

NOAA Response to:

Ocean Exploration's Second Decade:
A Decadal Independent Review of the U.S. Ocean
Exploration Program

A Report to the
NOAA Science Advisory Board
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Introduction

In February 2012 the NOAA Science Advisory Board (SAB) in consultation with the Ocean Exploration Advisory Working Group (OEAWG), invited an expert, independent review of the NOAA Ocean Exploration program for the first time in the Program's 10-year history. The National Oceanic and Atmospheric Administration (NOAA) is the lead agency for the Program through the Office of Oceanic and Atmospheric Research's (OAR) Office of Ocean Exploration and Research (OER). The SAB asked the reviewers to "consider past performance, but more importantly, advise NOAA on the future of the Ocean Exploration program and recommend steps to strengthen the Program and its leadership of the U.S. ocean exploration enterprise over the next decade." Paul Gaffney and Jesse Ausubel agreed to co-chair the review at the request of SAB Chairman Ray Ban.

Because ocean exploration is an inherently multidisciplinary activity, the co-chairs recommended review Panel members who represented a range of disciplines involved in ocean exploration. The Panel included representatives with expertise in multiple scientific disciplines, technology, education, public engagement, marine resource management, policy, and diplomacy. Panel members were selected from across academic, public, private, and non-governmental organization sectors. (See Appendix A for a list of panelists).

Program staff and key external partners provided the Panel with presentations covering all facets of the Program. The co-chairs presented the Panel's findings to the SAB during its July 2012 meeting, and the final report¹ at the SAB's November meeting. SAB Chairman Ray Ban sent the transmittal letter to then-NOAA Administrator Jane Lubchenco in November 2012. (See Appendix B for the transmittal letter).

The review Panel found that there is "undiminished motivation for ocean exploration," noting that that the Ocean Exploration program has achieved success in science, mapping, data management, education, engagement, and influencing policy, as well as helping NOAA and the nation improve diplomacy with other nations such as Indonesia. The Panel noted the scale of the task that remains and the need to increase the pace and efficiency of exploring the global ocean. In contrast, the Panel also noted the need for the Program to establish and build on more succinct priorities, thereby establishing a framework for NOAA and others to strategically explore and characterize unknown and poorly known ocean areas and phenomena.

The review Panel offered 10 recommendations for NOAA consideration and action. This document describes NOAA's response to each recommendation, including actions taken since the review and, as appropriate, milestones for addressing longer-term actions.

¹ "Ocean Exploration's Second Decade, Decadal Independent Review of the U.S. Ocean Exploration Program" Invited by the Science Advisory Board, http://www.sab.noaa.gov/Meetings/2012/november/OE_Review_Report_Final.pdf

RECOMMENDATION 1

SET STRATEGIC GOALS AND PRIORITIES

The Ocean Exploration Program must establish processes in order to define program boundaries and set measurable goals and priorities mindful of the particular risks of exploration (i.e., accept risk, unpredictability).

NOAA Response

NOAA agrees with this recommendation.

The Panel recommendation to set “strategic goals and priorities” articulates the need for NOAA to take a higher-level view of strategic planning for ocean exploration that accounts for national ocean priorities; defines NOAA priorities for ocean exploration in light of national needs; and complements, rather than duplicates, the ocean exploration efforts undertaken by other federal and non-government institutions.

What We Have Done

NOAA’s mission and priorities drive the Ocean Exploration Program. NOAA has, and will continue to, engage and leverage communities of stakeholders to define program boundaries and set measurable goals and priorities as the Panel recommends to further the NOAA mission. For example, since the Panel met, the Program has consulted with partners ranging from the OEAWG and other NOAA Programs and line organizations to academic institutions and state and regional management organizations to learn more about their efforts and to integrate their ocean exploration efforts and priorities with NOAA’s priorities and efforts. These consultations helped the Program plan and execute major partnership expeditions such as the Atlantic Canyons Undersea Mapping Expeditions in 2012. In 2013, leveraging the unique capabilities of NOAA Ship *Okeanos Explorer*, NOAA and partners collected baseline information off the U.S. east coast to address scientific and management priorities and yield new discoveries in tsunami research, fisheries assessments, habitat mapping, and potential energy development.

But most importantly, NOAA, with the Aquarium of the Pacific, convened *Ocean Exploration 2020: A National Forum*. *Ocean Exploration 2020* charged this first-ever gathering of the Nation’s ocean exploration community with taking a strategic view of ocean exploration and to define elements of a national program. The results, which are described in detail in NOAA’s response to recommendation 3, represent the community’s consensus view of priorities and direction for ocean exploration in the U.S. and are critical to NOAA’s ocean exploration activities and to the agency’s coordination of a national ocean exploration program.

What We Will Do

NOAA will prepare a NOAA strategy for ocean exploration, and a draft national strategy for ocean exploration that includes all stakeholders in a national program, including sister federal agencies, academic institutions, private explorers, and foundations.

The new NOAA ocean exploration strategic plan will describe goals and exploration priorities in support of NOAA’s mission. It will align with the NOAA Next Generation Strategic Plan and the new NOAA Five-Year Research and Development Plan (2013-2017). The NOAA plan will

incorporate the relevant parts of the National Ocean Policy Implementation Plan; complement the exploration efforts of other federal agencies and external partners; and build on the investments NOAA has made in its ocean exploration program. .

NOAA continues to engage partners in refining its ocean exploration strategy for 2015-2016 and will integrate the results of *Ocean Exploration 2020* into that strategy. The purpose of this first national forum on ocean exploration was for the extended ocean exploration community to develop a framework for a national ocean exploration strategy (see response to recommendation 3 for more information on the results of *Ocean Exploration 2020*).

NOAA will use the results of *Ocean Exploration 2020* to continue to refine exploration priorities and supporting activities for FY15, position the Program for FY16, and to develop a draft national ocean exploration strategy that will be provided to the new NOAA Ocean Exploration Advisory Board for further input and refinement. NOAA expects the Ocean Exploration Advisory Board will meet for the first time in the summer of 2014. (See response to recommendation 10).

Both the NOAA ocean exploration strategic plan and the draft national ocean exploration program strategic plan will reflect the authorizing language in the Ocean Exploration Act of 2009 (33 U.S.C. § 3401-3426). That law describes NOAA's statutory authority and responsibilities to coordinate a national ocean exploration program and to conduct a NOAA ocean exploration program.

Milestones

1. Prepare a revised NOAA ocean exploration strategy, based on *Ocean Exploration 2020* results and in continuing consultation with external and internal stakeholders (April 2014)
2. Prepare a draft national ocean exploration strategy based on *Ocean Exploration 2020* results and in continuing consultation with key national stakeholders (Summer 2014)
3. Present draft national and revised NOAA ocean exploration strategies to the new Ocean Exploration Advisory Board for their advice and consultation (Summer 2014)

RECOMMENDATION 2

NOAA LEADERSHIP SUPPORT

Top NOAA leadership must publicly and repeatedly articulate the importance of ocean exploration to the nation and to NOAA's own mission.

NOAA Response

NOAA agrees with this recommendation.

The NOAA Ocean Exploration Program has always benefited from strong external support. Ocean exploration, however, is inherently a “high risk/high return” activity that provides substantive, but often unpredictable, benefits that cannot be measured fully until years later. Ocean exploration results and findings can be disruptive if they indicate the need for changes to existing priorities and policies to meet previously unforeseen challenges. Thus, support for such high-risk ventures that generate unpredictable outcomes can be a challenge in this era of fiscal constraint and competing demands. NOAA leadership is best able to support ocean exploration when other NOAA programs see the value in it.

What We Have Done

The Program has expanded efforts to engage other NOAA programs in identifying exploration priorities that meet their mission requirements, planning multi-program/multi-discipline projects and expeditions, and implementing these efforts and evaluating the results. The Atlantic Canyons Undersea Mapping Expeditions (ACUMEN) illustrates the Program's success in developing internal and external partnerships to establish baseline ecosystem characterizations in support of the NOAA Habitat Blueprint—a priority for NOAA leadership. (ACUMEN is discussed in recommendation 6).

The Program has worked closely with the OAR Assistant Administrator and current NOAA leadership to build support for ocean exploration. The Program is improving its internal communications, using traditional mechanisms as well as new social media tools to ensure NOAA programs and leadership are aware of key ocean exploration activities. And the Program has renewed its efforts to better communicate the value of how past work has—and continues to—benefit other NOAA mission priorities.

Since the review, the Program has increased its involvement in NOAA senior councils, especially the NOAA Observing Systems Council, and on NOAA planning teams to identify opportunities for meeting NOAA requirements through ocean exploration expeditions, whether conducted aboard the NOAA Ship *Okeanos Explorer* or with partners aboard other vessels.

What We Will Do

In addition to the ongoing efforts to improve coordination and communication with other NOAA programs and line offices, the Program will establish an Ocean Exploration steering committee to regularly bring together NOAA programs with a need for, or an interest in, ocean exploration from across NOAA. The Ocean Exploration program will use this committee to define other mission needs that exploration can serve; similar to how the Program uses the National Ocean Partnership Program to identify needs across federal agencies.

RECOMMENDATION 3

NATIONAL FORUM

The Ocean Exploration Program should implement PL 111-11's requirement to establish and enable an annual high-level National Forum on Ocean Exploration across sectors to encourage partnerships, investments, technology development, and expeditions.

NOAA Response

NOAA agrees that a National Forum on Ocean Exploration is a unique opportunity to advance the National Ocean Exploration Program as the President's Panel and the Ocean Exploration Act of 2009 (33 U.S.C. § 3401-3426; Public Law 111-11) describe. Such a Forum is a means by which NOAA and key partners can convene ocean exploration stakeholders—private, academic, and government—to help develop a consensus-based framework for a National Ocean Exploration Program.

What We Have Done

NOAA and the Aquarium of the Pacific hosted the first national forum on ocean exploration 19-21 July 2013 in Long Beach, at the Aquarium of the Pacific. *Ocean Exploration 2020: A National Forum* brought together over 110 of the nation's leading ocean explorers from relevant disciplines and asked them to:

- define the desired attributes of a National Program of Ocean Exploration; and
- identify strategies and tactics to shape and maintain a National Program of Ocean Exploration that provides incentives for partners to collaborate on planning, executing, and evaluating the results of ocean exploration activities.

The consensus vision for a national ocean exploration program in 2020 that emerged includes seven major elements:

1. *Priorities:* The ocean exploration community sets clear priorities for exploration that are revisited on a regular basis. Participants identified the Arctic, ocean acidification, and the water column, as important priorities, along with the Indo-Pacific and Central Pacific.
2. *Partnerships:* A dynamic network of partnerships link private organizations, academic institutions, and public agencies to achieve national priorities for ocean exploration.
3. *Platforms:* A greater number of ships, submersibles, and other platforms are dedicated to ocean exploration.
4. *Technology Development:* Increased private sector investment is complemented by an expanded federal role in testing and validating new technology.
5. *Citizen Science:* Citizen scientists and explorers will play an increasingly important role in ocean exploration. New, more capable, and often lower cost technologies are reinforcing this trend.

6. *Data Sharing:* All data from publicly funded, dedicated civilian ocean exploration should be available quickly and widely and no additional cost.
7. *Public Engagement:* A coordinated communication network allows explorers to engage the public effectively in ocean exploration expeditions and activities.

Participants agreed that a national program must be flexible, responsive, and inclusive, and called for NOAA to act as coordinator and facilitator of such a program. Participants also agreed there is a critical need for effective communication among the federal agencies involved in ocean exploration.

Ocean Exploration 2020 helped to attract new ocean exploration stakeholders, as well as participants representing the next generation of scientists, engineers, and technicians through opportunities to participate online and by linking the National Forum to public events at the Aquarium of the Pacific.

In addition to the Aquarium of the Pacific, contributing partners included the Global Foundation for Ocean Exploration, the Schmidt Ocean Institute, and Google, Inc. Cosponsors included National Geographic, Esri, the Ocean Exploration Trust, National Science Foundation, the National Aeronautics and Space Administration, the U.S. Geological Survey, the Bureau of Ocean Energy Management, and the Department of State.

What We Will Do

Ocean Exploration 2020 generated momentum for a national program of ocean exploration. To take full advantage of the National Forum's results, the Program will use key conferences and meetings to share *Ocean Exploration 2020* results, co-host a summit on citizen exploration, and host a meeting of key oceanographic institutions to share information about upcoming expeditions. The Program expects the new OEAB to play an important role in helping NOAA capitalize on *Ocean Exploration 2020* and to prepare for the second National Forum.

A second National Forum is planned for 2015. The National Aquarium of Baltimore will co-host the Forum with NOAA.

More information and the *Ocean Exploration 2020* report are available at:
<http://oceanexplorer.noaa.gov/oceanexploration2020/welcome.html>

Milestones

1. Incorporate report results into FY15 and FY16 planning
2. Co-host Citizen Explorer Summit (May 2014)
3. Incorporate results into a draft national strategic plan (Summer 2014)
4. Host coordination meeting of key oceanographic institutions and foundations (September 2014)
5. Co-host second National Forum with the National Aquarium (2015)

RECOMMENDATION 4

RADICAL NEW MANAGEMENT MODELS

The Ocean Exploration Program should:

- *Carefully evaluate administrative overhead and business processes in both Ocean Exploration and the relevant parts of NOAA.*
- *Improve transparency of expenditures and commitments.*
- *Credibly value partnerships.*
- *Consider competitive Cooperative Institute models.*
- *Explore multi-year funding strategies.*
- *Consider crowd sourcing, prizes, medals.*
- *Check new models for consistency with Congressional intent.*

NOAA Response

NOAA agrees with this recommendation and recognizes how critical innovative partnerships are, especially during times of declining federal budgets. This recommendation contains several elements, which can be consolidated into two primary areas of focus:

- *Business processes:* Ensure internal administrative and business processes are cost-effective, transparent, and evaluated. Consider competitive Cooperative Institutes, crowd sourcing, prizes, and other models as options; and
- *Expand partnerships:* Explore multiyear, highly leveraged funding strategies with external partners, such as foundations, to stabilize funding cycles and allow for uninterrupted operations.

A. Business Processes

The Program has operated in a number of different ways since it was established. NOAA acknowledges the need to evaluate business processes continually and ensure they are cost effective and are tailored to supporting the most critical missions.

Subsequent to the review Panel, the Program provided the OEAWG with additional information on the cost of doing business when engaged in multi-agency, multi-partnership activities – in essence managing resources well beyond the base funds provided.

For example, NOAA benefits from an established partnership with the Cooperative Institute for Ocean Exploration, Research, and Technology (CIOERT), based at the Harbor Branch Oceanographic Institute at Florida Atlantic University. Other CIOERT partners are the University of North Carolina at Wilmington and SRI International. With CIOERT, the Program is exploring and characterizing deep coral and sponge communities along the southeast U.S. and disseminating

the information to the South Atlantic Fishery Management Council, developing new sensors for AUVs, and developing new instruments for gauging the relative health of marine habitats subject to stress from phenomena such as ocean acidification.

Most recently, in partnership with the National Ocean Service and the Cooperative Institute for Marine and Atmospheric Studies (CIMAS), the Program and CIOERT have launched a multi-year campaign to locate and characterize mesophotic coral and sponge communities in the Gulf of Mexico, adding critical information to the nation's ongoing assessment of this region in the aftermath of the Deepwater Horizon spill. CIOERT recently underwent an external five-year review by NOAA's Science Advisory Board that strongly endorsed CIOERT's activities and impact.

Other NOAA activities that respond to this recommendation include:

- *Grand Challenge in Ocean Mapping and Observing.* The FY14 included \$1 million for NOAA to issue a "Grand Challenge" to increase the rate of ocean discovery, by providing incentive based prizes to foster scientific and technological innovation in ocean mapping and observations. The Ocean Exploration program is playing an active role in organizing the Challenge. The X-Prize Foundation is a potential partner.
- *TFORT.* The Program leads the Interagency Task Force on Ocean Exploration and Research Technology (TFORT), which operates under the National Oceanographic Partnership Program's Interagency Working Group for Ocean Partnerships to investigate new technologies and applications . (See recommendation 7).

What We Will Do: Business Processes

In addition to continuing to develop the opportunities the Program already has initiated, NOAA will continue to seek new methods for improving efficiencies, reducing costs, and leveraging opportunities and external funding.

B. Expand Partnerships

This recommendation encourages more of the creative partnerships and modes of operation that have been successful in the past and that could bring increased Program stability and growth. This recommendation affirms the Program's approach to internal and external partnerships that look beyond conventional means in all areas of operations. Furthermore, such partnerships can help offset the impact of some of the administrative constraints under which NOAA (and all other federal agencies) must operate.

In June 2013, the Program signed an agreement with the Global Foundation for Ocean Exploration, a new foundation established specifically to support the national and NOAA's ocean exploration mission. The agreement allows the foundation and NOAA to develop new modes of operation that support ocean exploration expeditions; the development of advanced undersea technologies; and development of new scientific, engineering, and technical capacity with an emphasis on training the next generation. The agreement also allows NOAA to engage new partners toward meeting other elements of this recommendation.

The Ocean Exploration program continues to develop and strengthen its partnership with the Ocean Exploration Trust (OET), which operates the exploration vessel *Nautilus*. The Program works with OET to identify exploration priorities that complement NOAA's, coordinate expeditions to collect data for base line characterization of areas of importance, and to accelerate technology development. In a unique arrangement using a Joint Project Agreement (JPA), OET matches NOAA's investment in the Trust dollar-for-dollar, significantly extending the impact of the Program.

NOAA's Cooperative Institute model provides an existing mechanism to obtain the benefits of nimble private or academic institutions to further the expediency of NOAA's exploration mission. Depending upon availability of new resources, the Program will evaluate how best to leverage the flexibility and expertise inherent in Cooperative Institutes.

What We Will Do: Expand Partnerships

In seeking to establish new relationships with existing Cooperative Institutes or establishing a new Cooperative Institute focused on ocean exploration, NOAA is mindful of the importance of nurturing a national ocean exploration program. Strategic partnerships are central to the success of a national program.

Smaller-scale partnerships are also important, and the Ocean Exploration program is developing a series of partnerships with organizations focused on citizen exploration, visualization, and in other areas important to a national ocean exploration program and the future of ocean exploration.

Finally, the Program is in discussion with other foundations to expand its network of partnerships and to increase efficiencies and effectiveness as the Panel recommends.

RECOMMENDATION 5 TARGETED EXPEDITIONS

The Ocean Exploration Program should:

- *Restore the extramural Targeted Expedition program to at least \$10 million every year.*
- *Derive targets from the Strategic Plan. These may be geographic, thematic, and/or phenomenological (e.g. Arctic, vents, ocean acidification).*

NOAA Response

NOAA agrees that a vibrant competitive grants program is a critical part of the ocean exploration program and will fund a limited number of grants in FY14.

What We Have Done

Historically, the Program operated a targeted exploration grants program modeled on the National Science Foundation's grant process. This successful program provided one of the largest sources of competitive grant funding for ocean exploration between 2002 and 2008. It led to more than 400 peer-reviewed publications, yielded key results and discoveries in marine life and resources, and contributed to resource protection such as the designation of Papahānaumokuākea and Marianas Trench Marine National Monuments and expansion of the Monterey Bay National Marine Sanctuary.

Starting in 2004, and with the guidance of the OEAWG and the external community, the Program partnered with the Institute for Exploration, University of Rhode Island, and the University of New Hampshire, to focus on the development of a new paradigm for collaborative, non-competitive exploration using telepresence. This included the acquisition and conversion of the nation's first vessel dedicated to ocean exploration, the NOAA Ship *Okeanos Explorer*, as well as the development of a shore-based network of Exploration Command Centers that enable communities of explorers to engage in real-time exploration and operational decision making from shore. This operational paradigm allows thousands of participants to engage and collaborate, as opposed to the dozen or so scientists working on a ship under the traditional extramural grant model. A critical component of the success of this effort was the policy and funding commitment made by multiple public and private partners, as well as dedicated funding provided by Congress.

In adopting the new collaborative exploration using telepresence model, and in the face of significant budget cuts, external competitive awards through the targeted exploration program declined.

In response to the Panel's recommendation, however, the Program prepared an initial, announcement of opportunity for possible extramural grants in three priority areas: the Arctic, Caribbean, and Gulf of Mexico. The Program received over 100 pre-proposals on topics that range from ocean acidification to innovative applications of technology to marine heritage. The Program is in the process of having twenty-three full proposals peer reviewed and expect to award more than \$3 million in grant funding this year.

What We Will Do

NOAA is committed to working toward a revitalized competitive extramural grants program in the out years. Objectives for an expanded extramural grants program are to:

- advance priorities for the Arctic, and for phenomena like ocean acidification;
- respond to *Ocean Exploration 2020* recommendations for U.S. exploration priorities (see recommendations 1 and 3);
- support new expeditions to the Extended Continental Shelf using the rich foundation of mapping data collected in this region over the past several years (see recommendation 8);
- leverage funding from the Bureau of Ocean Energy Management, the National Science Foundation, and other federal agencies;
- leverage investments in ocean exploration made by foundations, non-governmental organizations, and the private sector;
- investigate and apply new management models for conducting collaborative exploration using the NOAA Ship *Okeanos Explorer* and other similarly equipped vessels;
- establish partnerships with other federal agencies and partners to provide competitive peer-reviewed opportunities for scientists to follow up on the data and information collected by NOAA Ship *Okeanos Explorer*; and,
- take innovative approaches to expand the use of the collaborative exploration paradigm nationwide and in other countries.

NOAA will continue to collaborate with the National Science Foundation and other federal partners in developing this new extramural funding program. Such collaboration could allow NOAA and other federal agencies to leverage funding from multiple sources to address national ocean exploration objectives and priorities.

RECOMMENDATION 6

OKEANOS EXPLORER

The Ocean Exploration Program should:

- *Consider diverting all Okeanos Explorer funds for targeted exploration charters.*
- *Confirm the Okeanos Explorer’s real continuing annual and daily costs.*

NOAA Response

NOAA does not agree it should divert all *Okeanos Explorer* funds to targeted exploration charters because doing so is not in the best interest of NOAA’s ocean exploration mission. NOAA considers collaborative expeditions aboard the *Okeanos Explorer* to achieve results that meet the national interest in ways targeted exploration charters do not.

The cost to NOAA to operate the *Okeanos Explorer* was \$9,150,000 in FY 2012 and \$9,705,000 in FY 2013. Budget estimates indicate that the cost to operate the ship in FY 2014 will decline to approximately \$9,650,000. These figures include both ship operations costs paid for by the Office of Marine and Aviation Operations (OMAO), and Ocean Exploration program costs for conducting expeditions aboard the ship.

Cost per day to operate the ship and missions systems in FY 2012 was \$59,032 for 155 operating days and \$70,326 per day for 138 operating days in FY 2013. The cost per day to operate the ship and mission systems is expected to be lower in 2014--estimated at \$60,692--because NOAA’s funding levels for ship time increased and the ship will sail more days. These costs can best be understood in context, which is provided in section B below.

A. Systematic Telepresence-enabled Exploration vs. Targeted Exploration

The first component of this recommendation suggests that “targeted exploration”—which NOAA interprets as a grant program to fund researchers to conduct exploration on University National Oceanographic Laboratory System (UNOLS) or other platforms – is of higher value or otherwise preferable to a dedicated ship as a mechanism to conduct systematic, collaborative expeditions (or telepresence-enabled exploration).

NOAA disagrees that targeted exploration is of higher value than collaborative exploration using telepresence as described in Recommendations 5 and 6, and instead recognizes the importance and complementary contributions of both approaches to ocean exploration. Recommendation 5 discussed the value and benefits of targeted exploration.

NOAA also acknowledges the community consensus of *Ocean Exploration 2020* which recognized that dedicated platforms and systematic approaches, collaborative public-private partnerships, open data with easy public access, and public engagement and citizen science were as important as more traditional and “closed” models of targeted exploration and research, and proprietary data.

This three-part section reviews the value and benefits of telepresence enabled collaborative exploration.

1. *Mission Value and Benefits*

Okeanos Explorer expeditions begin with consultations with NOAA programs, external partners, and the ocean exploration community to identify areas of interest and to set expedition priorities. Expedition planners design cruises to focus on these priorities and engage scientists who may participate from shore via telepresence. During expeditions, as many as 50 participants on shore work with a chief scientist aboard the ship to execute the mission. Great emphasis is placed on releasing quality assured data that meets federal standards in real time or near-real time and is available to all through expedition websites and NOAA archives and other sources.

Expeditions result in characterizations of ocean places, habitats, biology, and processes that contribute to NOAA's Next Generation Strategic Plan, Habitat Blueprint and the Five-Year Research and Development Plan. The two examples below illustrate the value of systematic, collaborative exploration to NOAA and to the nation.

- Deep Benthic Habitats and Deepwater Horizon Impacts

In 2012, the Program conducted an *Okeanos Explorer* expedition to explore deep benthic habitats and their associated communities, canyons, shipwrecks, cold seeps, and gaseous seeps, to test methods to detect gas seeps and to measure gas flux in the Gulf of Mexico. As a result, new techniques for understanding the natural flux of methane into the ocean are now proven, and critical time series data near the Macondo well were closely coordinated with the Natural Resource Damage Assessment process and the science community investigating Deepwater Horizon impacts. The ship even fulfilled a joint NOAA Office of Response and Restoration and BOEM request to survey an oil platform damaged by Hurricane Ivan in 2004. Long-term efforts to quell a leak at that site had been unsuccessful and the 2012 survey results redirected repair efforts to a new location. The collaborative exploration model allowed the expedition to characterize sites quickly by tapping scientific expertise across disciplines—and across institutions and agencies. These preliminary characterizations allowed non-NOAA vessels to conduct expeditions in 2013 to investigate these sites in more detail.

- Atlantic Canyons Undersea Mapping Expeditions (ACUMEN)

In 2012 and 2013 a cross-NOAA team of scientists and external partners conducted a mapping and exploration 'blitz' focused on deep water canyons along the continental slope between the U.S – Canada EEZ boundary and offshore Virginia. The canyons were poorly known and of high interest to federal and state agencies with research and management responsibilities. NOAA's ability to respond to the need with the *Okeanos Explorer* catalyzed and leveraged the complementary capabilities of four other research vessels. The series of expeditions collected and made publicly available more data and information on Atlantic canyons than all known previous work to date.

Scientists and managers used ACUMEN expeditions to obtain deep-sea coral community location information and refine predictive models that the New England and Mid-Atlantic Fishery Management Councils are using to develop and implement a deep-sea coral conservation strategy for U.S. waters in the Northwest Atlantic. The survey also provided critical new information to an ongoing U.S. Geological Survey investigation of submarine landslides and their role in tsunami generation. Post-campaign data analyses have identified hundreds of potential mid-water near bottom gas plumes, which are likely carbon

dioxide and methane, off the East Coast. The full implications of the findings, including for climate change and ocean carbon budgets, are still being determined. The findings and the spatial extent of the coverage would have been impossible in such a short period of time without the collaborative exploration model—and a dedicated exploration vessel.

2. *Cost Savings to the Ocean Exploration Program*

If NOAA moved from a dedicated vessel to multiple charters, NOAA's ability to support ocean exploration expeditions would be sharply reduced.

Since 2005, NOAA has invested heavily in infrastructure associated with *Okeanos Explorer*, her associated mission systems, shore-side telepresence infrastructure, and associated personnel. OMAO provides the majority of funding and staff to manage and operate the vessel's standard services and operations, or *vessel capabilities*. Ocean Exploration provides funding and staff to manage, maintain, upgrade, and operate the vessel's *mission capabilities*: deep water mapping, ROVs, telepresence, science, and data management.

NOAA funding for all vessels is allocated through the Fleet Allocation Council. Line Office leadership ultimately makes project level decisions. Each year, NOAA programs submit ship time proposals to the Council, which balances these requests against available funding. Appropriations, repair periods for individual ships, and other factors help determine final allocations, which are documented in the annual Fleet Allocation Plan (FAP). Although the *Okeanos Explorer* is dedicated primarily to ocean exploration, the Program—like all other NOAA programs—participates in this process. NOAA, through OMAO, funds the operational days that the Fleet Allocation Council and Line Office assigns to the Program. The Program does not bear the cost of these days.

Table 1 shows the number of operational days allocated to *Okeanos Explorer* for FY 2012 and FY 2013, as well as the number of days allocated in FY 2014 under the approved Fleet Allocation Plan. It also shows the number of days the Program itself funded to augment the NOAA allocation. These days are charged at an internal day rate that varies according to OMAO operating costs.

Table 1
Allocation of Okeanos Explorer Operational Days by Year

<i>Allocation</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>
OER (Funded by OER)	42	74	0
OER (Funded by OMAO)	111	47	145
Other NOAA	2	17	14
<i>Total FAP</i>	<i>155</i>	<i>138</i>	<i>159</i>

Funding limitations dictated the number of operational days for the *Okeanos Explorer* in these three years; the result is a low utilization rate for the ship when compared to UNOLS vessels (see Table 3).

Funding limitations restricted the number of operational days for the *Okeanos Explorer* in 2012 and 2013. A dry dock repair period will limit operational days in FY14. Assuming OMAO receives a similar marine services appropriation in the out-years, the annual number of operational days is likely to significantly increase and the daily rate for the ship decrease.

In FY14, OMAO will fund more than 60% of all *Okeanos Explorer*-related costs. Given the NOAA budget structure and the NOAA Fleet Allocation Process, NOAA cannot and will not consider transferring all *Okeanos Explorer* funding in OMAO to the Program for ocean exploration charters. Consequently, if NOAA moved from a dedicated vessel to multiple charters, the Program would lose access to the majority of annual funding OMAO provides for *Okeanos Explorer* operations and NOAA's ability to support ocean exploration expeditions would be reduced sharply.

3. *Operational Value and Benefits*

There are operational values and benefits in operating a dedicated platform for collaborative expeditions. In addition to the cost savings the Program realizes by using a NOAA vessel, a NOAA-operated dedicated platform provides operational efficiencies and benefits to the Program such as:

- an end-to-end data management pipeline that routinely produces quality assured, archived and publicly available data in six weeks or less;
- integration of the Program's mission systems aboard the *Okeanos Explorer* to minimize or eliminate mobilization and demobilization costs and times;
- the ability to catalyze partner investments in shore-based infrastructure such as Exploration Command Centers and high speed Internet networks that compliments and extends NOAA's investments and expands the collaborative exploration model to other institutions, platforms and applications;

- a platform for instrument development and test bed operations for new tools and methods; and,
- other public vessel benefits that facilitate operations (e.g., sovereignty, regulation waivers, self-insurance, classified security information access, data archive centers, port clearances).

Two examples illustrate additional aspects of the value of NOAA operating a dedicated ship of exploration:

- Integrated Ocean and Coastal Mapping Program: Key to the Program's success is the data management partnership with NESDIS that allows quality controlled and attributed *Okeanos Explorer* data to be made available to the public in NOAA archives in six weeks or less. From 2009 to 2013, 57 unique vessels conducting 1,134 cruises contributed multibeam files to the NGDC archives; the *Okeanos Explorer* contributed fully 9% of these files. According to NGDC, the Program is the only contributor that routinely submits quality controlled and attributed files or that provides these files within weeks of the end of a cruise.
- Nimble and Timely Response to NOAA Requirements: During the 2013 field season, the Program reprogrammed five days of an *Okeanos Explorer* Northeast U.S. mapping cruise to conduct a repeat multibeam survey in response to an unexplained surge event. This activity, coordinated with NOAA's Tsunami Research Center, is aiding tsunami researchers and warning system operators in the identification of non-seismic and landslide-generated tsunami marine hazards.

3. *Benefits to Science and Society*

Collaborative exploration using telepresence provides value to the external scientific community as well as society at large. The model allows any number of scientists to participate fully in expeditions—a distinct advantage over traditional models where the science party is limited by berth space aboard a ship.

This collaborative mode of operation breaks down cultural and academic barriers often present in single discipline expeditions, and helps to link scientists and the public to create a more ocean literate society. Collaborative expeditions aboard the *Okeanos Explorer* engage the next generation of scientists and engineers, educators, resource managers, and others to strengthen the community of ocean explorers in support of NOAA's enterprise objective for Stakeholder Engagement.

Collaborative, multidisciplinary expeditions yield standardized, quality assured, baseline characterization data that is made available to the science community to catalyze more efficient research data collection operations and experiments. The science community leverages characterization data for additional partnerships, grants, and publication, and value is added to produce new value and products for diverse academic, public, and private interests. *Okeanos Explorer* data is similar to the weather observations and analysis produced by the National Weather Service—data and products that third parties ingest, add value, and repackage the results for customized markets and uses.

Finally, dedicated platforms also serve as an important NOAA, national, and global symbol for ocean exploration. These platforms can be leveraged in the way NASA space shuttles once were icons for space exploration to excite the public and catalyze government partnerships and as an instrument of diplomacy. The 2010 *Okeanos Explorer* expedition to Indonesia is good example of the value of a U.S. operated dedicated ship of exploration in advancing diplomatic—as well as scientific—objectives.

What We Will Do: Systematic Telepresence enabled Exploration vs. Targeted Exploration

NOAA agrees it is critical to understand the costs associated with operating the collaborative exploration infrastructure and the funding required to engage scientists and others in executing expeditions and developing standard baseline characterizations of the areas explored.

Equally important is understanding the benefits to be gained by the collaborative and open priority planning process; engaging on-shore communities of interested parties in real-time; and ensuring data, information, and products are accessible and widely disseminated.

NOAA will continue to monitor the costs—and the benefits of collaborative exploration using telepresence.

B. Cost Analysis

Complete information on annual and daily operating costs was not available to the review panel at the time of the review. This section provides NOAA costs for ship and mission operations and UNOLS costs for ship operations and asset leases in 2012 and 2013 to allow rough comparisons. Since the review, the Program has refined its internal cost analysis and worked with NOAA’s ship operator, OMAO, to clarify NOAA’s costs for operating the NOAA Ship *Okeanos Explorer* as a platform dedicated primarily to ocean exploration. For context only, NOAA also obtained operational day² rates for UNOLS vessels with similar capabilities to the *Okeanos Explorer*. These vessels have deep-water multibeam systems and are capable of deploying deep water remotely operated vehicles (ROVs). NOAA ship operations costs include direct costs to OMAO for the *Okeanos Explorer*’s fuel, crew, pier facilities, and maintenance, so the UNOLS comparisons are not 1:1.

OMAO Operating Costs

OMAO funds and manages ship operations costs. These costs include crew, fuel, consumables, and other daily ship operations costs; shore-side infrastructure; maintenance; and logistics and supply systems, among others. As the result, the Program is able to take advantage of OMAO’s significant investment in the ship and shore-side infrastructure.

In FY 2012, OMAO *Okeanos Explorer* ship operations costs were \$6.06 million (of that amount, the Program provided OMAO with \$473,000 to fund an additional 42 operational days). In FY 2013, OMAO *Okeanos Explorer* ship operations costs were \$6.44 million (of that amount, the

² An “operational day” is defined as a day underway or in port away from home port.

Program provided OMAO with \$828,000 to fund 74 operational days). In FY 2014, OMAO will fund all 159 planned operational days at a budgeted cost of \$6.5 million.

Ocean Exploration and Research Program Costs

The Ocean Exploration program funds mission operations costs. These include costs for scientific and technical personnel, telepresence services, ROV and multibeam operations, end-to-end data management, and data and product development.

The Program's mission costs in 2012 for 153 operational days were \$3.09 million. This equates to an average daily cost of \$20,200 per operational day to the Program for systematic telepresence enabled exploration mission operations.

The Ocean Exploration program's mission costs in 2013 for 121 operational days were \$3.265 million. This equates to an average daily Program cost of \$26,980 per operational day for systematic telepresence enabled exploration operations. Consideration of these averages should include understanding that not all days are ROV operational days—which cost more--and FY2012 and FY2013 costs included development costs for the ROV *Deep Discoverer* (see below).

The Program's mission costs for 2014 are budgeted at \$3.15 million. Assuming 2013 cost factors, this equates to an approximate average daily Program cost of \$19,811 per operational day.

Total NOAA Cost to Operate the Okeanos Explorer

Table 2 summarizes NOAA's ship operations and mission operations costs for the 155 *Okeanos Explorer* operational days in 2012 and the 138 operational days in 2013. Note that the Ocean Exploration program used 153 of the 155 operational days in 2012, and 121 of the 138 operational days in 2013.

Table 2
NOAA Costs to Operate the *Okeanos Explorer* 2012 and 2013 with 2014 Projections

	<i>2012</i>	<i>2013</i>	<i>2014³</i>
EX Operations Cost (Fleet Allocation Plan)	\$5,587,000 ⁴	\$5,612,000	\$6,500,000
OER Program Funded Days	\$473,000	\$828,000	0
<i>Total EX Operations Cost</i>	<i>\$6,060,000</i>	<i>\$6,440,000</i>	<i>\$6,500,000</i>
OER Mission Costs	\$3,090,000	\$3,265,000 ⁵	\$3,150,000
<i>Total NOAA Costs</i>	<i>\$9,150,000</i>	<i>\$9,705,000</i>	<i>\$9,650,000</i>

Sources: OMAO ship operation costs provided by the OMAO CFO on October 24, 2013 and February 7 and 18, 2014. OER mission operations costs provided by OER on October 24, 2013 and February 6, 2014.

Table 3 provides a summary of OMAO and day rates of comparable UNOLS vessels for the indicated number of operational days in 2012 and 2013. Rates are total annual costs divided by the number of operating days. The *Okeanos Explorer* rate is calculated using the same methodology as UNOLS costs using the OMAO-provided annual costs shown in Table 1.

³ Planned and budgeted. Actual expenditures may vary

⁴ There are no indirect OMAO headquarters administration overhead costs (for example, OMAO HQ personnel costs) included because they are distributed across OMAO and it is not possible within the NOAA financial system to assign such costs to the *Okeanos Explorer* or any other specific NOAA vessel.

⁵ Included in OER's mission costs is development of the *Deep Discoverer* ROV system in 2012 and 2013. The Program conducted 74 days of ROV operations in FY 2013 compared to only 47 days of ROV operations. ROV operations cost more than non-ROV operations and so Program costs are higher in FY 2013 despite sailing fewer days.

Table 3
Average 2012 and 2013 Ship Operations Day Rates for Representative
Exploration Capable Platforms

<i>Year</i>	<i>R/V Thomas G. Thompson rate (days)</i>	<i>R/V Kilo Moana rate (days)</i>	<i>Okeanos Explorer rate (days)</i>	<i>R/V Atlantis rate (days)</i>
2012	\$30,757 (175)	\$34,000 (222)	\$39,096 (155)	\$41,650 (223)
2013	\$34,502 (260)	\$35,500 (253)	\$46,667 (138)	\$43,242 (229)

Source: UNOLS vessels (*Moana, Thompson, Atlantis II*) calendar year 2012 and 2013 costs provided by UNOLS on February 6, 2014. OMAO costs provided by the OMAO CFO on February 7, 2014.

Please note that if the *Okeanos Explorer* was funded to operate at a similar number of days as a typical UNOLS vessel, (i.e., approximately 220 operational days) the vessel day rate would drop to about \$33,750 using FY 2013 costs and operational factors.

Remotely Operated Vehicles

OER also funds the development, maintenance, and operations of deep water remotely operated vehicles. In FY 2012 the Program operated the *Little Hercules/Seirios* two-body ROV system while developing the new *Deep Discoverer* ROV. The program operated the ROV system for just 47 days. In FY 2013, the Program tested and began to operate the *Deep Discoverer/Seirios* system and operated the ROV 74 days. Fifty-eight days of ROV operations are planned in 2014. Table 4 shows the costs to the program of engineering and operating these systems in FY 2012 and 2013 as well as the cost to lease the National Deep Submergence Facility's (NDSF) *Jason II/Medea* two-body system.

Table 4
Average 2012-2013 Remotely Operated Vehicle Day Rates for
NOAA and UNOLS Systems

<i>Year</i>	<i>Program ROV System Day Rate⁶</i>	<i>NDSF Jason II + Medea Day Rate⁷</i>
2012	\$14,200	\$20,000
2013	\$13,900	\$20,000
2014	\$18,300 ⁸	\$21,000

Source: UNOLS NDSF *Jason II + Medea* calendar year 2012 and 2013 costs provided by WHOI ROV Operations Coordinator on February 5, 2014. OER *Deep Discoverer* rates provided by OER on February 6, 2014.

What We Will Do: Further Cost Analysis

NOAA believes that regular, accurate cost comparisons between the use of a dedicated NOAA platform and charter platforms are useful to ensure that the Program operates in the most cost-effective way possible. The Program will evaluate these costs annually (including five-year projections) in the context of NOAA’s ocean exploration strategy and the goals of the National Ocean Exploration Program and report the results regularly to the new OEAB.

C. Summary

NOAA believes the use of the *Okeanos Explorer* for collaborative telepresence enabled exploration is not only desirable, but also prudent and cost effective. The *Okeanos Explorer* is an effective and valuable complement to targeted exploration. At this time NOAA will continue to operate the *Okeanos Explorer* as a cost-effective, integrated, dedicated ocean exploration platform. NOAA will continue to maximize the value of the *Okeanos Explorer* by leveraging NOAA and partner investments in ship and shore-based platforms, assets, and infrastructure. The Program will continue to coordinate with NOAA programs to meet priority missions and to service needs across the agency.

Finally, we expect foundation partners to bring additional resources that support a dedicated ship of exploration, furthering leveraging NOAA’s investments in the ship and its systems.

NOAA is mindful that as technology evolves the future of ocean exploration may well lie in a network of ships of opportunity, for example, or a lower-cost fleet of research vessels designed to

⁶ The Program costs include staging, maintenance, and other expenses to help ensure the NOAA ROV costs are comparable to the NDSF costs. The Program figures also include development costs for the *Deep Discoverer*. The daily rate is calculated as an average daily cost for ROV technicians and engineers combined with development and maintenance costs (total cost to the program to operate the vehicle in that year divided by the number of days the ROV operated).

⁷ The *Jason* ROV day rate is charged for underway days and inport staging/detabling days. The rate includes all onboard technical support/pilots as well as a data manager, all shipping costs within the US, shoreside maintenance and developmental costs. A transport and deployment risk insurance premium is also included in that 20K per day rate. The rate does not include foreign shipment and specialized/custom sensor modifications.

⁸ The budgeted 2014 rate includes development for new capabilities, including instruments, cameras, and manipulator arms for the ROV. The 2014 day rate is increased over 2013 is because the number of ROV operating days is reduced from 74 in 2013 to 58 in 2014.

accept “plug and play” containerized systems of many kinds—including submersibles and telepresence systems or mixes of ship, AUV, and ROV technologies-- that should greatly increase efficiencies while reducing the cost of ocean exploration.

NOAA will continually monitor *Okeanos Explorer* costs and compare those costs to existing and emerging alternatives, including charters and the new technologies that will eventually surpass the capabilities of the ship and others like it.

RECOMMENDATION 7 TECHNOLOGY

Ocean Exploration must partner to stay abreast of new technologies:

- *Development of sensors, exploration instruments and vehicles, and information technology (hardware and software) costs too much for Ocean Exploration alone to lead.*
- *Ocean Exploration pioneered telepresence, but the context is changing fast and staying abreast is critical.*

NOAA Response

NOAA agrees with this recommendation.

Given rapid developments in technology and increasing costs of research and development, NOAA, other federal agencies, academic institutions, and private enterprises must develop new partnerships and “radical new management models” to advance undersea technology and meet growing challenges. The Program sees its role as a facilitator and coordinator, helping to identify compelling challenges that attract private-sector technology development, to provide useful testing environments, and to adopt new ocean exploration sensors and systems. NOAA also envisions a role in transitioning new technologies to meet exploration, research, management, and monitoring requirements as appropriate. *Ocean Exploration 2020* affirmed the importance of this role for NOAA in coordination with its federal partners.

What We Have Done

In response to this recommendation, the Program has taken the following action:

- *Internal Technology Team:* The Ocean Exploration program has established an internal team to work with NOAA line offices and other partners to define ocean exploration challenges requiring technological solutions; identify new technologies that could be adapted to address some of these challenges; and form and foster partnerships with industry, academia, and agency laboratories to conduct innovative technology pilot projects.
- *Interagency Technology Task Force:* The Program and its government and industry partners have established the Task Force on Ocean Exploration and Undersea Research Technology and Infrastructure (TFORT), which operates under the National Oceanographic Partnership Program’s Interagency Working Group for Ocean Partnerships.

TFORT’s current priority involves identifying planned missions that demand technological innovation and developing budget strategies that could combine partner resources to develop new instruments and platforms. The team is also considering ways to attract vendors who may want to “showcase” their technologies, delivering mission critical information at little to no cost.

- *Telepresence*: The Program is expanding core exploration capabilities—especially telepresence—to make them more accessible to users, available on other ships, and capable of providing new types of data. For example, the Program is working with partners to:
 - distribute more data from the *Okeanos Explorer* and other similarly equipped vessels over the Internet to allow anyone online to monitor expeditions in real time and to contribute their observations; and
 - develop a “flyaway” telepresence system consisting of portable, containerized, end-to-end systems that include a submersible and supporting instruments, a control room, data processing systems, and telecommunications equipment. Such systems allow any number of types of research vessels to engage shore-based scientists and the public through telepresence.

What We Will Do

In addition to continuing to develop the activities described above, NOAA will continue to invest in technology development through its CIOERT and its long-running relationship with the National Deep Submergence Laboratory at Woods Hole Oceanographic Institution.

NOAA is renewing and expanding its interagency service agreement (ISA) with the Naval Undersea Warfare Center in Newport, Rhode Island, to include support of undersea vehicles, underwater communications, distributed network systems, and mission planning and operations.

Finally, NOAA will work through its existing federal agency partnerships and seek to expand its private sector relationships to develop *Ocean Exploration 2020* recommendations on technology development to advance this part of the National Ocean Exploration Program.

RECOMMENDATION 8 EXTENDED CONTINENTAL SHELF

The Program has achieved outstanding results, and political demand is high. But OER should accelerate its work to finish its share in three years.

NOAA Response

NOAA agrees with this recommendation.

What We Have Done

Mapping the U.S. Extended Continental Shelf (ECS) provides the most basic information needed to set exploration priorities in this geographically vast area; to manage, protect, and conserve undersea resources; and to provide for national security and navigational safety. NOAA expects to complete its share of the ECS mapping effort to meet the information requirements of Article 76 of the Law of the Sea Convention within the next three years. But given the importance of potential ECS areas to U.S. national interests, the Program also intends to continue exploration of this vast region with partners for years to come.

What We Will Do

NOAA believes the ECS data archive is a rich resource for NOAA and its partners in government, academia, and the private sector to set national ocean exploration priorities in the National Forum and other venues.

NOAA expects that these results will in turn inform revisions to the NOAA ocean exploration strategic plan and the new National Ocean Exploration Program strategy (see recommendation 1). These ECS data-derived priorities will help establish priorities for new extramural funding programs (see recommendation 5).

RECOMMENDATION 9 BRANDING

The Ocean Exploration Program should:

- *Develop icons.*
- *Cultivate champions.*

NOAA Response

NOAA agrees with this recommendation.

The discoveries, images, maps, and other results of ocean exploration are inherently charismatic. Ocean exploration also offers a trove of material for formal and informal education for all ages and is a powerful way to reinforce Science, Technology, Engineering, and Mathematics (STEM) priorities.

The Program’s communications strategy highlights the importance of increasingly using social media to engage a broader public. The Program’s response to this recommendation is focused both internally, with improvements to websites and social media tools, and externally, through preparation for the National Forum and how the Forum itself is organized.

The Program has greatly benefited from formal partnerships with institutions that focus on communications and engagement such as the Ocean Exploration Trust and Institute for Exploration, the Exploratorium, the network of aquaria around the country, the Smithsonian Institution and Sant Ocean Hall, as well as informal, but no less valuable partnerships with institutions such as the National Geographic Society and the Discovery Channel.

What We Have Done

Since the Review, the Program has dramatically expanded its online presence to reach broader, younger, and more dynamic audience. For example, the NOAA Ocean Explorer website has been redesigned and updated, including sections on breaking news and other events that highlight the ocean exploration activities of other federal agencies, academic institutions, private enterprises, and others. The Program also posts daily on Facebook and Twitter and is experimenting with new social media tools. NOAA believes the tools and techniques are in place, and positioning the Program to cultivate high-profile champions for the national ocean exploration program—not just a single agency.

NOAA, in collaboration with the Aquarium of the Pacific, used the National Forum to experiment with new ways to engage a broader community through its online presence. From “Tweetchats” to publicize the National Forum or “virtual breakout sessions” to engage the online community, NOAA expects the results of these experiments will help develop a new brand identity for ocean exploration and expand audience reach.

NOAA signed a letter of intent with Silvergate Media, owner of the children’s TV show “The Octonauts.” The Octonauts, with a mission to “Explore! Rescue! Protect!” is intended for three to five-year-olds and is written with a commitment to scientific accuracy. By reaching three to five-year olds, NOAA also reaches their parents.

What We Will Do

NOAA will continue to work with the community of ocean explorers to create new icons representing ocean exploration. From dedicated ships such as the *Okeanos Explorer* and the *Nautilus*, to charismatic characters other graphics that capture and stimulate the imagination – all options are open. The Program also recognizes the need to engage non-traditional, non-ocean science partners in the development of icons, and has intentionally sought such representatives of these communities as part of the process of soliciting applicants for the OEAB.

NOAA will develop a formal partnership with Silvergate that infuses science into Octonauts episodes, builds an identity with the Octonauts for NOAA and vice versa, develops characters based on NOAA assets such as *Okeanos Explorer*, includes educational materials and messaging in Octonauts toys and other products, and collaborates on public events to raise awareness of ocean exploration.

RECOMMENDATION 10

OCEAN EXPLORATION ADVISORY BOARD

The Ocean Exploration Program should establish an Ocean Exploration Advisory Board and:

- *Coordinate with the NOAA Science Advisory Board to multiply influence and achieve efficiencies.*
- *Avoid conflicts of interest.*

The new Advisory Board should assist the Program in the development of a five-year Strategic Plan and monitor implementation progress.

NOAA Response

NOAA agrees with this recommendation.

What We Have Done

The Program has taken the following steps toward establishing the Ocean Exploration Advisory Board (OEAB):

- Prepared the charter, membership balance plan, and other documents defining an OEAB that the Federal Advisory Committee Act (FACA) and the Department of Commerce require. These were approved in August 2012.
- Prepared a conflict of interest policy statement with criteria for evaluating whether potential candidates may present a conflict of interest if they were to serve on the OEAB. (Note that the Program developed the conflict of interest statement to respond to the Review recommendation. While it is clearly good policy, such a statement is not required under the FACA rules).
- Solicited OEAB candidates through a Federal Register Notice published on 29 October 2012. Following an analysis of the 48 candidates who applied, the Program concluded that gaps remained and solicited additional candidates in a second Federal Register Notice published on 30 April 2013. The second solicitation yielded high quality applicants to fill the gaps.
- Selected candidates for the Administrator's consideration. These candidates have been vetted and cleared internally and are in NOAA's FACA clearance process.
- NOAA expects to seat the new OEAB by the summer of 2014.

SUMMARY AND NEXT STEPS

NOAA and the Program appreciate the time, effort, and input from the panelists, and especially thank the co-chairs Paul Gaffney and Jesse Ausubel, as well as Jerry Schubel, the SAB liaison to the OEAWG. The advice, counsel, and recommendations from the Panel are critical for both the continued refinement and improvement of the NOAA Ocean Exploration Program, and more importantly, for setting a foundation for the partnerships essential for establishing a formal National Ocean Exploration Program.

NOAA is committed to taking the following key steps:

- Develop a new NOAA strategic plan for ocean exploration.
- Work with partners to develop a national strategy and program for ocean exploration.
- Generate understanding and support for ocean exploration across NOAA and at all levels – ensuring NOAA programs understand and value exploration as a fundamental requirement for meeting their mission objectives.
- Support a regular National Forum focused on ocean exploration, as well as coordinating and facilitating other workshops, conferences and events in support of a National Ocean Exploration Program.
- Investigate, evaluate and implement “radical new management models.”
- Reprise the extramural targeted exploration grant program, with a focus on engaging other agencies and institutions to leverage and make available more funding and resources than would otherwise be the case in support of exploring unknown and poorly known ocean areas and phenomena.
- Continue to work with partners to expand the telepresence-enabled exploration model and engage communities of scientists, educators, students, and other interested parties onshore at Exploration Command Centers and through the Internet, using the most cost-effective and productive means necessary.
- Explore new partnerships and new business models for encouraging and accelerating the development of new undersea technologies, including innovative use of existing technologies.
- Complete bathymetric surveys of the remaining areas that may be considered part of the U.S. Extended Continental Shelf, and strategically and systematically use this information as a framework for guiding exploration and research in support of the NOAA mission and to meet national objectives as articulated in the National Ocean Priorities Implementation Plans.
- Work with partners to cultivate new champions for ocean exploration.
- Establish and take full advantage of the OEAB, which like the NOAA Science Advisory Board, will provide advice and counsel to NOAA and partners on ocean exploration strategies, priorities, and programs.

APPENDIX A
OCEAN EXPLORATION REVIEW PANEL MEMBERS

Jesse Ausubel – Co-Chair

Director, Program for the Human Environment
The Rockefeller University

VADM Paul Gaffney, USN (Ret.) – Co-Chair

President, Monmouth University (at time of Review)

Susan Avery

Director, Woods Hole Oceanographic Institution

Rodey Batiza

Program Director, National Science Foundation

Jean May-Brett

Math-Science Partnership Program Coordinator
Louisiana Department of Education

James Delgado

Director, Marine Heritage Program
Office of National Marine Sanctuaries, NOAA

Terry Garcia

Vice President for Mission Programs, National Geographic Society

Hon. Cameron Hume

Former U.S. Ambassador to Indonesia, South Africa, and Algeria

Jeffrey Karson

Department Chair and Jesse Page Heroy Professor of Earth Sciences
Syracuse University

James Kendall

Regional Director, Alaska OCE Region
Bureau of Ocean Energy Management, Department of the Interior

Eric Lindstrom

Physical Oceanography Program
National Aeronautics and Space Administration

Marcia McNutt

Director, U.S. Geological Survey (at time of Review)
Department of the Interior

Steve Ramberg

Chief of Naval Research Chair
National Defense University

APPENDIX B
TRANSMITTAL LETTER FROM THE SCIENCE ADVISORY BOARD
TO THE NOAA ADMINISTRATOR

November 26, 2012

The Honorable Jane Lubchenco
Administrator
National Oceanic and Atmospheric Administration
Herbert C. Hoover Building Room 6811
14th Street & Constitution Avenue NW
Washington, DC 20230

Dear Dr. Lubchenco:

I am pleased to transmit to you the following report from the Ocean Exploration and Research (OER) Program review. This review was conducted under the Science Advisory Board Ocean Exploration Advisory Working Group (OEA WG) as per its terms of reference. The review panel found that the OER Program has had impressive successes in science, mapping data management, education, politics, and diplomacy. However, there remain vast unexplored regions of the ocean. The panel's major finding is that there is an undiminished motivation for ocean exploration research. The panel affirmed that ocean exploration is distinct from comprehensive surveys and at-sea research, including hypothesis-driven investigations aimed at the ocean bottom, artifacts, water column, and marine life.

The review panel felt that the OER program is critical to ocean research. Its multidisciplinary approaches equip explorers with the very best in marine research technology. However, the work of the OER program is unfinished. Based on the panel's findings, ten recommendations were made: 1) Setting strategic goals and priorities, 2) Gaining NOAA leadership support, 3) Running a national forum on ocean exploration, 4) Establishing radical new management models, 5) Establishing the extramural targeted expedition program, 6) Diverting all *Okeanos Explorer* funds for targeted exploration charters, 7) Developing partnerships to stay abreast of new technologies, 8) Accelerating work on the Extended Continental Shelf (ECS) mapping, 9) Developing icons and cultivating champions, and 10) Establishing an Ocean Exploration Advisory Board.

The OER Program is critical to conducting quality ocean research. The panel found this review very successful and commends NOAA on embarking on innovative ocean exploration. The SAB felt this was a very useful report and a great example of why NOAA leadership should continue to support the effort of the OER Program.

If you have any questions, comments or concerns, please let me know.

Sincerely,



Raymond J. Ban
Chair, NOAA Science Advisory Board
Managing Director, Ban & Associates, LLC.

Attachment

cc: Jerry Schube
Larry Mayer
Bob Ballard
Jesse Ausubel
VA DM Paul Giffney
Tim Arano
John McDonough
David McKinre
Sanya Compton
Cynthia Decker