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DISASTER SURVEY REPORT 77-1

The ARGO MERCHANT Oil Spill Incident: Dec. 15, 1976 to Feb. 15, 1977

A REPORT TO THE ADMINISTRATOR

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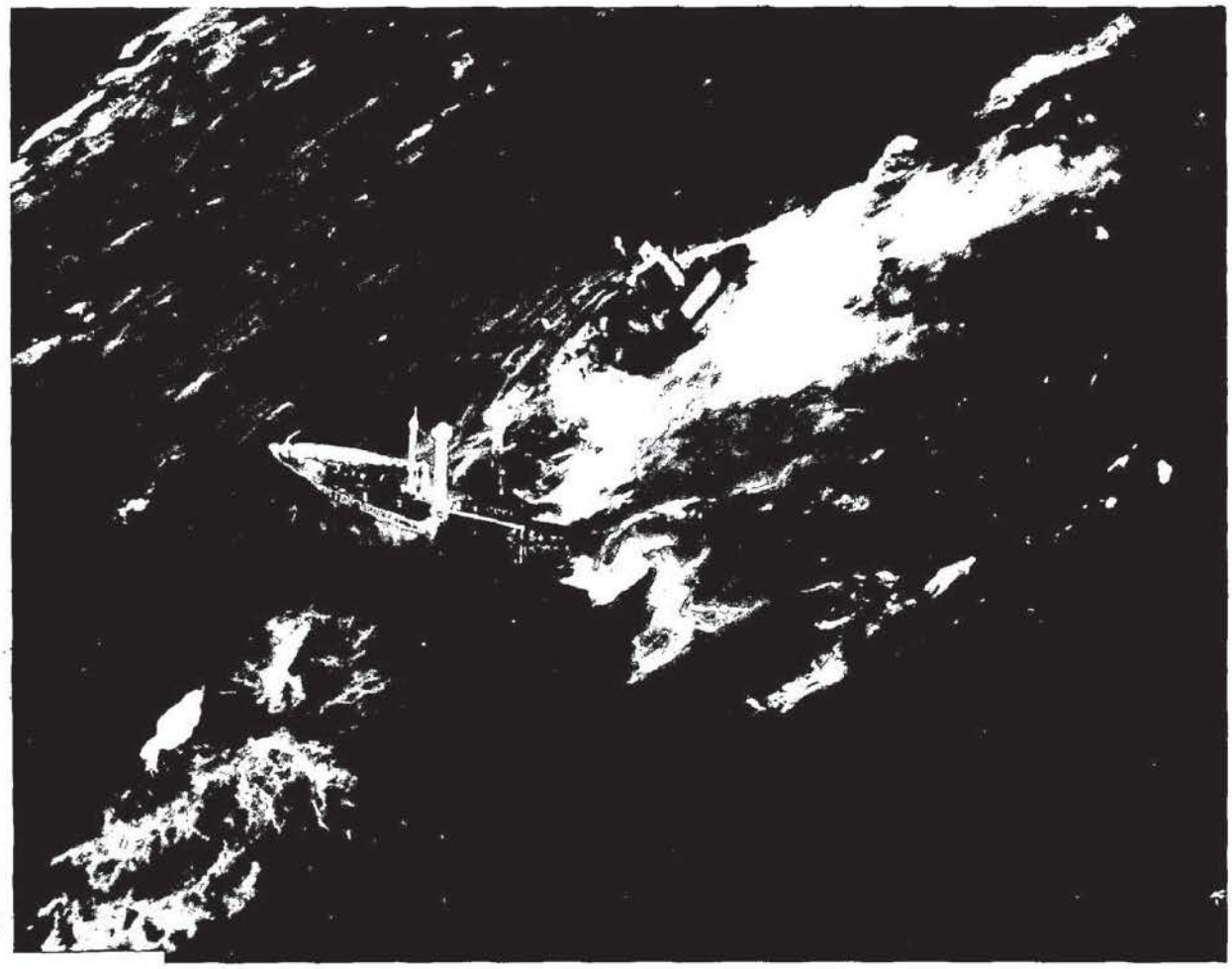

U.S. National Oceanic and Atmospheric Administration

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July 1977

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U.S. DEPARTMENT OF COMMERCE
Jaunita Kreps, Secretary

National Oceanic and Atmospheric Administration
Robert M. White, Administrator

Tanker ARGO MERCHANT foundering off the coast of Nantucket, Mass. (U.S. Navy Photograph released by Department of Defense, Washington, D.C., January 10, 1977)

FOREWORD

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On January 17, 1977, I requested Donald P. Martineau, Deputy Associate Administrator for Marine Resources, National Oceanic and Atmospheric Administration, to undertake a review of NOAA performance relative to the ARGO MERCHANT incident. Specifically, I requested a review to determine the effectiveness of our organization in responding to both our National Contingency Plan responsibilities as well as to short and long-term assessments of the resulting impacts upon the marine environment and associated fishery resources. I was particularly interested in establishing where any deficiencies might have existed that require remedy to further improve our effectiveness in responding to any future major oil spill incidents.

The enclosed report by Dr. Martineau and the survey team presents their findings on the performance of all NOAA elements which participated in providing data, information, equipment or other services associated with the Federal response to the ARGO MERCHANT incident. The general conclusion of the survey team is that the NOAA elements performed in an outstanding manner in responding to one of the largest oil spills to occur off our shores, often working under the most difficult of environmental conditions in the Northwest Atlantic. The personnel involved are to be highly commended for their diligence and dedication.

Robert M. White

Robert M. White
Administrator

PREFACE

A NOAA survey team traveled to Massachusetts February 7-9, 1977, to interview NOAA personnel, other Federal and state officials, and scientists from local institutions associated with the NOAA participation in the ARGO MERCHANT incident. In addition, other individuals were interviewed directly in the Washington, D.C., area or through telephone interviews where time or distance prevented visits. The survey team included Robert Beck, Deputy Associate Administrator for Environmental Monitoring and Prediction; John Mirabito, Office of the Associate Administrator for Environmental Monitoring and Prediction and alternate Commerce member to the National Response Team under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); Jean Snider, ecologist, Office of the Associate Administrator for Marine Resources; Roland Paine, Public Affairs Officer (Oceanic Programs), Office of Public Affairs; and the undersigned.

At the outset, the team established its purposes as the following: 1) to determine the adequacy of response of NOAA elements both to the Regional Response Team's activities and to the On-Scene Coordinator's requirements and needs, as defined by the NCP; and 2) to evaluate the response of NOAA elements to the problem of assessing the potential damage to the marine environment and fish stocks of the area, which is one of the most productive fisheries areas of the world.

It was not the intent of the survey to describe the total response by Federal, state, and private groups, nor was it the purpose of this survey to evaluate the technical quality of the data or the resulting scientific assessments. Data were still being evaluated and assessments made beyond the concluding date of the period for the survey. A more complete description of the scientific efforts is contained in The ARGO MERCHANT Oil Spill - A Preliminary Scientific Report.*

The survey was limited to the period extending from December 15, 1976, when the ARGO MERCHANT was grounded, to February 11, 1977, when the Coast Guard determined that the wreckage contained no oil and that cleanup and containment activities were no longer necessary. This survey constitutes the first evaluation of a NOAA response to a major oil spill. The spill did not occur within territorial seas, where the States have primary responsibility for assessing damage to the marine environment and fishery resources, nor did the oil go ashore during the period covered by the survey. Consequently, the assessment of environmental and resource damage was predominantly a Federal action, in which NOAA played the principal role. The survey provided an opportunity to determine the extent of interaction not only among the many NOAA elements involved, but also the extent of their interaction with Federal, state, local, and private organizations and individuals.

* NOAA Special Report: The ARGO MERCHANT Oil Spill - A Preliminary Scientific Report. Edited by Peter L. Grose and James S. Mattson. March 1977. U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

The survey members were particularly impressed with the cooperation evidenced among Federal agencies and the local scientific community. The team is indebted to the numerous individuals not only from within NOAA, but also from other Federal and state agencies, and from the scientific community, for their contribution to the survey. It would not have been possible without their willing cooperation and assistance.

Donald P. Martineau
Deputy Associate Administrator for
Marine Resources
National Oceanic and Atmospheric
Administration

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1. THE ARGO MERCHANT INCIDENT

A. The Grounding and Break-Up

At 0710 EST, December 15, 1976, the U.S. Coast Guard Station on Nantucket Island received a report from the Liberian tanker SS ARGO MERCHANT en route from Puerto La Cruz, Venezuela, to Salem, Mass., that she was aground in international waters about 28 miles (45 kilometers) southeast of Nantucket Island on Fishing Rip. The vessel had a crew of 39 and was carrying approximately 7.7 million gallons of number 6 fuel oil. The report from the vessel stated that the engine room was flooded and that she was in danger of breaking up. Coast Guard units arriving at the grounding site at approximately 0800 EST reported weather conditions of overcast skies, temperature of 43°F (6°C), winds from the southwest at 15 knots, seas of 6 feet (2 meters), and visibility of 10 miles (16 kilometers). Within 1 hour of the grounding, the Regional Response Team was activated by the Commander, First Coast Guard District.

The Coast Guard appraised the vessel's condition and indicated that the potential spillage of oil was a grave and imminent threat to the coastline and related interests of the United States. Because oil spill removal is limited to the navigable waters of the United States and to adjoining shorelines and waters of the contiguous zone under the National Contingency Plan, the Commander, First Coast Guard District, Boston, requested authority to implement the provisions of the Intervention Convention Act. This Act permits the United States to assume full control of all salvage operations, including all public and private efforts, towards eliminating the pollution danger if actions by the owner/agent of the stranded vessel are considered to be inadequate, ill-timed, or inappropriate. The Commandant, Coast Guard, authorized intervention on December 15, 1976.

On the day of the grounding, the On-Scene Coordinator was advised that the vessel was leaking oil from an underwater hole in a starboard tank and he decided to evacuate 20 members of the crew. By late evening the vessel had lost its emergency power supply due to flooding of the engine room. On the next day, December 16, the Commander, First Coast Guard District, invoked the Intervention Convention Act and assumed control of all salvage activities. Later that day flooding became uncontrollable and conditions on the ARGO MERCHANT became so critical that all remaining crew members were evacuated.

On December 17, the vessel developed a 5 to 10-degree starboard list and the main deck astern was awash. A heavy oil slick extended to the northwest for 5 miles (8 kilometers), then westward for 3-1/2 miles (5.6 kilometers). Meanwhile, worsening weather conditions impeded the salvage effort.

On December 18, the vessel continued to settle in the water with a list of 15 degrees. The Coast Guard estimated at the time that approximately 100,000 gallons of oil had been discharged and declared the incident to be a major spill in accordance with the criteria contained in the National Contin-

gency Plan. Concentrations of oil were observed drifting from the starboard side. Heavy pools of oil (pancakes) were observed 27 miles (43 kilometers) east of the ship.

The situation aboard the ARGO MERCHANT did not change appreciably during December 19 and 20. Despite heavy seas and icing conditions, preparations were made to pump out the remaining oil in the ship. During this time the discharged oil had formed plumes averaging 2 miles (3.2 kilometers) wide and 16 miles (25.6 kilometers) long. Oil slicks were visible extending to the east-northeast for a distance of 60 miles (97 kilometers).

On the morning of December 21, the ARGO MERCHANT broke in two sections 100 feet aft of the forward navigational bridge. At this time the Coast Guard estimated that 50 to 75 percent of the cargo had been lost. An overflight of the area revealed a heavy slick extending eastward 6 miles (9.6 kilometers) averaging 2.5 miles (4 kilometers) wide. The sheen extended 8 miles (13 kilometers) east from mixed heavy concentrations that covered an area 60 miles (97 kilometers) east and 25 miles (40 kilometers) north.

On December 22 the bow section broke forward of the bridge, releasing additional oil. During the next several days the discharged oil covered an area east of the grounding approximately 100 miles (161 kilometers) long and 30 miles (48 kilometers) wide.

On December 31, the Coast Guard fired explosive projectiles into the fore peak tank to prevent the relatively buoyant bow section from drifting into the shipping lane. The release of trapped air also was intended to stabilize the bow section, a serious hazard to the divers who were preparing to examine the wreck and determine the amount of oil still on board.

The combination of strong currents, high seas, and severe weather conditions prevented diving operations during the entire month of January. On February 11, as a result of improving weather conditions, a series of dives was completed in which it was determined that all tanks of the ARGO MERCHANT were open to the sea and devoid of oil. Overflights of the wreck site on February 12 and 14 resulted in no sightings of oil. On February 15, 1977, the Coast Guard announced that future air surveillance of the wreck site would be conducted in conjunction with routine fisheries patrols.

B. Area of the Incident

Nantucket Shoals is the general name of the numerous different broken shoals that lie southeast of Nantucket Island and make this one of the most dangerous parts of the coast of the United States for navigation (figure 1). Located at the southeastern edge of Nantucket Shoals is Fishing Rip where the grounding took place. Fishing Rip has depths of 3 to 10 fathoms and is about 26 miles (42 kilometers) along its north-south axis and extends 6.5 miles (10.7 kilometers) from east to west.

Tidal currents in this area are strong and erratic, reaching a velocity of 3 to 5 knots. They are caused by the obstruction of the shoals; in some cases, they are deflected to such an extent as to cause the direction to

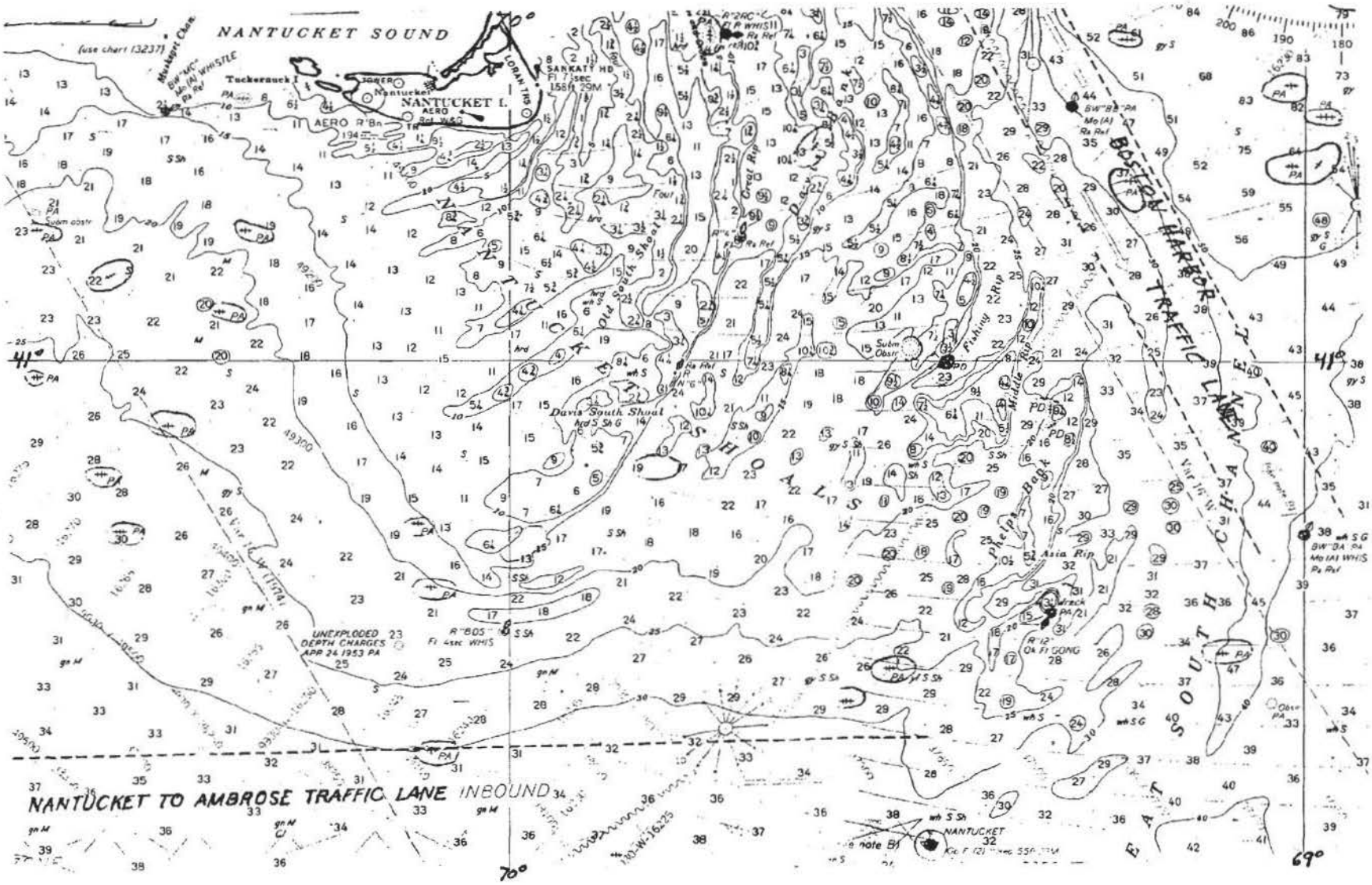

Figure 1.--Portion of bathymetric chart for Gulf of Maine and Georges Bank, depths in fathoms. (National Ocean Survey, NOAA Chart 13009, Nov. 1925) ⊗ indicates approximate location of ARGO MERCHANT grounding.

change 180 degrees from one side of a shoal to the other. Although mean surface currents throughout this area are normally light, averaging 2 to 3 nautical miles per day, drifting northward, the combination of rotary tidal currents and wind produce heavy seas within the shoals, making both surface and subsurface operations very hazardous (figure 2).

There are relatively few clear and calm days in the Nantucket Shoals area during the winter months. A rapid succession of storms invade this region from the west and south, producing precipitation in the form of snow and rain accompanied by fairly constant northwesterly and westerly winds with velocities in excess of 10 knots occurring nearly 50% of the time. In advance of these storms there are short periods of easterly to southerly winds (figure 3).

From December 15 to February 15, weather conditions at the scene of the ARGO MERCHANT were unusually severe. A series of low pressure areas developed off the middle Atlantic and southeast coast and intensified as they moved northward into New England waters. In addition, fast moving low pressure areas approaching from the Great Lakes area produced extremely low temperatures.

As these storms progressed northward they reinforced an intense low pressure system in the vicinity of Labrador. As a result, a strong northerly to northwesterly flow of frigid Arctic air persisted over New England on the offshore waters. This produced strong gusty winds ranging from 20 to 40 knots, sub-freezing temperatures, structural icing, precipitation, and rough seas with waves ranging from 10 to 20 feet high. These rigorous meteorological conditions abated in early February, permitting the series of successful diving operations to be completed on February 11, 1977.

The Nantucket Shoals-Georges Bank region represents one of the most productive fishing grounds in the world, supporting one of the Nation's most active fishing industries. From 1968 to 1972, the catch from the Nantucket Shoals-Georges Bank region represented approximately 57% of the total catch made in New England waters, averaging approximately 500,000 metric tons per year.

On Nantucket Shoals, the peak spawning activity of cod is from December through February; haddock, February through April; yellowtail flounder, March through May; and mackerel, April through June. These spawning concentrations are in areas that could be affected by any oil release. In addition to the presence of eggs during spawning, the larval stages of these species plus others are present for even longer periods of time.

There is significant fishing activity in this area during the winter months. Sizeable catches of silver hake, red hake, pollock, herring, and mackerel are taken, as well as shellfish such as rock crab, lobster, sea scallop, and conchs.

On Muskeget Island off Nantucket there is a small breeding colony of 10 to 15 gray seals. This is the only breeding colony of this species in U.S. waters.

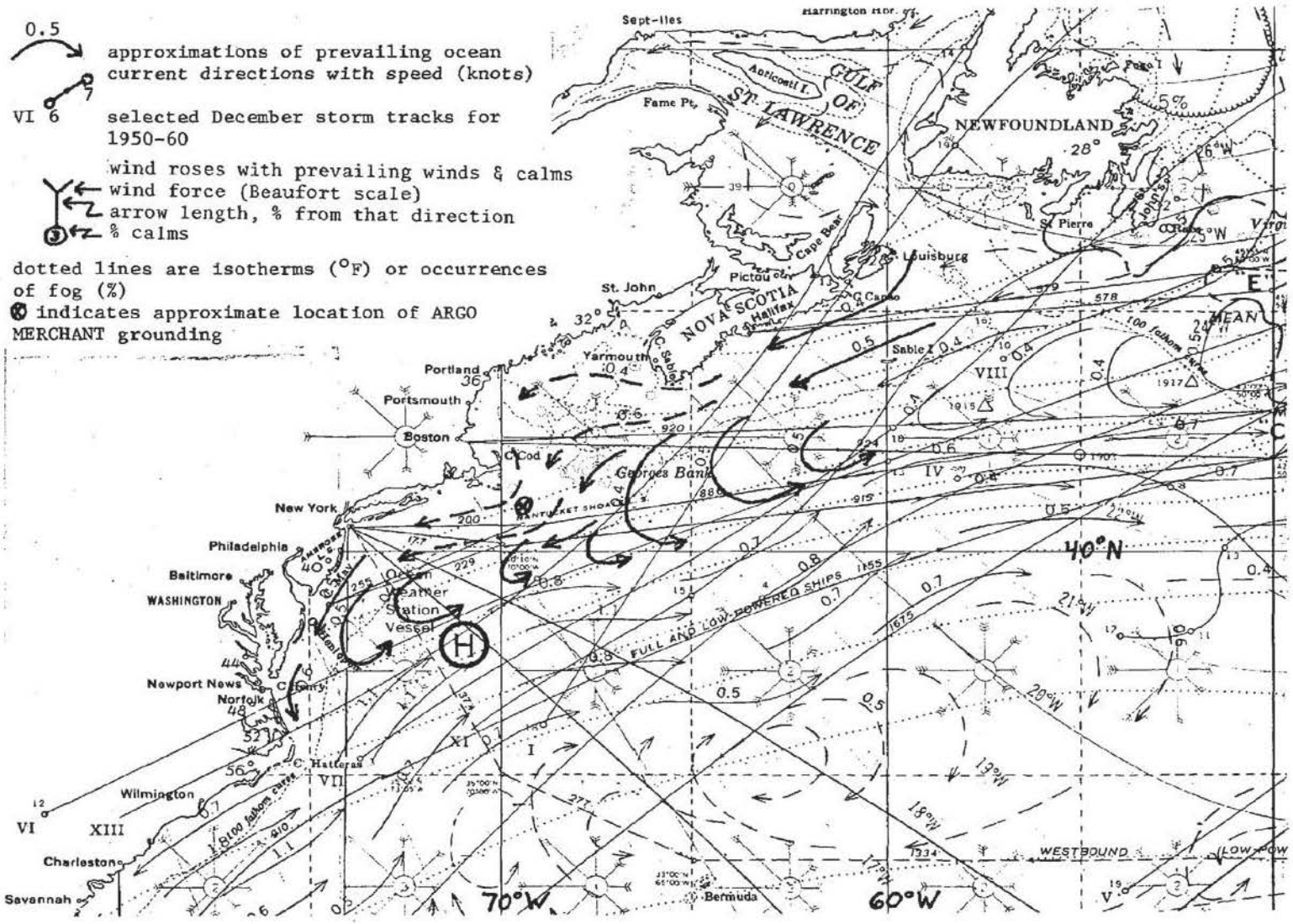

Figure 2.--Portion of U.S. Navy Pilot Chart of North Atlantic Ocean (Dec. 1976).

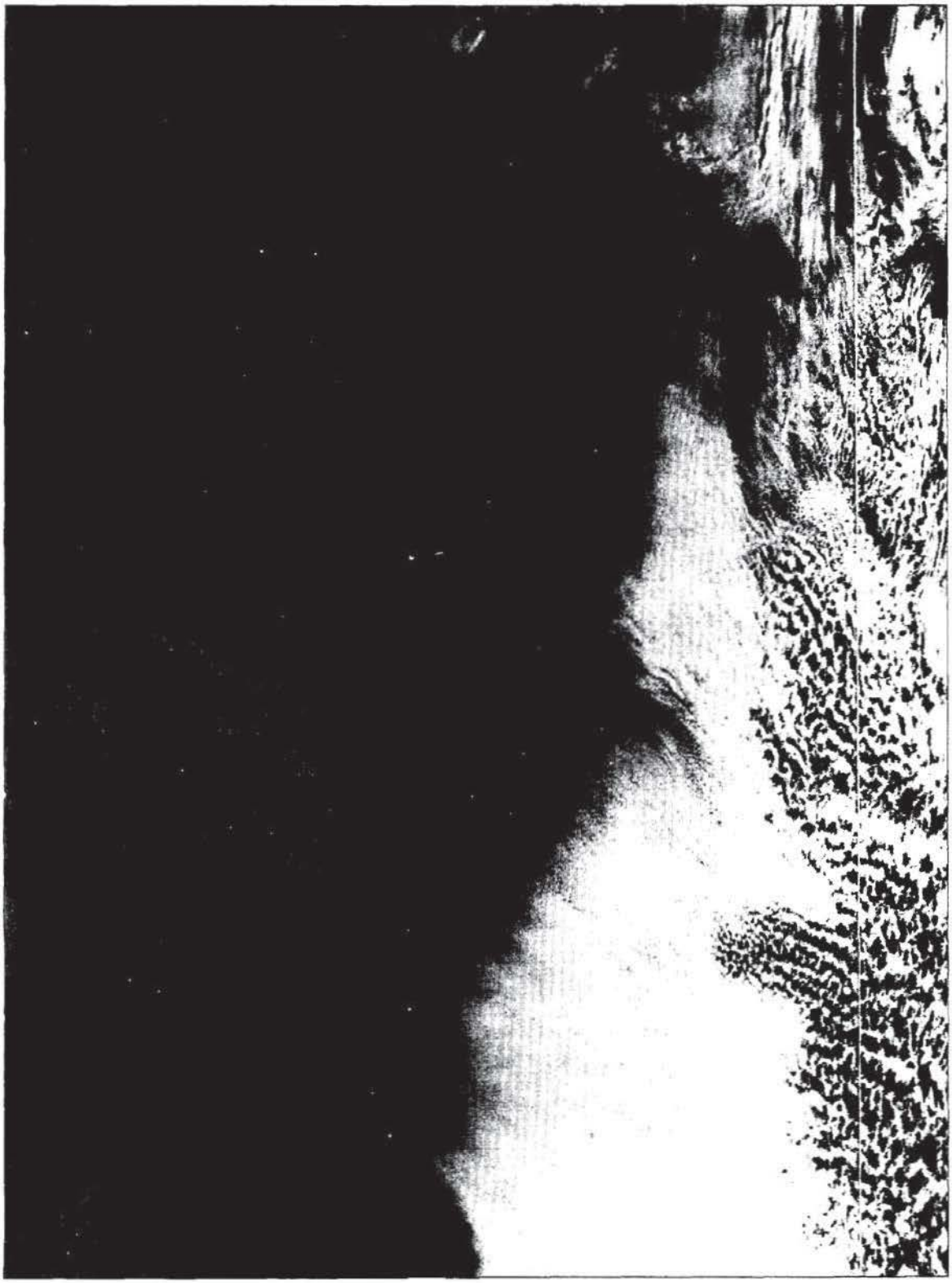

Figure 3.--Satellite photograph Jan. 2, 1977, showing storm systems moving across eastern United States.

2. NOAA RESPONSE TO THE ARGO MERCHANT INCIDENT

A. National and Regional Contingency Plans

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) is the basis for all Federal action to minimize pollution damage to the navigable waters of the United States from discharges of oil or hazardous substances. The Plan became part of the Code of Federal Regulations in June 1970 pursuant to the Water Quality Improvement Act of 1970, and assumed its present format in August 1973 to comply with the provision of the Federal Water Pollution Control Act Amendments of 1972. The current version of the Plan was published in February 1975 with minor changes incorporated in March 1976.

The primary purpose of the Plan is to provide a coordinated Federal response to an unexpected, and usually accidental, discharge of oil or hazardous substance that poses a threat to the public health or welfare. This is accomplished by establishing a flexible organization consisting of individuals designated as Federal On-Scene Coordinators (OSCs) and advisory groups capable of providing expertise and assistance as required. The latter groups consist of Regional Response Teams (RRTs) and a National Response Team (NRT). Normally, Federal On-Scene Coordinators are furnished by the Coast Guard for coastal waters, the Great Lakes, and ports and harbors, and by the Environmental Protection Agency on inland waters for the purpose of coordinating and directing the Federal pollution control efforts at the scene of a discharge or potential discharge. In the case of the ARGO MERCHANT, the Coast Guard designated the On-Scene Coordinator.

The Coast Guard and Environmental Protection Agency are also responsible for developing and implementing Regional Contingency Plans for their respective areas of responsibility. These plans identified 1) key personnel capable of coping with potential problems within the region, 2) the environmental resources that would be jeopardized should a discharge occur, and 3) procedures, equipment, and techniques available to protect and/or reduce damage to the marine environment in the event of a pollution discharge.

The Regional Response Team (RRT) acts within a region on an emergency basis to provide assistance to the OSC. They draw their membership from regional components of Federal agencies. The National Contingency Plan designates as primary agencies the Departments of Transportation, Defense, Commerce, and Interior, and the Environmental Protection Agency. These agencies are to be represented on all RRTs. However, the survey team found that at the time of the ARGO MERCHANT grounding there was no designated Department of Commerce representative on the appropriate Regional Response Team.

The National Contingency Plan designates as advisory agencies the Departments of Justice, State, Housing and Urban Development, Health, Education and Welfare, and the Energy Research and Development Administration.

Additionally, appropriate State agencies are actively encouraged to participate as full members of the RRTs.

The National Contingency Plan specifies that:

> the Department of Commerce, through NOAA, is to provide support to the NRT, RRT and OSC with respect to: Marine environmental data; living marine resources; current and predicted meteorological, hydrologic and oceanographic conditions for the high seas, coastal and inland waters; and maps and charts, including tides and currents for coastal and territorial waters and the Great Lakes. When requested by NRT, MARAD will provide advice on the design, construction and operation of merchant ships.

Both the National Weather Service and the National Marine Fisheries Service were contacted by the Regional Response Team because of the expertise they could provide. However, they were contacted directly by the Coast Guard and not by a designated Department of Commerce representative on the Regional Response Team.

B. NOAA Implementation Directives

NOAA Circular 72-12 dated January 25, 1972, sets forth guidelines for implementing the NCP. It states in part that each Major Line Component (MLC) with a significant involvement will coordinate with the appropriate regional or district offices of the Environmental Protection Agency (EPA) and the U.S. Coast Guard. In addition, through inter-MLC coordination there will be established a system for notifying all concerned NOAA personnel through the appropriate Weather Service Forecast Office (WSFO). This WSFO will function as a single point of contact for the U.S. Coast Guard or EPA Regional Response Team (RRT) to notify other NOAA elements. The selection of a WSFO to serve in this alerting capacity is based on its 7 days, 24-hours per day operating schedule.

Operations Manual Letter 72-21 dated December 4, 1972, issued by the National Weather Service designates Weather Service Forecast Office Boston as the single point of contact for EPA Region I and U.S. Coast Guard First District. Regional Operations Manual Letter E-15-76 dated June 28, 1976, further delineates procedures for each Weather Service Forecast Office within the National Weather Service, Eastern Region, for providing support to the On-Scene Coordinator. In compliance with these directives, the Weather Service Forecast Office Boston has included in its Station Duty Manual instructions relating special weather support to the On-Scene Coordinator.

In implementing its role in the National Contingency Plan, the National Marine Fisheries Service has prepared Contingency Plans for each of its Regions. The NMFS Contingency Plan of 1972 for the Northeast Region designates the Regional Director as the Response Coordinator for NMFS and the Chief, Environmental Assessment Division of the Northeast Region, as his

alternate. The Plan also established the Northeast Regional Office as the primary Regional Response Center to coordinate whatever NMFS action may be required.

C. NOAA Reaction to the Regional Response Team

On the morning of December 15, 1976, the marine forecaster from WSFO Boston was informed by the Coast Guard of the grounding of the ARGO MERCHANT. Immediately the WSFO alerting and supporting functions were implemented. About 8:30 a.m., the Northeast Regional Office of the National Marine Fisheries Service was advised of the stranded tanker by the chairman of the RRT. The WSFO Boston also discussed the situation with EPA Region I and informed the National Weather Service Eastern Region headquarters of the latest developments. Late that afternoon the Commander, First Coast Guard District, Boston, requested that special weather forecast services for the scene of the grounding be provided every 6 hours. In addition the Coast Guard Research and Development Center at Groton, Conn., requested detailed 48-hour forecasts of surface wind conditions in the Nantucket Shoals area as an input for computing oil spill trajectories. These special forecast services commenced at 1700 EST December 15, 1976 (figure 4).

The Regional Director, Northeast Region, as the NMFS participant on the Regional Response Team, was notified by the RRT of the ARGO MERCHANT grounding at approximately 0830 EST December 15, 1976. As early reports indicated that the ship had run aground and that there was a reasonable chance for refloating, the Regional Director waited until more information was available before notifying the Northeast Fisheries Center at Woods Hole, Mass., on December 16, 1976. NMFS Headquarters, however, was alerted on December 15. On the morning of December 17, 1976, scientists from the Northeast Fisheries Center met with local scientists at the Woods Hole Oceanographic Institution to discuss an action plan that the Woods Hole scientific community might pursue. This was the initial session of meetings from which were developed the cruises for assessing the resource and environmental damage. After the break-up of the ARGO MERCHANT, the Regional Director, Northeast Region, NMFS, also initiated a series of actions which included arrangements with the Boston Aquarium to treat any mammals that might have been contaminated; the inauguration of weekly reports from port agents on direct loss of catch or fouling or loss of gear; a survey of seafood processors; and providing the means for cleaning nets contaminated by the spilled oil.

D. Response by the NOAA/Coast Guard Spilled Oil Research Team

The Spilled Oil Research (SOR) team is an element of NOAA's Outer Continental Shelf Environmental Assessment Program (OCSEAP), a major environmental study being conducted by NOAA for the Department of Interior, Bureau of Land Management. One of the objectives of OCSEAP is to understand the processes governing the behavior of oil in the marine environment in order to develop models for predicting oil spill trajectories. The need for field verification of experimental models led to the formation of specially trained teams capable of responding rapidly to accidental oil spills. Such spills, if studied within the first 72 hours, provide an unusual opportunity to evaluate the movement of various types of oil under actual conditions and in

MONDAY DEC 20 1976

SPECIAL FORECAST FOR U.S. COAST GUARD

PASS TO:

CGCDONE BOSTON MA
INFO: OPS GROUP WOODS HOLE MA
OPS AIRSTA CAPE COD MA
CGC VIGILANT
CG OCEANOGRAPHIC UNIT WASHINGTON DC

SPECIAL FORECAST FOR THE FISHING RIP AREA.

GALE WARNINGS IN EFFECT.

SYNOPSIS..INTENSIFYING GALE CENTER NORTHERN VERMONT WILL MOVE TOWARD THE EASTNORTHEAST 25 TO 30 KNOTS. TRAILING COLD FRONT WILL PASS THE TANKER SITE AROUND 09Z TUESDAY.

SOUTHERLY WINDS 20 TO 30 KNOTS AND GUSTY SHIFTING TO WEST AND NORTHWEST WITH COLD FRONT PASSAGE AND INCREASING TO 30 TO 40 KNOTS DURING TUESDAY. NORTHWEST WINDS 30 TO 35 KNOTS AND GUSTY TUESDAY NIGHT. RAIN REST OF THE NIGHT CHANGING TO SNOW SQUALLS DURING TUESDAY. TURNING SHARPLY COLDER TUESDAY WITH FALLING TMPS DURING THE DAY DIPPING TO THE TEENS TUESDAY NIGHT WITH PSBLY SOME FRZG SPRAY DEVELOPING. VISIBILITY FREQUENTLY BELOW A MILE DURING MOST PRECIPITATION PERIODS. SEAS MAY BUILD TO 10 TO 20 FEET IN THE NORTHWEST WINDS TUESDAY.

AVIATION: AHEAD OF THE FRONT..CEILINGS AND VISIBILITY VRBL TO BELOW 5 HND FT AND A MILE..FOLLOWING THE FRONT CEILING 1 TO 2 THSD FT AND VSBY AROUND X 5 MILES VARIABLE TO UNDER 1 THSD FT AND 3 MILES IN SNOW SQUALLS. BLUSTERY NW WNDS WITH FREEZING LEVEL LOWERING TO NEAR SURFACE FURING THE DAY WITH LIGHT TO MDT ICG DVLPG IN CLOUD AND PRECIPITATION..

ACF....202225E

Figure 4.--Example of special weather forecasts given by National Weather Service for U.S. Coast Guard.

oceanographic and meteorological situations.

The Spilled Oil Research effort is conducted by teams comprised of personnel from NOAA, the U.S. Coast Guard, and the Alaska Department of Environmental Conservation. These teams operate out of Juneau and Fairbanks, Alaska; Seattle, Wash.; Boulder, Colo.; and Washington, D.C.; and can respond to spills occurring in Alaskan waters and off the west and east coasts of the United States.

The SOR team's initial participation in the ARGO MERCHANT incident was not a part of the NOAA response provided within the framework of the National Contingency Plan. Instead, it represented the field phase of a research project that was designed to make in-situ studies of the behavior of oil in the marine environment.

The East Coast SOR team composed of scientists from the Center for Experiment Design and Data Analysis of NOAA's Environmental Data Service first learned of the ARGO MERCHANT incident from a headquarters representative of the National Marine Fisheries Service about noon on December 15, 1976. As a result, team members of the East Coast Team arrived that night at Hyannis, Mass. On the following day, December 16, 1976, other members of the SOR team assembled at Hyannis, which was selected as SOR headquarters because it was adjacent to a commercial airfield where incoming shipments of supplies could be readily picked up and where small aircraft could be rented. The first SOR team overflight of the grounded vessel was made on December 16 in a rented aircraft. The SOR team also contacted the On-Scene Coordinator and made arrangements to fly as observers on daily mapping flights. These flights began December 17, 1976. The SOR team, as requested by the Coast Guard, took more responsibility in coordinating the efforts of the scientific community until mid-January, when the Marine Ecosystems Analysis Program (MESA) Office assumed responsibility for the study of long-term effects.

E. Support to the National Response Team

In reply to a request by the National Response Team on January 13, 1977, for a recommendation regarding disposition of the wreck of the ARGO MERCHANT, assessments were made by the National Marine Fisheries Service, the SOR team, and the National Weather Service. The assessments dealt with the likely consequences of destroying the wreck and releasing any possible remaining oil; they evaluated such action in terms of both the potential impact on fishery resources and of the oceanographic and meteorological conditions likely to be experienced between January and early summer 1977.

By means of these assessments, NOAA recommended to the NRT that: 1) if possible, the oil remaining in the wreck not be released by further destruction of the wreck; and 2) if, however, there was a high probability that the wreck would break up by itself, with consequent release of the oil, then the remaining oil should be purposely released as soon as possible under the most favorable oceanographic and meteorological conditions.

This recommendation was forwarded to the NRT on January 21, 1977, with an offer to support any action to minimize the potential adverse impact upon

the environment and ecosystem.

Further disposition of the wreck and its cargo was not required as a result of an inspection of the remains of the hulk by the Navy Superintendent of Salvage on February 11, 1977, at which time no oil was found in the wreck.

3. SUPPORT TO THE ON-SCENE COORDINATOR

The offshore location of the grounding, the magnitude of the spill, and the proximity of one of the world's most productive fisheries brought into play several elements of the National Oceanic and Atmospheric Administration in various supporting roles to the On-Scene Coordinator. This support included special marine weather services, technical advice on oil movement, fisheries assessment, logistics and coordination of the scientific effort, and public information. This chapter describes the support services that were provided.

A. Marine Forecasts

On December 15, 1976, WSFO Boston, after consultation with Coast Guard officials, completed arrangements to supply the On-Scene Coordinator with special forecasts of wind, weather, visibility, sea and swell every 6 hours. Included were aviation forecasts in support of flight operations.

All forecasts, warnings, and advisories were sent via direct teletype to the Coast Guard District Office where they were relayed to the headquarters of the On-Scene Coordinator at the U.S. Coast Guard Air Station, Cape Cod. Additional addressees on all weather messages were the Coast Guard Cutters at the scene, the Coast Guard Operations Group at Woods Hole, and the Coast Guard Oceanographic Unit, Washington, D.C. On December 17, 1976, WSFO Boston was requested to transmit the special wind forecast directly to the Coast Guard Oceanographic Unit, Washington, D.C., instead of to the Research and Development Unit at Groton, Conn.

In addition to the forecast services described above, WSFO Boston provided weather briefings by telephone to the SOR team, the Coast Guard, NOAA pilots, and the news media.

As a result of the great interest generated by the ARGO MERCHANT, WSFO Boston was requested to supply meteorological information to the following:

Brookhaven National Laboratory
Department of the Interior, U.S. Geological Survey
Environmental Protection Agency
Woods Hole Oceanographic Institution
Navy Oceanographic Office
Office of the Attorney General of the State of Massachusetts
National Marine Fisheries Service

Critical hourly weather observations requested by the WSFO on December 15 were provided by the Nantucket Light Vessels throughout the ARGO MERCHANT incident. These observations were relayed by teletype to WSFO Boston via Coast Guard circuits. WSFO Boston at first did not receive weather obser-

vations that were being made by Coast Guard vessels at the scene of the wreck. A meeting with the On-Scene Coordinator in which the importance of this information was stressed resulted in the regular transmission and receipt of these meteorological data. On February 11, 1977, the Coast Guard notified WSFO Boston that the ARGO MERCHANT survey had been completed and that there was no further requirement for special weather services.

B. Oil Movement and Behavior

Although the SOR team was not provided for within the National Contingency Plan, it contributed substantially to the support of the OSC by providing him with information on oil spill movement and behavior, as well as a general expertise on oil dynamics.

Upon arrival, the SOR team contacted the OSC and was able to arrange for team members to fly as observers on the Coast Guard daily mapping overflights, begun on December 17, 1976. On these flights, time series photographs of the slick were taken, including infrared pictures; measurements were made to determine the oil-surface water differential velocity; and oil samples were collected for hydrocarbon analysis. This information was provided the Oceanographic Unit of the Coast Guard for use in their forecast model. Visual observations from these flights were transcribed to charts to display daily movement and dispersion of the spill (figure 5). In most cases, the team was working through the Coast Guard Oceanographic Unit, rather than the OSC.

The other activities performed by the SOR team, although not specifically requested by the OSC, provided additional supportive information useful to the Coast Guard in its effort to determine the distribution of the oil. On December 28, 1976, the SOR team requested satellite tracking buoys from the National Data Buoy Office to aid in the tracking of the spill's movement (figure 6). Within 48 hours of the request, one buoy, provided by Nova University, arrived at Hyannis and was deployed on the 31st in the center of a large concentration of oil. The second, which was never used, arrived about a day later, having been assembled in Santa Barbara, Calif. The deployed buoy transmitted reliable data until at least January 13 when its telemetered position was found to be close to the sighted oil. In a further attempt to determine the fate of the oil, the U.S. Navy was asked by the SOR team to provide a diving team to make underwater observations and photographs of the underside of the slick and the bottom. Such information supplemented other data on the distribution and dispersion of the spill.

EDS provided an additional service to the OSC by running a trajectory model based on historical wind data. This model yielded the statistical probability of oil coming ashore and provided the OSC with extra information on potential onshore impact (figure 7).

The survey team also noted that in addition to contributions by in-house elements, the Sea Granters of the New England area were active in responding locally to the grounding and subsequent break-up of the ARGO MERCHANT by providing support to the OSC and Federal agencies. On December 17, Sea Grant researchers from the Massachusetts Institute of Technology contacted the Coast Guard and offered to assist with computer model forecasting

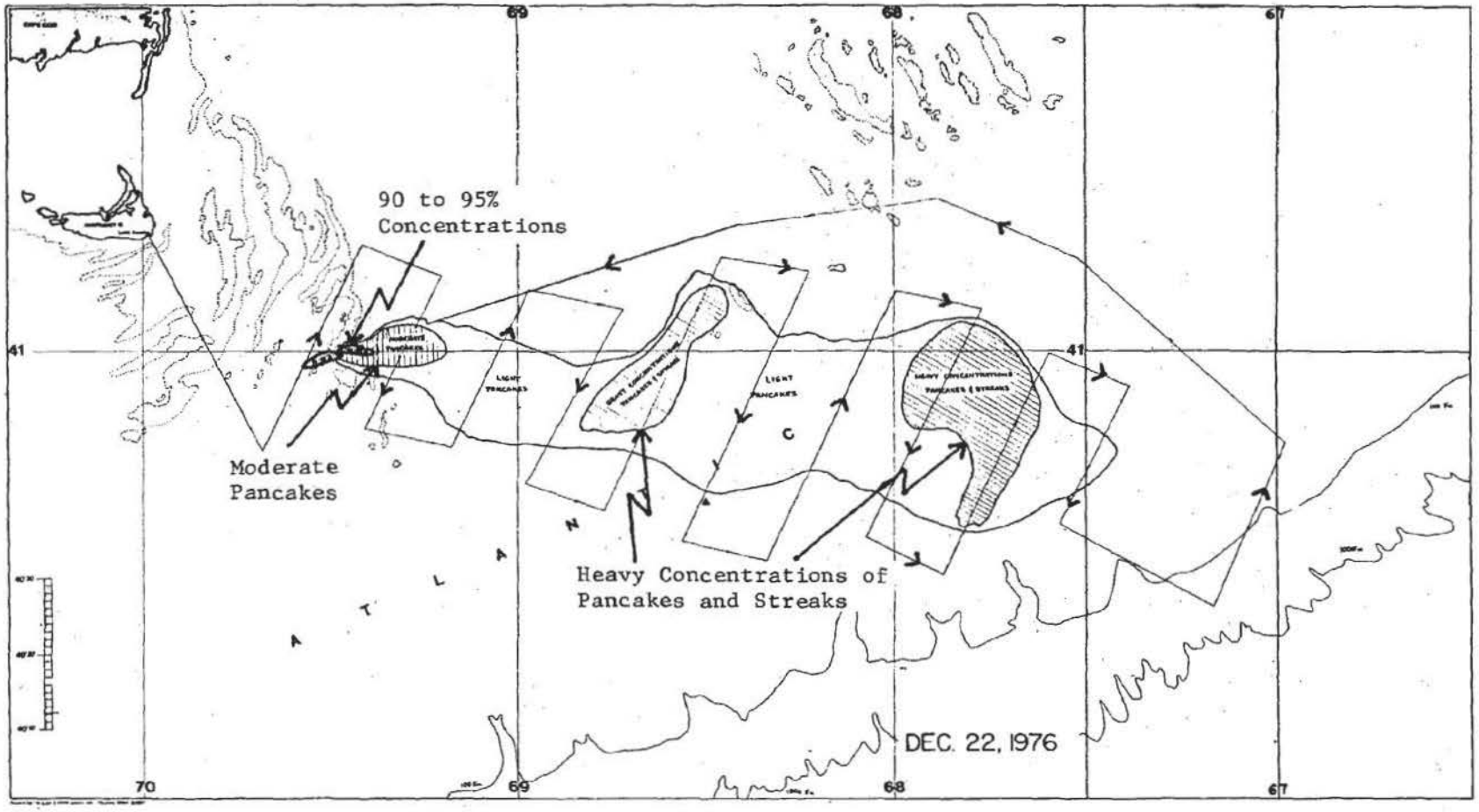

Figure 5.--Representative oil spill map, Dec. 22, 1976. (Courtesy of U.S. Coast Guard)

- mixed oil, heavy to pancakes
- moderate oil concentration
- oil spill boundary
- trackline flown
- mammal sightings

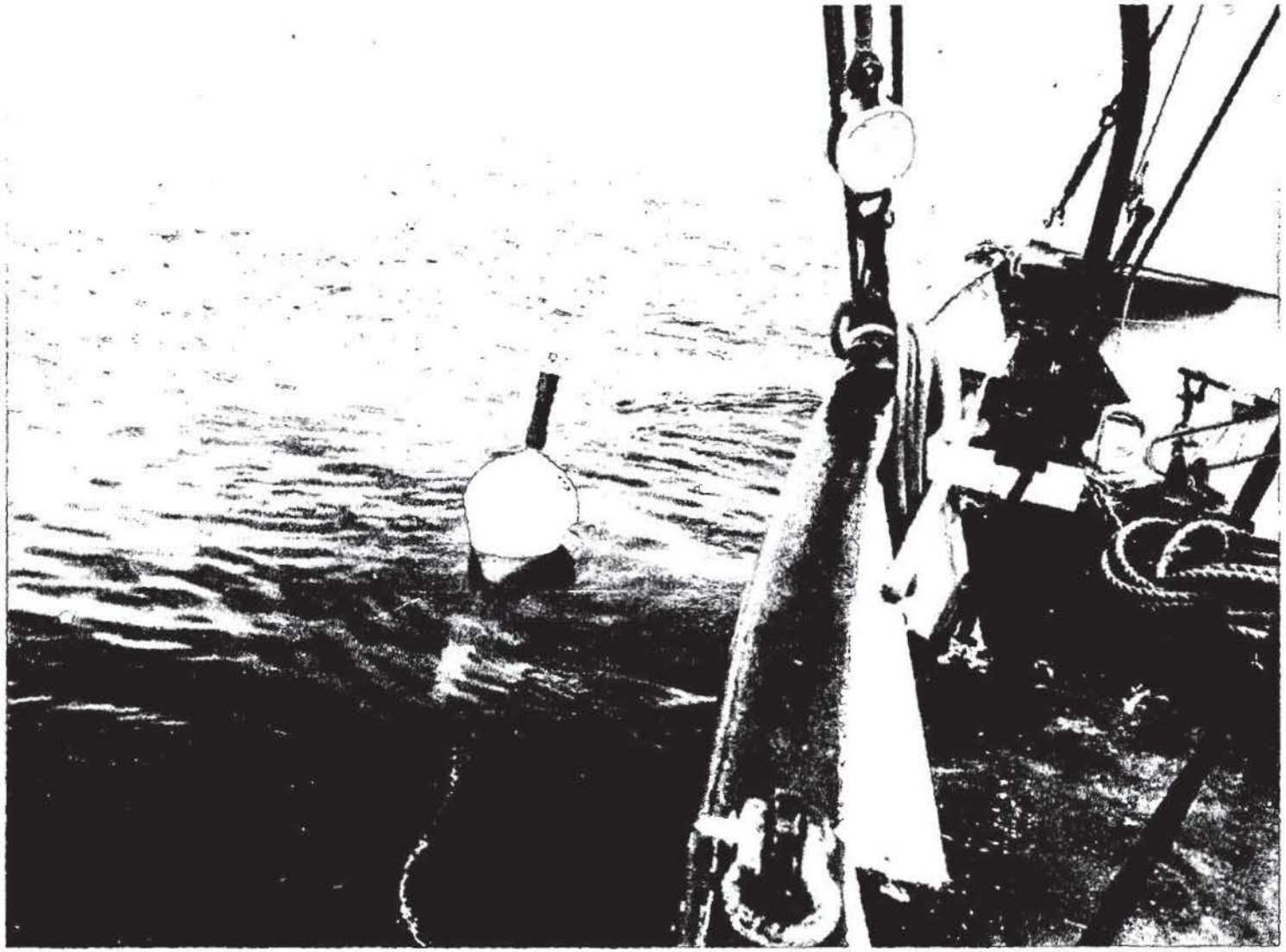

Figure 6.--Deployed satellite tracking buoy, similar to one used to track oil slick movement.

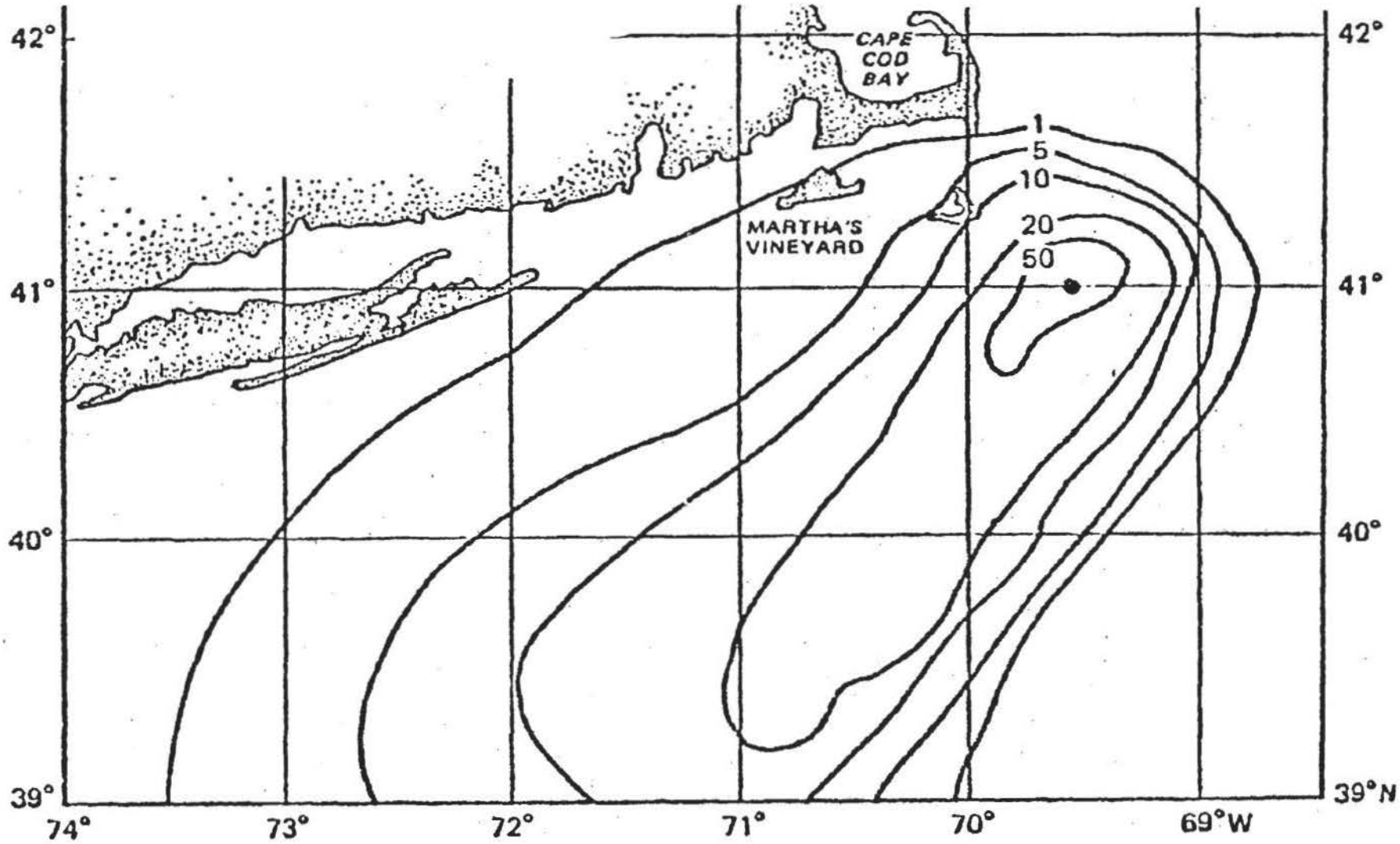

Figure 7.--Climatological oil spill model (percent impact for 10-mile square areas) for winter (winds and west current). (CEDDA/EDS)
Constraints: 1. Wind-driven current. 2. Wind record for winter (1955-70) months Nantucket Island. 3. Sea current: Set 270°, drift 0.25 kts

of spill trajectories and responses using environmental models previously developed at MIT under Sea Grant support. The researchers were advised that the Coast Guard computer models would be used. From December 16 to 19, other MIT scientists visited the ARGO MERCHANT to study first hand the dispersion, spreading, and mass transport of the oil slick; to obtain in situ data and oil/water samples for laboratory analysis; and to evaluate logistic problems of the incident. As a result of these efforts a description of the oil, the first available, was provided to all agencies requesting it. Additional analyses of the oil and the effects of weathering were also arranged with Sea Grant researchers at the University of Southern California.

C. Fisheries Impact Assessments

In response to a request by the On-Scene Coordinator, the Northeast Fisheries Center provided on December 28 an assessment of the potential impact of the spill on the fisheries of the area. It stated that if the oil stayed primarily on the surface and dissipated rapidly the effects might not be great and probably would not be long-lasting. The direct physical effect of displacing fisheries from contaminated areas was considered to be of a more immediate concern. However, that effect could not be predicted at the time. Other than scientists from the Northeast Fisheries Center providing back-up to the On-Scene Coordinator at meetings and press conferences, no additional assessments of the impact upon fisheries were sought by or provided to him. Rather, surveys were undertaken to assess and provide the basis for long-term assessment.

D. Coordination of the Scientific Community

The SOR team also was requested to aid the Coast Guard by providing an interface between the On-Scene Coordinator and the scientific community involved in research activities concerning the oil spill. This responsibility was in addition to the research efforts of the team concerned with the movement and behavior of the oil. Such assistance was requested on December 16 by a representative of the Coast Guard Oceanographic Unit who reported directly to the On-Scene Coordinator.

In addition to serving as a focus of information for both the disposition of the oil spill and the related research activities being carried out, the SOR team participated in and organized coordination meetings. The first significant coordination efforts with the local scientific community occurred at a meeting organized by the Woods Hole Oceanographic Institution on December 17. This meeting was attended by local NOAA entities - the EDS liaison representative and scientists from the Northeast Fisheries Center - as well as by representatives from the SOR team. Sampling programs and ship and equipment availability were discussed at this meeting and at one held on the following day. At these meetings, the SOR team began its role of Federal leadership and coordination of the local scientific community.

A 2-day workshop meeting also was organized by the SOR team to formulate plans for the collection and analyses of samples from the area affected by the oil spill. The meeting took place at the Woods Hole Oceanographic Institution on January 3 and 4 and was attended by 35 to 40 participants. A de-

tailed outline of a plan to evaluate the extent and magnitude of the area possibly affected by oil in the bottom sediments resulted from this meeting. It also provided the basis of an estimate for funding requirements to carry out assessment efforts. The subsequent support provided by NOAA for the activities aboard the University of Rhode Island's ship, the ENDEAVOR, resulted from this meeting. Subsequent to the organization of the scientific cruises to acquire the information outlined at this workshop, the coordinating responsibility of the SOR team was transferred to the MESA program for development of a long-term assessment program. This latter effort was not to support the On-Scene Coordinator, but rather to determine the long-term impact upon the marine ecosystem of this important and productive fishing area.

E. Logistics Support

The forecast of onshore winds on December 25, 1976, raised fears that the oil would flow toward the shores of Nantucket Island. In an effort to trace its approach, drift cards were dropped to permit visual inspection of the shoreward drift of the oil. Because of a shortage of drift cards, the On-Scene Coordinator requested NOAA's assistance through the SOR team in this matter. As a result, drift cards were shipped by air express from Boulder, Colo., to Cape Cod and dropped by Coast Guard aircraft between the last-known westernmost boundary of the oil slick and Nantucket Island.

A problem arose in early January when Coast Guard aircraft were not available to conduct aerial surveys of the spilled oil. Because of the operational need for information on oil movement, the OSC asked NOAA for assistance. A NOAA C-130 aircraft was dispatched to Cape Cod, and conducted oil mapping flights on January 12 and 13, 1977.

F. Public Affairs

On several occasions the On-Scene Coordinator or his staff requested the assistance of elements of NOAA in dealing with the high degree of news media and public interest in the ARGO MERCHANT oil spill. At his request, a statement was prepared by the Northeast Fisheries Center on the possible effect of the oil spill on fisheries. Upon several occasions, members of the SOR team briefed newsmen on behavior of the oil, when so requested by the Coast Guard. At a press conference called by the On-Scene Coordinator in Falmouth on December 28, representatives of both the Northeast Fisheries Center and the SOR team were present to answer questions about their respective activities. SOR team members also assisted in a briefing for the Secretary of Transportation on December 31.

4. RESEARCH AND ENVIRONMENTAL DAMAGE ASSESSMENT

Soon after the ARGO MERCHANT grounding, the local scientific community undertook activities to assess the impact of the oil spill upon the ocean resources and ecosystem. Shortly thereafter, the OSC asked the SOR team to assist in coordinating these activities and to act as a liaison between the Coast Guard and the scientific community. Following this initial short-term response, the Administrator of NOAA, on December 29, directed the Environmental Research Laboratories (ERL) to lead and coordinate NOAA's effort to assess both the short-term and long-term impacts of the oil spill. These assessments were undertaken in accordance with NOAA's statutory responsibilities, particularly under Title II of the Marine Protection, Research, and Sanctuaries Act of 1972 and the Fishery Conservation and Management Act of 1976.

The Director of ERL designated the SOR team responsible for the short-term assessment as a follow-on to its assignment from the Coast Guard. The report, The ARGO MERCHANT Oil Spill - A Preliminary Scientific Report, March 1977, provides a summary of the preliminary findings from the scientific activities. The long-term assessment was assigned to the Marine Ecosystem Analysis Program of ERL. Transition of responsibility was carried out during the joint coordination of the cruises of the ENDEAVOR following the January 3-4 workshop at Woods Hole, Mass.

At a meeting held January 5, 1977, in Washington, D.C., representatives of the Coast Guard, Environmental Protection Agency, Department of the Interior, Massachusetts Office of Environmental Affairs, and NOAA agreed that NOAA would prepare a report of the preliminary results of the scientific activities during the initial phase of the ARGO MERCHANT response. This report would be made available to the other agencies to assist them in the preparation of reports required of them. It was also agreed that NOAA would lead the long-term impact studies and head an Interagency Coordination Group.

The survey team recognizes that analysis of the full impact of the oil spill and of the oil movement across the Nantucket Shoals and Georges Bank will require months, and that longer-term efforts may be required to assess possible chronic effects. From December 15, 1976, to February 15, 1977, only initial assessments were undertaken.

A. Resource Damage Assessments

The National Marine Fisheries Service, through both its Northeast Regional Office and Northeast Fisheries Center, initiated actions to provide assessments of the damage to the fisheries resources of the area--first, through available information at the Center and knowledge of the spill, and later through surveys of the area of Nantucket Shoals - Georges Bank and of the local fishing industry.

Fishery Resources. In order to carry out direct assessments of the impact upon fisheries, the Northeast Fisheries Center undertook a 1-1/2 day

survey cruise (figure 8) aboard the DELAWARE II commencing on December 22 to sample the fish, shellfish, and associated plankton populations both within the oil slick and outside the affected area. Samples of sediment and surface and subsurface water also were collected to examine for contamination. A second survey of longer duration was made aboard the DELAWARE II from January 4 to 10. A total of 43 stations were completed and included temperature and salinity samples, the release of seabed drifters, trawling, dredging, and plankton sampling. The Northeast Fisheries Center also arranged for a third survey to be conducted through the cooperation of scientists aboard the research vessel WIECZNO of the Polish Institute of Sea Fisheries. Samples collected aboard the WIECZNO are being analyzed by scientists from both the Northeast Fisheries Center and Poland, as part of the on-going arrangement between the two organizations to study the fisheries of the northwestern Atlantic Ocean.

In addition to the DELAWARE II cruises, the three cruises of the ENDEAVOR were designed to continue the assessment of oil impact on the biology of the affected area. While resources are not available for the analyses of all the collected samples, an analysis of results from the DELAWARE II and the ENDEAVOR is presently underway. The Northeast Fisheries Center Laboratories at Sandy Hook, N.J.; Narragansett, R.I.; Milford, Conn.; and Woods Hole, Mass., have undertaken an analysis of the DELAWARE II cruise samples. Fish and invertebrate species have been sent to the NOAA National Analytical Facility in Seattle, Wash., for detailed hydrocarbon analyses.

Preliminary findings have been reported by the Northeast Fisheries Center in a press brief of February 7 and in the report, The ARGO MERCHANT Oil Spill - A Preliminary Scientific Report, March 1977.

Mammals. The Northeast Region made arrangements with the Boston Aquarium for the disposition and care of stranded animals. The Northeast Fisheries Center also coordinated a marine mammals observation program aboard the second cruise of the DELAWARE II (January 4-10). Besides this shipboard effort, four fisheries surveillance flights involving NMFS observers were diverted over the area of the spill for the purpose of observing marine mammals.

The SOR team made aerial observations of marine mammals from daily slick mapping flights and provided support from December 29 to January 13 by a trained observer who was a consultant for the Marine Mammal Commission. The team also asked fishermen and pilots in the area to join a "whale watch," requesting that they report any sightings to NOAA at the SOR team phone number.

In addition, workshops were held on December 28 and January 28. One was sponsored by the Marine Mammal Commission and the other by NOAA. These meetings were designed to make recommendations on 1) measures that would be taken to help stricken marine mammals during the ARGO MERCHANT spill, and 2) long-range research recommendations on the effect of oil spills on marine mammals. Such meetings served to disseminate information and to improve coordination among the various groups. Members of the SOR team and/or the NMFS Regional Office attended these meetings.

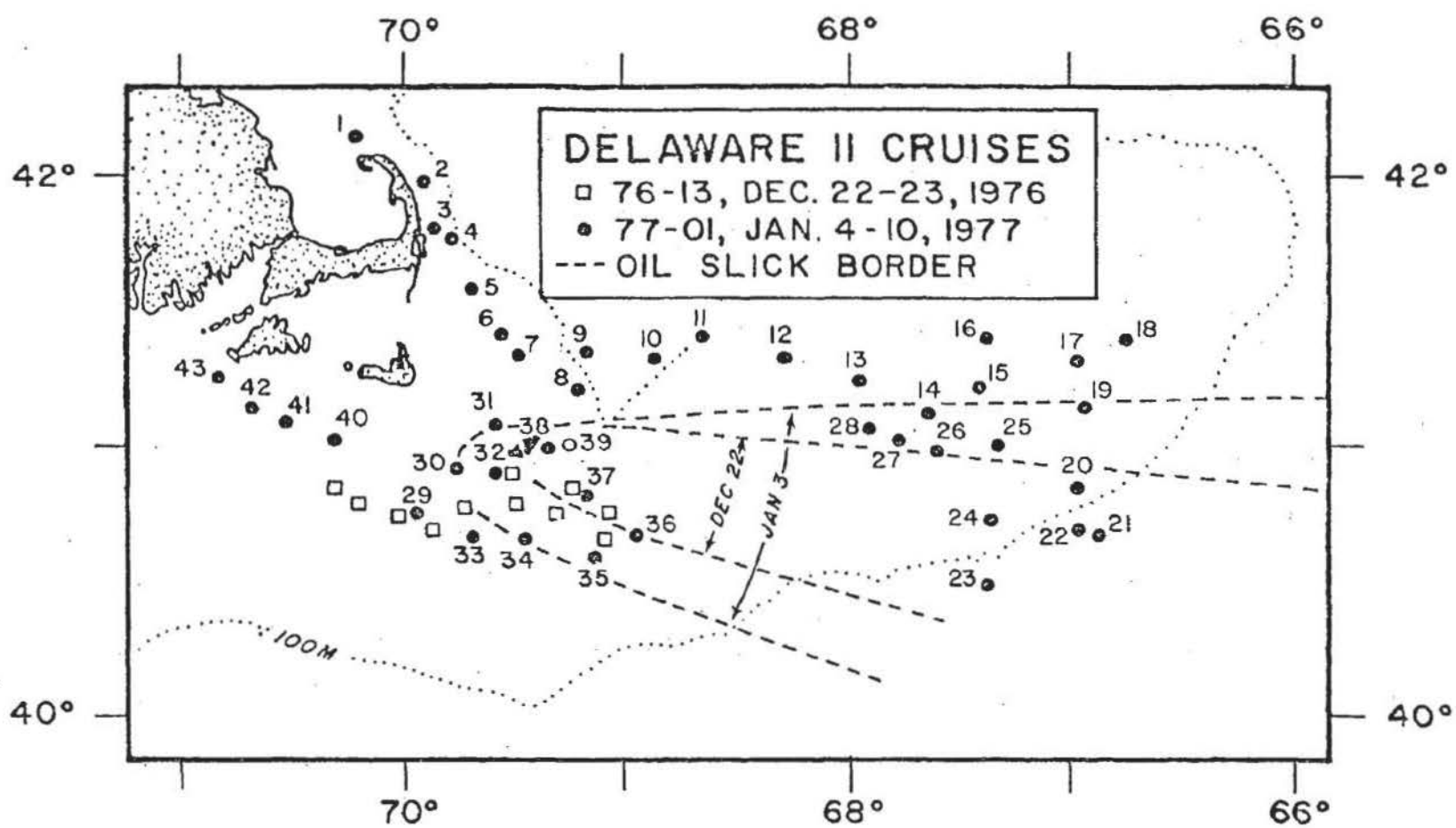

Figure 8.--Station locations of DELAWARE II cruises, DE 76-13 and DE 77-01. Oil slick borders for Dec. 22, 1976, and Jan. 3, 1977, indicated by dashed lines.

Fishing Industry. Besides the surveys by the DELAWARE II, the Northeast Region/NMFS initiated steps on December 22, 1976, to determine the impact of the oil spill upon the local fishing and seafood processing industries. NMFS' port agents interviewed commercial fishermen at seven ports in the course of acquiring marketing and statistical information. A telephone survey of fish processors was also conducted. A verbal directive was given by the Regional Director on December 17 followed by a written memo on December 23 that outlined procedures for documenting interviews and for handling contaminated samples. Weekly reports to the Director, Northeast Region, NMFS, from port agents in response to the directive indicated that only 5 fishing trips among the 4,000 fishing trips covered through January encountered direct loss of catch or fouling or loss of gear. All five instances occurred in areas southeast of the oil spill. In addition, the Northeast Region arranged with the Fairhaven Laboratory of the Massachusetts Department of Food and Drugs for notification of any samples of fish landed that indicated the presence of oil. A check at the request of the survey team substantiated that no contaminated samples from the ARGO MERCHANT had been received by that laboratory. At the end of the period covered by this survey, port agents were continuing the interview program.

B. Environmental Assessments

NOAA elements were involved in assessing the impact of the spill upon the ocean environment primarily through a coordinating function and through assistance in planning and financing scientific studies. NOAA scientists from ERL and NMFS participated in cruises of the OCEANUS and ENDEAVOR from the Woods Hole Oceanographic Institution (WHOI) and the University of Rhode Island (URI), respectively. Sea Grant investigators from URI participated on the initial cruise of the ENDEAVOR (December 28-30) that was designed to evaluate sediment contamination for hydrocarbons, make physical measurements, carry out hydrocarbon identification, and determine species composition of benthic organisms.

The major involvement of NOAA elements was in the organization of the workshop on January 3-4 and the subsequent support of ENDEAVOR cruises EN003, EN004, and EN005 from January 26 through February 27. Arrangements were also made for hydrocarbon analysis of samples collected in the initial assessment phase. An intertidal survey of beaches and inlets of Nantucket Island was coordinated by NOAA when a wind shift threatened to drive the oil onto the beaches of Nantucket Island. The survey was organized on December 26 by the Marine Ecosystems Analysis Program of ERL and conducted over the following 2 days along three beach transects in order to provide crude baseline data prior to any possible spill impact. Details of the survey are described in the report, The ARGO MERCHANT Oil Spill - A Preliminary Scientific Report, March 1977.

At the Woods Hole workshop, NOAA also assumed the critical function of managing and tracking the scientific data and samples obtained from the investigations of the many involved academic and Federal groups. Aware that the data being collected in the ARGO MERCHANT incident might be introduced in litigation, the Environmental Data Service, upon the request of EPA, instituted a Chain of Custody procedure on January 7 based on EPA, Region I, guidelines.

Scientists and institutions involved in environment and resource impact assessments were advised of the procedure for preservation of the integrity of collected samples.

At the conclusion of the period covered by the survey, samples were still under analysis, the ENDEAVOR cruises had not been concluded, and the plans for long-term impact assessments were still in a formative stage, dependent upon the results from initial studies and potential funding.

5. INFORMATION DISSEMINATION

Three permanent NOAA installations near where the ARGO MERCHANT ran aground have regular contacts with the public and news media as part of their normal operations. They were logical points of contact for the public and for representatives of the news media, industry, and scientific groups seeking information about relevant aspects of the oil spill. The three are the Northeast Regional Office, NMFS, Gloucester, Mass.; the Northeast Fisheries Center, NMFS, Woods Hole, Mass.; and the Weather Service Forecast Office, NWS, Boston, Mass.

Establishment of the Spilled Oil Research team at Hyannis, Mass., provided the potential for a fourth information point. However, the SOR team operations plan (Memorandum of July 30, 1976, from James Mattson to team members) stipulated:

"Team members are cautioned against commenting to the news media while responding to spills, and reminded that the Coast Guard has the responsibility for such spills. NOAA team members should receive clearance for any news item through the local USCG district affected. NOAA/ERL will have control over any press release made by the NOAA team members."

As a result, the team did not initially provide information directly to the public or the news media. In response to requests from the Coast Guard, however, the SOR team from December 26 to 28 first began briefing newsmen on the behavior of the oil from day to day, as observed from their overflights and oil dynamics experiments. At this point, the SOR team became the fourth NOAA point of contact for media inquiries on the spill.

Staff members of the Northeast Fisheries Center began receiving inquiries from the press about possible effects of the ARGO MERCHANT grounding on the first or second day after the event occurred. When the ship broke in two on December 21 the volume of inquiries increased markedly. Media inquiries began at the Northeast Regional Office about 3 days after the grounding. The Regional Director and Center Director conferred by telephone and agreed that the Regional Office should reply to queries wherever possible, with the Center providing necessary information. The Deputy Regional Director was designated to undertake this responsibility, and a scientist at the Center was designated as liaison.

The two types of queries most frequently received were: Where is the spill headed? (these were referred to the Coast Guard), and What are the effects on fish? The latter were responded to with general information on the nature of the resource, and often with a statement to the effect that the extent of the damage could not be surmised until more was known about the behavior and movement of the oil. The Regional Office sometimes referred detailed questions on the resources to the liaison scientist at the Northeast Fisheries Center for a more complete reply.

On December 21, at a meeting of the Regional Response Team, the On-Scene Coordinator asked that the NMFS Regional Office provide a statement on the possible impact of the spill on fisheries, for use either as a news release or as a back-up fact sheet for replying to queries. At the request of the Regional Director, the Northeast Fisheries Center prepared the statement and transmitted it to the On-Scene Coordinator, where it was used as background but was not issued as a news release.

A. News Releases and Press Conferences

Press Conference, Boston. A press conference was held in Boston's Logan Airport on December 22, incident to Congressional committee hearings held that day in Boston on the Federal response to the ARGO MERCHANT spill. Present at the conference were a U.S. Senator, the Administrator of the Environmental Protection Agency, an Assistant Secretary of Commerce, and the NOAA Administrator. The NOAA contribution to the news conference was restricted to noting the facts as then known. It avoided speculation or judgments about the ultimate fate of the oil or seriousness of the event.

Dropping of Drift Cards. On the night of December 25-26, drift cards were flown by the SOR team from Boulder, Colo., to the Coast Guard station, and subsequently deployed by the Coast Guard in front of the ARGO MERCHANT oil slick. The cards were used to give advance warning of oil wash-up on the beaches of Nantucket, a possibility because of predicted onshore winds. Public notification of this effort was required in order that any wash-up of drift cards be promptly reported to the Coast Guard, enabling clean-up crews to be in place.

Accordingly, at the request of the Coast Guard, the SOR team worked with Coast Guard public information personnel at Otis to draft a news release. On December 26, after the cards were deployed, the Coast Guard information personnel telephoned the media in the Cape Cod and Boston areas, reading the release to them and giving the telephone number of the SOR team in Hyannis as a source of further information.

Falmouth Press Conference. In view of the public and media interest generated by the dropping of the drift cards, a member of the SOR team indicated to a Coast Guard information officer a willingness to have SOR team participation in a news conference to describe the research that they were undertaking. The On-Scene Coordinator decided to hold a news conference on all aspects of the spill, including the activities of the SOR team and possible impacts on fisheries as seen by the Northeast Fisheries Center, and the conference was held December 28 in Falmouth.

Upon learning of plans for the conference, NOAA's Director of Public Affairs, then on leave in Boston, went to Hyannis to assist in preparations. A fact sheet entitled "Highlights of NOAA Participation--Atlantic Oil Spill" was prepared, summarizing the activities of the SOR team, NMFS research from the DELAWARE II, involvement of the Environmental Research Laboratories, and special forecasts of the National Weather Service (Appendix II). Brief fact sheets on two activities involving public participation, the drift card releases and a NOAA whale watch, were also prepared.

The three fact sheets were made available to the press at the Falmouth press conference, and at the request of the On-Scene Coordinator representatives of the SOR team and the Northeast Fisheries Center were present to answer questions.

Data Buoy Deployment. In an effort to follow the drift of the oil slick on days when weather prevented aircraft overflights, the SOR team obtained a small data buoy with capability to be tracked by Nimbus satellite, and on December 31 deployed the buoy in the oil from a Coast Guard helicopter. A team member informed the NOAA Office of Public Affairs of the plan on December 29, and a news release was written and issued from Washington on December 30 (Appendix III).

Hyannis News Briefing. Owing to the continuing media interest in the spill, the SOR team requested that NOAA's Office of Public Affairs provide an on-scene information officer to coordinate the replies and ease the burden on their time. A public affairs representative worked in Hyannis January 3-6. As the oil moved further away from shore and the threat to beaches and fishery resources lessened, media interest declined. The public affairs representative and the team therefore agreed to close out the information activities on the project with a news briefing at which a summary of the activities thus far carried out could be presented. The briefing was called for January 6 by a representative of the Northeast Fisheries Center. Few newsmen attended.

B. Congressional Hearings and Public Meetings

Public Meetings of Regional Fishery Management Councils. At public meetings of both the New England Regional Fishery Management Council and the Middle Atlantic Regional Fishery Management Council during December and January, the Director of the Northeast Regional Office, NMFS,--a member of both Councils by statute--briefed the meetings on the movement of the oil and the possible effects on fishery resources, as then known.

Congressional Hearing, Boston. The Administrative Practices and Procedures Subcommittee of the Senate Judiciary Committee held a public hearing in Boston on December 22 to inquire into the spill. Among those giving testimony or answering questions were representatives of the State of Massachusetts, the Environmental Protection Agency, the Coast Guard, and the NOAA Administrator.

Marine Mammal Meeting, Boston. The Marine Mammal Commission sponsored a meeting in Boston on December 28 designed to evaluate both immediate needs with respect to marine mammals and the ARGO MERCHANT spill, and any long-term efforts that should be made. Participants were leading New England scientists with interest in marine mammals. NOAA was represented by a staff member of the Northeast Regional Office, NMFS, and by a member of the SOR team who briefed the meeting on the progress of the spill.

Public Meeting, Providence, R.I. The Coastal Resources Council of the State of Rhode Island held a public meeting at the State House January 5, 1977, to consider the impact of the ARGO MERCHANT oil spill and to plan for

future spills that might endanger the shore. Among those briefing the public on the ARGO MERCHANT spill was a scientist from the Narragansett Laboratory of the Northeast Fisheries Center.

Public Hearing, Falmouth, Mass. The Coast Guard held a public hearing in Falmouth, Mass., on January 19, 1977, on the options of disposing any oil that might remain in the hulk of the ARGO MERCHANT. NOAA's National Response Team representative was present. Among the briefings presented to the public at the hearing was one on research activities, presented by the head of the MESA long-term assessment group then on the scene.

C. Transition and Termination

MESA was assigned long-term assessment responsibilities. The head of the MESA assessment group gradually became more involved in the associated public information activities, and appeared at the January 19 hearing in Falmouth. This was the final public informational event in the period covered by the survey team.

Subsequently, an analysis was made by the survey team of the news coverage of NOAA's involvement in the ARGO MERCHANT disaster, as reflected in newspaper and magazine clippings for the period. The purpose of the analysis was to determine the adequacy of NOAA's response to the needs of the media (Appendix I).

6. LOGISTICS AND ADMINISTRATION

The response to the ARGO MERCHANT was of an unanticipated scale and consequently required a major administrative effort. Most of the local installations in the area carried out their operation within their normal administrative channels. Nevertheless, problems of support and funding were experienced by the National Marine Fisheries Service. The greatest impact noted, however, was upon the SOR team that responded to the area and was requested to assume tasks beyond its original purpose.

A. Logistic Support

The NOAA response required the deployment of vessels and aircraft and the use of uniquely available equipment.

Ships. As early as December 17 it was determined by scientists from the Woods Hole Community that a vessel was needed for assessment purposes. Initial inquiries within NMFS and ERL indicated that the DELAWARE II, on a survey at that time, was unavailable due to required yard modifications to be followed by a high priority project to investigate a serious anoxia condition off the New Jersey coast. However, on December 20 the vessel was diverted at the direction of the Office of Fleet Operations after clearance from the Office of the Associate Administrator for Marine Resources. The vessel subsequently conducted DELAWARE cruise DE 76-13 from December 22 to 24 for the purpose of carrying out the initial assessment of impact upon fisheries. It then continued to Sandy Hook, its homeport, and later returned to Woods Hole for the DELAWARE cruise DE 77-01 from January 4 to 10. The DELAWARE II was the only NOAA vessel that finally participated in the initial assessments. Most of the fisheries and biological sampling was carried out aboard it.

At the request of the Office of the Associate Administrator for Marine Resources, for possible other ship support, the Office of Fleet Operations also placed the crews of the Mt. MITCHELL, KELEZ, and RESEARCHER on stand-by during the Christmas-New Years holiday until requirements were defined by the SOR team and the period of operations determined for carrying out assessments of the initial impacts. The workshop held at the Woods Hole Oceanographic Institution on January 3-4 established these requirements, and the Office of Fleet Operations representative at the meeting indicated that none of the NOAA vessels could meet the total requirements as developed. Consequently, it was decided that the ENDEAVOR would better serve as the vessel for the subsequent assessment cruises. The cruises of this vessel from January 26 to February 27 were supported by NOAA funding.

Aircraft. Most of the aircraft support for NOAA personnel was provided by the Coast Guard with H-3 helicopters and HU-16E fixed winged aircraft. In addition, arrangements were made by the SOR team for NASA to carry out overflights. No NOAA aircraft were operated in support of the SOR team because of lack of resources. However, at the request of the Coast Guard,

the NOAA C-130 was deployed on a reimbursable basis for flights on January 12 and 13. None of the NOAA aircraft capabilities, including those of the C-130, were reflected in the Regional Response Plan. The C-130 was only made available as a result of the MESA coordinator becoming aware of the Coast Guard need. The aircraft was released for the purpose by the Director of ERL.

Equipment. In addition to employing their own equipment for research and assessments, NOAA units also provided equipment to the Coast Guard. Drift cards, which were deployed between the spill and the beaches of Nantucket on December 26, had to be supplied by aircraft from Boulder, Colo. The National Data Buoy Office obtained an instrumented buoy from Nova University, which was implanted on December 31 into a large pancake of oil. The National Data Buoy Office also obtained a second buoy from the manufacturer in Los Angeles. The first buoy was available within 2 days and the second in 4 days. However, the equipment was not initially available when the NOAA elements first responded. The SOR team also supplied to the Coast Guard sterile bag samplers for collecting water samples for analysis of oil contamination.

B. Administrative Matters

The scale of the response operations could not be accommodated by the Northeast Fisheries Center, the only NOAA facility in the immediate area of the On-Scene Coordinator. The SOR team established its center of operations in Hyannis, Mass., close to the nearest commercial airport. The activities of the SOR team, both to carry out its own research and to coordinate the efforts of the scientific community from this location, required the local procurement of services and support. These procurements covered a wide range from graphics reproduction to scientific cruises and analysis of samples.

The arrangements for the services and support were made locally by the SOR team and later the MESA coordinator. The processing and most authorizations for procurements were done by the procurement office in Boulder, Colo., the base for the SOR team and the MESA program. By and large, this arrangement worked satisfactorily. However, with the variety of needs to be met through procurement, several situations arose with regard to administrative procedures and means for handling them. For example, the problem arose as to the means for providing food to volunteers who offered to help the beach investigations under most adverse weather conditions. Similarly, there was uncertainty as to the types of items that were permissable under a contract for housing and operations center logistics. There was no on-site administrative or procurement officer, nor were there guidelines developed beforehand to address such situations.

C. Funding

Costs associated with the initial responses of NOAA units were borne within the existing resources of those units. The deployment of the DELAWARE II in support of fishery assessments for NMFS was accomplished by the rescheduling of operations, but the analyses of the samples collected aboard the DELAWARE II required additional funding resources. In the case of the SOR team, initial support of its activities was provided from a reimbursable contract with the Bureau of Land Management. This contract was part

of the BLM sponsored OCS Environmental Assessment Program (OCSEAP) which included a study of oil spills. The Coast Guard, which was part of the SOR team with NOAA, also provided logistic support for their efforts, but only if those efforts were in support of, or in conjunction with, Coast Guard operations. No funding was made available to NOAA elements from the Coast Guard contingency fund, except for reimbursement for the use of the C-130 aircraft. That fund is for the purpose of clean-up, containment, and dispersal and not for research or assessment purposes.

The lack of a prescribed institutional arrangement for funding in the early stages of planning was a matter of concern to the responding scientific community, both Federal and academic. As the local institutions began to develop plans to assess potential impacts, the question of funding became a matter of concern. At the workshop organized by the SOR team on January 3-4 in Woods Hole, this question arose, and one of the results of that workshop was a funding estimate to carry out the remainder of an initial assessment and a longer-term effort of 1 year to 15 months. On the basis of these requirements it was decided by the Associate Administrator to provide funding for the initial assessing, including the analyses of the first collected samples, by reserve funds within the Department of Commerce and funding from the Department of Interior. Funding for the longer-term assessment was to be sought by NOAA through a supplemental budget request for FY 1977.

As early as December 20, the Assistant Secretary of Interior for Program Development and Budget offered assistance to NOAA, including funding support. Following the January 3-4 workshop it was agreed among NOAA, Interior, and EPA that NOAA and Interior would jointly fund assessment activities and EPA would provide for preparation of the required environmental assessment report. On January 18 funds were released to NOAA from Secretary of Commerce's reserve and on February 8, the Associate Administrator for Marine Resources executed an Inter-Agency Agreement with BLM to cover the study of possible impacts from the ARGO MERCHANT oil spill. With these funds the initial assessment was supported. The request for an FY 1977 Supplemental was sought and disallowed by the Office of Management and Budget in early February 1977.

In addition to specific funding requirements, the deployment of personnel to the area involved travel and per diem costs for periods of up to 4 weeks. Most of these costs were accommodated through travel funds of the responding elements. For at least one element, however, these expenses seriously affected their travel ceiling authorizations. No separate travel fund or authorization was established to accommodate costs incurred from the total NOAA response to the ARGO MERCHANT incident.

7. FINDINGS AND RECOMMENDATIONS

In responding to the ARGO MERCHANT incident, all elements of NOAA performed in an outstanding manner. They provided expertise, knowledge, and capabilities to the On-Scene Coordinator, and they also provided Federal leadership to the many local groups, bringing them together in a way that made possible a relatively coordinated assessment of damage to the ocean environment and marine resources of the area. Rather than detract from the contributions and outstanding efforts of those involved in the NOAA response to the ARGO MERCHANT incident, it is the intent of the survey team that its findings and recommendations outline means whereby NOAA can be more responsive to major oil spills in the future.

The following sections outline the findings that resulted from the survey, and make recommendations that the team believes are required to improve NOAA's effectiveness in responding to future major oil spills.

A. National Contingency Planning

The NOAA elements, as provided for in the National Contingency Plan (NCP), responded to the ARGO MERCHANT incident by providing much information to the NRT, the RRT and OSC in response to their requests. In addition, the ARGO MERCHANT incident demonstrated that NOAA's capabilities are much broader than those described in the NCP. For example, the applicability of NOAA ships, buoys, and aircraft was ably demonstrated by the activities of NOAA elements. Moreover, the present plan does not take into account that the Department of Commerce, under the Fishery Conservation and Management Act of 1976, is responsible for the management of resources lying within the fishery conservation zone (3-200 nautical miles). The Department of Commerce therefore must take steps to reduce adverse effects of oil spills such as that of the ARGO MERCHANT to carry out its management responsibilities. As a consequence, the NOAA role has not been adequately defined in the NCP and the team believes that this contributed to the lack of a Federal focus in dealing with the local scientific community in the early stages of the incident

The Department of Commerce should seek modification of the NCP to reflect an appropriate role for NOAA in the Federal response to major oil spills. The survey team considers it to be in the national interest that NOAA capabilities for carrying out marine environmental and resource assessments and for providing scientific and technical information and expertise be specifically incorporated into the national plan and also reflected in Regional Response Plans.

The working relations between NOAA and the Coast Guard and between NOAA and EPA during the ARGO MERCHANT incident established patterns of cooperation and relationships between agencies that should be more formally developed. The survey teams believe that in addition to modifying the NCP, NOAA should seek to develop interagency agreements with the Coast Guard and EPA to delineate more explicitly agency responsibilities and use of agency

capabilities.

B. Regional Response

The basic means of notification for NOAA response and assistance to a Regional Response Team and to the On-Scene Coordinator in the event of an oil spill is through the Commerce representative of the RRT. At the time of the ARGO MERCHANT incident, there was no such designated Commerce representative on the RRT in the First Coast Guard District. The local NOAA elements, NWS and NMFS, were instead advised of the incident by the Coast Guard, which requested scientific and technical assistance. While the Director, Northeast Region, NMFS, has subsequently been designated the Commerce representative on the RRT, in the first Coast Guard District, the Commerce representation on all RRT's should be reviewed and a clear channel of communication and responsibilities be established.

The established channel of communication between the OSC and other Federal agencies is through the RRT. Responsible senior regional NOAA officials did provide data and expertise to the OSC and RRT upon request. However, it was primarily because of the direct contact between the OSC and the SOR team that the wide range and availability of NOAA expertise and resources were made known to the OSC. The survey team recognizes that some confusion existed owing to the lack of a single designated NOAA focus; however, it is important that in the future NOAA-designated officials exercise strong initiative to coordinate with the OSC and RRT, to make sure that they know the full extent of NOAA resources that might be brought to bear, and give them maximum assistance in support of clean-up and containment activities.

In many instances, oil spills are likely to occur in territorial waters, which are within the jurisdiction of the states; in the cases of spills beyond territorial waters there is often a high probability of impacts on coastal state areas. It is, therefore, essential that effective communications be established with responsible state agencies. In the case of ARGO MERCHANT, the oil did not go ashore but at one point it appeared to threaten the beaches of Nantucket Island. Contact was made with representatives of the Commonwealth of Massachusetts at working levels, but in the initial period there was lack of a positive liaison with the state, particularly at the relevant policy levels. It is essential that NOAA elements establish contact with their state counterparts and that any designated NOAA spokesman also establish liaison with policy level spokesmen responsible for state-related activities. These state spokesmen, or their designees, should to the extent possible be considered active participants in NOAA response activities. In the case of responses to spills in territorial waters, NOAA should work with the state designees as well as the OSC.

C. NOAA Response Reaction

The lack of a designated representative on the RRT and a NOAA-designated focus for liaison with the OSC resulted in delay in advising the Office of the Administrator of the incident; this led to multiple inquiries by senior management during the course of the NOAA response. There is at present no formal procedure for advising the Administrator of a major oil spill or of the

total NOAA response to an incident. In future events, the Commerce representatives on the responding RRT's should notify individuals within the Office of the Administrator and should be responsible for recommending the types and extent of NOAA participation required.

The coordination of a NOAA response was further impeded by the lack of a designated NOAA-level spokesman at the scene of the incident. Within the NMFS and NWS, spokesmen carried out their responsibilities for their respective activities in support of the OSC. In addition, the Coast Guard asked the SOR team to coordinate all scientific activities, NOAA and non-NOAA elements. However, the role of the SOR team with respect to other NOAA elements had not been internally clarified. Given the diverse range of capabilities and organizational elements that did respond to the ARGO MERCHANT incident, and that are likely to respond to future incidents, it is essential that a single spokesman be designated to coordinate, and direct if need be, all NOAA elements participating in such responses.

Each NOAA element tended to respond as an independent entity, particularly in the initial period of the grounding and break-up of the ARGO MERCHANT. Within NMFS, the Northeast Region and Northeast Fisheries Center did immediately develop a combined response, but coordination between Primary Operating Elements was limited and only developed as involvement with non-NOAA groups increased. The total NOAA response demonstrated that the agency can provide a wide range of services and capabilities, but a plan of action to assure a more coordinated and integrated response should be developed for each region. Such plans also should be periodically reviewed and updated and, when feasible, practice exercises should be run.

The capabilities of NOAA to respond to oil spills are substantial, as evidenced by the breadth of NOAA involvement in the Federal response to ARGO MERCHANT. Many of these capabilities are unique. The Regional Response Plan in effect at the time of the ARGO MERCHANT grounding did not have an up-to-date inventory of these NOAA capabilities to assist the OSC. In order for NOAA to be more effective in responding to future incidents, its capabilities should be inventoried both nationally and regionally, and should be reflected in updated regional plans. Inventories should include not only in-house capabilities but also those of contractors and grantees who can be called upon.

The survey team also noted the immediate responsiveness of local Sea Grant programs and the potential they possess for augmenting the NOAA in-house efforts. Any NOAA regional plans should recognize this capability and include the regional Sea Grant activities as integral elements.

D. Scientific Coordination

In the evolution of the Federally sponsored response to the ARGO MERCHANT incident, NOAA emerged as the Federal spokesman for the coordination and conduct of the environmental and resource investigations that were carried out. Initially, however, NOAA was unprepared to undertake a task of such magnitude. The capability did exist to determine the impact upon fishery resources. The DELAWARE II was diverted and rescheduled to acquire data for initial impact investigations. The funding required for the analysis of the resulting

samples was not initially available so that this aspect of the NOAA response was limited.

While no conceptual plan existed for carrying out necessary environmental and resource investigations for impact assessments in response to major oil spills, a preliminary plan developed by the SOR team for a planned controlled oil spill did serve as a basis for coordinated study of spilled oil behavior. The survey team considers the design of a conceptual plan an essential element in future NOAA responses, recognizing that each incident will require uniquely designed investigations to acquire data for assessment purposes.

The ability of the SOR team, once having been requested by the Coast Guard to assist in coordinating the scientific efforts, was hampered internally within NOAA by lack of a clear delegation of authority to coordinate the efforts of other NOAA elements and externally by the initial lack of identified funding resources and confusion regarding Federal agency leadership of assessment activities. The ERL role in the assessments was communicated slowly throughout NOAA, although agreement was reached by Primary Operating Element directors. The authority and responsibilities of any designated lead element within NOAA in response to a future major oil spill should be clearly defined and understood by all levels participating in the response.

E. Funding

The ARGO MERCHANT also demonstrated that the scientific community in the area in which an incident occurs can provide essential expertise and capabilities and should be used. Many scientists in the area were experienced in the study of oil spills or in hydrocarbon research. Participation in the ARGO MERCHANT incident, however, resulted in their being diverted from their ongoing research, much of which is sponsored by general grants and contracts. While funding was obtained from the Department of Commerce and the Department of Interior for initial assessment purposes, the delays in determining the sources and amount of resources available affected the timing of the investigations and the involvement of the scientific community. A source of funding should be available to NOAA and non-NOAA elements for research on future oil spills, and mechanisms should be established to make possible prompt release of such funds so that the scientific community can be mobilized and essential samples acquired.

Long-term sampling investigations require a commitment of investigators, who in turn require funding. Not only must a source of funding be readily identified to support such investigations, but arrangements must be made with agencies sponsoring the ongoing research efforts of the investigators to accommodate any delays they incur from participating in short- or long-term assessments.

F. Administrative Matters

In addition to the need for funding resources, the experience from the ARGO MERCHANT incident has shown that immediate need for services to support operations and scientific investigations requires the development of procurement procedures to support remote units at on-site locations in a timely

manner. The procurement procedures used by and large worked well, but better communication between on-site and procurement personnel is required.

The amount of travel and per diem incurred in a response to a major oil spill can be significant. The costs incurred for the ARGO MERCHANT incident seriously affected the travel ceilings of some programs. A separate travel budget and ceiling is needed for future responses so as not to inhibit the response or seriously affect ongoing NOAA programs.

The magnitude of the NOAA response also required considerable logistic support. Aircraft and vessel support was for the most part provided by the Coast Guard. Shore-based facilities and ground transportation were arranged locally through lease or rental. The survey team does not believe that the local NOAA facilities could have provided the necessary support for all responding NOAA elements that needed to be in close proximity to the OSC.

G. Data Management - Chain of Custody

The samples acquired by Federal and academic groups have the potential of being used in any litigation arising from the oil spill. Therefore, they must be handled in such a manner as to secure and document the chain of custody over them from the time of their collection. The survey team recommends that the Environmental Data Service establish standard instructions for maintaining the chain of custody during the processing, analysis, and storage of samples collected during response to oil spills. Such instructions should be developed in consultation with EPA. All NOAA elements responding to an oil spill should be familiar with the instructions and assist non-Federal groups to comply with them.

H. Information Dissemination

The ARGO MERCHANT incident was a news event of national significance. The NOAA installations in the area and the SOR team were often queried by the media as to the status of the oil spill and the consequences of its impact. NOAA spokesmen carried out their efforts to inform the public in a responsible manner. When requested, they provided support for the Coast Guard at press conferences. The survey team's analysis of press clippings turned up no inconsistencies in the information provided to the media by the four NOAA spokesmen. However, the survey team recommends that when responding to future major oil spills, a single NOAA public affairs point of contact be designated. He should serve as a liaison between NOAA scientists and the media so that media representatives have the opportunity to talk to the appropriate experts, and he should coordinate all public affair matters for the NOAA responding elements.

APPENDIX I

Analysis of Clippings

The behavior and fate of the oil, and its potential impact on beaches and on the living resources of the area, were of great interest not just to scientists but to the general public and to state and local officials with management responsibility in these areas. NOAA personnel were deeply involved in relevant research, and it was therefore natural for news media representatives to question them upon numerous occasions; their replies as printed or broadcast were important to public understanding of the event.

Because there was not a central NOAA information point through which data and requests for information could be channeled, and because of the high degree of public and media interest, the survey team decided as a part of its responsibility to examine the adequacy of NOAA response to the media. One tool for making this examination has been a detailed analysis of periodical clippings covering the event. Obviously the televised interviews and radio reports are not susceptible to such an analysis, but it can probably be assumed that patterns emerging in the written media are not too different from those in the electronic media.

National Weather Service forecasts, being a routine and regular service, are not included in this analysis.

A total of 60 clippings from Boston and Cape Cod newspapers, wire service reports, national weekly periodicals, and newspapers outside the Boston-Cape Cod area were analyzed for the period Dec. 21 - Jan. 16. NOAA individuals or organizations were quoted on 24 occasions in the clips; this excludes duplications such as a wire service story that was published in several newspapers.

Exclusive of the NOAA Administrator and National Weather Service employees, the clippings quote or refer to by name:

One staff member of the Northeast Regional Office, NMFS; three members of the SOR team; seven members of the Northeast Fisheries Center, NMFS.

NOAA spokesmen were sometimes inaccurately identified in news stories, but in no case was there a significant error or was an individual labeled as speaking for other than his own group within NOAA.

Prior to Dec. 23, there were quotations from three NOAA spokesmen, one from the Northeast Regional Office, NMFS, and two from the Northeast Fisheries Center, NMFS. In addition, there was one reference to "Scientists at the Woods Hole Oceanographic Institution and the National Marine Fisheries Service." The NMFS spokesmen discussed possible long-term effects of the oil on the resource, possible short-term effects on the fishing industry, and a plan to monitor fish landings.

On Dec. 23, the clips reflected statements by the NOAA Administrator at the Boston press conference.

A North Carolina newspaper on Dec. 27 discussed the effects of oil on fish and attributed the information to "scientists at the Woods Hole Oceanographic Institute and the National Marine Fisheries Service." This was apparently a rewrite of news dispatches.

On Dec. 27 and Dec. 29, a member of the SOR team was quoted about the drift cards and on the weather's effect on slick movement, and again on Dec. 29 on possible bottom contamination.

In one of the Dec. 29 stories, a staff member of the Northeast Fisheries Center reported on the apparent lack of contamination of fish or ocean bottom by the spill.

Several articles on Dec. 31 reported the data buoy effort and SOR team member responses to inquiries about it.

A Jan. 4 wire service story carried comments by an SOR team member about the possible ultimate track of the oil if it became caught in the Gulf Stream.

A Jan. 6 article drew extensively upon a National Marine Fisheries Service scientist's comments about the effect of the spill on marine life and the possible direction of the spill.

A weekly periodical dated Jan. 10 quoted a National Marine Fisheries Service staff member on possible effects of the oil on lobsters, and an SOR team member on the drift cards.

A Jan. 12 wire service report quoted two scientists from the Northeast Fisheries Center on the possible effect of the event on living resources.

Other attributions to NOAA in late January and February show no deviation from the pattern already established.

It should be noted that on several occasions there were strong statements in the press, sometimes from Federal officials, that might have caused undue concern or that apparently were not supportable by the evidence at hand. In no case did these statements emanate from NOAA organizations or individuals.

In conclusion, the analysis showed that responses given by NOAA spokesmen to media inquiries were on the whole both informative and carefully considered. NOAA spokesmen did not go beyond the facts known at the particular time of the inquiry. While they showed a commendable willingness to discuss alternative possibilities when this was desirable to put known facts into context, they also showed a commendable restraint in the face of possible spill. There was remarkable agreement among the statements made by NOAA spokesmen from different organizations, often interviewed separately by newsmen seeking the broadest possible base of information. This is an indication of the care and skill with which NOAA spokesmen made their comments, rather than of prearranged

coordination among the different NOAA units. Finally, the number of individuals quoted on behalf of NOAA should occasion no surprise, owing to the long period of time covered and the number and variety of organizations and kinds of expertise involved.

APPENDIX II

Fact Sheet Released to the Press, December 28, 1976 at Falmouth, Mass.

Major components of the National Oceanic and Atmospheric Administration, from its Environmental Research Laboratories and Environmental Data Service, to its National Weather Service and National Marine Fisheries Service, are at work on the scene of the Nantucket oil spill.

With support from the Bureau of Land Management, NOAA's Spilled Oil Research team has been in being for many months. Its primary goal is to improve predictive modeling techniques to a point of high utility and accuracy, not only in this spill but in such others as occur during the Nation's drive for increased oil production. Four quick-response teams have been formed--in Washington, Seattle, Juneau, and Fairbanks, comprising personnel from NOAA, the U.S. Coast Guard, and state authorities of Alaska. Coordination is through the NOAA Environmental Research Laboratories in Boulder, Colo.

For more than a year, NOAA scientists have been collecting spill information with a view to refining existing models and isolating key parameters most in need of study. Major areas of interest include determining more accurately the speed with which oil moves over surface water and how quickly it breaks up and enters the water column.

The first members of the NOAA team arrived at Cape Cod on the day of the spill. The force has since grown to an average of 15. Now, with the program still far from finished, preliminary information has been found which is expected to prove useful throughout this incident and others which may follow.

Our first finding--one which has important and encouraging implications for the fishing industry--came when a Navy team, diving beneath the path of the oil at NOAA's request on Thursday, December 23, found the oil under a 30 foot diameter oil "pancake" to be as smooth on the bottom as on the top, giving no indication of oil sinking towards the bottom. Since then, measurements made by Dr. Jerry Milgram of MIT have confirmed the team's belief that the oil is not sinking in large concentrations. The fact that divers on the bottom beneath the path of the slick's travel found no visible oil indicates that the level of bottom contaminants may well be expected to be small and spread over a large area. Even though the divers looked at only one small area, the predominantly tidal currents in the area assure us that the oil slick had passed over that spot at least 14 times since the grounding.

On December 26, 3,000 drift cards were released between the oil and the island of Nantucket; on December 27, another 3,000 were released somewhat closer to shore. Should the oil come ashore, the bright orange squares should provide nearly a day's advance warning--enough time to have cleanup crews in position to function effectively.

The most accurate measurements thus far attained of the motion of oil on

the sea have been made through the use of simultaneous, independent views of satellite and aerial photos and visual observations.

One of the great slicks from the spill--a 300-foot by 700-foot "pancake" 6 inches thick, containing at least a half-million gallons of oil--was found on Christmas Day by Joe Deaver, a Coast Guard oceanographer, and Al Kegler of the Department of Conservation, State of Alaska, a member of the NOAA SOR team. This mammoth slick has been labelled and is being constantly tracked.

Surface currents and the absolute velocity of oil have been measured by "tagging" oil patches with drift cards. One 90-foot patch, tagged on December 19, was found again on the 25th. This pancake had travelled only 47 miles to the southeast in 7 days.

Subsurface (i.e., just below the underside of a slick) water samples are being taken from several ships and await analysis. Such analyses will soon provide concrete information on how oil enters the water column.

The DELAWARE II, a National Marine Fisheries Service research ship, has sampled fish life at 11 stations south and west of the spill site. It has taken 15 species in the as yet unaffected area. They will be analyzed for hydrocarbons and, should the spill penetrate the sampled area, it will be revisited to determine what changes have occurred. Samples of cod, pollock, and sand lance eggs and larvae have been taken from another site. They will be analyzed at NMFS laboratories with a view to determining their genetic states. Next week, the DELAWARE II will go out again, this time to the scene of the spill, to gather more information.

Shore sites are under study--sand, marsh, and embayment areas--by a team totalling 30 persons from a variety of institutions, assembled with the assistance of NOAA's Environmental Research Laboratories. Thus far, the bodies of approximately 700 oil-soaked gulls have washed ashore and will go to laboratories for analysis. The same shore site areas will be restudied should oil fouling occur there.

Special forecasts have been provided by the National Weather Service for all operations during the crisis. This service is continuing.

APPENDIX III

U.S. Department of Commerce News Release

RELEASE: Thursday
December 30, 1976

Data Buoy to
Track Oil Spill

HYANNIS, MASS....A Spilled Oil Research Team from the National Oceanic and Atmospheric Administration and the Coast Guard tomorrow will deploy a drifting buoy in the middle of the largest oil concentration from the wrecked tanker ARGO MERCHANT, weather permitting. The buoy will be tracked twice daily by Nimbus satellite; permitting the team to follow the drift of the oil without regard to weather conditions.

The particular "pancake" of oil to be tracked is the largest of many thousands that make up the oil slick from the Liberian tanker. It was spotted on Christmas day, 10 days after the vessel went aground on Nantucket Shoal, and since then has been tracked by Coast Guard aircraft when weather conditions permitted. The mass is about 700 feet long by 300 feet wide, and up to four inches thick, "with the consistency of peanut butter," said a NOAA scientist.

The buoy, flown up on loan from Nova University, Fort Lauderdale, Fla., is a spar ten feet long, with a floatation collar. When deployed by Coast Guard helicopter, three feet of the buoy will be above water. At noon and midnight the buoy position will be determined by NASA and relayed to the NOAA/Coast Guard Spilled Oil Research Team at Hyannis.

Additional buoys of this type will be deployed at the wreck site, weather permitting, if oil continues to leak from the vessel.

The buoy was developed by NOAA's Data Buoy Office in Bay Saint Louis, Miss., and more than 100 are in use by oceanographic programs throughout the world.

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