REPORT FROM EUROPE

Time of Trial for European Research Cooperation

London. This has been a year of some fulfillment and much trial for Europe's research programs. During 1964, efforts toward setting up cooperative experiments in the areas of cancer, fundamental biology, rocketry, space research, astronomy, high-energy physics, and nuclear energy made progress, and their continuance seemed assured, but clouds of uncertainty hung over most of them. On the side of progress were the coming into force of treaties, the selection of laboratory sites, and the successful operation of major equipment. Among the uncertainties were worries about the diffuseness of some of the efforts, the overrunning of budgets, the usefulness of equipment being developed, and the colossal cost of the logical next steps in the program.

That international research programs are not easy to define and launch is illustrated by the events that led up to agreement, in 1964, on a proposal to create an international center for research, documentation, and statistics on cancer. This center will probably be placed in Lyons, France, where the idea originated, and will work in association with the World Health Organization and the International Union against Cancer. In the first days of October, representatives of Britain, France, Italy, the United States, and West Germany agreed to present the idea to the next WHO general assembly, in April. Each nation that joined the center would make a fixed annual contribution. This plan was far less sweeping than the suggestion, endorsed by de Gaulle in late 1963, that nations donate 0.5 percent of their military budgets to a world war on cancer (*Science*, 28 August). The United States could hardly have been expected to endorse the spending of a sum considerably greater than the budget of its own National Cancer Institute on an international anticancer effort. Thus, agreement could be reached only on the more modest proposal.

Although efforts to develop a European Molecular Biology Organization continue, encouraged by the interest of private foundations, a proposal for establishing an international biological and medical laboratory to be attached to the World Health Organization is under a cloud. Not only was the idea sent back for further study at the last WHO general assembly but the recently dissolved Advisory Council on Scientific Policy in Britain strongly opposed it. The following excerpts from the Advisory Council's expressed views on the project are a significant comment on international collaboration in biology:

> The belief that the concentration in one very large institution of leading scientists from a number of countries would promote an interchange of knowledge and ideas which does not take place at the present time is, in our view, mistaken. We believe that, on the contrary, concentration of this kind might well have a sterilizing effect and reduce the influence of the people concerned on the development of research. . . .
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> [There are] disadvantages [in] concentrating the best scientific talent in one place, thus isolating it from teaching functions in national universities. . . . Centralized institutions [are] valuable only where research facilities required [are] of such an expensive character that they could not be provided on a national basis. The facilities required in this case need not be exceptionally costly nor beyond the means of most countries with a capability for the . . . research . . . in question.
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> [In] the biological sciences in British universities, something of a revolution is in progress, and a new biology—which is more closely associated with the physical sciences—is now developing. But there is still an insufficient supply of first-class scientists to lead research and teaching in this field at our universities, and our most urgent need is to increase the supply of suitably trained research workers. It would be harmful to [Great Britain] and to its progress in biological research if a number of our leading biologists were to withdraw to an international laboratory.

The closely defined project to establish a major European observatory in the Southern Hemisphere (*Science*, November 6) met with unalloyed success in 1964. After more than 10 years of discussion the five-nation treaty launching the project came into force. By year's end the European Southern Observatory had ordered two telescopes, and design was far advanced on two more. Field studies in South Africa continued, and the organization had acquired land in Chile as a site for its telescopes.

Also coming into force were treaties under which twin agencies would be set up to develop rockets and satellites for space exploration: the European Launcher Development Organization (ELDO) and the European Space Research Organization (ESRO) (*Science*, 17 April). For these projects, success was not unalloyed. To be sure, the Blue Streak rocket that will form the first stage of ELDO's three-stage satellite launcher was fired successfully at Woomera, Australia, and ESRO took a number of important steps. It reached agreement with the U.S. National Aeronautics and Space Administration for launching of ESRO's first two satellites (to measure cosmic radiation and ionospheric phenomena in polar regions) with rockets provided by NASA. From Salto di Quirra, an Italian launching site in eastern Sardinia, ESRO launched a rocket, in July, for studying diffusion and photoionization in the upper atmosphere through the release of clouds of barium and ammonia. ESRO formally decided to set up telemetry and tracking stations in Belgium, the Falkland Islands, and Alaska, and it signed an agreement with Sweden to use a site near Kiruna for launching rockets. The six experiments to be carried aboard the satellite for measuring cosmic rays (to be launched in the spring of 1967) were approved by ESRO's council in late November, as were the four to be carried aboard the satellite which will measure ionospheric phenomena (to be launched in the fall of 1967). The ESRO council approved 14 payloads to be launched from sounding rockets during 1965, and a provisional payload for a proposed medium-sized satellite for making stellar observations.

Nonetheless, both agencies faced difficulties. For ELDO, there were two

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problems. Costs have exceeded the original budget figure of $200 million by nearly $100 million, and it is not clear who is going to buy the ELDO launcher. Thus, the French and Italian governments some months ago requested a complete review of the ELDO program, and the ELDO administration is preparing studies for a meeting in January of ministers from ELDO countries. As for the rocket itself, called the Europa, it had been intended for use by ESRO and possibly for use in a European communications satellite system. But now ESRO will get its first two satellite-launching rockets free from NASA, and it has made no promise not to buy other U.S. rockets, which would presumably cost less than Europa. Meanwhile, development of the international communications satellite system dominated by the Americans proceeds rapidly.

An important part of ESRO's program has been a technical center somewhat similar in concept to NASA's Goddard Space Flight Center. According to the plan, the center is to be located in the Netherlands, the computer work will be done at a German calculation center in Darmstadt, and fundamental physical research will be done near Rome. The center's staff of 250 (the figure will rise later to 800) began working in buildings of the Technical University of Delft on the assembling of payloads for rocket and satellite flights. But the Delft site proved unsuitable. After months of talking, member nations agreed on a new site between Noordwijk and Leiden. Equipment and staff will be transferred from Delft as buildings rise on the new site. While ESRO's council, at its December meeting, approved the 1965 budget ($35 million in contracting authority and $17 million in payments), it also decided that a review of the scientific, technical, and financial aspects of the 8-year ESRO program was needed.

European Center for Nuclear Research

During 1964 the European Center for Nuclear Research (CERN) in Geneva reported a number of technical and scientific achievements. In June, use of a British 1.5-meter liquid-hydrogen bubble chamber in connection with the experimental program of the 28-Bev proton synchrotron was initiated. In the first experiments with the chamber the interactions of high-energy negative kaons with protons were studied. On 13 December, the 2-meter CERN liquid-hydrogen bubble chamber was tested for the first time, and the test was successful. This chamber will be used for research during 1965.

On 10 October CERN entertained officials from its member countries in celebration of the 10th anniversary of the date on which the CERN treaty become effective. Edoardo Amaldi, head of Italy's National Institute for Nuclear Physics and a leader in CERN's founding, cited a number of reasons for CERN's success: its clearly defined objective; the fact that this objective reflects the aspirations of scientists; and its policy of integrating its research program with national efforts.

In June, participants at a London meeting sponsored by the Society for Visiting Scientists gave additional views on the reasons for CERN's success. CERN's studies are abstruse, they said, removed from immediate civil or military exploitation, concerned with matters a politician would rather steer clear of—matters he can leave to others. Since little money is to be gained soon from high-energy physics, there are few black marks if such a project founders. As the politician sees it, the center's by-product is prestige for Europe and for the idea of European cooperation. CERN, he says, has striven for an American-style informality and ease of information exchange, but has not become a thief of talent because few scientific posts at CERN are permanent. CERN focuses on a single big machine, the proton synchrotron; the construction of the synchrotron held everyone together for 7 years, and its existence prevents dispersal of central research activities among member states. The project was so expensive that it demanded collaboration from most of Europe. As the scientist sees it, through research with the big proton synchrotron Europe can reasonably hope to compete with the Americans in making fundamental contributions to knowledge. Many observers feel that leaders of other cooperative efforts in Europe have failed to note the special reasons for CERN's success and to learn through CERN's experience.

CERN has its own difficulties, however. Its administration seeks money for exploiting the capabilities of the existing machines more fully and, in addition, large capital outlays for adding a set of storage rings to the proton synchrotron, for building a new proton synchrotron about ten times the size of the present one, and for building several smaller accelerators in various regions of Europe (*Science*, 22 May).

CERN's council has given fairly strong backing to studies of a unified plan for the future of high-energy physics in Europe. At its most recent meeting (15 and 16 December) the council approved expenditure of a supplementary $1.6 million for more studies, a considerable increase over the $0.9 million approved for this purpose for 1964. Also, the idea that budgets will be steadily expanded seems established. From a plateau of about $13 million reached in 1957–59, at the end of the construction phase, the budgets rose steadily to $25.2 million in 1964. At its December meeting the council approved a 1965 budget of $30 million and an estimate of $31.4 million for 1966.

But it is another matter to find $60 million for the storage rings and $340 million for the large accelerator, and to build up European spending on high-energy physics to $375 million a year by 1977. For example, the British Advisory Council on Scientific Policy has calculated that scientific spending through research councils and the University Grants Committee should almost double by 1970, increasing from $216 million in 1964–65 to $406 million. Of this sum (about one-fourth Britain's total expenditure on research and development), Britain's contribution to CERN would take $30 million if construction of both the storage rings and the new accelerator were approved and started, while Britan's own National Institute for Research in Nuclear Science would demand another $39.2 million. Restating doubts first expressed in late 1963, the Advisory Council said it had "accepted the scientific case for the proposed developments but emphasized the urgent need, before decisions were made on the proposals, to explore fully the possibility of international cooperation in constructing a machine of very high energy." It also put on record its view that "further substantial expenditure on high energy physics could not be justified unless adequate support was assured for the legitimate needs of other branches of science."

Informal meetings among Soviet, U.S., and European physicists at Vienna during the summer had showed, the council said, that there was "no immediate prospect of intercontinental construction of an accelerator of energy in the 300 bev range," and that the time was "not yet ripe for discussing intercontinental collaboration in the construction of an accelerator of energy in very much higher ranges." So the ball was back in the hands of CERN and its member nations. And these nations, said the Advisory Council, cannot consider the new machines "in isolation from the needs of other areas of science."

Faced with these difficult issues, the CERN council will meet again in March to decide whether to build the storage rings. In December the council approved, in principle, a report by CERN's scientific policy committee, headed by Louis LePrince-Ringuet, which urged a decision on construction of the 300-Bev accelerator in 1966 or 1967.

European Atomic Energy Community

The disagreements about the future of CERN's basic research program seem relatively polite next to the arguments that went on during most of 1964 about the work of the European Atomic Energy Community (Euratom) in developing nuclear energy.

It is true that Euratom took one notable step forward in 1964, the signing of an agreement to develop a fast breeder reactor in Arkansas, a project on which Euratom, the U.S. Atomic Energy Commission, the research center at Karlsruhe in West Germany, and 17 American utility companies will collaborate. The agreement also provides for supply, by the U.S., of 350 kilograms of plutonium for European reactors such as the Rapsodie at Cadarache, France. Many observers feel that the agreement will significantly hasten the development of breeder reactors, which must play an increasingly important role in nuclear power as the demand for fissile material mounts.

Since its establishment in 1958 under the same treaty which set up the six-nation Common Market, Euratom has created large research groups at such places as the Belgian Nuclear Energy Center at Mol and an Italian research center at Ispra. At Ispra, the design for a heavy-water reactor with an organic moderator is being studied. Euratom's budget was expanded from $215 million in the first 5-year plan (1958–62) to $425 million in the second (1963–67). The budget of the second plan includes about $16 million for a biology program, administered by R. K. Appleyard in Brussels. The biology program pays for direct research done at Mol by a group under E. di Ferrante and at Ispra by a group under P. Bourdeau, and for other work done under contract by various biological laboratories. More than 25 such contracts have been signed, and at least 15 more have been approved. Euratom has also established a joint training scheme, with laboratories in Paris, Tubingen, Brussels, Leiden, and Naples.

Programs like the one in biology are in jeopardy because of a growing feeling on the part of governments of some Euratom members that Euratom's budget has gotten out of hand, and that the agency is straying from its prime purposes of developing reactor technology and conducting research on thermonuclear fusion. The member nations of Euratom were quarreling until just before Christmas about the direction its research effort should take—the effort which has become Euratom's central function since the original idea of constructing many power reactors faded. These reactors were to free Europe from dependence on Middle Eastern oil, which was cut off during the Suez crisis of 1956, but then supplies of conventional fuel became larger and cheaper. Hence, Euratom could move at a slower pace; under a special U.S.-Euratom plan, construction was started on only three reactors.

The quarrel of 1964 is not likely to end in retention of the status quo. A redirection of Euratom's research is in the wind. The member nations—Belgium, France, Holland, Italy, Luxembourg, and West Germany—did not agree on everything, but they did agree that Euratom had undertaken too many disconnected lines of study.

Euratom's executive commission provided the opening by asking for a 10-percent increase in the 1963–67 budget to allow for development of new ideas and for inflation. Member states, notably France, replied with memoranda criticizing the whole Euratom program. The French attacked Euratom for not having spent more money on France's graphite-moderated, gas-cooled natural-uranium reactors. Euratom executives replied that the French were too secretive about the details of these reactors, and added that the power authorities choose reactors for themselves, on the basis of economic considerations, which at present favor U.S. enriched-uranium reactors. But France was joined by other member states, notably Germany, in opposing any upward revision in the budget. There followed several months of wrangling over which projects might be cut. Italy objected to most cuts. Holland wanted the laboratory at Petten, Holland, to be made a general research center, and France adamantly opposed this. Euratom's executive commission itself then came forward with suggestions for cuts. Meanwhile, approval of the budget for 1965 was held up by the arguments over the total program.

Finally, the Euratom council of ministers adopted a compromise budget in which spending for 1965 was reduced from $90 million to about $76 million. The budget was approved only on condition that Euratom's entire program be reviewed by 1 April. If the Euratom commission's proposals for cuts are any clue, review of the program will mean reductions in most items except projects for developing fast reactors and fusion.

To some observers, the difficulties now being faced by many of the collaborative European research projects are a sign that some efforts fit the criteria for a successful international project better than others, and that international projects are inherently hard to start, hard to run, and hard to stop. This may be true, but most American readers are familiar with the rigidities of many research projects in a country of continental dimensions. In the United States, too, one sees intense bargaining among regions or among enterprises which have gained momentum. Some of the problems in Europe stem from the normal difficulties of redirecting large research or development programs whose basis has weathered away. Nuclear-energy or aerospace laboratories in the United States have faced these problems for two decades. The bargaining in Europe over which countries will get the research contracts and the research centers cannot be avoided in all fields as it has been avoided up to now in high-energy physics. Such competition seems to be only somewhat more rigorous than the tussles in the United States over the location of accelerators and research centers.

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