Response to Follow-Up Questions for David L. Evans
Northeast Regional Meeting
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Question 1: NOAA's Office of Ocean Exploration is giving more and more funds to academia, but the academic community is having delays with getting these funds. Could you offer some recommendations on moving money in efficient and timely ways to the academic community?

Answer: Yes, the NOAA Office of Ocean Exploration has spent 70% of its funds with academia, industry, and other sources beyond NOAA. The delays encountered by the academic community in receiving these funds are largely attributable to our grants processing and distribution system. NOAA recently convened a Program Review Team (PRT) to examine ways to improve our programs and processes. In relation to grants processing, the PRT recommended implementation of several short and long-term goals to improve the grants process. In response, NOAA has reconstituted the NOAA Grants Council to streamline, implement and oversee the grants process. Through the Council, NOAA addressed the PRT recommendations, by meeting with congressional staff immediately following Appropriations, developing guidance to streamline distribution of funds and facilitating grantee submission of complete and accurate applications. While results may not be immediately apparent, the implementation of improved tracking and reporting of performance should result in a significant improvement in grant processing.. Additional steps toward improvement to grants processing include:

- Program Offices will begin work on Announcements of Opportunity, RFP's and other calls for financial assistance or work to be done under contract earlier in the fiscal year, providing more time for acquisition professionals to obligate government funds and hastening award. This was initiated in FY2003.
- Grants and Program Offices will train employees to prepare better acquisition packages. NOAA is exploring the implementation of a Federal Program Officers training and certification program.
- Annual Grants Workshops to provide instruction for recipients are held in DC, Boulder and other key locations. Grant application packages which contain fewer errors or omissions will speed processing time.
- Current thresholds for legal and other review are being analyzed with a goal to reduce oversight, streamline processing, and reduce review time.

Question 2: Can NOAA take leadership in the IOOS enterprise? If not, why not? What needs to change for there to be a leading, coordinating agency at the Federal level - or is this needed? How would funding be handled in a multi-agency governance setup?

Answer: Yes, NOAA can take leadership. There should be formal establishment of operating principles and governance. Oversight by a body external to any given federal agency will be required to achieve the vision of an integrated observing system that is sustained. The National Oceanographic Partnership Program (NOPP) governance provides an infrastructure to implement

at least the near-term investment strategy. In October 2000, a NOPP Memorandum of Agreement (MOA) was approved establishing Ocean.US as the NOPP interagency ocean observation office. Oversight for the Ocean.US is provided by an Executive Committee established by the National Ocean Research Council (NORLC). This MOA establishes as one of the responsibilities of Ocean.US to "integrate existing and planned elements to establish a sustained ocean observing system to meet common research and operational agency needs." More specifically, Ocean.US will (1) develop and maintain the long-range vision of the IOOS which will serve as the conceptual foundation for the IOOS and will define the goals of the system; (2) ensure integration of the elements of the IOOS; (3) serve as the focal point to coordinate the implementation and development of the system with the NOPP Interagency Working Group (IWG), the Ocean Research Advisory Panel (ORAP), the Federal Oceanographic Facilities Council (FOFC), and the international community; (4) report regularly to the Executive Committee (EXCOM) for guidance and to the IWG for coordination and provide an annual report that assesses the status of the IOOS and its products and charts the way forward (including external reviews); (5) recommend enhancements to existing systems, new projects, needs for research and development, and identification of system components suitable for transition from research to operations; and (6) carry out all tasks as directed by the NORLC.The NORLC would function as a Board of Directors for the IOOS. It sets policies and Ocean.US functions as the executive agent for the Council, i.e., the NORLC sets policies that are implemented by an independent, interagency office, Ocean.US, under the oversight its Executive Committee. Ocean.US works closely with the IWG to ensure the coordinated and phased implementation of the IOOS. Ocean.US oversees a Management Office that coordinates the development of Federal Centers and regional associations. Day-to-day operations (including monitoring data streams, the timely generation of products, etc.) are managed and performed by responsible agencies, federal operational centers, and regional associations.

Regional Associations should be established to oversee the operation of regional observing systems. Regional systems are needed to provide data and information on phenomena that are more effectively detected or predicted on regional scales that go beyond the jurisdiction of individual states. Depending on regional priorities, the regional observing systems will increase the resolution at which common variables are measured, supplement common variables with additional variables, and provide data and information that are tailored to the requirements of stakeholders in the region.

Funding would be handled through careful interagency planning and programming. The fundamental problem with the current arrangement is that the interagency office (Ocean.US) has responsibility without authority. The establishment of priorities for implementing and developing the IOOS, determination of funding levels, and specification of the roles of federal agencies should be a responsibility of Ocean.US, and the process should be initiated three years prior to the fiscal year the funds are to be spent. Ocean.US collaborates with participating NOPP agencies (through the IWG, the EXCOM, or another body specifically established for this purpose) and regional associations to establish priorities for FY+3.

Question 3: Among some oceanographers, ocean managers, and industry the NODC is seen as an ineffective, inefficient, and antiquated data collection/archival/distribution system. Many Federal agencies, as well as most federally-funded research programs

establish their own, separate databases. Even within NOAA, there are several databases that are relevant to ocean research and management. What do you think the Commission can do to bring some order to this, and develop an integrated ocean database?

Answer: NOAA has the federally-mandated mission to provide for the archive, access, and scientific stewardship for the long-term oceanographic observational record. NOAA and the National Oceanographic Data Center (NODC) recognize the concerns expressed within the question above dealing with oceanographic data. In a report to Congress last year[1], NOAA identified the overarching challenges (and possible solutions) facing the Nation and NOAA's national data centers. Challenges include:

- More Data to Manage. New knowledge, new technologies, and new issues are serving to expand environmental data-gathering efforts. Over the past two decades the oceanographic observational paradigm has shifted from large, internally-consistent data sets derived from a few major programs, to large, heterogeneous data sets derived from an increasingly large number of independent observational efforts.

- Increasing Demand for Data and Data Products. The emergence and use of the Internet has resulted in increasing requirements to satisfy services for on-line access to data and information. New user groups (e.g., climate change research, ecosystem management, and others) are presenting expanded requirements for integrated archived data and information sets drawn from multiple sources and presented in a consistent form.

- Increasing Complexity of Data. While an increasing fraction of oceanographic data today is produced in digital form (thereby facilitating automated processing, archival and on-line access), there continue to be important oceanographic and coastal marine observations that do not yet lend themselves to automated, digital processing (e.g., living marine resources, ecosystem, and biological). Standards for national oceanographic and coastal marine observations have not yet been defined. This contrasts with international weather observing programs that have for the common benefit established standard data management and exchange protocols that facilitate data exchange, archival, and analysis.

- An Established National Infrastructure. The oceanographic research community has been notably successful in exploiting emerging, new information technologies with a concomitant reduction in observational costs and increase in observational data output. Corresponding national data archive and management capital investments have struggled to stay abreast, exacerbated by rapidly increasing costs of successfully competing with the private sector for human talent in the information technology market.

These issues present a national challenge, the solution to which will be based on the development of a national strategy for an Integrated and Sustained Ocean Observing System (IOOS) program. This strategy, in order to be successfully implemented, must embody from the

[1] "The Nation's Environmental Data: Treasures at Risk. Report to Congress on the Status and Challenges for NOAA's Environmental Data Systems," U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Washington, DC, August 2001, 52 pp., (http://www.ngdc.noaa.gov/noaa_pubs/treasures.shtml).

beginning an integrated data management and communications component. Working in partnership with Ocean.US (under the auspices of the National Ocean Research Leadership Council, NORLC), NOAA and NODC are helping to lead a national team of federal, academic, industry and state agency representatives that is formulating the data management and communication component for this national strategy. Key aspects include:

- A proposed implementation strategy for an enhanced, distributed (virtual vs. monolithic) oceanographic data management and dissemination system that links observational, data management, and product delivery systems across all data users;

- The development of national standards, protocols and formats to improve access, data management, distribution, and subsequent archival;

- The development of oceanographic "middleware" protocols to enable more seamless access to heterogeneous, multi-disciplinary data;

- Use of existing federal standards for metadata descriptions of oceanographic data to enable improved data discovery (e.g., using Internet—based discovery applications);

- Use of improved data transport protocols (e.g., Internet language based protocols) to simply users' access to archived and observational data[2].

While these discussions are now engaged at the national level, NODC is moving forward to implement many of the emerging consensus recommendations as first steps towards a national, flexible, virtual oceanographic data management system within an IOOS framework. For example, NODC internal data collection and archive processes are being revised and integrated into an Internet-compatible environment. This enables Internet-accessible oceanographic data to be captured and archived from geographically distributed sources within the research and operational communities, more automated capture of data description (metadata) information, and significantly shortened "time-to-archive" cycle times (to order of hours instead of months). Exploiting electronic financial management industry technologies, NODC has implemented electronic data security key technology derived from Internet banking industry that helps ensure the long-term integrity of federally-archived oceanographic data. Improved oceanographic metadata capture will result in improved discovery of oceanographic data using publicly domain Internet and National Spatial Data Infrastructure enabled information search engines. On the international front, NODC and NOAA are working towards the development of international oceanographic data exchange and communication standards through the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and the Global Climate Observing System (GCOS).

Significant challenges remain. A national full, free, immediate and unrestricted access data policy for oceanographic observational data is critical. Such a policy will significantly improve

[2] For additional information please refer to "Ocean.US, 2002. An Integrated and Sustained Ocean Observing System (IOOS) for the United States: Design and Implementation," Ocean.US, Arlington, VA, 21 pp. (http://www.ocean.us.net/)

the access to, and enable the archival and long-term stewardship of oceanographic data as funded observational programs come and go. The security into the future of the long-term oceanographic observational record transcends individual activities, programs and agencies; it is this role that NOAA's national data centers serve. Meaningful partnerships between government, academia, industry, and the public (such as those fostered under NORLC activities) are critical to the successful consensus development of national oceanographic data exchange standards and protocols. The standards and protocols, similar in principle to those developed in support of the Internet, will provide a flexible framework within which to forge a national observing system.

Question 4: Over the past 30 years, research groups have grown substantially within NOAA. What can the commission do to help the Federal Government take full advantage of creative research groups outside of the system, minimize competition between NOAA and extramural groups, and ensure operational objectives are met in full partnership with these academic/industry research groups?

Answer: NOAA is an operational agency, which must focus on the products and services that are appropriate for the Federal Government to provide to the nation. A well-supported research program is essential to sustain these services and to anticipate and respond to future requirements. NOAA's research portfolio should extend from exploratory research, conducted largely within the extramural community, to directed research, which should be the purview of NOAA's in-house research groups working in collaboration with industry and academic institutions. In addition, NOAA research scientists should also be prepared to lead and sustain major research programs, guiding research from the exploratory phase through to the various stages of development leading to operational benefits.

NOAA requires staff scientists who are credible to the scientific community in order to provide technical expertise to the NOAA managers and forefill the agency's mission. The expertise needs to be timely and directed, and staff scientists provide continuity and institutional knowledge and minimize perceived conflict of interests. Many of the agency's operations are high risk and high return investments that have been transferred from research to operational mode only after years of sustained scientific investigation. One prominent example is the nine years (1985-1994) to fully implement the Tropical Atmosphere Ocean (TAO) array of buoys across the tropical Pacific Ocean for monitoring and forecasting El Nino and La Nina. While academic and industry researchers were an integral part of the TAO success, it was the long-term sustained involvement of NOAA staff scientists that kept the project on track within the agency. In short, NOAA needs in-house scientists for the agency to be a credible manager in the face of complicated and competing ocean problems.

Oceanography is advancing at an accelerating rate and NOAA will never have expertise in all areas of research that apply to its mission. Instead, NOAA already taps into the academic research community through programs and collaborations such as Sea Grant Colleges (OAR), Joint Institutes (OAR, NESDIS, NMFS) and the Cooperative Institutes (NOS, NESDIS). NOAA also offers ocean-related grants and contracting opportunities to industry and academic through the Office of Global Programs,Ocean Exploration the Coastal Ocean Program, and other arrangements that help maintain the scientific rigor within the agency. However, oceanography

funding has remained essentially level for the past 20 years according to the Ocean Studies Board of the National Academies of Science. Therefore, there is bound to be competition, real or perceived, for resources between NOAA scientists and extramural groups.
NOAA should more clearly articulate and promulgate its research requirements, based on operational needs, to enable complete end-to-end planning and support of research programs, incorporating internal and extramural research to the fullest extent possible.

The Commission can help in several ways:
NOAA needs to play a much stronger role in determining the requirements for ocean products and services. Its roles and responsibilities must be clearly defined. NOAA must be encouraged and enabled to exert leadership in the ocean community to define operational requirements and to establish the agenda for directed research. That is, define the operational "pull" for research. At the same time the agency should be aware of, and a major supporter of, the research "push" of the extramural community. This requires NOAA to make clear its requirements and the extramural community to cooperate to support these requirements rather than force NOAA to support activities extraneous to its needs. The Commission could help by articulating the role of NOAA as an operational ocean agency and by encouraging the alignment of extramural research with the NOAA mission.

NOAA is already committed to spending 50% of new research funds outside of NOAA through a peer-reviewed, competitive process. Internally, it will increasingly align its research capability towards directed research and look to the extramural community to provide most of its exploratory research needs.

NOAA must ensure the timely transition of research to operations to free resources to invest in new research requirements. The Commission could help by supporting and encouraging the NOAA stated desire to transition research observing systems and technology, such as the TOGA TAO array, to operations. This is a necessary step to ensure the sustainability of the observing system and the recognition of its value to NOAA's operations.

An effective research enterprise is one that ensures that the entire life cycle of the program is adequately and appropriately supported. In practice this is often not the case. Too much extramural research that does not transition to satisfy operational requirements is an ineffective use of resources from the perspective of the Federal government. Therefore, it is essential that those determining the overall funding strategy for ocean products and services be aware of the entire "value-chain". That is, ensure funding is available in the right place at the right time to transition research adequately. The Commission can help by recommending strategies to support and sustain major new operational requirements from the initial research investment through to the operational implementation.

Question 5: What specific steps can the Commission recommend to integrate the remote sensing community (academia/research/industry) into NOAA operations?

Answer: An effective academic, research and industry partnership is critical to provide for new NOAA operational remote sensing capabilities. Recognizing this, NOAA's National Environmental Satellite, Data, and Information Service (NESDIS), as the lead office within NOAA for operational satellite remote sensing, has a number of major initiatives to strengthen these partnerships. These initiatives are: 1) Increased NOAA participation in the National Oceanographic Partnership Program (NOPP), 2) the Ocean Remote Sensing (ORS) Program; 3) a new NESDIS-academia initiative for a Cooperative Institute for Satellite Oceanography (CISO); and, 4) a NASA-NOAA Joint Center for Satellite Data Assimilation. These initiatives are oriented to provide for jointly-funded activities across research and operational remote sensing activities that have the potential for tangible operational capability improvement in NOAA's remote sensing services.

NOPP, operating under the auspices of the National Ocean Research Leadership Council (a multi-agency federal partnership) is a facilitating agent that helps encourage academic, research, industrial and NOAA operational community partnerships in remote sensing. NOPP also provides an important conduit for a more effective 'operational pull' for new science and technologies. NOAA, NASA, and the Navy are using NOPP through Broad Agency Announcements (or BAA, which is equivalent to an RFP) in soliciting investigations involving explicit partnerships between academic researchers, industry and NOAA operational organizations. Landmark awards have been made as a result of these BAAs, two in FY 2001 and another two in FY 2002. These awards coupled the best capabilities of the research communities with operational centers in a funded partnership that have focused on demonstrating the utility of near-real-time satellite observations in an operational setting. Financial incentives provided under this program enable operational center to dedicate attention to examine the impact on forecasts of new sources of observations, rather just doing its 24 hours a day/7 days a week operational job. At the same time, these incentives draw academic researchers into the operational centers to learn what they do and think about how operational forecasts might be improved. Recent examples include 1) combining altimetry and scatterometry data to develop an operational ocean surface current product and 2) the development of operational ocean surface wind products based on scatterometry. The National Weather Service Marine Prediction Branch is currently evaluating a promising new higher-resolution ocean wind product for possible operational deployment developed under NOPP sponsorship with funding by NOAA, NASA and the Navy. With NASA and other domestic and international partners, NOAA/NESDIS also supports data acquisition and operational application of altimeters, scatterometers, radiometers, and radars under NOPP competed grants. These instruments are envisioned to deliver near real time sea surface height, wind temperature, and color, which may be used with other conventional ocean data to characterize ocean features associated with important fisheries and habitats.

The NESDIS Ocean Remote Sensing program supports NOAA internal and extramural remote sensing research. ORS also supports the NOAA CoastWatch program (http://coastwatch.noaa.gov/COASTWATCH), cross-NOAA line office effort to provide ocean and coastal remote sensing "extension service" to NOAA, state and public users. CoastWatch

also has an active outreach effort to industry to facilitate the availability of satellite oceanographic data to industry. The ORS program has an annually announced (Federal Register Notice) competitive program that awards grants to academic, industry and other institutions for ocean remote sensing research relevant to the NOAA satellite oceanography operational mission.

The Cooperative Institute for Satellite Oceanography provides a focal point for research done in academia, with a specific goal of increasing NOAA's operational mission presence in the academic research community, and to facilitate technology transition. Established by NESDIS as a result of a national competition, the Cooperative Institute will help identify the longer-range research questions/issues and provide guidance to NOAA for planning and development. The institute is a vehicle for examining operational research questions that may be addressed using satellite data. As these designs evolve over time, the powerful combination of research satellites and associated computational platforms set within an operational framework provides an essential tool for exploring and evaluating operational concepts and training personnel while preparing users for new data types.

A new NASA-NOAA Joint Center for Satellite Data Assimilation has been initiated to accelerate satellite data utilization in numerical models. These activities are investments in the future critical operational activities of optimum data utilization, user interactions, and long-term education and academic tie-ins. This center, with anticipated participation by multiple federal agencies will accelerate the operational use of satellite-derived observations into numerical forecast models, both atmospheric and ocean.

It is worthwhile as well to mention a recent NOAA Educational Partnership Program for Minority Serving Institutions sponsored initiative that has led to the establishment of a NOAA Cooperative Center for Remote Sensing. This effort, the result of a national competition, has selected the City University of New York and a consortium of educational institutions to expand NOAA's partnerships with the minority serving academic research and education communities in the areas of remote sensing research.

These initiatives respond to the critical importance of funded partnerships between NOAA, academia, industry and other federal agencies. Through such partnerships meaningful relationships, enabled by shared visions and needs, can be established that significantly strengthen technology and expertise transition into operational remote sensing services.