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NOAA FLEET MIX STUDY

FY81, FY84, AND FY88

PREPARED FOR NOAA, OFFICE OF FLEET OPERATIONS
UNDER CONTRACT NA-79-SAC-00632

23 AUGUST 1979

GENERAL OFFSHORE CORPORATION

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OVERVIEW

This is the final version of the contracted NOAA Fleet Mix Study for FY81, FY84 and FY88. This overview statement does not appear in any of the drafts previously submitted.

The purpose of this statement is to highlight certain essential elements and premises of this report. It will be noted that ten new ships have been recommended to be phased into the Fleet at various times through FY88.

It is important to point out that this new ship program was based on the approach a prudent businessman would take given the challenge of meeting program requirements over the long-term at lowest cost. The goal of maximum cost effectiveness was the guiding theme throughout this effort.

With respect to program requirements themselves, it became quickly evident after our initial round of interviews with the major program elements that it would not be possible to structure a fleet mix plan based on detailed project-by-project requirements over the total period of interest. The nature of NOAA's at-sea investigative work, with the exception of nautical charting, does not lend itself to detailed planning so far in advance. Therefore, the approach taken was to perform an exhaustive review in-house of the various NOAA program descriptions, planning documents and position papers to determine an overall envelope of ship requirements (size and type) for the period FY81 through FY88. In constructing this envelope, it was found that NOAA needed a nucleus of controlled fleet assets, whether owned or chartered, composed of a larger number of smaller class vessels and a smaller number of larger class (primarily Class I) ships. There is a caveat, however, in reducing the number of Class I ships in that if NOAA's program requirements over the next few years change to include a greater amount of required open-ocean long endurance work, obviously the recommendation for decreasing the number of Class I ships should be re-examined. Also, the addition of the recommended smaller vessels must occur before deactivation of the Class I ships.

The subject of the role of chartered ships was treated extensively. However, the adherence to procurement regulations restricting the chartering of ships for no more than one year rendered it impossible to structure a fleet mix plan incorporating specific charter recommendations. Without the capability for multi-year chartering, NOAA is forced to rely on the so-called "spot charter" market, which is inefficient, costly, and sometimes unsafe. NOAA cannot meet its long-term program requirements effectively and economically without multi-year chartering capability. At the same time, NOAA's chartering practices and procedures need to be upgraded, and this report contains detailed discussions in that regard.

While there are always arguments for and against conclusions and recommendations in a study of this nature, the entire effort was aimed at producing an objective unbiased document that would assist NOAA in planning future fleet needs.

FOREWORD

The undersigned would like to thank the many individuals throughout the Office of Fleet Operations and the major program elements of NOS, ERL, and NMFS both at the headquarters level and in the field, for their cooperative effort during the conduct of this study.

A few words are in order about the basic philosophies, rationales, and factfinding philosophy underlying this effort so that the reader will have the appropriate perspective.

It is important to note that the contractor had no responsibility to make value judgements or priority determinations on program requirements. That is, no attempt was made to tell the program people which programs they should be conducting or how to prioritize the work within the program. There was no practical or valid way to separate mandated or required work (or the extent of such work) from that which may not be totally essential to NOAA's mission. The contractor did make judgements with respect to ship size and characteristics in broad terms in the light of general overall mission requirements.

Neither was it possible to analyze each program requirement in terms of number of ship days requested. This was due partly to time constraints, but primarily because the nature of most of NOAA's work, except in the case of NOS, does not lend itself to detailed definition beyond current programs. There is a corollary problem in this regard in that there is an almost universal tendency to structure programs to specific ships, sometimes because of personal preference or familiarity and sometimes because of the ship's known specific program support capabilities.

Analyses and projections contained in this report were prepared from recorded cost data furnished by the Office of Fleet Operations, and is similarly formatted for consistency and ease of comparison and interpretation.

With respect to the rehabilitation program, the cost of continuing ownership versus alternatives and efficient matching to future program requirements were given prime consideration in determining justification for rehabilitating/upgrading. The existence of, and prior investment in, any given ship was considered of secondary importance. Of primary importance, however, is the fact that in every case where a recommendation is made either to forego rehabilitation or deactivate a given ship, such recommendation should not be implemented without prior implementation of the corresponding recommendation for replacement. To do otherwise would destroy the basis on which the future program efficiency and cost economies were projected.

The philosophy underlying the new ship construction recommendations was based on maximum versatility using appropriate stock hull designs which would lend themselves to economic modification to NOAA's requirements. It was contemplated that single-purpose dedicated program requirements could be efficiently met through the use of modularized equipment and laboratory vans. The new ship program itself is based on the contractor's rationale that ship needs basic to NOAA's mission would be most efficiently and economically met by a nucleus of fleet assets under NOAA's complete control. This can be accomplished either by outright ownership or long-term charter/build programs or a combination thereof as described in the body of this report.

C. W. Gattas,
Principal Investigator

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EXECUTIVE SUMMARY

Introduction

This report was prepared under Contract NA-79-SAC-00632, awarded to General Offshore Corporation on 20 October 1978. It is the result of a nine month study effort involving the contractor's marine operations analysts, technical analysts, cost analysts, and specialized consultants. The work was directed toward determining per the contract work statement ". . . . the appropriate number and types of Government-owned vessels and the role of charter ships to effectively support all NOAA programs at minimum long-term cost to the Government . . . .". The milestone periods of interest were specified as FY81, FY84, and FY88.

The effort included a detailed examination of current procedures for ship time requests and program requirements; projected ship time requirements and fleet allocation; degree of effectiveness of ship utilization to support programs; scheduled maintenance and repair; chartering philosophy, procurement regulations, and chartering practices and procedures; vessel operating costs and charter costs; the ship rehabilitation program; program justifications for new ship construction; and an overview of probable total NOAA ship needs by class through FY88.

Current Fleet Status

NOAA's present fleet consists of 24 operational ships and one new ship (CHAPMAN, probable delivery in January 1980). The fleet is grouped into six categories determined as a function of horsepower and tonnage. Class I is the largest size category and consists of four ships. There are also four Class II ships. Roughly half the fleet consists of Class III and Class IV ships (six of each). There are three Class V ships and one Class VI ship.

Of significant import is the age of the fleet (Appendix I). SURVEYOR, a Class I ship, is 19 years old. The youngest Class I ship (RESEARCHER) is 9 years old. The other two Class I ships (OCEANOGRAPHER and DISCOVERER) are each 13 years old. The average age of the Class II ships is approaching 12 years. Five of the Class III and IV ships are over 16 years old, including KELEZ, which is 35 years old. The age profile of the remainder of the fleet is generally the same. This recitation of current age is important because OFO judges the economic life of a NOAA ship to be 25 years without midlife rehabilitation. Although this economic lifetime may vary a few years either way in specific cases, 25 years is a valid average basis for planning purposes and is generally used throughout the maritime industry. Therefore, decisions on rehabilitation of ships at or beyond midlife are due to be made shortly and will directly affect the future fleet mix. Presently, OFO is considering the upgrading/rehabilitating of 16 ships of the NOAA fleet, including all Class I and II ships, during the 1980's.

For the current fiscal year (FY79), it appears that the existing NOAA fleet will be capable of meeting approximately 66 percent of the total shiptime requirements for all NOAA programs. This will increase to approximately 70% for FY81 when the CHAPMAN will be in service.

Rehabilitation Program

Present projections call for rehabilitating 15 ships, 13 of which are scheduled for such work between now and FY88. The disposition of this rehabilitation program has a profound effect on the optimum fleet mix during this period, at least as great as the program requirements themselves. In fact, decisions made regarding rehabilitation of certain ships in the NOAA fleet tend to dictate fixing portions of the fleet mix irrespective of projected program requirements.

The NOAA fleet profile of the 1970's is not the most efficient mix for the probable program requirements of the 1980's. This prompted a critical examination of the rehabilitation program. The analysis indicates that it will be better to retire or surplus SURVEYOR and DISCOVERER when their work can be reassigned rather than rehabilitate and continue high operating and maintenance costs over such a long period of time when those ships represent an overkill in the light of program requirements. It is recommended that NOAA investigate the possibility and cost of "mothballing" these fleet assets in the event that national defense or other priority needs for long endurance deep-ocean work arise in the future.

Chartering Practices and Procedures

Although operation of the NOAA fleet is centrally managed there is no similar function with respect to charter ships. In fact, NOAA does not "charter" ships in the Admiralty sense of the word; NOAA contracts for ship services. The difference is important in that a true chartering function would almost certainly prove more effective in supporting appropriate program needs than present chartering practices and procedures. This will become progressively significant between now and FY88 because even with full utilization of the NOAA fleet, it appears increased chartering activity will be necessary to meet the anticipated program requirements. These requirements would be well served if NOAA could borrow a page from the Navy's book. The U.S. Navy is the largest Government user of charter ship services. Most of their charters are obtained through the Military Sealift Command (MSC), whose specialized legal and procurement personnel provide a responsive chartering service. MSC's Special Projects Group has been known to obtain a charter on a competitive basis within 24 hours of a sponsor's request. It would benefit NOAA either to develop a similar capability in-house; contract it out; or engage MSC to provide the service.

Given the present procurement regulations prohibiting the use of long term charters, the role of charter ships in the NOAA fleet mix is essentially relegated to covering deficiencies (although NMFS does charter in certain selected instances because ". . . . it is dollar efficient and because commercially chartered vessels provide assessment information that is comparable to the real world of the fishing industry and the methods it employs"). These regulations apparently derive from 41USC11 which states in part that "No contract or purchase on behalf of the United States shall be made, unless the same is authorized by law or is under an appropriation adequate to its fulfillment . . . ." and similar wording in other sections of the U.S.

Code. Although it was beyond the contracted scope of this study to explore means by which enabling legislation or suitable appropriations could be obtained to permit multi-year chartering, the need is clearly evident. Long term chartering could also be used most cost effectively in the acquisition of certain new ships. NOAA's objective is to obtain the required fleet characteristics over the long term at the lowest overall cost to the Government through an appropriate balance of owned and chartered ships. The lack of multi-year chartering authority is a serious impediment to the objective.

One effect of the lack of a formalized chartering program is that all NOAA ship time is allocated before any thought is given to chartered ships. This sometimes results in ship assignments not really efficient to program needs simply because a ship is there and it is base funded. This points up a curiosity about the funding system itself. The programs do not have to pay for the use of NOAA ships, even though the ships exist only because of the program requirements. But the programs do have to pay for charter ship time. There is both an understandable reluctance to charter regardless of overall cost effectiveness and a built-in temptation to structure a program to the largest usable ship for the longest possible time. There is not much doubt that the NOAA fleet profile and fleet utilization would be markedly different if the program budget requests had to cover NOAA ship operating costs.

New Ship Construction

Considering the age of the NOAA fleet and the fact that there appears to be an ever-widening gap between program support requirements and fleet characteristics, a modest but well planned new ship construction program is essential to any fleet mix plan optimized for program efficiency at lowest cost.

This study indicates the need for ten new ships if future NOAA program requirements are to be met most economically. In each case where new construction is recommended as replacement for existing ships, it is mandatory that planning, budgeting and procurement be accomplished such that the new ships will be fully operational at the time their predecessors are deactivated. SURVEYOR and DISCOVERER are cases in point; it will not be possible to deactivate these ships as recommended and still meet NOAA program requirements if suitable replacements are not on line at the time of deactivation.

A Class IV ship configured for circulatory survey work should be deployed on the West Coast. This would allow the McARTHUR, a Class III ship presently doing circulatory work to be returned to the nautical charting mission for which she was originally designed to fill charting requirements there. While this would be a much more efficient utilization of McARTHUR, care should be taken in planning the switch so that no time gap occurs in the West Coast circulatory work.

MT. MITCHELL is excessive to NOAA program requirements on the East Coast and should be transferred to the West Coast where remote project areas dictate the need for greater endurance.

Class III hydrographic survey ships on the East Coast are routinely used to support a maximum of two automated hydrographic survey launches. These ships should be assigned to coastal work and areas in the Carribean. A hydrographic ship capable of supporting at least four survey launches is required for extensive work in protected waters along the East and Gulf Coasts. Construction of a new ship similar to a 176' to 190' stock utility ship is recommended for this work. The advantage of using a stock design as a basis is that architectural changes and subsequent build costs are much more economical than designing a ship from the keel up. There are several naval architecture firms that offer such services. These ships are ABS Classed Maltese Cross Al and certified for all oceans. They are so certificated by the U.S. Coast Guard for full ocean service. In addition, these vessels meet the North Sea convention rules for work in that area.

Figure 1, a stock design for a 176' version, is included for illustrative purposes only. While the ship described is not suited for this service as presently configured, the basic hull design can be modified economically before construction begins to provide adequate berthing and equipment spaces by extending the superstructure as well as increased freeboard and other desired characteristics. In fact, 184' and 190' versions of this hull have been built to meet a variety

FIGURE 1: **OUTBOARD PROFILE OF STOCK 176' FREEDOM CLASS UTILITY SHIP.**

of service requirements and are still considered "stock" hulls. The only potential problem is draft as the length increases, but again a competent naval architect should be able to recommend changes that will yield the desired results. Moreover, use of smaller 22' survey launches will allow the mother ship overall length to remain in the 176' range thereby minimizing the draft problem.

Although Hydrographic Field Units have been considered as an alternative to the utility ship, there are substantial program requirements in areas which do not lend themselves to efficient field unit operation due to the lack of logistic support and other factors.

Two new 127' coastal fisheries research ships, similar to the CHAPMAN, are needed: one on the East Coast to support the Ocean Pulse project and to relieve the ALBATROSS IV and DELAWARE II of some of the assignments which are an overkill for these ships; one on the West Coast for inshore ecosystem research, inshore marine mammal research, and exploratory stock assessment.

A new 75' fisheries research ship is needed for estaurine and near-shore work which is not within the range of program managed vessels and for which it is not possible to use the ALBATROSS IV or DELAWARE II. Two out of the four existing fisheries program managed boats on the East Coast could be retired with the addition of one 75 foot vessel.

National Marine Fisheries Service has the research responsibility for regulation of tuna fisheries and does not operate the type of ship used by the industry. A new 175' to 180' tuna seiner (Figure 2) is

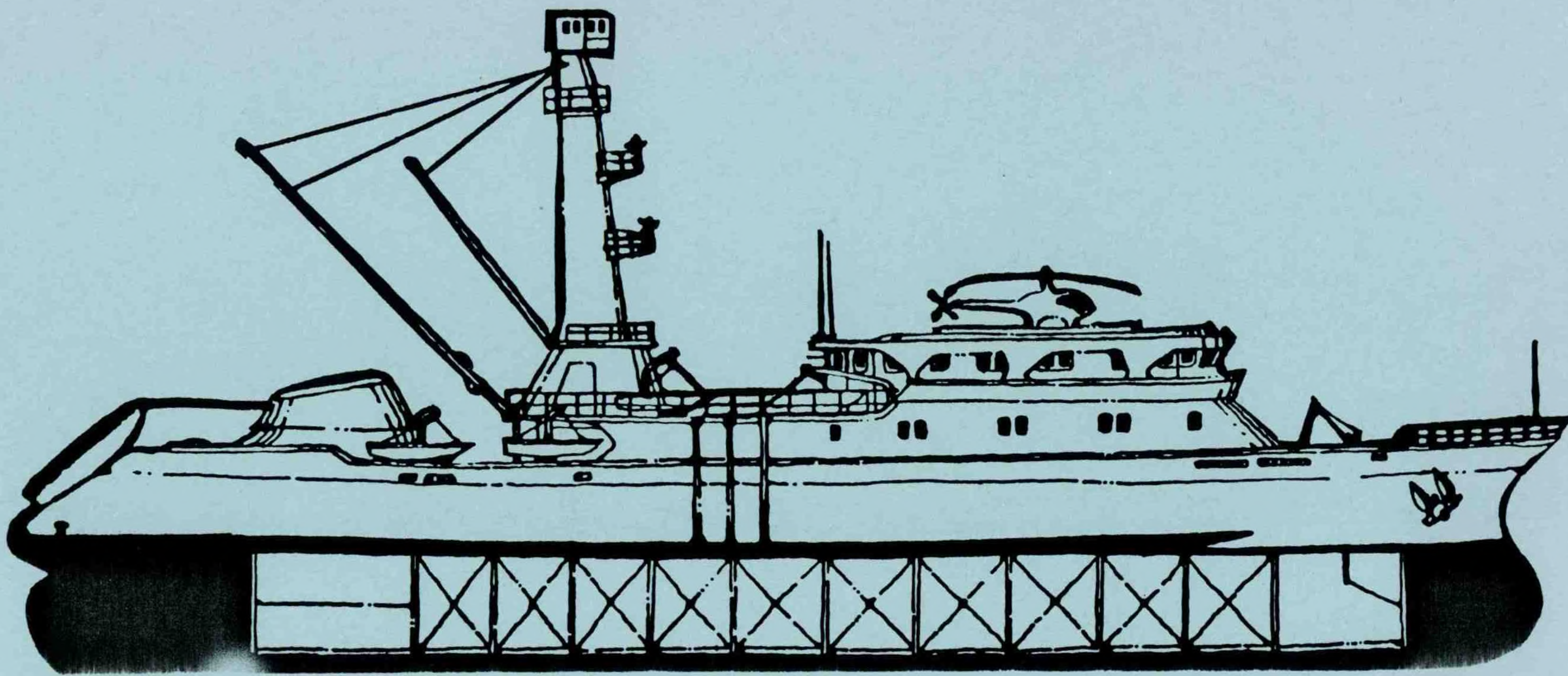


Figure 2: **TYPICAL PROFILE OF STOCK TUNA SEINER.**

recommended for tuna/porpoise studies and also to do some work in the southwest region which has been neglected since retirement of the GILBERT. The ship should be equipped with a helo platform. These are proven stock hulls and while the industry has used 214' to 220' hulls in recent years, many operators are planning to return to the 175' to 180' ships. The vessels can be ordered without the refrigeration/ freezing equipment.

A new coastal oceanographic research ship in the 120' - 130' range is needed on the West Coast to support MESA and other scientific studies in nearshore areas which must presently be assigned to large research platforms.

The subject of the BOWERS replacement has been studied at length, and it is recommended that a 90' stock fishing hull be built. The only difference would be the substitution of berthing spaces for the fish holds. Program equipment and laboratories would be housed in modular vans.

A new 90' to 100' research vessel should be built to replace SHENEHON in order to more efficiently support continuing environmental research programs on the Great Lakes.

Assuming the various West Coast research programs projected by ERL come to fruition, particularly the climate research programs, a new Class III ship sized to a Class II capability for productive extended endurance in the open ocean will be required. This ship is intended as a replacement for DISCOVERER and should be on line before the ship is deactivated.

Conclusions

NOAA's program requirements have undergone a gradual but significant evolution over the years since the NOAA fleet building program of the 1960's. This is an on-going evolution and the fleet must undergo equally significant change if it is going to support program requirements efficiently and cost effectively.

The ships built in the 1960's are continuing to serve NOAA well in the present time, but the overall mission profile for which they were designed will not have as much open-ocean emphasis in the 1980's when these ships are approaching the end of their economic life. A new cycle is beginning, and for the most part, the requirements of the 1980's can be best met by a numerically larger fleet of generally smaller ships incorporating advanced design concepts and technological improvements in plant, machinery and auxiliary systems. One of the major conclusions of this report is that future NOAA ships should be proven modern stock hulls with good sea-keeping capabilities adaptable to a variety of tasks and working environments. To the maximum extent practical, program equipment, especially single-purpose and dedicated laboratories, instrumentation, and computers should be self-contained in standard size vans designed for easy installation, removal, and land transportation. "To the maximum extent practical" is the operative term. It is entirely possible that the quality of certain long-term work, such as nautical charting, could be compromised by modularization. A detailed investigation beyond the scope of this effort would be required to reach a determination of practicality in such cases.

Rehabilitation of any ship should not be automatic and based simply on a cost/benefit analysis of extended life. The continued cost of ownership should be compared to alternative replacement. Obviously, if one plans to build an exact duplicate of the ship in question and have the same manning requirements, the cost/benefit rates will most certainly favor rehabilitation. However, when the situation is such that a new ship can be built to meet the program requirements at a savings in operating costs that will more than pay for her construction in less than half her economic life, it presents an attractive alternative to rehabilitation. If the respective new ship recommendations of this report are implemented (and only if they are implemented), it will be possible to forego rehabilitation of SUREVEYOR and DISCOVERER, deactivate them as soon as the new ships can be brought on line, and meet the respective program requirements at the lowest long-term cost to the Government.

The projected cost of operating the DISCOVERER and SURVEYOR in FY 1984, based on a nominal inflation factor of 6%, as shown in Appendix 7, is approximately $18K to $19K per operating day, assuming 210 days at sea. This amounts to an annual operating cost of almost $4 million for each vessel. Although it is not possible to project the exact manning scale for the replacement vessels at this point, the annual operating cost should not be more than $2 million per vessel. Projected program requirements for FY 1984 reflect a need for only three Class I vessels, and since the SURVEYOR will be 24 years old at that time, it is logical to plan her replacement to coincide with the end of her economic service life. The same rationale holds true for the DISCOVERER in FY 1988, when she will be 22 years old. Program requirements at this point indicate a need for an upgraded Class III or a lighter Class II, and it would be prudent to plan replacement with a hull similar to the 222' Mariner Class vessel to coincide with deactivation of DISCOVERER. Again, in each case replacement ships must be on line before or simultaneous with, deactivation.

The acquisition of smaller, more efficient, and more cost effective new ships with dramatically lower cost of operation and maintenance will result in savings that will more than pay for their construction costs in less than three years. (Currently, labor costs of NOAA owned ships are about 75% of the total cost of operation and maintenance.) An optimized mix of ships and selective rehabilitation will not only extend the overall fleet life at lowest overall long-term cost, but will also result in more total NOAA ship days available for program use.

NOAA's current chartering practices and procedures must also be upgraded to efficiently serve program needs in the 1980's. Contracting for ships services while presently adequate will have to be more closely coordinated if the increased chartering needs of the 1980's are to be planned and executed effectively. The recently instituted centralized charter record-keeping function is a step in the right direction. In view of the anticipated increased chartering requirements over the next ten years, NOAA's needs can be well served by a centrally coordinated chartering function supported with professional marine procurement expertise working closely with regional program personnel, particularly if funding for new ships is not obtained in a timely manner.

Recommendations

As a result of this study, the following actions are considered prerequisite to an optimal fleet mix plan for the 1980's and earliest practicable implementation is recommended. Note that the recommendations are listed in descending order of priority.

1. Build ten new vessels as follows:
   a. One 120'-130' coastal research vessel for West Coast ERL use.
   b. Two Class IV coastal fisheries research ships similar to the CHAPMAN for the West Coast and the Northeast.
   c. One 90' stock hull fishing vessel to replace BOWERS.
   d. One upgraded Class III (light Class II) ship as replacement for DISCOVERER for West Coast research programs.
   e. One 175'-190' (or 222' depending on final configuration and operational requirements) stock hull utility ship to support East and Gulf coast charting requirements.
   f. One 75' shallow draft fisheries research ship for Northeast estaurine and near shore work.
   g. One 175' to 180' stock hull tuna seiner for fisheries research in the Southwest.
   h. One Class IV vessel for West Coast circulatory work.
   i. One Class V vessel for research on the Great Lakes.

2. Propose enabling legislation to allow multi-year chartering.

3. Assign MT. MITCHELL to the West Coast.

4. Reassign McARTHUR to its original mission of hydrographic charting and surveying.

5. Deactivate SURVEYOR (Note: dependent on prior implementation of 1.e. and 3 above).

6. Deactivate DISCOVERER (Note: dependent on prior implementation of 1.d. above).

7. Set up a central point of coordination for all NOAA chartering.

The recommended fleet mix for FY81 through FY88 is shown in the schedule presented in Table 1. In terms of days at sea, at least six cases (Figure 3) were considered:

Case 1: Present NOAA fleet assuming an average of 210 days at sea per ship and presently planned charter for all years through FY88.

Case 2: Same as Case 1 except an average of 250 days at sea was assumed for NOAA ships.

Case 3: Recommended fleet mix per Table 1, including new ships, rehabilitation, charter, and assuming an average of 210 days at sea for NOAA ships.

Case 4: Same as Case 3 except an average of 250 days at sea was assumed for NOAA ships.

Case 5: Recommended fleet mix per Table 1, assuming average of 210 days at sea for NOAA ships, and covering all deficits by charter.

Case 6: Same as Case 5 except an average of 250 days at sea was assumed for NOAA ships.

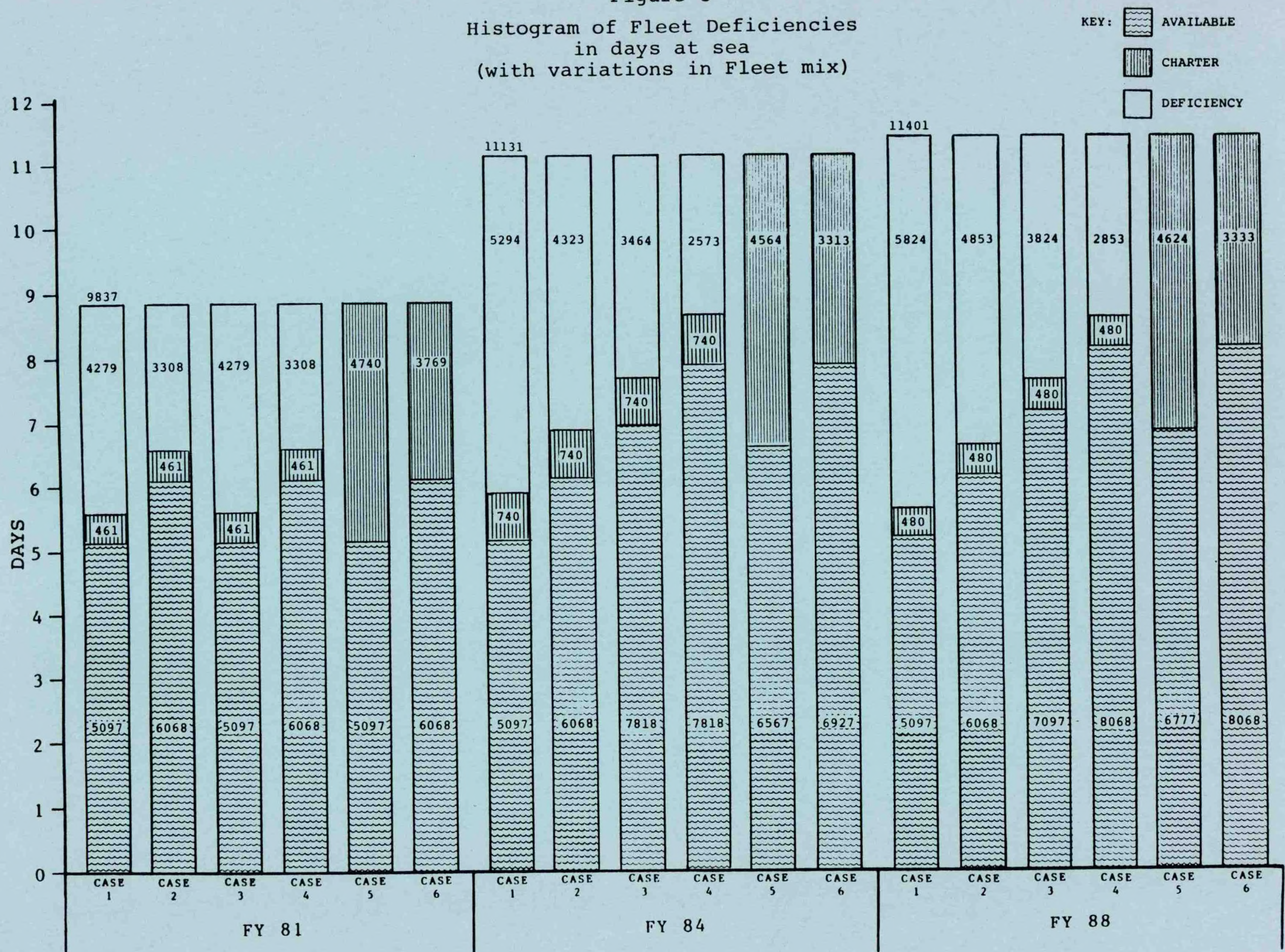
Table 1: **RECOMMENDED FLEET MIX PLAN FY'81 THROUGH FY'88. (SPECIFIC WORK AREAS/ASSIGNMENTS ARBITRARILY SHOWN BY CONTRACTOR.)**

	SHIP	HOME PORT	FY'81	FY'82	FY'83	FY'84	FY'85	FY'86	FY'87	FY'88
I	DISCOVERER	SEATTLE	OCSEAP, ALASKA							DEACTIVATE
	OCEANOGRAPHER	SEATTLE	OCEANOGRAPHIC RESEARCH, PACIFIC OCEAN							
	RESEARCHER	MIAMI	OCEANOGRAPHIC RESEARCH, ATLANTIC OCEAN							
	SURVEYOR	SEATTLE	OCSEAP, ALASKA				DEACTIVATE			
II	FAIRWEATHER	SEATTLE	CHARTING SURVEYS, HAWAII/ALASKA							REHAB
	FREEMAN	SEATTLE	OCSEAP/FISH RESEARCH, ALASKA							
	MITCHELL	NORFOLK/SEATTLE	CHT. SURV. E. COAST			CHT. SURV. MARIANAS		REHAB	CHT. SURV. MAR. I	
	RAINIER	SEATTLE	CHARTING SURVEYS, ALASKA/HAWAII						REHAB	
III	ALBATROSS IV	WOODS HOLE	FISHERIES RESEARCH E. COAST							
	DAVIDSON	SEATTLE	CHT. SUR. ALASKA		REHAB	CHARTING SURVEYS W. COAST/ALASKA				
	MCARTHUR	SEATTLE	CIRC. SURV. ALASKA			REHAB	CHART SURV. W. COAST/ALASKA			
	OREGON II	PASCAGOULA	FISHERIES RESEARCH, GULF OF MEX. CARRIBEAN							
	PEIRCE	NORFOLK		REHAB	CHARTING SURVEYS, GR. LAKES/VIRGIN IS.					
	WHITING	NORFOLK	REHAB	CHARTING SURVEYS E. COAST/VIRGIN IS.						
	NEW CONSTR 175'	NORFOLK				CHARTING SURVEYS, E. COAST				
	NEW CONSTR 175'	SAN DIEGO			FISHERIES RESEARCH E. & CENTRAL PACIFIC					
	NEW CONSTR 222'	SEATTLE							OCEANOGRAPHIC RESEARCH, W. COAST	
IV	CROMWELL	HONOLULU	REHAB	FISHERIES RESEARCH, CENTRAL PACIFIC						
	DELAWARE II	WOODS HOLE	FISHERIES RESEARCH, EAST COAST							
	FERREL	NORFOLK	CIRCULATORY SURVEYS EAST & GULF COASTS							
	JORDAN	SAN DIEGO	FISHERIES RESEARCH WEST COAST							
	KELEZ OR REPLACE	NORFOLK	OCEANOGRAPHIC RESEARCH & MONITORING, EAST & GULF COASTS							
	CHAPMAN	SEATTLE	FISHERIES RESEARCH, WEST COAST/ALASKA							
	NEW CONSTR 130'	SEATTLE			OCEANOGRAPHIC RESEARCH, W. COAST					
	NEW CONSTR 166'	SEATTLE				CIRCULATORY SURVEYS, ALASKA				
	NEW CONSTR 127'	WOODS HOLE		FISHERIES RESEARCH, EAST COAST						
	NEW CONSTR 127'	SAN DIEGO/SEATTLE			FISHERIES RESEARCH WEST COAST					
V	COBB OR REPLACE	SEATTLE	FISHERIES RESEARCH ALASKA							
	OREGON OR REPLACE	KODIAK	FISHERIES RESEARCH ALASKA							
	RUDE/HECK	NORFOLK	WIRE DRAG EAST & GULF COASTS				REHAB	WIRE DRAG		
	NEW CONSTR 90'	MIAMI		FISHERIES RESEARCH S.E. & GULF COASTS						
	NEW CONSTR 90'-100'	DETROIT							GR LAKES RESEARCH	
VI	NEW CONSTR 75'	WOODS HOLE			FISHERIES RESEARCH N.E. COAST					
	MURRE II OR REPLACE	JUNEAU	FISHERIES RESEARCH ALASKA							
	SHENEHON	DETROIT							DEACTIVATE	
	* RORQUAL	WOODS HOLE			DEACTIVATE					
	DAYS AVAILBLE		5,097			6,567				6,777
	REQUIREMENTS		9,910			11,131				10,881
	PLANNED CHARTER		460			740				480
	DEFICITS		4,353			3,824				3,692

*PLUS DEACTIVATION OF ONE OTHER PROGRAM OPERATED VESSEL

Figure 3

Histogram of Fleet Deficiencies
in days at sea
(with variations in Fleet mix)



Even with the new ship construction recommended, substantial deficits are still indicated. This means that some of the projected program work will have to be deferred or covered by additional chartering.

Table 2 and Figure 4 contain a comparison of ship operations and maintenance costs for fiscal years 1981 through 1988, prepared from the recommended fleet mix plan shown in Table 1.

For consistency purposes, 210 days at sea were used for each ship year. Projected 1979 operations and maintenance costs shown in Appendix 3 were used as the basis for projecting ship class costs, and all projected costs are in 1979 dollars .

The projections show an increased cost of from 5.7% in FY81 to a peak of 26.3% in FY84, when the maximum number of ships will be in operation, and reducing to 14.8% in FY88 after deactivation of two Class I ships. This is an average cost increase of 16.3% over the eight year period. However, the ship days at sea increase from 7.8% in FY81 to a peak of 42.2% in FY84 and FY88. This is an annual average increase of 32% increase in ship days at sea versus the average increase in cost of 16.3%.

The projected cost decrease per ship day over 1979 cost will be approximately $764 or 11.1% reduction in FY84, increasing to over $1,322 or 19.3% reduction in cost per ship day in FY88. This translates into an effective $5.3 million cost reduction in FY84 based on ship days at sea per recommended fleet mix, and an effective cost reduction of over $9.2 million in FY88.

TABLE 2

NOAA PROJECTED SHIP DAYS AT SEA AND OPERATION
BASED ON RECOMMENDED NEW MIX COSTS
USING 1979 PROJECTIONS AND DOLLARS IN THOUSANDS BASED ON 210 DAYS AT SEA

	FY81	FY82	FY83	FY84	FY85	FY86	FY87	FY88
Ship Days at Sea:								
Class I	840	840	840	840	630	630	630	420
Class II	840	840	840	840	840	840	840	840
Class III	1,260	1,260	1,470	1,680	1,680	1,680	1,680	1,890
Class IV	1,260	1,470	1,890	2,100	2,100	2,100	2,100	2,100
Class V	840	1,050	1,050	1,050	1,050	1,050	1,050	1,260
Class VI	210	210	420	420	420	420	420	420
Total Ship Days at Sea	5,250	5,670	6,510	6,930	6,720	6,720	6,720	6,930
Ship Operations Annual Cost at Sea:								
Class I	$11,326	$11,326	11,326	11,326	8,495	8,495	8,495	5,663
Class II	8,636	8,636	8,636	8,636	8,636	8,636	8,636	8,636
Class III	7,838	7,838	9,145	10,451	10,451	10,451	10,451	11,758
Class IV	5,204	6,071	7,805	8,673	8,673	8,673	8,673	8,673
Class V	1,958	2,447	2,447	2,447	2,447	2,447	2,447	2,937
Class VI	355	355	710	710	710	710	710	710
Total Ship Operations Cost	$35,317	$36,673	$40,069	$42,243	$39,412	$39,412	$39,412	$38,377
Avg. Cost Per Ship Sea Day	$6.727	$6.468	$6.155	$6.096	$5.865	$5.865	$5.865	$5.538
Total Cost Increase Over 1979	5.7%	9.7%	19.9%	26.3%	17.9%	17.9%	17.9%	14.8%
Ship Days at Sea Increase Over 1979	7.8%	16.4%	33.6%	42.2%	37.9%	37.9%	37.9%	42.2%
Decrease Cost Per Ship Day Over 1979	$(.133)	$(.392)	$(.705)	$(.764)	$(.995)	$(.995)	$(.995)	$(1.322)
Percent Cost Decrease Per Ship Day Over 1979	(1.9%)	(5.7%)	(10.3%)	(11.1%)	(14.5%)	(14.5%)	(14.5%)	(19.3%)

Increased savings resulting from deactivation of program managed vessels are not reflected.

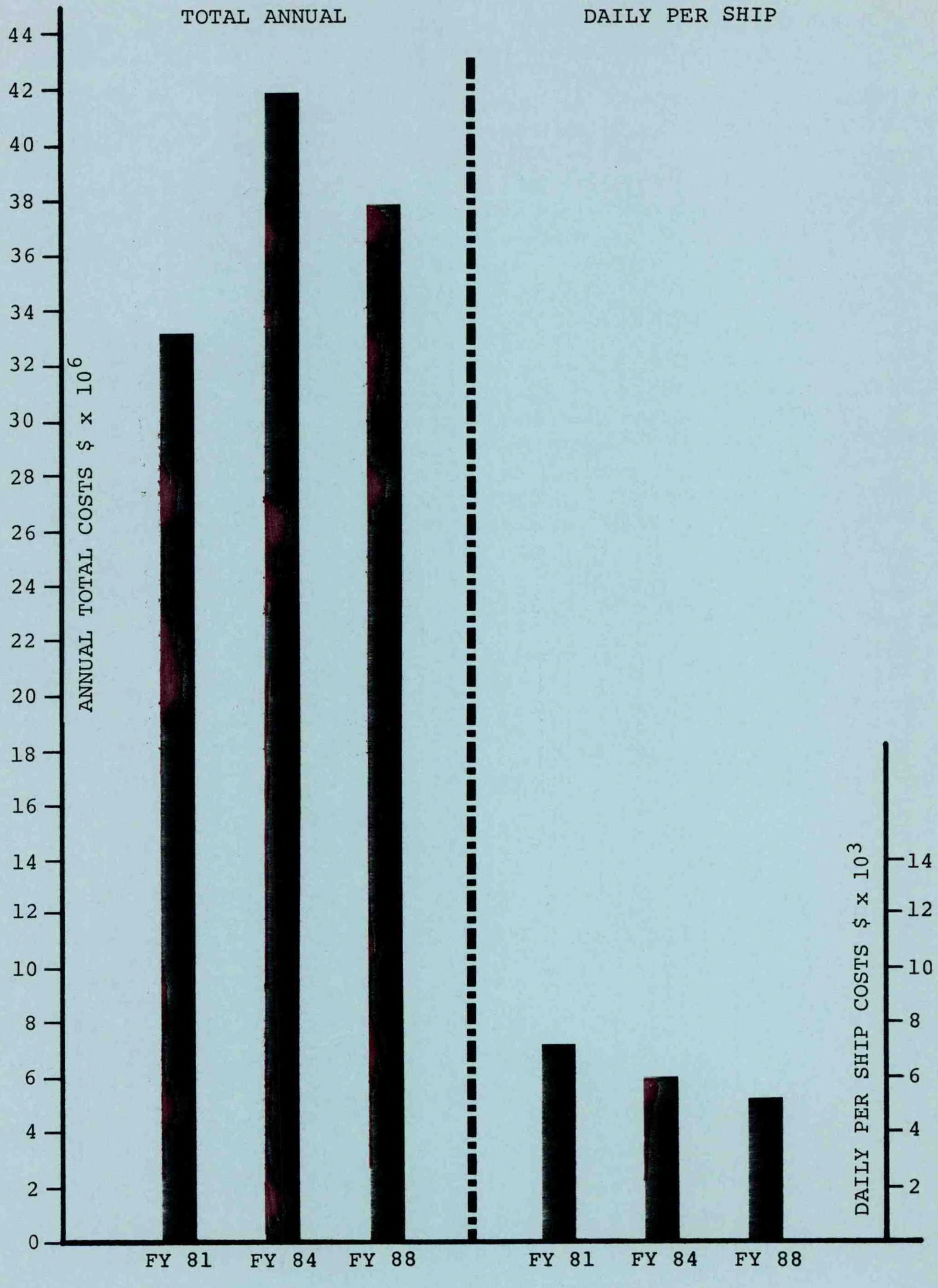


Figure 4: SHIP OPERATION AND MAINTENANCE COST
(ANNUAL TOTALS AND AVERAGE DAILY PER SHIP COST)

Because the present overall mix of vessels within NOAA's fleet is composed of a higher percentage of large vessels, than is necessary to do the job, this study recommends a reduction in the number of large vessels and addition of several small vessels. In total, this will better meet NOAA's requirements while reducing NOAA's overall cost per day at sea. This cost reduction, while not resulting in a direct savings, will avoid higher rates of expenditures than would be necessary if the present fleet mix were used to satisfy the projected requirements. Column 1 in Table 3 shows this effective operating cost reduction. While both the sea days provided, as well as operating costs would increase in the aggregate, the expenditure of 30 million dollars for an appropriate fleet mix is cost effective in the long term, particularly once the SURVEYOR and DISCOVERER deactivations are effected.

It is important to note that even these projected costs are overstated (and that the cost reduction will even be greater) because they do not take into account the anticipated reduced costs of manning and maintaining the new ships. That is, the costs were projected based on the present operation and maintenance costs of comparable NOAA class ships. Per direction, no attempt was made to anticipate manning scales for the new ships recommended.

TABLE 3 OPERATING COST REDUCTION BASED ON RECOMMENDED FLEET MIX PLAN (DOLLARS IN MILLIONS)*

	(1) EFFECTIVE OPERATING COST REDUCTION		(2) NEW CONSTRUCTION COST	
	YEAR	CUM	YEAR	CUM
FY81	$ .7	.7	$ 4.5	4.5
FY82	2.2	2.9	10.4	14.9
FY83	4.6	7.5	6.5	21.4
FY84	5.3	12.8	2.5	23.9
FY85	6.7	19.5	-	23.9
FY86	6.7	26.2	-	23.9
FY87	6.7	33.9	6.5	30.4
FY88	9.2	42.1	-	30.4

(1) Calculated from Table 2

(2) Based on Table 1 - New Construction Schedule

*1979 dollars used throughout

SECTION 1

FUTURE FLEET MIX RATIONALE

The present fleet is capable of accomplishing 66% to 70% of NOAA programs. By FY88, however, the projected NOAA fleet, including the ten new ships recommended, will be capable of meeting only 62% of program requirements. Even with the institution of an effective chartering program, the need for additional platforms is clearly evident. Program requirements from the present time through FY88 escalate by about 20% although firm objectives cannot be specifically identified more than a few years in advance because in many cases varying conditions dictate program emphasis as required. In NMFS, for example, emphasis in resource surveys depends on unpredictable anomalies in migration, weather, and other factors. This is a problem common to all regions. The degree of foreign vessel support, particularly in the outyears, could impact requirements and is difficult to predict. ERL has a problem in identifying specific milestone objectives beyond a year or so past the current year because future research is largely dependent on what is learned (or not learned) as a result of on-going work. NOS on the other hand does not have such problems to any great extent; marine charting programs can be, and are, specifically planned many years in advance.

Based on currently available program information the study indicates that not all of the present Class I ships will be required through the 1980's. The requirements for which these ships were designed and built have been met to a large extent, and while there are continuing requirements for large ship capability as a basic nucleus, one Class I research ship on each coast appears sufficient to meet NOAA's requirements for large research platforms. Missions of the 1980's can be more cost effectively accomplished by smaller ships with no degradation of program support at reduced ceilings and greater energy conservation. For example, future work contemplated for SURVEYOR and DISCOVERER could be accomplished by other smaller NOAA ships. The savings in operation and maintenance costs would support the operation and maintenance of four smaller ships (Class III), thereby doubling available ship time without increased operating funds or personnel ceilings.

Fleet availability may also be increased by carefully examining current fleet utilization with respect to base funded ship days. That is, wherever possible a ship that is base funded for 180 to 190 days of operation should be considered instead of a short-term 20 to 30 day planned charter. Depending on the particular ship, location, and circumstance, the cost to the program may be lower than charter ship costs because the only program costs for the NOAA ship would be for overtime and fuel. Although this is currently being done to some extent, an attempt should be made to plan more of these requirements sufficiently in advance to optimize this approach to greater NOAA fleet utilization.

The cost of new ship construction is a prime consideration in replacing existing large ships with smaller platforms. However, costs can be dramatically lower than NOAA costs experienced in the 1960's through the careful selection of off-the-shelf proven basic hull designs, such as oilfield ships designed for use in northern latitudes. It is no longer necessary to design a new ship from the keel up to satisfy NOAA program requirements and safety considerations. Design changes in superstructure, living accommodations and lab space can be effected at relatively small costs.

Table 4 summarizes the projected ship day requirements for all NOAA major program elements for FY81, FY84, and FY88. This is followed by a detailed presentation of NOS, ERL, and NMFS program requirements.

National Ocean Survey

The nautical charting program presently has been allocated use of six hydrographic surveying ships:

		Operational Days Funded	
Ship	Class	East Coast	West Coast
FAIRWEATHER	II		180
RAINIER	II		180
MT. MITCHELL	II	180	
PEIRCE	III	188	
WHITING	III	188	
DAVIDSON	III		188
		556	548

These six ships plus RUDE and HECK which perform wire drag work to support charting represent the total ship effort to provide up-to-date hydrographic surveys of 2 million square nautical miles of responsibility area. They are capable of providing approximately 60%

TABLE 4

ALL NOAA COMPONENTS
SEA DAYS BY CLASS

		FY 81					FY 84					FY 88				
		EAST COAST		WEST COAST			EAST COAST		WEST COAST			EAST COAST		WEST COAST		
		CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL
NOS	Requirements	1610	284	920	551	3365	1720	184	740	846	3490	1670	94	780	856	3400
	Available (NOAA)	946	180	376	460	1862	946	180	376	360	1862	946	180	376	360	1862
	Planned Charter	0	0	0	0	0	130	0	0	0	130	0	0	0	0	0
	Deficit ( )	(664)	(104)	(544)	(191)	(1503)	(644)	(4)	(364)	(486)	(1498)	(724)	86	(404)	(496)	(1538)
ERL	Requirements	110	240	90	720	1160	200	240	370	480	1290	600	250	400	350	1600
	Available (NOAA)	180	180	0	720	1080	180	180	0	720	1080	180	180	0	720	1080
	Planned Charter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Deficit ( )	70	(60)	(90)	0	(80)	(20)	(60)	(370)	240	(210)	(420)	(70)	(400)	370	(520)
NMFS	Requirements	2517	0	2545	250	5312	2681	0	3290	250	6221	2651	0	3420	250	6321
	Available (NOAA)	750	30	1245	130	2155	750	30	1245	130	2155	750	30	1245	130	2155
	Planned Charter	141	0	320	0	461	160	0	320	0	480	160	0	320	0	480
	Deficit ( )	(1626)	30	(980)	(120)	(2696)	(1771)	30	(1725)	(120)	(3586)	(1741)	30	(1855)	(120)	(3686)
TOTAL	Requirements	4237	524	3555	1521	9837	4601	424	4400	1576	11001	4921	344	4600	1456	11321
	Available (NOAA)	1876	390	1621	1210	5097*	1876	390	1621	1210	5097*	1876	390	1621	1210	5097*
	Planned Charter	141	0	320	0	461	290	0	320	0	610	160	0	320	0	480
	Deficit ( )	(2220)	(134)	(1614)	(311)	(4279)	(2435)	(34)	(2459)	(366)	(5294)	(2885)	46	(2659)	(246)	(5744)

*Does not include recommended new construction vessels.

Note: Numbers of days shown as requirements by class may vary from those submitted to the contractor to reflect recommended mix.

of the areal coverage necessary to maintain the NOS suite of nautical charts. Additionally, in 1981, the Marianas Islands portion of the U.S. Trust Territory in the Pacific Ocean will become a Commonwealth and further increase the area of surveying responsibility in excess of 500,000 square nautical miles.

There is the need for surveying capabilities in extensive shallow bodies of water on the East and Gulf Coasts. Presently there are no capabilities within NOS to survey such areas as Chandeleur Sound, Florida Bay, sounds inside the outer banks of North and South Carolina and numerous other inshore areas. A ship capable of carrying at least four small automated launches appears appropriate. A basic offshore workboat type similar to the present utility ships previously described that can be ballasted for sea keeping qualities and deballasted for shallow draft can be inexpensively modified for survey work and should be considered. The East Coast based Class II is routinely used for coastal work which is well within the capabilities of a Class III. Continued operation of a Class II ship on the East Coast does not appear justified.

NOS is considering rehabilitation and modification to the SURVEYOR for assignment to the Marianas. The fact that an existing Class II ship appears excessive to East Coast needs and is fully capable of deployment to the Marianas indicates: 1) Consideration of transfer of the MT. MITCHELL to the West Coast (further justified by the remoteness of other project areas in Alaska and Hawaii); and 2) that funding for rehabilitation and modifications to the SURVEYOR would be more wisely applied to the construction of a more suitable smaller class ship for East Coast work such as the aforementioned 176' to 190' utility ships. Remote areas requiring the endurance of a Class II ship do not exist on the East Coast.

The NOS oceanography program has dedicated use of a Class IV (FERREL) on the East Coast and a Class III (McARTHUR) on the West Coast. The FERREL appears adequate for circulatory type surveys on the East and Gulf Coasts; however, the McARTHUR was designed and built for use as a hydrographic survey ship. McARTHUR is poorly configured for its present circulatory survey assignment because in addition to the lack of deck space, equipment maintenance and repair area, and stowage capacity, over-the-side operations on the fantail cannot be viewed from the bridge, which represents a potentially serious safety hazard. McARTHUR should be replaced with a smaller, more suitably configured ship to permit her return to the nautical charting program.

NOS is becoming increasingly involved in ocean monitoring, ocean dumping and other oceanographic related activities on the East Coast. Conduct of this type project from a survey configured ship is inefficient and ineffective and should be assigned to a research configured vessel, again, employing modularized equipment and laboratory vans. If future East Coast requirements increase, NOS could presently utilize a large portion of a small coastal research ship's time.

Two wire drag vessels are considered adequate to NOS needs.

A significant new NOS program requirement has developed since the submission of the preliminary FY81 report. Under Sec. 407, Title IV of Public Law 95-372, Outer Continental Shelf Lands Act Amendments enacted 18 September 1978, Congress has mandated NOAA, through the Secretary of Commerce, to develop charts identifying obstructions for avoidance use by commercial fisherman who are currently suffering extensive damage and loss of income as a result of such obstructions. NOS has been specifically tasked to develop and implement a technical plan for surveying and charting fishing obstructions in consonance with the above mandated requirement.

Although the plan calls for maximum utilization of existing data from a wide variety of sources such as commercial fishing companies, NMFS, offshore oil field operators, BLM, U.S. Navy, certain Sea Grant universities, etc., a considerable amount of survey work must be accomplished. The program is scheduled to begin in FY81 and continue through FY87. Since the work cannot be deferred and the specialized capability exists in industry, contract survey and attendant charter ship time will be necessary to support NOS production of useable obstruction charts.

Table 5 presents the projected NOS requirements in FY81, FY84, and FY88. The table shows the number of days required along with the class vessel for both the East and West Coast. Marine charting, the major work component is detailed in Table 6 for the same time periods.

TABLE 5

NOS REQUIREMENTS
SEA DAYS BY CLASS

	FY 81					FY 84					FY 88				
	EAST COAST		WEST COAST			EAST COAST		WEST COAST			EAST COAST		WEST COAST		
	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL
Marine Charting	900		720	300	1,920	900		540	660	2,100	1020		540	660	2,220
Wire Drag	380				380	380				380	380				380
Bathymetric Mapping		30		105	135		30		110	140				60	60
Ocean Dumping		94		26	120		94		26	120		94		26	120
Estuarine Surveys	200		200		400	200		200		400	200		200		400
NY Bight Monitoring	50				50	50				50	50				50
Ocean Monitoring	80				80	60				60	20		40		60
Sediment Stability		40			40		60			60				60	60
Geodynamics		60		60	120				50	50				50	50
Nuclear Waste Disposal		60		60	120	130				130					
	1,610	284	920	551	3,365	1,720	184	740	846	3,490	1,670	94	780	856	3,400
Ship days funded for dedicated NOS programs	946	180	376	360	1,862	946	180	376	360	1,862	946	180	376	360	1,862
Planned Charter Deficit ( )	(664)	(104)	(544)	(191)	(1,503)	130 (644)	(4)	(364)	(486)	130 (1,498)	(724)	86	(404)	(496)	(1,538)

Ocean Waves - piggyback

Note: Numbers of days shown as requirement by class may vary from those submitted to the contractor to reflect recommended mix.

TABLE 6

MARINE CHARTING
SEA DAYS BY CLASS

	FY 81					FY 84					FY 88				
	EAST COAST		WEST COAST			EAST COAST		WEST COAST			EAST COAST		WEST COAST		
	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL
Delmarvanc	180				180										
Georgia Coast	60				60										
Chart Evaluation	120				120	120				120	120				120
Gulf of Mexico	240				240	120				120	120				120
Lake Superior	120				120	120				120					
Lake Michigan						120				120	120				120
St. Croix	60				60	180				180					
Maine Coast	120				120	120				120	240				240
Long Island Sound						60				60					
Nantucket Sound						60				60					
Georges Bank											120				120
Puerto Rico											240				240
Cape Cod Bay											60				60
	900				900	900				900	1020				1,020
Wire Drag	380				380	380				380	380				380
Cook Inlet			180		180										
Gulf of Alaska			120		120			120		120					
Shelikof Str.			240		240			240		240					
Alaska Peninsula				120	120				90	90				120	120
Chart Evaluation			60		60			60		60			60		60
S.E. Alaska			60		60			120		120			120		120
San Francisco Bay			60		60										
Hawaii				180	180				180	180				180	180
Bristol Bay									90	90				180	180
Amelia Island									120	120					
Marianas Islands									180	180				180	180
Pr. William Sound													120		240
			720	300	1020			540	660	1200			540	660	1,200

Note: Numbers of days shown as requirements by class may vary from those submitted to the contractor to reflect recommended mix.

Environmental Research Laboratories

Ships and funded days of operation allocated to ERL programs are as follows:

Ship	Class	East Coast	West Coast
DISCOVERER	I		210
OCEANOGRAPHER	I		180
RESEARCHER	I	180	
SURVEYOR	I		210
FREEMAN	II		120
KELEZ	IV	180	
		360	720

It should be noted that requirements for Class III or smaller ships on the West Coast increase from 90 days in 1981 to 370 days in 1984 and 400 days in 1988. Some of this work is presently being accomplished by larger NOAA ships; some work is being chartered; and some is not being done. There appears to be an immediate need for a small coastal research ship on the West Coast. Although program requirements have increased, the need for large research ships has declined, indicating that DISCOVERER and SURVEYOR will be surplus to the efficient conduct of ERL programs. This is based on the assumption that the Fleet Allocation Council will dedicate FREEMAN to NMFS programs as requirements on OCSEAP decrease after FY84. One large research ship on each coast which has full oceanographic capabilities and endurance for ocean-wide operations and deployment in remote areas appears to be adequate to NOAA's needs through FY88 and probably beyond.

New program initiatives for Gulf Coast MESA work in the FY88 time frame could result in a sharp increase in ship time requirements. Since this occurs at the end of the study period in question, the total East Coast research requirements for coastal research vessel time beyond FY88 should be evaluated at some future point to determine whether or not VIRGINIA KEY, at the end of her economical life, should be replaced with a 90' to 100' coastal research vessel.

Prior to FY81, the NOAA Fleet Allocation Council determined which ships of the fleet would be dedicated to specific organizational components under normal circumstances. This determination allocated 540 days at sea to OCSEAP. Obviously as OCSEAP winds down redetermination of an equitable distribution of ship time will have to be made. For the purpose of this study, no attempt will be made to project a decision of the FAC. Ship time for dedicated use will be tabulated at the present rate of allocation and shown as days of availability in excess to actual requirements. See Table 7.

TABLE 7

ERL REQUIREMENTS
SEA DAYS BY CLASS

	FY 81					FY 84					FY 88				
	EAST COAST		WEST COAST			EAST COAST		WEST COAST			EAST COAST		WEST COAST		
	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL
OCSEAP				495	495			120	230	350			60	90	150
MESA	25		48		73	60		80		140	200		140		340
Ocean Energy & Climate		60		120	180		60		120	180		60		120	180
Geology & Geophysics	15	70			85	30	60			90	40	60			100
Chemistry & Biology	50	30	21		101	40	80	110	50	280	80	80	120	60	340
Physical Oceanography	20	80	21	105	226	70	40	60	80	250	80	50	80	80	290
Great Lakes Research											200*				200*
	110	240	90	720	1,160	200	240	370	480	1,290	600	250	400	350	1,600
Ship days funded for dedicated ERL Programs	180	180	0	720	1,080	180	180	0	720	1,080	180	180	0	720	1,080
Deficit ( )	70	(60)	(90)	0	(80)	(20)	(60)	(370)	240	(210)	(420)	(70)	(400)	370	(520)

* (Proposed replacement of program-managed SHENEHON with centrally managed larger ship.)

National Marine Fisheries Service

Eleven ships of the NOAA fleet are dedicated to NMFS programs as follows:

Ship	Class	Operational Days Funded East Coast	West Coast
RESEARCHER	I	30	
FREEMAN	II		130
OREGON II	III	250	
ALBATROSS IV	III	250	
CROMWELL	IV		250
JORDAN	IV		250
DELAWARE II	IV	250	
OREGON	V		189
COBB	V		166
MURRE II	VI		140
CHAPMAN	IV		(under construction)

NMFS is by far the largest requestor of NOAA ship time. Fisheries is also the largest user of chartered ship services. Although the CHAPMAN is expected to be in full service in FY81, there will still be significant deficits in FY81, FY84, and FY88 (see Table 8). As mentioned previously, the contractor was not in a position to evaluate the true impact of these deficits on program effectiveness. While we have noted the difficulties in structuring fisheries programs beyond a few years, a more formalized approach to setting priorities among the program work anticipated would be helpful to future fleet planners. This could, and should, be done by the regions so as not to compromise local needs. Note that while the requirements are escalated over the outyears, there is not a proportional increase in proposed charter. Since the total deficits cannot be fully covered by the NOAA fleet (including new ships proposed), the implication is that

TABLE 8

NMFS REQUIREMENTS
SEA DAYS BY CLASS

	FY 81					FY 84					FY 88				
	EAST COAST		WEST COAST			EAST COAST		WEST COAST			EAST COAST		WEST COAST		
	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	CLASS III TO VI	CLASS I OR II	TOTAL
NWFC			1440	250	1690			2110	250	2360			2240	250	2490
SWFC			1105		1105			1180		1180			1180		1180
NEFC	1541				1541	1541				1541	1541				1541
SEFC	976	___	___	___	976	1140	___	___	___	1140	1110	___	___	___	1110
	2517	0	2545	250	5312	2681	0	3290	250	6221	2651	0	3420	250	6321
Available (NOAA)	750	30	1245	130	2155	750	30	1245	130	2155	750	30	1245	130	2155
	1767	-30	1300	120	3157	1931	-30	2045	120	4066	1901	-30	2175	120	4166
Planned Charter	141	0	320	0	461	160	___	320	___	480	160	___	320	___	480
DEFICIT ( )	(1626)	30	(980)	(120)	(2696)	(1771)	30	(1725)	(120)	(3586)	(1741)	30	(1855)	120	(3686)

funding increases would be necessary to cover the deficits, not only for deferred lower priority work, but also for high priority work. Tables 9 through 12 detail the projected NMFS requirements by region.

SEFC has requested a new ship based on a 90' stock hull fishing vessel as a replacement for BOWERS. Considering the total resource survey requirements over the long term and the relatively in-shore work areas, this is a logical choice. In addition, the decision to proceed with a stock hull and modularized equipment and laboratory vans is the most cost effective approach to supporting the varying program needs efficiently. New ships are also indicated for NEFC and SWFC. A detailed discussion is contained in the section titled "New Ship Construction."

TABLE 9
NMFS-NEFC PROJECT REQUIREMENTS
SEA DAYS BY CLASS

	FY 81, FY 84 & FY 88		
	EAST COAST		
	CLASS III TO VI	CLASS I OR II	TOTAL
Ocean Pulse	385		385
MARMAP - Resources Survey I - Icthyoplankton	386		386
MARMAP - Resources Survey II - Clam & Scallop Surveys	90		90
MARMAP - Resources Survey II - Bottom Trawl Surveys	300		300
MARMAP - Fisheries Oceanography	70		70
MARMAP - Resources Survey III - Long Lining	80		80
Primary Productivity	40		40
MARMAP Survey Technology - Gear Test & Development	150		150
Pathobiology	20		20
Manned Undersea Research & Tech.	20		20
	1541		1541
Available* (NOAA)	530		530
DEFICIT ( )	(1011)		(1011)

*Undetermined amount of additional time availability on RORQUAL, KYMA, PHALAROPE & SHANG WHEELER
30 days RESEARCHER time included.

TABLE 10

NMFS-SEFC PROJECT REQUIREMENTS
SEA DAYS BY CLASS

	FY 81			FY 84			FY 88		
	EAST COAST								
	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	TOTAL
MARMAP Resources Survey II - Groundfish	135		135	140		140	140		140
MARMAP Survey Technology - Gear Tech.	140		140	170		170	170		170
MARMAP Resources Survey II - Reef Fish	260		260	190		190	130		130
MARMAP Resources Survey II - Shrimp	70		70	40		40	40		40
MARMAP Resources Survey III - Pelagics	55		55	120		120	150		150
Habitat Investigations	30		30	10*		10*	10		10
Reimbursable Projects	85*		85*	90*		90*	90		90
Marine Mammals and Endangered Species	85		85	280		280	280		280
International Research Committments	60		60	40		40	40		40
Aquaculture	6*		6*	10*		10*	10		10
Observer Shuttle ****	50*	—	50*	50*	—	50*	50	—	50
	976		976	1140		1140	1110		1110
Available (NOAA)	250**	—	250**	500***	—	500***	500	—	500
	726		726	640		640	610		610
*Planned Charter	141	—	141	160	—	160	160	—	160
Deficit	(585)		(585)	(480)		(480)	(450)		(450)

**Assume 90' will not be operational in '81

***Assume 90' operational for 250 days in '84

**** May be eliminated by FY 80 due to changed operating mode

TABLE 11

NMFS-NWFC PROJECT REQUIREMENTS
SEA DAYS BY CLASS

	FY 81			FY 84			FY 88		
	WEST COAST								
	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	TOTAL
MARMAP Resources Survey II - Groundfish Survey	491	45	536	1210		1210	1290		1290
MARMAP Resources Survey II - Shrimp/Crab Survey	329	60	389	400		400	400		400
MARMAP Survey Technology - Gear Development	330		330	150		150	150		150
MARMAP Resources Survey - Hydroacoustic Bottom Fish		145	145		150	150		150	150
MARMAP Resources Survey - Herring Assessment	230		230	150	100	250	150	100	250
Marine Mammals & Endangered Species	60		60	105		105	150		150
Fishery Development - At Sea Processing And Preservation				95		95	100		100
	1440	250	1690	2110	250	2360	2240	250	2490
Available (NOAA)	745	130	875	745	130	875	745	130	875
	695	120	815	1365	120	1485	1495	120	1615
Planned Charter	320	-	320	320	0	320	320	0	320
Deficit ( )	(375)	(120)	(495)	(1045)	(120)	(1165)	(1175)	(120)	(1295)

TABLE 12

NMFS-SWFC PROJECT REQUIREMENTS
SEA DAYS BY CLASS

	FY 81			FY 84			FY 88		
	WEST COAST								
	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	TOTAL	CLASS III TO VI	CLASS I OR II	TOTAL
Inshore Ecosystem Research	75		75	150		150	150		150
MARMAP Resources Survey III CALCOFI	500		500	500		500			
Marine Mammals - Coastal	50		50	50		50	50		50
Marine Mammals - Tuna/ Porpoise Interaction	230		230	230		230	230		230
MARMAP Resources Survey II Exploratory Stock	250	—	250	250	—	250	750	—	750
	1105		1105	1180		1180	1180		1180
Available (NOAA)	500	—	500	500	—	500	500	—	500
Deficit ( )	(605)		(605)	(680)		(680)	(680)		(680)

SECTION 2

FLEET REHABILITATION/UPGRADE

Tradeoffs and Costs

Since the majority of the NOAA fleet is either at, or beyond mid-life, and considering the long budget cycle lead time, the impetus for quick decision making is imperative. On the other hand, the decisions concerning fleet rehabilitation will have the most profound effect on NOAA's optimum future fleet mix - both with regard to the effectiveness/efficiency of supporting NOAA programs and overall long-term cost/benefit.

Consider that there is no longer a need either presently or anticipated over the long term for the number of Class I ships in the fleet. The per ship operation and maintenance costs for these vessels currently ranges between $13,000 and $14,000 per sea day (195 to 210 days per year). By FY84, these costs would rise to over $18,000 per day assuming a relatively modest inflation rate of 6%; about $21,000 per day at 9%; and $24,000 per day at 12% (which hopefully would be the worst case). By FY88, these costs extrapolate to $23,000; $29,000; and $37,000 respectively.

This means that by FY84, at an annual inflation rate of 6% (which is probably unrealistically low), the operation and maintenance cost of a Class I ship will approach $3,800,000 per 210 day working year, which is $1,000,000 higher than at present. Using the same basis, this cost becomes $4,830,000 per working year in FY88.

By contrast, a Class III ship will cost $1,743,000 to operate and maintain in FY84, or $2,000,000 less than a Class I. In FY88, the cost will be $2,200,000 per working year, or $2,600,000 less than a Class I. As might be expected, a Class II ship falls about halfway between.

Other than cost, the matter of fuel consumption is also assuming greater significance. It is not entirely unlikely that fuel conservation programs could curtail NOAA fleet operations to some extent in the 1980's thereby adversely affecting program work. Current technology in ship propulsion, such as the new SCR diesel-electric plants allow ships like the 222' Mariner class utility ship to cruise at 12 knots on a consumption of 2800 gallons per day, or 8 knots on a consumption of 1400 gallons per day.

The point of the above exercise is to emphasize that any decision to rehabilitate a Class I ship based on a cost/benefit ratio calculated on extension of useful life versus the cost/benefit ratio of new construction must be weighed very carefully. Such an analysis is meaningful only if one assumes exact replacement in kind. The question now becomes: "Do we rehabilitate a ship simply because it exists and represents a prior capital investment, without regard to whether or not it will meet our future program needs efficiently and cost effectively?"

To take a specific example: the current estimate to rehabilitate DISCOVERER beginning in FY84, is $3 million. In FY84, the cost of a new Class III ship, assuming the 176' to 190' stock hull utility ship, will be in the order of $4.5 to 5.5 million exclusive of program equipment. (Current cost without design changes is about $3 to $3.8 million depending on final equipage.) The differential of $1 to $2.5 million would be recovered in the first two working years through the difference in operating and maintenance costs of this ship versus DISCOVERER. In addition, NOAA would have a new, more effective/efficient ship with a 25-year life. The extended life of a rehabilitated DISCOVERER would be a costly liability rather than a cost effective support to future NOAA programs.

Rehabilitation of SURVEYOR, a Class I ship, requires immmediate attention. The combination of OCSEAP work through FY84 (and possibly beyond), survey work off Alaska and in the Marianas Islands area (due to become a Commonwealth in 1981), and fisheries marine mammal survey requirements suggests the need for a large long-endurance platform with helicopter capability and excellent sea-keeping qualities. At NOS, SURVEYOR is being programmed as a candidate platform and a rehabilitation program structured to the above was formulated. SURVEYOR, OCEANOGRAPHER, and DISCOVERER are all West Coast ships, and since long-term overall NOAA program requirements do not seem to support a need for three Class I West Coast ships, some additional thought should be given before selection of SURVEYOR for the above role. MT. MITCHELL, which represents an overkill on the East Coast, is capable of doing the survey work. SURVEYOR could then serve out her useful life on OCSEAP work and be retired. There does not appear to be sufficient justification for extending SURVEYOR for the proposed helicopter fisheries marine mammal survey program, since helo capabilities are otherwise obtainable.

Exclusive of the SURVEYOR, $26.1 million is being projected for rehabilitation of 15 NOAA ships between FY81 and FY91 at a level of $3.5 million per year through FY90 and $1.0 million for FY91. In FY84, $2.2 million is projected for rehabilitation of FAIRWEATHER, a Class II ship. By FY84, $2 million will probably buy little more than half of what it will buy now. In FY88, it will buy far less again. This would seem to indicate that in the out-years, "rehabilitation" will either be minor facelift or the costs as presently projected are grossly underestimated.

<u>Other Considerations</u>

Any discussion of vessel rehabilitation must necessarily include considerations of the equipment for which that vessel is a platform.

The most significant changes in survey equipment are in the areas of data handling and processing. Current developments include the addition of microprocessing techniques to the presentation stage of data acquisition, allowing more information to be derived from the data collected. While the data gathering process has not varied significantly, the means for displaying, recording and storing that data has undergone some radical changes, and development continues in that direction. Larger plotters, more automation and increased volumes of data will impact vessel requirements in the foreseeable future.

With the ability to handle larger volumes of data comes the requirement for efficient means to collect larger quantities of survey information. The current mother ship/survey launch system should be re-examined to increase survey launch capability. In addition, other forms of wide area data collection are becoming feasible. Airborne data acquisition of bathymetry and magnetics as well as temperatures, wave heights and gravity is currently being done, with other parameters becoming more achievable as technology improves. With the similar improvements in communication techniques, long term coverage from far distant remote sensing arrays should become more practical also. Improved processors and CPUs that are capable of plotting relative positions of several satellite platforms simultaneously as well as plotting the results from these platforms on individual recorders will become increasingly available.

The present Hydroplot system being used by the hydroparties presents several drawbacks to survey efficiency. Due to the use of PDP-8 computers as the main controller of the system, checks and controls must be maintained manually, much of which can be automated by the use of modern techniques.

The new technology available in Electronic Data Processing provides a cost efficient, logical and accurate means to upgrade not only the volume of information collected, but the speed and quality with which that information is reduced.

In contrast to current methods, the new survey parties will operate survey boats equipped with multi-beam echo sounders, accurate, self-calibrating positioning systems, CPUs that are small in physical size and power consumption that possess large, fast memory cores. These new generation computers drive ancillary equipment such as CTRs, disc units, reel-to-reel recorders, incremental plotters, helmsman displays, automatic steering devices and throttle couplers to maintain uniform speed across the bottom.

Because continual checks are made during data collection as well as data processing, errors are less likely and would show up as obvious mistakes. Because the CPUs are computing each sounding and position as they go, they can give immediate indications of questionable data.

Data storage on board is made easier because the survey data is all on disc and instantly retrievable for further processing or reanalysis. Future survey launches can be smaller and lighter because of the reduced size of solid state on board equipments, which will yield obvious advantages in terms of mother ship stowage and handling capabilities. In addition, those personnel released from manual duties such as contouring and record scanning, are available to man survey boat crews. The newer, more-automated survey equipments may or may not reduce the numbers of personnel required, but in either case, the personnel mix will change in favor of more data interpreters vice data takers.

New technology in automation provides the fleet with the means and opportunity to upgrade their mission capability. Future fleet ships should be built or rehabilitated with the increased state-of-the-art in survey equipment in mind.

SECTION 3

NEW SHIP CONSTRUCTION

This study indicates that a well planned new ship construction program is essential if future NOAA program requirements are to be met efficiently and cost effectively. However, to yield maximum benefits, such planning must be carefully integrated with a selective fleet rehabilitation program. A new vessel justified by program needs at this point in time may well satisfy requirements in the later out-years which were intended to be served by scheduled rehabilitation of a larger ship. And this will probably be true in more than one case. A review of NOAA's planned rehabilitation program reveals that OREGON, KELEZ, COBB, and MURRE II are not scheduled for rehabilitation, and properly so. These ships should be replaced rather than rehabilitated because while still serviceable, they are well beyond their economic life. In fact, these ships or their respective replacements were treated in this study as fixed components of the NOAA fleet (Table 1) and do not appear in the ten-ship new contruction program recommended. NOAA is taking an enlightened and refreshing view with regard to new ship requirements. The decision to go to stock hull designs to the maximum extent possible will have a salutary effect on both cost and lead time for new ship construction. Moreover, modern commercial vessel design lends itself to a wide range of versatility. This stock hull approach, coupled with the concept of using easily installed and removed modularized equipment and laboratory vans where appropriate should give NOAA more program flexibility and economic efficiency than was ever possible in the past. To round out a complete management mechanism for the most efficient program use of the total fleet capability, a comprehensive equipment inventory control system, which would include vans, winches, and other support equipment, should be instituted.

Multi-Year Chartering

This study has previously mentioned the need for multi-year chartering capability in order for NOAA to be truly able to meet its long-term program requirements at minimum long-term cost to the Government. The whole question of a new ship construction points up a most compelling argument for multi-year chartering. In view of the fact that a new ship is considered to have a useful life of 25 years and given the increasing cost of new ship construction, solid long-term program requirements are needed to justify new ship acquisition. It is not likely that a five-year program will be considered sufficient justification for building a new ship. The obvious question is: "What will it be doing for the next twenty years?" If the answer is not considered sufficient justification to build a new ship, and the requirement cannot be covered by an existing NOAA ship, the alternative is to charter. But, if no suitable hull can be found in the charter market, no commercial ship operator will be willing to make the required investment in return for a one-year charter commitment. One possible solution to this dilemma is the long-term (in this case, 5 years) charter with options to buy and/or continue to charter for additional periods. There are at least a dozen ship operators who would welcome the opportunity to bid on this type of contract.

Under such an arrangement, NOAA could specify the ship it needs and the bidders would propose to furnish such a ship. The successful bidder would then use the long-term charter commitment to finance construction of the ship. NOAA would also have the flexibility of chartering the ship on a bareboat basis (i.e., NOAA furnishes its own operating crew) if so desired. This is not normally possible, or desirable, on short-term charters. To aid in arriving at a decision of time charter versus bareboat charter, the solicitation could ask for bids both ways. In either case, NOAA would have the ship it needs for five years with the flexibility of buying it at a pre-negotiated option price, continuing to charter, or terminating its use either because those particular program requirements have been satisfied or the requirements have changed such that a different type or size of ship is needed.

In terms of cost, it is impossible to predict the exact rate the successful offeror will bid, but it is possible to arrive at an educated estimate. The offeror will have taken NOAA's ship specification and shopped for bids from various builders. Assuming his best acceptable bid was $3 million, he will be looking at $3000 per day as a starting point for determining the rate for the ship itself (i.e., bareboat, no crew). This is based on the widely accepted, but seldom admitted, industry rule-of-thumb that 0.1% of the hull value will provide an acceptable return on investment. This is in turn based on the general premise that a ship operator will buy a ship, and his banker will lend him the money, if he can realistically expect to charter that ship 200 days per year for the first 5 years. Simple arithmetic shows that he recovers the initial hull cost over that period, and although he has not recovered interest expense, he has, at least theoretically, 20 years of revenue-producing life left on the ship. So, on a $3 million ship, $3000 per day is the likely starting point. Depending on the ship itself and each individual bidder's own circumstances, the final bid rates will range both upward and downward from that figure. If the ship is extremely special purpose and not readily convertible to other uses, the rate will likely approach full recovery of investment, interest, and profit over the five-year-period in which case NOAA would be better off to own the ship. On the other hand, if the ship is adaptable to the bidder's own business, he will begin massaging the rate downward and, assuming he has an adequate financing relationship, will probably submit a successful bid in the range of $1200 to $1300 per day on a bareboat basis for a 365-day year. Over the five-year period, NOAA would have spent $2,190,000 to $2,372,500 for the use of a $3 million ship, which if built under a Government contract would have cost NOAA probably in the order of $4 million, assuming a modified stock hull, in addition to the Governments own interest expense. But at this point NOAA would have the options previously mentioned which, if the contract were properly negotiated, would include buy-out at an attractive option purchase price and/or continued charter at a more favorable rate scaled to the terms of the additional commitment.

There is also a strong argument for multi-year chartering capability for existing ships in the charter market and for less than five years. Take the case of a two or three year requirement wherein a suitable ship is available, but extensive outfitting and mobilization costs are involved. There is the time and expense entailed both in the beginning mobilization phase and the ending demobilization phase. Even though these exposures can be somewhat minimized by the use of equipment and laboratory vans, they can consume a significant portion of a one-year charter. True, the charter can contain options for the additional annual periods, but again a more favorable charter rate can be negotiated in most cases (exceptions will be found in the fishing vessel charter market) when a multi-year commitment can be offered.

NOAA should also have the capability to enter into build/charter contracts (15 to 20 years). Without such a capability, no opportunity exists for comparing essentially full-life cost of an owned ship versus a chartered ship in a given situation. Obviously, fixed full-life program requirements would have to exist which would have justified NOAA construction of a new vessel in the first place. In this very long-term charter, the offeror would contract to build the ship the same as in the five-year example. The difference is that in this case, a bareboat charter would not offer any advantages. The bidders would be asked to quote time charter rates exclusive of fuel, port charges, subsistence for NOAA's program personnel, and miscellaneous program supplies and expendables. They will also quote some basis for rate escalation over the years to cover increases in crew wages, maintenance costs, benefits, and other variables. The Military Sealift Command has used this approach, and in fact, operates on an owned and chartered fleet mix basis structured to the fulfillment of mission requirements at lowest overall long-term cost to the Government. The fact that they have a basic military mission most likely facilitates obtaining waivers from restrictive procurement regulations. NOAA's mission, though not basically military is very similar in many respects and a concerted effort should be made to obtain special enabling legislation or at least case-by-case waivers to allow NOAA to commit to multi-year charters. Without such a capability, the question of an optimum fleet mix of owned and chartered vessels at lowest long-term cost to the Government cannot be validly answered. The question assumes significant proportions in view of the fact that NOAA will need ten new ships, either owned or long-term chartered, over the next ten years in order to remain at roughly the present level of availability to requirement percentage, i.e., about 60-70%.

SECTION 4

CHARTERING PRACTICES AND PROCEDURES

Although contracting for ship services has been generally responsive to program needs, there have been minor program schedule slippages, cost impacts, and other low-level inefficiences resulting from the current practices and procedures. If chartering is to become a significant component of the fleet mix in years to come, these relatively negligible problems can assume serious proportions for the future fleet mix planners. Present procurement personnel are, by and large, not sufficiently knowledgeable about the peculiarities of contracting for ship services. The solicitation format and procedures and the resulting contract itself tend to discourage many qualified bidders who are accustomed to dealing with more simplified solicitations and pro-forma charters such as those used by the Military Sealift Command (which strike an appropriate balance between commercial chartering and Government procurement regulations, provisions, terms, and conditions). There are procurement personnel within NOAA who are unfamiliar with commonly understood marine community language, such as "fully found" for example, which has a significant impact on bid rates. In addition, procurement personnel often have little or no advance warning of unplanned charter ship requirements necessitating quick procurement action and quick bidder response.

Until recently, NMFS was the only major program element that budgeted at least in part for charter ship time costs as a line item.

Planned charter funds were included in program funds. This is a logical and reasonable approach. In other areas of NOAA, however, charter funds were not budgeted at all. As a result, programs were cut back in many cases (when NOAA ship time was not allocated) to provide funds for charter hire costs. This suggests not only a dilution of program effort, but also (because of limited funds) the probability of resorting to a ship that is only marginally suitable.

As previously mentioned, there is no coordinated chartering function within NOAA. Contracting for ship services is accomplished by various procurement offices using the same solicitation procedures and contract forms as used for routine supplies and services. While NOAA has been getting by in this fashion, certain program needs which can and should be met through the use of chartered ships would be more efficiently served by a knowledgeable streamlined chartering function. Exploring means by which NOAA might obtain enabling legislation for multi-year charter commitments should include enlisting the aid of chartering professionals. There are many advantages to having access to professional chartering expertise, whether developed in-house or obtained from outside sources. As a minimum, these include:

- Wide knowledge of the total charter market and ship availability.
- Knowledgeable assessment of ship capabilities.
- Knowledgeable assessment of rates proposed.
- Quick response
- Knowledgeable negotiation

- Familiarity with maritime regulations and practices; Admiralty law; safety at sea requirements; and the terms, conditions, and special language of proper charter agreements.
- Informed opinion with respect to projected ship availability and charter rates to assist future fleet mix planners.

Properly organized, this coordinated chartering function, in time, would represent a single dependable source for charter ship availability, estimates of charter ship costs, and responsive charter ship procurement. Ideally, this office would develop and maintain a master "bidder's list" file. Short-term spot charters (under $2,500) could still be fixed in the field under chartering guidelines and pro-forma charter forms issued by the chartering expert. Reporting and clearance procedures as well as funding control could remain as at present.

If such a coordinated chartering function were established, a projected plan for charter ship utilization, similar to the NOAA Fleet Allocation Plan, could be submitted to this activity for advance planning. To the maximum extent possible it would include the required ship characteristics/capabilities, probable start date, location, and duration. Obviously, unforeseen chartering requirements will arise, and some projected chartering needs may not materialize, but for the most part overall chartering efficiency will be better served. This is an important consideration in view of the probable chartering activity over the next ten years.

The coordinated chartering function described above is similar to that performed for the U.S. Navy by the Special Projects Group at the Military Sealift Command. Experts in Government procurement and Admiralty law have long ago developed chartering solicitation procedures and pro-forma charter agreements which have served Navy program needs quite effectively. This group is experienced in chartering all manner of ships for research, survey work, and special technical missions without geographic limitation. It represents a possible alternative to establishing such capability within NOAA. Except for long term charter agreements, procurement regulations and policies are not materially different from those governing NOAA. With respect to long-term charters, the Navy has had several five-year programs which 1.) could not be accommodated by their own oceanographic fleet and 2.) did not justify new construction, that were effectively conducted under multi-year charters.

Other requirements of a very long term nature (15 to 20 years) were often met in the past by charter/build procurements. In those cases, the Navy specified the exact ship requirements as though they were having the ship built for themselves, but the procurement package went out to industry to provide, operate, and maintain the ship on a charter basis for the entire period. The successful bidder then used a long-term charter commitment to obtain financing (usually under a MARAD Title XI guaranty) for the ship. This is exactly the scenario described in Section 3 of this report dealing with new ship construction.

Another possible mechanism for alleviating problems attendant with frequent chartering (most especially the recurring administrative load at the program level) is the Indefinite Quantity Contract (IQC) approach. Presently, some NOAA contracts for ship services are written to extend over a period of time up to a year, but the ship is required only at intermittent intervals during that period. Many qualified marine operators are reluctant to bid under such arrangements. An IQC can be written for a one-year period, with options for additional years, to include a variety of ship types and classes as well as miscellaneous logistic support services to be supplied on an as-needed quick response basis. Some Navy IQC's also include extensive lists of equipment to be supplied on a rental basis. Under such arrangements, the contractor serves as a combination broker, ships agent, and supplier of specialized equipments and services. Again, many qualified bidders who would be reluctant to deal directly with the Government would not hesitate to subcontract to a private company. In many cases, the prime contractor will own one or more ships, have a marine engineering and operations department, and own or have ready access to deck handling equipment and a variety of electronic and data collection instrumentation such as precision recorders, current meters, profilers, side scan sonars, underwater TV's and related items. The ships, equipment, and services are paid for only when used. The assumption is made that no non-NOAA equipment would be used until data formatting is compatible.

Some consideration should be given to setting up a pilot program to let one such contract in a selected geographic area. If it proves successful, the program could probably be expanded to efficiently serve NOAA's total peripheral needs with only three such contracts: one on the East Coast; one serving the southeast and Gulf of Mexico; and one on the West Coast.

SECTION 5

COST COMPARISONS (NOAA-OWNED VERSUS CHARTERED SHIPS)

It is difficult to make a direct cost comparison between NOAA-owned and chartered ships. In the first place, almost all NOAA-owned ships are custom-designed, custom-built vessels. No directly comparable platforms exist in the commercial charter market. In the second place, the operation and maintenance costs of NOAA-owned ships include program support, which means that the program support cost component would have to be established in each specific case where a chartered ship would have to be augmented with such support. This is difficult because NOAA's cost allocation and accumulation system does not provide sufficient detail to establish such program support costs on a case-by-case basis.

One approach to cost comparison would be to consider a turn-key situation for a specific work package. A chartered ship complete with equipment and technical personnel to do seismic, magnetometer, side scan sonar, precision plotting and charting and other work necessary for drilling site surveys, hazard assessment, and environmental impact statements currently costs a client $6,000 to $7,000 per day. This includes the ship (125' to 175' oilfield utility ship), crew, equipment, and scientific party for 24-hour operation. At the end of the project he receives all the raw data, reduced data, and interpretation and analysis. Those costs are representative for work done on the East Coast (Baltimore Canyon, Georges Bank, Blake Plateau, e.g.) and in the Gulf of Mexico. Comparable work on the West Coast

(Santa Barbara) costs $1,000 to $2,000/day higher due to charter and labor market conditions.

If NOAA performed the same work with a Class III ship, the daily operating cost would be in the same range, but that cost does not include the acquisition cost of the program equipment or the cost of the ship. These costs are identified as the original acquisition cost of the vessel and equipment amortized over their respective projected useful lives.

Another comparison can be made using the new 90' stock hull as an example. NOAA's estimate to build this ship is $1.2 million including program equipment, which tracks well with this contractor's estimate of $900,000 for the ship itself. But this assumes building the boat for a commercial customer to commercial standards. NOAA's projected operation and maintenance cost is $424,000 per year or approximately $1,696 per day for 250 operating days. This includes fuel and some equipment. By contrast, the same ship could be chartered for $1,320 to $1,345 per day, 365 days per year (less 30 days for yard work) including a crew of seven, exclusive of fuel (but inclusive of subsistence for crew). This would be the initial year's daily rate on long-term (5-year) charter. The rate would be escalated 4% to 5% each year for the remaining four years. (This relatively low escalation rate is possible because depreciation and interest on the ship remain fixed over the entire term.) To this must be added NOAA's cost of $300,000 for program equipment, maintenance of program equipment, and program support personnel. But, NOAA would not be spending the

$900,000 for the ship itself. In addition, the ship would be available for work well over 300 days per year versus the apparent maximum of the 250 NOAA ship-day year. Ships built under Government contract cost much more than equal ships built under commercial contracts. This is because shipyards consider Government work higher risk due to contract language, constant inspection which disrupts (or tends to disrupt) work, documentation and slow, relatively difficult payment schedule.

Note that the above is based on comparison of owned versus chartered for a five-year period. The charter approach would be even more attractive if it were based on a very long term arrangement such as the fifteen-year build/charter agreement discussed elsewhere in this report.

These are only two isolated examples of cost comparisons that could be made using specific cases. Rough comparisons can also be made between the operation and maintenance costs of the various classes of NOAA ships and representative charter costs of ships of comparable lengths. This information is contained in the appendices. The immediate question is whether we are comparing apples to oranges. For example, there is no ship shown in the partial listing of charter vessels that compares with a NOAA Class I ship. True, but there are vessels in the charter list that are entirely capable of doing work that Class I ships are doing and likely to be doing. Of course, program support equipment and personnel must again be added to the charter ship. Note the 222' Mariner class (Figure 5) can be chartered

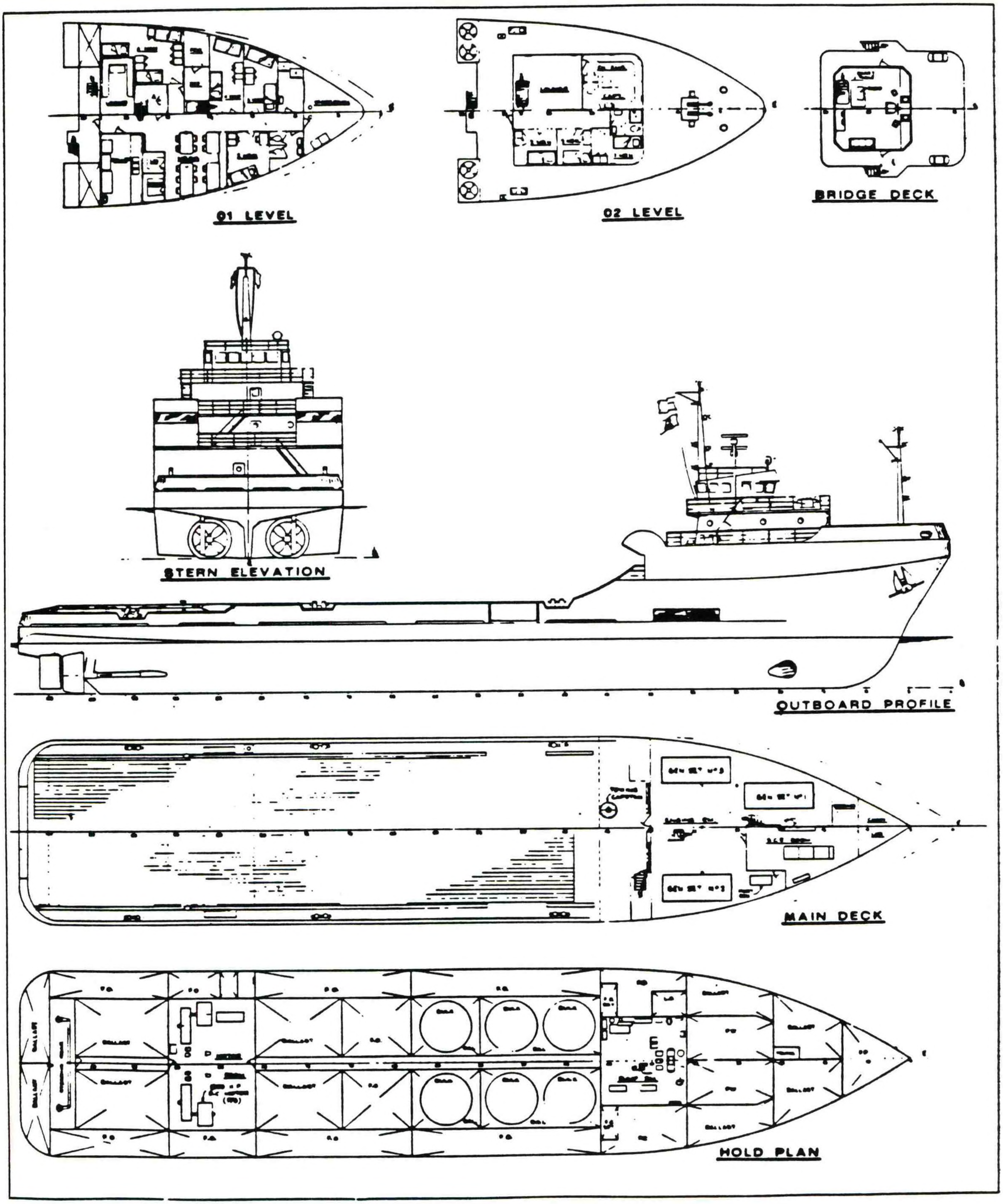


FIGURE 5: **STOCK MARINER CLASS UTILITY SHIP.**

for $4,200 per day. This is almost $10,000/day less than the operating and maintenance cost of the average Class I ship. There are additional economics since the ship is much more fuel efficient. Assuming a 200-day operating year, that means $2 million, which should buy a lot of program support equipment and personnel.

There is no doubt that program requirements can be effectively and efficiently met by the use of such platforms together with modularized laboratory vans and equipment. The question that needs to be addressed is the seaworthiness and seakindliness of chartered vessels. No ship is a bargain if safety must be compromised; neither is it a bargain if scientific working party efficiency is degraded by a lack of seakeeping qualities. It is important to note in this regard that the more recent stock hulls designed for oilfield work have been built to highly upgraded specifications. Almost all such recent ships over 150' have been built to North Sea Convention regulations which invoke the most stringent construction and inspection requirements of classification agencies such as American Bureau of Shipping, Lloyds of London and Det Norske Veritas. Engine rooms of the new 222' Mariner Class are above the waterline. Even the so-called "mudboats" must now meet U.S.C.G. inspection requirements.

In addition, there are some older well constructed hulls in the charter market that are certified for all-oceans service. Until recently, the R/V F.V. HUNT was in service. A converted 185' cable ship, this vessel spent five years in oceanographic and survey work in the Northern and Eastern Pacific, the Bering Sea, Sea of Okhotsk, South China Sea, and waters off Alaska. She had been through numerous typhoons and logged in excess of 300 working days each year.

There is no question that there are safe efficient platforms available for charter that would be suitable for NOAA program needs.

SECTION 6

COST DATA AND ANALYSIS

All cost data and comparisons for specific years referred to in this section are based on the Government fiscal year reporting period.

Appendix I contains some basic information about the NOAA ships over 65 feet in length including class, length, location, primary mission and proposed funding schedule of rehabilitation and upgrade. Actual days at sea and average operations and maintenance cost per day at sea for 1975 through 1978 are shown in Appendix 2. Also included are the latest 1979 projected figures. For analytical purposes, 1975 data should be excluded because of the limited availability in 1975 of the DISCOVERER, SURVEYOR, MILLER FREEMAN, GEORGE B. KELEZ, TOWNSEND CROMWELL, and BOWERS. For example, 1975 Class I ship operations and maintenance cost per day at sea without the DISCOVERER and SURVEYOR was $9,937 versus $15,977 per day with those ships included; and Class III cost per day was $2,525 without the KELEZ and CROMWELL versus the $3,962 per day shown. Data for 1976 through 1978 appear to be very consistent for comparison purposes. These data were used in evaluating the 1979 estimates and in projecting 1984 and 1988 ship operations costs.

An analysis of the data shown in Appendices 2 through 9 shows the following:

(1) Ship utilization, based on days at sea, have progressively been increasing, reflecting increased demand and improved utilization of ship time.

(2) Fleet operations and maintenance cost per day at sea has increased at the average rate of 7.9% per year from 1976 through 1978. The 1979 estimated costs per day at sea reflect only a 3.6% increase over 1978 costs with approximately the same number of days at sea projected. However, this figure is distorted by extraordinary costs in 1978. Approximately $1 million of material or equipment and maintenance costs were obligated in 1978 for upgrade of the DAVID STARR JORDAN and DELAWARE II over and above the normal equipment and maintenance costs. The 1979 estimated increase in cost per day at sea over 1978 adjusted for the extraordinary 1978 expenditures is 6.9%. This still appears to be somewhat conservative.

(3) Projected overall operations and maintenance cost for 1979 reflects a 6.6% increase over 1978 versus the increases over prior years of 8.2% in 1978, 13.4% in 1977, and 17.4% in 1976. This reflects a very positive trend. The figures are detailed in Appendix 6.

(4) Appendix 6 also details object Class costs as a percent of ship operations cost for 1975 through 1978. These figures show that labor and related personnel benefits cost are approximately 75% of total ship operations cost (excluding maintenance and equipment). Although overall costs reflect a positive trend, labor costs are significantly increasing as a percent of total cost. Labor-related costs were 72.9%

of operation cost in 1976, 72.0% in 1977 and 74.9% in 1978. Non-labor costs, excluding personnel benefits, were 27.1% in 1976, 28.0% in 1977 and 25.1% in 1978. Figures for 1979 are not available. Equipment and maintenance costs fluctuate significantly from year to year, and data required to differentiate between costs applicable to repair, maintenance and replacement versus costs incurred for upgrading, rehabilitation or acquisition of additional equipment is not available.

(5) Projected vessel operations cost for FY 1984 and 1988 (Appendices 7 and 8) were developed by analyzing actual detailed costs from 1975 through 1978, and the estimated cost for 1979. Inconsistencies were eliminated or adjusted in developing a cost base for each ship. For projection purposes, all ship costs were based on 210 days at sea. The primary purpose was to develop a ship class cost and to project the overall operations cost, and not to project individual ship cost. Since approved inflation factors were not available, inflation factors of 6%, 9% and 12% were used for comparison purposes.

(6) Appendix 9 contains a partial listing of vessels 65 feet in length or over that are presently on the charter market. The vessels shown are fairly representative of the types of charter vessels available and the daily charter rates reflect current market conditions.

Cost records and data available for actual cost of operating and maintaining the NOAA fleet from 1975 through 1978 appear to be complete in total, and accumulated and recorded in a consistent manner. Therefore, the analysis and projections prepared from these records was similarly formatted for consistency and ease of interpretation. Ship base operation costs and overhead costs, including future retirement pay obligations and depreciation expense, are not considered direct ship operations costs by NOAA. Consequently, they were excluded for analytical purposes.

Analysis of the data provided shows that the trend for the last four years has been favorable from a ship utilization and cost effectiveness standpoint.

Information on charter activities from 1975 through 1978 was not centrally maintained, and is incomplete. Therefore, the available data is not useful for analytical purposes, but it does reflect a trend of increasing need and use of charter vessels.

A restructuring of the object class cost accumulation system to identify and segregate program support costs from vessel operation costs is necessary if future fleet mix planners are to perform valid cost analysis of vessel operations. This would greatly assist in the identification, analysis and evaluation of program and/or ship costs, and would provide a sound basis for future planning and budgeting purposes as well as identifying present problem areas from a cost/ efficiency standpoint. This could then also be expanded into a computerized system, providing automated reporting, planning and budgeting capabilities.

APPENDICES SUMMARY

Appendix 1	Ships of the NOAA Fleet
Appendix 2	NOAA Fleet Days at Sea and Average Cost Per Day at Sea
Appendix 3	NOAA's Ship Operations and Maintenance Obligations - 1979 Projections
Appendix 4	NOAA's Actual Ship Operations and Maintenance Obligations - 1977 and 1978
Appendix 5	NOAA's Actual Ship Operations and Maintenance Obligations - 1975 and 1976
Appendix 6	Ship Support Services - Actual Obligations. Object Class Cost as a Percent of Ship Operations Cost.
Appendix 7	Projected Vessel Operations Cost for FY 1984 (including maintenance)
Appendix 8	Projected Vessel Operations Cost for FY 1988 (incldluing maintenance)
Appendix 9	Partial Listing of Vessels, 65 Feet or Over, Presently on the Charter Market

SHIPS OF THE NOAA FLEET

Class	Vessel	Length	Loc.	Primary Mission	Year Built	Scheduled Rehab.	Age at Rehab.	Est. Rehab.* Cost (millions) 1979 Dollars
I	OCEANOGRAPHER	303'	PMC	Oceanography	1966	1985	19	3.05
I	DISCOVERER	303'	PMC	Oceanography	1966	1984	18	3.05
I	RESEARCHER	278'	AMC	Oceanography	1970	1989	19	3.10
I	SURVEYOR	292'	PMC	Oceanography	1960	-	-	-
II	FAIRWEATHER	231'	PMC	Nautical Charting	1968	1988	20	2.05
II	RAINIER	231'	PMC	Nautical Charting	1968	1987	19	2.05
II	MT. MITCHELL	231'	AMC	Nautical Charting	1967	1986	19	2.05
II	MILLER FREEMAN	215'	PMC	Fisheries Research	1967	1990	23	2.10
III	PEIRCE	163'	AMC	Nautical Charting	1963	1982	19	1.30
III	WHITING	163'	AMC	Nautical Charting	1963	1982	19	1.30
III	McARTHUR	175'	PMC	Ntcl Chrt/Currents	1966	1983	17	1.35
III	DAVIDSON	175'	PMC	Nautical Charting	1967	1983	16	1.35
III	OREGON II	170'	AMC	Fisheries Research	1967	-	**	-
III	ALBATROSS IV	187'	AMC	Fisheries Research	1962	-	**	-
IV	GEORGE B. KELEZ	177'	AMC	Oceanography	1944	1983***	39	Replace
IV	TOWNSEND CROMWELL	164'	PMC	Fisheries Research	1963	1981	18	1.10
IV	DAVID STARR JORDAN	171'	PMC	Fisheries Research	1965	-	**	-
IV	DELAWARE II	156'	AMC	Fisheries Research	1968	-	**	-
IV	FERREL	133'	AMC	Currents	1968	1989	21	1.10
V	RUDE	90'	AMC	Nautical Charting	1966	1986	20	1.15
V	HECK	90'	AMC	Nautical Charting	1966	1986	20	
V	JOHN N. COBB	94'	PMC	Fisheries Research	1950	1983***	33	Replace
V	OREGON	100'	PMC	Fisheries Research	1946	1982***	37	Replace
VI	MURRE II	86'	PMC	Fisheries Research	1943	1985***	42	Replace

* $9.9 million for equipment and management costs not included.

** Fisheries vessels upgraded with resources by extended jurisdiction.

*** Scheduled for replacement.

APPENDIX 1

NOAA FLEET DAYS AT SEA
AND AVERAGE COST PER DAY AT SEA

Class	Ship	Days at Sea 1975	1976	1977	1978	1979*	Operations & Maint. Cost per Day at Sea** 1975	1976	1977	1978	1979*
I	OCEANOGRAPHER	190	181	172	185	195	10,273	11,600	13,767	13,583	13,939
I	DISCOVERER	66	187	207	215	210	40,477	12,894	13,088	11,537	13,198
I	RESEARCHER	185	182	199	191	195	9,591	11,083	11,598	13,918	13,550
I	SURVEYOR	69	193	220	208	210	25,367	12,129	10,833	11,580	13,249
		510	743	798	799	810	15,977	11,925	12,240	12,535	13,484
II	FAIRWEATHER	190	183	189	180	195	8,290	9,279	8,705	10,883	11,538
II	RAINIER	193	191	187	187	195	8,435	9,009	9,661	10,340	10,947
II	MT. MITCHELL	213	186	199	214	210	6,934	9,143	11,269	13,199	10,740
II	MILLER FREEMAN	-	192	248	248	250	-	7,840	6,426	7,470	7,901
		596	752	823	829	850	7,853	8,967	8,856	9,931	10,282
III	PEIRCE	209	193	189	192	188	4,371	5,006	5,676	5,351	6,445
III	WHITING	205	195	195	195	188	4,020	5,305	5,989	5,694	6,341
III	McARTHUR	210	206	191	197	188	4,720	5,679	6,465	6,336	8,005
III	DAVIDSON	193	191	191	208	188	5,250	7,186	6,964	6,797	6,794
III	OREGON II	208	211	244	246	215	2,018	2,994	3,018	3,271	4,747
III	ALBATROSS IV	203	196	207	225	250	3,467	5,217	6,168	6,281	4,997
		1,228	1,192	1,217	1,263	1,217	3,962	5,199	5,603	5,556	6,221
IV	GEORGE B. KELEZ	116	198	194	199	180	7,759	3,613	4,508	4,502	5,154
IV	TOWNSEND CROMWELL	48	187	249	255	250	16,825	3,456	3,703	3,317	3,810
IV	DAVID STARR JORDAN	195	203	245	254	250	2,688	2,973	3,576	5,589	3,908
IV	DELAWARE II	193	171	235	196	250	2,436	3,786	3,652	5,845	3,738
IV	FERREL	216	190	195	215	190	2,456	2,443	3,607	3,750	4,039
		768	949	1,118	1,119	1,120	4,209	3,242	3,787	4,483	4,130
V	RUDE/HECK	372	364	336	374	380	1,529	1,640	2,516	2,156	2,017
V	JOHN N. COBB	178	172	168	169	166	1,462	1,783	2,151	2,056	2,708
V	OREGON	180	184	197	184	189	1,601	1,775	1,753	2,241	2,331
		730	720	701	727	735	1,530	1,709	2,214	2,130	2,331
VI	MURRE II	155	133	129	148	140	586	923	1,180	1,249	1,691
VI	BOWERS	93	139	99	-	-	1,197	780	645	-	-
		248	272	228	148	140	815	850	948	1,249	1,691
	TOTAL	4,080	4,628	4,885	4,885	4,872					

* estimated ** average

APPENDIX 2

NOAA'S SHIP OPERATIONS & MAINTENANCE OBLIGATIONS
1979 Projections

Class	Ship	Ship Operations	Ship Maint. & Equip.	Total
I	OCEANOGRAPHER	2,059.5	658.6	2,718.1
I	DISCOVERER	2,113.0	658.6	2,771.6
I	RESEARCHER	1,983.7	658.6	2,642.3
I	SURVEYOR	2,123.7	658.6	2,782.3
	Class Total	8,279.9	2,634.4	10,914.3
II	FAIRWEATHER	1,734.2	516.0	2,250.2
II	RAINIER	1,618.6	516.0	2,134.6
II	MT. MITCHELL	1,735.8	519.7	2,255.5
II	MILLER FREEMAN	1,459.3	516.0	1,975.3
	Class Total	6,547.9	2,067.7	8,615.6
III	PEIRCE	872.1	339.5	1,211.6
III	WHITING	852.7	339.5	1,192.2
III	McARTHUR	1,165.4	339.5	1,504.9
III	DAVIDSON	937.7	339.5	1,277.2
III	OREGON II	681.1	339.5	1,020.6
III	ALBATROSS IV	909.8	339.5	1,249.3
	Class Total	5,418.8	2,037.0	7,455.8
IV	GEORGE B. KELEZ	690.5	237.2	927.7
IV	TOWNSEND CROMWELL	715.1	237.3	952.4
IV	DAVID STARR JORDAN	739.8	237.3	977.1
IV	DELAWARE II	697.2	237.3	934.5
IV	FERREL	530.1	236.3	766.4
	Class Total	3,372.7	1,185.4	4,558.1
V	RUDE/HECK	566.9	199.5	766.4
V	JOHN N. COBB	303.4	146.2	449.6
V	OREGON	329.1	100.0	429.1
	Class Total	1,199.4	445.7	1,645.1
VI	MURRE II	185.0	51.8	236.8
		25,003.7	8,422.0	33,425.7

NOAA'S ACTUAL SHIP OPERATIONS & MAINTENANCE OBLIGATIONS
1977 & 1978

		1977			1978		
Class	Ship	Ship Operations	Ship Maint. & Equip.	Total	Ship Operations	Ship Maint. & Equip.	Total
I	OCEANOGRAPHER	1,980.1	387.8	2,367.9	1,862.9	582.0	2,444.9
I	DISCOVERER	1,956.2	753.0	2,709.2	1,859.1	621.3	2,480.4
I	RESEARCHER	1,832.0	476.0	2,308.0	1,925.9	732.4	2,658.3
I	SURVEYOR	1,791.1	592.1	2,383.2	1,941.2	490.5	2,431.7
	Class Total	7,559.4	2,208.9	9,768.3	7,589.1	2,426.2	10,015.3
II	FAIRWEATHER	1,382.8	262.6	1,645.4	1,577.0	382.0	1,959.0
II	RAINIER	1,456.3	350.3	1,806.6	1,606.2	327.4	1,933.6
II	MT. MITCHELL	1,897.5	345.1	2,242.6	2,294.8	476.9	2,771.7
II	MILLER FREEMAN	1,240.5	353.3	1,593.8	1,217.0	351.7	1,568.7
	Class Total	5,977.1	1,311.3	7,288.4	6,695.0	1,538.0	8,233.0
III	PEIRCE	819.3	253.4	1,072.7	818.0	209.5	1,027.5
III	WHITING	832.6	335.3	1,167.9	800.9	309.5	1,110.4
III	McARTHUR	1,016.6	218.3	1,234.9	1,085.5	162.6	1,248.1
III	DAVIDSON	811.4	518.8	1,330.2	893.8	520.0	1,413.8
III	OREGON II	580.7	155.8	736.5	590.8	213.9	804.7
III	ALBATROSS IV	832.0	444.7	1,276.7	895.3	517.9	1,413.2
	Class Total	4,892.6	1,926.3	6,818.9	5,084.3	1,933.4	7,017.7
IV	GEORGE B. KELEZ	616.3	258.2	874.5	688.3	207.6	895.9
IV	TOWNSEND CROMWELL	644.9	277.2	922.1	638.4	207.5	845.9
IV	DAVID STARR JORDAN	674.5	201.6	876.1	690.1	729.6	1,419.7
IV	DELAWARE II	609.5	248.7	858.2	575.7	885.6	1,461.3
IV	FERREL	587.6	115.8	703.4	551.8	160.7	712.5
	Class Total	3,132.8	1,101.5	4,234.3	3,144.3	2,191.0	5,335.3
V	RUDE/HECK	612.9	232.5	845.4	560.4	246.0	806.4
V	JOHN N. COBB	278.4	83.0	361.4	274.9	72.5	347.4
V	OREGON	290.4	55.0	345.4	332.1	80.2	412.3
	Class Total	1,181.7	370.5	1,552.2	1,167.4	398.7	1,566.1
VI	MURRE II	117.5	34.7	152.2	137.4	37.5	174.9
VI	BOWERS	60.4	3.5	63.9	-	-	-
	Class Total	177.9	38.2	216.1	137.4	37.5	174.9
		22,921.15	6,956.7	29,878.2	23,817.5	8,524.8	32,342.3

APPENDIX 4

NOAA'S ACTUAL SHIP OPERATIONS & MAINTENANCE OBLIGATIONS 1975 & 1976

		1975			1976		
Class	Ship	Ship Operations	Ship Maint. & Equip.	Total	Ship Operations	Ship Maint. & Equip.	Total
I	OCEANOGRAPHER	1,498.0	453.9	1,951.9	1,650.1	449.5	2,099.6
I	DISCOVERER	871.5	1,800.0	2,671.5	1,843.5	567.7	2,411.2
I	RESEARCHER	1,291.9	482.5	1,774.4	1,626.6	382.3	2,008.9
I	SURVEYOR	774.4	975.9	1,750.3	1,747.4	593.5	2,340.9
	Class Total	4,435.8	3,712.3	8,148.1	6,867.6	1,993.0	8,860.6
II	FAIRWEATHER	1,144.3	430.8	1,575.1	1,433.4	264.7	1,698.1
II	RAINIER	1,191.4	436.7	1,628.1	1,446.6	274.1	1,720.7
II	MT. MITCHELL	1,236.2	240.7	1,476.9	1,475.7	343.8	1,819.5
II	MILLER FREEMAN	-	-	-	1,031.5	473.9	1,505.4
	Class Total	3,571.9	1,108.2	4,680.1	5,387.2	1,356.5	6,743.7
III	PEIRCE	659.0	254.6	913.6	812.9	153.3	966.2
III	WHITING	635.0	189.0	824.0	767.6	266.8	1,034.4
III	McARTHUR	746.5	244.8	991.3	952.3	217.6	1,169.9
III	DAVIDSON	689.0	324.2	1,013.2	736.4	636.1	1,372.5
III	OREGON II	388.7	31.0	419.7	479.7	152.1	631.8
III	ALBATROSS IV	572.2	131.5	703.7	756.3	266.3	1,022.6
	Class Total	3,690.4	1,175.1	4,865.5	4,505.2	1,692.2	6,197.4
IV	GEORGE B. KELEZ	306.2	593.8	900.0	526.7	188.6	715.3
IV	TOWNSEND CROMWELL	161.0	646.6	807.6	546.6	99.7	646.3
IV	DAVID STARR JORDAN	426.8	97.4	524.2	495.2	108.3	603.5
IV	DELAWARE II	398.1	72.1	470.2	490.9	156.6	647.5
IV	FERREL	386.6	143.9	530.5	390.5	73.7	464.2
	Class Total	1,678.7	1,553.8	3,232.5	2,449.9	626.9	3,076.8
V	RUDE/HECK	457.3	111.5	568.8	501.7	95.4	597.1
V	JOHN N. COBB	211.0	49.3	260.3	243.2	63.5	306.7
V	OREGON	222.3	65.9	288.2	255.7	71.0	326.7
	Class Total	890.6	226.7	1,117.3	1,000.6	229.9	1,230.5
VI	MURRE II	80.3	10.6	90.9	108.0	14.7	122.7
VI	BOWERS	68.7	42.7	111.4	73.5	34.9	108.4
	Class Total	149.0	53.3	202.3	181.5	49.6	231.1
		14,416.4	7,829.4	22,245.8	20,392.0	5,948.1	26,340.1

APPENDIX 5

SHIP SUPPORT SERVICES - ACTUAL OBLIGATIONS
Object Class Cost as a Percent of Ship Operations Cost

		1975	1976	1977	1978
1111	Commissioned Officers	9.6%	8.6%	8.0%	7.5%
114-113X	Wage Marine	35.4%	35.8%	34.2%	36.2%
115X	Other Compensation	13.2%	14.2%	14.7%	15.9%
116X	Leave Surcharge	7.5%	6.0%	6.4%	6.6%
118X	Shore & Comp. Time	1.4%	1.7%	1.8%	1.9%
	TOTAL LABOR	67.1%	66.3%	65.1%	68.1%
12XX	All Other Personnel Benefits	7.3%	6.6%	6.9%	6.8%
21XX	Travel	.7%	.5%	.6%	.7%
22XX	Transportation of Things	.2%	.1%	.6%	.7%
23XX	Rents, Comm. & Utilities	.6%	.7%	1.3%	1.1%
24XX	Printing, Reproduction	-	-	-	-
25XX	Other Contractual Services	1.4%	3.4%	3.5%	2.4%
2615	Rations	5.4%	4.7%	4.2%	4.1%
2617	Fuel	11.2%	12.1%	11.1%	10.9%
26XX	Other Supplies	6.1%	5.4%	7.2%	5.7%
	All Other	-	.1%	-	-
	TOTAL NON-LABOR	32.9%	33.7%	34.9%	31.9%
	*Ship Operations Cost (less equip. & maint.)	14,601.0	19,171.0	21,369.9	22,172.5
	% Increase over Prior Year	-	31.3%	11.5%	3.8%
	* Equipment Cost	12.5	1,221.0	1,547.4	1,639.0
	* Ship Maintenance Cost	7,829.4	5,948.1	6,956.7	8,524.8
	* TOTAL SHIP SUPPORT SERVICES	22,442.9	26,340.1	29,878.2	32,342.3
	% Increase over Prior Year	-	17.4%	13.4%	8.2%

* Actual dollars (in thousands).

PROJECTED VESSEL OPERATIONS COST FOR FY 84 (INCLUDING MAINTENANCE)
(All ship costs in thousands and based on 210 days at sea)

Class		6% Inflation Factor		9% Inflation Factor		12% Inflation Factor	
		Cost Per Day at Sea	Annual Cost	Cost Per Day at Sea	Annual Cost	Cost Per Day at Sea	Annual Cost
I	OCEANOGRAPHER	17.6	3,696	20.3	4,263	23.2	4,872
I	DISCOVERER	19.0	3,990	21.8	4,578	25.0	5,250
I	RESEARCHER	17.6	3,696	20.2	4,242	23.1	4,851
I	SURVEYOR	18.2	3,822	20.9	4,389	23.9	5,019
	Class Total	18.1	15,204	20.8	17,472	23.8	19,992
II	FAIRWEATHER	13.5	2,835	15.5	3,255	17.7	3,717
II	RAINIER	13.6	2,856	15.5	3,255	17.8	3,738
II	MT. MITCHELL	16.2	3,402	18.6	3,906	21.3	4,473
II	MILLER FREEMAN	11.9	2,499	13.6	2,856	15.6	3,276
	Class Total	13.8	11,592	15.8	13,272	18.1	15,204
III	PEIRCE	7.8	1,638	8.9	1,869	10.0	2,100
III	WHITING	8.2	1,722	9.3	1,953	10.5	2,205
III	McARTHUR	9.3	1,953	10.7	2,247	12.0	2,520
III	DAVIDSON	9.7	2,037	11.2	2,352	12.6	2,646
III	OREGON II	5.8	1,218	6.6	1,386	7.5	1,575
III	ALBATROSS IV	9.0	1,890	10.3	2,163	11.6	2,436
	Class Total	8.3	10,458	9.5	11,970	10.7	13,482
IV	GEORGE B. KELEZ*	5.5	1,155	6.3	1,323	7.1	1,491
IV	TOWNSEND CROMWELL	5.4	1,134	6.2	1,302	7.0	1,470
IV	DAVID STARR JORDAN	6.2	1,302	7.1	1,491	8.1	1,701
IV	DELAWARE II	6.2	1,302	7.1	1,491	8.2	1,722
IV	FERREL	4.2	882	4.8	1,008	5.6	1,176
IV	CHAPMAN	5.5	1,155	6.3	1,323	7.2	1,512
	Class Total	5.5	6,930	6.3	7,938	7.2	9,072
V	RUDE/HECK	4.7	987	5.3	1,113	6.2	1,302
V	JOHN N. COBB*	2.3	483	2.6	546	3.0	630
V	OREGON*	2.3	483	2.6	546	3.1	651
	Class Total	3.1	1,953	3.5	2,205	4.1	2,583
VI	MURRE II*	2.1	441	2.5	525	2.8	588
	TOTAL		46,578		53,382		60,921

*or similar type replacement

PROJECTED VESSEL OPERATIONS COST FOR FY 88 (INCLUDING MAINTENANCE)
(All ship costs in thousands and based on 210 days at sea)

Class		6% Inflation Factor		9% Inflation Factor		12% Inflation Factor	
		Cost Per Day at Sea	Annual Cost	Cost Per Day at Sea	Annual Cost	Cost Per Day at Sea	Annual Cost
I	OCEANOGRAPHER	22.2	4,662	28.5	5,985	36.4	7,644
I	DISCOVERER	23.9	5,019	30.7	6,447	39.2	8,232
I	RESEARCHER	22.2	4,662	28.5	5,985	36.4	7,644
I	SURVEYOR	22.9	4,809	29.5	6,195	37.6	7,896
	Class Total	22.8	19,152	29.3	24,612	37.4	31,416
II	FAIRWEATHER	17.0	3,570	21.9	4,599	28.0	5,880
II	RAINIER	17.1	3,591	22.0	4,620	28.1	5,901
II	MT. MITCHELL	20.5	4,305	26.4	5,544	33.7	7,077
II	MILLER FREEMAN	15.0	3,150	19.3	4,053	24.6	5,166
	Class Total	17.4	14,616	22.4	18,816	28.6	24,024
III	PEIRCE	9.8	2,058	12.6	2,646	16.1	3,381
III	WHITING	10.3	2,163	13.3	2,793	16.9	3,549
III	McARTHUR	11.8	2,478	15.2	3,192	19.4	4,074
III	DAVIDSON	12.4	2,604	15.9	3,339	20.2	4,242
III	OREGON II	7.3	1,533	9.4	1,974	12.0	2,520
III	ALBATROSS IV	11.4	2,394	14.6	3,066	18.6	3,906
	Class Total	10.5	13,230	13.5	17,010	17.2	21,672
IV	GEORGE B. KELEZ*	6.8	1,428	8.8	1,848	11.3	2,373
IV	TOWNSEND CROMWELL	6.8	1,428	8.7	1,827	11.2	2,352
IV	DAVID STARR JORDAN	7.8	1,638	10.0	2,100	12.8	2,688
IV	DELAWARE II	7.8	1,638	10.1	2,121	12.9	2,709
IV	FERREL	5.3	1,113	6.9	1,449	8.8	1,848
IV	CHAPMAN	6.9	1,449	8.9	1,869	11.4	2,394
	Class Total	6.9	8,694	8.9	11,214	11.4	14,364
V	RUDE/HECK	5.9	1,239	7.5	1,575	9.7	2,037
V	JOHN N. COBB*	2.9	609	3.7	777	4.7	987
V	OREGON*	2.9	609	3.8	798	4.8	1,008
	Class Total	3.9	2,457	5.0	3,150	6.4	4,032
VI	MURRE II*	2.7	567	3.5	735	4.4	924
	TOTAL		58,716		75,537		96,432

APPENDIX 8

PARTIAL LISTING OF VESSELS, 65 FEET OR OVER, PRESENTLY ON THE CHARTER MARKET

Location	Type of Vessel or Type of Work Suitable For	Name	Length Overall (In Ft.)	Cost/Day Short Term (1979 dlrs)	Cost/Day Long Term (1979 dlrs)
AK	Crab fishing, nautical charting	PACIFIC APOLLO	165	3,000	2,400
EC	Diving, bathymetery, mammal surveys	VENTURE	125	1,500	1,300
EC	Mammal studies, charting	PEIRCE	158	1,750	1,500
EC	Shallow survey, diving	HUMBLE	115	1,350	1,100
WC	Oceanography	SEVERIANA	100	1,150	950
GC	Nautical charting, oceanography	SEA TRANSPORTER	125	1,450	1,200
GC	Transportation to foreign vessels	ADA	65	520	465
CB	Oceanography, nautical charting, fisheries research	LANGEVIN	144	1,700	1,550
EC	Salvage, charting, diving support, towing	MOBY II	85	1,250	1,050
EC	Oceanography, charting, fisheries research	RED JACKET	165	2,100	1,700
EC	Submersible work	ALOHA	144	2,400	2,200
EC	Oceanography, charting	ANNANDALE	90	1,500	1,300
EC	Current studies, fisheries research	SOUTHERN VENTURE	74	1,300	1,150
EC	Submersible work, charting	UNDERSEA HUNTER	85	1,550	1,400
WC	Fisheries research, porpoise surveys	TRADITION	127	1,850	1,600
EC	Oceanography, nautical charting, hazard surveys	FAY	176	2,600	2,250
EC	Fisheries research, oceanography	SUB SIG	118	1,950	1,800
EC	Shallow surveys, diving	HELEN B	100	1,775	1,525
EC	Charting, fishing obstructions, oceanography	INDIAN SEAL	204	3,600	3,200
EC	Diving survey, shallow charting	ATLANTIC TWIN	90	1,550	1,400
EC	Fisheries research, oceanography	ADVANCE II	190	2,800	2,500
EC	Fisheries research, oceanography	CAPE HENLOPIN	120	1,750	1,600
GC	Fisheries research	GUS III	89	900	800
WC	Resource survey	ANN MARIE	87	2,000	1,800
WC	Resource survey	PAT MARIE	101	2,000	1,800
WC	Fisheries research	PACIFIC RAIDER	125	2,250	2,100
GC	Fisheries research	LADY WEESA	70	650	500
GC	Resource survey, oceanography	STATE HORN/RACE	110	1,500	1,350
WC	Stock assessment	NORTH PACIFIC	86	1,250	1,100
WC	Fisheries research	FOREMOST	95	1,550	1,400
EC	Fisheries research	SILVER LINING	78	1,550	1,475
GC	Charting, fishing obstructions, oceanography	ACADIAN MARINER	216	4,000	3,800

NOTE:
1. All prices are plus fuel and food
2. Locations: EC - East Coast; AK - Alaska; WC - West Coast; CB - Caribbean; GC - Gulf Coast
3. Short term, 30 -150 days; Long term, annual charter