NAVY OCEANOGRAPHY

By J.R. Seesholtz, RADM (Ret.), USN

Two very good articles in the November 1989 issue of *Oceanography* magazine provide some excellent coverage of their subject areas, but some of the views and positions presented merit comment. These articles were "Comments on Oceanographic Instrument Development" by Carl Wunsch and "History of the U.S. Academic Oceanographic Research Fleet and the Sources of Research Ships" by T.K. Treadwell, D.S. Gorsline, and R. West.

First, both articles overlook what I believe is the biggest development in oceanography in the past quarter century, the advent of space-based oceanography. With the space age, remarkable new platforms and instruments with the means to sample many places worldwide—even several times a day—became available. Observations from satellites have probably revealed more about ocean dynamics than many years of cruises by all the world's academic fleets using advanced instrumentation might have provided. We need modern ships with improved instruments, but great instruments on new platforms (satellites) have come to our aid, especially in the last two decades, and we should not overlook their significance in taking our accountings.

Second, the Navy is cited for losing interest in several areas, notably ships and instruments. In my view there are several explanations for this, and we might do well to learn from these lessons of the past. While many oceanographers regard the 1960s and 1970s as a golden age, there is another view. Particularly during the 1960s great payoffs from investments in oceanography were promised, or at least inferred. Some results were delivered; however, the perception, not necessarily in the Navy, but in the greater community at large which is aware of ocean affairs was that the promise remains largely unfulfilled.

Also with the creation of a Federal Ocean Program in the late 1960s there was an announced dedicated shift to civil (NSF and other government departments) funding support of much academic work. The Navy, at least in part, believed these funds were "transferred" from the Navy to other budgets to accommodate this shift. The Navy built over twenty ships in that earlier (1960-1972) building program. With limited military, civil or university money to operate them, five were eventually leased to foreign governments and are still operated by foreign laboratories or institutions.

There is in the Navy an awareness of the price paid for oceanography. Most of those involved, at least in my tenure as Oceanographer of the Navy, felt the Navy has profited from its support of oceanography, especially in helping improve anti-submarine warfare (ASW) capabilities. Nevertheless, during the 1980s some related developments and attitudes toward oceanographic ships and space systems are worth noting. First, the Navy Remote Ocean Sensing System (NROSS) satellite was planned as the centerpiece of a much improved capability to describe present ocean conditions and support the forecast of future ones, especially in support if ASW, but also for other important purposes. NROSS failed for a variety of reasons, many of them wrong. One stated reason was budget limits, but a stringent, narrowly defined requirement to show a direct marked improvement in oceanographic support capabilities to the operating fleet also became an important bureaucratically-contrived but effective and elusive obstacle to overcome. Several key decision-makers did not consider improving our basic ocean knowledge or Navy leadership in (space) oceanography sufficient justification to pursue the program. I did not agree with the position, but had to live with it. In the end, NASA upheld its part of promised NROSS support and did pursue the scatterometer (wind instrument) construction. The scatterometer will fly on another satellite. The Navy-supported altimeter for NROSS will also likely be providing oceanographic data from orbit sometime during the 1990s. At the same time, the Navy did provide an important oceanographic instrument by having data from the GEOSAT altimeter made widely available to the scientific community.

On the subject of improving models and supporting data costs, which are noted as wrong choices by the Navy, the 1980s brought us face-to-face with some harsh realizations. The data available from satellite-derived sea surface temperatures and much other information went largely unused. It was realized that properly incorporating these and other data (from satellites, history, buoys, ships, etc.) into appropriate models could lead to improved real-time ocean descriptions and forecasts. Simply put, to do the best we could under the circumstances, one rational choice was to "look at the top of the ocean and model."

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FRONT COVER

THE VIEW through a window of the U.S. space shuttle *Columbia*, photographed on August 9, 1989, with a Linhof camera and 70 mm lens. The photograph, taken from an altitude of approximately 300 km about two hours after local noon, shows complex patterns of sunlight reflecting from the ocean surface near Georges Bank and the southwestern Gulf of Maine, off the U.S. east coast. The sun-glitter patterns reveal several interesting ocean processes (see the article beginning on page 43). Photographs taken from low orbit often show mesoscale and sub-mesoscale ocean phenomena with remarkable clarity, providing information difficult to obtain by other methods. (From NASA photograph number STS 28-151-216.)

BACK COVER

OBLIQUE VIEW of the eleven-year mean temperature field in the upper 500 m in Fram Strait. View direction is to the northeast. The continental shelf of Greenland is shown in the foreground with the islands of Svalbard (Spitsbergen being the largest) to the right of the model. A section of the water has been removed to reveal a cross sectional view of the warmer Atlantic inflow (colored orange) as it wraps around Spitsbergen Island into the colder water (colored purple) of the Arctic Ocean. The recirculation of the warmer Atlantic water to the west, across Fram Strait, and then south is seen in the plan view, which is cut to a depth of approximately 175 m. See the article beginning on page 23.

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Using this approach has brought some considerable improvement in real-time oceanographic "forecasting." At the same time the Navy oceanography community found itself strongly pressed by some academics to support developing models requiring far finer scales of input than the basic data-gathering system could readily support; nevertheless, considerable support was eventually diverted toward helping these efforts. As always seems the case, all too often the choices faced were how to allocate shortages among many worthwhile and interesting programs, but outside pressure often distorts a rational process for setting priorities. Also, a major early 1980s criticism of U.S. environmental forecasting efforts was on the scale (large grid spacing) of the wide-area models in use. The European weather forecasting effort at Reading, England was held up as an example of where U.S. efforts should go. With their finer scale models, their observed skill, especially in atmospheric forecasts of several days, was cited as better than any in the US. One natural and appropriate reaction was to try to duplicate or improve upon their success.

Finally, the Navy ships currently planned are not built in isolation. While only two academic ships are in the near-term program, they are part of a larger program to replace an operational naval oceanographic fleet facing block obsolescence resulting from the big build-up of the 1960s. The goal of the 1980s program (begun in 1985) was to build ships on a continuing, supportable basis which would meet the needs of the Navy, and in part the nation, and also avoid a future block obsolescence problem. Whether building more academic ships in the outyears (beyond 5 years) of the program in the current budget climate will be achieved is now less certain. The then-Secretary of Navy, John Lehman, and Chief of Naval Research, RADM J. Brad Mooney, among others, at least urged us into taking the first steps, and the two academic ships now being built are the fruits of that commitment.

While I am on my soapbox, a word of caution on our new golden age or gold calf of support seems in order. I refer to the global climate change or greenhouse effect issue in which so many are wrapping their ocean and atmosphere program support requests. Fortunately, there are many moderate voices, as the recent session of the AGU demonstrated. Yet, there are those who appear to be trying to extract maximum support by raising maximum concern. Perhaps the more responsible community members need to put more emphasis on just how uncertain are our models and the errors usually accompanying long range forecasts? In any event, we are probably not in any immediate danger of killing the goose that lays the golden egg, and even politicians may not have memories that are that long. Do any of them remember Malthus? Or was he right after all?

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RESPONSE BY T.K. TREADWELL

I appreciate the opportunity to respond to J.R. Seesholtz's recent letter. Admiral Seesholtz's comments about remote sensing do not concern the article which I co-authored; that intentionally dealt solely with oceanographic ships. However, I can respond to his views about oceanography and the Navy. The following thoughts are my own, and don't necessarily reflect those of my co-authors.

Certainly oceanography was over-sold during the 1960s; so also were many other programs such as space research. But remember the temper of the times: there was a pervasive faith that "science" could solve all our problems. In part, oceanography and space science especially thrived because the one enjoyed the aura of romance of the sea, and the other the aura of science fiction. Perhaps most important of all, keeping ahead of the Soviets in everything became a national mania. As a result, not only researchers but the public, legislators and administrators were enthusiastic; they wanted to believe.

The Navy's faith in science led to the establishment of the Office of Naval Research, and to their commendable initial support of oceanography, both basic and applied. A little-known sidelight, by the way, is that most senior Navy officers did not share the national enthusiasm. My problems in selling oceanography were not with younger, science-oriented officers; nor with Congress, the White House, and top Department of Defense administrators such as Paul Nitze and Jim Wakelin. Resistance usually came from the captains and junior admirals who had just won a war with guts and pig-iron, and felt that they could do it again without any help from the long-hairs.

Perhaps they were closer to being right than the others. Marine research did help, for example, in anti-submarine warfare; but the laws of physics couldn't be repealed—sonars often simply wouldn't work, regardless of how much money we plowed into science. The feeling grew that the cost-to-benefits curve was flattening out. Also, the National Science Foundation took over much of the support of basic research, as well as the building and operation of ships; other agencies developed their own specialized programs. New techniques, notably remote sensing, offered alternatives to classical shipborne science. Simultaneously, the Cold War begin to thaw, and international cooperation (seldom a strong suit for the Navy) became popular. It is no surprise that the Navy progressively lost interest in oceanography, and certainly some adjustment was in order.

My personal feeling, however, is that the pendulum has swung too far—the Navy was perhaps too enthusiastic forty years ago, but it is too disinterested now. I well remember the early days of World War II, when the Navy's capability in oceanography was essentially zero. It had so few research ships that those of the Coast and Geodetic Survey were conscripted. There was only a handful of square-peg scientists like myself who had been pounded into the Navy's round hole. (I started out on the submarine S-48, doing acoustic research with the Columbia University Division of War Research, using a yacht as our surface research vessel.) My basic concern now is whether the Navy is going down that same channel; whether it has enough ships, laboratories, scientists, and (perhaps most important of all) good-will from academic researchers to carry it in case peace *doesn't* break out.

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PUBLIC SKEPTICISM

By Cyril Galvin

David Brooks' editorial, "Wolf!" (*Oceanography*, November 1989), illustrates a problem that skeptics see in the advertised threat from greenhouse warming. The editorial refers to a *Houston Chronicle* article

as alleging "that many scientists concerned about pollution, ozone depletion and global warming are motivated more by pecuniary interests than by altruistic desires to advance the common good." This allegation, the editorial says, "may be dismissed as extremist or irrational, unworthy of reaction." The tone of the editorial is that the scientist is above such suspicion.

If the *Chronicle* article does suggest that greenhouse scientists are motivated by pecuniary rather than altruistic interests, then it is, of course, wrong. But its error is not because scientists are morally superior, but because it twice misunderstands the motivation of scientists: few, if any, world-class scientists entered science to get rich, and relatively few entered the physical sciences to advance the common good.

A subtle discussion of their actual motivation is in the same issue of *Oceanography* (Nov. 89, H. Stommel, "Why We are Oceanographers"). Scientists become scientists to discover things about the world around us. The currency of science is not dollars, but fame for discovery, and that fame increases with the unexpectedness and generality of the discovery. In seeking fame, scientists are not morally superior to non-scientists. There are many examples of how the desire for fame corrupted a scientist's actions, from the subconscious rejection of non-confirming data to the brutal discrediting of rival theories.

Predictions of the effects of greenhouse warming are part of the scientific fame of those making the predictions. When the predictors seek to influence public policy with advice based on their predictions, a citizen is only being prudent in requiring skeptical review.

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My comments about the Chronicle *article were prompted mostly by its summary statement, "we are being peddled protection from non-existent hazards." To me, this seems an extreme and irrational view, given the mounting evidence for ozone depletion and global warming and the environmental hazards they portend. Far from being exempt from public scrutiny, scientists face an added obligation to sift available evidence and interpret it responsibly for a critical public. —DAB* ❑

Convergent Shelf Flow at Cape Mendocino

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Magnell, B.A., C.D. Winant, N.A. Bray, J.F. Borchardt, C.L. Greengrove, C.E. Dorman, R.L. Bernstein, 1989: *The Northern California coastal Circulation Study: Results of the Pilot Program.* Prepared for Department of Interior, Minerals Management Service, EG&G WASC Oceanographic Services Report No. NCCCS-89-2, Waltham, Massachusetts, 270 pp.

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Winant, C.D., C.E. Dorman, C.A. Friehe, and R.C. Beardsley, 1989: The Marine Layer off Northern California: An example of supercritical channel flow. *J. Atmos. Sci., 45,* 3588-3605. ❑

Physical Oceanography in the 1990s

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In the late 1980s, as a cure for perceived lagging productivity in science, the federal government began to push multi- and interdisciplinary research. By tradition and its very nature, ocean science has always been at least multidisciplinary and in many cases interdisciplinary. The hard questions concerning global climate change in the next decade will require advances in areas of common need, such as moored technology for chemistry and biology, modeling as an integrator of fields, and a fuller appreciation of the wealth of intellectual problems in ocean science.

New tools for measuring currents and improved models capable of handling the messy combination of processes at work in the coastal ocean may make the 1990s the decade of the coastal oceanographer. Again, some of the growth in this area will be fed by a community more closely tied to societal needs in the coastal domain. Finally, to match the observations from space, the hydrographic efforts, and the models, it is possible to forsee a global *in situ* ocean measurement network based on very-long-term site moorings, global drifter and float networks, and even perhaps the first "Slocums," as Stommel suggested. The latter will bring ocean science closer to meteorology, but not to the point, one hopes, where scientists no longer go to sea. ❑