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U.S. NAVAL OCEANOGRAPHIC OFFICE
GEOMAGNETIC SURVEYS
1953—1965

BROCHURE No. 3

Magnetics Division

1966

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HYDROGRAPHIC SURVEYS DEPARTMENT
U. S. NAVAL OCEANOGRAPHIC OFFICE
WASHINGTON, D. C. 20390

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A B S T R A C T

Since 1953, the U.S. Naval Oceanographic Office has conducted geomagnetic surveys over various ocean areas of the world. Information on survey locations, dates, navigational control, track patterns, data format, and availability of geomagnetic technical reports, charts, and other publications is presented.

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I. INTRODUCTION

A. General

The U. S. Naval Oceanographic Office has been conducting geomagnetic investigations of ocean areas since the initiation of Project MAGNET surveys in 1953. These world-wide airborne surveys provide information for computing and charting all elements of the earth's magnetic field. With the introduction of the proton precession magnetometer, total magnetic intensity measurements could be made routinely from steel-hull ships. Shipboard magnetic surveys have been conducted by this Office since 1957. The information derived from these airborne and shipboard magnetic surveys is necessary to provide for safe navigation of ships and aircraft, to meet special Naval requirements, and to support the scientific research programs of the United States.

The purpose of this brochure is to present a brief description of geomagnetic surveys accomplished by the U. S. Naval Oceanographic Office since April 1953 and to provide information on the format and availability of the resulting data. It is anticipated that this basic brochure will be brought up to date by annual supplements. This publication revises and replaces the Geomagnetic Survey Information Brochure No. 2 previously distributed by the U. S. Naval Oceanographic Office.

This brochure is made available to assist other organizations in their survey planning and research investigations. It is requested that similar information be provided to this Office on an exchange basis to avoid duplication of survey and research efforts.

B. Instrumentation

Airborne magnetic measurements are made with a Naval Ordnance Laboratory Vector Airborne Magnetometer (VAM-2). Using this magnetometer system, total magnetic intensity, inclination, and declination are determined to the following respective accuracies: ± 15 gammas, ± 0.1 degree, and ± 0.2 degree. To reduce the effects of aircraft motion, angular measurements are averaged over a 100 second period centered on each 5 minute GMT. The observed data are recorded on continuous analog strip charts and, since 1964, are sampled and recorded digitally every three seconds by a magnetic tape recording system.

The Project MAGNET survey aircraft are air swung over the Coast and Geodetic Survey Magnetic Observatory at Fredericksburg, Virginia to compensate for the disturbing effects of the aircraft's magnetic field and to determine VAM-2 alignment errors. The VAM-2 is calibrated and standardized periodically in the laboratory and at the Fredericksburg Magnetic Observatory.

All shipboard magnetic measurements are made with proton precession magnetometers which record total magnetic intensity with an absolute accuracy of $\pm 1-2$ gammas. Measurements are made at 2 to 6 second time intervals continuously underway. The sensor unit is towed 500 to 1000 feet astern of the survey ship to minimize the effects of the ship's magnetic field. Data are recorded with time on analog and digital recorders.

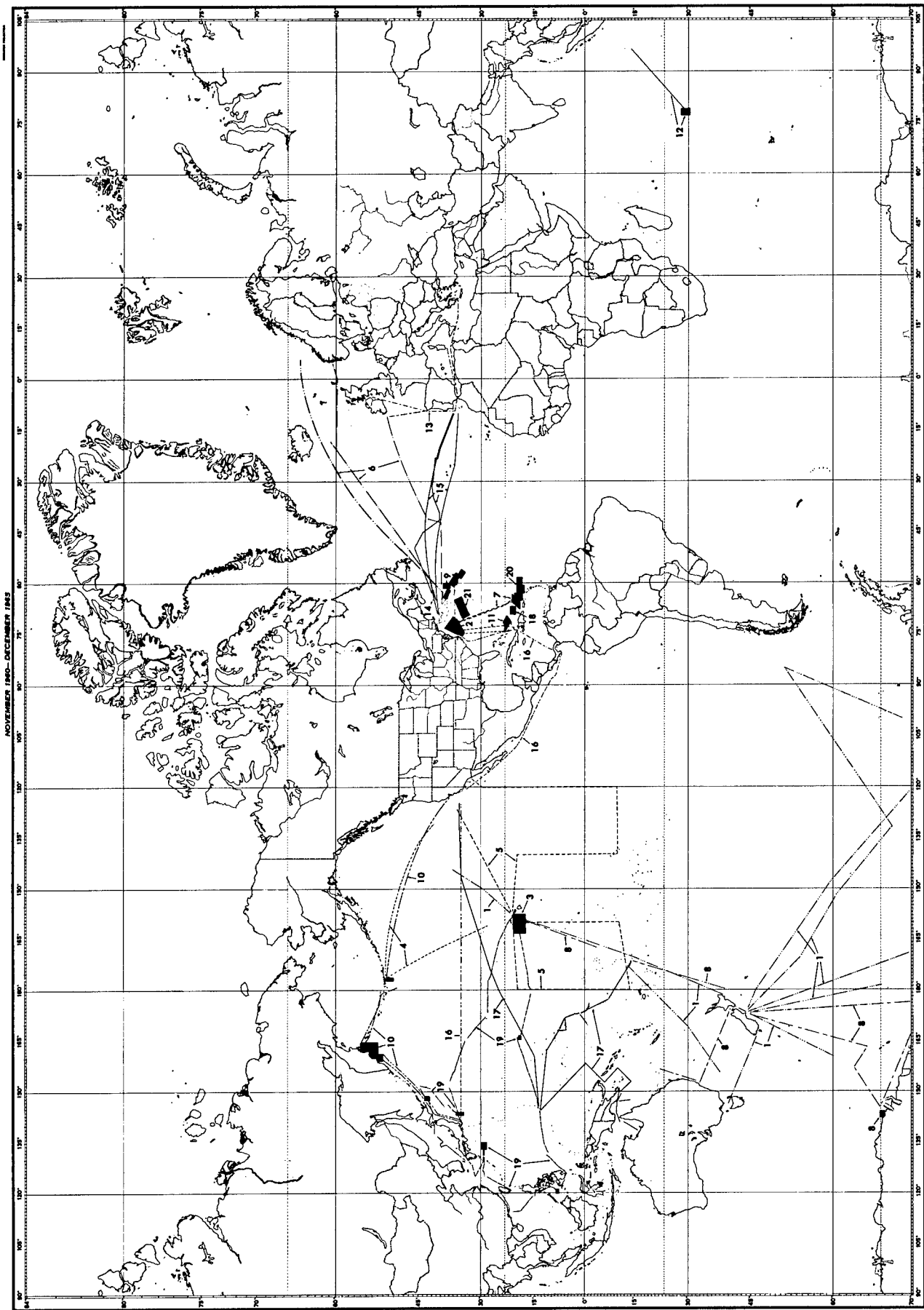
II. SPECIAL GEOMAGNETIC SURVEYS

The U. S. Naval Oceanographic Office has conducted detailed geomagnetic surveys with aircraft in response to specific requirements, or on an opportunity basis aboard ships while they were engaged in some other priority survey mission. These special surveys are usually conducted on a regular grid track pattern and often produce sufficient data for the construction of contour charts. Data collected along tracks to and from the survey areas provide profile information in areas where frequently no other geomagnetic data are available.

The survey locations and descriptions are presented on the following pages. The resultant data are usually presented as contour charts or profiles in technical or informal reports along with a discussion of the survey conditions, instrumentation, data processing, and in some instances, analysis and interpretation.

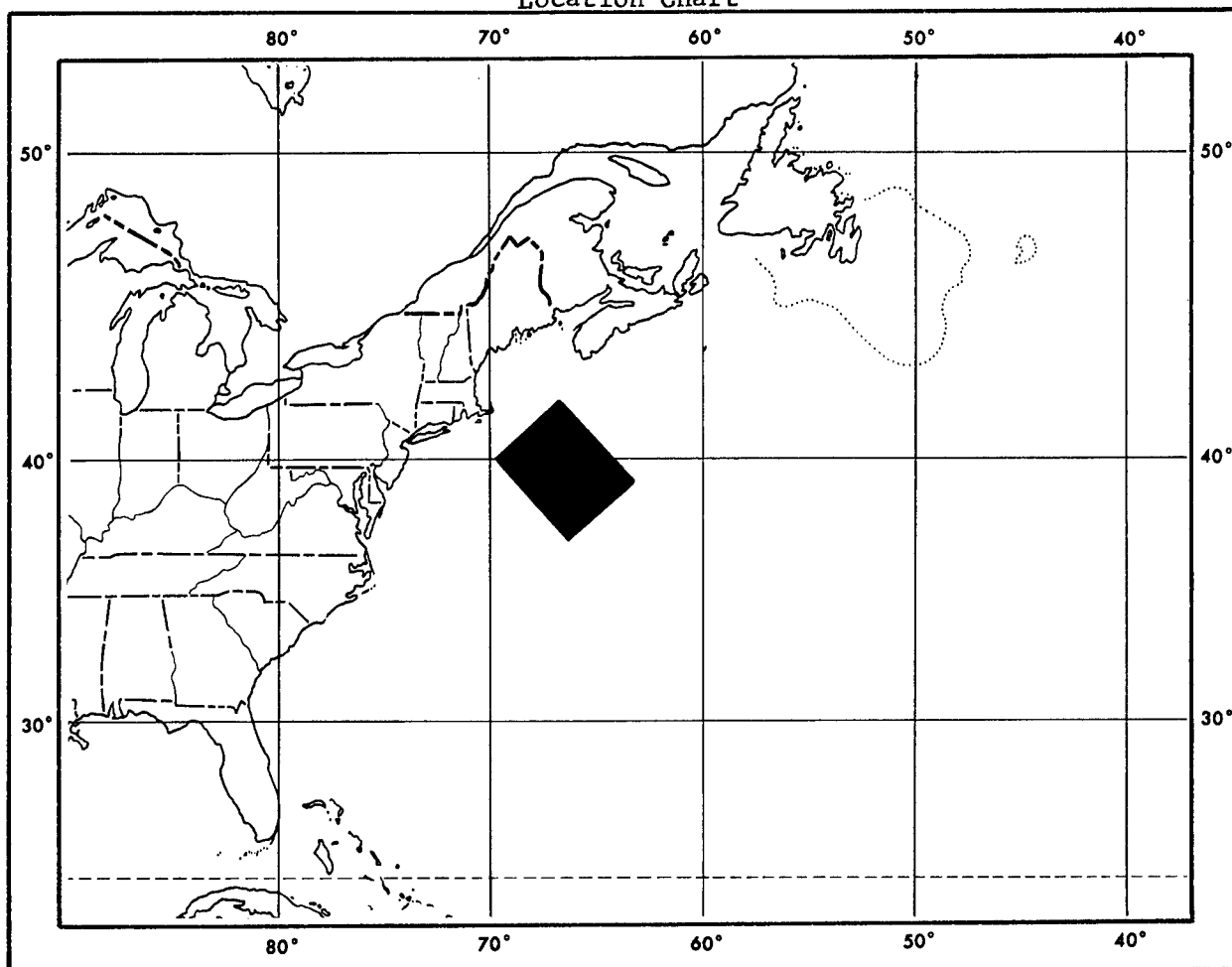
Map of the North Pacific showing sampling stations and hydrographic data. The map includes the North American coast, the Aleutian Islands, and the Kamchatka Peninsula. Sampling stations are marked with numbers 1 through 25. A thick black line indicates a specific track or boundary. A legend in the bottom right corner defines symbols for 'STATION', 'TEMPERATURE', 'SALINITY', and 'DENSITY'.

U.S. NAVAL OCEANOGRAPHIC OFFICE
SHIPBOARD MAGNETIC SURVEYS



A. Airborne Surveys

1. New England Seamount Chain Survey Location Chart



Aircraft: NC-54R BUNO 90396

Survey Dates: May 1957

Navigational Control: Loran-A, Doppler radar

Miles Surveyed: 38,000 square miles

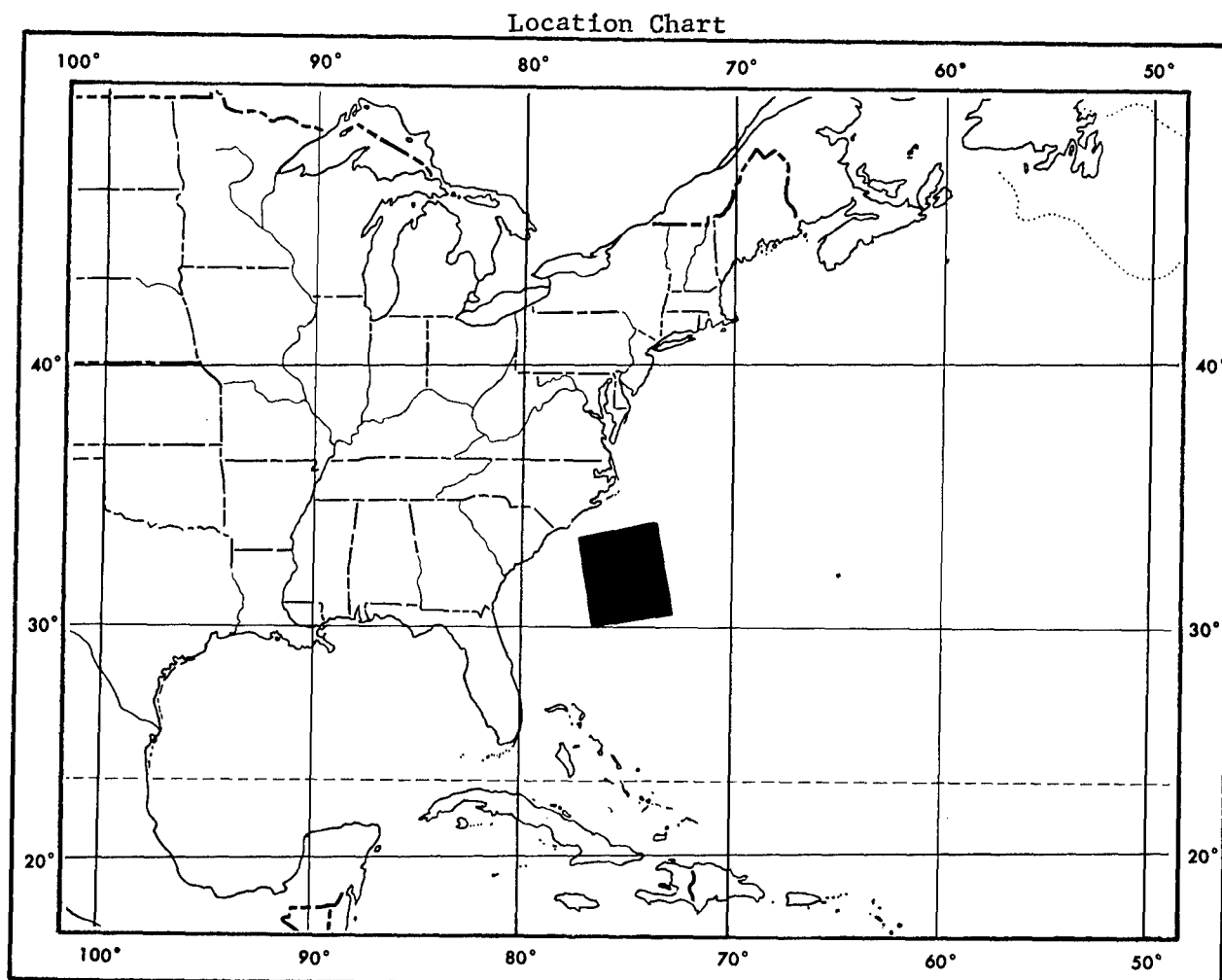
Track Pattern: 5-mile spacing, NW-SE track orientation

Altitude: 1000 feet

Data Format: Total intensity, inclination, vertical intensity, horizontal intensity, and residual total intensity contour charts.

Reports: Technical Report 166, "A Study of Aeromagnetic Data - New England Seamount Area."

2. Charleston Rise Survey



Aircraft: NC-54R BUNO 90396

Survey Dates: April 1957

Navigational Control: Loran-A, Doppler radar

Miles Surveyed: 31,000 square miles

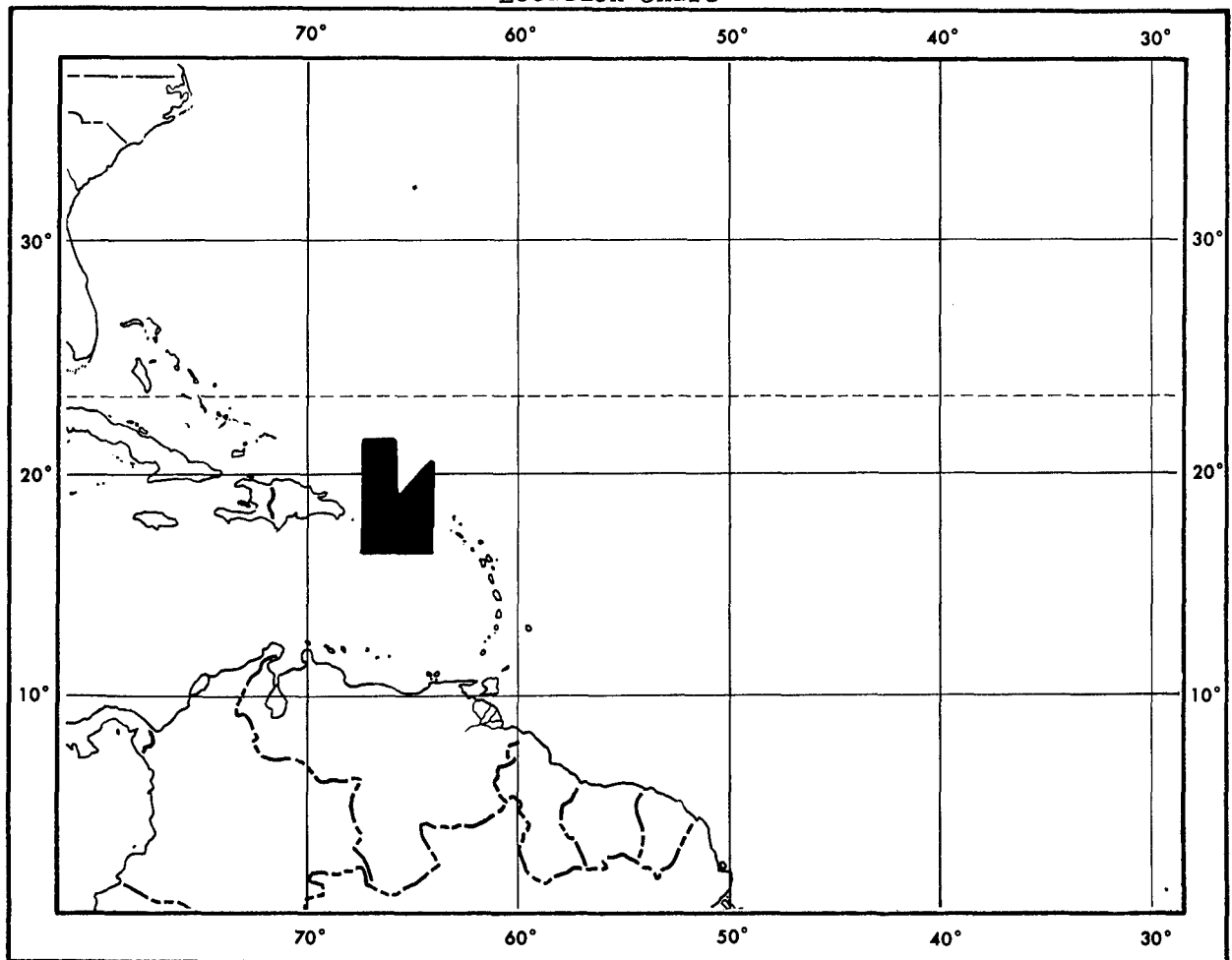
Track Pattern: 5-mile spacing, NW-SE track orientation

Altitude: 1000 feet

Data Format: Total intensity, residual magnetic intensity contour charts.

3. Puerto Rico Trench Survey

Location Chart



Aircraft: NC-54R BUNO 90396

Survey Dates: July 1962

Navigational Control: Loran-A, visual, Doppler radar

Miles Surveyed: 49,000 square miles

Track Pattern: 10-mile spacing, N-S track orientation

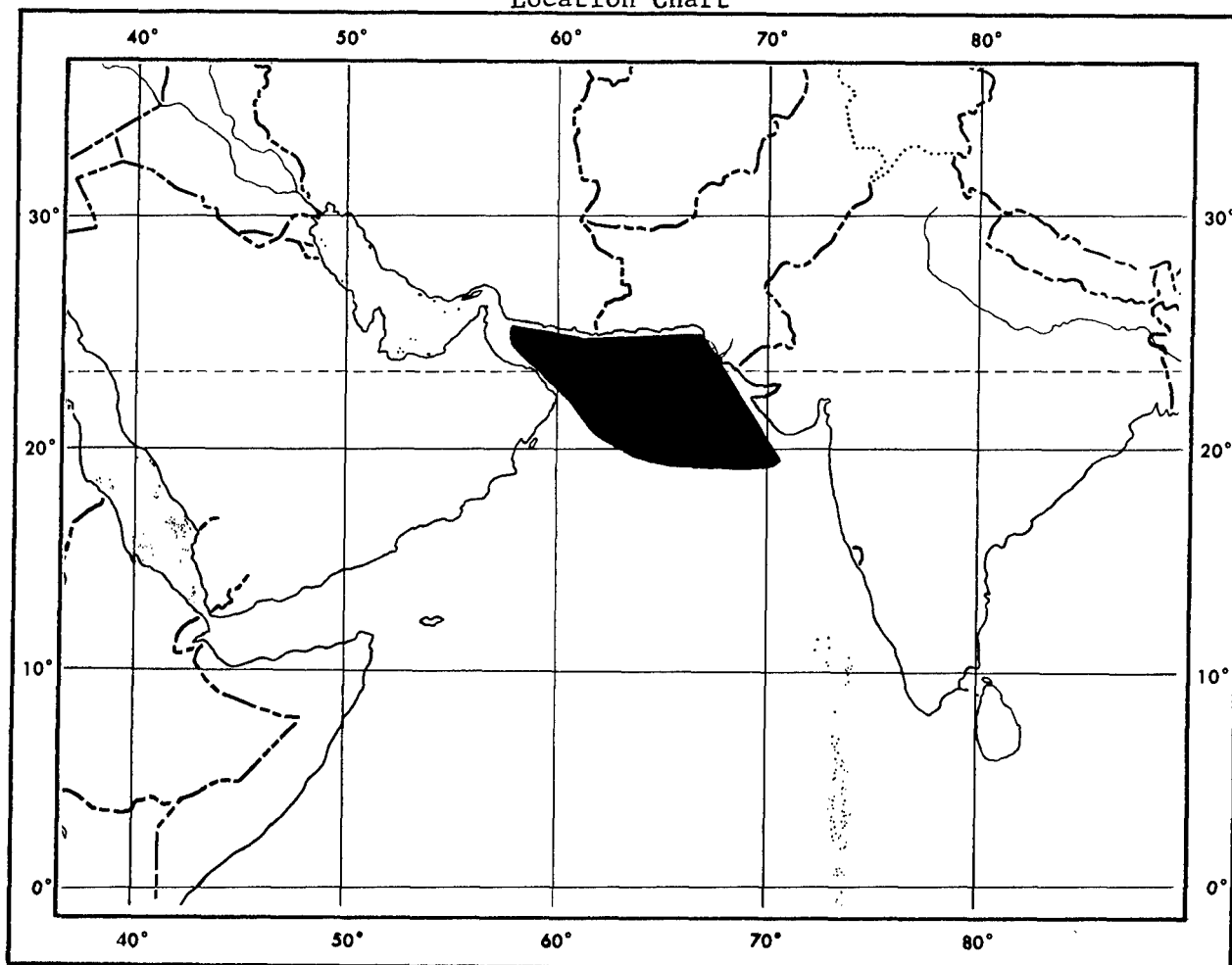
Altitude: 1000 feet over water; 10,000 feet over land

Data Format: Total intensity, residual magnetic intensity contour charts.

Reports: Informal Manuscript Report No. M-1-63, "Preliminary Report on Special Aeromagnetic Survey Puerto Rico Trench."

4. North Arabian Sea Survey

Location Chart



Aircraft: NC-54R BUNO 90396

Survey Dates: January 1961

Navigational Control: Dead reckoning and celestial

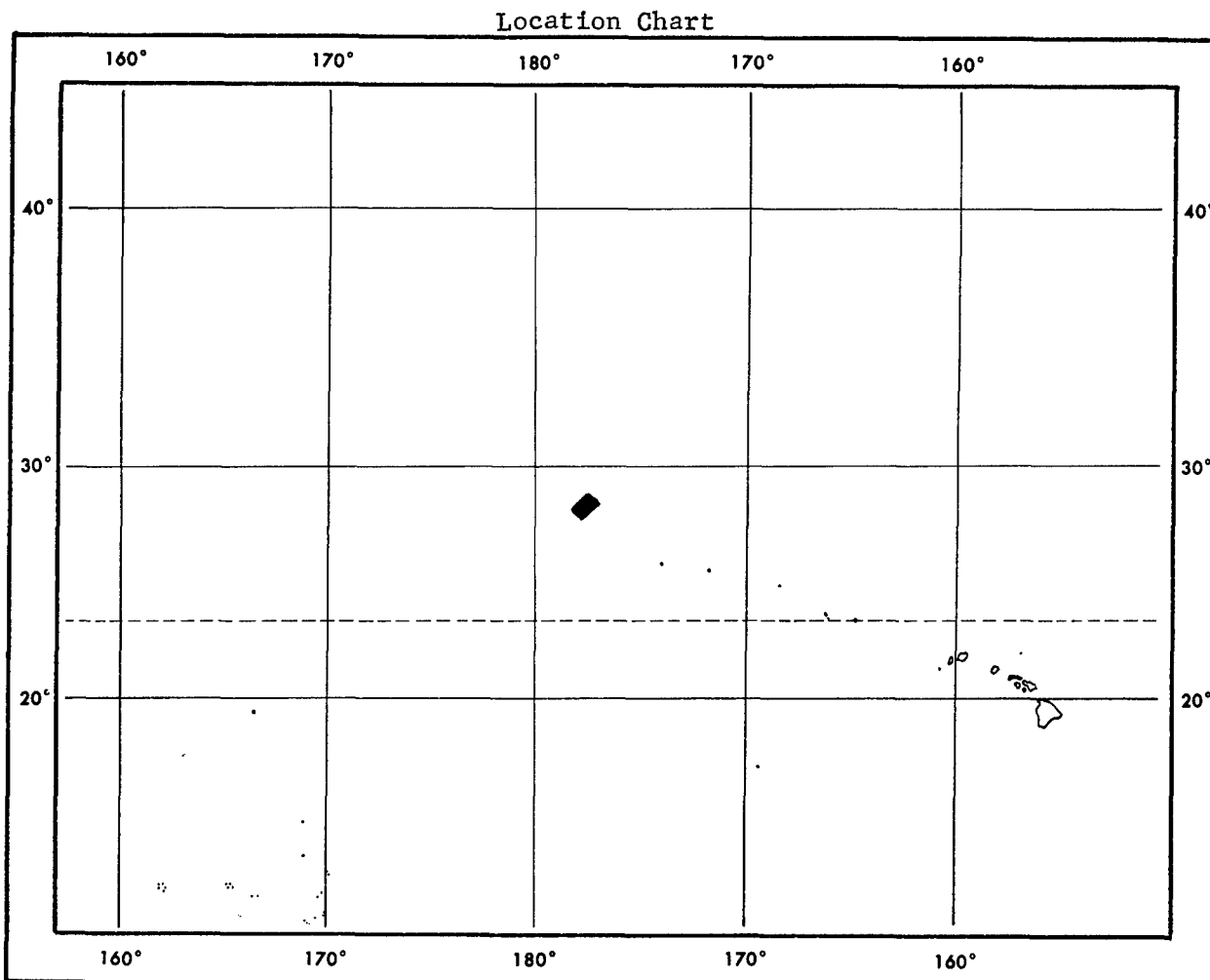
Miles Surveyed: 130,000 square miles

Track Pattern: Radial pattern south from Karachi, Pakistan; maximum spacing of radials averaged 45 miles

Altitude: 1000 feet

Data Format: Total intensity contour chart.

5. Midway Islands Survey



Aircraft: NC-54R BUNO 90396

Survey Dates: April 1963

Navigational Control: Ground radar, Doppler radar

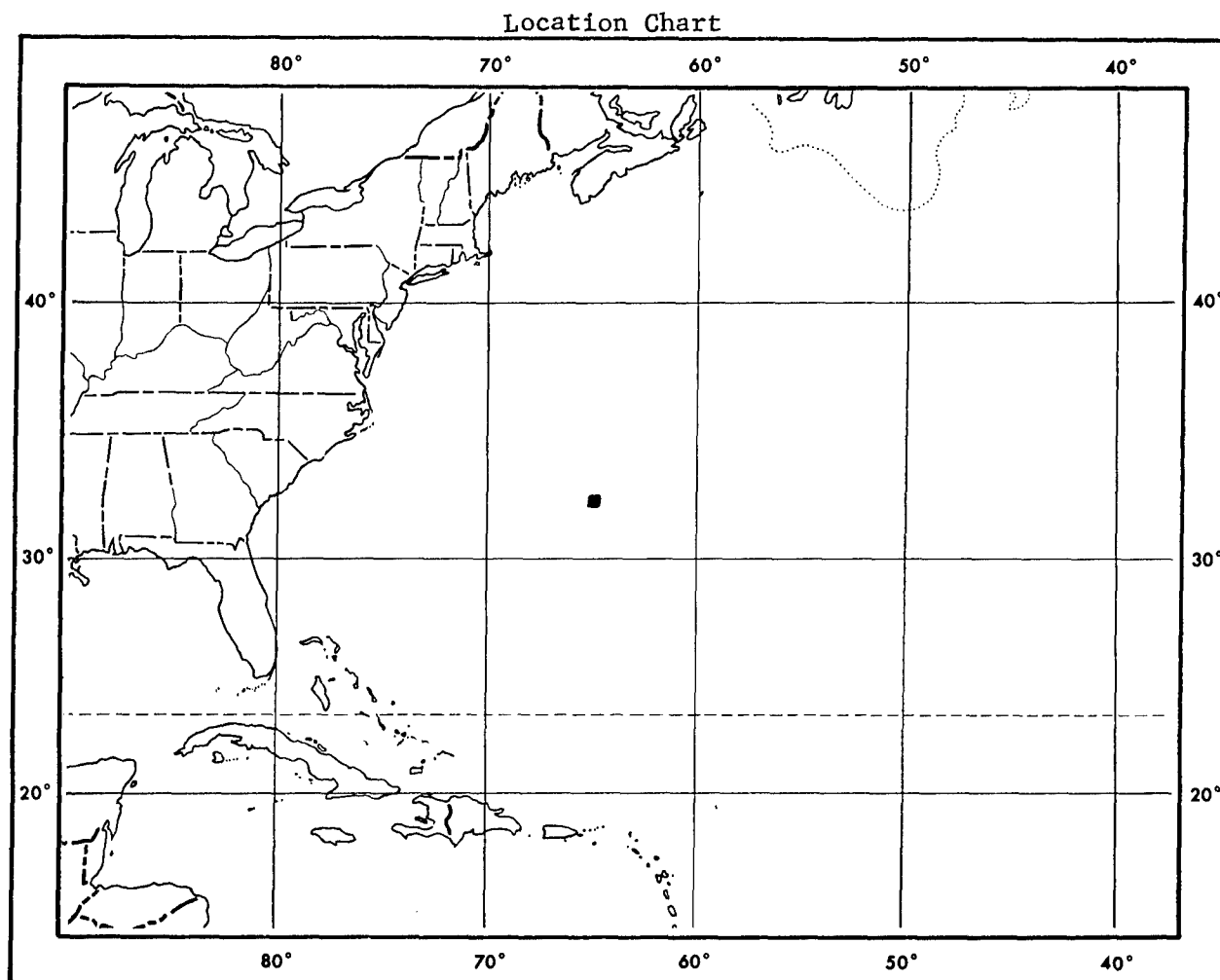
Miles Surveyed: 2400 square miles

Track Pattern: One-mile spacing, NE-SW track orientation

Altitude: 500, 2000, 6000 feet

Data Format: Total magnetic intensity contour chart.

6. Plantagenet Bank Survey



Aircraft: NC-54R BUNO 90396

Survey Dates: January 1961

Navigational Control: Loran-C

Miles Surveyed: 52 square miles

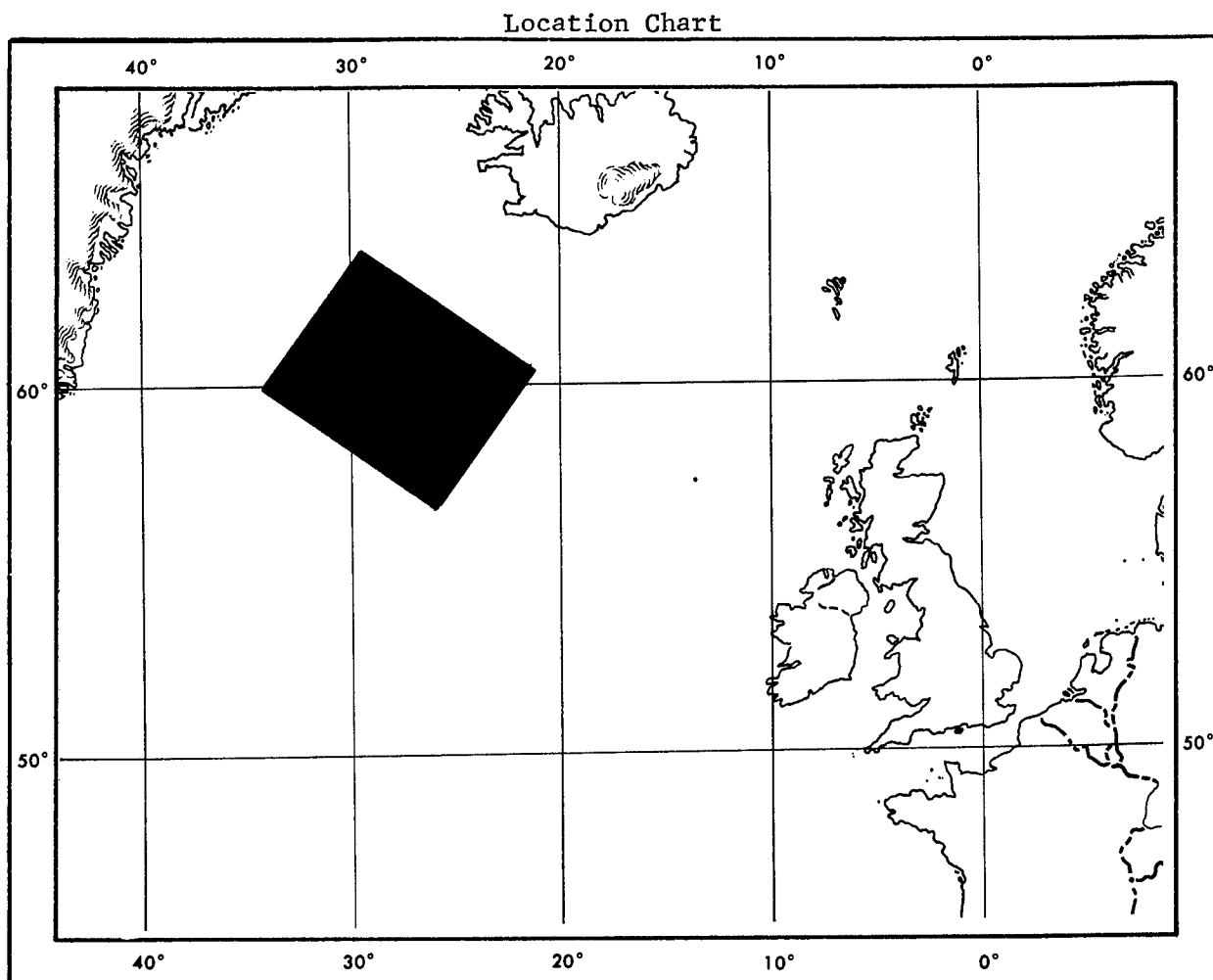
Track Pattern: 1/2-mile spacing, E-W track orientation

Altitude: 500 feet

Data Format: Contour charts of total magnetic intensity, inclination, declination, anomalous X, Y, and Z components of the earth's field.

Reports: Technical Report 144, "A Study of Aeromagnetic Component Data Plantagenet Bank."

7. Aeromagnetic Survey of Reykjanes Ridge



Aircraft: NC-54R BUNO 90396

Survey Dates: October - November 1963

Navigational Control: Loran-A

Miles Surveyed: 58,000 square miles

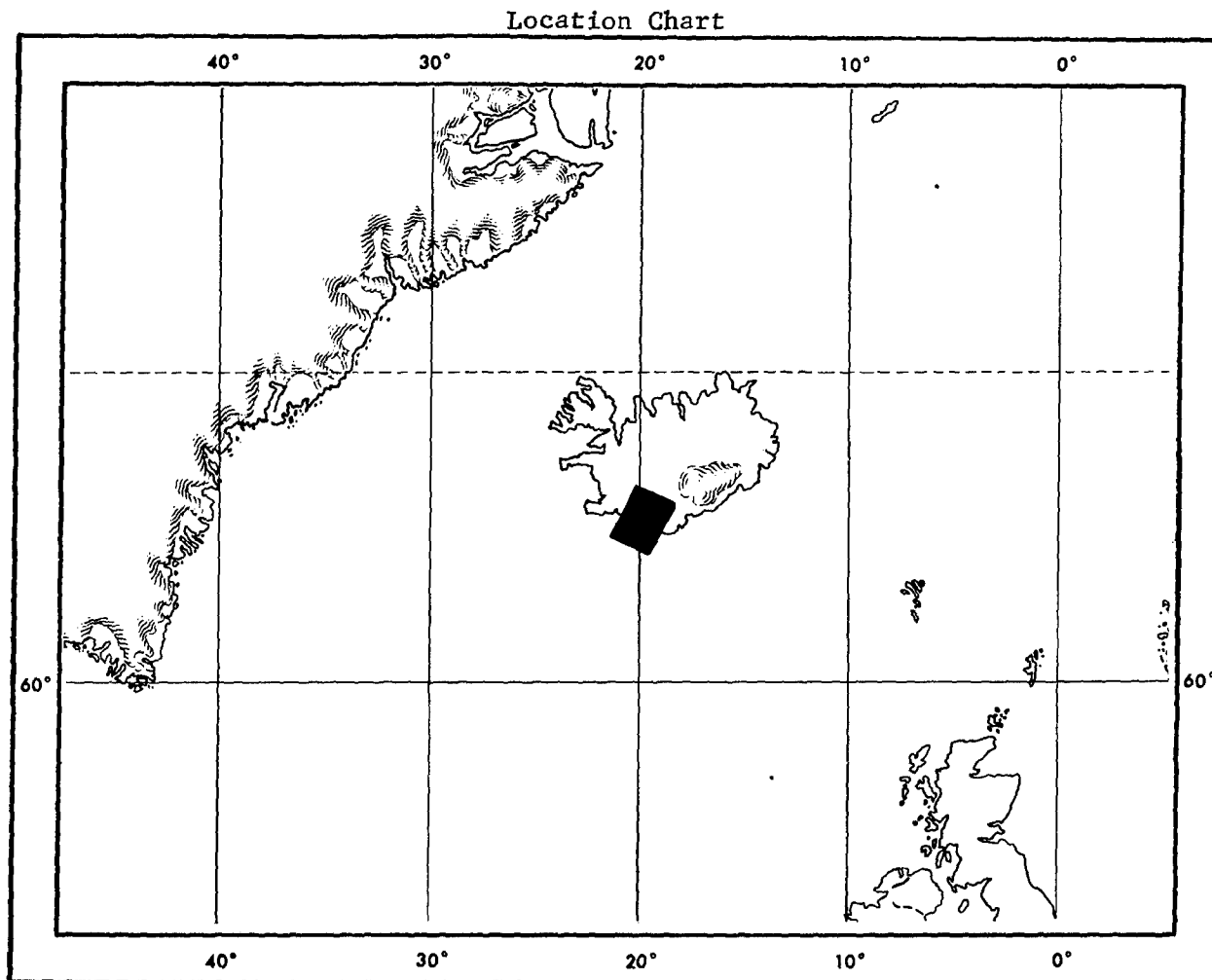
Track Pattern: 2-4 nautical mile spacing, tracks flown along Loran-A rates generally orientated NW-SE.

Altitude: 1500 feet

Data Format: Total intensity and residual total intensity charts.

Report: Informal Report No. H-3-65, "An Airborne Geomagnetic Survey of the Reykjanes Ridge, 1963."

8. An Aeromagnetic Survey of Westmann Islands, Iceland (Surtsey)



Aircraft: NC-54R BUNO 90396

Survey Dates: November 1963 and February 1964

Navigational Control: Visual, aircraft radar

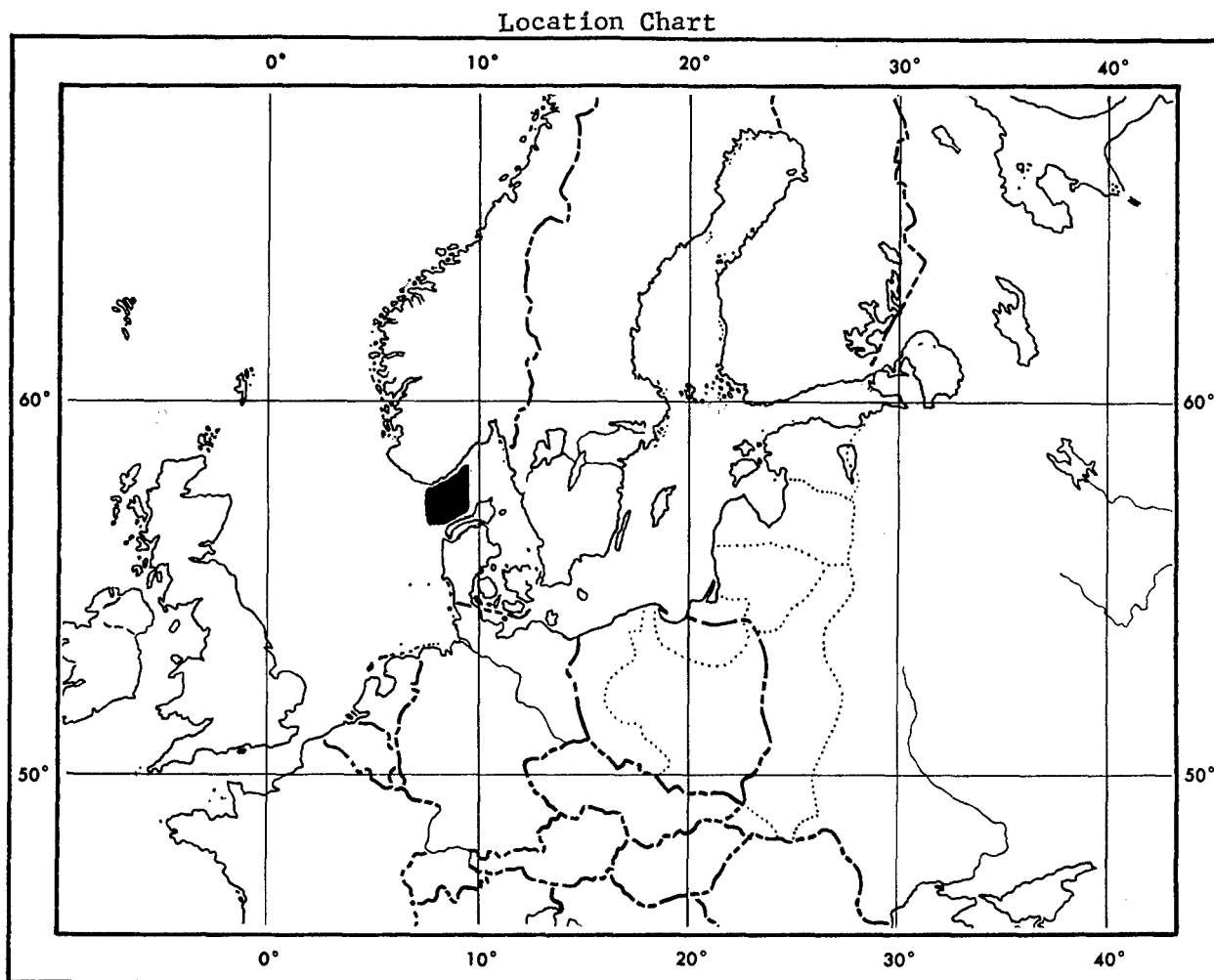
Miles Surveyed: 3600 square miles (Surtsey Island), 1100 square miles (Surtsey and South Iceland)

Track Pattern: One-mile spacing at 2000 feet; 2-mile spacing at 6000 feet; NW-SE track orientation at both levels

Altitude: 2000 feet (Surtsey) and 6000 feet (Surtsey and South Iceland)

Data Format: Total magnetic intensity contour charts.

9. Aeromagnetic Survey of the Skagerrak



Aircraft: NC-54R BUNO 90396

Survey Dates: September 1958

Navigational Control: Visual, aircraft radar, and Doppler radar

Miles Surveyed: 5500 square miles

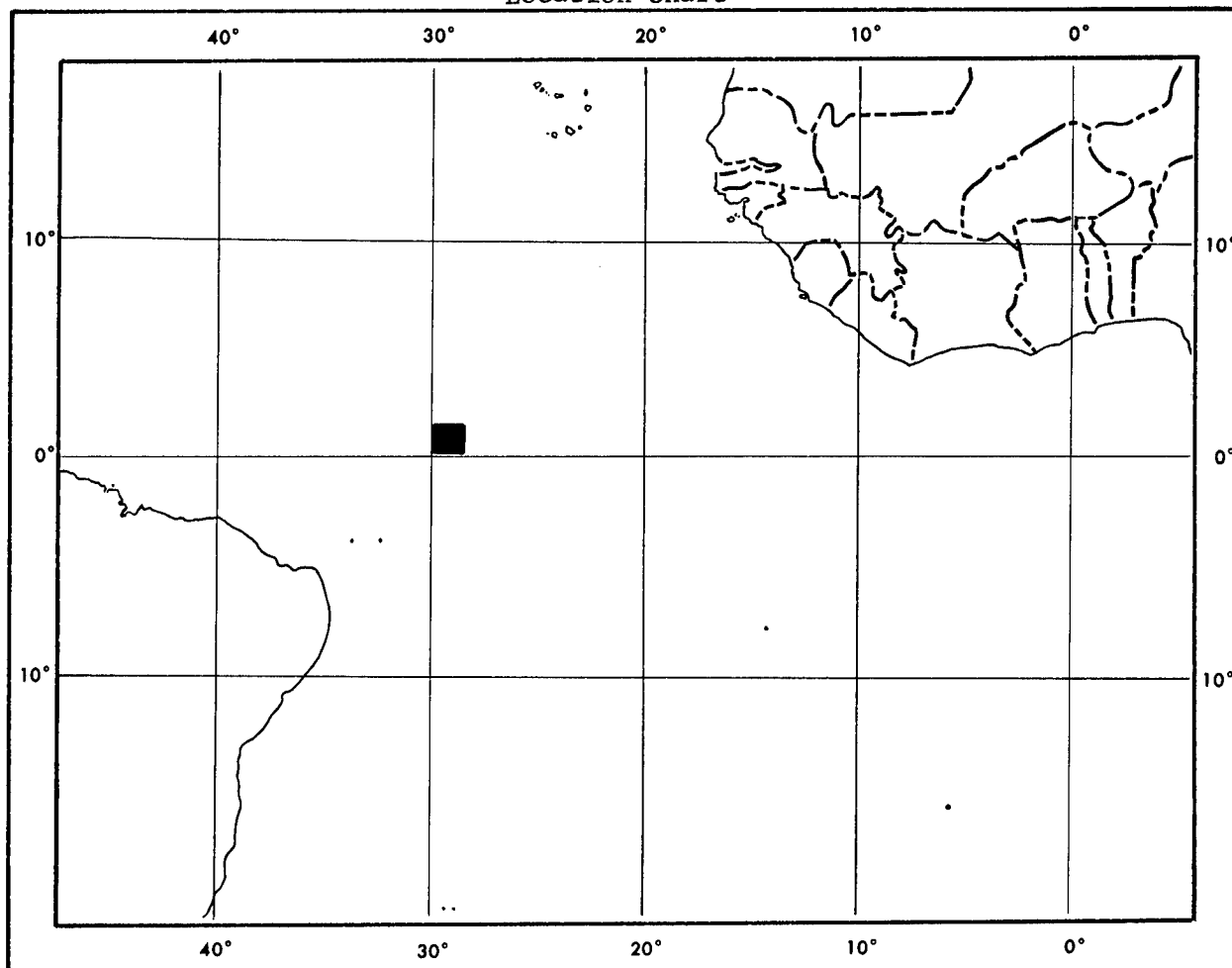
Track Pattern: 10-mile spacing; N-S track orientation

Altitude: 1000 feet

Data Format: Total magnetic intensity contour chart.

10. Aeromagnetic Survey St. Paul and St. Peter Rocks

Location Chart



Aircraft: NC-54R BUNO 90396

Survey Dates: July 1963

Navigational Control: Aircraft radar and Doppler radar

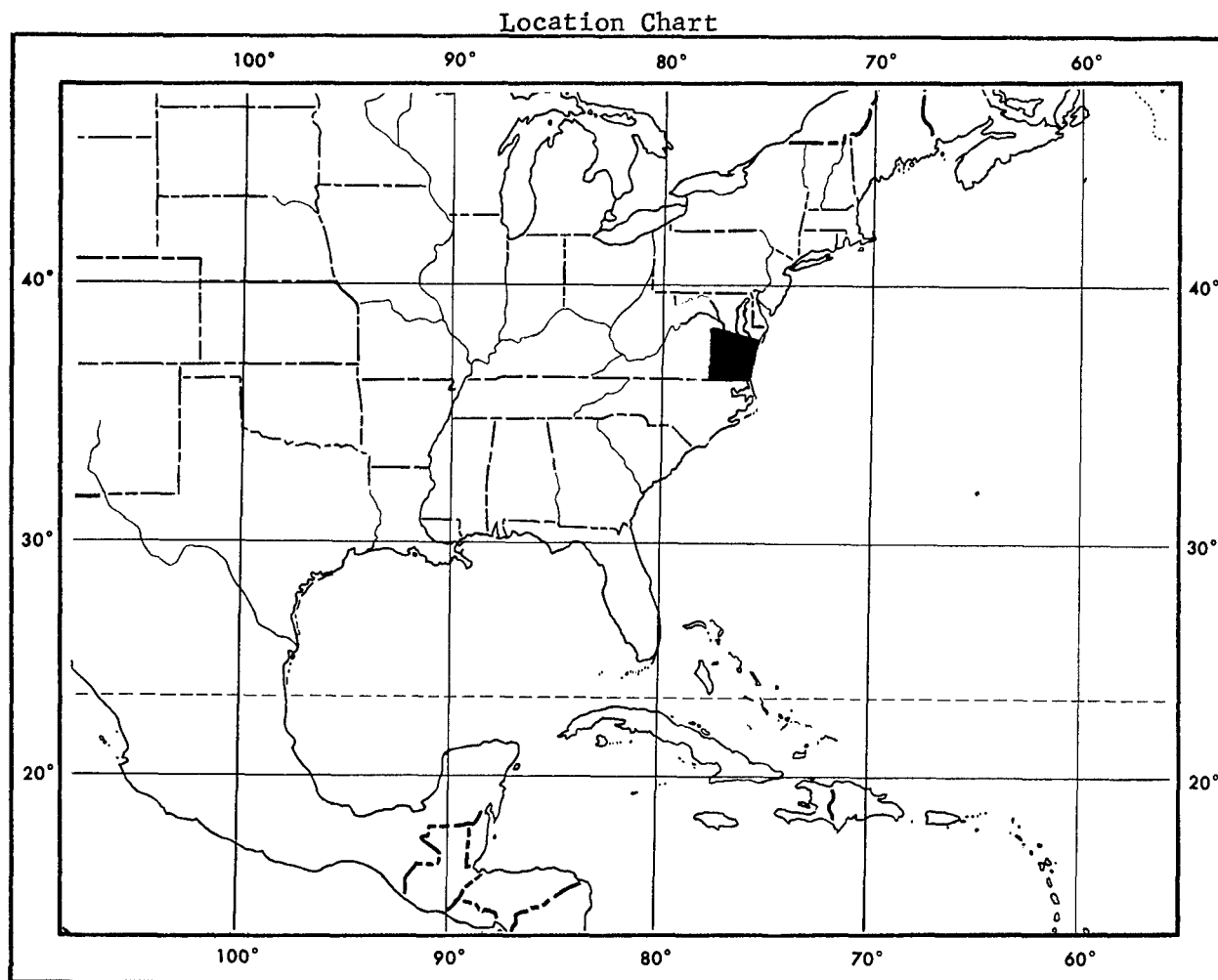
Miles Surveyed: 3600 square miles

Track Pattern: Radial pattern, maximum spacing of radials averaged 25 miles

Altitude: 500 and 1000 feet

Data Format: Total magnetic intensity contour chart.

11. Aeromagnetic Survey of Eastern Virginia



Aircraft: NC-54R BUNO 90396

Survey Dates: October 1961

Navigational Control: Visual fixes and Doppler radar

Miles Surveyed: 10,000 square miles

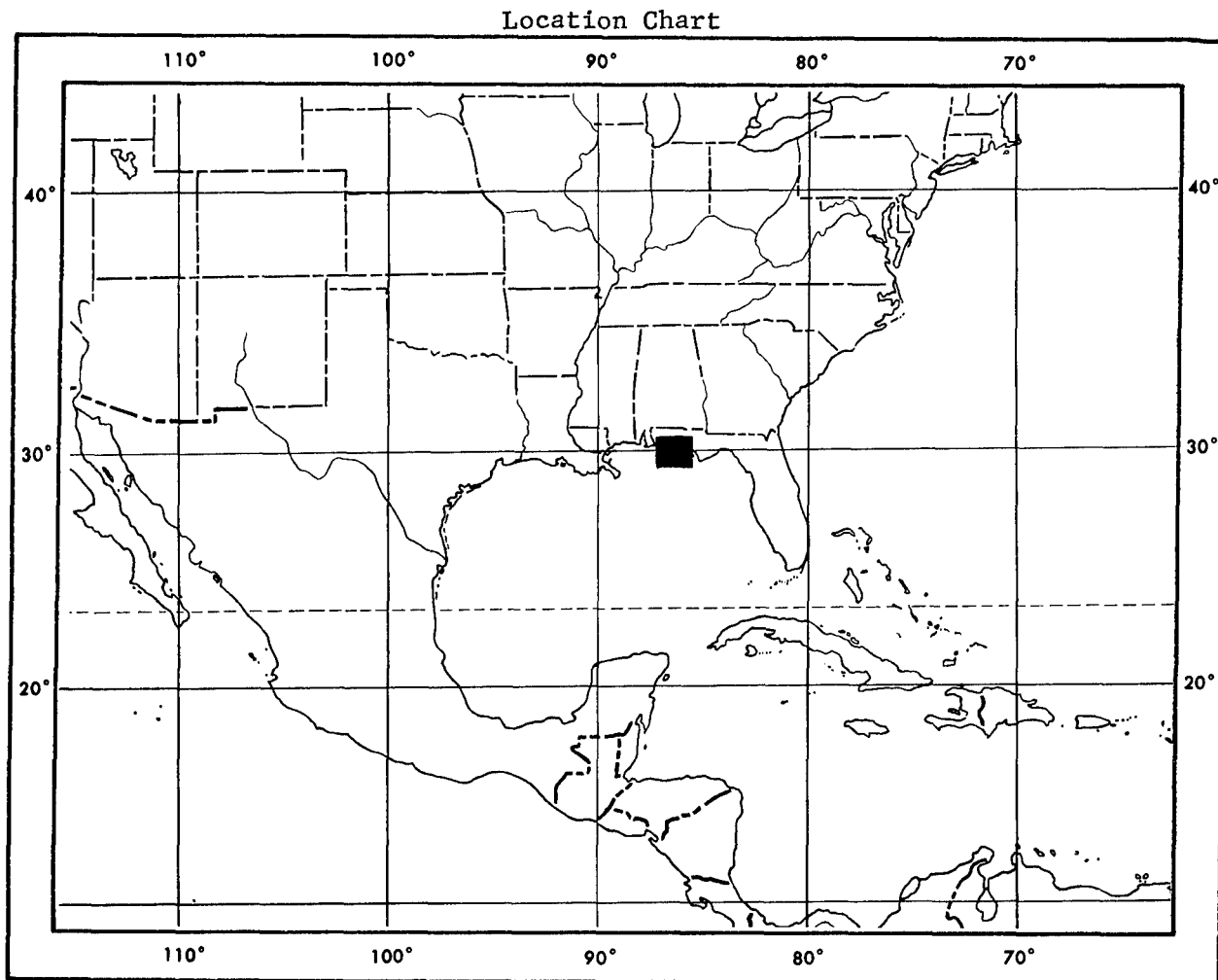
Track Pattern: 15-mile spacing, E-W track orientation

Altitude: 1800 to 3600 feet

Data Format: Total magnetic intensity and second vertical derivative contour charts.

Reports: Informal Manuscript Report No. M-10-63, "An Interpretation of an Aeromagnetic and Gravity Survey of Eastern Virginia."

12. Aeromagnetic Survey of the Gulf Coastal Area near Pensacola, Fla.



Aircraft: WV-2 BUNO 126513

Survey Dates: September 1959

Navigational Control: Ground radar

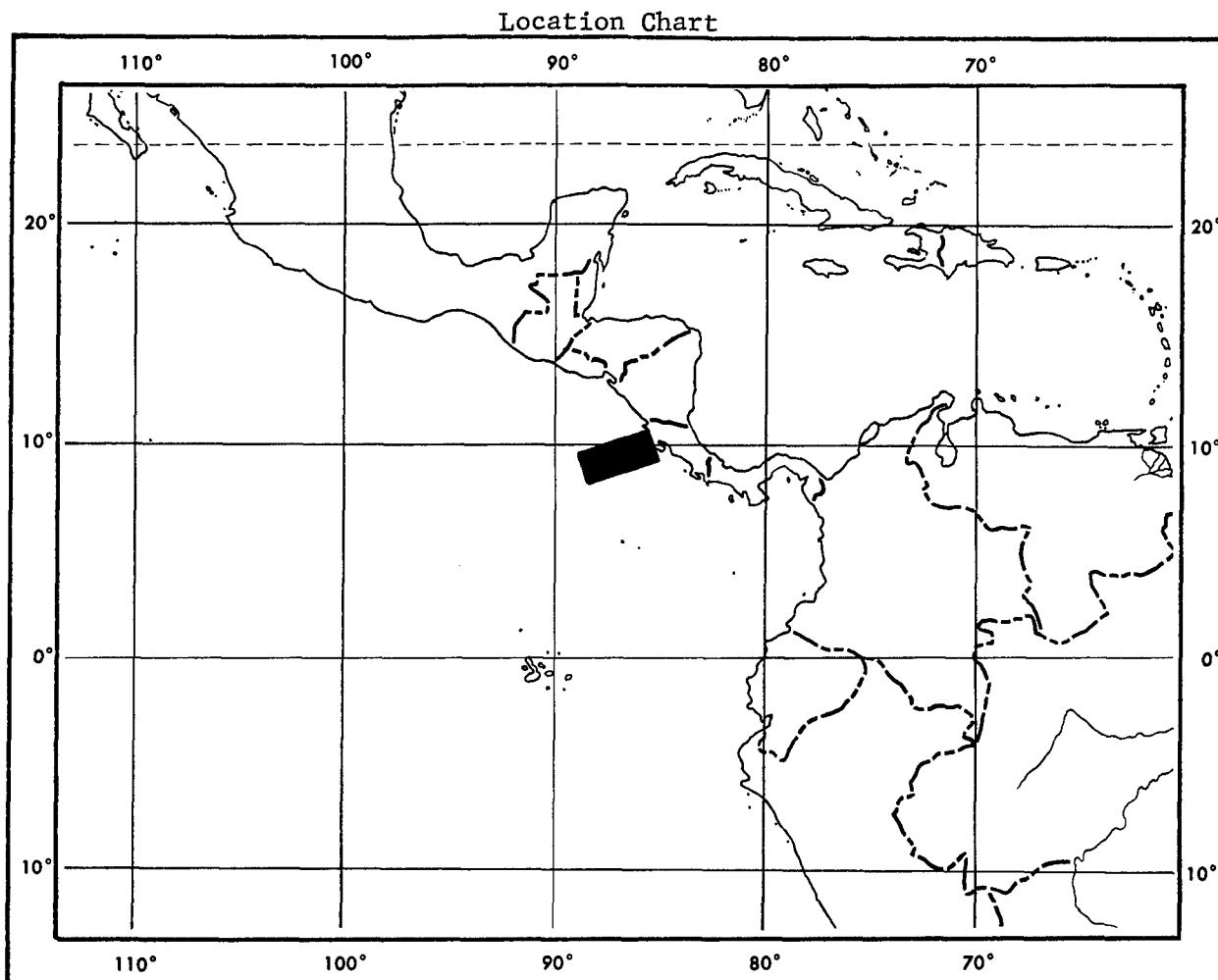
Miles Surveyed: 3600 square miles

Track Pattern: 2-mile spacing, N-S, E-W track grid.

Altitude: 20,000 feet

Data Format: Total magnetic intensity, inclination, and declination contour charts.

13. Aeromagnetic Survey of the Guardian Bank



Aircraft: NC-121 BUNO 145925

Survey Dates: January 1964

Navigational Control: Aircraft radar and Doppler radar

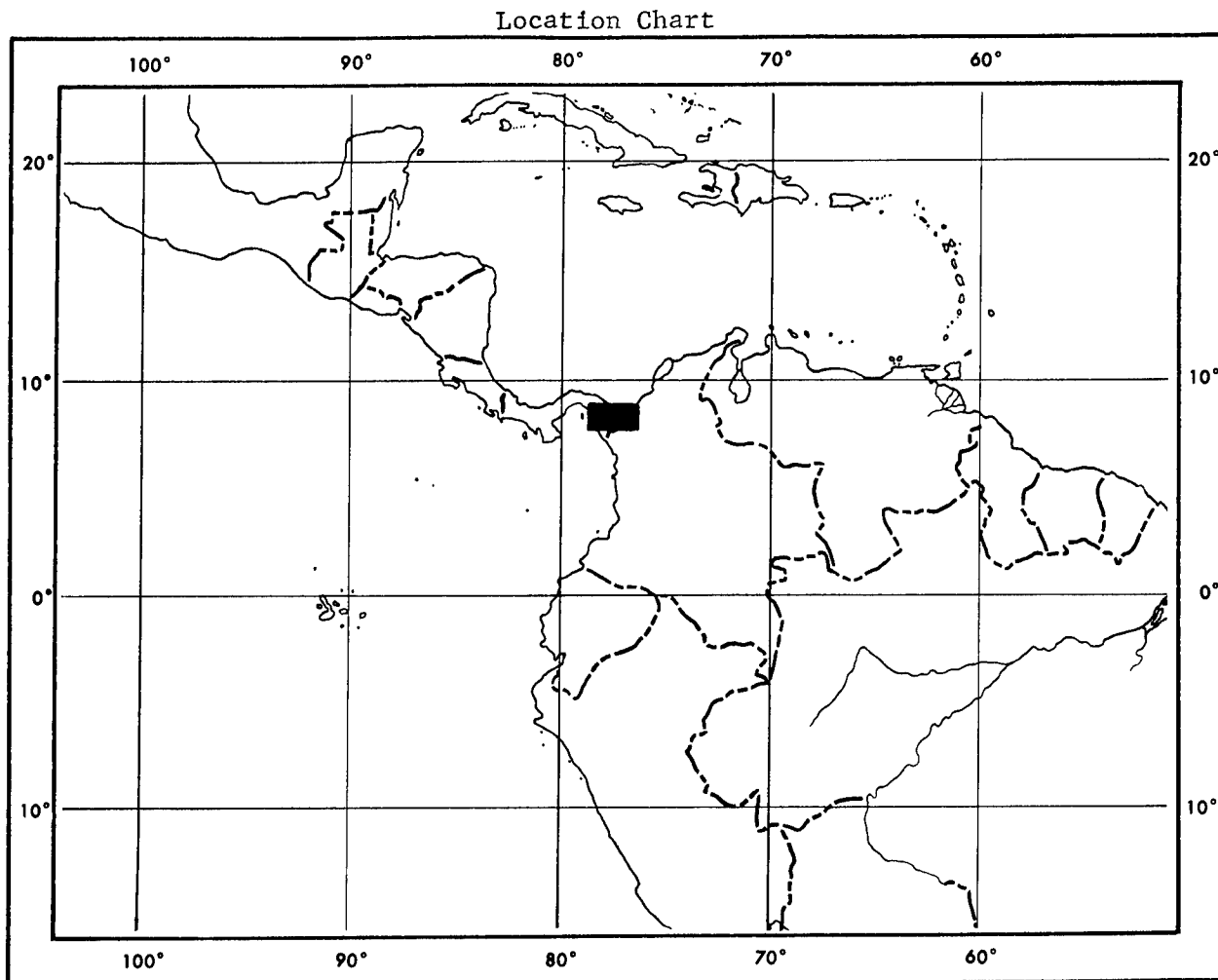
Miles Surveyed: 13,500 square miles

Track Pattern: 10-mile spacing, NE-SW track orientation

Altitude: 1000 feet

Data Format: Total magnetic intensity contour chart.

14. Panama Survey



Aircraft: NC-121 BUNO 145925

Survey Dates: April 1963

Navigational Control: Visual

Miles Surveyed: 7500 square miles

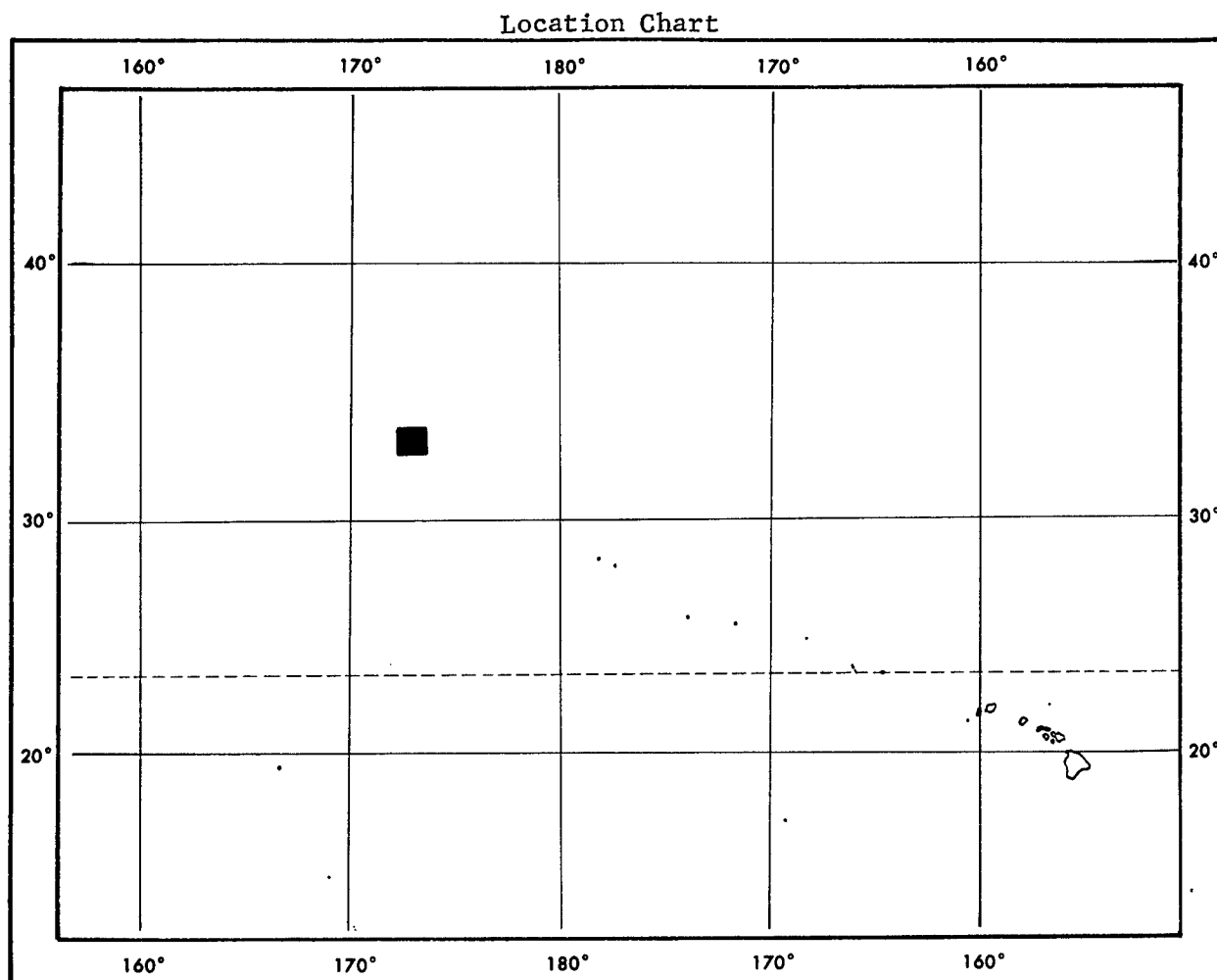
Track Pattern: 10-mile spacing, E-W track orientation

Altitude: 10,000 feet

Data Format: Total magnetic intensity, declination, and inclination contour charts and total magnetic intensity, declination and inclination residual contour charts.

Reports: Informal Report No. IR H-5-65, "An Airborne Geomagnetic Investigation of a Reported Declination Anomaly in Eastern Panama."

15. Milwaukee Bank Survey



Aircraft: NC-54R BUNO 90396

Survey Dates: August 1963

Navigational Control: Doppler radar

Miles Surveyed: 3600 square miles

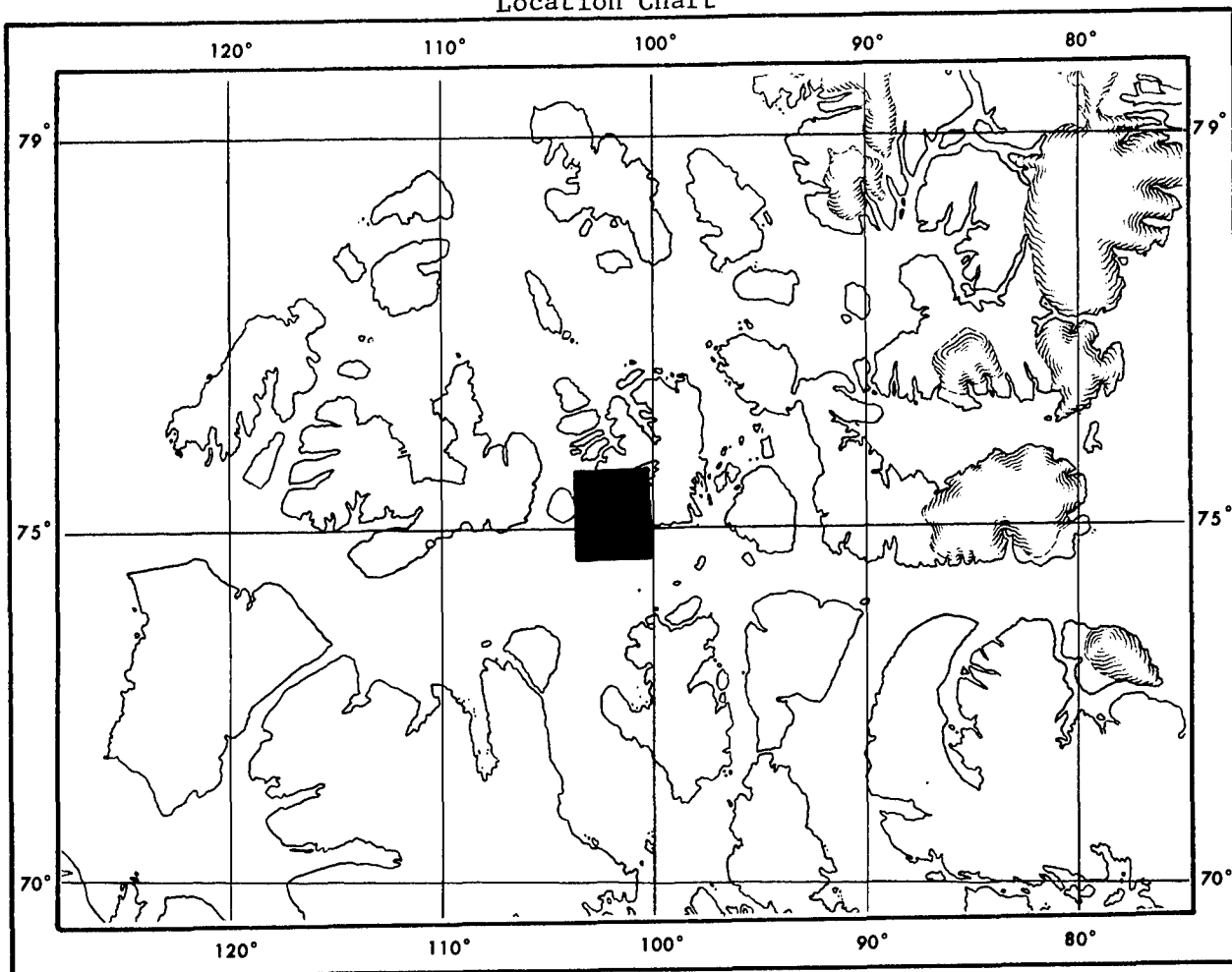
Track Pattern: 10-mile spacing, N-S track orientation

Altitude: 1500 feet

Data Format: Total magnetic intensity contour chart.

16. Search for the North Magnetic Pole, 1960

Location Chart



Aircraft: WV-2 BUNO 126513

Survey Dates: 2 September 1960

Navigational Control: Aircraft radar

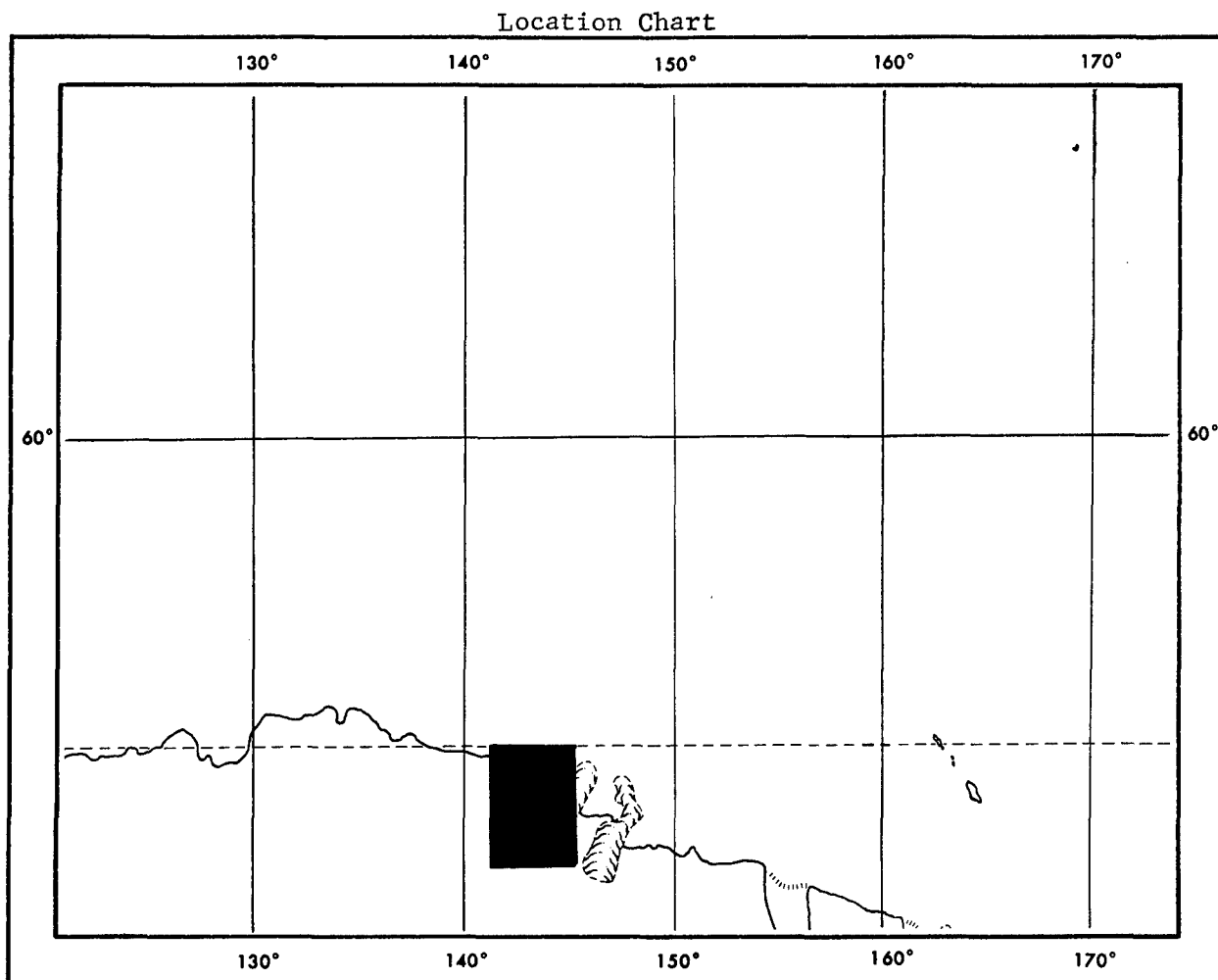
Miles Surveyed: 8000 square miles

Track Pattern: Triangular search patterns

Altitude: 11,000 feet

Data Format: Inclination contour chart.

17. Search for the South Magnetic Pole, 1960



Aircraft: WV-2 BUNO 126513

Survey Dates: 23 October 1960

Navigational Control: Aircraft radar

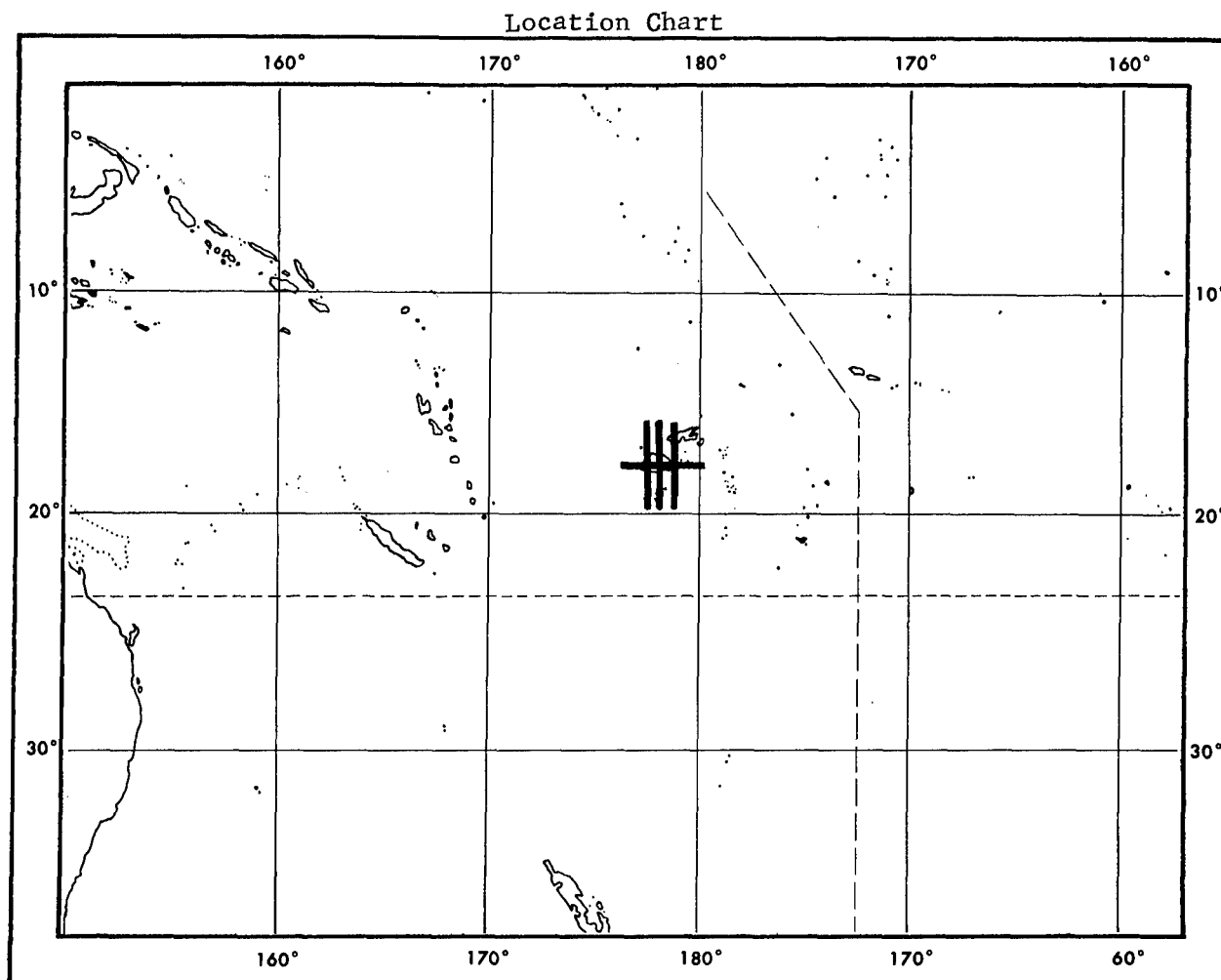
Miles Surveyed: 8000 square miles

Track Pattern: Triangular search patterns

Altitude: 13,000 feet

Data Format: Inclination contour chart.

18. Four Magnetic Profiles over Fiji Island Group



Aircraft: NC-121 BUNO 145925

Survey Dates: May 1963

Navigational Control: Radar and visual

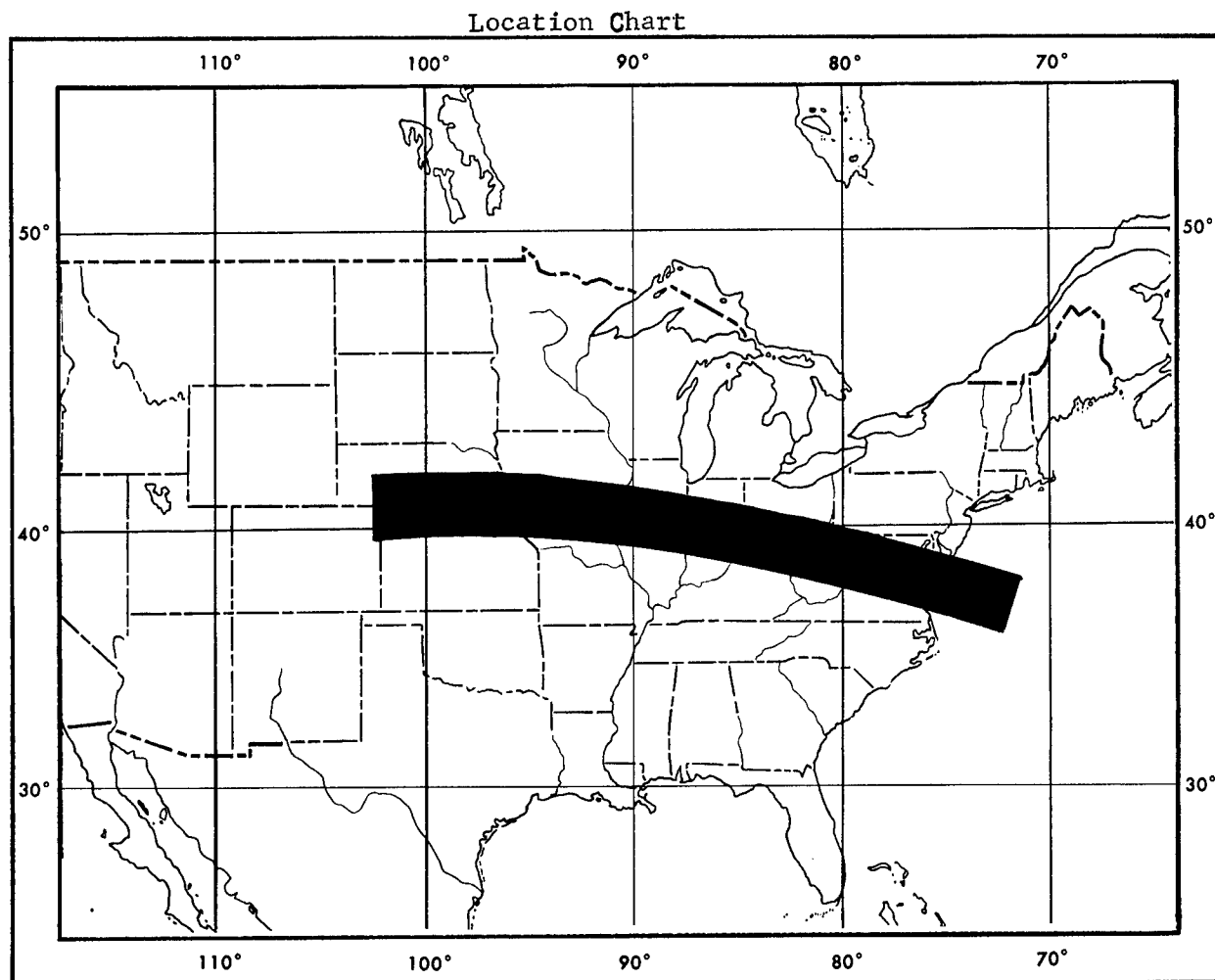
Miles Surveyed: 750 miles

Track Pattern: Three N-S and one E-W profiles

Altitude: N-S profiles flown at 9000 feet; E-W profile flown at 4000 feet

Data Format: Total magnetic intensity profiles available.

19. A 100 mile wide Crustal Survey across the United States (East of 103°W)



Aircraft: NC-54R BUNO 90396, NC-121K BUNO 145925

Survey Dates: August 1962 - June 1964

Navigational Control: Radar, visual

Miles Surveyed: 140,000 square miles

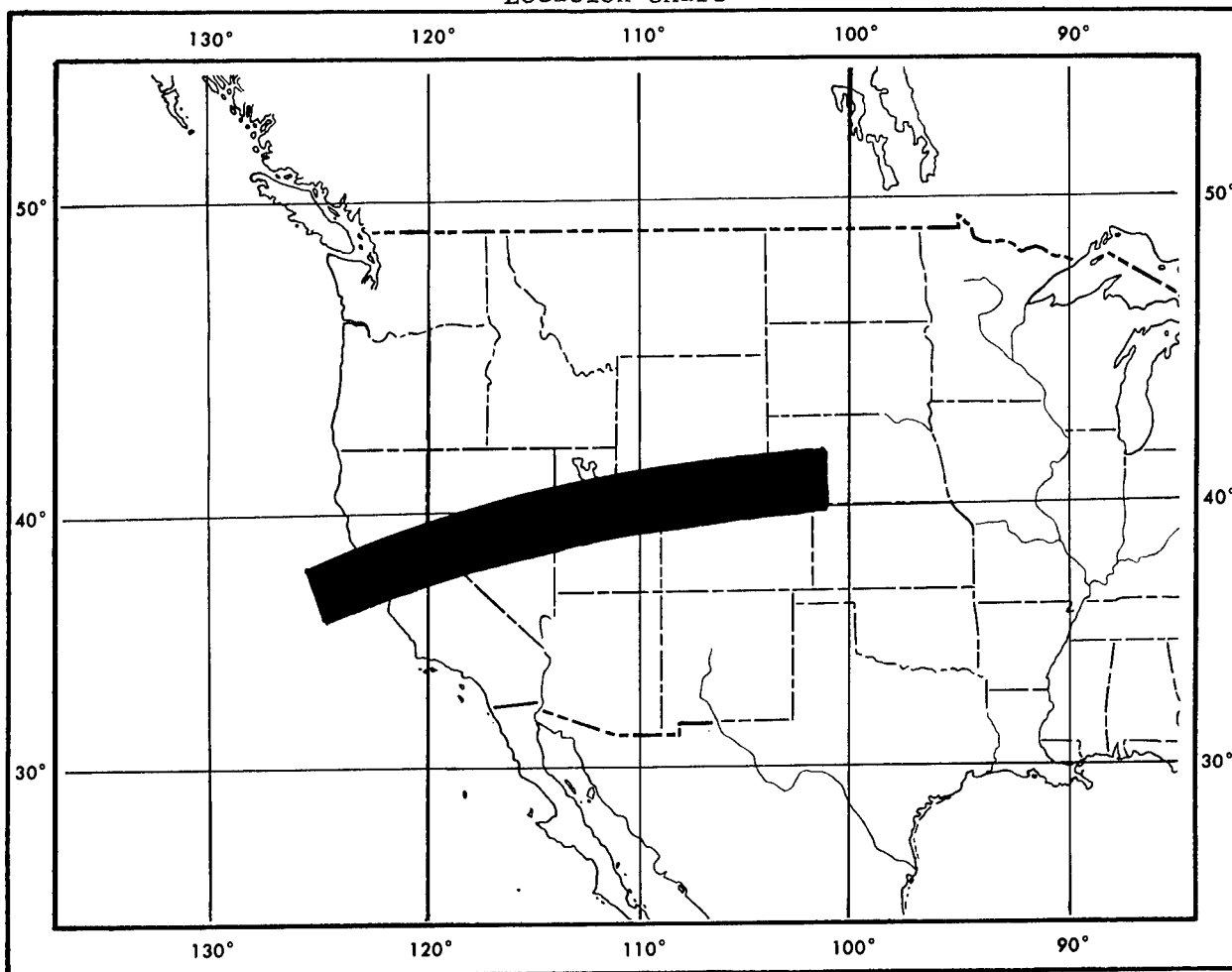
Track Pattern: 5 mile spacing, E-W track orientation

Altitude: 6000 feet

Data Format: Residual total intensity charts and nested profile graphic in process.

20. A 100 mile wide Crustal Survey across the United States (West of 102°E)

Location Chart



Aircraft: NC-54R BUNO, NC-121K BUNO 145925

Survey Dates: August 1962 - February 1965

Navigational Control: Radar, visual

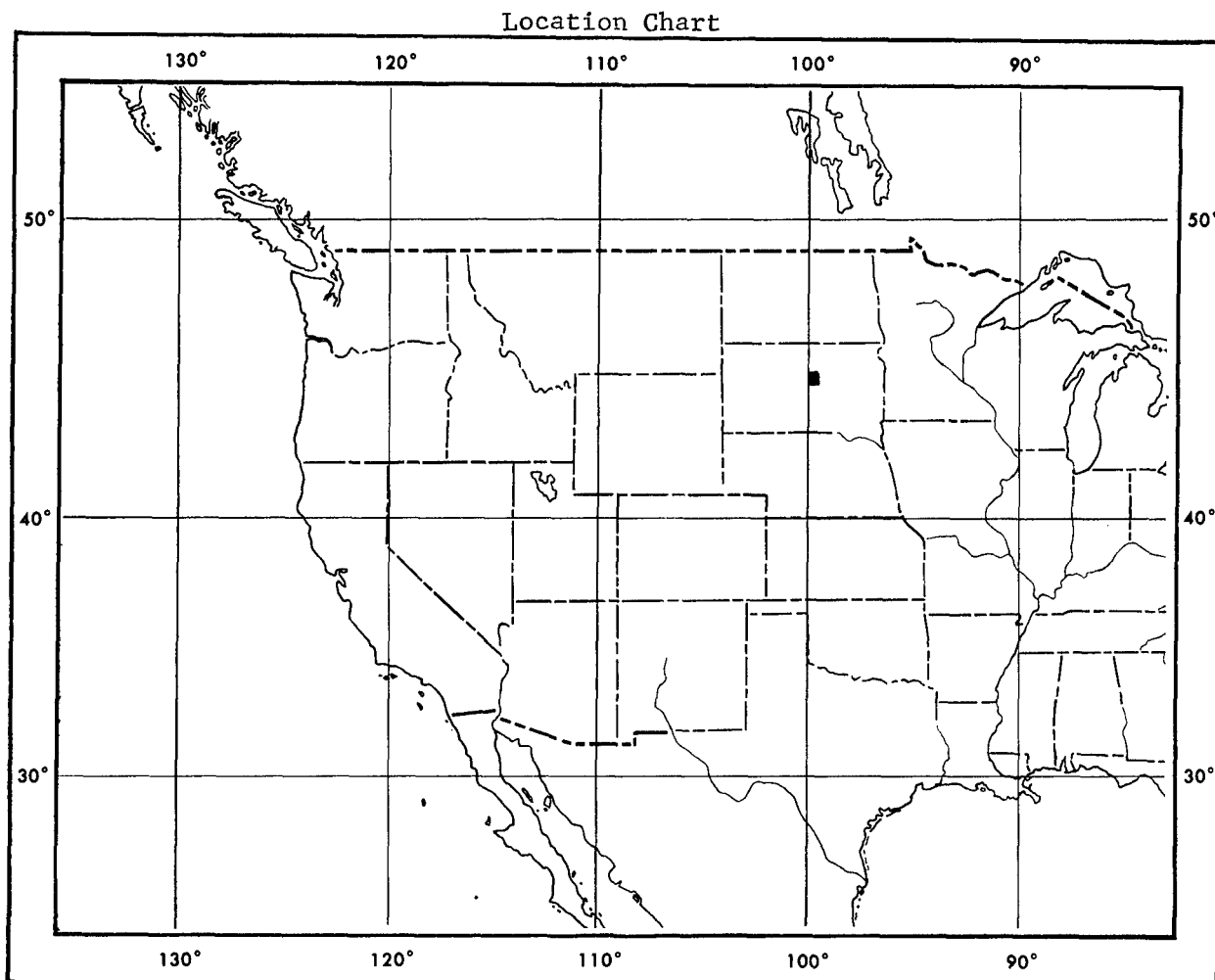
Miles Surveyed: 100,000 square miles

Track Pattern: 5 mile spacing, E-W track orientation

Altitude: 16,000 feet 103°W to San Francisco, 6000 feet over Pacific Ocean and Coastal Range.

Data Format: Residual total intensity charts and nested profile graphic in process.

21. Central South Dakota Survey



Aircraft: NC-121K BUNO 145925

Survey Dates: December 1964

Navigational Control: Ground radar

Miles Surveyed: 1500 square miles

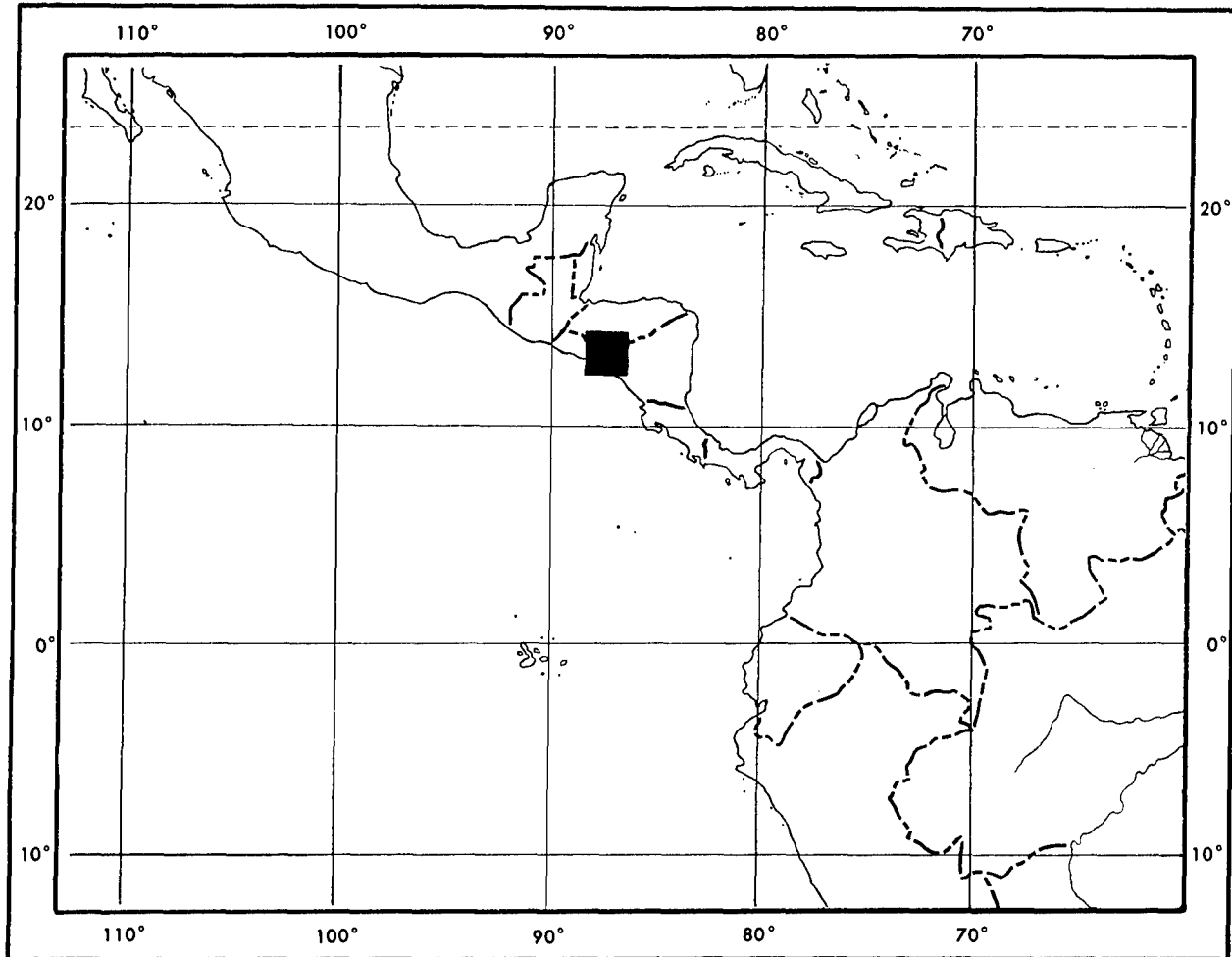
Track Pattern: 2-mile track spacing, E-W track orientation

Altitude: 500 feet above terrain, 1100 feet above terrain, and 1700 feet above terrain.

Data Format: Total intensity chart at 500 feet and 1700 feet. Declination chart at 500 feet, 1100 feet, and 1700 feet. Residual declination chart at 500 feet, 1100 feet, and 1700 feet.

22. Gulf of Fonseca Survey

Location Chart



Aircraft: NC-121K BUNO 145925

Survey Dates: October 1964

Navigational Control: Aircraft radar, visual

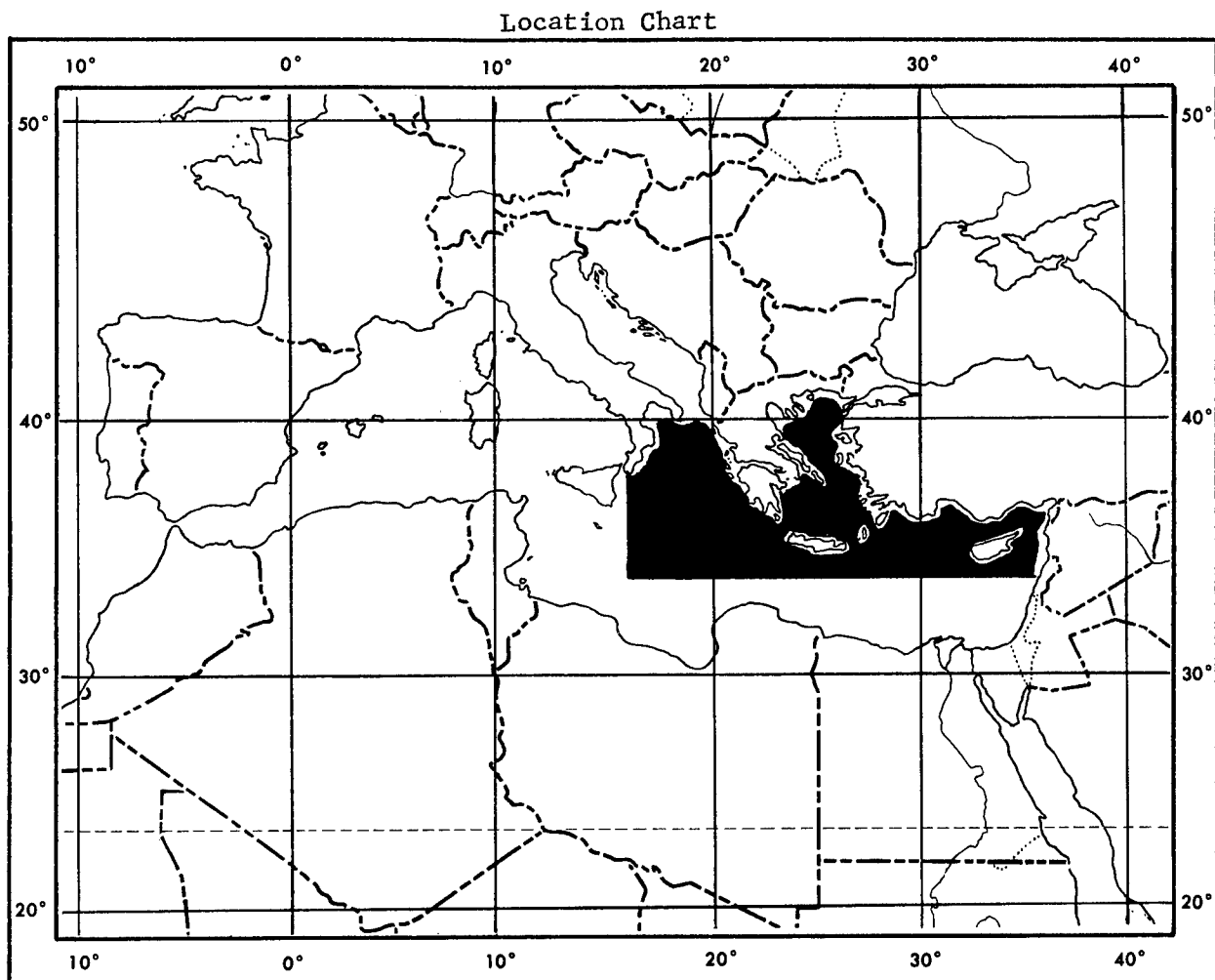
Miles Surveyed: 24,000 square miles

Track Pattern: 8-mile track spacing, E-W orientation

Altitude: 7200 feet south of 13°30'N, 9300 feet north of 13°30'N

Data Format: Total magnetic intensity and residual magnetic intensity contour charts, residual total intensity profiles.

23. Eastern Mediterranean Survey



Aircraft: NC-54R BUNO 90396

Survey Dates: July - September 1957

Navigational Control: Aircraft radar, Doppler radar, visual

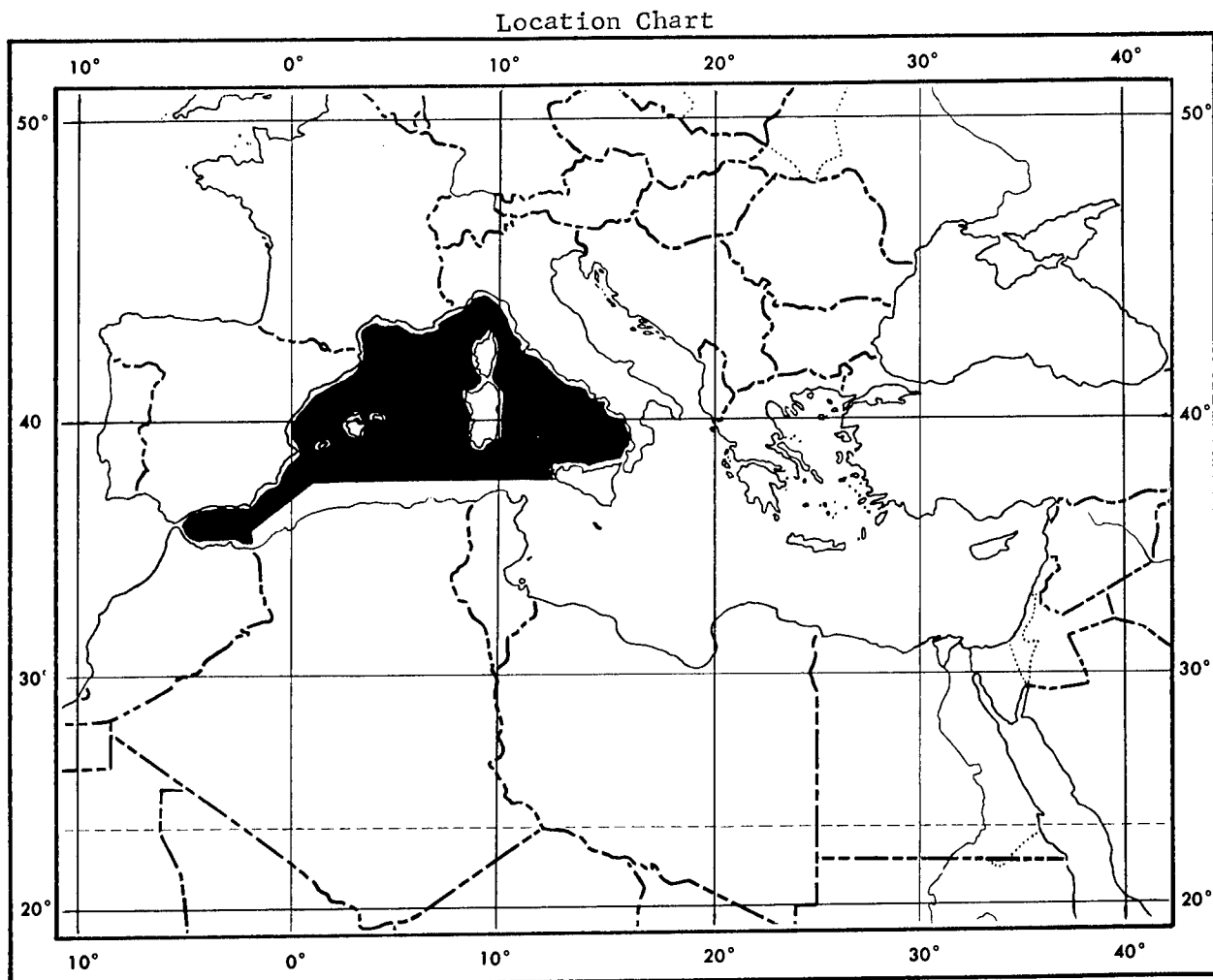
Miles Surveyed: 190,000 square miles

Track Pattern: 10-mile spacing, N-S track orientation with 3 E-W cross tracks

Altitude: 1000 feet

Data Format: Total magnetic intensity contour chart.

24. Western Mediterranean Survey



Aircraft: NC-54R BUNO 90396

Survey Dates: February - April 1958

Navigational Control: Aircraft radar, Doppler radar, visual

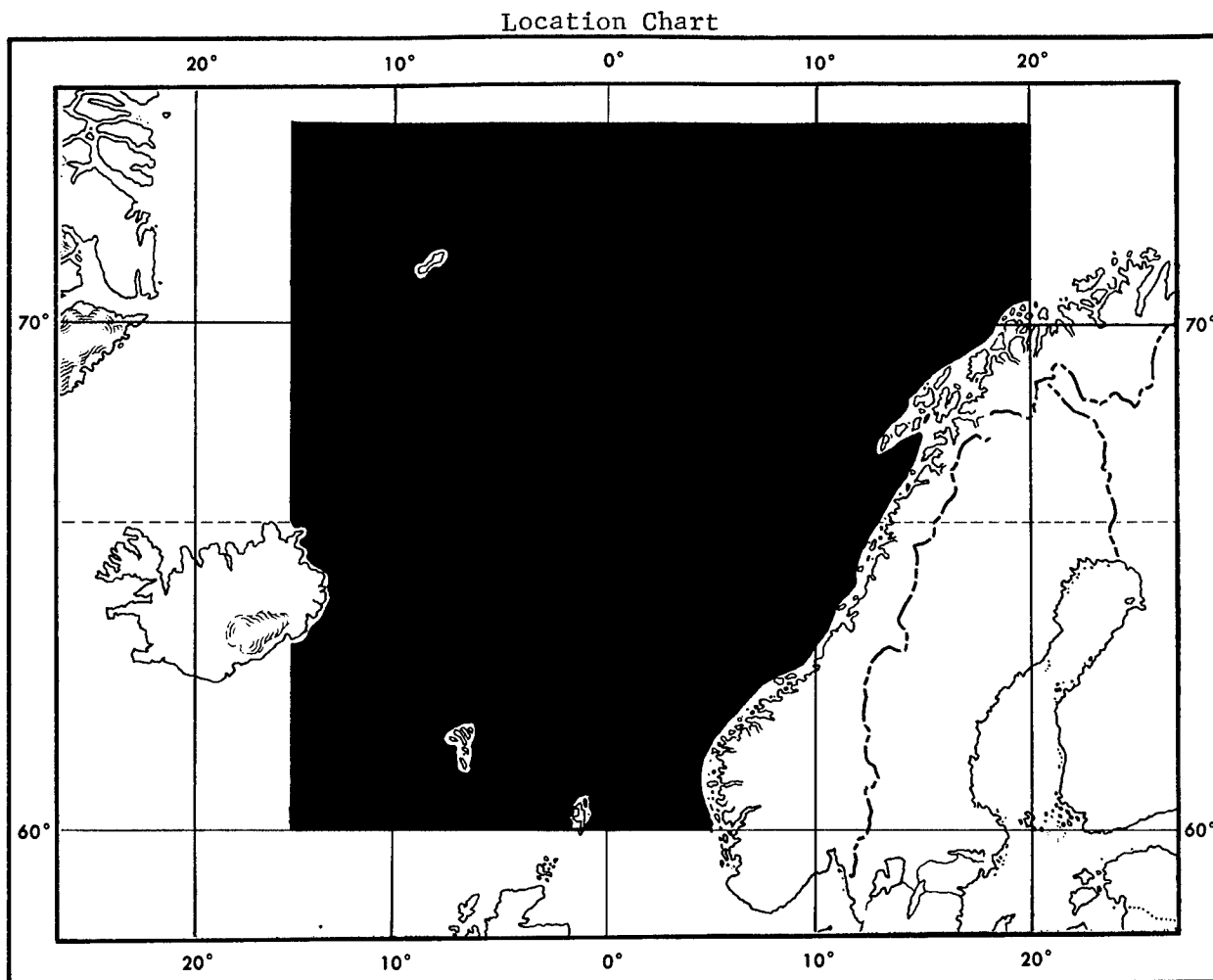
Miles Surveyed: 190,000 square miles

Track Pattern: 10-mile spacing, E-W track orientation primarily with 5 N-S cross tracks

Altitude: 1000 feet

Data Format: Total magnetic intensity contour chart.

25. Norwegian Sea Survey



Aircraft: NC-54R BUNO 90396, WV-2 BUNO 126513

Survey Dates: July 1958 - June 1959

Navigational Control: Radar, Doppler radar, visual, Loran-A south of 62°.

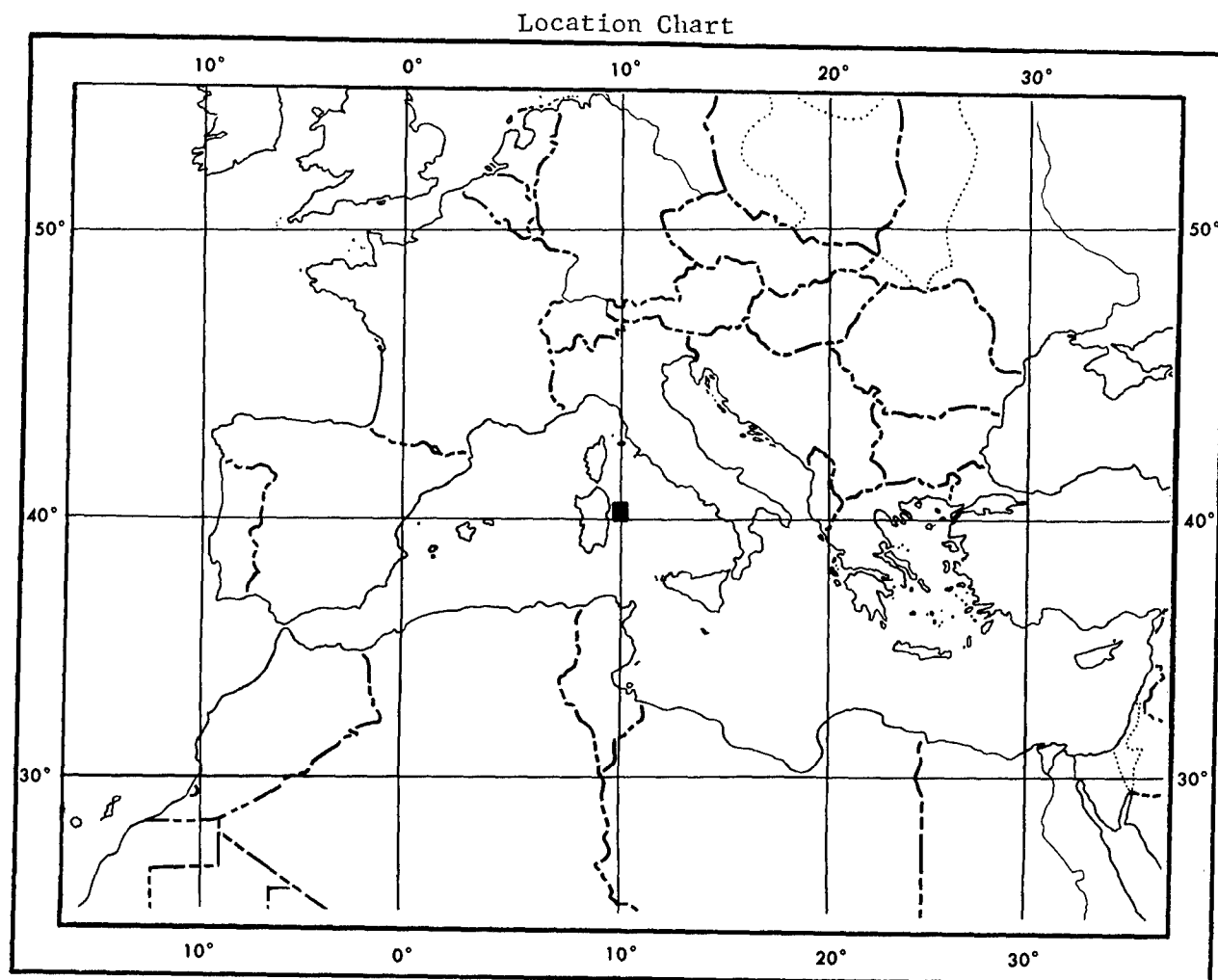
Miles Surveyed: 456,000 square miles

Track Pattern: 10-mile spacing, E-W track orientation primarily with 4 N-S cross tracks

Altitude: 1000 feet

Data Format: Total magnetic intensity contour chart under construction.

26. A Survey in the Western Tyrrhenian Sea



Aircraft: NC-54R BUNO 90396

Survey Dates: September 1957

Navigational Control: Radar, Doppler radar

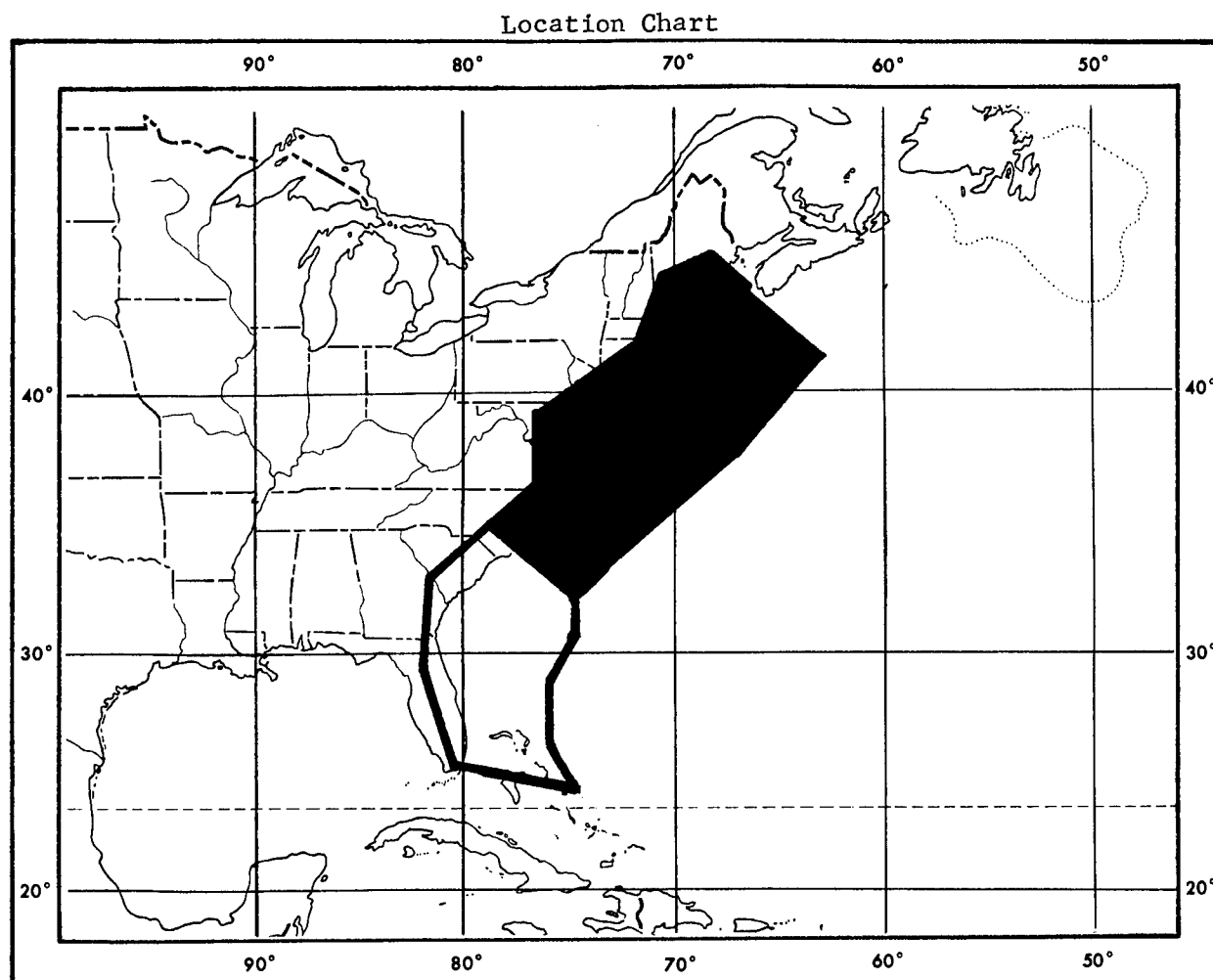
Miles Surveyed: 900 square miles

Track Pattern: 3-mile spacing, E-W, N-S grid

Altitude: 1000 feet

Data Format: Total magnetic intensity contour chart.

27. United States Atlantic Continental Shelf Survey



Aircraft: NC-54R BUNO 90396

Survey Dates: 27 May 1964 - 23 Nov 1964; 30 Oct 1964 - 31 Dec 1965

Navigational Control: Loran-A, aircraft radar, Doppler radar, and visual

Miles Surveyed: Survey 60 percent complete

Track Pattern: 5-mile spacing, NW-SE orientation with approximately 6 cross tracks.

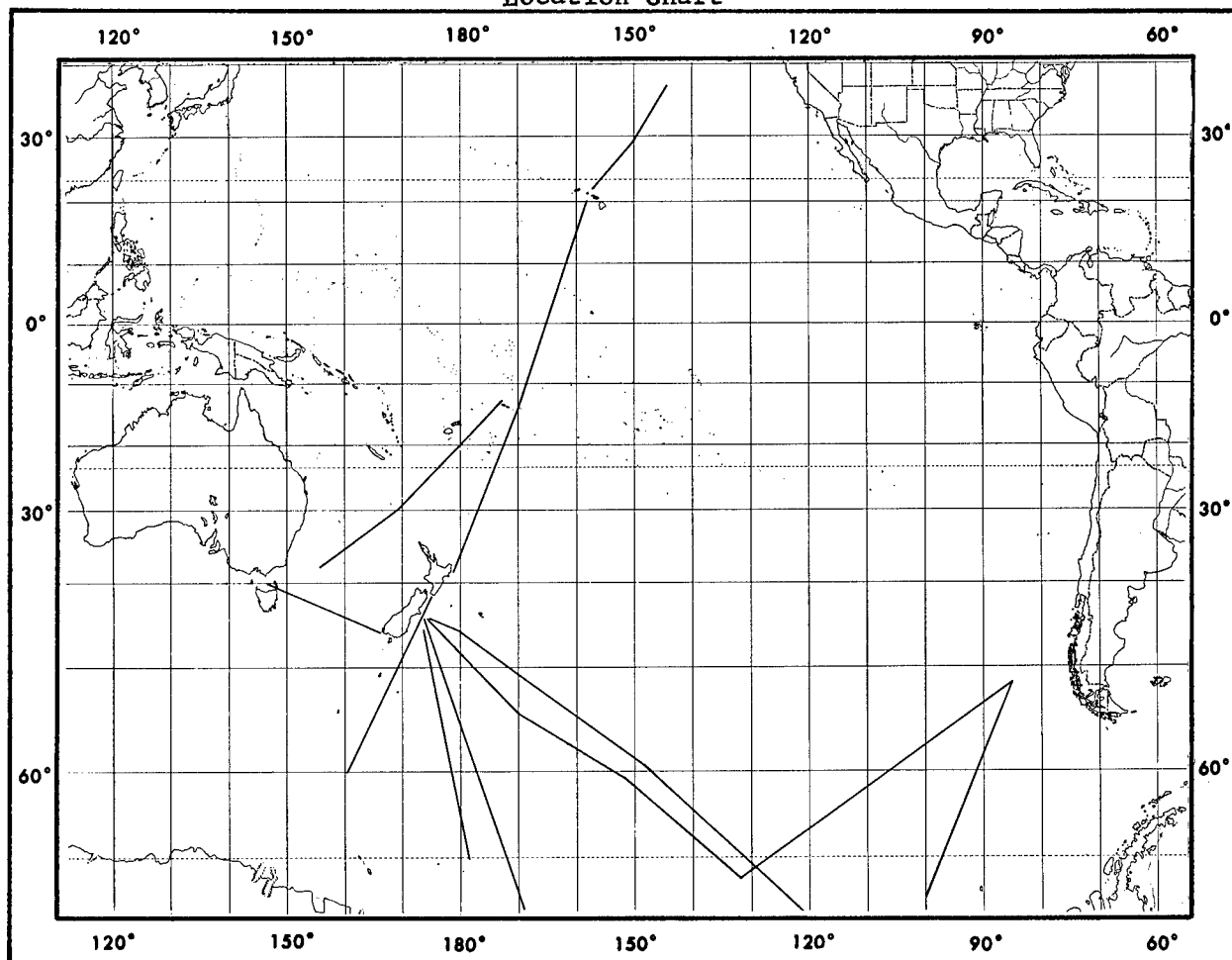
Altitude: 500 feet over the ocean, 2500 feet over land north of the Potomac River, and 1500 feet over land south of the Potomac River.

Data Format: Total intensity charts in process; data is also available in open file at the Magnetics Division, U. S. Naval Oceanographic Office.

B. Shipboard Surveys

1. Deep Freeze 1961

Location Chart



Ship: USS STATEN ISLAND (AGB-5)

Survey Dates: 7 November 1960 - 5 May 1961

Navigational Control: Celestial and dead reckoning

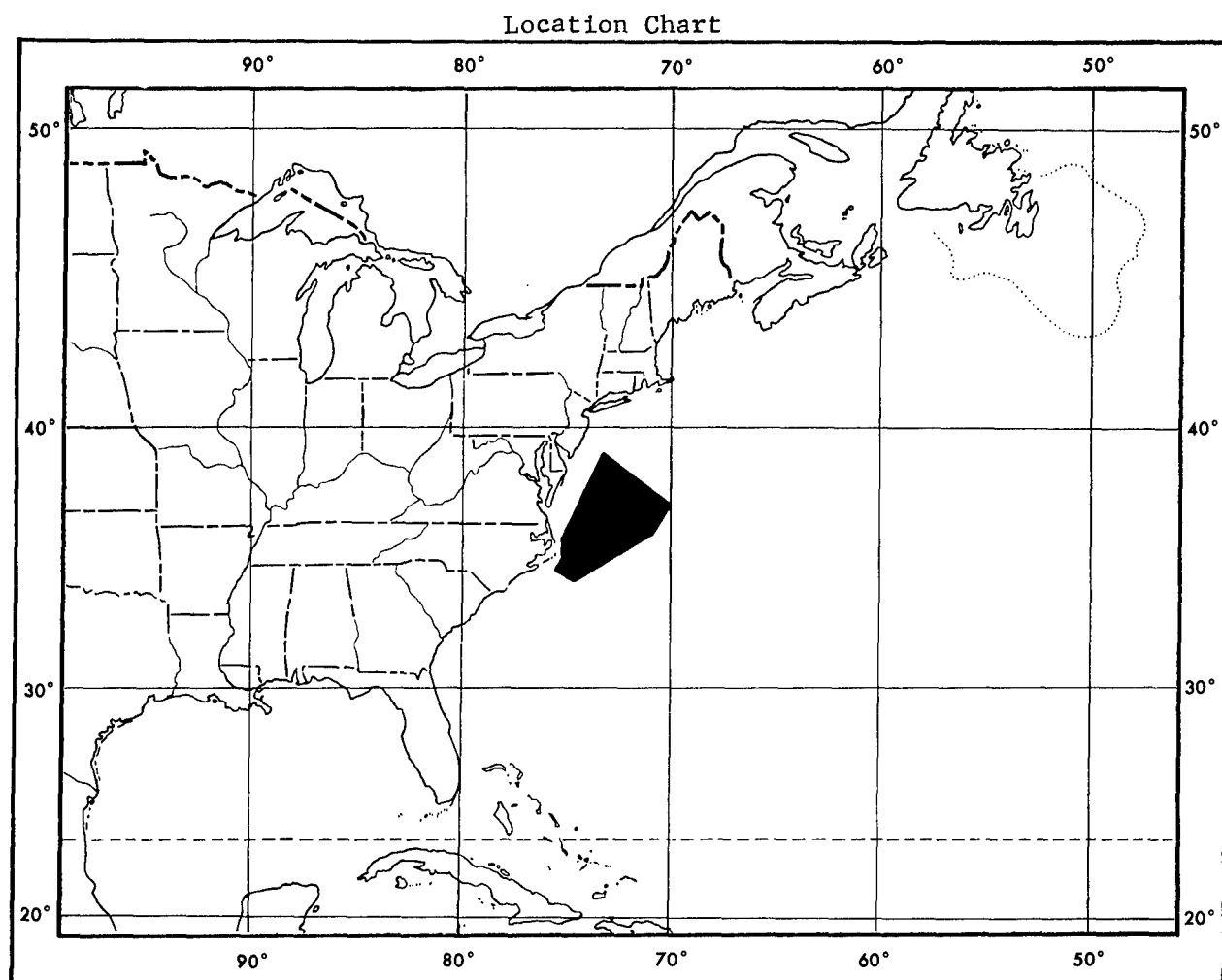
Miles Surveyed: 22,000 nautical miles

Track Pattern: Single track

Data Format: Profiles of magnetic intensity with regional gradient removed plotted along tracks on bathymetric contour chart in Antarctic region. Certain magnetic and bathymetric profiles presented separately. Magnetic data collected from U. S. to New Zealand presented in total intensity profile form.

Reports: Technical Report 105, "Operation Deep Freeze 61, 1960 - 1961 Marine Geophysical Investigations."

2. U. S. East Coast Survey



Ship: USS PREVAIL (AGS-20)

Survey Dates: 17 - 25 July 1961

Navigational Control: Loran-A and radar

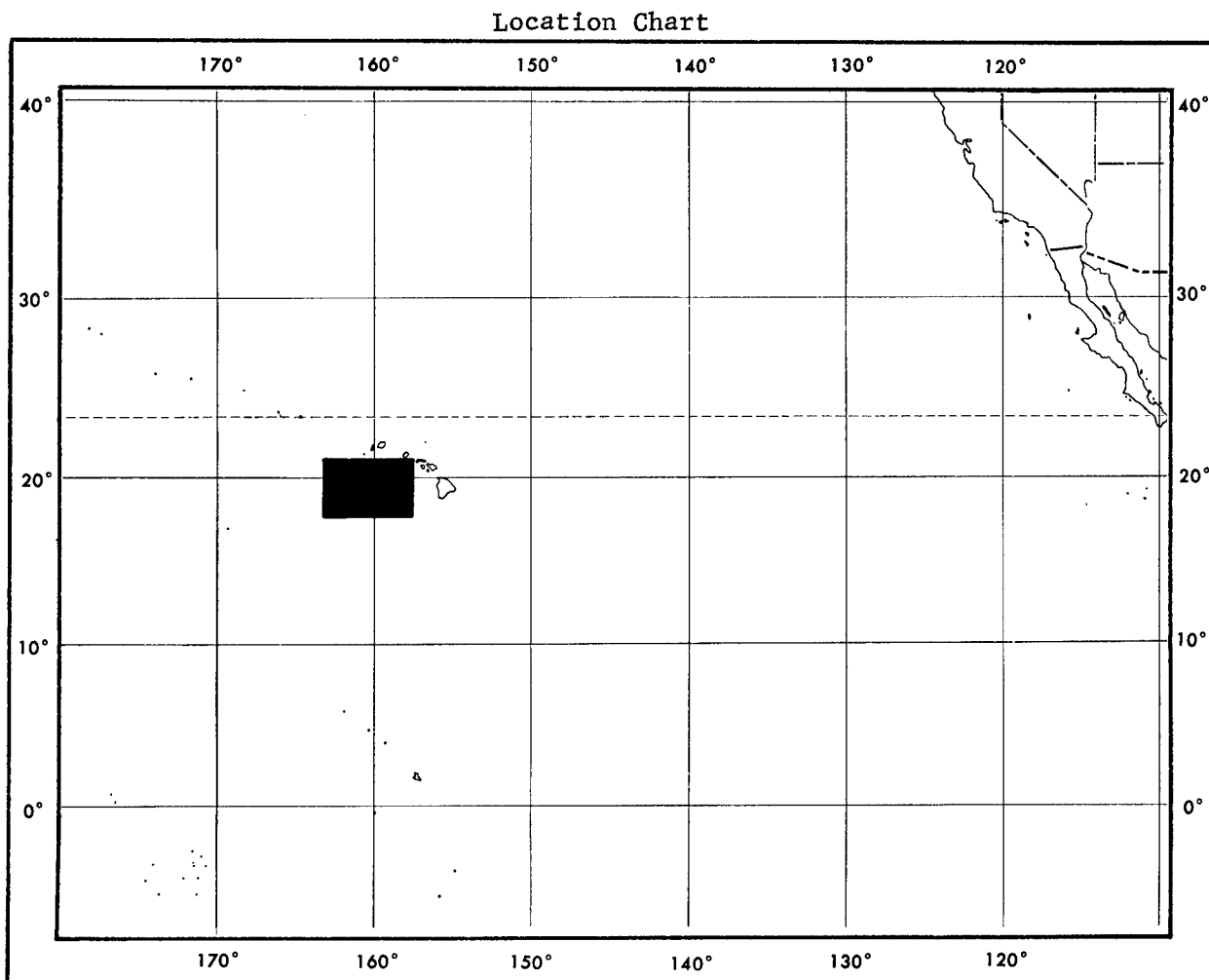
Miles Surveyed: 43,200 square miles

Track Pattern: 30-mile spacing, normal to the continental slope

Data Format: Total and residual magnetic intensity contour charts. Magnetic and bathymetric profiles along each track.

Reports: Technical Report 133, "A Marine Magnetic Survey off the East Coast of the United States."

3. Survey South of the Hawaiian Islands



Ship: USS REHOBOTH (AGS-50)

Survey Dates: June - July 1961

Navigational Control: Loran-A

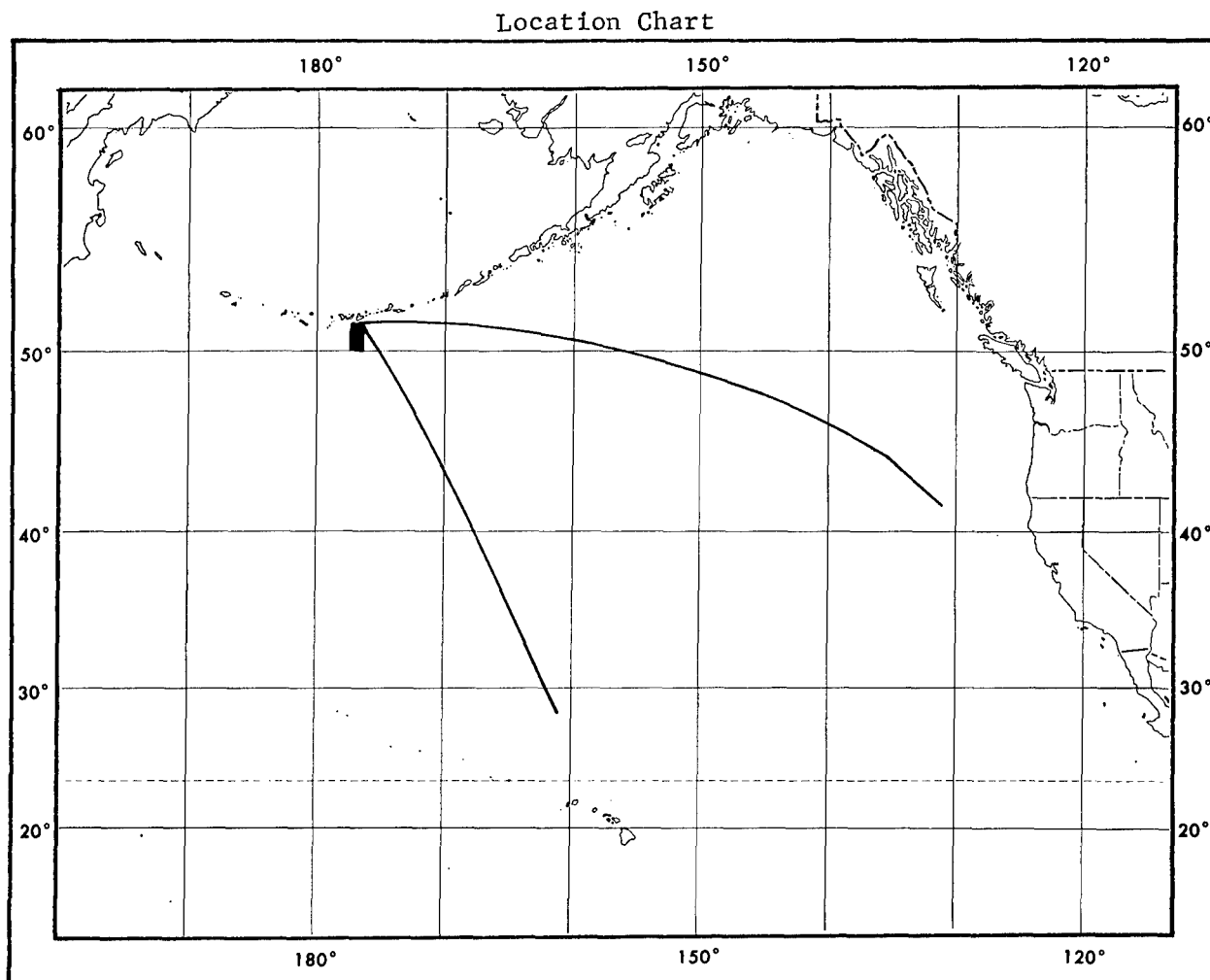
Miles Surveyed: 56,000 square miles

Track Pattern: 5 to 7 mile spacing, in E-W direction

Data Format: Total and residual intensity contour charts of the entire survey area. Total intensity and bathymetric profiles across the major magnetic feature in the area. Eight detailed development areas over seamounts within the area.

Reports: Technical Report 137, "A Marine Magnetic Survey South of the Hawaiian Islands."

4. North Pacific Survey - 1961



Ship: USS REHOBOTH (AGS-50)

Survey Dates: 9 September - 7 November 1961

Navigational Control: Loran-C, celestial, and dead reckoning

Miles Surveyed: 3,600 nautical miles; additional 2,500 square mile survey area over Aleutian Trench.

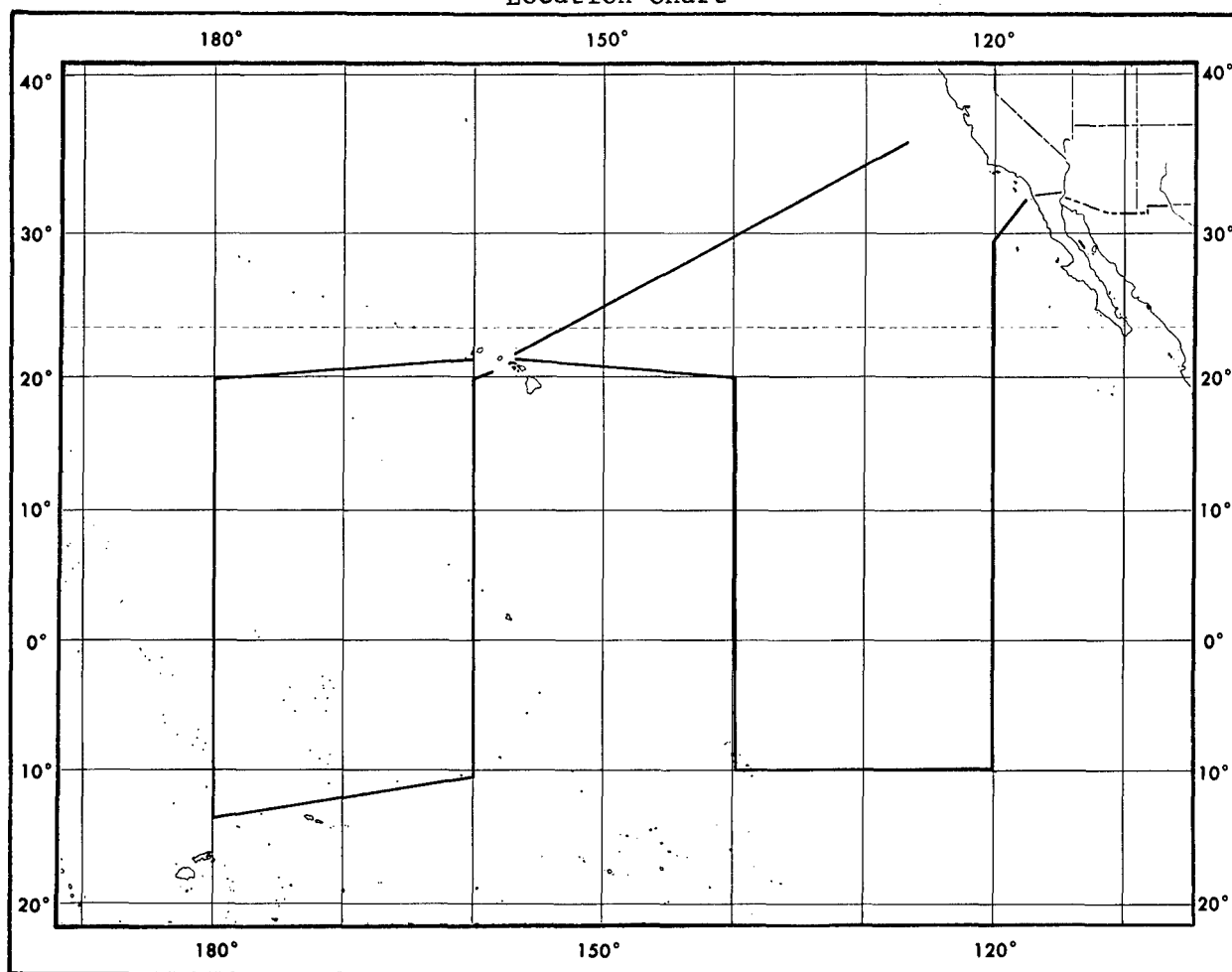
Track Pattern: Single track; 10-mile spacing, N-S, over Trench

Data Format: Profiles of magnetic intensity with regional gradient removed plotted along survey tracks on bathymetric contour chart. Total magnetic intensity contour chart over Aleutian Trench: Profile charts of magnetic intensity and bathymetry.

Reports: Single track data from this survey, combined with surveys 5 and 10, is available in Informal Manuscript Report M-4-63, "Marine Magnetic Profiles in the Pacific Ocean 1961 - 1962." Contour chart and profiles are contained in Informal Report IR H-3-66, "Geomagnetic Measurements in the North Pacific Ocean Aboard USS REHOBOTH (AGS-50), 1961."

5. Equatorial Pacific Survey

Location Chart



Ship: USS REHOBOTH (AGS-50)

Survey Dates: 25 April - 6 August 1961

Navigational Control: Loran-A, celestial and dead reckoning

Miles Surveyed: 26,000 nautical miles

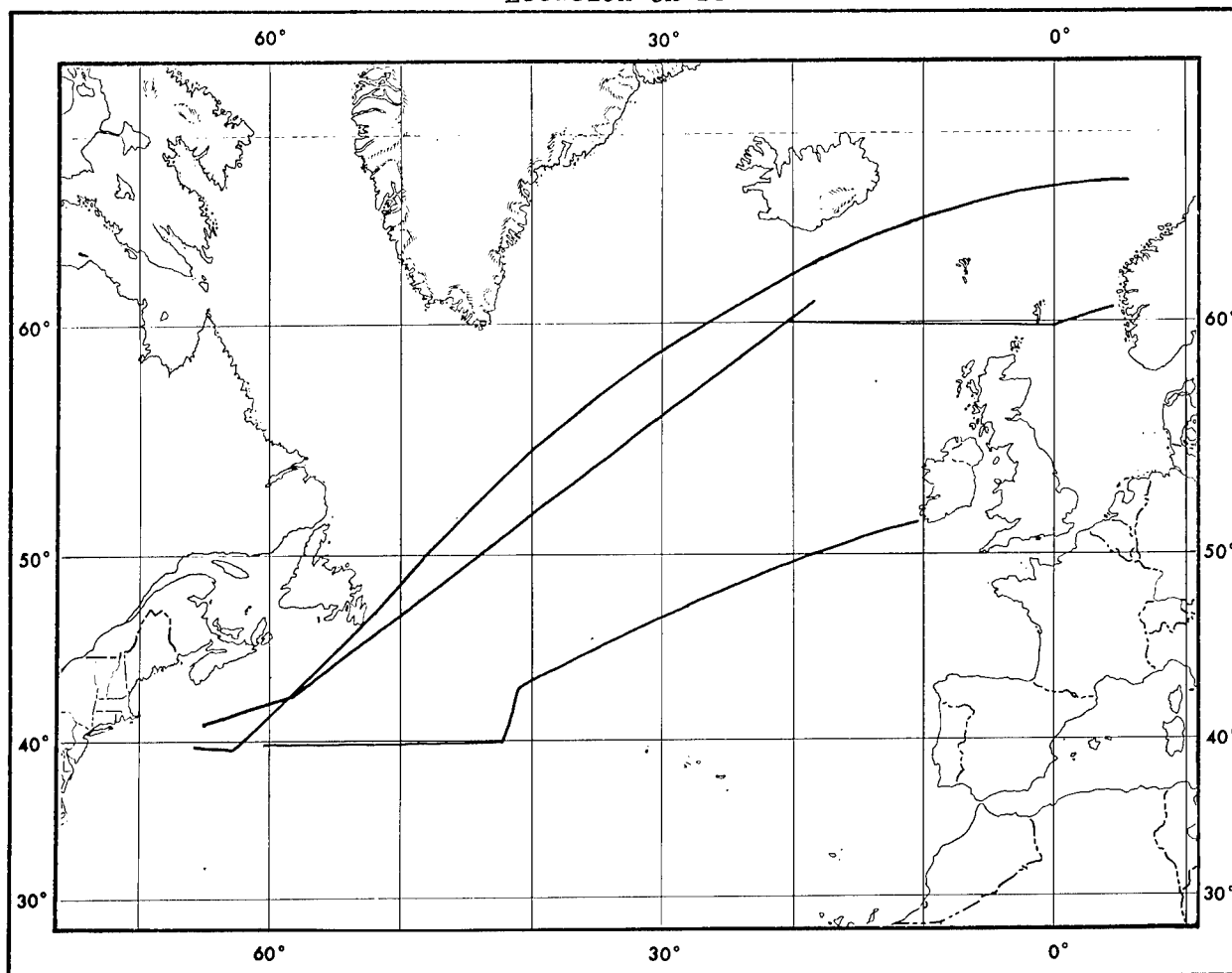
Track Patterns: Single track

Data Format: Profiles of magnetic intensity with regional gradient removed plotted along survey tracks on bathymetric contour charts.

Reports: Information from this survey, combined with surveys 4 and 10, is available in Informal Manuscript Report M-4-63, "Marine Magnetic Profiles in the Pacific Ocean 1961 - 1962."

6. North Atlantic Survey

Location Chart



Ship: USNS BOWDITCH (T-AGS-21); USNS DUTTON (T-AGS-22); USNS MICHELSON (T-AGS-23)

Survey Dates: 20 November 1961 - 13 March 1962

Navigational Control: Loran-C, Loran-A, Decca, celestial and dead reckoning.
Spacing between ships maintained by radar.

Miles Surveyed: 17,200 nautical miles

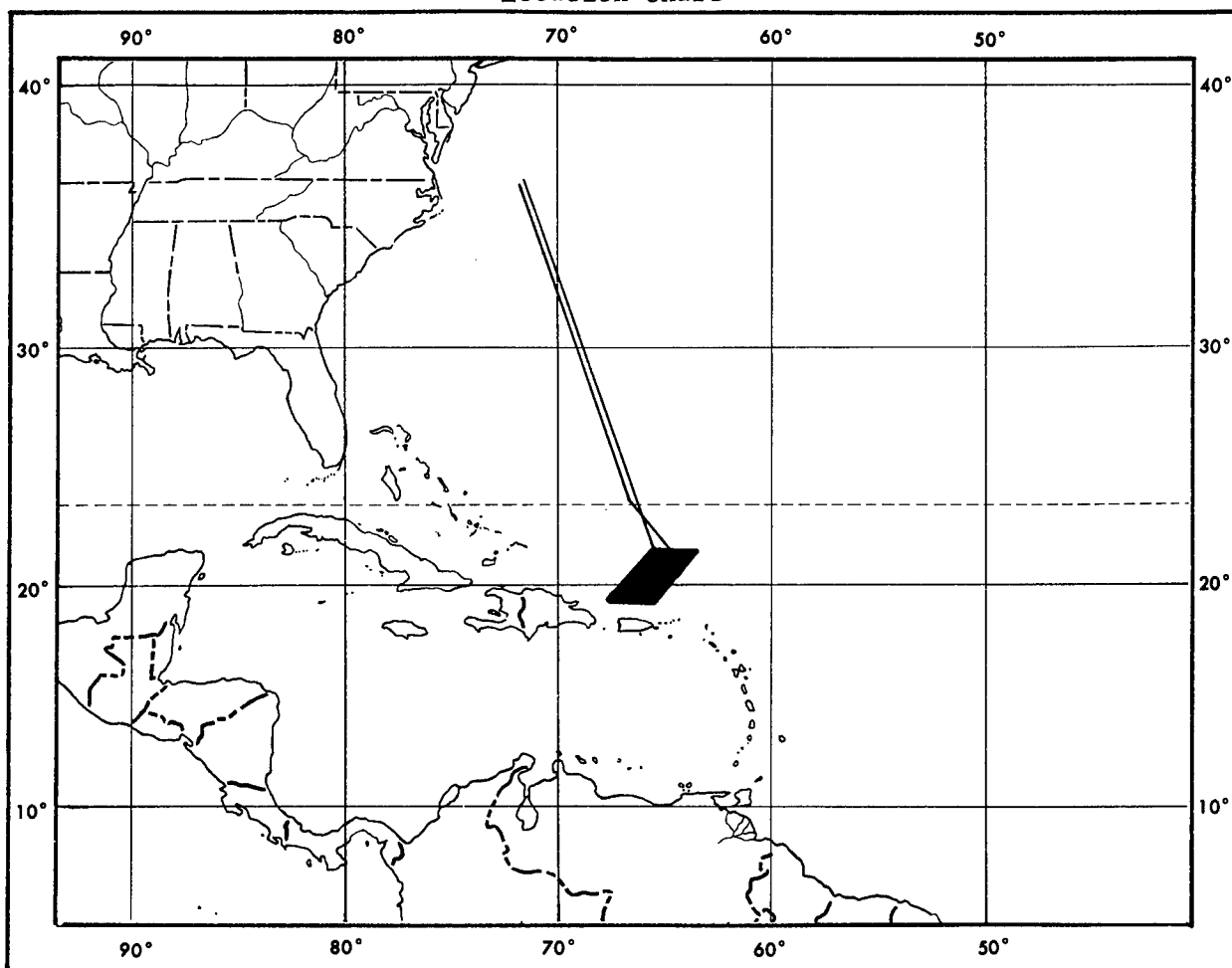
Track Pattern: 10 mile spacing simultaneously

Data Format: Total intensity and bathymetric profiles.

Reports: Technical Report 161, "Geomagnetic and Bathymetric Profiles Across the North Atlantic Ocean."

7. Puerto Rico Trench Survey

Location Chart



Ship: USS PREVAIL (AGS-20)

Survey Dates: 18 February - 31 March 1962

Navigational Control: Loran-A

Miles Surveyed: 20,000 square miles. An additional 2,700 nautical miles of enroute tracks.

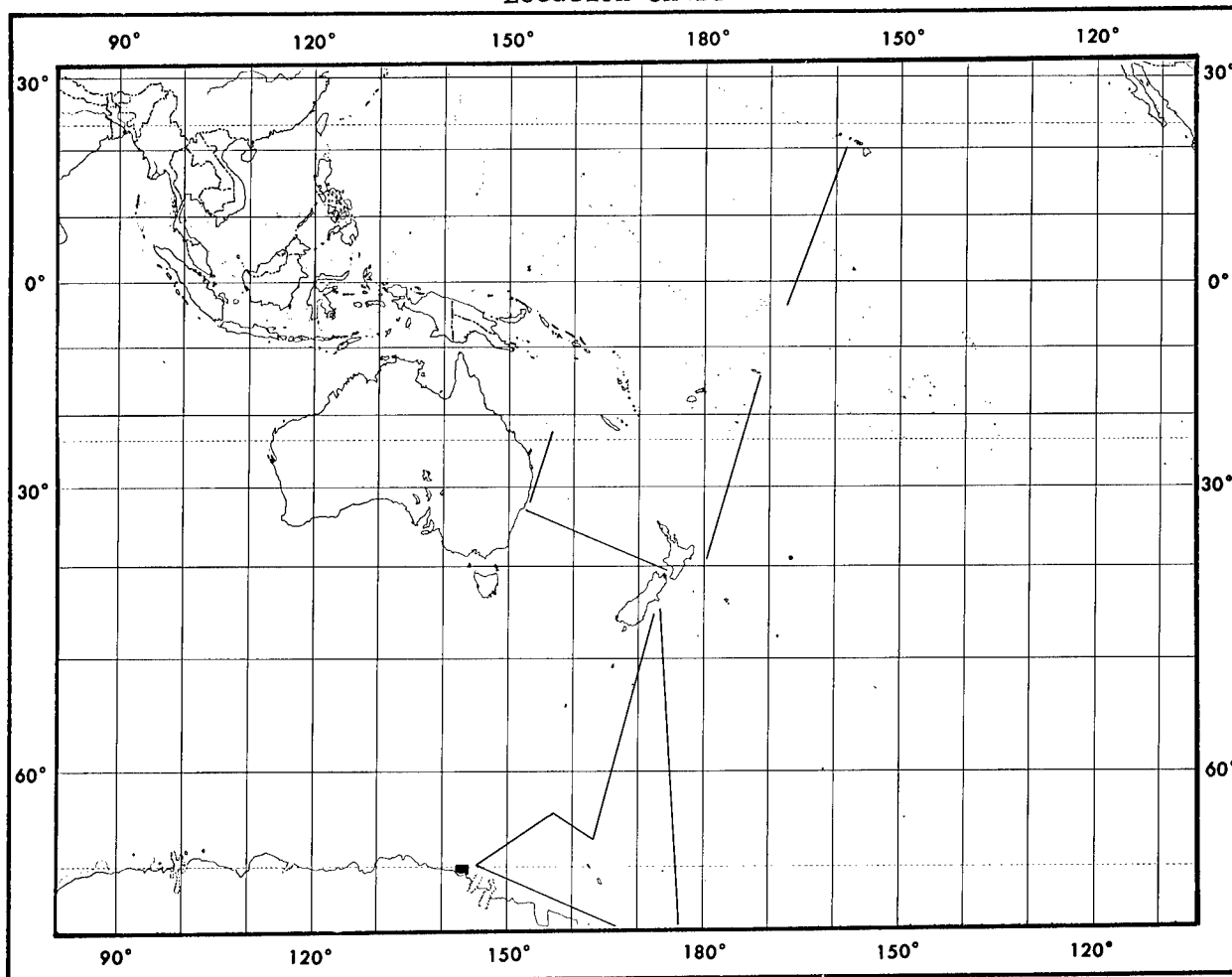
Track Patterns: 5 mile spacing, NE - SW orientation

Data Format: Total and residual intensity contour charts. Continuous magnetic and bathymetric profiles.

Reports: Informal Manuscript Report M-6-63, "Analysis of Puerto Rico Trench Marine Magnetic Survey Data." A further analysis of these data combined with the data from the airborne Puerto Rico Trench survey is contained in Informal Manuscript Report M-1-64, "Magnetic Anomalies North of Puerto Rico; Trend Removal with Orthogonal Polynomials."

8. Deep Freeze 1962

Location Chart



Ship: USS BURTON ISLAND (AGB-1)

Survey Dates: 24 October 1961 - 14 March 1962

Navigational Control: Radar, celestial, and dead reckoning

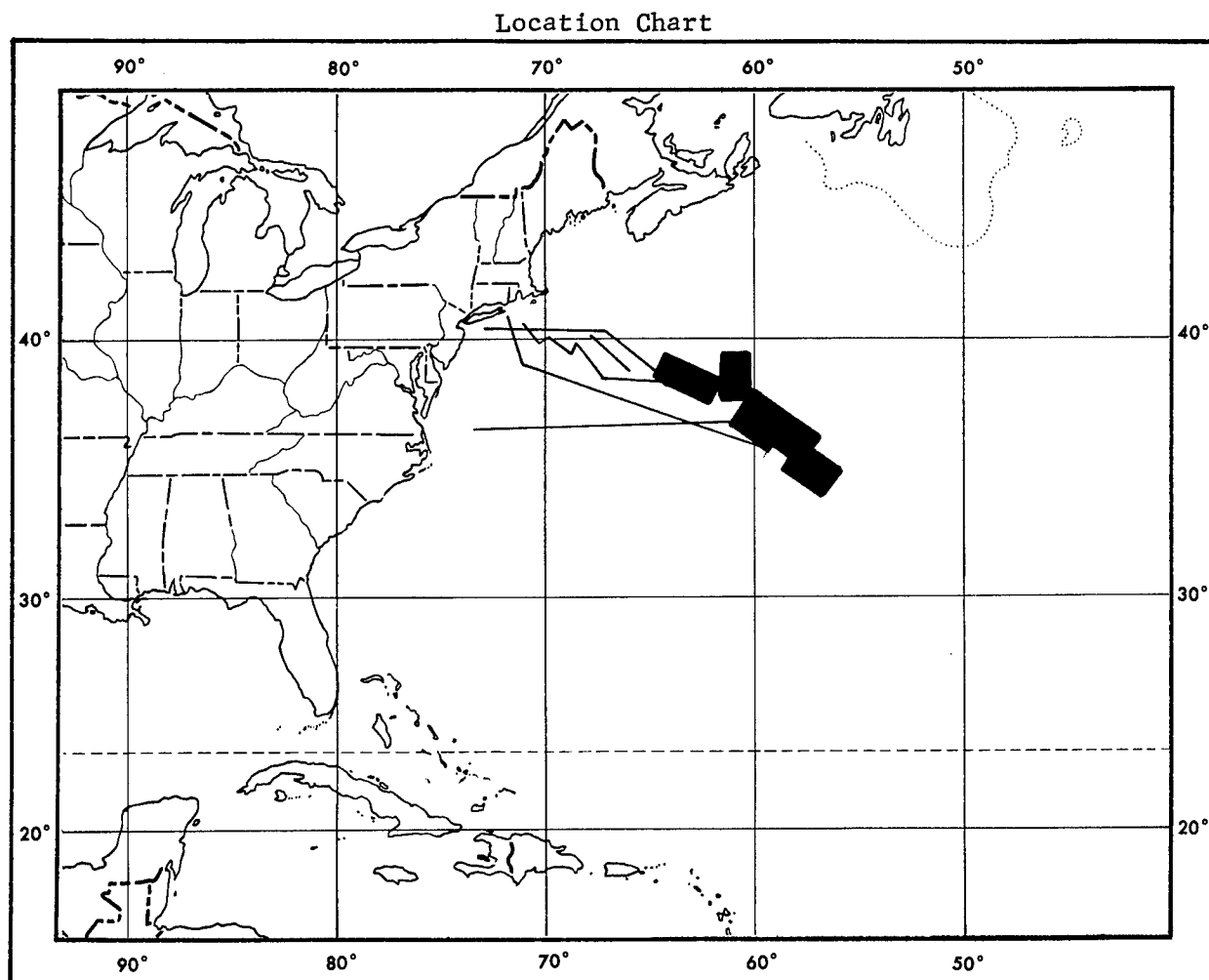
Miles Surveyed: 1,600 square miles in Commonwealth Bay. Additional 10,000 nautical miles of continuous magnetic and bathymetric profiles.

Track Pattern: 5 mile spacing in Commonwealth Bay, N-S orientation

Data Format: Total intensity contour chart of detailed survey area. Data collected along other tracks presented as total intensity and bathymetric profiles.

Reports: Technical Report 118, "Operation Deep Freeze 62, 1961-1962 Marine Geophysical Investigations."

9. New England Seamount Survey



Ship: USS SHELDRAKE (AGS-19)

Survey Dates: 4 June - 14 August 1962

Navigational Control: Loran-A

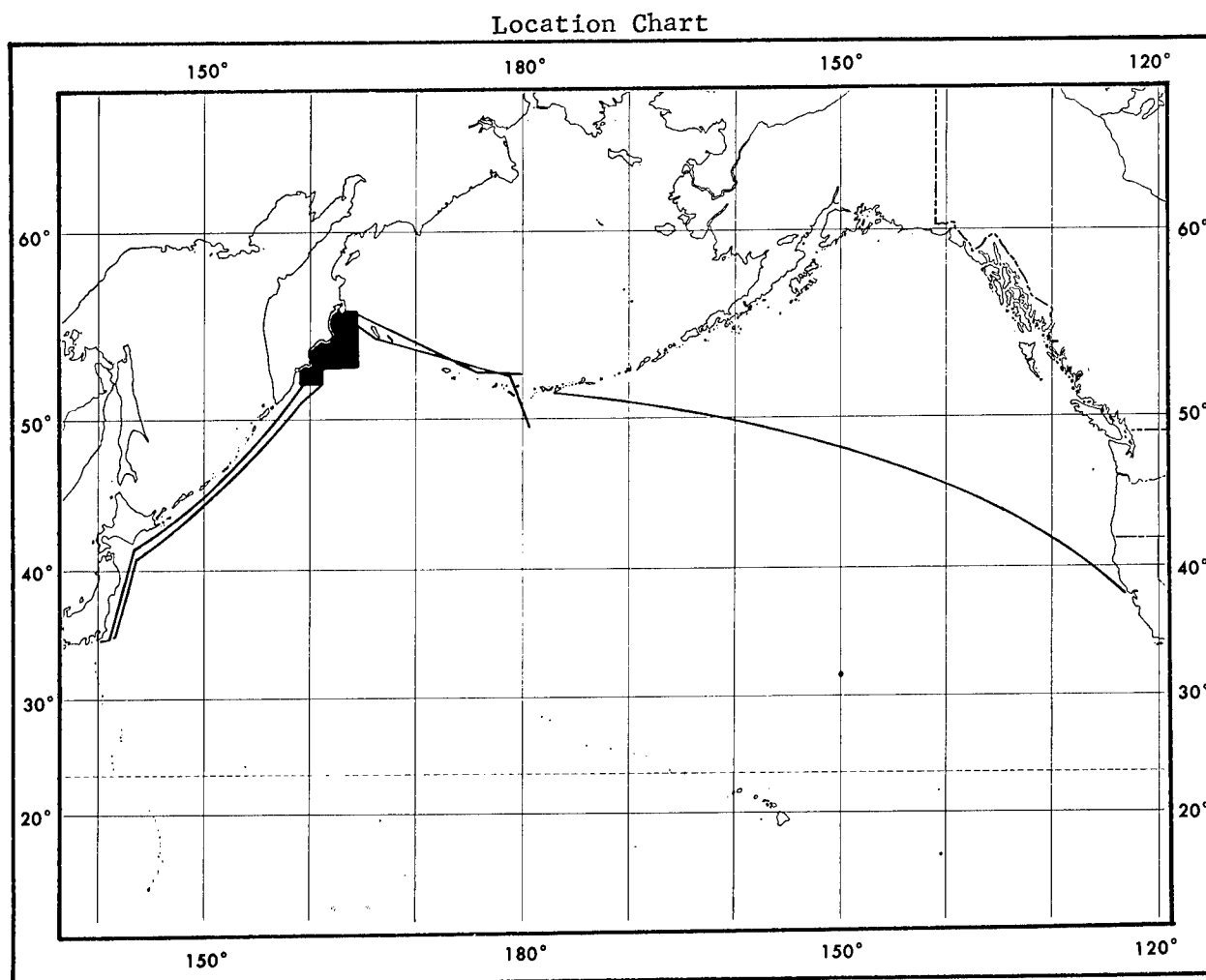
Miles Surveyed: 30,000 square miles detailed survey area. Additional 2,800 nautical miles of continuous magnetic and bathymetric data collected along enroute tracks.

Track Pattern: 5-mile spacing, normal to the seamount chain.

Data Format: Total intensity contour charts. Total intensity and bathymetric profile sheets for five enroute tracks.

Reports: Technical Report 159, "A Marine Magnetic Survey of the New England Seamount Chain;" Informal Manuscript Report M-8-63, "Summary of Magnetization Computations for Kelvin Seamount." A brief article on this survey entitled "A Bathymetric and Geomagnetic Survey of the New England Seamount Chain" also appears in the International Hydrographic Review, Vol. XLI, No. 1, Jan 1964.

10. North Pacific Survey - 1962



Ship: USS REHOBOTH (AGS-50)

Survey Dates: 25 May - 8 September 1962

Navigational Control: Loran-C, radar, celestial, and dead reckoning

Miles Surveyed: 32,500 square miles. Additional 6,732 nautical miles of continuous magnetic profile along enroute tracks.

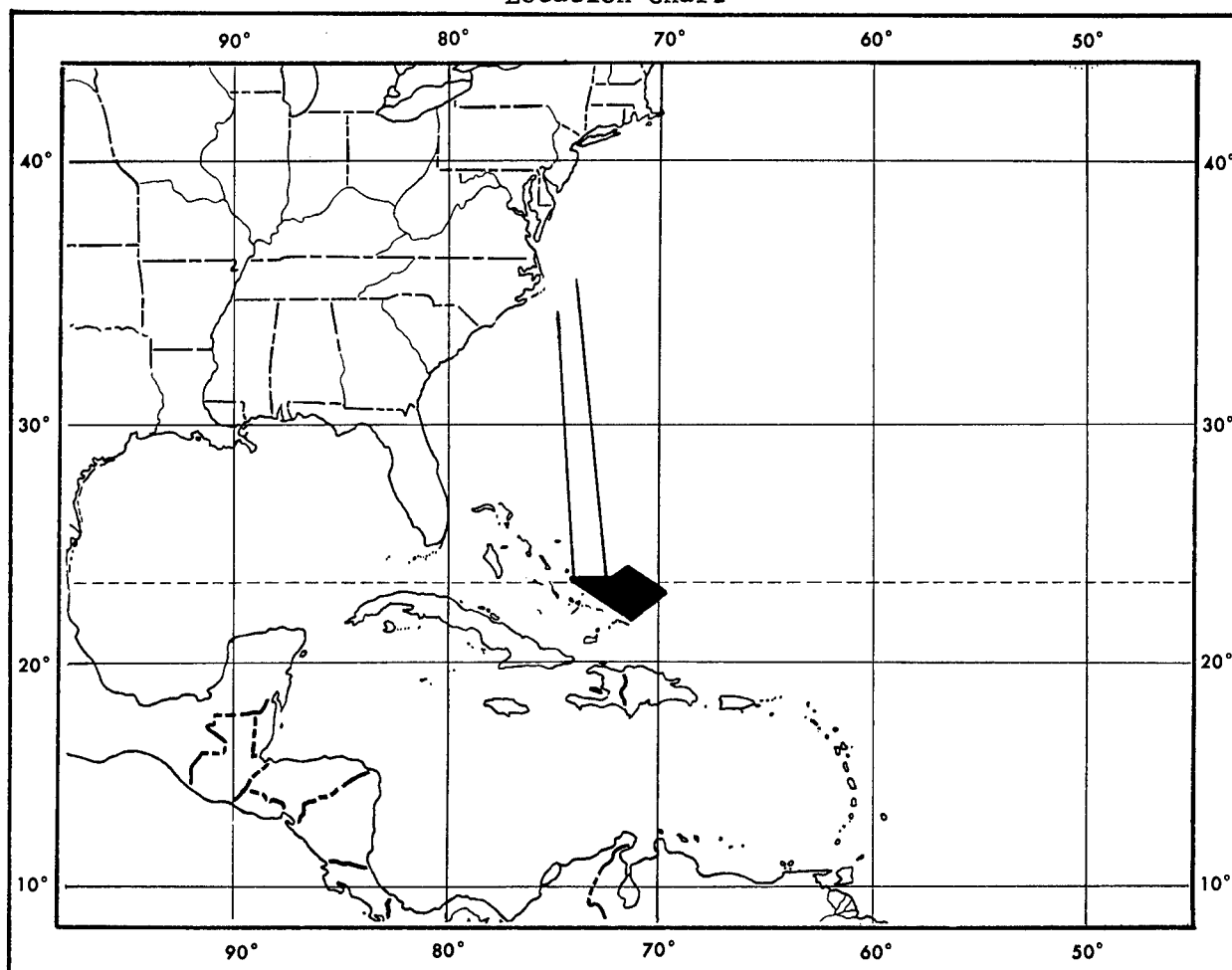
Track Pattern: 5 mile spacing, E-W and NW-SE orientation

Data Format: Total intensity contour charts.

Reports: Technical Report 168, "Marine Magnetic Surveys in the Northwest Pacific Ocean." Profiles of magnetic intensity with regional gradient removed plotted along enroute survey tracks, combined with information from surveys 4 and 5 are presented in Informal Manuscript M-4-63, "Marine Magnetic Profiles in the Pacific Ocean 1961 - 1962."

11. South Bahamas Survey

Location Chart



Ship: USS SHELDRAKE (AGS-19)

Survey Dates: 22 October - 25 November 1962

Navigational Control: Loran-A

Miles Surveyed: 18,000 square miles. Additional 2,350 nautical miles of continuous magnetic and bathymetric profiles along enroute tracks.

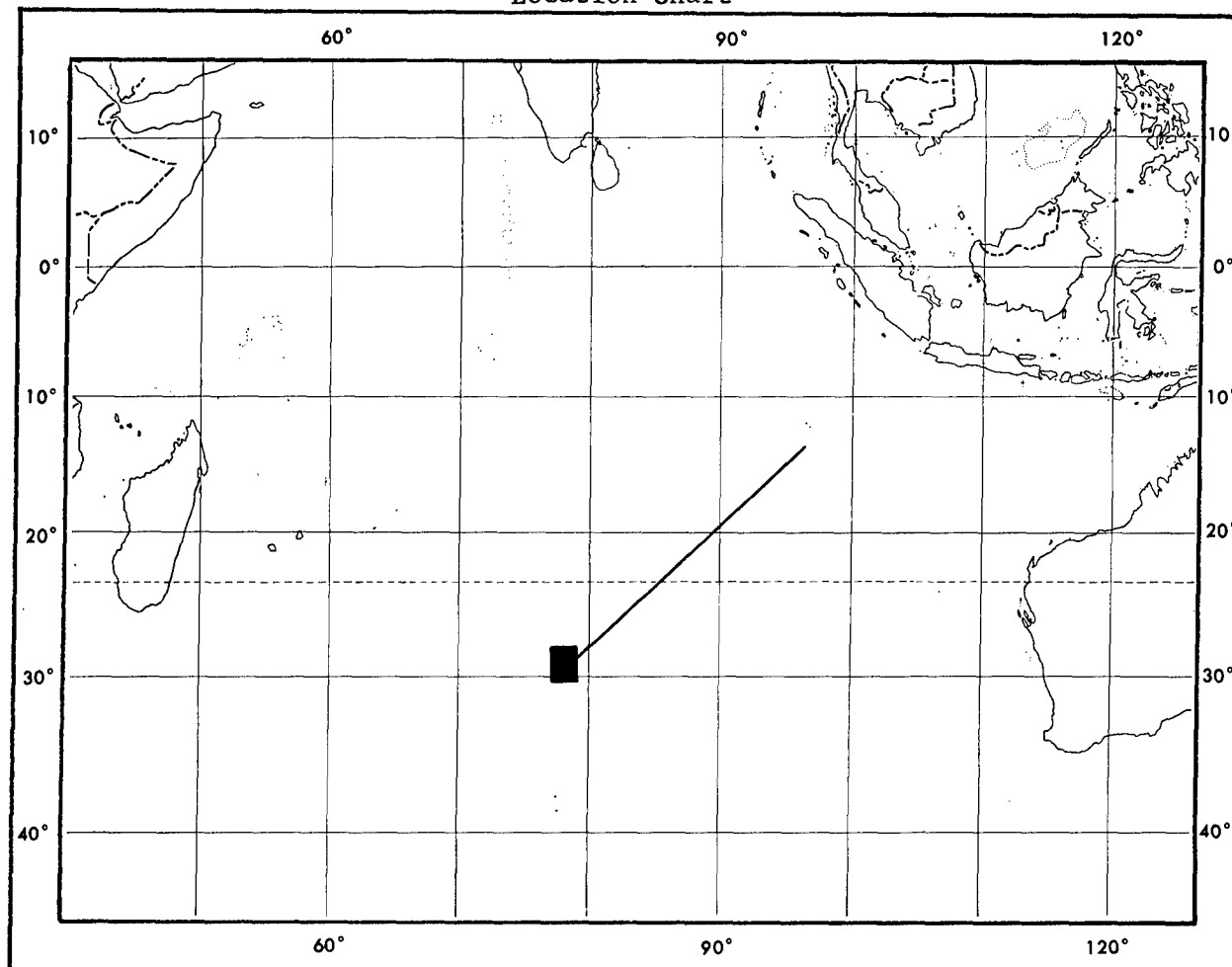
Track Pattern: 5 mile spacing, NE-SW orientation

Data Format: Total and residual intensity contour charts. Data along enroute tracks presented as continuous total intensity and bathymetric profiles.

Reports: Technical Report 160, "Marine Magnetic Survey off the Southern Bahamas." A geologic interpretation of the survey area using an orthogonal polynomial residual intensity contour chart is presented in Informal Manuscript Report M-7-63, "Geologic Interpretation of Marine Magnetic Data in an Area off the Southern Bahama Islands."

12. Indian Ocean Survey

Location Chart



Ship: USNS CORE (T-AKV-41)

Survey Dates: August - December 1962

Navigational Control: Celestial and dead reckoning

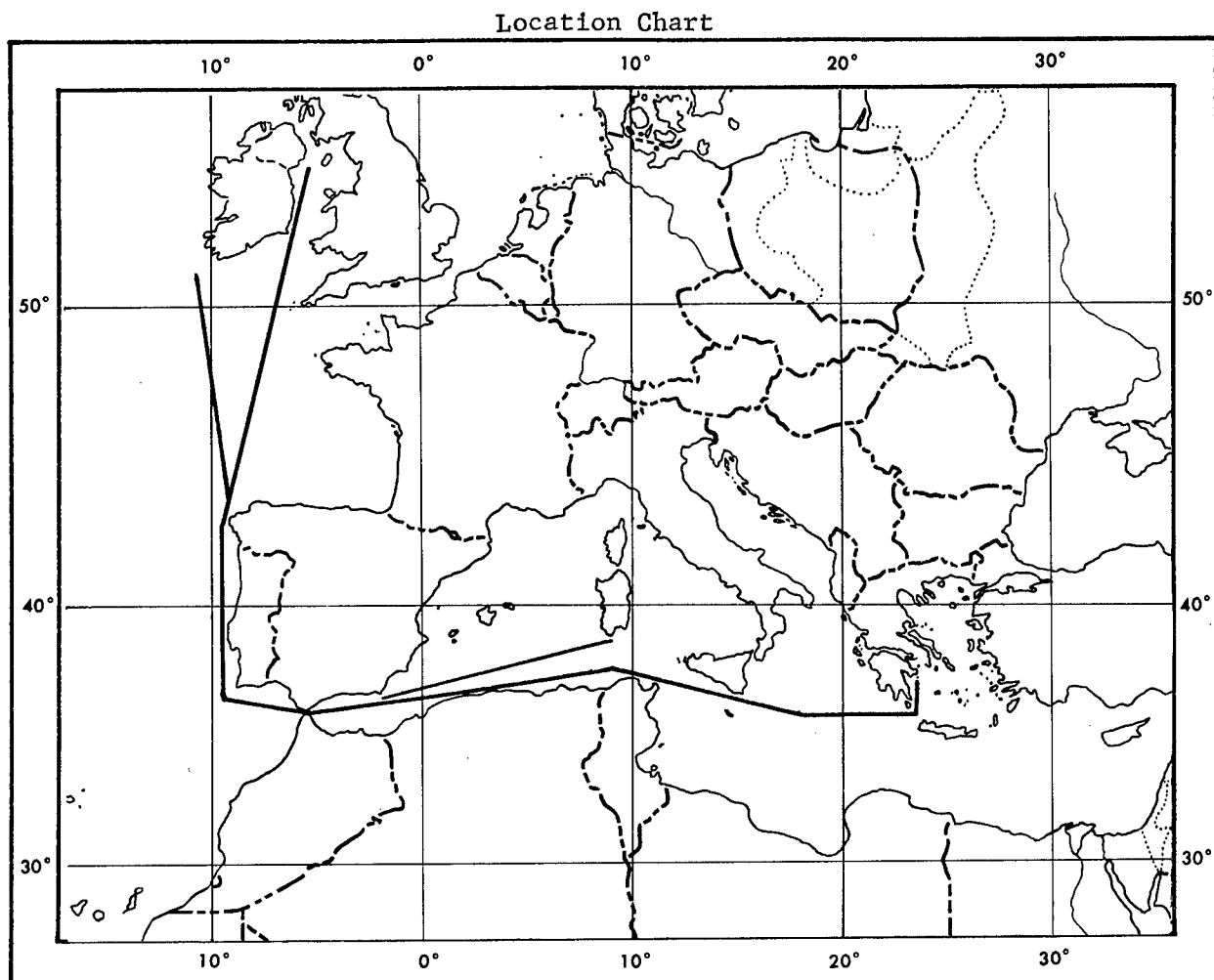
Miles Surveyed: 10,000 square miles. Additional 1000 nautical miles on continuous magnetic profile along enroute tracks.

Track Pattern: 5 mile spacing, N-S orientation

Data Format: Total intensity contour chart of the survey area and profiles of enroute magnetic intensity data with regional gradient removed plotted along survey track on bathymetric contour chart.

Reports: Informal Manuscript Report M-9-64, "A Marine Magnetic Survey of an Area in the Central Indian Ocean."

13. Belfast - Piraeus Survey



Ship: USNS BOWDITCH (T-AGS-21), USNS DUTTON (T-AGS-22), USNS MICHELSON (T-AGS-23)

Survey Dates: 5 October - 11 October 1962

Navigational Control: Loran-C, radar, celestial, and dead reckoning

Miles Surveyed: 4,500 nautical miles of survey track

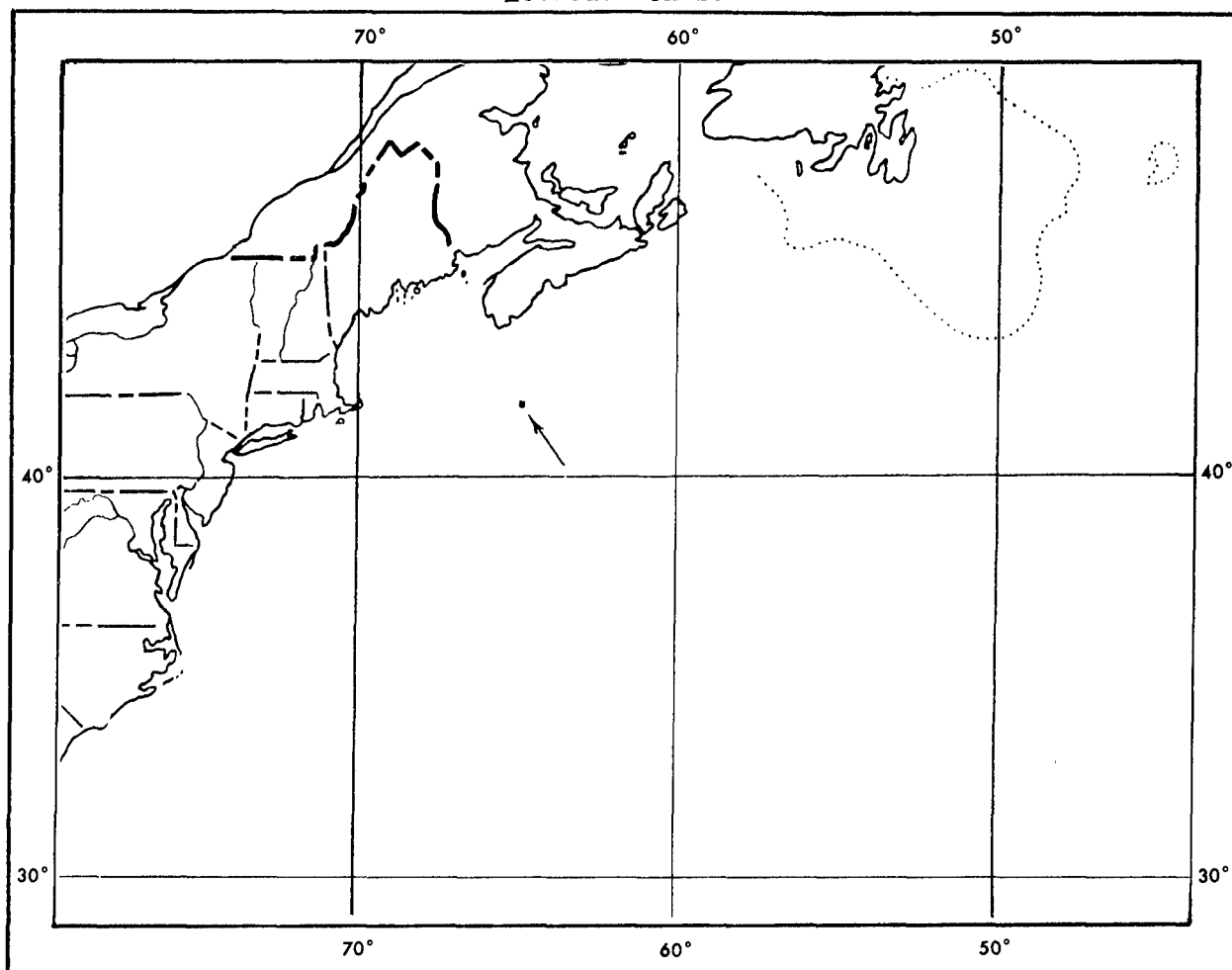
Track Pattern: Single track

Data Format: Continuous magnetic-bathymetric-gravimetric profiles.

Reports: Informal Report H-2-66, "Geophysical Profiles in the Northeastern Atlantic Ocean and the Mediterranean Sea, 1962-1963."

14. Thresher Search

Location Chart



Ship: USNS GILLISS (AGOR-4)

Survey Dates: April - August 1963

Navigational Control: Loran-A, Loran-C

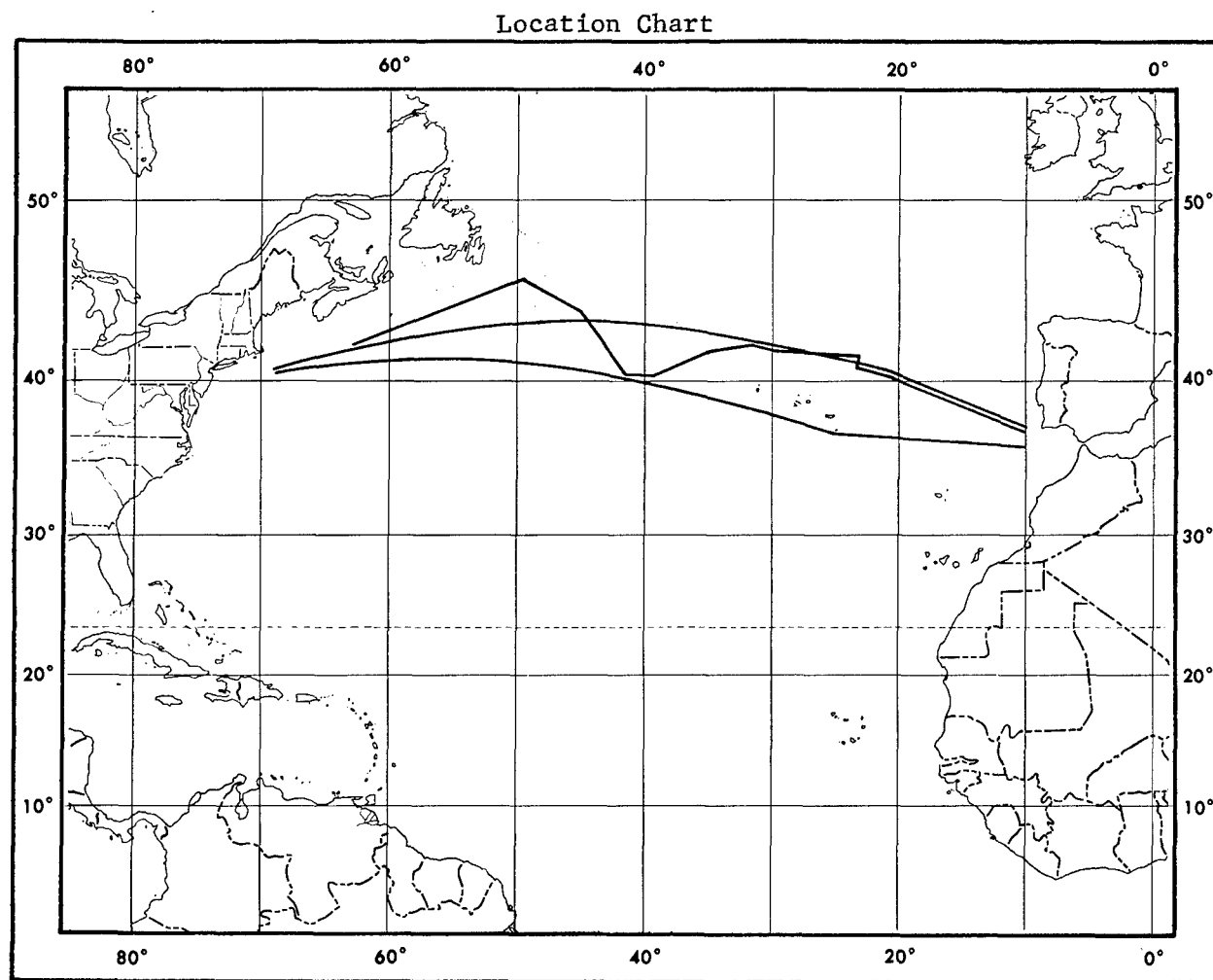
Miles Surveyed: Approximately 7 square mile area with magnetometer sensor at depths exceeding 8,000 feet.

Track Pattern: Irregular

Data Format: Total intensity contour chart.

Reports: Informal Manuscript Report M-2-64, "A Deep-Towed Magnetometer System." Describes development and design of a deep-towed magnetometer system and its subsequent use in search operations.

15. Atlantic Crossings, Gibraltar to New York



Ship: USNS MICHELSON (T-AGS-23), USNS BOWDITCH (T-AGS-21), USNS DUTTON (T-AGS-22)

Survey Dates: August, September 1963, February 1964

Navigational Control: Loran-C, Loran-A, celestial, and dead reckoning

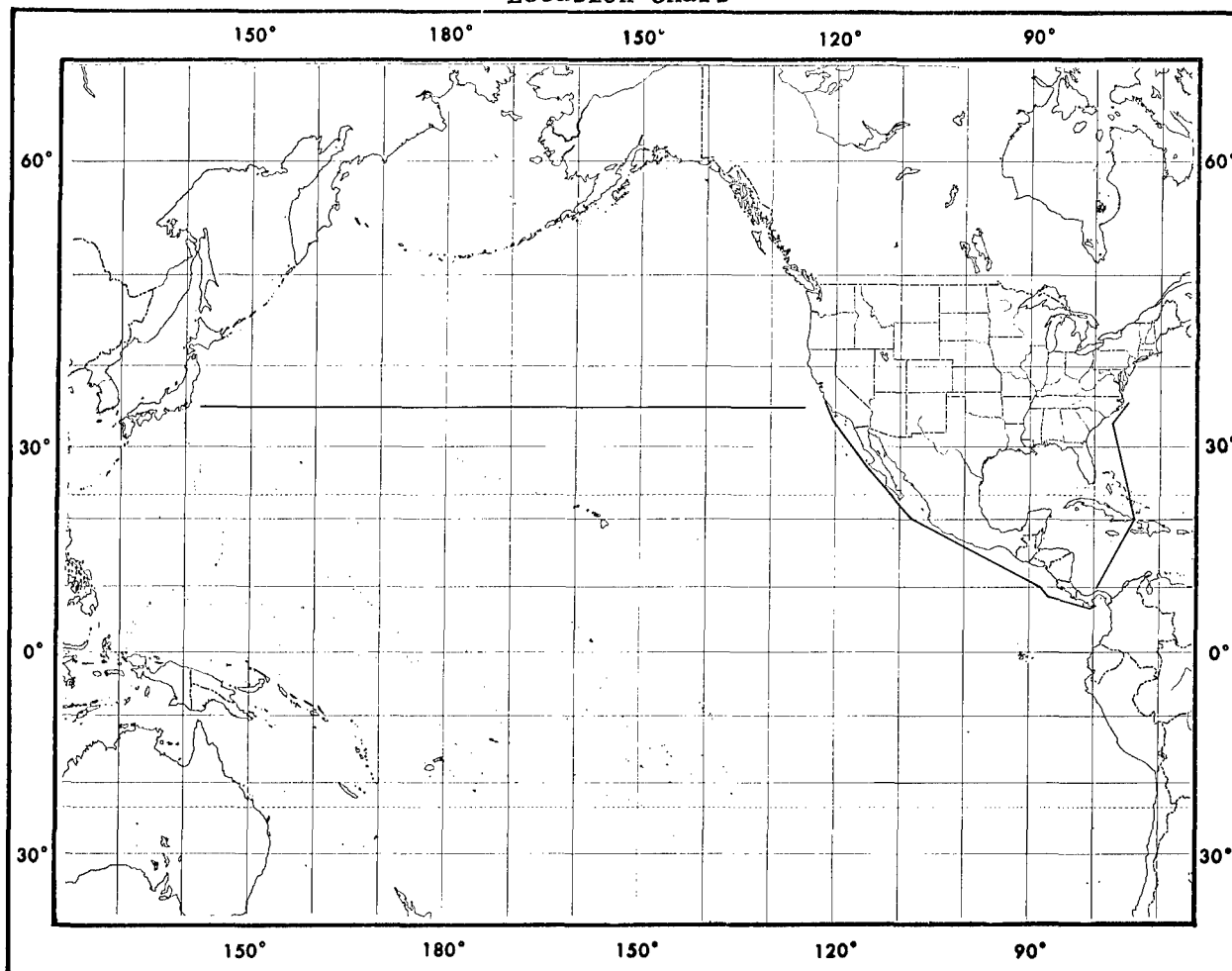
Miles Surveyed: Approximately 10,000 miles of survey track.

Track Pattern: Single track

Data Format: Total intensity data plotted at 50 gamma intervals, maxima and minima, on 1:500,000 scale Transverse Mercator Projections.

16. Ocean Track, New York to Tokyo

Location Chart



Ship: USNS BOWDITCH (T-AGS-21)

Survey Dates: 27 October - 26 November 1963

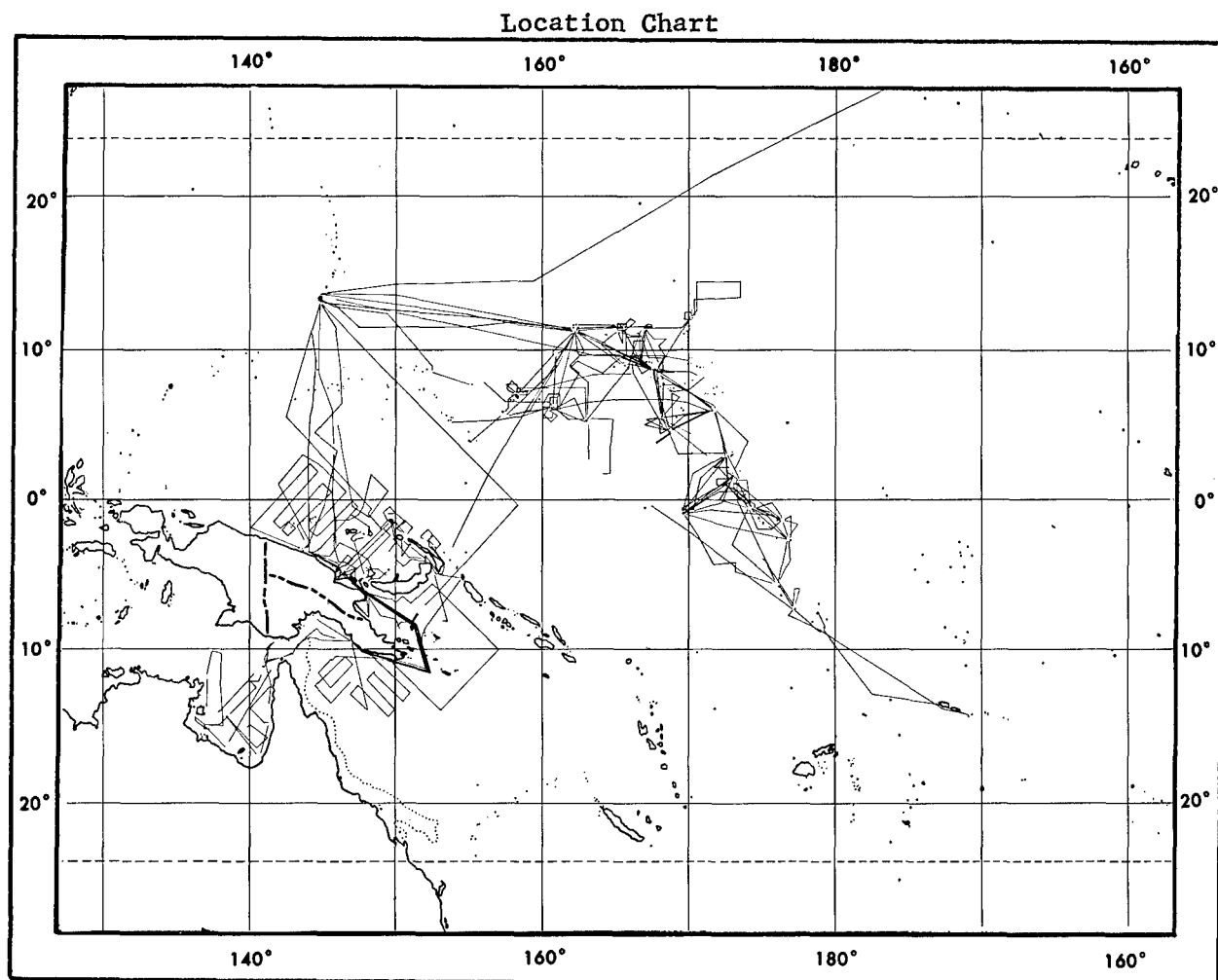
Navigational Control: Loran-C, Loran-A, celestial, and dead reckoning

Miles Surveyed: Approximately 10,700 miles enroute survey track via Panama Canal and San Francisco.

Track Pattern: Single track

Data Format: Total intensity data plotted at 50 gamma intervals, maxima and minima, on 1:500,000 scale Transverse Mercator Projections.

17. Southwest Pacific Survey



Ship: USNS SGT CURTIS F. SHOUP (T-AG-175)

Survey Dates: 18 May 1963 - 1 November 1965

Navigational Control: Loran-A, radar, celestial, and dead reckoning

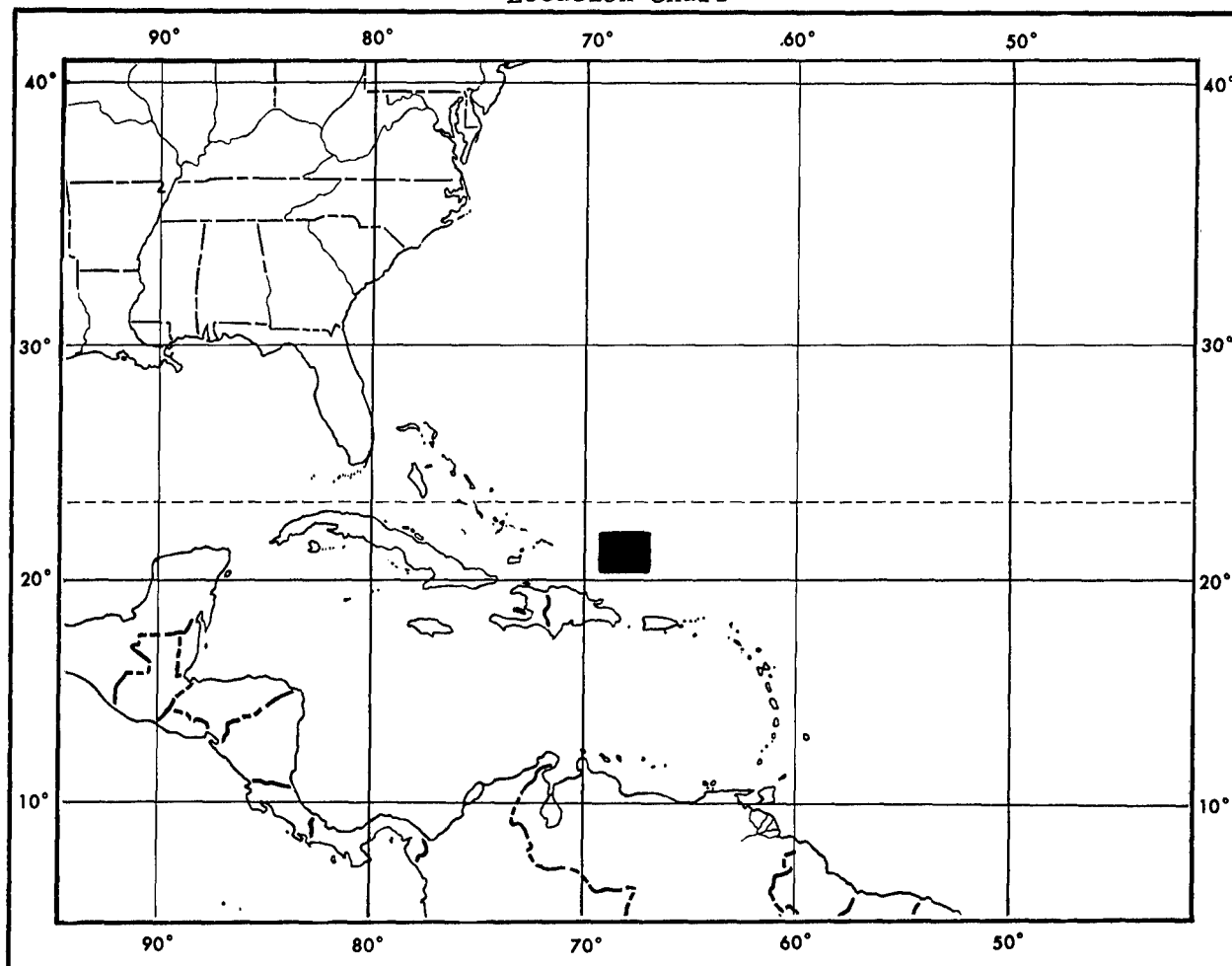
Miles Surveyed: 78,500 miles enroute survey track

Track Pattern: Irregular

Data Format: Total intensity data plotted at 50 gamma intervals, maxima and minima, on 1:500,000 scale Transverse Mercator Projections.

18. Hispaniola Survey

Location Chart



Ship: USAC'S A. J. MYER

Survey Dates: 26 March - 15 April 1964

Navigational Control: Loran-C and Loran-A

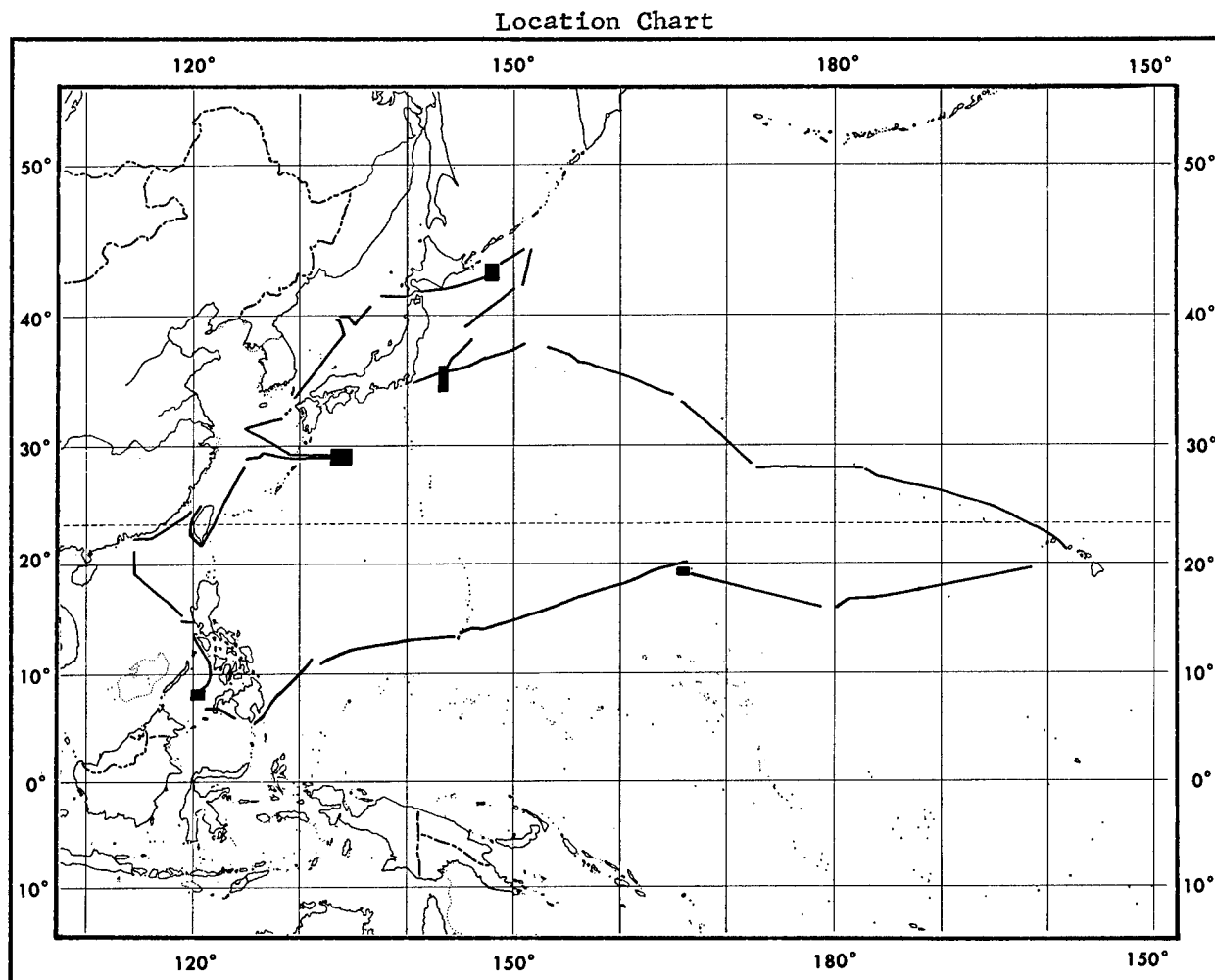
Miles Surveyed: 11,000 square miles

Track Pattern: 3 mile spacing, E-W orientation

Data Format: Total and residual intensity contour charts.

Reports: IR H-1-65, "Geomagnetic Survey of an Area Northeast of Hispaniola."

19. Western Pacific (Reconnaissance) Survey 1964



Ship: USNS DAVIS (AGOR-5)

Survey Dates: May - September 1965

Navigational Control: Radar and visual within range of land; Loran-A, celestial, and dead reckoning on most tracks.

Miles Surveyed: 13,500 nautical miles; an additional 7,600 square-mile coverage in 5 survey areas.

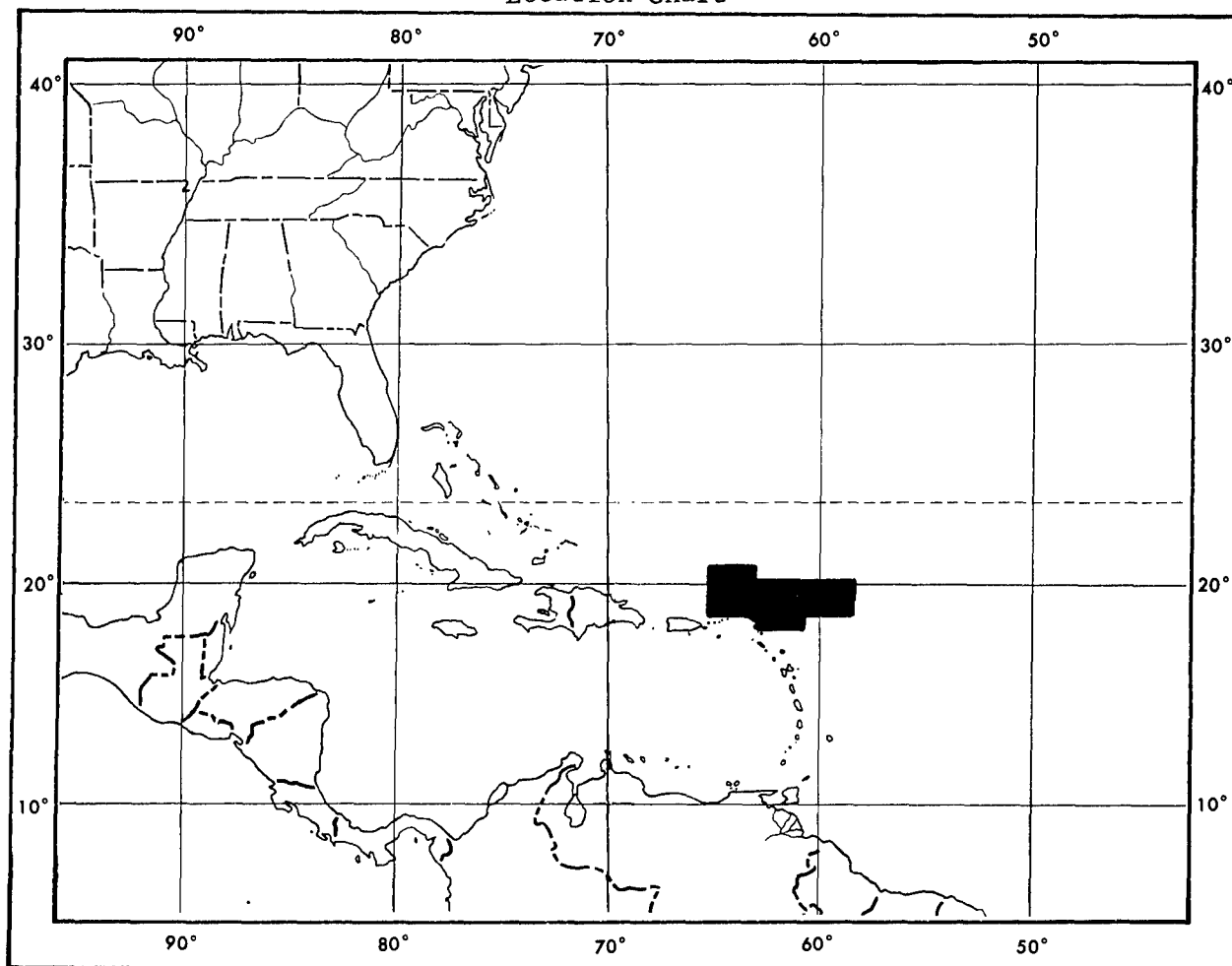
Track Pattern: Single track; 5-10 mile spacing, N-S or NE-SW in survey areas.

Data Format: Total intensity and bathymetric contour charts; profile charts of magnetic intensity and bathymetry with ship's track.

Reports: Contour charts and profiles are presented in Informal Report H-4-66, "Geomagnetic Measurements in the Pacific Ocean Aboard USNS CHARLES H. DAVIS (AGOR 5), 1961."

20. Antilles Atlantic Ocean Surveys

Location Chart



Ship: USACS A. J. MYER

Survey Dates: September - December 1964

Navigational Control: Lambda-Decca

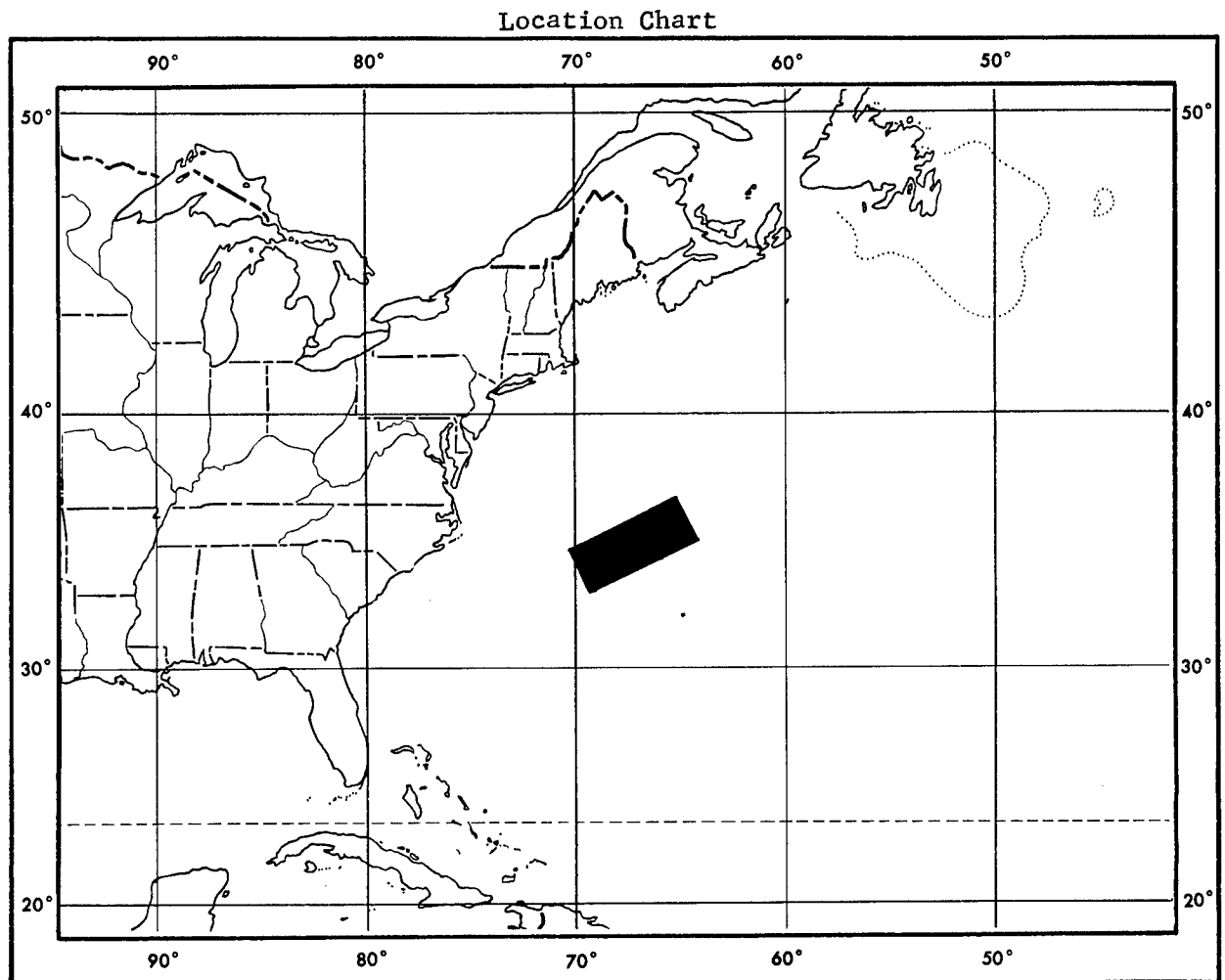
Miles Surveyed: 41,000 square miles

Track Pattern: 3 mile spacing; part N-S, part E-W orientation

Data Format: Total and residual intensity contour charts.

Reports: IR H-5-66, "Shipboard Magnetic Survey of an Area North of the Lesser Antilles."

21. Area Northwest of Bermuda (Reconnaissance) Survey



Ship: USNS GILLISS (AGOR-4)

Survey Dates: November - December 1964

Navigational Control: Loran-A, celestial, dead-reckoning

Miles Surveyed: 30,000 square miles

Track Pattern: Northwest-Southeast, 30-mile spacing

Data Format: Total intensity data plotted at 50-gamma intervals, maxima and minima, on 1:500,000 scale Transverse Mercator Projections; total magnetic intensity contour chart showing general magnetic characteristics.

Reports: Contour chart contained in Informal Report H-6-66, "Shipboard Magnetic Survey of an Area Northwest of Bermuda."

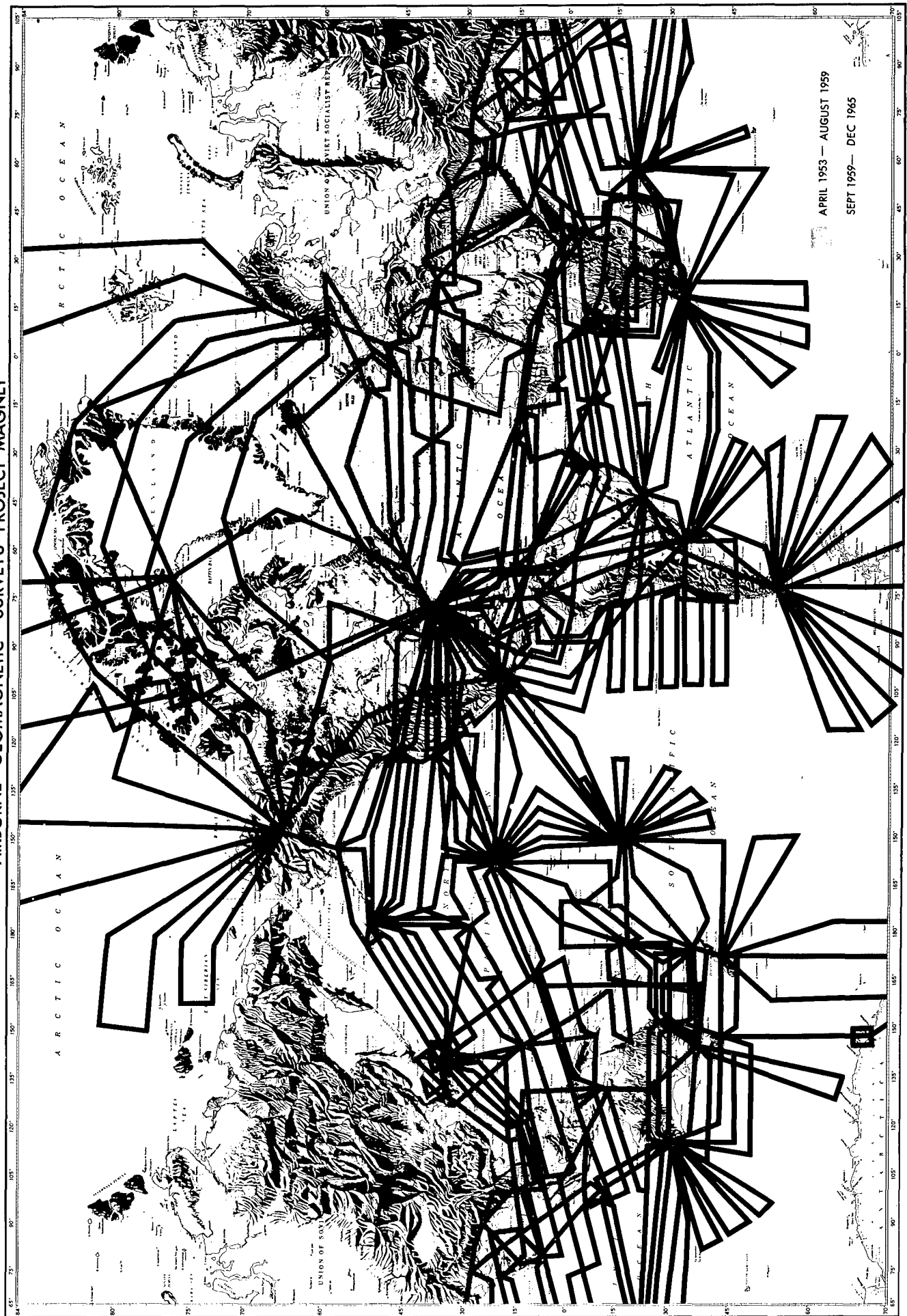
III. PROJECT MAGNET

Among the more significant of the U. S. Naval Oceanographic Office's geophysical surveys is Project MAGNET, the world-wide airborne geomagnetic survey. This survey normally employs two aircraft equipped with vector airborne magnetometers which measure the intensity and direction of the earth's magnetic field. The normal data output for the VAM-2 is continuous total magnetic intensity and periodic vector magnetic data spaced at five minute (GMT) intervals or about 15-20 nautical miles along the survey track. From these data, the magnetic elements -- declination, inclination, horizontal intensity, vertical intensity, and total intensity -- are determined and used in the compilation of the world isomagnetic charts published by this Office.

The survey is programmed to cover all ocean areas with equal priority. Tracks generally are oriented east-west and spaced 200 miles apart. The accompanying figure shows the Project MAGNET tracks flown as of 31 December 1965. Although flight altitudes vary from 4000 feet to 20,000 feet depending on survey conditions, the majority of the survey tracks are flown between 8000 and 10,000 feet altitude. The primary navigational control is celestial navigation. Doppler radar, radar, Loran-A, Loran-C, and visual navigational control are used when appropriate.

Geomagnetic data derived from Project MAGNET surveys are presented in tabular form along with the time and space coordinates in Special Publication No. 66, "Airborne Geomagnetic Data 1953-1961," and in Special Publication No. 66 -- Supplement No. 1, "Airborne Geomagnetic Data 1962-1963." Approximately 43,000 data points have been observed since 1953 and are available in these tabular listings, data cards, or magnetic tape. Total intensity profiles are available on microfilm. (See Section IV C.)

AIRBORNE GEOMAGNETIC SURVEYS—PROJECT MAGNET



IV. PUBLICATIONS

A. Reports

The following reports may be ordered from the Distribution Control Department, U. S. Naval Oceanographic Office, Washington, D. C. 20390:

(1) Technical Reports

TR-105, "Operation Deep Freeze 61, 1960-1961 Marine Geophysical Investigations," June 1962	No Charge
TR-118, "Operation Deep Freeze 62, 1961-1962 Marine Geophysical Investigations," February 1965	No Charge \$ 1.25
TR-133, "A Marine Magnetic Survey Off the East Coast of the United States," September 1962	\$.40
TR-137, "A Marine Magnetic Survey South of the Hawaiian Islands," September 1962 (reprinted May 1965)	.85
TR-144, "A Study of Aeromagnetic Component Data -- Plantagenet Bank," G. A. Young and A. L. Kontis, January 1964	.30
TR-159, "A Marine Magnetic Survey of the New England Seamount Chain," James E. Walczak, October 1963	.40
TR-160, "Marine Magnetic Survey Off the Southern Bahamas," Dewey R. Bracey and Otis E. Avery, July 1963	.40
TR-161, "Geomagnetic and Bathymetric Profiles Across the North Atlantic Ocean," Otis E. Avery, November 1963	1.35
TR-166, "A Study of Aeromagnetic Data -- New England Seamount Area," A. L. Kontis and G. A. Young, February 1965	.70
TR-168, "Marine Magnetic Surveys in the Northwest Pacific Ocean," Dewey R. Bracey, September 1963	.25

(2) Informal Reports

IMR M-1-63, "Preliminary Report on Special Aeromagnetic Survey -- Puerto Rico Trench, 1962," Wilburt H. Geddes and Leonard S. Dennis, May 1963

IMR M-3-63, "Analysis of Approximating Residual Total Magnetic Intensity by the Projection of the Anomalous Force on the Earth's Normal Field," A. L. Kontis and G. A. Young, September 1963

IMR M-4-63, "Marine Magnetic Profiles in the Pacific Ocean 1961-1962," Dewey R. Bracey, September 1963

IMR M-5-63, "Special Aeromagnetic Survey -- Mayaguez Area Puerto Rico," Leonard S. Dennis and Charles L. Gunn, Jr., June 1963

IMR M-6-63, "Analysis of Puerto Rico Trench Marine Magnetic Survey Data," Gerald D. Van Voorhis and Jerry C. Carroll, September 1963

IMR M-7-63, "Geologic Interpretation of Marine Magnetic Data in an Area Off the Southern Bahama Islands," Dewey R. Bracey, November 1963

IMR M-8-63, "Summary of Magnetization Computations for Kelvin Seamount," Gerald Van Voorhis and James Walczak, January 1964

IMR M-9-63, "A Marine Magnetic Survey of an Area in the Central Indian Ocean," Gordon D. Burton, January 1964

IMR M-10-63, "An Interpretation of an Aeromagnetic and Gravity Survey of Eastern Virginia," N. J. DiPiazza, December 1963

IMR M-2-64, "A Deep-towed Magnetometer System," J. C. Carroll and J. E. Walczak, June 1964

IR H-1-65, "A Geomagnetic Survey Northeast of Hispaniola," Gordon D. Burton, 1965

IR H-3-65, "An Airborne Geomagnetic Survey of the Reykjanes Ridge 1963," J. G. Baron, J. R. Heirtzler, and G. R. Lorentzen, 1965

IR H-4-65, "Proton Magnetometer Test On Board a Survey Aircraft," O. E. Avery and F. N. Waits, 1965

IR H-5-65, "An Airborne Geomagnetic Investigation of a Reported Declination Anomaly in Eastern Panama," J. G. Baron and G. R. Lorentzen, 1965

IR H-1-66, "Magnetic Anomalies North of Puerto Rico: Trend Removal with Orthogonal Polynomials," Gerald D. Van Voorhis and Thomas M. Davis, 1966

IR H-2-66, "Geophysical Profiles in the Northeastern Atlantic Ocean and the Mediterranean Sea, 1962-1963," D. E. Frankowski, 1966.

IR H-3-66, "Geomagnetic Measurements in the North Pacific Ocean Aboard USS REHOBOTH (AGS 50), 1961," R. F. Obrochta, 1966.

IR H-4-66, "Geomagnetic Measurements in the Pacific Ocean Aboard USNS CHARLES H. DAVIS (AGOR 5), 1964," D. R. Bracey, 1966.

IR H-5-66, "Shipboard Magnetic Survey of an Area North of the Lesser Antilles," O. E. Avery, J. C. Carroll, D. R. Bracey, 1966.

IR H-6-66, "Shipboard Magnetic Survey of an Area Northwest of Bermuda," Herbert K. Schneider, 1966.

(3) Other Reports and Publications

Special Pub. 66, "Airborne Geomagnetic Data, 1953-1961,"
1963

\$6.50

Special Pub. 66 Supplement No. 1, "Airborne Geomagnetic
Data, 1962-1963," 1965

2.00

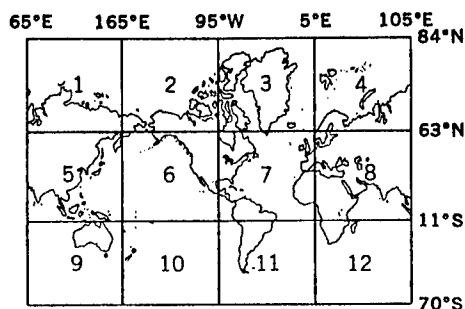
"Aeromagnetic Survey of the Gulf of Fonseca," Norbert
J. O'Neill, 1965

No Charge

B. Charts

(1) Epoch 1965.0 World Magnetic Charts: These charts of the magnetic elements were compiled using spherical harmonic analysis techniques by the U. S. Coast and Geodetic Survey in consultation with the Royal Greenwich Observatory and in collaboration with the U. S. Naval Oceanographic Office. The world charts employ the Mercator projection, scale 1:39,000,000 at the Equator, and extend from 84°N to 70°S. The polar charts are printed on a polar stereographic projection, scale 1:10,000,000 at 71° and extend from 55° latitude to the poles. The U. S. Naval Oceanographic Office publishes the Magnetic Variation Charts every 5 years (1965, 1970, 1975, etc.) and all other magnetic charts every 10 years (1965, 1975, 1985, etc.). The charts are available at \$1.00 each from the Distribution Control Department, U. S. Naval Oceanographic Office, Washington, D. C. 20390, or the Branch Oceanographic Offices.

<u>Chart Title</u>	<u>H.O. Chart No. and Type</u>	
Magnetic Inclination or Dip, Epoch 1965.0	1700	World
	1700N	North Polar
	1700S	South Polar
Magnetic Horizontal Intensity, Epoch 1965.0	1701	World
	1701N	North Polar
	1701S	South Polar
Magnetic Vertical Intensity, Epoch 1965.0	1702	World
	1702N	North Polar
	1702S	South Polar
Magnetic Total Intensity, Epoch 1965.0	1703	World
	1703N	North Polar
	1703S	South Polar
Magnetic Variation, Epoch 1965.0	1706	World
	1706N	North Polar
	1706S	South Polar
Magnetic Grid Variation, Epoch 1965.0	1706N-G	North Polar
	1706S-G	South Polar
Magnetic Variation, Epoch 1965.0; World Chart in 12 sheets (Mercator projection, scale 1:12,233,000 at the Equator)	15281 (1 through 12)	



15281 Series Index

(2) Preliminary Special Magnetic Survey Charts. The following preliminary charts presenting data from special magnetic surveys are available on request from the Magnetism Division, U. S. Naval Oceanographic Office, Washington, D. C. 20390:

Charleston Rise Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1957

North Arabian Sea Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1961

Midway Islands Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1963

Westmann Islands Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1964

Skagerrak Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1958

St. Paul and St. Peter Rocks Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1963

Pensacola Gulf Coast Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1959

Guardian Bank Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1964

Milwaukee Bank Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1963

North Magnetic Pole Inclination Contour Chart, Aeromagnetic Survey, 1960

South Magnetic Pole Inclination Contour Chart, Aeromagnetic Survey, 1960

Central South Dakota Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1964

Gulf of Fonseca Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1964

Eastern Mediterranean Sea Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1957

Western Mediterranean Sea Total Magnetic Intensity Contour Chart, Aeromagnetic Survey, 1958

Western Tyrrhenian Sea Total Magnetic Intensity Contour Chart,
Aeromagnetic Survey, 1957

C. Data

Original geomagnetic data recordings can not be released outside the U. S. Naval Oceanographic Office. The data can be inspected, however, upon prior arrangement with the Director of the Magnetics Division. Some data are available on microfilm and can be provided upon special request.

1. Microfilm Copies of Project MAGNET Total Magnetic Intensity Recordings

Microfilm copies of total magnetic intensity analog traces recorded on Project MAGNET from 1953 through 1963 are available from the Distribution Control Department, U. S. Naval Oceanographic Office, Washington, D. C. 20390. A tabulation of aircraft altitude and position for each five minutes of time is included with each profile. A microfilm index, which sequentially lists survey tracks for each microfilm reel, and a set of track location charts are presented on the following pages. Full scale track location charts (scale 1:12,250,000) are available on request.

Microfilm Reel of Project MAGNET Total Intensity Data	\$ 6.00 ea
Complete Set of 9 Reels	\$ 54.00
(Minimum order is one reel)	

MICROFILM REEL INDEX FOR PROJECT MAGNET TRACKS

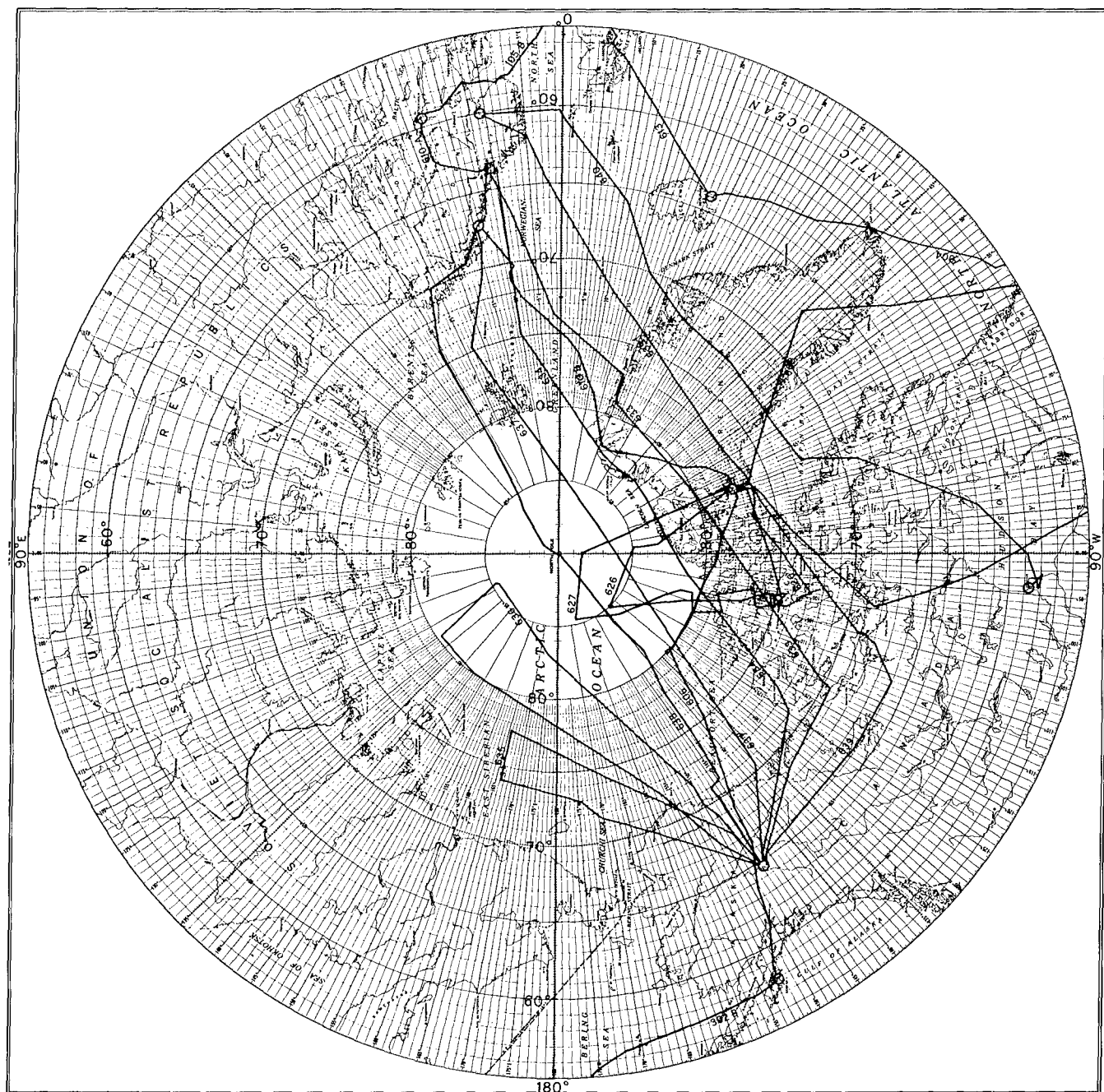
Reel <u>1</u>	Reel <u>1</u>	Reel <u>2</u>	Reel <u>2</u>	Reel <u>3</u>	Reel <u>4</u>	Reel <u>4</u>	Reel <u>5</u>	Reel <u>5</u>
P001	0003	0016	0061	0069	T006B	T106	T203	123
P002	0004	0017	0062	0070	T008	T107	T204	126
P003	0005	0018	0063	0071	T012	T108A	T205	140
P004	0006	0019	0064	0072	T013	T108B	T206	141
P005	0007	0020	0065	0073	T014	T109A	T207	201A
P006	0008	0021	0066	0074	T015	T109B	T208	201B
P007	0009	0022	0067	0075	T015D	T112	T209	201C
P008	0010	0023	0068	0076	T017A	T113	T210	203A
P009	0011	0024		0077	T020	T114	T211	203B
P010	0012	0025		0078	T024	T115	T212	204A
P011	0013	0026		0079	T025	T116	T213	
P012	0014	0027		0080	T026	T201	T215	
P013	0015	0028		0081	T028	T202	T216	
P014		0029		0082	T030		T224A	
P015		0030		0083	T031		T224B	
P016		0031		0084	T032		T301	
P017		0032		0085	T033		T302	
P018		0033		0086	T034		T307	
P019		0034		0087	T035		T400	
P020		0035		0088	T041		T401	
P021		0036		0089	T042		T405	
P022		0037		T001A	T043		T406	
P023		0038		T001B	T044		T407	
P024		0039		T003A	T045		T410	
P025		0040		T003B	T046		T412	
P026		0041		T005	T047A		T413	
P027		0042		T006A	T047B		T414	
P028		0043			T058		T415	
P029		0044			T060		T501	
P030		0045			T061		102	
P031		0046			T062		104A	
P032		0047			T063		104B	
P033		0048			T064A		105A	
P034		0049			T064B		105B	
P035		0050			T065		106	
P036		0051			T066		107	
P037		0052			T069		108	
P038		0053			T074		109	
P039		0054			T075		110	
P040		0055			T076		111A	
P041		0056			T101		111B	
P042		0057			T102		112	
P043		0058			T103		113	
0001		0059			T104		114	
0002		0060			T105		115	

MICROFILM REEL INDEX FOR PROJECT MAGNET TRACKS

<u>Reel</u> <u>6</u>	<u>Reel</u> <u>7</u>	<u>Reel</u> <u>8</u>	<u>Reel</u> <u>9</u>
204B	343	437	604
205A	344	440	606
205B	345	441	610A
206	345A	442	610B
211	347	443	613
215	348	444	626
217	349	445	627
218	350	447	633
301	353	449	634
302A	354	450	635
302B	355	451A	636
304	356	451B	637
305A	357	452	638
306	358	501	639
307	359A	503	640
308A	359B	505	701
308B	360	507	706
308C	361	509	707
309	362A	510	708
310	362B	511	709
311	364	512	715
312	375	512B	716
316	401	513	717
318	402	514B	
320	404	515C	
321	405	516A	
322A	407	517	
322B	408	520	
323B	411	521	
324	415	523	
325A	416	526	
325B	421	527	
326	425	529	
327A	426	530	
329	428	531	
330	431	532	
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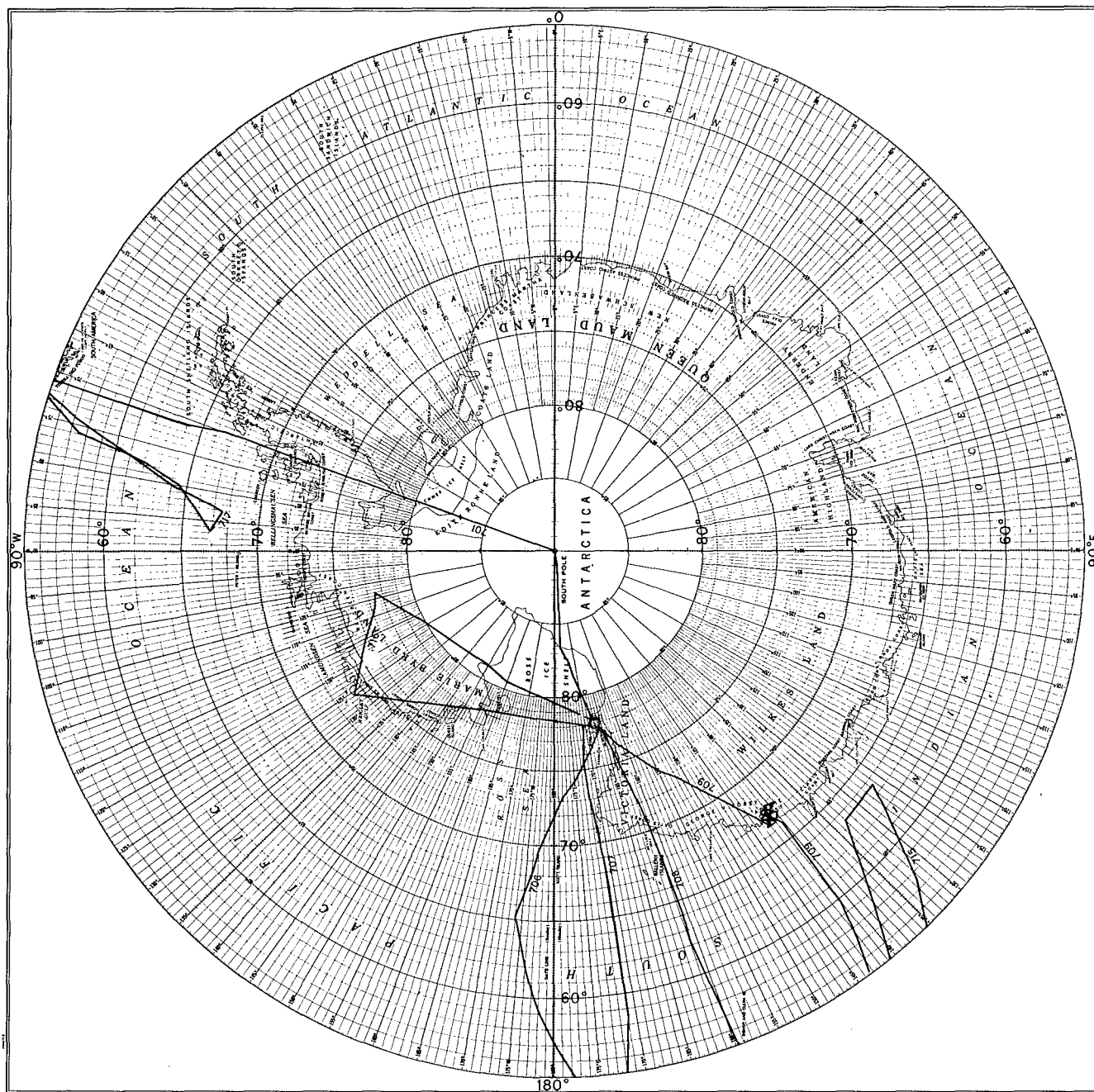
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ANTARCTIC



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CHART 1 OF 12

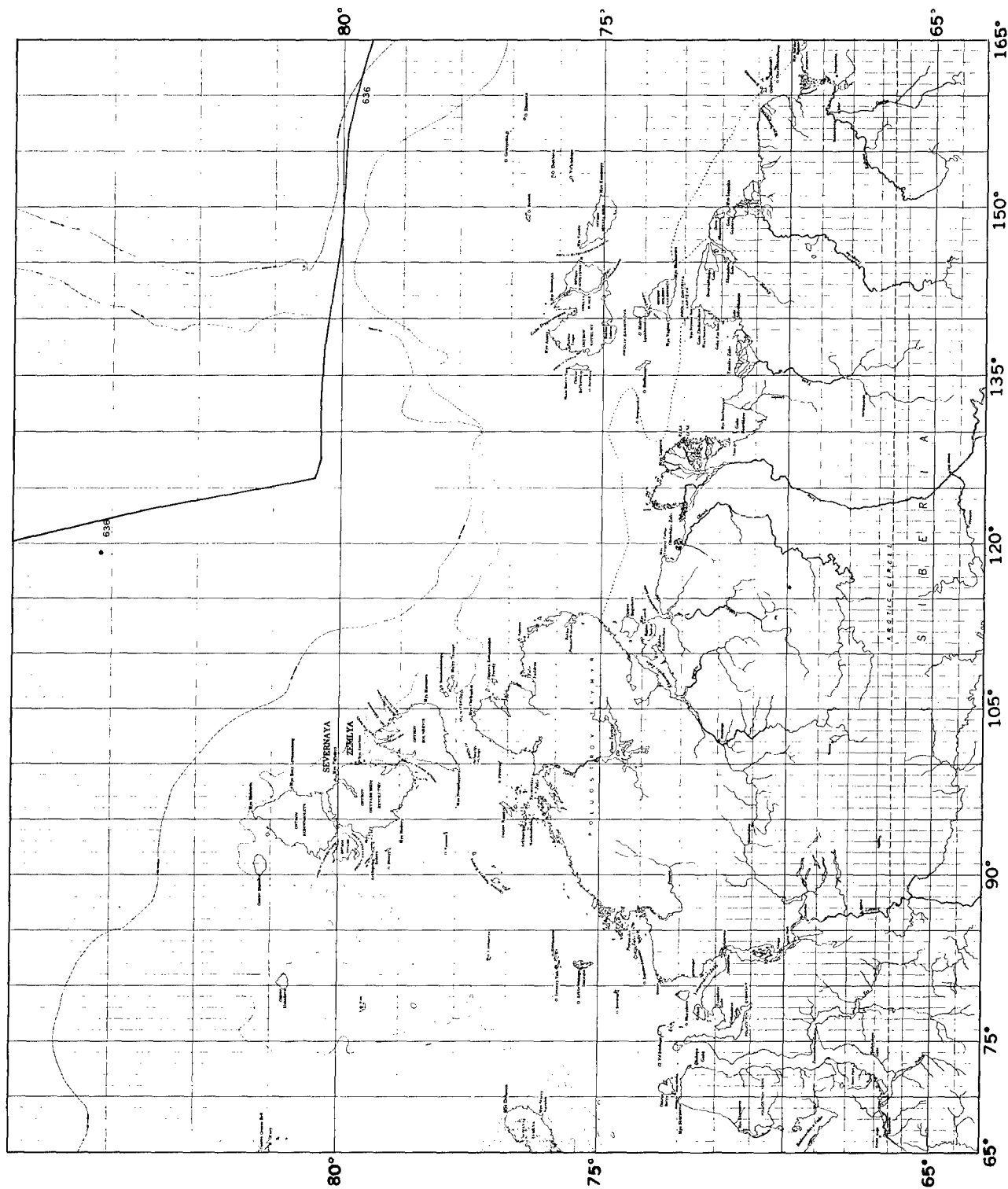
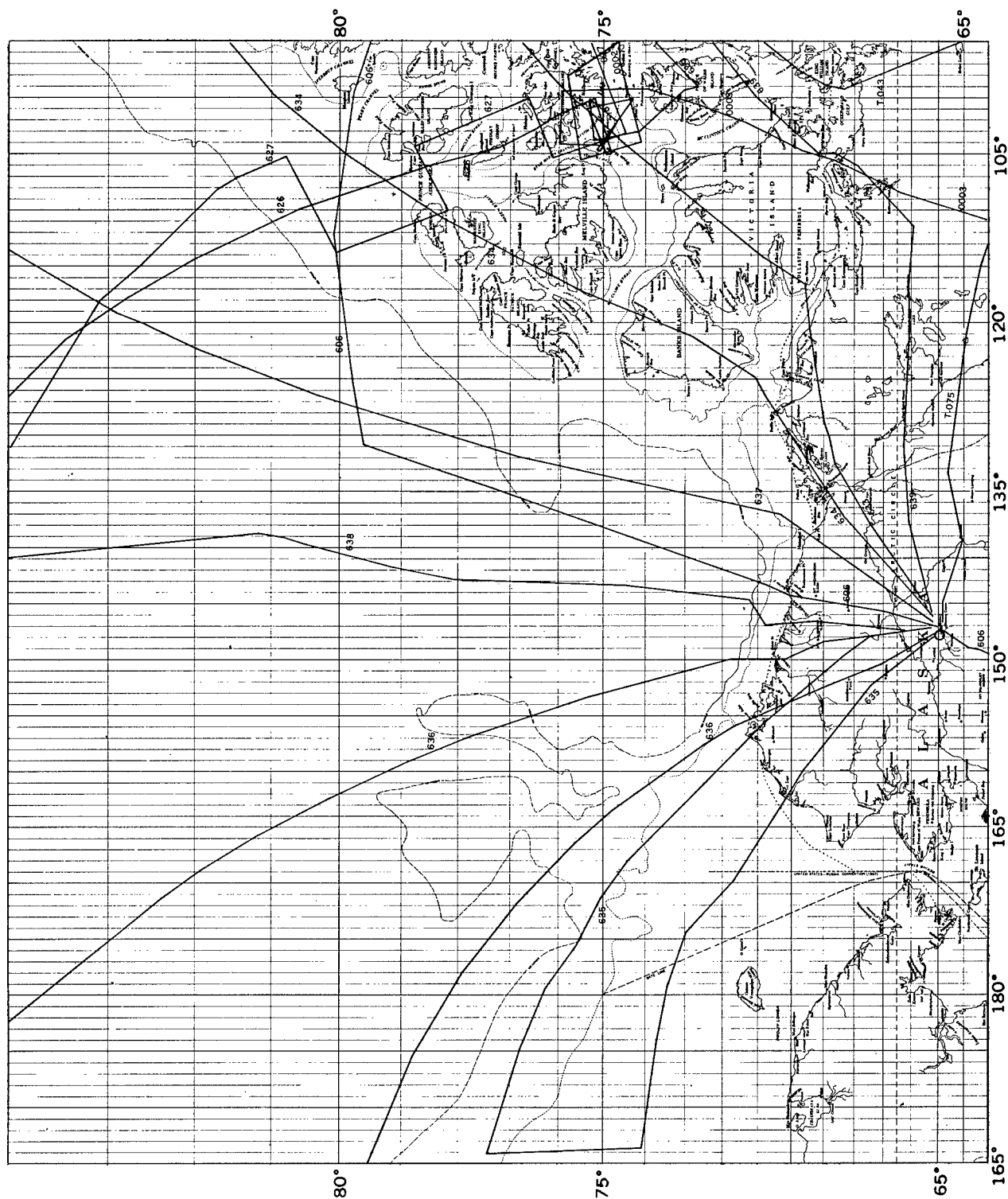


CHART 2 OF 12



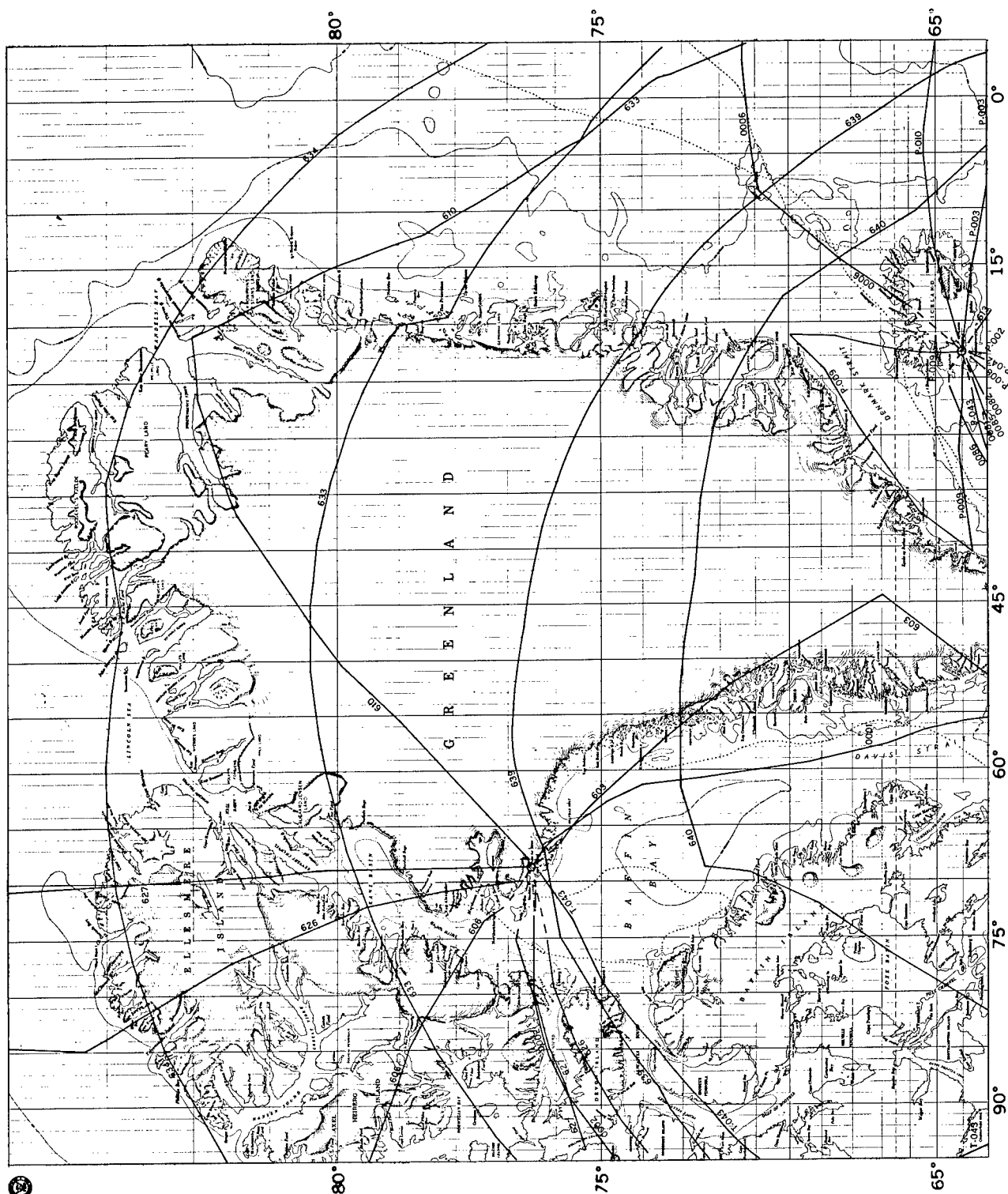
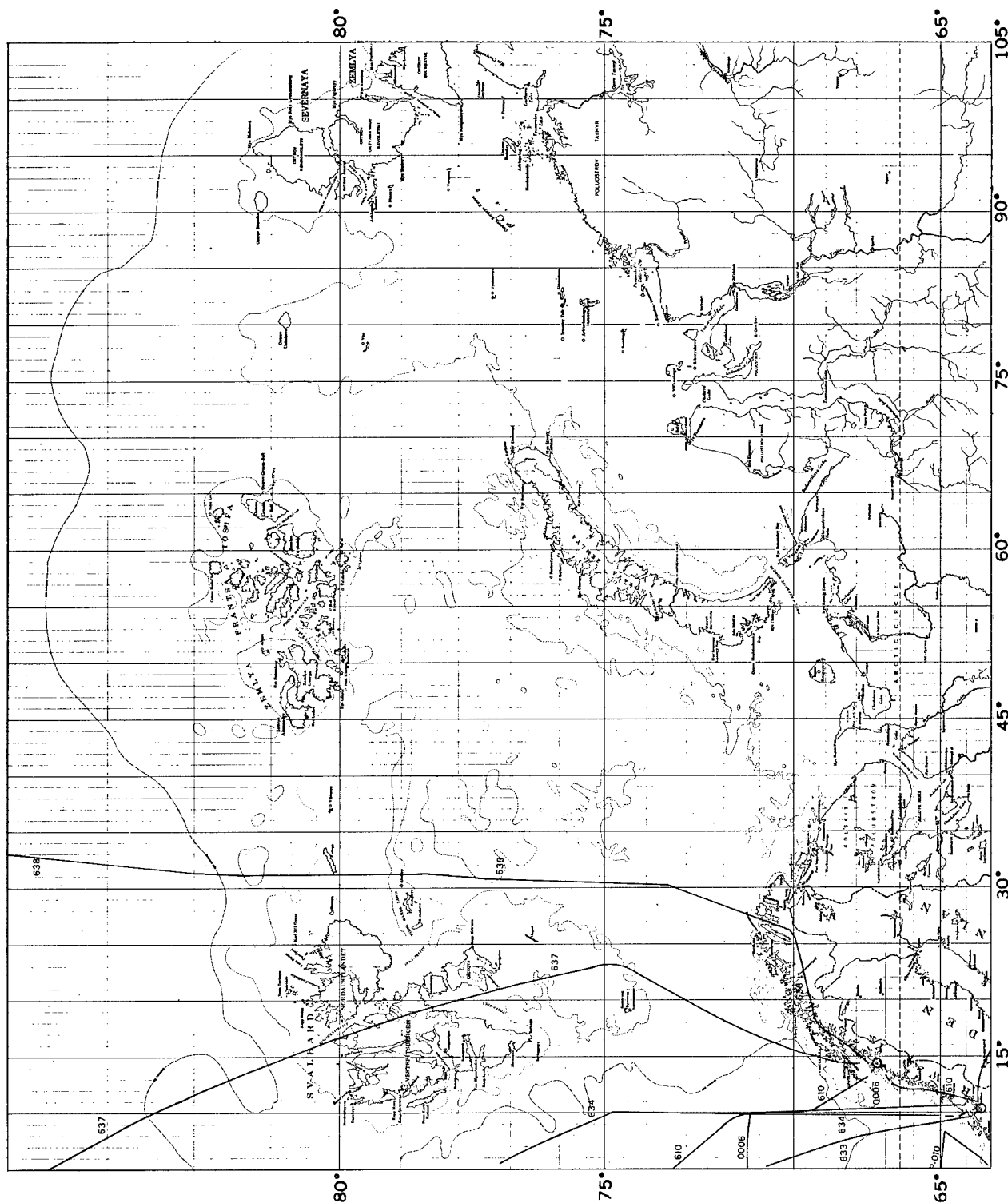
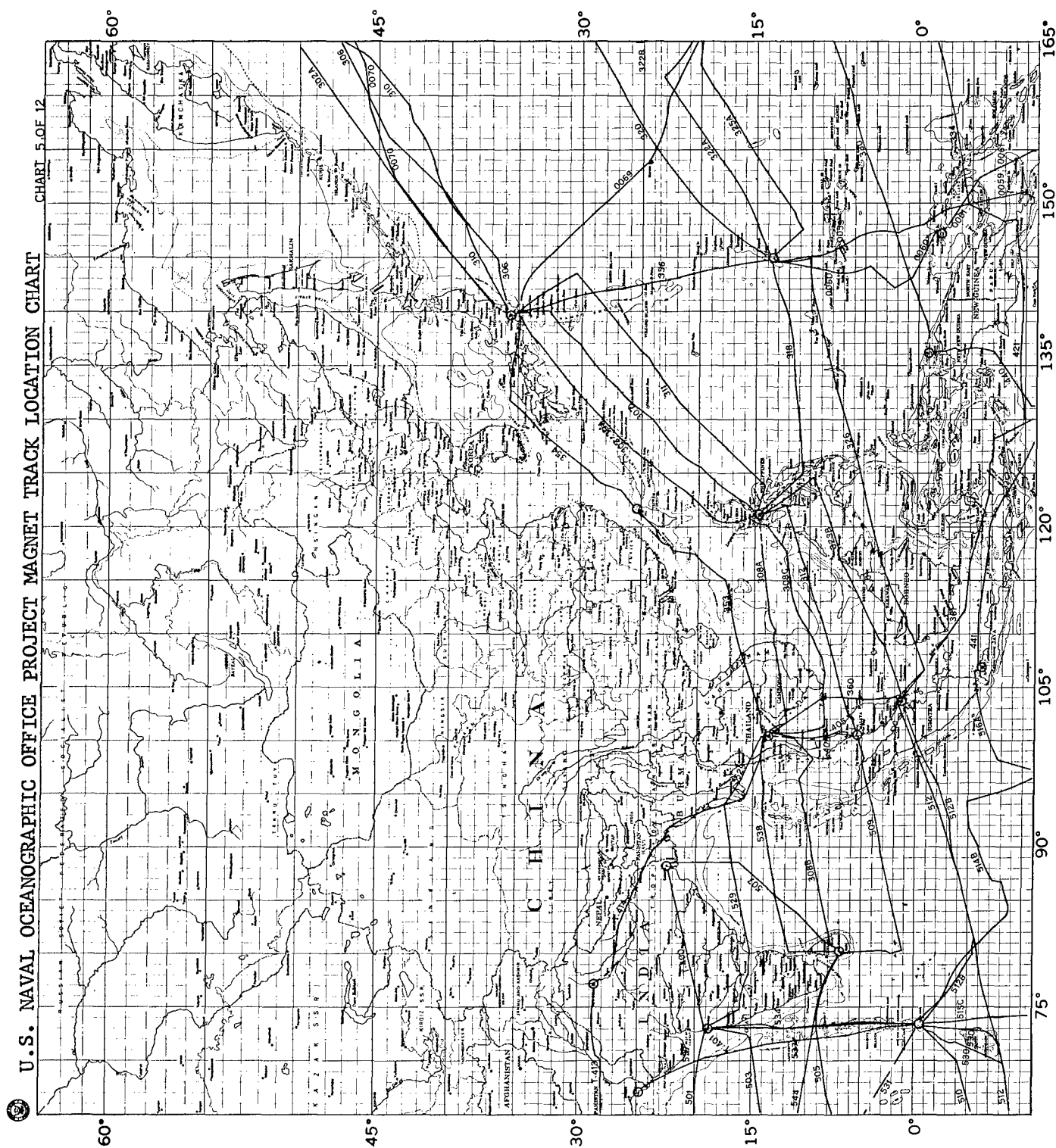


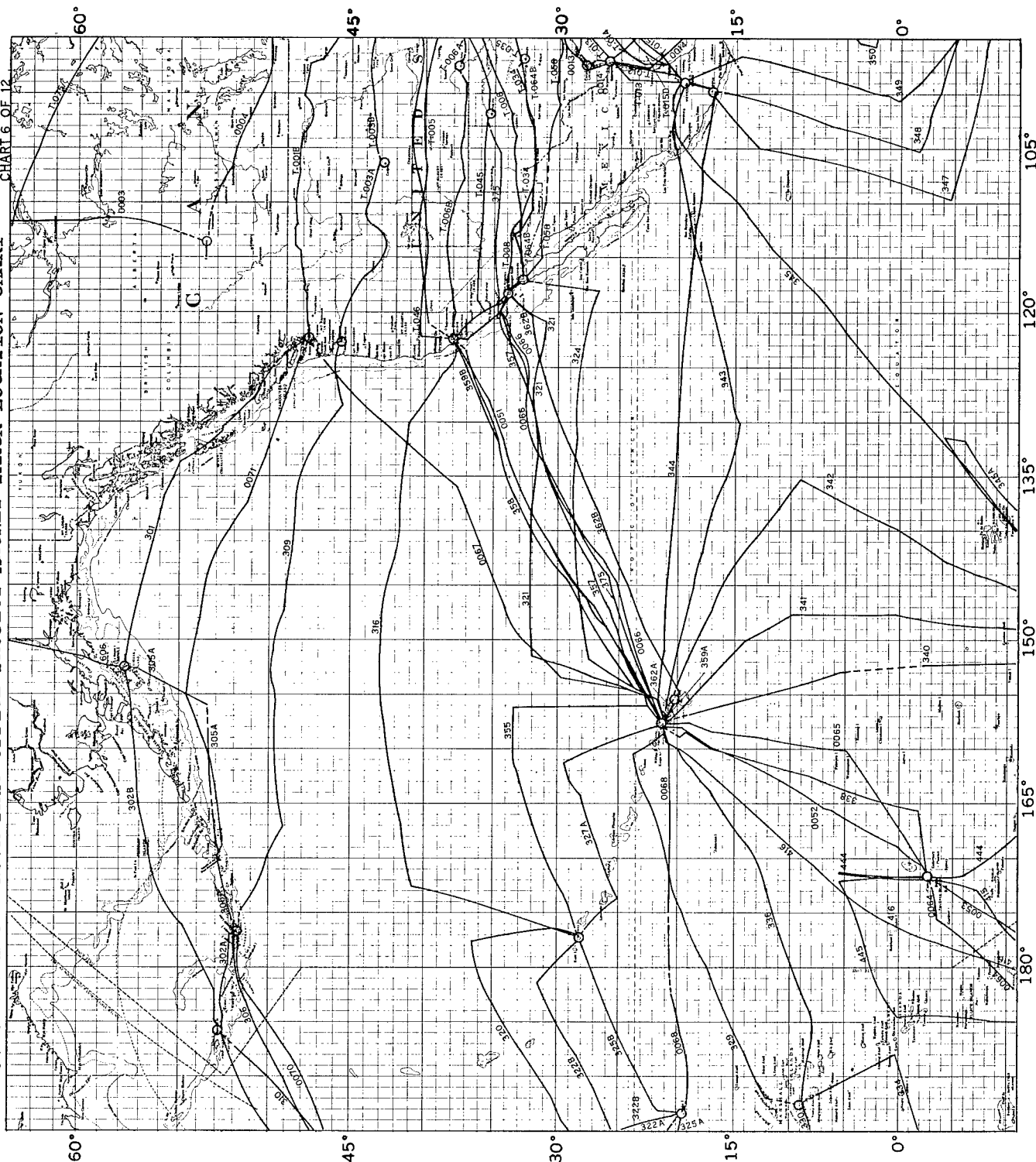
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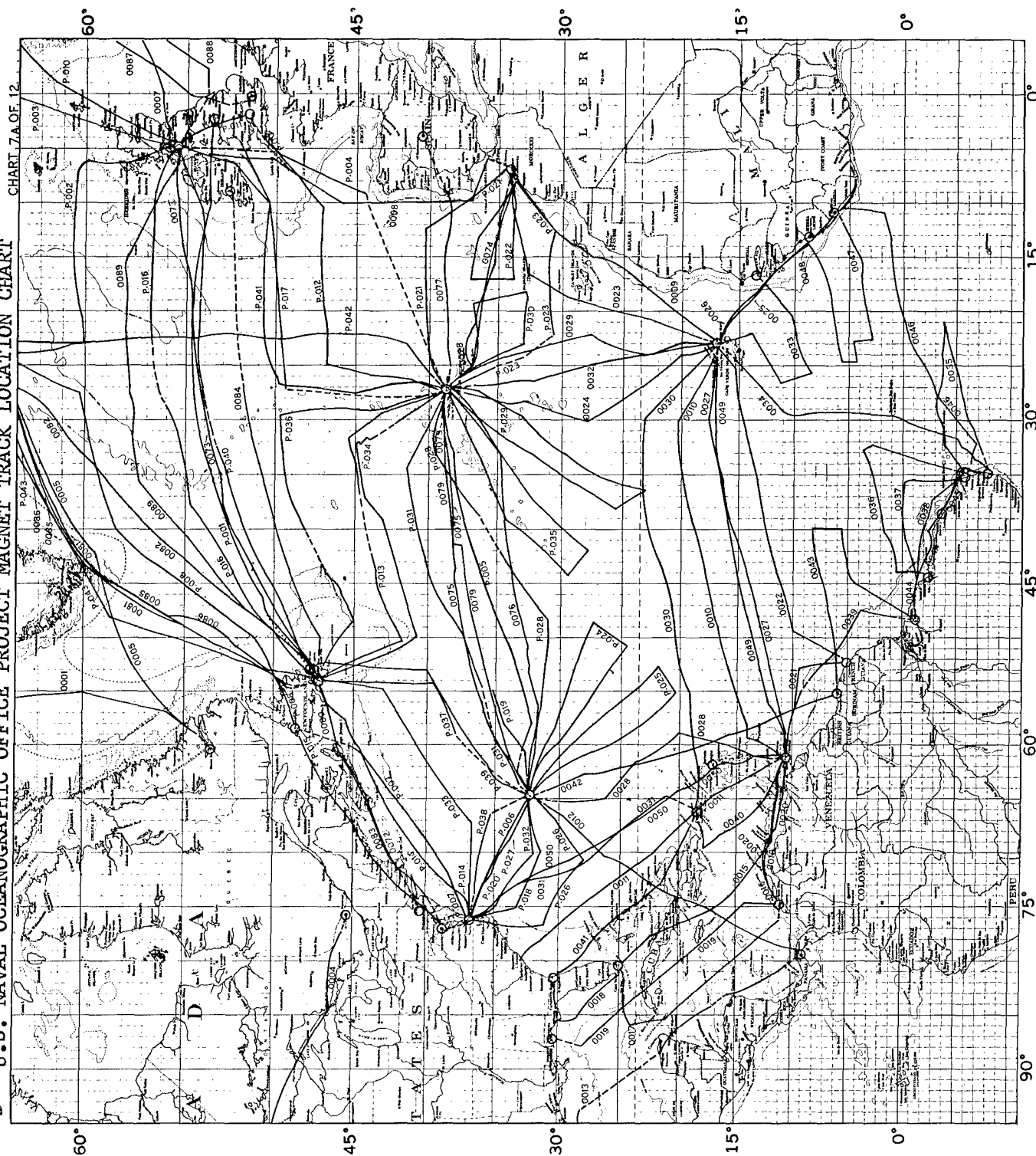


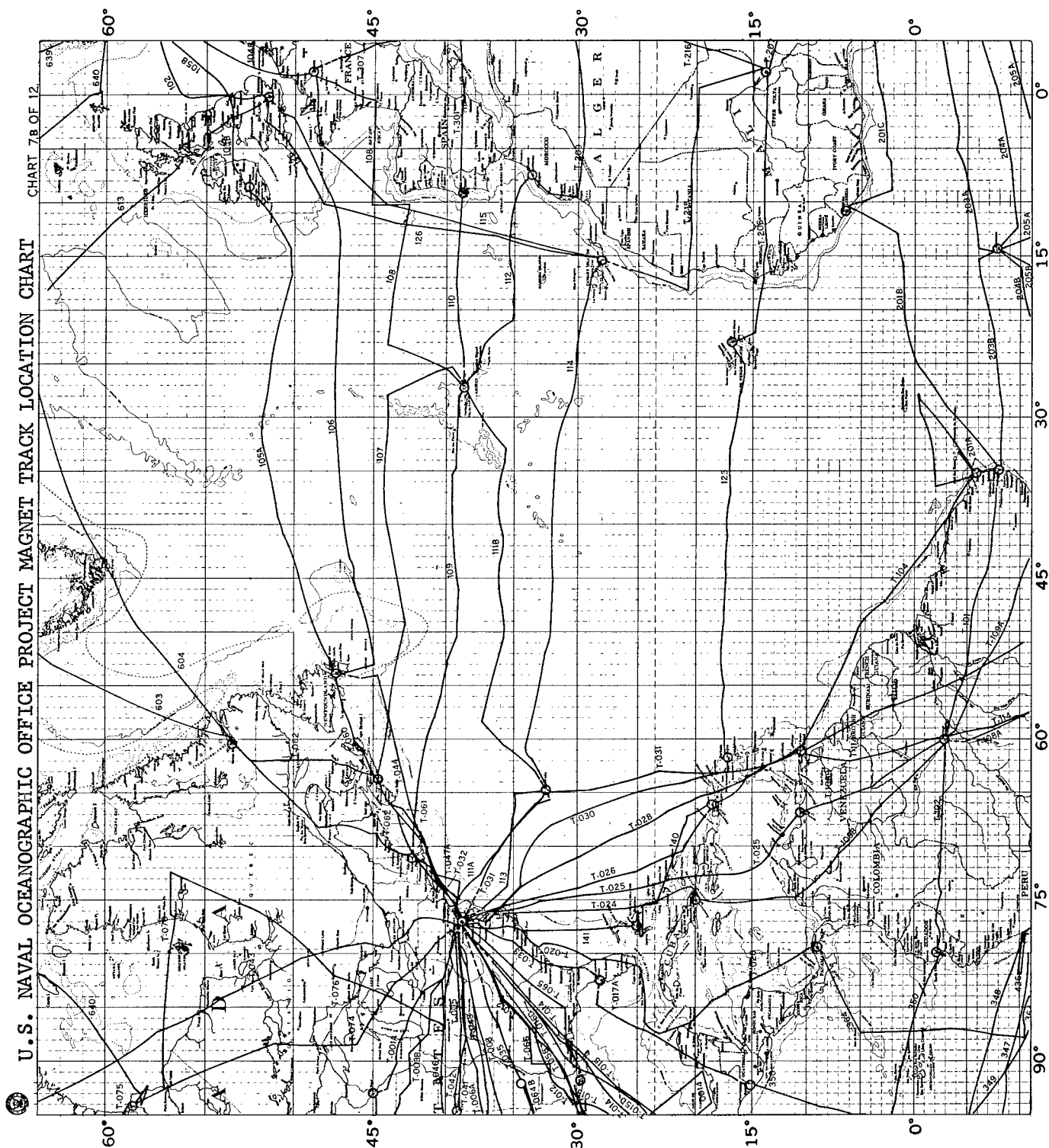
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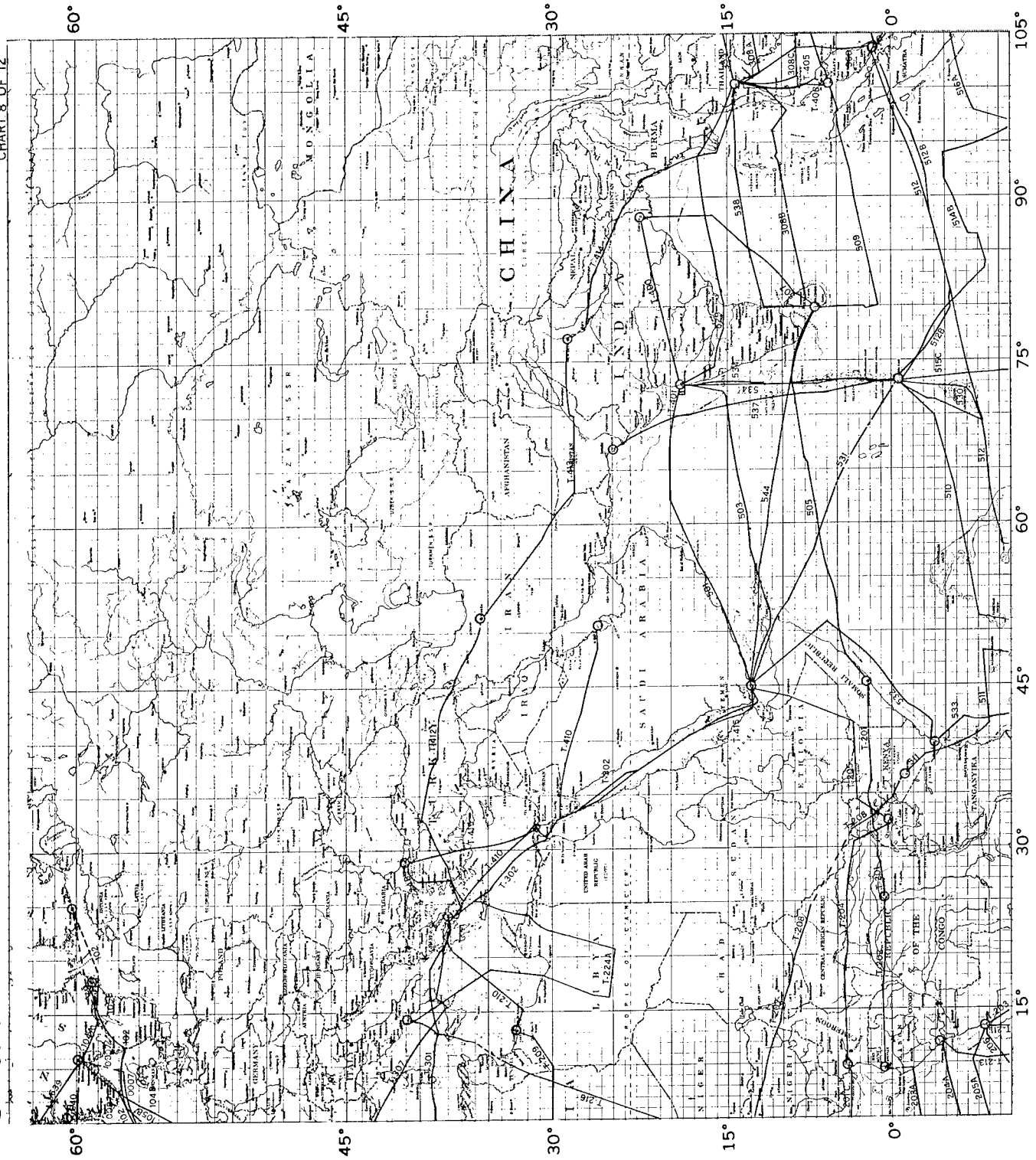
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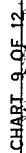


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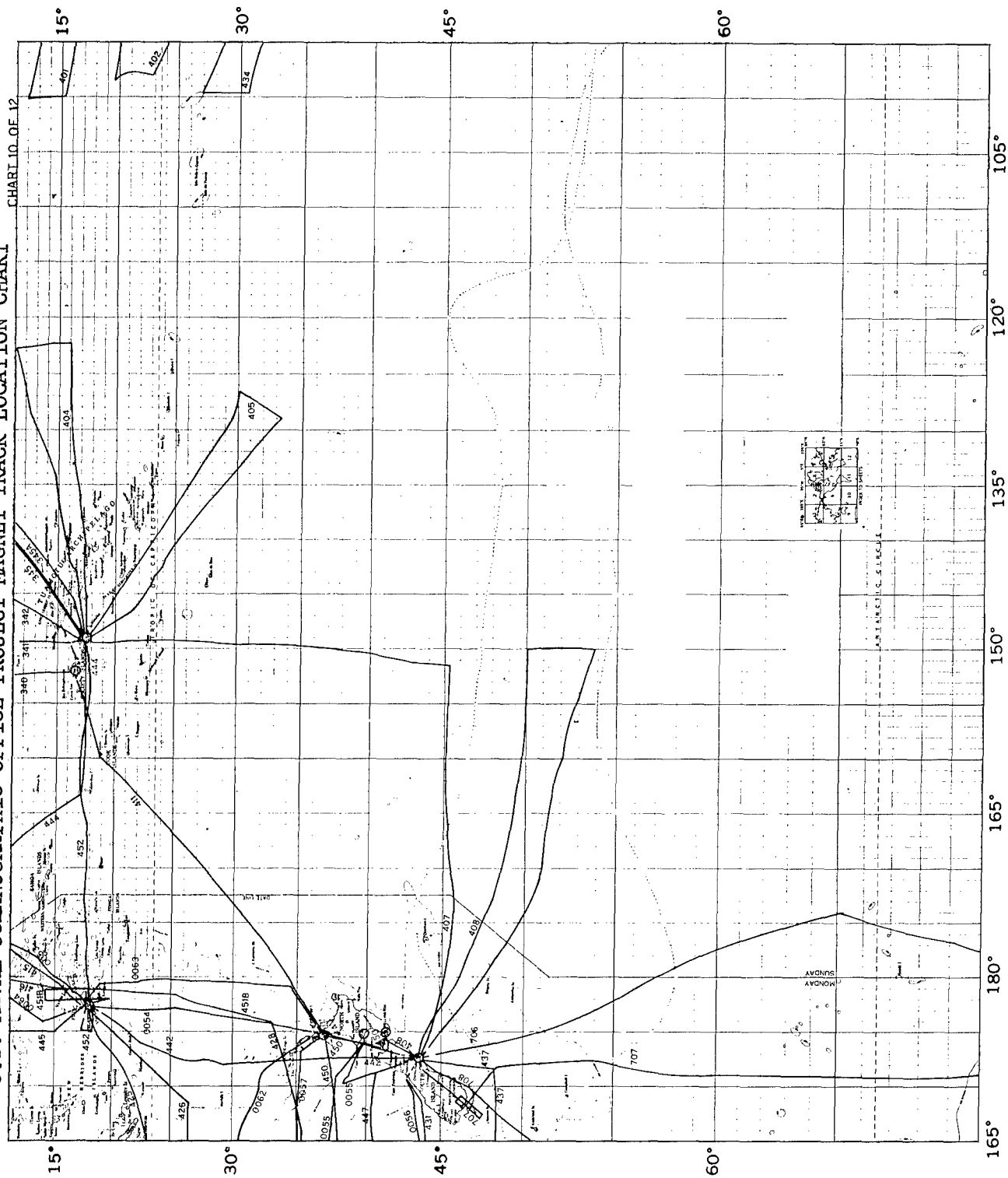


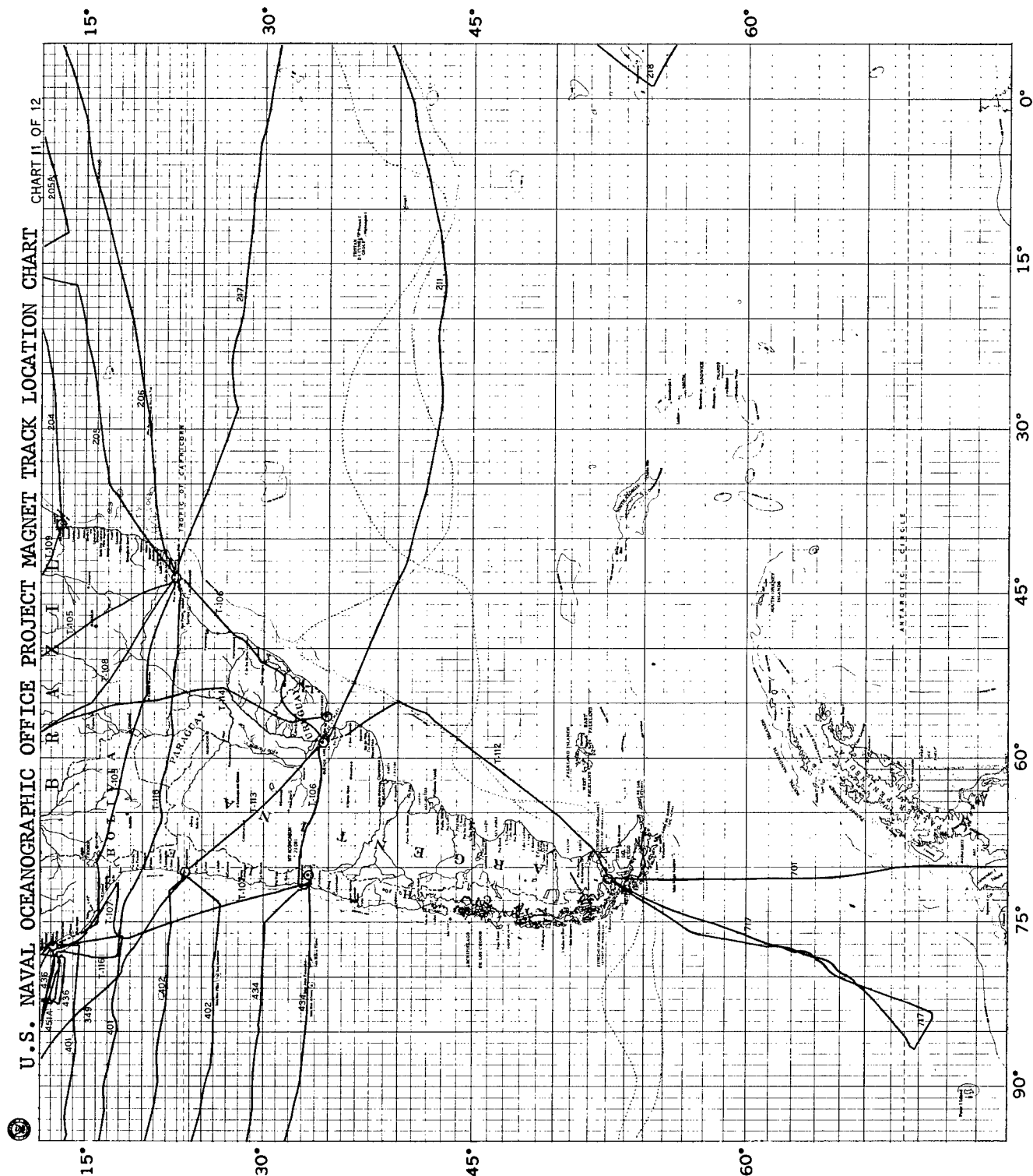






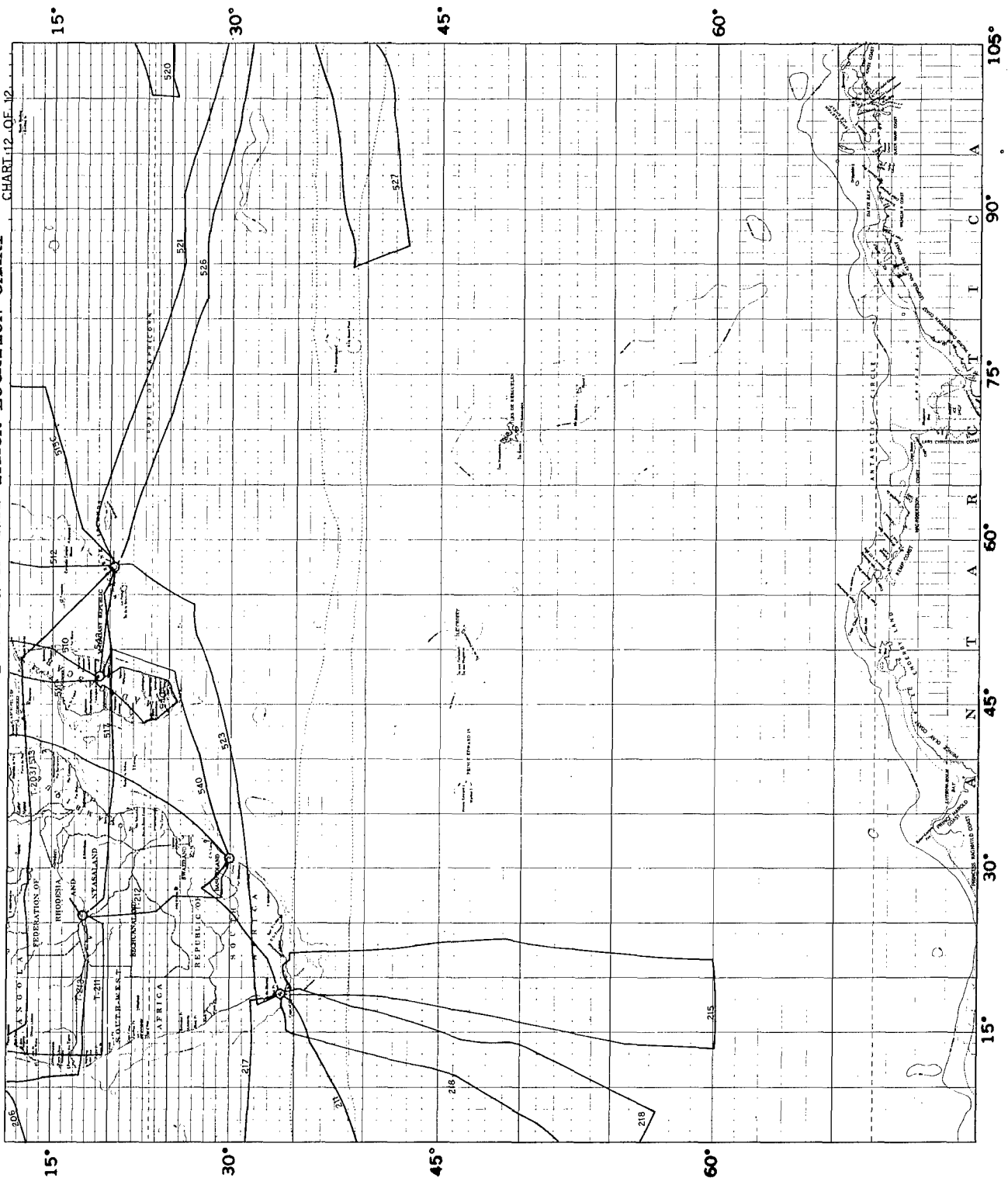
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