THE INSTITUTE FOR NAVAL OCEANOGRAPHY

By Christopher N.K. Mooers

ON October 1, 1986, the University Corporation for Atmospheric Research (UCAR), under a Cooperative Agreement with the Office of the Chief of Naval Research, assumed the management and operation of the Institute for Naval Oceanography. The Institute is sponsored by the Office of Naval Research, the Office of Naval Technology and the Oceanographer of the Navy. As annunciated on July 17, 1984, the Institute is an initiative of the Secretary of the Navy. Its overall mission is to ensure the Navy's leadership in oceanic and atmospheric modeling and exploitation of satellite remote sensing data and supercomputer technology. The Institute is chartered to be linked with academic and research institutions and other agency programs. Its research and development program serves to hasten the day when the oceanographer's equivalent of the meteorologist's synoptic weather chart is available on a regular basis.

The Institute's personnel are employees of UCAR and are governed by the policies and procedures established for its sister organization, the National Center for Atmospheric Research (NCAR). INO is located at NASA's (John C.) Stennis Space Center (SSC) which is 24km north of the Mississippi Gulf Coast and 72km northeast of New Orleans. The SSC is a 150km^2 space engine test facility surrounded by a 470km^2 buffer zone. Today, 5,500 people are employed at the SSC, including about 2,000 military and civilian employees of the Naval Oceanography Command and Program. At the two-year mark in its history, the Institute employs 34, including 14 Ph.D. scientists and two visiting scientists. The Institute is expected to continue to grow at the rate of several new scientific personnel per year.

Christopher N.K. Mooers, *INO, NSTL, MI. 32529.*

The Institute is the first created for a dedicated effort in ocean modeling and prediction research. Reflective of Navy requirements and scientific imperatives, the Institute is focused on its goal: "The INO will develop and demonstrate mesoscale eddy-resolving ocean prediction systems on a global basis." The program today concentrates on ocean model and data base development and evaluation, four-dimensional data assimilation, interfacing ocean and acoustic models, and coupling oceanic and atmospheric models.

The facilities of the Institute include a VAX 8800, a USAN satellite link to the Cray™ computers at NCAR and NRL, and several workstations. When the Navy's Class VII supercomputer is delivered to the Naval Oceanographic Office (NAVO) at the SSC in about two years, the Institute expects to receive a major allocation of its resources, which will be shared with the involved academic community. In the meantime, the Naval Ocean Research and Development Activity (NORDA), which is co-located with INO at the SSC, will acquire a mini-supercomputer which will be operated in a similar fashion.

The Institute is positioned on the interface between academia and in-house Navy laboratories such as NORDA at the SSC and the Naval Environmental Prediction Research Facility (NEPRF). The latter is co-located with the Fleet Numerical Oceanography Center (FNOC) in Monterey, California. It is expected to facilitate an accelerated transition of academic research results to operational products. Thus, it is essential for INO to have strong relationships with academia as well as with Navy laboratories, operational centers, and operational and policy commands. To date, INO's interactions with academia have been through collaborative research; workshops, symposia and colloquia; seminars; visiting scientist programs; and the ISRP (INO Sponsored Research Program), which only employs solicited research proposals. Presently, there are twenty academic scientists involved in the ISRP.

The institutional strategy includes combining the efforts of INO's scientists with those of ISRP scientists through research teams/working groups. The major themes of the Institute's research program are mesoscale eddy-resolving ocean prediction systems, in order of priority, for the North Atlantic, North Pacific, coastal ocean, and global ocean, together with concomitant studies of ocean-acoustic model interfacing: both forward (such as sensitivity analyses) and inverse (such as acoustic tomography) topics.

Here, ocean prediction is used in the broad sense of simulation, hindcast, nowcast and forecast. The highest initial priority is for nowcasting, followed by short-term (ca. one week) forecasting. The phrase "ocean prediction systems" connotes that observing systems and modeling systems are combined, through 4-D data assimilation, to make oceanic field estimates.

A rich set of scientific issues needs to be addressed. For example, how much vertical and horizontal resolution are required to represent accurately the essential mesoscale ocean dynamics? How do you best represent vertical structure in a dynamical model: layers, levels, isopycnic surfaces, dynamical modes, orthogonal polynomials, or other? And how much resolution is needed to represent ocean mass field variability for acoustic predictions? As an example of another type of scientific issue,

how do you evaluate ocean models when the data bases are incomplete and otherwise imperfect? What is an optimum mix of satellite sensors and orbits, plus drifting and moored buoys, floats, and ships-of-opportunity to achieve an ocean nowcast or acoustic propagation prediction?

When significant progress has been made with developing mesoscale eddy-resolving ocean prediction systems, system analyses of ocean-acoustic prediction systems, and coupling atmospheric and oceanic models, the Institute anticipates modeling marine ecosystems. In the meantime, the conduct of ocean OSSEs (Observing System Simulation Experiments) is a major research objective. The ocean OSSEs will allow quantification of the value for mesoscale ocean prediction of one proposed observing system network versus another, and they will facilitate the orderly design of such networks.

To facilitate the conduct of OSSEs, as well as the demonstration of ocean prediction systems, INO plans to initiate the Experimental Center for Mesoscale Ocean Prediction (ECMOP), which will be an INO-based organization and activity for establishing, maintaining and operating community libraries of models and data bases on the Class VII supercomputer.

Overall, INO is an unprecedented institution with initiative that will afford both the Navy and academia with exceptional opportunities to move ahead in the era of numerical models, supercomputers, digital telecommunication networks, satellite and acoustic remote sensing, telemetering *in-situ* data networks, and increased understanding of ocean processes. Conceptually, the creation of the Institute recognizes that we have neither perfect models nor complete data sets; yet, using optimal estimation theory, models and data can be combined through data assimilation to provide improved estimates of oceanic fields on a regular basis, which in turn will support the advance of scientific inquiries, as well as the practical exploitation and management of the ocean.

As the Institute succeeds, it will add to the vitality and viability of the ocean sciences community through stimulation of the development of needed infrastructure in operational oceanography (because model products will need to be produced routinely in operational centers), which, in turn, will create new demand for graduates and research results, and new commercial opportunities and means to conduct ocean resource management. ■

GERMANY'S NEW RESEARCH CENTER FOR MARINE GEOSCIENCES (GEOMAR)

By Stephanie Pfirman

GEOMAR was founded in June 1987 as an institution dedicated to marine geosciences and technological development. The institution consists of three interacting organizations: the Research Center for Marine Geosciences, the "Technologie GmbH," and the Technology Park. The GEOMAR Research Center for Marine Geosciences is central to this new institution. The director of the Research Center is Joern Thiede. Its four departments are:

- Marine Environmental Geology, Erwin Suess, Head. Emphasis is organic chemistry, in particular the anthropogenic and environmental influences on sea floor environments and changes in geotechnical properties of sea floor sediments.
- Paleoceanography, Joern Thiede, Head. Emphasis is the geologic development of the oceans, and the attendant development and circulation of water masses with biological and sedimentological influence.
- Marine Geophysics (selection of Head is proceeding). Emphasis is the development of continental margins and ocean basins, using reflection seismic profiling and modeling of marine geodynamics.
- Petrology of Oceanic Crust (Head position to be advertised). Emphasis is magmatic and volcanic processes associated with formation and development of oceanic crust.

The "GEOMAR Technologie GmbH" operates the Study Center and the Technology, Service and Development Center. Dr. Harald Baecker is its managing director. Under the auspices of the Christian-Albrechts University, Kiel, the Study Center will offer advanced education and training in marine geosciences. Education will also be provided for land geologists, marine-geology technicians, and for research diving. Researchers from third-world countries will be offered developmental assistance.

Stephanie Pfirman, *GEOMAR, Wischhofstr 1-3, Bldg. 4, D-2300 Kiel 14, Federal Republic of Germany.*

The Technology, Service and Development Center will provide support services for the Research Center and thereby ensure rapid transfer of research and development experience to the field of applied geology. The Center manages a marine-geoscientific equipment supply, the research and development laboratories and workshops, and a sample and data archive. It provides outfitting and equipment operation for research expeditions. The Center develops, maintains and operates monitoring systems and stations, carries out sea floor surveys, and develops new instrument systems for the departments of the Research Center.

The GEOMAR Technology Park will be developed around the Research Center and "Technologie GmbH." Kiel was chosen as the location for GEOMAR because the Christian-Albrechts University and its associated Institut für Meereskunde together have the highest concentration of researchers in marine disciplines in Europe. They provide an unparalleled academic environment that permits GEOMAR to begin work at the highest level. The city of Kiel is located on a fjord open to the western Baltic Sea, with easy access for research ships of all nations. GEOMAR has a 500m-long dock suitable for most ocean-going research vessels. The Technology Park will be located directly across the fjord from the Institut für Meereskunde and the University. GEOMAR personnel now have their offices in one of the few historical buildings in the fish market that survived World War II. This building and an adjacent one are being refurbished to accommodate the first scientists. With a budget of approximately 55 million DM (nearly $30 million U.S. dollars), a 6,000m^2 building will be constructed starting in the fall of 1989. By 1991, 40 positions for scientists are expected to be filled and 20 for technical and support personnel. By 1994, GEOMAR institutes will involve several hundred employees, including project-related appointments. ■