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

BIKINI ATOLL ML
U.S.N. 1946
SECOND
884
SHEET 1 OF 4

~~OFFICIAL USE ONLY~~

~~OFFICIAL USE ONLY~~

4062886

BIKINI ATOLL M.I.
U.S.N. 1946
SECOND

884

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

2 of 4

OFFICIAL USE ONLY

OFFICIAL USE ONLY

		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

*THIRD ORDER STATIONS

BIKINI ATOLL M.I.
U.S.N. 1946
SECOND
884
3
4

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.
U.S.N. 1946 SECOND
884 4 4

OFFICIAL USE ONLY

Station	Position	Azimuth	Back Azimuth	To Station	Log of Dis.	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

Datum U S N 1946
Bikini Atoll, M. I.
Scientific Stations
Second
884
1 of 1

OFFICIAL USE ONLY

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

OFFICIAL USE ONLY

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

* Third Order Stations

BIKINI ATOLL M.I.
PLANE GRID

CASTLE GRID

BIKINI ATOLL M.I. — CASTLE GRID
PLANE 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
5

DIANE S. NIXON

BIKINI ATOLL M.I.
PLANE GRID

CASTLE GRID

SALT to					100,421.6	113,966.8
Uncle	S87-48-36.0W	14789.5	S 565.2	W14778.7	99,856.5	99,188.1
Coca	N13-30-58.0W	32894.5	N31983.4	W 7688.1	132,405.1	106,278.7
Oboe	N77-39-28.5E	13370.6	N 2857.9	E13061.6	103,279.6	127,028.4
UNCLE to					99,856.5	99,188.1
Victor *	N62-31-10.2W	18398.7	N 8490.0	W16322.8	108,346.5	82,865.3
Yoke	N60-14-20.0W	33603.5	N16680.3	W29171.3	116,536.8	70,016.8
Coca	N12-17-23.3E	33312.0	N32548.6	E 7090.7	132,405.1	106,278.7
Oboe	N82-59-25.4E	28050.0	N 3423.1	E27840.3	103,279.6	127,028.4
Salt	N87-48-36-0E	14789.5	N 565.2	E14778.7	100,421.6	113,966.8
VICTOR to *					108,346.5	82,865.3
Yoke	N 57-29-04.0W	15236.9	N 8190.3	W12848.5	116,536.8	70,016.8
Coca	N44-13-17.2E	33570.9	N24058.6	E23413.4	132,405.1	106,278.7
Uncle	S62-31-10.2E	18398.7	S 8490.0	E16322.8	99,856.5	99,188.1
YOKE to					116,536.8	70,016.8
Zebra- *	N54-21-03.0W	9460.8	N 5513.9	W 7687.8	122,050.7	62,328.9
Alfa *	N55-19-57.6W	13390.0	N 7616.4	W11012.9	124,153.2	59,003.9
Bravo *	N50-58-49.9W	17027.8	N10720.4	W13229.4	127,257.2	56,787.3
Charlie	N13-15-45.2E	56261.0	N54760.4	E12907.0	171,297.2	82,923.8
Coca	N66-21-56.6E	39582.0	N16868.3	E36262.0	132,405.1	106,278.7
Uncle	S60-14-20.0E	33603.5	S16680.3	E29171.3	99,856.5	99,188.1
Victor *	S57-29-04.0E	15236.9	S 8190.3	E12848.5	108,346.5	82,865.3

BIKINI ATOLL M.I.

PROJECTION PLANE GRID

CASTLE GRID

JOB NO. 884 SHEET 5 OF 5

			LATITUDE	LONGITUDE	NORTH	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 SINISGALLI TO
DIANE S. NIXON

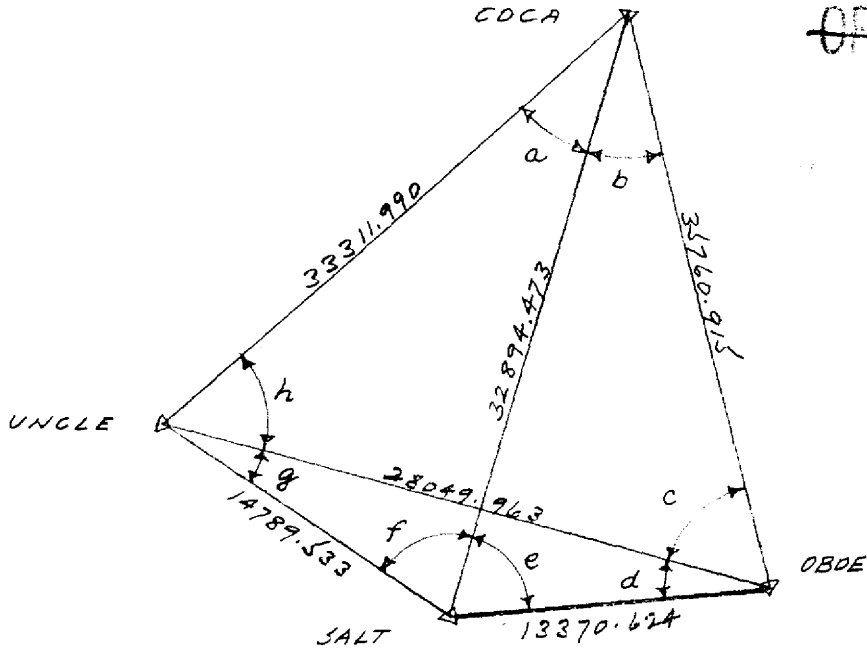
OFFICIAL USE ONLY

OFFICIAL USE ONLY

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"

~~USE ONLY~~

13370.624
Sin. 21-57-03.0
(37381082)

(99979007)
Sin 91-10-26.5
35760.915

(91945117)
Sin 66-52-30.5
32894.473

E.

32894.473
Sin 75-31-12.7
(96823583)

(98052526)
Sin 78-40-26.0
33311.990

(43532407)
Sin 25-48-21.3
14789.533

13370.624
Sin 4-19-10.6
(08401892)

(17626160)
Sin 169-50-52.5
28049.963

(09293480)
Sin 5-19-56.9
14789.482

Ee

28049.963
Sin 47-45-24.3
(74029734)

(87917220)
Sin 61-32-33.6
33311.949

94380432
Sin 70-42-02.1
35760.869

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

7-53

OBOE-SALT-UNCLE-COCA

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	SPHERIC'L ANGLE	SPHERIC'L EXCESS	PLANE ANGLE AND DISTANCE	[illegible]
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

~~OFFICIAL USE ONLY~~

JOB NO 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY JSH 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'		COCA	to 3	OBOE		324	31	17.1

SUM OF ANGLES 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	COCA		λ'	165	21	27.917

4.2825381		11-36-27.232	4.0374241		11-32-43.482
9.4047542			9.9108644		
8.5124969		4.2825381	8.5125007	1st term -288.9277	S 4.0374241
2.1997892	+158.4124	9.9855237	2.4607892		Sin α 9.7636029
8.5607		8.5096673	8.0748		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(α+φ) 9.3013438
4.3996		2.0903124 +123.116	4.9216		-Δφ 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

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-53

		°	'	"			°	'	"
COCA	OBOE	324	31	17.1	α	3 OBOE to 2 COCA	144	31	58.9
		+21	57	03.0	3d ∠	B	-66	52	30.5
COCA	SALT	346	28	20.1	α	3 OBOE to 1 SALT	77	39	28.4
		+	0	15.5	Δα		-	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		Δλ		+	01	17.388	Δφ	-	0	28.359		Δλ	-	02	11.366
11 29 50.670	SALT	λ'		165	22	45.305	φ'	11	29	50.670	1 SALT	λ'	165	22	45.3[illegible]

			Logarithms	Values in seconds		Logarithms		Values in seconds		Logarithms	Values in seconds
		½(φ+φ')	11-32-29.303						½(φ+φ')	11-30-04.849	
4.0011390		s	4.0011390		s	3.6101675			s	3.6101675	
9.9877809					Cos α	9.3299030					
8.5124983					B	8.5125007					
2.5014182	+317.2621	Sin α	9.3690605		h	1.4525712	1st term	+28.3512	Sin α	9.9898451	
8.00228			8.5096681			7.22033				8.5096681	
8.73812			0.0088033			9.97969				0.0088033	
0.71848			1.8886709	+77.3875		0.71540				2.1184840	-131.3663
7.4589	0.0029		9.3011976			7.91542		0.0082		9.2997066	
5.0028			1.1898685	-15.483		2.9051				1.4181895	+26.193
1.9861						1.9833					
6.9889	0.0001					4.8884		0.0000			
	+317.2651							+28.3594			

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-63

			°	'	"					°	'	"
	2 COCA to 3 SALT		346	28	20.1	α	3 SALT to 2 COCA		166	28	36.6
	3		+ 25	48	21.3	3d L	8		− 78	40	26.1
	COCA to 1 UNCLE		12	16	41.4	α	3 SALT to 1 UNCLE		87	48	09.5
			−	0	14.3	Δα			−	0	29.6
			180	00	00.0				180	00	00.0
α'	1 UNCLE to 2 COCA		192	16	27.8	α'	1 UNCLE to 3 SALT		267	47	39.9

FIRST ANGLE OF TRIANGLE 75-31-12.7

			°	'	"					°	'	"
φ	11 35 07.935	2 COCA	λ	165	21	27.917	φ	11 29 50.670	3 SALT	λ	165	22	45.305
Δφ	− 05 22.902		Δλ	−	01	11.247	Δφ	− 0 05.636		Δλ	−	02	28.134
φ'	11 29 45.033	1 UNCLE	λ'	165	20	16.670	φ'	11 29 45.034	1 UNCLE	λ'	165	20	16.671

Logarithms	Values in seconds					Logarithms	Values in seconds				
4.0066167		½(φ+φ')	11-32-26.484			s	3.6539695	½(φ+φ')	11-29-47.835		
9.9899509			Logarithms	Values in seconds		Cos α	8.6836773		Logarithms	Values in seconds	
8.6124983		s	4.0066167			B	8.6124910	s	3.6539695		
2.6090639	1st term +322.8983	Sin α	9.3276819			h	0.7601378	Sin α	9.9996805		
8.0133 23		A'	8.6096682			s²	7.3079 4	A'	8.6096682		
8.6556 36		Sec φ'	0.0088009			Sin²α	9.999936	Sec φ'	0.0088009		
0.71848		Δλ	1.8627677	−71.2472		C	0.7608	Δλ	2.1721191	−148.634	
7.38707	2d term +0.0024	Sin ½(φ+φ')	9.3011682				8.0223 38	Sin ½(φ+φ')	9.2996296		
5.0181		−Δα	1.6539362	+14.214		h²	1.6003	−Δα	1.4716487	+29.624	
1.9861						D	1.9830				
7.00042	3d term +0.0010						3.4833				
	−Δφ +322.9017							3d term −Δφ	+0.0008 +5.6357		

JOB № 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-53

			°	'	"
α	2	to 3			
		S	+		
α	OBOE	to 1 UNCLE	82	59	25.2
Δα			−	0	55.8
			180	00	00.0
α′	UNCLE	to 2 OBOE	262	58	29.4

			°	'	"
α	3	to 2			
3d ∠		a	−		
α	3	to 1			
Δα					
			180	00	00.0
α′	1	to 3			

FIRST ANGLE OF TRIANGLE

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

°	'	"			°	'	"
φ			3	λ			
Δφ				Δλ			
φ′			1	λ′			

	Logarithms	Values in seconds
s	3.9319489	
Cos α	9.0864908	
B	8.5125007	
h	1.5309404	1st term +339.579
s²	7.86390	
Sin² α	9.99348	
C	0.71540	
	8.57278	2d term +0.0374
h²	3.0619	
D	1.9863	
	5.0482	3d term +0.0000
		−Δφ +33.996

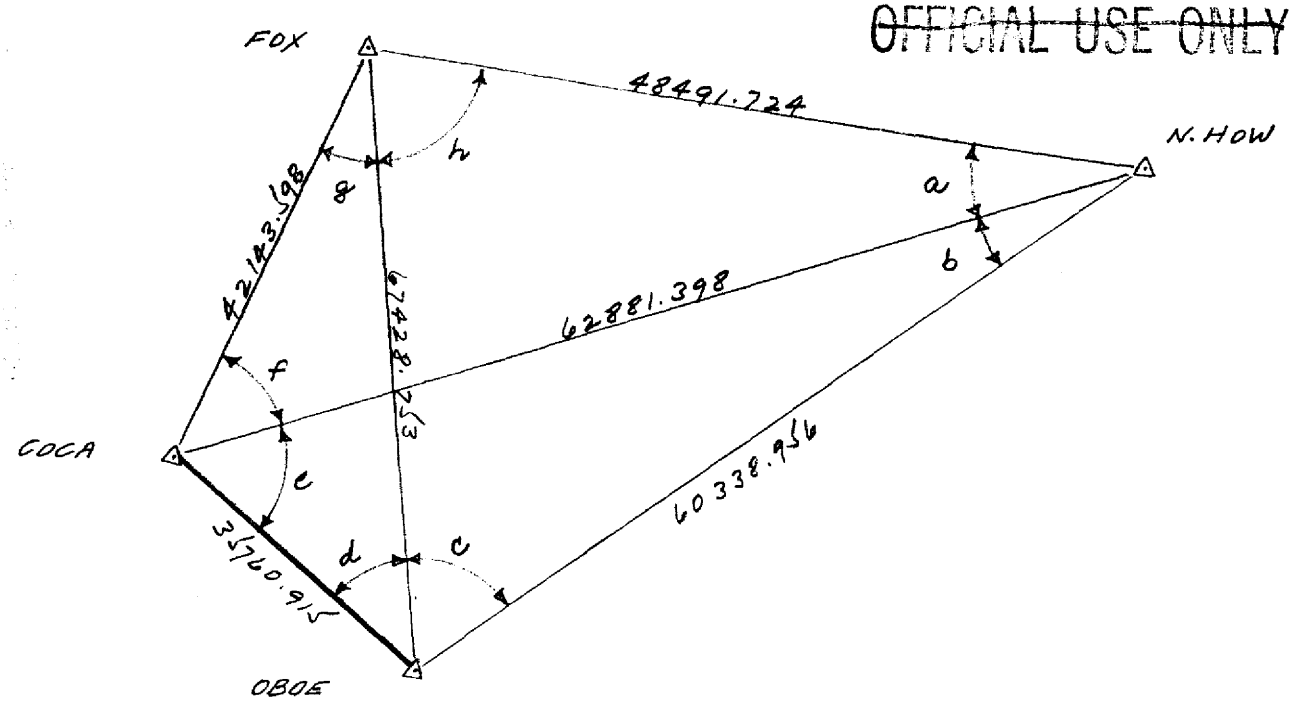
	° ' "
½(φ+φ′)	11-30-02.031

	Logarithms	Values in seconds
s	3.9319489	
Sin α	9.9967418	
A′	8.5096682	
Sec φ′	0.0088009	
Δλ	2.4471598	−280.001
Sin ½(φ+φ′)	9.2996763	
−Δα	1.7468361	+55.826

	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		



	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	Log Sin b	347	
c		495	d	813	
e		226	f	542	
g.		589	h.	795	
		488		499	
				488	
				11	

11 / 187.4 = 0.06"

	(97464883)	(93524149)
35760.915	Sin 77-04-16.3	Sin 69-16-01.9
Sin 33-39-41.8	62881.398	60338.956
(55428688)		

R1

	(66960389)	(77046689)
62881.398	Sin 42-02-11.4	Sin 50-23-45.0
Sin 87-34-03.6	42143.598	48491.724
(99909904)		

	(54310199)	(86895105)
35760.915	Sin 32-53-42.2	Sin 119-39-46.9
Sin 27-26-30.9	42143.559	67428.753
(46084917)		

R2

	(69686648)	(86712069)
67428.753	Sin 44-10-34.1	Sin 60-07-32.7
Sin 75-41-53.7	48491.713	60338.915
(96900759)		

OFFICIAL USE ONLY

HOLMES & NARVER INC. - ENGINEERS - CONSTRUCTORS

TRAVERSE COCA-FOX-N.HOW-OBOE

CALC. BY LSH

CHKD. BY

DATE 7-53

JOB NO. 884

SHEET NO. OF

STATION	BEARING	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	CO-ORDINATES NORTH	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

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

OFFICIAL USE ONLY

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
		01.3				14780.29	4.1696830
1-2						18391.32	4.2646129

JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

SOLUTION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH 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			e		− 45	43	46.9
NAN	N. HOW	165	18	17.1	α	3	OBOE	to 1	N. HOW	221	36	15.5
		− 0	22	22.6	Δα					+ 01	20	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

Check of Triangle 56-19-41.8

11 30 42.595	NAN		165	33	32.574	φ	11	30	19.029	OBOE	λ	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	46.528	N. HOW	λ'	165	31	39.801

		Logarithms	Values in seconds
4.1292483		½(α+α') 11-34-14.562	
9.9855562			
8.5125005		s 4.1292483	
2.6273050	−423.9406	Cos α 9.4042824	
8.25850		A 8.5096668	
8.80856		Sec φ' 0.0090083	
0.71563		Δλ 2.0522058	−1127732
7.78269	0.0061	Sin ½(φ+φ') 9.3022815	
5.2546		1.3544873	+22.620
1.9835			
7.2381	0.0017		
	−423.9328		

	Logarithms	Values in seconds
s	4.2646138	
Cos α	9.8737554	
b	8.5125007	
h	2.6508699	1st term −447.5792
A	8.5096668	
Sin² α	9.64431	
C	0.71540	
	8.88894	2d term +0.0774
D	5.3017	
	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
Sin² ½(φ+φ')	9.3021603	
	1.9076058	−80.836

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

SUM OF 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	58.302
11 41 27.251	FOX		λ′	165	24	26.220	φ′	11	41	27.251	1	FOX	λ′	165	24	26.219

					Logarithms	Values in seconds			
4.1696832		½(φ+φ′)	11-39-36.890		4.1087473		½(φ+φ′)	11-38-17.593	
9.6618475			Logarithms	Values in seconds	9.9577746			Logarithms	Values in seconds
8.5124969		s	4.1696832		8.5124983		s	4.1087473	
2.3440276	−220.8145	Sin α	9.9486170		2.5790202	1st term −379.3326	Sin α	9.6236389	
8.33937		A′	8.5096662		8.21749		A′	8.5096662	
9.89723		Sec φ′	0.0091042		9.24728		Sec φ′	0.0091042	
0.72018		Δλ	2.6370706	−433.5814	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	5.1580		−Δα	1.5559300	−35.969
1.9876					1.9861				
6.6757	0.0005				7.1441	3d term +0.0014			
	−220.7235					Δφ −379.3160			

JOB No. 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-54

		°	'	"
OBOE to FOX		177	25	41.3
		−	0	06.1
		180	00	00.0
FOX to OBOE		357	25	35.2

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

$\frac{1}{2}(\phi+\phi')$ 11-35-53.140

		Logarithms	Values in seconds
4.3128613	s	4.3128613	
9.9995623	Sin α	8.6519790	
8.5125007	A'	8.5096662	
2.8249243 1st term −668.2274	Sec φ'	0.0091044	
8.62572	Δλ	1.4836109	−30.4516
7.30396	Sin ½(φ+φ')	9.3032940	
0.71540	−Δα	0.7869049	+06.1
6.64508 2d term 0.0004			
5.6498			
1.9833			
7.6331 3d term 0.0043			
−668.2232			

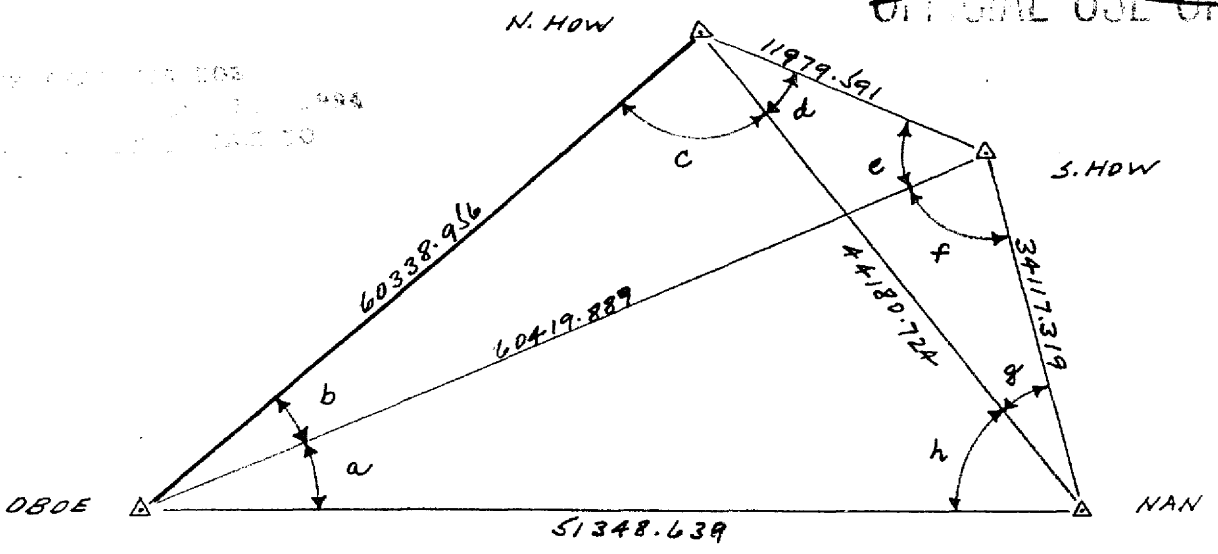
α	3	to 2			
3d ∠		8	−		
α	3	to 1			
Δα					
			180	00	00.0
α'	1	to 3			

φ				3	λ		
Δφ					Δλ		
φ'				1	λ'		

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

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

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



	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"

	(1974 2209)	(99 571188)
60338.956	Sin 11-23-10.5	Sin 84-41-31.4
Sin 83-55-18.1	11979.591	60419.889
(99437811)		

R1

	(5641 5187)	(84908285)
60419.889	Sin 34-20-36.3	Sin 58-06-43.4
Sin 87-32-40.3	34117.319	51348.639
(99908132)		

	(716 05426)	(83222732)
60338.956	Sin 45-43-46.8	Sin 56-19-41.6
Sin 77-56-31.6	44180.724	51348.630
(97793704		

R2

	(16681034)	(47506886)
44180.724	Sin 9-36-08.7	Sin 28-21-49.8
Sin 142-02-015	11979.576	34117.331
(6 L S 19719)		

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

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

Station	Bearing	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
	S 5-07-17.6E	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

OFFICIAL USE ONLY

S. HOW – NAN

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

STATION	OBSERVED ANGLE	CORRN.	SPHERICAL ANGLE	PROBABLE ERROR	LOGARITHM OF SINE	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
					1565.10	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
					1565.10	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

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 16.7

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

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

4.0169903		11-33-31.150	4.2651958	11-33-19.367
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		0.7857276 +6.106	5.1145	1.9878418 −97.239
1.9435			1.9833	
7.0978	0.0011		7.0978	0.0013
	−337.1095			−360.6764

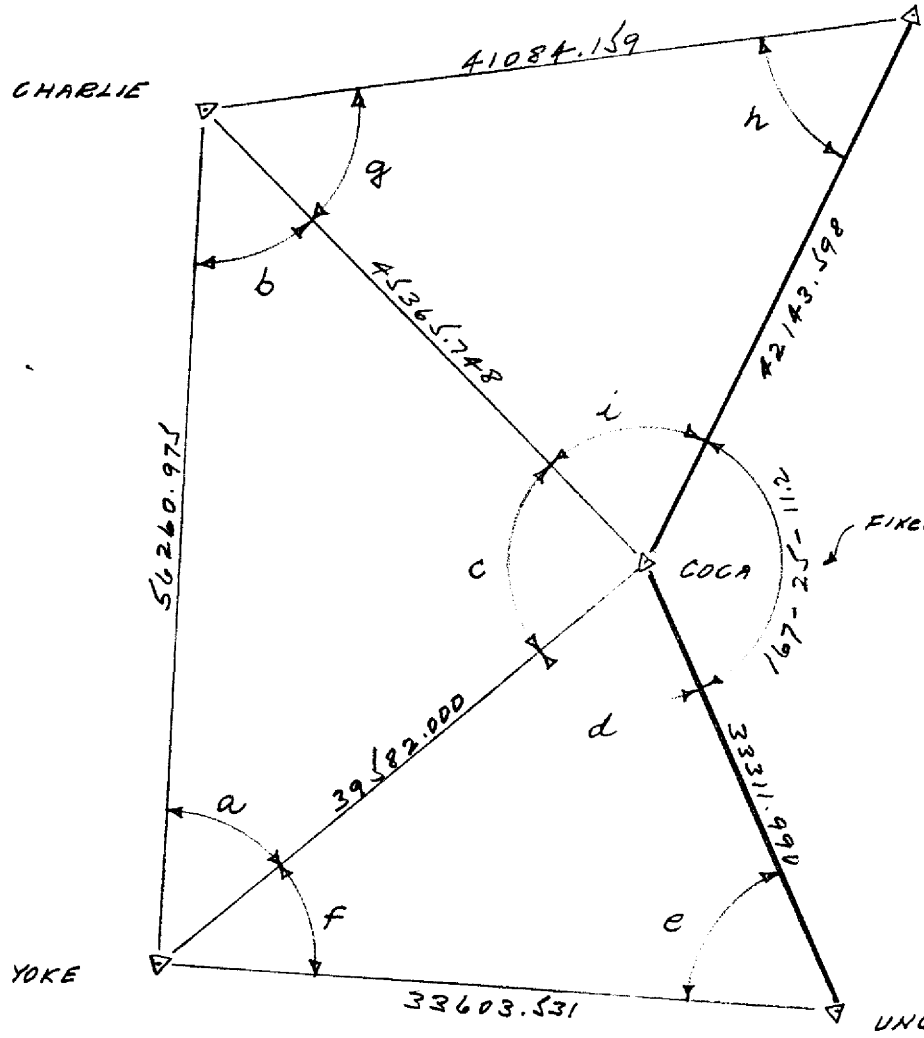
NOTE — STA. NAN = USN-ENYU

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

JOB NO. 884
SHEET 1 OF 2

TITLE QUADRANGLE ADJUSTMENT CHARLIE-YOKE
BY LSH DATE 7-63

~~OFFICIAL USE ONLY~~ FOX USE ONLY



47-45-24.3
119-39-46.9
167-25-11.2

360-
192-34-48.8

	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	i = 18.4
b	44-14-53.2	52.1	52.1	~~51.8~~	51.4	c = 57.3
c	82-38-58.4	57.3	57.2	57.2		d = 33.4
	03.3					49.1
d	54-04-34.1	33.4	33.3	33.3		48.8
e	72-31-44.2	43.5	43.6	43.3		0.3
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					

~~OFFICIAL USE ONLY~~

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

JOB NO. 884

SHEET 2 OF 2

TITLE QUADRANGLE ADJUSTMENT CHARLIE - YOKE

BY L.S.H. DATE 7-53

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

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	355
		285	355				
		22	82.1			22 / 82.1 = 0.27	

	(91387112)	(82782857)
42143.598	sin 66-02-45.3	sin 55-51-18.3
sin 58-05-56.4	45365.748	41084.159
(84896246)		
	(80979510)	(95387438)
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 53-06-11.8⁴
sin 44-14-51.8⁴	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

L-54

7-53

UNCLE-YOKE-CHARLIE-FOX

8-84

YOKE - CHARLIE

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

STATION	OBSERVED ANGLE	CORR	CORRECTED ANGLE	SPHERICAL EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHMS	
					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	
UNCLE	72-31-44.2	-0.7	43.5	0.2	43.3	9.9794880	YOKE
	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	
YOKE	53-06-11.7	-0.1	11.6	0.2	11.4	9.9029368	CHARLIE
	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	
COCA	55-51-18.4	-0.1	18.3	0.0	18.3	9.9178312	
	0.00				13827.51	4.1407438	CHARLIE
					12522.47	4.0976900	

JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-3-53

				°	′	″
α	COCA	to	UNCLE	12	16	41.4
θ				+54	04	33.3
α	COCA	to	YOKE	66	21	14.7
Δα				−	01	13.1
				180	00	00.0
α′	YOKE	to	COCA	246	20	01.6

Third angle of triangle 53-23-43.5

				°	′	″
α	UNCLE	to 2	COCA	192	16	27.2
3rd ∠ θ				−72	31	43.5
α	UNCLE	to 1	YOKE	119	44	43.7
Δα				−	0	58.6
				180	00	00.0
α′	YOKE	to 3	UNCLE	299	43	45.1

	φ	Station		λ
φ	11 35 07.935	COCA	λ	165 21 27.917
Δφ	− 02 37.552		Δλ	− 06 04.727
φ′	11 32 30.383	YOKE	λ′	165 15 23.190

	φ	Station		λ
φ	11 29 45.033	UNCLE	λ	165 20 16.670
Δφ	+ 02 45.350		Δλ	− 04 53.480
φ′	11 32 30.383	YOKE	λ′	165 15 23.190

Logarithms		Values in seconds
4.0815136		
9.6032345		
8.5124983		
2.1972464	1st term	+157.4876
8.16303		
9.92383		
0.71848		
8.80534	2d term	0.0639
4.3945		
1.9861		
6.3806	3d term	0.0002
	−Δφ	+157.5517

½(φ+φ′) 11-33-49.159

	Logarithms	Values in seconds
s	4.0815136	
Sin α	9.9619151	
A′	8.5096676	
Sec φ′	0.0088719	
Δλ	2.5619683	−364.7273
sin ½(φ+φ′)	9.3020201	
−Δα	1.8639884	+73.112

	Logarithms		Values of seconds
s	4.0104005		
Cos α	9.6956112		
B	8.5125010		
h	2.2185127	1st term	−165.3913
s²	8.02080		
Sin² α	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

½(φ+φ′) 11-31-07.708

	Logarithms	Values in seconds
s	4.0104005	
Sin α	9.9386388	
A′	8.5096677	
Sec φ′	0.0088719	
Δλ	2.4673789	−293.4803
sin ½(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	FOX	204	51	30.2
		+66	02	45.5				−55	51	18.3
FOX	CHARLIE	90	54	51.7	α	COCA	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	COCA	328	59	24.5

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 06421			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
4.0976907	
8.2029765	
8.5124951	
0.8131623	−6.5037
8.19538	
9.99989	
0.72252	
8.91779	0.0828
1.6063	
1.9899	
3.5962	3d term 0.0000
−Δφ	−6.4209

½(φ+φ′) 11-41-30.461

	Logarithms	Values in seconds
s	4.0976907	
Sin α	9.9999447	
A	8.5096662	
Sec φ′	0.0091070	
Δλ	2.6164086	−413.4363
Sin ½(φ+φ′)	9.3067403	
−Δα	1.9231489	+83.782

	Logarithms		Values in seconds
s	4.1407434		
Cos α	9.9330807		
B	8.5124983		
h	2.5863224	1st term	−385.7646
s²	8.28149		
Sin² α	9.42360		
C	0.71848		
	8.42357	2d term	+0.0265
h²	5.1726		
D	1.9861		
	7.1587	3d term	+0.0014
		−Δφ	−385.7367

½(φ+φ′) 11-38-20.803

	Logarithms	Values in seconds
s	4.1407434	
Sin α	9.7117977	
A	8.5096662	
Sec φ′	0.0091070	
Δλ	2.3713143	−235.1334
Sin ½(φ+φ′)	9.3042061	
−Δα	1.6761204	+47.437

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-4-53

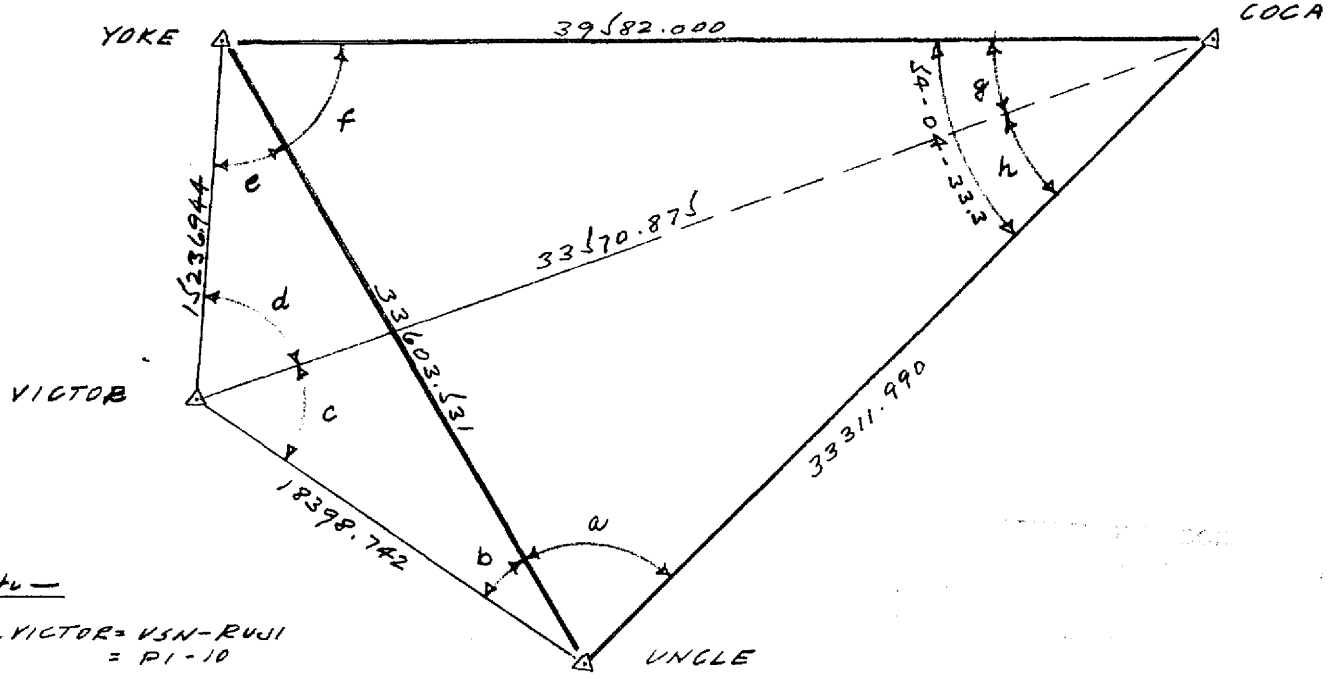
COCA	YOKE	6.6	21	14.7		YOKE	to	COCA	246	20	01.6
		+ 82	38	57.2	3rd				- 53	06	11.6
COCA	CHARLIE	149	00	11.9	α	YOKE	to	CHARLIE	193	13	50.0
		-	0	47.4	Δα				+	0	26.1
									sec	cc	cc
CHARLIE	COCA	328	59	24.5		CHARLIE		YOKE	13	14	16.1
		Balance	44	14	51.6						

11	35	07.935	COCA		165	21	27.917	11	32	30.383	YOKE		165	15	23.190
+	06	25.737			-	03	55.133	+	09	03.289			+	02	09.594
11	41	33.672	CHARLIE		165	17	32.784	11	41	33.672	CHARLIE		165	17	32.784

		Logarithms	Values in seconds
			11-38-20.803
		4.1407434	4.2342234
		9.9330807	9.9883168
		8.5124983	8.5124996
	−385.7646	2.5863224	2.7350398 −543.3001
		8.28149	8.46845
		9.42360	8.71918
		0.71848	0.71679
	0.0265	8.42357	7.90442 0.0080
		5.1726	5.4701
		1.9861	1.9846
		7.1587	7.4547 0.0028
	−385.7368		−543.2893

		Logarithms	Values in seconds
			11-37.02.028
		4.2342234	
Sin α		9.2595890	
		8.5096662	
Sin α'		0.0091070	
		2.1125856	+129.5972
		9.3040002	
		1.4165858	−26.097

PERFORM THIS ONLY ONCE



Note —

Sta. VICTOR = VSN-RUJI
= P1-10

	MEAS ∠	GEO. COND.		TRIG. COND	
a	72-31-43.3	43.3	32.4	33 53	43.3
b	2-16-48.8	49.1			50.2
c	73-15-33.3	33.7		32.6	
d	101-42-19.7	20.1		21.2	
e	2-45-16.8	17.1	00.5	59.4	16.0
f	53-23-43.4	43.4			43.4
g	22-08 —	39.4		39.4	
h	31-55 —	53.9		53.9	

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

33311.990	4.522 6006		39 53 82.0	4.594 4977	
Sin a+b	9.984 55 32	53.7	Sin e+f	9.919 3397	14.1
Sin d	9.990 8728	4.4	Sin c	9.981 1925	6.3
	4.498 0266	10.1		4.498 1299	20.4
				2.66	10.1
				3.3	30.5

33/30.5 = 1.1"

OFFICIAL USE ONLY

33311.990 Sim 73-15-32.6 (95761690)	(96505906) Sim 74-48-33.5 33570.875	(5289 0706) 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 22-08-394 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

OFFICIAL USE ONLY

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	53752857	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

1994

~~OFFICIAL USE ONLY~~

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

Station	To station	°	′	″			Station		To station	°	′	″
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	48.2	α′	1	VICTOR	to 3	UNCLE	297	27	20.9

Sum of angles in 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	+238.7096
8.01996	
9.68682	
0.71848	
8.42526	0.0266
4.7557	
1.9861	
6.7418	0.0006
	+238.7368

½(φ+φ′) 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
h²	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

½(φ+φ′) 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

4 SH 8-11-53

YOKE	VICTOR	302	29	01.0	α
		+ 0		25.9	$\Delta\alpha$
VICTOR	YOKE	122	29	26.9	α'

TRIANGLE

11 32 30.383	YOKE	λ	165	15	23.190
− 01 21.185		$\Delta\lambda$	+ 02	09.279	$\Delta\phi$
11 31 09.198	VICTOR	λ'	165	17	32.469

Logarithms | Values in seconds

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

	Logarithms	Values in seconds
s	3.6669128	
Sin α	9.9261083	
A'	8.5096680	
Sec ϕ'	0.0088370	
$\Delta\lambda$	2.1115261	+129.2785
Sin $\frac{1}{2}(\phi+\phi')$	9.3002900	
$-\Delta\phi$	1.4123161	−25.89

3.6669128		
9.7300215		
8.5124996		
1.9094339	+81.1772	
7.33383		
9.85222		
0.71679		
7.90284	0.0080	
3.8193		
1.9846		
5.8039	0.0001	
$\Delta\phi'$	+81.1853	

s	
Cos α	
B	
h	
s^2	
Sin$^2\alpha$	
C	
n^2	
D	

Logarithms | Values in seconds

1st term "

2nd term +

3rd term +

$-\Delta\phi$

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

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

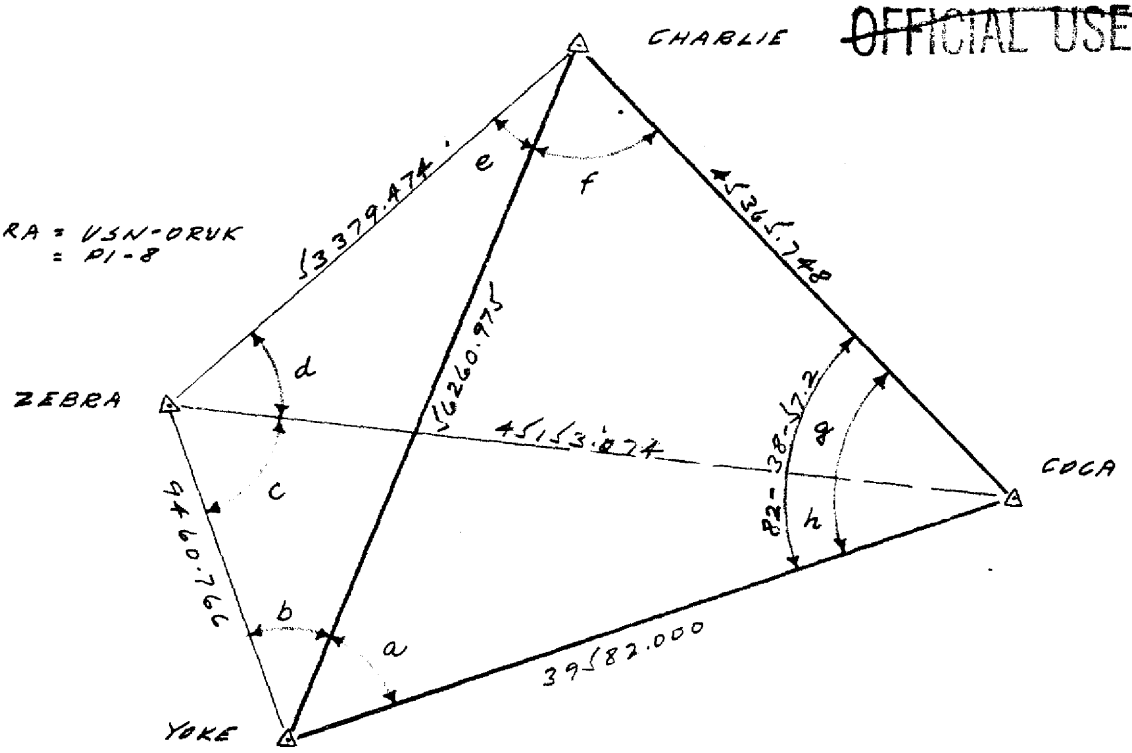
HOLMES & NARVER, INC.
ENGINEERS . CONSTRUCTORS
LOS ANGELES, CALIFORNIA

JOB NO. 684
SHEET 1 OF 2

TITLE QUADRANGLE ADJUSTMENT ZEBRA
BY LSH DATE 8-53

~~OFFICIAL USE ONLY~~

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

3982.000	4.5974977		4536.748	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
	4.4400712	27.8		4.4400718	33.9
				712	27.8
				6	61.7

6/61.7 = 0.1"

~~OFFICIAL USE ONLY~~

39S82.000
Sin 48-S4-21.8
(7S363286)

(8S970471)
Sin 120-42-S9.6
45153.063

(1801S097)
Sin 10-22-386
9460.766

4536S.748
Sin S4-02-S4.4
(8095I369)

(80S71871)
Sin S3-40-47.0
45153.074

(95251190)
Sin 72-16-18.6
S3379.474

S6260.97S
Sin 102-S7-16.2
(9745S4839)

(92463S05)
Sin 67-36-48.2
S3379.463

(16387886)
Sin 9-2S-SS.6
9460.776

		[illegible]	COSINE	SINE	[illegible]	[illegible]	CO-ORDINATES NORTH	EAST
YOKE							116,536.762	70,016.764
	N54-21-03.0W	9460.766	58282049	81260093	N5513.928	W7687.827		
ZEBRA							122,050.690	62,328.937
	N22-41-40.8E	53379.474	92257400	38582017	N49246.515	E20594.878		
CHARLIE							171,297.205	82,923.815
ZEBRA							122,050.690	62328.937
	N76-44-35.2E	45153.074	22931743	97335169	N10354.387	E43949.821		
COCA							132,405.077	106,278.758

457

7-53

YOKE-ZEBRA-CHARLIE

884

OFFICIAL USE ONLY

ZEBRA

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

STATION	OBSERVED ANG					
					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

JOB Nº 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	3 COCA	to 2 CHARLIE	149	00	11.9
		+53	40	47.2	3d ∠		8	−72	16	18.6
CHARLIE	ZEBRA	22	40	11.7	α	3 COCA	to 1 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'	1 ZEBRA	to 3 COCA	256	42	24.6 (7)

THIRD ANGLE OF TRIANGLE 54-02-54.7

φ	Station		°	'	"		°	'	"	Station		°	'	"
11 41 33.672	CHARLIE	λ	165	17	32.784	φ	11	35	07.935	3 COCA	λ	165	21	27.917
− 08 08.636		Δλ	−	03	26.961	Δφ	−	01	42.899		Δλ	−	07	22.094
11 33 25.036	ZEBRA	λ'	165	14	05.823	φ'	11	33	25.036	ZEBRA	λ'	165	14	05.823

			½(φ+φ') 11-37-29.354					½(φ+φ') 11-34-16.486	
			Logarithms / Values in seconds					Logarithms / Values in seconds	
4.2113903					4.1387033				
9.9650796					9.3608113				
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	2d 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	3d term +0.0001			
	+488.6359					−Δφ +102.8986			

OFFICIAL USE ONLY

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

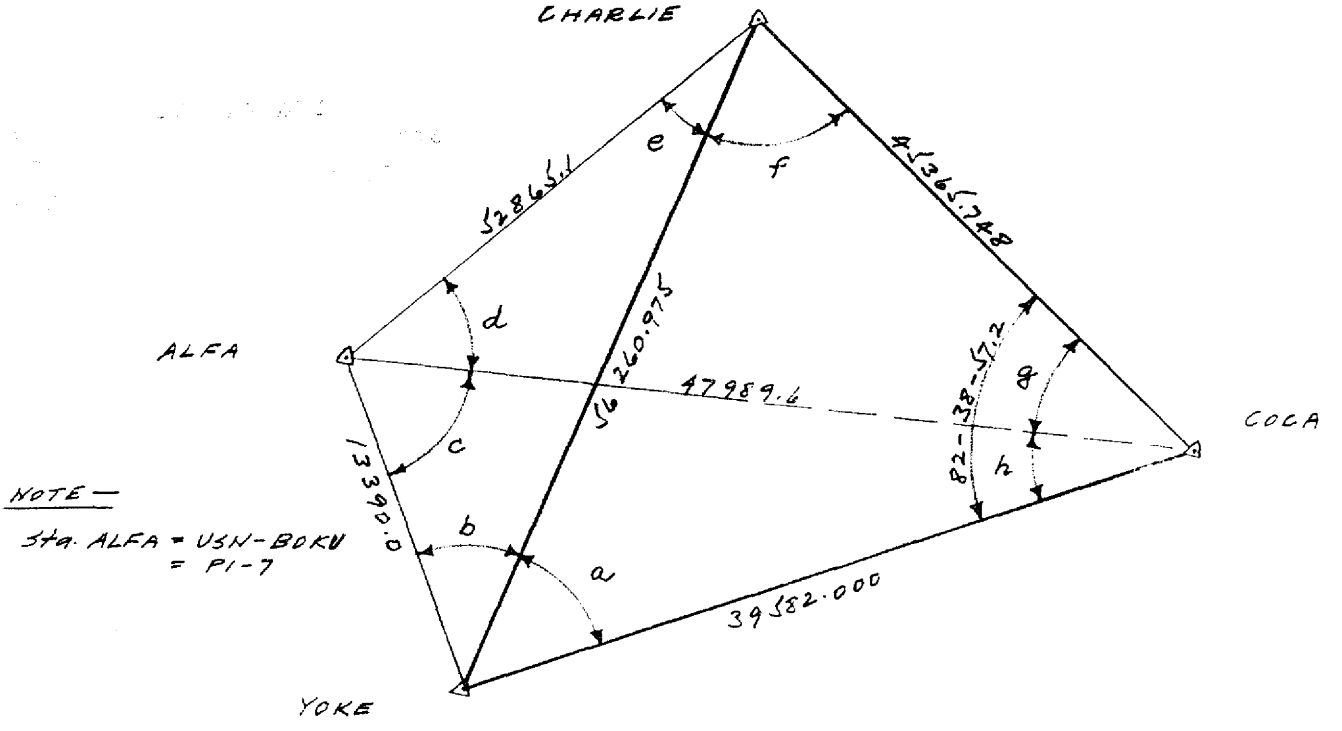
COMPUTED BY LSH DATE 8-11-53

		°	′	″				°	′	″
					α	3 to 2				
		+			3d ∠	8		−		
YOKE to ZEBRA		125	37	01.9	α	3 to 1				
		−	0	15.4	Δα					
		180	00	00.0				180	00	00.0
ZEBRA to YOKE		305	36	46.5	α′	1 to 3				

FIRST ANGLE OF TRIANGLE

			°	′	″		°	′	″			°	′	″
11 32 30.383 YOKE		λ	165	15	23.190	φ				3	λ			
+ 0 54.653		Δλ	−	01	17.367	Δφ					Δλ			
11 33 25.036 ZEBRA		λ′	165	14	05.823	φ′				1	λ′			

Logarithms	Values in seconds			Logarithms	Values in seconds		Logarithms	Values in seconds
3.4599448		½(φ+φ′)	11-32-57.710	s		½(φ+φ′)		
9.7651967				Cos α				
8.5124996		s	3.4599448	B		s		
1.7376411	−54.6564	Sin α	9.9100511	h		Sin α		
6.91989		A′	8.5096676			A′		
9.82010		Sec φ′	0.0088953	Sin² α		Sec φ′		
0.71679		Δλ	1.8885588 −77.3675	C		Δλ		
7.45678	0.0029	Sin ½(φ+φ′)	9.3014904		2d term +	Sin ½(φ+φ′)		
3.4753		−Δα	1.1900492 +15.5 (4)	h²		−Δα		
5.4599				D				
	0.0000				3d term +			
−Δφ	−54.6533				−Δφ			



NOTE —
Stg. ALFA = USN-80KV
= PI-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	4.5974977		4536.748	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"

~~OFFICIAL USE ONLY~~

45365.748	(93305595)	(84700390)
Sin 53-11-47.1	Sin 68-54-58.7	Sin 57-53-14.7
(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	52865.1	89177998	45246930	S47144.0	W23919.8	171,297.2 124,153.2	82,923.8 59,003.9
COCA ALFA	S80-05-52.1W	47989.6	17195250	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	00	0
ALFA	CHARLIE	206	51	50.4	ALFA	COCA	260	03	37.8

ANGLE OF TRIANGLE 53-11-47.4

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

		Logarithms	Values in seconds
4.2071848		11-37-39.772	4.1651630
9.9503528			9.2359136
8.5124950		4.2071848	8.5124983
2.6700326	+467.7702	9.6552191	1.9135749
2.41437		8.5096675	8.33033
9.31044		0.0089043	9.98693
0.72248		2.3809757 −240.4228	0.71848
8.44729	0.0280	9.3043865	9.03574
5.3401		1.6853622 +48.456	3.8271
1.9899			1.9861
7.3300	0.0022		5.8132
	+467.8004		

		Logarithms	Values in seconds
½(φ+Φ)		11-34-26.904	
Sin a		4.1651630	
Sin a'		9.9934672	
Sec a'		8.5096675	
ΔA		0.0089043	
Sin ½(φ−Φ)		2.6772020	−475.5584
1st term	+81.9549	9.3024084	
2nd term	0.1086	1.9796104	+95.414
3rd term	0.0001		
−Δφ	+82.0636		

JOB No 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-13-53

						α	3	to 2			
						$3^d\angle$		a	−		
YOKE		ALFA	124	38	07.3	α	3	to 1			
			−	0	22.2	$\Delta\alpha$					
									180	00	00
ALFA		YOKE	304	37	45.1	α'					

11	32	30.383	YOKE			165	15	23.190	ϕ	3	λ
+	01	15.489				+	01	50.829	$\Delta\lambda$		$\Delta\lambda$
11	33	45.872	ALFA			165	13	32.361	ϕ'		λ'

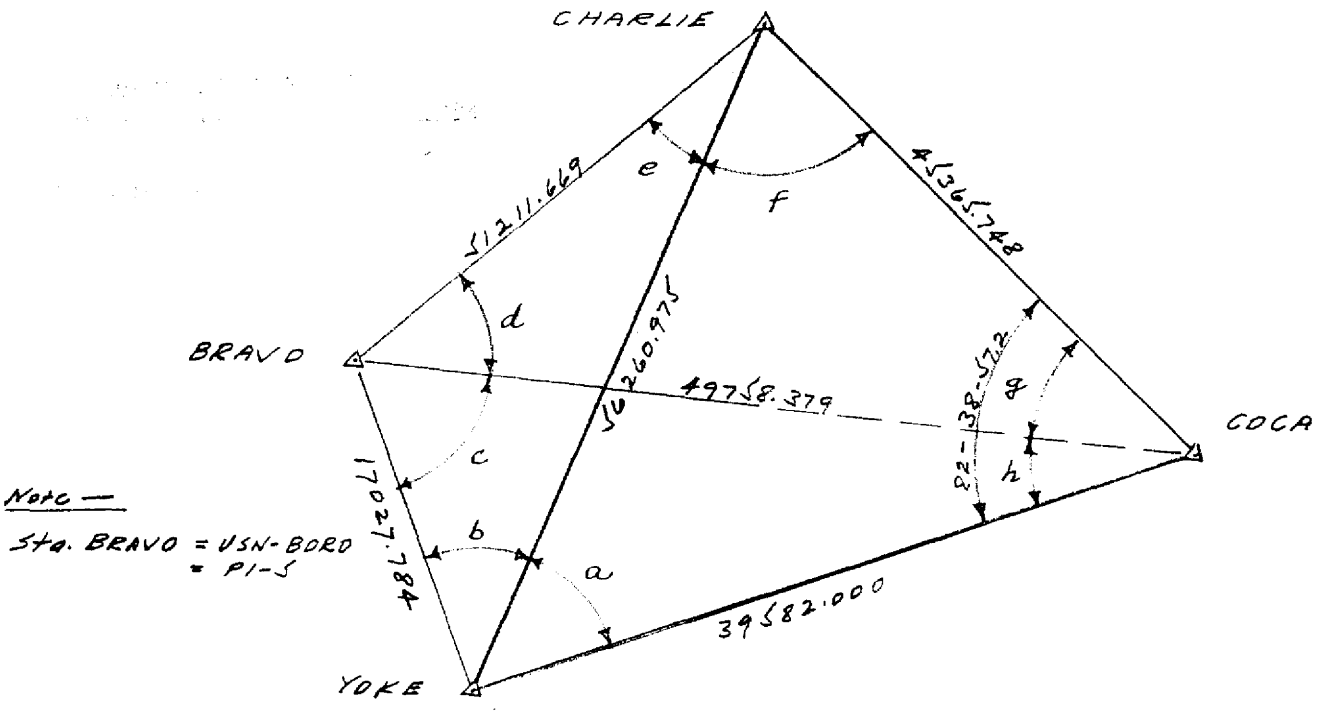
								11-33-08.128	s		
3.6107909								3.6107909			
9.7546172								9.9152867			
8.5124996								8.5096675			
1.8779077		−75.4932						0.0089043			
7.22158								2.0446494	−110.8280		
9.83057								9.3015977			
0.71679								1.3462471	+22.195		
7.76894		0.0059									
3.7658											
1.9846											
5.7404		0.0001									
		−75.4872									

OFFICIAL USE ONLY

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

JOB NO. 884
SHEET 1 OF 2

TITLE QUADRANGLE ADJUSTMENT BRAVO
BY LSH DATE 8-53



Note —
Sta. BRAVO = USN-BORD
= P1-5

	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	4.597497		4536.748	4.656728	
sin a+b	9.948532	10.9	sin a+b	9.944607	11.3
sin d	9.904469	15.7	sin c	9.849164	21.1
	4.450002	26.6		4.450007	32.4
				002	26.6
				5	59.0

5/59.0 = 0.1"

45365.748
Sim 53-22-25.8
(80254-510)

(88025316)
Sim 61-40-22.5
49758.379

(90596262)
Sim 64-57-11.7
51211.669

39582.000
Sim 44-57-28.0
(70658551)

(88824712)
Sim 117-20-46.5
49758.480

(30396609)
Sim 17-41-45.5
17027.784

56260.975
Sim 98-19-53.8
(98944599)

(90064579)
Sim 64-14-24.1
51211.699

(29946222)
Sim 17-25-31.1
17027.747

		DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	COORDINATES NORTH	COORDINATES EAST
YOKE							116,536.762	70,016.764
BRAVO	N50-58-49.9W	17027.784	62958447	77693204	N10720.428	W13229.431	127,257.190	56,787.333
CHARLIE	N30-41-16.3E	51211.669	85996042	51036.073	N44040.008	E26136.425	171,297.198	82,923.758
BRAVO							127,257.190	56,787.333
COCH	N84-03-42.1E	49758.379	10345753	99463387	N5147.879	E49491.369	132,405.069	106,278.702

YOKE-BRAVO-CHARLIE

BRAVO

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

STATION		OBSERVED ANGLE	CORR.	SPHERICAL EXCESS		REDUCED OBSERVED ANGLE	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

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	$3^d\angle$		B	- 64	57	11.7
CHARLIE	to 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

FINAL ANGLE 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	17.876
11 34 16.649	BRAVO	λ'	165	13	10.041	ϕ'	11	34	16.650	1 BRAVO	λ'	165	13	10.041

		Logarithms	Values in seconds
	$\frac{1}{2}(\phi+\phi')$	11-37-55.162	
4.1933851	s	4.1933851	
9.9345896	Sin α	9.7075614	
8.5124950	A'	8.5096674	
2.6404697	Sec ϕ'	0.0089176	
8.38677	$\Delta\lambda$	2.4195315	+262.7432
9.41512	Sin $\frac{1}{2}(\phi+\phi')$	9.3045440	
0.72248	$-\Delta\alpha$	1.7240755	+52.976
8.52437			
5.2801			
1.9899			
7.2700			

+436.9881
0.0334
0.0019
+437.0234

	Logarithms	Values in seconds
s	4.1808823	
Cos α	9.0156095	
B	8.5124983	
h	1.7089901	
s^2	8.36176	
Sin$^2\alpha$	9.99531	
	0.71848	
	9.07555	
	3.4180	
	1.9861	
	5.4041	

1st term +51.1670
2 term 0.1179
3 term 0.0000
$-\Delta\phi$ +51.2849

		Logarithms	Values in seconds
	$\frac{1}{2}(\phi+\phi')$	11-34-42.292	
s	4.1808823		
Sin α	9.9976542		
A'	8.5096674		
Sec ϕ	0.0089176		
$\Delta\lambda$	2.6971215	-497.8763	
Sin $\frac{1}{2}(\phi+\phi')$	9.3025665		
$-\Delta\alpha$	1.9996880	+99.928	

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

Computed by: LSH Date: 8-11-53

			°	'	"							
						α	3	to 2				
			+			3d ∠		8		-		
YOKE		BRAVO	128	59	15.0	α	3	to 1				
			-	0	26.7	Δα						
			180	00	00.0					180	00	00.0
BRAVO		YOKE	308	58	48.3	α'	1	to 3				

Third angle of triangle

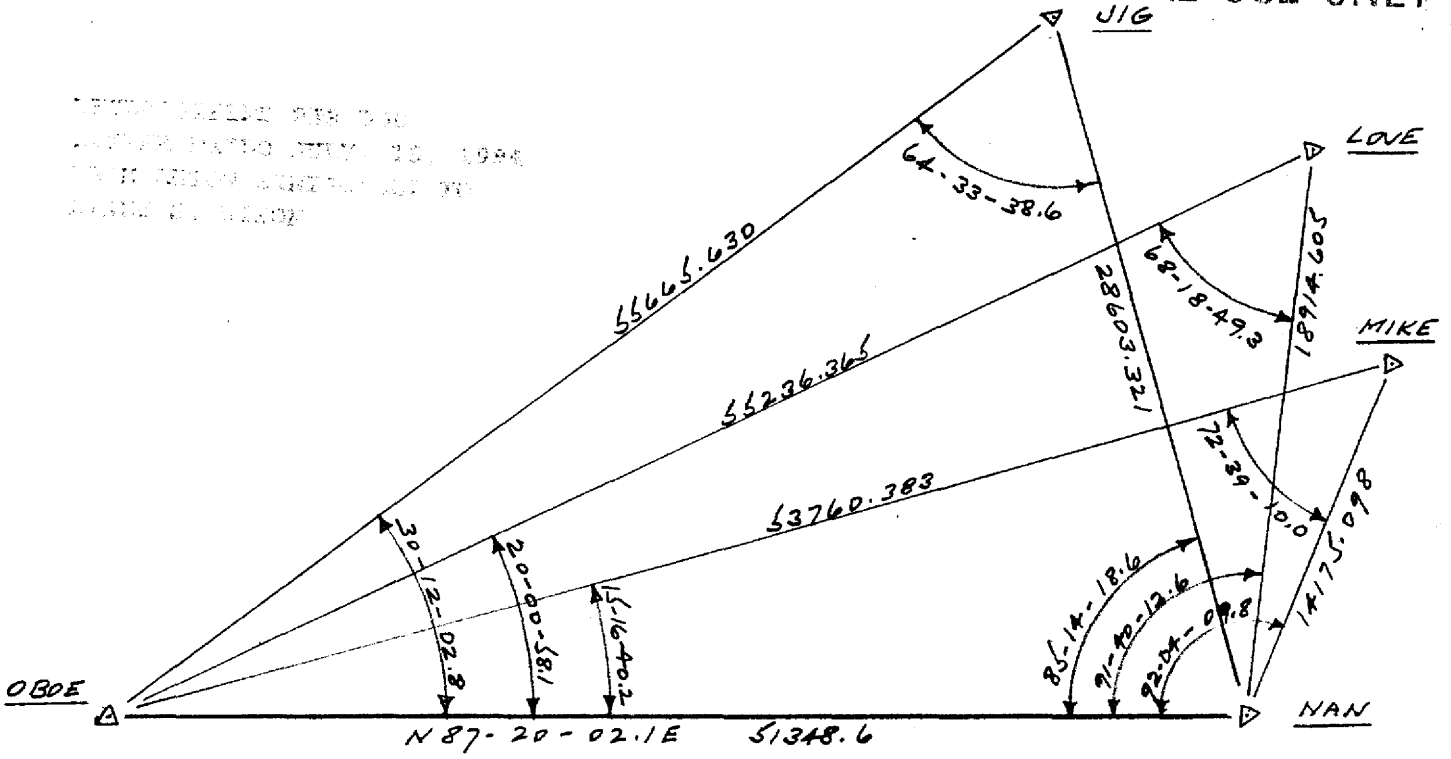
			°	'	"		°	'	"			°	'	"
11 32 30.383	YOKE	λ	165	15	23.190	φ				3	λ			
+ 01 46.267		Δλ	-	02	13.149	Δφ					Δλ			
11 34 16.650	BRAVO	λ'	165	13	10.041	φ'				1	λ'			

			Logarithms	Values in seconds
3.7151740		$\frac{1}{2}(\phi+\phi')$	11-33-23.516	
9.7987548				
8.5124996		s	3.7151740	
2.0264284	1st term −106.2729	Sin α	9.8905793	
7.43034		A'	8.5096674	
9.78116		Sec φ'	0.0089176	
0.71679		Δλ	2.1243383	−133.1491
7.92829	2d term +0.0085	$\sin\frac{1}{2}(\phi+\phi')$	9.3017562	
4.0528		−Δα	1.4260945	+26.7
1.9846				
6.0374	3d term 0.0001			
	Δφ −106.2647			

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

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

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		179-59-59.5	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

(99957518)
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							103,279.6	127,028.4
JIG	N 57-07-59.3 E	56665.630	54268874	83993389	N 30751.799	E 47595.383	134,031.4	174,623.8
NAN	S 7-25-39.3 E	28603.321	99160904	12927299	S 28363.312	E 3697.637	105,668.1	178,321.5
OBOE							103,279.6	127,028.4
LOVE	N 67-19-04.0 E	55236.365	38561978	92265779	N 21300.235	E 50964.262	124,579.8	177,992.7
NAN	S 0-59-45.3 E	18914.605	99984894	01738115	S 18911.748	E 328.758	105,668.1	178,321.5
OBOE							103,279.6	127,028.4
MIKE	N 72-03-21.9 E	53760.383	30808591	95135854	N 16562.817	E 51145.399	119,842.4	178,173.8
NAN	S 0-35-48.1 E	14175.098	99994578	01041410	S 14174.329	E 147.621	105,668.1	178,321.5

LSH 8-53 JIG-LOVE-MIKE 884

~~OFFICIAL USE ONLY~~

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	9.7016953
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

~~OFFICIAL USE ONLY~~

13

JOB No ____

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY ________ DATE ________

	Station		°	'	"
α 2	NAN	to 3 OBOE	87	21	45.3
			+ 85	14	18.7
α 2	NAN	to 1 JIG	172	36	04.0
			−	0	07.4
			180	00	00.0
α 1	JIG	to 2 NAN	352	35	56.6

	Station		°	'	"
α 3	OBOE	to 2 NAN	267	20	02.4
3d ∠		3	− 30	12	02.9
α 3	OBOE	to 1 JIG	237	07	59.5
Δα			+	01	35.9
			180	00	00.0
α	JIG	to 3 OBOE	57	09	35.3

SUM OF ANGLES OF TRIANGLE 64-33-38.7

φ			Station		°	'	"
11	30	42.595	NAN	λ	165	33	32.574
+	04	41.384		Δλ	−	0	37.058
11	35	23.979	JIG	λ'	165	32	55.516

	°	'	"	Station		°	'	"
φ	11	30	19.029	3 OBOE	λ	165	24	56.671
Δφ	+	05	04.950		Δλ	+	07	58.845
φ'	11	35	23.979	1 JIG	λ'	165	32	55.516

Logarithms	Values in seconds
3.9404318	
9.9963688	
8.5125005	
2.4493011	−281.3851
7.88086	
8.21967	
0.71563	
6.81616	0.0007
4.89861	
1.9835	
6.8821	0.0008
−Δφ	−281.3836

½(φ+φ') 11-33-03.287

	Logarithms	Values in seconds
s	3.9404318	
Sin α	9.1098362	
A'	8.5096672	
Sec φ'	0.0089466	
Δλ	1.5688818	−37.0580
Sin ½(φ+φ')	9.3015479	
−Δα	0.8704297	+7.420

	Logarithms		Values in seconds
s	4.2373353		
Cos α	9.7345501		
B	8.5125007		
h	2.4843861	1st term	−305.0606
s²	8.47467		
Sin² α	9.84849		
C	0.71540		
	9.03856	2d term	+0.1093
h²	4.9688		
D	1.9863		
	6.9551	3d term	+0.0009
		−Δφ	−304.9504

½(φ+φ') 11-32-51.504

	Logarithms	Values in seconds
s	4.2373353	
Sin α	9.9242454	
A'	8.5096672	
Sec φ'	0.0089466	
Δλ	2.6801945	+478.8445
Sin ½(φ+φ')	9.3014264	
−Δα	1.9816209	−95.856

JOB № 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-13

		°	'	"			°	'	"
NAN	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	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	LOVE	λ'	165	33	29.362

Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds
		½(φ+φ')	11-32-16.399		s	4.2262412		½(φ+φ')	11-32-04.616	
3.7608129		s	3.7608129		Cos α	9.5861678		s	4.2262412	
9.9999381		Sin α	8.2273830		B	8.5125007		Sin α	9.9650410	
8.5125005		A'	8.5096675		h	2.3248997	1st term +211.3001	A'	8.5096675	
2.2732515	−187.6082	Sec φ'	0.0089062		s²	9.93008		Sec φ'	0.0089062	
6.45477		Δλ	0.5067696	−3.2119	Sin² α	8.45248		Δλ	2.7098559	+512.6913
7.52163		Sin ½(φ+φ')	9.3010645		C	0.71540		Sin ½(φ+φ')	9.3009430	
0.71563		−Δα	9.8078341	+ 0.642		9.09796	2d term +0.1253	−Δα	2.0107989	−102.518
4.69203	0.0000				h²	4.6498				
4.5465					D	1.9863				
1.9835						6.6361	3d term +0.0004			
6.5300	0.0003						−Δφ +211.1744			
Δφ	−187.6079									

OFFICIAL USE ONLY

JOB Nº 884

HOLMES & NARVER, INC.
ENGINEERS-CONSTRUCTORS

POSITION COMPUTATION SECOND ORDER TRIANGULATION

COMPUTED BY LSH DATE 8-53

			°	′	″						°	′	″
NAN		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	56.2	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

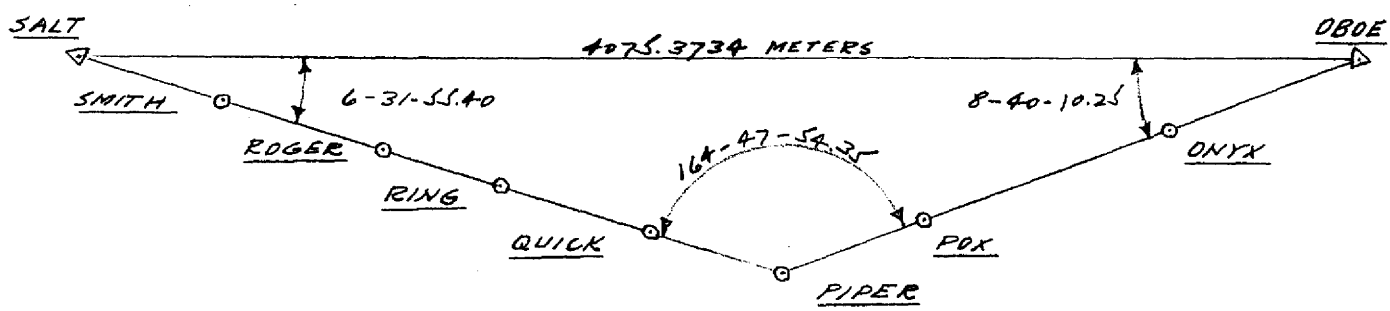
Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds
		½(φ+φ′)	11-31-52.901					½(φ+φ′)	11-31-41.118	
3.6355421		s	3.6355421		s	4.2144783		s	4.2144783	
9.9999787		Sin α	7.9962165		Cos α	9.4886699		Sin α	9.9783444	
8.5125005		A′	8.5096676		B	8.5125007		A′	8.5096676	
2.1480213	−140.6117	Sec φ′	0.0088860		h	2.2156489	1st term −164.3043	Sec φ′	0.0088860	
7.27108		Δλ	0.1503122	−1.4136	s²	8.42896		Δλ	2.7113763	+514.4893
5.99243		Sin ½(φ+φ′)	9.3008221		Sin² α	9.95669		Sin ½(φ+φ′)	9.3007004	
0.71563		−Δα	9.4511343	+0.283	C	0.71540		−Δα	2.0120767	−102.820
3.97914	0.0000					9.10105	2d term +0.1262			
4.2960					h²	4.4313				
1.9835					D	1.9863				
6.2795	0.0001					6.4176	3d term +0.0003			
	−140.6116						−Δφ −164.1778			

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

JOB NO. 884
SHEET 1 OF 3
BY LSH DATE 8-53

TITLE BIKINI 1953 BASE LINE OBOE - SUGAR

COMPUTATION OF BASE LINE ~~OFFICIAL USE ONLY~~



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	0.6745×0.0015	0.0010 m
SMITH-ROGER	F 449.9479 B 449.9477	$20\sqrt{.4499478} = 0.0134$	0.0002	" $\times 0.0001$	0.0001
ROGER-RING	F 300.0139 B 300.0157	$20\sqrt{.3000148} = 0.0110$	0.0018	" $\times 0.0009$	0.0006
RING-QUICK	F 749.8725 B 749.8739	$20\sqrt{.7498732} = 0.0173$	0.0014	" $\times 0.0007$	0.0005
QUICK-PIPER	F 293.0265 B 293.0264	$20\sqrt{.2930264} = 0.0108$	0.0001	" $\times 0.00005$	0.0003
PIPER-FOX	F 417.9350 B 417.9369	$20\sqrt{.4179359} = 0.0129$	0.0019	" $\times 0.0009$	0.0006
FOX-ONYX	F 749.9793 B 749.9790	$20\sqrt{.7499791} = 0.0173$	0.0003	" $\times 0.0001$	0.0001
ONYX-OBOE	F 600.0134 B 600.0121	$20\sqrt{.6000128} = 0.0155$	0.0013	" $\times 0.0006$	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 = 1:2,055,391

PROBABLE ERROR IN MEASUREMENT = 0.0014663 = 1:2,803,567

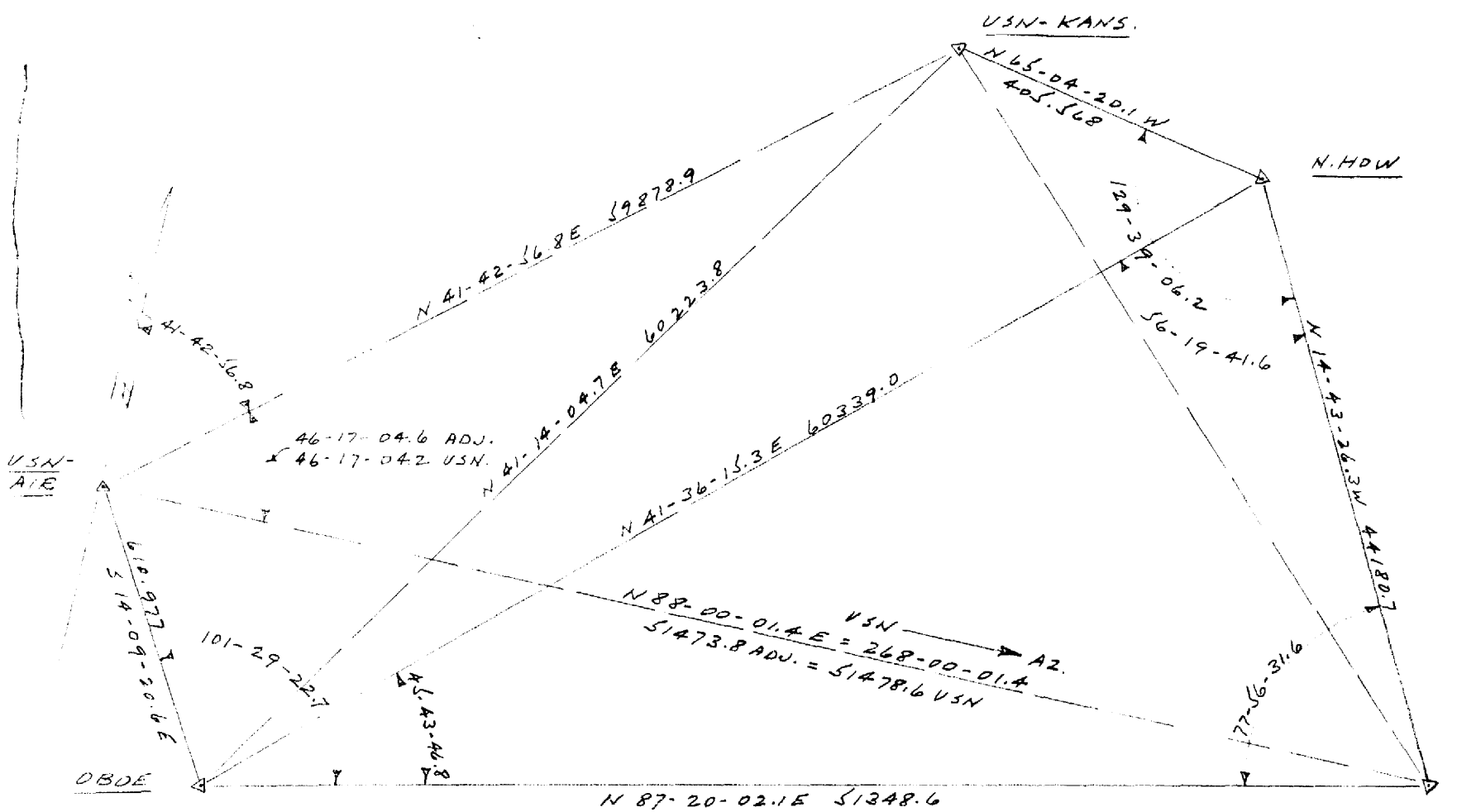
OFFICIAL USE ONLY

HOLMES & NARVER INC.-ENGINEERS CONSTRUCTORS
COMPUTATION OF BIKINI-1953 (OBOE-SUGAR) BASE LINE

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

SECTION	DATE	DIR. OF MEAS.	TAPE NO	SUP-PORT	UNCORR. LENGTH NO.	UNCORR. LENGTH METERS	TEMP "C"	CORRECTIONS: TEMP METERS	CORRECTIONS: SET-BACK METERS	CORRECTIONS: INCLINATION METERS	CORRECTIONS: SEA LEVEL METERS	REDUCED LENGTH METERS	ADOPTED LENGTH 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	-.0268	-.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	= 7686.516 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 VALUE FOR FORWARD AZIMUTH USN AIR-USN ENYU 268-00-01.4

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

JOB NO. 684
SHEET 1 OF 3
BY LSH DATE 8-1-62

TITLE ORIGIN OF POSITION AND AZIMUTH

OFFICIAL FILE COPY

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							105,668.057	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							103,279.579	127,028.407
N.HOW	N 41-36-15.3E	60338.956	74774884	66398168	N 45118.384	E 40063.961	148,397.963	167,092368
USN-KANS	N 66-04-20.1N	405.568	42147507	90683998	N 170.937	W 367.785	148,568.900	166,724.583
OBDE	S 41-14-04.6W	60223.825	75201668	65914408	S 45289.321	W 39696.176	103,279.579	127,038.407
AIR							103,872.00	126,879.00
USN-KANS	N 41-42-[illegible] E 59878.905		74645487	66543604	N 44696.900	E 39845.583	148,568.900	166,724.583

LSH

7-20-93

USN STA. AIR-ENYU-KANS

884

2 3

FOR [illegible] 884

[illegible]ATION 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		+ 0 8 37.406
11 30 42.595	USN-ENYU	165 33 32.574

4.1756022		11-30-33.548
8.5427347		
8.5125007		4.1756022
1.2502376	-17.8171	9.9997354
8.39120		8.5096680
9.99947		0.0088254
0.7154S		2.7138310 +517.405
9.1861.2	0.1277	9.3000024
2.5017		2.0138334 -103.237
1.9833		
4.485c	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

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
		77	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	55.168	11 30 42.595	USN-ENYU	165	33	32.574
- 0 05.877		+ 0	01	50.3	- 0 23.567		- 08		35.902
11 30 19.029	OBOE	165	24	56.671	11 30 19.028	OBOE	165	24	56.672

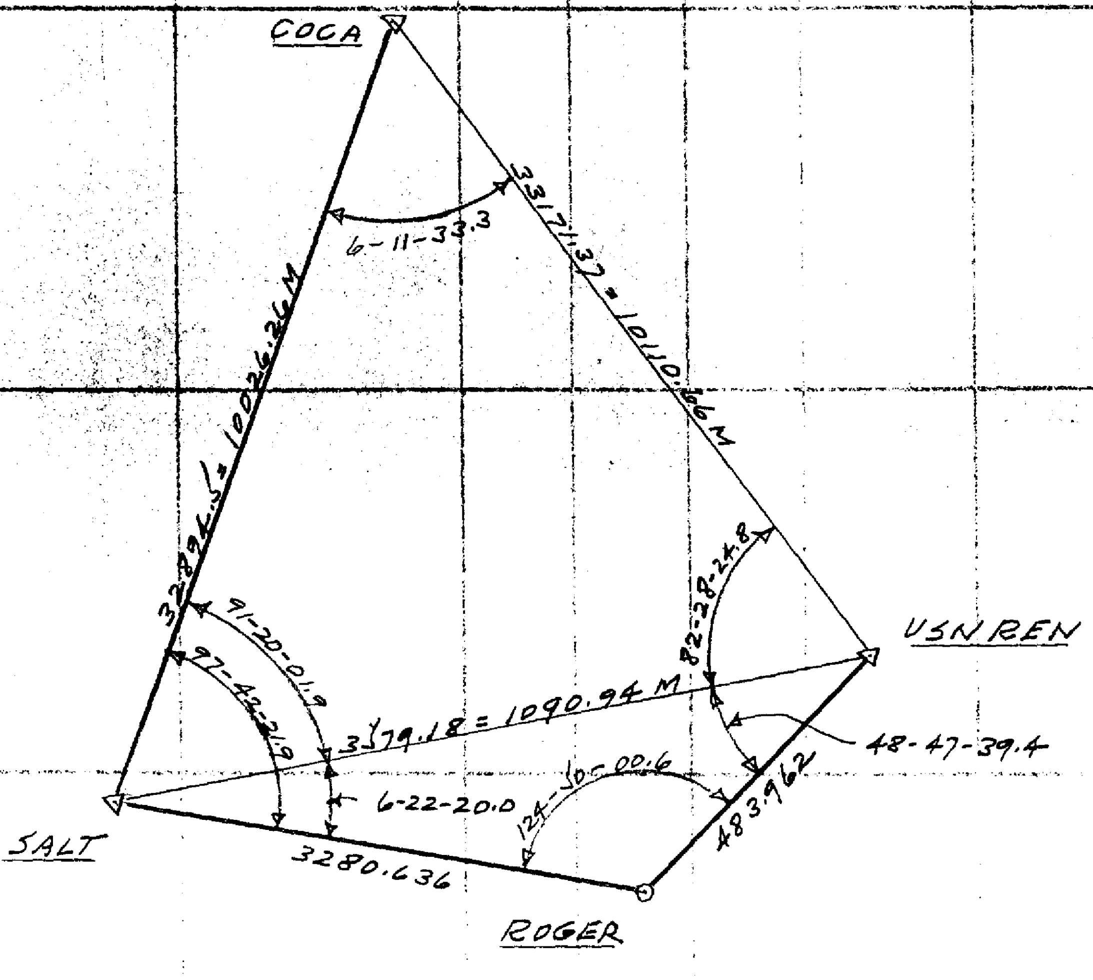
2.2700407		11-30-21.968	4.1945443	11-30-30.812
9.9966081			8.6629027	
8.5125007		2.2700407	8.5125005	4.1945443
0.7691495	+5.8769	9.3883821	1.3699475	+23.4395 9.9995397
4.54008		8.5096681	8.38909	8.5096681
8.77674		0.0088154	9.99908	0.0088154
0.71545		0.1769063 + 1.5028	0.71563	2.7125675 - 515.9024
4.03237	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 12-53

SALT	COCA	166	28	35.6	∝	3 COCA	to 2 SALT	346	28	20.1
		91	20	21.9	3d ∠		B	− 6	11	33.3
SALT	USN-REN	257	48	37.5	∝	3 COCA	to 1 USN-REN	340	16	46.8
		+	0	07.0	Δ∝			+	0	22.5
		180	00	00.0				180	00	00.0
USN-REN	SALT	77	48	44.5	∝'	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	3 COCA	165	21 27.917
+ 0 07.496		Δ∝	+	0	35.186	Δφ	−	5	09.770		+	1 52.574
11 29 58.166	USN-REN	∝'	165	23	20.491	φ'	11	29	58.165	1 USN-REN	165	23 20.491

			Logarithms	Values in seconds		Logarithms	Values in seconds		Logarithms	Values in seconds
3.0378001		½(∝+∝')	11-29-54.418		s	4.0047795		½(φ+φ')	11-32-33.050	
9.3245851			Logarithms	Values in seconds	Cos ∝	9.9737515			Logarithms	Values in seconds
8.5124910		b	3.0378001		B	8.5124983		s	4.0047795	
0.8748769	−7.4968	Sin ∝	9.9900965		h	2.4910293	1st term +309.7628	Sin ∝	9.5281829	
6.07560		A'	8.5096683		s²	8.009956		A'	8.5096683	
9.98020		Sec ∝'	0.0088064		Sin²∝	9.05637		Sec ∝'	0.0088064	
0.71508		Δ∝	1.5463713	+35.1861	C	0.71848		Δφ	2.0514371	+112.5737
6.77088	.0006	½(∝+∝')	9.2995975			7.78441	2d term +.0061	Sin(∝+∝')	9.3012352	
1.7497		−Δ∝	0.8459688	−7.014	D	4.9821		−Δ∝	1.3526723	−22.525
1.9830						1.9861				
3.7327	.0000					6.9682	3d term +.0009			
	−7.4962						−Δφ +309.7698			