



MAKING WAVES

January 31, 2012

National Science Foundation (NSF)

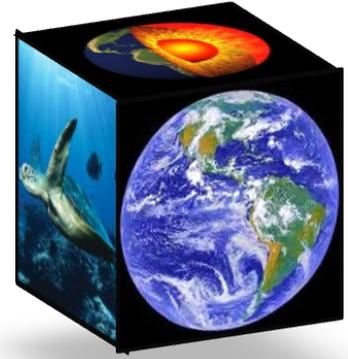
Winter, 2012

Inside this issue:

OCE Division	1
Director's Message	
Budget Update	2
SEES, CREATIV, and SAVI	2
Upcoming Solicitation Due Dates	3
DISCO & PODS	3
IODP	4
Deep Biosphere	5
OOI	5
Policy Reports	5
OCE in the News	6
CAREER	6
Proposal Tips	7
Reviewer/Panelist	8
Career Opportunities	9
OCE Staff Changes	9
Eos Article	10
Journalism Workshop	12

OCE Division Director's Message

In this issue of *Making Waves*, you will again find updates on the NSF budget, program solicitations, policy news, OCE staff changes, and other topics. I want to highlight two items. First, let me encourage you to become familiar with [NSF-Wide Investments](#). In addition to managing the division's core research and education programs, OCE program officers are actively involved in cross-Foundation working groups that manage dynamic, cross-cutting initiatives. Many of these initiatives focus on complex, multi-disciplinary, data-driven research issues that the ocean sciences community can both contribute to and benefit from. Previous newsletters listed new program solicitations under the NSF-wide investment on [Science, Engineering and Education for Sustainability \(SEES\)](#), and this issue provides another update. Previous newsletters also gave information on [EarthCube](#), a collaborative effort by NSF's Geosciences Directorate and the Office of Cyberinfrastructure to facilitate the conduct of geosciences research by supporting community-based cyberinfrastructure. EarthCube is part of the evolving NSF-wide investment [Cyberinfrastructure Framework for 21st Century Science and Engineering \(CIF21\)](#). Please watch for CIF21-related solicitations and consider how your research and education efforts might fit under the CIF21 umbrella. Also take a look at a new pilot grant mechanism called the [Creative Research Awards for Transformative Interdisciplinary Ventures \(CREATIV\)](#). I encourage PIs who seek their research funding from OCE to explore broader opportunities across NSF. Participation in NSF-wide investments will both expand research opportunities and offer PIs potential new sources of funding.



EarthCube

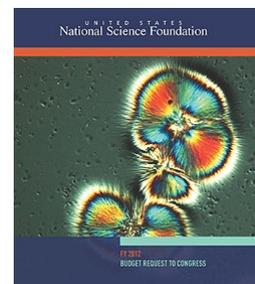
Second, I would like to encourage you to review and comment on the draft National Ocean Policy Implementation Plan that has been released for public comment until February 27. Your perspectives and insights could be incredibly valuable as the Implementation Plan is being finalized. See the related [NSF press release](#) and go to the [National Ocean Council website](#) to read and comment on the draft plan.

OCE welcomes the New Year with its challenges and opportunities. I look forward to engaging directly with many of you at the [Ocean Sciences Meeting](#) in February in Salt Lake City.

David Conover, Director
Division of Ocean Sciences

Budget Update

NSF's FY 2012 (October, 2011 – September, 2012) funding appropriation was finalized in mid-November at \$7,033 million, an increase of 2.5 percent over the previous year. NSF is working internally and with Congress to finalize distribution of the budget, so the OCE total should be known soon. The President's FY 2013 budget request to Congress will be rolled out on February 13. We will provide a more complete overview of the budget situation in the Spring newsletter.



FY 2012 Budget

SEES—Science, Engineering and Education for Sustainability

Please see the *Eos* article on “A Focus on Science, Engineering, and Education for Sustainability” that is reproduced in the Appendix. Under the [SEES](#) umbrella, the following programs have upcoming deadlines:



SEES

- [Dimensions of Biodiversity](#) (NSF 12-528) April 10, 2012
- [Decadal and Regional Climate Prediction using Earth System Models \(EaSM\)](#) (NSF 12-522) May 11, 2012.

Several other SEES-related solicitations are being updated. Please also watch for possible future SEES focus areas related to chemistry/materials/engineering (renewable, non-toxic materials, process improvements), coastal and Arctic regions (vulnerability, resilience, cultural impacts), hazards and disasters (science, engineering, risk assessment, decision-making), and information science and engineering (energy consumption, clean computing issues).

Creative Research Awards for Transformative Interdisciplinary Ventures (CREATIV)

CREATIV is a new NSF grant mechanism to provide funding for unusually creative high-risk / high-reward interdisciplinary projects. This comes under the auspices of the Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) initiative. Proposals on any NSF-supported topic will be accepted for support in FY 2012 up to June 15, 2012. A key element of CREATIV is that awards must be substantially co-funded by at least two intellectually distinct NSF divisions or programs, and thus PIs must obtain written authorizations from two or more NSF program directors before submitting a proposal. See the [CREATIV webpage](#) for guidelines.

Science Across Virtual Institutes (SAVI)

In October, 2011, NSF announced efforts to foster increased interaction among scientists, engineers and educators around the globe through “virtual institutes.” Science Across Virtual Institutes (SAVI) proposals can be submitted as a supplemental funding request to an existing award, or as part of a full proposal to the NSF program that best fits the proposed subject matter. See the [SAVI webpage](#) for guidelines.



Upcoming Solicitation Due Dates

OCE programs continue to have 2 target dates per year for unsolicited proposals: February 15 and August 15. In addition, under the [Oceanographic Centers, Facilities and Equipment](#) umbrella, the published target dates are October 15 for Oceanographic Instrumentation, November 1 for the Ship Operations Program, November 15 for Oceanographic Technical Services, and December 1 for Shipboard Scientific Support Equipment. The next review panel for Oceanographic Centers, Facilities and Equipment proposals will be in February, 2012, and the submission “target” dates allow for a little flexibility. Anyone considering submission of a proposal after the target dates should communicate with the cognizant Oceanographic Centers, Facilities and Equipment program manager before doing so.



Orca

Credit: Jeanne Cato, NSF

In addition to opportunities referenced elsewhere in the Newsletter, we'd like to highlight the following, with their next proposal due dates:

- [Innovation Corps Program \(I-Corps\)](#) (NSF 11-560) March 15, 2012
- [National Ocean Sciences Accelerator Mass Spectrometry Facility \(NOSAMS\)](#) (NSF 12-521) March 19, 2012
- [Long-Term Ecological Research \(LTER\)](#) (NSF 12-524) March 21, 2012
- [Assembling the Tree of Life \(ATOL\)](#) (NSF 10-513) March 26, 2012
- [Macrosystems Biology \(NSF 10-555\)](#) April 2, 2012
- [Integrative Graduate Education and Research Traineeship Program \(IGERT\)](#) (NSF 11-533) May 1, 2012 (letters of intent)
- [Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics](#) (NSF 10-544) May 28/29, 2012 (type 1 proposals)
- [Hydrologic Sciences](#) (NSF 09-538) June 1, 2012

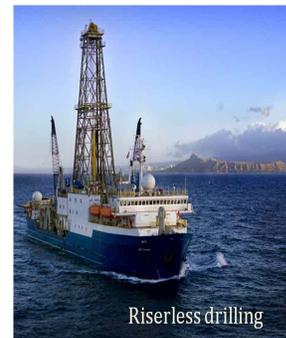
DISCO and PODS

The 23rd Dissertations Symposium in Chemical Oceanography (DISCO) and the 7th Physical Oceanography Dissertations Symposium (PODS) will be held October 7-11, 2012 in Lihue, Kaua'i. These symposia provide new and upcoming doctorate recipients in both chemical and physical oceanography a unique opportunity to present and discuss their dissertation research in an open forum with their professional peers. Travel, hotel accommodations, and meals for 25 invited chemical oceanography participants and 25 invited physical oceanography participants will be paid by the sponsoring agencies (NSF and NOAA for DISCO, and NSF and ONR for PODS). Participation is by invitation only. To be eligible to apply, dissertations must have been completed after June 30, 2011, or applicants must provide certification from their Department Chair or Dean that they will complete their degree by July 1, 2013. The deadline to apply is April 23, 2012. Information about eligibility and application materials can be found on the [DISCO](#) and [PODS](#) websites. If more information is needed, please contact either Amy Nye or Karen Selph at DISCO@soest.hawaii.edu or PODS@soest.hawaii.edu.

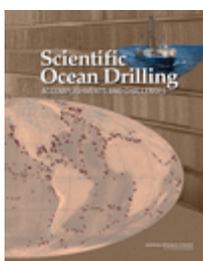


Integrated Ocean Drilling Program (IODP) Update

As reported in the last newsletter, NSF recently announced a new model for supporting international scientific drilling after the current IODP ends. Should a new drilling program be authorized by the National Science Board, a top NSF Geosciences priority is for continued JOIDES Resolution operations. NSF and its partners are working hard to ensure continued international access to all three IODP drilling platforms and to establish a new Science Advisory Structure (SAS) optimized for efficiency and use by all IODP platforms. To this end, a Framework document for the new IODP has been created, based substantially upon discussions at IWG+ meetings and incorporating contributions from all current IODP platform providers. This new SAS is expected to follow the general structure of the current revised IODP SAS, with the addition of a Facility Governing Board (FGB) for each IODP platform. The FGBs will include substantial scientific representation, with this representation making the critical science decisions in scheduling.



JOIDES Resolution

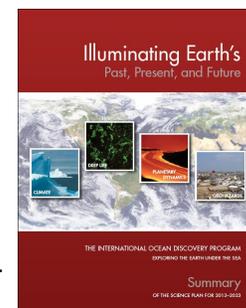


NSF welcomes the recent publication of [Scientific Ocean Drilling: Accomplishments and Challenges](#), written by a National Research Council committee co-chaired by Bob Duce and Art Goldstein. This study identified scientific accomplishments of DSDP, ODP and IODP and examined whether the recently published IODP Science Plan, [Illuminating Earth's Past, Present, and Future](#) would lead to additional significant and transformative research. The committee determined that these scientific programs have contributed with great success to a broad range of earth science disciplines, and identified numerous examples of scientific accomplishments that would not have been achieved without scientific ocean drilling. The study noted the value of

Improving program efficiency through addressing multiple science objectives on single expeditions, and emphasized the need to support technological research, innovation and development to enable transformative science achievements in the future. The study systematically examined the four research themes of the new IODP science plan (climate and ocean change, biosphere frontiers, Earth connections, and Earth in motion), noting that challenges within the themes range in potential for transformative science and therefore require prioritization by the community. NSF is engaging with the U.S. community on this prioritization. Results of an online community survey conducted in December and January under the auspices of USAC will be posted on the web for comment, and a workshop will be held in Denver April 30 - May 2, 2012 to define specific priorities and recommendations to NSF.

Other NSF activities in support of IODP renewal consideration are ongoing. A subcommittee of the Advisory Committee for the Geosciences Directorate, headed by Susan Lozier of Duke University, is examining the IODP Science Plan, the National Research Council Report, and other reports and community resources to make a recommendation on whether NSF should pursue NSB approval of post-2013 IODP scientific ocean drilling. NSF/GEO has requested time during the May, 2012 National Science Board meeting to provide an IODP update and, if appropriate, will seek Board authorization for a new Cooperative Agreement for science operation of the JOIDES Resolution in the new IODP at the Board's July 2012 meeting.

Finally, OCE welcomes Dr. Jim Beard of the Virginia Museum of Natural History as the new NSF/IODP rotator. He started in December, 2011.



NSF Workshop on Science Journalism

Please see the attached flyer from Cheryl Dybas for "From Ship to Shore to the News: NSF Workshop on Science Journalism." The workshop will be held at the 2012 Ocean Sciences Meeting on February 22.



Deep Biosphere Proposals

OCE recognizes the emerging and exciting field of deep biosphere research. NSF currently funds a Science and Technology Center in this area, the [Center for Dark Energy Biosphere Investigations \(C-DEBI\)](#). NSF does not have a “Deep Biosphere” program, so proposals in this research area are handled within the current NSF “core” programs based on the nature of the science and hypotheses proposed. When OCE program officers receive a proposal to study aspects of this system, they primarily consider the science questions addressed by the proposal, rather than specifics such as the habitat being studied, types of platforms needed for research, or nature of samples, to decide which program is most appropriate for review. Program officers may also look to other divisions or directorates (i.e., the Earth Sciences Division or the Biological Sciences Directorate) for assistance.



In order to provide a more consistent approach to reviewing deep biosphere proposals, OCE program officers have initiated discussions with other divisions and directorates in NSF on how best to handle these proposals and expect to provide further guidance in the future.

Ocean Observatories Initiative (OOI) Update

OOI Project Update – Glider Testing and Data from At Sea Test Moorings

This quarter the OOI project continued design, build and development activities. Gliders under contract with Teledyne-Webb were delivered for east/west coast testing. If testing and acceptance go well, production unit deployments and data delivery to the community are scheduled for Summer, 2012. The project has decided to share the preliminary test data from the At Sea Test moorings deployed last quarter. The web link is: <http://cgsn-omc.who.edu/oms>. These data were collected by the Ocean Observatories Initiative (OOI) project purely for internal system development purposes during the construction phase of the project and are offered for release to the public with no assurance of data quality, consistency, or additional support. The test moorings are scheduled for retrieval in April 2012. The mooring tests will inform final mooring designs that are planned for build in 2013.



Policy Reports

The National Science Board released a report in December on the [National Science Foundation's Merit Review Criteria: Review and Revision](#). In the report, the Board calls for the community to continue to use the Intellectual Merit and Broader Impacts criteria in developing and evaluating NSF proposals, and charges NSF to develop an implementation plan to address issues related to the lack of clarity for the Broader Impacts criterion. Have a look at the [NSF press release](#) and the report itself, and be on the lookout for updates to the NSF Grant Proposal Guide and release of a set of FAQs.

The National Research Council released an interim report in November, 2011 on [Approaches for Ecosystem Services Valuation for the Gulf of Mexico after the Deepwater Horizon Oil Spill](#). The report encourages a broad “ecosystem services” approach to assessing damage from the spill in order to expand options for restoration projects beyond addressing specific ecological damage to specific habitats or resources.

In early January, the National Research Council released [A Review of the U.S. Global Change Research Program's Strategic Plan](#). The report reviews the draft 10-year strategic plan for the U.S. Global Change Research Program (USGCRP). While endorsing the proposed broadening of USGCRP's scope to better integrate the social and ecological sciences, inform climate change mitigation and adaptation efforts, and emphasize decision support, the report calls for increased focus on developing critical science capacity, linking production of knowledge to its use, and strengthening the program's governance structure.

Initiated by the U.S. Carbon Cycle Interagency Working Group and the Carbon Cycle Science Steering Group, [A U.S. Carbon Cycle Science Plan](#) was released in October, 2011. The plan outlines a strategy for refocusing U.S. carbon cycle research based on community priorities.



OCE Research in the News

Here is a sampling of OCE-related project activities highlighted in the [News section on the NSF webpage](#):



[Gulf of Mexico Topography Played Key Role in Bacterial Consumption of Deepwater Horizon Spill](#)



[Scientists Look to Microbes to Unlock Earth's Deep Secrets](#)



[Catching a Coral Killer](#)



[Comprehensive Study Makes Key Findings of Ocean pH Variations](#)



[Scientists Assess Radioactivity in the Ocean From Japan Nuclear Power Facility](#)



[One if by Land, Two if by Sea? Climate Change "Escape Routes"](#)

CAREER Program Highlighted at the AGU Meeting

At the December, 2011 American Geophysical Union (AGU) meeting, 52 Faculty Early Career Development (CAREER) program awardees in the Geosciences Directorate presented results of their work and reflections on how the award influenced the path of their careers in a session entitled, *Impacts of Over a Decade of CAREER Awards*. It was a lively session with presentations about the impacts of undergraduate research experiences, teaching teachers of deaf students about the Earth through visual sandbox models, using partnerships with GK-12 projects to integrate new science topics in K-12, dispelling the myth that CAREER awards are only made to major research institutions, and many others.

[The CAREER program](#) offers the National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations. NSF can also nominate recipients of CAREER awards for the Presidential Early Career Awards for Scientists and Engineers (PECASE). The next deadline for submission of CAREER proposals to NSF's Geosciences Directorate is July 25, 2012.

OCE encourages and would like to see more CAREER proposals. It is very important for prospective PIs to contact their NSF program officer prior to submitting a CAREER proposal. The program officer can provide guidance on the distinguishing characteristics of a successful CAREER proposal and point you to resources that may help you develop yours. Contact Michelle Hall mihall@nsf.gov for more information.



Tips to Help Your Proposal

OCE offers the following suggestions in the hope that common compliance issues can be avoided, thus resulting in fewer proposals being returned without review, and facilitating an efficient and effective review process. In this issue we focus on the following sections: Biographical Sketch; References Cited; and Annual, Final and Project Outcomes Reports.

Biographical Sketch:

The most common compliance errors are made in the biographical sketch. Requirements for Biographical Sketches are given in [Section II.C.2f of the NSF Grant Proposal Guide](#). The most common—and easily preventable—errors include:

1) Publications

Error: Including more than 10 publications.

Correct: Pick the 5 most closely related publications and up to 5 other significant publications.

2) Collaborators and Co-Editors

Error: Not including an updated list of collaborators and co-editors.

Correct: Alphabetically list names, together with current organizational affiliations, of collaborators (during last 48 months) and co-editors (during the last 24 months).

3) Graduate Advisors and Postdoctoral Sponsors

Error: Not including the names of one's own PhD advisor(s) and postdoctoral sponsor(s), and/or placing this information in the Professional Preparation section.

Correct: List the names and current organizational affiliations of your own PhD advisor(s) and postdoctoral sponsor(s). Note next to their name if an advisor or sponsor is deceased. Note if you did not participate in a postdoctoral program.

4) Thesis Advisor (your students)

Error: Giving only the number of graduate students advised, or, only the names of those advised in the last 5 years.

Correct: Give the total number of graduate students you have advised, and list their names and current organizational affiliations. (This conflict is not time limited.)

5) Postgraduate-Scholar Sponsor (your mentees)

Error: Listing only the number of postdocs sponsored.

Correct: Give the total number of postdocs sponsored, and list the names and current organizational affiliations of individuals you sponsored within the last 5 years. Note if no postdocs have been sponsored in the past 5 years.

References Cited:

Requirements for References Cited are given in [Section II.C.2e of the NSF Grant Proposal Guide](#). We are seeing more proposals that use the numbering reference style. Strictly speaking, this is not against the rules. However, NSF program officers, *ad hoc* reviewers, and panelists all find the numbering reference style annoying because it requires constant shifting back and forth between the text and the reference section to identify which references relate to which text, and whether the cited references are appropriate. PIs submitting proposals to OCE are encouraged to use the author-title-journal-date style for their references.

The Grant Proposal Guide states that the References Cited section “must include bibliographic citations only and must not be used to provide parenthetical information outside of the 15-page Project Description.” PIs are cautioned not to use the reference section to list publications generated from prior support rather than putting that information in the Results from Prior NSF Support section of the Project Description.

Annual, Final and Project Outcomes Reports:

Technical Reporting requirements are given in [Section III.E of the NSF Award and Administration Guide](#). If a PI is delinquent on required project reports and they submit a new proposal, each time a program officer looks at the new proposal in the NSF electronic database, flashing lights warn that the PI has a delinquent report on a funded project. This is true whether you are PI or co-PI on the funded project. Note that a new award cannot be made – the system will not allow it – until required reports have been submitted and approved. Please submit timely reports via FastLane.



Serving as a Reviewer/Panelist

**By Michael Lesser and Mike Sieracki
OCE Program Directors**

Maintaining a thorough and credible proposal review process requires a consistent level of community involvement, and the more the better! We are rotators in the Biological Oceanography program, but observations we make here will be relevant across OCE. As rotators, we see both sides of the merit review story and would like to address here the pressing issue of getting sufficient reviews to evaluate your proposals. First, we generally have a good picture of who consistently returns *ad hoc* reviews and serves on panels. A major challenge is that the community response to requests for reviews and serving on panel is overwhelmed by the need, while at the same time we are stressing those individuals who do respond positively to our requests. We need broader participation. We often find ourselves sending out 8-12 requests for a proposal review with the hope of getting at least 3, but ideally 5 or more, experts to evaluate the proposal, and we are always scrambling to make that happen as panel approaches. This is why many of you often see a “feast or famine” number of reviews on your proposals: one submission gets three reviews while another may get eight or more. The Biological Oceanography program does not normally ask anyone to *ad hoc* review more than two proposals per cycle. However, this can be problematic because some of you serve across disciplines (biological, chemical, geological, physical) in Ocean Sciences, with each program potentially requesting two reviews per cycle. If you get overloaded and cannot do a review, please suggest alternate reviewers (maybe a colleague in your lab) or actively decline to review. This is better for us than no information. The real solution is for more members of our community to participate in the process so that the work and benefits are distributed.



Gentoo Penguins
Credit: Wally Walker, NSF

In addition to doing *ad hoc* reviews, another great opportunity for participating in the peer review process is to serve on a panel. We especially need experienced PIs for panels! Panel is the most intensive (but fun!) intellectual experience we know of in the ocean sciences. While we think people should be begging to come to panel for the intellectual stimulation and to see how the process at NSF works, the reality is that we have to invite many scientists for each one who accepts. Each program at NSF has a slightly different culture, so serving on Ocean Sciences panels, as well as panels of other divisions and directorates, will broaden your experience base and attune you to a variety of intellectual (and funding!) opportunities.

We all rightfully expect our proposals to get a good and fair review. For the peer review system to work, we all have to pitch in. We need both new investigators and those who are well-seasoned to commit to actively participating in the process. Younger PIs should self-identify as people who want to contribute to the proposal review process, so that when you become more seasoned or after getting funded we can then bring you in for panel.

As we confront funding constraints now and in the future, our community will need to demonstrate the best grant writing skills to rise to the top of the pile to be funded. We appreciate the time and energy that so many of you contribute to advancing ocean sciences' research and education.

Opportunities to Learn about NSF

If you would like to meet directly with NSF administrators and program officers, including representatives from OCE, plan to attend an [NSF Regional Grants Conference](#) when it is held in your area. The next such conference will be March 19-20, 2012, hosted by Loyola and Northwestern Universities, and registration is available on the [conference website](#).



CAREER OPPORTUNITIES IN OCE

In the last newsletter, we encouraged you to consider joining OCE for 2-3 years as a [rotating program officer](#).

OCE currently has posted announcements for a Biological Oceanographer (Program Director) ([OCE-2012-0004](#)) and a Biological Oceanographer (Assistant Program Director) ([OCE-2012-0006](#)). The announcements close on March 5, 2012. Please check the USAJobs website for further information.

We would also like to highlight opportunities for early-career researchers to work at NSF for 1-2 years as a [Science Assistant](#). NSF Science Assistants typically have a Bachelors or Masters degree in a relevant science or engineering field, work for 1-2 years at NSF, and then often pursue further graduate training. NSF divisions hire Science Assistants from an NSF-wide applicant pool, as described in the most recent position announcement. The next window to apply for Science Assistant positions will be March 20 – April 19. OCE expects to hire a Science Assistant(s) to start in the summer timeframe, so looks forward to seeing some excellent candidates.



Recent OCE Staff Changes

James Beard: Jim joined OCE as a rotating Program Manager for Ocean Drilling in December. He comes to NSF from his position as Director of Collections and Research and Curator of Geology at the Virginia Museum of Natural History. His work of late focuses on the chemistry of serpentinization and serpentinite-hosted hydrothermal systems, an interest sparked by two ODP/IODP expeditions.

Robert Mason: Rob, who was a Program Director in the Chemical Oceanography section, returned in mid-January to his position as professor with a joint appointment in Marine Sciences and Chemistry at the University of Connecticut. He will be getting back into academics by teaching a graduate level Chemical Oceanography class this spring, and catching up on research into mercury biogeochemistry in the marine environment and atmosphere.

S. Bradley Moran: Two weeks after Rob Mason's departure, Dr. Brad Moran, Professor in the Graduate School of Oceanography at the University of Rhode Island, is expected to be onboard to serve as a rotating Program Director in the Chemical Oceanography Program. Brad is a marine geochemist with expertise in U-Th series radioisotopes, a specialty he has applied to a variety of problems in oceanography.

Eos Article

Tim Killeen, University of Colorado at Boulder, Boulder, Ben van der Pluijm, University of Michigan, Ann Arbor, Marge Cavanaugh, NSF, Arlington, VA, A Focus on Science, Engineering, and Education for Sustainability, Eos, Vol. 93, No. 1, 3 January 2012. Copyright [2012] American Geophysical Union. Reproduced/modified by permission of American Geophysical Union.

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NSF Headquarters

This newsletter is designed to share timely information about the National Science Foundation's Division of Ocean Sciences. If you have comments or questions, please communicate with the relevant OCE program officer, or with Larry Weber (lweber@nsf.gov), who serves as newsletter editor. The newsletter will be distributed by email and posted on the [OCE homepage](#). Please feel free to forward to colleagues.

If you would like to subscribe to the OCE Newsletter, please follow the instructions below:

- 1) Send an email to: listserv@listserv.nsf.gov.
- 2) In the text of the message, put the following command:
subscribe ocnewsletter your name

Example: subscribe ocnewsletter John Doe

- 3) You will receive instructions via email on how to proceed.

If you do not want to receive the newsletter by email, please send an email to:
OCENEWSLETTER-signoff-request@LISTSERV.NSF.GOV.

You can also contact Margarida Yuan (myuan@nsf.gov) for assistance.



A Focus on Science, Engineering, and Education for Sustainability

PAGES 1–3

In a sustainable world, human needs would be met without chronic harm to the environment and without sacrificing the ability of future generations to meet their needs. Addressing the grand challenge of sustainability, the U.S. National Science Foundation (NSF) has developed a coordinated research and education framework, called the Science, Engineering, and Education for Sustainability (SEES) portfolio (<http://www.nsf.gov/sees>). The growing family of SEES activities, currently consisting of 11 programs, represents a major interdisciplinary investment by NSF that reflects the following topical themes: environment, energy and materials, and resilience. The SEES research and education program portfolio emphasizes the use of systems-based approaches to address critical challenges at the nexus of environmental, energy and materials, and economic systems, including social and behavioral dynamics and questions of human resilience and vulnerability.

The SEES portfolio seeks to increase capabilities for understanding, predicting, and responding to changes in the linked natural, social, and built environment. Within the above three themes of SEES, NSF supports a variety of new programs that are proceeding down three pathways to advance sustainability: (1) building the knowledge base, (2) growing the workforce of the future, and (3) forging critical partnerships. Through SEES's goals and themes, proposed linkages and partnerships, and planned future trajectory, scientists can enact targeted plans for ensuring the sustainable future of human society. The research and education communities are strongly encouraged to create interdisciplinary proposals that address aspects of sustainability.

Building the Sustainability Knowledge Base

The growing and pervasive challenges of global change demand a better understanding of the interactions among human and environmental processes—collectively, the spheres of sustainability science and engineering. In this arena, NSF recognizes its important role in support of the basic foundational disciplinary research, as well as the interdisciplinary research that links natural and behavioral sciences, engineering, and education.

Through SEES, NSF is supporting development of the knowledge base needed to tackle the multifaceted challenges of sustainability at both individual component and full complex systems levels. The program portfolio includes support for (1) research at the environment-society interface; (2) innovative strategies for energy generation and materials, distribution, and use; and (3) the study

of societal factors such as vulnerability, resilience, and sensitivity to regional change.

NSF, working closely with the community through its advisory committees, has identified various research focus areas as key investment priorities that will strengthen societal understanding of the relationships between human behavior and natural processes. Specific challenges identified for current support include Earth system modeling, fresh water security, ocean acidification, sustainable energy, biodiversity, coupled natural and human activities, and climate science education. Areas under consideration for future focused investment include natural hazards, sustainable materials, and vulnerable regions (e.g., arctic and coastal regions), as well as the resilience of populations (e.g., in developing countries) to forthcoming changes.

Scientists and organizations whose research focuses on the scientific challenges of sustainability are encouraged to get involved through submission of interdisciplinary proposals under a range of SEES solicitations in NSF's upcoming cycles of funding opportunities.

Growing the Sustainability Workforce

Future U.S. economic competitiveness, energy independence, and sustainable growth depend on a talented and motivated workforce with strong competencies in science, technology, engineering, and mathematics. Various educational and career growth opportunities under SEES, whether embedded in research efforts or targeted human capacity initiatives, will promote a future science and engineering workforce that both reflects the nation's diversity and has the skills necessary to advance knowledge and examine solutions needed to overcome critical scientific and societal sustainability challenges. Interdisciplinary experiences for undergraduate, graduate, and doctoral students; postdoctoral fellows; and early-career scientists are an important part of the SEES investment portfolio.

Further, SEES-supported fellowships, research network development, and partnerships with other organizations specifically target development and retention of early career scientists at critical transition points in their education and career pathways. Future activities may also include opportunities for middle- and late-career scientists to retool their capabilities in support of sustainability science and engineering research and education.

Forging Sustainability Partnerships

NSF works with other federal agencies and national and international stakeholders

whose functions and missions complement the SEES investment and the nation's goals. NSF and 12 other federal agencies have an overarching domestic program to respond to environmental change through the United States Global Change Research Program (USGCRP), which is currently finalizing its next 10-year strategic plan for the 2012–2022 period (<http://www.globalchange.gov/>). SEES represents a significant new contribution by NSF to USGCRP. In other examples, NSF is partnering with the U.S. Department of Energy in support of Earth system modeling and energy research, particularly as it pertains to renewable and sustainable energy pathways; the U.S. Department of Agriculture on Earth system modeling and in areas of relevance to food production and security; and the U.S. Geological Survey on hydrological and related sciences.

Many of the intellectual and practical SEES challenges are global in scope and require a comparative understanding of geographic, ecological, and cultural variability. Several national and international global change research programs are promoting research that is substantially improving the understanding of Earth systems processes and the ways that these systems are changing. However, as the needs of stakeholders engaged in global change research and policies increase, new systems for international coordination of both basic and applied research are coming to the fore. In response, funding organizations from many countries, including the United States, are moving toward more active coordination of funding for sustainability research. The International Council of Scientific Unions; the International Social Science Council; various bodies such as the United Nations Educational, Scientific, and Cultural Organization and United Nations Environment Programme; and the International Group of Funding Agencies for Global Change Research's Belmont Forum (<http://www.belmontforum.org>) are spearheading a new alliance among global environmental change stakeholders. This combined effort seeks to establish a new framework to coordinate research for sustainability (<http://www.icsu.org/earth-system-sustainability-initiative>).

Harnessing the complementary international efforts will foster cross-fertilization of ideas and will provide access to international expertise, facilities, and data. In 2012 and beyond, NSF's Partnerships for International Research and Education program will focus on sustainability research with other countries by facilitating the exchange of ideas, materials, instrumentation, researchers, and students. The global impact of many of these partnerships will be enhanced by linking with NSF's newly announced Sustainability Research Networks that will support collaborative team approaches to meeting environmental and societal challenges.

The Path Forward

Scientific agencies and organizations are increasingly bringing knowledge, discoveries, and progress to the marketplace. Included in SEES's efforts are activities aimed at bolstering university-industry interactions that connect fundamental research developments with regional and national innovation centers. To be most valuable, the knowledge gained through enhanced focus on sustainability must be provided to the public and businesses on relevant time and space scales.

NSF also places significant emphasis on computational and data-rich science and engineering, with the goal of providing a sustainable, community-based and open cyberinfrastructure for researchers and learners. This is another major challenge because the number and volume of data sets have grown to proportions beyond the range of traditional data handling tools. Transformative approaches and innovative technologies are needed for heterogeneous data to be integrated, made interoperable, explored, and repurposed by researchers in

disparate fields. This will facilitate a myriad of uses across institutional, disciplinary, spatial, and temporal boundaries. Geospatial data, metadata, enabling software/hardware, and training are essential elements relied on by the sustainability workforce and must be optimized to increase researchers' productivity and capabilities. To aid in this, NSF's Earth Cube initiative (<http://www.nsf.gov/geo/earthcube/>), which involves a new partnership between NSF's Directorate for Geosciences and Office of Cyberinfrastructure, seeks to develop a sustainable cyberinfrastructure for data-enabled science and engineering central to furthering scientific understanding of the Earth system. To this end, a growing set of funding opportunities for geoinformatics projects in sustainability are available.

Sustainability science, engineering, and education require a multifaceted consideration of the natural environment, human populations, energy and materials use, built environment, and human behavior so that the challenges brought on by large-scale environmental change and modern resource demands—economic, technological,

agricultural, and cultural—can be met. NSF's SEES portfolio transcends basic sustainability research and education through new partnerships and by bridging the gap with societal application and adaptation. Confronting today's grand challenge of sustainability, NSF's growing family of SEES programs supports natural and social sciences, engineering, and education, involving every one of NSF's directorates and offices. To ensure a healthful future, SEES relies on the energetic engagement of research and education communities from AGU and other scientific organizations to help create, nurture, grow, and disseminate the emerging knowledge base on sustainability.

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From Ship to Shore to the News

NSF Workshop on Science Journalism



**National Science
Foundation**



**2012
Ocean Sciences Meeting
TOS/ASLO/AGU
Salt Lake City, Utah**

**Wed., February 22, 2012
Time: 12:30 - 2:00pm
Room 150 ABCG**

Lost World Discovered Near Antarctic Vents. Sea Cucumbers: Dissolving Coral Reefs? Seawater Won't Halt Burmese Python Invasion. These headlines introduced recent marine science news stories. Did these articles attract readers? If so, what's the secret to their success?

Participants in this workshop will learn how to present science in an interesting way while retaining factual accuracy — the key to good science communication and science journalism. Science journalism aims to transmute scientific concepts and results from jargon-based language often understandable only by scientists, to news relevant to the lives of general readers (listeners/viewers).

The workshop explores science writing for a non-scientific audience. Participants will review examples of good science writing from newspapers like the New York Times and Washington Post, and news magazines like Science News and New Scientist; “dissect” the structure of science news and feature articles; discuss how popular coverage of science has changed in recent years; and learn the basics of science journalism.

Participants will have the opportunity to write a general-audience science article about research presented at the conference, and individual feedback will be offered to those interested.

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