

U.S. COMMISSION ON OCEAN POLICY



Reports of Site Visits Associated with the Southwest Regional Meeting Cabrillo Aquarium, San Pedro, California April 18-19, 2002

Background/Areas of Site Visits

On April 17, 2002, the U.S. Commission on Ocean Policy held simultaneous site visits in association with the Commission's Southwest Regional public meeting in San Pedro, California. One site visit took place at the Scripps Institution of Oceanography (SIO) in La Jolla; the other included the Monterey Bay Aquarium, Monterey Bay Research Institute and the Navy's Fleet Numerical Center.

Scripps Institution of Oceanography, La Jolla, California

Monterey Bay Aquarium and Research Institute

U.S. Navy Fleet Numerical, Monterey Bay, California

Scripps Site Visit

The Scripps site visit opened with a welcome and an overview of the visit from Dr. Charles Kennel, Director of SIO. Graduate students then gave a brief description of their individual research projects. Those presentations were followed by a series of experts from Scripps who made presentations to the Commission.

Commissioners participating in the site visit:

Mrs. Lillian Borrone
Dr. James Coleman
Ms. Ann D'Amato
Mr. Larry Dickerson
Mr. Paul Kelly
Dr. Andy Rosenberg
Mr. Bill Ruckelshaus

Commission staff:

Dr. Ken Turgeon
Mr. Terry Schaff
Ms. Roxanne Nikolaus
Ms. Angela Corridore.

Also in Attendance:

Mr. Brian Baird, Ocean Program Manager with the Calif. Department of Resources

Dr. Jim Yoder, Director of Ocean Sciences at the National Science Foundation
Mr. Humberto Peraza, Office of Senator Barbara Boxer
Mr. Eduardo Valerio, District Director, Office of Senator Dianne Feinstein

Navy Basic and Applied Research with Focus on Acoustics

- Dr. William Kuperman, Director, Marine Physical Lab, SIO
- Dr. William Hodgkiss, Deputy Director for Scientific Affairs, SIO

Dr. William Kuperman discussed the uses of ocean acoustics, including environmental remote sensing, acoustic data communication, and undersea warfare. He noted that the U.S. Navy, specifically the Office of Naval Research (ONR), has the national responsibility for acoustics and has maintained a strong relationship with the academic community in this area. Acoustics and signal processing research includes ocean ambient noise, passive acoustics, active acoustics and acoustic data communication.

Dr. Kuperman stressed the importance of students gaining at-sea research experience and noted the current trend toward students learning ocean sciences solely from books and computers. He commented that budget issues, most notably the loss of Navy 6.1 (basic) and 6.2 (applied) research dollars, will make it harder for researchers to fund at-sea experience for their students.

Monitoring the Ocean Acoustically: A Review and Strategy for the Future

- Dr. Peter Worcester, Research Oceanographer, SIO
- Dr. Walter Munk, Secretary of Navy Professor of Oceanography, SIO

Dr. Peter Worcester discussed ocean acoustic tomography, commenting that since the mid-1970's, this method of monitoring the ocean has become an effective tool for remote sensing of the ocean interior on a wide range of time and spatial scales. The rationale for monitoring the ocean acoustically is that these methods provide integral measurements and once the system is in place, it can be used to rapidly and repeatedly make such measurements. An added benefit is that acoustic methods can be applied in adverse environments. He noted the roles of acoustic tomography in an ocean observing system including:

- Using the remote sensing capabilities for regional programs in which other methods would not be effective.
- Serving as a component of process-oriented studies in which large-scale, big picture data are needed.
- Moving deployment toward basin to global scales as acoustic technology is enhanced.

He commented that the operational costs of a tomographic network are low, adding to the appeal of the method. He described the Acoustic Thermometry of Ocean Climate (ATOC) and noted the initial goals of determining the precision with which acoustic methods can measure large-scale change in ocean temperature and what effects acoustic transmissions have on marine life. Dr. Worcester concluded by noting two issues of concern. First, the use of acoustic remote sensing has been held back somewhat by concerns over the impact of sound on marine life. He commented that while the scientific use of undersea sound is a minor component of the overall anthropogenic sound in the ocean, the current regulatory structure makes obtaining authorization for conducting ocean acoustic research so arduous that it has had a chilling effect on the field. Second, the Office of Naval Research is virtually the only

funding source for ocean acoustic research. While the Office of Naval Research (ONR) has declared ocean acoustics to be a national Naval responsibility, dependence on a single sponsor leaves the field vulnerable.

In response to a question of whether demonstration of a practical application for ocean acoustics would aid in obtaining additional support, Dr. Hodgkiss commented that the academic discipline of learning about sound and physics turns into remote sensing applications. He also noted that acoustics are used in medical applications. Dr. Kennel stated that acoustics is one tool that can be used to obtain a continual picture of the ocean.

It was noted that agencies sometimes experience difficulty in obtaining the information necessary to do permitting. Dr. Worcester responded that regulations need to be appropriately scaled to the source of the acoustics.

Science in Support of Regional Coastal Management

- Dr. Robert Guza, Co-Director, Integrative Oceanography Division, SIO
- Dr. Richard Seymour, Head, Ocean Engineering Research Group, SIO

Dr. Robert Guza and Dr. Richard Seymour discussed their efforts to measure and predict waves and subsequent beach changes (erosion and other sand transport) in Southern California. They commented on the Coastal Data Information Program (CDIP), which uses a combination of instrumentation and models to monitor and forecast wave conditions along the west coast of the U.S. The wave measurements and modeling capabilities of CDIP are used extensively in the Southern California Beach Processes Study (SCBPS). The goal of this study is to develop and implement strategies to monitor and model beach erosion with the ultimate purpose of providing information for more effective local and regional management of sandy shores.

Drs. Guza and Seymour commented that results from SCBPS could serve as a model for regional systems in other areas or a national system. They noted the importance of maintaining data quality and commented that the academic community needs to be involved in this kind of system. They also stated that the role of the federal government is to provide easy access to technology and that the application of data standards should be a partnership between the states and the Federal government.

Climate Change

- Dr. Dean Roemmich, Professor of Oceanography, SIO
- Dr. Detlef Stammer, Director, Center for Observations, Modeling and Prediction, SIO
- Dr. David Pierce, Programmer/Analyst, Climate Research Division, SIO

Dr. Dean Roemmich provided an overview of the use of ocean observations for better understanding and prediction of the climate system. He noted that an international consensus has been reached on the critical elements of an ocean observing system for climate and that some of these elements already exist. He commented on key elements that are being implemented or have been identified for implementation, including:

- The Argo Project – a global array of profiling floats (to be complete by 2005) that provides data on a variety of parameters;
- Time series stations – various time series stations collect a range of measurements;

- Deep ocean hydrography – select transects are repeated every five to ten years to study deep ocean circulation;
- Boundary current measurements – a comprehensive plan for this element is still under development, but is likely to include the use of cost-effective underwater gliders for coverage of all the oceans; and
- Acoustic thermometry – provides integral measurements of temperature and heat content over large horizontal areas.

Dr. Roemmich noted that technology transfer is a major international challenge, and while there is little resistance to the idea, there are nations that are unable to participate. When asked whether there are structural issues the Commission should consider, Dr. Roemmich commented on the concept of an operational observing system and a new relationship/partnership between academia and funding agencies. Dr. Kennel commented on the National Oceanographic Partnership Program, Ocean.US and the National Ocean Research Leadership Council as a model structure for managing and integrating an ocean observing system.

Dr. Detlef Stammer discussed the relevance of ocean data assimilation for climate research. His work examines the dynamics of ocean circulation, its variability over space and time and the associated transport properties and how these relate to climate.

Dr. David Pierce discussed the Accelerated Climate Prediction Initiative (ACPI). This initiative aims to show that problems with initializing climate models because of a lack of real ocean temperatures can be solved. Eliminating this problem will allow useful predictions of precipitation and temperature and, as a result, water resource availability. These predictions can then be used to better manage reservoirs and energy facilities. Dr. Pierce noted that computational limitations are a key factor in this type of work. He stated that there is a lack of computer facilities with the ability to handle anything more than a demonstrational project.

DEOS: Dynamics of Earth and Ocean Systems

- Dr. John Orcutt, Director, Cecil and Ida Green Institute of Geophysics and Planetary Physics, SIO

Dr. John Orcutt discussed the proposed Dynamics of Earth and Ocean Systems (DEOS) program. Developed in 1997 to foster the establishment of a long-term presence in the ocean, DEOS promotes long-term ocean observations and the collection of long-term time series data as the only viable means to observe changes in the ocean. Dr. Orcutt stated that an Ocean Observations Initiative has been approved by the National Science Board at \$130M over five years and is expected to be in the Fiscal Year 2004 National Science Foundation budget. He commented on the three elements of DEOS: plate scale observatories, coastal observatories and a global network of moorings. He noted the DEOS belief that moored ocean buoys are a key component of a long-term ocean observing system and represent a feasible method for obtaining sustained time series observations. Both the U.S. and Britain have complete design studies for such buoys, and Dr. Orcutt described demonstration experiments for components of the mooring system.

He also commented on the NEPTUNE Program, a plate-scale system consisting of a network of cabled observatories designed to provide power and communications for thousands of experiments. Dr. Orcutt noted societal needs for sustained, long-term

ocean observations in the oceans, including the increasing coastal population and the need to educate the public on the oceans, resource identification and assessment, and hazard mitigation. He commented that enhancement of existing and development of new technologies is making it possible to study the oceans in new ways.

Marine Microbial Diversity

- Dr. Farooq Azam, Professor of Marine Biology, SIO

Dr. Farooq Azam discussed the role microbes play in the structure of marine ecosystems and the impact of microbial activity on global climate change, fisheries and coastal ocean health. He commented that because of the lack of knowledge of the marine microbial world, informed management of issues ranging from harmful algal blooms and coastal pollution to fisheries and aquaculture has been impaired. He also discussed the controls microbes exert over the ocean's carbon cycle and the associated implications for global warming. Dr. Azam recommended the development of a new type of ocean exploration, exploration on the fine scale. He noted that this is possible given the new technologies that are now available. He stated that the result will be a fundamental understanding of how microbes affect marine ecosystems, leading to improved predictive models of global change and enhanced prediction of the ocean's response to natural and anthropogenic stresses.

Crisis in the Oceans and Marine Fisheries

- Dr. Jeremy Jackson, Director, Geosciences Division, SIO

Dr. Jeremy Jackson discussed the importance of history in matters of marine conservation management. He noted that ecosystems commonly described by ecologists as pristine were in fact overfished prior to the onset of ecological observations. This viewpoint has played a role in the unsuccessful marine management seen today that addresses only the current crisis events rather than the historical, underlying causes of change. He stated that historical analyses are needed to provide a meaningful baseline and critical data on the pattern of changes in an ecosystem as a result of anthropogenic and natural alterations. These analyses are also valuable as basic management tools to address crises such as fisheries collapse, eutrophication and disease outbreak. He commented that changes due to overfishing often precede other events such as pollution, appearance of invasive species and climate change, and noted that all of these factors may work together to hamper the reversal of changes in ecosystem structure. He provided examples of this including the overfishing of oysters in the Chesapeake Bay prior to the current problems of eutrophication and anoxia due to excess nutrient runoff. He stated that environmental impact studies should be required for all fisheries activities and that these studies can be done in an inexpensive and time efficient manner.

Science-based Design of Marine Protected Areas

- Dr. Enric Sala, Deputy Director, Center for Marine Biodiversity and Conservation, SIO

Dr. Enric Sala discussed a method of designing marine reserve networks that maximizes the protection of biodiversity and species at risk due to overfishing. As an example, he described a case study in the Gulf of California that tested this method. The method quantifies patterns of biodiversity such as species richness, community structure, distribution of habitats, and location of spawning aggregates and nursery sites. A GIS-model is then used to design a network that optimizes the conservation

goals of protecting biodiversity, including hotspots; protecting vulnerable species by incorporating critical spawning and nursery sites; and maintaining connectivity between protected areas through migration or larval dispersion patterns. These three conservation goals also represent the three requirements for establishing an effective network of protected areas. Dr. Sala commented that the creation of marine reserves should:

- Involve local communities for better enforcement of reserves and fisheries regulations;
- Include ecological studies to provide a scientific basis for the network design; and involve NGOs and government officials in charge of marine conservation.

Center for Marine Biodiversity and Conservation

- Dr. Nancy Knowlton, Director, Center for Marine Biodiversity and Conservation, SIO

Dr. Nancy Knowlton discussed the new Center for Marine Biodiversity and Conservation established at SIO in May 2001. Given the threats to marine biodiversity and the challenges facing biodiversity researchers, the goals of the Center are:

- Investigation – assessing the status of marine ecosystems and developing models for the future;
- Education – training the next generation of biodiversity and conservation scientists;
- Integration – developing new approaches that link various disciplines, including social sciences;
- Communication – increasing public knowledge of science issues and providing sound scientific analyses to policy makers; and
- Application - designing strategies to prevent and reverse biodiversity collapse.

Dr. Knowlton commented that much of the Center is in place, but there is a need for additional support for graduate and post-doctoral fellows, visiting researchers, interdisciplinary workshops, and faculty in social sciences. She noted that achieving the Center's goals will require a broad range of partners.

Appendix I

Participants:

- Dr. Charles Kennel, Director of SIO
- Dr. William Kuperman, Director, Marine Physical Lab
- Dr. William Hodgkiss, Deputy Director for Scientific Affairs
- Dr. Peter Worcester, Research Oceanographer
- Dr. Walter Munk, Secretary of Navy Professor of Oceanography
- Dr. Robert Guza, Co-Director, Integrative Oceanography Division
- Dr. Richard Seymour, Head, Ocean Engineering Research Group
- Dr. Dean Roemmich, Professor of Oceanography
- Dr. Detlef Stammer, Director, Center for Observations, Modeling and Prediction at Scripps
- Dr. David Pierce, Programmer/Analyst, Climate Research Division

- Dr. John Orcutt, Director, Cecil and Ida Green Institute of Geophysics and Planetary Physics
- Dr. Farooq Azam, Professor of Marine Biology
- Dr. Jeremy Jackson, Director, Geosciences Division
- Dr. Enric Sala, Deputy Director, Center for Marine Biodiversity and Conservation
- Dr. Nancy Knowlton, Director, Center for Marine Biodiversity and Conservation

Monterey Bay Aquarium and Monterey Bay Aquarium Research Institute

The site visit to the Monterey Bay Aquarium and the Monterey Bay Aquarium Research Institute included presentations from top area resource managers, researchers, oceanographers and other experts on coastal marine protection, marine sanctuaries, marine reserves and other issues pertinent to the California coast.

The site visit began with an overview of ocean issues from Ms. Julie Packard, the executive director of the Monterey Bay Aquarium and a member of Pew Oceans Commission. Following several other presentations, the group left the aquarium and traveled to the Monterey Bay Aquarium Research Institute at Moss Landing. The presentations at the institute included a discussion of coastal and marine protection, the role of research institutions in federal partnerships, local and state governance and advances in oceanographic research technology.

Commissioners Participating in the Site Visit:

Vice Admiral Paul Gaffney, II, USN

Professor Marc Hershman

Dr. Frank Muller-Karger

Mr. Edward Rasmuson

Dr. Paul Sandifer

Commission Staff:

Dr. Thomas R. Kitsos

Ms. Laura Cantral

Ms. Kate Naughten

Capt. David Titley, USN

Ms. Deborah Trefts

Others in Attendance:

Capt. Chris Gunderson, USN, Deputy Oceanographer of the Navy

Ms. Julie Packard, Monterey Bay Aquarium

Mr. Scott Treibitz, Tricom Associates

Monterey Bay Aquarium: Introductory Remarks and Perspectives on the Oceans

- **Ms. Julie Packard** - Executive Director, Monterey Bay Aquarium and Member of the Pew Oceans Commission
- **Dr. Johanna Polsenberg** - Staff, U.S. Congressman Sam Farr and the U.S. House of Representatives Oceans Caucus

A native Californian as well as one of the founders of the 25-year-old Monterey Bay Aquarium, Ms. Julie Packard welcomed the Ocean Commission to Monterey, and thanked the Commissioners for their commitment to improving national ocean policy.

Ms. Packard pointed out that because California was home to 34 million people and the sixth largest economy in the world, the state could provide some valuable lessons to Commission and to the nation regarding ocean and coastal. She also noted that the aquarium, the largest regional aquarium in the nation, was in an excellent position to deliver information on the health of the oceans and marine creatures to the public and encourage much-needed stewardship of the ocean and its resources by the public. Ms. Packard then offered several recommendations to the Commissioners for their consideration, based on her own experiences and those experiences she had as a member of the Pew Commission.

Dr. Polsenberg's presentation touched on ocean policy issues at the federal level, including the effort to develop marine reserves.

Sanctuaries and Reserves - Lessons Learned and New Tools for the Future

- **Mr. Bill Douros** – Superintendent, the Monterey Bay National Marine Sanctuary -
- **Dr. Mark Carr** - Associate Professor of Ecology and Evolutionary Biology, University of California Santa Cruz
- **Dr. George Matsumoto** – Education and Research Specialist, Monterey Bay Aquarium Research Institute

Mr. Bill Douros gave an overview of the history and current status of the Monterey National Marine Sanctuary, which was dedicated in September 1992. His comments addressed ecosystem protection efforts at the sanctuary; community participation in the stewardship of the sanctuary; the role of stakeholders in solving resource management problems; and the value of partnerships.

Following that presentation, Dr. Mark Carr gave a presentation on the science behind marine reserves and marine protected areas. Finally, Dr. George Matsumoto gave an overview of the importance of forming ocean science educational partnerships. As an example of current educational tools, he gave a live demonstration of the aquarium's interactive exhibit, "Exploring Monterey Canyon". The demonstration included a live audio and video link to a remotely operated vehicle, also called an ROV, operated by the aquarium's research institute. Following the demonstration, the Commissioners left for the Monterey Bay Aquarium Research Institute at Moss Landing.

Monterey Bay Aquarium Research Institute at Moss Landing (MBARI)

The MBARI site visit kicked off with presentations that addressed the state perspective on coastal planning, development and marine protection; the role of research institutions in federal partnerships; and new advances in technology in ocean research.

Coastal Marine Protection-A State Perspective

- **Mr. Fred Keeley** - California State Assemblyman
- **Mr. Michael Mantell** - Former Undersecretary of Resources for California Coastal
- **Dr. Gary Griggs** - Director, Institute of Marine Sciences, UC Santa Cruz and Chair-University of California Marine Council

A California State Assemblyman and the author of California's Marine Life Management Act of 1998, Mr. Fred Keeley addressed the marine resource protection

challenges facing California. His remarks provided an overview of the act, which includes measures to address the importance of clear authority for the state game department to actively manage fisheries and ecosystems; the importance of managing the state's commercial and recreational fisheries to ensure sustainability; stakeholder participation in the development of fishery management plans; and other measures that relate to fisheries management.

Mr. Michael Mantell's topic, "Preserving California's Coastal Land Resources", focused the Commission's attention on the Elkhorn Slough watershed. The key points he addressed included the assertion that government can do more to improve coastal and ocean resources in a more coordinated and strategic manner; government should seek ways to effectively engage in partnerships with the private sector to remedy existing environmental problems and prevent future ones involving coastal and ocean resources; and private land stewardship and restoration activities offer some of the most promising opportunities for improving coastal and near shore marine environments.

The increasing conflict between coastal development and coastal hazards was the focus of Dr. Gary Griggs' presentation to the Commission. He pointed out that the societal cost of coastal hazards will continue to increase based on the growing density of coastal populations, our nation's inability to predict the timing for large-scale events, including hurricanes, earthquakes and El Ninos. Dr. Griggs stressed that the nation should focus on reducing the number of people who would be impacted by coastal hazards and that the U.S. should not subsidize hazard-prone coastal development or reconstruction. In closing, he urged the Commission to think about long-term sustainability rather than short-term fixes.

The Role of Research Institutions - Federal Partnerships

- **Dr. Gary Griggs** - Director, Institute of Marine Sciences, UC Santa Cruz and Chair-University of California Marine Council

In his second presentation to the Commission, Dr. Griggs highlighted many of the benefits of the partnerships among academic institutions and federal agencies. Some of those benefits include:

- The costs of university research to agencies are born only for the duration of the project which allows the agency to move on to other projects without having to carry the cost of federal staff or infrastructure.
- University research provides the option for rapid changes, lending flexibility rather than inertia to changing federal priorities
- University research funds awarded through peer-review and competition ensures that best science is supported by tax dollars and duplication is minimized.

Ocean Research and Technology

- **Dr. Marcia McNutt** - President and CEO of the Monterey Bay Aquarium Research Institute; President of the American Geophysical Union; Chair of Presidential Ocean Exploration Commission

Dr. Marcia McNutt gave an overview of recent advances in ocean research technology and her vision for the future. According to Dr. McNutt, there is a paradigm shift underway in the oceanographic research community. In her view, the emphasis is shifting from the outfitting research vessels with people and equipment for month-

long expeditions to the harnessing of the nation's technological creativity to tackle large-scale scientific issues through global observing and exploration efforts. She asserted that this shift will require managers and researchers to develop new interfaces among science, engineering, marine operations, data management and observing systems. She stressed that MBARI has already dealt with many of the challenges presented by the paradigm shift, specifically by instituting a centralized funding structure. She highlighted several specific research challenges that MBARI faced and the solutions the institute developed as part of the facility tour that followed her presentation. The tour included demonstrations of several high-tech research tools, including the latest version of the autonomous underwater vehicle, or AUV.

Following the tour, the Commissioners departed for the Navy's Fleet Numerical Meteorology and Oceanography Center.

Appendix I

Participants:

- Ms. Julie Packard, Executive Director, Monterey Bay Aquarium and member of the Pew Oceans Commission
- Dr. Johanna Polsenberg, staff, Congressman Sam Farr and House Oceans Caucus
- Mr. Bill Douros, Superintendent, The Monterey Bay National Marine Sanctuary
- Dr. Mark Carr, Associate Professor, UC Santa Cruz and co-PI - the PISCO project
- Dr. George Matsumoto, Education and research specialist, Monterey Bay Aquarium Research Institute
- Mr. Fred Keeley, State Assemblyman from central California coast
- Mr. Michael Mantell, Former Undersecretary of Resources for CA, heads law firm Resources Law Group
- Dr. Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz and Chair, Univ of CA Marine Council
- Dr. Marcia McNutt, President and CEO of MBARI

Fleet Numerical Meteorology and Oceanography Center (FNMOC) Site Visit

After attending briefings at the Monterey Bay Aquarium and Monterey Bay Aquarium Research Institute, the Commissioners and staff toured the FNMOC facilities for one hour. They received briefings on the following topics:

- Current operational support to DoD forces and the nation
- Transition of research and development to operations
- Local, national, and international collaboration

In addition to the briefings, the Commissioners toured the operations and computing centers of FNMOC and had the opportunity to talk with the sailors and civilians on watch.

Welcome and Introduction

FNMOCC Commanding Officer, Navy Captain Joe Swaykos, welcomed the Commissioners to Monterey and provided a brief overview of the global capabilities and responsibilities of the center. He stressed the close relationship with the Naval Oceanographic Office and the U.S. Air Force. Captain Swaykos also highlighted the mutual support between FNMOCC and the DoC/NOAA National Centers for Environmental Prediction (NCEP). FNMOCC serves as the national backup site for NCEP; this capability was exercised for several days earlier this year due to a fire at the NCEP Operations Center in Camp Springs MD.

Captain Swaykos briefly described the numerical modeling suite supported by FNMOCC. The primary tools are a global atmospheric model (NOGAPS), which provides boundary conditions to a regional, relocatable, coupled air-sea model (COAMPS). This numerical suite provides weather and oceanographic guidance for DoD, and is also used by the National Weather Service, the Department of Energy, and allied nations.

Much of the input data and model output are available to the general public. Specifically:

- 100% of the global products,
- 90% of the regional products, and
- 99% of the collected raw data are available to any interested user.

Captain Swaykos emphasized the advantage of having the Naval Research Laboratory (Marine Meteorology Division) co-located on the same campus. Such proximity ensured that researchers had a good understanding of day-to-day operational challenges, and the operators could see the strengths and limitations of today's R&D.

Captain Swaykos discussed many of the institutions with which FNMOCC has forged a relationship. They include military and civilian academic institutions, national centers of expertise in a variety of subjects (e.g., National Hurricane Center, Central Intelligence Agency, CORE), and international organizations and efforts such as the Global Ocean Data Assimilation Experiment (GODAE), the European Centre for Medium Range Forecasting and the United Kingdom Meteorological Office.

Finally, Captain Swaykos discussed how FNMOCC is moving many of their business practices and customer focus and outreach activities to the World Wide Web.

- **Mr. Michael Clancy – Central California Environmental Prediction Initiative (CCEPI) Overview**

Mr. Clancy briefed the Commissioners on the Central California Environmental Prediction Initiative (CCEPI). This proposed program:

- Is collaborative among central California Federal, state, and local institutions
- Establishes the central California region as a "natural laboratory" to understand air/sea processes and their impact on both the local weather and local ocean environment
- Combines robust observing and modeling components

This proposed program has many similarities with the Gulf of Maine Ocean Observing System (GoMOOS).

Mr. Clancy also provided an overview of key components of FNMOC's infrastructure. They include:

- The Primary Oceanographic Prediction System (POPS). As its name implies, POPS is the computational backbone for FNMOC. It:
 - Runs both operational and R&D jobs
 - Serves jobs ranging from one to 512 simultaneous processors
 - Incorporates redundant design, shared file systems, and multi-level security
- The Applications, Transactions, and Observations Subsystem (ATOC). ATOC manages, collects, and processes over 6 million observations per day, including satellite derived data, airport reports, and aircraft observations.
- Computation facilities that serve as a principal node on the GODAE network.

Navy Research Laboratory's Marine Meteorology Division

- **Dr. Philip Merilees, Superintendent, Naval Research Laboratory (NRL), Marine Meteorology Division, Monterey**

Dr. Merilees spoke briefly to the Commissioners and concentrated on the following topics:

- NRL Monterey's three main missions:
 - Transition relevant meteorology products for the warfighter
 - Develop core numerical weather prediction systems for DoD (primary) and national use.
 - Increase the nation's understanding of atmospheric phenomena.
- He stressed the synergy of having a dedicated R&D laboratory in the same building as the operators / users of the technology developed by his lab. This physical set up allows for both formal and informal collaboration between operators and researchers, provides an accessible "real-world" test bed for new technology, and ensures each community understands the other's strengths and challenges.
- As an example of this cooperation, NRL has recently obtained a 128-processor Silicon Graphics Interface (SGI) Origin 2000 that has sufficient computing capability to run mesoscale numerical coupled atmosphere-ocean models in an environment that mimics the operational computing environment. With this tool, researchers can develop code that runs directly on the operational machine, rather than waiting (and paying) for another set of contractors to convert R&D computer code into code that will work in the operational environment.
- Work on enhancing visualization technology for the end-user. Specifically, Dr. Merilees discussed a program called "My Wxmap" that has rapidly gained wide acceptance by the user community.

Summary:

FNMOC has the intellectual, physical, and computational capability and capacity to serve as the DoD center of expertise for numerical weather prediction. FNMOC is also provides capable and tested backup to NCEP to provide NWP products for the nation.

The collocation of the R&D center directly supporting the operations center is well-received on both sides, and well supported by management.

FNMOC is exploring ways to leverage their intellectual capital and physical science relationships they have built up in central California with new ways of finding computer power to run current generation numerical models. FNMOC fully supports the R&D required to reach the goal of performing operational numerical weather prediction in a distributed computing environment.

Powerpoint briefs of several of the FNMOC and NRL presenters are available on CD-ROM at the Ocean Commission office.

Appendix I

Participants:

- Captain Joseph Swaykos, Commanding Officer, FNMOC
- Mr. Michael Clancy, Chief Scientist, FNMOC
- Dr. Philip Merilees, Superintendent, Naval Research Laboratory Monterey