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Report to the Chairman, Subcommittee on Oceanography and the Great Lakes, Committee on Merchant Marine and Fisheries, House of Representatives

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# OCEAN RESEARCH FLEET

# NOAA Needs to Plan for Long-Term Fleet Requirements

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The Honorable Dennis M. Hertel, Chairman
Subcommittee on Oceanography and
the Great Lakes
Committee on Merchant Marine And Fisheries
House of Representatives

In response to the request of the former Chairman, this report provides information on the ability of the National Oceanic and Atmospheric Administration's research fleet to carry out its current and future mission requirements and the status of its plans to modernize the fleet.

Copies of this report are being sent to other appropriate congressional committees; the Secretary of Commerce; the Under Secretary of Commerce for Oceans and Atmosphere; the Director, Office of Management and Budget; and other interested parties.

This report was prepared under the direction of John M. Ols, Jr., Director, Housing and Community Development Issues, who may be reached on (202) 275-5525 if you or your staff have any questions. Other major contributors are listed in appendix IV.

Sincerly yours,

J. Dexter Peach
Assistant Comptroller General

chief scientists and party chiefs GAO interviewed, 28 said that NOAA's fleet was inadequate for meeting their research needs. The majority of those interviewed also believed that NOAA needs to upgrade existing ships and build additional ships to support future research.

A 1988 engineering consultant study of the fleet concluded that the fleet is generally in good condition for its age, especially considering the limited funding available for maintenance and other factors such as the ships' heavy operating schedules. The consultant concluded that most of the ships need to be upgraded to extend their useful life and that others should be replaced. According to the consultant and NOAA officials, past efforts to upgrade the ships have generally not ensured that the useful life of the ships will be extended because of resource limitations and other priorities.

Although NOAA's staff has developed a draft plan to modernize the fleet, NOAA has not officially adopted a plan for meeting future fleet support needs. The plan will be submitted to the Under Secretary for Oceans and Atmosphere for his consideration in November 1989.

The Congress is currently considering legislation that authorizes NOAA to modernize and expand the fleet and provides NOAA with the authority to enter into multiyear contracts and leases. NOAA could use this authority to experiment with long-term chartering/leasing arrangements to obtain future ship support.

# Principal Findings

## Users Report That Fleet Support Is Inadequate

Twenty-eight of the 41 scientists and party chiefs GAO interviewed said that NOAA's fleet support was less than adequate for their research needs during fiscal years 1986 through 1988 because of an insufficient number of days-at-sea and/or certain limitations of the ships and problems with the ships' equipment. Such limitations and problems included inadequate working or laboratory space and winches that were unable to lower equipment to necessary depths.

Notwithstanding these shortfalls in fleet support, most fleet users said they were able to accomplish most or all of their research objectives. Objectives, however, may be modified or reduced because of ship limitations. Most users said that they did not collect data or information in the

ships, $85 million to replace four ships, and $120 million to build seven additional ships.

A June 1986 GAO report on NOAA's use of private ships pointed out that available cost data on chartering versus the use of NOAA ships were not comparable. In 1988, the National Research Council's Marine Board assessed strategies available to NOAA to meet future ship support needs and found that data comparing the cost of contractor services with NOAA-performed services were not conclusive. The Marine Board recommended that NOAA experiment with long-term charters to determine their effectiveness in providing some of the necessary ship support.

The House Committee on Merchant Marine and Fisheries is considering legislation (H.R. 897) that requires NOAA to modernize its fleet and authorizes it to enter into multiyear contracts and lease agreements. NOAA could use this authority to experiment with long-term chartering/leasing arrangements as an alternative way to obtain some ship support. GAO supported the objectives of H.R. 897 in testimony before the Subcommittee on Oceanography and Great Lakes, House Committee on Merchant Marine and Fisheries, on April 27, 1989.

As of September 1989, NOAA had not approved the draft plan, and NOAA staff were revising it to, among other things, provide more flexibility in options to modernize the fleet.

## Recommendation

In order for NOAA to fulfill its mission effectively and efficiently, the Secretary of Commerce should ensure that NOAA, with departmental approval and support, officially adopts a plan to provide long-term ship support to its users. This plan should, among other things, provide flexibility so that NOAA can, if provided by the Congress, exercise multiyear contracting authority to experiment with long-term chartering/leasing arrangements. Such an experiment should be used to determine the effectiveness of these arrangements in providing some of NOAA's future ship support.

## Agency Comments

NOAA officials agreed with the facts contained in this report and indicated that a modernization plan will be submitted to the Under Secretary for Oceans and Atmosphere for his review in November 1989.

**Abbreviations**

| | |
|---|---|
| AMC | Atlantic Marine Center |
| ATI | Advanced Technology, Inc. |
| EEZ | Exclusive Economic Zone |
| GAO | General Accounting Office |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| PMC | Pacific Marine Center |
| RCED | Resources, Community, and Economic Development Division |

- the National Climate Program Act, as amended (15 U.S.C. 2901 et seq.);
- the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (16 U.S.C. 1431-1439, 33 U.S.C. 1401 et seq.); and
- the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978, as amended (33 U.S.C. 1701 et seq.).

NOAA's management structure consists of nine staff offices and five line offices. The three line offices that primarily use the ships in NOAA's research fleet are the

- National Ocean Service, which prepares and publishes aeronautical charts, conducts precise geodetic and oceanographic surveys, predicts tides and currents, and prepares and publishes navigational charts and related materials for coastal waters and the Great Lakes. The Service is also participating in a comprehensive effort to map the Exclusive Economic Zone (EEZ).[2]
- National Marine Fisheries Service, which seeks to discover, describe, develop, and conserve the living resources of the global sea, especially as they affect the American economy and diet.
- Environmental Research Laboratories in NOAA's Office of Oceanic and Atmospheric Research, which conduct fundamental investigations to improve man's understanding of the physical environment.

## The NOAA Fleet

NOAA has a fleet of ships with many scientific capabilities, ranging from coastal craft that work chiefly in near-shore areas to major deep water oceanographic ships that work throughout the world. The ships are staffed by a NOAA Corps of commissioned officers, wage marine employees, and general schedule technicians. Appendix I provides a profile of the NOAA fleet in fiscal year 1988.

In addition to its fleet, NOAA has chartered privately owned vessels, on a short-term basis, to help meet its requirements for vessel support beyond the budgeted capacity or capability of its fleet.

Total vessel support for NOAA's programs and projects from NOAA and private vessels has averaged about 4,600 days-at-sea annually over the last 3 fiscal years. Of this total, NOAA vessels provided an average of

[2]In 1983, the United States established the EEZ and proclaimed sovereign rights for the purpose of exploring, conserving, and managing all natural resources, both living and nonliving, of the seabed and subsoil of this area. This area was formerly established by the Fisheries Management and Conservation Act of 1976, which extended U.S. territorial jurisdiction to 200 nautical miles off the coast for the purpose of protecting fishery resources.

**Table 1.1: Summary of Budget Information on NOAA Fleet for Fiscal Years 1986 Through 1989**

Dollars in millions

| Fiscal year | NOAA's budget request | President's budget request | Budget appropriation |
|---|---|---|---|
| 1986 | $70.2 | $47.9 | $55.3 |
| 1987 | 65.9 | 47.5 | 58.8 |
| 1988 | 64.7 | 54.6 | 58.9 |
| 1989 | 69.4 | 54.4 | 56.4 |

Source: National Ocean Service

## Objectives, Scope, and Methodology

In a letter dated February 11, 1988, the then Chairman, House Subcommittee on Oceanography,[3] Committee on Merchant Marine and Fisheries, asked GAO to review several aspects of the operation and maintenance of NOAA's research fleet. He expressed interest in specific allegations of poor maintenance, repair, and repair contracting procedures for vessels based in the Seattle area. He also expressed interest in whether some of these problems were symptomatic of a broader problem of block obsolescence in the NOAA fleet and the lack of any fleet replacement plan. Of key concern was what effect these indicated problems may have on NOAA's ability to effectively carry out its current and future missions and fulfill its statutory responsibilities.

Information on allegations of poor maintenance, repair, and repair contracting practices for vessels based in the Seattle area was reported to the then Chairman in Ocean Research Fleet: Contracting Practices for Repair of NOAA Ships (GAO/RCED-89-25, Oct. 31, 1988). With regard to the other concerns expressed by the then Chairman in his request to us, we agreed to obtain information on NOAA's efforts to

- provide fleet support to meet current and future mission requirements,
- maintain and upgrade its aging fleet and equipment, and
- plan for fleet support to meet future mission requirements.

We conducted our review at NOAA headquarters in Washington, D.C., and at the field installations indicated below. The locations represented NOAA line offices of the National Ocean Service, the National Marine Fisheries Service, and the Office of Oceanic and Atmospheric Research:

- Atlantic Marine Center, Norfolk, Virginia;
- Pacific Marine Center, Seattle, Washington;

[3]Currently the Subcommittee on Oceanography and the Great Lakes.

so. In addition, we obtained and reviewed NOAA budget requests and related documents, fleet allocation correspondence and reports, various program planning documents on projected requirements for future fleet support, and the 1988 report of the Marine Board, National Research Council, a committee of marine experts, on its evaluation of alternative strategies for obtaining ship services to meet NOAA mission requirements.

Our work was conducted between April 1988 and May 1989 and was performed in accordance with generally accepted government auditing standards.

To help determine the extent of the shortfall in days-at-sea, we asked these 18 fleet users to estimate to the extent possible the additional days they needed for their research in fiscal year 1988. Thirteen estimating for their own research needs said that they needed an average of 18 additional days-at-sea for each of their research programs (ranging from 5 to 90 additional days-at-sea). For example:

- Seven fishery scientists said they needed 5 to 30 additional days-at-sea to collect biological and environmental data about renewable living resources and their supporting environments. Collectively, these scientists said they received about half the time they needed in fiscal year 1988.
- An oceanography chief scientist said he needed 5 additional days-at-sea to conduct research related to improving the ability to predict hazardous or special environmental conditions in the oceans, Great Lakes, and the Alaskan Arctic. He said he had 8 days (about 60 percent) of the time he needed.

The remaining five users said they could not estimate the additional days they needed for their research alone. They estimated additional time needed for the program in which they were involved. The average additional time needed was 76 days-at-sea (ranging from 12 to 360 additional days). For example, a party chief estimated that 360 additional days-at-sea were needed for hydrographic surveys to produce nautical charts.

## NOAA's Assessments Support Users

The users' estimates of additional days-at-sea needed for their research or programs are similar to NOAA's assessments. Each year, NOAA Assistant Administrators are required to develop ship-time requirements for the next 5 years. The 1986 5-year plan projected that users' requirements for ship time would increase from 4,125 days in 1986 to about 5,300 in 1990. The plan projected that NOAA would be able to meet about 85 percent of the projected needs. NOAA actually met about 86 percent of the ship time needed in 1986; however, it met only about 78 percent of the need in 1987 and 74 percent in 1988.

The shortfall in fiscal year 1988 days-at-sea affected many of NOAA's programs. For example, NOAA projected that it needed 1,050 days-at-sea in fiscal year 1988 to map the EEZ, the territory extending 200 nautical miles from the U.S. coastline. However, NOAA planned to provide only 588 days because of funding reductions and because it had to support

reasonable expectation for endurance is 1 week underway and 2 weeks on station.

Laboratories, Space Availability, and Accommodations. At least 14 of the 28 users said they had problems with the space or furnishings available for laboratories, the storage of scientific equipment and samples, working on deck, or accommodations. For example, a party chief said because the decks of the Heck and the Rude were too small to carry large-sized work boats for survey work, smaller work boats with inadequate survey equipment must be used. In addition, a fishery scientist said that laboratory space aboard the Delaware II was insufficient for his research.

In instances in which two or more scientists used the same ship, we noted that the same basic ship characteristics were often mentioned as hindering their research. The 28 fleet users who rated fleet support as inadequate had conducted research on 14 NOAA ships. Examples of commonly cited problems follow:

- Five of seven fishery scientists conducting research aboard the Delaware II said the ship's accommodations, cranes, and laboratories hindered their research.
- At least three of the five oceanography and fishery scientists conducting research aboard the Oceanographer said that the ship's winches, speed, deck working area, overside handling gear, or laboratory hindered their research.

## Fleet Limitations Generally Had a Moderate Impact

The 28 fleet users who said fleet support was inadequate also told us to what extent they were unable to meet their research objectives. Sixteen said they met most or all of their objectives. However, their research objectives may have been modified or reduced because of fleet support limitations. Therefore, we asked them to what extent, if at all, the inherent limitations decreased the effectiveness of their research. Twenty-four said their effectiveness in conducting research was generally decreased because they did not collect information in either the amount or quality needed. In addition, 27 said that those who need to use NOAA research are adversely affected by limitations in ship support.

### Most Objectives Were Met

Although most of the 28 fleet users said they met most or all of their objectives, users may have tailored their objectives to accommodate the limitations in fleet support. For example, one scientist said, "I meet all

shortfall in fleet support include federal and state fishery managers, commercial fishermen, seafood consumers, commercial and recreational boaters, and federal and state environmental regulatory agencies. For example:

- An oceanography scientist was unable to collect sufficient water conductivity, temperature, and depth data fundamental to NOAA's analysis of water pollutants. The scientist said that environmental regulatory agencies, such as the Environmental Protection Agency and Washington State's Department of Ecology, are adversely affected by the lack of adequate data. One local official told us that, in the past, NOAA has provided monitoring data on heavy metals entering Puget Sound in Washington, and he is concerned because NOAA has discontinued this work.
- A party chief said that, because some important fishing and navigation areas had not been charted or resurveyed, commercial shippers and fishermen are at risk of running into rocks or other obstructions.

## NOAA Fleet Generally Sound but Maintenance and Upgrades Needed

According to Advanced Technology, Inc. (ATI),[1] which assessed the condition of NOAA's fleet, the vessels, overall, are in good condition considering their age. However, ATI pointed out that because of the age of the fleet, NOAA faces block obsolescence of its fleet in the next 10 years without an aggressive upgrade program. ATI proposed an upgrade and replacement program to extend the service life of the ships.

ATI said the general condition of the NOAA fleet was a positive reflection of well-maintained vessels, especially considering the limited funding, heavy operating schedules, and reduced crew sizes that have characterized NOAA operations in recent years. ATI attributed the overall good condition of the fleet primarily to NOAA personnel and noted that

- funding for maintenance and repairs has been limited for many years while inflation has increased costs and
- resources for NOAA's upgrade program were not adequate to extend the service life of all systems and structures of the ships, and the priorities did not ensure the reliable, extended service life of the fleet.

Some of the ships, the contractor said, could easily be labeled in excellent condition. However, ATI said 4 of NOAA's 23 ships (the Albatross IV, the Townsend Cromwell, the John N. Cobb, and the Surveyor) needed replacing for various reasons, including their age, condition, marginal capability to carry mission objectives, and, in one case, an obsolete engine system. ATI recommended that the ships have limited upgrades to improve operations and/or reduce hazards until they were replaced.

## Repair and Upgrade Needs Not Met

Although the ATI assessment found that the general condition of the fleet was good, it noted that repairs that should have been made to the ships have been delayed because of scarce resources. We also noted a backlog of maintenance and repairs and delays in NOAA's program to upgrade the fleet.

### Deferred Maintenance and Repairs

Funding for maintenance and repair of the NOAA fleet has been limited for many years, while the cost of repairs has increased. As a result, fleet maintenance has been caught between rising costs, increasing obsolescence, and limited funding. As table 3.1 shows, between fiscal years

[1] In June 1987, NOAA awarded a contract to ATI, a systems engineering contractor, to assess NOAA's fleet. ATI's report entitled Assessment and Plan to Extend the Service Life of Vessels of the NOAA Fleet was issued in January 1988.

According to the 1980 plan, NOAA planned to upgrade the 15 ships by the end of 1990; however, NOAA had only partially upgraded 6 ships by 1988. The Chief said that NOAA has deviated from its schedule of ship rehabilitation because of budget constraints, cost increases to rehabilitate ships, and other competing priorities for resources.

The Chief, Ship Systems Branch, told us, for example, that the 10-year upgrade plan needed funding ranging from $3.5 million in the first year to $9 million in the tenth year. However, NOAA obtained funding of only $3.5 million each year to upgrade the fleet. The Chief said that NOAA's rehabilitation work done on the ships was to upgrade their mission abilities, rather than to extend their useful life. He also cited cases where rehabilitation funds were used for other priority work on ships that were not rehabilitated. For example, when an interior tank on the Mt. Mitchell corroded and deteriorated the hull plating, NOAA used rehabilitation funds for emergency repairs. ATI's assessment of the Mt. Mitchell, after the tank failure and emergency repairs, recommended that an upgrade of the ship include an inspection, repair, and coat of the interior, bottom tank used for the storage of oily water. ATI recommended similar inspections and treatment of water tanks on other NOAA ships that had been through NOAA's rehabilitation program.

In addition, the Chief said that in 1984 the Director, National Ocean Service, canceled scheduled rehabilitation work on the McArthur—an oceanographic research ship—to purchase electronic surveyor system equipment for other ships. The Chief, Ship Systems Branch, added that the National Ocean Service Director also canceled rehabilitation work on the Rude and Heck to do rehabilitation work on the Discoverer. In addition, he said, four ships originally scheduled for rehabilitation in the 10-year plan—the Rainier, Fairweather, Mt. Mitchell, and Ferrel—were not rehabilitated because of changing priorities. The Chief, Ship Systems Branch, said studies for upgrade work on the Rainier, Fairweather, and Mt. Mitchell are now planned to begin in fiscal year 1990 and in fiscal year 1991 for the Ferrel.

## ATI Assessment of Rehabilitation Needs

ATI's assessment of NOAA's fleet recommended major upgrade work for ships, including those partially rehabilitated by NOAA. It estimated that upgrade and replacement would cost $168,064,000 over a 10-year period (fiscal years 1990-99): $82,914,000 for upgrading ships and $85,150,000 for replacing the four ships. NOAA has included ATI's recommendations for upgrading in its draft program development plan to modernize the fleet (see ch. 5).

## Instrumentation Is Aging and Not Being Replaced

The instrumentation and data-processing equipment of the NOAA fleet are aging and are not state-of-the-art technology. NOAA has pointed out the need to replace out-of-date instrumentation, and chief scientists and party chiefs who use NOAA ships said out-of-date instrumentation has hindered their research. However, the Chief, Operational Systems Engineering Branch, who is responsible for major acquisitions and procurement of equipment systems, told us that budget constraints have prevented NOAA from replacing the instrumentation.

## Fleet Instrumentation Is Aging

Fleet instrumentation managers have expressed concern about the aging condition of NOAA's instrumentation and data-processing equipment. For example, according to the Chief, Operational Systems Engineering Branch, NOAA's fleet instrumentation is, generally speaking, in abysmal condition and adversely affects NOAA's productivity and efficiency. This branch provides for the acquisition and logistic support of major equipment systems costing between $100,000 and $2 million for all NOAA ships. The Chief of the Pacific Marine Center's Electronics Engineering Branch said he was also concerned about the aging equipment. This branch supports the less expensive instrumentation needs of the NOAA fleet managed by that center. Also, his branch is using and maintaining instruments that are over 20 years old, and spare parts are difficult to obtain. For example, he said the fleet is using computers that are 18 to 19 years old. Because the manufacturer no longer produces spare parts for these computers, repairs have to be made with used parts.

## Aging Instrumentation Hinders Research

Fleet users reported that the condition of electronic instrumentation aboard the ships hindered their research. Thirteen of the 28 scientists who reported that fleet support for their current research was inadequate said the ships' computer systems and/or scientific instruments hindered their research. Problems with the ships' acoustic systems, navigation and positioning systems, and communications systems also adversely affected their research. For example:

- The computer aboard the ship a fishery scientist used is outdated. The scientist also said that the ship's conductivity, temperature, and depth recorder system is outdated and should be replaced.
- Two fishery scientists, one from each coast, said computer systems aboard the ships needed a better power system.
- The ship a party chief sailed on did not have a back-up for its side scan sonar, which is used to map the ocean bottom. The chief said time is lost

instrumentation, and data acquisition and processing systems. NOAA received $1.4 million for equipment in its appropriation—$1.1 million for multibeam systems needed to survey, among other areas, the EEZ and $300,000 for a study by academic institutions to develop an agenda of national priorities for the marine electronics industry.

For fiscal year 1988, NOAA's budget request to the Department of Commerce included $1.3 million to fund fleet instrumentation and equipment purchases, such as global positioning systems, satellite communication systems, oceanographic winches, and rigid hull rescue boats. NOAA's fiscal year 1988 appropriation for marine services of approximately $59 million included $1.1 million for additional multibeam systems and approximately $700,000 to continue the marine electronics industry study.

In its fiscal year 1989 request to the Congress, NOAA did not include any additional funds for instrumentation modernization and did not receive any funds for this purpose. A NOAA official told us that NOAA did not request funds for instrumentation because it focused its priorities on obtaining funds for ship rehabilitation. However, NOAA included an estimate of about $33 million to be spent over a 5-year period to upgrade instrumentation as part of an overall draft plan prepared in 1988 to modernize the fleet. The proposed instrumentation upgrade calls for essentially the same types of equipment that NOAA has wanted to obtain since the fiscal year 1986 budget.

Limitations caused by such budget constraints have not helped to reverse the trend toward outdated, inefficient instrumentation. For example, because his office cannot buy equipment on a fleetwide basis, the Chief of the Operational Systems Engineering Branch said he purchases equipment on a piecemeal basis when he can afford to. He usually does this by using end-of-year funds on a cost-sharing basis with other program offices. He pointed out the following inefficiencies in the way NOAA acquires instrumentation for its ships:

- Because NOAA acquires its instrumentation on a piecemeal basis, instrumentation is not standardized throughout the fleet. The Chief of the Operational Systems Engineering Branch said that he would prefer to buy a standard, proven equipment package from a manufacturer who can also provide spare parts. Instead, NOAA buys individual ship systems when it can afford them, resulting in a mixture of equipment, some of which is incompatible.

# Ability to Meet Increasing Program Requirements at Risk

Managers of NOAA's programs and users of the NOAA fleet expect the demand for time at sea on NOAA ships to rise considerably over the next 20 years. Much of the increased demand stems from increased economic development of fisheries and other offshore resources, and from the need for additional research into such topics as changes in the earth's climate. The demand for NOAA ships is expected to greatly exceed NOAA's current capacity, requiring additional ships as well as upgrades to the existing fleet. Fleet users we spoke to generally do not believe that new technologies will reduce ship time because, among other reasons, they will still need a certain amount of ship time to collect data. The users also did not believe that other agencies could carry out NOAA's research if NOAA was unable to do so because the other agencies did not have the budget, mandate, expertise, or resources, such as vessel support. They indicated that inadequate fleet support on NOAA's part will place at risk many projects related to fishing, mapping and charting, and ocean research.

## Increased Demand for Ship Time

NOAA's assessments conclude that its fleet will be unable to meet the increasing demand for research and survey time at sea. Its most recent short-term (5-year) study found that the fleet cannot meet the demand, and its long-term (20-year) plan, developed in 1988, projects that, in addition to upgrading existing ships, NOAA will have to add seven new ships by the year 2009 if it is to meet projected demands. An independent study by the Marine Board of the National Research Council reached similar conclusions with regard to the increased demand for research and survey time aboard NOAA ships.

## Projections in the Current 5-Year Plan

NOAA's current 5-year draft plan on supporting ship needs anticipates that available days-at-sea on NOAA ships will fall considerably short of projected needs. The plan, which covers 1990 through 1994, is based on estimates of ship-time requirements prepared by the Assistant Administrators of the NOAA offices, who are the major users of NOAA's fleet. It projects that annual user requirements will average about 7,000 days-at-sea throughout the period. The plan points out that the fleet can provide 3,645 days-at-sea to support NOAA programs operating at the fiscal year 1989 funding level with 17 active ships.[1] The plan notes that, at the fiscal year 1989 level, the fleet can provide about 52 percent of the identified NOAA program requirements for ship time during the 5-year plan.

[1]The President's 1989 budget request proposed deactivating six NOAA ships.

role to continue over the next 20 years. Beginning in 1990 and continuing throughout the 20-year period, NMFS has projected that it will need about 3,100 days-at-sea, which includes support from chartered vessels and two new NOAA ships. A NMFS biologist who specializes in vessel support said the increased days-at-sea would provide more accurate stock estimates. One rapidly increasing NMFS requirement for ship time is the result of the expansion of U.S. fishing activity in Alaskan waters and the elimination of foreign fishing in these areas.

- Expansion of U.S. Fishing Activity in Alaskan Waters. According to the NMFS specialist in vessel support, until 1986 NMFS relied in part on data gathered from foreign fishing vessels in the EEZ in the Gulf of Alaska and the Bering Sea to help estimate the size of fish stocks. Beginning in 1986, he said, domestic fishing replaced and virtually eliminated all foreign fishing in the area, resulting in the loss of about 500 days-at-sea in support from foreign research ships. To make up for this loss and to monitor the rapid expansion of U.S. fishing activity, NMFS projected that it would need at least 1,060 annual days-at-sea of the approximate 3,100 days-at-sea, including support from chartered vessels, that it needed for all NMFS programs. NMFS also called for one new ship to be dedicated to fisheries research in Alaskan waters.
- Global Climate Change. The Executive Director, Oceanic and Atmospheric Research, said that this office's ship-time requirements will increase over the next 20 years because it is becoming involved in international climate research projects. These global climate projects investigate such phenomena as the oceanic transport of heat and the background concentrations of ozone and carbon dioxide. This office expects its need for ship time to nearly double between fiscal year 1988 and the year 2008 as the global programs come on line and larger areas of the Pacific Basin are studied. Of the 920 days-at-sea that the office projects it will need annually for its programs by the year 2009, the majority of them, 525, are for programs examining changes in the global climate.

## Marine Board Also Sees Increasing Need for NOAA's Ships

In 1988, the Marine Board of the National Research Council issued a study that in part addressed the future need for NOAA ships. The study stemmed from a 1986 NOAA request to the Marine Board to assess NOAA's potential use of chartered vessels. The Marine Board recognized that such an assessment depended on NOAA's future mission requirements. It found that NOAA's need for ship time will increase because of its future activities and a national focus on the global oceans. The Marine Board pointed to the 1983 declaration of the EEZ, the increased use of marine resources, and the national commitment to global ocean investigation as

## Need for NOAA Ships Not Likely to Be Reduced by New Technologies or Other Agencies' Capabilities

Although most users in our survey (40 of 41) said new computers, satellite systems, or other new technologies would be important to their future research, very few believed that such technologies would reduce the need for ship time. Furthermore, most scientists in our survey did not believe that other federal or state agencies involved in marine research could perform NOAA's research if NOAA was unable to do so.

For example, most users said that the following would, to different degrees, be important to their research:

- computers that integrate monitoring and navigation data, and
- the Global Positioning System, which allows users to determine their navigational positions to within a few meters or less through the use of satellites.

Many fleet users identified different benefits to their research resulting from the use of such technologies. For example, 34 of the 41 users said that the new technologies would

- improve the processing and reduction of data on board the ships and the transmission of data between ship and shore,
- allow for the adjustments of data or sample collection efforts while at sea and thus avoid the delay entailed in waiting for the next cruise to make corrections, and
- increase the collection of data or samples.

Despite the possible benefits from implementing such technologies, 32 of the 41 fleet users said new technologies would not reduce the need for ship time. Even with the improvements in processing and transmitting data, some said they would still need a certain amount of time to collect the data. Others said the improved efficiencies in collecting and processing the data would permit them to collect and process more data than they do now.

Most fleet users we interviewed also believed that other agencies could not carry out NOAA's research if NOAA was unable to do so. Of the 31 users we interviewed who said that they were at least somewhat familiar with the marine research performed by other agencies, 25 said that such agencies would be able to carry out NOAA's future research to only a small or very small extent. Another five users believed other agencies could carry out the research to a moderate extent, and only one thought other agencies could carry out future research to a great extent.

Dungeness crab populations would be limited to local and geographically narrow areas. He said that on the basis of these limited studies, he would not be able to generalize to other areas in the Southeast Alaskan Gulf, where the crab populations differ in their life cycles.

Some scientists said they feared disruptions in the continuity of their survey data that must be collected over time. For example, a Southwest marine mammal scientist said the National Marine Fisheries Service needed to be consistent in its data collection efforts over time to eliminate some biases and to be able to make assumptions affecting yearly population estimates. Regarding his 5-year survey of dolphins endangered by tuna harvesting, he said that he must maintain the same precision level over the course of study if the yearly data points are to be comparable. If the National Marine Fisheries Service's efforts were reduced to such a degree that it took 15 years to conduct a survey, he said, NOAA might be too late to save the dolphin stocks from depletion.

According to many fishery scientists, one potential consequence of restricted fleet support for their future research is that the Regional Fishery Management Councils and other agencies would not have the complete or accurate information needed to manage marine resources. For example, an Alaskan fishery scientist said state fish managers need accurate information from the National Marine Fisheries Service to set quotas and to maintain stocks.

A shortfall in fleet support could also have economic consequences for the fishing industry. For example, an Alaskan fishery scientist said a more accurate stock assessment of sable fish populations led to increased profits for the fishing industry. Because of a 1985 cooperative study with the Japanese, he said that the National Marine Fisheries Service was able to determine that the sablefish population was twice the expected size. As a result, the North Pacific Fishery Management Council was able to set higher quotas in 1986 for the fishing industry. The harvest of domestically processed sablefish increased from 12,215 metric tons in 1985 to 21,568 metric tons in 1986. According to the scientist, the increased harvest resulted in an additional $16 million in profit for the fishing industry and is directly attributable to the higher quota set by the Council. He also said that, in general, the smaller the margin of error in stock assessment, the less conservative the National Marine Fisheries Service has to be in recommending stock quotas.

Another oceanography scientist said his research is used by NOAA program offices and various federal, state, and local environmental regulatory agencies interested in the long-range effects of changes in the estuarine environment, such as that caused by pollution. However, the scientist said that he is currently forced to use Class III ships, which have an inadequate number of scientific berths, inadequate lab space, and no room for a van which is used as a laboratory with its own equipment or as a storage area. He told us that if he does not acquire time aboard more suitable ships, his group will continue to face limitations in future data collection efforts and analyses.

a limited upgrade to the four ships to correct potentially hazardous conditions and to increase operational capabilities and reliabilities as much as possible until the ships can be replaced.

- NOAA would also construct seven additional ships.

The Service has included in its draft plan the upgrade work to be done on each ship and general characteristics of the new and replacement ships, including their size, capacities (such as speed, endurance, and range), and scientific capabilities. NOAA estimates, in terms of 1987 dollars, that the upgrade work will cost about $83 million, that the four replacement ships will cost about $85 million, and that the seven additional ships will cost about $120 million.

In March 1989, the then Under Secretary for Oceans and Atmosphere told us that NOAA needs a plan to modernize the fleet and that the agency is looking closely at what its mission needs will be. In addition, NOAA's problems in modernizing the fleet were caused by funding constraints, according to its former Under Secretary. He also pointed out that other agencies operating oceanographic research fleets also have a need to modernize their fleets but have limited budgets. He suggested that the ultimate solution may be to focus attention and concentrate resources on having a national oceanographic fleet in place of the separate agencies' fleets. The former Under Secretary stated that NOAA's final plan to modernize the fleet will be developed by the Department of Commerce's and the Administration's budget process. A Commerce budget office official told us that the Department has not provided any budget advice to NOAA about the fleet modernization plan. He said that it would be premature for the Department to provide such advice until NOAA submits a plan to the Department.

In September 1989, an Office of NOAA Corps Operations official told us that the Office was revising the draft development plan to provide more flexibility in options to modernize the fleet and to respond to comments made on the draft by NOAA Assistant Administrators responsible for programs supported by the ships. The Office will submit the revised draft plan to the newly appointed Under Secretary in November 1989 for his consideration and is planning to send it to the Secretary of Commerce in January 1990, according to this official.

In the report, we pointed out the following:

- Most NOAA chartering of private vessels has been done by the National Marine Fisheries Service.
- NOAA officials who favored private vessels cited such advantages as private vessel availability, more modern vessels, quality crews, and low cost.
- NOAA officials who generally favored NOAA vessels said, among other things, that NOAA vessels were safer than chartered ships; crew support of scientists was more efficient on NOAA ships than it would be on commercial ships; NOAA vessels were more readily available to meet planned projects, whereas commercial firms may not choose to bid on a particular project; and, over the long-term, NOAA's ship costs are comparable with or are lower than the costs for similarly configured chartered ships.
- Available cost data on chartering and the use of NOAA ships were not comparable.

GAO recommended that NOAA develop more information on chartering before it deactivated additional ships. GAO suggested, as one option, that NOAA could gradually increase the use of private vessels so that it could obtain additional experience and data.

To obtain additional information about the desirability of chartering, the Administrator of NOAA, on August 29, 1986, asked the Chairman of the Marine Board, National Research Council, "to assess the issues associated with chartering research vessel support from the private sector versus operating NOAA ships." The Marine Board issued its final report in 1988. It found, among other things, that

- NOAA could potentially use chartering to its advantage in carrying out certain program areas, such as fisheries and EEZ surveys, but other program areas, such as hydrographic surveys in support of mapping and charting, are not conducive to chartering;
- data comparing the cost of contractor services with NOAA- performed services are not conclusive; and
- for many chartering alternatives, long-term charters are more cost-effective than short-term charters.

Accordingly, the Marine Board recommended, among other things, the following actions:

The legislation also authorizes NOAA to enter into multiyear contracts and leasing agreements for the construction, lease, or other acquisition of vessels, equipment, and services, provided there is reasonable expectations that there will be funding from the Congress and that competition and economic efficiency will be encouraged. The legislation authorizes NOAA to enter into a multiyear charter agreement for one of the seven additional ships.

We supported the objectives of H.R. 897 and its requirement that NOAA develop a fleet modernization program in our testimony before the Subcommittee on Oceanography and Great Lakes, House Committee on Merchant Marine and Fisheries, on April 27, 1989.

## Conclusions

Although NOAA has identified users' long-term needs and ship support to carry out those needs, it has not adopted a plan to modernize the fleet to meet these needs. NOAA needs to adopt a modernization plan for the fleet if it is to ensure that the fleet will be able to adequately support program needs in the future. If authority is provided by the Congress, such a plan should provide for experimenting with long-term chartering/leasing in order to determine the effectiveness of this approach for obtaining some of NOAA's future ship support.

## Recommendation

In order for NOAA to fulfill its mission effectively and efficiently, we recommend that the Secretary of Commerce ensure that NOAA, with departmental approval and support, officially adopt a plan to provide long-term ship support to its users. This plan should, among other things, provide flexibility so that NOAA can, if provided by the Congress, exercise multiyear contracting authority to experiment with long-term chartering/leasing arrangements. Such an experiment should be used to determine the effectiveness of these arrangements in providing some of NOAA's future ship support.

## Agency Comments

NOAA officials, including the Director of NOAA Corps Operations, reviewed a draft of this report and agreed with the facts contained in it. The Director stated that a decision concerning what will be done about the fleet is needed. He noted that NOAA's most recent estimates of program requirements for fleet support have increased from 7,000 days-at-sea to about 8,500 to 9,000 days-at-sea. A draft modernization plan will be submitted to the Under Secretary for Oceans and Atmosphere for his review in November 1989.

# Support Provided by NOAA Vessels for Fiscal Years 1986 Through 1988

| | Days-at-sea | | |
|---|---|---|---|
| **Program area** | **FY 1986** | **FY 1987** | **FY 1988** |
| National Ocean Service | | | |
| Nautical charting | 838 | 856 | 827 |
| EEZ ocean surveys | 349 | 396 | 480 |
| Estuary and coastal assessments and other | 274 | 242 | 274 |
| **Total** | **1,461** | **1,494** | **1,581** |
| National Marine Fisheries Service | | | |
| Resource assessment | 1,540 | 1,509 | 1,531 |
| Porpoise studies | 120 | 246 | 256 |
| Other | 0 | 30 | 0 |
| **Total** | **1,660** | **1,785** | **1,787** |
| Oceanic and Atmospheric Research | | | |
| EPOCS[a] | 129 | 138 | 142 |
| VENTS[b] | 61 | 72 | 67 |
| FOCI[c] | 20 | 57 | 63 |
| TOGA[d] | 0 | 61 | 0 |
| Other | 232 | 282 | 308 |
| **Total** | **442** | **610** | **580** |
| Total fleet support | 3,563 | 3,889 | 3,948 |

[a]Equatorial Pacific Ocean Climate Studies

[b]Hydrothermal venting research program

[c]Fisheries-Oceanography Coordinated Investigations

[d]Tropical Oceans and Global Atmosphere

not attempt to develop specific information regarding the number and type of ship equipment systems or instrumentation that NOAA needed to support its research. Such an effort would have required an expanded sample of fleet users in every NOAA program requiring fleet support and would have greatly enlarged the scope of our survey.

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# Methodology Used to Select Primary Users to Interview

The primary users of NOAA ships we selected to interview were chief scientists and party chiefs associated with the three NOAA line offices that primarily use the ships in marine research—the National Marine Fisheries Service, the National Ocean Service, and the Office of Oceanic and Atmospheric Research.

Chief scientists are responsible for the scientific complement of the crew during the trip and are jointly responsible with the ship's commanding officer for the collection and preservation of scientific data. The chief scientist is also responsible for the disposition of data, feedback on data quality, and the archiving of data and specimens collected. Party chiefs are the commanding officers and principal investigators of the ships conducting hydrographic surveys of the National Ocean Service.

To help ensure that we obtained current information on the fleet's ability to support research, we limited our interviews to scientists and party chiefs who led research projects or surveys in fiscal year 1987, the latest completed fiscal year when we selected fleet users. Using data provided by the Atlantic and Pacific Marine Centers, we identified 120 chief scientists and party chiefs who met this criterion. These included 82 chief scientists from the National Marine Fisheries Service, 3 chief scientists and 12 party chiefs from the National Ocean Service, and 23 chief scientists from the Office of Oceanic and Atmospheric Research.

From this group we judgmentally selected 41 who represented at least 25 percent of the fiscal year 1987 ship users in each of the three NOAA units. Our sample of 41 included

- 29 National Marine Fisheries Service chief scientists from the Alaskan Fishery Center in Auke Bay, Alaska; the Northwest Fishery Center in Mukilteo and Seattle, Washington; the Southwest Fishery Center in La Jolla, California; and the Northeast Fishery Center in Woods Hole, Massachusetts;
- 6 Oceanic and Atmospheric Research chief scientists from the Pacific Marine Environmental Laboratory in Seattle, Washington, and the Scripps Institute of Oceanography in La Jolla, California; and
- 6 National Ocean Service party chiefs from the Pacific Marine Center in Seattle, Washington, and the Atlantic Marine Center in Norfolk, Virginia.

We decided a judgmental sample would allow us to obtain sufficient evidence to determine whether the NOAA fleet was adequately supporting its mission research, particularly since the sample included chief scientists or party chiefs in each major mission area of NOAA support. We did

# NOAA Fleet, Fiscal Year 1988

| Vessel | Class[a]/ length[b] | Year built | Marine center[c] | Scientists[d] | Primary mission |
|---|---|---|---|---|---|
| Oceanographer | I/303 | 1966 | PMC | 24 | Oceanography |
| Discoverer | I/303 | 1966 | PMC | 24 | Oceanography/ hydrography |
| Surveyor | I/292 | 1960 | PMC | 16 | Oceanography/ hydrography |
| Malcolm Baldrige | I/278 | 1970 | AMC | 16 | Oceanography |
| Fairweather | II/231 | 1968 | PMC | 4 | Hydrography |
| Rainier | II/231 | 1968 | PMC | 4 | Hydrography |
| Mt. Mitchell | II/231 | 1967 | AMC | 4 | Hydrography |
| Miller Freeman | II/215 | 1967 | PMC | 11 | Fisheries/ oceanography/ environmental assessment |
| Albatross IV | III/187 | 1962 | AMC | 15 | Fisheries |
| McArthur | III/175 | 1966 | PMC | 6 | Fisheries/ oceanography/ environmental assessment |
| Davidson | III/175 | 1967 | PMC | 2 | Hydrography |
| Oregon II | III/170 | 1967 | AMC | 15 | Fisheries |
| Peirce | III/163 | 1963 | AMC | 2 | Hydrography |
| Whiting | III/163 | 1963 | AMC | 2 | Hydrography |
| David Starr Jordan | IV/171 | 1965 | PMC | 13 | Fisheries |
| Townsend Cromwell | IV/164 | 1963 | PMC | 9 | Fisheries |
| Delaware II | IV/156 | 1968 | AMC | 9 | Fisheries |
| Ferrel | IV/133 | 1968 | AMC | 6 | Environmental assessment |
| Chapman | IV/127 | 1980 | AMC | 6 | Fisheries |
| John N. Cobb | V/93 | 1950 | PMC | 4 | Fisheries |
| Rude | V/90 | 1966 | AMC | 0 | Hydrography |
| Heck | V/90 | 1966 | AMC | 0 | Hydrography |
| Murre II | VI/86 | 1943 | PMC | 5 | Fisheries |

[a]NOAA vessels are grouped by classes that are determined by a combination of each ship's gross tonnage and rated horsepower. The classes range from I, the largest, to VI, the smallest.

[b]Length in feet.

[c]AMC=Atlantic Marine Center, Norfolk, Virginia
PMC=Pacific Marine Center, Seattle, Washington

[d]This is the number of scientists that the ship can accommodate. These are berths or spaces in addition to the officers and crew of the ship.

- "NOAA should issue a full RFP [request for proposal] for EEZ bathymetric surveying and convey a serious intent to award a long-term contract in order to obtain accurate cost data. This should be undertaken by NOAA as an experimental program(s) with a clear recognition that funds must be set aside to implement this recommendation."
- "NOAA should establish agency policy and procedures to enter into long-term multiyear contracts for ship charters and related scientific services."

## Current Status of Expanded Chartering as an Alternative to Obtaining Ship Support

The Marine Board also pointed out that multiyear charters can offer a highly capable and well-outfitted ship at attractive prices. But NOAA has maintained that it is constrained from using multiyear contracts. An official in the Office of NOAA Corps Operations told us that his office does not have the authority to enter into long-term contracts. However, the Marine Board pointed out that long-term leasing can be done by agencies with annual appropriations. The Board stated that contracts are written with federal payments subject to the availability of funds. It also stated that contractors will expect a cancellation penalty payment provision.[1]

NOAA's June 1988 draft program development plan for modernizing the fleet provides for experimenting with chartering to obtain support. However, it does not propose any specific policy about using long-term charters to carry out future requirements in particular program areas.

## The House Merchant Marine and Fisheries Committee Is Considering Legislation to Modernize the Fleet

The House Committee on Merchant Marine and Fisheries is considering legislation (H.R. 897) that would require NOAA to develop and implement a fleet modernization and expansion program. Specifically, the proposal requires NOAA to

- modernize 19 ships in its current fleet;
- replace 4 ships in its fleet;
- construct, charter, or otherwise acquire 7 additional ships; and
- modernize its fleet instrumentation.

[1]Contracts using fiscal year appropriations that are written with federal payments for future years subject to the availability of funds cannot bind the government beyond the end of the fiscal year. Furthermore, a provision that would levy a penalty payment if the contract was canceled might well violate statutory prohibitions against obligation of current appropriations to meet the needs of other years.

## Chartering—An Alternative Strategy for Obtaining Needed Ship Support

Although the scientific needs for fleet support have been increasing, budget requests over the past several years have proposed deactivating ships in NOAA's fleet. The budgets have, in some cases, proposed chartering private vessels as a way of obtaining needed ship support. The cost-effectiveness of chartering to provide needed fleet support is not clear. The National Research Council's Marine Board recommended that NOAA experiment with chartering to determine its desirability.

The Marine Board found that long-term, multiyear chartering may be more cost-effective than the alternative of short-term chartering. GAO believes NOAA's lack of long-term, multiyear contracting authority is an impediment to NOAA's use of chartering for needed fleet support.

Legislation has been introduced in the Congress to provide NOAA with long-term contracting authority that, if enacted, would enable NOAA to experiment with long-term chartering/leasing as an alternative way of obtaining the ship support envisioned in the draft modernization plan.

### Effectiveness of Chartering Is Not Clear

The 1984 budget request to the Congress proposed deactivating 10 NOAA ships and obtaining needed ship time through private-sector charters. Since that time, budget requests to the Congress have continued to propose deactivating ships. The fiscal year 1989 budget proposal suggested deactivating seven NOAA ships and noted that the Marine Board was developing a methodology to compare chartering with the use of NOAA ships to obtain needed support.

The Congress has generally refused to support the budget requests to deactivate significant numbers of NOAA ships. The Marine Board study pointed out that Members of Congress have been concerned that proposals to decrease the fleet and obtain ship support through charters will adversely affect NOAA's ability to accomplish its missions and not result in real cost savings.

Congressional concern over chartering as an alternative to meeting NOAA's ships needs prompted the Chairpersons and Ranking Minority Members of the House Committee on Merchant Marine and Fisheries and four of its Subcommittees to request in 1985 that GAO investigate the feasibility of achieving cost savings by using private-sector vessel support instead of using NOAA's own vessels. On June 11, 1986, we issued our report entitled Deactivating Research Vessels: National Oceanic and Atmospheric Administration's Use of Private Ships (GAO/RCED-86-133).

# Plan Needed to Meet Long-Term Fleet Requirements

As the previous chapters have discussed, NOAA is in a quandary: it must address future demands that call for even more ships at a time when repair and upgrade backlogs are eroding the size and responsiveness of its existing fleet. Over the past 10 years, NOAA has not fully implemented its plans for upgrading ships and equipment because it has not had sufficient funds to carry out the plans.

NOAA staff, who are responsible for managing the fleet, have drafted a program development plan for modernizing the fleet over a 10-year period. The plan calls for NOAA to upgrade existing ships and their equipment, replace other ships, and increase the size of the fleet to meet future program needs. As of September 11, 1989, NOAA had not officially approved the plan, and the staff was in the process of revising it to submit the plan to the Under Secretary for Oceans and Atmosphere for his consideration in November 1989.

The Congress is considering legislation that would authorize NOAA to modernize the fleet by upgrading ships and their equipment, replacing others, and increasing ship support by constructing, or otherwise acquiring, seven new ships. The proposed legislation authorizes NOAA to enter into multiyear contracts and lease agreements that it could use to experiment with long-term chartering/leasing as an alternative way to obtain ship support. Such an experiment would assist NOAA in determining the role of chartering in obtaining future fleet support.

NOAA needs to adopt a plan for modernizing the fleet that, among other things, provides for NOAA to experiment with long-term chartering/leasing arrangements as a way of obtaining some of its future ship support, if the Congress provides it with the necessary authority.

## NOAA's Planning for Long-Term Mission Requirements and Fleet Support

As of June 1988, the National Ocean Service had drafted a program development plan for modernizing the fleet to meet users' long-term requirements. The plan includes the following, to be carried out over a 10-year period:

- NOAA would conduct major upgrades on 19 of its ships to extend their life.
- It would replace four of the existing ships with newly constructed ships because the age, material condition, and limited operational capabilities of the existing ships do not warrant a major upgrade. The plan proposes

## Mapping and Charting Program Responsibilities

One program responsibility of the National Ocean Service is to conduct hydrographic surveys that provide the data for nautical charts. In evaluating the potential effect of reduced fleet support for future surveys, NOAA party chiefs were concerned about further reductions in the quality, scope, or number of surveys completed. For example, a NOAA party chief estimated that the National Ocean Service had already reduced its near-shore hydrographic survey work to 10 percent of what it was 20 years ago. He said he feared that further reductions would entirely eliminate such surveys.

NOAA party chiefs identified several groups that would be affected by a shortfall in fleet support for future hydrographic surveys. For example, NOAA party chiefs said that without accurate nautical charts, the lives or property of commercial shippers and fishermen, or recreational boaters were at risk. One party chief said uncharted fishing areas off Alaska along the Aleutian Islands and in Bristol Bay pose a risk to the fishermen who fish these areas. Some NOAA party chiefs were also concerned about the risk of environmental damage, such as an oil spill caused by a tanker running aground.

Another program responsibility of the National Ocean Service is to map and characterize the EEZ and to provide the data and information bases for developing and managing resources, and for resolving conflicts among users. A party chief said that if the National Ocean Service did not have the resources to carry out this responsibility, NOAA would be handicapping the nation in its ability to capitalize on the exploration of resources in the EEZ, and that private industry's cost of developing resources would increase.

## Ocean Assessments Program Responsibilities

A major role of the Office of Oceanic and Atmospheric Research is to obtain an understanding of environmental systems needed for national policy formulation and decision-making. The oceanography scientists in our survey were generally concerned that inadequate fleet support for their research meant their ability to help management groups and others would be diminished in the long term. For example, one oceanography scientist engaged in research to improve the ability to predict tsunamis (giant sea waves) said his research requires up to three cruises a year to recover, refurbish, and redeploy measurement instrumentation at five stations in the Pacific Ocean. His research may lead to better prediction of tsunamis; however, he said that if he did not have the fleet support to maintain the survey stations, he would not be able to obtain the data needed to carry out his research.

Fleet users said that other agencies could not carry out NOAA's future research because these agencies did not have the budget, the mandate, the expertise, or the resources, such as vessel support. For example, an Alaskan fishery scientist said, "NOAA supports repetitive research over a long period of time. States typically cannot provide the continued support needed for such research. This type of repetitive research requires an effective in-house fleet, allowing for some charter support."

## Inadequacies in Future Fleet Support Will Affect NOAA's Ability to Meet Program Responsibilities

The National Research Council's Marine Board concluded, and the NOAA fleet users agreed, that a shortfall in fleet support would affect NOAA's ability to meet its future program responsibilities. NOAA fleet users also told us that a shortfall would affect the various agencies and groups, both public and private, that rely on their research.

The 1988 Marine Board study of NOAA ship services concluded that NOAA's largest unmet needs will remain in fisheries, ocean assessments, and global climate research. The Marine Board noted that budgetary restraints have led to shortfalls in fleet availability and that NOAA's programs are already competing for ship time. In the Marine Board's estimation, the increased need for large oceanographic ships is likely to lead NOAA to deactivate smaller fishery ships, thus virtually eliminating the fisheries capability of the NOAA fleet. The Marine Board concluded that, overall, it appears that the nation's ocean needs are expanding, while capital expenditures for the fleet by NOAA are not keeping step with future or even present requirements.

Fleet users in our survey agreed with the Marine Board that a shortfall in fleet support would affect NOAA's ability to meet future program responsibilities in fisheries and ocean assessments, but they were also concerned about mapping and charting.

## Fishery Program Responsibilities

Under the Magnuson Fishery Conservation and Management Act and other statutes and international treaties, the National Marine Fisheries Service is responsible for providing the scientific and technical information needed to conserve, manage and develop living marine resources of commercial, recreational, or ecological importance. In evaluating how their research might be affected if NOAA could not meet their future fleet requirements, most fishery scientists said that either the scope, or the quality of stock assessments or complementary studies, such as environmental studies, would be affected. For example, an Alaskan fishery scientist said that if fleet support was reduced, his studies of the

factors that increase the need for ocean research and data acquisition. The Marine Board concluded that such national interests would especially affect NOAA's large oceanographic ships. To meet these future mission requirements, chartering of vessels may become an option of necessity rather than of choice, the Marine Board noted, unless NOAA takes action to plan and implement new ship construction.

## Fleet Users Identified Need to Upgrade Current Ships and Build New Ones

The NOAA chief scientists and party chiefs we spoke to generally agreed that improvements in existing instrumentation and ships are needed to support future research. Thirty-seven of the 41 fleet users in our survey called for upgrades of existing NOAA ships to support future research. Many different ship characteristics and instrumentation systems that needed upgrading were identified. Among the most frequently identified needs were winches, scientific instrumentation, laboratories, acoustical systems, computers, and storage areas for scientific equipment and samples.

The results of our interviews with fleet users on the need to upgrade instrumentation generally agreed with the conclusions of a NOAA-wide Instrumentation Working Group. This group, composed of members representing the primary vessel users, develops lists of needed equipment on an annual basis and sets priorities for the acquisitions. The current list includes a broad spectrum of equipment, from acoustic systems for fisheries research to gravity meters and magnetometers for geological investigations.

Beyond the upgrading of existing vessels, 25 of the 41 fleet users in our survey said that NOAA should also build 1 or more additional ships to support future research. The 25 fleet users included 15 fishery scientists, 4 oceanography scientists, and 6 party chiefs. Twenty-four believed that the new ships should be multipurpose in design, but they varied widely in their opinions about the number of new ships needed (ranging from 1 to 7) and the size and capabilities of the ships (ranging from Class I-type ships to Class V-type ships).[2]

[2]Classes of ships are determined by a combination of the ship's gross tonnage and rated horsepower. (See app. I.)

## Projections in 20-Year Plan

In 1988, NOAA projected the 20-year program requirements for fleet support beginning in 1990 and developed a fleet modernization plan to meet these and other requirements.

In assessing its ability to meet the increased need for ship time, NOAA found that its fleet will be able to meet about 75 percent of the annual requirement of the approximate 7,000 days-at-sea. To meet this portion, all ships would have to be (1) upgraded or replaced as necessary and (2) active, spending 230 to 240 days-at-sea each year. As we discussed in chapter 3, funding limitations have caused NOAA to fall behind schedule in upgrading its fleet. To meet the remaining 25 percent of anticipated requirements for ship time, NOAA has estimated that seven additional ships would be needed.

According to NOAA staff representing the major program areas, the increased need for days-at-sea stemmed from several major activities. The following are examples of the major requirements in NOAA's 20-year plan:

- Surveying the EEZ. In 1987, the Secretaries for Commerce and the Interior signed a charter to coordinate the federal mapping and research activities in the zone. NOAA's primary responsibility in the zone includes providing sea floor maps essential for planning resource exploration, exploitation, and management activities. NOAA's National Ocean Service, the responsible office, projected that throughout the 20-year period it will need about 1,250 days-at-sea annually to map the EEZ.
- Expanded mapping and charting support. The National Ocean Service estimated that NOAA would need 1,690 days-at-sea annually throughout the 20-year period to investigate obstructions to navigation and to survey coastal areas. The Service estimated that it would need three additional ships to meet these requirements. The Chief, Hydrographic Surveys Branch, said NOAA needed to conduct up-to-date surveys of U.S. coastal waters because of the shipment of hazardous materials in coastal areas. The Chief of the Nautical Charting Division said NOAA constantly receives reports of obstacles in harbors and entrance lanes and that NOAA needs the ship time to investigate the growing backlog of unconfirmed obstructions.
- Fisheries and marine mammal stock assessments. Since 1976, with the enactment of the Magnuson Fishery Conservation and Management Act, the National Marine Fisheries Service (NMFS) has needed ship time primarily to conduct stock assessments of fisheries and marine mammals in support of federal management of these resources. NMFS expects this

- NOAA's training costs also increase because training courses for several different types of equipment have to be developed instead of for one type.

each year because the vessel does not have a back-up when the side scan sonar fails.

## Budget Constraints Limit the Purchase of New Instrumentation

NOAA submitted budget initiatives to the Department of Commerce to modernize ship instrumentation for fiscal years 1986, 1987, and 1988. Generally, the Department's budget to the Congress requested significantly less funds each year for instrumentation modernization than NOAA initially proposed.

For fiscal year 1986, NOAA requested about $5 million to purchase ship data acquisition and processing systems, oceanographic and meteorological instrumentation, the Global Positioning Systems, and multibeam bathymetric survey systems.[3] NOAA pointed out that program efficiencies and/or cost savings would result from the acquisition of these systems. For example, NOAA estimated that by obtaining $1.5 million to acquire Global Positioning Systems to replace various navigation and positioning systems, it could increase the productivity of its hydrographic surveys and save about $1 million each year in productivity losses caused by the older, less efficient systems. NOAA also estimated a cost-benefit ratio of two to one in favor of the purchase of the Global Positioning Systems by comparing acquisition and replacement costs with the reduction in maintenance costs.

The Department's marine service budget request of $47.9 million for fiscal year 1986 included $1.1 million for multibeam survey systems. However, NOAA's appropriation for 1986 included only $200,000 for the Global Positioning Systems. The Chief, Operational Systems Engineering, said NOAA acquired two Global Positioning System receivers with the funds. It provided one receiver to the Mt. Mitchell and the Discoverer on a shared basis and one to the Surveyor. He also stated that the Global Positioning Systems that NOAA has acquired for a relatively small investment has greatly increased its productivity in performing hydrographic surveys.

For fiscal year 1987, NOAA's budget request to the Department of Commerce included $9.7 million to upgrade the instrumentation aboard its fleet. NOAA stated in the request that the instrumentation upgrade would improve the efficiency, productivity, and safety of the fleet and enable the fleet to meet program requirements. The new instrumentation would include global positioning systems, multibeam survey systems, scientific

[3]Instrumentation used to map the ocean floor.

The Chief, Ship Systems Branch, said he agreed with the ATI assessment of the upgrade work needed. He added that NOAA also had determined that the upgrade work was needed during its initial planning of the 1980 rehabilitation program, but it did not have the funds to do the work. He provided the following examples of how funding limited NOAA's ability to do the necessary work.

Malcolm Baldrige. In early fiscal year 1987, NOAA initially estimated upgrade costs for the Malcolm Baldrige, an oceanographic research vessel, to be more than $5 million. However, given the available funds, the estimate was reduced to $2.4 million, and then to $1.8 million. Further reductions resulted in a contract award of only $580,000. ATI identified over $7 million in rehabilitation costs to the Malcolm Baldrige to extend its service life. ATI included, for example, $125,000 in repairs to the ship's topside; NOAA included this work in its requirements for upgrade of the ship, but did not include it in the final priority list of items because of lack of funds. ATI also called for $650,000 to replace the ship's service generator and engines and to repair deteriorating bulkheads and deck. NOAA identified the need to replace three service generators, but its final priority lists provided for only minor repairs because of funding restrictions.

Discoverer. According to the Chief, Ship Systems Branch, rehabilitation of the Discoverer, an oceanographic research and hydrographic survey ship, began in fiscal year 1986 and was completed in fiscal year 1987 at a cost of about $5 million. He added that at the time the work was drawing to a close, ATI conducted its assessment of the major systems considered to have an impact on ship life and concluded that more than $6 million in additional rehabilitation work was needed. According to the Chief, Ship Systems Branch, some of NOAA's expenditures to upgrade the ship were to make the ship more usable for program requirements rather than to extend its useful life. For example, ATI said the ship's main propulsion engine and ship service generators were in poor condition. ATI noted that rehabilitation work on the Discoverer primarily addressed habitability features and operational equipment of the ship.

1982 and 1988, NOAA's annual expenditures for vessel repair have decreased from about $12 million to about $7.9 million.

**Table 3.1: NOAA Fleet Vessel Repair Expenditures for Fiscal Years 1982 Through 1988**

Dollars in millions

| Fiscal year | Vessel repair expenditures |
|---|---|
| 1982 | $12.0 |
| 1983 | 11.7 |
| 1984 | 11.5 |
| 1985 | 11.2 |
| 1986 | 10.0 |
| 1987 | 10.4 |
| 1988 | 7.9 |

Note: Repairs include items related to vessel maintenance and repair; ship modifications; and, in some cases, the cost of installing equipment

Decreased funding for maintenance and repairs has resulted in a backlog of repairs. As of January 1989, deferred maintenance and repairs for the 11 ships assigned to NOAA's Atlantic Marine Center totaled about $7,269,000. As of February 1989, the estimated deferred maintenance and repair costs for the 12 vessels assigned to the Pacific Marine Center totaled about $10 million.[2]

## Upgrades Not Completed

According to a 1988 draft NOAA document on modernizing the fleet, budgetary constraints have limited NOAA's upgrade program to partial upgrades of six vessels—considerably less than called for in a 1980 NOAA upgrade plan. For the most part, the upgrades were limited to cosmetic hull and topside repairs, deck and machinery room equipment problems requiring immediate attention, selected habitability work, scientific space upgrades, and electronic equipment. Many items repaired could be considered periodic maintenance and overhaul that would not substantially extend the service life of the vessel as an upgrade effort would.

According to NOAA's Chief, Ship Systems Branch, NOAA began to develop a rehabilitation and upgrade plan for its vessels in 1977 and issued a 10-year plan in February 1980. On the basis of an inspection by NOAA's engineering division, a list of 15 ships was identified for rehabilitation.

[2]The Chief of the Marine Engineering Branch at the Pacific Marine Center said that the estimate of deferred maintenance and repair costs is not a total estimate of work needed on the ships because, among other things, it does not include deferred major, expensive upgrade work and is not based on verified prices to do the work.

# Revitalization of Aging Ships and Equipment Needed

The NOAA fleet is in generally good condition for its age. However, the average age of the NOAA fleet is approaching 25 years—the industry-accepted service life for most ships. Because most of the ships were constructed about the same time (within 3 years of 1965), there is a high potential for problems to occur on the ships simultaneously. Extending the life of NOAA ships will require an extensive upgrading program to modernize vessels and equipment.

According to a 1980 plan to upgrade the fleet, NOAA planned to upgrade 15 ships by the end of 1990. However, because of budget constraints and other priorities, only partial upgrades had been completed on six ships by 1988. A program to upgrade NOAA's ships is estimated to cost about $83 million for fiscal years 1990 through 1999, according to a 1988 study conducted by Advanced Technology, Inc.

Because of budget constraints, maintenance and repairs on NOAA ships have been deferred. For example, we found that the estimated backlog of repairs ($17.3 million in early 1989) was more than twice the amount of repair expenditures in fiscal year 1988 ($7.9 million).

Budget constraints have also prevented NOAA from replacing out-of-date instrumentation and have led it to acquire instrumentation on a piecemeal basis. Consequently, equipment is not standardized throughout the fleet.

## Upgrading and Maintenance Needed to Extend Ship Life

Proper ship maintenance and repair is important to ensure that ships last their intended lifetime—normally 20 to 25 years. However, an upgrading program is required to extend the life of a ship. Upgrading normally takes place when the ship is about 15 years old and includes major machinery and equipment overhaul or replacement. The cost of such a program is significant, but it can extend the operating life of a ship by 15 to 20 years.

Most NOAA ships were built in the mid-1960s and are approaching the end of their normal 25-year service life. Most have not received any significant upgrading.

my objectives. However, I plan my objectives taking into account the limitations of the resources." Sixteen of the 28 said they were able to meet all or most of their research objectives, 9 said they met some of their objectives, and 3 said they met few or none.

In discussing research objectives that were not met, fleet users said fleet limitations forced them to curtail the area or frequency of their surveys, and in some cases the amount and type of data and samples collected. Specifically:

- Two oceanography scientists said that because they lost time because of winch failures aboard the Discoverer and Oceanographer, they were unable to collect as many samples as they needed.
- A party chief said that decreasing the number of days-at-sea for NOAA ships prevented the National Ocean Service from conducting hydrographic surveys as often as it had done in the past. He said NOAA was not documenting changes to the ocean floor as often as they occur.

## Effectiveness of Conducting Research Moderately Affected

Twenty-four of the 28 users said that their effectiveness in conducting research was decreased either to a very great, great, or moderate extent. Twenty-one said their effectiveness was decreased because they did not collect information in either the amount or the quality needed.

For example, fleet users said that inadequate ship time or ship capabilities limited research in the area of surveys, or the type, amount, or quality of information collected. Specifically:

- A shortage of research funds and the limited availability of a NOAA ship with special gear forced a fishery scientist's group to conduct clam surveys every 2 years instead of annually.
- A party chief said that the launch aboard the Heck cannot survey waters less than 20-feet deep because the launch's propeller wash creates too much interference for the side scan sonar to survey the ocean floor. Therefore, his group was unable to survey the shallow intercoastal waterway in the Gulf Coast, where 90 percent of the area's ship traffic occurs.

## Beneficiaries of NOAA's Research Moderately Affected

All but one of the 28 fleet users said limitations in fleet support also adversely affected those who need to use the NOAA research results to manage marine resources, formulate policy, or supplement their own research. Groups that users say have been adversely affected by a

other programs. NOAA actually provided 480 days-at-sea to map the zone in fiscal year 1988.

## Ship Limitations and Equipment Problems Hinder Research

The 28 fleet users who said fleet support was inadequate evaluated at our request the extent to which NOAA's vessels and equipment—such as winches, computers, and laboratories—had an impact on their research in fiscal years 1986 to 1988. All but 2 of the 28 fleet users identified at least 1 ship characteristic or equipment matter that hindered their research.

The six most frequently cited problems dealt with winches, storage areas for scientific equipment and samples, laboratories, endurance, deck working areas, and accommodations.

Winches. On NOAA ships, winches consist of a storage drum and cable and may have monitoring systems for gauging the cable's tension and depth. In combination with other deck equipment, winches are used for lowering gear, taking samples, servicing buoys, towing nets or sensors, and installing measurement systems. Twenty fleet users said winch limitations or problems hindered their research. For example:

- The winch aboard the David Starr Jordan was limited to a depth of 700 fathoms, according to a fishery scientist. However, he said he needed a winch to reach 1,200 fathoms to capture bottomfish species of commercial importance.
- An oceanography scientist said the winch used for towing conductivity, temperature, and depth measurement instruments aboard the Oceanographer was slow, difficult to control, and not able to take deep measurements.
- Three chief scientists have lost or feared losing expensive gear because of faulty winches. For example, a Northwest oceanography scientist said that in fiscal year 1988, he lost gear worth about $75,000 because the winch failed.

Endurance. The inability to remain at sea without refueling or reloading supplies is also a problem. Fourteen users said that the ship's lack of endurance hindered their research. These problems affected both hydrographic surveys and fishery research. For example, a party chief said that the Rude and the Heck had to refuel every 3 days while underway and had to add water every 5 days while working on station. He said that such limitations reduced the time available for surveying and that a

# Limitations in NOAA Fleet Support Reported by Many Users and NOAA

Twenty-eight of the scientists and party chiefs in our survey of fleet users said that NOAA's fleet support was less than adequate for their research needs between fiscal years 1986 and 1988. The two main reasons cited for the inadequacy were an insufficient number of days-at-sea and/or limitations of the ships and problems with the ship's equipment. NOAA's assessment of fleet support also shows that available ship time is not sufficient for users' needs.

Notwithstanding these limitations, most fleet users said that they were able to accomplish most or all of their research objectives. However, most added that they did not collect data or information in the amount or quality that was needed, and many said the usefulness of their research was adversely affected.

## Many Fleet Users Said Fleet Support Was Inadequate

Inadequate fleet support has affected scientific research primarily because of an insufficient number of days-at-sea and ship limitations, including equipment problems. At our request, the 41 users rated the adequacy of the fleet support they received between fiscal years 1986 and 1988. Twenty-eight of the 41 said fleet support was less than adequate for 1 or more of their program activities during these years.

The 28 fleet users included 18 scientists involved in fisheries research, 6 scientists involved in oceanography research, and 4 party chiefs involved in hydrographic surveying. Examples of these 28 fleet users and the type of research they conducted follow:

- Chief scientists collected biological and environmental data on renewable living resources (major fisheries, marine mammals, and endangered species) and their supporting habitats.
- Chief scientists studied how natural and human-induced changes on marine habitats affect the abundance of important commercial or recreational marine species.
- Chief scientists studied the general circulation of the global ocean to predict the ocean's response to long-term changes in the atmosphere.
- Party chiefs conducted hydrographic surveys for nautical charts.

### Inadequate Number of Days-At-Sea

Of the 28 fleet users in our survey who said that fleet support was less than adequate for their research needs, 18 said that they did not have a sufficient number of days-at-sea to do their research. The 18 fleet users who conducted research in 1 or more of 10 program activities included 16 fishery scientists, an oceanography scientist, and a party chief.

- Alaska Fisheries Center, Auke Bay, Alaska;
- Northwest Fisheries Center, Seattle, Washington;
- Southwest Fisheries Center, La Jolla, California;
- Northeast Fisheries Center, Woods Hole, Massachusetts; and
- Pacific Marine Environmental Laboratory, Seattle, Washington.

We also contacted numerous other organizations, agencies, contractors, and groups in order to, among other things, obtain their views about the condition of NOAA's fleet and its ability to carry out mission objectives. These entities included the

- Federal Oceanographic Fleet Coordination Council;
- University-National Oceanographic Laboratory System;
- Regional Fishery Management Councils;
- Advanced Technology, Inc.;
- Environmental Protection Agency;
- U.S. Geological Survey, Department of the Interior; and
- Minerals Management Service, Department of the Interior.

To evaluate NOAA's efforts to provide fleet support to meet current mission needs, we judgmentally selected for interviews 41 of 120 primary users of NOAA ships to obtain their views on the degree of satisfaction with the current level of support provided by NOAA's fleet—whether the number of days-at-sea was sufficient and whether certain ship characteristics were adequate to carry out their research (see app. III).

To help evaluate NOAA's efforts to deal with problems associated with the aging of its fleet and equipment, we reviewed various reports, documents, and correspondence relating to the repair, maintenance, and upgrading of the NOAA fleet and discussed these documents with NOAA officials and other personnel. As agreed with the former Chairman's office, we limited our work on determining the current condition of the fleet to reviewing existing studies, to help avoid duplicating work already performed. One assessment of NOAA vessels, a report issued in early 1988 by Advanced Technology, Inc., was a key study in this effort.

To assess the adequacy of NOAA's fleet in light of future mission requirements, we obtained the views of users of NOAA ships on the need to upgrade NOAA ships or build additional ships to support future research. We also obtained their views on whether new technologies will reduce ship time and whether other agencies, such as the Environmental Protection Agency, the National Science Foundation, or the Department of Defense, could help carry out NOAA's research if NOAA was unable to do

about 3,800 days-at-sea, and private sector vessels provided about 800 days-at-sea, or about 17 percent of NOAA's vessel time. Most of the private sector vessels have been used for NOAA's assessments of fisheries resources. Appendix II shows the support provided by NOAA vessels for fiscal years 1986 through 1988.

## Management of the NOAA Fleet

In fiscal year 1988, the Office of Marine Operations of NOAA's National Ocean Service was responsible for the use, operation, maintenance, and upgrade of the ships, small craft, equipment, and shore facilities of the NOAA fleet in support of NOAA programs and other activities. It also coordinated the chartering of non-NOAA vessels.

In January 1989, NOAA revised its management structure for the NOAA Corps, fleet, and aircraft operations. The functions, personnel, and other resources of the Offices of NOAA Corps, Aircraft Operations, and Marine Operations were consolidated into a new NOAA staff office—Office of NOAA Corps Operations. The authorities and responsibilities pertaining to the management and operation of the NOAA fleet, the marine centers, the NOAA Diving Office, and aircraft operations were assigned to this new office.

## Budget History of the Fleet

For the past several years, the President's budget requests to the Congress for the NOAA fleet have proposed a number of cost-cutting measures in the operations and support of the fleet. The 1989 budget request proposed to deactivate six NOAA vessels and reduce days-at-sea on seven additional vessels. Savings from these and other cost savings actions resulted in reductions of about $15 million from the amount that NOAA sought from the Department of Commerce in its fiscal year 1989 budget request. The President's budget requests to the Congress for fiscal years 1986 through 1988 contained similar proposals, which amounted to estimated budget savings of about, on average, $17 million a year from the budgeted amount NOAA requested from the Department of Commerce. However, the Congress added funds each year to the budget requests for the fleet, including about $7 million in fiscal year 1986, $11 million in 1987, $4 million in fiscal year 1988, and $2 million in fiscal year 1989. Table 1.1 shows NOAA's budget request to Commerce, the President's budget request to the Congress, and appropriations for fiscal years 1986 through 1989.

# Introduction

The National Oceanic and Atmospheric Administration (NOAA), an agency of the Department of Commerce, was established in 1970 to consolidate many of the nation's civil programs related to the oceans and atmosphere. Its broad goals include the development and operation of national programs to (1) manage and conserve selected marine resources, (2) monitor and predict weather and environmental conditions, (3) provide maps, charts, surveys, and specialized data for safe navigation, and (4) support research on advanced oceanic and atmospheric technology.

To help carry out these goals, NOAA maintains and operates a fleet of research and survey vessels. In fiscal year 1988, the fleet was composed of 23 vessels, ranging in length from 86 to 303 feet. The vessels operate primarily from bases in Norfolk, Virginia, and Seattle, Washington, as well as Pascagoula, Mississippi; Miami, Florida; Woods Hole, Massachusetts; San Diego, California; Honolulu, Hawaii; and Juneau, Alaska.

Most of the vessels were built in the 1960s and are approaching the end of a normal ship's life expectancy of 20 to 25 years. Although NOAA started a limited upgrade program in 1980 to address the most critical needs of selected vessels in the fleet, only six ships were partially upgraded by 1988. Recently, concerns have been raised in the Congress because of allegations of poor maintenance, repair, and contracting procedures for vessels based in the Seattle, Washington, area. Also of concern is what effect "block obsolescence"[1] of the fleet and the lack of a vessel replacement plan will have on NOAA's ability to carry out its mission and statutory responsibilities.

## NOAA Mission Objectives

NOAA is a science-based federal agency that derives its responsibilities for programs in atmospheric, oceanic, and earth science research from a number of statutory requirements, including

- the Coast and Geodetic Survey Activities Act, as amended (33 U.S.C. 883a et seq.);
- the Magnuson Fishery Conservation and Management Act, as amended (16 U.S.C. 1801 et seq.);
- the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 et seq.);

[1] Most NOAA vessels were constructed within 3 years of 1965; therefore, there is a high potential for many problems to occur on the ships simultaneously (block obsolescence) because of the similar age of most of the vessels.

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amount or quality they would have liked for their research purposes. Most fleet users also believed that those who might benefit from their research were adversely affected by shortfalls in fleet support needed for the users' research. For example, one fleet user said that because certain important fishing and navigation areas had not been charted or resurveyed, commercial shippers and fishermen are at risk of running into obstructions.

## Inability to Meet Increasing Program Requirements

Beginning in 1990 and continuing over the next 20 years, NOAA's program managers and fleet users expect the demand for sea time to increase considerably. The increase will be the result of economic development of fisheries and other offshore resources, and the need for additional research on trends or changes in the earth's climate. This increased demand for ship time is expected to exceed NOAA's current capacity, requiring additional ships as well as upgrades to the existing fleet. Fleet users generally do not believe that new technologies will reduce the need for ship time or that other agencies would carry out NOAA's research if NOAA was unable to do so.

## Insufficient Funds for Maintenance and Upgrading

Although the fleet is generally in good overall condition for its age, repairs that should have been made have been delayed and most of the ships are in need of upgrading to extend their useful life, while others should be replaced, according to a 1988 engineering consultant's assessment of the fleet. The consultant attributed the overall good condition of the fleet primarily to NOAA personnel and noted that (1) funding for maintenance and repairs has been limited for many years while inflation has increased costs and (2) resources and priorities for NOAA's upgrade program did not ensure reliable extended service life of the fleet.

In addition, NOAA's estimated backlog of repairs (about $17.3 million in early 1989) was more than twice the amount of repair expenditures in fiscal year 1988 ($7.9 million). According to a NOAA official, funds have been limited and upgrade work has been directed at improving the program capability of the ships and not toward extending their useful life.

## Plans Needed to Meet Long-Term Fleet Requirements

NOAA staff have projected long-term program requirements for ship support and have drafted a development plan to modernize the fleet. Among other things, the draft plan proposes upgrading existing ships, replacing others, and obtaining additional ship support. The draft plan estimates that it will cost (in 1987 dollars) about $83 million to upgrade

# Executive Summary

## Purpose

The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) develops and operates programs to manage and conserve selected marine resources; monitor and predict weather and environmental conditions; provide maps, charts, surveys, and specialized data for navigation; and provide research to advance oceanic and atmospheric technology. NOAA's fleet of research and survey vessels is used extensively in this work. However, most of these vessels are now nearing the end of their 20- to 25-year life expectancy.

Concerned about the condition of the NOAA fleet and its ability to meet mission requirements, the former Chairman, House Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, asked GAO to obtain information on NOAA's efforts to (1) provide fleet support to meet current and future mission requirements, (2) maintain and upgrade its aging fleet and equipment, and (3) plan for fleet support to meet future mission requirements.

## Background

NOAA's fleet of 23 research and survey vessels ranges from those that work chiefly in near-shore areas to deep water oceanographic ships that travel throughout the world. The vessels operate from ports throughout the United States.

Chief scientists from NOAA's National Marine Fisheries Service and the Office of Oceanic and Atmospheric Research, and hydrographic survey chiefs from the National Ocean Service are the primary users of these vessels. The chief scientists are responsible for the scientific complement on board the vessels during a trip and, with the commanding officer, for the collection and preservation of scientific data. Hydrographic surveys are headed by party chiefs who are the commanding officers and principal investigators of the ships conducting the surveys.

GAO interviewed 41 chief scientists and party chiefs who used NOAA vessels during fiscal year 1987. GAO asked these scientists and party chiefs to comment on how adequately the fleet supported their research needs during their experiences with the fleet from fiscal year 1986 through fiscal year 1988. All together, 120 chief scientists and party chiefs served on NOAA vessels in fiscal year 1987.

## Results in Brief

Overall, the majority of NOAA fleet users believe that allocated ship time and/or the capabilities of existing ships to conduct research are not sufficient to carry out current and future research activities. Of the 41