bility of an ELF system that would consist of the existing experimental facility at Clam Lake, Wisconsin, linked to a small Michigan facility made up of 130 miles of antenna and a single transmitter. The Michigan facility, contemplated in the original Seafarer plan as the first step toward a full system, would demand only 5 percent of the right-of-way originally to have been required. Yet, astonishingly, Navy officials were now saying that this small combination facility could, especially with a modest expansion of the Clam Lake unit, prove of real value in the principal submarine operating areas.

Up until 12 August, when Milliken sent his last letter to President Carter, the governor's staff was still weighing how to respond to this latest Seafarer proposal. William Taylor, the science adviser, thought the proposal had enough merit to warrant the governor's entering into negotiations with the Navy and DOD officials. Some others on the staff were more skeptical, but there was no one who would not have welcomed evidence that the Pentagon was at last willing to offer firm assurances that no Seafarer system would be built or subsequently expanded in Michigan without the governor's concurrence.

But whatever the hopes for another round of cooperative discussions about Seafarer, they were let down by continued evidence of ambiguity—one gubernatorial aide has called it "complicity and double-dealing"—in the Pentagon position. For instance, on the same day Milliken dispatched his letter to the White House, a news story from Washington appeared in the Lansing *State Journal* quoting a "senior Navy official" associated with Seafarer as saying that, by starting the ELF project with the small combined Clam Lake–Michigan system, the governor would be allowed "to save face gracefully."

Clearly, to break the current political impasse over Seafarer, there will have to be a recognition on the part of the Pentagon and the White House that, as one Michigan congressman has put it, "a deal is a deal." For, wisely or not, the Pentagon has made a solemn commitment to treat Governor Milliken as a full partner in the decision-making on Seafarer if the project is to be built in Michigan.

An agreement by the governor to allow a Seafarer system of even the most modest size would take political nerve, because such a system would in fact be regarded by many as a "foot in the door." Yet a politician of good will can work up his courage to make a tough decision if those he is dealing with will honor their commitments and not cause him embarrassment. In the case of Seafarer, the Navy and the Pentagon have yet to show an appreciation of this political truism.—LUTHER J. CARTER

National Bureau of Standards: A Fall from Grace

Most government agencies complain that their budgets have not kept pace with inflation and increasing demands for services. But officials at the National Bureau of Standards (NBS) say they have been hit harder than most—a view that is confirmed by a statutory Visiting Committee,* appointed by the Secretary of Commerce, and by staff members of the Senate Commerce Committee. The Visiting Committee goes so far as to say that "NBS current resources are inadequate or nonexistent in a number of research areas that have been identified as critical to national needs."

Malaise pervades NBS at its headquarters in Gaithersburg, Maryland—a suburb of Washington, D.C. Officials and laboratory scientists there see a pattern of declining performance and capability that began 10 years ago and picked up speed within the past 5 years as the bureau was loaded with new responsibilities that draw heavily on its allotted money and personnel. The causes of this situation are complex and involve a chain of government officials that stretches from NBS to the Department of Commerce (under whose aegis NBS falls) to the Office of Management and Budget (OMB), and includes members of Congress and even the President.

In recent years, Congress has made increasing demands on the technical expertise at NBS. It has passed 15 laws since 1965 giving the bureau new assignments. But during that time NBS has had a constant budget despite inflation and has had to reduce the number of its employees from 3163 permanent full-time workers to 3055. The result, say NBS administrators, is that the bureau is no longer able to fulfill its functions. The scientific reputation of NBS is also deteriorating. Morale is low and the best young researchers are no longer interested in working there. What was once a first-rate research institution is now in some danger of becoming a job shop.

The work of NBS is seldom in the news, and its mandated responsibility for developing and maintaining a large array of measurement standards hardly excites the imagination. But many of these standards are crucial to regulatory agencies, to consumers, and to businesses and industries. For example, the bureau recently established a calibration service for diagnostic x-ray units to help prevent the public from being overexposed to x-rays. It develops standards for measuring pollutants in air and water, thus ensuring that regulators measure pollutants in the same way as the industries they regulate. It issued a standard establishing safety requirements for toys. It helps industries calibrate gage blocks, which are used to check on the accuracy of measurements.

Some of NBS's work involves problems whose solutions require long-term research. One such problem is to devise means of measuring amounts of radioactivity in nuclear fuels at various stages of processing. This is necessary to provide a basis for accountability for nuclear materials. According to Arthur McCoubrey, director of the Institute for Basic Standards at NBS, these measurements "go beyond the existing state of the art," and NBS will require several years of research to come up with the necessary techniques. In the meantime,

* Members of the Visiting Committee are Edwin Gee, Senior Vice President of DuPont Company, Robert Dicke of Princeton University, Dale Compton, Vice President for Research at Ford Motor Company, William Carey of the American Association for the Advancement of Science, and Charles Peck, Group Vice President of Owens-Corning Fiberglas.

says McCoubrey, problems of tracing the more than 4 tons of nuclear fuel that have disappeared from laboratories and factories over the past 30 years may boil down to a lack of adequate measurement methods.

John Hoffman, director of NBS's Institute for Materials Research, cites several examples of deteriorating capabilities in his institute and in NBS as a whole. He reports that the bureau was recently required to develop standards for the use of recycled oil, which requires the testing of recycled oil in engines. The NBS, however, has no wear and lubrication scientists. Competence in electrochemistry (which is important for studies of water pollution and corrosion) is declining or lost, as is strength in alloy physics (which is needed to develop safe and effective substitutes for increasingly scarce and expensive materials, such as dental gold).

Technicians, according to Hoffman, are "an endangered species" at the bureau. Out of a total of about 2600 employees at Gaithersburg, only 10 or 15 are technicians. Highly trained Ph.D.'s now must do routine technical work and some have left NBS because of this. Productivity is also diminished and staff morale is low owing to budget problems and personnel cutbacks. "At times I feel these morale problems related to the budget process are becoming a continuous agony," Hoffman says.

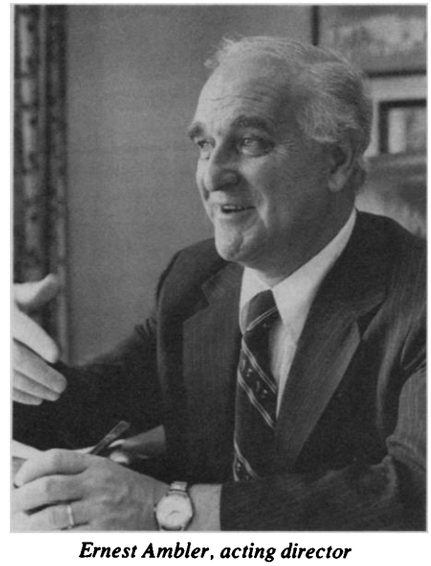
McCoubrey tells a similar story about the Institute for Basic Standards. His institute lost about 70 people out of 850 in the past year, and its budget was cut by 8 percent. It has had to terminate or greatly reduce what McCoubrey views as important programs. For example, it terminated its program on signal lighting for airports and airplane cockpits. It reduced its programs to develop means to calibrate flow instruments, which are important for measuring the flow of such things as oil and natural gas in pipelines.

McCoubrey charges that political forces require the bureau to respond to short-range problems for which answers can be found in 1 or 2 years, at the expense of long-term programs. Now, says McCoubrey, "people tend to come to NBS in order to work with a particular NBS scientist and not because NBS is a first-rate scientific institution."

The climate for research at NBS has been monitored by a committee composed of scientists and engineers at the bureau, who tell a similar story. The problem, according to Richard Deslattes who, for the past year, was chairman of the committee, is that "we are mandated

to produce results only of immediate and tangible public benefit, at the cost of losing touch with the deeper and longer term benefits of rationally conceived and executed programs." He says that the message passed on to the laboratory scientists is that it is necessary to hide the best scientific work of the bureau which may not bear directly on politically popular problems. The result, he says, is that "there is a continuous sense of frustration in behalf of the NBS as an institution." Deslattes recognizes that NBS is not intended to be another Institute for Advanced Studies, but feels that there is room and a need for some excellent basic research at the bureau.

One example of "hidden" work is research on atomic and molecular data, which is directed by William Martin.



Ernest Ambler, acting director

Martin says he has been told informally by NBS administrators that his work is not salable to the Commerce Department and so it is buried under descriptions that make it difficult to identify. According to Martin, this work is applicable to energy research and is highly valued by physicists in universities. It could not easily be done outside NBS since it "does not lend itself to a Ph.D. thesis," being long-range and requiring tedious literature searches and the compiling of published data. Most of the people who are willing to do this sort of work, says Martin, are at NBS. But the bureau's abilities to keep these researchers are eroded by the message that their work is not salable.

The problems cited by the institute directors and laboratory scientists of NBS are confirmed by the Visiting Committee, which is required by law to report annually to the Secretary of Commerce on the condition of the bureau. The committee reports that "Shocking gaps exist in NBS's ability to carry out its basic assignment as well as the supplemental assignments that have been thrust upon the bureau." The committee points out that the amount of money devoted to basic research is now about half that devoted 10 years ago, a statement confirmed by Raymond Kammer, senior program analyst at NBS. In fiscal year 1978, $3 million is devoted to basic research out of a total of $70.4 million, Kammer says. In fiscal year 1965 nearly $7 million out of $26.5 million was devoted to basic research.

The sources of NBS's decline seem to be in various federal agencies, including NBS itself. The bureau has had four different directors in 10 years. "The NBS has been an admirable training ground for people to go on to other responsibilities," according to William O. Baker, head of Bell Laboratories in Murray Hill, New Jersey, and Chairman of the National Academy of Sciences NBS Evaluation Panels committee. But the most pressing problem is that its current leader, Ernest Ambler, has been an "acting" director for 2 years. "I think it is an outrage," Baker says, "Ambler has done superbly but damage is inevitable, both to him and to the conduct of the bureau. He is unable to speak out or plan without being confirmed as director." As yet, there are no plans afoot to confirm Ambler or to name a successor. Some observers say it's up to Jordan Baruch, the new Assistant Secretary for Science and Technology at the Department of Commerce, to initiate confirmation hearings. Baruch, however, evades the question of confirming a director, saying the respon-

sibility is in President Carter's hands.

Another source of NBS's problems is the Commerce Department, which the Visiting Committee accuses of having a "laissez-faire attitude." This analysis is confirmed by Elsa Porter, the new Assistant Secretary for Administration at Commerce. The Commerce Department, like the NBS, has had a rapid succession of leaders. "For the past 8 years, no Secretary of Commerce came in with the idea that he would stay around and improve the situation," she says. There were five secretaries during that period, which resulted in "an absence of sustained leadership" and subsequent internal problems at Commerce.

The Department of Commerce is responsible for presenting to OMB the bureau's case for more funds. The OMB, however, has blundered in its relations with NBS and contributed to the problems, according to the Visiting Committee. For example, the committee says that Congress gave NBS the task of prescribing tests of energy use or energy efficiency of household products. Although OMB approved this project, it told NBS to obtain funds from the Federal Energy Administration (FEA). Then OMB took the money for this project away from FEA. Joyce Walker, Deputy Assistant Director for Economics and Government at OMB, says that OMB took money away from FEA because of congressional directives.

Another example cited by the Visiting Committee of how OMB exacerbated NBS's problems concerns the Resource Conservation and Recovery Act of 1976. Congress gave NBS a deadiine of 2 years to develop guidelines for the specifications for materials recovered from wastes. But OMB has denied NBS any funds for this project. Walker explains, however, that NBS is to work with both the Environmental Protection Agency and the Department of the Interior on this project. The OMB has denied funds to all three agencies until they come up with a plan that ensures that they will not duplicate each other's work.

Some observers say the source of these difficulties with OMB may be the channels through which the bureau's budget is reviewed. Most of the government's science and technology agencies have their budgets reviewed together by analysts familiar with scientific issues, many of whom were brought in by Hugh Loweth, Deputy Associate Director for Energy and Science. The NBS budget, on the other hand, is reviewed in the economics and general government area of OMB. The Visiting Committee states that "the people from OMB responsible for oversight of NBS are nontechnical people and have little understanding of the relevance of this highly technical work." Ambler says circumspectly, "I would think that the most logical way to review the NBS budget would be to compare it to other science and technology budgets."

Administrators at OMB, however, say that it is neither possible nor necessarily desirable to have scientifically trained people review NBS's budget. Loweth points out that there is no single technical area that predominates in NBS's research, so it is not clear just what sort of scientists would be appropriate to review the bureau's budget. Moreover, NBS is a small agency compared to such agencies as the National Aeronautics and Space Administration, whose budget is reviewed by Loweth's technical staff, and it would be hard to justify bringing in technical people to review NBS's budget. Walker believes that it is entirely appropriate that OMB be peopled with generalists rather than specialists. Specialists, she says, may tend to be advocates of various programs and strong advocates are not necessarily desirable people to help divide up a limited amount of money.

Administrators Not Convinced

Administrators at OMB are not completely convinced that NBS's plight is so dire. Walker explains that, because NBS feels itself to be very important, it doesn't realize that the private sector could do some tasks equally well and that some tasks could be turned over to other agencies. Unfortunately, she says, OMB must give agencies less money than they could profitably use. The OMB wants to encourage NBS to monitor itself, to determine which of its programs could be dropped in order to make best use of limited funds.

Despite the current tales of woe of NBS, many observers have not given up hope that the situation may change. Even the Visiting Committee says that the bureau's decline is not irreversible and that good management and firm support for NBS at the Commerce Department can yet allow the bureau to regain its scientific reputation. Deslattes, reporting the scientists' view at NBS, says that there remains among the NBS staff a cadre with "deep reserves of intellect and culture within their disciplines." He concludes that changes in the way research at NBS is administered can renew the bureau's scientific vigor.

Administrators at NBS are pinning many of their hopes for change on Baruch, being encouraged by what they say was an unprecedented visit to the bureau on 26 July. During that visit, Baruch invited NBS managers to help him decide on the future role of NBS as a scientific and technical resource. He seems to have favorably impressed NBS administrators and convinced them of his sincerity.

Although the Visiting Committee suggested that NBS declare a moratorium on new assignments not directly funded by Congress, Baruch believes the bureau cannot abrogate its responsibilities in the face of decreasing funds—a laudable goal but one that is difficult, at the very least, to achieve. He indicates that NBS must maintain its classical role of "technologist of last resort," but wants the price paid for reprogramming made clear. "Congress and the Executive are reasonable. They know you can't get something for nothing," he says.

Porter is also concerned about the decline of NBS and hopes the situation will change as the bureau becomes more visible at Commerce. She and her associates are now trying to link the various programs at Commerce together. They are setting up weekly meetings of key program managers, for example. As a result of this increased communication, she predicts that "other parts of Commerce will appreciate NBS in a much deeper way."

Still another hint that NBS may be rescued comes from increased interest in the bureau in Congress. Members of the Senate Commerce Committee staff say they cannot remember when hearings on NBS were last held. Now, the committee "has a real commitment to look at NBS" and considers the status of the bureau to be one of the most important issues to be dealt with. As evidence of this concern, the committee plans to hold hearings on NBS in the near future, but they cannot estimate when the hearings will take place or specify what the hearings will accomplish.

It is still too early to say whether any of these professed plans to rescue NBS will be successful. But the fact that the bureau is receiving increased attention is, in itself, evidence to optimists that its decline may yet be halted and even reversed.—GINA BARI KOLATA

Erratum: In the report by D. Pious and C. Soderland entitled "HLA Variants of cultured human lymphoid cells: Evidence for mutational origin and estimation of mutation rate," (19 August, p. 769), the gametic mutation rate for an H-2 gene in mice was printed as 5×10^{-1} per gene per generation. This should have read "5×10^{-4} per gene per generation."

Erratum: In the article by R. A. Brink, J. W. Densmore and G. A. Hill (12 August, p. 625), C. W. Guillebaud is incorrectly listed as the author of reference 16; the name should appear at the beginning of reference 15.