

Report of the Committee of Visitors for the Ocean Science Facilities Programs

Submitted to the Advisory Committee for Geosciences

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A Committee of Visitors (COV) met from June 3 to 5, 2002 at the National Science Foundation to review Ocean Science Facilities programs within the Integrative Programs Section of the Division of Ocean Sciences (OCE). The review includes the programs that support Ship Operations, Oceanographic Technical Services, Oceanographic Instrumentation, Shipboard Scientific Support Equipment, Ship Acquisition and Upgrade, and several related activities. The COV was charged to provide assessments of (1) the quality and integrity of program operations and program-level technical and managerial matters pertaining to proposal decisions; and (2) the degree to which the outputs and outcomes generated by awardees have contributed to the attainment of NSF's mission, strategic goals, and annual performance goals.

The COV was provided a series of planning documents related to program activities, a summary of funding activities for FY 2001, and a series of figures and tables depicting budget history prior to the meeting (Appendix A). Program officers presented summaries of program activities to the COV on June 3. The COV then examined nearly all of the FY2001 proposal files for each of the Facilities programs on June 3, 4 and 5.

Program Background

The programs included in this program operate primarily to support operations of the UNOLS (University-National Oceanographic Laboratory System) Academic Research Fleet. These ships support the majority of the basic, and much of the applied, ocean science research done by academic scientists and engineers in the United States. UNOLS vessels also support ocean research for a variety of other Federal and State agencies, including the Office of Naval Research, National Oceanic and Atmospheric Administration, US Geological Survey, Minerals Management Service, Department of Energy, National Aeronautics and Space Administration and Environmental Protection Agency. Operating costs (ships and technicians) are allocated based on actual days of usage. Facility support costs (Oceanographic Instrumentation and Shipboard Scientific Support Equipment) are often fully borne by the NSF.

The Ship Operations Program accounts for the majority of the funds administered in these combined activities (some \$34.6M of \$56.3M total awards in FY2001). This program supports the day to day operations of ships in the fleet, as required by science, engineering or education proposals funded by the NSF. Ship Operations are funded by 5-year Cooperative Agreements. These agreements have been exempted by the National Science Board from conventional peer review for several reasons. The NSF supported science programs that utilize the fleet are subjected to extensive peer review. Further, the Research Vessels of the fleet, and the distributed system of marine facilities that support them, represent a major capital asset (28 ships with a replacement value of approximately \$500M) that is highly specialized for scientific studies. The fleet must be managed over a long time frame to sustain the highly trained crews and technicians that support the research conducted on these ships. However, the Ship Operation Program is periodically subjected to external review. An external Fleet Review Committee, chaired by Dr. Roland Schmitt, conducted the most recent review (Fleet Review Committee, 1999). This document was provided to the COV in advance of the meeting.

The Oceanographic Technical Services Program supports the marine research technicians and specialized instrumentation that sustain NSF supported scientific research at sea. These three-year proposals are reviewed by a panel of experts that meets every three years to review all the marine technician proposals.

The Oceanographic Instrumentation Program is intended to enhance the scientific capabilities and productivity of, primarily, the ships in the UNOLS fleet. These proposals, with a nominal 1-year duration, are subjected to mail review. In addition, they undergo panel review every third year when the Oceanographic Technical Services Program Panel meets.

The Shipboard Scientific Support Equipment Program is primarily intended to improve safety systems and enhance capabilities of the ships of the UNOLS fleet. Proposals submitted to this program are reviewed by a panel that meets each year.

The Ship Acquisition and Upgrade Program focuses on proposals for the design, construction, acquisition, major upgrades, or conversion of research vessels that will operate in the UNOLS fleet. Proposals submitted to this program generally undergo mail review and a special panel is then convened to consider the proposal at hand and the reviews. Recently, planning for fleet renewal has been coordinated nationally with the Federal Oceanographic Facilities Committee (FOFC Report, 2001).

Other important activities include support for the National Deep Submergence Facility, the National Ocean Science Accelerator Mass Spectrometer (NOSAMS) Facility and the University-National Oceanographic Laboratory System Office, as well as workshops and occasional studies that relate to operations of the fleet.

Findings

The COV finds that the programs under review provide outstanding support for the research programs funded by the Division of Ocean Sciences and, in general, for research programs funded by a spectrum of Federal agencies. These sea-going facilities provide the platforms on which the bulk of this Nation's academic oceanographic research is performed. Research conducted on UNOLS ships contributes to the fundamental base of knowledge on which we build our understanding of interannual changes in climate, formation of tropical storms, the structure of the deep-earth, fisheries management, global biogeochemical cycles and virtually all other basic understanding of the ocean systems. Educational programs make extensive use of the fleet through programs such as "Dive and Discover" and "REVEL".

The findings of the Academic Fleet Review provide significant support for the management structure under which the fleet is operated. The structure has evolved under the guidance of the Facilities Programs of OCE. This system has proven to be effective from an operational and a budgetary perspective. The NSF is to be commended for fostering the development of such a flexible and effective system. Our review focuses on the current management practices, particularly in response to comments of the previous COV (1997) and the Academic Fleet Review (1999), programmatic issues, suggested improvements, and future facilities challenges.

Management Practices:

We find that the Ocean Science Facilities Program uses a series of Management Practices that enable effective operation of Ocean Science Facilities. These practices include:

- *Utilization of Cooperative Agreements.* The Ship Operations program changed to five-year cooperative agreements in FY 2000 as the instrument for funding ship operations. The new five-year continuing Cooperative Agreements provide NSF with more flexibility to adjust annual budgets as cruise schedules change and as unanticipated needs arise. Program officials might consider applying Cooperative Agreements to other activities, such as the University of Miami SWAB program, that are considered routine undertakings.
- *Coordination of fleet activities.* OCE is to be commended for its insight and leadership in use of group purchases of shipboard equipment for cost saving and standardization across the fleet. For example, bulk purchases of immersion suits by LDEO, work boats through LUMCON, and INMARSAT units compatible with SEANET through UDEL, were distributed across the fleet to those who had requested and received approval from OCE. Of particular note, is the benefit that resulted from this group purchase approach for laboratory vans. UDEL took the lead in designing standardized vans consistent with U.S. Coast Guard criteria for construction of sea-going vans occupied by scientists. A group purchase of several types of these vans provided standardized equipment to the fleet at considerable cost savings. Recommendations below suggest that this management practice might be applied in other areas as well.

Other best management practices include sharing examples of well written program summaries with submitters of other proposals, the high level of interaction between

program officers, PIs, and other related NSF program managers, and the practice of funding proposals based upon estimated costs at the beginning of the year in order to assure funds are available to keep the fleet operating without interruption.

- *Safety Training.* We applaud the NSF initiative and dedication to strengthening the overall level of training among the UNOLS ship crews. The commitment in 1999 to provide supplemental funding “across the board” in support of the Seafarer’s Training, Certification and Watchkeeping Code – STCW95 – per guidance from the International Maritime Organization – is characteristic of the community leadership exemplified by NSF. This investment, while hardly insignificant (several hundred thousand dollars), will pay off in terms of ensured safety of operations.

Review of the individual institutional agreements and budgets reveals a wide diversity of costs associated with equivalent training packages. For example, costs for STCW-BST (Basic Safety Training) ranged from \$875 per individual, to more than \$3000 per individual in the proposals that we examined. Similar variability in cost was noted for other courses as well. We recognize that part of this range in costs is attributable to differences in services provided by the different instructional facilities around the United States (e.g. some include housing costs while others do not). We also recognize that in 2000 and 2001 the initial training initiative focussed on a larger-than-normal population of the ships’ crews (providing training for about 150 individuals). Nevertheless, NSF’s clearly stated, long-term commitment to providing a steady stream of resources for STCW training suggests the need for a community-based approach to this issue. Lessons learned from the community-wide approach to pooled equipment and group-buys of equipment might be applied to training. We recognize that the logistics of training crews, when taking into consideration cruise schedules and geographic constraints, might be too daunting to address in any centralized fashion. However, given the four-fold range in costs for training, NSF is encouraged to assess opportunities for gaining efficiencies (in costs and scheduling) through a centralized management or tracking of training.

- *Security.* Many ships in the UNOLS fleet routinely operate in international waters, and a few routinely operate in regions that have become increasingly prone to piracy and acts of international terrorism. U.S. oceanographic research vessels may become prime targets for such acts. Several weeks prior to September 11, 2001, one vessel operating in Somalian coastal waters was fired upon and actively pursued by pirates or terrorists. Fortunately, no bodily harm to the scientific party and crew was sustained. At least two institutions have proactively engaged in security training. Given the current international climate, the need for security awareness training for all vessels including those operating only within U.S. waters will most likely increase. To date recommendations and practices for security training, and more extensive security practices for vessels operating in unfriendly waters, do not appear to exist.

- *Ship Inspections.* OCE supports ship inspections by an independent contractor. These inspections provide operators with independent assessments of the state of their vessels, their capabilities and their potential for improvement. The COV noted several instances of positive references to the inspection process in the review of proposal

jackets. The inspection program underwent a hiatus for several years while the proposal was changed from a grant to a contract. The program is of sufficient importance that such lapses should be discouraged.

Merit Review. Each program has adapted a flexible proposal merit review process that is appropriately scaled to their needs. In general, as described in proposal jackets, intrinsic intellectual merit is not the primary review criterion for facilities. Instead, the intellectual merit review occurs in a separate review process of the research proposals that use these facilities. Proposals submitted to the appropriate disciplinary science programs or interdisciplinary special solicitations are reviewed by mechanisms appropriate to each program or solicitation for both their intellectual merit and their appropriateness in using the facilities. Although it was inappropriate to comment on the "intellectual merit" of the science awards for which the facilities were provided, the Committee carefully examined the "technical merit" of the facilities proposals from the standpoint of mail, panel and review analysis. Additionally, the Facility Program reviews focus extensively on Criterion II of the guidelines. However, it is clear from examining the program jackets that when intellectual merit review of a broader nature is appropriate (such as the NOSAMS renewal proposal), that such review is instituted. These reviews often consist of large numbers of mail reviews by a diverse set of reviewers, followed by a special panel.

Recommendations:

- *Quantitative Assessment of Service Quality.* The Ocean Science Facilities Programs manage a complex set of facilities equipment and science support infrastructure in support of ocean observation projects. The overall success of these efforts is measured by the scientific results reported in reviewed publications. However, these metrics do not provide useful direct links to Facilities Programs for assessing quality of service and evaluation of continuous improvement in support of the underlying science mission. The program managers very professionally compensate for this by their demonstrated detailed knowledge of the facilities, operations and scientist experiences.

However, development and use of high-integrity measures of service quality would provide a robust, defensible means to help panels and managers identify opportunities for improvement and a gauge for outcomes of instituted changes (e.g., recent efforts in Technical Services Program to fund a more uniform set of shared-use equipment to reduce effects of ship reassignments to individual science PI budgets).

Post-cruise UNOLS assessments, which provide ample opportunity for subjective interpretation, may not be appropriate for rigorous analytical use. It may be necessary for NSF to develop more rigorous measures of efficiency and quality of service.

- *Availability of Ship Inspection Recommendations and Follow-up.* Web based tracking of compliance with recommendations of UNOLS ship inspections should be considered. Operators must detail, in each annual proposal, the recommendations of the previous ship inspection and the modifications and repairs that are being made in

response to the recommendations. Such lists and the responses could be maintained on a web site (if privacy issues can be resolved) that would be available to a broad set of stakeholders, including the users of the ships. Awareness of the recommendations and responses would encourage greater input from users regarding perceived deficiencies in facilities, it would encourage continuous improvements of the facilities, and it would promote awareness of the efforts made by operators to accommodate science users.

- *Centralized Tracking of Safety Training.* We recommend that NSF support the development and maintenance of a centralized, web-based tool for tracking STCW training throughout the community of UNOLS ships' crews. This tool, if accessible by the UNOLS community, will facilitate 'comparison shopping' for training opportunities. With appropriate links to training service providers, this tool will offer UNOLS marine operators a more efficient and effective means for attaining the best training programs, at the best prices to fit their schedules. Operator-maintained databases of crew training status, if resident on this site could also present the NSF program managers the single-site reference for planning future training resources.

- *Clarification of Guidelines for Shipboard Facilities and Operating Proposals.* Extensive experience with fleet operations has been accumulated. In some cases, additional guidelines for proposals may now help clarify allowable costs and help define reasonable expectations for the level of operational support needed to sustain ship operations in normal circumstances. In particular, there appears to be some confusion regarding guidelines for submission of proposals for instrumentation and equipment, in spite of NSF's good efforts to clarify the program constraints. Effectively, each institution has two different opportunities for proposing purchase of equipment and/or instrumentation defined by NSF as items costing over \$5,000 (supplies such as personal computers, can also be purchased under ship operations Cooperative Agreements): i as part of the Shipboard Scientific Support Equipment program, or; ii. as a separate Oceanographic Instrumentation proposal. For the most part there is consistency within and between these programs regarding what is and is not allowable. However, we noted several instances of requests being rejected from one program as inappropriate, and being redirected to another program. Comments such as "*The panel felt that shipboard computers should be replaced as they become obsolete through ship operations*" appear somewhat arbitrary and reflective of a need for even clearer guidance. Recognizing that there will always be some confusion in this regard, the number of such "redirections" is reflective of a misunderstanding across the community about the guidelines for submission of equipment/instrumentation requests. NSF needs to provide a clearer definition of the relevant criteria and delimiting factors for submission of such requests to each of the three relevant programs.

In reviewing Ship Operations proposals, it was also clear that there were large variations in expectations for allowable levels of support, both shipboard and on shore, that were required to sustain marine operations. The variation in expectations appeared to produce some contention. Clearer guidelines would allow operators to identify areas where additional documentation would be required to justify enhanced support levels.

- *Documentation of Program Decisions.* Review of the proposal jackets found that program decisions were generally well documented. When questions arose regarding decision making, the missing component was usually identified as information that was passed on to proposers or awardees during an informal contact. Diary notations of such contacts would greatly increase the “readability” of program jackets. The previous COV (1997) made a similar comment.

Future Emphases:

- *Program Structure.* The COV recognizes and commends the Ocean Science Facilities programs for their community-oriented perspective in prioritizing platforms, support and instrumentation. This approach has worked superbly to provide the U.S. oceanographic community with the unquestioned leading sea-going capabilities for academic research. The issue at hand is whether the current management and funding paradigms will be suitable for emerging trends in oceanographic observational platforms and capabilities. The Facilities Programs under review have a traditional focus primarily on ships and the National Deep Submergence Facility. The programs under review make access to major ship based facilities nearly transparent for scientists with NSF funded research programs.

Looking at the developmental efforts within the science programs at NSF and other funding agencies, it is apparent that within just a few years the oceanographic community will also be using a range of additional platforms and sensors on a community-wide basis. These platforms may include drifters, gliders, cabled observatories, remotely operated vehicles, and shallow depth submersibles, as just a few examples. These systems do not currently fit comfortably for support within either the science programs or operations programs. The challenge for NSF is to position its programs (both acquisition of instrumentation and operational support) to support these whole new classes of community-based platforms, sensors and systems. Mechanisms are generally not in place to enable coupled support between science proposals and new facilities, as now exists to couple support between science proposals and ships. Consideration should be given to developing a parallel program to enable such transparent coupling, as has recently been done with the Ocean Bottom Seismometer pool. Should these be supported through a diversification of UNOLS responsibilities? Should NSF define new program areas to support these emerging capabilities? Can the current resources support these new capabilities in addition to the existing set of platforms and facilities? We recommend that the Ocean Sciences Division define this set of emerging community observational capabilities and develop a strategy for their procurement, management and support.

FY2002 COV REPORT TEMPLATE

Quality and Effectiveness of Merit Review:

Is the review mechanism appropriate?

As described within program proposal jackets, intrinsic intellectual merit is not the primary review criterion of proposals managed by the Facilities programs, since there is separate review, in appropriate disciplinary programs, of research proposals that used these facilities. The expectation that proposed facility operations and improvements will meet the technical needs of the separately-funded researchers, however, is a part of the review process, as is the history of quality support provided by the PI and his/her group. To that degree, technical merit is a criterion. This criterion is applied in essentially 100% of the proposals that were examined. Primarily, however, evaluation is based on the second review criterion of broader impacts.

Is the review process efficient and effective?

Each program has adapted a flexible proposal merit review process that is appropriately scaled to their needs. In general, as described in proposal jackets, intrinsic intellectual merit is not the primary review criterion for facilities. Instead, there is a separate intellectual merit review, in appropriate disciplinary programs, of research proposals that use these facilities. Proposals submitted to these programs are reviewed, by mechanisms generally appropriate to each program, for their appropriateness in enhancing the scientific capabilities and productivity of the facilities. These reviews focus primarily on Criterion II of the review guidelines, therefore. However, it is clear from examining the program jackets that when intellectual merit review of a broader nature is appropriate, that such review is instituted. These reviews often consist of large numbers of mail reviews by a diverse set of reviewers, followed by a special panel.

Is the time to decision appropriate?

The programs have adopted the practice of funding proposals based upon estimated costs at the beginning of the year in order to assure funds are available to keep the fleet operating without interruption. Thus, the decisions are made in an appropriate timeframe, considering the unique nature of the support.

Is the documentation for recommendations complete?

Review of the proposal jackets found that program decisions were generally well documented. When questions arose regarding decision making, the missing component was usually identified as information that was passed on to proposers or awardees during an informal contact. Diary notations of such contacts would greatly increase the “readability” of program jackets.

Are the reviews consistent with priorities and criteria in the program's solicitations, announcements and guidelines?

In some cases, additional guidelines for proposals may now help clarify allowable costs and help define reasonable expectations for the level of operational support

needed to sustain ship operations in normal circumstances. In particular, there appears to be some confusion regarding guidelines for submission of proposals for instrumentation and equipment, in spite of NSF's good efforts to clarify the program constraints. Effectively, each institution has two different opportunities for proposing purchase of equipment and/or instrumentation defined by NSF as items costing over \$5,000 (supplies such as personal computers, can also be purchased under ship operations Cooperative Agreement): i. as part of the Shipboard Scientific Support Equipment program, or; ii. as a separate Oceanographic Instrumentation proposal. For the most part there is consistency within and between these programs regarding what is and is not allowable. However, we noted many instances of requests being rejected from one program as inappropriate, and being redirected to another program. Comments such as *"The panel felt that shipboard computers should be replaced as they become obsolete through ship operations"* appear somewhat arbitrary and reflective of a need for even clearer guidance. Recognizing that there will always be some confusion in this regard, the number of such "redirections" is reflective of a misunderstanding across the community about the guidelines for submission of equipment/instrumentation requests. NSF needs to provide a clearer definition of the relevant criteria and delimiting factors for submission of such requests to each of the three relevant programs.

Implementation of NSF Merit Review Criteria:

Not applicable to facility.

Selection of Reviewers:

Did the program make use of an adequate number of reviewers for a balanced review?

Programs appeared to appropriately scale the number of reviewers to proposal size. Large facility proposals had eight or more reviewers, while Oceanographic Instrumentation proposals typically had three to five.

Did the program make use of reviewers having appropriate expertise and/or qualifications?

A good balance of reviewers was used. Proposals for large facilities, such as NOSAMS, used a range of reviewers including those with expertise in technology, as well as a selection of reviewers that made use of the data generated by the facility. Oceanographic instrumentation proposals included users from a variety of ocean science disciplines to cover the range of instrumentation included in each proposal.

Did the program make appropriate use of reviewers to reflect balance among characteristics....?

We noted that reviewers were used from academic, industrial and Federal backgrounds. These reviewers had an appropriate balance between national and regional interests. We did not find information readily available regarding diversity of reviewers.

Did the program recognize and resolve conflicts of interest when appropriate?

We noted that several potential conflicts of interest were identified in proposal reviews and, in some cases, those reviews were flagged and not used by the panel. We did not note any cases of obvious conflict of interest, and which were not identified.

Did the program provide adequate documentation to justify actions taken?

For the most part, there is very good documentation. In some cases, however, dealing with proposal administration, verbal requests made under Cooperative Agreements should also be documented in writing. This was also noted by the previous COV.

Resulting Portfolio of Awards:

Overall quality of research

The COV finds that the programs under review provide outstanding support for the research programs funded by the Division of Ocean Sciences and, in general, for research programs funded by a spectrum of Federal agencies. These sea-going facilities provide the platforms on which the bulk of this Nation's academic oceanographic research is performed. Research conducted on UNOLS ships contributes to the fundamental base of knowledge on which we build our understanding of interannual changes in climate, formation of tropical storms, the structure of the deep-earth, fisheries management, global biogeochemical cycles and virtually all other basic understanding of the ocean systems. Educational programs make extensive use of the fleet through programs such as "Dive and Discover" and "REVEL".

Are awards appropriate in size and duration for the scope of the projects?

Yes. Ship operations function under 5 year Cooperative Agreements that are negotiated each year at a level to support only the number of sea days required by the funded disciplinary research programs that use each ship. The Shipboard Instrumentation proposals are generally funded for 1 year, but we noted several instances where proposal duration was extended when "complicated" equipment acquisitions were anticipated. The Oceanographic Technical Services program funds at 3 year intervals, which is appropriate to maintain high quality technical support groups for the ships, while still being responsive to fluctuations in ship usage.

Does the program have an appropriate balance of:

- *high risk proposals*
- *multidisciplinary proposals*
- *innovative proposals*

These questions are not generally applicable to the Facility, as they respond to basic needs of the disciplinary science programs.

What percentage of projects address the integration of research and education?
These questions are not generally applicable to the Facility, as they respond to basic needs of the disciplinary science programs.

Tools Indicators:

Provision of facilities, databases or other infrastructure that enable discovery or enhance productivity by NSF research or education communities:

Yes, the basic function of this program is to provide facilities for access to the ocean that are used to enable discovery. Management systems developed by these programs enhance productivity by transparently coupling science proposals to facilities access via the ships of the UNOLS fleet. The programs have done an excellent job in terms of providing these ship board facilities. As noted in the review, one challenge facing the Ocean Facilities programs will be to develop similar mechanisms that provide equivalent access for the variety of major facilities that are being enabled by new technologies.

Provision of broadly accessible facilities, databases or other infrastructure that are widely shared by NSF research or education communities:

The basic function of this program is to provide facilities for access to the ocean that are widely shared. These facilities range from the Academic Research Fleet to the National Ocean Science Accelerator Mass Spectrometer to operational items such as the wire pool. The program does an excellent job in this regard.

Partnerships, e.g., with other federal agencies, national laboratories, or other nations to support and enable development of large facilities and infrastructure projects:

The operation of the Academic Research Fleet, through UNOLS, ensures that there are effective partnerships with the spectrum of Federal agencies (NOAA, NASA, NAVY/ONR, USGS, MMS, EPA, etc.) that use oceanographic research facilities. These partnerships extend from operation of the fleet through planning activities supported by UNOLS and the Federal Oceanographic Facilities Committee. The programs are also supporting development of the Iridium satellite communications network to extend high bandwidth data communications to the oceans.

Use of the Internet to make SMET information available to the NSF research or education communities:

The SEANET program is one excellent example of using the Internet to make SMET information available from ships at sea. This information is used for research and educational purposes.

Development, management, or utilization of very large data sets and information-bases:

Not applicable.

Development of information and policy analyses that contribute to the effective use of science and engineering resources:

The programs support extensive planning and policy activities, through UNOLS and the Federal Oceanographic Facilities Committee, to ensure that effective use of the fleet is made.

Appendix A:

Documents Provided to the COV

Division of Ocean Sciences (OCE): Proposal Submission Guidelines for Research Ship Operations, Instrumentation and Equipment, and Technical Services Support. NSF 00-39.

Cowles, T., L. Atkinson, J. Bash, J. Bellingham, M. Benfield, A. DeSilva, B. Hales, D. Hebert, R. Knox, M. Levine, C. Measures, S. Pegau, B. Sherr, E. Sherr, W. Smethie, Y. Spitz, and P. Wiebe. 2001. *Assessment of Future Science Needs in the Context of the Academic Oceanographic Fleet*. A Report Submitted to the National Science Foundation. Corvallis, Oregon. 18pp.

Fleet Review Committee, 1999. *The Academic Research Fleet: A Report to the Assistant Director for Geosciences by the Fleet Review Committee*. 85 pp.

FOFC Report, 2001. *Charting the Future for the National Academic Research Fleet: A Long-Range Plan for Renewal*. A Report from the Federal Oceanographic Facilities Committee (FOFC) of the National Oceanographic Partnership Program (NOPP) to the National Ocean Research Leadership Council (NORLC). 32 pp.

The DESCEND Workshop Committee, 2000. *Discovering the Oceans: Developing Submergence Science for the Next Decade (DESCEND)*. An Executive Summary from the UNOLS Workshop. 8pp.

Report of a Committee of Visitors for Oversight Review of the National Science Foundation Oceanographic Centers and Facilities Section (OCFS). October 1997. A Report Submitted to the Advisory Committee for Geosciences, National Science Foundation.

Response to Recommendations in the Committee of Visitors Report of the Oceanographic Centers and Facilities Section. October, 1997. A Report Prepared by Don Heinrichs, Division of Ocean Sciences, National Science Foundation.

OCE Facilities Program Descriptions: Ship Operations, Oceanographic Instrumentation and Technical Services, Shipboard Scientific Support Equipment, Ship Acquisition and Upgrade, and Miscellaneous Activities.

R/V Kilo Moana (AGOR 26) Oceanographic Research Ship Brochure.

2001 OCE Facilities Proposal Listing

Figures And Tables Provided to the COV:

Figure 1:

Fleet operating days as a function of a “full operating year” (as defined in the FOFC fleet renewal plan).

Figure 2:

Annual average number of operating days by ship (larger than 40m), 2000 – 2002.

Figure 3:

Percentage of total annual ship operating days apportioned between agencies, 1996-2002.

Figure 4:

Total academic fleet operating days (ships over 40m) over 14 years.

Figure 5:

NSF ship utilization percentage by OCE Programs (including OPP) across the fleet over 40m.

Figures 6 a, b, and c:

Ship utilization of NSF programs by ship class size. (a) Regional ships under 40m (130 feet), (b) intermediate ships 40 – 60m (130 – 200 feet) and (c) Global ships above 70m (240 feet).

Figure 7:

The funds requested vs. NSF-awarded funds for ship operations over the most recent 3 years.

Figures 8a and b:

Budgets over 10 years for the Facilities Programs, (a) for total ship operations and all other programs, and (b) for all other programs individually.

Table 1a and b:

The amount of Ocean Sciences Division funds directed to the top 10 funded institutions from 1996-2001, (a) across the Division, (b) Facilities only.

Table 2 a and b:

The “day rate” for (a) technical services, and (b) ship operations for 2001 and 2002 across the fleet.

Table 3:

Operating cost (NSF contribution) for ships over 40m as a percentage of the total NSF fleet operating cost.