

9924

Diag. Cht. No. 8863-2.

Form 504

U. S. COAST AND GEODETIC SURVEY

DEPARTMENT OF COMMERCE

DESCRIPTIVE REPORT

Type of Survey Topographic

Field No. Ph-34(48) Office No. T-9924

LOCALITY

State Alaska

General locality Andreanof Islands

Locality Bobrof Island

1943-54

CHIEF OF PARTY

S.B.Grenell, Chief of Field Party

L.W.Swanson, Div. of Photo. Wash., D.C.

LIBRARY & ARCHIVES

DATE November 10, 1959

9924

# DATA RECORD

T-9924

Project No. (II): CS-218  
Ph-34(48)

Quadrangle Name (IV): Bobrof Island

Field Office (II): Ship EXPLORER

Chief of Party: S. B. Grenell

Photogrammetric Office (III): Washington, D.C.

Officer-in-Charge: L. W. Swanson

Instructions dated (II) (III): 19 March 1952  
20 February 1953

Copy filed in Division of  
Photogrammetry (IV)  
Office files

Method of Compilation (III): Shoreline & photohydros by graphic methods  
Topography by Reading Plotter, Model "B"

Manuscript Scale (III): 1:20,000

Stereoscopic Plotting Instrument Scale (III): 1:20,000

Scale Factor (III): 1.0

Date received in Washington Office (IV): FEB 23 1953

Date reported to Nautical Chart Branch (IV): 2-28-55

Applied to Chart No. Date: Date registered (IV): 6 May 1957

Publication Scale (IV): Publication date (IV):

Geographic Datum (III): N.A. 1927

Vertical Datum (III):  
Mean sea level except as follows:  
Elevations shown as (25) refer to mean high water  
Elevations shown as (5) refer to sounding datum  
i.e., mean low water or mean lower low water

Reference Station (III): ROF 1943

Lat.: 51 54 08.945

Long.: 177 25 02.005

Adjusted  
~~Unadjusted~~

Plane Coordinates (IV): State: U.T.M. Zone: 1

Y= X=

Roman numerals indicate whether the item is to be entered by (II) Field Party, (III) Photogrammetric Office,  
or (IV) Washington Office.

When entering names of personnel on this record give the surname and initials, not initials only.

100% by

Louis Levin

# DATA RECORD

Field Inspection by (II): Interior inspection: None Date: 1953 Field Season  
Shoreline inspection by: C. W. Clark 1954 Field Season

Planetable contouring by (II): Date:

Completion Surveys by (II): Date:

Mean High Water Location (III) (State date and method of location):

Field Inspection of Photographs  
(1954 Field Season)

Projection and Grids ruled by (IV): A. Riley Date: 10-6-54

Projection and Grids checked by (IV): A. Riley Date: 10-6-54

Control plotted by (III): C. O. DeMarr Date: Oct. 1954

Control checked by (III): I. G. Lande Date: Oct. 1954  
J. Amburn

Radial Plot ~~22500000000~~ S. G. Blankenbaker Date: Nov. 1954  
~~Control checked by (III):~~

Stereoscopic Instrument compilation (III): Planimetry ) Louis Levin Date: Nov. 1954  
Contours ) Date:

Manuscript delineated by (III): Shoreline 1/10,000 - S. G. Blankenbaker Date: Nov. 4 '54  
Topo 1/20,000 - J. B. McDonald Dec. 1954

Photogrammetric Office Review by (III): Shoreline Compilation Date: Nov. 1954  
by Roscoe J. French  
Stereo. Instrument Compilation Jan. 1955  
by Orvis N. Dalbey

Elevations on Manuscript Date: Jan. 1955  
checked by (II) (III): Orvis N. Dalbey



Camera (kind or source) (III): *U.S.C. & G.S. Nine lens camera, model "B",  
f = 8.25 inches* [Also "D" camera (6869)]

PHOTOGRAPHS (III)

Number	Date	Time	Scale	Stage of Tide
14668	7-16-43	2:53	1:10,000	
14669	7-16-43	2:53	"	
14670	7-16-43	2:54	"	Computed 1.3 ft. above MLLW
14671	7-16-43	2:54	"	
14672	7-16-43	2:56	"	
14673	7-16-43	2:57	"	
14674	7-16-43	2:57	"	
34331	10-16-51	11:06	1:20,000	3.0 <i>ENR</i>
34332	10-16-51	11:07	"	Computed 2.8 ft. above MLLW
34335	10-16-51	11:18	"	
34336	10-16-51	11:19	"	
48-D-198	9-20-48	13:31-1340	1:10000 <i>ENR</i>	2.0 above MLLW

*Hru-208*

Tide (III)

Diurnal

Reference Station: *Sweeper Cove*  
~~Subordinate Station:~~ Use Sweeper Cove time for Bobrof  
~~Subordinate Station:~~ Use .9 for ratio of ranges

Ratio of Ranges	Mean Range	Diurnal Range
		3.7
		3.3 Bobrof

Washington Office Review by (IV): *Everett H. Ramey*

Date: *11 April 1955*

Final Drafting by (IV): *R. Kelly*

Date: *6-25-56*

Drafting verified for reproduction by (IV): *Wm O. Hallum*

Date: *8-29-56*

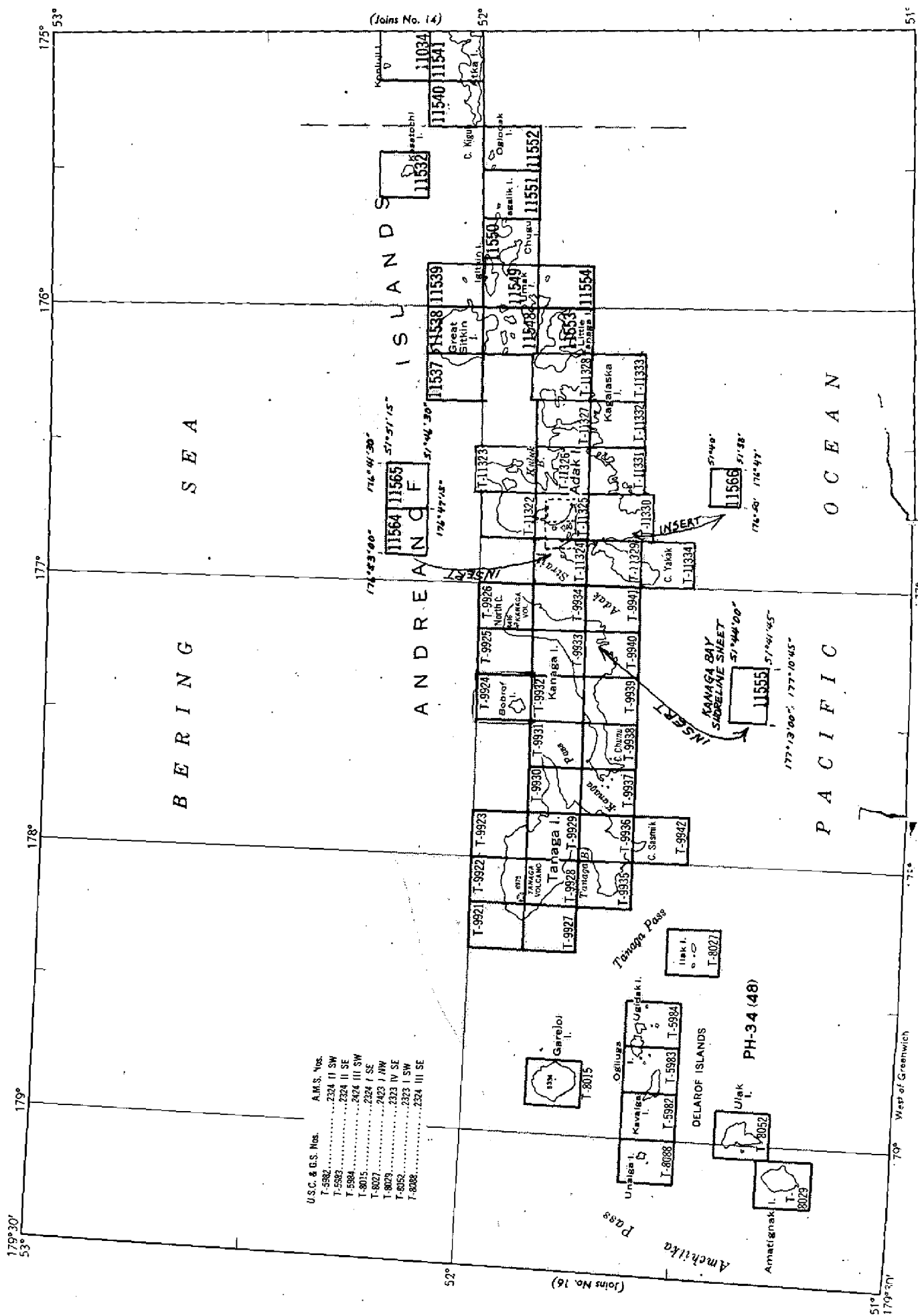
Proof Edit by (IV):

Date:

Land Area (Sq. Statute Miles) (III): *3*  
 Shoreline (More than 200 meters to opposite shore) (III): *10 miles*  
 Shoreline (Less than 200 meters to opposite shore) (III): *None*  
 Control Leveling - Miles (II): *None*  
 Number of Triangulation Stations searched for (II): *5* Recovered: *5* Identified: *5*  
 Number of BMs searched for (II): *None* Recovered: Identified:  
 Number of Recoverable Photo Stations established (III): *2*  
 Number of Temporary Photo Hydro Stations established (III): *29*

Remarks: *1 Recoverable topographic station identified for horizontal control.*

TOPOGRAPHIC MAPPING PROJECT PH-34  
Aleutian Islands ALASKA Part B



Summary to Accompany Topographic Map T-9924

This map is one of Project Ph-34. It covers Bobrof Island of the Aleutian Islands.

This map was compiled in 1954 by a combination of graphic and Reading Plotter methods. Field work, in advance of compilation, included the establishment of some additional horizontal and vertical control, complete shoreline inspection and the investigation of geographic names. Coast Pilot Notes and hydrography were also done in conjunction with the field work.

Compilation of the shoreline was done at a scale of 1:10,000 using nine-lens photographs taken in 1943. This compilation was reduced to 1:20,000 scale for a base for contouring, using nine-lens photographs at a scale of 1:20,000 taken in 1951. The compilation at a scale of 1:10,000 was because of the clarity of the 1:10,000 1943 photographs. This was only an expedient in the compilation process and the compilation was not retained. Map T-9924 was not field edited. After the addition of hydrographic information the map will be published by the Army Map Service as a standard topographic quadrangle.

Items registered under T-9924 will include a descriptive report, a copy of the manuscript at a scale of 1:20,000 and a copy of the published map.

*CRONER*



## FIELD INSPECTION REPORT

For Map T-9924

2. Areal Field Inspection

The entire area of Bobrof Island is covered by this one map.

Bobrof Island is a relatively small island about  $2\frac{1}{2}$  miles north and south by 2 miles east and west in extent.

The upper part of the island is usually cloud covered and there has been very little opportunity to observe higher elevations.

The elevation of the highest point of the island is 2419 feet. \* This point is triangulation station Bobrof Volcano, 1943. The high point appears to be a single peak without a crater. Partly surrounding the highest peak and at a lower elevation is part of the rim of a Caldera. \* 2421 MSL SHR

The terrain is very rugged and rises steeply from the water on the south, west and east sides. At the north point of the island is a large block of lava about 400 meters long, 200 meters wide and 400 feet high connected to the main part of the island by a low neck. This block of lava rises vertically from the water on the northeast, northwest and southwest sides and from seaward appears nearly level on top. There is a prominent inverted V slide with station SPAR at the apex on the west side. The south end of the lava block is a steep grass covered slope.

There is no evidence of any recent volcanic activity on the island.

The island is completely covered with 1:10,000 scale nine-lens photographs taken in 1943. The quality of these photographs is good. The quality of 1:20,000 scale nine-lens photographs taken in 1951 is generally poor. The latter photographs were not used for field inspection although an attempt was made to identify some of the horizontal control stations on them.

Two flight lines of 1:10,000 scale single-lens photographs cover the shoreline on the east and west sides of the island. The quality of these photographs is good. They were used to supplement 1:10,000 scale 9-lens photography.

All shoreline was field inspected. Field inspection is considered adequate for the area.

3. Horizontal Control

(a) The following supplemental horizontal control stations were established by fourth-order theodolite observations:

SPAR, 1953

BOBO, 1954



(b) All horizontal control is computed on the N. A. 1927 datum and no datum adjustments are necessary.

(c) All horizontal control was established by the U. S. Coast and Geodetic Survey.

(d) No specific stations were required by the instructions. Four stations were identified on each of four points of the island and they should be sufficient to control scale and orientation of the photogrammetric plot. Station BOBO, 1954 was identified but is not intended for horizontal control because of its close proximity to BOBROF (USN), 1943.

Peaks identified for vertical control P-001, P-002 and P-003 are not considered suitable for horizontal control. Geographic positions of these peaks have been computed.

(e) All Coast Survey stations were searched for and recovered.

(f) The following horizontal control stations were identified:

<u>Station</u>	<u>Photograph</u>	<u>Order of Accuracy</u>
BOBROF(USN), 1943	14672, 34336	Second
DOC, 1943	14672	Third
ROF, 1943	14673, 48-D-202	"
BO, 1943	14671	"
SPAR, 1953	14677, 34332	Fourth

#### 4. Vertical Control

(a) There are no bench marks within the area of this map.

(b) Elevations were established by trigonometric leveling by observations at station BOBROF (USN), 1943 and other triangulation stations on adjacent islands. Elevations are based on observations on the water surface.

Elevations were computed for all points identified for horizontal control. The vertical datum used is mean high water based on the stage of the tide computed from the tide tables at the time of observations on the water surface. The datum thus established is probably within 1 foot of mean high water. All elevations are thought to be well within the limits of accuracy required.

Only one zenith distance was observed on P-004 and a check was not obtained on the elevation.

Identification of vertical control points P-001, P-002 and P-003 was done aboard ship without benefit of a good horizontal view of the peaks (they are usually cloud covered), by stereoscopic examination of the best model available. Identification of these points is indicated as doubtful. Elevations are on the highest points of the peaks.

(c) Vertical control points were identified as follows:

No.	Horizontal Control Name	Photograph No.	Elevation in feet above MHW
--	BOBROF (USN), 1943	14672	231
P-001	Bobrof Volcano, 1943	14673	2419
P-002	--	14673	2105
P-003	--	14670	1902
P-004	SPAR, 1953	14667, 34332	402

Vertical control points identified are indicated on manuscript CS-295.

(d) Vertical control established is considered adequate for stereoscopic mapping.

#### 5. Contours and Drainage

Contouring is inapplicable. Drainage is obvious and well defined on the photographs.

#### 6. Woodland Cover

None exists. Vegetation is grass and other low plants.

#### 7. Shoreline and Alongshore Features

(a) All shoreline was field inspected from a launch running as close inshore as was safe. The mean high-water line was indicated at random intervals and most of it is obvious on the photographs. Shoreline inspection was done partly in 1953 and partly in 1954.

(b) The low-water line was not defined. Most of the shoreline is very steep and the low-water line and high-water line are the same. In a few places on boulder beaches the low-water line is a very short distance outside the high-water line.

(c) The foreshore is mostly boulders with some steep rock cliffs rising vertically from the water. The different types of shoreline are indicated on the photographs.

(d) Bluffs and cliffs rise up steeply from the water along the entire shoreline except on either side of the low neck connecting the lava block at the north end to the main part of the island. Types of bluffs and cliffs are indicated on the photographs in various places.

(e) There are no shoreline structures on the island.

#### 8. Offshore Features

Offshore features are very few and consist of several rocks all of which are very close to the shoreline. The approximate offshore limit

of kelp is indicated on the photographs. The inshore limit of hydrography is not shown on manuscript CS-295. Boat sheets will be forwarded to the Washington office at the close of the field season. The inshore limit of hydrography follows the general offshore limit of kelp and defines kelp areas better than that indicated on the photographs.

Heights of rocks were estimated either above mean high water or above the water surface at the time of field inspection. In the latter case the time and date are noted on the photographs.

9. Landmarks and Aids

There are no recommended landmarks and there are no aids to navigation within the area of this map.

10. Boundaries, Monuments and Lines

Inapplicable.

11. Other Control

Recoverable topographic stations established are SPAR and BOBO. Geographic positions of these two stations were computed from fourth-order theodolite observations.

Photo-hydro stations established are listed on extra pages at the end of this report.

The geographic position of photo-hydro station COP was computed from fourth-order theodolite observations.

The approximate locations of recoverable topographic stations and photo-hydro stations are indicated on manuscript CS-295.

12. Other Interior Features

Covered under Side Heading 2.

There are no known structures on the island. The ruins of a trappers cabin are visible on the photographs on the low neck near the north end of the island. Only the floor remains intact.

13. Geographic Names

To be reported in a separate report in connection with other phases of field work.

Charted names on this map are: BOBROF ISLAND, BOBROF VOLCANO and BERING SEA.



The name KANAGA SOUND applying to the water area south of Bobrof Island was recommended during the 1953 season. See "Special Report on Geographic Names - Tanaga and Kanaga Islands - USC&GSS EXPLORER - Season 1953."

14. Special Reports and Supplemental Data

Supplemental data include other phases of field work completed during the current season - hydrography, Coast Pilot Notes and geographic names - to be forwarded later.

Data forwarded with this report are:

Field and office photographs.  
Manuscript CS-295.  
Control station identification cards for horizontal and vertical control.  
Descriptions of recoverable topographic stations.  
Computations of triangles for fourth-order stations.  
Computations of geographic positions for fourth-order stations.  
Computations of elevations from zenith distance observations.

Other data to be forwarded at close of field seasons are:

Observations of horizontal directions, fourth-order.  
Lists of horizontal directions, fourth-order.  
Observations of zenith distances.  
Abstracts of zenith distances.  
Recovery notes, triangulation stations.  
Boat sheet EX-2154.

15. Field Inspection Notes

Photographs on which horizontal control identification notes appear are listed under Side Heading 3, Horizontal Control.

Photographs on which vertical control identification notes appear are listed under Side Heading 4, Vertical Control.

Photographs on which photo-hydro stations are identified are listed on the list of photo-hydro stations at the end of this report.

Photographs on which other field inspection notes appear are:

14667 thru 14674.  
9-20-48-D-200 thru 207.

16. Advance Manuscripts

Manuscripts CS-295, <sup>\*</sup> scale 1:10,000, compiled in 1943 was used for shoreline, plotting photo-hydro control, etc. for boat sheets.

*\* See Chart Letter L 277 (1945) for report on CS-295. ENR*



The datum on manuscript CS-295 is not indicated but is apparently Unalaska Datum. The N. A. 1927 datum was plotted on the manuscript from control stations plotted thereon.

The scale of the boat sheet is 1:20,000 and a photographic reduction of the manuscript was made at the Navy Photo Lab., Adak, for transfer of shoreline to the boat sheet.

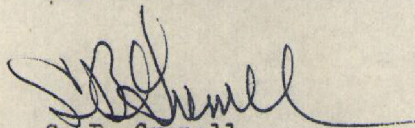
There appears to be slight discrepancies in scale and orientation of the manuscript but it was entirely satisfactory for the uses made of it.

*See 564*

Respectfully submitted

*Charles W. Clark.*  
Charles W. Clark  
Commander, USC&GS

Approved and forwarded:

  
S. B. Grenell  
Comdr., USC&GS  
Chief of Party



PHOTOGRAMMETRIC PLOT REPORT  
T-9924 Ph-34 (48)

21. Area covered. - The manuscript covers Bobrof Island, Alaska, only.
222. Method. - The island is covered with 1:10,000 scale nine lens positype photographs taken in 1943 and with 1:20,000 scale nine lens metal mounted photographs taken in 1951. The 1:10,000 scale photography was used for field inspection. *Field inspection: also some single-lens photographs. See §2. 24K*

The decision was made to lay two radial plots covering the island using both sets of photography. The 1:10,000 scale plot was assembled first and was used for shoreline compilation, location of photo-hydro signals, and for providing supplemental control for the 1:20,000 scale plot. (Five pass points were pricked that were common to both sets of photography.)

This plot report covers the two plots.

Manuscripts were ruled at 1:10,000 and 1:20,000 scales with polyconic projections and UTM Grids.

No master templet exists for the 1:10,000 scale photography. The 1951 master templet was used in preparation of the templets from the 1951 photography.

The closure and adjustment to control was satisfactory on both plots.

Photographs used in the plots:

<u>1:10,000 scale</u>		<u>1:20,000 scale</u>	
14668	14672	34331	34335
14669	14673	34332	34336
14670	14674		
14671			

23. Adequacy of control. - Stations P-001 (Bobrof Volcano USN, 1943); P-002, 1954; and P-003, 1954, were not held in the 1:10,000 scale plot. Radial plot positions 0.8 mm and 0.5 mm. off their plotted positions have been drilled and circled on the manuscript. On page 8 of the field inspection report these stations are rated as "not considered suitable for horizontal control". The intersections of radials for these points were fairly good considering the elevations of the stations and definitely fell off the plotted positions seemingly indicating tilt in the photography was not the reason for failure to hold the stations. The error is apparently in the selection of the photograph positions or in the computation or



observation of the Geographic Positions.

These control points (P-001; P-002; P-003) were not transferred to the 1:20,000 scale photography.

Bobrof (USN), 1943- Sub. Sta. No. 2, is the only other station considered as control for the plot that was not held within 0.2 mm. Bobrof (USN) 1943 (home station) and Bobo, 1954 (topo station) in the immediate vicinity were held in the 1:10,000 scale plot. Bobo, 1954, was used to control the 1:20,000 scale plot in the area.

24. Supplemental Data.- inapplicable.
25. Photography.- The 1:10,000 scale photography is adequate for radial plotting. The 1:20,000 photography flight lines are not the best for radial plotting.

Submitted by:

S. G. Blankenbaker  
S. G. Blankenbaker

November 4, 1954

Approved by:

Roscoe J. French  
Roscoe J. French

## COMPILATION REPORT

### 31. Delineation:

The shoreline was delineated by graphic methods from the 1:10,000 scale photographs by the Graphic Compilation Section. A photographic reduction was then made and transferred to the 1:20,000 scale manuscript by holding to the common pass points.

The contours and drainage were then compiled on the nine-lens plotter from the 1:20,000 scale photos and added to the manuscript. Although a single pair of photographs covered the entire island, it was necessary to use two models because of the cloud coverage on both models.

Except for some shadow areas on the steep bluffs, no unusual difficulty was encountered during instrument compilation.

### 32. Control:

Both models were set up using sea level, only, for vertical datum. The elevations of all vertical control points were read on the instrument, and these elevations checked very closely with those furnished by the field party.

The vertical control was more than adequate for 50' contours.

### 33. Supplemental Data:

There were none available.

### 34. Contours and Drainage:

See Item No. 31.

### 35. Shoreline and Alongshore Details:

The shoreline inspection was adequate and, except for a few small shadow areas, no unusual difficulty was encountered in delineating the H.W.L., alongshore details and offshore rocks.

### 36. Offshore Details:

Covered in side heading No. 35.

### 37. Landmarks and Aids:

See side heading No. 9.

### 38. Control for Future Surveys:

Forms 524 have been submitted for the two topo stations mentioned in paragraph 11. A list of the hydro and topo stations are included in "Notes to the Hydrographer".



39. Junctions:

Junction was made with T-9925 to the East and T-9932 to the South. \*  
There are no Junctions at the North and West limits.

\* water area enr

40. Horizontal and Vertical Accuracy:

There are no areas believed to be of subnormal horizontal or vertical accuracy.

See §66

46. Comparison with existing Maps:

Adak, Alaska (63) 1:250,000 1951 Edition, Reprinted 1953

See §63

47. Comparison with Nautical Charts:

Chart No. 8863 Scale 1:300,000 Date of publication - 1951  
Last correction date - 1/14/52

See §65

48. Geographic Names List:

See list of geographic names on following page.

49. Notes to Hydrographer:

A list of the topographic and hydrographic stations is on a separate page entitled, "Notes to the Hydrographer".

50. Compilation Office Review:

See enclosed Form T-2.

Approved:

S. V Griffith  
Chief, Cartographic Branch

Respectfully submitted:

Orvis N. Dalbey  
Orvis N. Dalbey  
Supervisory Cartographer

# GEOGRAPHIC NAMES

Survey No. T-9424

GEOGRAPHIC NAMES										
Survey No. T-9924										
Name on Survey										
	A	B	C	D	E	F	G	H	K	
Alaska										1
Andreanof Islands										2
Bering Sea										3
Bobrof Island										4
Bobrof Volcano										5
Redan Point										6
Kanaga Sound										7
(to SE. of Bobrof I.)										8
Names approved										9
12-2-54										10
L. Hock										11
										12
										13
										14
										15
										16
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										19
										20
										21
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										23
										24
										25
										26
										27

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Names approved  
12-2-54  
L. Hock

## Notes to the Hydrographer

The following hydrographic and topographic stations were established in the field:

### Photo-Hydro Stations

<u>Name</u>	<u>Photograph</u>	<u>Description</u>
AFT.	14671	WW on point of cliff
AIR.	14669	WW
BEE.	14668	WW on face of cliff
CAL.	14669	WW on boulder
COP.	14673	WW on point of rock
DEB.	14668	WW on boulder
ELK.	14667	WW on face of cliff
EST.	14673	WW on large boulder
FAG.	14668	Highest point of round top rock (No ww)
GEM.	14668	WW on boulder
HUB.	14669	WW on boulder at base of slide
IDA.	14669	WW on point of bluff
JUG.	14670	WW on W'ly high point of 20' rock
KID.	14669	WW on face of cliff
LIE	14670	WW
MAN.	14670	WW
NAG.	14671	WW on highest point of N'ly rock
OPE.	14672	WW
PET.	14671	WW
ROK	14671	Light colored rock (not used)
SAX.	14674	WW - east end of top of rock
SOB.	14672	WW
SOT.	14670	WW on point of bluff, left edge of large slide
TEE.	14672	Highest point of rock (not used)
TOP.	14670	Highest point of large rock (no ww)
TUG.	14674	WW on point of bluff
UNA.	14674	WW on boulder
USE.	14669	Spot of grass on bare spot on face of low bluff
WAG.	14674	WW on boulder

### Topographic Stations

<u>Name</u>	<u>Photograph</u>
BOBO, 1954	Not identified
SPAR, 1954	34332



Review Report  
Topographic Map T-9924  
11 April 1955

62. Comparison with Registered Topographic Surveys: None.
63. Comparison with Maps of Other Agencies: Adak, Alaska (USGS) 1:250,000  
1951 Edition, reprinted 1953.

No discrepancies.

64. Comparison with Contemporary Hydrographic Surveys:

H-8057	1:60,000	1953
H-8141	1:20,000	1954 (Print of Boat Sheet)

No discrepancies indicated. New topographic positions result from T-9924 and will effect a revision of hydrography.

65. Comparison with Nautical Charts:


8863	1951, corrected to 52-1/14
9145, 1:40,000	1945, corrected to 51-8/13

Charts show the elevation of Bobrof Volcano as 2875. This elevation was determined during this survey as 2421 mean sea level. Chart 9145 shows a rock awash at latitude  $51^{\circ} 53.3$  - longitude  $177^{\circ} 27.3$  which was not inspected by the field party or could not be interpreted from the photographs. Map T-9924 was applied to Chart 9145 on 2 December 1954 but the new chart was not examined during this review. Changes made to T-9924 are shown in red on the map manuscript.

66. Adequacy of Results and Future Surveys:


This survey complies with project instructions and National Map Accuracy Standards.

Reviewed by:


  
Everett H. Ramey




APPROVED:

  
\_\_\_\_\_  
Chief, Review Section  
Photogrammetry Division

  
\_\_\_\_\_  
Chief, Photogrammetry Division

  
\_\_\_\_\_  
Chief, Nautical Chart Branch  
Charts Division

  
\_\_\_\_\_  
Chief, Coastal Surveys Division



SCALE FACTOR.....1.0

SCALE OF MAP ..... 1:20,000.....

PROJECT NO. Ph-34.....

MAP T-9924

[illegible]

Plotted by: C.H.B.  
CHECKED BY: C.O.D.

DATE:

M-2388-12



MAP T-9924

PROJECT NO. Ph-34.

SCALE OF MAP.....1:20,000.

SCALE FACTOR 1.0

[illegible]

1 FT. = .3048006 METER

COMPUTED BY: T.C.L.

С. Н. В.

DATE \_\_\_\_\_

10-4-54

Plotted by: C.O.D.  
CHECKED BY:

DATE \_\_\_\_\_

M-2388-12



## PHOTOGRAMMETRIC OFFICE REVIEW

T. 9924

1. Projection and grids ☒ 2. Title ☒ 3. Manuscript numbers ☒ 4. Manuscript size ☒

## CONTROL STATIONS

5. Horizontal control stations of third-order or higher accuracy ☒ 6. Recoverable horizontal stations of less than third-order accuracy (topographic stations) ☒ 7. Photo hydro stations ☒ 8. Bench marks ☒  
9. Plotting of sextant fixes ☒ 10. Photogrammetric plot report ☒ 11. Detail points ☒

## ALONGSHORE AREAS

(Nautical Chart Data)

12. Shoreline ☒ 13. Low-water line ☒ 14. Rocks, shoals, etc. ☒ 15. Bridges ☒ 16. Aids to navigation ☒ 17. Landmarks ☒ 18. Other alongshore physical features ☒ 19. Other along-shore cultural features ☒

## PHYSICAL FEATURES

20. Water features ☒ 21. Natural ground cover ☒ 22. Planetable contours ☒ 23. Stereoscopic instrument contours ☒ 24. Contours in general ☒ 25. Spot elevations ☒ 26. Other physical features ☒

## CULTURAL FEATURES

27. Roads ☒ 28. Buildings ☒ 29. Railroads ☒ 30. Other cultural features ☒

## BOUNDARIES

31. Boundary lines ☒ 32. Public land lines ☒

## MISCELLANEOUS

33. Geographic names ☒ 34. Junctions ☒ 35. Legibility of the manuscript ☒ 36. Discrepancy overlay ☒ 37. Descriptive Report ☒ 38. Field inspection photographs ☒ 39. Forms ☒40. Orville N. Dalbey  
Reviewer

Supervisor, Review Section or Unit

41. Remarks (see attached sheet)

## FIELD COMPLETION ADDITIONS AND CORRECTIONS TO THE MANUSCRIPT

42. Additions and corrections furnished by the field completion survey have been applied to the manuscript. The manuscript is now complete except as noted under item 43.

\_\_\_\_\_  
Compiler\_\_\_\_\_  
Supervisor

43. Remarks:

*Div. of Photo*

COMPUTATION OF TRIANGLES  
COMPUTATION OF ELEVATIONS  
COMPUTATION OF GEOGRAPHIC POSITIONS

Project GS-218 Ph-34

Map T-9924  
Bobrof Island, Alaska

1954 Season

SHIP EXPLORER  
S. B. Grenell, Comdg.

P-001

COMPUTATION OF TRIANGLES

State: Alaska - Bobrof I.

11-9121

U. S. DEPARTMENT OF COMMERCE

NO.	STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3							4.469 889
1	P-001 Bobrof Volcano	( 9.3 12 52 )					0.000 684
2	SHIP, 1943	57 53 12	1943 Direction				9.927 882
3	ARIES, 1953	28 53 56					9.684 18.6
1-3							4.398 455
1-2						14281.0	4.154 759
						14286.7	4.154 928
2-3							4.029 144
1	P-001 Bobrof Volcano	( 38 28 56 )					0.206 020
2	OKING	56 12 56					9.919 672
3	SHIP, 1943	85 18 08	(Use 1943 Direction on Bobrof Vol.)				9.998 539
1-3						14283.6	4.154 836
1-2							4.233 703
2-3							
1							
2							
3							
1-3							
1-2							
2-3							
1							
2							
3							
1-3							
1-2							

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Peak S. of Bobrof Volcano. P-002

DEPARTMENT OF COMMERCE  
U. S. COAST AND GEODETIC SURVEY  
Form 25  
Ed. Jan., 1929

COMPUTATION OF TRIANGLES

State: Alaska - Bobrof I.

11-9121

NO.	STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3						4.264 720
	1 Peak P-002	(84 14 04)					0.002 202
F	2 SHIP, 1943	46 50 26					9.862 997
L	3 SUDAK, 1953	48 55 30					9.877 285
	1-3					13457	4.129 919
	1-2					13938.2	4.144 207
	2-3						4.469 889
	1 Peak P-002	(93 33 49)					0.000 841
F	2 SHIP, 1943	58 18 38					9.929 883
A	3 ARIES, 1953	28 07 33					9.673 398
	1-3					25154	4.400 613
	1-2					13935.7	4.144 128
	2-3						4.029 144
	1 Peak P-002	(39 21 49)					0.197 747
J	2 OKING	55 45 29					9.917 332
F	3 SHIP, 1943	84 52 42					9.998 263
	1-3					13938.7	4.144 223
	1-2						4.225 154
	2-3						
	1						
	2						
	3						
	1-3						
	1-2						

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Peak w. of Bobrof Volcano.

P-003

COMPUTATION OF TRIANGLES

State: Alaska - Bobrof I.

U. S. GOVERNMENT PRINTING OFFICE: 16-60265-1							
	STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3 P-003						4.264720
	1 Peak	(85 03 47)					0.001614
G	2 SHIP, 1943	44 12 46					9.843435
R	3 SUDAK, 1953	50 43 27					9.888801
	1-3					12876	4.109769
	1-2					14293.4	4.155135
	2-3 P-003						4.029144
	1 Peak	(37 44 30)					0.213176
K	2 OKING	54 44 48					9.912014
G	3 SHIP, 1943	87 30 42					9.999590
	1-3					14300.3	4.155344
	1-2						4.241910
	2-3						
	1						
	2						
	3						
	1-3						
	1-2						
	2-3						
	1						
	2						
	3						
	1-3						
	1-2						

Project Ph-34

## FOURTH-ORDER

DEPARTMENT OF COMMERCE  
U. S. COAST AND GEODETIC SURVEY  
Form 25  
Ed. Jan., 1929

## COMPUTATION OF TRIANGLES

State: Alaska - Bobroff I.

11-0121

NO.	STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3					12862.0	4.109308
	1 O COP	(90 24 40)					0.99997426
G.P.	2 SHIP, 1943	4 42 17 ✓					0.08202065
	3 BOBROFF (USN), 1943	84 53 03 ✓					0.99601646
	1-3					1055.0	(3.023 252)
	1-2					12811.1	(4.107 586)
	2-3					13692.8	4.136493
	1 O COP	(83 41 02)					0.99393006
	2 FOX	4 23 34 ✓					0.07659335
	3 BOBROFF (USN), 1943	91 55 24 ✓					0.99943663
	1-3					1055.2	
	1-2						
	2-3						
	1						
	2						
	3						
	1-3						
	1-2						
	2-3						
	1						
	2						
	3						
	1-3						
	1-2						

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## Project Ph-34

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

FOURTH-ORDER  
COMPUTATION OF TRIANGLES

State: Alaska - Bobrof I.

U. S. GOVERNMENT PRINTING OFFICE 16-50265-1							
	STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3						4.108774
	1 O SPAR	(23 45 16)	-			-	0.394892
	2 NUB, 1943	25 47 21	-				9.638550
	3 SUDAK, 1953	130 27 23	-				9.881328
	1-3					13874.4	4.142216
	1-2						4.384994
	2-3						4.080805
	1 O SPAR	(13 33 53)					0.629776
	2 SUDAK, 1953	150 45 32					
	3 ARIES, 1953	15 40 35					9.431691
	1-3					-	
	1-2					13876.3	4.142272
	2-3						
	1 O SPAR	( )					
	2 SUDAK, 1953						
	3 OMARS, 1953	15 00 51					
	1-3						
	1-2						
	2-3						
	1						
	2						
	3						
	1-3						
	1-2						

FOURTH-ORDER

Project Ph-34  
~~Form~~  
COMPUTATION OF TRIANGLES

State: Alaska - Bobrof I.

11-0121

U. S. GOVERNMENT PRINTING OFFICE: 1929

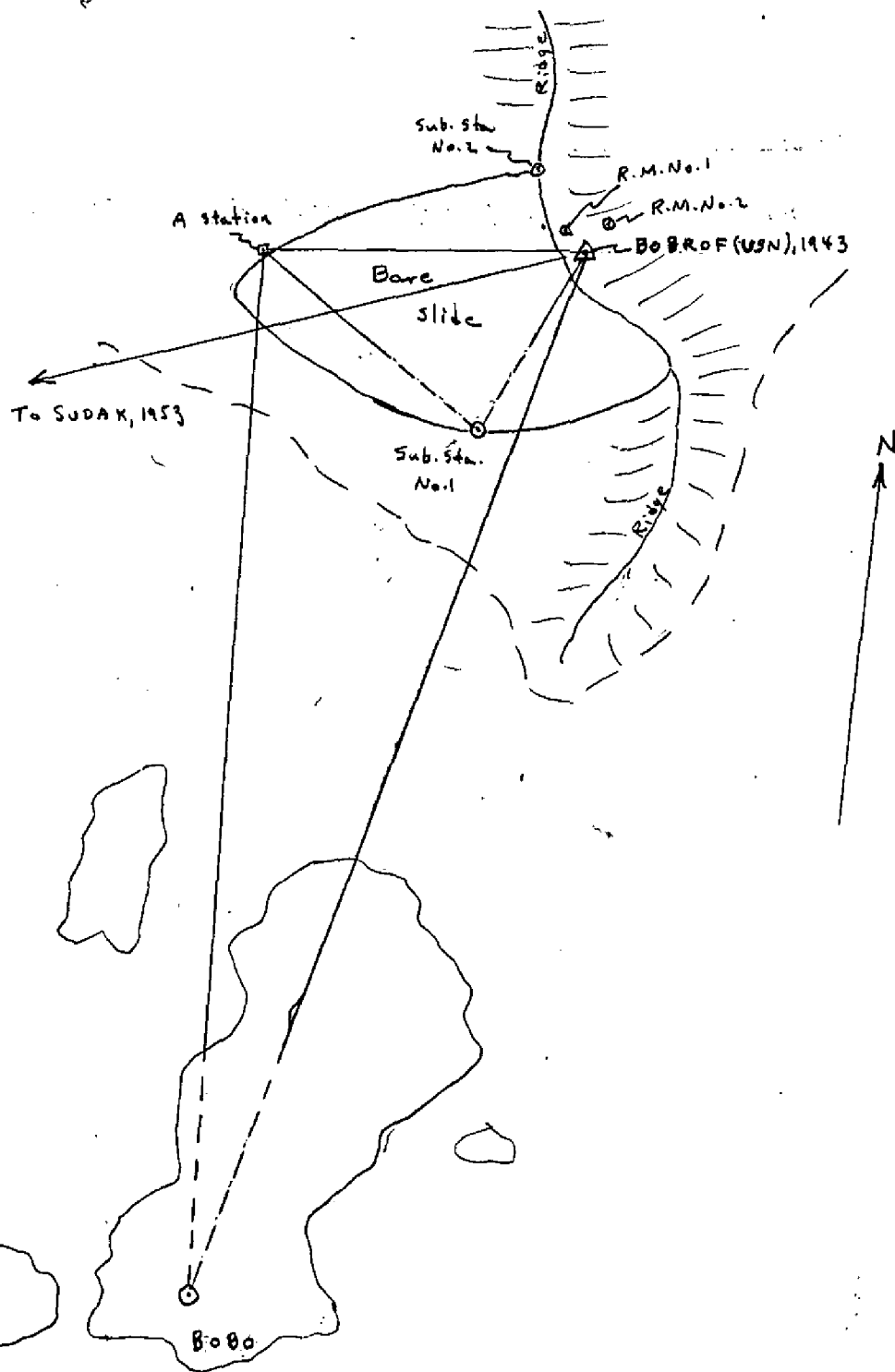
NO.	STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
2-3						57.53 m.	1.789 894 <sup>5</sup> ✓
1	BOBO	( 17 20 19 ) ✓					0.525 757 ✓
2	BOBROF A STATION	94 13 57 ✓					9.998 814 ✓
3	BOBROF (USN), 1943	68 25 44 ✓					9.968 465 ✓
1-3						192.52 m.	2.284 465 ✓
1-2						179.52 m.	2.254 116 ✓
2-3							
1							
2							
3							
1-3							
1-2							
2-3						57.53 m.	1.759 894 ✓
1	Sub. Sta. No. 1	( 83 - 40 - ) ✓					0.002 659 ✓
2	BOBROF A STATION	38 - 11 ✓					9.791 115 ✓
3	BOBROF (USN), 1943	58 - 08 ✓					9.929 050 ✓
1-3						35.78 m.	1.553 668 ✓
1-2						49.16 m.	1.691 603 ✓
2-3							
1							
2							
3							
1-3							
1-2							

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See sketch on other side.

✓ CDH

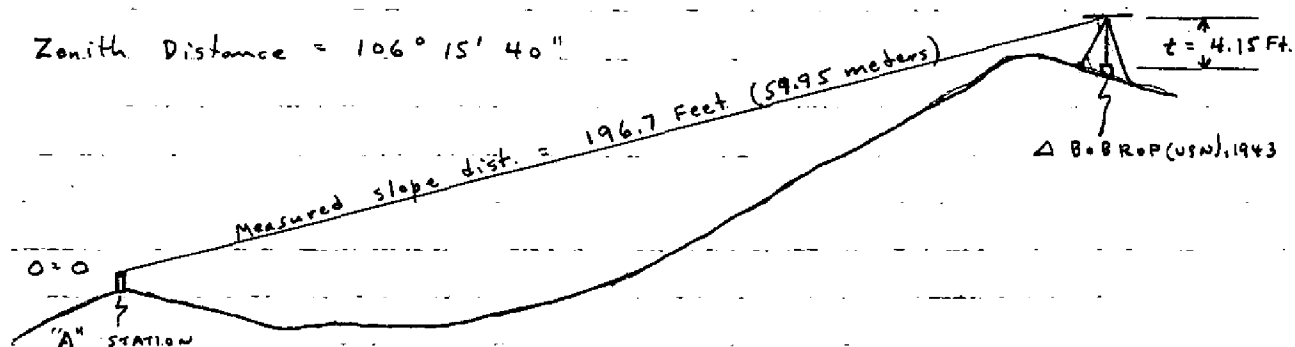
Sub





COMPUTATION OF  
HORIZONTAL DISTANCE AND DIFFERENCE IN ELEVATION  
BOBROF (USN), 1943 TO A STATION

Zenith Distance =  $106^{\circ} 15' 40''$



$$\text{Log cos } (Z.D. - 90^{\circ}) = 9.982269$$

$$\text{Log } 59.95 \text{ meters} = 1.777789$$

$$\text{Log Hor. Dist.} = 1.760058$$

$$\text{Hor. Dist.} = 57.55 \text{ meters}$$

$$\text{Log sin } (Z.D. - 90^{\circ}) = 9.44718$$

$$\text{Log } 196.7 \text{ Feet} = 2.29380$$

$$\text{Log Vert. Dist.} = 1.74098$$

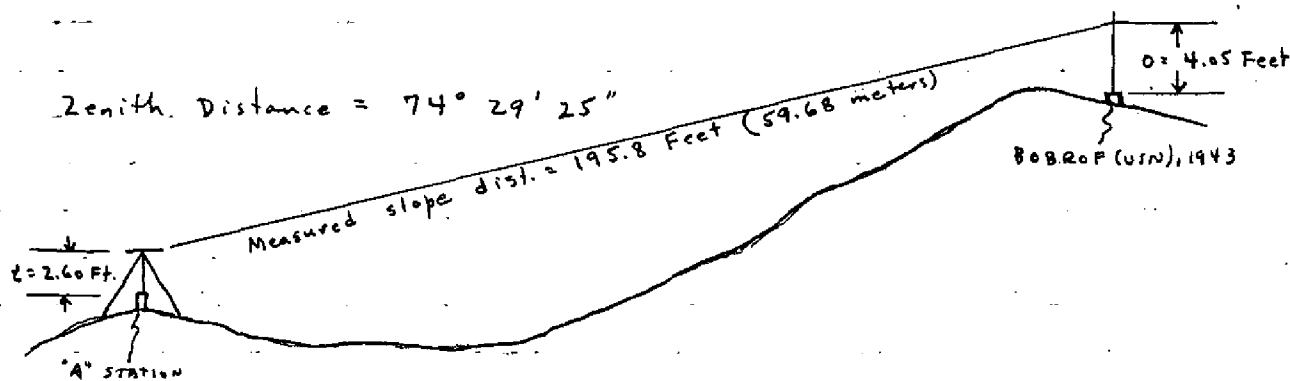
$$\text{Vert. Dist.} = -55.08 \text{ Feet}$$

$$t = +4.15 \text{ Feet}$$

$$0 = 0.00 \text{ Feet}$$

$$\text{Diff. in Elev. BOBROF to A station} = -50.93 \text{ Feet}$$

Zenith Distance =  $74^{\circ} 29' 25''$



$$\text{Log cos } (90^{\circ} - Z.D.) = 9.983890$$

$$\text{Log } 59.68 \text{ meters} = 1.775829$$

$$\text{Log Hor. Dist.} = 1.759719$$

$$\text{Hor. Dist.} = 57.51 \text{ meters}$$

$$\text{Log sin } (90^{\circ} - Z.D.) = 9.42716$$

$$\text{Log } 195.8 \text{ Feet} = 2.29181$$

$$\text{Log Vert. Dist.} = 1.71897$$

$$\text{Vert. Dist.} = -52.36 \text{ Feet}$$

$$t = -2.60 \text{ Feet}$$

$$0 = +4.05 \text{ Feet}$$

$$\text{Diff. in Elev. BOBROF to A station} = -50.91 \text{ Feet}$$

$$\text{Mean Hor. Dist.} = 57.53 \text{ meters}$$

$$\text{Mean Diff. in Elev.} = -50.92 \text{ Feet.}$$

✓ CDL

COMPUTATION OF ELEVATIONS AND REFRACTIONS FROM RECIPROCAL OBSERVATIONS

Station 1, occ.	SUDAK, 1953					
Station 2, obs.	BOOROF (USN), 1943					
Mean of $\zeta_1$ 1953 + 1954 obs.	89 48 39					
$\zeta_2$ 1954 obs.	90 16 51					
$\zeta_2 - \zeta_1$	0 28 12					
$\frac{1}{2} (\zeta_2 - \zeta_1)$	0 14 06					
$\frac{1}{2} (\zeta_2 - \zeta_1)$ in secs.						
log ditto						
T	log tan 7.61295					
log s		4.07886				
log [s tan $\frac{1}{2} (\zeta_2 - \zeta_1)$ ]						
log A						
log B						
log C						
log ( $h_2 - h_1$ )	1.69181					
$h_2 - h_1$	49.18					
$h_1$	21.17					
$h_2$	70.35					
2 log s						
log p = 9 - 2 log s						
p of ( $h_2 - h_1$ )						
$\alpha$ and mean $\phi$						
$\zeta_1 + \zeta_2 - 180^\circ$						
$\zeta_1 + \zeta_2 - 180^\circ$ in sec.						
log ditto						
log p						
colog s						
log $\frac{\sin 1''}{2} = 4.38454$						
log (0.5 - m)						
(0.5 - m)						
p of (0.5 - m)*						

\* Since (0.5 - m) varies as  $s^2$ , the weight  $p = \frac{s^2}{N}$ , where N is constant for a set and is preferably a power of 10.

See page

COMPUTATION OF ELEVATIONS FROM NONRECIPROCAL OBSERVATIONS.

Station 1, occ.	SHIP, 1943	NOB, 1943	BOBR OF (USN), 1943	BOBR OF (USN), 1943	BOBR OF (USN), 1943	BOBR OF (USN), 1943
Station 2, obs.	BOBR OF (USN), 1943	BOBR OF (USN), 1943	PLUTO, 1953	PLUTO, 1953	SHIP, 1943	BARNES (USN), 1943
Object sighted	Top of white signal cloth 1954	Top of tripod 1953 obs.	Top of Banner 1953 obs.	Ground. 1954	Water surface tangent of rock 1315 5/13/54	Top of tripod. 1954
$\xi_1$	89 46 30	89 58 12	90 01 48	90 02 44	90 22 09	90 05 06
$\alpha$ and mean $\phi$	155. 51-50	217 51-49	31 <sup>51-48</sup> <del>31-48</del>	31 51-48	335 51-50	60 51-51
$\log (0.5-m)$	9.63246	9.63246	9.63246	9.63246	9.63246	9.63246
$\log s$	4.10931	4.32405	4.33615	4.33615	4.10931	4.20378
$\text{colog } \rho$	3.19531	3.19510	3.19521	3.19521	3.19531	3.19467
$\text{colog sin } 1''$	5.31443	5.31443	5.31443	5.31443	5.31443	5.31443
$\log (k \text{ in secs.})$	2.25151	2.46604	2.47825		2.25151	2.34534
$k \text{ in secs.}$	178	292	301	301	178	221
$(90^\circ - \xi_1 + k) \text{ in secs.}$	+ 0 16 28	+ 0 06 40	+ 0 03 13	+ 0 02 17	- 0 19 11	- 0 01 25
$\log \text{ ditto}$						
T $\log \tan$	7.68034	7.28764	6.97113	6.82230	7.74665	6.61499
$\log s$	4.10931	4.32405	4.33615	4.33615	4.10931	4.20378
$\log [s \tan (90^\circ - \xi_1 + k)]$	1.78965					
$\log A$						
$\log B$						
$\log C$						
$\log (h_2 - h_1)$	1.78965	1.61169	1.30728	1.15845	1.85596	0.81877
$h_2 - h_1$	+ 61.61	+ 40.90	- 20.29	- 14.40	+ 71.77	- 6.59
$h_1$	17.58	$h_1$ 32.40	$h_2$ 85.80	$h_2$ 85.80	$h_2$ + 0.52	$h_2$ 61.77
$t - o$	- 0.03	- 2.08	+ 2.92	- 1.26	- 1.26	+ 1.03
Corrected elevation	73.16	$h_2$ 71.22	$h_1$ 68.43	$h_1$ 70.14	$h_1$ 70.51	$h_1$ 69.57
	Reject		Reject			
$\log p = 9 - 2 \log s$						
p		Mean	Elev.	BOBR OF (USN), 1943		
Weighted mean elevation of sta. obs.			70.36 230.8	meters Feet		

See page



COMPUTATION OF ELEVATIONS FROM NONRECIPROCAL OBSERVATIONS.

Station 1, occ.	ARIES, 1953	SHIP, 1943	OKING			
Station 2, obs.	Bobrof Volcano P-001	Bobrof Volcano P-001	Bobrof Volcano P-001			
Object sighted	Highest Point	Same	Same			
$\zeta_1$	88 24 15	87 09 18	87 36 44			
$\alpha$ and mean $\phi$	254 52	161 52	122 52			
$\log (0.5-m)$	9.63246	9.63246	9.63246			
$\log s$	4.39846	4.15493	4.23370			
$\text{colog } p$	3.19530	3.19539	3.19471			
$\text{colog sin } 1''$	5.81443	5.81443	5.81443	5.81443	5.81443	5.81443
$\log (k \text{ in secs.})$	2.54065	2.29721	2.37530			
$k \text{ in secs.}$	347	198	237			
$(90^\circ - \zeta_1 + k) \text{ in secs.}$	1 41 32 1 40 09	2 54 00	2 27 13			
$\log \text{ ditto}$	4.6446					
$T$	$\log \tan$ 8.47046	8.70465	8.63195			
$\log s$	4.39846	4.15493	4.23370			
$\log [s \tan (90^\circ - \zeta_1 + k)]$						
$\log A$						
$\log B$						
$\log C$	2.86302					
$\log (h_2 - h_1)$	2.86892	2.85958	2.86565			
$h_2 - h_1$	739.5	723.7	733.9			
$h_1$	4.2	10.6	3.4			
$z - o$	1.6	1.7	1.6			
Corrected elevation	745.3	736.0	738.9			
	Right					
$\log p = 9 - 2 \log s$						
$p$	Mean	Elev.	P-001			
Weighted mean elevation of sta. obs.		737.4	meters			
		2419	feet			

P-002

COMPUTATION OF ELEVATIONS FROM NONRECIPROCAL OBSERVATIONS.

Station 1, occ.	ARIES, 1953	SUDAK, 1953	SHIP, 1953	OKING		
Station 2, obs.	P-002 Peak A	P-002 Peak L	P-002 Peak A	P-002 Peak J		
Object sighted	Highest Point	Same	Same	Same		
$\delta_1$	88 37 49	87 25 22	87 28 18	87 53 30		
$\alpha$ and mean $\phi$	255 52	245 52	161 52	122 52		
$\log(0.5-m)$	9.63246	9.63246	9.63246	9.63246		
$\log s$	4.40061	4.12992	4.14421	4.22515		
$\text{colog } \rho$	3.19446	3.19459	3.19539	3.19471		
$\text{colog sin } 1''$	5.31443	5.31443	5.31443	5.31443	5.31443	5.31443
$\log(k \text{ in secs.})$	2.54196	2.27140	2.28649	2.36775		
$k \text{ in secs.}$	348	187	193	233		
$(90^\circ - \delta_1 + k) \text{ in secs.}$	1 28 01	2 37 45	2 34 55	2 10 23		
	1 26 37					
$\log \text{ ditto}$						
$T$	$\log \tan$ 8.40839	8.66200	8.65412	8.57916		
$\log s$	4.40061	4.12992	4.14421	4.22515		
$\log[s \tan(90^\circ - \delta_1 + k)]$						
$\log A$						
$\log B$						
$\log C$	2.80223					
$\log(h_2 - h_1)$	2.80900	2.79192	2.79833	2.80431		
$h_2 - h_1$	644.2	619.3	628.5	637.3		
$h_1$	4.2	21.2	10.6	3.4		
$t - o$	1.6	1.6	1.7	1.6		
Corrected elevation	650.0	642.1	640.8	642.3		
	Reject					
$\log p = 9 - 2 \log s$		Mean	Elev.	P-002		
$p$			6.41.7	meters		
Weighted mean elevation of sta. obs.			210.5	feet		

P-003

COMPUTATION OF ELEVATIONS FROM NONRECIPROCAL OBSERVATIONS.

Station 1, occ.	SUDAK 1953	SHIP 1943	OKING			
Station 2, obs.	P-003 Peak K	P-003 Peak B	P-003 Peak K			
Object sighted	Highest Point	Same	Same			
$\zeta_1$	87 34 28	87 46 55	88 10 48			
$\alpha$ and mean $\phi$	243 52	159 52	121 52			
$\log (0.5-m)$	9.63246	9.63246	9.63246			
$\log s$	4.10977	4.15514	4.24191			
$\text{colog } p$	3.19472	3.19537	3.19469			
$\text{colog sin } 1''$	5.81443	5.81443	5.81443	5.81443	5.81443	5.81443
$\log (k \text{ in secs.})$	2.25138	2.29740	2.38349			
$k \text{ in secs.}$	178	198	242			
$(90^\circ - \zeta_1 + k) \text{ in secs.}$	2 28 30	2 16 23	1 53 14			
$\log \text{ ditto}$						
$T$	8.63572	8.59872	8.51786			
$\log s$	4.10977	4.15514	4.24191			
$\log [s \tan (90^\circ - \zeta_1 + k)]$						
$\log A$						
$\log B$						
$\log C$						
$\log (h_2 - h_1)$	2.74549	2.75386	2.75977			
$h_2 - h_1$	556.5	567.4	575.1			
$h_1$	21.2	10.6	3.4			
$t - 0$	1.6	1.7	1.6			
Corrected elevation	579.3	579.7	580.1			
$\log p = 9 - 2 \log s$	Mean Elevation	P-003				
$p$	579.7	meters				
Weighted mean elevation of sta. obs.	1902	feet				

P-004

Project PH-34

COMPUTATION OF ELEVATIONS FROM NONRECIPROCAL OBSERVATIONS.

Station 1, occ.	SUDAK 1953					
Station 2, obs.	SPAR P-004					
Object sighted	Top					
$\zeta_1$	89 38 32 ✓					
$\alpha$ and mean $\phi$	236 ✓ 52					
$\log(0.5-m)$	9.63246 ✓					
$\log s$	4.14227 ✓					
$\text{colog } \rho$	3.19474 ✓					
$\text{colog sin } 1''$	5.81443	5.81443	5.81443	5.81443	5.81443	5.81443
$\log(k \text{ in secs.})$	2.28390 ✓					
$k \text{ in secs.}$	192 ✓					
$(90^\circ - \zeta_1 + k) \text{ in secs.}$	0 24 40 ✓					
$\log \text{ ditto}$						
$T$	$\log \tan$ 7.85584 ✓					
$\log s$	4.14227 ✓					
$\log[s \tan(90^\circ - \zeta_1 + k)]$						
$\log A$						
$\log B$						
$\log C$						
$\log(h_2 - h_1)$	1.99811 ✓					
$h_2 - h_1$	99.6 ✓					
$h_1$	21.2 ✓					
$t - o$	1.6 ✓					
Corrected elevation	122.4 ✓					
$\log p = 9 - 2 \log s$						
$p$	Elev. P-004					
Weighted mean elevation of sta, obs.	122.4 meters 402 feet					

✓ CDH



COMPUTATION OF ELEVATIONS FROM NONRECIPROCAL OBSERVATIONS.

Station 1, occ.	BOROF (USN) 1943	BOROF "A"				
Station 2, obs.	B080	B080				
Object sighted	Top of rock	Top of rock				
$\zeta_1$	106 06 20	102 26 33				
$\alpha$ and mean $\phi$						
$\log (0.5-m)$						
$\log s$						
$\text{colog } \rho$						
$\text{colog sin } 1''$	5.31443	5.31443	5.31443	5.31443	5.31443	5.31443
$\log (k \text{ in secs.})$						
$k \text{ in secs.}$						
$(90^\circ - \zeta_1 + k) \text{ in secs.}$	16 06 20	12 26 33				
$\log \text{ ditto}$						
$T$	9.46051	9.34369				
$\log s$	2.28446	2.25412				
$\log [s \tan (90^\circ - \zeta_1 + k)]$	1.74497	1.59781				
$\log A$						
$\log B$						
$\log C$						
$\log (h_2 - h_1)$	1.74497	1.59781				
$h_2 - h_1$	-55.59	-39.61				
$h_1$	70.36	54.84				
$t-o$	+ 1.26	+ 0.79				
Corrected elevation	16.03	16.02				
$\log p = 9 - 2 \log s$						
$p$						
Weighted mean elevation of sta. obs.						

✓ CD4.

# POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

11-9362 U. S. GOVERNMENT PRINTING OFFICE 1970

FOURTH-ORDER

Project Ph-34  
T-9924

POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

° ' "												
$\alpha$	2	186	28	24		$\alpha$	3	366	29	24		
$\Delta\alpha$		+ 25	47	21		$\Delta\alpha$		- 130	27	23		
$\alpha$	2	212	15	45		$\alpha$	3	236	02	01		
$\Delta\alpha$		+	8	53		$\Delta\alpha$		+	7	54		
$\alpha'$	1	180	00	00.0		$\alpha'$	1	180	00	00.0		
$\alpha'$	1	32	24	38		$\alpha'$	1	56	09	55		
° ' " FIRST ANGLE OF TRIANGLE												
$\phi$	51	44	26.874	2 NUB. 1943	$\lambda$	177	38	06.774	$\lambda$	177	36	51.103
$\Delta\phi$	+	11	03.371		$\Delta\lambda$	-	11	17.826	$\Delta\lambda$	-	10	02.154
$\phi'$	51	55	30.245	1 O SPAR	$\lambda'$	177	26	48.948	$\lambda'$	177	26	48.949
° ' " Values in seconds												
$s$	4.384994	° ' " Values in seconds										
$\cos\alpha$	9.927171	° ' " Values in seconds										
$B$	8.509951	° ' " Values in seconds										
$h$	2.822116	° ' " Values in seconds										
$s^2$	8.76999	° ' " Values in seconds										
$\sin^2\alpha$	9.454776	° ' " Values in seconds										
$C$	1.50645	° ' " Values in seconds										
	9.73120	° ' " Values in seconds										
$h^2$	5.6442	° ' " Values in seconds										
$D$	2.3908	° ' " Values in seconds										
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$s$	4.384994	° ' " Values in seconds										
$\cos\alpha$	9.927171	° ' " Values in seconds										
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FOURTH-ORDER

Project Ph-34

T-992X

POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

FIRST ANGLE OF TRIANGLE											
90° 24' 40"											
to 2											
to 1											
to 3											
to 4											
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POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

$\alpha$	2	to 3	114	36	54	$\alpha$	3	to 2	294	25	"	27
$2^d \angle$		&	+ 46	50	26	$3^d \angle$		&	- 48	55	"	30
$\alpha$	2	to 1	161	27	20	$\alpha$	3	to 1	245	29	"	57
$\Delta \alpha$						$\Delta \alpha$						
$\alpha'$	1	to 2	180	00	00.0	$\alpha'$	1	to 3	180	00	"	00.0

FIRST ANGLE OF TRIANGLE

FIRST ANGLE OF TRIANGLE																				
84 ° 14 ' 04 "																				
°	'	"				°	'	"				°	'	"				°	'	"
$\phi$	51	47	12.852	25418	1943	$\lambda$	177	22	17.285	$\phi$	51	51	19.861	850DAK, 1953	$\lambda$	177	36	51.103		
$\Delta\phi$	+	7	07.495			$\Delta\lambda$	+	3	51.871	$\Delta\phi$	+	3	00.482		$\Delta\lambda$	-	10	41.94		
$\phi'$	51	54	20.347	1 P-002		$\lambda'$	177	26	09.156	$\phi'$	51	54	20.343	1 P-002	$\lambda'$	177	26	09.15		

Values in seconds				Logarithms				Values in seconds				Logarithms				Values in seconds			
$s$	4.144207	$\frac{1}{2}(\phi+\phi')$	628.8	$s$	4.129919	$\cos \alpha$	9.617741	$s$	4.129919	$\sin \alpha$	9.959020	$s$	4.129919	$\sin \alpha$	9.959020	$s$	4.129919	$\sin \alpha$	9.959020
$\cos \alpha$	9.976844	$B$	8.509943	$B$	8.509943	$h$	2.257603	$h$	2.257603	$s^2$	8.259884	$s^2$	8.259884	$s^2$	8.259884	$\sec \phi'$	0.209744	$\sec \phi'$	0.209744
$B$	8.509943	$h$	2.257603	$h$	2.257603	$s^2$	8.259884	$s^2$	8.259884	$\sin^2 \alpha$	9.91804	$\sin^2 \alpha$	9.91804	$\sin^2 \alpha$	9.91804	$\Delta \lambda$	1.807497	$\Delta \lambda$	1.807497
$h$	2.630999	$\Delta \lambda$	2.365247	$\Delta \lambda$	2.365247	$\Delta \lambda$	2.365247	$\Delta \lambda$	2.365247	$\sin \frac{1}{2}(\phi+\phi')$	9.68611	$\sin \frac{1}{2}(\phi+\phi')$	9.68611	$\sin \frac{1}{2}(\phi+\phi')$	9.68611	$2d \text{ term}$	+0.485	$2d \text{ term}$	+0.485
$s^2$	8.28841	$2d \text{ term}$	+0.063	$2d \text{ term}$	+0.063	$2d \text{ term}$	+0.063	$2d \text{ term}$	+0.063	$3d \text{ term}$	4.5152	$3d \text{ term}$	4.5152	$3d \text{ term}$	4.5152	$3d \text{ term}$	+0.001	$3d \text{ term}$	+0.001
$\sin^2 \alpha$	9.004946	$3d \text{ term}$	-427.495	$3d \text{ term}$	-427.495	$3d \text{ term}$	-427.495	$3d \text{ term}$	-427.495	$-\Delta \phi$	2.3807	$-\Delta \phi$	2.3807	$-\Delta \phi$	2.3807	$-\Delta \phi$	-180.482	$-\Delta \phi$	-180.482
$C$	1.50717	$-\Delta \phi$		$-\Delta \phi$		$-\Delta \phi$		$-\Delta \phi$		$D$	6.8956	$D$	6.8956	$D$	6.8956	$D$		$D$	
$C$	1.50717	$D$	175.1	$D$	175.1	$D$	175.1	$D$	175.1	$D$	175.1	$D$	175.1	$D$	175.1	$D$		$D$	
$C$	1.50717	$D$	(972.0)	$D$	(972.0)	$D$	(972.0)	$D$	(972.0)	$D$	(972.0)	$D$	(972.0)	$D$	(972.0)	$D$		$D$	

FOURTH-ORDER

Project Ph-34

T-9924

# POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

11-9382 U. S. GOVERNMENT PRINTING OFFICE: 1970

Project Ph-34

T-9924

SURVEY NO. T9924

### Record of Application to Charts

[illegible]

M-2168-1

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.