ing the search for the *Thresher*, it was nearly impossible to keep *Trieste II* in operation without a long trip back to drydock. As part of the development program for the nuclear submersible, *NR-1*, the Navy is making a major effort to improve the reliability of components so that the prolonged power endurance of the nuclear reactor can be utilized.

Summary

The past decade has seen the development of small submersibles as a new and effective tool of geology, acoustics, marine biology, and physical oceanography. As with all tools, it has special capabilities and limitations. The methods of use and the needed engineering improvements are being identified. Scientists, engineers, government, and industry are responding so that advances toward both less-expensive simple vehicles and high-performance complex vehicles are proceeding.

The National Council for Marine Resources and Engineering Development has stated, "By a number of circumstances, some of the result of planned marine development, but the most fortuitous contributions from other fields, we find the technologies ripe for meeting new marine requirements" (*12*). Apart from technologic advances there is (i) a continuing need to make scientists in many fields aware of the capabilities and possibilities of research submersibles. This can be done most convincingly by taking prospective investigators on a dive; however, there are but few seats, and dives cost more money than some owners feel they can afford on a continuing basis. It may thus be necessary to catalyze this process with some limited-term government support. There is also (ii) a need for intelligent construction standards and safeguards, both to enhance safety and provide a basis for reasonable insurance rates. Regulation of construction and operation is necessary for public good, but it should be kept to a minimum in order not to stifle development of an infant technology.

References and Notes

1. R. D. Terry, *The Deep Submersible* (Western Periodicals, North Hollywood, Calif., 1966).
2. E. Wenk, Jr., R. C. DeHart, P. Maudel, R. Kissinger, Jr., *Proc. Royal Inst. Naval Architects, London, Quart. Trans.* **102**, No. 4 (1960).
3. Committee on Oceanography report, *Oceanography 1960–1970* (NAS–NRC, Washington, D.C., 1959).
4. *Deep Submergence Systems Review Group Report*, Vol. 1–4, Department of the Navy, Office of the Secretary, Washington, D.C.
5. "Oceanography 1966," *Nat. Acad. Sci.–Nat. Res. Council Publ. No. 1492* (1967).
6. *Undersea Vessels for Oceanography*, Interagency Committee on Oceanography pamphlet No. 18, October 1965.
7. A. J. Schlosser, *N.E.L. Manned Submersible Oceanographic System* (U.S. Navy Electronics Laboratory, 1967).
8. National Council on Marine Resources and Engineering Development, *Questionnaire to Users and to Operators of Research Submersibles*, dated 22 May 1967.
9. S. C. Daubin, *Aircraft Salvage Operations in the Mediterranean—Underwater Vehicle Systems*, unpublished report prepared for Ocean Systems, Incorporated, October 1966.
10. Navy Electronics Laboratory, *Deep Submergence Log No. 1* (August 1966), *No. 2* (October 1966), and *No. 3* (February 1967); "Acoustic Research Studies with Deep Submergence Vehicles" *U.S. Navy Underwater Sound Laboratory (USL) Tech. Mem. No. 2211-06-66*, 2 December 1966; E. C. Buffington, E. L. Hamilton, D. E. Moore, *Direct Measurement of Bottom Slope Sediment Sound Velocity and Attenuation and Sediment Shear Strength from "Deep Star 4000"* (U.S. Navy Electronics Laboratory); R. F. Dill, *Military Significance of Deeply Submerged Sea Cliffs and Rocky Terraces on the Continental Shelf* (U.S. Navy Electronics Laboratory); G. V. Pickwell, "Syphonophores and Their Released Bubbles as Acoustic Targets within the Deep Scattering Layer," *Proc. U.S. Navy Symp. Military Oceanogr., 4th* (1967); F. P. Shepard, J. R. Curray, D. L. Inman, E. A. Murray, E. L. Winterer, R. F. Dill, *Science* **145**, 1042 (1964); F. P. Shepard, *Trans. N.Y. Acad. Sci. Ser. 2* **27**, 292 (1965); C. L. Brown, "The Use of Multiple Plankton Sampling Nets on Deep Research Vessels," *U.S. Navy Underwater Sound Laboratory (USL) Tech. Mem. No. 2213-58-67* (1967).
11. A. C. Vine, summary of workshop conference "Research Use of Deep Manned Vehicles," Woods Hole Oceanographic Institution, 16 December 1966.
12. *Marine Science Affairs—A Year of Transition* (Government Printing Office, Washington, 1967), p. 89.

13. I thank Allyn Vine and A. B. Rechnitzer for critical reading of the manuscript. I thank those operators, owners, and users of small submersibles who took time to answer the questionnaire on which much of this article is based.

NEWS AND COMMENT

Euratom: After 10 Years, Still Seeking the Way

Brussels. For some time the news of Euratom, the atomic energy organization of Europe's "Six," has been gloomy. Budget difficulties, uncertainties about internal structure, and, most important, questions about the agency's mission have led many to take a pessimistic view of Euratom's future. However troubled the present, Euratom's functions are nevertheless too valuable to be written off, although its form may alter considerably from that envisioned when the organization was established a decade ago.

One of Euratom's most pressing problems was dealt with in July when agreement was finally reached on its budget for the present year. Since 1967 is the last year of Euratom's second 5-year program, one of the results of the budget impasse was to block development of a third 5-year program. Consequently no new research program for next year has been accepted.

The basis for the July agreement was the settling of two disputes that have plagued Euratom. In the first case, a compromise was reached under which an Italian fast-reactor research program was given limited-term support by Euratom. In the other, the French Government agreed to advance $2.8 million for plutonium supplied by the United States for a French reactor at Cadrache. The cost was incurred when the U.S. Government decided to sell rather than lease the plutonium; the French argued that the responsibility for paying for it was Euratom's.

Coinciding with the budget crisis was a reorganization of the administrative structure of Euratom and, in fact, of the Brussels "Eurocracy" of the Common Market countries (Belgium, France, Germany, Holland, Italy, Luxembourg). What this amounts to is abolition of separate commissions and their replacement with a merged 14-man commission to head the Common Market, Euratom, and the European Coal and Steel Community.

In the case of Euratom a form of administration is supplanted which often seemed to magnify the political and

NSF Issues New Education Survey

The National Science Foundation last week published the most comprehensive collection of statistics yet available on U.S. financial assistance to institutions of higher learning. Contained in a volume titled *Federal Support to Universities and Colleges, Fiscal Years 1963–66* (NSF Publication 67-14),* the 137-page report specifies, by institution, state, and region, which ones are getting how much from the agencies that provide the bulk of federal support for academic activities. It also identifies significant trends and provides correlations of various data, such as the input of federal funds in relation to the institutions' output of graduate degree holders. For examining the financial basics of the federal relationship with higher education, the report takes its place at once as the most useful document available. Prepared by NSF, on the basis of data collected by the Federal Interagency Committee on Academic Science and Engineering, it represents a maturing of statistical services that has long been sought by virtually everyone concerned with federal support of higher education.

Among the most significant findings in the report were the following:

- Between 1963 and 1966, total expenditures on higher education in the U.S., from all sources, rose from approximately $11 billion a year to $15.2 billion; during this same period the federal contribution rose from $1.4 billion to $3 billion. (The figures are for on-campus activities and do not pertain to the contract research centers which a relatively few universities operate for federal agencies.)
- Support of "academic science" (defined as "obligations for research and development, R & D plant and other activities such as education in the sciences") accounted for the lion's share of federal support to colleges and universities. Thus, within the total of federal support during the period under study, federal expenditures for academic science rose from $1.3 billion to $2.2 billion.
- In the later years covered by the study, however, the most rapid growth was in support outside the sciences; in the nonscience areas the totals rose from $85 million in 1963 to $847 million in 1966.
- The major portion of the nonscience growth emanates from the construction and development programs administered by the U.S. Office of Education. OE's contributions rose from $67.3 million to $944.8 million over the 4-year period. Within the OE totals, funds for academic science rose from $26.6 million to $274 million.
- The number of institutions receiving federal support rose from 840 in 1963 to 2050 in 1966; the latter total represents four-fifths of the nation's institutions of higher learning. (The marked increase in the number of recipients of U.S. funds in large part reflects the growth of OE programs for the rapidly expanding system of junior and community colleges.)
- Institutions receiving $10 million or more rose from 40 in 1963 to 79 in 1966. One hundred institutions received 85.4 percent of total federal educational expenditures in 1963; by 1966 the share of the top 100 had dropped to 70.4 percent, and the list contained ten newcomers: University of Louisville, University of Connecticut, New York Medical College, Loyola University (Illinois), University of Massachusetts, University of Denver, Rice University, University of California at Santa Barbara, Southern Illinois University, and University of Alaska.
- Finally, in 1966 the top ten in total receipts of federal funds for on-campus activities were as follows: University of Michigan, $66.2 million; MIT, $63.2 million; Stanford, $60.6 million; Columbia, $60 million; University of Illinois, $58.4 million; Harvard, $54 million; UCLA, $51.2 million; UC, Berkeley, $50.3 million; Chicago, $45.2 million; and Ohio State, $39 million.—D.S.G.

* Copies of the report are available for 70 cents from the U.S. Government Printing Office, Washington, D.C. 20402. The report was prepared for the White House Office of Science and Technology under the general direction of Charles E. Falk, NSF planning director; the data was processed by the Office of Data Management, headed by Richard Mayer, and the analysis of data and preparation of the report were handled by the Office of Economic and Manpower Studies, headed by H. E. Riley.

financial difficulties of the organization. The old five-man commission displayed little energy and, as compared with the Common Market commission, commanded little prestige.

Under the new regime, most of Euratom's functions will be directed by one of the commissioners, Fritz Helwig, although control of some functions, such as health physics and social affairs, will be placed elsewhere. Helwig, it appears, will to some degree be expected to assume the role of "general manager."

It is too early to tell how the new dispensation will work. The old administrative substructure is still functioning, and results of a study on a new organization are due in a month or so. The word is already out, however, that the number of directors-general—top administrators below the commissioners—will be sharply reduced, probably from the present 40 to 22. The general expectation is that the new commission will be much tougher, and the hope is that, for Euratom, it will be more effective.

The big question hanging over Euratom, however, is the one of its role. The original idea was that Euratom would do on a collective basis for the Six what the nations couldn't do individually in the field of atomic energy. In the mid-1950's none of the Six had a major national atomic energy program. It was a period of enthusiasm for European integration, and Euratom, as a vehicle for cooperation in developing the peaceful uses of the atom, raised great hopes.

In general, Euratom has not succeeded brilliantly where commercial considerations came into play. Commercial interests have come to be identified with national interests. Euratom has lacked a constituency; industry has its own interests to consider, and Euratom appears as a rival to the national programs of the most active governments. In commercially nonsensitive areas—the biology research program and the thermonuclear fusion research program, for example—Euratom, it is generally agreed, has been more successful.

Much of the controversy and much of the interest has naturally centered on fast breeder reactors, in which Euratom has invested a heavy dose of R & D funds. Expectations for the breeder reactors' becoming the power-generating stars of the 1970's are high, and so, therefore, are the stakes. It is not surprising that it has been national attitudes toward the fast-reactor "pro-

totype" program of Euratom that have been the most sharply defined.

A case in point was the Italian project involved in the budget impasse resolved earlier this summer. The Italians have been unhappy about the use of large sums of Euratom money in fast-breeder projects dominated by France and Germany. Italian objection amounted to a charge that Italy was not getting a fair share of funds for such work, and that therefore Italy would be handicappd when the fast-breeder-reactor payoff comes.

The recent dispute dates back to an Italian project for the so-called RAPTUS reactor, for which Euratom provided support in the early 1960's. By 1964 or 1965 it had become clear that the RAPTUS project was unpromising, and the Italians decided to shift attention to building a testing reactor for fissile materials as a first step toward a fast breeder reactor.

It was suggested that Euratom support the projected Fuel Element Prototype reactor (or PEC, from the Italian) instead of the RAPTUS project. France opposed the PEC project and, because a change of program must be unanimously approved, this amounted to a veto. The French view was based at least in part on disagreement with the Italian approach. In developing a fast breeder reactor one of two general courses can be followed. One is to build a prototype fast reactor, as the French and the British have chosen to do. The alternative is to build a materials-testing reactor first and then proceed to the fast reactor itself, as the Italians propose to do.

The Italians had spent about $2 million of $9 million earmarked for the original project. Under the compromise of July, a contract between Euratom and the Italian Government provides a ceiling sum of $6.75 million for fast-reactor work in Italy. The agreement specifies that only work for which funds have been committed by the end of 1967 will be supported. Design studies for the PEC reactor may be included, but the Italians have had to forego their demands that PEC become a Community project.

As the fast-reactor program enters its second or commercial phase, tensions are expected to increase. France has agreed to extend its association with the Community on fast-reactor work to the end of this year. It had expired at the end of 1966, and the delay in renewing it had caused pessimistic speculation about French plans. The Dutch in par-

NEWS IN BRIEF

● **SCIENTISTS FOR MIDEAST PEACE:** Eighty American leaders in the arts, sciences, and public affairs have called on the U.S. government to initiate renewed action to induce the Arab States into direct negotiations with Israel. A statement signed by the 80, including 16 Nobel laureates, was sent to President Johnson. It was initiated by five scientists: Louis F. Fieser, professor of chemistry, Harvard University; Maurice Goldhaber, director, Brookhaven National Laboratory; Robert Hofstadter, professor of physics, Stanford University and 1961 Nobel laureate; I. I. Rabi, professor emeritus, Columbia University; and David Rittenberg, chairman, department of biochemistry, Columbia University. More than half of those signing the statement are scientists. The statement cites Israel's development as a center of intellectual dynamism and as "one of the world's great sources of scientific research. Enabled to develop in peace, Israel's contribution to the region and to the world may rival in fruitfulness and enduring quality that of the ancient state in the days of the Bible."

● **ARCHES OF SCIENCE AWARD:** James B. Conant, president-emeritus of Harvard University, has been named the 1967 recipient of the Arches of Science Award. The prize, consisting of $25,000 and a gold medal, has been given annually since 1965 by the Pacific Science Center, Seattle, to an American who has made the "outstanding contribution to the public understanding of the meaning of science to contemporary man."

● **WASHINGTON OUTPOST:** The National Association of College and University Officers (NACUBO) has joined the burgeoning number of university-connected organizations with national offices in Washington, D.C. NACUBO, which has a membership of about 1000 institutions, has not previously had national headquarters although it has represented 80 schools in Washington since 1961 through the office of its Committee on Government Relations. An announcement stated the new headquarters will serve initially to stimulate activities in professional development, and to disseminate information on technical matters. Kenneth A. Dick will head the office as its executive vice president. He previously was financial vice president of the University of Idaho. The committee and new national office will share offices at 1785 Massachusetts Ave., NW, Washington, D.C. 20036.

● **PEST CONTROL:** A role in international pest control has been assigned to the Federal Committee on Pest Control (FCPC). Donald F. Hornig, the president's science adviser and director of the Office of Science and Technology, announced the FCPC will advise U.S. pest control operations in foreign countries as well as be more directly involved in domestic policy matters "such as development of guidelines for the safe control of insects, rodents, weeds, plant diseases and other pests." The committee began operation in 1961 following its establishment by the secretaries of Agriculture, Interior, Defense, and Health, Education, and Welfare to review all federal pesticide application programs and to coordinate the pest control activities of the departments. Under its new charter the FCPC will also work closely with the departments of State and Housing and Urban Affairs, with state and local governments, and with international, local, and regional groups.

● **N.Y. APPOINTMENTS:** Two Nobel laureates and an economist have been appointed to the faculty of the State University of New York. Sir John Eccles, an Australian physician who was a co-recipient of the prize for medicine in 1963, will join the School of Medicine at Buffalo 1 July as a distinguished professor of medicine. His salary will be $36,000 annually. Julian Schwinger, a physics professor at Harvard University and co-winner of the award in physics in 1965, has been appointed distinguished visiting professor for physics at Stony Brook. His appointment is effective for the fall semester and his salary will be prorated at the rate of $35,000 a year. Kenneth K. Kurihara, lecturer in economics at Rutgers, was appointed distinguished professor of economics at Binghamton. Kurihara's appointment is effective 1 February. He will receive $28,000 a year.

ticular have expressed concern about French intentions and had declined to participate in the budget compromise unless the French gave assurances that the results of fast-reactor work done in France would be available to all members of the Community. The Dutch gave up this stand in the July compromise, but no assurances from France have been forthcoming.

German association on fast-reactor work is also scheduled to expire at the end of the year. German private industry, heavily supported with government funds, has moved into fast-reactor development work. Some observers feel that the French are progressing rapidly in fast-reactor development, but that French industry cannot exploit the new technology as rapidly as German industry can. For this reason there is speculation that the French are reluctant to see information going freely to the Germans. If the two dominant countries in fast-reactor development should not renew their associations on the work, Euratom would be left with a vast hole in its research program.

To some extent Euratom is facing the same transitional problems that the Atomic Energy Commission in the United States and the Atomic Energy Authority in Britain are facing. The advent of the competitive kilowatt-hour produced by fission-reactor-powered generating plants ends an important early chapter in Euratom's R & D effort. And private industry is assuming a rapidly increasing share of work on the fast reactors. With four research installations employing more than 2000 of its staff of 3000, Euratom, like the AEC and AEA, is beginning to think and talk more of diversification.

Here the scope for Euratom appears ample. The organization is the logical one to assume research responsibilities for the Common Market countries, and these responsibilities can only expand. Levies on movements of goods in the agricultural common market, for example, are accumulating, and the demand for agricultural research is sure to rise. These funds, and funds from the European development fund to be used in behalf of underdeveloped countries associated with the Common Market, could, in part at least, be devoted to research.

Euratom provides the existing mechanism most likely to be effective in dealing with the problems of the "technology gap," to which the Common Market is now addressing itself. What Euratom can do is already being explored.

This doesn't mean that Euratom will give up its work on atomic energy. Its task as an agency for the supply of atomic fuels is certain to grow. The Euratom inspection system, if it can be made to mesh with the larger system contemplated under a nuclear nondissemination treaty (*Science*, 21 July), will increase in importance. And Euratom's work in the dissemination of scientific information, if properly cultivated, should prosper.

If Euratom has proved something of a disappointment in its first 10 years, perhaps the reason is that too much was expected of it as a pathfinder for European integration. Euratom's experience proves, as much as anything, that its members are unready for real supranational cooperation, industrially as well as politically.—JOHN WALSH

Smale: NSF Shifts Position

The National Science Foundation last week substantially revised its position on the grant application of Stephen Smale. The change, a conciliatory one that is apparently aimed at bringing the case to an amicable conclusion, would open the way for Smale to continue as principal investigator of an NSF-supported mathematics research project at Berkeley (*Science*, 6 October).

At the end of August the Foundation suggested that Smale's application for renewal and expansion of support for himself and the group be broken down into at least two separate proposals. The suggestions, contained in a letter from William E. Wright, NSF division director for mathematical and physical sciences, stated that "one of the new proposals should confine itself strictly to the needs of Professor Smale without involving NSF support of other faculty members."

Last week, while letters of inquiry and protest continued to arrive at the Foundation headquarters in substantial numbers, a new letter signed by Wright, dated 23 September, went out to Berkeley. Alleging "numerous and widespread misinterpretations" of the August letter, it went on to state:

"The Foundation remains convinced that timely negotiations can result in a grant to the University of California with Professor Smale as principal investigator, which would support his research needs and those of his immediate collaborators in a manner completely consistent with our ability to sustain mathematical research generally."

Thus, after having sought to remove Smale as principal investigator, NSF, in effect, has taken the position that it is now willing to consider renewal of something resembling the arrangement that is provided for in the existing grant. No details were furnished as to the "numerous and widespread misinterpretations" of the August letter.

Smale responded that he is pleased by the new NSF position. But what he will do about it is not yet clear. He still insists that NSF substantiate or withdraw its charges of poor administrative performance on his part. He had also indicated interest in a proposal to NSF, originated by L. Bers of Columbia, that a small panel of mathematicians be appointed to look into and advise on the case. No action has been taken on the proposal.

Nor is it likely that any will be. For, in the matter of Stephen Smale, NSF's deepest longing is to put the case to rest and restore the sense of good faith that has traditionally existed between the Foundation and its academic clients. To turn the controversy, or any part of it, over to an outside committee might only serve to keep things boiling, when otherwise they might simply quiet down. In the view of some people associated with NSF this is especially so when the outside committee would probably be drawn from the ethereal ranks of mathematics.

Meanwhile, nothing more has been heard from Representative Richard L. Roudebush, the Indiana Republican who leaped in to take credit for NSF's initially negative response to Smale's grant application. At this point, it appears that the congressman belongs in the crowded camp of Washington "rainmakers." They incessantly beat the drums, and when it rains, they announce, "Look what I did."—D.S.G.