DOCUMENT RESUME

06194 - [B1446492]

Modernization of Nevis Synchrocyclotron Facility. PSAD-78 103; B-181892. May 23, 1978. 4 pp. + appendix (11 pp.).

Report to Rep. Olin E. Teague, Chairman, House Committee on Science and Technology; by Elmer B. Staats, Comptroller General.

Issue Area: Science and Technology: Management and Oversight of Programs (2004).
Contact: Procurement and Systems Acquisition Div.
Budget Function: General Science, Space, and Technology: General Science and Basic Research (251).
Organization Concerned: National Science Foundation; Columbia Univ.: Nevis Lab.
Congressional Relevance: House Committee on Science and Technology; Senate Committee on Commerce, Science, and Transportation. Rep. Olin E. Teague.

The synchrocyclotron facility at Columbia University's Nevis Laboratory was built under a contract with the Office of Naval Research (ONR); in 1965, the National Science Foundation (NSF) assumed funding responsibility. In 1966-67, NSF granted $4.5 million to Columbia University of modernizing its synchrocyclotron facility. Findings/Conclusions: NSF did not require the university or laboratory to maintain accounting records or to periodically report the actual cost of the modernization. Funds from other grants and from ONR and the Atomic Energy Commission were used for modernization, but records did not separately identify expenditures. Although costs could not be verified, they were estimated at about $14 million. NSF did not make a detailed assessment of the proposed design before awarding initial funds and did not conduct a comprehensive, technical review until October 1973 in spite of delays. The review identified inadequate design as the cause of delays. The synchrocyclotron still has not achieved the performance levels of its original design goals and, as of March 1978, NSF did not know when goals would be met. NSF informed Nevis that the synchrocyclotron's performance did not justify continued support. Columbia proposed continuing operations at Nevis up to June 30, 1978, and then continuing research at other facilities. Recommendations: The Director of NSF should terminate funding for the synchrocyclotron project. (HTW)

6192

REPORT BY THE

Comptroller General

OF THE UNITED STATES

Modernization Of Nevis Synchrocyclotron Facility

At the request of the House Committee on Science and Technology, GAO is reporting on the modernization and management of the Nevis Synchrocyclotron, a machine which accelerates charged particles and whose beams are created for experimental uses.

The National Science Foundation granted $4.5 million to Columbia University in 1966-67 for modernizing its synchrocyclotron facility. Delays were encountered, but the Foundation did not conduct a comprehensive, technical review of the project until October 1973; it has continued to grant funds even though it does not know when the design goals will be met. The Foundation did not require Columbia to separately identify modernization costs, but estimates place the total at about $14 million.

The Foundation has informed Columbia that the synchrocylcotron's performance did not justify further support; Columbia has proposed to continue its research at other facilities.

GAO recommends that the Director of the National Science Foundation terminate funding for the synchrocyclotron project.

PSAD-78-103
MAY 23, 1978

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-181892

The Honorable Olin E. Teague
Chairman, Committee on Science
and Technology
House of Representatives

Dear Mr. Chairman:

We have completed our study on the use of National Science Foundation grants to modernize the synchrocyclotron facility at Columbia University's Nevis Laboratory.

Your office requested on September 15, 1976, that we report on (1) the adequacy of the cost records for the modernization and (2) Foundation and grantee management of the project. Our observations are summarized below and discussed in more detail in appendix I. Your letter of September 15, 1976, also asked for studies of three other Foundation-related matters. A report was previously furnished you on the Research Applied to National Needs (RANN) program (HRD-77-54, March 15, 1977). The other two review areas are the management of research equipment and the administration of research grants.

This study follows up our report "Answers to Questions on Government-Supported Medium Energy Particle Accelerators" (PSAD-75-77, June 2, 1975), which reported that there had been lengthy delays in the Nevis synchrocyclotron facility modernization and that Columbia University did not maintain records of the total cost.

BACKGROUND

The synchrocyclotron is a machine which accelerates charged particles to high speed in a vacuum tank. When the accelerated particles strike a target, charged particle beams are created for experimental use.

Nevis Laboratory's synchrocyclotron was built under a contract with the Office of Naval Research. Following its completion in 1950, the Office funded the facility's operations and research. In 1965 the Office of Naval Research, the Atomic Energy Commission, and the National Science Foundation jointly decided that the Foundation should assume funding responsibility and the synchrocyclotron should be modified and its experimental area enlarged.

The Foundation funded Columbia University's proposals for extending the facility and modifying the synchrocyclotron in June 1966 and May 1967, respectively. The purpose of the modification was to raise the energy, intensity, and quality of the synchrocyclotron beams used in experiments.

COST AND MANAGEMENT OF PROJECT

Our study showed that the Foundation did not require Columbia University or Nevis Laboratory to maintain accounting records or to periodically report the actual cost of the modernization. From June 1966 through December 1977, the Foundation awarded $23.2 million to Columbia for the Nevis synchrocyclotron modernization, operations, and medium energy physics research. About $4.5 million of this was for modernization, but Nevis also used funds from operations and medium energy research grants. Because grantee records did not separately identify all expenditures relating to the modernization, we could not determine its actual cost. A Nevis official, however, estimated that about $3.3 million of Foundation grant funds were used. We were unable to verify this estimate because it was based primarily on personal knowledge and recollection. Office of Naval Research and Atomic Energy Commission funds were also used for modernization. The total cost of modernization is estimated at about $14 million.

We found no evidence that the Foundation assessed in detail the proposed design or technical details of the modernization proposal before awarding the initial funds in May 1967. Additionally, the Foundation did not make or obtain independent studies of the complete design before the machine was shut down for modification in September 1970. Operation was scheduled to resume in 1971; however, this was delayed. Although aware of the delays through staff visits to Nevis, the Foundation did not conduct a comprehensive independent technical review of the project until October 1973. That review identified inadequate design as the cause of the delays. Reviewers reported that there were many untested new design features and that nearly every synchrocyclotron component tested to that time required redesigning.

The Nevis synchrocyclotron still has not achieved the performance levels of its original design goals. As of March 1978, the Foundation still did not know when they would be met. In August 1977 the Foundation expressed extreme concern about continued delays and lack of progress in meeting minimum goals for reliable operation. The Foundation informed Nevis that the synchrocyclotron's performance

did not justify supporting it as a research tool and that support could not be continued indefinitely on an expectation of achieving design goals.

In December 1977 Columbia proposed (1) continuing physics research and synchrocyclotron operations at Nevis for the period January 1 to June 30, 1978, (2) terminating operation of the synchrocyclotron at the end of that period, and (3) continuing physics research at other accelerator facilities through December 31, 1978.

The Foundation awarded Columbia $1.8 million. The Foundation, however, did not inform Columbia that it will not approve extension of the proposed June 30, 1978, date for terminating synchrocyclotron operations. Meanwhile, Nevis is continuing development work to improve performance of the synchrocyclotron.

Although the Foundation would not categorically state that funding will be terminated, its officials informed us in March 1978 that they did not plan to fund synchrocyclotron operations beyond June 30, 1978.

CONCLUSIONS AND RECOMMENDATION

The Foundation did not require Columbia University to maintain accounting records that separately identified synchrocyclotron modernization expenditures or to submit periodic reports of the cost. Therefore, we could not determine the actual cost or verify the estimate we obtained.

The Foundation funded the modernization without obtaining independent engineering or cost validation studies of the complete synchrocyclotron design. It did not conduct a comprehensive independent technical review of the project until 2 years after the machine was to have resumed operation.

The Foundation has continued to grant Columbia additional funds even though design and performance goals were not met. Since September 1970 the synchrocyclotron has either been shut down or operating far below hoped for capabilities. Columbia University has now proposed to continue its research at other facilities after June 30, 1978.

We feel there is sound basis for the Foundation's appraisal in August 1977 that the performance of the Nevis synchrocyclotron did not justify support as a research tool or for the expectation of eventually achieving design

goals. As of March 1978, the Foundation still did not know when these goals would be met. We recommend, therefore, that the Director of the National Science Foundation terminate funding for the synchrocyclotron project.

SCOPE OF REVIEW

We reviewed financial records, grant proposals, and technical documents at Columbia University, New York, New York, and Nevis Laboratory, Irvington, New York. We also reviewed documents and interviewed officials of the National Science Foundation, Department of Energy, Office of Naval Research, and the Defense Contract Audit Agency.

As your office requested, we did not obtain formal comments on matters discussed in this report. We did, however, discuss its content with Foundation representatives and incorporated their comments where appropriate. We discussed the results of our work at Columbia and Nevis with the University's Controller and the Laboratory's Deputy Director.

As arranged with your office, we are sending copies of this report to the Director, National Science Foundation, and to officials of the Department of Energy, the Office of Naval Research, Columbia University, and Nevis Laboratory.

Sincerely yours,

Comptroller General
of the United States

APPENDIX I

NEVIS LABORATORY SYNCHROCYCLOTRON MODERNIZATION PROJECT

RECORDKEEPING AND REPORTING

One purpose of our study of the modernization of the synchrocyclotron at Columbia University's Nevis Laboratory was to evaluate records and reports on the cost. We looked at (1) National Science Foundation recordkeeping and reporting requirements, (2) grantee recordkeeping, and (3) estimated synchrocyclotron facility modernization costs.

NSF recordkeeping and reporting requirements

The Foundation did not require Columbia University or Nevis Laboratory to maintain accounting records or to periodically report on the actual cost of the modernization.

Foundation accounting procedures for grantees, issued in June 1963, required that records be maintained for each grant in accordance with generally accepted accounting practices that would permit preparation of required final reports and the determination that grant funds were used for the general purpose for which the grant was made.

The Foundation's Grant Administration Manual issued in October 1973 required that grantees should provide (1) accounting records supported by appropriate documentation, (2) records which adequately identify the source and application of funds for Foundation-supported activities, and (3) records that provide accurate, current, and complete disclosure of the financial status of each Foundation-supported project in accordance with Federal reporting requirements. The Foundation does not require its grantees to maintain any particular financial management system or classification of accounts.

A Foundation grantee prepares a proposal for each grant and for funding amendments to each grant. The proposal includes a description of work to be performed and a budget categorizing expenditures (salaries, permanent equipment, expendable equipment and supplies, travel, publication costs, other direct costs, and indirect costs). After the grant award, the grantee is to maintain records and make fiscal reports to the Foundation.

APPENDIX I

The Foundation made the following grants to Columbia for modernizing the Nevis synchrocyclotron facility, medium energy physics research, and Nevis synchrocyclotron operations.

Grant number	Stated purpose	Grant period	Amount
GP6206	Research, operations	June 1966 to Apr. 1968	$ 1,700,000
GP6205	Synchrocyclotron design studies, experimental area expansion	July 1966 to Mar. 1969	501,600
GP7177	Synchrocyclotron modernization	May 1967 to Oct. 1972	4,015,000
GP8943	Research, operations	May 1968 to Oct. 1971	2,661,700
GP22786	Research, operations	May 1970 to Oct. 1975	8,070,100
MPS75-17396	Research, operations	Apr. 1975 to June 1977	4,360,000
PHY77-07577	Research, operations	Apr. 1977 to Dec. 1977	1,900,000
Total			$23,208,400

Grants GP6205 and GP7177 were for synchrocyclotron facility modernization; however, except for GP6206, Nevis also used funds from the research and operations grants for modernization. The Foundation also made grants for high energy physics research, but said that these grants were not used for the synchrocyclotron project.

The actual cost of the modernization cannot be determined because the Foundation did not require accounting records to be maintained or reports to be submitted segregating amounts of research and operations grant funds used for modernization.

Nevis estimated it used $8.8 million of Foundation research and operations grant funds for modernization, beginning with grant GP8943 awarded in May 1968. The Foundation could not tell us when they were informed of this. The Foundation's Director, Division of Physics, said he believed the agency was always aware which funds were being used for the modernization.

APPENDIX I

Grantee recordkeeping

While Columbia may have kept its accounting records in accordance with Foundation requirements, it did not maintain its records in a way that separately identified all modernization expenditures.

Official grantee records, maintained by the Columbia University Controller, divided each grant into categories of expense, such as salaries or supplies. However, there was no indication of whether the expenditures related to research experiments, operations, or modernization.

Nevis Laboratory also maintained records of grant expenditures. Some research and operations grant expenditures were identified as used for the modernization. Other expenditures, such as salaries, were not so identified, making it impossible to determine total modernization costs.

We tested the adequacy of the grantee's accounting records on two grants--MPS75-17396 and GP22786.

For grant MPS75-17396 we traced 29 expenditures totaling about $81,500 to supporting documentation. We found that these charges were for synchrocyclotron related work or research; however, for 10 expenditures Columbia's records did not agree with Nevis' records. We noted differences in the categorization of expenditures and in expenditure amounts. Most of the differences were for small amounts.

We also traced expenditures reported to the Foundation on grant GP22786 to Columbia's records. We noted that the final fiscal report was submitted to the Foundation about 7 months after it was due and that total expenditures on the grant exceeded the grant amount by about $155,000. Columbia reported that it funded $130,000 of this overrun. The University wrote off the remaining $25,000 by arbitrarily reducing amounts for salaries and indirect costs charged to the grant and reported to the Foundation.

Estimated synchrocyclotron facility modernization costs

Estimates of the Foundation, Office of Naval Research, and Atomic Energy Commission funds used for modernization total about $14 million.

APPENDIX I

National Science Foundation

During our 1975 study, 1/ Nevis' Deputy Director estimated that about $8 million of Foundation medium energy physics grants had been used for modernization.

The Foundation asked Nevis' Deputy Director in April 1976 to analyze budgets for Foundation grants through March 30, 1976, and to identify funds used for modernization. At our request, this analysis was updated to include all grants through PHY77-07577, ending December 31, 1977. Nevis' Deputy Director estimated that $13.3 million of $23.2 million awarded by the Foundation was used for modernization.

Estimated modernization costs:	Amount (thousands)
Synchrocyclotron design and construction	$ 6,581
Retrofit	2,568
User facility	4,173
Total	$13,322

Synchrocyclotron modification costs after September 1, 1974, are termed retrofit rather than design and construction because the Foundation considered the modification complete. According to Nevis officials, by September 1974 all machine components had been installed and, if the machine worked perfectly, a beam could have been extracted to an external target. At that time, however, the machine could only accelerate a beam internally; an extracted beam was not achieved until August 1975. Nevis' Deputy Director said that it is difficult to determine whether synchrocyclotron-related costs incurred after September 1, 1974, were modification costs, operating costs, or improvement costs, for improvements may be made on an operating machine.

1/"Answers to questions on Government-supported medium energy particle accelerators" (PSAD-75-77, June 2, 1975).

APPENDIX I

The user facility estimate includes costs for beam line magnets, power supplies, a building extension, and experimental area design and construction.

Nevis' Deputy Director used laboratory and university records and reports in preparing his estimate. Where these were inadequate for allocating costs, in particular salaries, allocations were made primarily on the basis of personal knowledge and recollection. The Nevis estimate may be reliable; however, since much of it was not based on historical accounting records, we were unable to verify it.

Nevis' $13.3 million estimate did not include the value of shielding and a surplus magnet obtained by the laboratory at no cost. Nevis' Deputy Director estimated the value of these at as much as $200,000. The estimate also does not include $565,000 of Office of Naval Research and Atomic Energy Commission funding.

Office of Naval Research

In April 1964 the Office authorized Nevis to spend $50,000 for a design study as part of the synchrocyclotron modification. This consisted of construction and testing of a model magnet and a model radio frequency system. An additional $75,000 was authorized in April 1965 for continuing the study.

Additionally, the Office approved reprogramming its research and operations funds for design studies by Yale University after Nevis said that it needed "professional assistance." Nevis used over $82,000 of these funds for the Yale studies. The Foundation also awarded $48,850 for the Yale studies under grant GP6205. Nevis, however, with Foundation approval used these funds to extend the synchrocyclotron experimental area.

Atomic Energy Commission

During modernization of the synchrocyclotron facility, the Commission funded neutron spectroscopy work at Nevis. From October 1970 to September 1975, $81,000 was authorized for synchrocyclotron-related equipment and supplies. These funds were for equipment to be installed inside the synchrocyclotron vacuum chamber, new beam paths, and synchrocyclotron shielding. The Commission also authorized $277,000 for synchrocyclotron use and services from October 1970 through September 1975. Since no neutron spectroscopy research was done with the synchrocyclotron during this period,

it appears that these funds were used for modernizing synchrocyclotron components needed for spectroscopy research. Since termination of the Commission contract in 1975, the Foundation has funded the neutron spectroscopy work under research and operations grants MPS75-17396 and PHY77-07577.

SYNCHROCYCLOTRON MODERNIZATION PROJECT MANAGEMENT

The second purpose of our study was to examine Foundation and grantee management of the modernization. We looked at (1) synchrocyclotron design and development, (2) cost estimating, and (3) synchrocyclotron performance.

Synchrocyclotron design and development

In 1965 the Office of Naval Research, the Atomic Energy Commission, and the National Science Foundation prepared a plan for Federal support of medium energy accelerator programs at universities and recommended modernization of the Nevis synchrocyclotron at a cost of approximately $3.9 million.

In January 1966 Columbia submitted a proposal to the Foundation requesting support for Nevis' (1) research and operations, (2) facilities improvements, and (3) design studies to determine the feasibility of major modifications to the synchrocyclotron. For the 9-month period beginning July 1, 1966, the Foundation awarded $501,600 for the design studies and extension of the synchrocyclotron experimental area.

While the Foundation did not obtain the results of the design studies, its program director visited Nevis on November 10, 1966, where, according to the agency, he assessed "many of the results." The Foundation said the study results were incorporated into a Columbia proposal submitted in January 1967 to modify the synchrocyclotron over a 3-year period--2 years for design and fabrication of components and 1 year for installation and testing.

Columbia's 1966 proposal, which included the goals of the modernization, had been sent for independent review by scientists at several universities. The Foundation's program director said that because there was no change in the scientific desirability of the project, the 1967 proposal for modernization was not sent out for review. Instead, reviewer comments on Columbia's 1966 proposal were used to support approval by Foundation management of Columbia's

APPENDIX I

1967 proposal. However, we found that none of the four reviewers of the 1966 proposal commented specifically on the merits or validity of the proposed synchrocyclotron design, and only one commented on the feasibility of its modernization. This reviewer said that "not all of the suggested improvements have been demonstrated to be feasible."

The Foundation arranged for two accelerator experts to visit Nevis on January 20, 1967, to examine certain technical aspects of the proposed synchrocyclotron design. After their 1-day visit both experts provided comments to the Foundation, but neither commented in detail on the complete technical design.

We could find no evidence that the Foundation did any detailed analyses to assess the validity of the proposed design or technical details set forth in Columbia's 138-page proposal before (1) telling the National Science Board in March 1967 that the project had been reviewed for scientific merit and that detailed studies showed the feasibility of converting the Nevis synchrocyclotron to a higher intensity accelerator and (2) awarding the $3.9 million grant for synchrocyclotron modernization in May 1967.

Because only preliminary studies were completed before the Foundation's 1967 grant award, it appears that the project may have been approved more on the basis of being a recognized part of the National Physics Program than being a valid design. Nevis' first project status report to the Foundation in August 1969 indicated that theoretical or feasibility studies were still being done. Nevis reported:

> "The conversion of the Nevis Synchrocyclotron has progressed to the point where essentially all of the broad aspects of the project have been fixed and most of the details have been or are in the process of being completed. Theoretical studies of the magnetic field shape (in conjunction with the model magnets), of the central region, the extraction region, and of the rf system are more or less completed, and all reenforce the feeling that the basic concepts for the design of this machine are valid."

In September 1970, when Nevis shut its synchrocyclotron down for modification, the Foundation still had not made or obtained any independent engineering validation studies of the complete synchrocyclotron design. The modification,

APPENDIX I

scheduled for completion in 1971, was delayed. The Foundation was aware of this but did not provide technical assistance to Nevis on a scale which seems to have been needed. Foundation officials said that providing technical assistance to grantees is not normally its role.

The Foundation did not conduct a comprehensive independent technical review of the project until October 1973. This review identified inadequate design as the cause of the delays. There were many untested new design features and nearly every synchrocyclotron component tested to that time required redesigning. Nevis officials did not agree with these findings.

The October 1973 review also found that the project was poorly organized, the expected date of March 1974 for an extracted beam was unreasonably optimistic, and that an unknown additional allowance of months or years must be added to the schedule.

In December 1973 the Foundation informed Nevis that the technical review findings raised serious questions regarding the project's viability. However, in January 1974, in its fiscal year 1975 budget submission to the Congress, the Foundation stated, "The upgraded Columbia Nevis Synchrocyclotron will soon be in operation * * *." Further, in a February 13, 1974, memorandum to National Science Board members, the agency stated that the project had received "highly favorable" peer review. However, we found that three of the four peer reviewers of Columbia's January 1974 proposal had not commented on the technical design or management aspects of the synchrocyclotron modernization project, and the other wrote, "I have no basis on which to assess the probability that the Nevis machine will achieve design performance."

The Foundation memorandum also informed National Science Board members of the October 1973 technical review, but did not indicate that there were serious questions regarding the project's viability. The Foundation reported only that the review identified several components of the modified cyclotron as requiring separate testing before any definitive schedule for actual operation could be determined.

Cost estimating

Columbia's January 1967 proposal to the Foundation requested an estimated $4,851,600 to modify the Nevis synchrocyclotron. Nevis' Deputy Director said the cost estimate was developed after some initial design work had been performed, but before the synchrocyclotron design was complete. The proposed cost was arrived at by estimating the quantity and price of some materials for major synchrocyclotron components and by discussing the project with groups which had previously built synchrocyclotrons.

William M. Brobeck and Associates, an engineering research, design, and development company, reviewed Nevis' tentative synchrocyclotron conversion costs in December 1966. Brobeck commented on Nevis' cost data and informed Nevis that its design description was not complete enough to permit preparation of an independent cost estimate. Nevis and the Foundation were unable to provide us with the data reviewed by Brobeck. Nevis also was not sure where documentation supporting its proposed cost is stored.

We did not find any evidence in Foundation grant files that the agency made or obtained a detailed analysis of Nevis' cost estimate before recommending in March 1967 that the National Science Board approve the project. The Foundation informed the Board that, because of uncertainties in cost estimates and possible escalation of costs, the project cost estimate included an amount for contingencies. The Foundation also told the Board that Columbia agreed that use of the contingency funds would be subject to Foundation approval.

Following Board approval, the Foundation awarded $3,915,000 to Columbia under grant GP7177 for synchrocyclotron modernization. This included 16 percent, or $540,000, for contingencies and escalation. The Foundation, however, did not establish any baseline costs for synchrocyclotron components against which to measure and control the expected cost increases.

Final design of the synchrocyclotron, according to Nevis' Deputy Director, was very different in several respects from what was proposed. Neither the Foundation nor Nevis, however, prepared cost estimates based on the final design, and, following shutdown of the synchrocyclotron for modification in September 1970 the Foundation did not require Nevis to periodically prepare estimates of the total

cost. Although Nevis estimated its modernization cost for our review in October 1974, the Laboratory did not prepare an estimate of its total modernization cost for the Foundation until April 1976.

Synchrocyclotron performance

In August 1974 the Foundation first established a specific target date by which performance criteria for the Nevis synchrocyclotron was to be met. The Foundation told Nevis to consider the end of December 1974 as a target date for (1) obtaining a coasting proton beam of significant intensity at full radius and (2) having the complete extraction system ready for installation and testing in the cyclotron. The Foundation told Nevis that it would base its plans for future funding on the extent to which these goals were met. Nevis did not meet these goals.

Following a Foundation technical review at Nevis in February 1975, two more goals were established for the Nevis synchrocyclotron--a reliable extracted beam for experiments at 1 microamp by April 1976 and reliable operation at an extracted 10 microamps before October 1976. The Foundation's program director told Nevis in May 1975 that these were minimum goals that it hoped would be bettered.

In March 1976 Nevis established additional minimum performance criteria with the objective of demonstrating reliable high intensity performance over a test period from September 15, 1976, through December 15, 1976. Nevis felt that if these criteria were not met, the synchrocyclotron project's chance for success would be so diminished that the project would be considered unworthy of further funding and effort.

The Nevis synchrocyclotron project did not meet the 1975 or the 1976 goals and still has not achieved the performance levels of its original design goals. The Foundation does not know when the design goals will be met.

In August 1977 the Foundation expressed extreme concern about continued delays and lack of progress in meeting minimum goals for reliable operation. The Foundation informed Nevis that the synchrocyclotron's performance did not justify supporting it as a research tool and that support could not be continued indefinitely on an expectation of achieving design goals.

APPENDIX I

Following a Foundation technical review of the Nevis project in November 1977, Columbia proposed (1) continuing physics research and synchrocyclotron operations at Nevis for the period January 1 to June 30, 1978, (2) terminating operation of the synchrocyclotron at the end of that period, and (3) continuing physics research at other accelerator facilities through December 31, 1978.

The Foundation awarded Columbia $1.8 million. The Foundation however, did not inform Columbia that it will not approve extension of the proposed June 30, 1978, date for terminating synchrocyclotron operations. Meanwhile, Nevis is continuing development work to improve performance of the synchrocyclotron.

(952161)