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NATIONAL OCEAN SURVEY BATHYMETRIC MAPPING PROGRAM

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INTRODUCTION

This is a summary of a lecture given at the XIIth I.H. Conference by Captain Lavon L. POSEY, NOS, NOAA, on behalf of the author. Captain POSEY worked closely with Mr. BANKS in developing a clear description of the Bathymetric Programme to obtain the necessary funds to make it an ongoing and permanent programme in NOS.

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More than ever before, the United States is concentrating its scientific and engineering capabilities in two important areas: one is the development of the natural resources on its outer continental shelf and the other is the protection and development of the land and water resources of the country's coastal regions.

The National Ocean Survey recognized in 1966 that bathymetric maps would be required to support these programs, and that it possessed the necessary data to establish a viable bathymetric program. Although we have vast amounts of oceanographic data and the expertise to produce from this data detailed bottom contours that portray a complete picture of the topographic/geologic features of the ocean floor, many areas exist where additional data are required to complete this mapping program.

Between 1966 and 1975, approximately 54 bathymetric maps were produced of the outer continental shelf (Fig. 1), but the past 7 years have been the most

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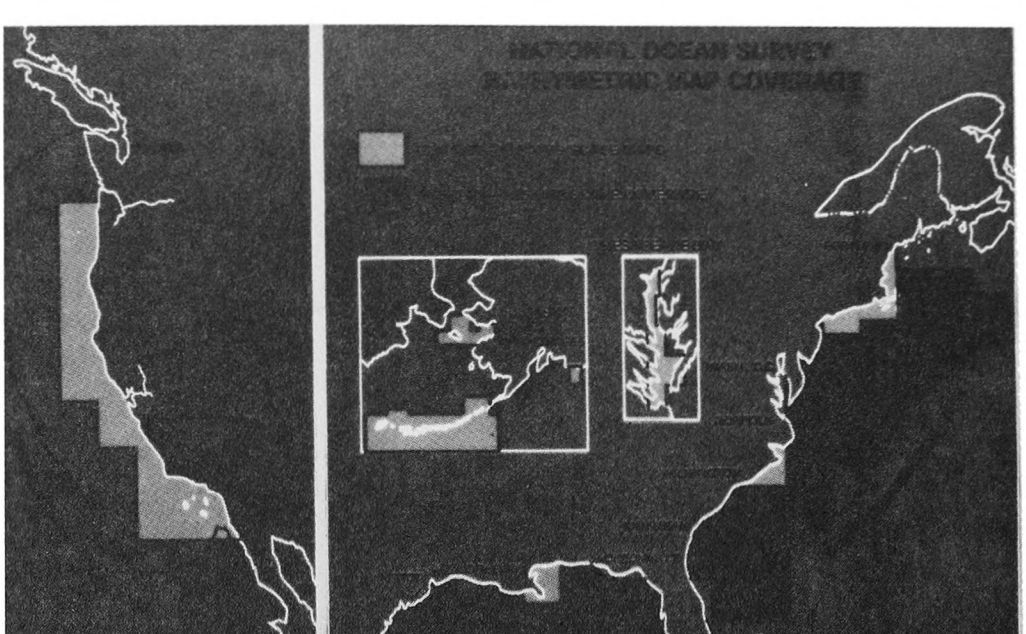

FIG. 1

productive period. During this time, 88 bathymetric maps have been produced to support the accelerated pace of the country's offshore exploration and production operations, primarily in the Gulf of Mexico, along the east coast of the United States, and in Alaska's Shelikof Strait and Cook Inlet.

Bathymetric maps produced in this series are constructed on the universal transverse Mercator projection at 1:250 000 scale. Each covers a geographic area of one degree of latitude by two degrees of longitude, except for Alaska where the longitudinal coverage is three degrees. This format provides for a uniform series of maps over the entire outer continental shelf and its slope. The contours are in meters and are compiled manually at the scale of the surveys to obtain maximum detail and to retain the same basic configurations when compilations are used to produce other scale maps.

The contour intervals are determined by the complexity of the bottom terrain – gradual slope as compared to steep slope. For example, on the east coast, as illustrated by the map section shown on Fig. 2, the maps south of 42° generally have a 10-meter contour interval supplemented by 2 meters to the 200-meter contour line. Beyond the 200-meter contour, the interval is every 50 meters supplemented by 10-meter contours.

For those maps covering areas north of 42°, the steep slope will only allow 10-meter contours to be shown to the 200-meter contour line, and in this case, 10-meter contours can also be shown beyond 200 meters (Fig. 3).

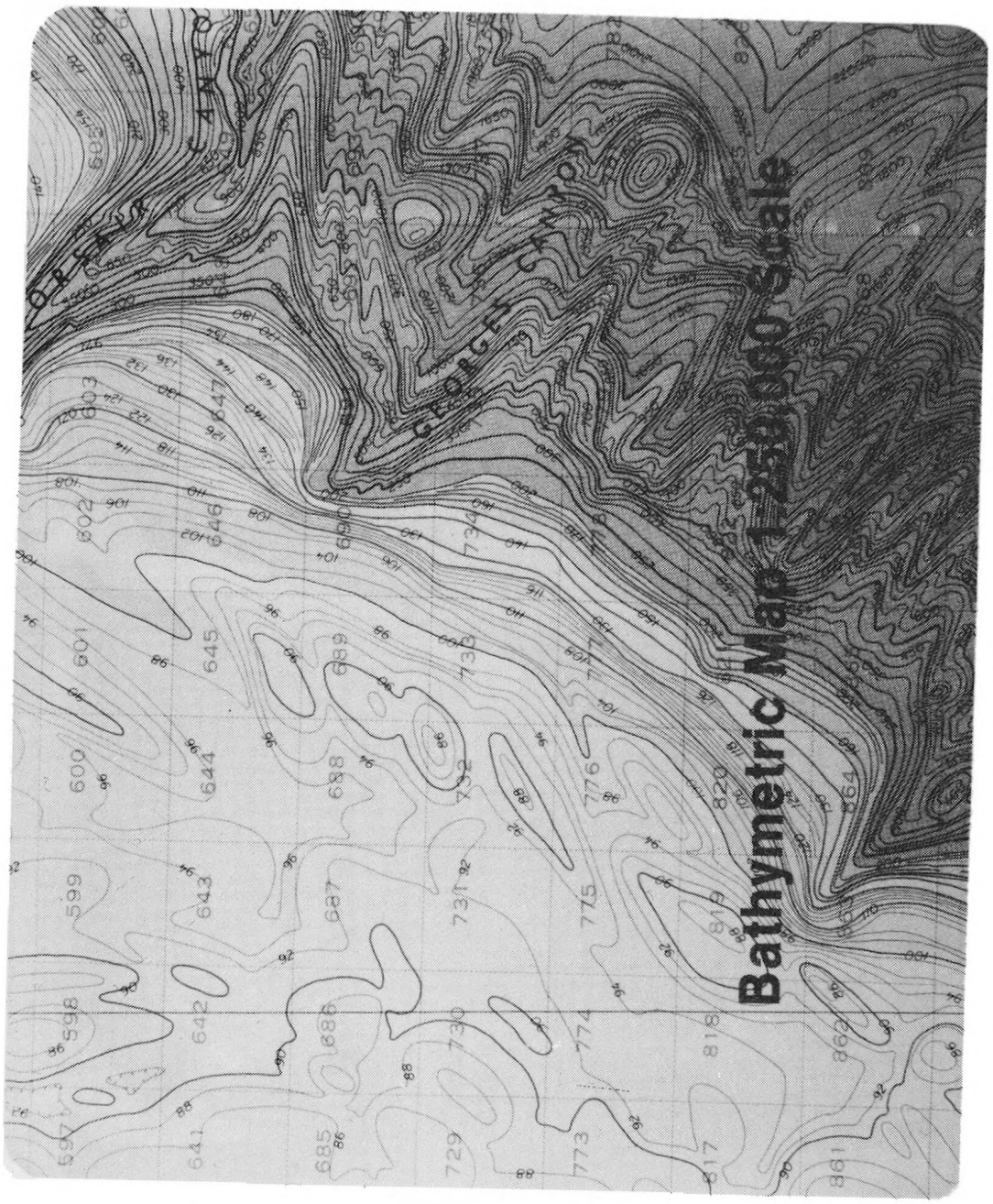

FIG. 2

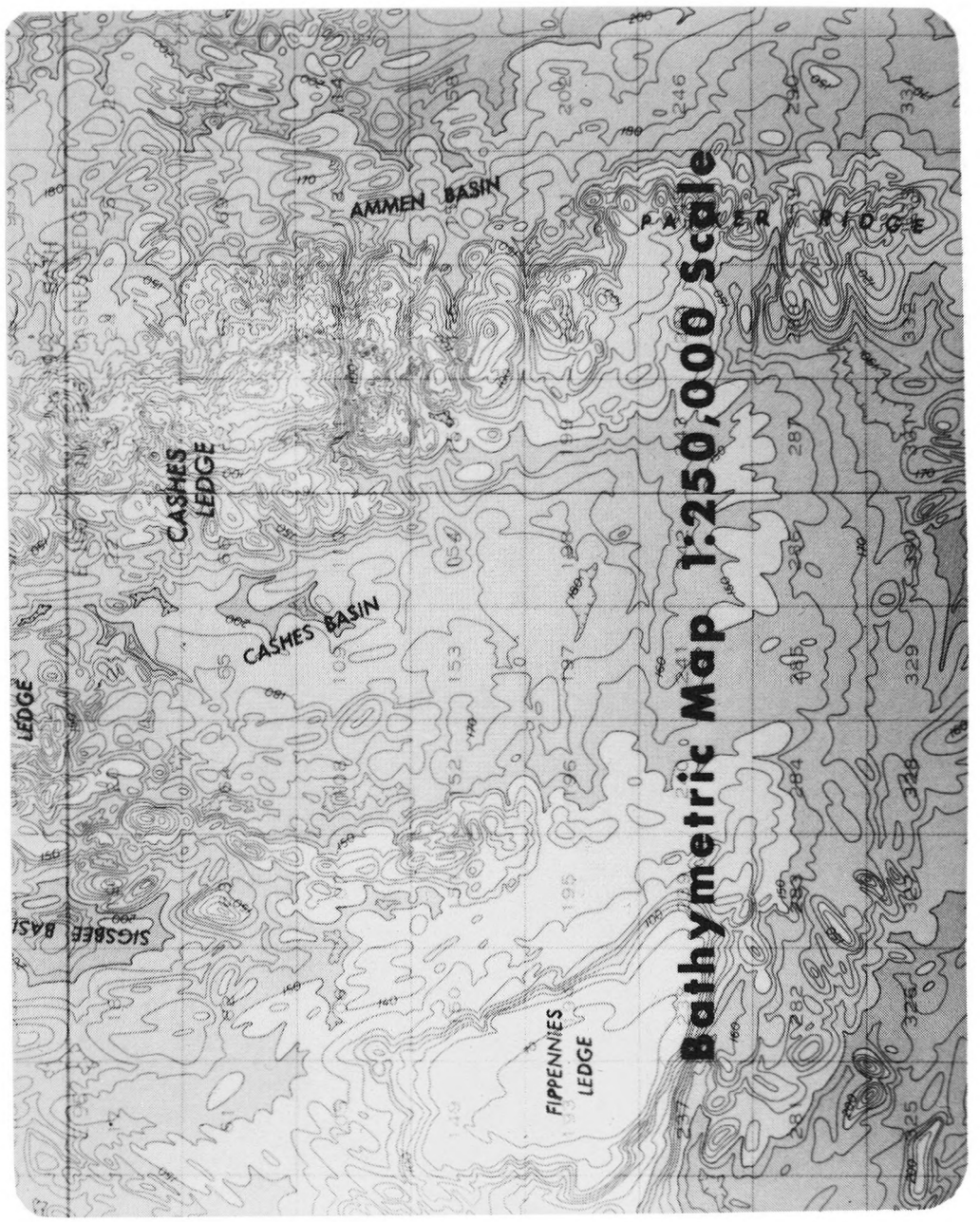
Bathymetric Map 1:250,000 Scale
AMMEN BASIN
CASHES LEDGE
CASHES BASIN
FIPPENNIES LEDGE
PAPER RIDGE

FIG. 3

Because the scales of nearly all the basic surveys used to compile the contours are larger than 1:250 000, they are subject to a certain degree of generalization when they are reduced to the final published map scale. The degree of generalization and elimination of detail depends on the scale of the survey, which can vary from 1:2 500 to 1:120 000. The reductions are used to prepare inked manuscripts for engraving the necessary reproducibles for printing the final maps or making advance black and white copies. As portrayed here, the published maps are printed multicolored with varying shades of blue to emphasize the bottom gradient. Additional information shown on the map includes names of underwater features, and offshore lease block areas overprinted in red. Each lease block contains approximately 5 700 acres.

The principal users of bathymetric maps are the scientists and engineers at the United States Department of the Interior's Bureau of Land Management, and Exploration Companies. In conjunction with other information, these maps are used to prepare comprehensive environmental impact statements of potential gas and oil areas that will be leased to private companies for exploration and development. Some of the information contained in these reports is (1) identification of areas with a high probability of gas and oil deposits; (2) the type of drilling structure that should be used for exploration and development; (3) areas of endangered species and fish habitats; and (4) analysis of sea bottom stability, based on sediment distribution and currents.

To assist federal and state agencies in preparing effective programs for developing and protecting the coastal zones of the United States, the National Ocean Survey and the United States Geological Survey of the Department of the Interior agreed in 1975 to jointly produce a unique new series of maps that would show both the land and ocean topography on one map. These maps are called topographic/bathymetric maps, or more commonly topo/bathy maps. To produce these maps, the United States, Geological Survey combines our bathymetry and shoreline with their existing 1:24 000-, 1:100 000-, and 1:250 000-scale topographic maps. It is the National Ocean Survey's responsibility to provide the Geological Survey with manuscripts at the published scale of the topo/bathy maps. Like the "all-wet" bathymetric maps, contours are in meters and are compiled at the scale of the surveys to show as much detail as the survey data and scale of the map will permit.

During the early stages of this program, the topo/bathy mapping effort was concentrated on the 1:250 000-scale maps to support our outer continental shelf activities. On this particular 1:250 000 map (Fig. 4), the bathymetry is at 2-meter intervals and the offshore lease areas are overprinted in red.

To support the State and Federal Agencies involved in the protection and development of the land, coastal zones, and water resources, the 1:24 000- and 1:100 000-scale maps were introduced into the program around 1976.

Figure 5 is an example of a 1:24 000-scale map, covering a portion of the Georgia coast, the primary contour interval is 1 meter with 1/2-meter contours added to provide better bottom definition. These contours are the screen black or gray line, and the low water areas are shaded in brown. The land topography on all scale topo/bathy maps is generally portrayed in the same detail as the bathymetry. On the 1:24 000-scale maps two methods are used to portray land

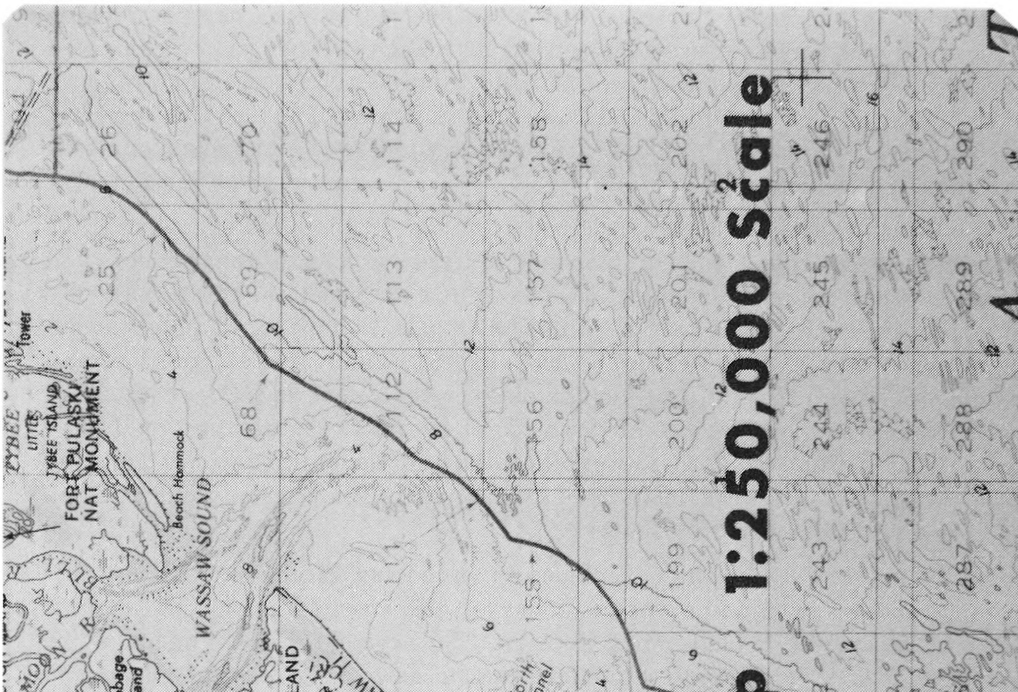
Topo-Bathy Map 1:250,000 Scale
HUNTER ARMY AIRFIELD
Windsor Forest
Sandfly
Isle of Hope
SKIDAWAY ISLAND STATE PARK
SKIDAWAY ISLAND
WILMINGTON R
Cabbage Island
WASSAW SOUND
Beach Hammock
FORT PULASKI NAT MONUMENT
Tower
WASSAW ISLAND
WASSAW ISLAND NWR
ODINGSELL R
Pine Island
OSSABAW SOUND
Raccoon Key
Bradley Pt
Egg Islands
Little Don Island
Torreys Landing
Harveys Island
OGEECHEE RIVER
VERNON R
OSSABAW ISLAND
BRADLEY RIVER
North Channel
South Channel
CHATHAM CO
BRYAN CO
SAINT CATHERINES SOUND
REDBIRD CR
Allister
Montgomery
Burnside

FIG. 4

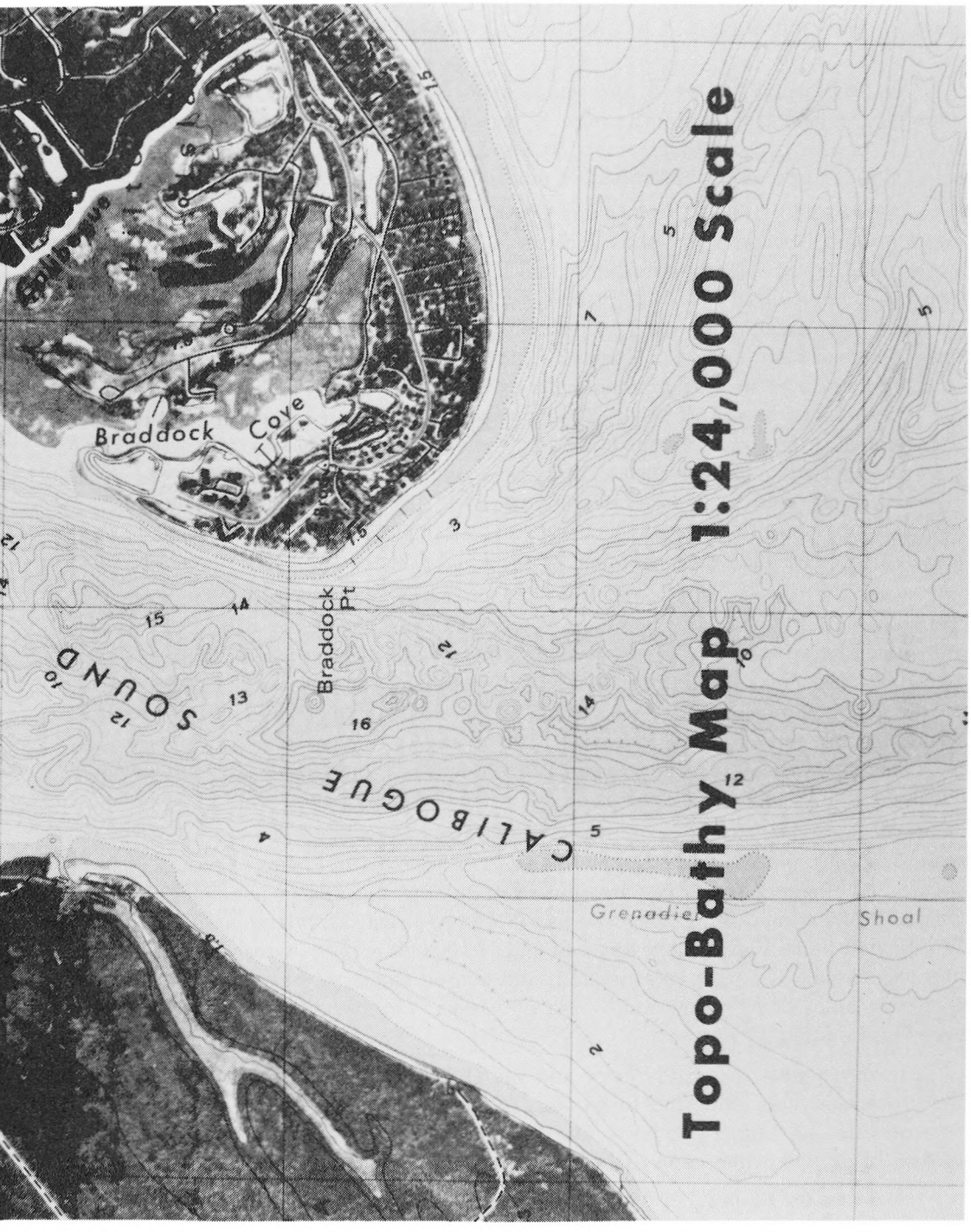
Topo-Bathy Map 1:24,000 Scale
Braddock Cove
Braddock Pt
CALIBOGUE SOUND
Grenadier Shoal

FIG. 5

topography. In this case, the orthophoto method was used because it was considered the best means for showing the land relief and features. The orthophoto overprint is prepared from a photo image base compiled from 1:80 000-scale aerial photographs and enhanced by overprinting photogrammetrically derived land contours.

As indicated in figure 6, the standard line format is the second method for showing the land topography. Because of the steep terrain, the bathymetric contour interval on this 1:24 000-scale map is 2 meters, as compared to the 1/2-meter interval on the previous 1:24 000-scale map of the Georgia coast.

As for the 1:100 000-scale maps (see Fig. 7), both the land and bathymetric contours and elevations are shown in metric units, with the offshore lease areas overprinted in red. This is a portion of the 1:100 000 map covering the Georgia and South Carolina coastline. The primary contour interval of the bathymetry is 2 meters, supplemented by the 1-meter contours shown by the screen black or gray lines. The land contours are at 5-meter intervals and the remaining land topography is generally derived by cartographic methods from the basic 1:24 000-scale maps. At the present time, about 60 maps of various scales are being placed in production each year. For the conterminous United States, coverage at 1:250 000 and 1:100 000 scale is expected to be completed during the late 1980's. The time frame for the 1:24 000 maps will be considerably longer since they are produced only when coastal states identify a need for them. Sixteen hundred 1:24 000 maps will be required to cover the entire shoreline of the United States.

Over the past 7 years more than 70 topo/bathy maps have been published; this includes 1:24 000-scale coverage of the entire coastline of the state of Georgia and portions of the states of Washington, Wisconsin, and Michigan. The 1:100 000-scale maps cover most of South Carolina and a portion of Georgia and are used in planning and performing broad coastal zone area studies. The 1:250 000-scale topo/bathy maps cover areas of the east coast from New Jersey to Georgia and nearly all the California coastline (Fig. 8). In the Gulf of Mexico, partial coverage at 1:250 000 scale is available from the west coast of Florida to Texas.

The National Ocean Survey has provided the United States Geological Survey with bathymetry to publish an additional 170 topo/bathy maps. Coastal areas covered by these manuscripts are illustrated by the diagonal white lines which include 1:24 000 maps of Chesapeake Bay (Potomac River, Maryland, and Virginia), Washington State, Florida, and Puget Sound; 1:100 000 maps of Oregon, California, Florida, Virginia, Georgia, Washington, and coastal states in the Gulf of Mexico; 1:250 000 maps cover Maryland, Virginia, Alaska, Florida, Alabama, New York, and Massachusetts.

It may appear that bathymetry and shoreline information cannot be obtained by a potential user until the topo/bathy map is published. On the contrary, if someone has an immediate need for this data, the National Ocean Survey will furnish black and white copies from the manuscript.

A necessary by-product of this increased bathymetric mapping effort is a new map and chart catalog of bathymetric maps and special purpose charts which is published and updated annually by the National Ocean Survey.

The coastal mapping efforts of the National Ocean Survey and Geological Survey have not been restricted to only producing maps. A coastal mapping

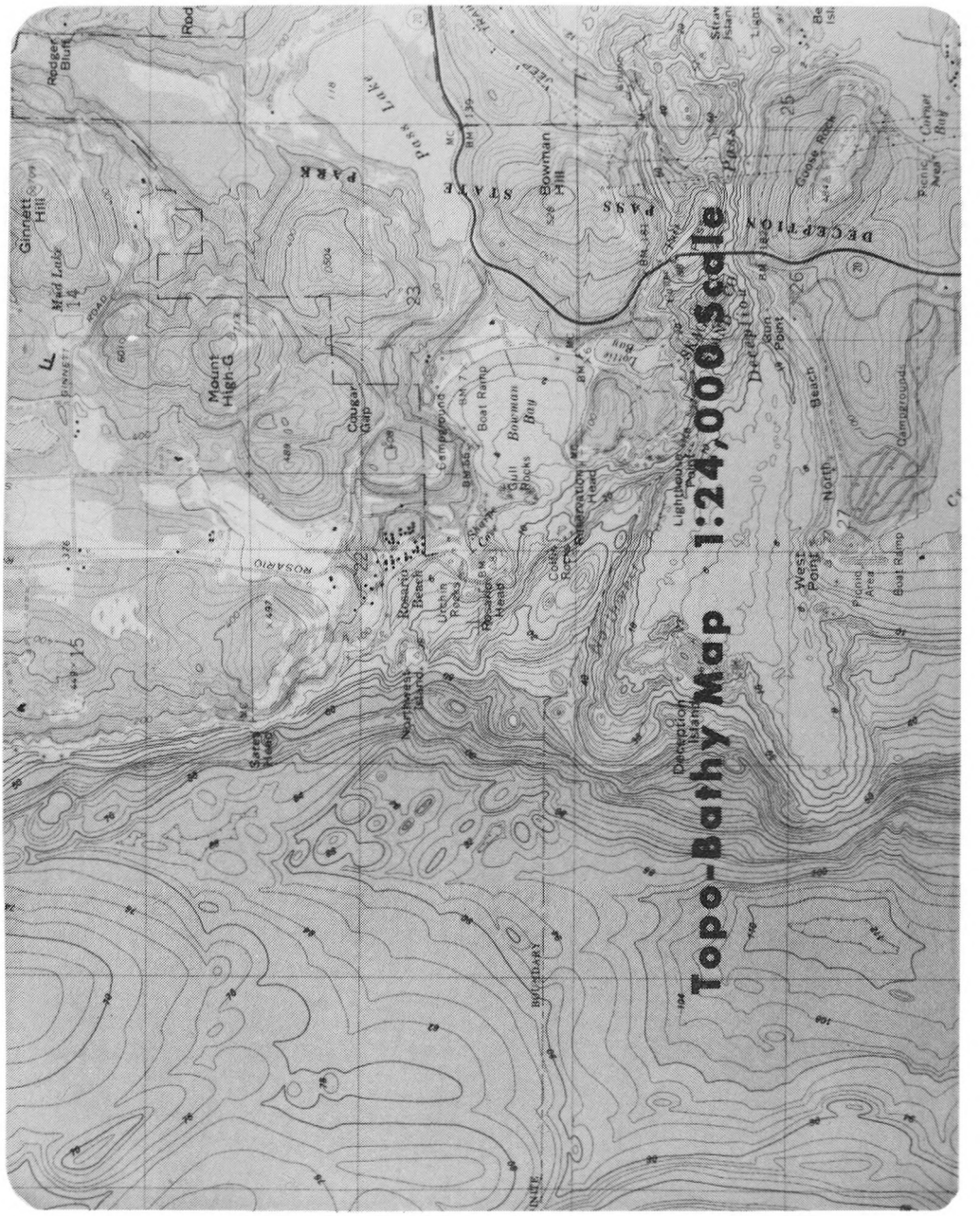
Topo-Bathy Map 1:24,000 Scale
Mount High-G
Cougar Gap
Bowman Bay
Bowman Hill
Deception Pass
Rosario Beach
Rosario Head
Lighthouse Point
Sun Point
West Point
Deception Island
Northwest Island
Gull Rocks
Urchin Rocks
Boat Ramp
Campground
Picnic Area
Goose Rock
Ginnett Hill
Rodger Bluff
Mud Lake
Lake Erie
PARK
STATE
PASS
DECEPTION
ROSARIO
BREAKWATER
Cranor Bay

FIG. 6

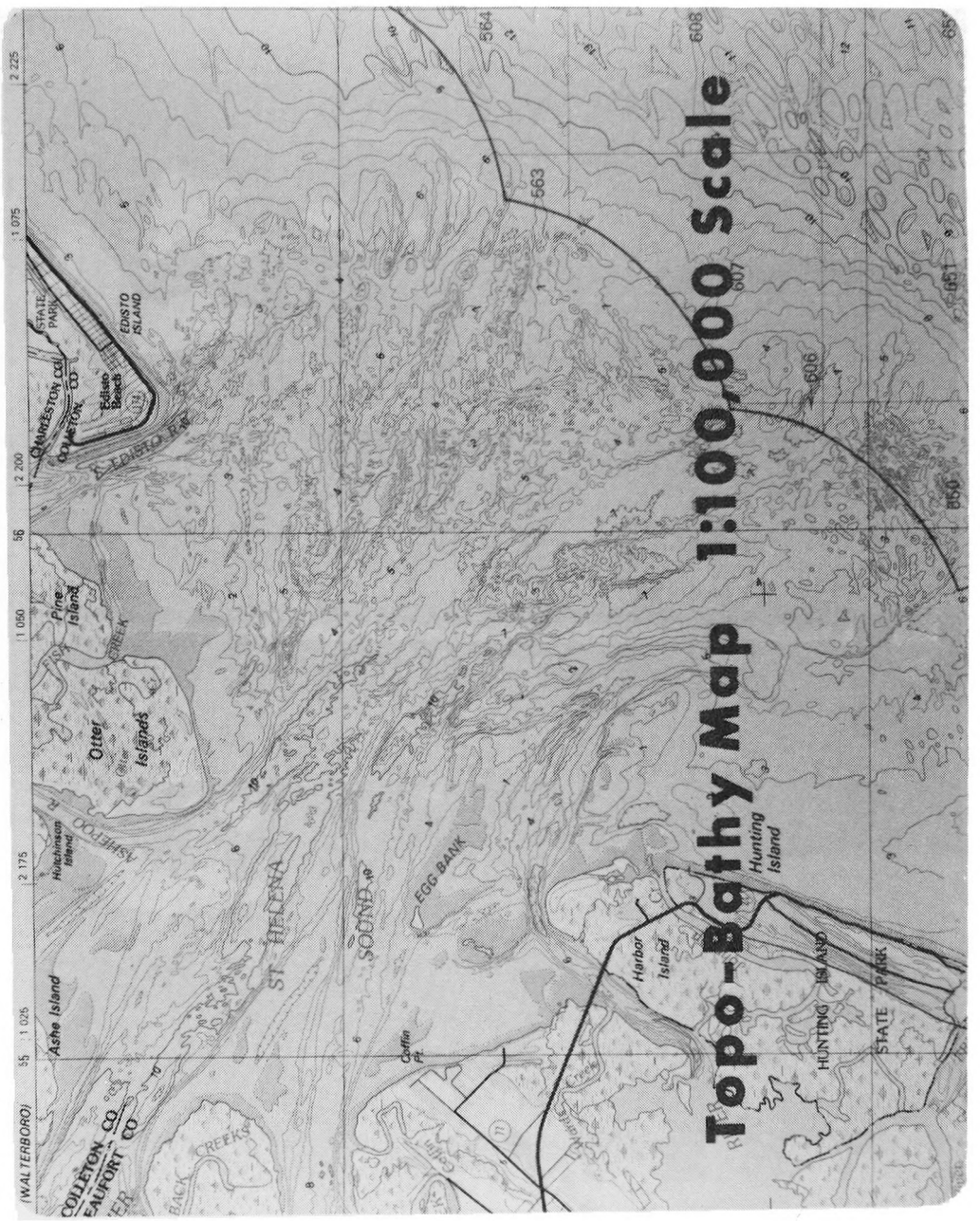
Topo-Bathy Map 1:100,000 Scale
ST HELENA SOUND
EGG BANK
Ashe Island
Otter Islands
Pine Island
Hutchinson Island
Harbor Island
Hunting Island
HUNTING ISLAND STATE PARK
EDISTO ISLAND
Edisto Beach
COLLETON CO
BEAUFORT CO
CHARLESTON CO
Coffin Pt
BACK CREEKS
ASHEPOO R
(WALTERBORO)

FIG. 7

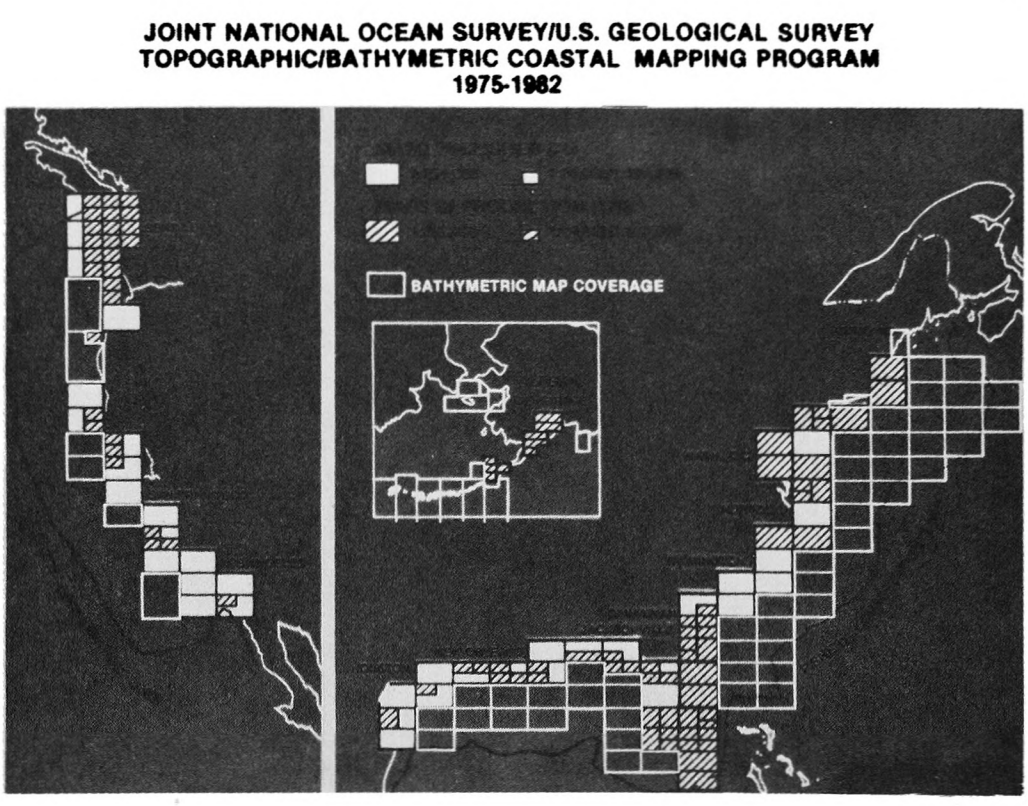

FIG. 8

handbook has been jointly published by these agencies. This multipurpose handbook provides general information and guidance; it is neither a textbook nor a technical manual, but rather, an introduction to coastal mapping. It was prepared with the requirements of the entire coastal community in mind and to help states determine their mapping requirements, select the best topo/bathy maps for their needs, deal effectively with personnel who scientifically gather and process data, and who accurately prepare the maps they have selected for meeting the state's requirements.

Showing the bathymetry and topography on one map (see Fig. 9) is not only a cost-effective way for the United States to produce these maps, but, more importantly, it makes it possible for coastal states, involved federal agencies, and private industry to perform various studies and investigations, and to make comprehensive long-range plans without using two or more maps, possibly at differing scales. Possible users of these maps include, but are not limited to, resource development, restoration of beach erosion, identifying future disposal and dredge sites, land use planning, determining effects of sediment flows, establishing fishing and wildlife reserves, developing recreational areas, and countering the effects of storm surges.

In the years ahead increasing demands will be placed on many governments and industries to develop new technology that will provide more economical and

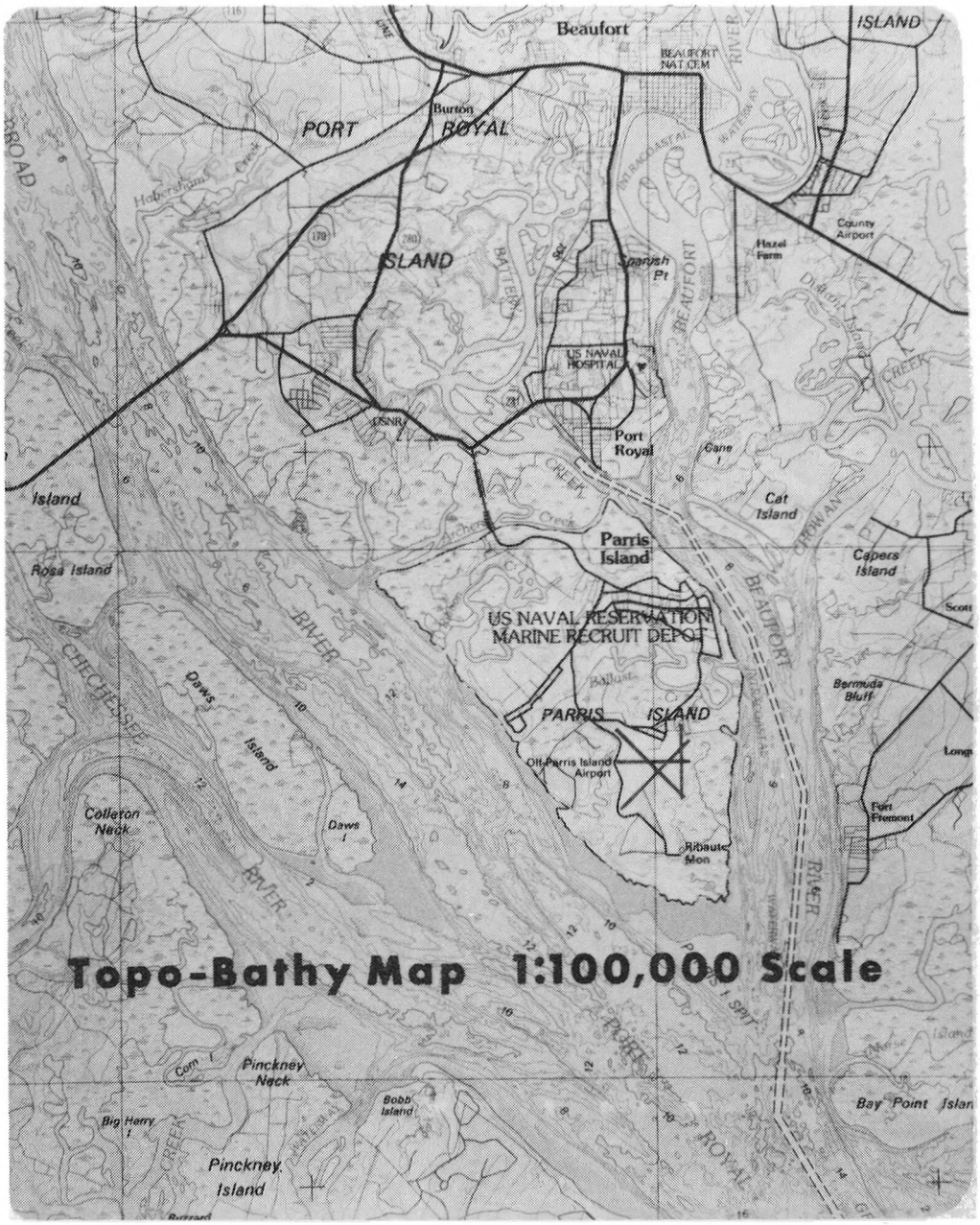

FIG. 9

efficient means of protecting and developing coastal areas and extracting marine resources from the oceans of the world. A basic knowledge of these environments will still remain a strong prerequisite for scientists and engineers in meeting these challenges. The bathymetric and topo/bathy maps described today will continue to play an important role in the United States' efforts in meeting its goals in this area, and we invite our colleagues of the International Hydrographic Organization to comment on this mapping approach.