EDUCATION AND PUBLIC AWARENESS
DRAFT STRATEGIC PLAN

SUBMITTED BY THE ORION EDUCATION AND PUBLIC AWARENESS COMMITTEE

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EXECUTIVE SUMMARY

“IT HAS BEEN MY OWN PERSONAL PASSION TO BEAT THE DRUM TO ENCOURAGE MORE SCIENTISTS TO BECOME AWARE OF THEIR OBLIGATION AND RESPONSIBILITY IN EDUCATION AT MULTIPLE LEVELS. THIS DOES NOT MEAN THAT RESEARCHERS MUST BECOME EXPERT EDUCATORS. BUT IT DOES MEAN FOSTERING COLLABORATIONS BETWEEN RESEARCHERS AND EDUCATORS IN ORDER TO GET THE POINT ACROSS. THESE RELATIONSHIPS ARE NOT JUST INCREDIBLY REWARDING, THEY ARE INTEGRAL.” – DR. DOROTHY L. STOUT, 2001.

The ORION Education and Public Awareness Strategic plan will ensure that the value and impact of ORION research is maximized. This plan focuses on the education structure that we feel is necessary to provide a sustained impact on learning using the observatory science and technology as the content. Proposed ORION research projects are exciting, dynamic, information gathering initiatives that use innovative technologies and engineering techniques to answer key questions. To any life long learner this type of cutting edge science and technology is attractive and intriguing. Educationally, these essential questions, research, and technology can be aligned to a variety of National and state standards. These include standards for math and technology literacy as well as the science and technology content standards of the National Science Education Standards and state standards, so that teachers can easily integrate this new information into existing curriculum.

Education and Public Awareness is a crucial component of ORION (and OOI). This education strategic plan provides a mechanism to address fundamental changes in science education by focusing on foundational, enduring, systemic efforts. The proposed structure utilizes guidance from the ORION project office, a central coordination office, a data translation and visualization function, and the presence of observatory educators throughout the nation to enable sustained partnerships between scientists, engineers, and educators to make and maximize contributions toward the overall ORION Education Goals. The specific objectives, strategies, and details about how these partnerships will be made and maintained will be provided in the ORION Education Implementation Plan which is currently under development by the ORION Education and Public Awareness Committee (Appendix 5.1).
ORION scientists will use a diverse suite of cabled sensors, moored buoys, and free-swimming vehicles to generate a wealth of traditional and novel oceanographic, meteorologic, and biologic information. These data streams, the cutting-edge technologies used to produce and analyze them, and the human story of exploration they embody represent a treasure trove of engaging storylines for use in education and public awareness. The ORION scientific community has the opportunity to introduce their excitement and relevance of their research to new audiences. This should lead to a better engaged populace that is knowledgeable about the ocean.

The primary overarching goals for ORION Education are to:

GOAL I: Promote awareness, appreciation, and understanding of ORION’s importance to society.

GOAL II: Showcase transformational ocean discoveries achieved through ocean observatories.

We have the following recommendations that will provide scalable, cost effective, and sustainable links between ORION science and technology research and a wide range of existing education and research programs (Figures 4.1 and 4.2):

1. The creation of an Education and Communications Coordination Office (ECCO) as a competitively bid National Facility.

2. The integration of data translation and visualization functionality within the CyberInfrastructure effort (or as an independent facility in the longer-term).

3. That ORION hire a National Education Manager to be housed within the ORION Project Office. This Manager will be advised by the Education and Public Awareness Committee and oversee the Education and Communications Coordination Office (ECCO) and the Data Translation and Visualization (DTAV) function.

4. That each funded observatory effort include at least one educator on staff (or someone with the appropriate background). These observatory-based educators and data translators/visualizers will form the nucleus of an ORION Education and Data Translation Council which will report to the National Education Manager.
INTRODUCTION


The Ocean Observatories Initiative (OOI) and the Ocean Research Interactive Observatory Networks (ORION) are bringing the ocean back into national prominence. The words of President Kennedy are, perhaps, more important now than they were in 1961 when, caught up in the race to put a man on the moon, the United States put ocean research and exploration on the back burner. To maximize the value and the impact of ORION and OOI, it is imperative that ocean science researchers (and their institutions) become proactive in searching out and setting up relationships with both informal and formal education organizations (K-20). The ORION effort directly addresses three of the four recommendations in the National Academies publication *Rising Above the Gathering Storm*: 1) it will improve K-12 science and mathematics education, 2) sustain and strengthen the nation’s traditional commitment to long-term basic research that has the potential to be transformational, and 3) it will provide a setting for the development, recruitment, and retention of the best students, scientists, and engineers (NAS, 2005).

The primary mission for ORION educators is to maximize the program’s educational value and scope as ORION develops and grows. *Science and Engineering Indicators 2006* states that “The Internet was a distant second (18%)” in terms of getting news about science and technology but it is, however, the only consistently growing source” (NSB, 2006). Steel et al. (2005) states that the written media (newspapers and internet) are likely to be more effective in improving ocean literacy than television and radio which will have a negative effect. It is crucial for ORION to utilize a variety of methods if we want the public to learn about the transformative research and discoveries enabled by observatories.
The need for engaging, high-quality ocean-focused educational materials is widely recognized (COSEE, 2001; Areias et al. 1999), particularly in light of increasing human activity near the coast and the strain is places on ocean ecosystems (Summers, 2002). Also widely recognized is the rich context and motivation that ocean-observing initiatives can provide for studying the interactions of science, technology, and society (McManus et al., 2000; Areias et al. 1999).

ORION researchers and educators need to be proactive in order to maximize our efforts and resources. Two broad overarching goals have been proposed during an earlier ORION workshop (Schofield and Tivey, 2005). These are to support an ORION National Education Office that would coordinate the observatory education efforts and that ORION education must, while working closely with researchers, have its own vision and projects. This ORION Education and Public Awareness Strategic Plan is the culmination of the ORION Puerto Rico workshop and intensive discussions and work by the ORION Education and Public Awareness Committee (EPAC) to integrate the community input into a single comprehensive plan.

This strategic plan will ensure that the research discoveries, technology innovations, unique near real-time information streams, and interactivity of the OOI infrastructure of the ORION program are used to capture the imagination of all Americans; engage young and old in scientific exploration and discovery; address key needs of the U.S. public education system (kindergarten through grade...
and identify and address critical graduate and continuing education issues affecting the ocean science and technology workforce. A critical part of this plan depends on the ability to foster mutually beneficial partnerships between researchers, technologists, and educators by building on the intellectual strengths at existing oceanographic, academic, and non-profit education institutions. It is also important that education and public awareness representatives are actively engaged in the planning and designing of observatory facilities to better integrate research, science, and technology learning.

WE NEED TO WORK ON TOMORROW'S WORKFORCE TODAY

“If the U.S. is to maintain its economic leadership and compete in the new global economy, the Nation must prepare today’s K-12 students better to be tomorrow’s productive workers and citizens. …. Scientific and engineering occupations are expected to continue to grow more rapidly than occupations in general … Long-term the growth in science and engineering occupations has far exceeded that of the general workforce — with more than four times the annual growth rate of all occupations since 1980….This emerging workforce, consisting of degreed and highly skilled technical workers will need to begin developing their mathematical and science skills early in their educational career. In addition, rapid advances in technology mean (all/many more workers) …. will require solid foundations in science and math to be productive and capable members of our Nation’s society.” NSB0602

There are a number of challenges that must be met including: 1) making effective use of existing exemplary ocean science education programs and projects such as those at Consortium for Oceanographic Research and Education (CORE), Ocean.US, Joint Oceanographic Institutions (JOI), Centers for Ocean Sciences Education Excellence (COSEE), Earthscope, and many others (including terrestrial observatory efforts such as the National Ecological Observatory Network or NEON); 2) developing education and public awareness programs that are relevant to different audiences including students, teachers, adults, youth and community groups, family groups, informal educators, university faculty, public policy makers, and the public (Figure 4.1); 3) building a seamless education plan that links the excitement of cutting edge research from ORION with relevant practical applications from the Integrated Ocean Observing System (IOOS); and 4) developing a well thought out plan for increasing the flow of students, scientists, and engineers to build and sustain a diverse ocean observing workforce. This plan provides the basis for a more detailed implementation plan that will begin to address these challenges.
This strategic plan also incorporates a set of key guiding principles, included below, which will be applied to all activities. Although none of these individual principles are unique to ORION, their integration is critical to sustain education audiences as enduring stakeholders in ocean observing systems for ocean science and discovery.

I. **Science and technology are interrelated:** Science drives the development of innovative tools, and new technology elicits new scientific questions. ORION is a remarkable example of how scientists and engineers work together to find solutions.

II. **The Ocean is fascinating:** There is inherent excitement in ocean discovery. ORION data and models are especially well suited to tell stories that are engaging and relevant to new audiences.

III. **Ocean Literacy needs improvement:** The definition of “literacy” has evolved in recent times and is now widely described as the ability to locate, evaluate, use, and communicate using a wide range of resources. ORION provides a powerful platform to enhance public literacy with an emphasis on the Ocean.

IV. **A diverse workforce is needed:** The scientific community needs to proactively promote and encourage sustained efforts to engage diverse learners to join in the ocean observatory effort. To be successful the ORION program needs skilled technologists, scientists, and educators from all backgrounds.

V. **Assessment is crucial:** Continual audience interaction, feedback, and evaluation are indispensable for the advancement of any education program. The longevity of
ORION provides an unprecedented opportunity to conduct longitudinal, long-term studies relevant to science education in general and ocean education in particular.

VI. The target audiences are broad: The intended audiences for this plan fall into the categories of researchers, decision makers, informal educators, formal educators, students, and the public.

VII. Collaborations are crucial: To the maximum extent possible, ORION Education should strive to align its goals with (and seek to link to) key programs such as those at NSF (e.g. Math and Science Partnership Program), Consortium for Oceanographic Research and Education (CORE), Ocean.US, Joint Oceanographic Institutions (JOI), Centers for Ocean Sciences Education Excellence (COSEE), Earthscope, and many others (including terrestrial observatory efforts such as the National Ecological Observatory Network or NEON).

This plan outlines a process for developing the management infrastructure necessary to sustain a coordinated and coherent education program that is aligned with the science and technology research objectives of the ORION program. The proposed organization plan provides for dynamic observatory-based education and communication activities as well as strategic national-level education and communication programs. A single Education Manager (based in the ORION Project Office) would oversee the national Education and Communications Coordination Office (ECCO; the Director of this office would report to the Education Manager) and the Data Translation and Visualization (DTAV) function. Close collaboration between the proposed ECCO/DTAV functions and the individual observatory Principal Investigators will ensure synergies between science and education. This committee is currently working on a more detailed Education and Public Awareness Implementation Plan that will provide detailed objectives, strategies, and potential deliverables.
CHAPTER ONE

Education and Communications Coordination Office (ECCO)

ORION will use ocean-observing science and technology infrastructure to engage communities in ocean exploration and discovery; increase awareness, understanding, and appreciation of the oceans; strengthen science and technology education; and inspire, motivate, and nurture people from all backgrounds to pursue science and technology careers generally, and ocean sciences careers specifically. – ORION Puerto Rico Workshop Report, 2005

The national presence of the ORION program coupled with the dynamic nature of the observatories requires an education program that can be both responsive to national education needs as well as dynamic in capturing recent scientific advances from the observatories. The successes of national science and education organizations such as the Centers for Ocean Sciences Education Excellence (http://www.cosee.net) and the National Estuarine Research Reserve System (http://www.nerrs.noaa.gov) have illustrated the importance of having a strong, centralized office to oversee and coordinate regional efforts. We propose that a national Education and Communications Coordination Office (ECCO) be formed (along with an education and communications-focused Data Translation and Visualization function that will be coupled with the ORION CyberInfrastructure effort (DTAV); see Chapter Two). This ECCO would be put out for a competitive bid using this strategic plan and the forthcoming implementation plan as guides to the final Request For Proposals. As seen in the ORION Centralized and Distributed Model diagram (Figure 4.3), there is an ORION Observatory-based Educator (Appendix 5.2) located within each of the funded observatory facilities. Working closely with researchers (science and engineering), the Educator will help translate research into value added products for different educational audiences (Appendix 5.3).

ECCO will track and inform the distributed ORION education and public awareness...
network about national science education initiatives (e.g. Ocean Literacy) and identify opportunities for collaboration and gaps that ORION can fill. It is most efficient to have a central office tracking national program initiatives while keeping regional ORION observatories aware of relevant cross-cutting issues. As the ORION program evolves, so too will ECCO’s strategy and plans, based on sound short- and long-term assessment. To maximize the reach and impact of ORION education and public awareness, the organization will present a uniform, recognizable “face” to the public. ECCO will facilitate and coordinate communication among regional initiatives, and take the lead with respect to issues relevant to a national audience. The intention is to avoid “reinventing wheels,” encourage leveraging of existing resources, identify effective practices, and provide a mechanism for contextualization of regional observations and technology.

To enable ECCO to generate products that address national needs, ECCO and the Data Translation and Visualization function (DTAV) will be closely coordinated as described in Chapter Three. The distributed nature of the ORION data and information user community will amplify the importance of creating and maintaining an accessible and exciting web presence. ORION educational and communication programs should be regularly and rigorously evaluated to reveal what is working and what is not, thereby building a case for public and private support of the most worthy education and public awareness endeavors. There are four primary goals for ECCO that will be reached by the use of both proactive and reactive approaches. The former are driven by planned goals, and adhere closely to planned objectives and strategies; the latter include opportunistic, and often time-sensitive responses to natural, scientific or political events.

**GOAL I:** ECCO will set, implement, and, as warranted, modify the ORION education and public awareness strategic plan.

**GOAL II:** ECCO will coordinate ORION’s education efforts with the national science education agenda.

**GOAL III:** ECCO will coordinate ORION education and communication efforts across the network.

**GOAL IV:** ECCO will ensure effective, nationally coordinated education and communication efforts are maintained and sustained.
CHAPTER TWO

Data Translation and Visualization (DTAV)

“The use of abstract, non-representational pictures to show numbers is a surprisingly recent invention, perhaps because of the diversity of skills required – the visual-artistic, empirical-statistical, and mathematical. It was not until 1750-1800 that statistical graphics...were invented.... Often the most effective way to describe, explore, and summarize a set of numbers – even a very large set – is to look at pictures of those numbers. Furthermore, of all methods for analyzing and communicating statistical information, well-designed data graphics are usually the simplest and at the same time the most powerful.” – Tufte 1983.

The ORION Data Translation and Visualization (DTAV) function will help develop and disseminate science-based storylines within a broad community of educators, students, resource managers, and citizens. Dissemination of real-time, near real-time, and event-driven information will be facilitated with user-friendly visualizations accompanied by engaging content. ORION educators will work closely with researchers during proposal development to request funds for products that will be designed for use in a broad range of venues, including classrooms, science centers, Internet sites, television and radio, and community programs for children and adults. Despite the obvious need for and benefits of materials that promote ocean literacy, most such materials currently fail to meet users’ needs because they are of poor quality and/or not closely aligned with national and state standards for science teaching, professional development, assessment, or content (COSEE, 2001; McManus, 2000; Areias, 1999).

LINK WITH CYBERINFRASTRUCTURE

It is critical that staff with expertise in both cyberinfrastructure and education are employed to create visualizations for education and public awareness. These visualizations will often be similar to those used by researchers, but will require additional interpretation and/or associated content. Education staff involved in DTAV will need guidance from CI staff, while the CI staff will need guidance from the DTAV education staff on education requirements and usability of CI products and services by educators. Tight collaborations from the beginning of the ORION effort will reduce duplication of effort and enhance productivity.

ORION observatory data will flow to the DTAV group (Figure 4.3) within the ORION Cyberinfrastructure group (CI) — whose charge includes providing “easy access to [ORION]
observations by the science and education communities” (Terms of Reference, ORION CI Committee, 2005). While most observatory data will be processed by CI to a level equivalent to that of NASA’s Level 2 (Asrar and Greenstone, 1995), we expect that data products translated by DTAV will typically occupy Level 3 (variables mapped on uniform space-time grid scales, usually with some completeness and consistency) and Level 4 (model output or results from analyses of lower-level data) (Di et al, 2004).

A consistent feature of national and state standards (AAAS, 1993; MD Dept. of Education, 2000; NRC, 1996; Rutherford and Ahlgren, 1990; VA Board of Education, 1995) is their focus on inquiry-based learning. This focus reflects cognitive research (e.g., Bransford et al., 2000) confirming that inquiry is a critical component of students’ ability to develop an enduring understanding of science content and practice. The standards also reflect a growing recognition of instructional technology’s important role in promoting inquiry (Coley, 1997; Morse and Sabelli, 1997), including use of visualizations to facilitate data analysis (Gordin and Pea, 1995). Data visualizations take advantage of the human visual system’s unique ability to discern patterns in complex data (Pea et al., 1997), thus allowing novice users to interpret such data without sophisticated mathematical skills.

Educators working closely with the CyberInfrastructure group will develop the types of data-visualization products that pedagogical research (e.g., Edelson et al., 1997; Edelson and Gordin, 1998) has shown to be most effective. This relationship will ensure that education and public awareness efforts are considered in data management policies and will facilitate rapid and full access to the data. Having ready access to ORION data and visualizations in useful forms is of special interest to educators. Because of the large number of people that are visual learners, it is extremely important to create graphic representations of data, analyses, and models in order to develop deeper conceptual understandings in mathematics and science. Participation of educators early in the planning and development of data protocols for ORION can help ensure that the
information products that are created will meet educators’ needs. In particular, these products should serve as a resource for recognizing patterns and for making quantitative tests of students’ hypotheses.

DTAV is a critical component of the larger effort to leverage ORION data and storylines into the realm of education and public awareness. The facility will open a window for a full-range of users into the unique technologies and body of knowledge that ORION embodies. Greater knowledge and appreciation of ORION science should increase public and legislative support for the ocean-observing effort at local, regional, and national scales.

*This drawing shows a simplified view of the internal wave that formed just north of Monterey Canyon during the Monterey Upper water column Science Experiment. Phytoplankton are concentrated on the up-current side of the wave (closest to the canyon), but are relatively sparse directly over the wave crest. Image: (c) 2005 MBARI*

DTAV will provide a systematic process for information translation based on successful models used by NASA, the American Museum of Natural History, the National Park Service, and existing operational ocean observatories such as COOL/LEO-15.

ORION will provide the ability to “investigate processes at the scales at which they occur.” In a similar vein, DTAV will generate products and provide services that are appropriate for the audience they are intended to serve – capturing and augmenting ORION’s unique capabilities and products. DTAV will also create a broader audience by inviting new people to follow along as scientists set out to sea, journey to their research sites, install their tools and, finally, examine the outcome. There are two primary goals for DTAV:

**Goal I:** DTAV will become the primary source of data translation and visualization for all users of ORION data.

**Goal II:** DTAV will ensure incorporation of ORION’s most recent cutting-edge scientific and technological breakthroughs into captivating products for use in education and public awareness.
CHAPTER THREE

Education Program Management

In transformative partnerships, the participants engage in a form of interorganizational relationship where the participants engage in reciprocal patterns of communication for the purposes of identifying shared vulnerabilities, developing shared goals and a shared understanding of how they will pursue and achieve these goals. – Gordon Kingsley, first COSEE PI conference, 2003.

This plan outlines a process for developing the management infrastructure necessary to sustain a coordinated and coherent education program that is aligned with the science and technology research objectives of the ORION program. The proposed organization structure provides for dynamic observatory-based education and communication activities as well as strategic national-level education and communication programs. A single Education Manager would oversee the national Education and Communications Coordination Office (ECCO) and the Data Translation and Visualization (DTAV) function within CyberInfrastructure (with the DTAV education staff reporting to the ECCO Director, and the ECCO Director reporting to the Education Manager). Close collaboration between the proposed ECCO/DTAV functions and individual PIs and their technical and educational staff at the ocean observatories will ensure synergies between science and education. As such, the ECCO/DTAV will operate in close collaboration with the funded observatories (Figures 4.1 – 4.3) to develop and evaluate 1) data products that meet audience needs and 2) education programs (pilot products) that can be readily scaled up for the benefit of the entire ORION network. The benefits of this approach include streamlined communication, reduced cost, and shared resources. From this design, the partners will create a dynamic repository of data products, lessons learned, and effective practices that can be accessed and navigated by the ORION program community.

The National ECCO will ensure a national presence for ORION education that responds to national education initiatives and coordinates the observatory-based efforts. Observatory principal
investigators would be responsible for reporting to the Education Manager on their efforts to achieve education goals at the observatory level. One suggested strategy to achieve these goals is to hire at least one education coordinator and one data translator/visualizer that would be fully integrated into the observatory team. Additionally, a national council would be established to build consensus, share ideas, establish collaborative partnerships, and provide a discussion forum the education and communication efforts of ORION. The council would consist of the observatory-based education staff as well as staff from the national ECCO and from the educators within CyberInfrastructure.

Management objectives are focused on the development, distribution, and evaluation of ocean observing systems data and education products to end user audiences. In this case the end users span a range of formal (e.g., K-16 teachers, pre-service teachers, students) to informal audiences (e.g., aquaria, museum, and science center visitors) and the media (e.g., newspapers, Internet, book publishers, television).

**Goal I:** Education Manager will develop a management and communication plan that ensures the integration of education and public awareness into the ORION cyberinfrastructure group, the research that uses observatory resources, and the ORION project office.

**Goal II:** Education Manager will set up a system for evaluating and documenting the management and communication plan to aid future program development.
**Communication Sectors**

**Assets Translated to Stories of Broad Interest Feeds All Sectors**

- Informed Strategic Communications
- Strategic Communication
- Education (Formal, Informal, Non-formal)
- Science Literate Children & Adults
- Partner/Peer Communication
- Informed Peers & Potential Partners
- Observation Educators
- Data Translation and Visualization
- DTAV
- Education Communications and Coordination Office ECCO
- ORION Data/Content

**FIGURE 4.1**

**BROAD OVERVIEW SHOWING HOW ORION ASSETS CAN BE LEVERAGED**

This figure shows a broad overview of how ORION assets can be leveraged into both existing and new opportunities/programs (note that this figure doesn’t yet reflect an anticipated close relationship with CyberInfrastructure). The products coming from the ORION education framework will be useful for partner/peer communications, education, and specific targeted audiences. Eventual users will include the researchers involved directly in ORION. As the ORION data/content are produced, the ORION Education and Public Awareness education effort will develop products for different audiences. Not indicated in this figure is the oversight by a National Education Manager based in the ORION Project Office.
**Structural and Functional Commonality Among Education Endeavors**

<table>
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<tr>
<th>Structural and Functional Commonality Among Education Endeavors</th>
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<tbody>
<tr>
<td><strong>Regional Structure</strong></td>
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<tr>
<td>ORION—Implementing Organizations</td>
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<tr>
<td>Coastal, Regional, Global</td>
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<tr>
<td>IOOS — Regional Associations</td>
</tr>
<tr>
<td>Pacific Islands, Alaska, Pacific NW, Central CA, So. CA, Gulf Coast, SE-Atlantic, Mid-Atlantic, NE, Great Lakes, Caribbean</td>
</tr>
<tr>
<td>COSEE — Regional centers</td>
</tr>
<tr>
<td>COSEE-West, California, Gulf Coast, Florida, Southeast, Mid-Atlantic, Northeast, Great Lakes</td>
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<tr>
<td><strong>Place-based Structure</strong></td>
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<tr>
<td>NERRS — 26 Sites</td>
</tr>
<tr>
<td>NMSP — 14 Sanctuaries</td>
</tr>
<tr>
<td>NEON — 20 Districts</td>
</tr>
<tr>
<td>Earthscope— ???</td>
</tr>
<tr>
<td><strong>State-based Structure</strong></td>
</tr>
<tr>
<td>AMS — Local Implementation Teams in ~25 states</td>
</tr>
<tr>
<td>Sea Grant— Network of 30</td>
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<tr>
<td>Colleges/Institutions</td>
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<tr>
<td>GLOBE—Partners in all 50 states</td>
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* ORION, IOOS and NEON are proposed

<table>
<thead>
<tr>
<th>Functional/Thematic Education Groups</th>
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<tbody>
<tr>
<td>COSEE — Thematic centers</td>
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<tr>
<td>COSEE-Ocean Systems, Ocean Learning Communities</td>
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<tr>
<td>IOOS — Information Translation and Story Development</td>
</tr>
<tr>
<td>ORION — Data Translation and Visualization</td>
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<tr>
<td>DLESE — Discovery of learning materials and associated data and tools</td>
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<table>
<thead>
<tr>
<th>Education Coordinating Groups</th>
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<tbody>
<tr>
<td>COSEE — Central Coordinating Office</td>
</tr>
<tr>
<td>IOOS — Central Coordinating Site for Education (includes extension and communications)</td>
</tr>
<tr>
<td>ORION — Education and Communications Coordination Office</td>
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<tr>
<td>NEON — Education Central</td>
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<tr>
<td>GLOBE — GLOBE “Program” Office</td>
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<tr>
<td>AMS — Education Office</td>
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<tr>
<td>DLESE — Program Center</td>
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<td>Earthscope — Program Office</td>
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**Figure 4.2**

**Structural and Functional Commonality Among Existing and Proposed Education Endeavors.**

For this ORION Education and Public Awareness plan to succeed, it will be essential that we make effective use of existing exemplary ocean and Earth science education programs and projects as well as proposed programs/projects that are just getting started. The lists above are certainly incomplete but represent some examples for collaborations. There are additional subject areas (e.g. mathematics, English, social sciences) and organizations (e.g. home schooling, continuing education, community groups) where ORION information can be leveraged and integrated into formal and informal education.
**FIGURE 4.3**

**PROPOSED ORGANIZATION FOR ORION EDUCATION AND PUBLIC AWARENESS**

This diagram has the three types of potential observatories (global, regional, and coastal) on the left hand side. Within each of these facilities would reside staff with expertise in education and/or data translation and visualization. These staff members would form the Education and Data Translation Council which would report directly to the Director of the Education Communications and Coordination Office (ECCO) (this person could be the same as the National Education Manager housed within the ORION Project Office). The Education and Public Awareness Committee serves in an advisory role to the National Education Manager. The education staff focused on Data Translation and Visualization (DTAV) will be integrated within the ORION CyberInfrastructure program, but will report to the National Education Manager.
APPENDIX 5.1

EDUCATION AND PUBLIC AWARENESS COMMITTEE MEMBERS AND OTHER CONTRIBUTORS

The following all made significant contributions to this Education and Public Awareness Strategic Plan. The EPAC was formed and within three months of its initial meeting was able to generate the first draft for submission to the ORION Executive Steering Committee. The work that the EPAC did would not have been possible without the support of the ORION Project Office, Blanche Meeson (Ocean.US) and Alexandra Isen (NSF). Additional advice and comments from John Graybeal (MBARI) were invaluable.

The contributions of the Puerto Rico workshop (Schofield and Tivey, 2005) participants were the nucleus for this strategic plan and all the main goals proposed are addressed within although some of the terminology has shifted (e.g. Education Network is now termed Education Community and the Data Management facility is now the Data Translation facility) to better reflect the current usage of the terms.

EPAC MEMBERS

George Matsumoto (Chair) - Monterey Bay Aquarium Research Institute
Julie Bursek - NOAA/Channel Islands National Marine Sanctuary
Roman Czujko - American Institute of Physics
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Sharon Franks - Scripps Institution of Oceanography
Sharon Gilman - Coastal Carolina University
Amy Holt-Cline - University of New Hampshire
Darryl Keith - Environmental Protection Agency
David Malmquist - Virginia Institute of Marine Science
Janice McDonnell - Rutgers University
Carrie McDougall - NOAA
Mike Wright - Digital Library for Earth System Education (DLESE)
Karen Romano Young - Children’s author and illustrator
Yi Chao – California Institute of Technology (Liason from CyberInfrastructure Committee)

ORION PROJECT OFFICE ASSISTANCE

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Outgoing Director, Ocean Observing, Peter Milne (JOI);
Incoming Director, Kendra Daly
Program Associate, Emily Griffin (JOI)
Education Director, Sue Cook (CORE)
Program Coordinator, Henry Hope (CORE)
Meeting/Travel Coordinator, Julie Farver (JOI)
APPENDIX 5.2

WHO IS AN ORION OBSERVATORY EDUCATOR?

This unique position requires a set of skills and abilities that are not commonly found in one person. In order to carry out the task required of effectively translating primary ocean observing science in a variety of forms, a strong background in both science and education is needed. Each Observatory Educator should have demonstrated experience in working and teaching in science education; have strong academic experience in ocean science and education; have the ability to write curriculum and activities that translate high level science concepts to the classroom and/or broader audiences; be able to coordinate and facilitate educator workshops, as well as pilot new education materials and assess them; be able to write, distribute and follow up on a needs assessment before creating materials or programs as well as be comfortable developing partnerships with Aquaria, Museums, and Science Centers in order to participate in the development of exhibits or long term partnering projects. In order to do all of this, the Observatory Educator must have strong written and oral communication skills; have experience in public awareness and media relations; have some graphic art skills to develop brochures, posters, and aid website development and be able to communicate comfortably with scientists and classroom teachers in order to bridge this gap. These observatory educators must also have experience working with data visualizations in a variety of educational settings. This is essential since the ORION funded science projects may rely wholly on visualizations to explain the remote environments and concepts that are fundamental to their programs. The observatory educator needs to have an understanding of basic cognitive learning theory in order to best direct what type of products and visualizations will be appropriate for the directed audience. Each educator must be comfortable with establishing clear communication lines with their local/national DTAV partner in order to accomplish these goals.
APPENDIX 5.3

THE JOB OF AN OBSERVATORY-BASED EDUCATOR

The goal of the observatory-based education program is to interact closely with researchers in order to develop proposals that integrate research and education. This will help involve an eager education community and build and inform the public audience that increasingly expresses an interest in understanding and protecting the ocean. Eventually, there will be a treasury of materials, productions, and programs that can be accessed by all ORION personnel -- scientists and educators, and which can be served easily to the media and other external agencies. The job of the observatory-based educator is to look in two directions simultaneously -- toward the ORION COMMUNITY and toward the EDUCATION COMMUNITY AND PUBLIC to anticipate, coordinate, act, and follow up as needed.

ORION COMMUNITY:

While the thrust of the Educator’s job is to strategically bring new science to the education community and the public, the input comes from the science itself. The people, processes, and concepts involved in the planning and execution of ORION must be identified, pursued, coordinated, and presented. In addition to reaching goal audiences and venues in the education community and public, an Educator’s goal is to establish and perpetuate a network of information for ORION scientists, allowing them ways to communicate about their work, as well as to access for themselves Educator-generated programs and materials developed around their work. The person placed in this role must be assertive, creative, resourceful, and knowledgeable, with abundant flexibility and stamina.

EDUCATION COMMUNITY AND PUBLIC

The Educator must know ORION’s audiences of formal and informal education, as well as its venues: the media, the internet, museums, aquaria, IMAX theaters, schools, libraries, television, radio, publishing, and the internet. He or she should be able to identify the best method for presenting ORION people, processes, and concepts, in terms of the audience’s level of understanding, the attributes of the designated medium, and the qualities of what’s being presented. This role -- deciding what to do and how -- will be considered in light of what is available through other Educators and with the educators in the venues to be reached.

Other Educators: Quarterly meetings should facilitate a fluid exchange, enhance planning, and reduce duplication of effort.

Educators in the venues: the Educator should maintain a steady communication and mutual awareness of needs and opportunities with educators in museums, ocean observatories, aquaria, schools, etc. Educators should develop plans for special thrusts surrounding ORION events as well as other events and meetings (e.g. Ocean Week, National Science Teachers Association and National Marine Educators Association conferences)
REFERENCES


Bahner, L., 2001. The Chesapeake Bay and Tidal Tributary Volumetric Interpolator. NOAA Chesapeake Bay Office, Annapolis, MD.


