

Paula Keener-Chavis
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I find it odd to think that we, as a Nation, know more about the landscape of the moon than we know about the landscape of the planet on which we live—that is of course, if you take into account the mountain ranges, volcanoes, underwater trenches, and deep sea vents that make up the landscape beneath our ocean. I also find it odd that even though we live on an Ocean Planet, approximately two-thirds of which is covered by water, approximately 95% of the ocean remains unexplored. And it has always been my philosophy and belief that we are all born with an innate curiosity about the natural world.

Today, we have sophisticated technological capabilities that have made the ocean more “visible” and more accessible than it has ever been before. As a result of “new technological eyes,” hundreds of new species and new ecosystems have been discovered—some of which may hold the keys to the origin(s) of life on Earth, cures to life-threatening diseases, and knowledge about presently-unknown metabolic pathways for obtaining and using energy to support life here on Earth.

In 2000, the President’s Ocean Exploration Panel developed recommendations for a national Ocean Exploration Strategy. In a report, entitled *Discovering Earth’s Final Frontier: A U.S. Strategy for Ocean Exploration*, the Panel recommended that our country undertake a national Ocean Exploration Program in which discovery and the spirit of challenge are the cornerstones—just as discovery and the spirit of challenge probably were cornerstones of ocean exploration several thousand years ago. Global in scope, and initially concentrated in U.S. jurisdiction, the results of the program would be scientifically documented and widely disseminated.

The report recognizes that within the last few decades, advances in undersea technology have revolutionized the way we think about the oceans and the life within them. New exploration tools can take researchers into the deepest reaches of the oceans, either directly or by telepresence. The following key objectives of an Ocean Exploration Program were identified by the Panel:

- Mapping the physical, geological, biological, chemical, and archeological aspects of the ocean; such that the U.S. knowledge base is capable of supporting the large demand for this information from policy makers, regulators, commercial ventures, researchers, and educators;
- Exploring ocean dynamics and interactions at new scales, such that our understanding of the complex interactions in the living ocean supports our need for stewardship of this vital component of the Planet’s life support system;
- Developing new sensors and systems for ocean exploration, so as to regain U.S. leadership in marine technology; and
- Reaching out in new ways to stakeholders, to improve the literacy of learners of all ages with respect to ocean issues.

The Ocean Exploration Panel also made the following recommendations for what should be included in the Program:

- Interdisciplinary voyages of discovery within high-priority areas, including the U.S. Exclusive Economic Zone (EEZ) and the continental margin, the Arctic, and poorly-known areas of the Southern Oceans and inland seas. U.S. inventory of the living and nonliving resources in the ocean should be second to none, particularly within our own EEZ and continental margins.
- Platform, communication, navigation and instrument development efforts, including the capitalization of major new assets for ocean exploration in order to equip our explorers with the very best in marine research technology.
- Data management and dissemination, so that discoveries can have maximum impact for research, commercial, regulatory, and educational benefit.
- Educational outreach, in both formal and informal settings, to improve the science competency of America's schoolchildren and to realize the full potential of citizenry aware and informed of ocean issues.

We advocated a new national Ocean Exploration Program to permit exploratory expeditions for two reasons: 1) The initial phase of oceanographic discovery ended before a significant portion of the oceans was visited in even a cursory sense; and 2) marvelous new tools now exist that permit exploration in spatial and temporal dimensions that were unachievable 50 years ago. For these reasons, we must go where no one has ever gone before, "see" the oceans through a new set of technological "eyes," and record these journeys for posterity."

When meeting with staff members of the House of Representatives and the Senate in Washington shortly after the report was presented to the President, one of the most frequently asked questions was, "What impact do you think we will see in the Panel's recommendations for ocean exploration as we enter a new Administration? My reply was simply this, "Ocean exploration is not a partisan issue. It is an American issue and it is vital to the health of our Planet."

As mentioned above, one of the four key recommendations of the Panel's report was that of "reaching out in new ways to stakeholders, to improve the literacy of learners of all ages with respect to ocean issues." It is within this context that I would like to address needs, both at the regional and national levels, as they relate to ocean science education. Over the past decade, the scientific community has been challenged to become increasingly more involved in reform efforts in science education through the development of innovative pedagogy, specifically that involving the integration of research and education and bringing the results of these effective collaborations to educators, students, media, and the general public. Nevertheless, in the National Research Council's (NRC's) publication entitled The Role of Scientists in the Professional Development of Educators (1996), points to issues related to perceptions, misconceptions, and a general lack of understanding between the scientific and education communities of what teachers "do" in the classroom as teaching professionals and what scientists "do" as scientific researchers in the laboratory and/or the field.

The lack of understanding within both of these professional communities has long been a barrier to broad-reaching effective collaborations between the two groups and thus, the integration of scientific research into high quality, engaging educational products and experiences. In fact, the NRC (1996) states, "Although there are many effective partnerships between teachers and scientists, to expand effective...programs,

teachers' and scientists' understanding and appreciation of each other's responsibilities must be improved."

The value of including educators and others in ocean science research experiences and translating these experiences back into materials and resources appropriate for classroom and/or general public use has been successfully demonstrated in a variety of programs throughout the country for years. And although providing educators with first-hand experiences in the process of ocean science research and discovery is an obvious and very natural avenue for the integration of ocean science research in the classroom, programs that provide opportunities for educators to become involved in ocean science research have been limited and, for the most part, disconnected. Furthermore, the ocean science community often is not aware of pedagogical approaches which lead to effective teaching and learning, the needs of educators and school administrators, and the responsibility the education community has to meet accountability standards set forth by many State Departments of Education.

Interestingly enough, it is the interdisciplinary nature of ocean science education that has served as more hindrance than an asset to integrating the results of ocean science research into education on a broad scale. And despite the fact that the need for scientists to work with educators to enhance the general public's understanding of science has been promulgated for years in reports such as *Science for All Americans*, *NSF in a Changing World*, *Turning to the Sea: America's Ocean Future*, and most recently, the Ocean Exploration Panel's report entitled *Discovering Earth's Final Frontier: A U.S. Strategy for Ocean Exploration*, the ocean science community did not answer this call. I believe the reasons for this are grounded in what I have just outlined above.

This "lack of action" has resulted in lost opportunities for program collaboration among educators and scientists, a lack of educational product development based on exciting ocean science research and discoveries, a general lack of information dissemination among the education and research communities and the general public, lost opportunities to leverage funding, and ineffective and inefficient efforts to recruit educators, scientists, students, and others in these rich and rewarding opportunities.

With the recent establishment of the Ocean Exploration Program within the National Oceanic and Atmospheric Administration (NOAA), I believe there exists an unprecedented opportunity to focus hundreds of millions of eyes on our essentially unexplored world of water—and in doing so, reach out in new ways to stakeholders to improve the literacy of learners of all ages with respect to ocean issues, thus fulfilling one of the four key recommendations of the Ocean Exploration Panel. NOAA's recently established Office of Ocean Exploration has recognized the great potential for generating exciting outreach and education opportunities associated with these ocean exploration efforts and supported an education initiative to bring the excitement of ocean exploration and discovery coupled with scientific research to classrooms throughout the country this fall.

Drawing upon multiple partnerships, many of which were new to the Agency, NOAA funded a pilot educational initiative through the National Undersea Research Center at the University of North Carolina, Wilmington and the South Carolina Statewide Systemic Initiative's Charleston Math & Science Hub at the College of Charleston, that incorporated the results of a major ocean exploration initiative, entitled *The Deep East 2001 Voyage of Discovery*, into innovative lesson plans accompanied with a CD-ROM,

the Ocean Exploration web site (<http://oceanexplorer.noaa.gov>), and other supporting educational materials. The lesson plans contained adaptations for deaf students, bringing cutting-edge ocean science discovery to these students for the first time. These materials formed the basis of three regional Deep East Teacher Development Institutes hosted in three geographic regions from Connecticut to Charleston as a pilot for a larger national education program on ocean exploration. Those teachers participating in these pilot Deep East Teacher Professional Development Institutes engaged their students as Deep East Exploration Schools of Discovery interacted via the web with scientists and educators on board the RV *Atlantis* during the expedition.

I am pleased to report that another initiative that calls for the integration of ocean science research into education is about to begin at the national level through efforts of the National Science Foundation (NSF). The NSF recently released an Announcement of Opportunity for Centers for Ocean Science Education Excellence (COSEE) to be established throughout the country. The Mission of the COSEE is to significantly enhance ocean learning opportunities for all ages levels, including adult and informal education, by incorporating the work of ocean science researchers into high-quality products and services, and providing opportunities for networking between oceanographic researchers and educators. The COSEE network will serve as a window to ideas, information, and resources that connects and celebrates ocean science teaching, learning, and scientific discovery at all levels. The overarching goal is to increase and enhance collaborations and communications among ocean scientists, educators, and the general public (*Current: The Journal of Marine Education* Vol. 17, 2001).

Finally, a natural avenue in reaching large numbers of educators and scientists interested in ocean science education is through the National Marine Educators Association (NMEA)—an exemplary professional organization that delivers marine education nationally and regionally through its 1,100 members and 17 state chapters. NMEA produces newsletters, websites, conferences, workshops and other special marine education events for their audiences. Additionally, it publishes *Current*, a peer-reviewed journal that provides information connecting educators with current marine science research and marine education practices and *NMEA News*, a quarterly newsletter that keeps members informed of marine education activities taking place at the regional and national levels.

Additionally, NMEA is a full partner in the BRIDGE, a nationally recognized website that provides educators with free, fast, and convenient access to teacher-friendly, peer-reviewed websites and original data-based activities that bring accurate, current marine science data into the classroom. The BRIDGE is funded through the National Oceanographic Partnership Program. Both NMEA and the Bridge have become strategic infrastructure elements in ocean science education nationally. The BRIDGE network of links ties together resources from over 900 peer- and scientist-reviewed ocean science-related websites. BRIDGE users come from all over the U.S. and 120 other countries. Additionally, NMEA's annual conferences are the focal point for delivery of updated information on national marine education activities. NMEA has official associate status with the National Science Teachers Association (NSTA), including the sponsorship of a full day of marine education workshops and sessions at the NSTA annual national convention. The organization is also involved in the development of national and regional

marine education policy and programs through its members who represent NMEA on government committees, commissions, and advisory panels.

In closing, I will tell you that the atmosphere within the ocean sciences community and its responsibility to become involved in science education at the national level has changed, as evidenced by the work of the Ocean Exploration Panel, the recently-established Office of Ocean Exploration, and the NSF COSEE Initiative. “The ocean has never been closer to the classroom” is a quote that has been heard, along with many others like it in response to Deep East educational offerings, and it clearly demonstrates the success of NOAA’s first year in Ocean Exploration and the great potential that ocean exploration has for generating exciting educational opportunities based on exploration and discovery.

We made a recommendation in the Ocean Exploration Panel report for funding of the Ocean Exploration Program for an initial period of 10 years. After much deliberation and thought at our meeting in Monterey in September of 2000, the Ocean Exploration Panel further recommended that the approximate level of new funding for annual operation of the Program should be on the order of \$75 million, which is less than one-hundredth of one percent of the Federal discretionary budget. The program is currently funded at \$14 million, an amount that is about 80% less than what the Panel recommended. This level of funding is not adequate to unfold what we envisioned in our Report and thus does not enable the development of a systemic program for ocean exploration that was envisioned as necessary at the present level of funding. The outcome of this is that hundreds of new species and new ecosystems remain undiscovered—some of which may hold the keys to the origin of life on Earth, cures to life-threatening diseases, and knowledge about presently-unknown metabolic pathways for obtaining and using energy to support life here on Earth.

I would like to leave you with this thought—I believe that there are two events that will forever be etched in the history of mankind. One is the Lewis and Clark Expedition and the other occurred when man first set foot on the moon. I believe that our new era of ocean exploration presents us with one more opportunity to capture the American spirit of discovery in the same way it was captured by Lewis and Clark and landing man on the moon. In seizing this opportunity, we have an unprecedented chance to focus hundreds of millions of eyes on our essentially unexplored world of water. This needs to be done through a nationally coordinated, fully funded ocean exploration program that uses innovative partnerships and in doing so, educates millions about the critical role the ocean plays in their lives. Maybe then, most members of the general public would come to know that 70% of the oxygen they breathe comes from the ocean, that photosynthesis is no longer the only metabolic pathway known to mankind, and that marine organisms are serving as models for how the human nervous system functions and how cancerous tumors develop and grow.