BIKINI ATOLL MI
U.S.N. 1946
SECOND
NO 884
SHEET 1 OF 4

ALFA (*)	11-33-45.872	206-51-50.4	26-52-38.9	CHARLIE	4.2071848	16113.31	52865.1
	165-13-32.361	260-03-37.8	80-05-13.2	COCA	4.1651630	14627.26	47989.6
		304-37-45.1	124-38-07.3	YOKE	3.6107909	4081.28	13390.0
BRAVO (*)	N 11-34-16.650	210-38-54.3	30-39-47.3	CHARLIE	4.1933851	15609.36	51211.7
	E 165-13-10.041	264-01-20.3	84-03-00.2	COCA	4.1808823	15166.39	49758.4
		308-58-48.3	128-59-15.0	YOKE	3.7151740	5190.08	17027.8
CHARLIE	N 11-41-33.672	270-53-27.9	90-54-51.7	FOX	4.0976907	12522.49	41084.2
	E 165-17-32.784	328-59-24.5	149-00-11.9	COCA	4.1407434	13827.49	45365.7
		13-14-16.1	193-13-50.0	YOKE	4.2342234	17148.39	56261.0
		22-40-11.7	202-39-30.0	ZEBRA	4.2113903	16270.10	53379.5
		26-52-38.9	206-51-50.4	ALFA	4.2071848	16113.31	52865.1
		30-39-47.3	210-38-54.3	BRAVO	4.1933851	15609.36	51211.7
COCA	N 11-35-07.935	324-31-17.1	144-31-58.9	OBOE	4.0374241	10899.94	35760.9
	E 165-21-27.917	346-28-20.1	166-28-35.6	SALT	4.0011390	10026.26	32894.5
		12-16-41.4	192-16-27.2	UNCLE	4.0066167	10153.52	33312.0
		66-21-14.7	246-20-01.6	YOKE	4.0815136	12064.62	39582.0
		149-00-11.9	328-59-24.5	CHARLIE	4.1407434	13827.49	45365.7
		204-51-30.2	24-52-06.2	FOX	4.1087473	12845.39	42143.6
		255-15-15.2	75-17-18.3	N. HOW	4.2825381	19166.29	62881.4
FOX	N 11-41-27.251	297-18-02.3	117-19-29.9	N. HOW	4.1696832	14780.30	48491.7
	E 165-24-26.220	357-25-35.2	177-25-41.3	OBOE	4.3128613	20552.34	67428.8
		24-52-06.2	204-51-30.2	COCA	4.1087473	12845.39	42143.6
		90-54-51.7	270-53-27.9	CHARLIE	4.0976907	12522.49	41084.2

* THIRD ORDER STATIONS

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N. HOW	N 11-37-46.528	316-56-04.7	136-56-21.4	S. HOW	3.5624582	3651.39	11979.6
	E 165-31-39.801	345-17-54.5	165-18-17.1	NAN	4.1292483	13466.30	44180.7
		41-37-36.3	221-36-15.5	OBOE	4.2646138	18391.36	60339.0
		75-17-18.3	255-15-15.2	COCA	4.2825381	19166.29	62881.4
		117-19-29.9	297-18-02.3	FOX	4.1696832	14780.30	48491.7
S. HOW	N 11-36-19.705	354-54-19.7	174-54-25.8	NAN	4.0169903	10398.97	34117.3
	E 165-33-02.103	53-01-03.2	232-59-26.0	OBOE	4.2651958	18416.02	60419.9
		136-56-21.4	316-56-04.7	N.HOW	3.5624582	3651.39	11979.6
JIG (*)	N 11-35-23.979	352-35-56.6	172-36-04.0	NAN	3.9404318	8718.30	28603.3
	E 165-32-55.516	57-09-35.3	237-07-59.5	OBOE	4.2373353	17271.71	56665.6
LOVE (*)	N 11-33-50.203	359-01-57.4	179-01-58.0	NAN	3.7608129	5765.18	18914.6
	E 165-33-29.362	67-20-46.8	247-19-04.3	OBOE	4.2262412	16836.09	55236.4
MIKE (*)	N 11-33-03.207	359-25-54.9	179-25-55.2	NAN	3.6355421	4320.58	14175.1
	E 165-33-31.160	72-05-05.0	252-03-22.2	OBOE	4.2144783	16386.20	53760.4
NAN	N 11-30-42.595	87-21-45.3	267-20-02.4	OBOE	4.1945443	15651.08	51348.6
	E 165-33-32.574	165-18-17.1	345-17-54.5	N.HOW	4.1292483	13466.30	44180.7
		172-36-04.0	352-35-56.6	JIG	3.9404318	8718.30	28603.3
		174-54-25.8	354-54-19.7	S.HOW	4.0169903	10398.97	34117.3
		179-01-58.0	359-01-57.4	LOVE	3.7608129	5765.18	18914.6
		179-25-55.2	359-25-54.9	MIKE	3.6355421	4320.58	14175.1

*THIRD ORDER STATIONS

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		AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE LOG METERS	METERS	FEET
OBOE	N 11-30-19.029	77-39-28.4	257-39-02.2	SALT	3.6101675	4075.3743	13370.624
	E 165-24-56.671	82-59-25.2	262-58-29.4	UNCLE	3.9319489	8549.66	28050.0
		144-31-58.9	324-31-17.1	COCA	4.0374241	10899.94	35760.9
		177--25-41.3	357-25-35.2	FOX	4.3128613	20552.34	67428.8
		221-36-15.5	41-37-36.3	N. HOW	4.2646138	18391.36	60339.0
		232-59-26.0	53-01-03,2	S. HOW	4.2651958	18416.02	60419.9
		237-07-59.5	57-09-35.3	JIG	4.2373353	17271.71	56665.6
		247-19-04.3	67-20-46.8	LOVE	4.2262412	16836.09	55236.4
		252-03-22.2	72-05-05.0	MIKE	4.2144783	16386.20	53760.4
		267-20-02.4	87-21-45.3	NAN	4.1945443	15651.08	51348.6
SALT	N 11-29-50.670	87-48-09.5	267-47-39.9	UNCLE	3.6539695	4507.85	14789.5
	E 165-22-45.305	166-28-35.6	346-28-20.1	COCA	4.0011390	10026.26	32894.5
		257-39-02.2	77-39-28.4	OBOE	3.6101675	4075.3743	13370.624
UNCLE	N 11-29-45.033	117-27-53.7	297-27-20.9	VICTOR	3.7488026	5607.93	18398.7
	E 165-20-16.670	119-44-43.7	299-43-45.1	YOKE	4.0104005	10242.37	33603.5
		192-16-27.2	12-16-41.4	COCA	4.0066167	10153.52	33312.0
		262-58-29.4	82-59-25.2	OBOE	3.9319489	8549.66	28050.0
		267-47-39.9	87-48-09.5	SALT	3.6539695	4507.85	14789.5
VICTOR (*)	N 11-31-09.198	122-29-26.9	302-29-01.0	YOKE	3.6669128	4644.22	15236.9
	E 165-17-32.469	224-11-48.2	44-12-35.3	COCA	4.0099788	10232.43	33570.9
		297-27-20.9	117-27-53.7	UNCLE	3.7488026	5607.93	18398.7

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*THIRD ORDER STATIONS

OFFICIAL USE ONLY

YOKE	N	11-32-30.383	125-37-01.9	305-36-46.5	ZEBRA	3.4599448	2883.66	9460.8
	E	165-15-23.190	124-38-07.3	304-37-45.1	ALFA	3.6107909	4081.28	13390.0
			128-59-15.0	308-58-48.3	BRAVO	3.7151740	5190.08	17027.8
			193-13-50.0	13-14-16.1	CHARLIE	4.2342234	17148.39	56261.0
			246-20-01.6	66-21-14.7	COCA	4.0815136	12064.62	39582.0
			299-43-45.1	119-44-43.7	UNCLE	4.0104005	10242.37	33603.5
			302-29-01.0	122-29-26.9	VICTOR	3.6669128	4644.22	15236.9
ZEBRA (*)	N	11-33-25.036	202-39-30.0	22-40-11.7	CHARLIE	4.2113903	16270.10	53379.5
	E	165-14-05.823	256--42-24.7	76-43-53.3	COCA	4.1387033	13762.69	45153.1
			305-36-46.5	125-37-01.9	YOKE	3.4599448	2883.66	9460.8
USN-AIR	N	11-30-24.906	268-00-01.4	88-01-44.6	USN-ENYU	4.1956022	15689.25	51473.8
	E	165-24-55.168	345-50-39.4	165-50-39.7	OBOE	2.2700407	186.23	610.977
USN-ENYU	N	11-30-42.595	88-01-44.6	268-00-01.4	USN-AIR	4.1956022	15689.25	51473.8
	E	165-33-32.574	87-21-45.3	267-20-02.4	OBOE	4.1945443	15651.08	51348.6

NOTE: USN-ENYU = STA. NAN

*THIRD ORDER STATIONS

Bikini Atoll, M. I.
DATUM U S N 1946

Scientific Stations

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		AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE LOG	METERS	FEET
WP-20	N 11-41-26.895	264-13-36.2	84-13-50.0	Charlie	3.3161382	2070.80	6793.94
	E 165-16-24.754	321-43-47.7	141-44-48.9	Coca	4.1711207	14829.28	48652.4
WP-30.10,	N 11-39-58.546	218-50-44.4	38-50-59.1	Fox	3.5440184	3499.60	11481.6
90.40	E 165-23-13.741	248-24-16.1	68-24-46.0	USN-MON	3.6816798	4804.85	15763.9
WP-50	N 11-29-48.014	173-45-39.2	353-45-32.1	Coca	3.9951247	9888.37	32442.1
	E 165-22-03.388	266-19-24.6	86-19-33.0	Salt	3.1048079	1272.94	4176.318
WP-60	N 11-37-39.493	302-01-31.8	122-01-39.7	Aomon	3.1469710	1402.72	4601.1
Eniwetok	E 162-18-48.326	16-44-25.3	196-44-15.8	Coral	4.0104251	10242.95	33605.4

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BIKINI ATOLL M.I.
PLANE GRID

FROM ANTON SINLEALLI TO
DIANE S. NIXON

CASTLE GRID
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	DISTANCE	LATITUDE	DEPARTURE	COORDINATES NORTH	COORDINATES EAST	
ALFA to *				124,153.2	59003.9	1
Bravo *	N35-31-51.8W 3814.2	N3104.0	W 2216.6	127,257.2	56787.3	2
Charlie	N26-54-08.0E 52865.1	N47144.0	E23919.9	171,297.2	82923.8	3
Coca	N80-05-55.1E 47989.6	N8251.9	E47274.8	132,405.1	106278.7	4
Yoke	S55-19-57.6E 13390.0	S7616.4	E11012.9	116,536,8	70016.8	5
Zebra *	S57-41-36.9E 3934.0	S2102.5	E 3325.0	122,050.7	62328.9	6
						7
BRAVO to *				127,257.2	56787.3	8
Charlie	N30-41-16.3E 51211.7	N44040.0	E26136.4	171,297.2	82923.8	9
Coca	N84-03-42.1E 49758.4	N 5147.9	E49491.4	132,405.1	106278.7	10
Yoke	S50-58-49.9E 17027.8	S10720.4	E13229.4	116,536.8	70016.8	11
Alfa *	S35-31-51.8E 3814.2	S 3104.0	E 2216.6	124,153.2	59003.9	12
						13
CHARLIE to				171,297.2	82923.8	14
Fox	S89-05-02.6E 41084.2	S 656.8	E41078.9	170,640.4	124002.7	15
Coca	S30-59-06.2E 45365.7	S38892.1	E23354.9	132,405.1	106278.7	16
Yoke	S13-15-45.2W 56261.0	S54760.4	W12907.00	116,536.8	70016.8	17
Zebra *	S22-41-40.8W 53379.5	S49246.5	W20594.9	122,050.7	62328.9	18
Alfa *	S26-54-08.0W 52865.1	S47144.0	W23919.9	124,153.2	59003.9	19
Bravo *	S30-41-16.3W 51211.7	S44040.0	W26136.4	127,257.2	56787.3	20
						21
COCA to				132,405.1	106278.7	22
Oboe	S35-28-01.0E 35760.9	S29125.5	E20749.7	103,279.6	127028.4	23
Salt	S13-30-58.0E 32894.5	S31983.4	E 7688.1	100,421.6	113966.8	24
Uncle	S12-17-23.3W 33312.0	S32548.6	W 7090.7	99,856.5	99188.1	25
Yoke	S66-21-56.6W 39582.0	S15868.3	W36262.0	116.536.8	70016.8	26

* Third Order Stations

OFFICIAL USE ONLY

BIKINI ATOLL M.I.
PLANE GRID

CASTLE GRID
JOB NO. 884 SHEET 2 OF 5

COCA to					132,405.1	106,278.7	4
Charlie	N30-59-06.2W	45365.7	N38892.1	W23354.9	171,297.2	82,923.8	5
Fox	N24-52-12.1E	42143.6	N38235.4	E17724.0	170,640.4	124,002.7	6
N.How	N75-15-57.1E	62881.4	N15992.9	E60813.6	148,398.0	167,092.4	7
							8
FOX to					170,640.5	124,002.7	9
N. How	S62-41-51.5E	48491.7	S22242.5	E43089.7	148,398.0	167,092.4	10
Oboe	S 2-34-18.8E	67428.8	S67360.9	E 3025.7	103,279.6	127,028.4	11
Coca	S24-52-12.1W	42143.6	S38235.4	W17724.0	132,405.1	106278.7	12
Charlie	N89-05-02.6W	41084.2	N 656.8	W41078.9	171,297.2	82,923.8	13
							14
N.HOW to					148,398.0	167,092.4	15
S. How	S43-05-16.1E	11979.6	S8748.8	E 8183.5	139,649.2	175,275.8	16
Nan	S14-43-26.3E	44180.7	S42729.9	E11229.1	105,668.1	178,321.5	17
Oboe	S41-36-15.3W	60339.0	S45118.4	W40064.0	103,279.6	127,028.4	18
Coca	S75-15-57.1W	62881.4	S15992.9	W60813.6	132,405.1	106,278.7	19
Fox	N62-41-51.5W	48491.7	N22242.5	W43089.7	170,640.4	124,002.7	20
							21
S.HOW to					139,649.2	175,275.8	22
Nan	S 5-07-17.6E	34117.3	S33981.1	E 3045.6	105,668.1	178,321.5	23
Oboe	S52-59-25.8W	60419.9	S36369.6	W48247.4	103,279.6	127,028.4	24
N. How	N43-05-16.1W	11979.6	N 8748.8	W 8183.5	148,398.0	167,092.4	25
							26
JIG to *					134,031.4	174,623.8	27
Nan	S 7-25-39.3E	28603.3	S28363.3	E 3697.7	105,668.1	178,321.5	28
Oboe	S57-07-59.3W	56665.6	S30751.8	W47595.4	103,279.6	127,028.4	29

* Third Order Stations

LOVE to *					124,579.8	177,992.7
Nan	S 0-59-45.3E	18914.605	S18911.7	E 328.8	105,668.1	178,321.5
Oboe	S67-19-04.0W	55236.4	S21300.2	W50964.3	103,279.6	127,028.4
MIKE to *					119,842.4	178,173.8
Nan	S 0-35-48.1E	14175.1	S14174.3	E 147.7	105,668.1	178,321.5
Oboe	S72-03-21.9W	53760.4	S16562.8	W51145.4	103,279.6	127,028.4
NAN to					105,668.1	178,321.5
Oboe	S87-20-02.1W	51348.6	S 2388.5	W51293.1	103,279.6	127,028.4
N. How	N14-43-26.3W	44180.7	N42729.9	W11229.1	148,398.0	167,092.4
Jig *	N 7-25-39.3W	28603.3	N28363.3	W 3697.7	134,031.4	174,623.8
S. How	N 5-07-17.6W	34117.3	N33981.1	W 3045.6	139,649.2	175,275.8
Love *	N 0-59-45.3W	18914.6	N18911.7	W 328.8	124,579.8	177,992.7
Mike *	N 0-35-48.1W	14175.1	N14174.3	W 147.7	119,842.4	178,173.8
OBOE to					103,279.6	127,028.4
Salt	S77-39-28.5W	13370.6	S 2857.9	W13061.6	100,421.6	113,966.8
Uncle	S82-59-25.4W	28050.0	S 3423.1	W27840.3	99,856.5	99, 188.1
Coca	N35-28-01.0W	35760.9	N29125.5	W20749.7	132,405.1	106,278.7
Fox	N 2-34-18.8W	67428.8	N67360.9	W 3025.7	170,640.4	124,002.7
N. How	N41-36-15.3E	60339.0	N45118.4	E4006400	148,398.0	167,092.4
S. How	N52-59-25.8E	60419.9	N36369.6	E48247.4	139,649.2	175,275.9
Jig *	N57-07-59.3E	56665.6	N30751.8	E47595.4	134,031.4	174,623.8
Love *	N67-19-04.0E	55236.4	N21300.2	E50964.3	124,579.8	177,992.7
Mike *	N72-03-21.9E	53760.4	N16562.8	E51145.4	119,842.4	178,173.8
Nan	N87-20-02.1E	51348.6	N2388.5	E51293.1	105,668.1	178,321.5

* Third Order Stations

BIKINI ATOLL M.I.
PLANE GRID

CASTLE GRID

JOB NO. 884 SHEET 3 of 5

BIKINI ATOLL M.I.
PLANE GRID

CASTLE GRID

Station	Bearing	Distance	Latitude	Departure	Coordinates North	Coordinates East
SALT to					100,421.6	113,966.8
	S87-48-36.0W	14789.5	S 565.2	W14778.7		
Uncle					99,856.5	99,188.1
	N13-30-58.0W	32894.5	N31983.4	W 7688.1		
Coca					132,405.1	106,278.7
	N77-39-28.5E	13370.6	N 2857.9	E13061.6		
Oboe					103,279.6	127,028.4
UNCLE to					99,856.5	99,188.1
	N62-31-10.2W	18398.7	N 8490.0	W16322.8		
Victor *					108,346.5	82,865.3
	N60-14-20.0W	33603.5	N16680.3	W29171.3		
Yoke					116,536.8	70,016.8
	N12-17-23.3E	33312.0	N32548.6	E 7090.7		
Coca					132,405.1	106,278.7
	N82-59-25.4E	28050.0	N 3423.1	E27840.3		
Oboe					103,279.6	127,028.4
	N87-48-36-0E	14789.5	N 565.2	E14778.7		
Salt					100,421.6	113,966.8
VICTOR to *					108,346.5	82,865.3
	N 57-29-04.0W	15236.9	N 8190.3	W12848.5		
Yoke					116,536.8	70,016.8
	N44-13-17.2E	33570.9	N24058.6	E23413.4		
Coca					132,405.1	106,278.7
	S62-31-10.2E	18398.7	S 8490.0	E16322.8		
Uncle					99,856.5	99,188.1
YOKE to					116,536.8	70,016.8
	N54-21-03.0W	9460.8	N 5513.9	W 7687.8		
Zebra- *					122,050.7	62,328.9
	N55-19-57.6W	13390.0	N 7616.4	W11012.9		
Alfa *					124,153.2	59,003.9
	N50-58-49.9W	17027.8	N10720.4	W13229.4		
Bravo *					127,257.2	56,787.3
	N13-15-45.2E	56261.0	N54760.4	E12907.0		
Charlie					171,297.2	82,923.8
	N66-21-56.6E	39582.0	N15868.3	E36262.0		
Coca					132,405.1	106,278.7
	S60-14-20.0E	33603.5	S16680.3	E29171.3		
Uncle					99,856.5	99,188.1
	S57-29-04.0E	15236.9	S 8190.3	E12848.5		
Victor *					108,346.5	82,865.3

BIKINI ATOLL M.I.

PROJECTION PLANE GRID

CASTLE GRID

JOB NO. 884 SHEET 5 OF 5

	BEARING	DISTANCE	LATITUDE	LONGITUDE	COORDINATES NORTH	COORDINATES EAST
ZEBRA to *					122,050.7	62,328.9
Charlie	N22-41-40.8E	53379.5	N49246.5	E20594.9	171,297.2	82,923.8
Coca	N76-44-35.2E	45153.1	N10354.4	E43949.8	132,405.1	106,278.8
Yoke	S54-21-03.0E	9460.8	S 5513.9	E 7687.8		

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

OFFICIAL USE ONLY

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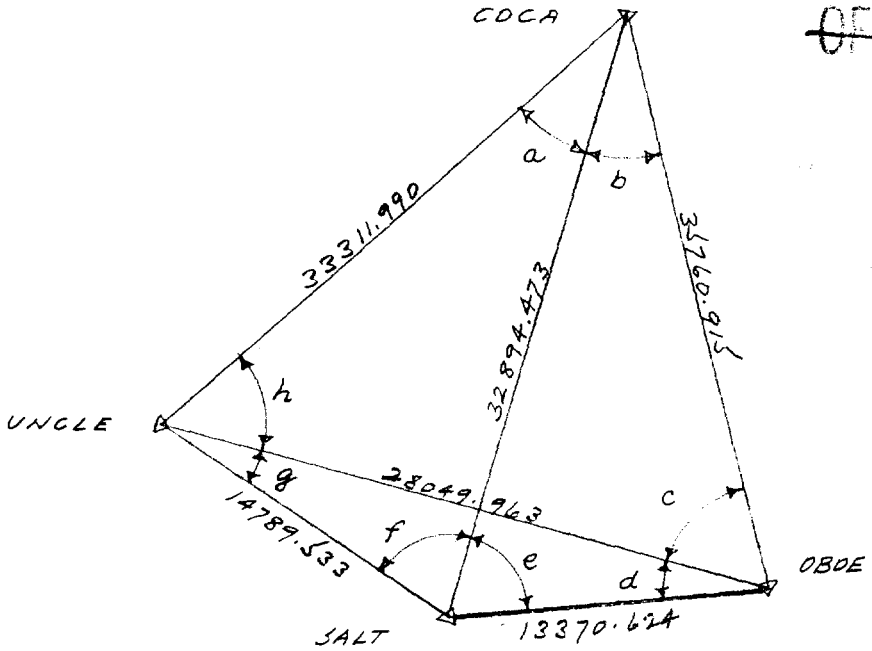
HOLMES & NARVER, INC.
ENGINEERS · CONSTRUCTORS
LOS ANGELES, CALIFORNIA

JOB NO. 884
SHEET 1 OF 2

TITLE QUADRANGLE ADJUSTMENT COCA-UNCLE
BY LSH DATE 7-53



	MEAS ∠	GEO. COND.		TRIG. COND.	
		A	B		
a	25-48-21.0	21.1	21.8	21.3	
b	21-57-03.3	03.4	02.5	03.0	
c	61-32-35.0	35.1	34.1	33.6	
d	5-19-57.1	57.1	56.4	56.9	
e	91-10-27.6	27.7	27.0	26.5	
f	78-40-24.4	24.5	25.5	26.0	
g	4-49-10.2	10.2	11.1	10.6	
h	70-42-00.8	00.9	01.6	02.1	

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

Log Sin.	a	9.6388149	43.5	Log Sin	b	9.5726492	52.7
	c	9.9440745	11.4		d	8.9681675	225.9
	e	9.9999084	0.4		f	9.9914586	4.7
	g	8.9243896	249.4		h	9.9748816	7.4
		8.5071874	304.7			8.5071569	289.7
		569	289.7				
		305	594.4				

305 / 594.4 = 0.51"

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

JOB NO. 884
SHEET 2 OF 2

TITLE QUADRANGLE ADJUSTMENT COCA-UNCLE BY LSH DATE 7-63

~~OFFICE USE ONLY~~

	(99979007)	(91965117)
13370.624	Sin 91-10-26.5	Sin 66-52-30.5
Sin. 21-57-03.0	35760.915	32894.473
(37381082)		

E.

	(98052526)	(43532407)
32894.473	Sin 78-40-26.0	Sin 25-48-21.3
Sin 75-31-12.7	33311.990	14789.533
(96823583)		

	(17626160)	(09293480)
13370.624	Sin 169-50-52.5	Sin 5-19-56.9
Sin 4-19-10.6	28049.963	14789.482
(08401892)		

E2

	(87917220)	94380432
28049.963	Sin 61-32-33.6	Sin 70-42-02.1
Sin 47-45-243	33311.949	35760.869
(74029734)		

STATION	BEARING	COURSE	COSINE	SINE	LATITUDE	DEPARTURE	CO-ORDINATES NORTH	CO-ORDINATES EAST
USN- AIR							103,872.000	126,879.000
	S 14-09-20.6 E	610.977	96963463	24455813	S 592.424	E 149.419		
OBOE							103,279.580	127,028.420
	S 77-39-28.5 W	13370.624	21374796	97688884	S 2857.944	W 13061.613		
SALT							100,421.636	113,966.807
	S 87-48-36.0 W	14789.533	03821340	99926960	S 565.158	W 14778.731		
UNCLE							99,856.478	99,188.076
	N 12-17-23.3 E	33311.990	97708346	21285616	N 32548.594	E 7090.662		
COCA							132,405.072	106,278.738
	S 35-28-01.0 E	35760.915	81445041	58023317	S 29125.492	E 20749.669		
OBOE							103,279.580	127,028.407
COCA							132,405.072	106,278.738
	S 13-30-58.0 E	32894.473	97230424	23371878	S 31983.436	E 7688.056		
SALT							100,421.636	113,966.794
OBOE							103,279.580	127,028.420
	S 82-59-25.4 W	28049.963	12203584	99252570	S 3423.101	W 27840.309		
UNCLE							99,856.479	99,188.111

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

CALC. BY LSH
CHKD. BY
DATE 7-53
TRAVERSE OBOE-SALT-UNCLE-COCA
SHEET NO. 884

OFFICIAL USE ONLY

OFFICIAL USE ONLY

COMPUTATION OF TRIANGLES

COCA-UNCLE

COMPUTED BY LSH CHECKED BY DATE 7-23-53

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHMS
2-3						4075.3743	3.6101675
1	COCA	21-57-03.3	-0.3	03.0	0.0	03.0	0.4273481
2	OBOE	66-52-32.1	-1.6	30.5	0.0	30.5	9.9636231
3	SALT	91-10-27.6	-1.0	26.6	0.1	26.5	9.9999088
1-3		03.0				10026.25	4.0011387
1-2						10899.95	4.0374244
2-3							4.0011387
1	UNCLE	75-31-11.0	+1.7	12.7	0.0	12.7	0.0140188
2	COCA	25-48-21.0	+0.3	21.3	0.0	21.3	9.6388127
3	SALT	78-40-24.4	+1.7	26.1	0.1	26.0	9.9914588
1-3		56.4				4507.86	3.6539702
1-2						8549.51	4.0066163
2-3						4075.3743	3.6101675
1	UNCLE	4-49-10.2	+0.4	10.6	0.0	10.6	1.0756230
2	OBOE	5-19-57.1	-0.2	56.9	0.0	56.9	8.9681788
3	SALT	169-50-52.0	+0.5	52.5	0.0	52.5	9.2461577
1-3		59.3				4507.85	3.6539693
1-2						8549.55	3.9319482
2-3							3.9319482
	COCA	47-45-24.3	0.0	24.3	0.0	24.3	0.1305938
	OBOE	61-32-35.0	-1.3	33.7	0.1	33.6	9.9440740
	UNCLE	70-42-00.8	+1.4	02.2	0.1	02.1	9.9748820
		00.1				10153.50	4.0066160
						10899.94	4.0374240

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 7-31-53

		°	′	″					°	′	″
N. HOW	OBOE	41	37	36.3	α	3 OBOE	to 2 N. HOW		221	36	15.5
		+ 33	39	42.0	3d ∠		8		− 77	04	16.6
N. HOW	COCA	75	17	18.3	α	3 OBOE	to 1 COCA		144	31	58.9
		−	02	03.1	Δα				−	0	41.8
		180	00	00.0					180	00	00.0
COCA	N. HOW	255	15	15.2	α′	1 COCA	to 3 OBOE		324	31	17.1

THIRD ANGLE OF TRIANGLE 69-16-01.9

					°	′	″		°	′	″				°	′	″
11	37	46.528	N. HOW	λ	165	31	39.801	φ	11	30	19.029	3	OBOE	λ	165	24	56.671
−	02	38.593		Δλ	−	10	11.884	Δφ	+	04	48.906			Δλ	−	03	28.754
11	35	07.935	COCA	λ′	165	21	27.917	φ′	11	35	07.935	1	COCA	λ′	165	21	27.917

4.2825381		11-36-27.232		4.0374241			½(φ+φ′)	11-32-43.482	
9.4047542				9.9108644				Logarithms	Values seconds
8.5124969		4.2825381		8.5125007			s	4.0374241	
2.1997892	+158.4124	9.9855237		2.4607892	1st term	−288.9277	Sin α	9.7636029	
8.56507		8.5096673		8.07485			A′	8.5096673	
9.97105		0.0089397		9.52721			Sec φ′	0.0089397	
0.72018		2.7866688	−611.8835	0.71540			Δλ	2.3196340	−208.7536
9.25630	0.1804	9.3036436		8.31746	2d term	+0.0208	Sin ½(φ+φ′)	9.3013438	
4.3996		2.0903124	+123.116	4.9216			−Δα	1.6209778	+41.781
1.9876				1.9833					
6.3872	0.0002			6.9049	3d term	+0.0008			
	+158.5930				−Δφ	−288.9061			

JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

SECOND ORDER TRIANGULATION COMPUTATION

SHEET NO 4 SH DATE 8-3-53

COCA		OBOE	324	31	17.1	α	3	OBOE	to 2	COCA	144	31	58.9
			+ 21	57	03.0	$3^d\angle$			8		- 66	52	30.5
COCA		SALT	346	28	20.1	α	3	OBOE	to 1	SALT	77	39	28.4
			+	0	15.5	$\Delta\alpha$					-	0	26.2
			180	00	00.0						180	00	00.0
SALT		COCA	166	28	35.6	α'	1	SALT	to 3	OBOE	257	39	02.2

TRIANGLE 91-10-26.6

11 35 07.935		COCA	λ	165	21	27.917	ϕ	11	30	19.029	3 OBOE	λ	165	24	56.671
- 05 17.265			$\Delta\lambda$	+ 01	17	17.388	$\Delta\phi$	-	0	28.359		$\Delta\lambda$	-	02	11.366
11 29 50.670		SALT	λ'	165	22	45.305	ϕ'	11	29	50.670	1 SALT	λ'	165	22	45.305

$\frac{1}{2}(\phi+\phi')$ 11-32-29.303

	Logarithms	Values in seconds
s	3.6101675	
Cos α	9.3299030	
B	8.5125007	
h	1.4525712	1st term +28.3512

$\frac{1}{2}(\phi+\phi')$ 11-30-04.849

	Logarithms	Values in seconds
s	3.6101675	
Sin α	9.9898451	
	8.5096681	
	0.0088033	
$\Delta\lambda$	2.1184840	-131.3663
	9.2997066	
	1.4181895	+26.193

			Logarithms	Values in seconds
4.0011390				
9.9877809				
8.5124983				
2.5014182	+317.2621	Sin α	9.3690605	
8.00228			8.5096681	
8.73812			0.0088033	
0.71848			1.8886709	+77.3875
7.4589	0.0029		9.3011976	
5.0028			1.1898685	-15.483
1.9861				
6.9889	0.0001			
	+317.2651			

	0.0082		
	0.0000		
	+28.3594		

OFFICIAL USE ONLY

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-53

				°	′	″
α	2 COCA	to 3	SALT	346	28	20.1
2d ∠		8		+ 25	48	21.3
α	2 COCA	to 1	UNCLE	12	16	41.4
Δα				−	0	14.3
				180	00	00.0
α′	1 UNCLE	to 2	COCA	192	16	27.X (2)

				°	′	″
α	3 SALT	to 2	COCA	166	28	35.6
3d ∠		8		− 78	40	26.1
α	3 SALT	to 1	UNCLE	87	48	09.5
Δα				−	0	29.6
				180	00	00.0
α′	1 UNCLE	to 3	SALT	267	47	39.9

FIRST ANGLE OF TRIANGLE 75-31-12.7

	°	′	″	Station		°	′	″
φ	11	35	07.935	2 COCA	λ	165	21	27.917
Δφ	−	05	22.902		Δλ	−	01	11.247
φ′	11	29	45.033	1 UNCLE	λ′	165	20	16.670

	°	′	″	Station		°	′	″
φ	11	29	50.670	3 SALT	λ	165	22	45.305
Δφ	−	0	05.636		Δλ	−	02	28.634
φ′	11	29	45.034	1 UNCLE	λ′	165	20	16.67[illegible]

	Logarithms	Values in seconds	
s	4.0066167		
cos α	9.9899509		
B	8.5124983		
h	2.5090659	1st term	+322.8983
s²	8.01323		
sin² α	8.65536		
C	0.71848		
	7.38707	2d term	+0.0024
h²	5.0181		
D	1.9861		
	7.0042	3d term	+0.0010
		−Δφ	+322.9017

$\frac{1}{2}(\phi+\phi')$ 11-32-26.484

	Logarithms	Values in seconds
s	4.0066167	
Sin α	9.3276819	
A′	8.5096682	
Sec φ′	0.0088009	
Δλ	1.8527677	−71.2472
Sin ½(φ+φ′)	9.3011685	
−Δα	1.1539362	+14.254

	Logarithms	Values in seconds	
s	3.6539695		
Cos α	8.5836773		
B	8.5124910		
h	0.7501378	1st term	+5.6252
s²	7.30794		
Sin² α	9.99936		
C	0.71508		
	8.02238	2d term	+0.0105
h²	1.5003		
D	1.9830		
	3.4833	3d term	+0.0000
		−Δφ	+5.6357

$\frac{1}{2}(\phi+\phi')$ 11-29-47.852

	Logarithms	Values in seconds
s	3.6539695	
Sin α	9.9996805	
A′	8.5096682	
Sec φ′	0.0088009	
Δλ	2.1721191	−148.634
Sin ½(φ+φ′)	9.2995296	
−Δα	1.4716487	+29.624

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

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-53

		°	'	"				°	'	"
α	2 to 3				α	3 to 2				
	S	+			$3^d\angle$	a		−		
α	OBOE to 1 UNCLE	82	59	25.2	α	3 to 1				
		−	0	55.8	Δα					
		180	00	00.0				180	00	00.0
α'	UNCLE to 2 OBOE	262	58	29.4	α'	1 to 3				

FIRST ANGLE OF TRIANGLE

	° ' "			°	'	"		°	'	"			°	'	"
φ	11 30 19.029	2 OBOE	λ	165	24	56.671	φ				3	λ			
Δφ	− 0 33.996		Δλ	−	04	40.001	Δφ					Δλ			
φ'	11 29 45.033	1 UNCLE	λ'	165	20	16.670	φ'				1	λ'			

	Logarithms	Values in seconds	
s	3.9319489		
Cos α	9.0864908		
B	8.5125007		
h	1.5309404	1st term	+339.579
s^2	7.86390		
$Sin^2 α$	9.99348		
C	0.71540		
	8.57278	2d term	+0.0374
h^2	3.0619		
D	1.9863		
	5.0482	3d term	+0.0000
		−Δφ	+33.996

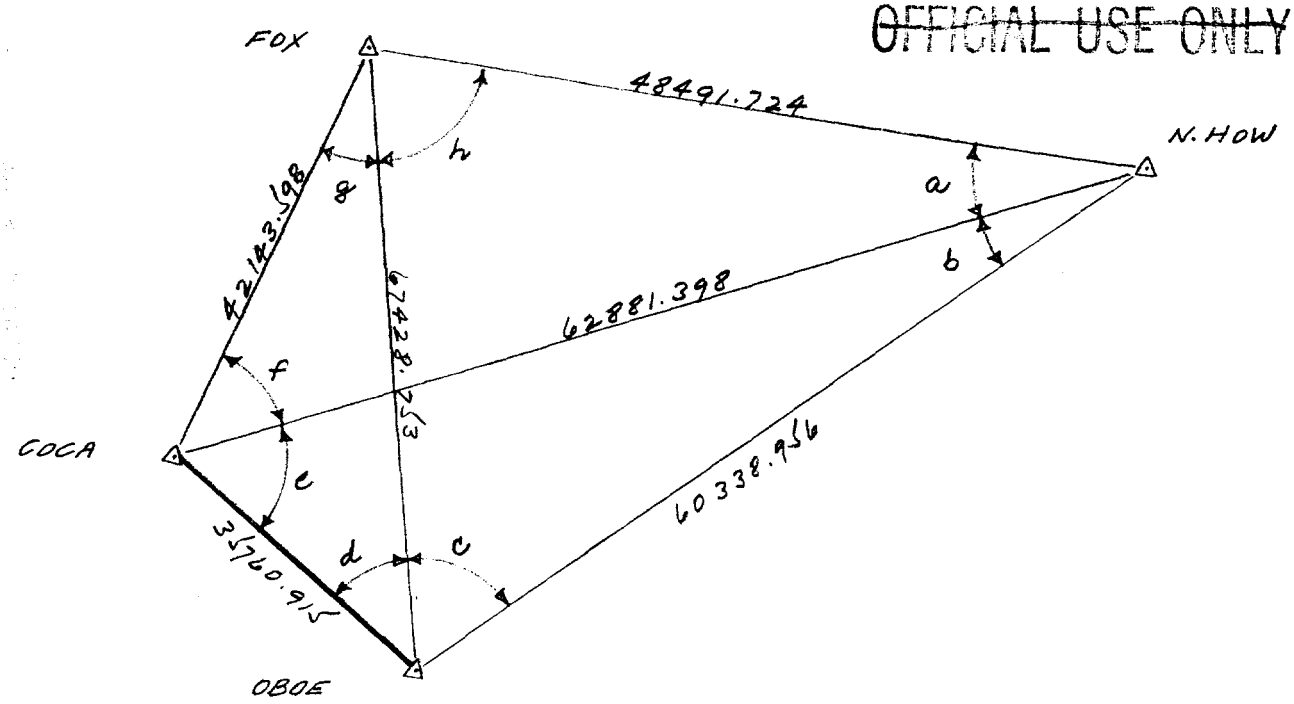
$\frac{1}{2}(\phi+\phi')$ 11-30-02.031

	Logarithms	Values in seconds
s	3.9319489	
Sin α	9.9967418	
A'	8.5096682	
Sec φ'	0.0088009	
Δλ	2.4471598	−280.001"
$Sin\frac{1}{2}(\phi+\phi')$	9.2996763	
−Δα	1.7468361	+55.826

	Logarithms	Values in seconds	
s			
Cos α			
B			
h		1st term	
s^2			
$Sin^2 α$			
C			
		2d term	+
h^2			
D			
		3d term	+
		−Δφ	

$\frac{1}{2}(\phi+\phi')$

	Logarithms	Values in seconds
s		
Sin α		
A'		
Sec φ'		
Δλ		
$Sin\frac{1}{2}(\phi+\phi')$		
−Δα		



	MEAS. ∠	GEO. COND.		TRIG. COND.		
a	42-02-10.4	09.7	09.9	11.3	11.4	
b	33-39-43.5	42.8	43.3	41.9	41.8	
c	44-10-32.8	32.1	32.7	34.1	~~34.2~~	34.1
d	32-53-44.5	43.8	43.6	42.2	~~42.1~~	42.2
e	69-16-01.3	00.6	00.4	01.8	01.9	
f	50-23-47.7	47.0	46.5	45.1	45.0	
g	27-26-30.8	30.1	29.5	30.9	~~31.0~~	30.9
h	60-07-34.6	33.9	34.1	32.7	~~32.6~~	32.7

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

Log Sin	a	9.8258145	23.4	Log Sin	b	9.7437393	31.6
	c	9.8431465	21.7		d	9.7348859	32.6
	e	9.9709225	8.0		f	9.8867566	17.4
	g	9.6635532	40.6		h	9.9380812	12.1
		9.3034367	93.7			9.3034630	93.7
						367	93.7
						263	187.4

263 / 187.4 = 1.40"

Log Sin a — 178
c 495
e 226
g. 589
488

Log Sin b 324
d 813
f 542
h. 795
499
488
11

11 / 187.4 = 0.06"

35760.915
Sin 33-39-41.8
(55428688)

(97464883)
Sin 77-04-16.3
62881.398

(93524149)
Sin 69-16-01.9
60338.956

R1

62881.398
Sin 87-34-03.6
(99909904)

(66960389)
Sin 42-02-11.4
42143.598

(77046689)
Sin 50-23-45.0
48491.724

35760.915
Sin 27-26-30.9
(46084917)

(54310199)
Sin 32-53-42.2
42143.559

(86895105)
Sin 119-39-46.9
67428.753

R2

67428.753
Sin 75-41-53.2
(96900759)

(69686648)
Sin 44-10-34.1
48491.713

(86712069)
Sin 60-07-32.7
60338.915

OFFICIAL USE ONLY

STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	CO-ORDINATES NORTH	CO-ORDINATES EAST
COCA							132,405.072	106,278.738
	N 24-52-12.1 E	42143.598	90726414	42056127	N 38235.375	E 17723.965		
FOX							170,640.447	124,002.703
	S 62-41-51.5 E	48491.724	45868618	88859833	S 22242.484	E 43089.665		
N. HOW							148,397.963	167,092.368
	S 41-36-15.3 W	60338.956	74774884	66398168	S 45118.384	W 40063.961		
OBOE							103,279.579	127,028.407
COCA							132,405.072	106,278.738
	N 75-15-57.1 E	62881.398	25433423	96711638	N 15992.892	E 60813.630		
N. HOW							148,397.964	167,092.368
OBOE							103,279.580	127,028.420
	N 2-34-18.8 W	67428.788	99899270	04487268	N 67360.867	W 3025.710		
FOX							170,640.447	124,002.710

CALC. BY LSH
CKD. BY
DATE 7-53
TRAVERSE COCA-FOX-N.HOW-OBOE
JOB NO. 884
SHEET NO. OF

~~OFFICIAL USE ONLY~~

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

COMPUTATION OF TRIANGLES

FOX - N. HOW

COMPUTED BY L.S.H. CHECKED BY DATE 7-23-53

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						10899.94	4.0374241
1	N. HOW	33-39-43.5	-1.5	42.0	0.2	41.8	0.2562654
2	OBOE	77-04-17.3	-0.7	16.6	0.3	16.3	9.9888481
3	COCA	69-16-01.3	+0.6	01.9	0.0	01.9	9.9709237
1-3		02.1				19166.27	4.2825376
1-2						18391.33	4.2646132
2-3							4.2825376
1	FOX	87-34-05.4	-1.5	03.9	0.3	03.6	0.0003914
2	N. HOW	42-02-10.4	+1.2	11.6	0.2	11.4	9.8258179
3	COCA	50-23-47.7	-2.7	45.0	0.0	45.0	9.8867540
1-3		03.5				12845.38	4.1087469
1-2						14780.29	4.1696830
2-3						10899.94	4.0374241
1	FOX	27-26-30.8	+0.2	31.0	0.1	30.9	0.3364412
2	OBOE	32-53-44.5	-2.1	42.4	0.2	42.2	9.7348814
3	COCA	119-39-49.0	-2.1	46.9	0.0	46.9	9.9389953
1-3		04.3				12845.37	4.1087467
1-2						20552.31	4.3128606
2-3							4.3128606
1	N. HOW	75-41-53.9	-0.4	53.5	0.3	53.2	0.0136728
2	OBOE	44-10-32.8	+1.5	34.3	0.2	34.1	9.8431496
3	FOX	60-07-34.6	-1.7	32.9	0.2	32.7	9.9380795
1-3		01.3				14780.29	4.1696830
1-2						18391.32	4.2646129

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY L S H DATE 7-28-53

NAN	OBOE	87	21	45.3	α	3	OBOE	to 2	NAN	267	20	02.4
		+ 77	56	31.8	3dL			@		- 45	43	46.9
NAN	N. HOW	165	18	17.1	α	3	OBOE	to	N. HOW	221	36	15.5
		- 0	22.6		Δα					+ 01	20.8	
		180	00	00.0						180	00	00.0
N. HOW	NAN	345	17	54.5	α'	1	N. HOW	to 3	OBOE	41	37	36.3

Sum of Triangle 56-19-41.8

11 30 42.595	NAN	165	33	32.574	φ	11	30	19.029	OBOE	165	24	56.671
+ 07 03.933		- 01	52.773	Δφ	+ 07	27.500			Δλ	+ 06	43.130	
11 37 46.528	N. HOW	165	31	39.801	φ'	11	37	46.529	N. HOW	165	31	39.801

	Logarithms	Values in seconds
½(φ+φ')	11-34-14.562	
s	4.1292483	
Cos α	9.9855562	
b	8.5125005	
h	2.6273050	-423.9406
A'	8.25850	
Sec φ'	8.80856	
Δλ	0.71563	
Sin²½(φ+φ')	7.78269	0.0061
-Δα	5.2546	
C	1.9835	
D	7.2381	0.0017
		-423.9328

	Logarithms	Values in seconds
s	4.1292483	
Cos α	9.9421824	
b	8.5096668	
h'	8.52923	
Sin²α	9.64431	
C	0.7540	
	2.0522058	-112.7732
	9.3022815	
	1.3544873	+22.620

	Logarithms	Values in seconds
s	4.2646138	
Cos α	9.8737554	
b	8.5125007	
h	2.6508699	1st term -447.5792
h'	8.52923	
Sin²α	9.64431	
C	0.7540	
	8.88894	2d term +0.0774
	5.3017	
D	1.9833	
	7.2850	3d term +0.0019
		-Δφ -447.4999

	Logarithms	Values in seconds
½(φ+φ')	11-34-02.779	
s	4.2646138	
Sin α	9.8221566	
A'	8.5096668	
Sec φ'	0.0090083	
Δλ	2.6054455	+403.1304
Sin²½(φ+φ')	9.3021603	
-Δα	1.9076058	-80.836

OFFICIAL USE ONLY

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 7-31-53

		°	′	″					°	′	″
N. HOW	COCA	75	17	18.3	α	3 COCA	to 2	N. HOW	255	15	15.2
		+42	02	11.6	3d ∠		8		−60	23	45.0
N. HOW	FOX	117	19	29.9	α	3 COCA	to 1	FOX	204	51	30.2
		−	01	27.6	Δα				+	0	36.0
		180	00	00.0					180	00	00.0
FOX	N. HOW	297	18	02.3	α′	1 FOX	to 3	COCA	24	52	06.2

TRIANGLE 87-34-03.9

					°	′	″		°	′	″			°	′	″
11	37	46.528	N. HOW	λ	165	31	39.801	φ	11	35	07.936	3 COCA	λ	165	21	27.917
	+03	40.723		Δλ	−	07	13.581	Δφ	+	06	19.316		Δλ	+	02	58.308
11	41	27.251	FOX	λ′	165	24	26.220	φ′	11	41	27.251	1 FOX	λ′	165	24	26.2[illegible]

			½(φ+φ′) 11-39-36.890			Logarithms	Values in seconds		½(φ+φ′) 11-38-17.593	
4.1696832			Logarithms	Values in seconds	s	4.1087473			Logarithms	Values in seconds
9.6618475					cos α	9.9577746				
8.5124969		s	4.1696832		B	8.5124983			s	4.1087473	
2.3440276	−220.8145	Sin α	9.9486170		h	2.5790202	1st term	−379.3326	Sin α	9.6236389	
8.33937		A′	8.5096662		s²	8.21749			A′	8.5096662	
9.89723		Sec φ′	0.0091042		Sin² α	9.24728			Sec φ′	0.0091042	
0.72018		Δλ	2.6370706	−433.5814	C	0.71848			Δλ	2.2511566	+178.3022
8.95678	0.0905	Sin ½(φ+φ′)	9.3055832			8.18325	2d term	+0.0152	Sin ½(φ+φ′)	9.3047734	
4.6881		−Δα	1.9426538	+87.630	h²	5.1580			−Δα	1.5559300	−35.969
1.9876					E	1.9861					
6.6757	0.0005					7.1441	3d term	+0.0014			
	−220.7235						Δφ	−379.3160			

JOB № 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

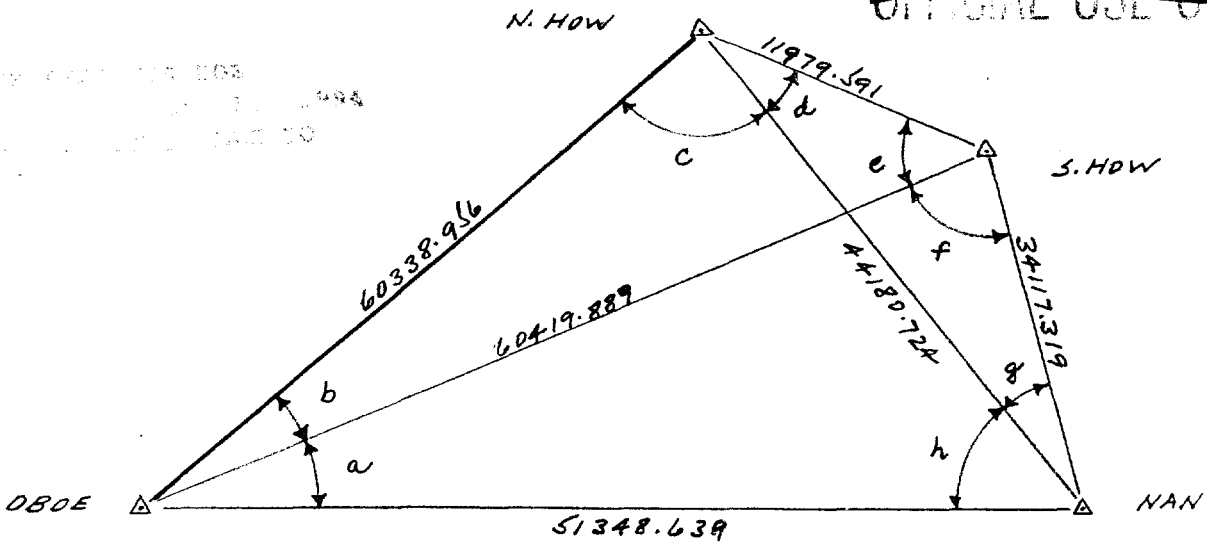
COMPUTED BY LSH DATE 8-3-54

		°	'	"				°	'	"
					α	3 to 2				
		+			3d ∠	8		−		
OBOE to FOX		177	25	41.3	α	3 to 1				
		−	0	06.1	Δα					
		180	00	00.0				180	00	00.0
FOX to OBOE		357	25	35.2	α'	1 to 3				

FIRST ANGLE OF TRIANGLE

			°	'	"		°	'	"			°	'	"
11 30 19.029	OBOE	λ	165	24	56.671	φ				3	λ			
+ 11 08.222		Δλ	−	0	30.451	Δφ					Δλ			
11 41 27.251	FOX	λ'	165	24	26.220	φ'				1	λ'			

Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds
4.3128613		½(φ+φ')	11-35-53.140		s			½(φ+φ')		
9.9995623			Logarithms	Values in seconds	Cos α				Logarithms	Values in seconds
8.5125007		s	4.3128613		B			s		
2.8249243	1st term −668.2274	Sin α	8.6519790		h		1st term	Sin α		
8.62572		A'	8.5096662		s²			A'		
7.30396		Sec φ'	0.0091044		Sin² α			Sec φ'		
0.71540		Δλ	1.4836109	−30.4516	C			Δλ		
6.64508	2d term 0.0004	Sin ½(φ+φ')	9.3032940				2d term +	Sin ½(φ+φ')		
5.6498		−Δα	0.7869049	+06.1	h²			−Δα		
1.9833					D					
7.6331	3d term 0.0043						3d term +			
	−668.22 2/3						−Δφ			



	MEAS. ∠	GEO. COND.		TRIG. COND.	
a	34-20-35.8	36.3	35.1	36.3	
b	11-23-11.8	12.3	11.7	10.5	
c	56-19-40.6	41.1	40.4	41.6	
d	28-21-49.3	49.8	51.0	49.8	
e	83-55-15.2	15.7	16.9	18.1	
f	58-06-43.4	43.9	44.6	43.4	
g	9-36-06.5	06.9	07.5	08.7	
h	77-56-33.5	34.0	32.8	31.6	

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

Log Sin	a	9.7513923	30.8	Log Sin	b	9.2954083	104.5
	c	9.9202403	14.0		d	9.6767612	39.0
	e	9.9975513	2.2		f	9.9289517	13.1
	g	9.2222080	124.4		h	9.9903114	4.5
		8.8913919	171.4			8.8914326	161.1
						3919	171.4
						407	332.5

407 / 332.5 = 1.22"

60338.956
Sim 83-55-18.1
(99437811)

(19742209)
Sim 11-23-10.5
11979.591

(99571188)
Sim 84-41-31.4
60419.889

R1

60419.889
Sim 87-32-40.3
(99908132)

(56415187)
Sim 34-20-36.3
34117.319

(84908285)
Sim 58-06-43.4
51348.639

60338.956
Sim 77-56-31.6
(97793704

(71605426)
Sim 45-43-46.8
44180.724

(83222732)
Sim 56-19-41.6
51348.630

R2

44180.724
Sim 142-02-015
(6519719)

(16681034)
Sim 9-36-08.7
11979.576

(47506886)
Sim 28-21-49.8
34117.331

HOLMES & NARVER INC. ENGINEERS - CONSTRUCTORS

TRAVERSE N. HOW-S. HOW-NAN-OBOE

CALC. BY LSH DATE 7-53 JOB NO. 884

CHKD. BY DATE SHEET NO. OF

OFFICIAL USE ONLY

STATION	[illegible]	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	CO-ORDINATES NORTH	CO-ORDINATES EAST
N. How							148,397.963	167,092.368
	S43-05-16.1E	11979.591	73030868	68311835	S 8748.799	E 8183.478		
S. How							139,649.164	175,275.846
	S5-07-17.6E	34117.319	99600755	08926902	S 33981.107	E 3045.620		
NAN							105,668.057	178,321.466
	S87-20-02.1W	51348.639	04651514	99891758	S 2388.489	W 51293.058		
OBOE							103,279.568	127,028.408
OBOE							103,279.580	127,028.420
	N52-59-25.8E	60419.889	60194743	79853572	N36369.597	E48247.440		
S. How							139,649.177	175,275.860
N. How							148,397.963	167,092.368
	S14-43-26.3E	44180.724	96716.150	25416.262	S42729.895	E 11229.089		
NAN							105,668.068	178321.457

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

OFFICIAL USE ONLY

~~OFFICIAL USE ONLY~~

COMPUTATION OF TRIANGLES

S. HOW – NAN

COMPUTED BY L.S.H. CHECKED BY DATE 7-23-53

STATION	OBSERVED ANGLE	CORR'N	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND SIDES	LOGARITHM
					18391.36	4.2646138
S. HOW	83-55-15.2	+3.0	18.2	0.1	18.1	0.0024485
OBOE	11-23-11.8	-1.3	10.5	0.0	10.5	9.2953957
N. HOW	84-41-29.9	+1.6	31.5	0.1	31.4	9.9981337
	56.9				3651.39	3.5624580
					18416.03	4.2651960
						4.2651960
NAN	87-32-40.0	+0.5	40.5	0.2	40.3	0.0003990
OBOE	34-20-35.8	+0.6	36.4	0.1	36.3	9.7513960
S. HOW	58-06-43.4	+0.1	43.5	0.1	43.4	9.9289500
	59.2				10398.99	4.0169910
					15651.10	4.1945450
					18391.36	4.2646138
NAN	77-56-33.5	-1.7	31.8	0.2	31.6	0.0096891
OBOE	45-43-47.6	-0.7	46.9	0.1	46.8	9.8549459
N. HOW	56-19-40.6	+1.2	41.8	0.2	41.6	9.9202419
	01.7				13466.32	4.1292488
					15651.10	4.1945448
						4.1292488
S. HOW	142-01-58.6	+3.0	01.6	0.1	01.5	0.2109857
NAN	9-36-06.5	+2.2	08.7	0.0	08.7	9.2222229
N. HOW	28-21-49.3	+0.5	49.8	0.0	49.8	9.6767565
	54.4				3651.38	3.5624574
					10398.99	4.0169910

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JOB NO. 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

COMPUTATION SECOND ORDER TRIANGULATION

L.S.H 8-3-53

N. HOW S. HOW 316 56 04.7
+ 0 1.67

S. HOW N. HOW 136 56 21.4

11 37 46.528 N. HOW 165 31 39.801
- 01 26.823 + 01 22.302
11 36 19.705 S. HOW 165 33 02.103

11-37-03.116

3.5624582
9.8636649
8.5124969
1.9386200 +86.8204
7.12492
9.66863
0.72018
7.51373 0.0034
3.9677
1.9876
5.9553 0.0001
+86.8238

3.5624582
9.8343134
8.5096671
0.0089707
1.9154094 +82.3018
9.3040113
1.2194207 - 16.7

[illegible] JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

COMPUTATION SECOND ORDER TRIANGULATION

L.S.H. 7-28-53

NAN	OBOE	87	21	45.3		OBOE	NAN	267	20	02.4
		87	32	40.5				34	20	36.4
NAN	S. HOW	174	54	25.8		OBOE	S. HOW	232	59	26.0
		−	0	06.1				+	01	37.2
S. HOW	NAN	354	54	19.7		S. HOW	OBOE	53	01	03.2

58-06-43.5

11 30 42.595	NAN	165 33 32.574	11 30 19.029	OBOE	165 24 56.671
+ 05 37.110		− 0 30.471	+ 06 00.676		+ 08 05.432
11 36 19.705	S. HOW	165 33 02.103	11 36 19.705	S. HOW	165 33 02.103
		11-33-31.150			11-33-19.367

4.0169903			4.2651958		
9.9982821			9.7795580		
8.5125005		4.0169903	8.5125007		4.2651958
2.5277729	−337.1110	8.9482648	2.5572545	−360.7900	9.9022947
8.03398		8.5096671	8.53039		8.5096671
7.89653		0.0089707	9.80459		0.0089707
0.71563		1.4838929 −30.4714	0.71540		2.6861283 +485.4319
6.64614	0.0004	9.3018347	9.05038	0.1123	9.3017135
5.0555		6.7857276 +6.106	5.1145		1.9878418 −97.239
1.9835			1.9833		
7.0890	0.0011		7.0978	0.0013	
	−337.1095			−360.6764	

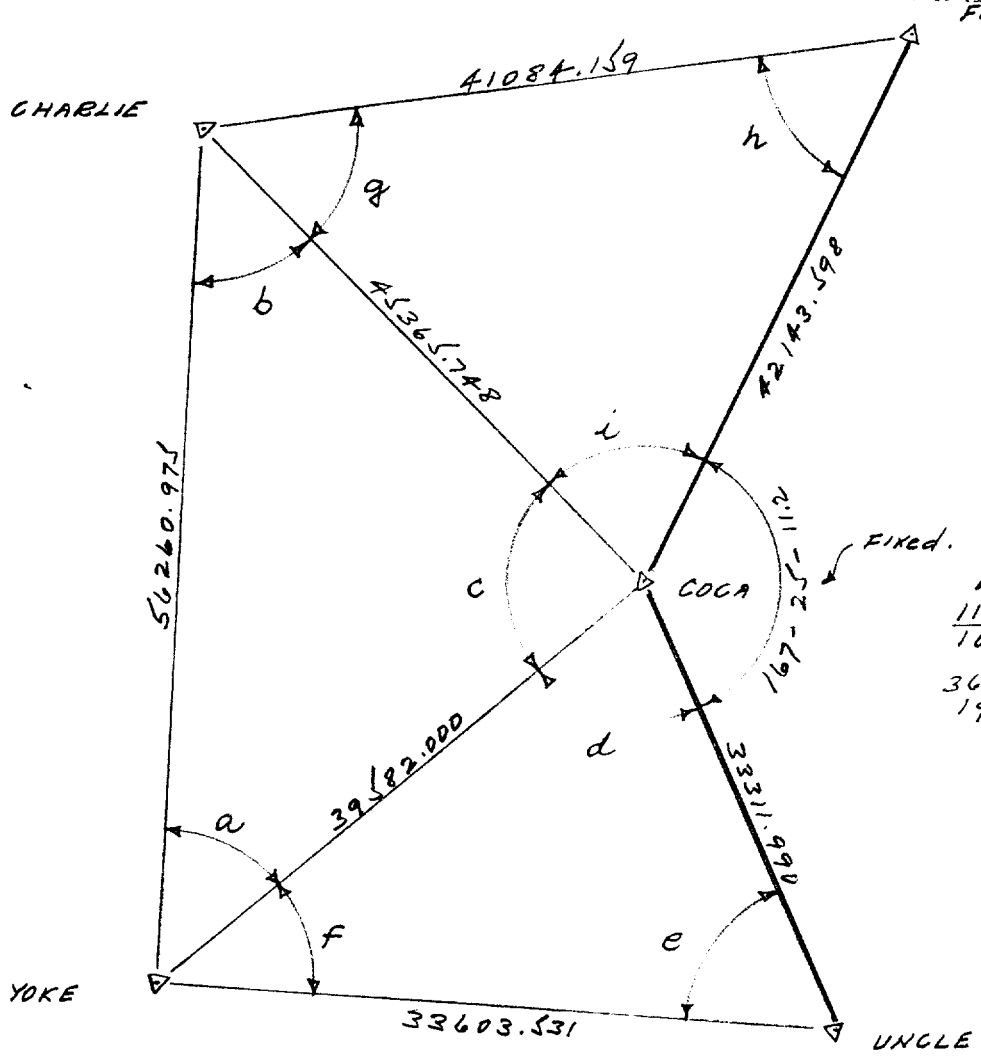
NOTE:- STA. NAN = USN-ENYU

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

JOB NO. 884
SHEET 1 OF 2

TITLE QUADRANGLE ADJUSTMENT CHARLIE-YOKE
BY LSH DATE 7-53

~~OFFICIAL USE ONLY~~ FOX ~~USE ONLY~~



	MEAS ∠	GEO. COND. 180° per Δ	GEO. COND. i+c+d=48.8	TRIG. COND.	
a	53-06-11.7	10.6	10.7	~~11.0~~	11.4
b	44-14-53.2	52.1	52.1	~~51.8~~	51.4
c	82-38-58.4	57.3	57.2	57.2	
	03.3				
d	54-04-34.1	33.4	33.3	33.3	
e	72-31-44.2	43.5	43.4	43.3	
f	53-23-43.8	43.1	43.1	43.4	
	02.1				
g	58-05-56.1	56.1	56.1	56.4	
h	66-02-45.5	45.5	45.6	45.3	
i	55-51-18.0	18.4	18.3	18.3	
	00.0				

i = 18.4
c = 57.3
d = 33.4
49.1
48.8
0.3

~~OFFICIAL USE ONLY~~

~~[illegible]~~

TRIG. EQ. $\dfrac{\text{FOX-COCA } (\sin h)(\sin b)(\sin f)}{\text{UNCLE-COCA } (\sin e)(\sin a)(\sin g)} = 1$

Fox-Coca		4.1087471		Uncle-Coca		4.0066165	
Sin	h	9.9608853	9.4	Sin	e	9.9794882	6.6
	b	9.8437079	21.6		a	9.9029357	15.8
	f	9.9045904	15.6		g	9.9288881	13.1
		3.8179307	46.6			3.8179285	35.5
		285	355				
		22	82.1			22 / 82.1 = 1.27	

	(91387112)	(82762057)
42143.598	Sin 66-02-45.3	Sin 55-51-18.3
Sin 58-05-56.4	45365.748	41084.159
(84896246)		
	(80979510)	(95387433)
33311.990	Sin 54-04-33.3	Sin 72-31-43.3
Sin 53-23-43.4	33603.531	39582.000
(80276949)		
	(99178144)	(79971784)
39582.000	Sin 82-38-57.2	Sin 53-06-11.8^4
Sin 44-14-51.8^4	56260.975	45365.749
(69776059)		

UNCLE						99,856.478	99188.076
YOKE	N 60-14-20.0W	33603.531	49638486	86810257	N 16680.284 W 29171.312	116,536.762	70016.764
COCA	N 66-21-56.6 E	39582.000	40089719	91612305	N 15868.313 E 36261.983	132,405.075	106,278.747
FOX						170,640.447	124,002.703
CHARLIE	N 89-05-02.6W	41084.159	01598557	99987222	N 656.754 W 41078.909	171,297.201	82,923.794
COCA	S 30-59-06.2 E	45365.748	85730161	51481448	S 38892.129 E 23354.944	132,405.072	106,278.738
CHARLIE						171,297.201	82,923.794
YOKE	S 13-15-45.2W	56260.975	97332901	22941368	S 54760.439 W 12907.037	116,536.762	70,016.757

LSH

7-53

UNCLE-YOKE-CHARLIE-FOX

884

OFFICIAL USE ONLY

COMPUTATION OF TRIANGLES

YOKE - CHARLIE

COMPUTED BY L.S.H CHECKED BY DATE 7-23-53

STATION	OBSERVED ANGLE	CORR	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE		
					10153.52	4.0066167	
YOKE	53-23-43.8	-0.3	43.5	0.1	43.4	0.0954092	
COCA	54-04-34.1	-0.8	33.3	0.0	33.3	9.9083752	YOKE
UNCLE	72-31-44.2	-0.7	43.5	0.2	43.3	9.9794880	
	02.1				10242.38	4.0104011	
					12064.63	4.0815139	
					12064.62	4.0815136	
CHARLIE	44-14-53.2	-1.6	51.6	0.2	51.4	0.1562935	
COCA	82-38-58.4	-1.2	57.2	0.0	57.2	9.9964160	CHARLIE
YOKE	53-06-11.7	-0.1	11.6	0.2	11.4	9.9029368	
	03.3				17148.38	4.2342231	
					13827.51	4.1407439	
					12845.39	4.1087473	
CHARLIE	58-05-56.1	+0.5	56.6	0.2	56.4	0.0711115	
FOX	66-02-45.5	0.0	45.5	0.2	45.3	9.9608850	CHARLIE
COCA	55-51-18.4	-0.1	18.3	0.0	18.3	9.9178312	
	0.00				13827.51	4.1407438	
					12522.47	4.0976900	

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-53

2	COCA	to 3	UNCLE	12	16	41.4		3	UNCLE	to 2	COCA	192	16	27.2
				+ 54	04	33.3	3rd ∠					− 72	31	43.5
	COCA	to 1	YOKE	66	21	14.7	α	3	UNCLE	to 1	YOKE	119	44	43.7
				−	0.1	13.1	Δα					−	0	58.6
				180	00	00.0						180	00	00.0
1	YOKE	to 2	COCA	246	20	01.6	α'	1	YOKE	to 3	UNCLE	299	43	45.1

Check: Angle of Triangle 53-23-43.5

	11	35	07.935	COCA	λ	165	21	27.917	φ	11	29	45.033	UNCLE	λ	165	20	16.670
	−	02	37.552		Δλ	−	06	04.727	Δφ	+	02	45.350		Δλ	−	04	53.480
	11	32	30.383	YOKE	φ'	165	15	23.190	φ	11	32	30.383	YOKE	λ'	165	15	23.190

Logarithms		Values in seconds
4.0815136		
9.6032345		
8.5124983		
2.1972464		+157.4876
8.16303		
9.92383		
0.71848		
8.80534		0.0639
4.3945		
1.9861		
6.3806	3rd term	0.0002
	Δφ	+157.5517

Logarithms		Values in seconds
½(φ+φ')	11-33-49.159	
	4.0815136	
Sin α	9.9619151	
A'	8.5096676	
Sec φ'	0.0088719	
Δλ	2.5619683	−364.7273
Sin²½(φ−φ')	9.3022021	
−Δα	1.8639884	+73.112

	4.0104005		
Cos A	9.6956112		
B	8.5125010		
h	2.2185127	1st term	−165.3913
s²	8.02080		
Sin²α	9.87728		
C	0.71502		
	8.61310	2d term	+0.0410
h²	4.4370		
D	1.9830		
	6.4200	3d term	+0.0003
		−Δφ	−165.3500

Logarithms		Values in seconds
½(φ+φ')	11-31-07.708	
	4.0104005	
Sin α	9.9386388	
A'	8.5096677	
Sec φ'	0.0088719	
Δλ	2.4675789	−293.4803
Sin²½(φ−φ')	9.3003554	
−Δα	1.7679343	+58.605

JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-53

		°	'	"				°	'	"
FOX	COCA	24	52	06.2	α	COCA	to 2 FOX	204	51	30.2
		+ 66	02	45.5	3-2		B	− 55	51	18.3
FOX	CHARLIE	90	54	51.7	α	COCA	to 1 CHARLIE	149	00	11.9
		−	01	23.8	Δα			−	0	47.4
		180	00	00.0				180	00	00.0
CHARLIE	FOX	270	53	27.9	α'	CHARLIE	to 3 COCA	328	59	24.5

[illegible] of Triangle 58-05-56.6

				°	'	"		°	'	"			°	'	"
11 41 27.251	FOX		λ	165	24	26.220	φ	11	35	07.935	COCA	λ	165	21	27.917
+ 0 06.421			Δλ	−	06	53.436	Δφ	+	06	25.737		Δλ	−	03	55.133
11 41 33.672	CHARLIE		λ'	165	17	32.784	φ'	11	41	33.672	CHARLIE	λ'	165	17	32.784

Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds
4.0976907		½(φ+φ')	11-41-30.461		s	4.1407434		½(φ+φ')	11-38-20.803	
8.2029765					Cos α	9.9330807				
8.5124951		s	4.0976907		B	8.5124983		s	4.1407434	
0.8131623	− 6.5037	Sin α	9.9999447		h	2.5863224	1st term −385.7646	Sin α	9.7117977	
8.19538		A'	8.5096662		s²	8.28149		A'	8.5096662	
9.99989		Sec φ'	0.0091070		Sin² α	9.42360		Sec φ'	0.0091070	
0.72252		Δλ	2.6164086	−413.4363	C	0.71848		Δλ	2.3713143	−235.1334
8.91779	0.0828	Sin ½(φ+φ')	9.3067403			8.42357	2d term +0.0265	Sin ½(φ+φ')	9.3048061	
1.6063		−Δα	1.9231489	+83.782	h²	5.1726		−Δα	1.6761204	+47.437
1.9899					D	1.9861				
3.5962	3d term 0.0000					7.1587	3d term +0.0014			
−Δφ	− 6.4209						−Δφ −385.7367			

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

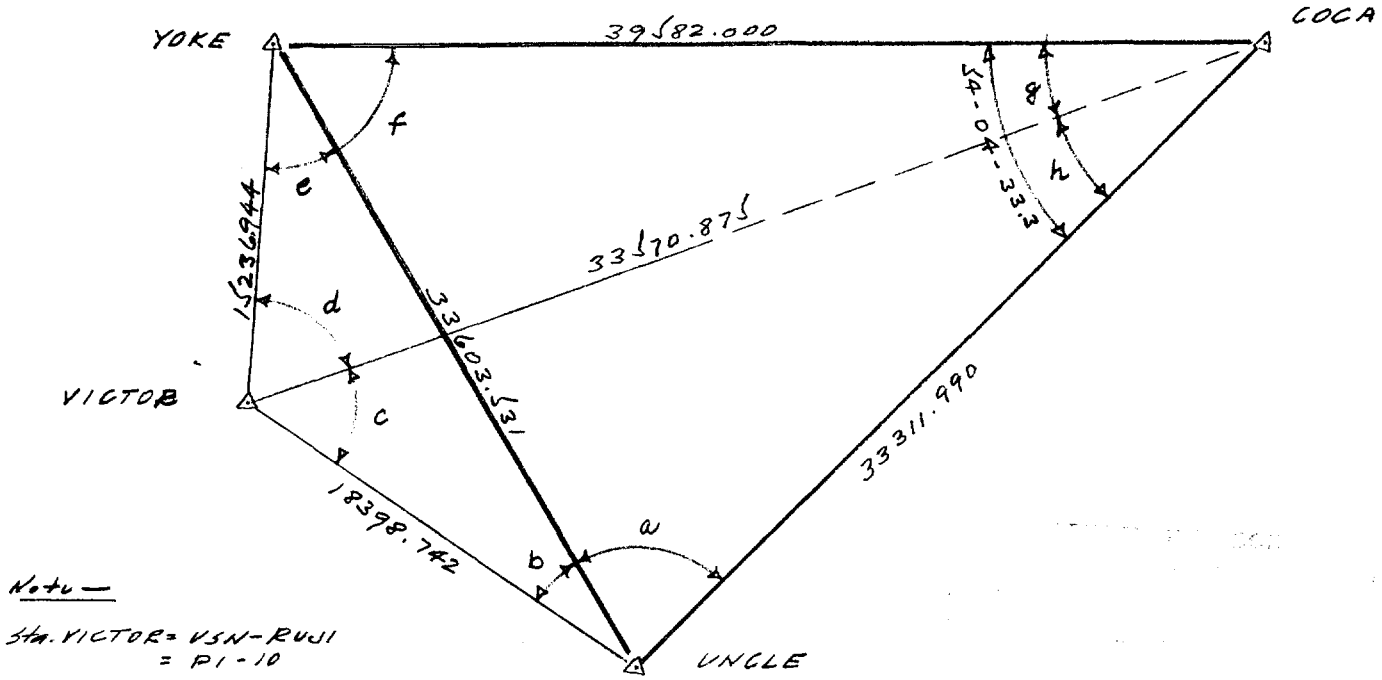
COMPUTED BY LSH DATE 8-4-53

		°	′	″					°	′	″
COCA	YOKE	66	21	14.7	α	3 YOKE	to 2	COCA	246	20	01.6
		+ 82	38	57.2	3d ∠		6		− 53	06	11.6
COCA	CHARLIE	149	00	11.9	α	3 YOKE	to 1	CHARLIE	193	13	50.0
		−	0	47.4	Δα				+	0	26.1
		180	00	00.0					180	00	00.0
CHARLIE	COCA	328	59	24.5	α	CHARLIE		YOKE	13	14	16.1

Sum of angles & ... distance 44-14-51.6

°	′	″			°	′	″		°	′	″			°	′	″
11	35	07.935	COCA	λ	165	21	27.917	φ	11	32	30.383	3 YOKE	λ	165	15	23.190
+	06	25.737		Δλ	−	03	55.133	Δφ	+	09	03.289		Δλ	+	02	09.594
11	41	33.672	CHARLIE	λ′	165	17	32.784	φ′	11	41	33.672	CHARLIE	λ′	165	17	32.784

Logarithms			Logarithms	Values in seconds		Logarithms		Values in seconds		Logarithms	Values in seconds
4.1407434		½(φ+φ′)	11-38-20.803		s	4.2342234			½(φ+φ′)	11-37-02.028	
9.9330807					Cos α	9.9883168					
8.5124983		s	4.1407434		B	8.5124996			s	4.2342234	
2.5863224	1st term −385.7646	Sin α	9.7117977		h	2.7350398	1st term	+543.3001	Sin α	9.3595890	
8.28149		A′	8.5096662		s²	8.46845			A′	8.5096662	
9.42360		Sec φ′	0.0091070		Sin² α	8.71918			Sec φ′	0.0091070	
0.71848		Δλ	2.3713143	−235.1334	C	0.71679			Δλ	2.1125856	+129.5942
8.42357	0.0265	Sin ½(φ+φ′)	9.3048061			7.90442	2d term	0.0080	Sin ½(φ+φ′)	9.3040002	
5.1726		−Δα	1.6761204	+47.437	h²	5.4701			−Δα	1.4165858	−26.097
1.9861					D	1.9846					
7.1587	0.0013					7.4547	3d term	0.0028			
Δφ	−385.7368						−Δφ	−543.2893			



Note —

Stn. VICTOR = VSN-RUJI
= P1-10

	MEAS ∠	GEO. COND.		TRIG. COND	
a	72-31-43.3	43.3	32.4	33S	43.3
b	2-16-48.8	49.1			S0.2
c	73-1S-33.3	33.7		32.6	
d	101-42-19.7	20.1		21.2	
e	2-4S-16.8	17.1	00.S	S9.4	16.0
f	S3-23-43.4	43.4			43.4
g	22-08 —	39.4		39.4	
h	31-SS —	S3.9		S3.9	

$$\text{TRIG. EQ} = \frac{\text{Coca} - \text{Uncle}\ (\sin a + b)(\sin d)}{\text{Coca} - \text{Yoke}\ (\sin e + f)(\sin c)} = 1$$

33311.990	4.S226006		39S82.0	4.S914977	
Sin a+b	9.984SS32	S.7	Sin e+f	9.9193297	16.1
Sin d	9.9908728	4.4	Sin c	9.9811925	6.3
	4.4980266	10.1		4.4980299	30.4
				266	10.1
				33	20.S

33/30.S = 1.1"

33311.990 Sim 73-15-32.6 (95761690)	(96505906) Sim 74-48-33.5 33570.875	(52890706) Sim 31-55-53.9 18398.742
39582.000 Sim 101-42-21.2 (97920196)	(83049707) Sim 56-08-59.4 33570.945	(37694017) Sim 22-08-39.4 15236.944
33603.531 Sim 174-57-53.8 (08776524)	(03979366) Sim 2-16-50.2 15236.186	(04805561) Sim 2-45-16.0 18399.519

UNCLE							99,856.478	99,188.076
VICTOR	N62-31-10.2W	18398.742	46144670	88716794	N8490.039	W16322.774	108,346.517	82,865.302
YOKE	N57-29-04.0W	15236.944	37528857	84324554	N8190.293	W12848.485	116,536.810	70,016.817
VICTOR							108,346.517	82.865.302
COCA	N44-13-17.2E	33570.875	71664963	69743337	N24058.555	E23413.448	132,405.072	106,278.750

1514 8-53

UNCLE-VICTOR-YOKE

824

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[illegible]

VICTOR

COMPUTED BY L.S.H. CHECKED BY DATE 8-10-53

STATION	OBSERVED ANGLE	CORR.	CORRECTED ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHMS
					10153.62	4.0066167
VICTOR	73-15-33.3	-0.6	32.7	0.1	32.6	0.0188082
COCA	31-55 —	—	53.9	0.0	53.9	9.7233793
UNCLE	74-48-32.1	+1.4	33.5	0.0	33.5	9.9845539
					5607.95	3.7488042
					10232.43	4.0099788
					12064.62	4.0815136
VICTOR	101-42-19.7	+1.6	21.3	0.1	21.2	0.0091280
YOKE	56-09-00.2	-0.8	59.4	0.0	59.4	9.9193381
COCA	22-08 —	—	39.4	0.0	39.4	9.5762724
					10232.45	4.0099797
					4644.23	3.6669140
					10242.37	4.0104005
VICTOR	174-57-53.0	+0.8	53.8	0.0	53.8	1.0566775
YOKE	2-45-16.8	-2.8	16.0	0.0	16.0	8.6817441
UNCLE	2-16-48.8	+1.4	50.2	0.0	50.2	8.5998139
					5608.18	3.7488221
					4644.00	3.6668919

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION — SECOND ORDER TRIANGULATION

Computed by LSH Date 8-11-53

		°	′	″					°	′	″
COCA	UNCLE	12	16	41.4	α	3 UNCLE	to 2	COCA	192	16	27.2
		31	55	53.9	3-2 ∠				− 74	48	33.5
COCA	VICTOR	44	12	35.3	α	3 UNCLE	to 1	VICTOR	117	27	53.7
		−	0	47.2	Δα				−	0	32.8
		180	00	00.0					180	00	00.0
VICTOR	COCA	224	11	48.X (2)	α′	1 VICTOR	to 3	UNCLE	297	27	20.9

Angle of Triangle 73-15-32.7

					°	′	″		°	′	″			°	′	″
11	35	07.935	COCA	λ	165	21	27.917	φ	11	29	45.033	3 UNCLE	λ	165	20	16.670
−	03	58.737		Δλ	−	03	55.448	Δφ	+	01	24.165		Δλ	−	02	44.201
11	31	09.198	VICTOR	λ′	165	17	32.469	φ′	11	31	09.198	1 VICTOR	λ′	165	17	32.469

Logarithms		Values in seconds
4.0099788		
9.8553927		
8.5124983		
2.3778698	1st term	+2387.096
8.01996		
9.68682		
0.71848		
8.42526	2d term	0.0266
4.7557		
1.9861		
6.7418	3d term	0.0006
	−Δλ	+2387.368

$\frac{1}{2}(\phi+\phi')$ 11-33-08.567

	Logarithms	Values in seconds
s	4.0099788	
Sin α	9.8434120	
A′	8.5096680	
Sec φ′	0.0088370	
Δλ	2.3718958	−235.4484
Sin ½(φ+φ′)	9.3016022	
−Δα	1.6734980	+47.152

	Logarithms		Values in seconds
s	3.7488026		
Cos α	9.6638944		
B	8.5125010		
h	1.9251980	1st term	−84.1779
s²	7.49761		
Sin² α	9.89613		
C	0.71502		
	8.10876	2d term	+0.0128
h²	3.8504		
D	1.9830		
	5.8334	3d term	+0.0001
		−Δφ	−84.1650

$\frac{1}{2}(\phi+\phi')$ 11-30-27.116

	Logarithms	Values in seconds
s	3.7488026	
Sin α	9.9480672	
A′	8.5096680	
Sec φ′	0.0088370	
Δλ	2.2153748	−164.2006
Sin ½(φ+φ′)	9.2999358	
−Δα	1.5153106	+32.758

JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

COMPUTATION SECOND ORDER TRIANGULATION

LSH 8-11-53

		°	′	″
YOKE	VICTOR	302	29	01.0
		+	0	25.9
		180		
VICTOR	YOKE	122	29	26.9

			°	′	″
11 32 30.383	YOKE	λ	165	15	23.190
− 01 21.185		Δλ	+	02	09.279
11 31 09.198	VICTOR	λ′	165	17	32.469

$\frac{1}{2}(\phi+\phi')$ 11-31-49.791

	Logarithms	Values in seconds
s	3.6669128	
Sin α	9.9261083	
A′	8.5096680	
Sec φ′	0.0088370	
Δλ	2.1115261	+129.2785
$\sin\frac{1}{2}(\phi+\phi')$	9.3007900	
−Δα	1.4123161	−25.8 (9)

3.6669128		
9.7300215		
8.5124996		
1.9094339	1st term	+81.1772
7.33383		
9.85222		
0.71679		
7.90284	2d term	0.0080
3.8193		
1.9846		
5.8039	3d term	0.0001
	Δφ	+81.1853

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

JOB NO. 884
SHEET 1 OF 2

TITLE QUADRANGLE ADJUSTMENT ZEBRA
BY LSH DATE 8-53

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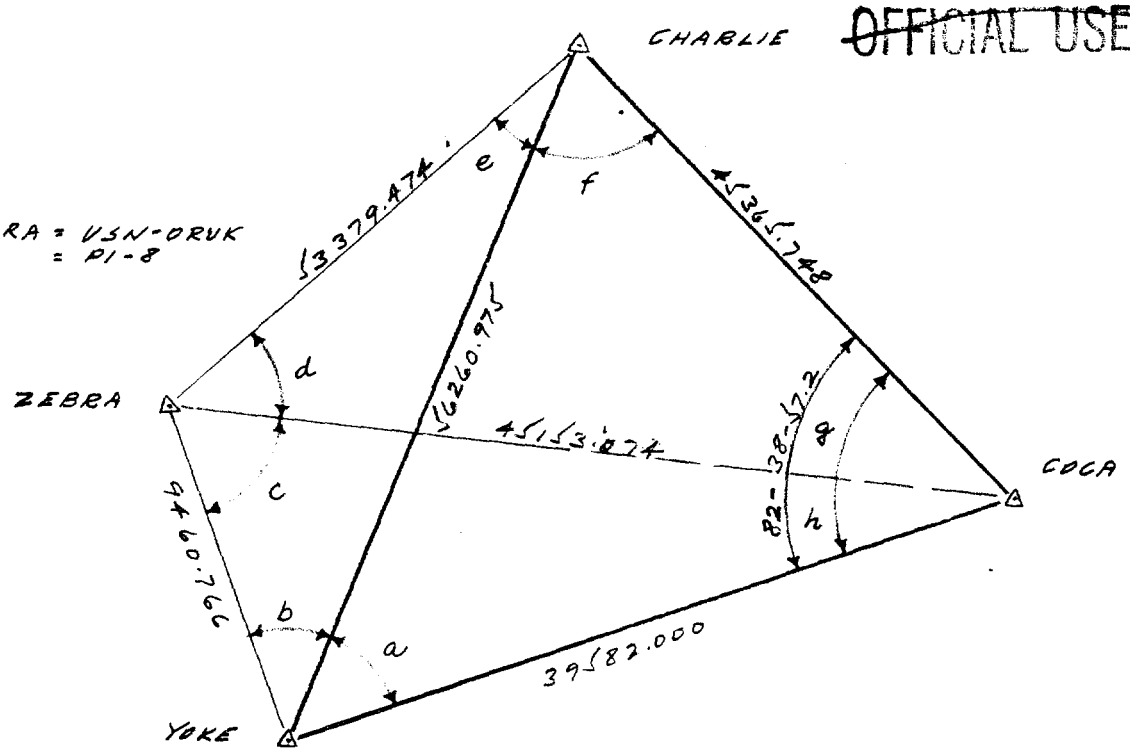
Note —
Sta. ZEBRA = USN-ORUK
= P1-8



	MEAS. ∠	GED. COND.		TRIG. COND.	
a	53-06-11.4	11.4	59.5	59.6	11.4
b	67-36-48.2	48.1			48.2
c	48-54-22.0	21.9		21.8	
d	54-02-54.5	54.3		54.4	
e	9-25-55.8	55.7	47.1	47.0	55.6
f	44-14-51.4	51.4			51.4
g	72-16 —	18.6		18.6	
h	10-22 —	38.6		38.6	

TRIG. EQ $\frac{\text{Coca-Yoke}\ (\sin a+b)(\sin g)}{\text{Coca-Charlie}\ (\sin e+f)(\sin c)} = 1$

39582.000	4.5974977		45365.748	4.6567281	
sin a+b	9.9343494	12.5	sin e+f	9.9061836	15.5
sin d	9.9082241	15.3	sin c	9.8771601	18.4
	4.4425712	27.8		4.4400718	33.9
				712	27.8
				6	617

6/617 = 0.1"

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39S82.000
Sin 48-54-21.8
(75363286)

(85970471)
Sin 120-42-59.6
45153.063

(18013097)
Sin 10-22-386
9460.766

4536S.748
Sin 54-02-54.4
(80951369)

(80571871)
Sin 53-40-47.0
45153.074

(95251190)
Sin 72-16-18.6
53379.474

56260.975
Sin 102-57-16.2
(97454839)

(92463505)
Sin 67-36-48.2
53379.463

(16387886)
Sin 9-25-55.6
9460.776

			COSINE	SINE			
YOKE							
ZEBRA	N 54-21-03.0 W	9460.766	.582820049	.812600938	N 5513.928	W 7687.827	116,536.762 70,016.764
CHARLIE	N 22-41-40.8 E	3379.474	.922574 00	.385820 17	N 49246.515	E 20594.878	122,050.690 62,328.937
							171,297.205 82,923.815
ZEBRA							122,050.690 62328.937
COCA	N 76-44-36.2 E	4515.074	.22931743	.97335169	N 10254.387	E 43949.821	132,405.077 106,278.758

L SH

7-53

YOKE-ZEBRA-CHARLIE

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ZEBRA

COMPUTED BY L.S.H. CHECKED BY DATE 8-10-53

STATION	OBSERVED ANG	CORR				
					12064.62	4.0815136
ZEBRA	48-54-22.0	-0.2	21.8	0.0	21.8	0.1228401
COCA	10-22 —	—	38.6	0.0	38.6	9.2555884
YOKE	120-42-59.6	+0.1	59.7	0.1	59.6	9.9343493
					2883.65	3.4599421
					13762.68	4.1387030
					13827.49	4.1407434
ZEBRA	54-02-54.5	+0.2	54.7	0.3	54.4	0.0917758
CHARLIE	53-40-47.1	+0.1	47.2	0.2	47.0	9.9061834
COCA	72-16 —	—	18.6	0.0	18.6	9.9788704
					13762.67	4.1387026
					16270.08	4.2113896
					17148.39	4.2342234
ZEBRA	102-57-16.5	-0.2	16.3	0.1	16.2	0.0111966
CHARLIE	9-25-55.8	-0.2	55.6	0.0	55.6	9.2145229
YOKE	67-36-48.2	0.0	48.2	0.0	48.2	9.9659704
					2883.65	3.4599429
					16270.11	4.2113904

55

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JOB № 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-11-53

		°	′	″				°	′	″
CHARLIE	COCA	328	59	24.5	α	COCA	to CHARLIE	149	00	11.9
		+ 53	40	47.2	∠			− 72	16	18.6
CHARLIE	ZEBRA	22	40	11.7	α	COCA	to ZEBRA	76	43	53.3
		−	0	41.7	Δα			−	01	28.7
		180	00	00.0				180	00	00.0
ZEBRA	CHARLIE	202	39	30.0	α′	ZEBRA	to COCA	256	42	24.7

ANGLE OF TRIANGLE 54-02-54.7

φ		λ	°	′	″	φ °	′	″		λ	°	′	″
11 41 33.672	CHARLIE	λ	165	17	32.784	11	35	07.935	COCA	λ	165	21	27.917
− 08 08.636		Δλ	−	03	26.961	−	01	42.899		Δλ	−	07	22.094
11 33 25.036	ZEBRA	λ′	165	14	05.823	11	33	25.036	ZEBRA	λ′	165	14	05.823

4.2113903		½(φ+φ′)	11-37-29.354		4.1387033		½(φ+φ′)	11-34-16.486	
9.9650796			Logarithms Values in seconds		9.3608113			Logarithms Values in seconds	
8.5124950		s	4.2113903		8.5124983		s	4.1387033	
2.6889649	+488.6128	Sin α	9.5859360		2.0120129	1st term +102.8047	Sin α	9.9882489	
8.42278		A′	8.5096676		8.27741		A′	8.5096676	
9.17187		Sec φ′	0.0088953		9.97650		Sec φ′	0.0088953	
0.72248		Δλ	2.3158892	−206.9613	0.71848		Δλ	2.6455151	−442.0945
8.31713	0.0208	Sin ½(φ+φ′)	9.3042799		8.97239	2nd term +0.0938	Sin ½(φ+φ′)	9.3023013	
5.3779		−Δα	1.6201691	+41.703	4.0240		−Δα	1.9478164	+88.678
1.9899					1.9861				
7.3678	0.0023				6.0101	3rd term +0.0001			
	+488.6359					−Δφ +102.8986			

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-11-53

		°	'	"
YOKE	to ZEBRA	125	37	01.9
		−	0	15.4
		180	00	00.0
ZEBRA	to YOKE	305	36	46.5

	°	'	"
α 3 to 2			
3d ∠ 8			
α 3 to 1			
Δα			
	180	00	00.0
α' 1 to 3			

FIRST ANGLE OF TRIANGLE

					°	'	"
11	32	30.383	YOKE	λ	165	15	23.190
+	0	54.653		Δλ	−	01	17.367
11	33	25.036	ZEBRA	λ'	165	14	05.823

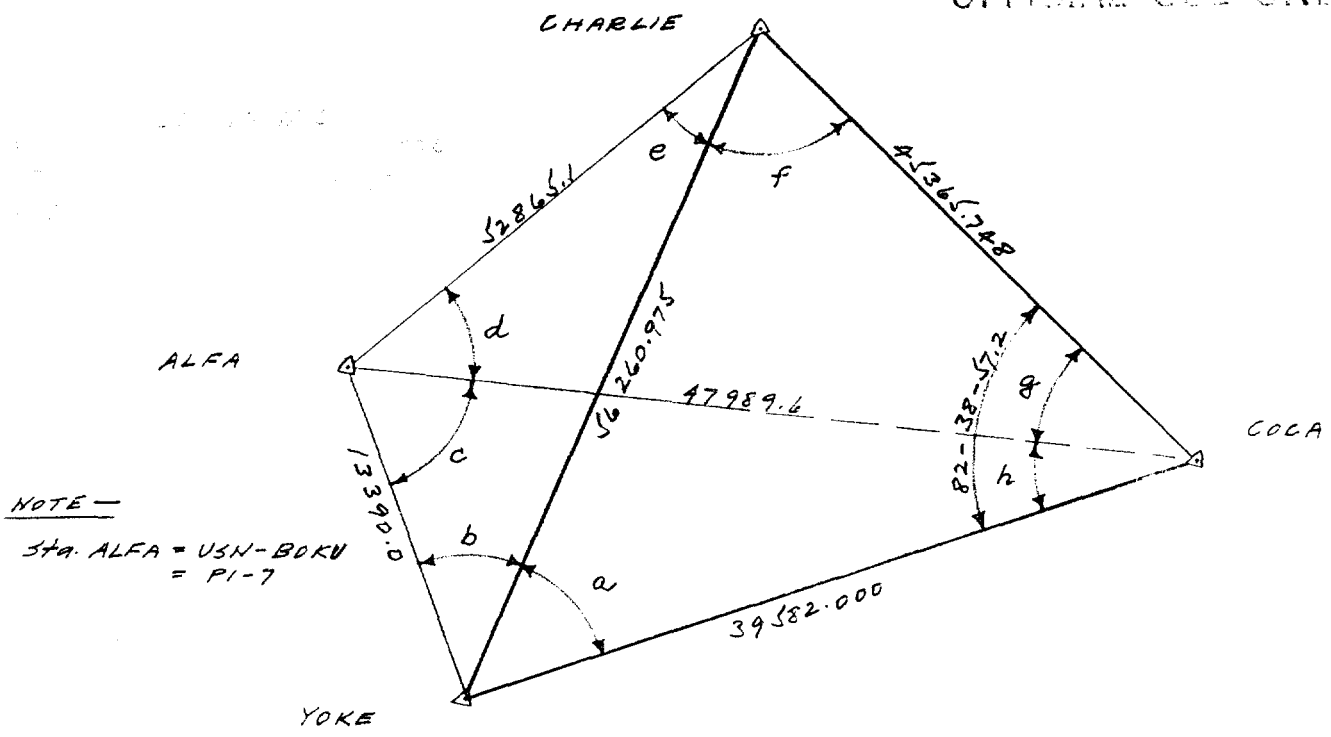
Logarithms	Values in seconds
3.4599448	
9.7651967	
8.5124996	
1.7376411	−54.6564
6.91989	
9.82010	
0.71679	
7.45678	0.0029
3.4753	
5.4599	
	0.0000
−Δφ	−54.6535

	Logarithms	Values in seconds
½(φ+φ')	11-32-57.710	
s	3.4599448	
Sin α	9.9100511	
A'	8.5096676	
Sec φ'	0.0088953	
Δλ	1.8885588	−77.3675
Sin ½(φ+φ')	9.3014904	
−Δα	1.1900492	+15.5 4

	Logarithms	Values in seconds
φ		
Δφ		
φ'		
s		
Cos α		
B		
h		
s²		
Sin² α		
C		
		2d term +
h²		
D		
		3d term +
		−Δφ

	°	'	"
λ			
Δλ			
λ'			
½(φ+φ')			

	Logarithms	Values in seconds
s		
Sin α		
A'		
Sec φ'		
Δλ		
Sin ½(φ+φ')		
−Δα		



NOTE —
Sta. ALFA = USN-BOKU
= P1-7

	MEAS ∠	GEO. COND.		TRIG. COND.	
a	53-06-11.4	11.4	49.3	50.5	11.4
b	68-35-37.7	37.9			39.1
c	44-34-12.0	12.2		11.0	
d	53-11-45.7	45.9		47.1	
e	13-38-23.9	24.0	14.4	14.2	22.8
f	44-14-51.4	51.4			51.4
g	68-54 —	58.7		58.7	
h	13-43 —	58.5		58.5	

TRIG EQ: $\frac{\text{Coca-Yoke}\ (\sin a+b)\ \sin d}{\text{Coca-Charlie}\ (\sin e+f)\ \sin c} = 1$

39582.000	4.597497		4.536748	4.6567281	
Sin a+b	9.9298466	13.0	Sin e+f	9.9278870	13.2
Sin d	9.9034643	15.8	Sin c	9.8462011	21.4
	4.4308086	28.8		4.4308162	34.6
				8086	28.8
				76	63.4

76 / 63.4 = 1.2"

45365.748	(93305595)	(84700390)
Sin 53-11-47.1	Sin 68-54-58.7	Sin 57-53-14.2
(80069391)	52865.122	47989.581
39582.000	(23739626)	(85083531)
Sin 44-34-11.0	Sin 13-43-585	Sin 121-41-505
(70177669)	13389.756	47989.287
56260.975	(93101884)	(23581496)
Sin 97-45-58.1	Sin 68-35-39.1	Sin 13-38-22.8
(99082787)	52864.912	13389.994

YOKE ALFA	N55-19-57.6W	13390.0	56881070	82246848	N7616.4	W11012.9	116,536.8 124,153.2	70016.8 59003.9
CHARLIE ALFA	S26-54-08.0W	5286.1	89177998	45246930	S7144.0	W2391.8	171,297.2 124,153.2	82,923.8 59,003.9
COCA ALFA	S80-05-44.1W	47989.6	17195260	98510524	S 8251.9	W47274.8	132,405.1 124,153.2	106,278.7 59,003.9

YOKE - ALFA - CHARLIE

ALFA

LSH 8-13-53

					12064.62	4.0815136
ALFA	44-34-12.0	-4.7	07.3	0.0	07.3	0.1538090
COCA	13-43 ——	——	58.5	0.0	58.5	9.3754739
YOKE	121-41-49.1	+5.2	54.3	0.1	54.2	9.9298407
					4081.28	3.6107965
					14627.27	4.1651633
					13827.49	4.1407434
ALFA	53-11-45.7	+1.7	47.4	0.3	47.1	0.0965334
CHARLIE	57-53-15.3	-0.9	14.4	0.2	14.2	9.9278854
COCA	68-54 ——	——	58.7	0.0	58.7	9.9699078
					14627.23	4.1651622
					16113.30	4.2071846
					17148.39	4.2342234
ALFA	97-45-57.7	-3.2	54.5	0.1	54.4	0.0040007
CHARLIE	13-38-23.9	-1.1	22.8	0.0	22.8	9.3725713
YOKE	68-35-37.7	+5.2	42.9	0.1	42.8	9.9689616
					4081.27	3.6107954
					16113.34	4.2071857

JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-13-53

CHARLIE	COCA	328	59	24.5	COCA	CHARLIE	149	00	11.9
		57	53	14.4			68	54	58.7
CHARLIE	ALFA	26	52	38.9	COCA	ALFA	80	05	13.2
		−	0	48.5			−	01	35.4
		180					180	00	
ALFA	CHARLIE	206	51	50.4	ALFA	COCA	260	03	37.8

THIRD ANGLE OF TRIANGLE 53-11-47.4

11	41	33.672	CHARLIE	λ	165	17	32.784	φ 11	35	07.935	COCA	λ	165 21	27.917
−	07	47.800		Δλ	−	04	00.423	Δφ −	01	22.063		Δλ	− 07	55.556
11	33	45.872	ALFA	λ'	165	13	32.361	φ' 11	33	45.872	ALFA	λ'	165 13	32.361

			Logarithms	Values in seconds		Logarithms		Values in seconds		Logarithms	Values in seconds
4.2071848		½(φ+φ')	11-37-39.772		s	4.1651630			½(φ+φ')	11-34-26.904	
9.9503528					cos α	9.2359136					
8.5124950		s	4.2071848		B	8.5124983			s	4.1651630	
2.6700326	+467.7702	sin α	9.6552191		h	1.9135749	1st term	+81.9549	Sin α	9.9934672	
2.41437		A'	8.5096675		s²	8.33033			A'	8.5096675	
9.31044		Sec φ'	0.0089043		Sin² α	9.98693			Sec φ'	0.0089043	
0.72248		Δλ	2.3809757	−240.4228	C	0.71848			Δλ	2.6772020	−475.5584
8.44729	0.0280	sin ½(φ+φ')	9.3043865			9.03574	2d term	+0.1086	sin ½(φ+φ')	9.3024084	
5.3401		−Δα	1.6853622	+48.456	h²	3.8271			−Δα	1.9796104	+95.414
1.9899					D	1.9861					
7.3300	0.0022					5.8132	3d term	+0.0001			
	+467.8004						−Δφ	+82.0636			

JOB № 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-13-53

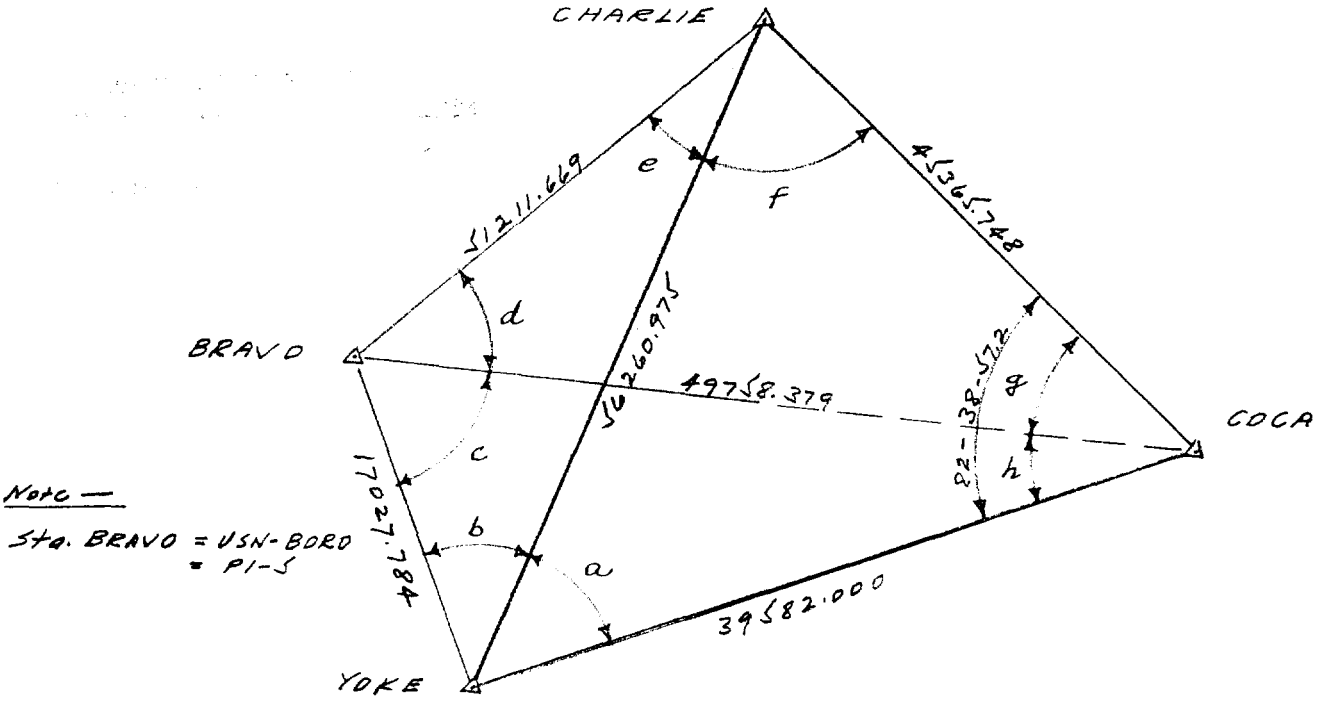
			°	′	″
YOKE	to	ALFA	124	38	07.3
			−	0	22.2
			180	00	00.0
ALFA		YOKE	304	37	45.1

		°	′	″
11 32 30.383	YOKE	165	15	23.190
+ 01 15.489		+	01	50.829
11 33 45.872	ALFA	165	13	32.361

½(φ + φ′) 11-33-08.128

3.6107909	
9.7546172	
8.5124996	
1.8779077	−75.4932
7.22158	
9.83057	
0.71679	
7.76894	0.0059
3.7558	
1.9846	
5.7404	0.0001
	−75.4872

3.6107909	
9.9152867	
8.5096675	
0.0089043	
2.0446494	−110.8280
9.3015977	
1.3462471	+22.195



	MEAS. ∠	GEO. COND.		TRIG. COND.	
a	53-06-11.4	11.4	46.4	46.5	11.4
b	64-14-34.6	35.0			35.1
c	44-57-27.9	28.1		28.0	
d	53-22-25.5	25.7		25.8	
e	17-25-30.9	31.2	22.6	22.5	31.1
f	44-14-51.4	51.4			51.4
g	64-57 —	11.7		11.7	
h	17-41 —	45.5		45.5	

Trig. Eq. $\frac{\text{Coca-Yoke}\ (\sin a+b)\ (\sin d)}{\text{Coca-Charlie}\ (\sin e+f)\ (\sin c)} = 1$

3982.00	4.599 7497		4536.748	4.656 7281	
sin a+b	9.948 5382	10.9	sin a+b	9.944 6077	11.3
sin d	9.904 4690	15.7	sin c	9.849 1649	21.1
	4.452 5002	26.6		4.450 5007	32.4
				002	26.6
				5	59.0

5/59.0 = 0.1"

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

JOB NO. 884
SHEET 2 OF 2

TITLE QUADRANGLE ADJUSTMENT BRAVO
BY LSH DATE 8-52

45365.748	(88025316)	(90596262)
sin 53-22-25.8	sin 61-40-22.5	sin 64-57-11.7
(80254510)	49758.379	51211.669
39582.000	(88824712)	(30396609)
sin 44-57-28.0	sin 117-20-46.5	sin 17-41-45.5
(70658551)	49758.480	17027.784
56260.975	(90064579)	(29946222)
sin 98-19-53.8	sin 64-14-35.1	sin 17-25-31.1
(98944599)	51211.699	17027.747

		DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	CO-ORDINATES NORTH	CO-ORDINATES EAST
YOKE							116,536.762	70,016.764
BRAVO	N50-58-49.9W	17027.784	62958447	77693204	N 10720.428	W 13229.431	127,257.190	56,787.333
CHARLIE	N30-41-16.3E	51211.669	85996042	51036073	N 44040.008	E 26136.425	171,297.198	82,923.758
BRAVO							127,257.190	56,787.333
COCH	N84-03-42.1E	49758.379	10345753	99463387	N 5147.879	E 49491.369	132,405.069	106,278.702

454 8-53 YOKE-BRAVO-CHARLIE 884

1994

OFFICIAL USE ONLY

OFFICIAL USE ONLY

COMPUTATION OF TRIANGLES

BRAVO

COMPUTED BY L.S.H. CHECKED BY DATE 8-10-53

STATION		OBSERVED ANGLE	CORR'N	SPHERICAL ANGLE	SPHERIC. EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						12064.62	4.0815136
1	BRAVO	44-57-27.9	+0.1	28.0	0.0	28.0	0.1508353
2	COCA	17-41 —	—	45.5	0.0	45.5	9.4828251
3	YOKE	117-20-46.0	+0.6	46.6	0.1	46.5	9.9485336
1-3						5190.08	3.7151740
1-2						15166.40	4.1808825
2-3						13827.49	4.1407434
1	BRAVO	53-22-25.5	+0.5	26.0	0.2	25.8	0.0955305
2	CHARLIE	61-40-22.3	+0.5	22.8	0.3	22.5	9.9446076
3	COCA	64-57 —	—	11.7	0.0	11.7	9.9571103
1-3						15116.36	4.1808815
1-2						15609.33	4.1933842
2-3						17148.39	4.2342234
1	BRAVO	98-19-53.4	+0.5	53.9	0.1	53.8	0.0046079
2	CHARLIE	17-25-30.9	+0.2	31.1	0.0	31.1	9.4763421
3	YOKE	64-14-34.6	+0.6	35.2	0.1	35.1	9.9545540
1-3						5190.07	3.7151734
1-2						15609.37	4.1933853

OFFICIAL USE ONLY

JOB No. 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-11-53

CHARLIE	COCA	328	59	24.5	α	3 COCA	to 2 CHARLIE	149	00	11.9
		+ 61	40	22.8	3rd $\angle$		&	- 64	57	11.7
CHARLIE	to 1 BRAVO	30	39	47.3	α	3 COCA	to 1 BRAVO	84	03	00.2
		-	0	53.0	$\Delta\alpha$			-	01	39.9
		180	00	00.0				180	00	00.0
BRAVO	CHARLIE	210	38	54.3	α'	1 BRAVO	to 3 COCA	264	01	20.3

SPHERICAL EXCESS OF TRIANGLE 53-22-26.0

11 41 33.672	CHARLIE	λ	165	17	32.784	ϕ	11	35	07.935	3 COCA	λ 165 21 27.917
- 07 17.023		$\Delta\lambda$	-	04	22.743	$\Delta\phi$	-	0	51.285		$\Delta\lambda$ - 08 17.870
11 34 16.649	BRAVO	λ'	165	13	10.041	ϕ'	11	34	16.650	BRAVO	λ' 165 13 10.047

Logarithms / Values in seconds

$\frac{1}{2}(\phi+\phi')$ 11-37-55.162

	Logarithms	Values in seconds
	4.1933851	
s	4.1933851	
Sin α	9.7075614	
A'	8.5096674	
Sec ϕ'	0.0089176	
$\Delta\lambda$	2.4195315	+262.7432"
Sin$^2\frac{1}{2}(\phi+\phi')$	9.3045440	
$-\Delta\alpha$	1.7240755	+52.976

4.1933851		
9.9345896		
8.5124950		
2.6404697		+436.9881
8.38677		
9.41512		
0.72248		
8.52437		0.0334
5.2801		
1.9899		
7.2700		0.0019
		+437.0234

Logarithms / Values in seconds

	Logarithms	Values in seconds
s	4.1808823	
Cos α	9.0156095	
B	8.5124983	
h	1.7089901	1st term +51.1670"
s^2	8.3617.6	
Sin$^2\alpha$	9.99531	
	0.71848	
	9.07555	2 term 0.1179
	3.4180	
	1.9861	
	5.4041	3 term 0.0000
		$-\Delta\phi$ +51.2849

$\frac{1}{2}(\phi+\phi')$ 11-34-42.292

	Logarithms	Values in seconds
s	4.1808823	
Sin α	9.9976542	
A'	8.5096674	
Sec ϕ	0.0089176	
$\Delta\lambda$	2.6971215	-497.8763
Sin$^2\frac{1}{2}(\phi+\phi')$	9.3025665	
$-\Delta\alpha$	1.9996880	+99.928

JOB № 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

Computed by LSH Date 8-11-53

			°	′	″
			+		
YOKE	BRAVO		128	59	15.0
			−	0	26.7
			180	00	00.0
BRAVO	YOKE		308	58	48.3

	°	′	″
α	3 to 2		
3d ∠	8		
α	3 to 1		
Δα			
	180	00	00.0
α′	1 to 3		

ANGLE OF TRIANGLE

					°	′	″
11	32	30.383	YOKE	λ	165	15	23.190
+ 01		46.267		Δλ	−	02	13.149
11	34	16.650	BRAVO	λ′	165	13	10.041

	°	′	″
φ			3
Δφ			
φ′			1

3.7151740	
9.7987548	
8.5124996	
2.0264284	−106.2729
7.43034	
9.78116	
0.71679	
7.92829	+0.0085
4.0528	
1.9846	
6.0374	0.0001
	−106.2647

½(φ+φ′) 11-33-23.516

	Logarithms	Values in seconds
s	3.7151740	
Sin α	9.8905793	
A′	8.5096674	
Sec φ′	0.0089176	
Δλ	2.1243383	−133.1491
Sin ½(φ+φ′)	9.3017562	
−Δα	1.4260945	+26.7

	Logarithms	Values in seconds
s		
Cos α		
B		
h		1st term
s²		
Sin² α		
C		
		2d term +
h²		
D		
		3d term +
		−Δφ

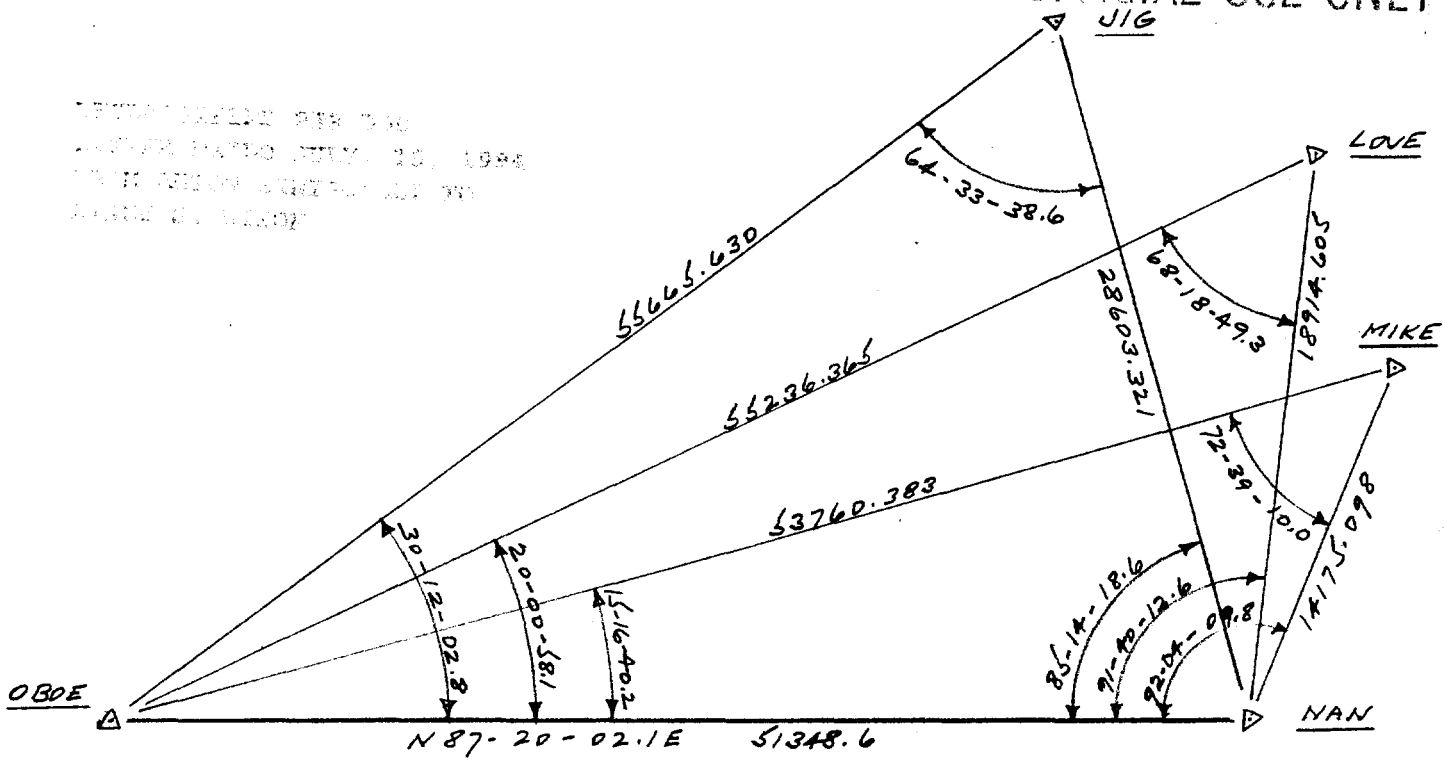
½(φ+φ′)

	Logarithms	Values in seconds
s		
Sin α		
A′		
Sec φ′		
Δλ		
Sin ½(φ+φ′)		
−Δα		

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

JOB NO. 884
SHEET 1 OF 1
BY LSH DATE 8-53

TITLE TRIANGLE ADJUSTMENT JIG-LOVE MIKE



JIG	30-12-03.7	02.8	LOVE	20-00-58.0	58.1	MIKE	15-16-41.1	40.2
	64-33-39.5	38.6		68-18-49.1	49.3		72-39-10.9	10.0
	85-14-19.6	18.6		91-40-12.4	12.6		92-04-10.7	09.8
	180-00-02.8	00.0		179-59-58	00.0		180-00-02.7	00.0

JIG 51348.6
sin 64-33-38.6
(70304103)

(50303168)
sin 30-12-02.8
28603.321

(99654886)
sin 85-14-18.6
56665.630

LOVE 51348.6
sin 68-18-49.3
(92922092)

(34228482)
sin 20-00-58.1
18914.605

(99958518)
sin 91-40-12.6
55236.365

MIKE 51348.6
sin 72-39-10.0
(95451538)

(26349986)
sin 15-16-40.2
14175.098

(99934783)
sin 92-04-09.8
53760.383

OBOE	N57-07-59.3 E	56665.630	54268874	83993389	N30751.799	E47595.383	103,279.6	127,028.4
JIG							134,031.4	174,623.8
NAN	S7-25-39.3 E	28603.321	99160904	12927299	S28363.312	E 3697.637	105,668.1	178,321.5
OBOE	N67-19-04.0 E	55236.365	38561978	92265779	N21300.235	E50964.262	103,279.6	127,028.4
LOVE							124,579.8	177,992.7
NAN	S0-59-45.3 E	18914.605	99984894	01738115	S18911.748	E 328.758	105,668.1	178,321.5
OBOE	N72-03-21.9 E	53760.383	30808591	95135854	N16562.817	E51145.399	103,279.6	127,028.4
MIKE							119,842.4	178,173.8
NAN	S0-35-48.1 E	14175.098	99994578	01041410	S14174.329	E 147.621	105,668.1	178,321.5

L-54 8-53 JIG-LOVE-MIKE

COMPUTATION OF TRIANGLES

JIG - LOVE - MIKE

COMPUTED BY LSH CHECKED BY DATE 8-53

STATION		OBSERVED ANGLE	CORR-N	SPHERICL ANGLE	SPHERICL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						15651.08	4.1945443
1	JIG	64-33-39.5	-0.8	38.7	0.1	38.6	0.0442925
2	NAN	85-14-19.6	-0.9	18.7	0.1	18.6	9.9984985
3	OBOE	30-12-03.7	-0.8	02.9	0.1	02.8	9.7015953
1-3		02.8				17271.71	4.2373353
1-2						8718.31	3.9404321
2-3						15651.08	4.1945443
1	LOVE	68-18-49.1	+0.3	49.4	0.1	49.3	0.0318811
2	NAN	91-40-12.4	+0.3	12.7	0.1	12.6	9.9998154
3	OBOE	20-00-58.0	+0.1	58.1		58.1	9.5343877
1-3		59.5				16836.07	4.2262408
1-2						5765.18	3.7608131
2-3						15651.08	4.1945443
1	MIKE	72-39-10.9	-0.8	10.1	0.1	10.0	0.0202171
2	NAN	92-04-10.7	-0.8	09.9	0.1	09.8	9.9997167
3	OBOE	15-16-41.1	-0.9	40.2	0.0	40.2	9.4207803
1-3		02.7				16386.19	4.2144781
1-2						4320.58	3.6355417
2-3							
1							
2							
3							
1-3							
1-2							

JIG.

LOVE

MIKE

JOB No ____

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

		°	′	″					°	′	″
NAN	OBOE	87	21	45.3	α	3 OBOE	to 2	NAN	267	20	02.4
		+ 85	14	18.7	3d ∠		δ		− 30	12	02.9
NAN	JIG	172	36	04.0	α	3 OBOE	to 1	JIG	237	07	59.5
		−	0	07.4	Δα				+	01	35.9
		180	00	00.0					180	00	00.0
JIG	NAN	352	35	56.6		JIG		OBOE	57	09	35.3

TRIANGLE 64-33-38.7

			°	′	″		°	′	″				°	′	″
11 30 42.595	NAN	λ	165	33	32.574	φ	11	30	19.029	3	OBOE	λ	165	24	56.671
+ 04 41.384		Δλ	−	0	37.058	Δφ	+	05	04.950			Δλ	+	07	58.845
11 35 23.979	JIG	λ′	165	32	55.516	φ′	11	35	23.979	1	JIG	λ′	165	32	55.516

			Logarithms	Values in seconds		Logarithms		Values in seconds		Logarithms	Values in seconds
		½(φ+φ′)	11-33-03.287		s	4.2373353			½(φ+φ′)	11-32-51.504	
3.9404318					Cos α	9.7345501					
9.9963688		s	3.9404318		B	8.5125007			s	4.2373353	
8.5125005		Sin α	9.1098362		h	2.4843861	1st term	−305.0606	Sin α	9.9242454	
2.4493011	−281.3851	A′	8.5096672		s²	8.47467			A′	8.5096672	
7.88086		Sec φ′	0.0089466		Sin² α	9.84849			Sec φ′	0.0089466	
8.21967		Δλ	1.5688818	−37.0580	C	2.71540			Δλ	2.6801945	+478.8445
0.71563		Sin ½(φ+φ′)	9.3015479			9.03856	2d term	+0.1093	Sin ½(φ+φ′)	9.3014264	
6.81616	0.0007	−Δα	0.8704297	+7.420	h²	4.9688			−Δα	1.9816209	−95.856
4.89861					D	1.9863					
1.9835						6.9551	3d term	+0.0009			
6.8821	0.0008						−Δφ	−304.9504			
	−281.3836										

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-13

		°	′	″				°	′	″
NAN	3 OBOE	87	21	45.3	α	3 OBOE	to 2 NAN	267	20	02.4
	∠	+ 91	40	12.7	3d ∠		8	− 20	00	58.1
NAN	1 LOVE	179	01	58.0	α	3 OBOE	to 1 LOVE	247	19	04.3
		−	0	00.6	Δα			+	01	42.5
		180	00	00.0				180	00	00.0
		359	01	57.4	α′	1 LOVE	to 3 OBOE	67	20	46.8

THIRD ANGLE OF TRIANGLE 68-18-49.4

			°	′	″		°	′	″			°	′	″
11 30 42.595	NAN	λ	165	33	32.574	φ	11	30	19.029	3 OBOE	λ	165	24	56.671
+ 03 07.608		Δλ	−	0	03.212	Δφ	+	03	31.174		Δλ	+	08	32.691
11 33 50.203	LOVE	λ′	165	33	29.362	φ′	11	33	50.203	1 LOVE	λ′	165	33	29.362

Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values seconds		Logarithms	Values seconds
		½(φ+φ′)	11-32-16.399		s	4.2262412		½(φ+φ′)	11-32-04.616	
3.7608129					Cos α	9.5861578				
9.9999381		s	3.7608129		B	8.5125007		s	4.2262412	
8.5125005		Sin α	8.2273830		h	2.3248997	1st term +211.3001	Sin α	9.9650410	
2.2732515	−187.6082	A′	8.5096675		s²	9.93008		A′	8.5096675	
6.45477		Sec φ′	0.0089062		Sin² α	8.45248		Sec φ′	0.0089062	
7.52163		Δλ	0.5067696	−3.2119	C	0.71540		Δλ	2.7098559	+512.6913
0.71563		Sin½(φ+φ′)	9.3010645			9.09796	2d term +0.1253	Sin½(φ+φ′)	9.3009430	
4.69203	0.0000	−Δα	9.8078341	+0.642	h²	4.6498		−Δα	2.0107989	+102.518
4.5465					D	1.9863				
1.9835						6.6361	3d term +0.0004			
6.5300	0.0003						−Δφ +211.1744			
Δφ	−187.6079									

JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-53

			°	′	″						°	′	″
NAN	to	OBOE	87	21	46.3	α	3	OBOE	to 2	NAN	267	20	02.4
	∠		+ 92	04	09.9	3d ∠			8		− 15	16	40.2
NAN	to 1	MIKE	179	25	55.2	α	3	OBOE	to 1	MIKE	252	03	22.2
			−	0	00.3	Δα					+	01	42.8
			180	00	00.0						180	00	00.0
MIKE	to 2	NAN	359	25	54.9	α′	1	MIKE	to 3	OBOE	72	05	05.0

THIRD ANGLE OF TRIANGLE 72-39-10.1

			°	′	″		°	′	″				°	′	″
11 30 42.595	NAN	λ	165	33	32.574	φ	11	30	19.029	3	OBOE	λ	165	24	56.671
+ 02 20.612		Δλ	−	0	01.414	Δφ	+	02	44.178			Δλ	+	08	34.489
11 33 03.207	MIKE	λ′	165	33	31.160	φ′	11	33	03.207	1	MIKE	λ′	165	33	31.160

Logarithms	Values in seconds
3.6355421	
9.9999787	
8.5125003	
2.1480213	−140.6117
7.27108	
5.99243	
0.71563	
3.97914	0.0000
4.2960	
1.9835	
6.2795	0.0000.1
	−140.6116

½(φ+φ′) 11-31-52.901

	Logarithms	Values in seconds
s	3.6355421	
Sin α	9.9962165	
A′	8.5096676	
Sec φ′	0.0088860	
Δλ	0.1503122	−1.4136
Sin ½(φ+φ′)	9.3008221	
−Δα	9.4511343	+ 0.283

	Logarithms		Values in seconds
s	4.2144783		
Cos α	9.4886699		
B	8.5125007		
h	2.2156489	1st term	−164.3043
s²	8.42896		
Sin² α	9.95669		
C	0.71540		
	9.10105	2d term	+ 0.1262
h²	4.4313		
D	1.9863		
	6.4176	3d term	+ 0.0003
		−Δφ	−164.1778

½(φ+φ′) 11-31-41.118

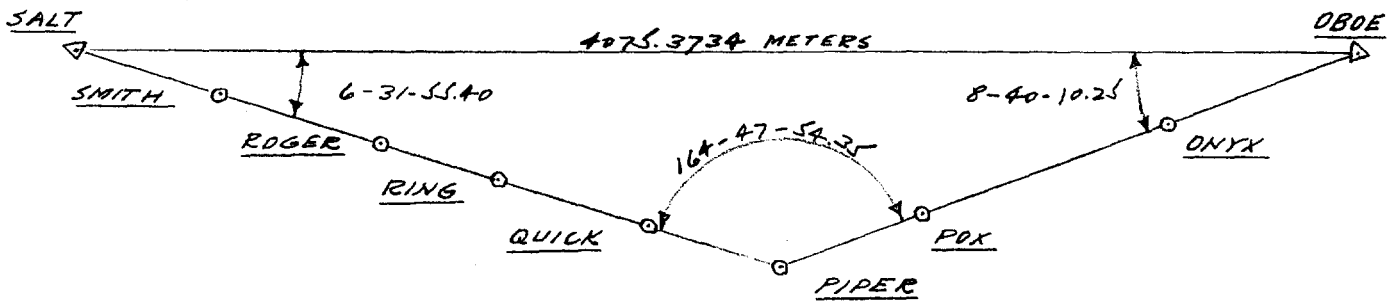
	Logarithms	Values in seconds
s	4.2144783	
Sin α	9.9783444	
A′	8.5096676	
Sec φ′	0.0088860	
Δλ	2.7113763	+ 514.4893
Sin ½(φ+φ′)	9.3007004	
−Δα	2.0120767	−102.820

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

JOB NO. 884
SHEET 1 OF 3
TITLE BIKINI 1953 BASE LINE OBOE - SUGAR
BY LSH DATE 8-53

~~OFFICIAL USE ONLY~~

COMPUTATION OF BASE LINE



SALT	6-31-55.25	+0.15	55.40
PIPER	164-47-54.20	+0.15	54.35
OBOE	8-40-10.10	+0.15	10.25
	179-59-59.55		0.00

	METERS	FEET
SALT-SMITH	549.9921	1804.432
SMITH-ROGER	449.9478	1476.204
ROGER-RING	300.0148	984.299
RING-QUICK	749.8732	2460.209
QUICK-PIPER	293.0264	961.371
	2342.8543	7686.515

	METERS	FEET
PIPER-POX	417.9360	1371.178
POX-ONYX	749.9792	2460.557
ONYX-OBOE	600.0127	1968.542
	1767.9279	5800.277

2342.8543 X Sin 6-31-55.40 = 266.5209
Cos " = 2327.6454

1767.9279 X Sin 8-40-10.25 = 266.4883
Cos " = 1747.7280

2327.6454
1747.7280
4075.3734 METERS = 13370.621 FEET
LENGTH OF BASE LINE

~~OFFICIAL USE ONLY~~

PROBABLE ERROR COMPUTATION

SECTION	MEAS. DIST.	DISCREPANCY 2 MEAS. OF SECTION		PROBABLE ERROR	
		ALLOWABLE MAXIMUM	ACT. DIFF.	$0.6745\sqrt{\frac{\Sigma V^2}{n(n-1)}}$	1 SEC
SALT-SMITH	F 549.9936 B 549.9906	$20\sqrt{.5499921} = 0.0148$ m	0.0030 m	0.6745 X 0.0015	0.0010 m
SMITH-ROGER	F 449.9479 B 449.9477	$20\sqrt{.4499478} = 0.0134$	0.0002	" X 0.0001	0.0001
ROGER-RING	F 300.0139 B 300.0157	$20\sqrt{.3000148} = 0.0110$	0.0018	" X 0.0009	0.0006
RING-QUICK	F 749.8725 B 749.8739	$20\sqrt{.7498732} = 0.0173$	0.0014	" X 0.0007	0.0005
QUICK-PIPER	F 293.0265 B 293.0264	$20\sqrt{.2930264} = 0.0108$	0.0001	" X 0.00005	0.0003
PIPER-POX	F 417.9350 B 417.9369	$20\sqrt{.4179359} = 0.0129$	0.0019	" X 0.0009 5	0.0006
POX-ONYX	F 749.9793 B 749.9790	$20\sqrt{.7499791} = 0.0173$	0.0003	" X 0.0001 5	0.0001
ONYX-OBOE	F 600.0134 B 600.0121	$20\sqrt{.6000128} = 0.0155$	0.0013	" X 0.0006 5	0.0004

0.0010^2
0.0001^2
0.0006^2
0.0005^2
0.0000^2
0.0006^2
0.0001^2
0.0004^2

$\Sigma = 0.00000215$

$\sqrt{} = 0.0014663$

FORWARD MEASURE = 4110.7821 M

BACKWARD MEASURE = 4110.7823 M

DIFF = 0.0002 M

ACTUAL DIFFERENCE IN MEASURES = 0.0002 = 1:2,055,397

PROBABLE ERROR IN MEASUREMENT = 0.0014663 = 1:2,803,507

HOLMES & NARVER INC.-ENGINEERS CONSTRUCTORS.

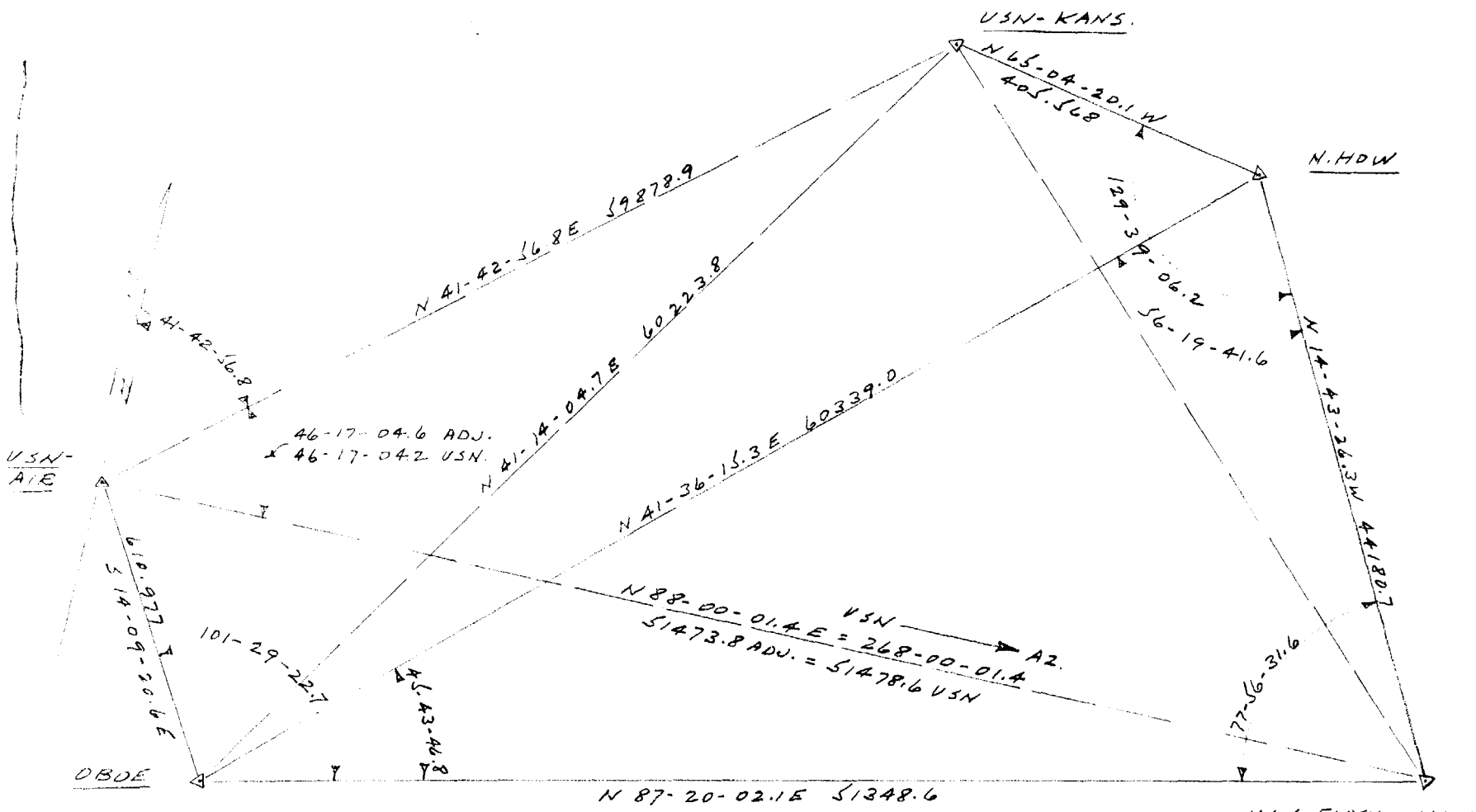
COMPUTATION OF BIKINI-1953 (OBOE-SUGAR) BASE LINE

~~OFFICIAL USE ONLY~~

CALC. BY: MC CHKD BY: LSH DATE: 8-53 JOB. NO. 884 LOCATION BIKINI ATOLL M.I.

SECTION	DATE	DIR. OF MEAS.	TAPE NO	SUPPORT	UNCORR. LENGTH NO.	UNCORR. LENGTH METERS	TEMP	CORRECTIONS TEMP	CORRECTIONS SET-BACK	CORRECTIONS INCLINATION	CORRECTIONS SEA LEVEL	REDUCED LENGTH	ADOPTED LENGTH
							"C"	METERS	METERS	METERS	METERS	METERS	METERS-FEET
DIVISION A													
SALT-SMITH	4-24-53	F	8173		11	49.99896		+.0024	+.0167	-.0141		549.9936	549.9921
	4-24	B	8193		11	49.99923		+.0032	+.0100	-.0141		549.9906	
SMITH-ROGER	6-2	F	8172		9	49.99913		+.0027	-.0033	-.0437		449.9479	449.9478
	6-2	B	8173		9	49.99896		+.0027	-.0019	-.0437		449.9477	
ROGER-RING	4-23	F	8193		6	49.99923		+.0020	+.0255	-.0090		300.0139	300.0148
	4-23	B	8173		6	49.99896		+.0019	+.0290	-.0090		300.0157	
RING-QUICK	5-28	F	8193		15	49.99923		+.0039	-.0868	-.0331		749.8725	749.8732
	5-28	B	8172		15	49.99913		+.0046	-.0846	-.0331		749.8739	
QUICK-PIPER	6-1	F	8172		5½	49.99913		+.0045	+18.0825	-.0557		293.0265	293.0264
	6-1	B	8173		5½	49.99896		+.0043	+18.0835	-.0557		293.0264	
												TOTAL	2342.8543
DIVISION B													
PIPER-FOX	4-28	F	8173		8	49.99896		+.0050	+17.9665	-.0282		417.9350	417.9360
	4-28	B	8193		8	49.99923		+.0053	+17.9660	-.0282		417.9369	
FOX-ONYX	6-1	F	8193		15	49.99923		+.0025	-.0098	-.0019		749.9793	749.9792
	6-1	B	8172		15	49.99913		+.0029	-.0090	-.0019		749.9790	
ONYX-OBOE	5-26	F	8172		12	49.99913		+.0045	+.0260	-.0067		600.0134	600.0127
	5-26	B	8173		12	49.99896		+.0048	+.0265	-.0067		600.0121	
												TOTAL	1767.9279
									SALT TO	PIPER		2342.8543 M	= 7686.515 Ft.
									PIPER TO	OBOE		1767.9279 M	= 5800.277 Ft.

~~OFFICIAL USE ONLY~~



ORIGIN OF GEOGRAPHIC POSITION — USN VALUES FOR STATION USN-AIR
LAT. N 11-30-24.906 LONG. E 165-24-55.168

BASIS OF GEODETIC AZIMUTH AND BEARINGS - CASTLE GRID. — USN AIR - USN ENYU 268-00-01.4

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

TITLE ORIGIN OF POSITION AND AZIMUTH

JOB NO. 284
SHEET 1 OF 3
BY LSH DATE 8-1-63

USN-AIR						103,872.00	126,879.00
OBDE	S 14-09-20.6E	610.977	96963463	24455813	S 592.424	E 149.419	103,279.576	127,028.419
USN-ENYU=NAN	N 87-20-02.1E	51348.639	04651514	99891758	N 2388.489	E 51293.058	105,668.065	178,321.477
USN-AIR	S 88-00-01.4W	51473.823	03489271	99939107	S 1796.061	W 51442.479	103,872.004	126,878.998
NAN							105,668.047	178,321.466
N.HOW	N 14-43-22.5W	44180.724	96716150	25416262	N 42729.895	W 11229.089	148,397.952	167.092.377
OBDE	S 41-36-15.3W	60338.956	74774884	66398168	S 45118.384	W 40063.961	103,279.568	127,028.416
OBDE	N 41-36-15.3E	60338.956	74774884	66398168	N 45118.384	E 40063.961	103,279.579	127,028.407
N.HOW	N 65-04-20.1N	405.568	42147507	90683998	N 170.937	W 367.785	148,397.963	167,092368
USN-KANS	S 41-14-04.6W	60223.825	75201668	65914408	S 45289.321	W 39696.176	148,568.900	166,724.583
OBDE							103,279.579	127,038.407
AIR	N 41-42-0.1E	59878.905	74645487	66543604	N 44696.900	E 39845.583	103,872.100	126,879.00
USN-KANS							148,568.900	166,724.583

LSH

7-20-53

USN STA. AIR-ENYU-KANS

884

2 3

884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

SECOND ORDER TRIANGULATION

L S H 7-27-53

USN-AIR	USN-ENYU	268	00	01.4
		+	01	43.2
USN-ENYU	USN-AIR	88	01	44.6

11	30	24.906	USN-AIR	165 24 55.168
+	0	17.689		+ 08 37.406
11	30	42.595	USN-ENYU	165 33 32.574

4.1956022		11-30-33.548
8.5427347		
8.5125007		4.1956022
1.2508376	-17.8171	9.9997354
8.39120		8.5096680
9.99747		0.0088254
0.71545		2.7138310 +517.405
9.10612	0.1277	9.3000024
2.5017		2.0138334 -103.237
1.9283		
4.4855	0.0000	
	-17.6894	

NOTE:— THE POSITION OF STATION AIR AND THE FORWARD AZIMUTH TO STATION ENYU, AS DETERMINED BY THE U.S.N. SURVEYS, ARE HELD FIXED IN THESE COMPUTATIONS

JOB NO. 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

SECOND ORDER TRIANGULATION

LSH 7-27-53.

USN-AIR	USN-ENYU	268	00	01.4	USN-ENYU	USN-AIR	88	01	44.6
		72	50	38.0			0	39	59.3
USN-AIR	OBOE	345	50	39.4	USN-ENYU	OBOE	87	21	45.3
		+ 0		0.3			− 01		42.9
OBOE	USN-AIR	165	50	39.7	OBOE	USN-ENYU	267	20	02.4

101-29-22.7

11	30	24.906	USN-AIR	165	24	56.168	11	30	42.595	USN-ENYU	165	33	32.574
− 0		05.877		+ 0	01	50.3	− 0		23.567		− 08		36.902
11	30	19.029	OBOE	165	24	56.671	11	30	19.028	OBOE	165	24	56.672

11-30-21.968 (values in seconds)

11-30-30.812

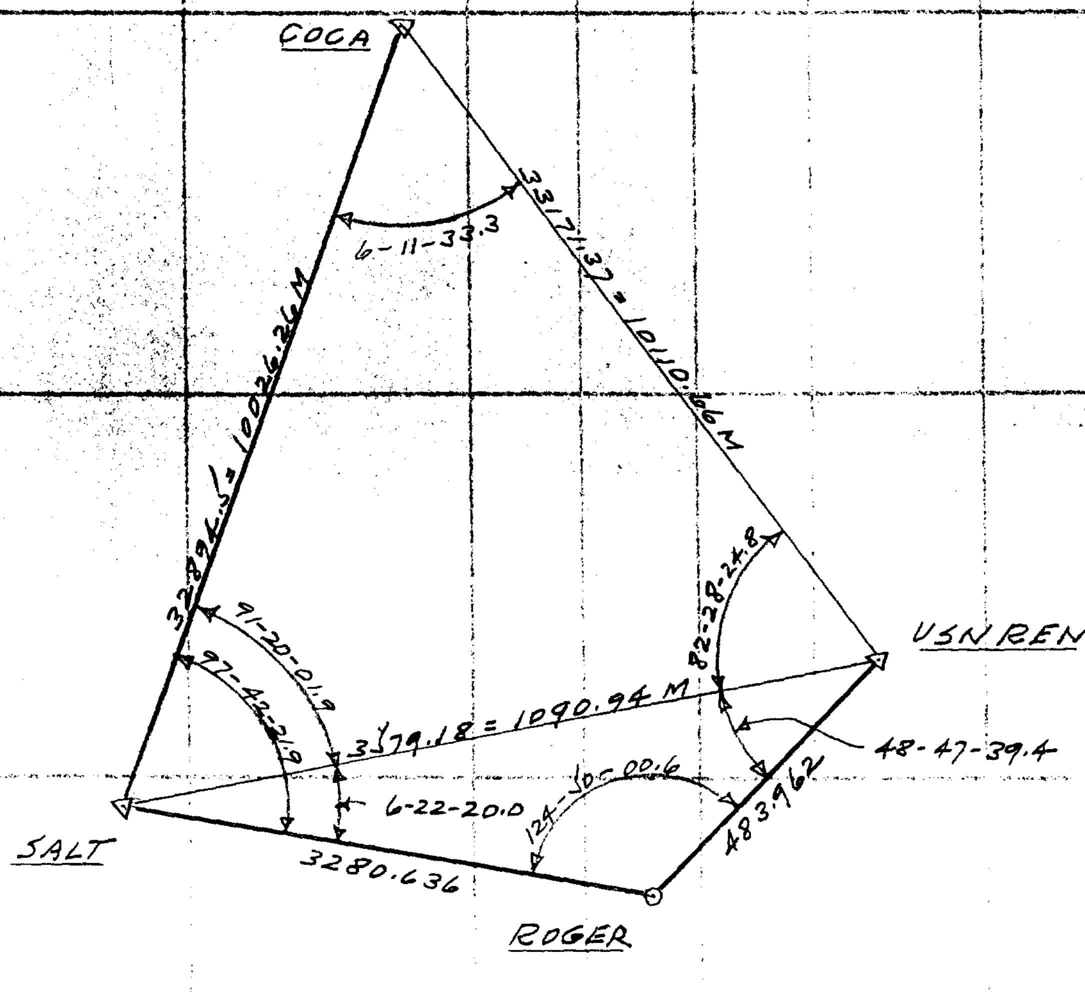
2.2700407			4.1945443		
9.9966081			8.6629027		
8.5125007		2.2700407	8.5125005		4.1945443
0.7491495	+5.8769	9.3883821	1.3699475	+23.4395	9.9995397
4.54008		8.5096681	8.38909		8.5096681
8.77674		0.0088154	9.99908		0.0088154
0.71545		0.1769063 + 1.5028	0.71563		2.7125675 − 515.9024
4.03237	0.0000	9.2998826	9.01380	0.1270	9.2999741
1.5383		9.4767889 − 0.300	2.7399		2.0125416 +102.920
1.9832			1.9835		
3.5215	0.0000		4.7234	0.0000	
	+5.8769			+23.5665	

NOTE:— U.S.N.-ENYU = STA. NAN

COMPUTATION OF TRIANGLES

COMPUTED BY L.S.H. CHECKED BY ______ DATE 10-√3

STATION		OBSERVED ANGLE	CORR-N	SPHERICAL ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						10026.26	4.0011390
1	USN-REN	82-28 ——	—	24.8	0.0	24.8	0.0037√79
2	SALT	91-20-01.9	—	01.9	0.0	01.9	9.9998823
3	COCA	6-11 ——	—	33.3	0.0	33.3	9.0329003
1-3						10110.66	4.0047792
1-2						1090.93	3.0377972
2-3							
1							
2							
3							
1-3							
1-2							
2-3							
1							
2							
3							
1-3							
1-2							



JOB NO 884

HOLMES & NARVER, INC.
ENGINEERS—CONSTRUCTORS

COMPUTATION SECOND ORDER TRIANGULATION

LSH 12-S3

SALT	COCA	166	28	35.6	α	3 COCA	to 2 SALT	346	28	20.1
		91	20	81.9	3rd $\angle$		B	− 6	11	33.3
SALT	USN-REN	257	48	37.5	α	3 COCA	to 1 USN-REN	340	16	46.8
		+	0	07.0	$\Delta\alpha$			+	0	22.5
		180	00	00.0				180	00	00.0
USN-REN	SALT	77	48	44.5	α'	1 USN-REN	to 3 COCA	160	17	09.3

SUM OF ANGLES OF TRIANGLE 82-28-24.8

11 29 50.670	SALT		165	22	45.305	ϕ	11	35	07.935	COCA		165	21	27.917
+ 0 07.496		$\Delta\lambda$	+	0	35.186	$\Delta\phi$	−	5	09.770		$\Delta\lambda$	+	1	52.74
11 29 58.166	USN-REN	λ'	165	23	20.491	ϕ'	11	29	58.165	USN-REN	λ'	165	23	20.491

3.0378001
9.3245851
8.5124910
0.8748769 −7.4968
6.0756O
9.98020
0.7150.8
6.77088 .0006
1.7497
1.9830
3.7327 .0000
−7.4962

$\frac{1}{2}(\phi+\phi')$ 11-29-54.418

	Logarithms	Values in seconds
b	3.0378001	
Sin α	9.9900965	
A'	8.5096683	
Sec ϕ'	0.0088064	
$\Delta\lambda$	1.5463713	+35.1861
$\frac{1}{2}\Delta\phi$	9.2995975	
$\Delta\alpha$	0.8459688	−7.014

Logarithms / Values in seconds

s	4.0047795	
Cos α	9.9737515	
B	8.5124983	
h	2.4910293	1st term: +309.7628"
s^2	8.009556	
$\sin^2\alpha$	9.05637	
C	0.71848	
	7.78441	2nd term: .0061
D	4.9821	
	1.9861	
	6.9682	3rd term: +.0009
		$-\Delta\phi$ +309.7698

$\frac{1}{2}(\phi+\phi')$ 11-32-33.050

	Logarithms	Values in seconds
s	4.0047795	
Sin α	9.5281829	
A'	8.5096683	
Sec ϕ'	0.0088064	
$\Delta\lambda'$	2.0514371	+112.5737
$\sin(\frac{1}{2}\Delta\phi)$	9.3012352	
$-\Delta\alpha$	1.3526723	−22.525