TOPIC: *TECHNOLOGY AND MARINE OPERATIONS*

KEY ISSUE: *Strategy for Technology Development to Meet Nation's Needs*

ISSUES RAISED

- Hawaii has a robust and dynamic technology-based ocean community and world-class ocean oriented academic institutions, but far removed from Washington D.C. and often overlooked. (Friedl)
- Best way to assure talent and attitude of Hawaii's technology-based community as part of nation's ocean future is to assure ocean development programs are open, competitive, and dynamic. (Friedl)
- Concerned about state of marine technology compared to its potential. Need to find and implement promising new technologies; raise the visibility of the highly underutilized potential of marine technology sector. (Wiltshire)
- Variety of technologies enables us to access the ocean from surface to deep in the seafloor. (Leinen)
- Appropriate infrastructure and technology innovation are needed to improve our decisions: "Illuminating the Hidden Planet, the Future of Seafloor Observatory Science." (Alberts)
- Ocean industries represent U.S. $750 billion annual expenditures: half oil and gas industry, a third in support of navies of the world. Major advances and breakthroughs in technologies of ocean industry result from research and development of these two components. (Clark)
- The increasingly complex nature of ocean science and technology requires fresh and unconventional partnerships among all members of the ocean science community. As Federal agencies, they must be agile, resilient, and interconnected, just like the science and technology itself. (Colwell)
- Connectivity is very important. As a matter of fact, the cyber infrastructure, one of the most ambitious connectivity efforts ever is in progress. The cyber infrastructure is the connection, in this case, of high-speed computing to every part of the country. Investing in information technology will continue. (Colwell)
- Many of the important global science programs are isolated from each other in their approach, objectives, and goals. And, they are focused on the narrower objectives of the individual facilities themselves and not on the broader scientific questions or strategic mission that all the observatories should be addressing. (Gagosian)
- Data and understanding lead to models and validation, which then leads to prediction. The predictions from numerical simulations can never be better or more comprehensive than the data used to initialize the model, nor the underlying physical and other processes of the model. (Gagosian)
- The Marine and Oceanographic Technology Network (MOTN) is a trade association dedicated to promoting the success of marine technology business. MOTN provides services and help to expand the business opportunities of its members, which is currently 68. This region has the highest concentration of marine science and technology firms and institutions in the world. (Merrill)
- Many of the same problems that are being dealt with today, were being dealt with 37 years ago. Some drastic changes are needed in the way this is all approached. Modern technology has a lot of those answers. (Lobecker)
- The use of remote sensing technologies in Alaska has not been great, primarily because there are not the assets that can respond. (Underwood)

- The Coast Guard has a number of remote sensing capabilities but what we have seen most often used are actual patrols and over flights by C-130s. We have had a number of incursions that are detected by remote sensing but we have never successfully completed the task because the violators simply turn around and run into international waters or waters of a foreign country. It is not really a matter of detecting the violators but also having the assets in place so that we can actually respond. (Burgess)
- Multi-beam mapping, and other existing technologies, provides depth and other information, allowing scientists to define differing bottom types and to quantify slope areas known to support certain types of fish. (Pawlowski)

PRESENTER RECOMMENDATIONS

- Recommend continued development and improvement of technologies for use in ocean and coastal research and monitoring activities. (Sedberry)
- Sustained government investment to support development of new technologies to conduct commerce (i.e., NOAA Office of Ocean Technology). (Clark)
- Prioritize federal research and development to facilitate large scale oil skimming vessels with greater recovery and storage capacity in broader range of sea conditions. (Hopkins)
- There should be continued support for innovation and increased technology transfer from the academic environment, research institutions and Federal laboratories into the private sector. (Merrill)
- Support is needed to continue to assist marine technology firms worldwide in their efforts to sell instrumentation all over the world and provide services. (Merrill)
- Provide more focused assistance in the newer markets in South America, Asia, and the new republics. (Merrill)
- Streamline domestic regulations. (Merrill)
- Support business improvement opportunities. (Merrill)
- Recognize the importance of existing technologies, like multi-beam mapping, in supporting science-based decision making for coastal and marine programs. (Pawlowski)
- The best technology available should be utilized for protection of marine sources from pollution and other adverse effects. (Lakosh)
- Recommend strengthening and advancing present outstanding ocean scientific and technological capabilities. What is needed is a considerable investment in technological development so that thirty years from now, we can look back and say that the advancements in this period were also spectacular. (White)
- Need help to enlighten EPA regarding passing law that will certify and regulate a new device whose performance is far superior to anything on the market today. Existing law refuses to recognize technology improvements. (Husick)
- For the multi-national Integrated Ocean Drilling Program to be a success, the United States must continue its support of the program, including a replacement for the Resolution. (West)

TOPIC: *TECHNOLOGY AND MARINE OPERATIONS*

KEY ISSUE: *Development of New Sensor Systems and Platforms for Working and Living at Sea*

ISSUES RAISED

- Parameters for success:
  1) Facilities with technical expertise and charter to support complex sensors, robotic platforms, and data needs of scientific community;
  2) Centers of excellence to develop first-rate sensors, platforms, and observation techniques on a community basis;
  3) Competitive processes that encourage periodic upgrades of facility capabilities;
  4) Mechanisms to support adoption of new paradigms of ocean observation. (Bellingham)
- Cost to develop molecular tools expensive, but as clinical laboratories develop them cost comes down; sensor technology is on verge of happening: NIH, NSF, DOE, USDA, EPA involved in technology. (Grimes)
- Three new sensor systems of particular relevance to ocean science and proposed user groups are underwater mass spectrometer, long path length spectrophotometer, dual-laser imaging system. (Betzer)
- MARAK is a meteorological company that has installed world's largest private coastal mesonet of about 200 stations along coast and Great Lakes for sailing and windsurfing communities. Public agencies have realized the value of this private sector data for variety of applications. [examples provided] (Titlow)
- Yes, sensors are put on fish, sea lions and Orcas. The elephant seals work very well because they are so large. To my knowledge there are no examples of salmon or another fish that have worn sensors that were heard inside a predator. The Orca that was mentioned, that died about ten years ago and was found to have 15 sea lion tags in its belly, is very interesting. Yes, it is a good way to learn about the food chain. (Grassle)

PRESENTER RECOMMENDATIONS

- Industry interactions: need to develop partnerships with oil and gas industry to share their data; increase development of sensors; industry interested in product development for specific user groups. (Seim)
- Urge NOAA to start now earmarking some funds for the development of biological sensors, so they can get to the same level as the physical and even chemical sensors. (Evans, D)

TOPIC: *TECHNOLOGY AND MARINE OPERATIONS*

KEY ISSUE: *Development of an Operational Coordinated Ocean Observing and Prediction System*

ISSUES RAISED

- Ocean observing systems allow us to take pulse of planet:
  1) Tropical Atmospheric Ocean array identify recurrence of El Nino;
  2) Not limited to climate change; includes weather forecasting and restoring and maintaining healthy ecosystems and living marine resources (e.g., fisheries);
  3) GOOS and APEC examples of data applied to managing resources;
  4) Goal is to integrate state and local governments, industry, and academia into consistent and accessible national system;
  5) Operational needs key driver; need to identify key ocean research areas and technological requirements. (Lautenbacher)
- Operational observing system can provide scientific data for:
  1) Management of living marine resources, including coral reefs;
  2) Ocean and coastal management and uses, including tourism and development. (Lautenbacher)
- NSF is working with academic community to provide new infrastructure for gaining access to oceans. Infrastructure is integrated network of ocean observatories that complements satellite, mooring, and float technologies and allows acquisition of long-term time-series and data on the ocean interior and seafloor. Will facilitate "temporal" exploration of oceans. Ocean observatories and observation system will complement, not replace, research vessels. (Leinen)
- Historic view of oceanography: most of previous century could be called "century of undersampling." Satellites have revolutionized oceanography; the ability to sample adequately and globally. Remote sensing enhances the need for shipboard observations; "sea-truth." Next two revolutions: climate and combined biological/physical/chemical models of ocean processes. Future: first priority is establishment and maintenance of an Ocean Observing System; dual goal of managing and sustaining ocean assets and of understanding ocean processes. [essential ingredients provided in Figure 5]. Probably most difficult requirement is that of "sustaining" observations. (Munk)
- Coastal observation systems: federal government can provide national framework, standards of protocols, definition of requirements, stable/opportunistic funding. (Davidson)
- There is national need for sustained and integrated observations of coastal waters. (Fletcher)
- Observing systems in east and southeastern U.S. [descriptions provided] (Seim)
- Concern from academic community that establishment of an observing system will cut into already slim funds; would be comfortable with restructuring. (Seim)
- Industry can participate in national observing system and is engaged in promoting and enhancing arrangements for offshore platforms providing research tool for academic and scientific community. (Caveney)
- Development of integrated ocean observing capability required, including moored high bandwidth telemetry buoys and arrays of seafloor sensors through government/industry partnerships; lacking motivation and funding. (Clark)
- Systems designed for long-term monitoring may serve double-duty as homeland sentinel systems. (Clark)
- Ocean observations:
  1) Long time-series data key for managing living resources, understanding ocean ecosystems, resolving uncertainties about role of oceans in climate change;

2) Providing new infrastructure beginning with integrated network of ocean observatories, incorporating advanced sensors for chemical and biological measurements [description of elements included] and provides basic hardware and infrastructure. (Colwell)

- Need to educate potential partners in effort to build effective observations system. (Colwell)
- NASA needs global ocean observing system:
  1) Integrate: combining "in situ" and space-based subsystems with ocean models and data assimilation techniques;
  2) Integrate: long-term data collection for research quality products and infusion of system design and technology change;
  3) Integrate across disciplines (physics, chemistry, biology). (Lindstrom)
- Ocean observations important issue for DOD: DOD collects significant amounts of data and bridge national security and civil communities by declassifying more data. [a one-page statement "The Importance of Ocean Observations to Naval Operations" is provided] (West)
- Ocean Observing Systems important to understand, manage, and protect coastal resources. (Farr)
- The cost of insufficient information is high and it is important that an investment is made in a real-time ocean observing system. (Richert)
- To complicate the issue further, each observatory seeks its own funding, thereby competing amongst the other observations. (Gagosian)
- The nation has the technology and the science potential. Priorities must be focused and the funding coordinated towards a common goal. (Gagosian)
- The design of an observing system to answer basic questions about the biology of the oceans will build on capabilities needed for safe and efficient coastal ocean operations of all kinds. The following are examples of information of immediate economic and strategic importance needed for understanding processes controlling the distribution and abundance of life in the ocean:
  1) Management of commercial and recreational operations in increasingly congested estuaries, embayment, and open coastal areas requires tracking systems and real-time, high—resolution information on ocean circulation.
  2) Continuous monitoring and management of pollutants and pathogens from point and non-point sources is necessary to protect human health.
  3) Rapid deployment of an observational and predictive capability to make unknown environments known has become an essential element for success of military operations.
  4) Forecasts of weather and ocean conditions affect peoples' daily lives as well as the viability of every coastal business—responses of fish, marine mammals, drifting gelatinous animals, clams, and crabs respond to atmospheric and ocean weather. (Grassle)
- The Gulf of Maine Ocean Observing System, Inc. (GoMOOS) is a prototype regional, user-driven, coastal ocean observing system. As such, our immediate goal is to provide data and information to serve a wide variety of public and private sector needs for decision-making, problem solving and research in the Gulf of Maine. GoMOOS has partnered with the research community to implement a versatile and state-of-the-art observing system for the Gulf of Maine. GoMOOS has two major components: 1) a technical component, which includes the infrastructure for acquiring, managing, archiving, and disseminating oceanographic and meteorologic data on an hourly basis; and 2) an institutional component, which allows GoMOOS to operate as an effective partnership within the region. (Bogden)
- GoMOOS should make the transition from being dependent on congressional plus-ups because that dictates year-to-year basis of looking for funding. Right now for a state agency to look at GoMOOS as providing a long-term commitment and return on its investment is a bit tenuous because our primary support is Federal funding. A model is being developed after a new kind of entity, a regional, coastal oceanic version of the Weather Service. And the same type of support is needed before other kinds of resources can be developed. (Bogden)

- A problem related to ocean observing systems transcends those very high technology observing systems. All of our members are acquiring data at unprecedented rates and the data stream is coming in at a much more rapid rate than it can be turned into useful information. (Jumars)
- Ocean.US, established under the National Ocean Partnerships Act, is the ocean agencies' effort to begin the implementation of an integrated and sustained ocean observing system. The interagency Ocean.US office's overall goal over the next decade is to integrate existing and planned elements to establish a sustained ocean observing system to meet the common research and operational agency needs in the following areas:
  1) Detecting and forecasting ocean components of climate variability;
  2) Facilitating safe and efficient marine operations;
  3) Ensuring National security;
  4) Managing resources for sustainable use;
  5) Preserving and restoring healthy marine ecosystems;
  6) Mitigating natural hazards; and
  7) Ensuring public health. (Evans, D)
- The integrated ocean observing system will comprise four main activities: [discussion provided]
  1) Operations and routine observations;
  2) Long-term research observation and observatories;
  3) Technology development to support the Ocean.US objectives and tools; and
  4) A web-based "commons" for access to models, algorithms, numerical techniques, etc. to foster improved productions by users. (Evans, D)
- Ocean.US is staffed by personnel assigned by the signatory agencies, presently Navy, NOAA, and NSF. And NASA is assuming the responsibility of providing a leader from the office no later than September, 2002. (Evans, D)
- Currently there is a very informal system that constitutes the Ocean.US framework. There is an MOU between nine agencies, nine of the 12 NOPP agencies that says they will participate to the extent that they have interest; that they will contribute resources that are in some way proportional to what they think they are getting out of it. And they will donate some people. But, the level of organization, the governance mechanism, is not much beyond a handshake—it is probably the lowest level or organization that one might imagine for such an important activity. (Evans, D)
- Ocean.US is headed toward success. The current funding situation is difficult right now but the attitudinal portion of it is positive. The executive committee meets regularly and the people who have authority over the programs are the people who come to those meetings. They come with the attitude of trying to figure out how to make the program work. The economy has changed over the last 18 months. And the availability of funds for accelerating initiatives, even those with very high potential payoff is greatly constrained. It is difficult to be optimistic about the receptiveness of OMB to even very important issues right now. There are other priorities that are consuming their attention. (Evans, D)
- There are very explicit connections between this as a Federally focused activity and all the grass roots efforts that are emerging in regions around the country. For example, in the Earline workshop, you will see that the vision for building the coastal component of the observing system really is to put together a consortium of all kinds of regional activities. This is a good approach because the measurement requirements, and the users of the data will vary from region to region. It is very important to put together these systems so they consider the users and products, and that somebody wants to take ownership for them. [discussion provided] (Evans, D)

- There is a tremendous interest in developing coastal observing systems in Alaska, and especially in the important bioregions, like Prince William sound, Kodiak, Bristol Bay, and Sitka Sound. There are a number of coastal communities that are rich in resources and have populations of people that are very dependent upon those resources and are interested in getting better information. (Thomas)
- There really is no fundamental difference between the definition of a military operational oceanographic requirement and a civil operational oceanographic requirement. (Spinrad)
- An integrated observing system will promote improved understanding of the oceans and climate with immediate applications for addressing a ranging of pressing problems ranging from agriculture to severe storms. (Withee)
- While funding of new instruments is essential, support for analysis of long term data sets derived from past and future research is equally important. (Jumars)
- Findings, goals and objectives presented for coastal and ocean observing. (CSO)

PRESENTER RECOMMENDATIONS

- Ocean observations: build on the evolutionary TOGA model. (Lucas)
- Provide incentives for federal agencies to be active participants in the regional systems. (Seim)
- Ensure proper support for regional observing systems does not come at expense of basic ocean research. (Seim)
- Direct funding (to NOPP) of the national ocean observing system must be established for sustained program to exist. (Seim)
- Coastal States Organization supports very comprehensive coastal and ocean observing systems. (MacDonald)
- Implement an integrated and sustained coastal and ocean observing system. (Thoroughgood)
- Improve interagency coordination and integration mechanisms (supports renaming and expanding authority of NORLC). NIH should participate in NORLC. (Thoroughgood)
- Ensure robust and innovative technical infrastructure:
  1) Restore ocean sciences portion of federal basic research budget to 7%;
  2) Adopt newly available technologies for high-speed, large band-width communications;
  3) Develop and maintain cadre of trained professionals and students; develop partnerships for exchange of personnel between academia, industry, and government (i.e., Intergovernmental Personnel Act). (Thoroughgood)
- Recognizing experimental capabilities as national assets requires balance between operational oceanography—within purview of ocean agencies—and innovative research. Best served by flexible partnerships among academic institutions and government. Remove competition by clearly defining scope of federal laboratory research, and stay within it. (Thoroughgood)
- Crucial that, through NORLC, federal agencies arrive at consensus for the operational requirements of an ocean and coastal observing system. (Thoroughgood)
- Operational systems need to include research goals to encourage continuous technological innovation and develop more effective capabilities to detect and predict meaningful changes. (Thoroughgood)
- Observing system must accommodate change, address numerous scientific and practical objectives simultaneously, and encourage seamless relationship between research and monitoring. (Thoroughgood)
- Balance between small and large scale programs will only be achieved with adequate funding that requires policymakers to understand the importance of the balance. (Thoroughgood)

- Endorse and recommend funding of the integrated and sustained ocean observing system. (Newton)
- There are several aspects of the ODP model that are also quite applicable for ocean observing systems and integrated discovery programs. One is the need for a long term funding line. Each time it is renewed it has new aspects to it, and they can do long term planning that way. That is absolutely essential for ocean observations, just as it is for ocean exploration. Ocean observing system and ocean exploration need to work together in proposals. There needs to be a big plan, finding the holes, and informing the community of where those holes are and encouraging people to put in proposals to fill the holes. (McNutt)
- Establish a National Coastal Ocean Observing System, coordinated by the Federal Government and implemented at the regional level by a federation of regional coastal ocean observing systems. [Further description provided.] (Richert)
- The Census of Marine Life group should be viewed as a cross-cutting science program that should be adopted in a number of different agencies. Business partners are very critical in the development of these regional needs. For example, forecasts have value, dollar value. The dollar-value forecasts are looked at, as are individuals' business plans, to see how they affect the bottom line. This is important because a lot of government funding is needed. In time, however, that government funding will transition to private funding, so the value added is increased. (Grassle)
- Urge Congress to fund the infrastructure required to observe the ocean and foster regional partnerships among industry, academia, and government to sustain observing systems. The elements of the Integrated and Sustained Ocean Observing System (ISOOS) have been defined and the recommendations of the Ocean.U.S. Workshop should be implemented. (Grassle)
- There has to be a national academic partnership of observing systems. There also needs to be a funding mechanism for phasing in regional systems, regional systems that respond to user needs in regions. It cannot be one size fits all. There should be strong linkages to science programs, which will emerge and have particular contributions at particular moments in time to the development of the system. It should be coordinated by Ocean.US and be a fully operational system. (Grassle)
- This nation has the technology and has the need. The resources must be allocated to create and sustain a national system. A recent NOAA cost/benefit analysis quantified the benefits from GoMOOS in dollar terms. Their conservative estimate of $30M/year exceeds operating costs by a factor of ten. In human terms, they estimated that GoMOOS observations applied to Coast Guard search and rescue could save six or more lives per year in the Gulf of Maine alone. (Bogden)
- Three recommendations that will allow the GoMOOS partnership to continue and will allow nascent systems in other regions to benefit as well:
  1) Long-term Federal funding for a national coastal ocean observing system
  2) Support for the national system as a federation of regional systems
  3) Coordination at the national level between the regional systems and the relevant Federal agencies.
- Perhaps all three of these objectives could occur through the expansion of the National Oceanographic Partnership Program (NOPP), and related offices such as Ocean.US. (Bogden)
- Engage CZM programs in the design and implementation of a national ocean observing system that meets coastal managers needs. This will require national legislation that establishes an ocean observing system. (Keeley)
- Make local, state, and regional investments in ocean observing. Federal funding should be used to leverage the investment of state resources in a national ocean observing system. (Keeley)

- Synthesize data into useful products. Ocean observing and prediction systems should be tasked with generating data and products for the primary purpose of making data products: national legislation that established an ocean observing system should authorize annual funding levels that provide significant resources, in a separate line item, for data synthesis and product development. (Keeley)
- Build state capacity. The Federal-state partnership that is required to make a national ocean observing system functional and useful will require an ongoing shared investment in building and maintaining local and state user capacity. National legislation that establishes an ocean observing system should contain statutory and authorization language that leverages and supports state efforts to use the intended data and products. (Keeley)
- The time is right to develop an observing system that (1) is based on sound science; (2) is responsive to the information needs of many user groups; (3) makes more effective use of existing resources, knowledge, and expertise for the public good; (4) provides a direct window to the ocean environment for research and public education; and (5) provides a framework that will enable government agencies to achieve their missions and goals more effectively. (Malone)
- Develop and fund a regionally based national system of observations and analysis that transcends existing jurisdictional and political boundaries, one that is better tuned to the scales of change in marine systems. (Malone)
- An integrated ocean observing system must be able to provide multi-disciplinary (physical, chemical, and biological) data and information to many user groups, and effectively and efficiently link observations; data acquisition, management, and dissemination; and data assimilation, modeling, and analysis in "end-to-end" fashion. [Further description provided.] (Malone)
- Mechanisms should be established to enable government agencies to collaborate more effectively, to take full advantage of new research capabilities, and to develop a more effective synergy between research enterprise and operational oceanography. (Malone)
- Recommend the Commission provide some impetus for the living resource community to get more involved with Ocean.US, including both the community at large, but also the people who have the resources to make things happen right now. (Evans, D)
- This effort must continue even if no other funds are received, and that is actually what is happening. (Evans, D)
- Seek the resources needed to develop and deploy an Ocean Observing System. (Keeney)
- Vigorously support efforts to establish an international, integrated ocean observing system. [Further description provided.] (Estabrook)
- The observing system and the science and technology associated with it present a range of opportunities to engage all citizens and educators, in particular, in many aspects of the ocean. (Lindstrom)
- There has to be a lead agency for ocean observing system. (McPherson)
- Should not just restore the observational system we used to have because we figured out how to do things better. (Joyce)
- The United States and its international partners should prepare a global ocean observing architecture plan based on shared operational requirements to ensure the system 1) takes full advantage of planned observation systems, 2) orchestrate common intersections towards efficiency, i.e., getting the best ocean observing system with available resources, and 3) actively considers important synergies between satellite and in situ systems. (Withee)
- Operational observing systems should be budgeted and implemented as integrated, quality, end-to-end systems that provide sound scientific data. (Withee)

- The ocean community must focus on an end-to-end strategy to provide products that meet the needs of the user community. This strategy must:
  1) Ensure continuity and integrity of calibrated data and information.
  2) Integrate remote sensing data with in situ observations.
  3) Develop comprehensive and realistic coupled land-ocean-atmosphere models.
  4) Coordinate efforts among researchers, data providers, and users of ocean and climate data and services.
  5) Develop applications and infrastructure to deliver meaningful products to users. (Asrar)
- Recommend the development and implementation of a comprehensive Ocean Observation and Prediction System. (White)
- Establish a synthesis program to support efforts to analyze large, long-term data sets with the goal of producing overview papers and to aid in identifying "data gaps" in the data. (Jumars)
- Develop a Coastal/Estuarine Observation System that recognizes links between watershed, estuary and ocean. (Wellenberger)
- Develop global oceanic and atmospheric observatories with support/or effective data management and assessment. (NASULGC)
- It is critical that we expand the reach of our ocean observing systems throughout the marine environment, including our nation's coastal areas. In addition, we must develop and deploy a robust data integration and management system and enhance our modeling capability to insure full benefit and utilization of the observational product from this system. This must include integration of biological data currently held captive in a variety of agencies. (West)
- Recommendations for coastal and ocean observing. (CSO)
- Specific recommendations presented. (Allen)

TOPIC: *TECHNOLOGY AND MARINE OPERATIONS*

KEY ISSUE: *Future Satellite Sensor Systems*

ISSUES RAISED

- Satellite measurements of oceanic and air-sea interaction quantities now play a fundamental role in oceanographic and climate research, as well as in weather and ocean state prediction. The technical ability to make accurate and useful ocean measurements from space has been demonstrated and consistent, decadal time series of a few key ocean quantities have been obtained. (Freilich)
- Spaceborne ocean observations have revealed new phenomena and allowed scientific studies of processes on critical space and time scales that were previously inaccessible using only data from in situ observing systems. (Freilich)
- Several significant obstacles must be surmounted before a comprehensive satellite ocean observing system for research and operations will become a reality. These challenges include the need for better temporal sampling and spatial resolution than is possible with individual satellite missions and present instruments; development and refinement of spaceborne techniques for measuring additional ocean quantities such as sea-surface salinity and the variables that control internal oceanic mixing processes; and, most importantly, national and international commitments to acquire simultaneous, multi-decadal ocean data sets. (Freilich)

PRESENTER RECOMMENDATIONS

- The whole constellation of satellites needs to be thought of in that context of a coordinated calibration/validation priority setting exercise. (Grassle)
- The US should make an investment in finding optimal means to utilize satellite data, in combination with in situ data, in our ocean, and air sea coupled models, demonstrating their utility in an operational setting. (Withee)
- Continued progress requires surmounting three main technical and programmatic challenges:
  1) Developing and demonstrating techniques for extending the set of ocean variables that can be measured accurately from space, including (for example) sea-surface salinity and quantities related to deep ocean mixing processes;
  2) Increasing the temporal and spatial resolution of the full suite of spaceborne ocean measurements to extend both the geographical (e.g., into the societally critical coastal zone) and the phenomenological extent of the data sets; and
  3) Extending the duration of the full, simultaneously measured ocean (and associated forcing) data set to allow resolution of important decadal ocean and climate processes – time scales well beyond the design lifetime of individual satellite measurements, but well within the demonstrated capability of operational satellite constellation programs. (Freilich)
- Need to establish predictable and efficient programmatic mechanisms for transitioning techniques and satellite missions – originally developed and demonstrated in the research context – to the operational observing systems designed to supply consistent, accurate, and timely measurements for decades into the future. (Freilich)

TOPIC: *TECHNOLOGY AND MARINE OPERATIONS*

KEY ISSUE: *Integrating Marine Operations Across Federal Agencies*

ISSUES RAISED

- NOAA home to National Water Level Observation Network, Physical Oceanographic Real Time System and National Data Buoy Center and Environmental Satellite and Data Information Service. (Lautenbacher)
- Portion of scientific community sees remotely operated vehicles (ROVs) as eventual replacements for occupied submersibles. Both are needed; there are aspects of submergence science best carried out with onsite human presence. Six critical areas in which occupied submersibles exceed capabilities of ROVs: engagement of the operator; visibility from vehicle; maneuverability; unobtrusiveness; reliability; and capacity for education, outreach and recruitment. [discussion of each provided] (Fryer)
- Renewal of the U.S. academic research fleet, (e.g., UNOLS fleet) in an orderly and planned set of steps over next two decades. UNOLS is 31-year old nonfederal consortium of about 60 oceanographic institutions with governing council and several standing committees. [description of UNOLS provided] (Knox)
- NSF has clear interest in enhancing facilities for performing basic ocean science research, along with Navy, NOAA and Coast Guard. Federal Oceanographic Facilities Committee of NOPP provides advice related to oceanographic facility use, upgrades, and investments. (Leinen)
- Fleet Renewal—What is the Problem?:
  1) Ships don't last forever. Can forecast probable useful lifetimes of existing fleet as done by FOFC [charts of ship days available and optimal ship days vs. average days needed, by class, are provided];
  2) Need new ships to do ocean science of the future. Autonomous observational devices will not replace research vessels; anticipate using smart combinations of unattended devices and directed adaptive observations from ships. [detailed discussion provided]

  Planning to solve the fleet renewal problem; FOFC "Fleet Plan" is first overall long range planning document for fleet renewal; contains timeline for recommended new ships:
  1) Document is only prospectus; contains no steps toward agency budget items and actual funded designs or acquisitions;
  2) Implementation steps must go forward as soon as possible;
  3) UNOLS approach would build additional three ships (FOFC recommended one) with fleet reduction of one; still short of actual demand. (Knox)
- Academic fleet: FOFC authored 2001 report "Charting the Future of the National Academic Research Fleet: A Long Range Plan for Renewal" commonly referred to as "Fleet Plan." Defines a federal interagency renewal strategy for the national academic research fleet. [detailed discussion of fleet and report recommendations provided] Focus is now implementation and Navy and NSF are exploring opportunities for funding for construction of regional vessels. (Leinen)
- Other FOFC coordination activities:
  1) Making effective use of autonomous underwater vehicle technologies and platforms will require new coordination mechanisms;
  2) New design and construction of human-occupied submersibles underway;
  3) Will soon start review of aircraft used for marine research and observations. (Leinen)
- Federal agencies asking for large investment over next decade to pay for renewal of academic fleet, U.S. component of ocean observing system, NSF observatories, IODP, and other oceanographic facilities. (Leinen)
- Ships, other research platforms, and ocean observing systems represent foundation of ocean science discovery for next several decades. (Leinen)

- Future vessel needs: Oceanographic research vessels capable of multi-mission operations; fishery vessels; fast patrol vessels; oil spill response vessels; and oil and gas exploration and drilling. Vessels themselves must be "green ships" like double hulls. (McCreary)
- Autonomous underwater vehicles is an emerging technology waiting for commercial application (mapping continental shelf). (Clark)
- The growth in maritime activity is having an impact on Coastal Guard mission:

  Marine Transportation System (MTS) (95% of cargo crossing our borders moves by ship):
  1) Increasing reliance on oceans for transportation of goods and people; [detailed statistics provided]
  2) New approaches to management of MTS required, including input from stakeholders;
  3) Decisions to increase port infrastructure should include vessel traffic considerations and impacts on local environment.

  Living Marine Resources:
  1) Increased port security significantly reduced enforcement of fisheries and related environmental laws, including Oil Pollution Act;
  2) In Seventh District there are five main concerns: enforcement of ship reporting system for North Atlantic Right Whale calving grounds; enforcement of fisheries management (i.e., Tortugas Reserve); protection of coral reefs; control of invasive species; illegal discharges of harmful pollutants. [description of each included]

  Maritime Security
  1) As land-based security increases, it is expected that a greater threat level of smuggling will be attempted via maritime environment (narcotics, people, weapons);
  2) Must build maritime domain awareness through combination of technology and increased international and interagency cooperation. (Carmichael)
- Telecommunications, submarine transoceanic cables, represent important market and challenges for maintaining (security, repairs, etc.). Marine biotechnology, marine minerals mining, mariculture, marine surveys, and undersea vehicles important ocean industries. (Clark)
- Research vessels need state-of-the-art technology; FOFC developing long-range renewal plan for academic research fleet. (Colwell)
- Recommendations with respect to multi-mission assets should give due consideration to full mission portfolio to which assets are dedicated. (Loy)

PRESENTER RECOMMENDATIONS

- Recapitalize scientific infrastructure and support systems (highest priority: UNOLS fleet and supercomputing capacity). (Thoroughgood)
- U.S. must make continuing commitment to upgrade, update, and replace facilities that support ocean technologies (submersibles, vessels, etc). (Clark)
- USGS:
  1) Immediate funding for creation of a USGS facilities infrastructure program to build a set of marine research labs associated with DOI parks and refuges in American Samoa, Palau, Midway, Palmyra Atoll, and Hilo Bay. [discussion provided]
  2) Immediate creation of a $10 million/year program within USGS aimed at biological support in the marine realm for DOI managers of marine resources. (Steiner)
- The federal government, through the interagency Federal Oceanographic Facilities Council, prepared a course for renewing the fleet in the report Charting the National Future for the National Academic Research Fleet: A Long-Rang Plan for the Future. CORE supports the plan, urges that adequate funding be made for its implementation, and recommends its endorsement by the Commission. (West)

TOPIC: *TECHNOLOGY AND MARINE OPERATIONS*

KEY ISSUE: *Strategy and Implementation Plan for Integrated Marine-Related Commerce and Transportation*

ISSUES RAISED

- Concern for maritime port security. Challenge is how to implement security strategy that ensures seaports and maritime industry against terrorism while maintaining flow of cargo and preserving efficiencies. Port security covers wide range of issues, waterways, industries, and facilities and impacts public and private facilities, both waterside and landside. Critical to move first line of defense off our shores to ports of origin; need to be in partnership with trading allies and maritime customers to ensure cargo as declared and verified. Security plans have evolved from emergency preparedness plans. Waterway security in place but lacking: Coast Guard coordinating with port and local police, but undermanned. (Edmunds)
- Comprehensive ocean policy will require special emphasis on transportation needs of those working in this environment. (McCreary)
- Classification is the mechanism by which the international maritime industry has traditionally regulated itself. Codifying standards through international conventions lies with International Maritime Organization; national agencies like Coast Guard implement standards. [detailed description of classification is provided] Current system of self-regulation through classification is most effective, practical method of further improving maritime safety. (Wade)
- IMO looking at vessel identification issues. (Wade)
- Outstanding issues: U.S. maritime trade- ocean policies must facilitate maritime trade; Need to address threats to our nation's security, including how science and services can support these efforts. (Bodman)
- Necessary to consider national security: Consider importance of marine transportation. Ports are essential for maintaining vital sea lines of communication for re-supply of deployed troops; source of vulnerability (i.e., containers). (Loy)
- The Marine Technology System (MTS) report was given to Congress as "the whole" and proved to be difficult for subcommittees to deal with, probably should have given one piece at a time to act on. (Loy)
- Overview of the MTS is provided. (Nagle)
- Investments being made in MTS include: vessels, navigation channels, land-side cargo handling facilities, and connections to interstate highway and rail. Federal government has been shifting financial responsibility for funding navigation services to others. General revenue funding most appropriate way for federal government to maintain U.S. trade. (Nagle)
- Port authorities serve as environmental stewards of America's coastlines and waterways; many port projects include conservation and enhancement features. (Nagle)
- Research, education, and integration of technical information into marine operations critical to continued improvements of MTS. (Nagle)
- Competition among ports is healthy and provides choices for consumer. Value in having wide range of ports. (Nagle)
- Have now developed competing priority to traditional role of moving commerce in form of providing security to our borders. (LaCapra)

- Seaport managers are scrambling for financial resources to respond to terrorism threats; hope short-term gap measures are adequate responses to unknown and undefined threats. Using funds previously committed to seaport customer for moving commerce. (LaCapra)
- Florida has reacted to meet post September 11 security in many ways. [list of 6 measures is provided] (LaCapra)
- Lessons to be learned from experiences of air travel industry:
  1) Federal standards and funding-minimum standards with funding;
  2) Seaport security plans—"production-ready" based on vulnerability/threat assessment;
  3) Integration/coordination of federal, state, and local agencies seaport security measures: communication and intelligence sharing by federal agencies inadequate;
  4) Maritime Security: ultimate goal is a "security zone" outside U.S. territorial waters with coordinated use of high-tech security equipment [examples provided] that may have dual role with ocean technology. (LaCapra)
- The Puget Sound Steamship Operators Association (PSSOA) encourages sustained maritime trade in concert with the modern principles of environmental stewardship and works to eliminate factors that unreasonably increase the cost and complexity of doing business in Washington State ports. (Hutchins)
- The PSSOA and other industry groups have attempted to push the safety envelope as far as possible without unbalancing the equilibrium existing between the Puget Sound trade region and its most ardent competitor in Canada and the province of British Columbia. (Hutchins)
- An issue that has not been addressed adequately is the pressing need for consistency of regulation along the coast and throughout the nation. (Hutchins)
- Puget Sound Harbor Safety and Security Committee have taken the initiative to be proactive in issues of marine safety and environmental stewardship. (Schneidler)
- Washington sits next to Canada. There are two ports that are hugely important, not only to Washington's economy, but to the U.S. economy. But, Washington, Oregon, and California are all going their own way. The shipping industry has no predictability. (Brautigan)
- The crisis of 9/11 has given us a greater need to know when vessels are coming in. We have 96 hours of notice in advance of when they will be here. (Berkowitz)
- One of the goals of the Maritime Administration is to actively promote and develop the domestic merchant marine so as to advance America's economic growth and competitiveness domestically and internationally through efficient and flexible transportation. (Ostrom)
- The question of whether or not focus can be placed on trying to prioritize transportation projects is really dependent on if there is political will in the various segments. The various segments have long been operating on their own and them actually be pulled together, since not all projects can be funded is not an easy challenge. (Ostrom)
- The demand on our national transportation system is growing so rapidly that it will be difficult to build ourselves, physically or financially, out of the approaching capacity crunch. The existing infrastructure cannot handle the projected growth in freight movements, and there are clearly limits to how much capacity can be increased on interstates and rail lines. (Ostrom)
- The expanded use of the marine transportation system has obvious benefits. In general, waterborne transportation is the most economic of modes on a ton-mile and a TEU-mile, that is 20 equivalent units mile basis. Congestion relief on main corridors will reduce business costs related to transportation delays. Marine transportation is also environmentally friendly. Vessels are less polluting on a per-container basis and have far fewer accidental spills or collisions than surface vehicles. (Ostrom)

- Challenges facing U.S. ports:
  1) Landside access
  2) Marine terminal, including the ship-to-shore interface
  3) Vessel traffic. (Ostrom)
- Intermodal connections between the transportation modes are often the weakest link in the nation's transportation system. The major ports of the nation are predominantly located in large metropolitan areas where truck and rail traffic compete with commuters on crowded highways. The Department of Transportation has been working on the issue of marine congestion for some time. The Maritime Administration and the U.S. Coast Guard have been charged with the responsibility of identifying and recommending water-based solution to transportation and planning needs. (Ostrom)
- A national port and harbor 'vision' is needed that coordinates a national strategy for future port deepening and that establishes regional alliances. (Koning)
- There are several intermodal projects which exhibit real potential for economic growth. The NY/NJ plan will feed containers to remote locations directly by barge, thereby alleviating congestion at NJ container terminals and on regional highways and effectively expand port facilities far beyond their present size. In San Francisco Bay, the Bay Area Water Transit Initiative believes an increased use of ferries for commuting will help the environment, relieve highway congestion, provide choice and reduce commuter stress. The only transportation system still functioning after the collapse of the world Trade Center, on 9/11, was the New York City maritime system. New York used the marine system VHF radios to maintain emergency communication after the attack. It was the only communication system still working. (Ostrom)
- If there was a national policy that addressed the regional transportation issue and encouraged that there were some benefits to regional cooperation, then it would be more likely to occur and the benefits would be received down the line. (Koning)
- The development of a port and harbor vision, and the national transportation strategy that Mr. Ostrom referred to need to be discussed around one table. (Koning)
- Yes, there is a potential for intercoastal use. If a vision was created that looked at larger ports and feeder ports, and the connection between those main ports and feeder ports, then the necessity for their increase may be realized so both their commercial and the recreational purposes may be accommodated. (Koning)
- Our marine transportation system is a key national asset that allows our ports to handle over 95% of the volume of cargo moving in and out of the country. (Leone)
- This discussion reflects on a regional port. The Port of Boston is the only full service port in New England. It handles over 1 million tons of containerized cargo per year with weekly direct service to and from Europe and Asia by a consortium of the largest steamship lines in the world and weekly feeder services from Halifax and New York. (Leone)
- The regional port is a vital component of the marine transportation system and the regional economy. (Leone)
- It is important to have a system whereby each region can develop the way it feels it is necessary. It's important at the local area to be able to plan what is important for your marine transportation needs. Not every port will go and build so that it can support the largest steamship lines and the largest vessels. Some ports should be 35, 45, 50 and 55 feet. The communities should be able to decide what they need and what they can support. Let the regional economy survive. (Leone)
- Some companies will decide to build very large vessels to try to reduce their ocean transportation costs. Other companies will build small, faster vessels. And you can't put the steamship industry all into one particular category. They've been innovative and they've tried to find ways to service. Ocean transportation rates have fallen, much to the chagrin of the industry, but to the benefit of the consuming public. They are trying to find ways to remain competitive. (Leone)

- The "Port of Boston Action Committee," which is a group of all the importers and exporters, has been asked what their needs are in this port and the clear answer is that they need to have direct all-water service into this port. It is clear that the people who rely on trade in this area need to have a lot of transportation into this particular port. Another part of it is containerized freight. We've talked to travel agents to try to promote the cruise business into this port, and we've brought in automobile imports and other bulk commodities as well. (Leone)
- The issue of port security is a complex issue because ports are both domestic and part of our border infrastructure. The port security efforts, the vulnerability assessments and the security measures that are going to be coming over the next few years will address both the domestic and the international sides. (Ross)
- The impact of the cruise ships in both economic and environmental terms is huge. Although cruise ships generate a tremendous amount of waste from the thousands of people on board, they are not subject to the same wastewater regulations that govern municipalities of comparable size. Cruise ships are exempt from any sort of water quality permitting requirements. While ships are required to treat sewage waste if dumped within three miles of shore, on-board treatment systems are rarely, if ever inspected. A recent Alaskan study found every ship inspected to be in violation of water quality standards. [discussion provided] (Balliet)
- Alaska has the greatest amount of Critical Survey areas in the U.S., followed by the Gulf of Mexico. (Whiting)
- The national survey capabilities in the private industry are more than adequate to take over this survey responsibility. A teaming arrangement is superior because somebody has to set the standard, somebody has to have that core capability in the government to provide the adequate oversight of contractor relationships and adequacy of our data. The government has the capability. (Whiting)
- In conducting marine surveys in Alaska, it is important to recognize the lack of coastal data and infrastructure. Alaska has 60% of the nation's charting backlog, and lacks accurate tidal datums for determining coastline. (Pawlowski)
- Marine Exchange of Alaska is a non-profit organization. The marine industry has supported us in this and developed this organization. The organization's goal is to provide information communication services to insure safe, secure, efficient, and environmentally responsible maritime operations. Alaska is the nation's maritime state. Our position is that protecting Alaska's rich maritime environment is a shared commitment. Our group is committed to work with government, the maritime industry, and the collective public on a problem that requires attention. Marine Exchange of Alaska prevents maritime casualties and assists with compliance of safety and environmental regulations. There is a plethora of regulation but the challenge is to have the regulations in the hands of mariners so they have them readily available and they can comply with them. Eighty percent of maritime casualties are attributable to the human element and that is the first priority. The group tries to work together with the maritime community to develop a cadre of maritime professionals [discussion provided] (Page)

PRESENTER RECOMMENDATIONS

- Lead agency for port security should be Coast Guard. (Edmunds)
- All ports must have security plan based on specific needs and requirements and not on mandated national standard. There is fundamental need for financial assistance. Imperative that all federal agencies share databases, improve lines of communication, and provide appropriate information to local agencies and police. (Edmunds)
- Customs Service in need of personnel and new technologies to increase speed and volume of container inspections. (Edmunds)
- Navigation charts are old and outdated, new surveys and data needed. (Edmunds)

- Implementation of low visibility navigation systems should have high federal priority. (Edmunds)
- Automated identification systems worth looking at for security and other issues. (Edmunds)
- Review interagency effort on Marine Transportation System. (Bodman)
- Don't focus on just large ports, smaller ones as well. Consider impact of deep dredging for 50-foot draft boats. (Woolsey, C)
- Need tighter regulations for chemical transportation. (McCreary)
- Safety at sea must be priority: accurate navigation charts with clear delineation of designated safety zones; monitoring airspace and vessel traffic with appropriate intercept and enforcement authority. (Thompson)
- Enhance Marine Transportation System: accurate nautical charts; safe access to ports/harbors (enhance dredging). (Caveney)
- Needed equipment is expensive. Consider making financial burden easier to bear:
  1) Expand MARAD Title XI policies;
  2) Promote "green ships" through tax incentives and incentives for vessel owners and operators;
  3) Establish high priority for oceanographic and fisheries research vessels. (McCreary)
- "Green Ships":
  1) All new chemical tankers should be built with double hull, those that cannot comply be phased out in expedited schedule;
  2) All vessels that carry potentially hazardous-to-the-environment cargos should be regulated under a national ocean policy;
  3) Segregated cargo tanks should be designed to allow fully independent loading and emptying of each unit; tank materials with high-yield strength and corrosion resistant properties, including coatings, should be encouraged;
  4) Tanker owners and crews should be required to participate in ongoing education to assure compliance with operational and safety standards. (McCreary)
- Consider innovative governance structures that can move us beyond simply using funding and discussion as only way to solve conflicts in MTS. (Nagle)
- Key to safe and secure maritime environment is to exploit all available information and threats, referred to as Maritime Domain Awareness (MDA). Achieving MDA beyond capability of single agency and requires mix of cooperation and technology. Port securities committees are representative of concerted efforts to foster and support exchange of information and coordinate security activities into comprehensive port security plan, similar to oil spill contingency plans. Need timely access to detailed information in three overlapping MDAs: international; coastal and harbors; port infrastructure. (Carmichael)
- Key to solutions is legislative guidelines that allow management of seaport security with Best Management Practices (BMPs):
  1) Minimum standards for the several security issues required by each port;
  2) An atmosphere of self-regulation in achieving standards BMPs;
  3) Incentives for private sector to engage with public domain to achieve partnership in protecting our borders and defining BMPs;
  4) Provide training of seaport security personnel in BMPs. Provide 75/25 match between federal government and seaports for cost of such personnel located at seaports;
  5) Provide that legislative intent is to ensure that seaport security and moving commerce are compatible priorities in order to ensure safety, security, and economic viability of moving international commerce. (LaCapra)
- PSSOA recommends the Commission recognize the region's accomplishments and trade competitiveness sensitivity. In formulating your plans and recommendations, we encourage you to complement the efforts of PSSOA and share their sensitivities. (Hutchins)

- The PSSOA urges the Commission to formulate your recommendations so that all regulations apply consistently throughout the nation. (Hutchins)
- Establish a state champion for navigation issues and have them compare efforts with neighboring states and then at a regional (e.g., eastern seaboard) and international level. (Koning)
- The model for regional transportation cooperation should have the policy work be at the national level with feedback, or fed to, a regional perspective and regional interests. A system would be necessary that allowed for differences between the regions and then implement it at the regional level. (Kurkul)
- Federal funding must adequately support The Port of Boston to dredge the channels and ensure the safety and security of our maritime borders. It must be maintained and improved to adequately serve the growing marine transportation needs of local and regional businesses and to meet the marine transportation needs of ocean carriers. (Leone)
- Support expanded authorities that would allow agencies to collaborate more effectively on marine transportation issues, such as codifying and clarifying the role of the Interagency Committee on the Marine Transportation System. (Keeney)
- There is a tremendous need for increased focus and priority placed on mapping and charting, particularly in the port and transportation system arena. NOAA is playing catch up with some of our important port transportation programs due to lack of funding. The volume of goods going into the ports is going to double by the year 2020 and the number of containers alone will quadruple by 2020. There is a great need for planning for the increased use of the ports in a way that has not been done in the past. (Keeney)
- Cruise ships pose additional problems worth mentioning in Alaska. Disturbance of wildlife is another problem that needs to be addressed. Fatal collisions with whales by cruise ships, as in Glacier Bay last year, and disruption of pupping harbor seals are two notable concerns. (Balliet)
- The cruise industry should be a model for environmental conduct because it depends upon the continued existence of our nation's pristine natural areas for its economic basis. (Balliet)
- There is a need to consider the most effective use of (hydrographic survey) contractor assets and personnel. (Whiting)
- Procurement issues to be dealt with include: hydrographic survey contracts; shoreline initiatives through the NGS; vessel time charter; and new national contracts for LIDAR and Hydro. (Whiting)
- I would like to emphasize the importance of the MTS to the nation and the necessity of ensuring that ocean and coastal management decisions don't affect the MTS in unacceptable ways. It is important that we address the many important issues necessary to strengthen the MTS—issues such as the need to implement a systematic approach to planning and development to incorporate environmental and concerns; the need to further identify port vulnerabilities and design plans to address them; and the need to find ways and means to fund the growing needs of the MTS. (Collins)