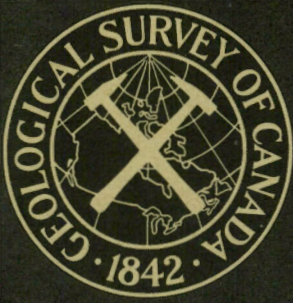


59-13



GEOLOGICAL  
SURVEY  
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CANADA

DEPARTMENT OF MINES  
AND TECHNICAL SURVEYS

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PAPER 59-13

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FROM CHURCHILL TO CORAL HARBOUR  
AND CHURCHILL TO GREAT WHALE RIVER

Margaret E. Bower

Price 50 cents

*July 5*  
1960



G E O L O G I C A L S U R V E Y  
O F C A N A D A

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By

Margaret E. Bower

D E P A R T M E N T O F  
M I N E S A N D T E C H N I C A L S U R V E Y S  
C A N A D A



## AEROMAGNETIC SURVEYS ACROSS HUDSON BAY FROM CHURCHILL TO CORAL HARBOUR AND CHURCHILL TO GREAT WHALE RIVER

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Two aeromagnetic flights across Hudson Bay were made by the Geological Survey of Canada while enroute to other projects (see Fig. 1). In June 1955, a flight was made from Churchill, Manitoba to Coral Harbour, Southampton Island, a distance of 510 miles. In August 1957, a line was flown from Churchill to Great Whale River, Quebec, a distance of 660 miles. The latter flight passed over the extreme southern end of the Belcher Islands.

### Flight 1 - Churchill to Coral Harbour

The aircraft was flown at an elevation of about 2,500 feet above sea-level. The flight path is known to be approximately a straight line between Churchill and Coral Harbour, although the camera was not in operation during flight and a small amount of deviation from this path is probable. The aeromagnetic profile has been corrected for regional variation. The average magnetic gradient is -3.2 gammas per mile in the direction of flight. The rate of decrease varies from 0.45 gammas per mile near Churchill to 3.75 gammas per mile at Coral Harbour. The magnetic records of the Dominion Observatory indicate that there was a maximum magnetic diurnal variation of about 25 gammas during the time of flight, therefore no correction has been made for diurnal drift.

### Flight 2 - Churchill to Great Whale River

The aircraft was flown at a constant elevation of 1,000 feet above both land and water. Over land the flight path was determined by means of continuous strip film. A constant heading was maintained over the water, but the flight path there could not be determined exactly. The aeromagnetic profile has been corrected for regional variation. The average magnetic gradient is -1.9 gammas per mile in the direction of flight. The rate of decrease varies from 1.75 gammas per mile near Churchill to 2.6 gammas per mile at Great Whale River, with a region of increasing magnetic intensity about 100 miles east of Churchill. As with the previous flight, no correction for diurnal drift was necessary.

The aeromagnetic data on the following pages have been compiled at a scale of 4 miles to 1 inch. The geomagnetic and aeromagnetic profiles have been plotted together for comparison. The vertical scale is in gammas, absolute total magnetic field, and refers to both of the profiles. The land elevation was obtained from topographical maps, and the depth of water from the Hydrographic Chart of Hudson Bay. None of this information was sufficiently detailed to give an accurate profile. Where the flight lines coincide with the position of a sounding, the depth has been shown by an 'x'. Between soundings the depths are interpolated.

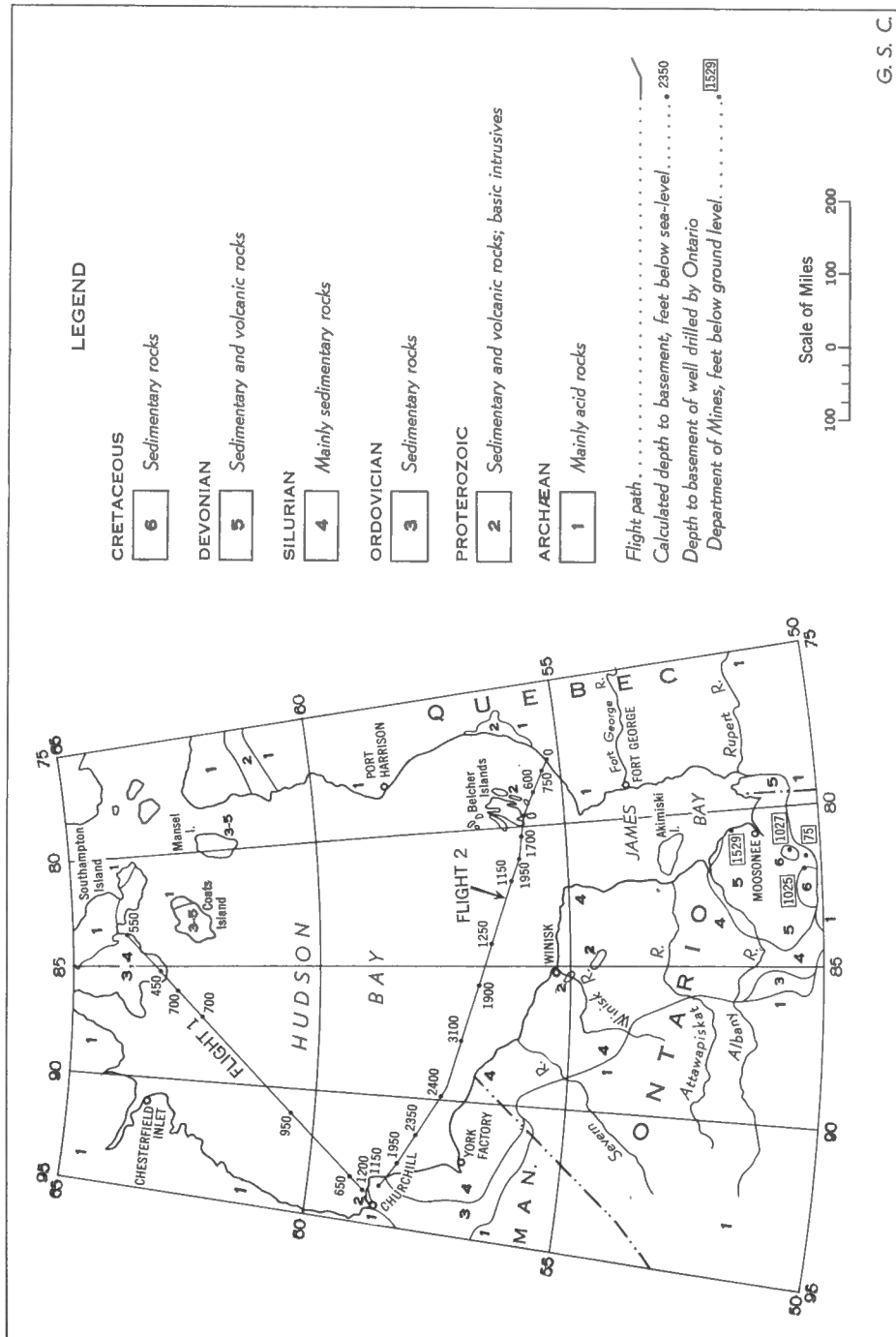


Figure 1. Sketch map of Hudson Bay area showing aeromagnetic flight paths, geology, and depths to basement rock

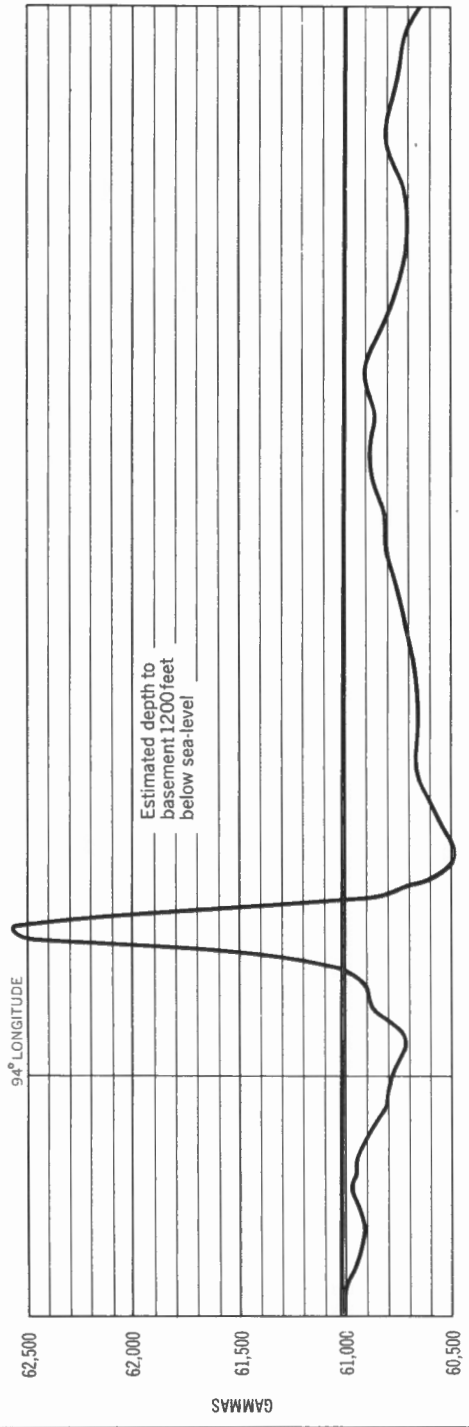
Wherever suitable aeromagnetic anomalies could be found, calculations were made to determine the depth to the Precambrian basement. It can be assumed that the overlying sedimentary rocks have negligible magnetic effect, and that the anomalies are caused entirely by the underlying crystalline rock. Both the 'half slope'<sup>1</sup> and 'half width'<sup>2</sup> methods of depth determination were used. The results obtained are maximum depths, that is, the rock causing the anomaly will be at or above the depth calculated.

Although the calculated depths of the Precambrian rock cannot be considered as exact values, they do indicate that there is no great thickening of the sedimentary rock in the areas traversed. To the south, in the James Bay Lowland, the Ontario Department of Mines has drilled a number of test wells, some of which reached the basement<sup>3</sup>. The maximum thicknesses of the sedimentary rocks were found to be: Ordovician, 600 feet; Silurian, 800 feet; and Devonian, 1,000 feet. It would appear from the depth calculations of Flight 2 that the sediments in that region are of the same order of thickness as those farther south.

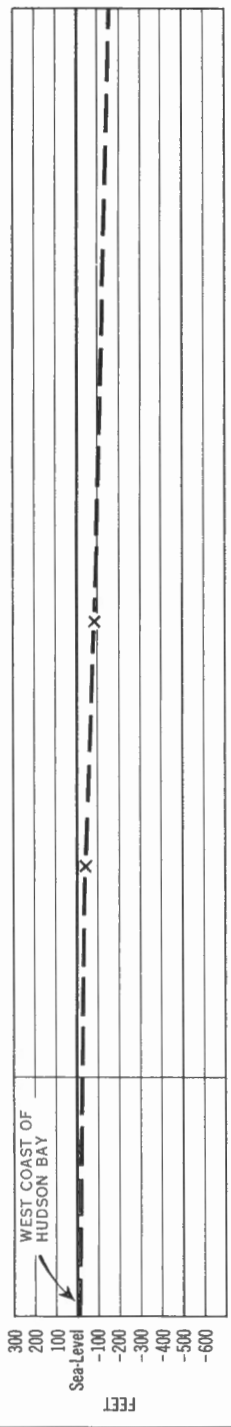
The most notable feature of Flight 1 is the 6,500-gamma anomaly about 45 miles from Churchill. It may be caused by a localized belt of Precambrian iron-formation similar to those that occur on the land to the west. The large anomaly north of Seal River, Manitoba is due to this type of rock<sup>4</sup>.

1. Peters, L. J.: The Direct Approach to Magnetic Interpretation and Its Practical Applications; Geophysics, vol. 14, No. 3, (1949).
2. Henderson, R. G. and Zeitz, I.: Analysis of Total Magnetic Intensity Anomalies Produced by Point and Line Sources; Geophysics, vol. 13, No. 3, (1948).
3. Ontario Department of Mines, Sixty-first Annual Report; vol. LXI, pt. 6, (1953).
4. Geological Survey of Canada: Magnetic Anomaly North of Seal River, Manitoba; Map No. 550G, (1957).

### FLIGHT 1



### AEROMAGNETIC AND GEOMAGNETIC PROFILES

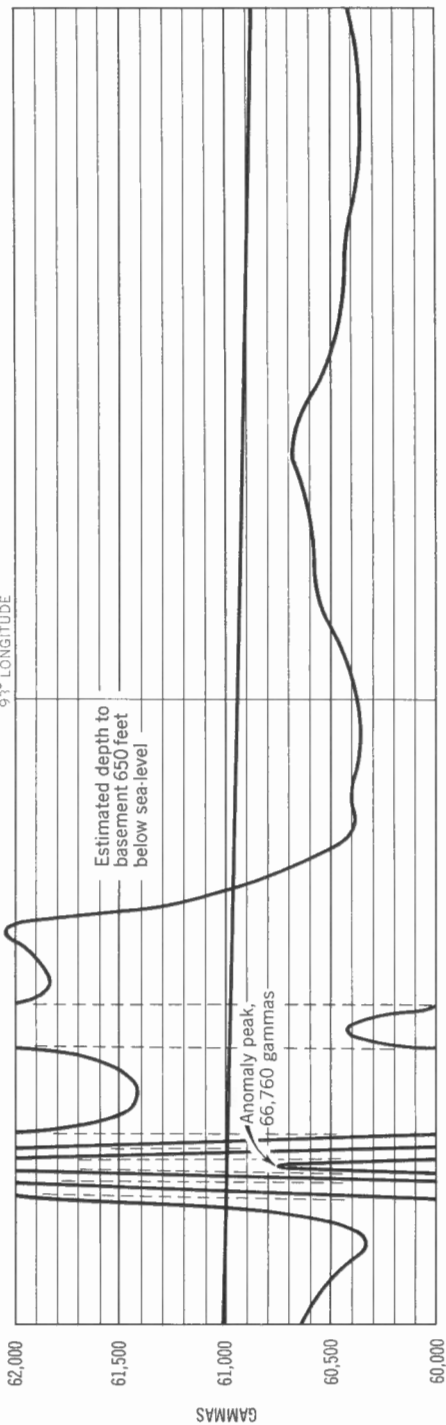


Scale of Miles

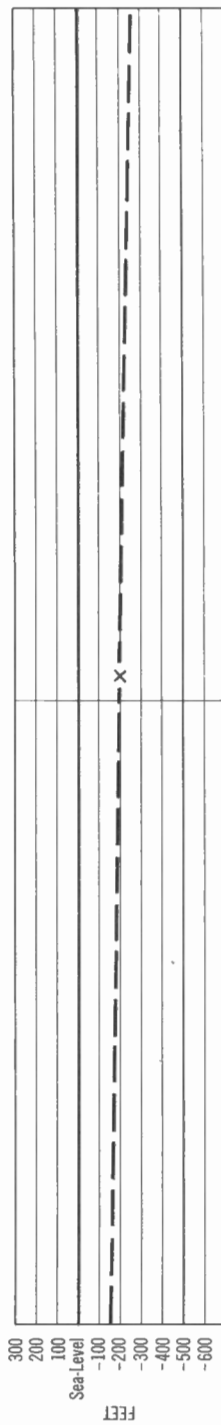


FLIGHT 1

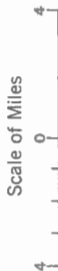
93° LONGITUDE



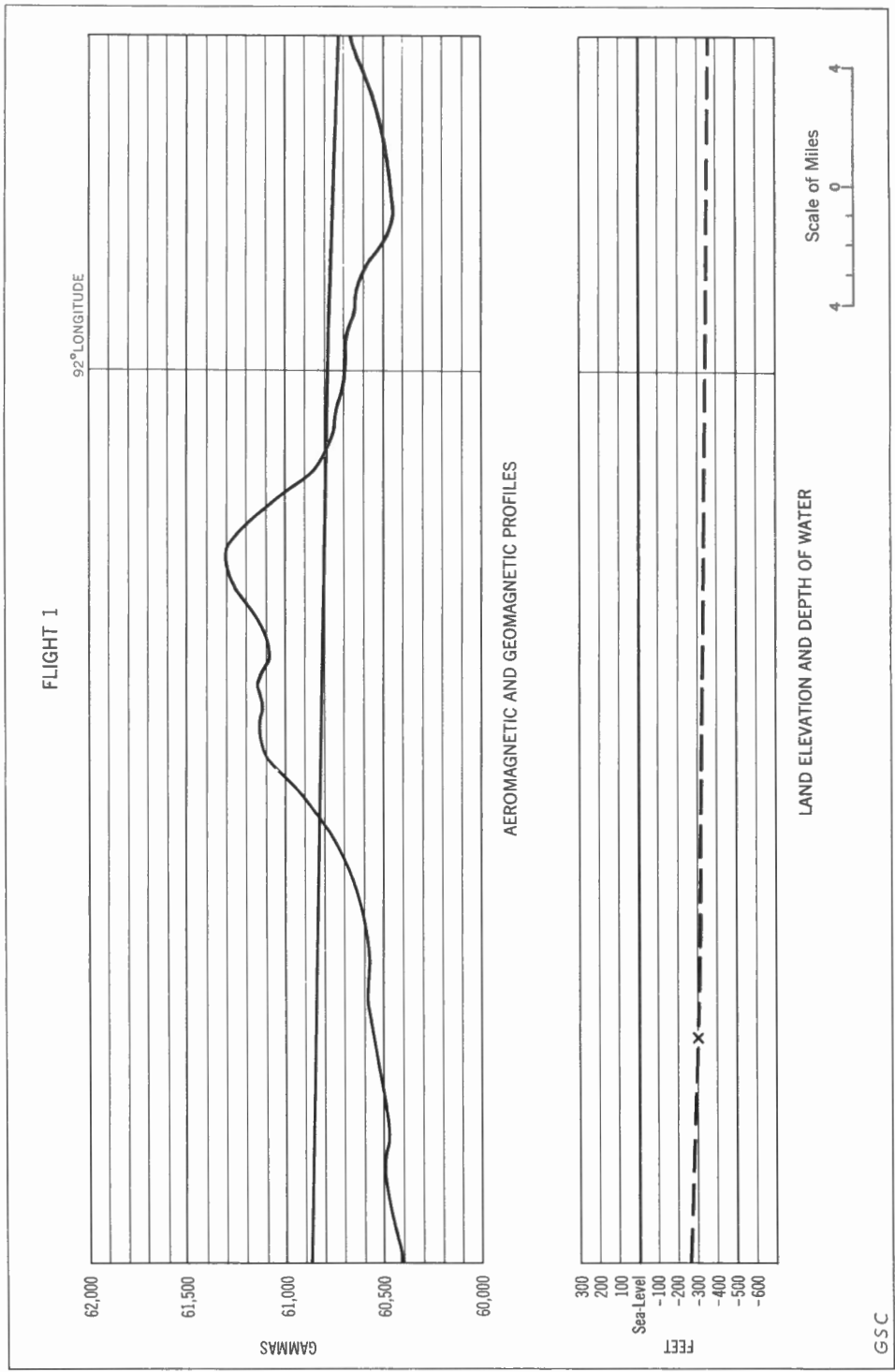
AEROMAGNETIC AND GEOMAGNETIC PROFILES



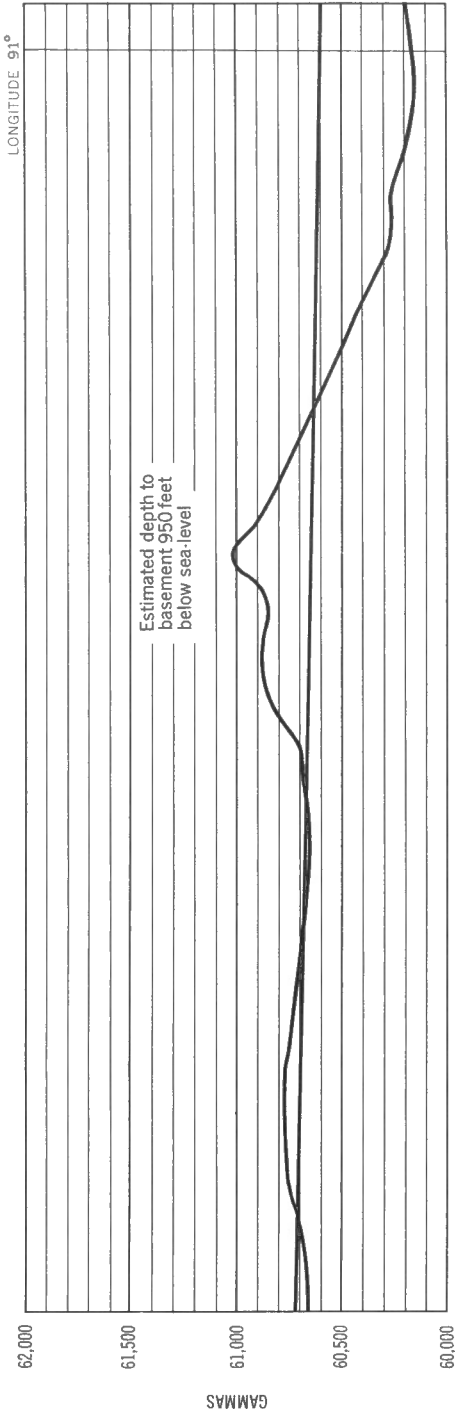
LAND ELEVATION AND DEPTH OF WATER



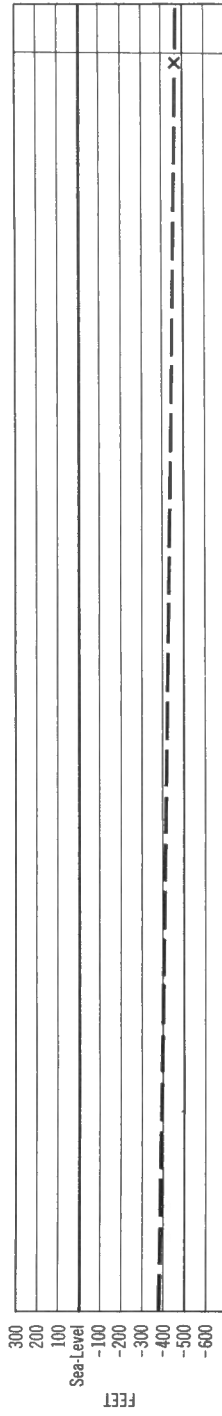




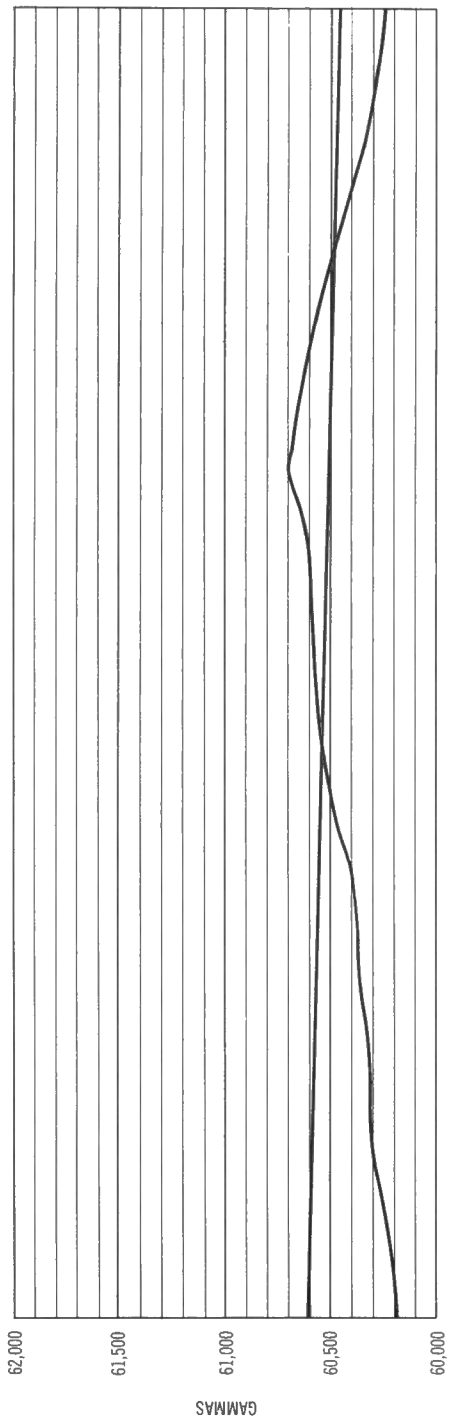
FLIGHT 1



AEROMAGNETIC AND GEOMAGNETIC PROFILES



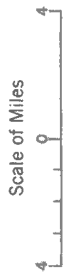
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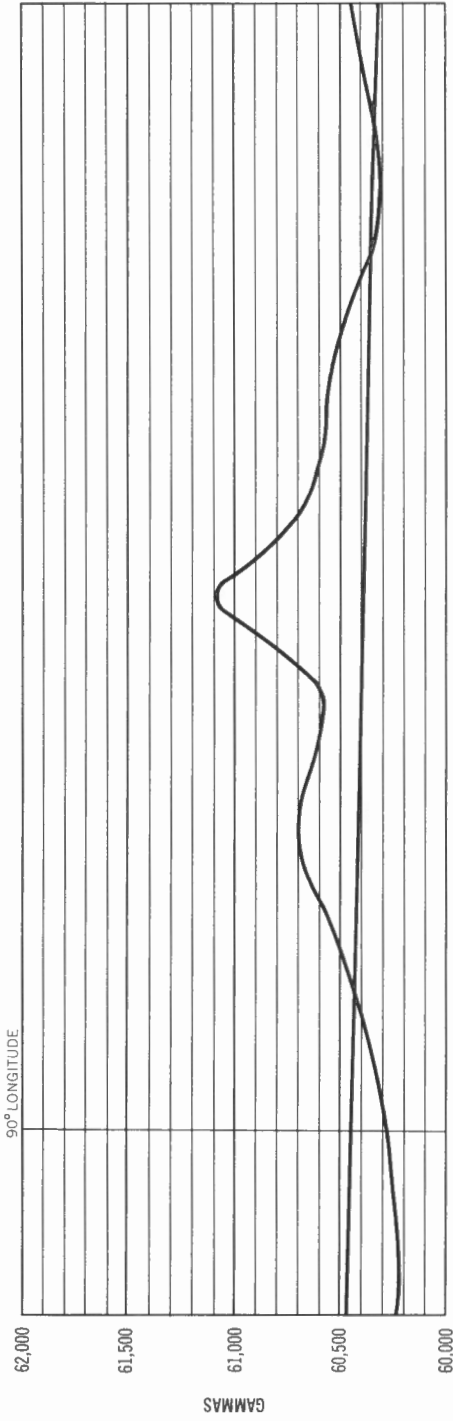
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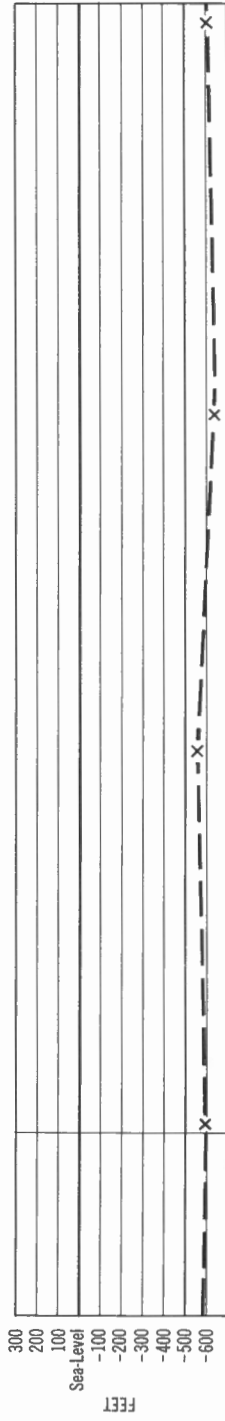
LAND ELEVATION AND DEPTH OF WATER



FLIGHT 1

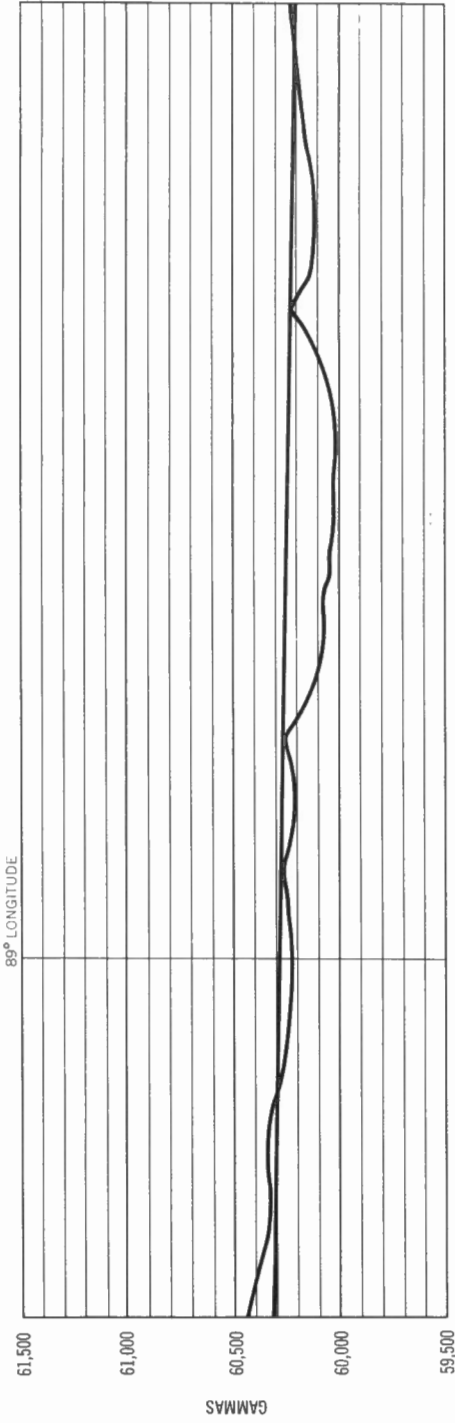


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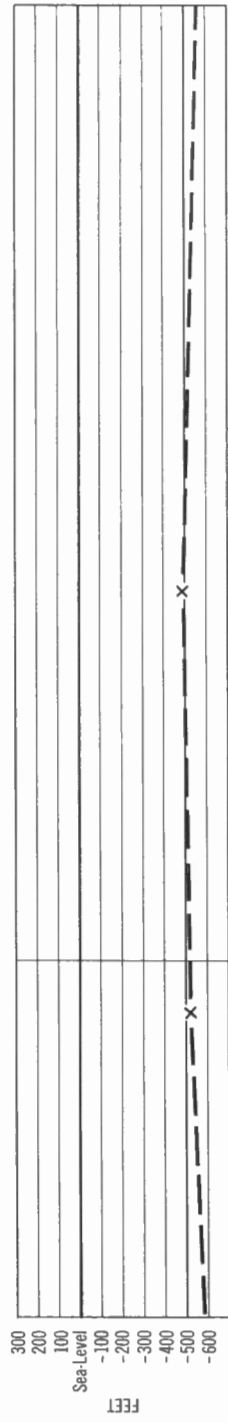


LAND ELEVATION AND DEPTH OF WATER

FLIGHT 1



AEROMAGNETIC AND GEOMAGNETIC PROFILES

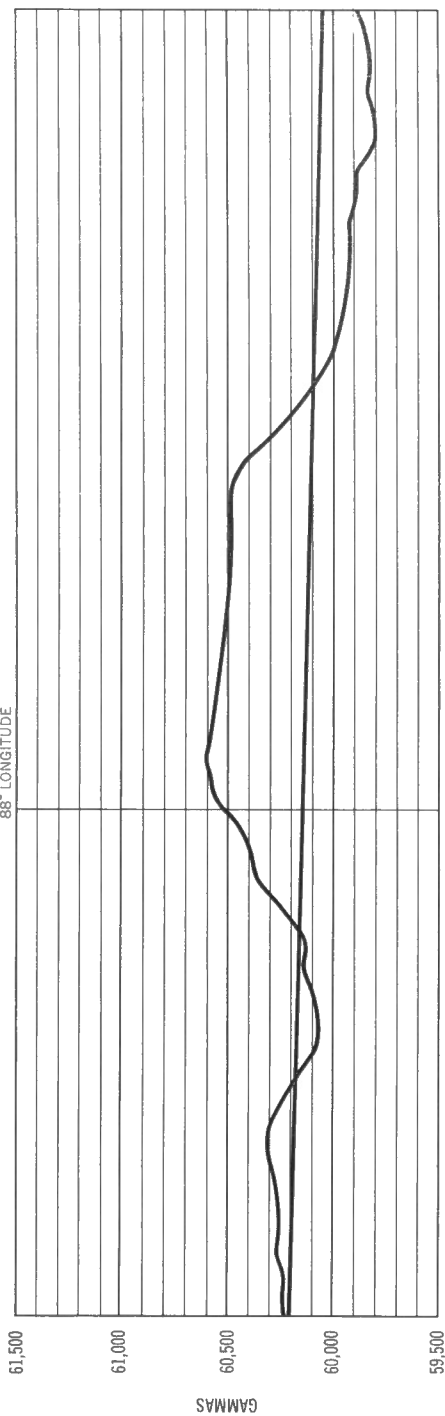


LAND ELEVATION AND DEPTH OF WATER

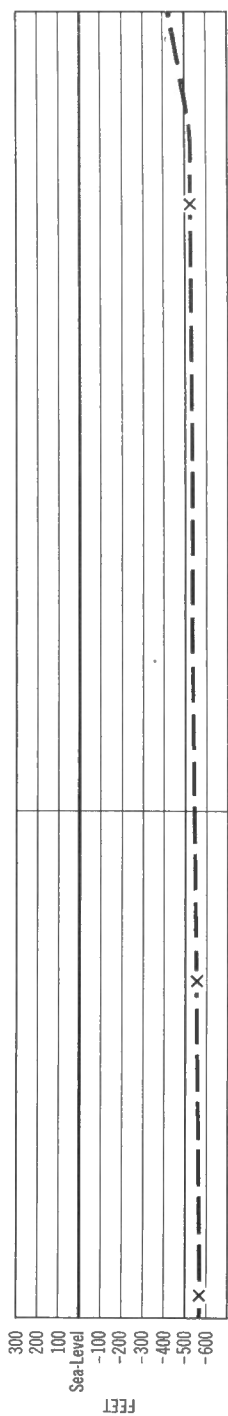


FLIGHT 1

88° LONGITUDE



AEROMAGNETIC AND GEOMAGNETIC PROFILES

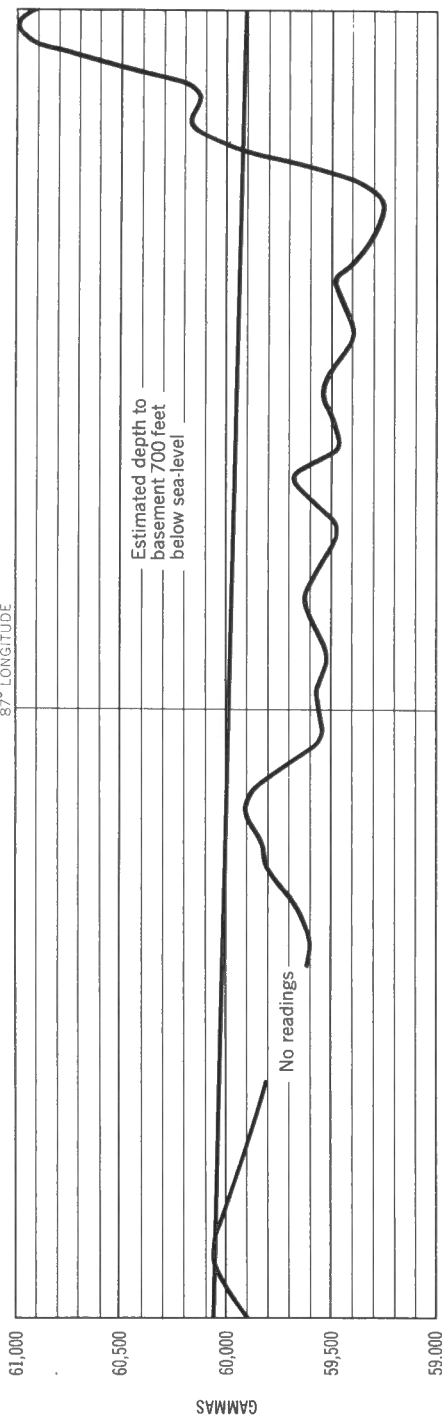


LAND ELEVATION AND DEPTH OF WATER

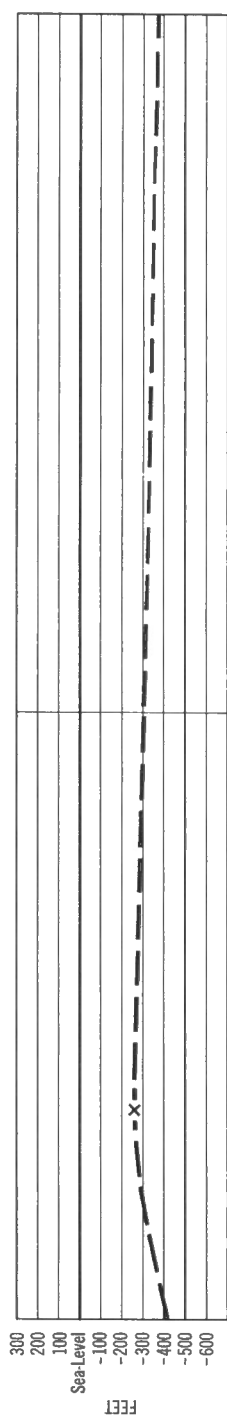


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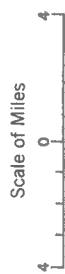
87° LONGITUDE



### AEROMAGNETIC AND GEOMAGNETIC PROFILES

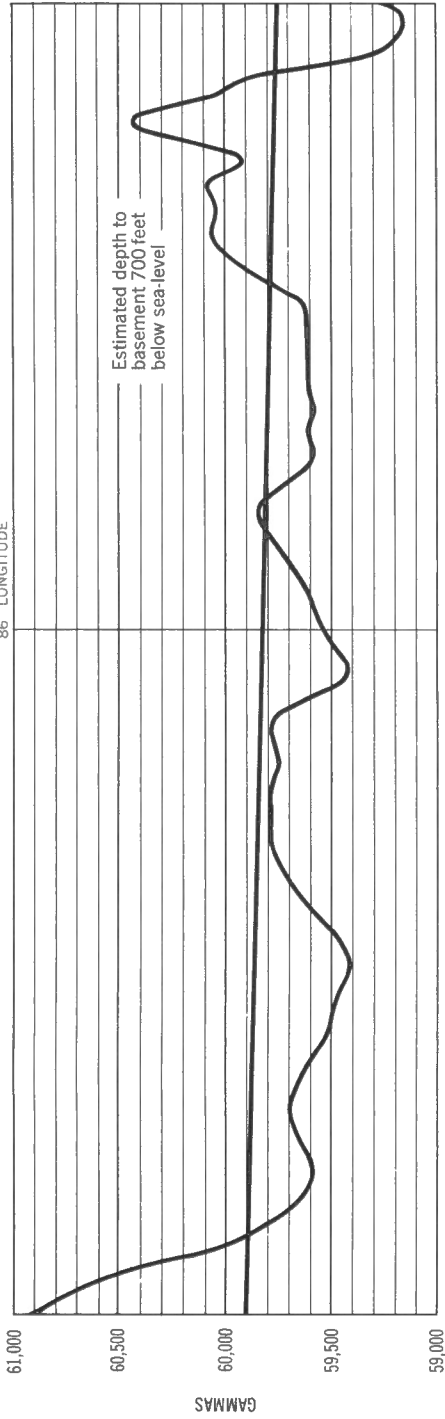


### LAND ELEVATION AND DEPTH OF WATER

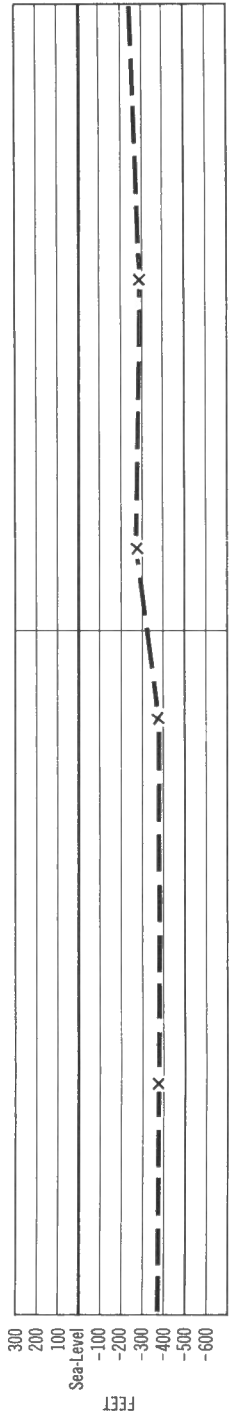


FLIGHT 1

86° LONGITUDE



AEROMAGNETIC AND GEOMAGNETIC PROFILES

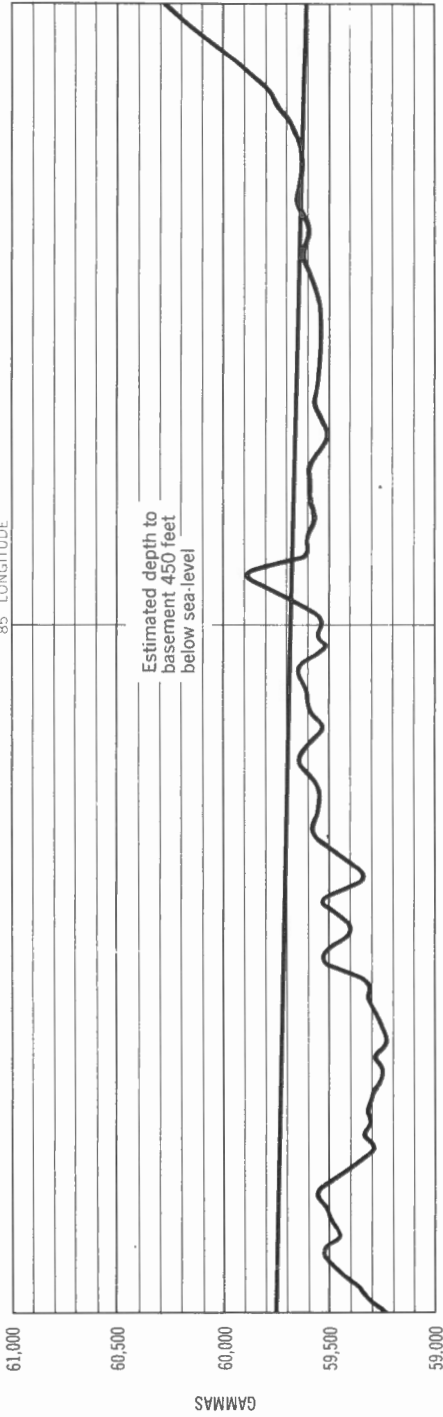


LAND ELEVATION AND DEPTH OF WATER

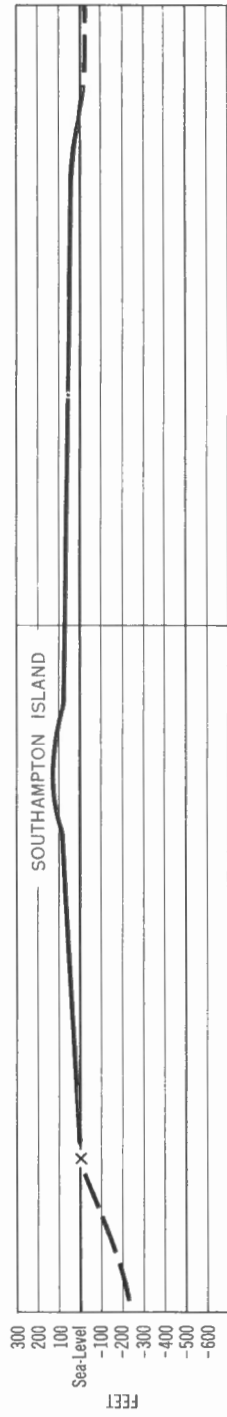


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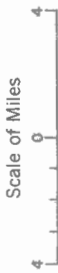
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AEROMAGNETIC AND GEOMAGNETIC PROFILES

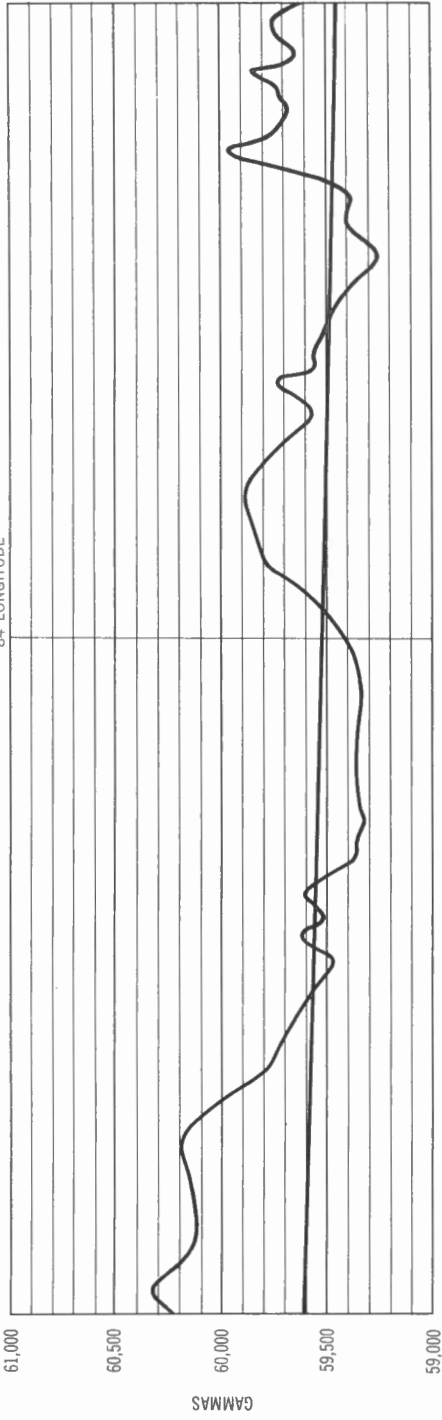


LAND ELEVATION AND DEPTH OF WATER



FLIGHT 1

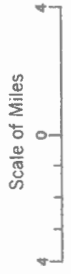
84° LONGITUDE



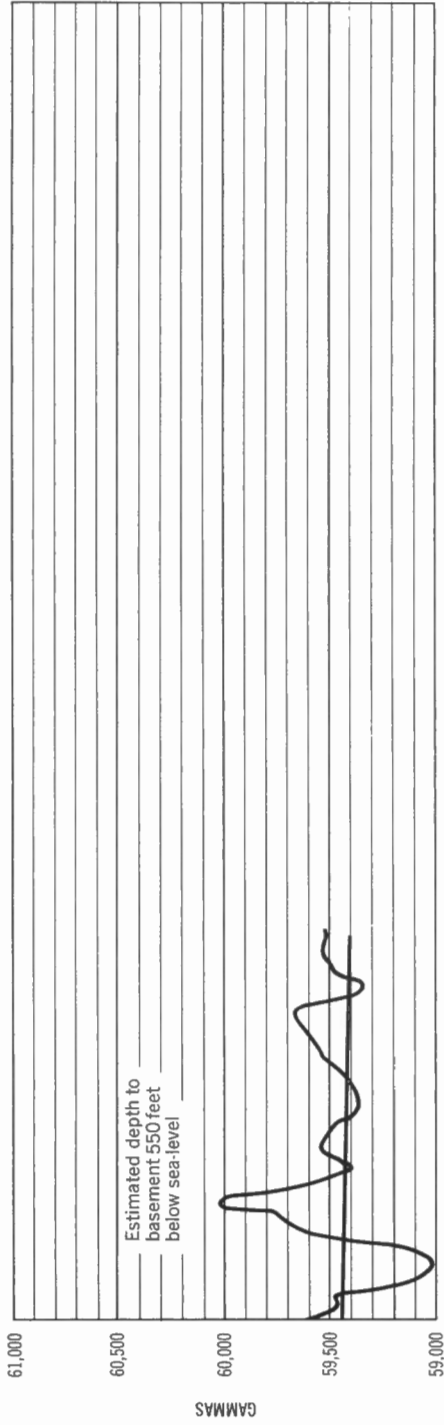
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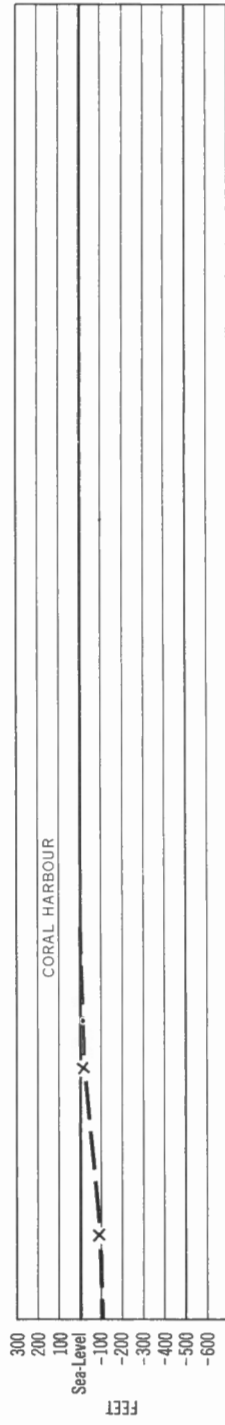
LAND ELEVATION AND DEPTH OF WATER



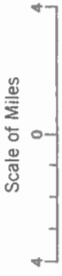
FLIGHT 1



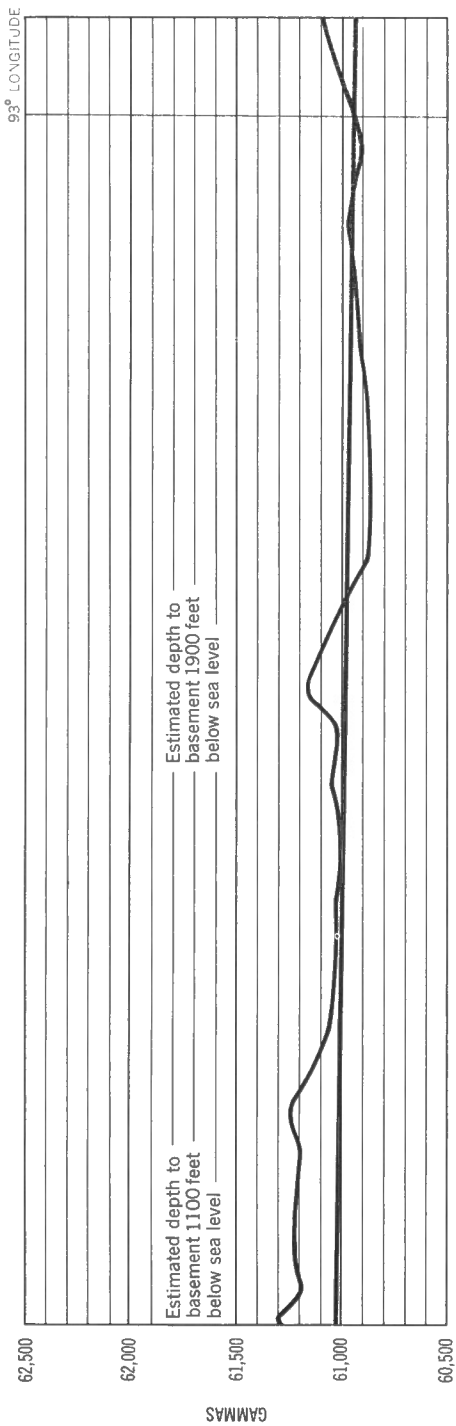
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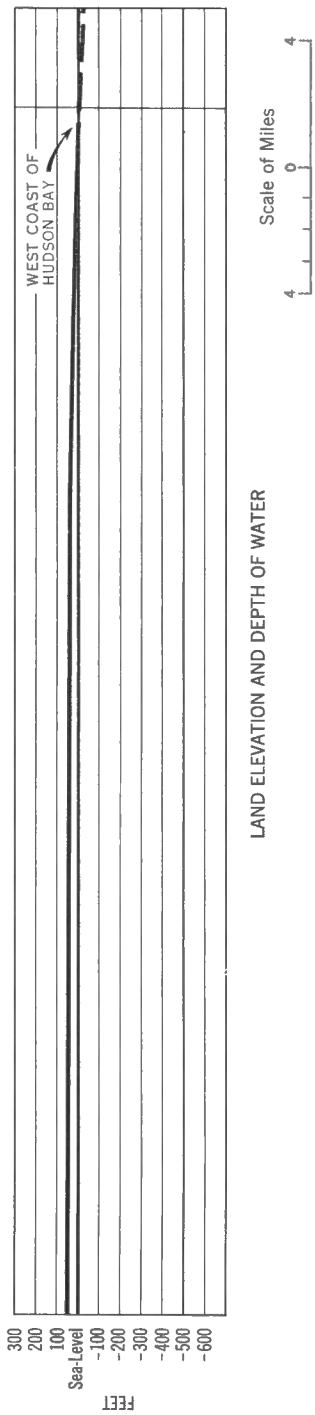
LAND ELEVATION AND DEPTH OF WATER



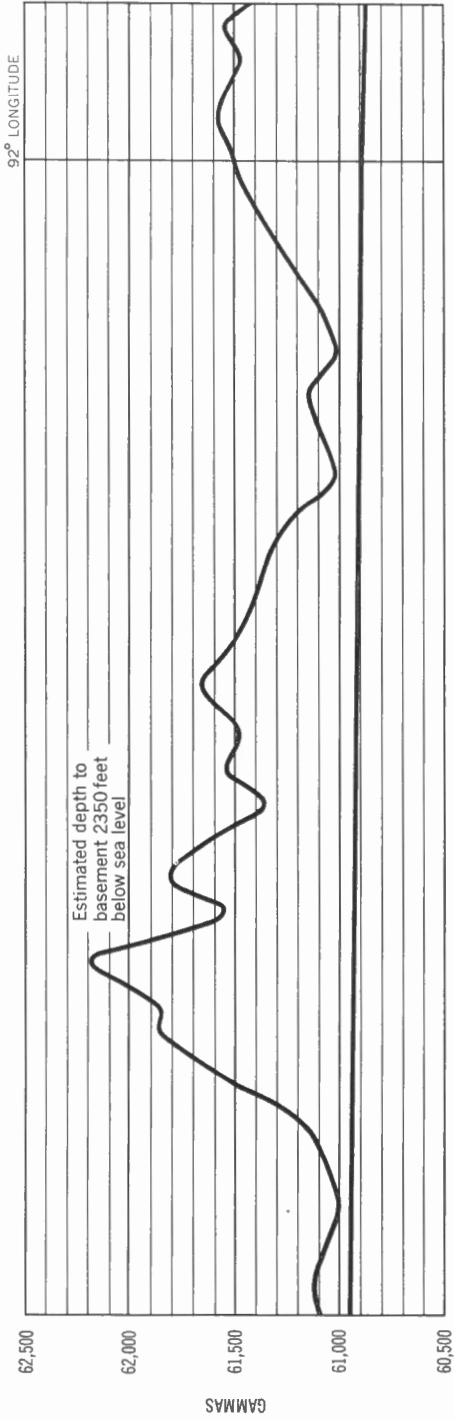
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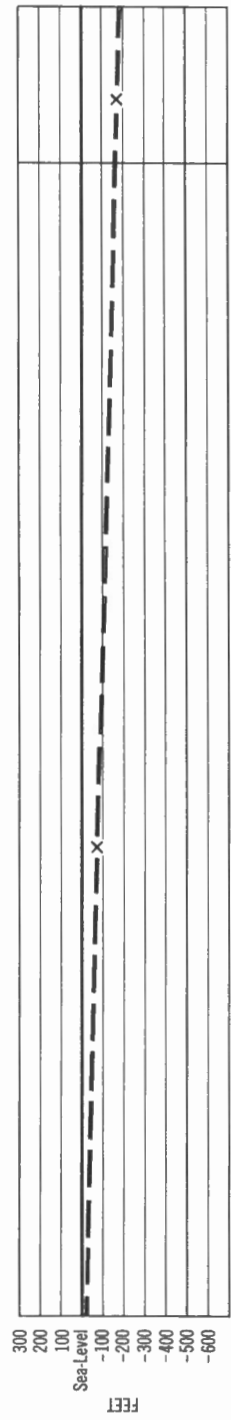
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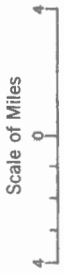
FLIGHT 2



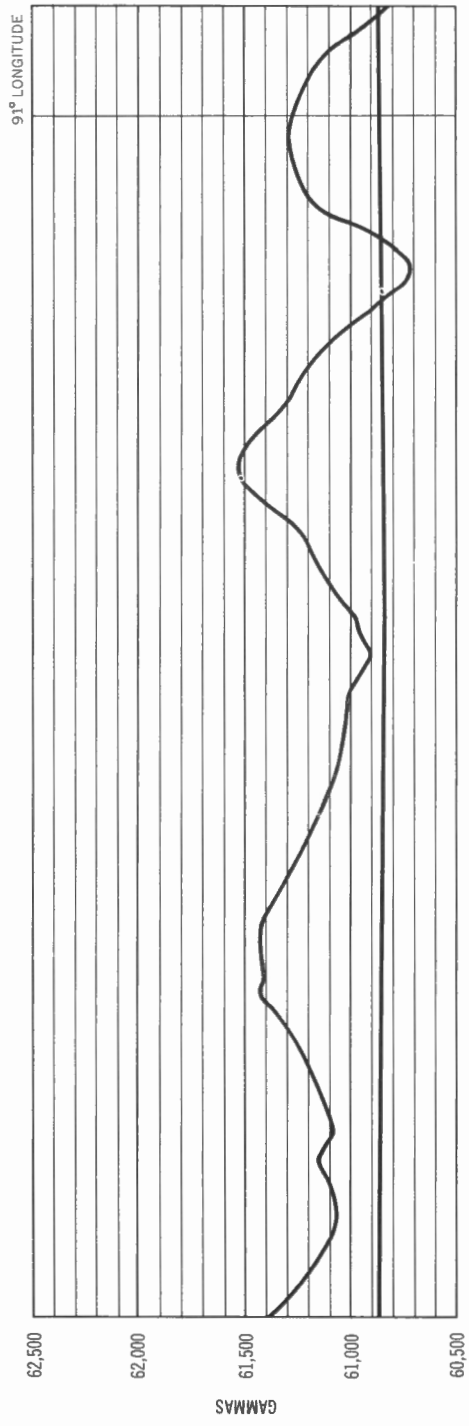
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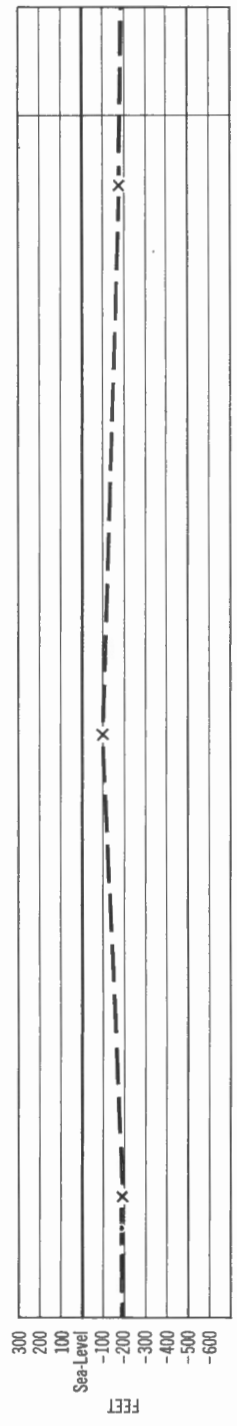
LAND ELEVATION AND DEPTH OF WATER



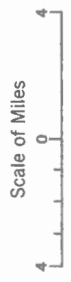
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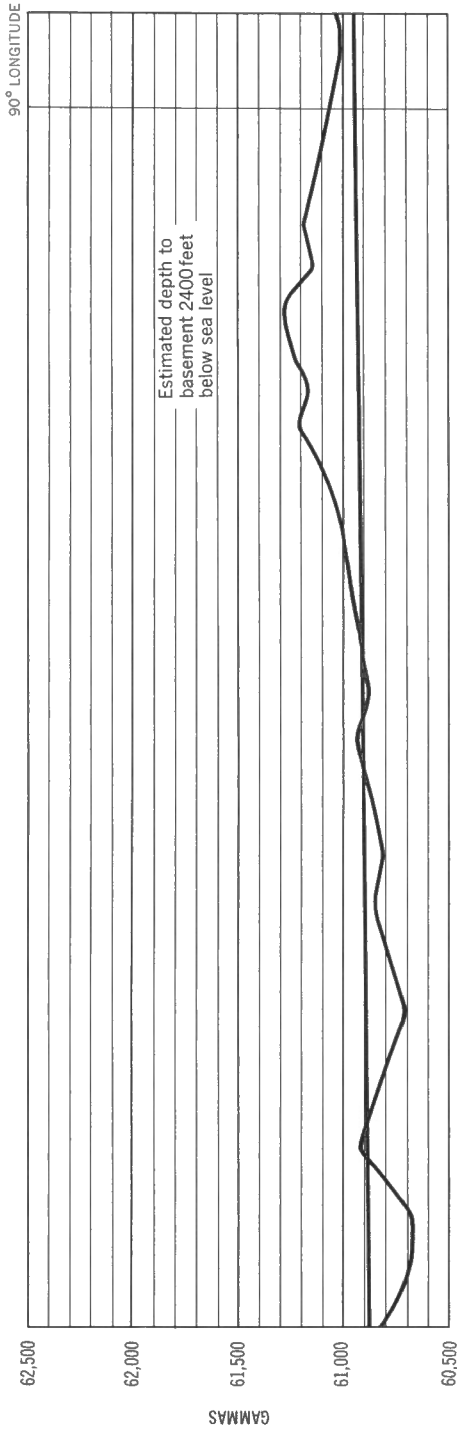
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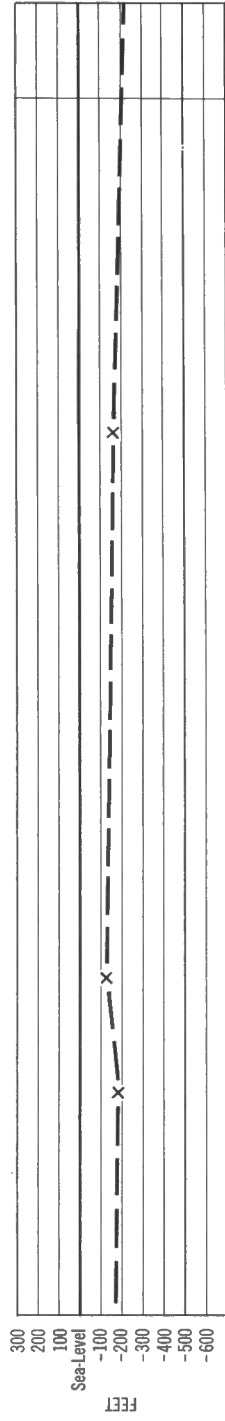
# LAND ELEVATION AND DEPTH OF WATER



FLIGHT 2

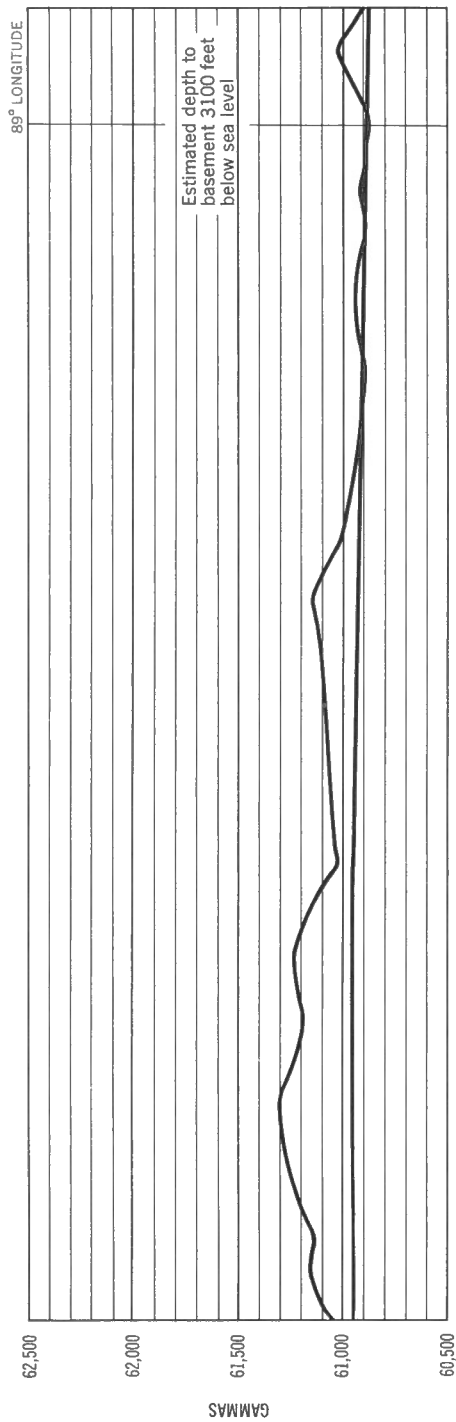


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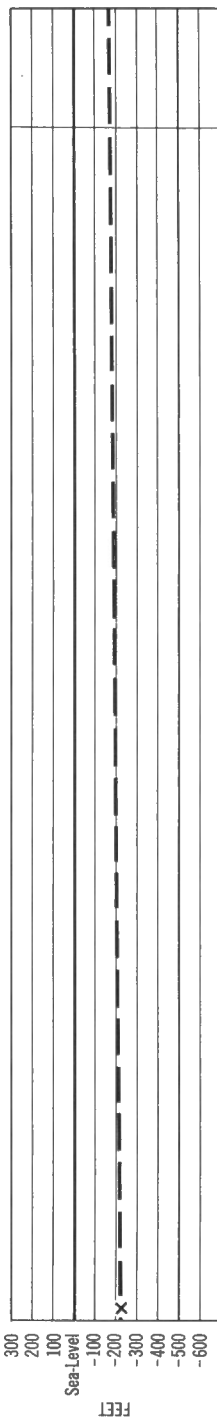


LAND ELEVATION AND DEPTH OF WATER

FLIGHT 2



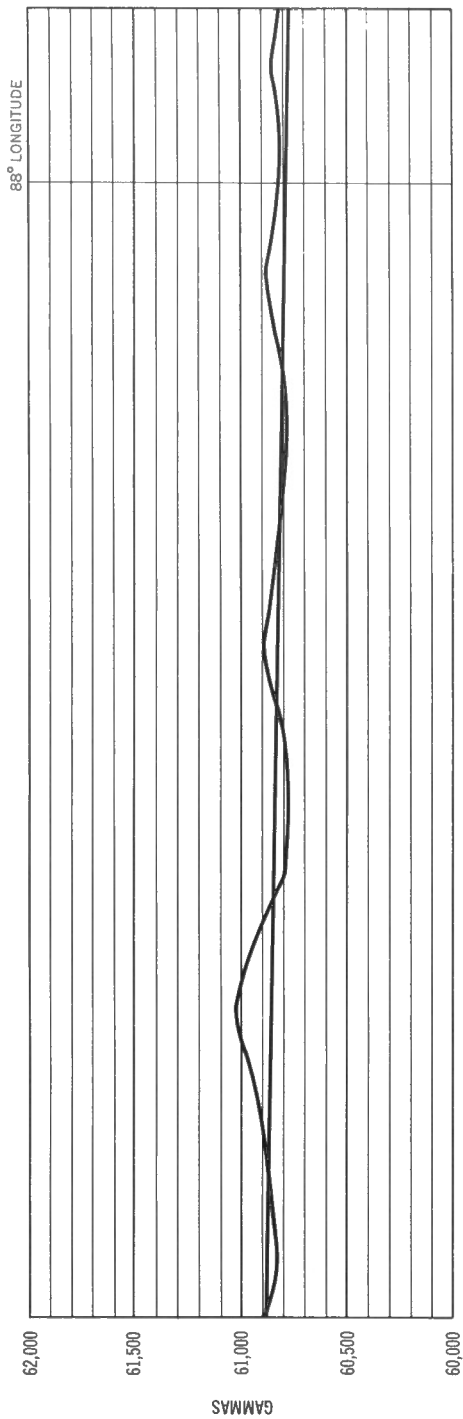
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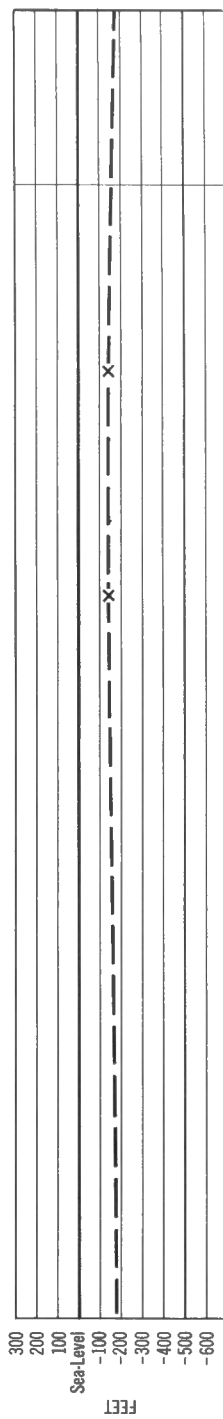
LAND ELEVATION AND DEPTH OF WATER



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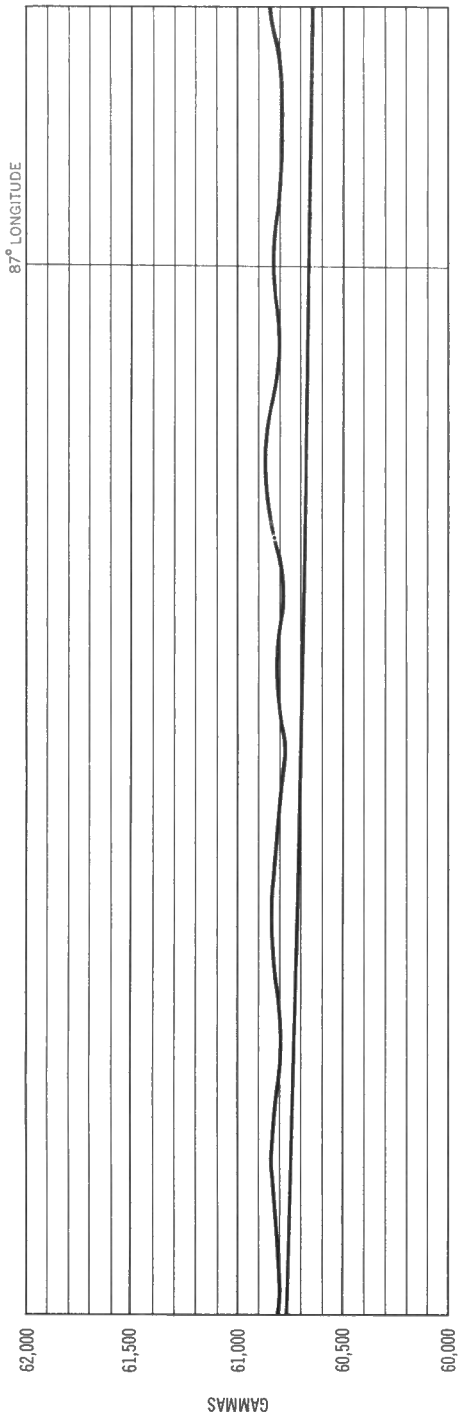


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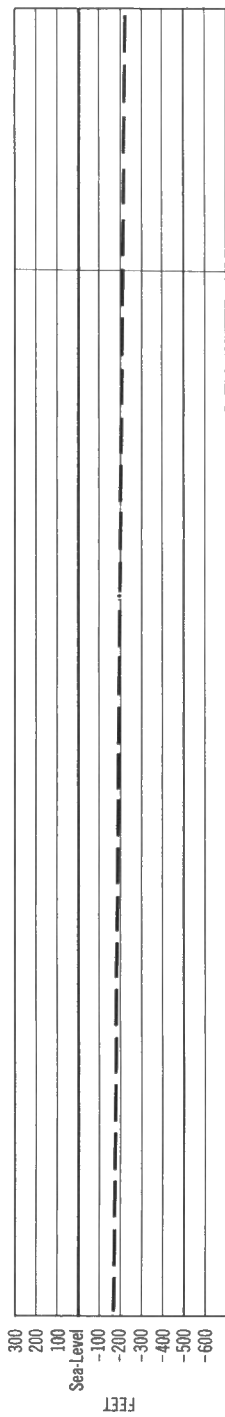


# LAND ELEVATION AND DEPTH OF WATER

FLIGHT 2



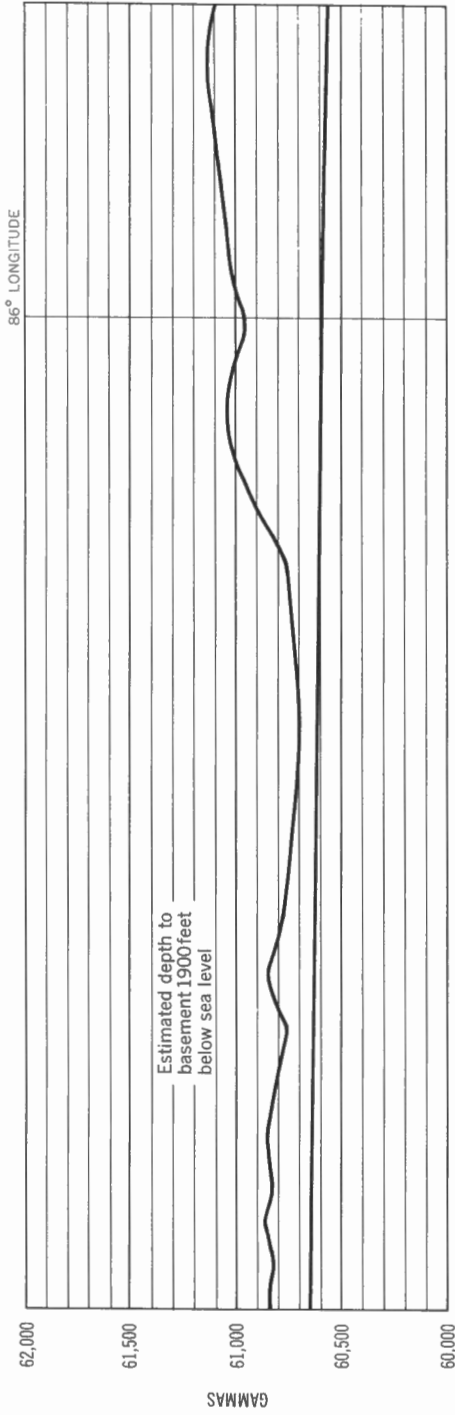
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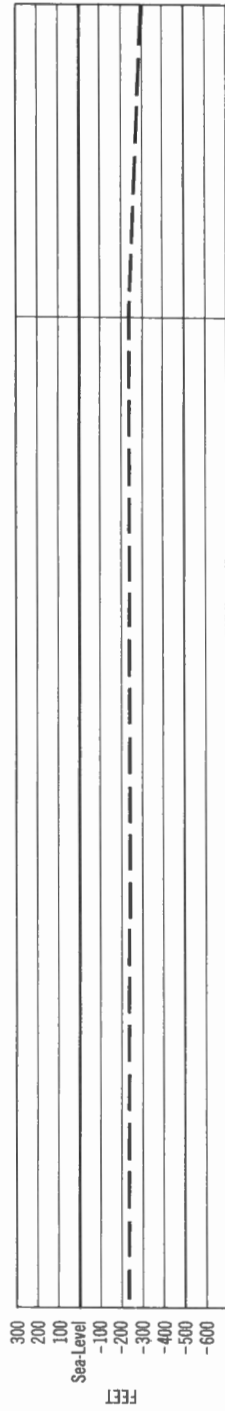
LAND ELEVATION AND DEPTH OF WATER

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FLIGHT 2

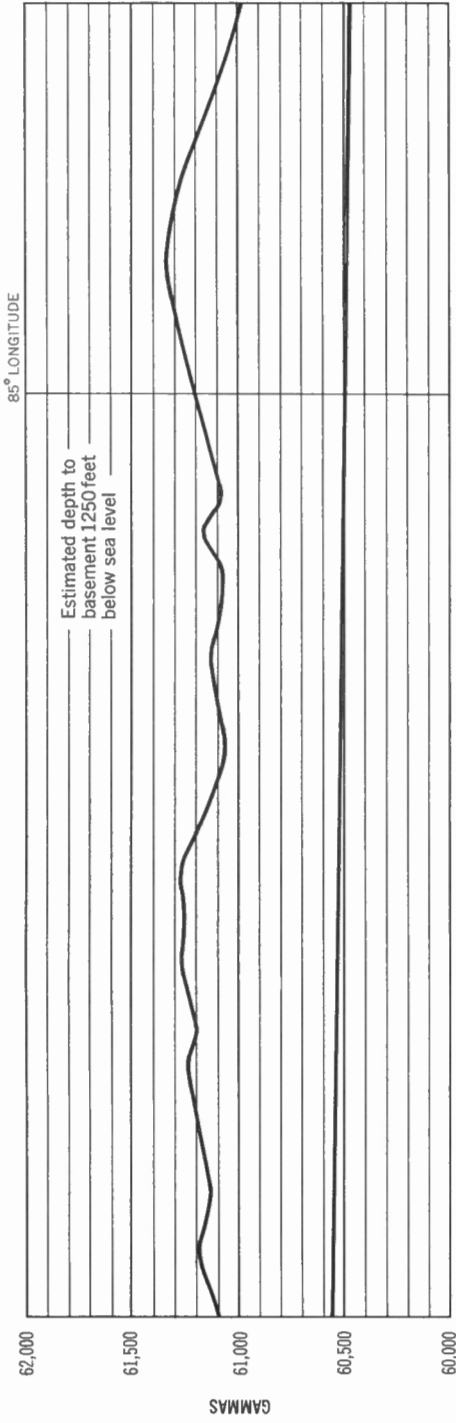


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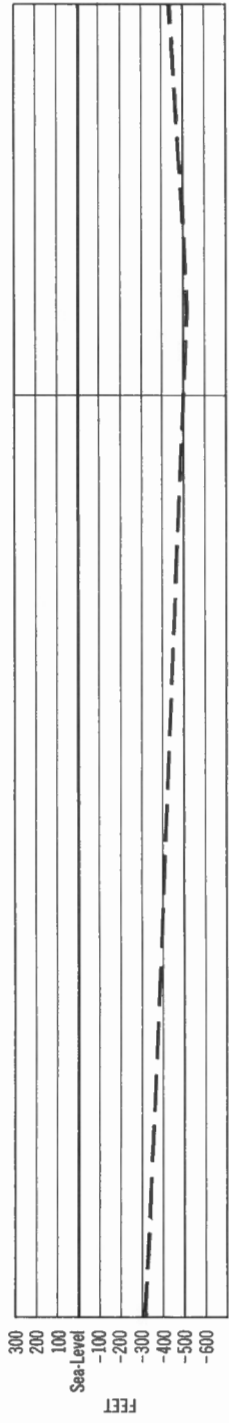


LAND ELEVATION AND DEPTH OF WATER

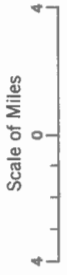
FLIGHT 2



AEROMAGNETIC AND GEOMAGNETIC PROFILES

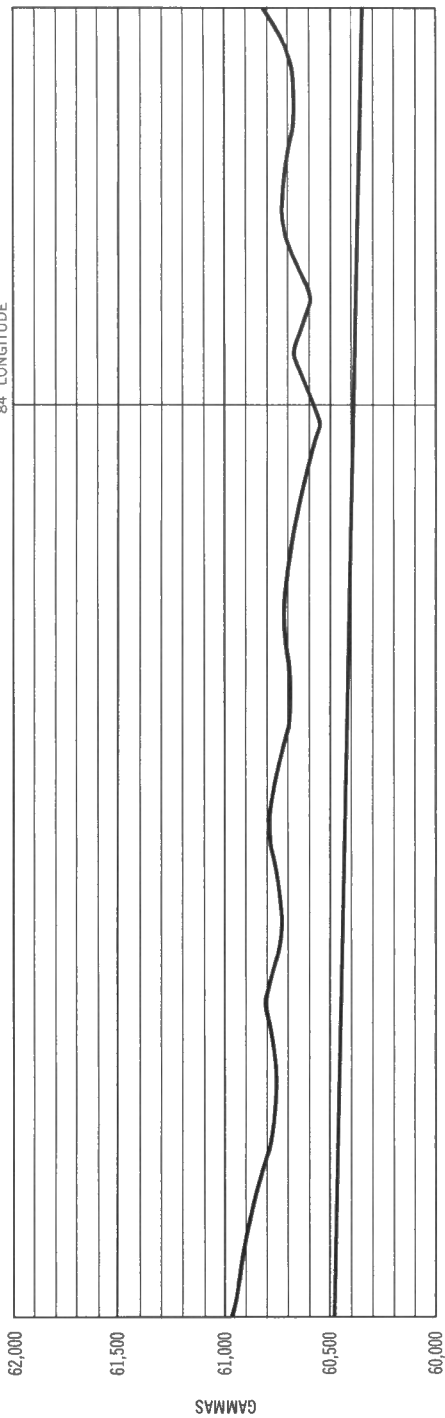


LAND ELEVATION AND DEPTH OF WATER

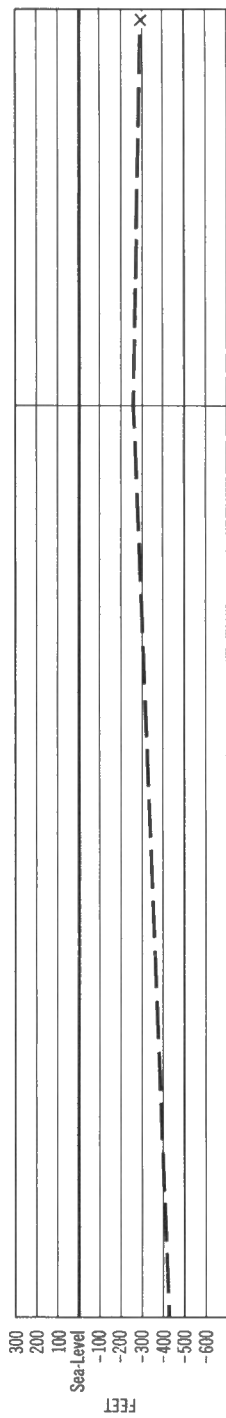


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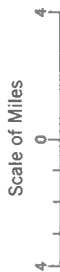
84° LONGITUDE



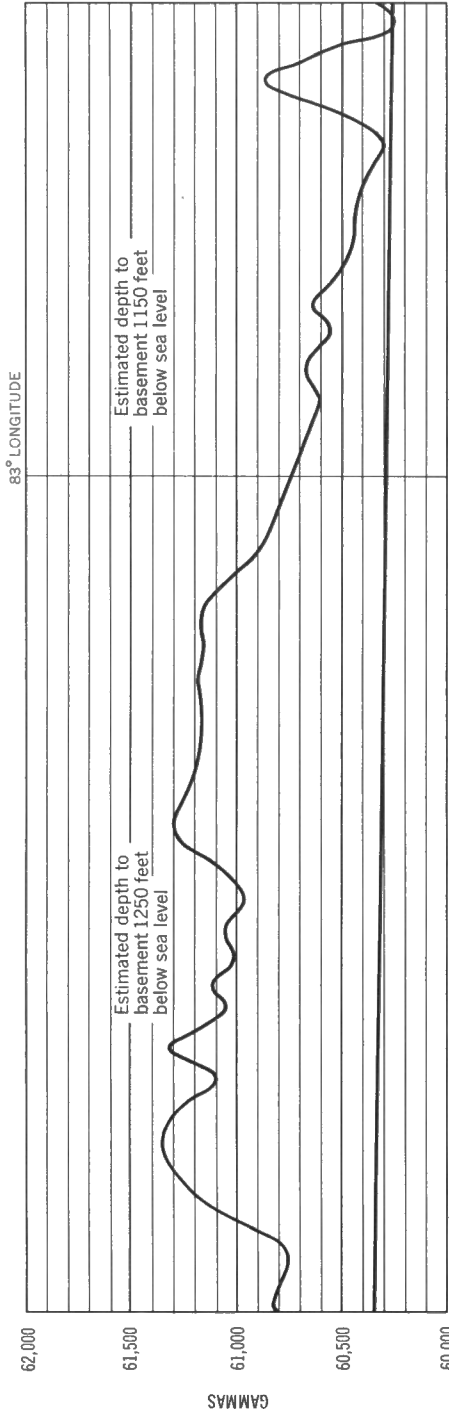
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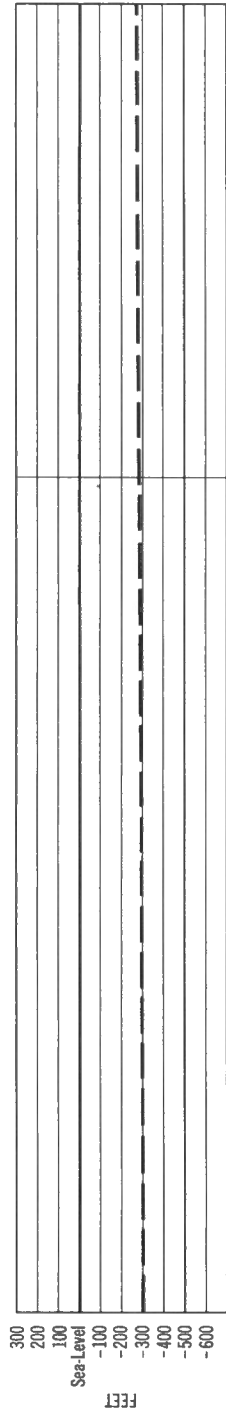
# LAND ELEVATION AND DEPTH OF WATER



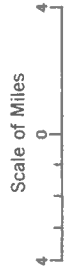
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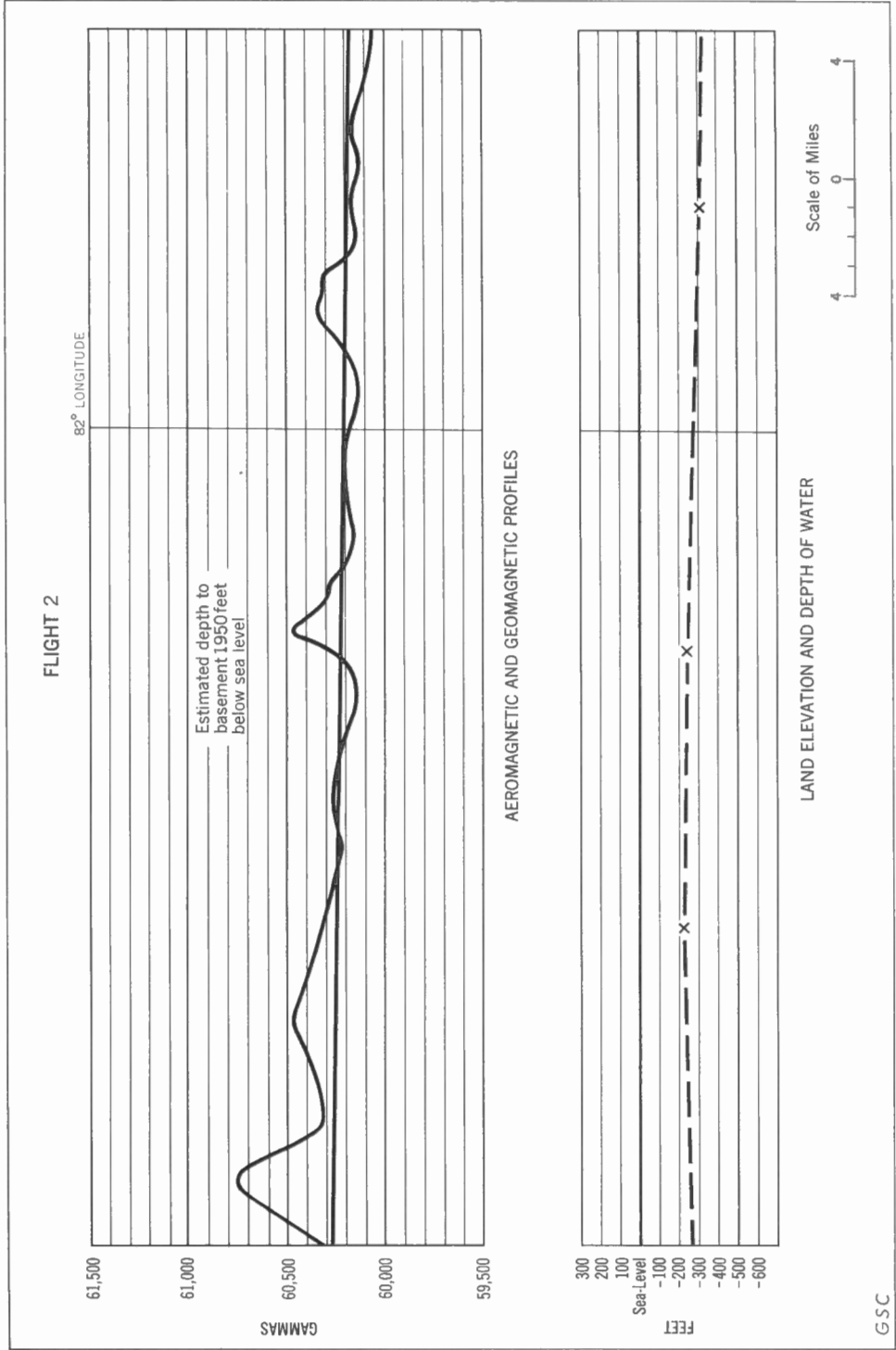


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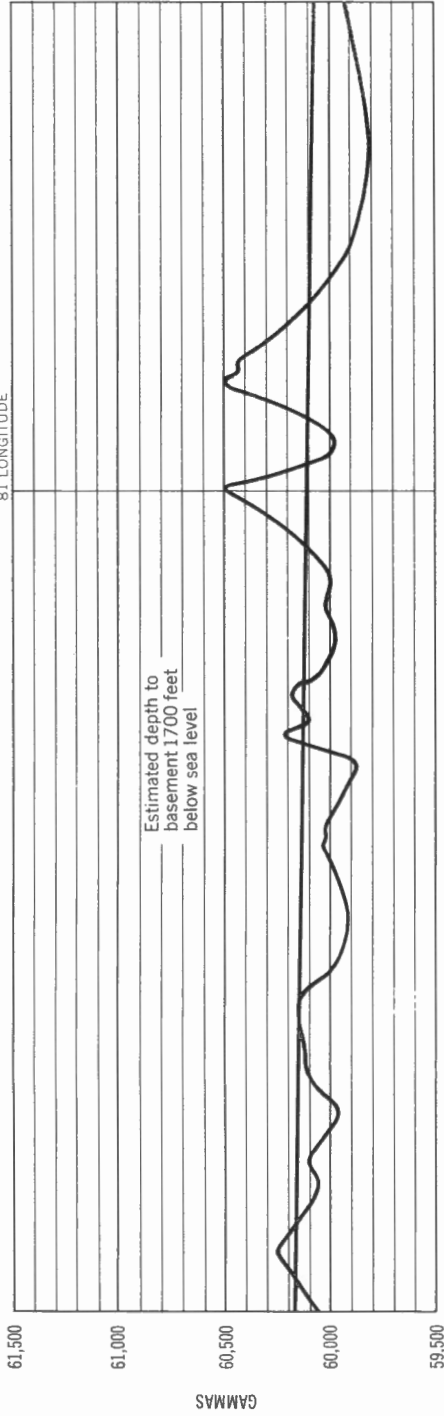
LAND ELEVATION AND DEPTH OF WATER



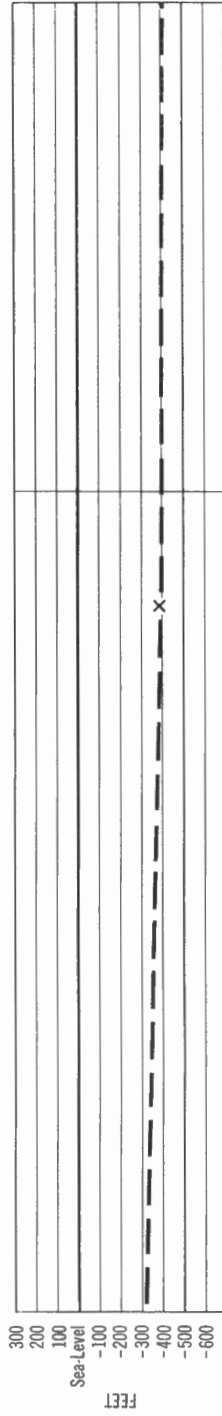


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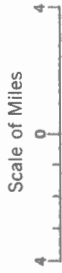
81° LONGITUDE



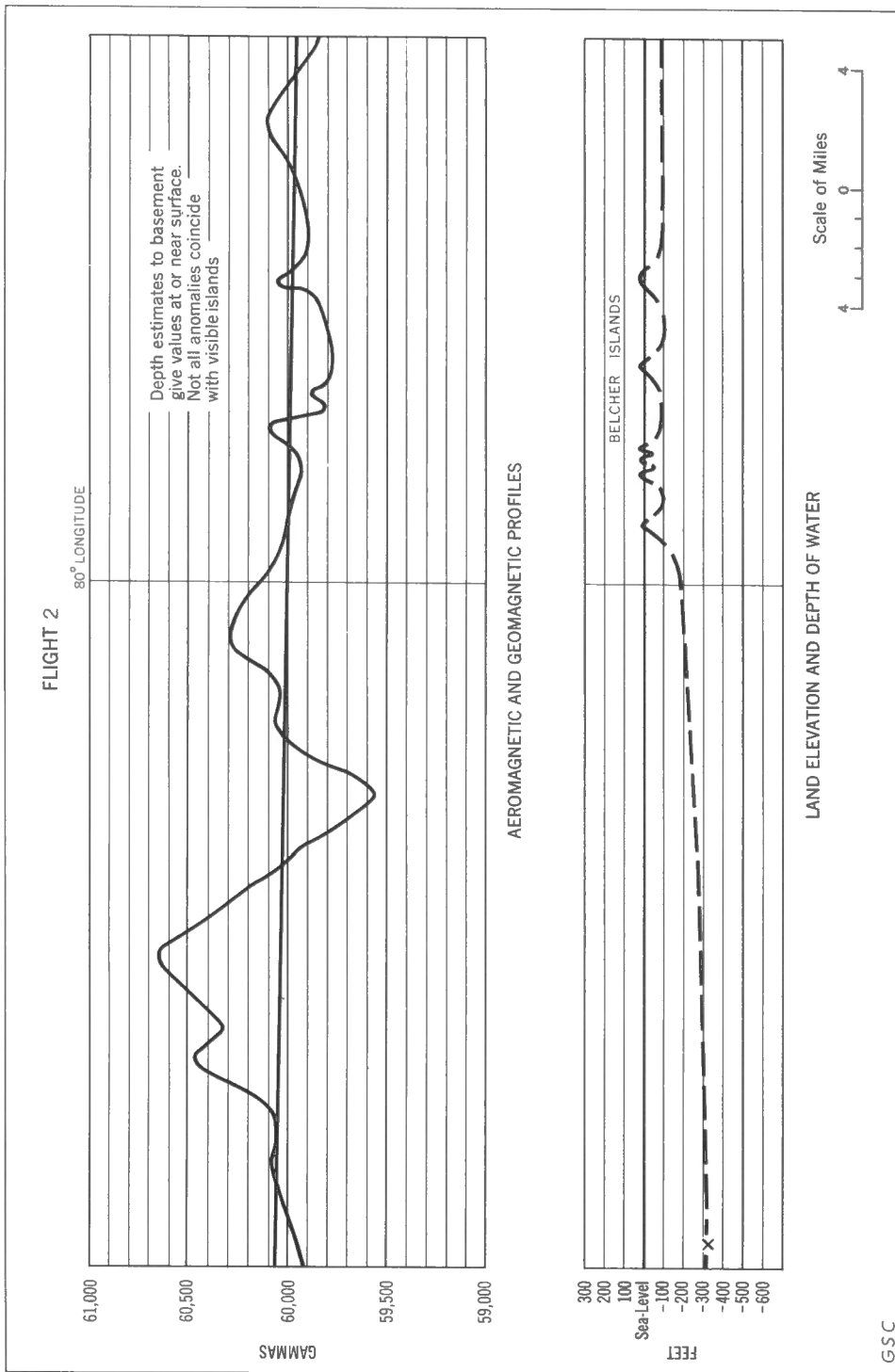
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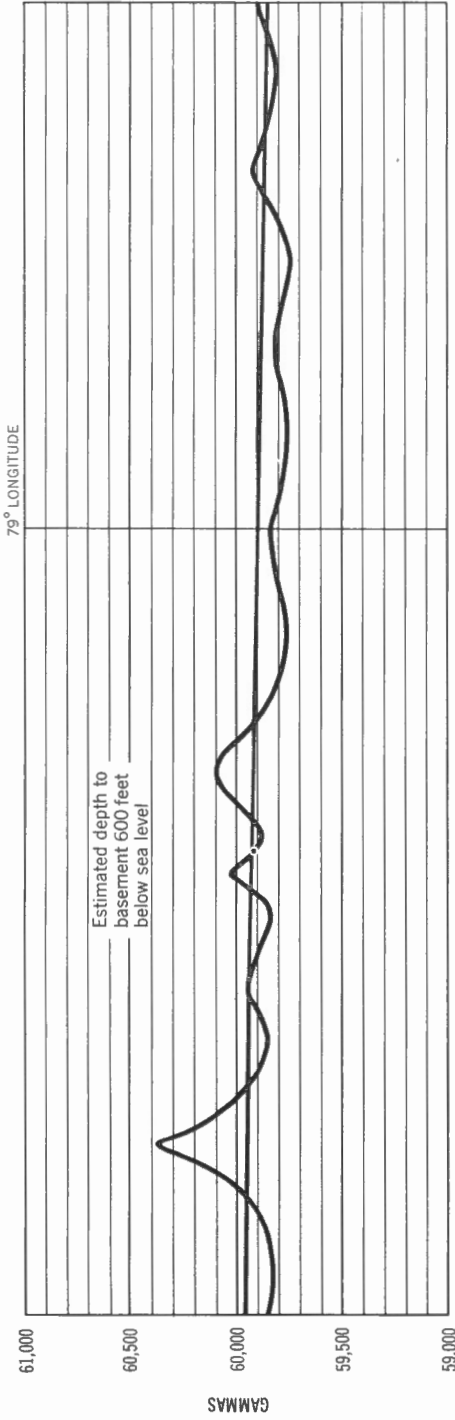
## LAND ELEVATION AND DEPTH OF WATER



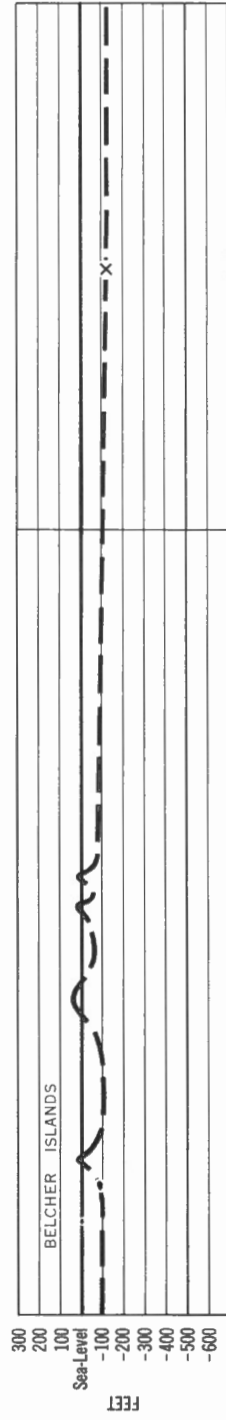




FLIGHT 2



AEROMAGNETIC AND GEOMAGNETIC PROFILES

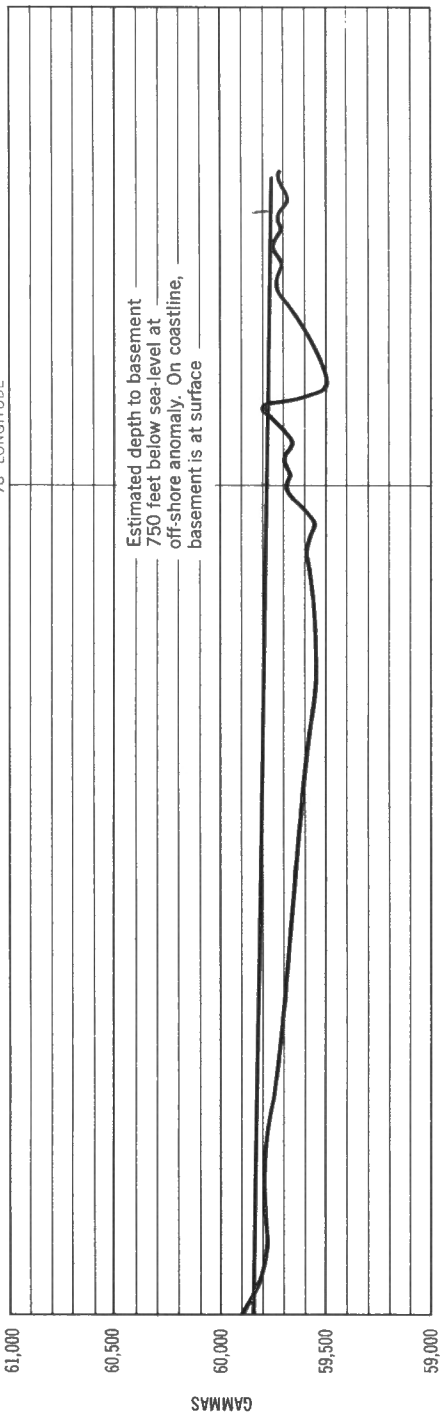


LAND ELEVATION AND DEPTH OF WATER

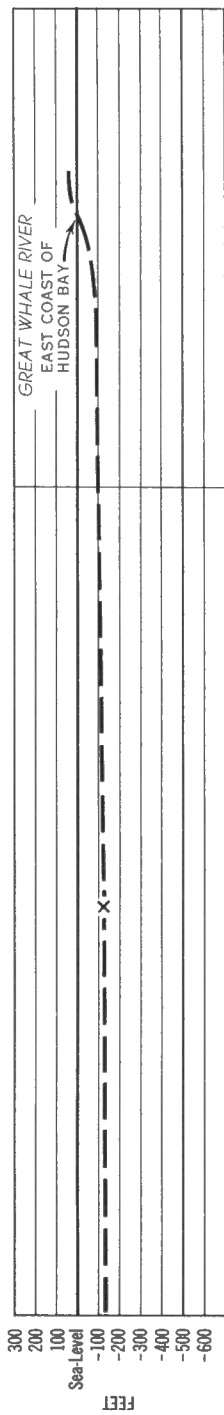


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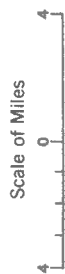
78° LONGITUDE



## AEROMAGNETIC AND GEOMAGNETIC PROFILES



LAND ELEVATION AND DEPTH OF WATER



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