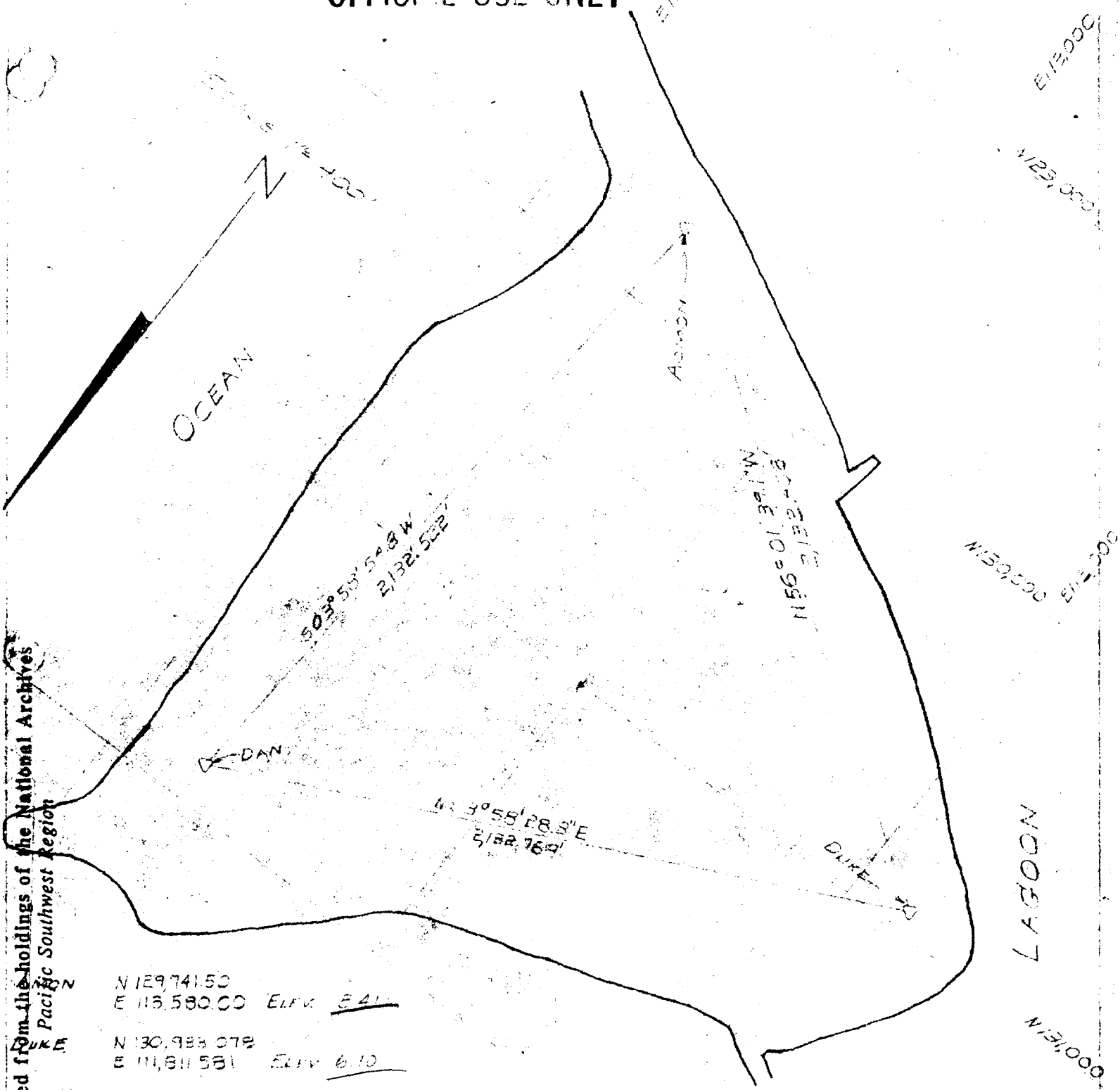

GENERAL CONTROL LAYOUT
SITE SALLY

~~SECURITY INFORMATION — RESTRICTED~~

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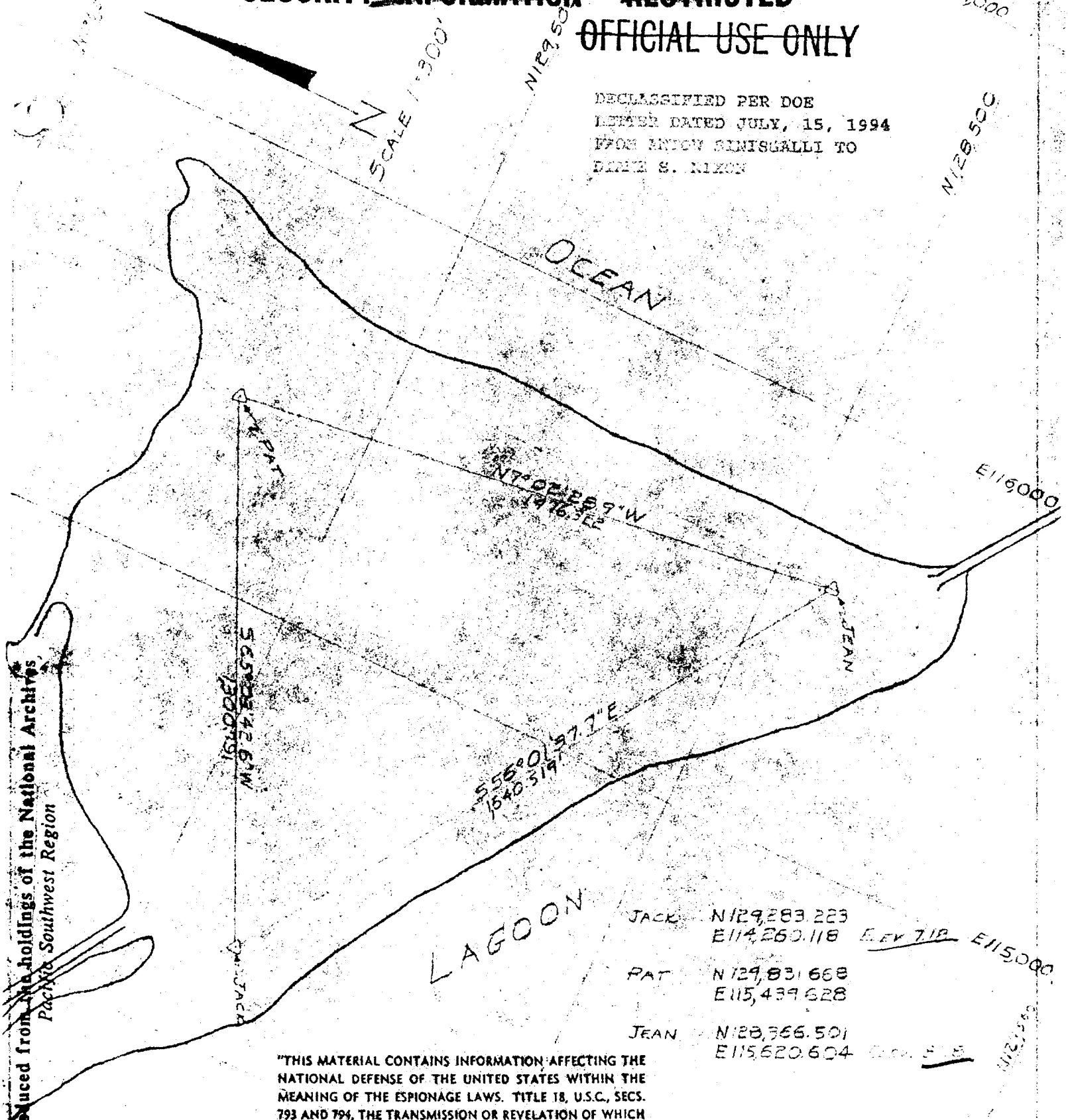

JACK N129,283.223
E114,260.118

PAT N129,831.668
E115,439.628

JEAN N128,366.501
E115,620.604

GENERAL CONTROL LAYOUT
SITE TILDA

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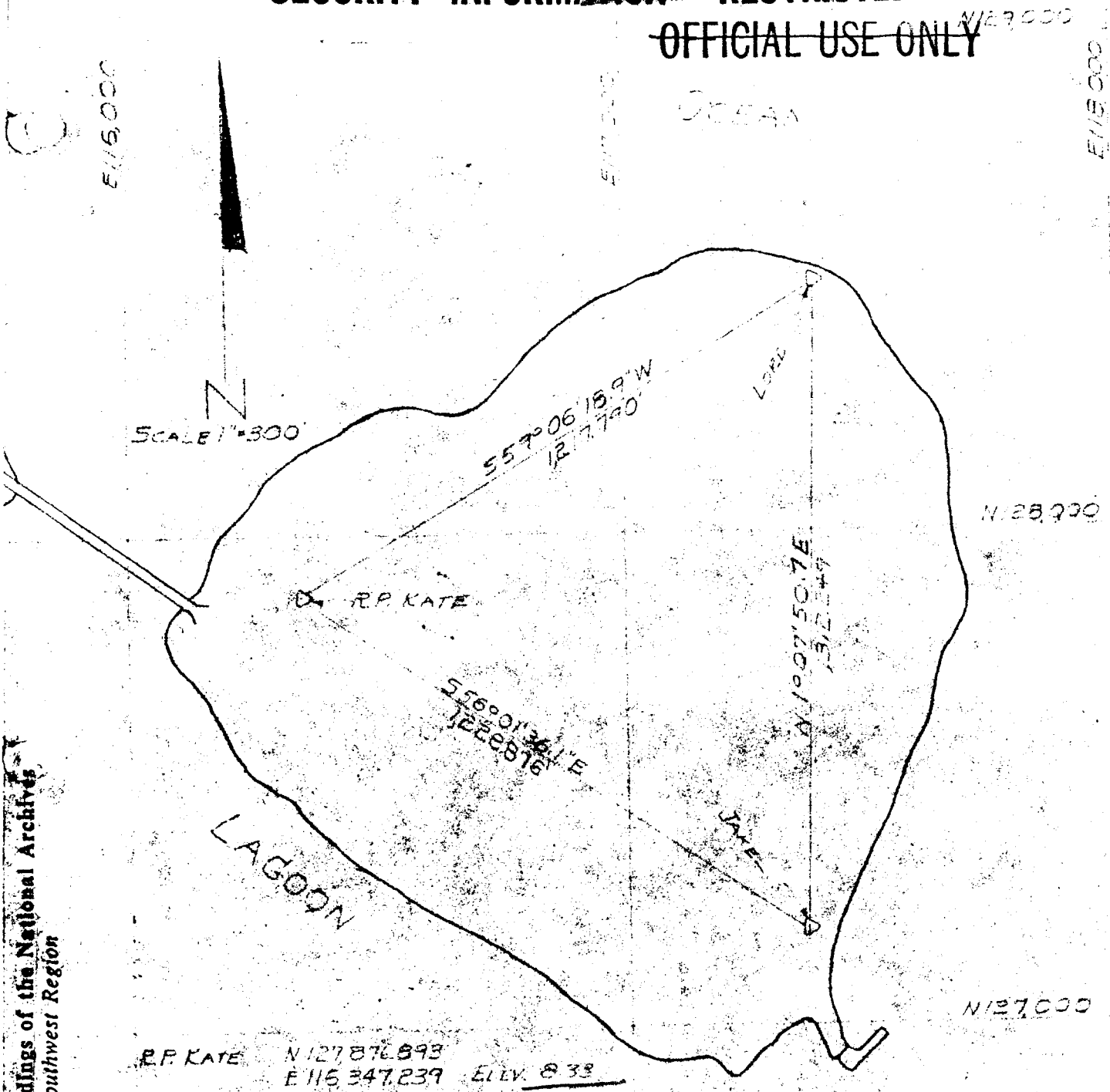

R.P. KATE N 127 876.893
E 116 347.239 ELEV. 8.33

JAPA N 127,190.159
E 117,366.343

LORD N 128,502.182
E 117 392.239

GENERAL CONTROL LAYOUT
SITE URSULA

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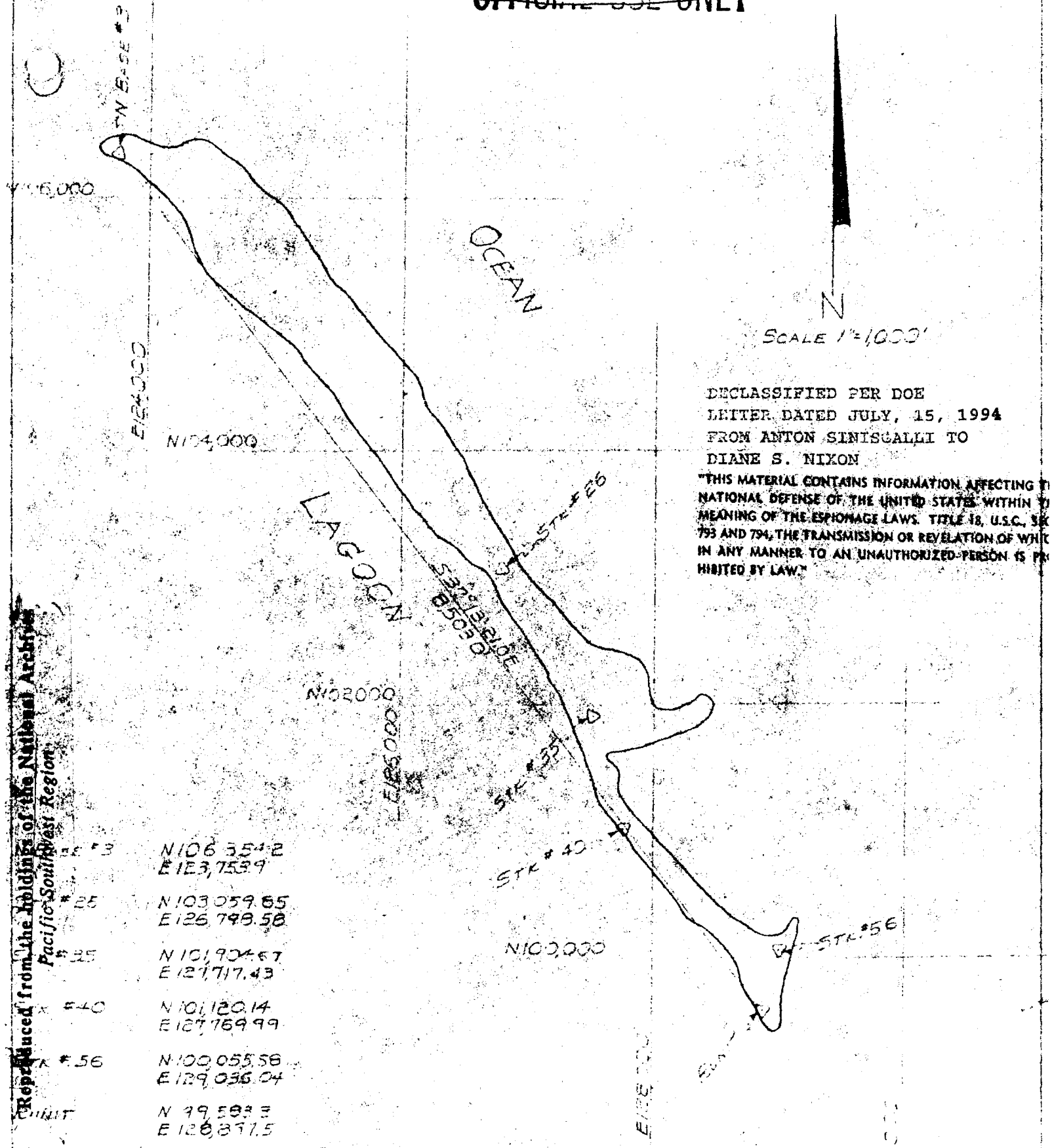


SCALE 1"=1,000'

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

"THIS MATERIAL CONTAINS INFORMATION AFFECTING TH
NATIONAL DEFENSE OF THE UNITED STATES WITHIN TH
MEANING OF THE ESPIONAGE LAWS. TITLE 18, U.S.C., SEC
793 AND 794, THE TRANSMISSION OR REVELATION OF WHIC
IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PRO
HIBITED BY LAW."

STK #3	N106 354.2 E1E3,753.9
STK #25	N103 059.65 E126 798.58
STK #35	N101,904.67 E127,717.43
STK #40	N101,120.14 E127,769.99
STK #56	N100,055.58 E129,036.04
LIMIT	N 99,582.3 E128,877.5

~~SECURITY INFORMATION RESTRICTED~~

GENERAL CONTROL LAYOUT

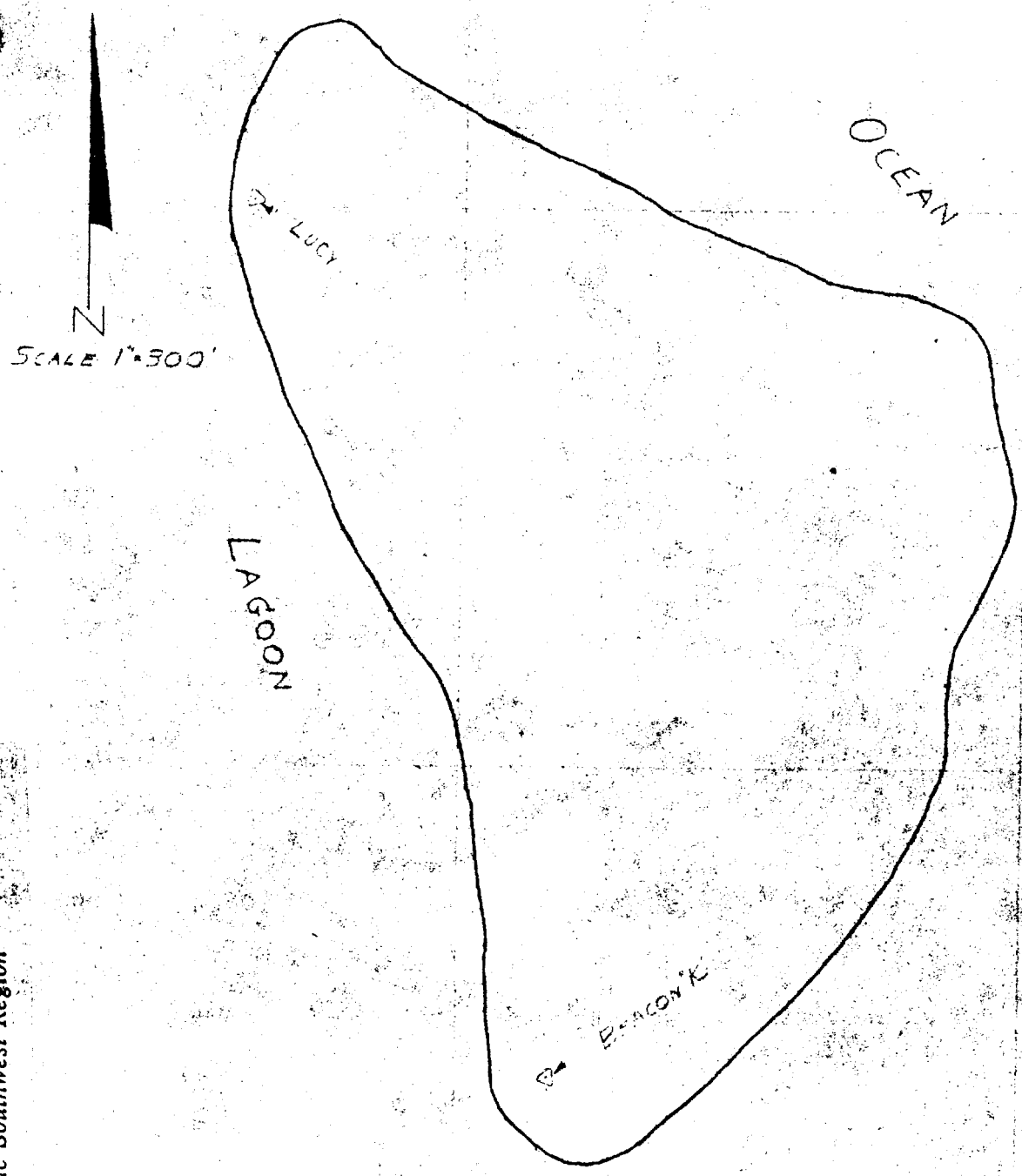
SITE MAP

~~OFFICIAL USE ONLY~~

177

~~SECURITY INFORMATION — RESTRICTED~~

~~OFFICIAL USE ONLY~~



"K" N123,452.95
E118,171.25

"THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS. TITLE 18, U.S.C., SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW."

GENERAL CONTROL LAYOUT
SITE VERA

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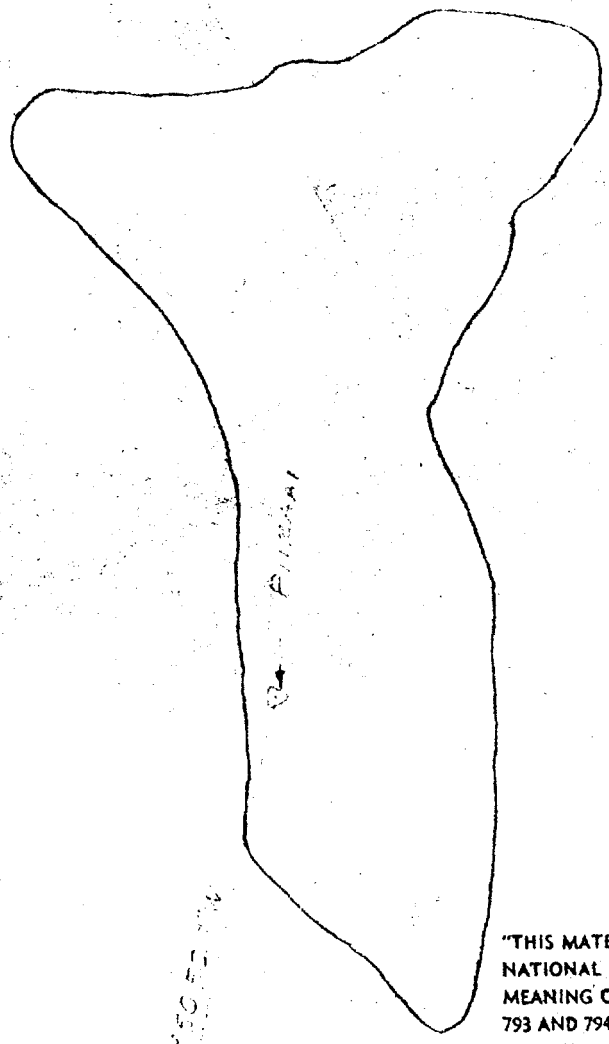
~~OFFICIAL USE ONLY~~

~~SECURITY INFORMATION — RESTRICTED~~

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



"THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS. TITLE 18, U.S.C., SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW."

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~~SECURITY INFORMATION — RESTRICTED~~

S-58

HOLMES & NARVER INC. · ENGINEERS · CONSTRUCTORS

GEOGRAPHIC POSITIONS

LOCATION Eniwetok Atoll M.I. Second ORDER TRIANGULATION
DATUM USN 1944 JOB NO. 942 SHEET 1 OF 1

STATION	LATITUDE LONGITUDE	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE LOG. METERS	METERS	FEET
Alice	11-38-46.347N	242-21-56.7	62-22-33.6	Gene	3.7959010	6250.302	20,506.2
	162-09-16.507E	260-31-54.4	80-33-02.8	Engebi	3.0169753	1039.861	34,116.1
		309-31-15.8	129-32-51.1	Coral	4.2703683	18636.668	61,143.8
Gene	11-40-20.683N	284-08-38.9	104-09-10.4	Engebi	3.6872608	4866.995	15,967.8
	162-12-19.333E	329-05-35.4	149-06-34.1	Coral	4.2356051	17203.037	56,440.3
				Alice	3.7959010	6250.302	20,506.2
Mack	11-32-57.854N	243-05-38.3	63-06-41.2	Piiraai	4.0274096	10651.471	34,945.7
	162-14-54.033E	285-33-27.5	105-33-54.9	Coral	3.6341150	4306.406	14,128.6
Yvonne	11-33-23.264N	75-02-10.5	255-01-22.7	Coral	3.8747550	7494.712	24,588.9
	162-21-09.895E	154-56-03.3	334-55-50.8	Piiraai	3.6491177	4457.770	14,625.2
		322-47-25.7	142-47-36.1	Runit	3.4136135	2591.872	8,503.5

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S-57

HOLMES & NARVER INC. - ENGINEERS - CONSTRUCTORS

LOCATION Eniwetok Atoll MI
PROJECTION Plane Grid

PLANE CO-ORDINATES

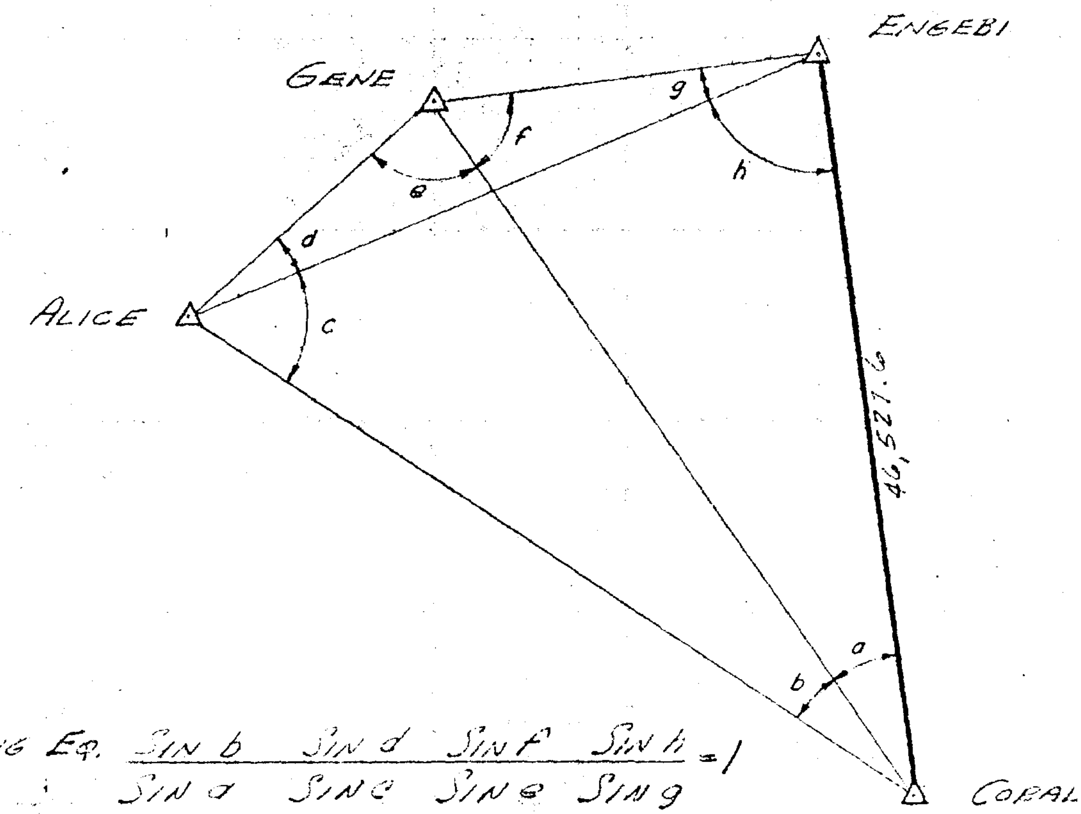
1955 Expansion

JOB NO. 942 SHEET 1 OF 1

	STATIONS	BEARING	DISTANCE	LATITUDE	DEPARTURE	COORDINATES NORTH	COORDINATES EAST	
1								1
2	Alice to					138,931.4	52,852.2	2
3	Gene	N62-23-32.4E	20,506.15	+ 9,502.85	+18,171.35	148,434.2	71,023.6	3
4	Engebi	N80-33-30.1E	34,116.13	+ 5,596.51	+33,653.96	144,527.9	86,506.2	4
5	Coral	S50-27-08.8E	61,143.82	-38,931.40	+47,147.78	100,000.0	100,000.0	5
6								6
7	Gene to					148,434.2	71,023.6	7
8	Engebi	S75-50-22.4E	15,967.80	- 3,906.34	+15,482.61	144,527.9	86,506.2	8
9	Coral	S30-53-25.9E	56,440.3	-44,527.9	+13,493.8	100,000.0	100,000.0	9
10								10
11	Mack to					103,791.2	86,389.6	11
12	Piiraai	N63-06-05.8E	34,945.67	+15,809.76	+31,164.91	119,601.0	117,554.5	12
13	Coral	S74-26-05.0E	14,128.57	- 3,791.20	+13,610.40	100,000.0	100,000.0	13
14								14
15	Yvonne to					106,354.5	123,753.6	15
16	Coral	S75-01-22.7W	24,588.92	- 6,354.56	+23,753.63	100,000.0	100,000.0	16
17	Piiraai	N25-04-44.5W	14,625.21	+13,246.40	- 6,199.16	149,601.0	117,554.5	17
18	Runit	S37-13-22.1E	8,503.49	- 6,771.24	+ 5,143.90	99,583.3	128,897.5	18
19								19
20								20
21								21
22								22
23								23
24								24
25								25
26								26

1281

TITLE QUADRANGLE ADJUSTMENT (GENE)



TRIG EQ. $\frac{\sin b \ \sin d \ \sin f \ \sin h}{\sin a \ \sin c \ \sin e \ \sin g} = 1$

	MEAS. ∡	GEO. COND.		TRIG COND.	
a	14-01-53.9	53.1	52.6	53.5	
b	19-33-44.6	43.7	43.8	42.9	
c	48-59-21.0	20.1	20.2	21.1	
d	16-09-59.0	58.1	58.6	57.7	
e	73-16-57.8	56.9	57.4	58.3	
f	44-56-58.3	57.4	57.3	56.4	
g	23-34-07.7	06.8	06.7	07.6	
h	97-25-04.8	03.9	03.4	02.5	

Log Sin b = 9.5248236 59.27 Log Sin a = 9.3846250 84.27
d = 9.4438424 44.20 c = 1.8771073 18.21
f = 1.8491000 21.10 e = 1.9812864 [illegible]
h = 1.9963503 2.744 g = 1.6024711 48.17

8.8141163 147.314 8.8140903 151.975
0903 147.314
260 299.289

260/299.289 = .87"

HOLMES & NARVER, INC.
ENGINEERS . CONSTRUCTORS
LOS ANGELES, CALIFORNIA

JOB NO. 176
SHEET 2 OF 2
TITLE Quadrangle Adjustment (Gene) BY MP DATE 7/11/55

Log Sin o = 7.5249183 59.27
d = 9.4938166 64.20
f = 9.8496950 21.10
h = 9.1963506 2.744
8.8641035 147.314
1034
1

Log Sin a = 9.3946825 84.29
c = 7.8777087 16.31
e = 9.9992960 1.205
g = 9.6024754 48.17
8.8641034 151.175
147.314
299.289

1 / 299.289 = .005"

4,521.6
Sin 44-36-54
(10647C9)

15,967.801
Sin 14-01-32.5
(24245578)

56,440.317
Sin 121-01-19.1
(82617221)

56,440.317
Sin 67-01-18.3
(92156002)

61,143.513
Sin 9?-16-58.3
(99835899)

20,536.147
Sin 19-33-42.9
(33432532)

46,521.6
Sin 45-59-21.1
(75458534)

61,143.520'
Sin 77-25-02.5
(99163205)

34,116.127
Sin 35-35-30.4
(55327624)

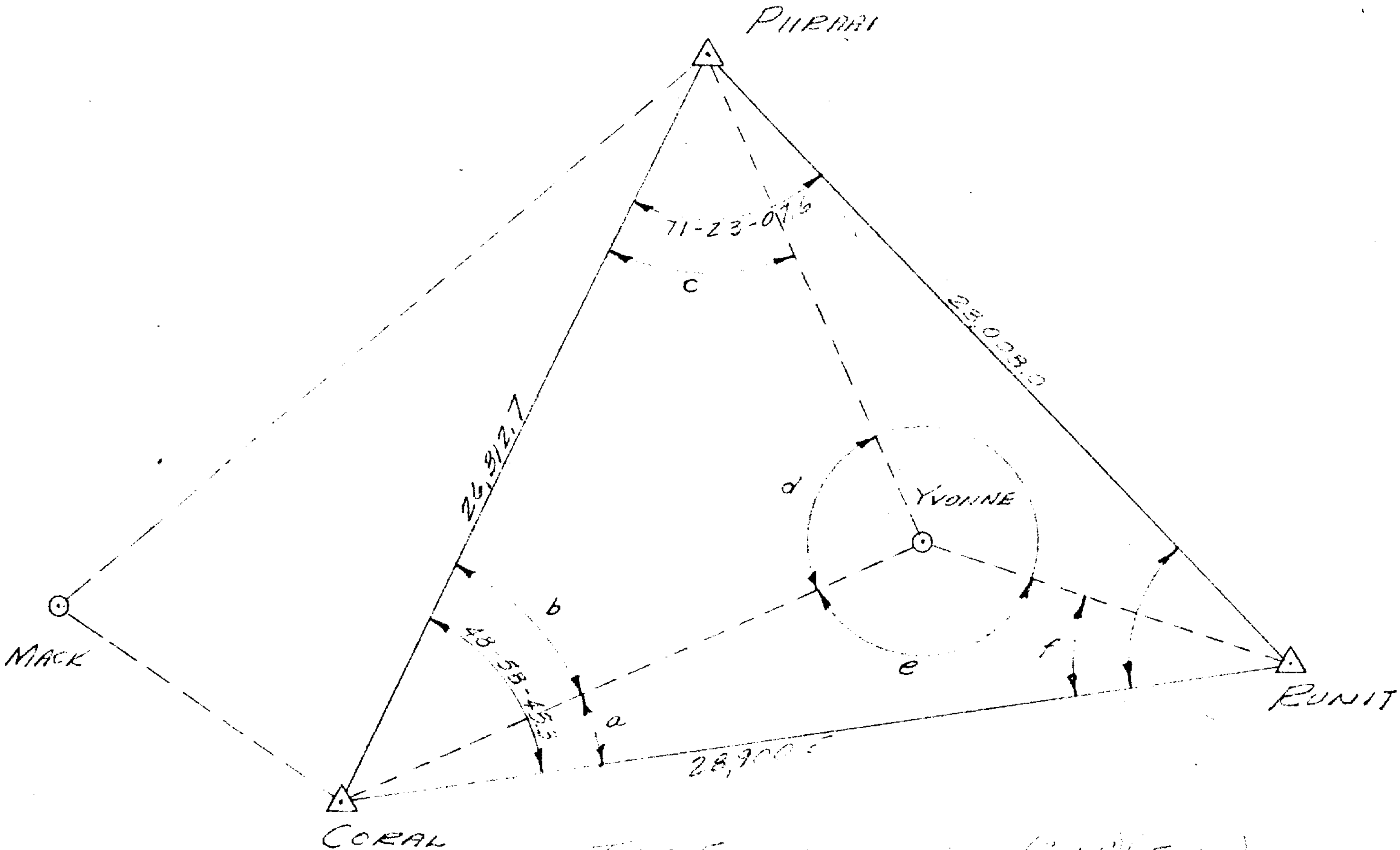
34,116.127
Sin 13-13-54.7
(66611732)

15,967.805
Sin 16-09-57.7
(25177159)

20,536.148
Sin 23-36-01.6
(40032279)

TITLE ANGLE ADJUSTMENT - YVONNE

BY M.R. DATE



TRIG. EQ. = [illegible] = 1

	MEAS. ∠	GEO. COND.		TRIG. COND. (a)	TRIG. COND. (b)
a	15-48-12.1	11.3	43.3	43.3	43.3
b	33-10-32.6	32.0			
c	66-55-38.5	37.3		35.4	35.2
d	79-53-52.2	50.7		52.1	52.8
e	112-14-46.7	46.9		45.5	44.8
f	51-57-03.5	01.8		03.2	03.4

[illegible] = 4.4[illegible]
Sin [illegible] = 1.9960381 16.47
Sin [illegible] = 1.9952127 [illegible]
4.3503877 26.224

[illegible] = 4.4[illegible]
Sin [illegible] = [illegible] [illegible]
Sin [illegible] = [illegible] [illegible]
4.3[illegible] [illegible]
[illegible] [illegible]
54 37.804

54/37.804 = 1.4"

HOLMES & NARVER, INC.
ENGINEERS - CONSTRUCTORS
LOS ANGELES, CALIFORNIA

JOB NO. 14?
SHEET 2 OF 2

TITLE ANGLE ADJUSTMENT - YVONNE
BY M.R. DATE

28,100.5 / SIN 113-14-45.5 (91556113)

8503.479 / SIN 15-48-11.3 (27233296)

24,588.866 / SIN 51-57-13.2 (78746875)

26,312.7 / SIN 79-53-52.1 (98449647)

14,625.214 / SIN 33-10-33.0 (54720618)

24,589.000 / SIN 66-55-35.4 (92000390)

DIFF. .13

$28,100.5 = 4.4487033$
SIN f' = 9.8962410 16.47
SIN d = 9.9932141 3.754
4.3503604 20.224

$26,312.7 = 4.4201655$
SIN c = 9.9631896 8.910
SIN e = 9.7664079 8.610
4.3503630 17.580
604 20.224
26 37.804

$26/37.804 = 0.7''$

28,100.5' / SIN 113-14-44.5 (91556640)

8503.471' / SIN 15-48-11.3 (27233296)

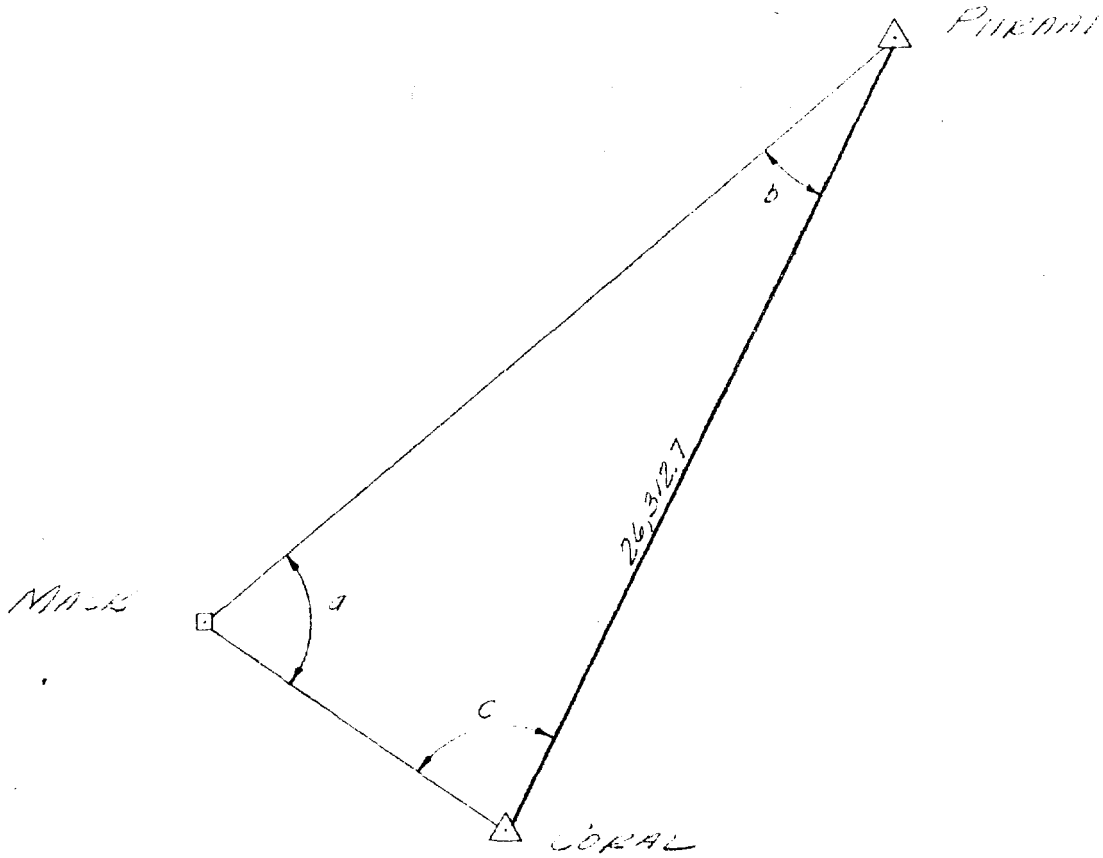
24,588.991' / SIN 51-57-02.7 (78744??4)

26,312.7' / SIN 79-53-52.8 (98447106)

14,625.??6' / SIN 33-10-32.0 (54720619)

24,588.95' / SIN 66-55-35.2 (92000248)

MEAN = 24,588.124' DIFF. .05'



OBSERVED ∠	ADJUSTED ∠
a 42-27-48.6	42-27-49.2
b 21-15-14.5	21-15-15.1
c 116-16-55.1	116-16-55.7
1.8	00.0

$$\frac{26,312.7}{\sin 42-27-49.2} \quad (\log 15,122.54)$$

$$\frac{14,129.57}{\sin 21-15-15.1} \quad (\log 36,250.62)$$

$$\frac{34,945.67}{\sin 116-16-55.7} \quad (\log 74,624.50)$$

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY K. C. DATE 6/24/55 JOB NO. 742 LOCATION YVONNE

α	2 [illegible]	to 3 [illegible]	22	50	50.7	α	3 Pierre	to 2 [illegible]	41	51	50.1
$2^d\angle$		8	+33	10	32.0	$3^d\angle$		8	-66	55	55.3
α	[illegible]	to 1 Yvonne	255	01	22.7	α	3 Pierre	to 1 Yvonne	354	55	55.8
$\Delta\alpha$				+	47.8	$\Delta\alpha$				+	12.5
			180	00	00.0				180	00	00.0
α'	1 Yvonne	to 2 [illegible]	75	02	10.5	α'	1 Yvonne	to 3 Pierre	154	56	08.3

FIRST ANGLE OF TRIANGLE 79-53-42.8

ϕ'	[illegible]			λ	162	17	10.844	Φ	11	33	34.632	3 Pierre	λ	162	23	37.557
$\Delta\phi$	+	0	1.11	$\Delta\lambda$	+	03	58.957	$\Delta\phi$	-	00	11.419		$\Delta\lambda$	+	01	01.239
ϕ'	11	34	[illegible] 1 Yvonne	λ'	162	21	09.801	ϕ'	11	33	23.213	1 Yvonne	λ'	162	24	38.796

	Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds
s	3.8[illegible]7254		$\frac{1}{2}(\phi+\phi')$	11-32-51.7585		s	3.6449[illegible]	
Cos α	9.[illegible]					Cos λ	9.9957[illegible]	
b	2.[illegible]		s	3.5742554		b	2.[illegible]	
h	1.[illegible]	1st term [illegible]	Sin α	9.[illegible]		h	2.[illegible]	1st term 131.4[illegible]
s^2	7.[illegible]		A'	[illegible]		s^2	7.[illegible]	
$\sin^2\alpha$	9.[illegible]		Sec ϕ'	0.0035146		$\sin^2\alpha$	9.[illegible]	
c	[illegible]		$\Delta\lambda$	2.378[illegible]	-238.2505	C	0.71877	
	[illegible]	2d term [illegible]	$\sin\frac{1}{2}(\phi+\phi')$	9.[illegible]			7.27115	2d term +1.0019
h^2	3.[illegible]		$-\Delta\alpha$	1.[illegible]	-47.840	h^2	4.2873	
D	1.[illegible]					D	1.7564	
	[illegible]	3d term [illegible]					6.[illegible]	3d term +[illegible]
		$-\Delta\phi$ [illegible]						$-\Delta\phi$ +131.4[illegible]

	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11-34-[illegible]	
		Logarithms / Values in seconds
s	3.64[illegible]	
Sin α	9.[illegible]	
A'	[illegible]	
Sec ϕ'	0.0035146	
$\Delta\lambda$	1.[illegible]	-60.[illegible]
$\sin^2\frac{1}{2}(\phi+\phi')$	[illegible]	
$-\Delta\alpha$	1.[illegible]	-12.[illegible]

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HOLMES & NARVER ENGINEERS-CONSTRUCTORS

COMPUTATION OF TRIANGLES

CALC. BY M.R. DATE 6/28/55 JOB NO. 943

CHKD. BY _____ DATE _____ LOCATION YVONNE-MACK

STATION	OBSERVED ANGLE	CORR-N	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3					8020.13	3.9041915
1 YVONNE	79-53-52.2	+0.4	52.3	0.0	52.3	0.0067856
2 COBAL	33-10-32.6	-0.6	32.0	0.0	32.0	9.7383510
3 PIERAI	66-55-38.8	-3.6	35.3	0.1	35.2	9.7951310
1-3					4457.714	3.6491131
1-2					7494.732	3.8747561
2-3					8803.12	3.9449227
1 YVONNE	112-14-49.7	-3.7	44.3	0.0	44.3	0.0938715
2 RONIT	31-57-03.5	-0.4	03.1	0.0	03.9	9.8962432
3 [illegible]	15-48-12.1	-0.8	11.3	0.0	11.3	9.4351002
1-3					7494.737	3.8747564
1-2					2591.877	3.4136.44
2-3					8020.13	3.9041815
1 MACK	42-21-48.6	+0.6	49.2	0.0	49.2	0.1706174
2 PIERAI	21-15-14.5	+0.6	15.1	0.0	15.1	9.5593155
3 COBAL	116-16-55.1	+0.7	55.8	0.1"	55.7	1.9526106
1-3					4396.400	3.6341144
1-2					6651.468	4.0274095
2-3						
1						
2						
3						
1-3						
1-2						

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY M.H. DATE 6/29/55 JOB NO. 942 LOCATION YVONNE

		°	'	"
α	2 BUNIT to 3 CORAL	90	50	32.2
2ᵈ ∠	&	+51	57	03.9
α	2 BUNIT to 1 YVONNE	142	47	36.1
Δα			−	10.4
		180	00	00.0
α'	1 YVONNE to 2 BUNIT	322	47	25.7

		°	'	"
α	3 CORAL to 2 BUNIT	270	49	34.0
3ᵈ ∠	&	−15	48	11.3
α	3 CORAL to 1 YVONNE	255	01	22.7
Δα			+	47.8
		180	00	00.0
α'	1 YVONNE to 3 CORAL	75	02	10.5

FIRST ANGLE OF TRIANGLE 112·14·48.7

	°	'	"			°	'	"
φ	11	32	16.080	2 BUNIT	λ	162	22	01.621
Δφ	+	01	07.184		Δλ		−	51.726
φ'	11	33	23.264	1 YVONNE	λ'	162	21	09.895

	°	'	"			°	'	"
φ	11	32	20.254	3 CORAL	λ	162	17	10.944
Δφ	+	01	03.011		Δλ	+	03	58.951
φ'	11	33	23.265	1 YVONNE	λ'	162	21	09.895

	Logarithms		Values in seconds
s	3.4136.29		
Cos α	9.9011639		
B	8.5124995		
h	1.8272276	1st term	−67.1857
s²	[illegible]		
Sin² α	[illegible]		
C	[illegible]		
	[illegible]	2d term	+0.0013
h²	3.6546		
D	1.1045		
	5.6?91	3d term	+0.0000
		−Δφ	−67.1844

$\frac{1}{2}(\phi+\phi')$ 11·32·49.672

	Logarithms	Values in seconds
s	3.4136.29	
Sin α	9.7815338	
A'	8.5096676	
Sec φ'	0.0088946	
−Δλ	1.7137059	+51.7260
Sin ½(φ+φ')	9.30.4075	
−Δα	1.0151164	+10.355

	Logarithms		Values in seconds
s	3.8747554		
Cos α	9.4123459		
B	8.5124997		
h	1.7996010	1st term	−63.0378
s²	7.749??		
Sin² α	9.96???		
C	0.716??		
	8.43?18	2d term	+0.0273
h²	3.5992		
D	1.1545		
	5.5837	3d term	+0.0000
		−Δφ	63.0105

$\frac{1}{2}(\phi+\phi')$ 11·32·51.7595

	Logarithms	Values in seconds
s	3.8747554	
Sin α	9.9849904	
A'	8.5096676	
Sec φ'	0.0088946	
Δλ	2.3793080	−238.950
Sin ½(φ+φ')	9.30.4390	
−Δα	1.6797370	−47.8340

(192)

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HOLMES & NARVER ENGINEERS-CONSTRUCTORS

COMPUTATION OF TRIANGLES

CALC. BY M.R. DATE 2/13/55 JOB NO. 942

CHKD. BY _____ DATE _____ LOCATION GENE

STATION	OBSERVED ANGLE	CORR-N	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2 - 3					14,181.641	4.1517265
1 ALICE	48-59-21.0	+0.3	21.3	0.2	21.1	0.1232913
2 ENGEBI	97-25-04.8	-2.2	02.6	0.1	02.5	9.9[illegible]3506
3 CORAL	33-35-33.5	-2.1	36.5	0.1	36.4	9.7[illegible]78
1 - 3					18636.674	4.270[illegible]
1 - 2					10398.617	4.016[illegible]
2 - 3					10398.617	4.0169756
1 GENE	138-13-56.1	-1.4	54.7	0.0	54.7	0.1764489
2 ENGEBI	23-32-07.7	0.0	07.7	0.1	07.6	9.6024754
3 ALICE	18-01-59.0	-1.3	57.7	0.0	57.7	9.4933366
1 - 3					6250.286	3.7956999
1 - 2					4867.002	3.6872611
2 - 3					14,181.641	4.1517265
1 GENE	44-56-59.3	-1.8	56.5	0.1	56.4	9.8[illegible]320
2 ENGEBI	121-01-12.5	-2.3	10.2	0.1	10.1	1.9[illegible]
3 CORAL	14-01-53.7	-0.4	53.5	0.0	53.5	9.3[illegible]35
1 - 3					17[illegible]47	4.[illegible]
1 - 2					4-[illegible]7.003	[illegible]
2 - 3					17303.047	4.[illegible]
1 ALICE	67-07-20.0	-1.1	18.9	0.1	18.8	0.[illegible]
2 GENE	93-10-57.3	-0.6	56.4	0.1	56.3	9.[illegible]
3 [illegible]	19-35-44.6	-1.6	43.0	0.1	42.9	9.[illegible]
1 - 3					[illegible]2	4.[illegible]
1 - 2					[illegible]	[illegible]

FORM 1

HOLMES & NARVER INC. - ENGINEERS - CONSTRUCTORS

TRAVERSE Coral-Alice-Gene-Engebi

CALC. BY [illegible] DATE [illegible]
CHKD. BY DATE
JOB NO. 942
SHEET NO. 1 OF 1

	STATION	BEARING	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	CO-ORDINATES NORTH	CO-ORDINATES EAST	
1	CORAL	[illegible] W	[illegible]	[illegible]	77104637	N39[illegible]	W47,147.778	100,000.00	100,000.00	1
2	ALICE	N62-2[illegible] E	[illegible].15	4634461	88614158	N9,502.850	E18,111.352	139,[illegible].339	52,852.222	2
3	GENE	S75-[illegible] E	15,967.8	24463852	96961435	S3,906.339	E15,492.608	148,434.248	71,023.574	3
4	ENGEBI							144,527.909	86,506.182	4
5										5
6										6
7	ENGEBI	S80-33-20.1 W	34,116.127	16404299	98645321	S 5,596.508	W33,653.963	144,527.9	86,506.2	7
8	ALICE	N62-23-36.4 E	[illegible].15	46341461	88614158	N9,502.850	E18,111.352	138,931.392	52,852.237	8
9	GENE	S75-50-22.8 E	15,967.8	24463852	96961435	S3,906.339	E15,492.608	148,434.242	71,023.589	9
10	ENGEBI							144,527.903	86,506.197	10
11										11
12										12
13										13
14										14
15										15
16										16
17										17
18										18
19										19
20										20
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24										24
25										25
26	192									26
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FORM T

HOLMES & NARVER INC. - ENGINEERS - CONSTRUCTORS

CALC. BY M.K.P. DATE 7/25/55 CHKD. BY _____ DATE _____ JOB NO. 942

TRAVERSE YVONNE (TRIANGULATION)

SHEET NO. 1 OF 1

	STATION	BEARING	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	CO-ORDINATES NORTH	CO-ORDINATES EAST	
1	PUBERAI							119,601.0	117,554.5	1
2	YVONNE	S25-04-44.5E	14,625.206	90572401	42386793	S13,246.400	E6,199.156	106,354.600	123,753.656	2
3	CORAL	S75-01-22.7W	24,588.924	25843174	96602952	S6,354.558	W23,753.626	100,000.037	100,000.030	3
4										4
5										5
6	RUNIT	N37-13-22.1W	8,502.497	79628921	60491612	N6771.235	W5143.896	99,583.3	129,897.5	6
7	YVONNE	S75-01-22.7W	24,588.924	25843174	96602952	S6354.558	N23,753.626	106,354.535	123,753.604	7
8	CORAL							99,999.777	99,999.778	8
9										9
10										10
11	PUBERAI	S25-04-44.5E	14,625.206	90572401	42386793	S13,246.400	E6,199.156	119,601.0	117,554.5	11
12	YVONNE	N37-13-22.1E	8502.497	79628921	60491612	S6,771.235	E5,143.896	106,354.600	123,753.656	12
13	RUNIT							99,583.365	129,897.552	13
14										14
15										15
16	PUBERAI	S43-06-05.5W	34,945.67	45240963	89181025	S15,807.758	W31,104.907	119,601.0	117,554.5	16
17	MINA	S77-20-55.0E	14,128.57	26833608	96332536	S3,791.205	E13,610.40	103,791.242	86,257.593	17
18	CORAL							100,000.037	100,000.053	18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28

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HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY M.E. DATE 7/19/55 JOB NO. 942 LOCATION GENE

		°	'	"
α'	2 ENSEBI to 3 CORAL	343°	08'	01.2"
2d L	B	+12.	01	10.2
α	2 ENSEBI to 1 GENE	104	09	10.4
$\Delta\alpha$			-	31.5
		180	00	00.0
α'	1 GENE to 2 ENSEBI	284	08	38.9

		°	'	"
α	3 CORAL to 2 ENSEBI	163°	08'	27.6"
3d L	B	-14	01	53.5
α	3 CORAL to 1 GENE	149	06	34.1
$\Delta\alpha$			-	58.7
		180	00	00.0
α'	1 GENE to 3 CORAL	329	05	35.4

FIRST ANGLE OF TRIANGLE 44-56-56.5

	°	'	"		°	'	"
ϕ	11	32	41.164	2 ENSEBI	λ	162	14	55.151
$\Delta\phi$			38.717		$\Delta\lambda$	-	02	35.818
ϕ'	11	40	20.683	1 GENE	λ'	162	12	19.333

	°	'	"		°	'	"
ϕ	11	32	20.254	3 CORAL	λ	162	17	19.746
$\Delta\phi$		08	00.429		$\Delta\lambda$	-	04	51.616
ϕ'	11	40	20.683	1 GENE	λ'	162	12	19.334

	Logarithms	Values in seconds	
s	3.6872610		
Cos α -	9.3883959		
B	8.5124997		
h -	1.5880539	1st term	-38.7506
g^2	7.3374[illegible]		
$\sin^2\alpha$	9.9[illegible]		
C	6.72[illegible]		
	3.[illegible]	2d term	+0.0117
h^2	3.1[illegible]		
D	1.9[illegible]		
	5.[illegible]	3d term	+0.0000
		$-\Delta\phi$	-38.7389

$\frac{1}{2}(\phi+\phi')$ 11-40-01.324

	Logarithms	Values in seconds
s	3.6872610	
Sin α	1.9886135	
A'	8.5998[illegible]	
Sec ϕ'	0.0000752	
$\Delta\lambda$	2.1126161	155.8175
$\sin\frac{1}{2}(\phi+\phi')$	9.3258324	
$-\Delta\alpha$	1.4964485	31.5100

	Logarithms	Values in seconds	
s	4.2356053		
Cos α	1.9335631		
B	8.5124997		
h	2.6816681	1st term -	480.4720
s^2	8.4712[illegible]		
$\sin^2\alpha$	9.42091		
C	8.716[illegible]		
	8.6408[illegible]	2d term	+0.0406
h^2	5.3633		
D	1.9945		
	7.3[illegible]	3d term	+0.0022
		$-\Delta\phi$	-480.4292

$\frac{1}{2}(\phi+\phi')$ 11-32-20.469

	Logarithms	Values in seconds
s	4.2356053	
Sin α	1.1194553	
A'	8.[illegible]	
Sec ϕ'	0.0000752	
$\Delta\lambda$	2.4645[illegible]	291.60[illegible]
$\sin\frac{1}{2}(\phi+\phi')$	1.3535745	
$-\Delta\alpha$	1.7685765	58.6042

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY M.R. DATE 6/28/55 JOB NO. 942 LOCATION MACK

			°	'	"
α	2 PIERAI to 3 CORAL		41	51	26.1
2d ∠	8		+21	15	15.1
α	2 PIERAI to 1 MACK		63	06	41.2
Δα			-	01	02.9
			180.	00	00.0
α'	1 MACK to 2 PIERAI		243	05	38.3

			°	'	"
α	3 CORAL to 2 PIERAI		221	50	50.7
3d ∠	8		-116	16	55.8
α	3 CORAL to 1 MACK		105	33	54.9
Δα				-	27.4
			180	00	00.0
α'	1 MACK to 3 CORAL		285	33	27.5

FIRST ANGLE OF TRIANGLE 42-27-49.2

	°	'	"			°	'	"
φ	11	35	34.682	2 PIERAI	λ	162	20	07.557
Δφ	-	02	36828		Δλ	-	05	13.524
φ'	11	32	57.854	1 MACK	λ'	162	14	54.033

	°	'	"			°	'	"
φ	11	32	20.254	3 CORAL	λ	162	17	10.944
Δφ	+	00	37.600		Δλ	-	02	16.911
φ'	11	32	57.854	1 MACK	λ'	162	14	54.033

	Logarithms	Values in seconds		
s	4.0274095			
Cos α	9.6553849			
B	8.5124980			
h	2.1952924	1st term	156.7806	
s²	8.05482			
Sin² α	9.90002			
C	0.71877			
	5.67421	2d term	+0.0472	
h²	4.3906			
D	1.9564			
	6.3470	3d term	+0.0002	
		-Δφ	156.8280	

	°	'	"			
½(φ+φ')	11	34	16.268			
		Logarithms	Values in seconds			
s		4.0274095				
Sin α'		9.9503103				
A'		8.5096676				
Sec φ'		0.0088837				
Δλ		2.4864711	305.5242			
Sin ½(φ+φ')		9.3022991				
-Δα		1.7185702	62.8883			

	Logarithms	Values in seconds	
s	3.6341144		
Cos α	9.4228783		
B	8.5124997		
h	1.5752924	1st term	37.6090
s²	7.26823		
Sin² α	9.76755		
C	0.71669		
	7.95247	2d term	+0.0090
n²	3.1506		
D	1.9545		
	5.1351	3d term	+0.0000
		-Δφ	37.6000

	°	'	"			
½(φ+φ')	11	32	39.054			
		Logarithms	Values in seconds			
s		3.6341144				
Sin α		9.9937731				
A'		8.5096676				
Sec φ'		0.0088837				
Δλ		2.1364388	136.7111			
Sin ½(φ+φ')		9.3012982				
-Δα		1.4377370	27.3991			

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY M.R. DATE 7/16/65 JOB NO. 942 LOCATION GENE

		°	'	"
α	2 ENGEBI to 3 CORAL	243°	08'	00.2"
2nd $\angle$	8	+ 97	25	02.6
α	2 ENGEBI to 1 ALICE	80	33	02.8
$\Delta\alpha$		-	01	08.4
		180	00	00.0
α'	1 ALICE to 2 ENGEBI	260	31	54.4

		°	'	"
α	3 CORAL to 2 ENGEBI	163°	08'	27.6"
3rd $\angle$	8	- 33	35	36.5
α	3 CORAL to 1 ALICE	129	32	51.1
$\Delta\alpha$		-	01	35.3
		180	00	00.0
α'	1 ALICE to 3 CORAL	309	31	15.8

FIRST ANGLE OF TRIANGLE 48-59-21.3

	°	'	"			°	'	"
ϕ	11	39	41.964	2 ENGEBI	λ	162	14	55.151
$\Delta\phi$		-	55.617		$\Delta\lambda$	-	05	38.644
ϕ'	11	38	46.347	1 ALICE	λ'	162	09	16.507

	°	'	"			°	'	"
ϕ	11	32	20.254	3 CORAL	λ	162	17	10.94+
$\Delta\phi$	+	06	26.094		$\Delta\lambda$	-	07	54.437
ϕ'	11	38	46.348	1 ALICE	λ'	162	07	16.507

	Logarithms	Values in seconds		
s	4.0169755			
Cos α	9.3153032			
B	8.5124960			
h	1.7447747	1st term	55.5516	
s^2	8.033950			
$\sin^2\alpha$	9.98813			
C	0.12131			
	5.74347	2d term	+0.0554	
h^2	3.48695			
D	1.9361			
	5.4754	3d term	+0.0000	
		$-\Delta\phi$	55.6170	

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	39	14.156		
s				4.0169755	
Sin α				9.9940669	
A'				8.5096667	
Sec ϕ'				0.0090343	
$\Delta\lambda$				2.5297434	338.6440
$\sin\frac{1}{2}(\phi+\phi')$				9.3053512	
$-\Delta\alpha$				1.8350946	68.4060

	Logarithms	Values in seconds	
s	4.2703684		
Cos α	9.8039412		
B	8.5124987		
h	2.5868155	1st term	386.2021
s^2	8.540074		
$\sin^2\alpha$	9.77422		
C	0.77669		
	9.03165	2d term	+0.1076
h^2	5.1736		
D	1.9845		
	7.1581	3d term	+0.0014
		$-\Delta\phi$	-386.0937

	°	'	"	Logarithms	Values in seconds
$\frac{1}{2}(\phi+\phi')$	11	35	33.30		
s				4.2703684	
Sin α				9.8871088	
A'				8.5096667	
Sec ϕ'				0.0090343	
$\Delta\lambda$				2.6761782	474.4366
$\sin\frac{1}{2}(\phi+\phi')$				9.3030904	
$-\Delta\alpha$				1.9792686	95.3586

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