

Panelist Response to Questions Posed to the “Education Panel” at Chicago Meeting of the Ocean Commission

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1. Who should be involved in coordinating a message on the importance and significance of the oceans?

Phase 1 of message development requires a grassroots, bottom-up investigation, that will capture the "essence" of what is significant to the lives of the American people concerning the oceans of the world. It is critical to know what the American people hold in their hearts and minds in order to create a meaningful message that will move them to action. We suggest that NOPP be charged with developing and crafting the principal message, in coordination with their partners and the American people.

This grassroots effort should include, private, non-profit and public organizations, anyone focused on the oceans or aquatic environment. Each of these groups must be able to see themselves in the message. This will encourage them to integrate the principal message into the fabric of their organization. As a result, the message will have longevity and broader deployment into the consciousness of the American people.

Individuals harvesting these ideas may be found in organizations both near and far from the oceans, include: fishermen; oil and gas companies; the national, regional, state or local parks; industry and government marine laboratories; informal learning centers such as Aquaria, "sea ports", and science centers; federally funded offices and programs such as NOAA's National Sea Grant, EPA's Chesapeake Bay Program; professional organizations (scientific, educational, industry); post-secondary education institutions; and K-12 educational jurisdictions with science learning standards on the environment.

Engagement of those listed above requires career meaningful reward structures. These structures motivate them to contribute their unique expertise to both the gathering and the dissemination of the message and reward them for exemplary efforts.

Phase 2 of message development is the creation of the message through a top-down process based on the information gathered from the American people. The groups who helped develop the "essence" must then be stimulated to integrate

the principal message into the fabric of their organizations so that it is expressed throughout their communication channels.

The message should focus on the role of the oceans in the Earth system. The Earth System umbrella theme, encourages both local and national groups to assemble a broad based coalition, thereby providing a much broader support base, and allowing groups/citizens from the American heartland to become engaged.

2. How to reach aquarium visitors with a message of personal responsibility?

Phase 3 is dissemination of the principal ocean messages to the American people. It is essential that all communication methods provide opportunities for people to forge their own intellectual and emotional connections to the meanings inherent in the resources of the aquarium.

Aquariums have the golden opportunity to hook visitors with the exotic beauty of sea life. Humans relate to and care about animals they can see in close proximity. There must be clear messages that allow the visitors to grasp and feel responsible for how their everyday actions effect the environments and therefore survival of sea creatures.

Visitors may be engaged in hands-on investigations while they visit an aquarium, utilizing universal themes that all can relate to. Through these universal themes (e.g., live, death, exploration, family, etc.) individuals can be moved to personal responsibility.

Aquariums may expand their effectiveness in message delivery by collaborating with local school programs, positioning the message in local newspapers, magazines, news reports, films, CD's, DVD's, interactive exhibits, web sites, guided tours, dramatic productions and art produced by the museum. We also recommend collaborative projects with private industry and institutions devoted to communication such as National Geographic, the Discovery Channel or even the Weather Channel.

3. How could aquariums get across a multidisciplinary message to visitors?

Aquarium decision makers and communication teams must produce environments and deliver messages that feed the American peoples hunger for adventure and excitement. The multidisciplinary nature of coastal and ocean

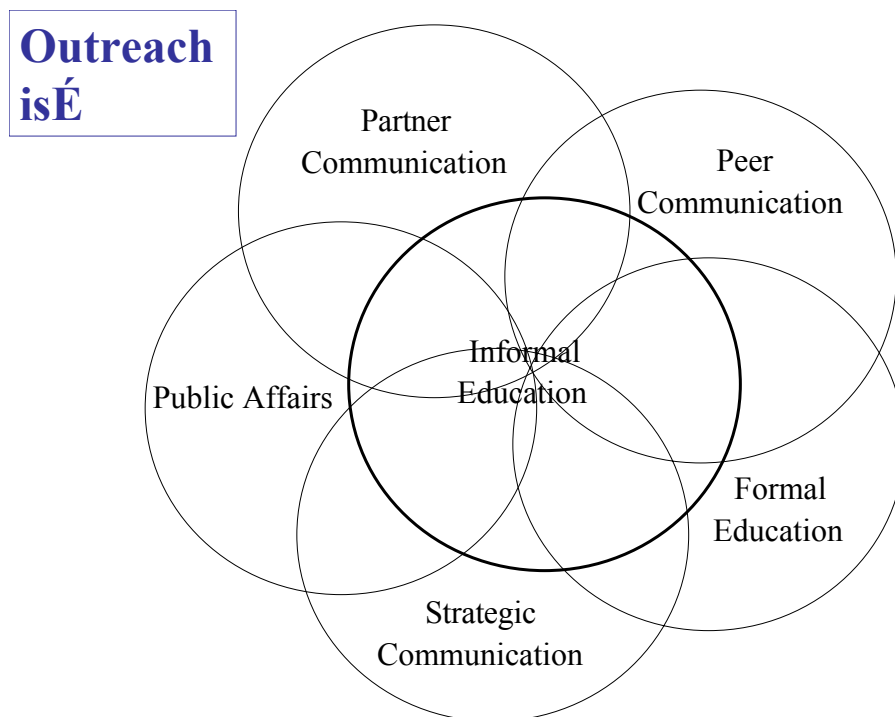
systems, simulated in aquariums, offer an exciting context in which to teach fundamental concepts of physics, biology, chemistry, geology and mathematics. Increased exposure to the oceans and coasts through NOPP'S ongoing, real-time ocean-based observing systems will stimulate the interest of visitors because it is happening now, and is relevant to their everyday lives.

Clear messages describing the connections between events in ones backyard to events on the other side of the world, embrace the relevance of studying Earth as a whole system. The more we learn, the more connections we find, and the more local impacts are identified.

Examples that have a clear focus on the oceans and the local impacts should be developed and used in aquarium settings.

4. Percentage of NASA's budget dedicated to the education and outreach program.

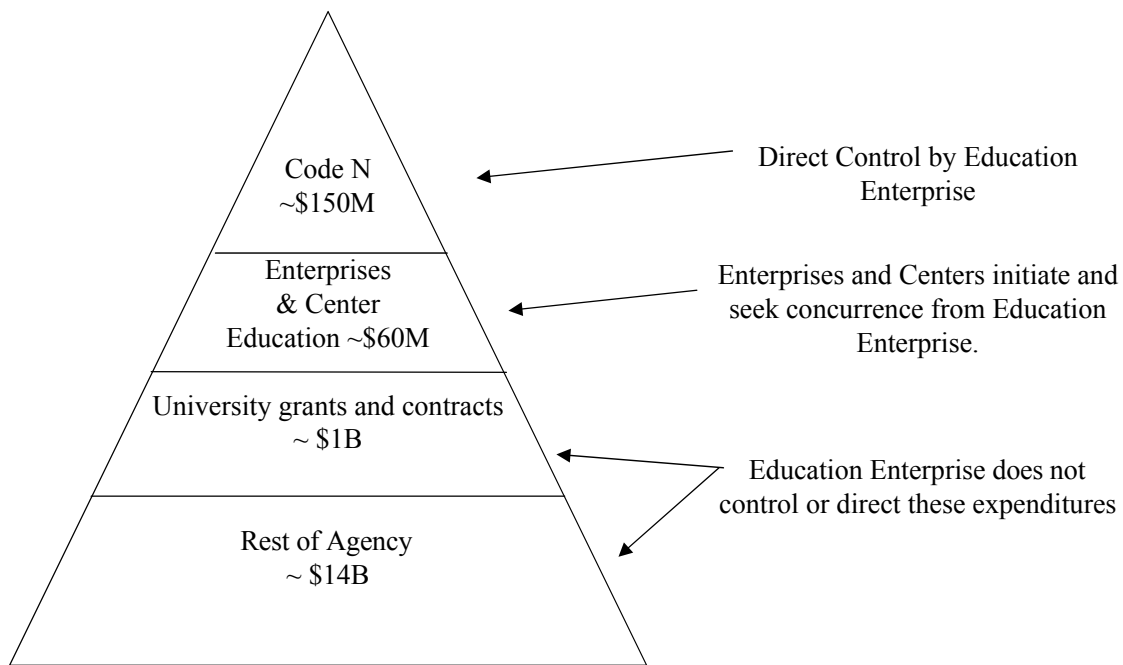
To provide a meaningful and coherent answer to this question, we define Outreach as a general term that includes all manner of efforts that engage the external community. As depicted below, outreach is comprised of 6 overlapping efforts in which informal education has significant overlap with the 5 other spheres. In this figure, formal and informal education



are defined as the professionals in these fields define them. The principal distinction between education and the other spheres is that education focus' on

learning at all depths, and attempts to move an individual's depth of learning from simple exposure to intimate knowledge and utilization in their career.

The estimates provided in response to this question refer to the investments for informal and formal education only. Even with this definition, each of the enterprises includes slightly different efforts within their formal and informal education programs. On the whole the Agency invests from 0.5 to 3% of its budget in education. Overall the Agency invests about \$210M, \$150M of which is invested at the agency level with the remaining \$60M coming from the Enterprise investments. The specifics of the Enterprise investments vary from Enterprise-to-Enterprise. For example in Earth Science about 1/2 of the investment supports graduate research and early career grants for recent PhD's. Traditionally, Earth Science and Space Science have invested a larger percentage of their overall budgets in education than have the other enterprises. In all cases, a full accounting of investments in education is somewhat ambiguous because of the issues associated with differentiating education (formal and informal) from the other forms of communication to various audiences.



5. Considering education responsibility lies primarily at local and state levels, what involvement should Federal Government have in ocean science education? (See research to learning.ppt)

The United States Federal Government is in the unique position to craft and disseminate a comprehensive, cohesive set of ocean science learning standards and goals for the education community and the general public. The National Science Education standards address ocean education in a limited way. We suggest the Federal Government charge the National Academy of Sciences with the incorporation of Earth System Science into the National Science Education Standards as a unifying/umbrella science. As part of these standards, a specific set of ocean science learning standards should be developed by ocean educators under NOPP leadership.

The federal government has the power to invigorate ocean science education by providing the "raw" resources and guiding the knowledge transfer process (see Knowledge Transfer Diagram attached). Strategic investments at two key points, indicated by the words Translators and Liaisons, in the diagram, will result in the rapid and ready integration of ocean science information into a wide range of science learning environments with little subsequent federal investment. First the translators interpret the raw resources creating useful materials for education organizations. Second the liaisons enable the transfer of those resources to education decision-makers.

The third key investment point is training of educators. Investing in educators yields scientifically sound professionals who will deploy learning materials that will impact 100s of millions of children and adults on a daily basis throughout their careers.

An example of a school system that benefited from investments in these three strategic areas, is the Earth and Space Science high school curriculum in Anne Arundle County Maryland. The county developed this curriculum with assistance from NASA. It is now deployed across all 12 of its high schools. A NASA liaison worked with the county decision-maker to integrate existing translated learning resources into the new curriculum. They established a teacher training structure that would prepare the county's teachers to deploy this new curriculum. Today, Earth and Space Science is the most sought after high school science course in the county (URL: <http://edmall.gsfc.nasa.gov/aacps/>). This high impact, low cost approach can and should be adopted by the ocean science community and utilized across the country. The time to act is now, while states and school districts are establishing and implementing state based learning standards and new curricula aligned with those standards.

6. How to diversify the student population and the work force in all areas of the ocean community?

The issues of diversity in both student and workforce populations are multifaceted and hence will require a 15-20 year, multi-pronged strategy. Student engagement across the entire learning spectrum must be addressed, from kindergarten through graduate school and into adulthood. School systems must include exploration of the unknown, discovery, risk-taking, and the adventure of science into the teaching of basic skills (reading, writing, and math) beginning in the early grades to stimulate the vision of a science career.

Convincing evidence shows students become engaged in the sciences, when they first perceive science as exciting and second as a successful career path. We recommend that the ocean science community address the first of these two issues by:

- Identifying the empowering, risk taking aspects of ocean careers, through examination of the existing workforce, including fishermen, oil rig operators, marine biologists, sailors and many more,
- Study the ocean science population to learn if there are unique personality traits, which draw people to successful ocean science, careers,
- Create a human resource data base which may be used to develop audience specific messages and curriculum investigations for students,
- Target underrepresented and underserved populations by creating informal learning messages. These messages must emphasis exploration of the unknown, discovery, risk-taking, and adventure, in the language and media accepted by the target audience.

To address the second issue, successful career paths, we recommend the following:

- Define all careers in the ocean science work force. Highlight the personality traits and academic training required for each career. Students must be able to "see themselves" in ocean science careers. Career descriptions must cover the economic incentives--this is especially important for underserved and underrepresented populations.
- Identify role models across the entire work force. Describe a typical workweek and the environment in which they spend their day. Emphasize the diversity of individuals involved. Tell the life story of the role models. What did they do to find their current positions?

- Students must be introduced to the "culture of science." Students from underrepresented and underserved populations may be unfamiliar with the culture of science, especially if there is no one in their families or their communities with science related careers.
- Parental involvement/engagement/education is of particular importance for these populations since in many cases the parents and even the community do not recognize the value of science and math performance in their children.
- Private industry will benefit from the growth of a talented work force. They should be encouraged to use their resources to support growth in ocean science careers. Private industry may assist the underserved and underrepresented, through collaborative programs between the school system, government and industry.
- Existing grass roots organizations, such as the Girl Scouts, Boy Scouts and 4-H clubs have embraced the teaching of Earth Science of which the Ocean is major component. These community-based groups should be encouraged through collaborative programs between the school system, government and industry.

Knowledge Transfer: From Scientists to the American Public

