is not yet complete but is expected to be ready for experimental use in July.

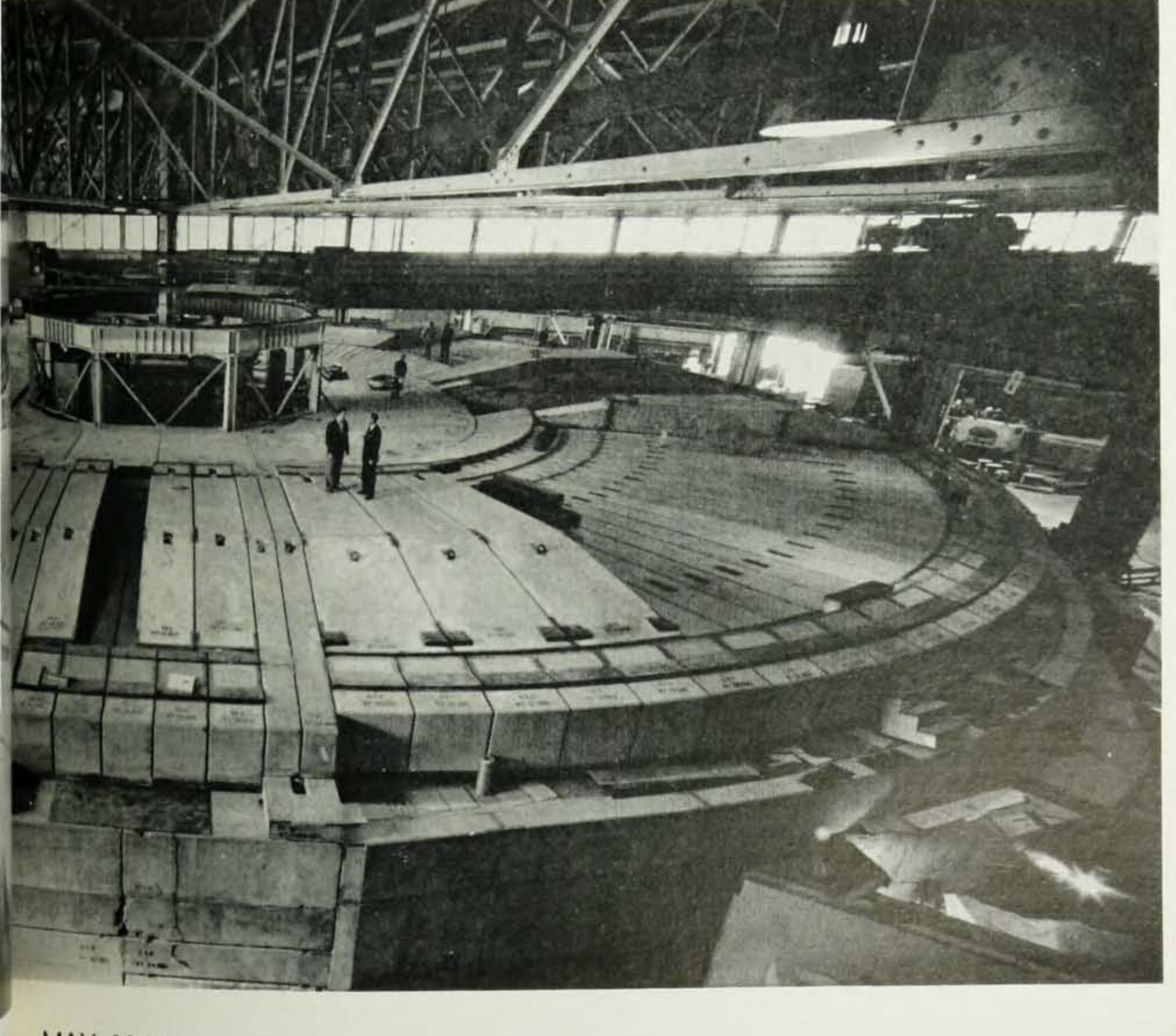
Because of the potential increase in beam intensity, the machine has been completely enclosed in concrete shielding. Formerly, a wall of concrete surrounded the outside of the Bevatron, with the top open. Some 13 000 tons of new concrete have been added to the 4000 tons used earlier. Shielding thickness is generally ten feet, with a minimum of seven feet in noncritical areas.

As a result of the alterations, it will be possible for three different experiments using the primary beam to be conducted at the same time. Relatively copious amounts of positive strange particles will be available. The K^+ intensity, for example, will be raised from about 50 particles per pulse to 5000 or more, yielding in turn, tertiary particles (e.g., K^0) in numbers adequate for study. In addition, higher-energy studies of secondary particles will be possible. The Bevatron previously produced pi mesons in sufficient numbers for good study at 2 BeV; now it will produce comparable numbers at 4 BeV.

Needs in Nuclear Structure

A committee of physicists convened by the National Science Foundation to study current research trends in nuclear-structure physics has expressed the view that the next few years should bring significant advances in the understanding of nuclear structure and has recommended that considerable support be committed to endeavors in the field. The conclusions expressed in the report of the committee are based on the group's examination and interpretation of recent theoretical and experimental developments in nuclear physics.

The report notes that in the theory of nuclear structure, the liquid-drop model, which is relatively unamenable to analysis by present mathematical techniques, is gradually giving place to the conception of



the nucleus as a dense core surrounded by a cloud of weakly interacting nucleons, a description which yields readily to the techniques of mathematical physics. The committee reviewed the development of experimental techniques (i.e., the construction of accelerators in the required energy range with extremely homogeneous and reliable beams, the incorporation of very rapid, high-resolution detection equipment in the apparatus, and the integration of high-speed computers in the detection equipment) and concluded that it is now possible to answer critical theoretical questions which could not previously be put to experimental test.

The committee made the following general recommendations: Appropriations for major facilities should be increased immediately; over the next five years sums between \$22 million and \$35 million per year should be expended. The operating budget for nuclear-structure research should be increased to permit procurement of auxiliary equipment for existing facilities; by 1967 the operating budget should be between \$70 million and \$90 million. Housing for accelerator laboratories should be underwritten as an integral part of the installation. Replacement of obsolete and inefficient equipment should be encouraged. Support should be given both to fundamental theoretical studies and to studies of the analysis of experimental results by newly developed computational techniques.

In the committee's view, the recommended increases in support for research in nuclear structure would be of benefit to all branches of physics. On the one hand, the study of elementary particles at high energies would benefit from a better understanding of nuclear processes and of the interactions between primary particles. On the other hand, the study of atomic physics and of the physics of gross matter would have a firmer foundation if more were known about the details of nuclear structure. Physics education would also benefit. Compared with other highly active fields of research, the cost of construction and maintenance of low-energy equipment is moderate, and therefore more feasible for smaller academic institutions. Furthermore, experiments can be done by fewer people than are likely to be required in high-energy programs. Thus smaller faculty groups could undertake research, and students would have the opportunity to become vitally involved in the programs.

The chairman of the panel was W. W. Havens, Jr., of Columbia University; other members were the late Tom W. Bonner of Rice University, D. Allan Bromley of Yale, Bernard L. Cohen of the University of Pittsburgh, Herman Feshbach of Massachusetts Institute of Technology, Hans Frauenfelder of the University of Illinois, J. Bruce French of the University of Rochester, Gertrude Goldhaber of Brookhaven National Laboratory, Emil J. Konopinski of Indiana University, Thomas Lauritsen of California Institute of Technology, Rubby Sherr of Princeton, and George M. Temmer of Florida State University. The full report has been issued as NSF document 62–45, *Research Trends: 1962–1967, Nuclear Structure Physics*. A limited number of copies are available on request from the National Science Foundation, Washington 25, D. C.

Federal Funds for Science

During the present fiscal year, basic-research obligations of the federal government are expected to increase about 32 percent, from \$1.1 billion in 1962 to \$1.5 billion in 1963, largely because of research expenditures in the space program. This parallels the rise in federal funds obligated for research and development generally, which show an increase of 31 percent, from \$11.2 billion during fiscal 1962 to \$14.7 billion in 1963. An estimated \$4.5 billion of this year's obligations supports research, both basic and applied. Of the remainder, \$8.5 billion is for development, \$1.6 billion for facilities, and \$100 million for scientific and technical information. These figures are a result of the most recent annual survey of the subject by the National Science Foundation. Complete results of the survey will be reported in *Federal Funds for Science XI*, to be published by the Government Printing Office.

According to the survey, 4 government agencies out of 27 using research and development funds expect to account for 95 percent of the total. The Department of Defense reports the largest amount, \$7.4 billion in 1963 as compared with \$6.7 billion in 1962. The National Aeronautics and Space Administration has doubled its expenditures—from \$1.4 billion in 1962 to \$2.8 billion in 1963. The Atomic Energy Commission and the Department of Health, Education, and Welfare also show large increases.

About four fifths of the funds are for support of work done under contract with the government. Approximately 65 percent of the contract funds go to industry, 12 percent to educational institutions, and the remainder to other organizations.

Federal funds for research and development in 1963 are estimated at sixteen times the figure for 1948. Over the fifteen years, R and D expenditures have increased from 2.5 percent to approximately 13 percent of the total federal budget.

Bubble Chamber

The University of Michigan has announced a program for the construction of what is expected to be the world's largest heavy-liquid bubble chamber. Containing freon or propane or a mixture of both, the chamber will be 40 inches in diameter and 26 inches deep. It will be surrounded by a 300-ton magnet which will generate a field of 40 000 gauss. The entire structure will be 45 feet long and 16 feet high.

The magnet is being assembled at Argonne National Laboratory. After being completed next year, the chamber will be brought to Argonne for use in conjunction with the 12.5-BeV zero-gradient synchrotron which is now under construction there. The entire project is financed by the Atomic Energy Commission at a cost of \$550 000. The work at the University of Michigan is