Weisskopf Panel Reports on High-Energy Physics in Next Decade

High-energy physics support ought to increase by an average of about 8% per year over the next decade, but in the first few years a larger increase will be needed to construct the 200-GeV Batavia accelerator, according to the High-Energy Physics Advisory Panel of the Atomic Energy Commission. In a recently issued 164-page report the panel, chaired by Victor F. Weisskopf, also recommended that a storage ring be built at the 20-GeV Stanford Linear Accelerator Center (SLAC) at the earliest possible date and that the next big accelerator make protons with 2000 GeV or more. By 1980 high-energy physics would be costing $480 million per year.

Weisskopf said that such an average increase would be in line with the increased support that can be expected in the future for basic science in general, so the panel is not asking any special consideration for high-energy physics. It would continue to receive between 5 and 6% of the support of all basic science from federal, state and industrial sources.

Current research. The recent budget tightening for physics research has kept high-energy support roughly constant in dollars over the last three years; this meant steadily decreasing support in actual value, the report noted. The decline occurred at a time when major new facilities were starting; SLAC for example, has not had enough money either to operate the machine full time or to run counter experiments simultaneously. The report urges that the budgets of existing high-energy laboratories and university research groups be increased by 10–15% per year for a few years to avoid further deterioration of research capability.

Equipment funds have been cut severely in the last few years, apparently to limit expansion of existing facilities; the panel urges that the equipment budget be restored to meet current needs of existing programs, provide for needs associated with new facilities and allow for development of new devices.

Immediate future. Completing the Batavia accelerator should have the highest priority for the near future, the panel says. Future budgets should allow for an energy increase to 400 GeV or more, once the machine has operated successfully at 200 GeV and some experience with research at this energy has been acquired.

Although the first successful colliding-beam experiments with electrons took place in the US, most of the present work is going on in Western Europe and Novosibirsk, USSR. The panel urged continued support of the storage-ring by-pass at the Cambridge Electron Accelerator and construction of an electron–positron device at SLAC.

Two huge bubble chambers are considered for the Batavia National Accelerator Laboratory (NAL). The 12-foot (3.7-meter) hydrogen chamber nearly finished at Argonne should be considered for removal to Batavia two years from now (if present schedules continue to be maintained). For neutrino physics, a larger chamber with higher magnetic field is essential, the panel says. It urges early construction of the 25-foot (7.7-meter) hydrogen chamber, which has been jointly proposed by Brookhaven and NAL; it would provide four times the neutrino interaction rate of the 12-foot chamber.

Support for cosmic-ray particle physics should be doubled; the sums are relatively small and offer a unique opportunity to do experiments at ultrahigh energies. The panel does not think a large national cosmic-ray laboratory is needed right now.

The panel urges that negotiation continue toward participation of US physicists in work at the 76-GeV Serpukhov accelerator in the USSR.

Future projections. Because the NAL accelerator can reach 400 GeV, the next step beyond should be 2000 GeV, the report says, and the machine should accelerate protons.

New technologies applicable to accelerator design are exceedingly promising, but none is far enough along

CONSTRUCTION PROGRESS AT BATAVIA. Building for the linear accelerator, which accelerates protons from 750 keV to 200 MeV, is at rear. At left is the enclosure for the booster synchrotron, which accelerates the 200-MeV protons to 10 GeV. Weisskopf panel says completion of 200-GeV accelerator should have highest priority for near future. Machine is scheduled for operations in mid-1972.

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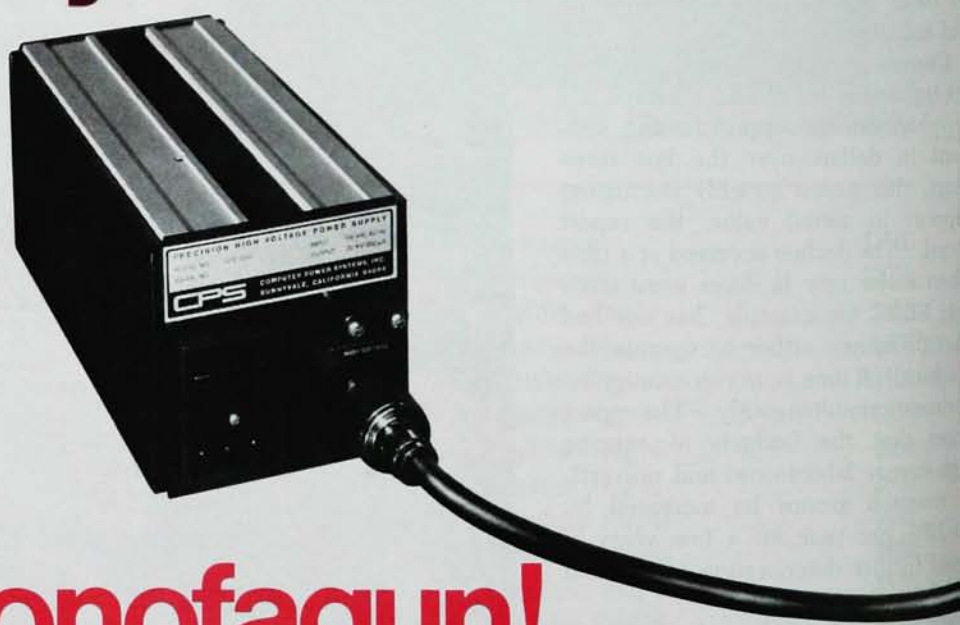

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that definitive designs can be made, according to the report. There are several promising approaches:

In the electron ring accelerator concept a ring is compressed, protons are trapped and then the ring can be accelerated. Experiments in the coming year will test ring stability and feasibility of magnetic expansion. Potentially the accelerator could produce high-energy protons in a structure of moderate length.

A superconducting alternating gradient synchrotron could have a stronger magnetic field with less power consumption and ring size than conventional machines. So far superconducting magnets with time-varying fields have shown excessive power losses; but recent work with highly stranded, twisted conductors suggests this problem may be solved soon.

Because the resistance of some very pure metals drops by several factors of ten at low temperatures, one could make high-field pulsed magnets for accelerators out of aluminum, say. Cryogenic refrigeration costs might be lower than that required for superconducting magnets.

Superconducting electron linear accelerators could provide higher energy per length than conventional linacs and offer a nearly continuous beam rather than the short duty cycle required by the high dissipation of power in conventional linac walls.

Several varieties of accelerators with superconducting dc magnetic fields have been proposed.

These new techniques are applicable not only to accelerators but also to detection equipment and beam transport. The report urges both intellectual and financial support for such research and development.

The panel believes that results from Serpukhov and Batavia will show many interesting phenomena between 30 and 200 GeV; it anticipates the need for revitalizing existing laboratories by increasing the energy of proton and electron accelerators into this range. As possibilities the report suggests that the SLAC accelerating structure could be replaced with superconducting microwave cavities and the Brookhaven AGS could have its energy boosted by using superconducting or cryogenic magnets.

Proton-proton storage rings should be added to the Batavia accelerator after some experimental experience with the CERN 25-GeV storage rings, according to the report. At present 100-GeV intersecting rings appear feasible for NAL, the panel notes.

The Physics Dropout: What Turns Him Off?

Why do physics students drop out and where do they go? This question stimulated a special attrition study by Susanne D. Ellis, supervisor of manpower studies at the American Institute of Physics (reported in *Physics Manpower 1969*, AIP publication No. R-220, August 1969). The study was supported by NSF.

Between 1960 and 1966 the number of college juniors who elected a physics major declined steadily, and of that decreasing group of junior-year physics majors more than one quarter dropped out of physics before completing the bachelor's degree. Furthermore, a sizable fraction of the physics students did not complete the graduate degree for which they enrolled.

A 70% response was received to questionnaires sent to former physics students and to those remaining in physics, who acted as a control group. The "dropouts" were subdivided into four categories: those dropping physics as an undergraduate major, physics bachelors who hold nonphysics jobs, physics bachelors pursuing nonphysics graduate study, and physics graduate "dropouts."

A qualitative analysis shows that there was no dominant reason why students abandoned physics at any one point. Also, the "dropout" does not differ on the following indices from his counterpart who remains in physics: sex, marital status and father's occupation. Most of the physics students are male; approximately one third are married; and the greatest percentage of their fathers are professionals, very few of them being physicists.

Students who remain in physics are more likely to come from doctorate-granting institutions.

Those who went on to graduate study had higher undergraduate grade averages than those who accepted immediate postbaccalaureate employment. But there was no significant difference in the undergraduate performances of students who do graduate work in physics and those who leave their graduate work altogether or study another discipline.

The control group offered the following recommendations for attracting and retaining physics students: more opportunities for individual research in college, more stimulating classroom presentation, and an improvement in student-faculty interactions.

Tax Reform Bill May Limit Scientific Society Activities

The tax reform bill passed by the House of Representatives in August severely limits activities of private foundations, which are defined as any organizations that are tax exempt under Section 501 (c) (3) of the Internal Revenue code. Four types of organizations are excluded, but none of these appear to be clearly scientific and engineering societies and federations of such societies. Private foundations would be limited in making their views known to Congress, and their advertising income from publications would be taxed, whether or not the publications are related to the exempt purpose of the organization.

The Senate Finance Committee was scheduled to hold hearings on the bill beginning in September or October. Several technical societies, including the A.I.P., are offering to present their views during the hearings.

NSF Announces Plans for 1970 Expenditure Limits

The National Science Foundation is imposing institutional expenditure limitations for fiscal year 1970; it is assuming that its own expenditure limitation will be about $495 million. Institutions (136 of them) whose expenditures for FY 1970 are estimated to be greater than $500 000 would be subjected to the limitation.

NSF will not impose limitations on major construction projects; reductions in these activities were accomplished by limiting amounts and numbers of new awards. Also exempt from expenditure limitations are fellowships, traineeships, travel awards and summer education programs.

Crystallographers Elect Guinier as New President

The new International Union of Crystallographers president is André Guinier, professor of solid-state physics at the faculty of science of Paris (Orsay), France. He succeeds N. V. Belov of the Soviet Union and will