2006 Committee of Visitors Report for the NSF Ocean Sciences Division

Date of COV: June 26-28, 2006
Programs: Ocean and Marine Geosciences Sections; Ocean Technology and Interdisciplinary Coordination Program; Ocean Sciences Education Program
Division: Ocean Sciences
Directorate: Geosciences

Committee Membership:

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Michael R. Roman, Co-Chair, University of Maryland
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1.Overview of Findings and Recommendations

Integrity and Efficiency of Program's Process and Management. The National Science Foundation (NSF) Ocean Sciences Division (OCE) Committee of Visitors (COV) finds that the research programs in the Ocean and Marine Geosciences Sections, the Ocean Technology and Interdisciplinary Coordination (OTIC) Program and the Ocean Sciences Education Program are well managed and support innovative, high quality science and education projects. The OCE management team members are high quality, dedicated and capable individuals doing an excellent job in facilitating and managing oceanographic research and education. These individuals should be lauded for their collegiality and cross-disciplinary communication. Deserving special mention is Larry Clark, who provided critical leadership in his tenure as Acting Division Director of OCE.

OCE processes approximately 1600 proposals per year, obtains at least three mail reviews for each proposal and conducts panel reviews for 86% of the submitted proposals to the science sections. Over the last three years 79-87% of submitted proposals are fully reviewed and processed within six months of receipt. Our review of 126 proposal "eJackets"(electronic files) and hard copy files indicates that in most cases, program directors provide a clear rationale for their funding decisions and that the PIs receive constructive comments on their proposals. Often the hard copy files had more comprehensive information regarding the funding decisions. It was noted that after a proposal was declined, the hard copy files are destroyed, thus making it sometimes difficult for the COV to reconstruct the decision process for declines. The recently implemented eJackets include a "review analysis" which is an overview of the review process and review decision for each proposal. These easily assessable electronic files were particularly helpful to the COV in our review of the funding decisions.

The COV felt that there was usually appropriate, but sometimes inconsistent review and feedback on the intellectual merit criterion and improving review and feedback on the broader impacts criterion. While broader impacts are increasingly assessed and evaluated as an essential component of proposals, the COV reiterates that intellectual merit is the more important criterion for selection of research awards.

The OCE proposal success rates for PIs from different subsets (women, men, minority, new PI and prior PI) ranged between 20 and 25%. Composition of mail reviewers and panel members was not reported statistically, but the COV noted no specific biases in their reading the eJackets.

Results of NSF Investments. The research NSF/OCE has supported in biological, chemical and physical oceanography, marine geosciences, ocean science education, and ocean technology and instrumentation has fostered a vibrant and innovative scientific community. A number of exciting new research directions have emerged in the past few years in areas such as marine microbiology, ecosystem processes, abrupt climate change, ocean mixing and mantle dynamics. Oceanography is a highly interdisciplinary science and OCE has supported a large number of interdisciplinary projects through programs such as GLOBEC, RIDGE, CoOP, OCCC, SOLAS, CLIVAR, ESH, MESH and MARGINS as well as through its participation in NSF-wide (e.g. Biocomplexity) and GEO-wide (e.g. Biogeosciences, Water Cycle) programs. The Division is also the U.S. host and collaborates with Japan in the Integrated Ocean Drilling Program (IODP). OCE provides all the U.S. funding, which amounts to about 60% of the support for the Scientific Ocean Drilling programs. The U.S. component of IODP includes funding through the Major Research Equipment Facilities Construction (MREFC) account for the refit of the Scientific Ocean Drilling Vessel. The Division invests substantially in developing new ocean technology and instrumentation. Major accomplishments in this area include the development of new sensors for in situ biological and chemical measurements, gliders and autonomous vehicles for remote characterization of ocean and seafloor properties, and a new generation of mooring technology. The Ocean Sciences Division has been very successful with funding for initiatives through the MREFC account including the

Scientific Ocean Drilling Vessel (SODV), Ocean Observatories Initiative (OOI), and the Alaska Region Research Vessel (AARV). These new initiatives put considerable pressure on basic core funding of research.

Many OCE funded scientists have received prestigious awards made possible through their exemplary scientific work funded through the Division of Ocean Sciences at NSF. These include several elected to the National Academy of Sciences: David Karl, Charlie Langmuir, Don Forsyth, and Marcia McNutt. OCE – funded scientists recently elected Fellows of the American Geophysical Union include: Tommy Dickey, Paul Quay, Paola Malanotte Rizzoli, Lynne Talley, Robert Thunell, Robert F. Anderson, Ken W. Bruland, Devendra Lal, François M. M. Morel, John R. Toggweiler William Curry, Margaret Delaney, Steven Emerson, Joseph Prospero, Sharon Smith, John Toole, and Edward Winterer.

Recommendations. OCE provides approximately 70% of the federal funding for academic ocean research. OCE should continue to emphasize basic research rather than mission-oriented science, since NSF remains the primary agency that funds disciplinary basic research in the Ocean Sciences. As the research awards, innovative ideas, and new technologies highlighted in section B illustrate, this basic research funded by the core areas of OCE is vital to the progress of oceanography. Starting in 2003 there has been a decrease in core funding in Biological Oceanography (BO), Chemical Oceanography (CO), Physical Oceanography (PO), and Marine Geology and Geophysics (MG&G). Growth in the core funds is essential for the mission of OCE and the health of the ocean science community. Increasing facility costs are impacting core funding. It is critical for NSF/OCE to retain flexibility in its ability to fund core science.

Growth in the education programs in which OCE participates is exemplary and essential for recruiting the next generation of oceanographers. More interactions between the education and research programs at OCE would enhance the broader impacts of the research. Alignment of Ocean Sciences Education so that the education and research programs are within the same section may facilitate this enhanced interaction.

The COV was concerned about inconsistencies in the substantive content of the mail reviews, panel reviews, and the review analyses among the different sections. Substantive content in the review process is needed by all parties to evaluate and make informed and wise funding decisions that are readily understandable and explainable to all involved. Generally the content of the review documents in the BO, CO and PO programs were noted by the COV as being complete and thorough. In much of the MG&G proposal documentation reviewed by the COV, however, it was difficult to reconcile the funding decision with the review analyses that were included in the proposal eJackets and paper jackets. Another concern of the COV is the different practices among the research programs in the Ocean and the Marine Geosciences Sections with regard to the resubmission of declined proposals. Whereas the BO, CO and PO programs discourage repeated proposal submissions without substantial revision and prior contact with the program directors, the MG&G program appears to have a significantly higher number of resubmissions of the same proposal with minor revisions. This puts a substantial burden on the mail reviewers, panel reviewers, and NSF staff. Closer alignment of BO, CO and PO and MG&G may encourage and facilitate uniformity in the review process as well as foster more interdisciplinary initiatives among all the oceanography research programs.

IPAs are vital to the Ocean Sciences Division in providing input from the oceanographic community, suggesting new reviewers, and processing proposals. In continuing to recruit high quality IPAs, more information needs to be given during the recruitment phase regarding travel to home institutions to continue ongoing research activities, and research funding opportunities after the IPAs complete their rotation. Also needed is additional training and guidance upon arrival.

Similar to comments made in the 2003 OCE-COV report, there were a number of questions asked in the NSF COV template that could not be answered because their were no metrics to quantify the result. OCE should strive to flag funded proposals that are innovative/high-risk as well as multidisciplinary so that the next COV can better assess the portfolio of OCE awards.

2. COV Review Process

The COV for NSF's Ocean Sciences Division met at NSF on June 26-28, 2006 to review programs in the Division's Marine Geosciences (MG) Section, the Ocean Technology and Interdisciplinary Coordination (OTIC) program, the Ocean Sciences Education program, and the Ocean Section (OS).

The meeting began with an overview of the COV process and the NSF conflict of interest policy. Larry Clark provided a clear and informative overview of the Division's research and education programs in context with the other divisions in the OCE directorate. He presented a set of figures with information on OCE program budgets and proposal statistics for the period 1998-2005. On the afternoon of the first day, the COV divided into two subgroups to hear presentations on program performance and results over the review period (2003-2006) from the program directors of the Ocean Section and Marine Geosciences Section. These program directors were David Garrison (BO), Donald Rice (CO), Eric Itsweire (PO) Gisele Muller-Parker and Lisa Rom (Ocean Sciences Education) and Rodey Batiza (Ocean Drilling Program). No program directors from MG&G participated in the COV review process. On the 2nd day of the meeting, the COV met with the OTIC program director, Alexandra Isern. On the 2nd day the COV also held separate meetings with the Division's program directors, IPAs, and two section heads (Larry Clark and Rodey Batiza) and Division Director (Julie Morris) in order to obtain their perspective on the management and operation of the Division's research and education programs. In addition to these presentations and meetings, the COV divided into groups for the review of 126 proposal eJackets and when necessary, paper jackets, submitted to the programs under review during the period 2003-2005. The committee as a whole discussed the results of these eJjacket reviews during the preparation of its report.

This COV report follows NSF's recommended format for 2006, including core questions for Parts A, B and C of the review template. These questions address the efficiency and integrity of the program's proposal processing and management, and the outcome of these investments in terms of NSF's goals in People, Ideas and Tools. We have completed the template based on an evaluation of the Division's research programs as a whole. This report also includes a summary of the Division's response to the last COV report (in 2003).

The COV wishes to thank the program management and staff, especially Brian Midson and Kandace Binkley, for their assistance in assembling the background proposal and budget information necessary for the COV to do their work and Brian Midson's technical assistance during the meeting.

3. Response to the 2003 Committee of Visitors Report

The 2003 COV made ten recommendations intended to improve the efficiency of the review process and outputs of NSF-OCE.

1. The Division is strongly encouraged to increase the number of permanent program directors and/or IPAs to reduce the workload on the existing staff. Increasing the number of Science Assistants in the Division would also help reduce the burden on program management.

OCE is at 105% of the allotted FTEs from NSF. The COV sees improvement with additional staff added recently, however, to maintain program quality, including improved interactions with PIs, program planning and coordination and interactions with other branches of NSF, additional staff would be helpful. The addition of Bill Lang to assist with environmental permitting and concerns is considered an essential recent hire for the Division.

2. A re-examination by NSF, and the home institutions of IPAs, of the financial and career incentives they provide to facilitate the recruitment of the highest quality individuals into IPA positions.

This remains a concern of the COV. See our recommendations.

3. A re-evaluation by the Division of the mix of expertise required on the support staff, as well as staff training needs, in light of the move toward electronic proposal processing.

OCE has added expertise in electronic proposal processing. As some support staff leave OCE, personnel with greater IT skills should be hired.

4. Clarifying for investigators and reviewers the variety of ways review criterion 2 can be met.

This recommendation was implemented in several ways, including town hall discussions at national meetings. PIs and reviewers still have some difficulty in addressing and evaluating criterion 2.

5. Encouraging OCE program directors to increase the utilization of SGER grants for funding small, high-risk, or rapid response, proposals and publicizing this opportunity to investigators**.**

The COV realizes that SGER grants are for funding special opportunities requiring a rapid response (weather disasters, ships of opportunity) and not necessarily high-risk/innovative research. SGER grant opportunities have been publicized by OCE.

6. Providing sufficient travel funds for program directors to attend meetings, workshops, and institutions to meet with investigators, especially young investigators.

The COV realizes that with the increasing responsibilities of processing proposals and interacting with other branches of NSF, increased travel by program directors would not be possible without additional staff. For some program directors limited time is a more significant factor than limited funds.

7. Continue to encourage and facilitate participation of under-represented groups in ocean research programs.

This recommendation has been implemented, for example through, ADVANCE (a program is to increase the representation and advancement of women in academic science and engineering careers) and MPOWIR (Mentoring Physical Oceanography Women to Increase Retention). Additional efforts are warranted due to the low number of scientists from under-represented groups in the OCE community.

8. Securing a significant increase in funding for ocean drilling and ocean observatory-related research in order to fully realize the potential of the major infrastructure investments the Division will be making in these areas over the next few years.

With increases in funding for ocean drilling and ocean observatory facilities, commensurate growth in research funding is needed and has yet to be realized. The Division's success with funding from the MREFC account for the SODV, the OOI and the AARV puts additional pressure on core research funding. Additional research base funding will be required to support these new facilities.

9. Placing a greater emphasis on compiling and publicizing major scientific achievements that result from NSF research support.

This recommendation is currently being implemented and should continue.

10. Increasing the efficiency of the COV process by providing the next COV with a written Division overview and a more complete set of information on proposals and funding history.

This recommendation was implemented. The proposal review analyses in the eJackets were informative in this COV review. Some statistics were still not available for the COV to answer all the questions in the template, specifically no coding exists for innovative, high-risk, or multidisciplinary proposals.

Response to other general comments and findings from the COV

The 2003 COV found that the panel summaries were often cursory and should be more complete to help the PI understand the basis for the panel's recommendation.

This still occurs in panel reviews, most often observed in MG&G. Panel reviewers writing summaries need uniform guidance in preparing the statements.

Investigate the possibility of implementing an automated reminder system for proposal reviewers.

This recommendation was implemented.

Pursue more integrated, multidisciplinary climate studies.

OCE has the OCCC, SOLAS, CLIVAR, ESH and MESH programs.

Develop a risk metric (e.g. new kind of experiment or instrument), and provide this information to the next COV.

This recommendation was not implemented.

Need an NSF-wide database of reviewer assignments.

The database exists but in it not clear that program directors use it.

FY 2006 REPORT TEMPLATE FOR
NSF COMMITTEES OF VISITORS (COVs)

The table below should be completed by program staff.

Date of COV: June 26, 2006 – June 28, 2006
Program/Cluster/Section: Ocean Section, Marine Geosciences Section, Ocean Technology and Interdisciplinary Program, and Ocean Sciences Education Program
Division: Ocean Sciences
Directorate: Geosciences
Number of actions reviewed: 126 Awards: 59 Declinations: 64 Other: 3
Total number of actions within Program/Cluster/Division during period under review: 2837 Awards: 709 Declinations: 1992 Other: 158
Manner in which reviewed actions were selected: **Highly-ranked declines** **Low-ranked awards** **Actions with high variability between mail review and panel review scores**

PART A. INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

A.1 Questions about the quality and effectiveness of the program's use of merit review procedures.

Provide comments in the space below the question. Discuss areas of concern in the space provided.

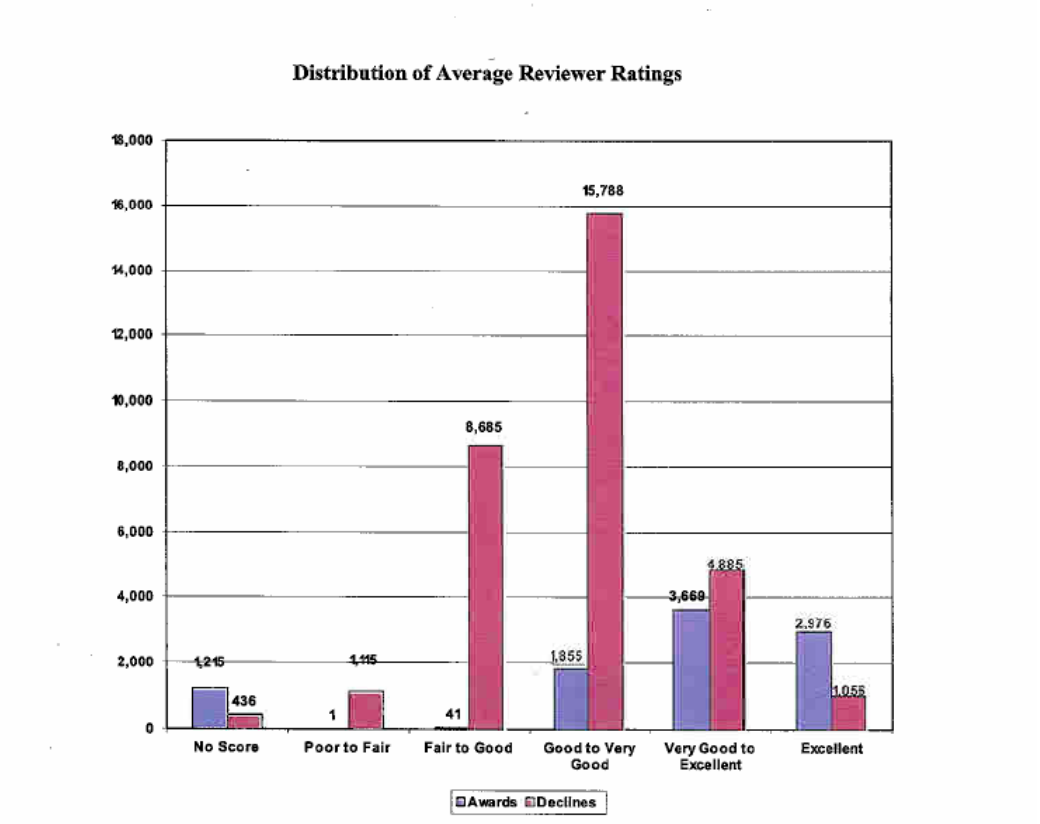
QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[1]
1. Is the review mechanism appropriate? (panels, ad hoc reviews, site visits) Comments: We find that the present procedures for handling proposals are appropriate. We commend the Division for their practice of reviewing proposals via mail reviews	Yes

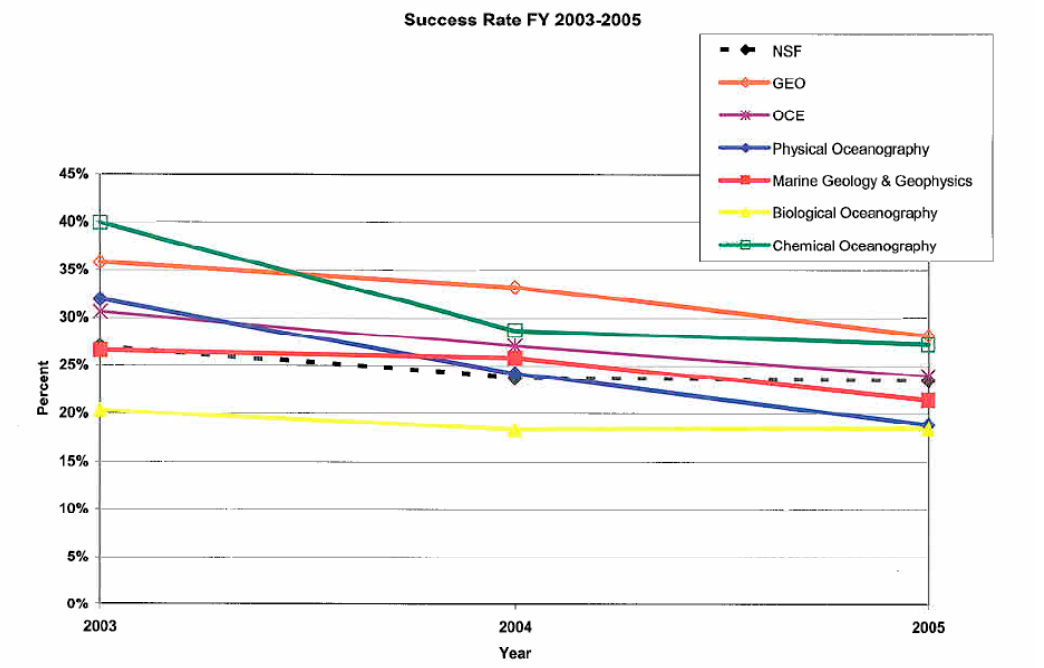
[1] If "Not Applicable" please explain why in the "Comments" section.

and panels (apart from programs that handle small numbers of highly specialized proposals). Site visits by programs (the COSEE program is the exception) are generally not conducted due to workload and time constraints, and the large number and wide geographic distribution of institutions funded by the Division. To address this absence, the Division welcomes visits from PIs. The COV was pleased to learn that travel resources have been increased to allow program directors to attend workshops and meetings to meet with PIs.	
2. Is the review process efficient and effective? Comments: Generally, the COV found that the review process was efficient and effective, especially given the high volume (about 1600 per year) of proposals handled by the Division, but noted that there is room for improvement. For the most part, proposal return rates have been relatively stable for the past three years. The effectiveness of the review process, notably in MG&G, may suffer due to the number of proposals submitted more than three times. The COV noted that one program in the Division requires the PIs to receive permission to resubmit the same proposal three or more times, which may reduce the workload on both the program directors and the community of reviewers that NSF relies upon. This practice may reduce the number of proposals that are quickly resubmitted by PIs, often with insufficient time to address substantive review comments, within the short interval between the declination of a proposal and the next proposal deadline. The COV recommends that the Division consider whether a more uniform resubmission practices would be helpful to the community.	Yes
3. Do the individual reviews (either mail or panel) provide sufficient information for the principal investigator(s) to understand the basis for the reviewer's recommendation? Comments: After reviewing a total of 126 jackets (for roughly 70 different projects, as many were collaborative), the COV found the information provided by the mail reviews and panels concerning the intellectual merit of proposals (criterion 1) was usually adequate and in many cases exemplary, whereas the information provided regarding broader impacts (criterion 2) was considered marginally adequate with room for improvement. Although many reviewers provide very detailed and constructive reviews, the COV notes that the quality of mail reviews is variable: many remain too cursory to provide justification for the score the reviewer assigned to the proposal. However, the COV is sympathetic to the fact that this problem is difficult for the Division to resolve by itself, and may require the reviewer community to recognize and address this issue. The increasing proposal review load may contribute to, or exacerbate this problem, so that measures to reduce the proposal review burden may improve the quality and consistency of mail reviews. Such measures may include a greater emphasis on increasing the size of the reviewer pool, decreasing the number of times a proposal may be reviewed without significant revision, requesting clarification of questions raised in mail and	Yes, but with varying quality

panel reviews instead of proposal resubmittal, and actively discouraging proposals that are not competitive.

The context of average reviewer ratings for FY 2005 given below for awards and declines would be useful for PIs as well as the overall information regarding proposal success rate.





4. Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation? Comments: Although some panel summaries provided detailed information for the PIs, the quality of the panel summaries varied significantly within the Division. The COV noted that many panel summaries contained in the eJackets reviewed were often rather cursory, uninformative, and unhelpful. Generally, the COV found that the Ocean Section panel summaries were the most useful to the PI and the MG&G panel summaries were the least useful to a PI. The COV noted that panel member written summaries can lead to an extreme range in the quality of these summaries. The COV recommends that at panel meetings, detailed instructions be given both orally and in writing to panel members on how to write the panel summaries, emphasizing the great value of the summaries to the PI in explaining the strengths and weaknesses of the proposals.	Not Always
5. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation? Comments: The COV noted that the documentation of the quality of information and feedback provided to the PIs varied strongly within the Division. In general, the COV felt that the Ocean Section provided documentation in the eJacket (review	Not Always

analyses, program director summaries, etc.) that clearly stated the program director's reasons for an award or decline decision. The COV also felt the same way about Ocean Drilling Program and Ocean Sciences Education proposals. However, the COV determined that the quality of feedback to the PIs present in the mail reviews, panel summaries, and program directors decision making process as documented in the eJackets for the MG&G section was often inadequate and needs improvement. The COV understands that the MG&G program directors directly communicate by phone or email with the PIs to explain the rationale for each funding decision. The COV applauds this, but notes that documenting constructive feedback, especially to younger PIs, is vital. The COV recommends that greater standardization of the quality and completeness of feedback to PIs continue to be a high priority, though it is currently variable among the sections.	
6. Is the time to decision appropriate? Comments: The COV considers the time to decision for the Ocean and Marine Geosciences sections, and the Oceanographic Technology and Interdisciplinary Coordination and Ocean Sciences Education program, to be excellent given the large number of submitted proposals. We note that proposals with a longer time to decision usually involve large interdisciplinary programs or ship scheduling issues. The COV appreciates the frustration on the part of PIs with delays in funding decisions for proposals involving ship time, but understands that the Division sometimes needs more time. In general, the COV commends program directors for clearly communicating to PIs the status of such proposals when delays for decisions are necessary.	Yes
7. Additional comments on the quality and effectiveness of the program's use of merit review procedures: The COV notes that the use of both mail and panel reviews by the Ocean and Marine Geoscience sections in making funding decisions for nearly all proposals is greatly appreciated by the community and distinguishes NSF from other agencies. Program directors were thoughtful and deliberative in resolving differences between mail and panel reviews. The COV found the new review analysis forms to be an especially valuable tool for evaluating the merit review process and program director decisions and strongly encourages their continued use and standardization of substantive content throughout the division. The COV noted that the merit review procedures used by most sections of the division were high in quality, but as noted above, the COV found a troubling a lack of uniformity and quality in the documentation of the reviews within the Division. The COV understands that in some sections the program directors personally email or call the PIs to explain the funding or decline decision, but phone calls and emails not documented in eJackets do not provide sufficient documentation of decisions.	

A.2 Questions concerning the implementation of the NSF Merit Review Criteria (intellectual merit and broader impacts) by reviewers and program officers.

Provide comments in the space below the question. Discuss issues or concerns in the space provided.

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[2]
1. Have the individual reviews (either mail or panel) addressed both merit review criteria? Comments: Mail and panel reviewers consistently address the intellectual merit criterion. The broader impacts criterion is less consistently addressed and there is need for the Division to reiterate the role of the broader impacts criterion in the review process. The COV notes considerable improvement in addressing broader impacts since the 2003 COV, but recommends additional emphasis and guidance for PIs and reviewers on the broader impacts criterion.	Yes, to a varying degree
2. Have the panel summaries addressed both merit review criteria? Comments: Panel summaries address the intellectual merit review criterion but vary significantly in the degree to which they address the broader impacts criterion. Uniform guidance for panel reviewers on the review criteria could be incorporated into panel instructions to increase the consistency of the review process.	Yes, to a varying degree
3. Have the *review analyses* (Form 7s) addressed both merit review criteria? Comments: The COV enthusiastically supports the review analyses concept, which unifies the various elements of the review process, justifies the program recommendation, and provides an "e-trail" of the proposal history. Inconsistencies in the degree to which the merit criteria are addressed by the individual and panel reviews are reflected in the review analyses.	Yes, to a varying degree

[2] In "Not Applicable" please explain why in the "Comments" section.

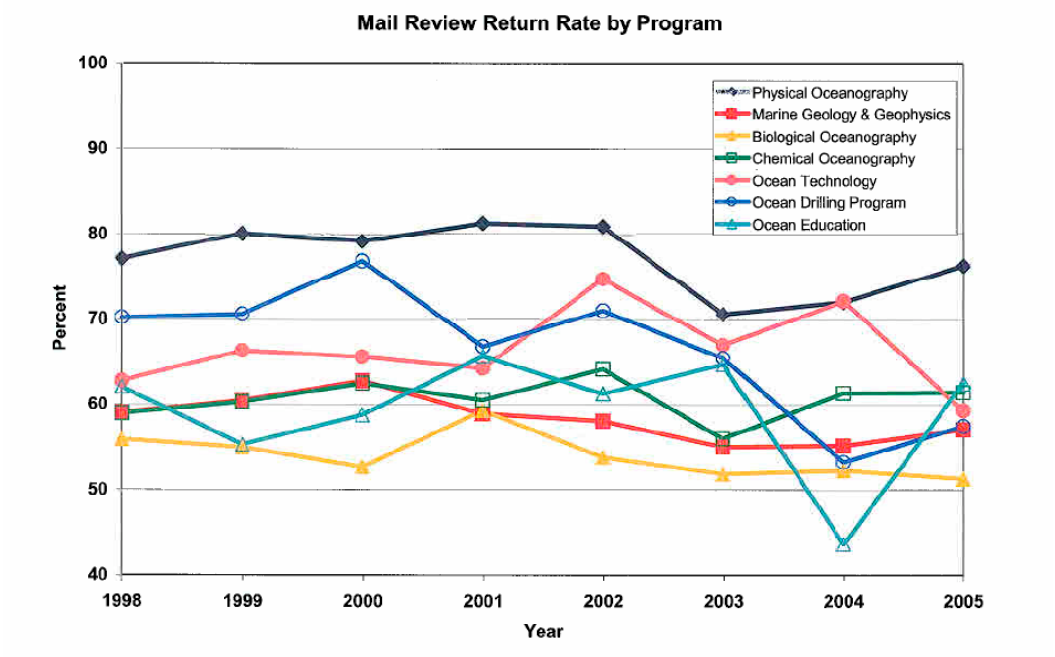
4. Additional comments with respect to implementation of NSF's merit review criteria:

The COV reiterates that intellectual merit must be the overriding criterion in determining which proposals to fund. Renewed emphasis on and clarification of the broader impacts criterion for PIs, individual reviewers, and panels will increase the impact of that criterion on the science supported by NSF. The COV finds the OCE implementation of NSF's merit review criteria is directly aligned with NSF's goals.

A.3 Questions concerning the selection of reviewers. Provide comments in the space below the question. Discuss areas of concern in the space provided.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE[3]
1. Did the program make use of an adequate number of reviewers? Comments: The NSF requirement of a minimum of three mail reviews per proposal appears to be met based on our eJacket reviews. Specific statistics on the number of reviews per proposal were not available. It was noted that some proposals had the minimum of three, while other proposals had a significantly higher number of reviews. There also appeared to be an inconsistency in the number of reviews requested for each individual proposal. Most proposals had more than three reviews and many were substantial, helpful, and insightful reviews for the principal investigators, the panel, and the program director. On average, eight reviews are requested for each proposal, but this number can vary considerably. In the 2003 COV, it was noted that proactive contact between program directors and reviewers results in a higher return rate of reviews. The number of proposals handled in some Programs might make this direct communications approach impractical. In response to the 2003 COV report, an automated, email follow-up communication to reviewers was initiated. The statistics in the figure below show that the percent of returns varies by Program, with the lowest return rates being in BO (~ 51%) and the highest percent returns being in PO (~ 76%), based on 2005 data.	Yes

[3] If "Not Applicable" please explain why in the "Comments" section.

	
2. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: Of the e-Jackets and hard copy project folders reviewed, the selections appear to have been well done, and the individuals appeared to be well qualified to be reviewing the proposals requested. It was noted in the 2003 COV that there appear to be a growing number of conflicts of interest between reviewers and proposals as more collaborative and multi-PI proposals are being submitted. We saw no indication that this issue has lessened during the 2006 COV review.	Yes
3. Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups?[4] Comments: There were insufficient data to evaluate this question. A question that arose was whether or not there was any overlap or consideration of the demographics of the submissions versus that of the mail reviewers or the panelists who evaluate proposals. Because of the voluntary nature of the review process, it is often not possible to get sufficient qualified reviewers that also meet regional criteria, gender balance, etc. It was also noted that review volunteers from some of the larger institutions are limited due to numerous conflicts of interest.	Unable to access

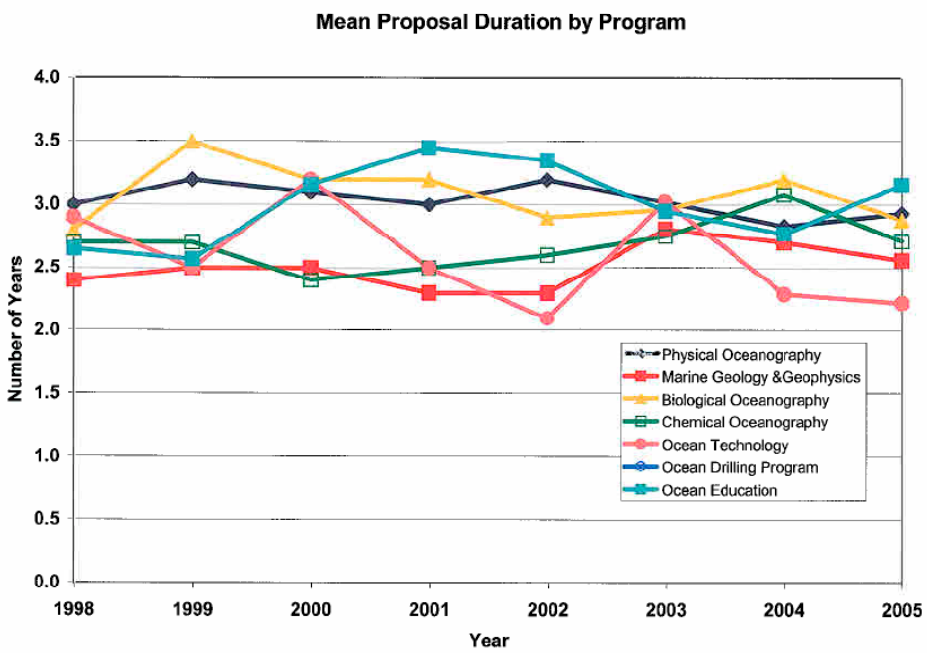
[4] Please note that less than 35 percent of reviewers report their demographics last fiscal year, so the data may be limited.

There is an awareness of the importance of trying to improve diversity of reviewers, while fulfilling the primary goal of finding enough review volunteers that have the appropriate scientific qualifications. It was noted that some programs have repeat panelists to provide a context from previous panel discussions and other programs have none.	
4. Did the program recognize and resolve conflicts of interest when appropriate? Comments: This is handled well in the programs. Panels address conflicts of interest in an appropriate fashion.	Yes
5. Additional comments on reviewer selection: Based on the discussions, it was generally felt that the increasing number of proposals submitted makes it more difficult to get adequate numbers of reviewers. There is a need to continue encouraging PI's to participate as reviewers. Especially important is to actively seek out new Ph.D.'s that are just entering their fields. IPAs bring in knowledge of colleagues to add as new reviewers.	

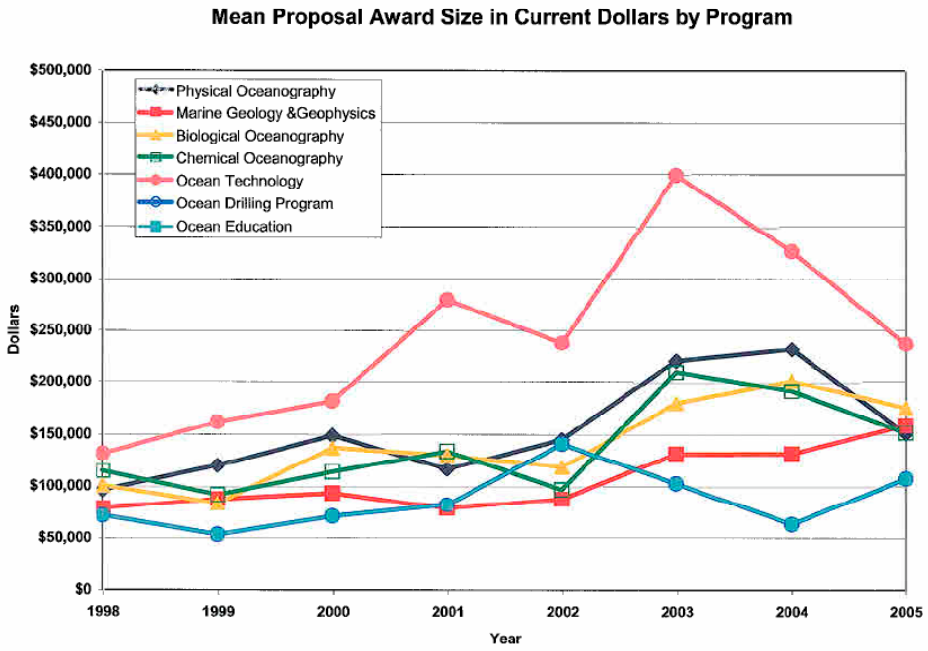
A.4 Questions concerning the resulting portfolio of awards under review. Provide comments in the space below the question. Discuss areas of concern in the space provided.

RESULTING PORTFOLIO OF AWARDS	APPROPRIATE, NOT APPROPRIATE[5], OR DATA NOT AVAILABLE
1. Overall quality of the research and/or education projects supported by the program. Comments: The COV did not have sufficient information to answer this question. From what we know and have seen, the quality of the work supported by OCE is high. While tracking of specific metrics might enable the COV to quantitatively answer this question, we are not suggesting any specific metrics. At the beginning of all submitted proposals there is a section on Results from Prior NSF Support. Reviewers take prior results into consideration as part of the overall evaluation of proposals. Thus, continued support of the majority of PIs is a measure that the quality of the research supported by OCE is quite high.	Data not available
2. Are awards appropriate in size and duration for the scope of the projects? Comments: The awards appear to be appropriate in size and duration for the scope of the projects funded that we reviewed. However, the downward trends are a concern, even though they are symptomatic of a declining budget for core OCE programs. Research grant durations have decreased from a maximum of 3.2 years in 2003 to about 2.95 years in 2005.	Appropriate

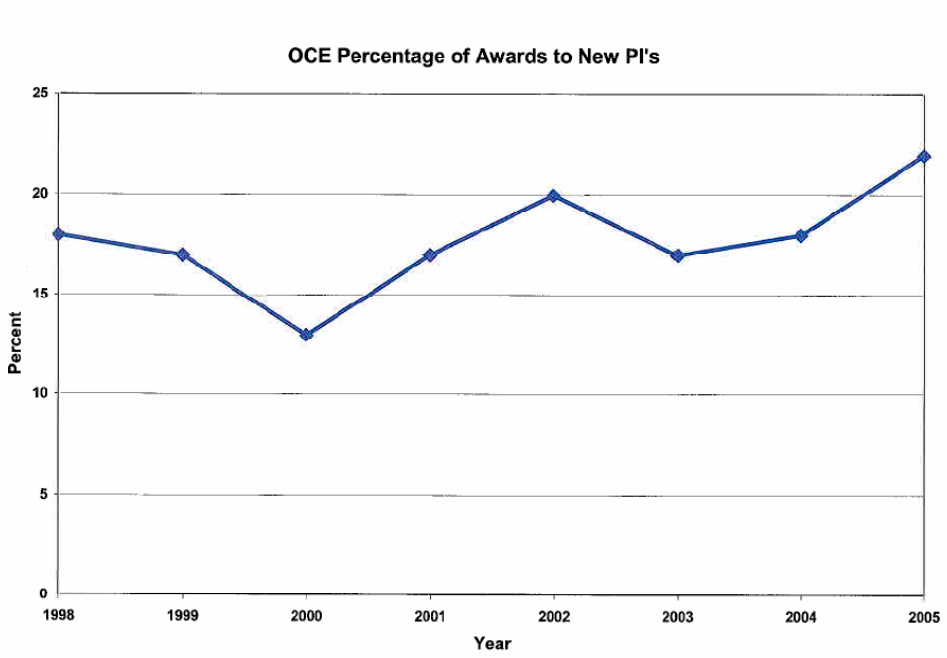
[5] If "Not Appropriate" please explain why in the "Comments" section.

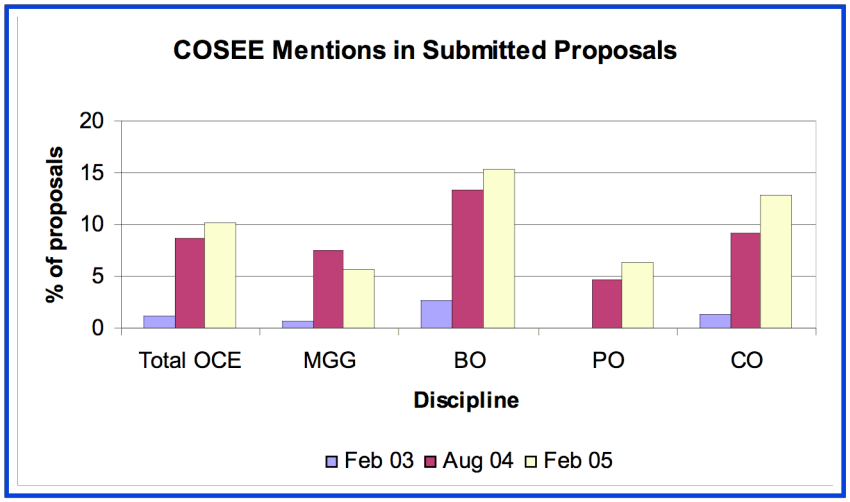


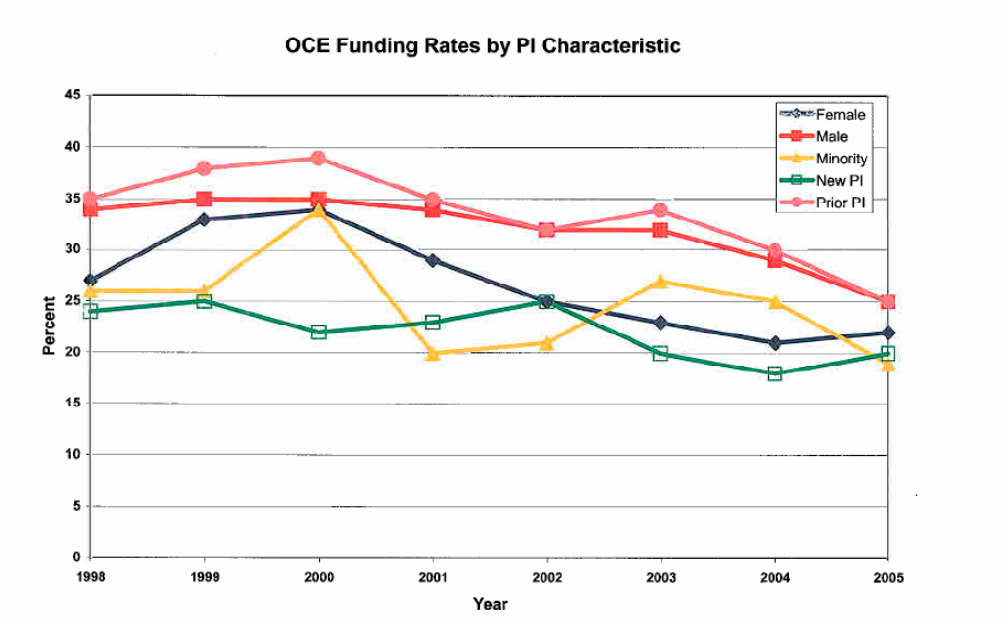
Decreasing duration is a concern as it implies more proposal pressure on OCE, more reviews for reviewers, and more proposal writing for PIs. Another concern is decreasing grant size. The annual mean proposal award size increased from 1998 through 2003, and has continued to increase slightly only for MG&G. The trend of decreasing award size in the research sections may be symptomatic of a general concern of the COV that core funding is diminishing and not keeping up with inflation (this is discussed elsewhere in the report). Another concern is that OTIC has made large commitments in terms of the Ocean Observatories Initiative (OOI), etc. However, a substantially decreasing award size for OTIC may signal a problem.

	
3. Does the program portfolio have an appropriate balance of: • Innovative/high-risk projects?[6] Comments: The COV did not have the information to answer this question. As suggested by the previous COV, it would be helpful if there were a definition of innovative/high risk research across OCE. In our review of 126 proposals, the COV noted one proposal being funded with low reviews but considered to be innovative/high risk. Note that we did not consider SGER grants as innovative/high risk as they are opportunistic. Nonetheless, SGER awards are appropriate to fund as rapid response awards.	Data not available
4. Does the program portfolio have an appropriate balance of: • Multidisciplinary projects? Comments: The COV has the sense that OCE is highly multidisciplinary both within OCE and across several directorates of NSF, and many such proposals are funded. The COV did not have quantitative information to answer this question. As suggested by the previous COV, it would be helpful if multidisciplinary proposals were coded. Examples of multidisciplinary work are microbiology of the deep biosphere in IODP, funding of paleoceanographic work in CO, funding of ocean-atmospheric interactions in PO, oceans and human health in BO, etc..	Appropriate

[6] For examples and concepts of high risk and innovation, please see Appendix III, p. 66 of the Report of the Advisory Committee for GPRA Performance Assessment, available at <www.nsf.gov/about/performance/acgpa/reports.jsp>.

5. Does the program portfolio have an appropriate balance of: • Funding for centers, groups and awards to individuals? Comments: The COV identified one Science and Technology Center as well as ten COSEEs in OCE. In addition there are many large collaborative proposals that appear to be appropriate and community driven. Of the more than 1000 proposals currently funded by OCE, roughly half are collaborative. This is another question that COV found difficult to judge quantitatively.	Appropriate
6. Does the program portfolio have an appropriate balance of: • Awards to new investigators? Comments: Yes, the COV commends OCE for their efforts in funding new investigators, and the percentage seems appropriate. In 2003 the percentage of awards to new investigators was 17%, in 2005 it increased to 22%.  	Appropriate
7. Does the program portfolio have an appropriate balance of: • Geographical distribution of Principal Investigators? Comments: The COV observed a broad geographic distribution of PIs in the eJackets reviewed. We have no impression of geographic bias. Our impressions are from looking at 126 proposals, and are not quantitative.	Appropriate

8. Does the program portfolio have an appropriate balance of: • Institutional types? Comments: Yes, the wide distribution of institutional types appears to be appropriate. The COV has no impression of obvious bias.	Appropriate
9. Does the program portfolio have an appropriate balance of: • Projects that integrate research and education? Comments: OCE supports 10 COSEEs. Postdocs, graduate students, and undergraduates are supported as integral contributors in research grants. Data were not available to quantify the numbers of postdocs, graduate students, and undergraduate students currently supported by OCE grants. The COV's impression is that the balance seems appropriate. COSEEs are increasingly mentioned in submitted proposals, for 2005, up to 16% in BO mention COSEEs. .  	Appropriate
10. Does the program portfolio have an appropriate balance: ▲ Across disciplines and subdisciplines of the activity and of emerging opportunities? Comments: Yes, there appears to be an appropriate balance of disciplines and subdisciplines. Examples of such programs are Oceans and Human Health, and the OOI.	Appropriate
11. Does the program portfolio have appropriate participation of underrepresented groups? Comments:	Improving

The participation may be appropriate with regard to the number of individuals from underrepresented groups in the Ocean Sciences. Funding rates are declining for PIs from underrepresented groups as well as other groups (see OCE funding rates by PI characteristic). However, though the community appears to be educating scientists from underrepresented groups in numbers commensurate with the overall population, there are "leaky" pipeline issues. The OCE has been involved with and supported some innovative ways to address pipeline issues for underrepresented groups, for example with MPOWIR and GeoDiversity, and also ADVANCE, at universities where there are a large number of OCE PIs. Participation of underrepresented groups is still inadequate in OCE, and less than in other scientific disciplines. Continued attentiveness to this issue is needed.  	
12. Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports. Comments: Yes, the program is responsive to national priorities. Examples of external reports issued over last few years and multi-agency collaborations include: **Surface Temperature Reconstruction in the last 2000 years**, National Research Council, June 2006. This report provides a critical view of surface temperature reconstructions, how they are evolving over time, as well as a good sense of how important understanding of the paleoclimate temperature record is within the overall state of scientific knowledge on global climate change.	Appropriate

America's Living Oceans: Charting a Course for Sea Change, Pew Oceans Commission, June 2003. This report emphasizes that all Americans depend on the oceans and affect the oceans, regardless of where they live. Ocean currents circulate the energy and water that regulate the Earth's climate and weather and, thus, affect every aspect of the human experience. Without reform, our daily actions will increasingly jeopardize a valuable natural resource and an invaluable aspect of our national heritage.

An Ocean Blueprint for the 21st Century- Final Report of the U.S. Commission on Ocean Policy, U.S. Commission on Ocean Policy, September 2004. This report contains the Commission's findings and recommendations for a new, coordinated and comprehensive national ocean policy.

The National Oceanographic Partnership Program (NOPP) is a collaboration of fifteen federal agencies to provide leadership and coordination of national oceanographic research and education initiatives. NOPP facilitates interactions among federal agencies, academia and industry; increases visibility for ocean issues on the national agenda; and achieves a higher level of coordinated effort across the broad oceanographic community.

The National Science and Technology Council (NSTC) Joint Subcommittee on Ocean Science and Technology (JSOST). The JSOST is currently developing the Ocean Research Priorities Plan and Implementation Strategy designed to establish and realize priorities for ocean science and technology. The JSOST held a public workshop on April 18-20, 2006 in Denver, CO to provide the ocean science communities an opportunity to interact and provide guidance on the development of the Ocean Research Priorities Plan.

The U.S. Climate Change Science Program (CCSP) was launched in February 2002 as a collaborative interagency program, under a new cabinet-level organization designed to improve the government wide management of climate science and climate-related technology development. The CCSP incorporates and integrates the U.S. Global Change Research Program (USGCRP) with the Administration's U.S. Climate Change Research Initiative (CCRI).

The NSF Long-Term Ecological Research (LTER) program supports fundamental ecological research that requires long time periods and large spatial scales to create a legacy of well-designed and documented ecological experiments; to conduct major syntheses and theoretical efforts; and to provide information necessary for the identification and solution of environmental problems.

13. Additional comments on the quality of the projects or the balance of the portfolio:

It is critical for NSF/OCE to retain flexibility in its ability to fund core science in BO, CO, PO and MG&G. In Ocean Sciences, NSF is the *primary* place to do science in disciplinary fields. The trend

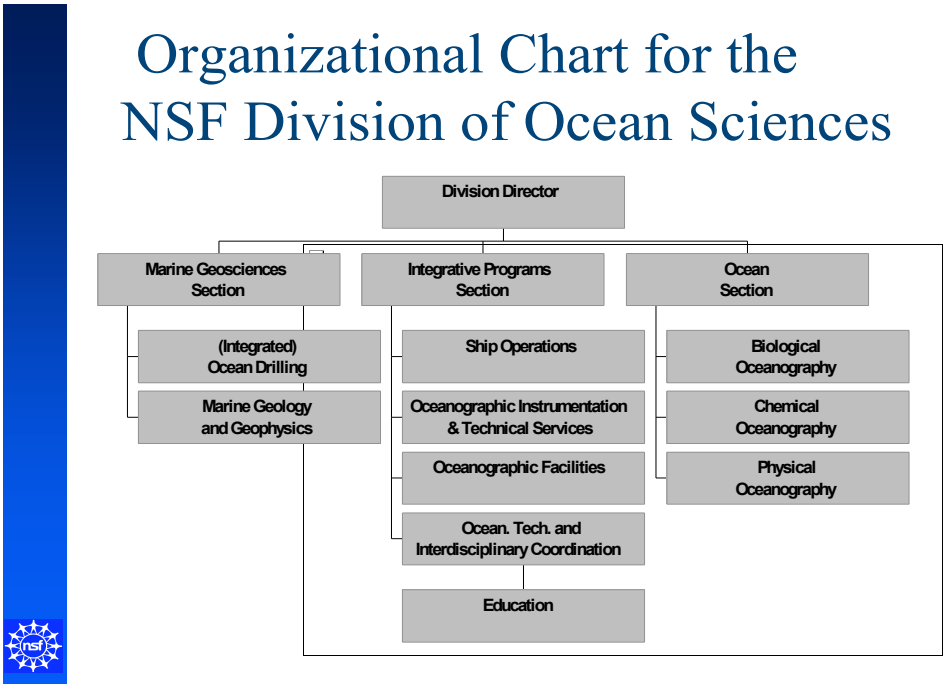
towards more mission orientation and societal relevance could put the core basic science research programs at risk.

In addition, operations and maintenance costs need to grow in parallel to maintain a healthy balance between funds for research and facilities.

A.5 Management of the program under review. Please comment on:

1. Management of the program.
Comments:

The Division of Ocean Sciences encompasses three sections as shown the organizational chart.



Program directors (including both permanent and IPAs) are commended by the COV for their experience, dedication and integrity. The work environment is collegial and cooperative and program directors are willing and eager to work across disciplines to advance the science.

The role of IPAs is crucial to the success of management within the Division. The IPAs complement the experience and corporate knowledge of the permanent program directors by providing input on current directions and interest in the scientific community.

2. Responsiveness of the program to emerging research and education opportunities.
Comments:

The Division has continued to be supportive and responsive to emerging research areas, particularly with regard to community inputs and rapid responses to episodic events. For example, the programs can spend up to 10% of their annual budget on Small Grants for Exploratory Research (SGER). In 2005, CO spent ~$0.5M from the core funds to support SGERs in response to Hurricane Katrina.

OTIC has been a key partner in facilitating the development and implementation of OOI, including cables, moorings, and autonomous vehicles.

Large-scale interdisciplinary programs also continue to play important roles in identifying emerging areas of research and education, such as Biocomplexity, the initiation of more COSEEs, and the implementation of a Science and Technology Center for Coastal Observation and Prediction.

Community acknowledgement of the importance of long term monitoring networks has further increased the number of centers for long-term ecological research (LTERs).

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.
Comments:

OCE continues to be effective in organizing and funding community driven initiatives at the national and international levels. Additional facilities funding are underway and planned from the MREFC account for the SODV, OOI and AARV. Program examples include Ocean Research Interactive Observatory Networks (ORION), Surface Ocean Lower Atmosphere Study (SOLAS), Ocean Carbon and Climate Change (OCCC), and GEOTRACES, an international study of the global marine biogeochemical cycles of trace elements and their isotopes.

4. Additional comments on program management:

The National Science Foundation supports 70% of the basic oceanographic research conducted nationally. An increase in proposal load would reduce the time available to program directors for interaction with the community and program planning. In this case, additional program directors would be appropriate for programs with high proposal loads.

The COV Panel encourages more effective collaboration between the Division and Human Resources to provide consistent and comprehensive information to prospective IPAs. Additionally, the development of a mentoring program for new IPAs, including the production of a manual, would ensure maximum use of their time and expertise, and similar IPA training practices within the Division.

Currently, panel summaries, feedback to PIs, and resubmission practices are inconsistent within the Division. The review analyses provided by BO, CO and PO are models for excellence in clarity of funding decisions.

Ocean Sciences Education would more logically be located with disciplinary science programs as

opposed to the Integrative Program Section. The advantage to placing education within the disciplinary science program is to foster the integration of education and research.

The rescission of funding for proposals approved due to insufficient monies for the needed ship time was significantly disappointing for the PIs and other individuals to be supported by those projects.

The COV was very disappointed that no permanent program director from MG&G participated in the COV review. Their insight would have been useful and direct communication valuable for the questions raised in our review.

PART B. RESULTS OF NSF INVESTMENTS

NSF investments produce results that appear over time. The answers to the first three (People, Ideas and Tools) questions in this section are to be based on the COV's study of award results, which are direct and indirect accomplishments of projects supported by the program. These projects may be currently active or closed out during the previous three fiscal years. The COV review may also include consideration of significant impacts and advances that have developed since the previous COV review and are demonstrably linked to NSF investments, regardless of when the investments were made. Incremental progress made on results reported in prior fiscal years may also be considered.

The following questions are developed using the NSF outcome goals in the NSF Strategic Plan. The COV should look carefully at and comment on (1) noteworthy achievements of the year based on NSF awards; (2) the ways in which funded projects have collectively affected progress toward NSF's mission and strategic outcomes; and (3) expectations for future performance based on the current set of awards. NSF asks the COV to provide comments on the degree to which past investments in research and education have contributed to NSF's progress towards its annual strategic outcome goals and to its mission:

- To promote the progress of science.
- To advance national health, prosperity, and welfare.
- To secure the national defense.
- And for other purposes.

Excellence in managing NSF underpins all of the agency's activities. For the response to the Outcome Goal for Organizational Excellence, the COV should comment, where appropriate, on NSF providing an agile, innovative organization. Critical indicators in this area include (1) operation of a credible, efficient merit review system; (2) utilizing and sustaining broad access to new and emerging technologies for business application; (3) developing a diverse, capable, motivated staff that operates with efficiency and integrity; and (4) developing and using performance assessment tools and measures to provide an environment of continuous improvement in NSF's intellectual investments as well as its management effectiveness.

B. Please provide comments on the activity as it relates to NSF's Strategic Outcome Goals. Provide examples of outcomes (nuggets) as appropriate. Examples should reference the NSF award number, the Principal Investigator(s) names, and their institutions.

B.1 <u>OUTCOME GOAL for PEOPLE</u>: Developing "a diverse, competitive and globally engaged workforce of scientists, engineers, technologists and well-prepared citizens."

Comments:

Many OCE funded scientists have received prestigious awards made possible through their exemplary scientific work funded through the Division of Ocean Sciences at NSF. These include several elected to the **National Academy of Sciences**:

- 2006 **David Karl**, professor of oceanography, department of oceanography, University of Hawaii at Manoa, David Karl's research on microorganisms in the ocean has vastly increased the world's realization of just how vital the seas are to the health of our planet. Award #'s; 9981313, 9906820,

9617409, 9601850, 9413249, 9301368, 9102642, 9016090, 8800329, 8600462, 8351715, 8311219, 8216673, 8109256, 8024255, 8005180, 7825446, 7820721, 7818926, 0334792, 0326616, 0216164, and 0215817

- 2006 **Charlie Langmuir**, professor of geochemistry. Professor Langmuir is director of graduate studies in the Department of Earth and Planetary Sciences, Lamont-Doherty Earth Observatory. His research focuses on the solid earth geochemical cycle, petrology, volcanology, ocean ridges, convergent margins, ocean islands, and composition and evolution of the earth's mantle. Award #'s; 0000937, 0099322, 0222537, 0242618, 0330852, 0453656, 8103343, 8411448, 8608335, 8615866, 8618484, 8618627, 8711120, 8801304, 8812339, 8812609, 9014925, 9103548, 9103867, 9117825, 9302933, 9303524, 9403622, 9413834, 9530137, 9530470, 9618572, 9907479, 9907639, 9911795, 9912380, and 9977429

- 2006 **Don Forsyth**, James L. Manning Professor of Geological Sciences, department of geological sciences, Brown University, Providence, R.I. Award #s; 0118671, 0527152, 768058, 7682194, 7909404, 7919411, 8208634, 8310074, 8511894, 8613946, 8817381, 8817391, 8818008, 8911326, 8915404, 9103592, 9202599, 9314489, 9402357, 9505667, 9521113, 9618224, 9712005, 9730542, 9812208, 9903026, and 9911729

- 2005 **Marcia McNutt**, president of the Monterey Bay Aquarium Research Institute, has made significant scientific contributions to geophysics and understanding Earth's crust. Award #s; 0096358, 8507816, 8512409, 8609529, 8710222, 8717826, 8817764, 8919140, 9012949, 9019717, 9221169, 1302192, 9415930, 9529981, 9629484, and 9996270

OCE – funded scientists elected **Fellows of the American Geophysical Union** in the previous three years include:

Tommy Dickey, University of California, Santa Barbara, "For the development, scientific application, and promotion of novel interdisciplinary observing systems for the ocean sciences." Award #s; 0099245, 0241121, 0338434, 8001709, 9243432, 091396, 9370553, 9415667, 9627281, 9643527, 9730471, 9819477, and 9987884
Paul Quay, University of Washington, "For outstanding research in the use of stable isotopes to study natural and man-made fluxes of carbon, oxygen and hydrogen through marine, atmosphere and freshwater systems." Award #a; 9911913, 9729728, 9708446, 9601698, 9413163, 9314687, 9207500, 9822434, 9016484, 9002476, 8820380, 8805987, 8615169, 8303592, 8219943, 0525843, 0327006, 0221032. 0095534, and 0093106
Paola Malanotte Rizzoli, Massachusetts Institute of Technology, "For fundamental contributions to advancing our understanding of ocean circulation and air-sea interaction through merging observations and models." Awards #s; 0084603, 0107530, 0324267, 05270303, 8118473, 8214821, 8512430, 8518487, 8614369, 9310416, 9403471, 9633145, 9906656, 9403471, and 9906656
Lynne Talley, University of California, San Diego, "For elucidating the dynamics, distribution and influences of intermediate waters throughout the world's oceans." Award #s; 9811958, 9712209, 9634281, 9529584, 9413160, 9203880, 9201313, 9004394, 9004230, 8918961, 8740379, 8658120, 8416211, 0424893, 0327544, 0223869, 0118046, and 0117271
Bob Thunell, University of South Carolina, "For his groundbreaking work in the development of novel paleoceanographic approaches and tracers, his innovative application of these tracers to elucidate past global climate change and for his leadership in paleoceanography and oceanography." Award #s; 0094771, 0117112, 0118349, 0315234, 0326313, 0432616, 7923736, 8306668, 8500663, 8614128, 8710459, 8917645, 9011846, 9102151, 9301413, 9401537, 9729697, 9810716, and 9906689
Robert F. Anderson, Lamont Doherty Earth Observatory, "For being master of the application of the element uranium and its daughter isotopes to problems in marine geochemistry." Award #s;

9977429, 9809273, 9730147, 9711870, 9632376, 9402019, 9314634, 9219558, 9117825, 9116042, 9022301, 8911427, 8900334, 8711404, 8700866, 8601213, 8410819, 8400804, 8315465, 8200141, 8026793, 0526522, 0426753, 0350497, 0326969, 0221833, 0196028, 0117249, 0221833, 0221339, 0196028, and 0096427

Ken W. Bruland, University of California, Santa Cruz, "For his exceptional contributions towards understanding ocean particle fluxes and biogeochemical cycles of trace elements." Award #s; 0137087, 0238347, 0324727, 0526601, 7513380, 7723689, 7919928, 7923322, 8216672, 8600452, 9000151, 9224047, 9314179, 9314291, 9416606, 9811114, 9416606, and 9977629

Devendra Lal, Scripps Institution of Oceanography (with VGP) "For the innovative and imaginative application of cosmogenic nuclides to the study of Earth and cosmic processes." Award #s; 8812985, 7682356, and 0454870

François M. M. Morel, Princeton University, (with Biogeochemistry) "For his studies of the trace metal chemistry of natural waters, the interaction of trace metal chemistry with the ocean biota, and the effects of these interactions on global biogeochemistry." Award#s; 9803348, 9711291, 9630572, 9116427, 8917688, 8615545, 8317532, 8118103, 7919549, 7808858, 7709000, 7515023, and 0351499

John R. Toggweiler, Geophysical Fluid Dynamics Laboratory, "For his fundamental contributions to our understanding of the ocean thermohaline circulation and the role of the ocean in glacial-interglacial climate change." Award #s 8414596, and 8711905

William Curry, Woods Hole Oceanographic Institution, "For his seminal contributions to Paleoceanography, including elucidating the history of deep water flow in three dimensions, and mentoring junior scientists entering Paleoceanography," Award #s; 9988088, 9986748, 9903605, 9711710, 9633499, 9503135, 9414202, 9402804, 9311396, 9311199, 9203187, 9116303, 9102846, 9102438, 9101734, 9018382, 8813307, 8800524, 8715956, 8710782, 8511014, 8410203, 8309124, 8200151, 8110161, 8029608, 0550271, 0524927, 0502428, 0354623, 0237561, 0099020, 0096469, 0081760, 0081760, and 0081147

Margaret Delaney, University of California, Santa Cruz, "For her innovative work defining links between biogeochemically important elements and past changes in climate; and her altruistic and exemplary service to the oceanographic community." Award #s: 0081637, 8614027, 8911530, 8916117, 9115946, 9224047, 9314291, 9416593, 9819114, and 9977629

Steven Emerson, University of Washington (with Biogeochemistry), "For his fundamental contributions to understanding the transport of carbon from the surface ocean into marine sediments and its consequences for carbonate preservation and paleoclimate." Award #s; 9911103, 9906922, 9819181, 9730081, 9728856, 9617487, 9402830, 9320911, 9314687, 9217233, 9203070, 9116316, 9016448, 9012376, 8922973, 8820380, 8800146, 8700550, 8615169, 8614514, 8502771, 8418345, 8315820, 8217256, 8214076, 8213927, 8101846, 8018189, 7925280, 7824840, 7818745, 7701892, 0526012, 0331843, 0242139, 0223372, 01162110, 0895103, and 0093828

Joseph Prospero, University of Miami (with Atmospheric Sciences), "For his outstanding research and international leadership in understanding mineral aerosols and their role in atmospheric and oceanic processes." Award #s; 7408385, 7712436,. 7914616, 8008354, 8112166, and 8405609

Sharon Smith, University of Miami, "For her leadership in the understanding of how, through evolution, zooplankton life cycles are intimately adapted to particular physical regimes and how these unique physical-biological couplings affect the broader marine ecosystem, including the oceanic carbon cycle." Award #s; 9911494, 9904689, 9310599, 9310577, 0432368, 0215667, and 0136132

John Toole, Woods Hole Oceanographic Institution, "For his significant discoveries and descriptions of ocean processes from turbulent mixing to the general circulation and for his innovative development of instruments to observe these processes." Award #s; 1179383, 0081502, 0115671, 0118401, 0217075, 0223421, 0241354, 0324233, 0326162, 0350743, 0424865, 0425677, 8308415, 8400128, 0515336, 8614447, 8716910, 9005218, 9104211, 9113533, 9115347, 9123528, 9206837, 9208839, 9320647, 9401343, 9415589, 9617072, 9710102, and 9906685

Edward Winterer, Scripps Institution of Oceanography, "For outstanding contributions to the

understanding of the geology of the Pacific Basin and the history of the Tethys." Award #s; 9019712, 8717079, 8710220, 8207771, 7522847, and 7516114

Other prestigious awards earned include:

- Dr. Jeff Nystuen, UW/APL -- 2003 Medwin Prize in Acoustical Oceanography from the Acoustical Society of America. Award #s; 0241245, 0549887, 9503896, and 9818726
- Dr. Robert Weller, WHOI, -- 2003 Sverdrup Gold Medal by the American Meteorological Society. Award #s; 8709614, 911059, 911054, 0424536, 0525657, 9313671, 9632357, 9201886, 9115000, 0115671, 9601625
- Dr. Kurt Polzin, WHOI, -- 2003, first U.S. recipient of the European Geophysical Society's Fridtjof Nansen Medal. Award #s; 9906731, 9727701, 0118401, and 0081502
- Professor Tom Rossby, URI – 2003, the Walter Munk Award for Distinguished Research in Oceanography from The Oceanography Society. Award #s; 0093647, 0117660, 0118536, 0137037, 0221073, 0241654, 0326907, 0432970, 7518930, 7611726, 7818662, 7926187, 8010839, 8110914, 8111498, 8310831, 8310833, 8504148, 8600512, 8716929, 8712348, 8901602, 8912016, 9202794, 9218219, 9314480, 9531878, 9617869, 9617986, 9811289, 9819724, and 9906775
- Dr. Bruce A. Warren, WHOI, -- 2004, AGU's Maurice Ewing Medal. Award #s; 9818246, 9729696, 9727407, 9413156, 9116289, 9104211, 9002708, 8614497, 8607913, 8213967, 8116520, and 7722814
- Professor Klaus Wyrtki, UH, -- 2004, The NAS Alexander Agassiz Medal for fundamental contributions to the understanding of the oceanic general circulation of abyssal and thermocline waters and for providing the intellectual underpinning for our understanding of ENSO (El Niño). Award #s; 7424383, 7506468, 7623173, 7624602, 7820035, 7820719, 7821320, 7921789, 8019028, 8213486, 8515404, and 8911163
- Professor Doron Nof, FSU, -- 2005 Nansen Medal from European Geophysical Scoiety's in recognition of his fundamental contributions to the understanding of the movement of fluids within the ocean and its relationship to the interaction with the atmosphere above. Award #s; 0241036, ,0545204, 8711030, 9012114, 9102025, 9503816, 9633655, and 9911324
- Dr. Joseph Pedlosky, WHOI, -- 2005 Sverdrup Gold Medal by the American Meteorological Society for developing geophysical fluid dynamics, including the theories of baroclinic instability and of ocean circulation driven by wind and buoyancy flux. Award #s; 9901654, 9810609, 9301845, 0451086, 0344094
- Professor John Allen, OSU, -- 2005 Henry Stommel Research Award from American Meteorological Society for his insightful and rigorous elucidation of ocean processes over the continental shelf and slope. Award #s; 0116138, 0218812, 7515202, 7600076, 7600596, 7803380, 7826820, 8014939, 8017929, 8026131, 8317390, 8405232, 8411613, 8620403, 9013263, 9314317, 9711481, and 9907854

ASLO AWARDS

Ruth Patrick Award for Environmental Problem Solving: **Ellen R. M. Druffel** 2004, for her sustained critical contributions on the composition and age of dissolved, particulate, and sedimentary carbon and for furthering the understanding of the processes governing the fate and distribution of oceanic carbon and the important role that the oceans play in global carbon flux. Award #s; 9815130, 9808537, 9711326, 9417391, 9396278, 9314691, 9101183, 8915919, 8716590, 8608263, 8416632, 8315412, 8315260, 8208231, 8111954, 7917652, 0551940, 050269, and 0137207

G. Evelyn Hutchinson Award: **Jed A. Fuhrman**, 2006, for his development of the emergent

field of microbial oceanography. Award #s; 9981371, 9906989, 9634028, 9218324, 9123889, 8996136, 8996117, 8716988, 8316903, 8711132, 8410074, 8406712, 8214498, 8207523, 0327034, and 0241723

Mark Abbott was recently appointed to the National Science Board. Award #s; 0000900, 0001300, 0244317, 8600338, and 9711344

B.2 OUTCOME GOAL for IDEAS: Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."

Comments:

The Ocean Sciences Division supports basic, interdisciplinary, multidisciplinary research and education in biological, chemical, physical oceanography and marine geology and geophysics. Emphasis in emerging fields and continuous funding is an important component to maintaining and developing high quality and innovative research. During this period there were several collaborations between different groups within the division.
Research supported during the past three years included:

Microbiology
Marine biodiversity, molecular applications to the study of organisms in the ocean
Understanding iron in the composition and structure of micro-plankton
Deep Sea processes
Discovery of the Lost City hydrothermal system
Predicting and tracking climate change
Seafloor topography, seamounts
Carbon and water, global carbonate system in hydrologic context
Ocean drilling
Ocean mantle dynamics
Continuation of Long Term Series, HOTS, BATS, LTERs
Rapid response to environmental events, e.g. Hurricane (Katrina) and tsunami research

Education:
Creation of COSSEE centers (Centers for Ocean Science Education Excellence)
Support of 20 REU sites under Ocean Sciences, REU to Ocean Sciences Meeting
Support of programs for dissertations symposia DIALOG, DISCO, PODS.
Encouragement for under-represented groups in ocean sciences

In this section, we present significant outcomes from research funded by the Division.

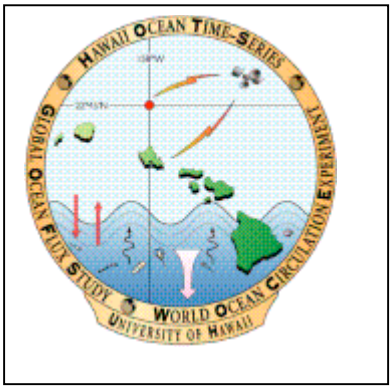
Marine Microbiologists Study Diversity of Life in the Oceans (PI Daniel Distel, University of Maine, OCE-0425795)

What is a bacterial species? New molecular methods have generated heated debate among microbiologists who study the diversity of bacteria in the oceans. Most marine bacteria have never been cultured and so cannot be separated into species on the basis of visible differences. In recent years, the nucleotide sequence of specific genes has been used to evaluate how closely related bacteria are to one another and to estimate how many different kinds of bacteria are present in an

environment. The ribosomal RNA gene (rRNA) provides an excellent evolutionary marker because the gene sequence changes very slowly over evolutionary time scales. By cloning this gene from natural samples, researchers can determine how many unique sequences are present in a sample. The debate over what constitutes a bacteria species stems from uncertainly regarding how different the sequence of a certain component of the rRNA gene can be before two bacteria should be grouped into different species. Different models of the evolutionary process yield different predictions of how much, and in what way, gene sequences should vary. In a recent paper (Nature 2004, vol 430, pp 551-554), Silvia G. Acinas and colleagues Vanja Klepac-Ceraj, Dana E. Hunt, Chanathip Pharino, Ivica Ceraj, Daniel L. Distel and Martin F. Polz examined the diversity of sequences in a large sample collected from the Plum Island Sound estuary in Northeastern Massachusetts. Using stringent procedures to eliminate methodological artifacts, they estimated that the sample contained a large number of unique sequences, but about 70 percent of these sequences differed from one another by less than 1 percent. These small variations could not be the result of inherent methodological artifacts, as is often assumed. The results indicate that marine bacteria appear to fall into natural groups that show slight within-group variations (microdiversity), but much more substantial between-group differences. These groups might be considered as candidates for the equivalent of “species” or “ecotypes”. Acinas and colleagues conclude that new, high-throughput methods may allow rigorous testing of the ecological significance of microdiverse clusters of rRNA genes, and may help to develop ecologically and evolutionarily meaningful definitions of bacterial species.

<u>Collaborative Research: Hawaii Ocean Time-series: Biogeochemistry and Ecology Component</u> (PI Michael Landry, of California-San Diego Scripps Inst of Oceanography, OCE-0324666)

Since Oct 1988, a comprehensive suite of environmental measurements have been obtained at the oligotrophic Sta. ALOHA (22'45N, 158'00'W) in the North Pacific Subtropical Gyre. This time-series activity - Hawai'i Ocean Time-Series (HOT) - was initiated within the 15-year U.S. Joint Global Ocean Flux Program; the results of the HOT program have been one of the stellar centerpieces of the U.S. JGOFS accomplishments. The core HOT measurements were selected to provide data to validate existing carbon-nitrogen-phosphorus biogeochemical models and, to improve them. Foremost in importance among the various ecosystem processes under investigation are: the flux of carbon at the air-sea interface, the rates and control mechanisms of primary production and particle export, and the pathways and intensities of nutrient (N and P) fluxes. Also important are the observed time-dependent changes in microbial biomass and biodiversity, and the relationships of these observed ecosystem changes to the broader extra-tropical climate forcing from the El Nino Southern Oscillation (ENSO) and other large scale ocean-atmosphere interactions. The emergent data from the HOT core measurement program are unique and robust and illuminate previously undocumented phenomena. The scientific results of the ongoing ocean time-series program have provided an unprecedented view of biogeochemical cycles and ecological processes in an under-sampled region of the world ocean. A very large number of HOT-related publications and reports have already appeared based on the research results obtained by program associated and independent, ancillary investigators. This award will support the important continuation of this ocean time-series core measurement program for an additional five-year period August 2003 to July 2008. During this period, Dr. Karl and collaborators will move the measurement program from a primarily ship-based effort with an approximately monthly frequency of observations, to a comprehensive ship / mooring / autonomous vehicle /cabled observatory / satellite based measurement program that covers a broader spectrum



of temporal and spatial scales.

Discovery of Lost City hydrothermal vent field (PI: Deborah Kelley, University of Washington, OCE-0137206)

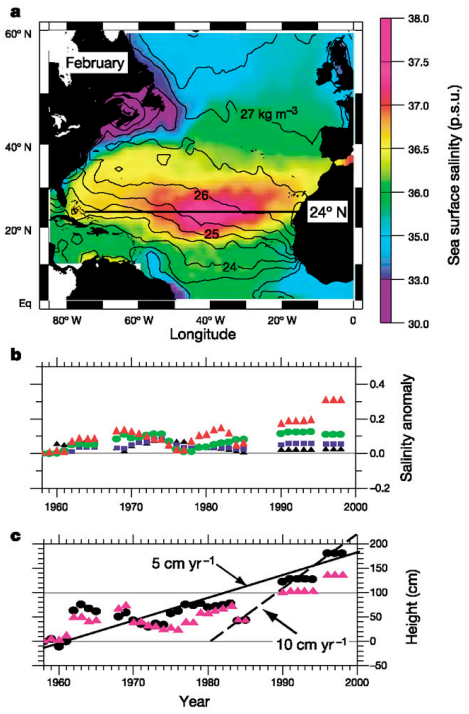
In 2000, a new kind of submarine hot spring environment was serendipitously discovered at 30°N on the Mid-Atlantic Ridge on 1-2 million year old mantle rocks that were formed deep within the Earth (1). This new hydrothermal ecosystem, called Lost City, is unlike any vent field found to date, hosting diffusely venting limestone monoliths that tower more than 60 meters above the surrounding seafloor. In April-May 2003, Lost City was revisited during an intense, interdisciplinary 32-day expedition utilizing the submersible Alvin and autonomous vehicle ABE (see http://www.lostcity.washington.edu/). Detailed mapping with ABE and direct observations with Alvin show that the field is an astounding, intensely beautiful area that hosts numerous 30-meter tall limestone chimneys over an area more than 350 meters in length. Subsurface mineral-fluid reactions within the mountain on which Lost City rests, produce >90°C fluids that contain very high hydrogen concentrations. The fluids are also elevated in methane and abiotically produced hydrocarbons, which serve as important energy sources for novel microbial communities that thrive within the porous chimney walls. Dating of the chimneys shows that hydrothermal activity has been on-going for at least 30,000 years (2). In contrast to black smoker systems that are driven by cooling of young volcanic rocks, fluid flow at Lost City is driven by heat produced during mineral-fluid reactions within the mountain. Modeling indicates that these types of reactions have the potential to drive hydrothermal flow for hundreds of thousands, possibly millions of years(2).

1 Kelley, D.S., J.A. Karson, D.K. Blackman, G.L. Früh-Green, D.A. Butterfield, M.D. Lilley, E.J. Olson, M.O. Schrenk, K.R. Roe, G.T. Lebon, P. Rivizzigno, and the AT3-60 Shipboard Party 2001 The Lost City Hydrothermal Field: A peridotite-hosted, off-axis system at 30°N on the Mid-Atlantic Ridge, Nature, 412, 145-149.

2 Früh-Green, G.L. D.S. Kelley, S.M. Bernasconi, J.A. Karson, K.A. Ludwig, D.A. Butterfield and C. Boschi, 2003 30,000 Years of Hydrothermal Activity at the Lost City Vent Field. Science, 302, 495-498

Saltier tropical oceans and fresher ocean waters near the poles further signs of global climate change's impacts (PI: Ruth Curry, PI: John Toole, Woods Hole Oceanographic Institution, OCE-0241354)

Tropical ocean waters have become dramatically saltier over the past 40 years, while oceans closer to Earth's poles have become fresher, scientists report in the December 18th issue of the journal Nature. These large-scale, relatively rapid oceanic changes suggest that recent climate changes, including global warming, may be altering the fundamental planetary system that regulates evaporation and precipitation and cycles fresh water around the globe. The study led by Ruth Curry of the Woods Hole Oceanographic Institution (WHOI) provides direct evidence that the global water cycle is intensifying. This result is consistent with global warming hypotheses that suggest ocean evaporation will increase as Earth's temperature does. By comparing recent and historical salinity



observations, the investigators observed that surface waters in tropical and subtropical Atlantic Ocean regions have become markedly saltier. Simultaneously, much of the water column in the high latitudes of the North and South Atlantic became fresher. This trend appears to have accelerated since 1990 when 10 of the warmest years occurred since records began in 1861. The scientists estimated that net evaporation rates over the tropical Atlantic have increased by five percent to ten percent over the past four decades. These findings are particularly significant as pressure on freshwater resources has become critical in many areas around the world. An acceleration of Earth's global water cycle can potentially affect global precipitation patterns that govern the distribution, severity and frequency of droughts, floods and storms. It would also exacerbate global warming by rapidly adding more water vapor-itself a potent, heat-trapping greenhouse gas-to the atmosphere. And it could continue to freshen North Atlantic Ocean waters to a point that could disrupt ocean circulation and trigger further climate changes. Curry et al., 2003. A change in the freshwater balance of the Atlantic Ocean over the past four decades. Nature 426, 826-829.

Minorities in Marine Science Undergraduate Program at the Shannon Point Marine Center (PI Name: Stephen Sulkin, Western Washington University OCE-0228618)

The Division of Ocean Sciences supports the Shannon Point Marine Center (SPMC) at Western Washington University to run a program called "Minorities in Marine Science Undergraduate Program" (MIMSUP). The MIMSUP program supports minority undergraduates during a semester of intensive research at SPMC. The researchers at SPMC mentor the students through their research during the semester and often for years following as they graduate and apply to graduate schools. Since the program's inception in 1991, more than 103 students have participated. In March, 2003 the program won a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring. The award identifies and rewards outstanding mentors and mentoring organizations that promote science, mathematics, and engineering education.

B.3 OUTCOME GOAL for TOOLS: Providing "broadly accessible, state-of-the-art S&E facilities, tools and other infrastructure that enable discovery, learning and innovation."

Comments:

The Division of Ocean Sciences invests in the development of a wide range of tools ranging from novel sensors to autonomous vehicles and specialized observation platforms including both ships and moorings. The OCE Division is also providing key support for the establishment and improvement of data libraries, including large program offices and easily navigable online systems, which broadly distribute information to researchers, educators, and the public at large. Here, we

provide several examples of OCE-supported projects that have continued the tradition of providing cutting-edge research and education tools.

Underwater Gliders for Monitoring Western Boundary Currents (PI: W. Brechner Owens, Woods Hole Oceanographic Institution OCE-0220769, PI: Russ Davis, University of California-San Diego Scripps Inst of Oceanography OCE-0220930)

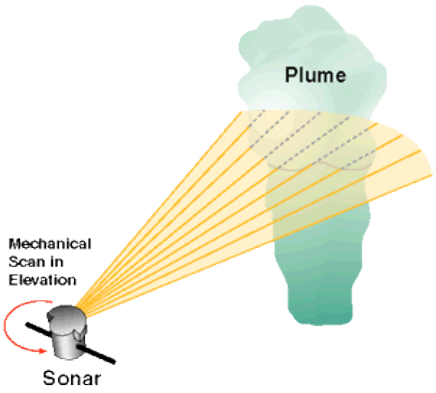
In October 2004, a small ocean glider named 'Spray' became the first autonomous underwater vehicle, or AUV, to cross the Gulf Stream underwater, proving the viability of self-propelled gliders for long-distance scientific missions and opening new possibilities for studies of the ocean. Spray is one of a class of small, reusable autonomous vehicles. It was designed to have a lifetime up to a year, with operating speeds of 20-35 cm/s and a depth range of 1500 m. It is equipped with Global Positioning System (GPS) navigation and two-way satellite communication so missions can be changed in the field. Spray glides up and down through the water on a pre-programmed course by pumping one liter (about four cups) of mineral oil between two bladders, one inside the aluminum hull and the other outside. This movement of oil between chambers changes the volume of the glider making it either denser or lighter than the surrounding water. This enables Spray to float and sink, while wings provide lift to drive the vehicle forward. Batteries power buoyancy change, onboard computers and other electronics. The glider records its position at the beginning and the end of each dive by rolling on its side to expose a GPS antenna embedded in the right wingtip.

Every seven hours during its journey, Spray spent about 15 minutes on the surface to relay via satellite its position and information about ocean conditions, such as temperature, salinity and pressure, back to Woods Hole, MA, and San Diego, CA, where scientists track its progress and determine course changes. Sensors on the glider can be changed depending on the type of mission planned. For this mission from Cape Cod to Bermuda, the Spray glider was equipped with a CTD (for conductivity, temperature and depth) instrument that measured temperature, salinity and pressure, and an optical sensor that measured turbidity in the water, which is related to biological productivity. The National Oceanic and Atmospheric Administration's Climate Observations Program funded additional sensor development. The National Science Foundation funded the Gulf Stream project to continue testing, develop reliability and demonstrate range predictions through a program of regular field use coupled with careful evaluation of the vehicle performance and condition after each field trial. *This work is notable because:* For this glider development, the highest technical priority was to ensure reliability and longevity. Through the work described here, the researchers have increased the glider's depth limit to 1,500 m, successfully guided it through the Gulf Stream from Woods Hole, MA to Bermuda (approximately 650 miles), communicated course changes while in route, and transmitted data via satellite back to scientists.

A General Purpose Tool for Acoustic Remote Sensing and Mapping of Hydrothermal Flow (PI: Christopher Jones, University of Washington, OCE-0136768)

Our present day ability to study hydrothermal systems is severely limited by our inability to detect and map flow fields in a systematic manner over large areas of the seafloor. Exploration still plays a fundamental role in the science of seafloor hydrothermal systems. Discoveries often happen by chance rather than by systematic surveying and remote sensing. Recent discoveries of a new type of 'off-axis' vent system by Kelley et al. 2001 highlight the need for new instruments that are capable of exploring the new areas of the seafloor and detecting both high and low temperature venting. Once a field has been located, our ability to model hydrothermal systems and their

relation to tectonic, magmatic, oceanographic, and biological processes is limited by the lack of tools for resolving critical spatial and temporal scales of flow. For example, our ability to estimate heat flux from an active ridge segment is limited by our inability to map distributions of localized and diffusive sources of heat over length scales that are characteristic of ridge tectonic processes. Observing the temporal/spatial variability and partitioning of energy between different types of flow is critical for understanding fluid circulation in the crust, its interaction with crustal alterations, and its interaction with biological habitat. The ability to model hydrothermal fluid circulation after it has left the seafloor and the entrainment of surrounding water into hydrothermally induced flow is limited by our inability to characterize flow at the scale of the entire plume within sub-tidal time scales. Point measurements made from a moving ROV or AUV, for example, are often subject to variability associated with tidal cycles. Interpretation of such aliased measurements requires well-defined forward models of tidal flow and its interaction with complicated topography. High-frequency acoustic remote sensing offers an attractive method of detecting and probing scales of hydrothermal flow that are unattainable by point sampling methods. Two new methods of detecting and characterizing flow are being developed: 1) scintillation thermography to detect and characterize diffuse flow fields; and 2) plume particulate scattering to estimate flow velocity and particulate concentrations in the high temperature vent plumes. *This work is notable because:* This instrument will lead to a new paradigm of exploration and remote sensing in the ocean.



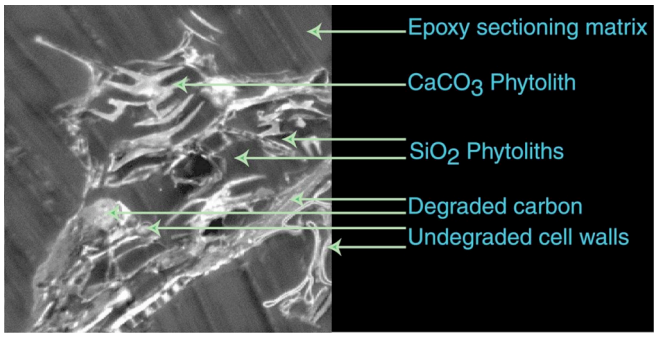
<u>JOIDES Resolution Research Vessel Completes 20 Years of Seafloor Drilling</u> (PI: Steven Bohlen, Joint Oceanographic Institutions Inc., OCE-9308410)

After 20 years, the equivalent of more than 16 circumnavigations, and the recovery of greater than 220 km of sediment and rock cores from nearly 1800 holes drilled in the ocean floor, the *JOIDES Resolution* research vessel returned to its home port of Galveston, Texas in October 2003. The homecoming marked the end of the final voyage of the Ocean Drilling Program (ODP) and the beginning of the newly inaugurated Integrated Ocean Drilling Program to be jointly led by the United States and Japan. In keeping with the tradition established by Captain Cook's exploration vessel of the same name, the *JOIDES Resolution* spent a generation addressing fundamental questions about the Earth. The seafloor samples acquired by the *Resolution* have provided new insights into Earth's climate history, the deep biosphere, seismically-active ocean margins, oceanic crustal structure, the flux of fluid and energy through the ocean floor, the formation of the present-day ocean basins, and the consequences of meteorite impacts. Over the history of the program, 1800 scientists from 30 nations participated in ODP cruises. Fifteen hundred U.S. scientists from more than 160 universities and research centers in 46 states sailed as shipboard scientists or used the program's sample and data archives. Many of the program participants were graduate students who have gone on to become leaders of the U.S. marine science community. With the participation of these U.S. scientists, the *Resolution* became the first vessel to sample microbes from hundreds of meters beneath the seafloor, to retrieve fluids that originate deep in seismogenic subduction zones, to recover pieces of the oceanic lower crust and upper mantle, to acquire cores that constrain periods of catastrophic global warming, and to deploy seismometers in boreholes as part of an effort to expand the global seismic monitoring network. These and other scientific results of ODP are documented in over 18,000 scientific publications and reports. *This work is notable because:* It showcases the extraordinary accomplishments of the JOIDES Resolution ocean drilling vessel during the 20-yr history of the

Ocean Drilling Program (ODP). Its successes led directly to the inauguration of the new US-Japan led Integrated Ocean Drilling Program (IODP).

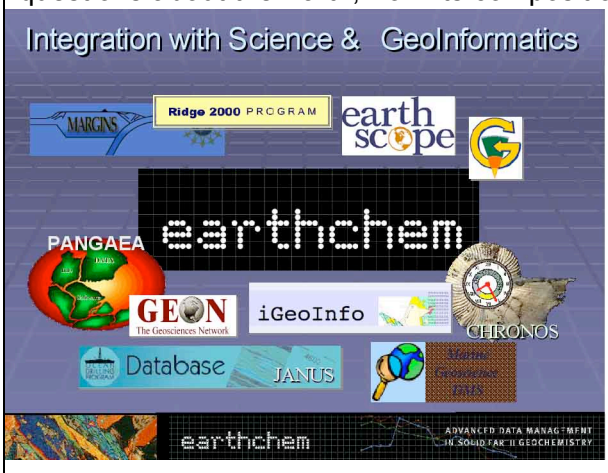
Nanoscale Investigations of Marine Organic Matter Diagenesis (PI: Jay Brandes, University of Texas at Austin OCE-0221295, PI: Chris Jacobsen, SUNY at Stony Brook, OCE-0221029, PI: George Cody, Carnegie Institution of Washington, OCE-0221336)

Determining the chemical structure of marine dissolved organic matter has long been an elusive goal for marine organic geochemists. A multidisciplinary team of investigators of geochemists and physical scientists will examine changes in the structure of uncharacterized organic matter as it undergoes diagenesis on a micro to nanoscale. By using Scanning Transmission X-Ray Microscopy (STXM), the group will be able to "map" macromolecular assemblages at a scale between bulk chemical analysis and individual molecule or molecular class levels. The Near Edge X-ray Absorption Fine Structure (NEXAFS) spectra generated by the STXM technology will allow the investigators to resolve distributions of functional groups containing carbon, nitrogen, and oxygen for regions smaller than 50 nanometers in diameter. In survey mode, a range of organic materials collected and contributed by researchers from different parts of the world's oceans will be examined using these techniques. This approach will be extended to sediment samples and suspended (trapped) particulates. Laboratory experiments using whole phytoplankton and bacterial cultures will be used to provide materials appropriate to the early stages of organic matter diagenesis. *This work is notable because:* This geoscience-based research is being conducted on the nanoscale level using new tools.



Facilities Support: Earthchem: Advancing Data Management in Solid Earth Geochemistry (PI: Dr. Kerstin Lehnert, Lamont-Doherty Earth Observatory, OCE- 0522195)

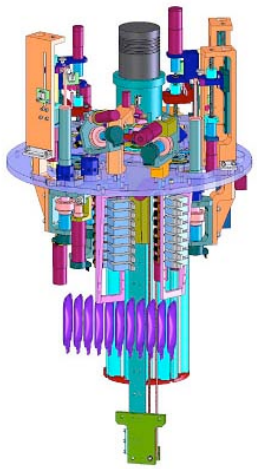
Geochemical data for solid earth samples provide essential information for answering fundamental questions about the Earth, from its compositional variation to its history, structure, and dynamics. The EarthChem project (www.earthchem.org) aims to maximize the application of solid earth geochemical data in Geoscience research and education by establishing an advanced data management system that will facilitate the compilation, communication, serving, and visualization of geochemical data. The ultimate goal is to allow researchers, educators, students, and the interested public to explore geochemical data alone and in the context of larger Earth Science datasets. EarthChem is based on and will expand the long-term collaborative effort of the successful geochemical online databases PetDB, NAVDAT, and GEOROC. In order to achieve its goals, EarthChem will develop a 'One-stop-shop for geochemical data' (EarthChem portal) with search capabilities across federated databases, a user interface that offers simple and straightforward access to all data holdings with the ability to obtain datasets specifically tailored to the user's individual needs in a standardized and integrated output format, and generally applicable tools for data quality assessment and data analysis and



visualization. EarthChem's second focus is the expansion of data holdings through incorporation of both legacy and future data, to provide access to and integrate the widest and richest datasets possible. Strategies include the facilitation of data submission from users and publishers via online interactive tools, contribution of focused projects, and entry of critical datasets as identified by the community. *This work is notable because:* Earthscope expands and combines essential geochemical online databases PetDB, NAVDAT, and GEOROC.

The Environmental Sample Processor (ESP): A Device for Detecting Microorganisms In Situ Using Molecular Probe Technology (PI: Chris Scholin, Monterey Bay Aquarium Research Institute, OCE-0314222)

Many of the diagnostic procedures for detecting molecular signatures share an overlapping set of requirements, such as collecting, concentrating, preserving and disrupting cells, applying a series of reagents in a timed sequence, removing particulates, applying solid phase extraction chemistries, and so on. Operationally, these methods can be divided into those that depend on intermolecular reactions, like and antibody/antigen binding, nucleic acid hybridization, and enzyme mediated processes and those that rely on separation and identification of target molecules based on their physical properties, such as size and hydrophobicity, etc. Optical and electrochemical transducers are used commonly to detect and quantify numerous molecular signatures. Our work to date indicates that a single electromechanical device could meet this core set of functional requirements and therefore carry out many different analytical procedures, in situ if desired. In a step towards realizing that goal, we have undertaken development of the Environmental Sample Processor (ESP), a project that involves scientists, mechanical, electrical and software engineers. The ESP is an electromechanical/fluidic instrument system designed to collect discrete water samples from the ocean subsurface, concentrate microorganisms (particulates), and automate application of molecular probes to identify microorganisms and their gene products. In addition, the ESP archives discrete samples for nucleic acid analysis, microscopy and other types of analytical procedures after the instrument is recovered. The ESP design goal is to develop a modular core instrument system that can be re-configured/modified to suit a wide variety of deployment and analysis scenarios, with emphasis placed upon making a more serviceable, robust, compact, lower power, and more user friendly device (http://www.mbari.org/microbial/ESP/). *This work is notable because:* It develops much-needed autonomous tools for understanding biological diversity in the oceans.



Solid model of the 2G ESP

B.4 OUTCOME GOAL for ORGANIZATIONAL EXCELLENCE: Providing "an agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices."[7]

Comments:

OCE operates an efficient and appropriate proposal review process that incorporates innovative use of technology and communication. This includes the implementation and continued upgrade of Fastlane for proposal submission and review and the development of eJackets (searchable electronic proposals that include all communication, individual and panel reviews, and a newly developed "review analysis" that explains the final funding decision). OCE continues to hire and maintain a diverse and capable staff with the needed strong technical skills that are essential in maintaining high efficiency and practice standards. The COV suggests that OCE investigate new mechanisms for recruiting high quality IPAs that are essential to the continued success of the OCE Division.

[7] For examples and further detail on the Organizational Excellence Goal, please refer to pp. 19-21 of NSF's Strategic Plan, FY 2003-2008, at <http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04201>.

PART C. OTHER TOPICS

C.1 Please comment on any program areas in need of improvement or gaps (if any) within program areas.

Overall, the COV was very impressed by the excellent caliber, collegiality, and dedication of the Division program directors and management. The COV review of the eJackets with some follow up with paper jackets provided ample evidence for the generally high quality of the review procedures followed within the Division.

As noted above, the Division should address inconsistency in the quality of review summaries (review analyses, feedback to PI) and provide more active guidance for the resubmission of proposals (including what constitutes significant revision).

The COV supports the decision to fund science that requires significant facility support, and recognizes that this need is fundamental to ocean-based science. Nonetheless, increasing support of science requiring major investment in facilities must be balanced with the need to maintain appropriate levels of funding for the core science programs. Increasing emphasis on facilities and on time-series observations must be offset by increased funding to the Division to maintain the balance between basic research and facility support.

The COV recommends that the Ocean Sciences Education section be aligned with the science sections. Its present location in Integrative Programs section is a hold over from previous administrative structures and no longer provides the best opportunity for the integration of research and education.

The COV appreciated the nuggets supplied to it by the Division program directors to highlight research results supported by the Division, and recognizes that they represent another demand on program directors time. The COV selected alternate and additional nuggets to represent innovation in the tools area. The COV feels that continued and greater attention to showcasing Division science within and external to NSF is warranted.

C.2 Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

The COV commends the Division for successfully meeting is goals for taking proposals to panel as well as receiving at least three mail reviews for each proposal. Almost 90% of proposals in Ocean and Marine Geoscience Sections were taken to panel in 2005. Only proposals for the Ocean Education and Ocean Technology and Interdisciplinary Coordination Sections, handling a small number of specialized proposals, were not taken to panel.

C.3 Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

The COV identified several agency-wide issues that impact the Division's performance.

The ability to attract IPAs maintains a concern to the 2006 COV, as it was to the 2003 COV. IPAs are essential to the intellectual vitality of NSF as well as representing an important bridge to the PI

community for NSF. Increasing the transparency of the application process, salary and per diem and travel arrangements, to incoming and prospective IPAs may help improve NSF's ability to attract strong IPA candidates.

The COV encourages continued communication with PIs both verbally and in email correspondence. Written documentation is needed specifically in making suggestions for resubmission of proposals.

C.4 Please provide comments on any other issues the COV feels are relevant.

During times when other agencies are reducing their support for oceanographic science, the COV commends the OCE Division for providing 70% of the funding for basic oceanographic research, and 75% of the funding for the academic oceanographic fleet. The Division thus plays a critical role in the support of basic science and education for the oceanographic community.

The COV notes that in a time of essentially level funding for the Division, the increased scientific demand for facilities (ships, long term observatories, instrumentation, etc.) is placing higher pressure on the core research funding available for proposals crucial for the scientific innovation and growth of oceanographic science. The COV notes that the optimal resolution of the inevitable tension between support for facilities and core program lies in increased funding levels for the Division.

The 2005 success rate of proposals requiring UNOLS ship time (10-20%) is significantly lower than for those not requiring ship time (20-30%) due to the increasing costs of ship operation and the higher proportion of costs for ship operation burden on the NSF. OCE provides about 75% of funding for the academic research fleet operations to support NSF-sponsored sea-going research and education projects. Other agency funding has remained flat for the last six years while the NSF contributes about $50M/yr. With the day rate for global class ships now averaging ~$22K/day, the NSF was able to fund one third fewer ship days from 2005 to 2007. Proposals requiring ship time are being deferred and fewer proposals are being submitted with the decline in the community expectations to receive ship time funding.

C.5 NSF would appreciate your comments on how to improve the COV review process, format and report template.

The COV is very grateful to the staff of the Division for their input and contributions to our report, and would like to single out Brian Midson, Assistant Program Director, for his invaluable technical assistance and insightful comments while writing our review. Figures showing various proposal evaluation parameters made by Brian Midson, Assistant Program Director and Kandace Binkley, Associate Program Director, were extremely helpful to the COV.

The COV found the eJackets to be extremely valuable (and paperless!) guide for our review. The new review analyses provided a vital summary of the mail reviews, panel summaries, and program director's decisions. The documentation of program director communications with PIs was generally thorough and extremely helpful. The COV recommends continued use of eJacket for future COVs and looks forward to the continued development and enhancement of the eJacket.

The COV found that completion of parts of the COV review report is impossible given the absence of metrics or of the data needed to address the question. Metrics and coding are lacking for definitions of success, high risk, and multidisciplinary research program. The COV suggests that metrics be provided or such questions be deleted from the COV template.

Several members of the COV commented on the lack of statistics on numbers of publications (as a function of year of publication) supported by OCE funding. This information should be easy to obtain from proposal annual or final reports, and would provide a new metric for the Division to demonstrate the productivity of its research portfolio. A web form, for example, completed by the PIs, providing complete bibliographic citations and short non-technical summaries, would help the Division provide these metrics and help select and write nuggets.

SIGNATURE BLOCK:

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For the Ocean Sciences Division COV
Mary Jo Richardson, co-chair

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For the Ocean Sciences Division COV
Michael R. Roman, co-chair