DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
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WASHINGTON, D.C. 20350-2000

IN REPLY REFER TO
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7 Jun 02

Admiral James D. Watkins
Chairman
U.S. Commission on Ocean Policy
1120 20th Street, NW
Suite 200 North
Washington, DC 20036

Dear Admiral Watkins:

Thank you for your letter of 3 May 2002 requesting amplifying information on issues of concern to the Department of Defense. The answers to these questions are attached for your consideration.

We look forward to continued interaction with the Ocean Commission as you formulate your ocean policy recommendations. Please do not hesitate to contact us if we can provide additional information.

Our point of contact is CAPT Kathy Shield, CNO(N962) at 202-762-0275.

R. W. Spinrad, Ph.D
Technical Director
Oceanographer of the Navy

Copy to:
DoD Task Force

1) How could Navy best participate in the development of national and international efforts for operational oceanography, including the acquisition and application of data, as well as establishment of any centralized operations?

The Navy can best participate in the development of national and international efforts for operational oceanography through use and expansion of its vast collection of personnel, infrastructure, and operational capabilities that have been developed over the last 150 years. In order to fulfill the requirements of the fleet for meteorology and oceanography (METOC) support, the Navy has created a comprehensive set of activities and a strong infrastructure for world-class oceanography. The implementation of these has resulted in the accumulation of a great deal of naval expertise in domestic and international oceanography. The infrastructure and experience are a powerful combination that could readily benefit a comprehensive, global system for operational oceanography. The Navy is willing and capable of taking on a significant role in this global system.

The Oceanographer of the Navy (CNO-N096) is the program sponsor for transition of METOC programs and products from research (usually out of the Office of Naval Research; ONR) to operational use. The Space and Naval Warfare Systems Command (SPAWAR) manages this transition process. After the test and evaluation phase, a successful product is moved into the final operational phase, in the case of METOC under the auspices of the Commander, Navy Meteorology and Oceanography Command (CNMOC). The two production centers supported by CNMOC are the Naval Oceanographic Office (NAVOCEANO) and the Fleet Numerical Meteorology and Oceanography Command (FNMOC). The centers collect and process all source data, maintain vast databases of ocean data, and build a large suite of products. Data sources include diverse platforms such as survey ships, drifting and fixed buoys, and satellites that measure oceanographic, geophysical, and hydrographic parameters with a variety of advanced sensors. Among the products are hydrographic maps, data layers for Geographic Information System (GIS) applications, annotated remotely sensed imagery, and grids for numerical ocean models. These production centers provide support to a network of operational Meteorology and Oceanography Centers, Detachments, and Facilities that are located around the world in support of naval operations. This network includes working level hydrographers, meteorologists, and oceanographers that are individually assigned to specific battle groups, ships, and shore facilities. This organization ensures that fleet oceanography and meteorology needs are met in a timely and efficient way.

As part of the process outlined above, the operational Navy METOC community actively integrates, on a regular basis, with the work of other agencies and organizations in ways that ensure benefit to all parties concerned. For example, the Office of Naval research (ONR) and N096 have a long history of successfully working with the National Oceanic and Atmospheric Administration (NOAA). The Oceanographer of the Navy, in fact, also serves as the Naval Deputy to NOAA, providing advice to the NOAA Administrator on items of mutual interest and cooperation to Navy and NOAA. For example, the Navy and NOAA cooperate in global weather modeling. FNMOC serves as

the back-up facility for NWS in case of catastrophic failure of their operations. Following such a failure in 2000, FNMOC quickly stepped into this backup role to provide seamless METOC support. NAVOCEANO has worked with the Coast and Geodetic Survey of the NOAA National Ocean Service and the University-National Oceanographic Laboratory System (UNOLS) to perform hydrographic survey work and integrate the work done in foreign economic exclusion zones with that in the US EEZ. In fact, the Navy owns most of the large UNOLS vessels currently in operation.

Navy is also an active partner in a number of multi-agency activities, including the Shared Processing Program (SPP), the National Oceanographic Partnership Program (NOPP), and the National Ice Center (NIC). The SPP reduces duplication between the central-site meteorology and oceanography production centers of the Navy, Air Force, and NOAA while providing a back up for these critical national capabilities.

NOPP is a collaboration of fourteen federal agencies established by legislation in 1997 to provide leadership and coordination of national oceanographic research and education programs. The National Ocean Research Leadership Council (NORLC), whose membership is made up of the heads of the participating agencies, leads NOPP. An SES-level Interagency Working Group (IWG), whose membership mirrors the NORLC, implements the NOPP. Navy has actively participated in this effort through both the Secretary of the Navy, who chaired the NORLC for the first four years, and the IWG, which has representatives from both ONR and N096. In 2000, after preparation of two reports on ocean observing systems requested by Congress, NOPP established Ocean.US, the national office for integrated sustained ocean observations. Ocean.US sponsored a national workshop in March 2002 to take the first steps to design and implement an integrated, sustained ocean observing system (ISOOS) for the US. The report from this workshop has been reviewed at the spring 2002 NORLC meeting and sent to the White House Office of Science and Technology Policy for eventual transmittal to Congress. The Navy will play a key role in the development and operation of the ISOOS. Navy also serves on the NOPP Federal Oceanographic Facilities Committee (FOFC), which advises the federal government on acquisition and scheduling of major oceanographic assets (ships, aircraft, and other platforms).

The NIC is a cooperative venture of Navy, NOAA, and the US Coast Guard to accomplish the national mission of providing operational global ice analyses and forecasts, and is co-located with the Naval Ice Center. This unique Navy/NOAA partnership has existed for almost 50 years, with the US Coast Guard joining in 1995 to contribute aircraft, icebreakers, and Marine Safety Offices. The NIC also benefits from a close international relationship and data exchange with the Canadian Ice Service and the Canadian Meteorological Centre of Environment Canada as well as ice services of other nations. The NIC model is a practical one that could be applied to other "operational" areas such as buoy operations. Regarding buoys, the Navy and NOAA recently entered into a new agreement for joint cooperation between the Naval Oceanographic Office and the National Data Buoy Center.

These are all solid examples of collaboration for meteorology and oceanography in the national interest. In each of these, the Navy plays a key leadership role in cooperation with agencies such as NOAA, US Coast Guard, the National Science Foundation, and the National Aeronautics and Space Administration (NASA). The Navy also works closely with academia and industry to leverage the cutting edge work that is supported by these sectors. ONR provides millions of dollars in funding to universities for basic and applied research. Both N096 and ONR are involved in numerous Cooperative Research and Development Agreements (CRADAs) with commercial entities to obtain the highest-quality technology.

In addition to collaborative efforts with US government agencies, the Navy METOC community is involved with a variety of international activities. This includes extensive cooperative work with NATO and non-NATO allies on operational METOC issues. Navy also participates in cooperative METOC work with other governments by way of agreements such as data exchange agreements (DEAs), and hydrographic and oceanographic cooperation agreements. Currently there are over 60 international Naval METOC agreements in effect, and still others in development. These agreements cover information on bathymetry, ocean circulation and temperatures, and a variety of atmospheric parameters. Other multi-national programs include those led by the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO) of the United Nations, as well as the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). These intergovernmental programs cover observational data exchange, and modeling efforts. A specific example of strong intergovernmental participation by Navy is the Global Ocean Data Assimilation Experiment (GODAE). GODAE is an international program designed to show how data from ocean observations can be assimilated into models to improve predictive capabilities and generate improved products. This US effort is supported by four federal agencies – Navy, NASA, NSF, and NOAA – and the first phase of this program is due to take place in 2003-2005.

The primary mission of the US Navy is national security. To support this mission, the Navy collects vast amounts of data on the marine environment and produces value-added oceanographic products. While there are important priorities that dictate a careful consideration of the release of these data and data products, these considerations do not necessarily preclude the release of these outside of the Navy. In recognition of the fact that these data and products, are of great value to scientists, resource managers, and citizens around the world, the Navy has worked intensively with the non-DoD community to release as much of the data and data products as possible. Examples of this cooperation include the following: 1) 78% of the METOC data available in the Master Oceanographic Observation Data Set (MOODS) at NAVOCEANO are freely available, including many data that have been unclassified since the end of the Cold War; 2) the source code for the operational Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS), a model run in multiple regions, is freely available; and 3) new agreements have recently been worked out with NOAA that allow the release of high-resolution bathymetric data in US coastal waters in all but a very few restricted areas off Kings Bay, GA and Puget Sound, WA.

As the Commission is well aware, Navy's worldwide capabilities through its two METOC production centers and regional METOC centers, facilities, and detachments are second to none. Similarly, at laboratories around the world, the Office of Naval Research supports world-class research and a multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, system, and ocean, atmospheric, and space sciences and related technologies. With military and civilian technical and policy experts around the world, Navy has the facilities, personnel, and experience to contribute significantly to leadership in both national and international efforts for oceanography. Navy is certainly capable of leading any centralized operations for such efforts, and will continue to work well in partnership with other agencies and organizations through national programs such as NOPP, and international groups such as IOC and WMO.

2) Could Navy's investment strategy and infrastructure for operational oceanography accommodate (or be adapted for) support of non-DoD oceanographic missions?

The Navy's current investment and infrastructure development procedures could certainly be adapted for non-DoD oceanographic missions. As the Commission is aware, the Department of Defense has developed a robust and rigorous, but still flexible process for planning and budgeting its programs (including its investment in oceanography) on a long-term basis. Portions of this process could be modified for non-defense oceanographic missions as well.

Central to the Department of Defense budgeting process is the Defense Planning Guidance, issued by the Secretary of Defense, which provides the armed services with goals, priorities, and objectives, including fiscal constraints, for the development of their programs. The Military Departments and Defense agencies use information provided by their programming offices to develop six-year plans detailing how they will achieve Department of Defense's overall goals. These long-range plans, called program objective memoranda (POM), are used for internal DoD purposes only. The Office of the Secretary of Defense (OSD) reviews the POM and provides additional specific guidance for modifying the POM. Using this guidance from OSD, the Military Departments prepare their bi-annual budget estimates and submit them to OSD for review. The President's Office of Management and Budget (OMB) then reviews, recommends modifications, and forwards it to the President for signature. The President then submits the budget request to Congress.

The Deputy Under Secretary of Defense for Science and Technology has strengthened the science and technology (S&T) strategic planning process to improve the S&T community's responsiveness to their warfighting and acquisition customers through the development of a series of strategic planning documents. These documents and the supporting individual S&T master plans of the military services and defense agencies guide the annual preparation of the DoD budget and program objective memorandums (POM).

In concert with the budget and requirements processes detailed above, the Oceanographer of the Navy has developed an efficient, adaptable strategy to transition meteorology and oceanography (METOC) research to operational use. Navy METOC has a concept of operations (CONOPS) for the Network Centric Warfare environment of the future. In essence, this plan is requirements-driven and capable of supporting the decision-making in the POM process.

The existing planning, programming and budgeting process includes a mechanism to assess resource levels necessary to meet the requirements and directs research activity to address new technology needs. The current process of determining requirements, allocating resources, and assessing program performance for the program areas of data collection and processing, modeling, data transmission, and data storage are not unique Navy requirements and would only require minor modifications to satisfy other agency requirements.

In fact, the DoD/DoN requirements and budgeting strategy and infrastructure are strong, well-tested paradigms that could be successfully implemented by an interagency group such as the NORLC, assuming the mandate of the NORLC is broadened beyond basic research. Employing this strategy and infrastructure for development of a national integrated, sustained ocean observing system would also be consistent with the thinking espoused in a recent report from the National Academy of Sciences by Frank Press (Allocating Federal Funds for Science and Technology, 1995, ISBN – 0-309-05347-1) and, thus, could be a valuable way to define the national objectives in operational oceanography.

3) What role should Navy play in National education and training in oceanography related to policy/law, science, operations and data management?

As you know, the primary responsibility for formal education in the US is held by the school systems, public and private. The US Department of Education is responsible for setting broad standards at the K-12 level while specific requirements and curricula are established at the state level. Public and private universities, community colleges, and technical schools provide undergraduate and graduate education. Oceanography and meteorology are perceived to be interdisciplinary specialties and, as such, are rarely taught at the K-12 or even undergraduate level. Sub-disciplines such as marine biology or environmental sciences are more frequently covered but most education in these fields occurs at the graduate level or through informal education programs.

Given the above facts, the Navy has an obligation to provide technical education to its personnel in the form of necessary training and also supports graduate education in a variety of ways. In addition, the Navy supports informal programs at all education levels, primarily on a local basis.

The Navy's enlisted specialists in meteorology and oceanography, Aerographer's Mates (AG's), receive significant operational training under the auspices of Commander Naval Education and Training (CNET). Initial skills training ("A" School) consists of 14 weeks of concentrated training in the fundamentals of synoptic meteorology, climatology, physics, atmospheric dynamics, electromagnetics, oceanography, and marine acoustics. While working in the Fleet as apprentice forecasters, they are required to complete two university level correspondence courses prior to attending the 31-week forecasting school ("C" School). Completion of this training qualifies them to become general, aviation, and military tactical weather forecasters, and ocean forecasters for the Department of Defense. When combined with a required amount of work experience, this training will also qualify them as "journeyman meteorologists" by the Department of Labor.

Condensed versions of this training are available to enlisted reservists through the Reserve Aerographer's Mate School (RAMS) and to new oceanography officers through the Basic Officer's Accession Training (BOAT) School run by the Naval Oceanographic Office.

In terms of specialized training, the production center at NAVOCEANO provides training through an International Hydrographic Office (IHO) Certified Categories A and B Hydrographic School. The IHO Category A and Category B Hydrographic programs might serve as models for additional training programs in physical oceanography and numerical modeling. In addition, the Navy supports the American Meteorological Society program for Certification in Consulting Meteorology that qualifies individuals to work on operational meteorology. In the course of developing a national operational ocean observing system, Ocean.US and its supporting agencies have also raised the questions of training for personnel to maintain this system once it is in place. This will certainly result in recommendations for the development of operational oceanography training far beyond what is currently available in the US in order to create a competent cadre of technical experts. Neither the IHO nor the AMS programs currently meet this

need; such training will have to be created and implemented with the development of the ISOOS. The Navy will play a key role in this aspect of education.

At the level of graduate education, the Navy supports its own DoD facility, the Naval Postgraduate School (NPS) in Monterey, CA. This graduate-only school offers both masters and doctoral degrees in meteorology and oceanography. It is one of the premier facilities in the country for the study of physical processes and modeling in the air and sea. Curricula developed here could be exported to other institutions or civilian students from other schools could be encouraged to attend the NPS on a short-term basis in order to take better advantage of this asset. Training programs for operational staff from other agencies is another opportunity to take advantage of the high quality of education offered at the NPS. In addition to NPS, the Navy supports other programs that enhance the undergraduate research experience, including the Naval Research Enterprise Intern Program (NREIP), a ten week intern program for participation in research under a mentor at a Navy laboratory, and the Science and Engineering Apprentice Program (SEAP), an eight week apprentice program with 35 DoD laboratories for summer science and engineering research experiences. The latter program is also available for high school Students.

In the past decade, a number of nation-wide programs for informal education have been developed. Examples of these at the K-12 level include the JASON Project sponsored by Dr. Robert Ballard and the Mystic (CT) Aquarium Institute for Exploration and the National Ocean Sciences Bowl (NOSB) supported by the Consortium for Oceanographic Research and Education (CORE). Both of these have been supported strongly by Navy but other programs should be identified, expanded across the nation, if necessary, and supported by the Navy METOC programs.

The NOSB is an excellent example of a program that engages high school students in the excitement of learning oceanography by combining it with the thrill of timed competition. NOSB was initiated in 1998 with sixteen regional competitions. Teams of four students go head-to-head in answering questions in a timed, buzz-in format similar to the television game show, Jeopardy. The winners of the regional competitions go on the national competition in the spring. The final four in the nationals are rewarded with various prizes, including trips to locations around the world and the US. This program has been expanded to 20 regions with more under consideration. Navy, NOAA, NASA, NSF, USGS, MMS, and several other federal agencies jointly fund it through NOPP with additional funds for ocean-related prizes and incidentals from several private foundations and individual contributors. This program reaches thousands of students every year and inspires teachers, parents, and volunteers alike. Programs such as this are instrumental in exposing teenagers to the science of oceanography and preparing them for possible future careers in the field.

In addition to programs that focus on K-12 students, the Navy has also taken a leadership role in training teachers through the Maury Project at the US Naval Academy. This program is run by the Navy and the American Meteorological Society with funding from CNMOC, ONR, AMS, and, initially, NSF. The program has been running for eight years and has graduated over 200 teachers, including some from every state in the US and several other countries as well. The Navy provides detailed instruction in oceanography

and meteorology from the faculty and staff at the USNA, materials, and facilities (shore and ship). Through this program, the Navy reaches thousands of students when the teachers bring what they've learned back to the classroom.

The Navy also supports high school teacher training efforts through the NOPP program. These include the COAST program (S. Walker, U. Southern Miss.), Project Oceanography (P. Coble, U. South Florida), The Bridge (L. Larkin, VA Inst. Mar. Science), and Project Tomorrow (M. DeLuca, Rutgers U.). More information on each of these can be found on the NOPP website at http://www.nopp.org.

Examples of local education activities supported by Navy include the OCEANS ALIVE program and the Engineering and Science Residential Program (ESRP) of the Secretary of the Navy. OCEANS ALIVE provides hands-on training for students and teachers with time aboard NAVOCEANO survey ships. The ESRP provides summer internships to high school seniors where they can work in a scientific environment and learn more about a specific topic and the Navy. Both of these are successful programs that could be used as models and expanded in a systematic way to include other federal and university programs. Undoubtedly these agencies and universities support similar programs so the key would be to work out cooperative efforts.

In summary, the Navy role in oceanographic education could best be met through implementation and financial support of national (and international) technical training, graduate, and informal education programs.