burgh. As Kurtzman readily points out, "as long as you have a $21 million excess of obligations, there's still a financial crisis." Even under the financially helpful state relationship, the University of Pittsburgh still needs large grants from corporations, trusts, and wealthy private givers. University officials hope that the state relationship will not serve to convince private givers that they no longer need to support the university. In light of this concern, university officials were understandably joyous in December when the Richard King Mellon Trusts announced a gift of $3.23 million for the creation of a department of neurology in the School of Medicine, the first major private gift to the university since it became state-related. The Mellon family's gifts have represented Pitt's largest single source of private support, and the university seized eagerly on the comment, in the letter announcing the gift, that "this grant can be taken as a reaffirmation of the faith of the Trustees of the Richard King Mellon Charitable Trusts in the University's future."

But the Mellons and other private givers have tended to lavish most of their gifts to the university in the areas of medicine and public health. No doubt many faculty members and administrators who have remained loyal to the university during the financial crisis expect their own areas to be better funded in the future than they have been in the past. Samuel P. Hayes, chairman of the history department, expresses the views of many of his colleagues in the academic disciplines when he says, "People here won't be satisfied unless there's a major drive to support the university with free and unallocated funds."

One of the main points of contention between Litchfield and the trustees was the amount of money the trustees had agreed to raise to help build Pitt into a great university. At one point Litchfield mentioned the figure $125 million, but the trustees always shied away from such specific figures. They still seem wary of making any specific financial commitments to their chancellor. When this reporter asked William H. Rea, the man who has now replaced Price as chairman of the board of trustees, what financial commitments the trustees had made to Posvar, Rea emphatically replied, "None." Rea explained that Posvar was a realistic man who didn't expect such arrangements. Posvar confirmed the statement that no financial commitments for the university had been made to him by the trustees.

In recent years the trustees of the University of Pittsburgh have chosen two men to assume the long task of making Pittsburgh a university of nationally recognized excellence. There are certain superficial similarities between Edward H. Litchfield and Wesley W. Posvar. Both lifted themselves to positions of prominence at an early age through their own abilities; both are political scientists; both were 41 when called to the chancellorship at Pittsburgh; both had held positions in academic administration but neither had headed a university before coming to Pitt. The trustees took an immediate liking to both men and made quick decisions to appoint each chancellor.

But such "liking" is put to a hard test when it comes to running a university as complex as Pittsburgh. As chancellor, Posvar will have to keep an ambitious faculty and student body happy, will have to maintain the confidence of the elected officials of Pennsylvania, and—perhaps most important of all—will have to encourage the Pitt trustees and other financial powers in the Pittsburgh area to increase their support of the university. Hired as an educator, the new university chancellor may soon conclude that his place in educational history will be largely determined by his skill in opening up the hearts and the coffers of the financial potentates of Pittsburgh.—BRYCE NELSON

CERN II: The Strong Focus Is on the 300-Bev Machine

London. There is no such thing as institutional genetics, but universities, research institutions, and government agencies seem to reproduce themselves in ways that perpetuate the old familiar strengths and defects. Among national institutions a pattern, a tradition, a style develops and hardens. Only when radically different demands arise is the mold likely to be broken.

When the European Organization for Nuclear Research (CERN) was conceived, multinational influences and special circumstances were sufficiently strong so that no particular academic or bureaucratic pattern was imposed. CERN consequently had latitude to develop an internal structure and external relations fashioned to meet its specific needs.

As J. B. Adams, now a member of the United Kingdom's Atomic Energy Authority but an influential figure in CERN's formative phase, and others have noted, the next step is for CERN innovations to become a new orthodoxy. In a more than usually candid essay on CERN in a recent book on research organization* Adams observed, "future European laboratories will no doubt be modeled on the system that CERN developed during these years, and depending on its ultimate efficacy, be either blessed or saddled with it."

Adams was alluding principally to the organization for research within the laboratory itself, but much the same thing can be said of CERN's relations to scientists in the CERN member countries and to the governments which support it. CERN successfully put high-energy physics into a European framework (*Science,* 27 January), and the CERN formula will no doubt be imitated in future "regional" research organizations. This does not mean, however, that CERN has solved for the member countries the problems they face in planning and financing their national programs in high-energy physics or in other sciences.

It was clear to CERN's founders that, if European scientists were to continue to work on the advancing frontier of research in their field, the demand for much more powerful and costly accelerators would have to be met by regional efforts. At the same time it was recognized that integration

**The Organization of Research Establishments,* Sir John Cockroft, Ed. (Cambridge, Univ. Press, London, 1966).

of national and European programs in particle physics research was essential if CERN was to flourish.

In both Europe and the United States high-energy physicists have realized that it was necessary both to plan ahead and, as the costs mounted, to support their requests with increasingly persuasive arguments.

In the U.S. in 1963 a panel formed jointly by the General Advisory Committee of the AEC and the President's Science Advisory Committee put forward a grand design for a national construction program for high-energy physics. Topping the list was a recommendation for construction of a 200-Bev proton synchrotron, which has traveled along the road to reality as far as selection last month of a site (*Science*, 23 December 1966). Recommended also in the 1963 report were a design study for an accelerator in the 600- to 1000-Bev range, construction of storage rings for the Brookhaven AGS machine, and construction of a 15.5-Bev very-high-current FFAG (fixed-field alternating gradient) accelerator.

In the same year European high-energy physics got its own grand design. Under CERN auspices a meeting of leading physicists was convened to consider plans for the construction of accelerators in Europe. Those who attended the meeting constituted themselves the European Committee on Future Accelerators (ECFA), and the committee set up a working party under the chairmanship of E. Amaldi (Italy) to propose specifics.

ECFA confirmed the recommendations of the group, and the Amaldi report became, substantially, ECFA policy on future accelerators. The two priority items for the European program on the ECFA list were intersecting storage rings for the CERN 28-Bev proton synchrotron and construction of a new accelerator of very high energy—a 300-Bev machine to be completed between 1973 and 1975.

Most of ECFA's members are university-based researchers, who feel that ECFA has evolved into an entity independent of CERN. ECFA has from the beginning been concerned with problems of balance between regional and national programs, and in its original report it put forward a program of two complementary parts, "summit program" and "base-of-pyramid program," names referring, respectively, to regional facilities and facilities in member states. The pyramid connotation may be a little unfortunate since the original pyramid builders contributed more to the grandeur than to the economic development of ancient Egypt, but the image is a convenient one and has become standard usage in Europe among those concerned with planning and paying for accelerators.

Progress has been made with the base-of-pyramid program, but the major milestone achieved in the quest for higher energy has been the decision to construct the intersecting storage rings (ISR) at CERN. The ISR repeats the configuration of the 28-Bev proton synchrotron at CERN (see photograph) and consists of two concentric 300-meter-diameter rings of magnets. The stationary target used in conjunction with the ordinary accelerator is supplanted. Protons ejected from the proton synchrotron and "stacked" in the fields of the two magnet rings travel in opposite directions. The two high-energy proton beams themselves collide. The rings, slightly distorted, are designed to intersect in eight places so that collisions will occur at the points of intersection in the rings themselves, where a very high vacuum has been created.

For experimentalists the ISR will have certain inherent limitations and perhaps some difficulties which are now only dimly seen. Only proton-proton collisions will occur—the ISR will not permit observation of the behavior of mu mesons or K mesons or other particles—and relatively few collisions will occur as compared with the number in the typical accelerator experiment. Because the collisions will occur in the vacuum vessel which is an integral part of the rings, rather than in a target, new types of detectors will have to be developed. Proponents of the ISR have argued successfully that the difficulties can be overcome and that the potential results from ISR experiments fully justify the project. Under some conditions, it is argued, events can be created which would otherwise require an accelerator with an energy above 1600-Bev.

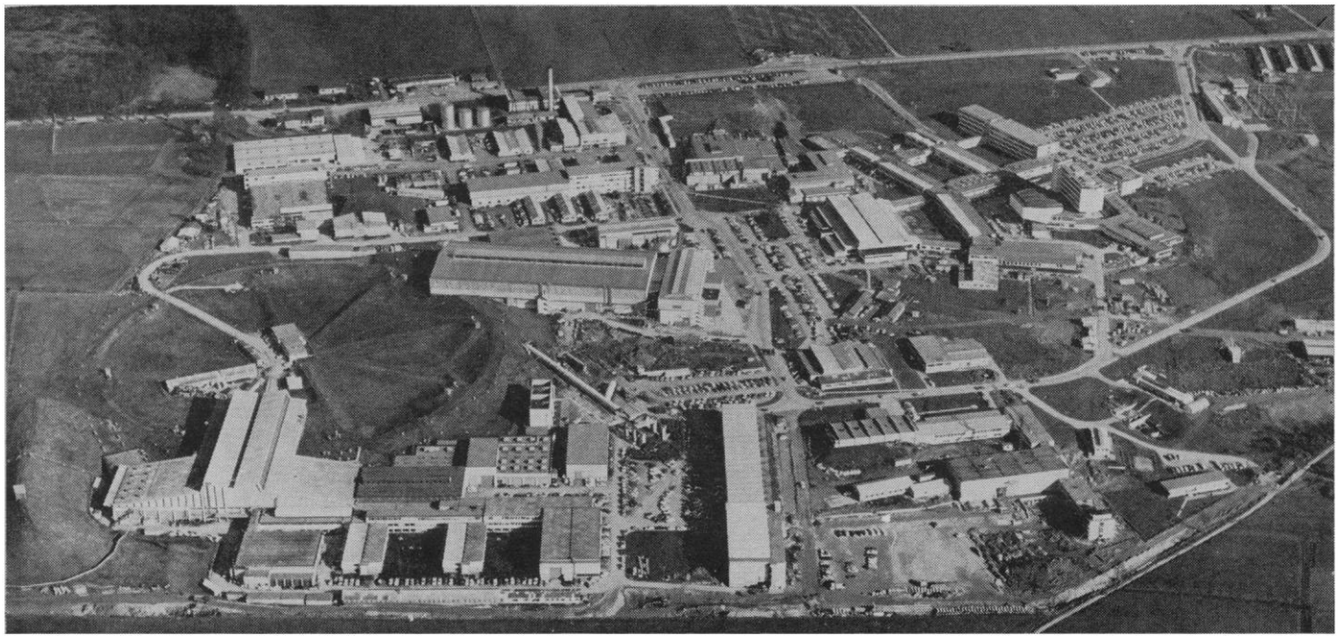
Construction costs of the ISR project, to be spread over 6 years, are put at 332 million Swiss francs (about $85 million at 1965 prices). Some physicists had reservations about the ISR project because it might reduce chances for approval of the 300-Bev accelerator. The decision to go ahead with the storage rings probably owes much to the widely shared desire to extend the productive life of the CERN laboratory and, not incidentally, to keep CERN design and engineering teams occupied and intact while greater things are planned.

With CERN committed to the ISR project, major attention has shifted to the 300-Bev machine, on which the longer-term hopes and aspirations of Europe's particle physicists are centered. At the CERN council meeting in mid-December the big machine was the major concern, although, at least at the beginning of the meeting, it was not a matter for which CERN formally had any responsibility. The CERN council, however, is obviously the natural forum for discussion of such a project, and one of the principal decisions taken by the council was to undertake to revise the present convention to include responsibility for the 300-Bev machine. There had been some debate over whether a separate council and administrative apparatus should be created, since membership of CERN II, so to speak, is expected to be slightly different from that of the present CERN, which is already being referred to as "CERN-Meyrin" (Meyrin is the satellite city near Geneva in which CERN was established).

Action on the convention has been scheduled for this year, and a draft convention is to be placed before the council at its June meeting by a CERN working group. Legal experts from the British and French foreign ministries are to sit in on the drafting meetings.

The sensitive subject of site selection has also been put on a timetable with an ambitiously early decision date. Nine sites are still under "active study." A report on characteristics of the sites has been scheduled for June, and a committee of three—dubbed "the three wise men" at CERN—who were chosen from countries with no site in the running and who, therefore, presumably have no axes to grind, will make specific recommendations. Geotechnical studies of the nine sites are uneven in detail, and all will have to be brought to the same level to provide a homogeneous basis for decision. It is tacitly acknowledged that, when the scientific arguments are in, bargaining at the political level will begin in earnest.

Construction costs for the big machine are put at a total of 1500 million Swiss francs (over $350 million). (This includes the cost of experimental equipment and would be expended over a period of about 10 years, with heavier expenditures coming toward the end of the period.) CERN has a good



The CERN facilities at Geneva. Storage Rings are being built adjoining the proton synchrotron on a wedge shaped piece of land extending from the left of the picture.

record of keeping projects within time schedules and cost estimates, and it wants to maintain it.

Design of the machine itself is regarded as no great hurdle. The degree of technical innovation required will not be excessive; the general features of the machine have already been agreed on. On the other hand, marked advances in injection and beam-handling aspects are being called for, and this will place substantial demands on the designers. If and when the go-ahead is given, it is probable that a design team with about 25 key people would be assembled. There seems to be no question that there is in Europe—particularly in Britain, France, and Germany—sufficient talent in accelerator design to do the job very well.

ECFA has two working groups currently occupied with problems raised by the 300-Bev machine. One group is surveying technical questions, especially questions about the kind of experiments which would be done and the kinds of accessory equipment needed.

The other ECFA working group is looking into manpower and financial questions. Member governments are increasingly concerned not only with the very sizable expenditures required for particle physics research but also with the effects of these programs on the training and utilization of scientific and technical manpower.

Justifications are important, since the basic decision on whether or not to build the 300-Bev machine is scheduled for the CERN council meeting to be held next December. National contributions for the project would be related to national income, as is the case with CERN. Until now, member nations have made contributions for preliminary studies on the big machine, but the sums involved have been relatively small. The member nations must now decide—and the decision is particularly thorny for small nations—whether they will be able to participate in the new project and at the same time support a sufficiently viable national program to make it all worth while. (Staying out of such a project would have costs of a different kind.) Inevitably the spotlight will fall on the three countries which would provide more than 60 percent of the budget—Britian, France, and Germany. In the preliminary phase France has been a strong advocate of the project, but, under de Gaulle, surprises in science policy as well as in other realms are regarded as possible. Germany appears to have entered a period of political and economic uncertainty, and Britian in the coming year will at best be passing through a period of recuperation, when projects of the size of the one in question will be exhaustively analyzed on the grounds of both money and manpower.

Arguments for the big machines will doubtless be aired more freely in coming months on both sides of the Atlantic. In Europe the arguments fall into two general categories. On the one hand it is argued that unless the 300-Bev machine is built, and built so that it comes into use in the late 1970's, the gains made at CERN both in international cooperation and in restoring European physics to the front rank can be lost. On the other hand, more "practical" arguments are advanced. No country which is a member of CERN has a major space program, it is pointed out, and high-energy physics has provided a kind of substitute by imposing demands for instrumentation, materials, and so forth which have forced the rate of advance of European technology.

When a decision on the 300-Bev machine is made, either in December or later, the nonscientific ingredients will obviously be important. Choice of a site will no doubt be the subject of hard bargaining. Balance of payments considerations alone insure that. Seemingly remote factors, such as the British application for entry into the European Common Market, could figure as well. If France resists British overtures, which is now regarded as likely, Britain may be less anxious to participate in a European scientific venture of such proportions. Should negotiations go well, the British Foreign Office might throw its weight on the side of participation. All of this is highly speculative, but in Europe as in the United States the fate of the big machine will be decisively affected by the way the economic and political winds blow.—JOHN WALSH