RECOMMENDATIONS FOR FY 1982 FACILITY CONSTRUCTION

A Report Submitted to

the DOE/NSF Nuclear Science Advisory Committee

from the

1980 Facilities Subcommittee

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I. 2. Charge to the Subcommittee

The charge recommended for the Subcommittee by the Nuclear Science Advisory Committee is as follows: "The Subcommittee shall consider proposals, plans, needs and opportunities for major new facilities or for substantial modifications and improvements to existing facilities in the field of fundamental nuclear research in the U.S.A. Acting with due regard to the scientific and financial priorities of the Long Range Plan (listed in Section I.5) devised by the Nuclear Science Advisory Committee, the Subcommittee shall draft a plan or plans, viable in the light of probable funding levels, for implementation in FY 1982. The Subcommittee report which accompanies the plan or plans shall include a technical and scientific evaluation of the alternatives considered and a justification for the action recommended to the parent Committee and shall give careful attention to the net fiscal impact of any proposed new facilities upon ongoing programs. In arriving at implementation recommendations to the parent Committee, the Subcommittee shall adhere to a schedule with maximum utility in the budgetary planning cycle of the funding agencies and shall, if possible, submit plans to the Nuclear Science Advisory Committee for consideration in early Spring of 1980."

I. 3. Evaluation Criteria

The Subcommittee's evaluations of the accelerator proposals (see Section III) were focused on the following issues: scientific value of the research goals which the facility addressed; cost effectiveness, technical feasibility, and projected performance capability of the proposed facility; scientific and technical strength of the sponsoring laboratory and its research program; the strength of its associated nuclear theory effort; user involvement both current and potential; support of the project by the sponsoring institution; construction time and operating cost after completion; and the project's impact upon the education of good students in nuclear science and upon other aspects of the ongoing and future national program. An important component of the Subcommittee's deliberations was concerned with whether the proposed facility was consistent with the Long Range Plan of the Nuclear Science Advisory Committee, both in the science addressed by the facility and in its funding pattern.

The following questions were considered by the Subcommittee: Does the facility provide capabilities for carrying out new and important research? To what degree would the proposed facility have unique capabilities? Can the accelerator be built in the projected cost and time frames? Are there technical aspects of the proposal which are as yet not understood and could advisably be studied further? What is the range of experimental parameters which the projected system will provide? What nuclear species can be accelerated and to what energies? Can the energy be varied easily? What are the intensities, the energy resolution and the time structure of the beam? What ancillary equipment will be required and what is the optimum arrangement of the target areas? How many experiments can be performed simutaneously? In view of the fact that the number of heavy-ion and electron accelerators which will be constructed is small and demand will be great, what provision is made for users at these facilities? What will be the strength and vitality of the user program at the facility? What is the ability of the sponsoring laboratory to carry out the proposed program in terms of availability of experienced

I Procedures of the Facilities Subcommittee

I. 1. The Subcommittee and its Operations

It was decided this year that the Facilities Subcommittee would be a committee of the whole of the parent Nuclear Science Advisory Commmittee (but under a different chairman). This decision was made to expedite and streamline the deliberations and also to reduce the number of meetings that would lead to the adoption of the Subcommittee's recommendations by the parent Committee. In retrospect, it is felt that this mode of operation has worked well. The members of the Facilities Subcommittee are listed in Appendix IV.1. and the representatives of the DOE and the NSF who attended as observers and consultants are given in Appendix IV.2.

In early January 1980 the Subcommittee received the six proposals that had been submitted to the Nuclear Science Advisory Committee by the agencies for recommendations for possible funding. These proposals are listed in Section I.4. Prior to its first meeting, February 7-9, 1980, which was a joint meeting with the parent Committee held at the NSF in Washington, the members of the Subcommittee studied and evaluated each proposal. To enhance and sharpen these appraisals two members were assigned to each proposal with the charge to carry out an in-depth evaluation of their proposal. Each team was encouraged to discuss questions that arose in this study with members of the sponsoring laboratory and to consult with other experts and knowledgeable persons.

The agenda of the meeting held on February 7-9, 1980 is given in Appendix IV.3. At this meeting each laboratory was given one hour in open session to present its proposal. This was followed by a one hour question and answer session conducted by the designated team, all members of the Subcommittee, as well as interested members of the audience. Subsequent to these presentations, the Subcommittee in closed session arrived at preliminary evaluations and recommendations for the proposals.

During the period between this meeting and the next joint meeting of the Subcommittee and its parent Committee on March 26-28, 1980 the members of the Subcommittee carried out extensive further studies of the proposals to resolve questions that had arisen and to prepare written statements on each proposal. Independent cost studies, additional verifications of technical feasibilities and performance expectations, consultations with management and home institutions on proposed staffing and support, development of discussion papers on the impact of the proposed facilities on nuclear science, and further investigations of potential users programs are examples of these studies.

The March 26-28, 1980 meeting of the Subcommittee was held at the NSF in Washington again in joint session with the parent committee. The agenda of this meeting is given in Appendix IV.4. During three closed sessions of this meeting the final recommendations of the Subcommittee were reached and presented to the parent committee. Following acceptance of these recommendations, the meeting was opened and key portions of the recommendations were announced to interested members of the audience.

personnel to participate in construction and in bringing the facility into operation? How great is the dedication of the in-house staff to the project? What is the relevant scientific capability of the resident scientific staff, who will perform and interpret experiments upon completion of the facility? What is the support of the host institution, as manifested by partial provision of construction funds, by provision of new faculty and staff positions, and by other demonstrations that the project has high priority within the institutional framework? What is the strength of nuclear physics in the host institution? The study of these and many other such questions formed the basis for the Subcommittee's decisions.

I. 4. Scope of the Study

The Subcommittee focused its deliberations on the six proposals for construction that had been submitted to the Nuclear Science Advisory Committee through the DOE and the NSF with a request to develop a set of recommendations for the FY 1982 budget. In developing these recommendations the Subcommittee was guided by the charge made to the Subcommittee by the parent Committee (Section I.2.), the evaluation criteria given in Section I.3, the Long Range Plan of the Nuclear Science Advisory Committee, and the scientific needs and opportunities of the nuclear community as outlined in Section I.5.

The six proposals considered are listed below, by title, estimated cost (in FY 1980 dollars), and approximate completion time (granted funding in FY 1982):

1. The American University and the University of Virginia: "A Proposal to Build a New Injector and Compression System at the Stanford Linear Accelerator Center for a Program of Research in Experimental Nuclear Physics"; $1.21M; 1983.

2. The Brookhaven National Laboratory: "Proposal for a Cyclotron Addition to the Brookhaven Tandem Facility"; $10.78M; 1984.

3. Florida State University: "A Grant Proposal for a Florida State Superconducting Booster"; $2.55M; 1983.

4. University of Colorado: "A Proposal for a National Light Ion Accelerator Facility"; $13.6M; 1986.

5. University of Washington: "A Proposal for a 18 MV Tandem Electrostatic Accelerator"; $8.9M 1985.

6. Yale University; "A Proposal for Conversion of the Yale MP Tandem Accelerator to STU Status"; 1978, "1979 Addendum to the Proposal for Conversion of the Yale MP Tandem Accelerator to STU Status"; "1980 Addendum to the Proposal for Conversion of the Yale MP Tandem Accelerator to ESTU Status"; $5.8M; 1984.

The Florida State Proposal was submitted to the NSF, the proposal from the American University and the University of Virginia was submitted to both NSF and DOE, and the remaining four proposals were submitted to the DOE. The magnitude of the problem facing the Subcommittee can be judged by the total

estimated cost of these six proposals, $42.84M. As will be developed in Section II.2., only some $8-9M were deemed available for construction in FY 1982 in accordance with the recommendations of the Long Range Plan of the Nuclear Science Advisory Committee and the prior construction commitments by the agencies.

The following documents provided essential information, background material, and guidance for the Subcommittee in its studies and deliberations that led up to the evaluations and recommendations presented in this report. These three documents are reports of the DOE/NSF Nuclear Science Advisory Committee:

> "A Long Range Plan for Nuclear Science," December, 1979.
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> "Recommendations for FY 1981 Facility Construction," April, 1979.
>
> "Recommendations for FY 1980 Facility Construction," April, 1978.

Also of importance in the studies is the earlier report:

> "Future of Nuclear Science," Ad Hoc Panel, Committee on Nuclear Science, Assembly of Mathematical and Physical Sciences, National Research Council/National Academy of Science, 1977.

1. 5. Scientific Needs and Opportunities

The contributions that the projects (proposed for consideration by the 1980 Facilities Subcommittee) could make to nuclear research are described below. Four of the construction projects considered involve some kind of upgrading of existing accelerators, a fifth is for replacing an existing accelerator, while the sixth involves specific additions to an existing high energy accelerator. The Brookhaven proposal is for a heavy-ion facility with a scope roughly comparable to the MSU accelerator which is now being constructed. The University of Washington and Yale proposals are for facilities with capabilities for precise heavy-ion and-light ion experiments at energies significantly above those presently operating tandem accelerators, while the Florida State proposal is for a tandem-booster system that would be comparable to the Washington and Yale facilities for a range of heavy ions. The University of Colorado proposal is for a facility oriented towards precise experiments with light ions and neutrons. The American University and the University of Virginia project would add an injector and energy compression to SLAC for high energy electron studies. The Subcommittee thinks that the research programs implied by these projects would form essential components of a vital and well balanced national effort in nuclear science.

These facilities would provide capabilities to increase present understanding of the characteristic modes of motion of nuclei, which is one of the fundamental tasks of nuclear physics addressed by the Long Range Plan. Results at lower energies indicate that studies of the giant resonances, of the intermediate structure associated with doorway states and with "nuclear molecules,"

and of clustering phenomena can all be very productively expanded by using projectiles of higher energy and larger mass. Of course, the use of higher energies and heavier projectiles may also reveal new, unanticipated modes of motion not previously manifested.

Increased polarized beam capabilities would make possible more intensive studies of parity non-conserving reactions which are important for the understanding of the weak interactions. These capabilities would also make possible significant progress in such fields as radiative capture studies of giant resonances and investigations of high-spin states, and spin-spin interactions.

Four of the proposed accelerator facilities are focused totally or partially upon heavy-ion science. They would provide capabilities for the vigorous study of heavy-ion reactions in the transition region of energies between those of present lower energy facilities and those of the few large national facilities now under construction. Multifaceted and detailed investigations of the energy dependence of complex processes such as particle transfer, quasi-elastic scattering, deep inelastic scattering, fusion and fission in the region extending from 10 MeV/amu to 40 MeV/amu, where it appears that major qualitative changes in behavior occur, are essential to a comprehensive understanding of heavy-ion phenomena. The limits to the fusion of systems of high angular momenta which are suggested at the highest energies of present accelerators could be thoroughly explored with these new proposed machines. Other limits of fusion, such as might be imposed by the energy of the system, can perhaps be identified. The mechanisms by which energy and matter are exchanged between projectile and target should depend upon the details of projectile, target and bombarding energy, but in ways which are not yet known. Intriguing indications have been found of dramatic changes which commence at the energies made available by these proposed facilities.

In all of these investigations of heavy-ion phenomena the variability of the projectile in terms of its mass and its type of internal structure, as well as in terms of its energy, plays an essential role. The proposed facilities offer this needed variability and, feature special capabilities of precision, intensity and beam control which could make possible a new generation of more discriminating and revealing experiments, as well.

One of the accelerator proposals is focused on light-ion studies and, in particular, studies with neutrons. Reactions involving neutrons as projectiles or reaction products, or both, reach final nuclei which are otherwise accessible only with complex charged particles. In particular, the isospin raising (n,p) reaction offers a particularly rich field of investigation. The simpler analyses of the reactions that are made possible when neutrons are used can contribute significantly to a better understanding of various aspects of nuclear structure. The combination of high beam intensity, long flight path and advances in fast timing techniques have made greatly improved precision in neutron experiments feasible. Such experiments would open a significant new avenue to the discovery and understanding of nuclear phenomena.

The remaining proposal would make possible important experiments which would give information on the electromagnetic properties of the very light nuclei at very high momentum transfer and would provide a stringent test of the nature of the nuclear force.

These remarks provide a brief description of some aspects of the scientific research which would become possible if the proposed facilities were constructed.

I. 6. Proposal Summaries

Brief descriptions of each of the six proposals considered by the Subcommittee follow. The chief characteristics of the proposed facility, its cost (in FY 1980 dollars) as given in the proposal, the estimated construction time, the projected increase in operating funds, and the main thrust of research to be addressed with the new facility are outlined. Further details can be found in Section III. or in the original documents listed above in Section I.4.

(1) The American University and the University of Virginia resubmitted a modified proposal (first submitted in 1979) to build a new injector and energy compression system for the linear accelerator at SLAC to provide a high current, high resolution electron beam for nuclear physics measurements in the range 0.4 - 2.9 GeV. These additions will be built by SLAC personnel over a period of 18 months at an estimated cost of $1.21M. The completed facility will be dedicated to the measurement of elastic and inelastic, charge and magnetic structure functions of ^{2}H, ^{3}H, ^{3}He, and ^{4}He. The measurements can be carried out with existing instrumentation in end station A at SLAC, but the total measurement program is estimated to cost $\leq$ $2.3M.

(2) The Bookhaven National Laboratory submitted a proposal that was greatly modified from the one submitted in 1978. The Laboratory now proposes to convert the SREL magnet into an intermediate energy heavy-ion afterburner, injected by the BNL double MP tandem. The total capital cost of $10.78M includes conversion of the SREL magnet into a variable energy isochronous cyclotron, transport components to conduct the beam from tandem to cyclotron and from cyclotron back to existing experimental areas, and a building addition to accommodate these facilities. Additional equipment needs for the early research program are estimated at $2-3M, but are not part of the present proposal. Incremental operating costs for the accelerator are stated as $1.5M including about $0.5M/year for electrical power. The estimated construction time is three years. The proposed facility would provide beams with energies ranging up to 150 MeV/amu for light ions such as ^{16}O and up to 18 MeV/amu for uranium. These energy and mass ranges would overlap the capability of existing tandem accelerators. The facility would be dedicated to heavy-ion physics.

(3) Florida State University proposed the addition of a 12 MV superconducting linac booster, modeled after the Argonne facility, for its existing 9 MV tandem. The facility would increase the energy of ions between Li and Fe to that obtained from an 18 MV tandem. The proposal requests funds for the accelerator and for new instrumentation of $2.55M. In addition Florida State has committed itself to a contribution of $0.63M for a new building housing the accelerator and target area, as well as ancillary equipment. Construction time is estimated at approximately two years. The proposed facility would require an annual increase in operating funds of $200K. The increase in energy and fast timing characteristics of the proposed booster, together with a polarized heavy-ion source, would greatly expand the heavy-ion research capability of the FSU group.

(4) The University of Colorado resubmitted a proposal made in 1979 for construction of an open four-sector cyclotron. This accelerator would utilize the present cyclotron as an injector to provide proton and deuteron beams (polarized and unpolarized) with energies up to 75 and 50 MeV, respectively, and He and Li beams with energies obtained from the relationship $K = AE/Q^2 =$ 100 MeV. The estimated construction time is five years which includes two years of design and study and three years of construction. The two cyclotrons would be coupled through an intermediate storage ring that could be used to increase the instantaneous beam intensity and to vary the duty cycle. Also incorporated in the proposal is building construction for a new experimental area and offices and shops. The proposed facility is specifically for light-ion experimentation and is focused strongly towards studies with neutrons. The proposal requests federal funding estimated at approximately $13.6M, including contingency costs. In addition, some $4.3M (FY 1978 dollars) will be sought from the state of Colorado for building construction and supplies. The incremental operating costs are estimated to be $0.8M/year.

(5) The University of Washington resubmitted a proposal (previously submitted in 1979, following a different one submitted in 1978) with considerable revision in response to last year's evaluation. This response involved a reduction in maximum voltage for a folded tandem electrostatic accelerator from 20 MV to 18 MV and a reduction in project costs (without contingency) to $8.9M. This cost reduction is due primarily to the possibility that the State of Washington will provide the $3.5M needed for the construction of the accelerator building. A four year project is planned. Incremental operating costs, associated largely with a users program, are estimated at $0.5M/year. An important part of the proposed research is based on the addition of a high intensity, polarized ion source for hydrogen ions, which it is hoped will be funded separately. The research program will involve both light-and heavy-ion physics.

(6) Yale University resubmitted a proposal for conversion of its 14 MV MP tandem Van de Graaff accelerator to a 20-22 MV facility. This proposal was subtantially the same as the one considered by the 1978 and 1979 Facilities Subcommittee and included in their priority listing for FY 1980 and FY 1981 construction. Since the project has not been funded, Yale resubmitted the proposal with significant modifications. Upgrading of the tandem involves enlarging the accelerator tank, increasing the length of the accelerator, enlarging the terminal, and using a new insulating gas mixture. Proposed new facilities include a beam pulsing capability and a polarized ion source for hydrogen ions. The major change from the earlier proposals is the proposed transfer of personnel, equipment, and building space from the Electron Accelerator Laboratory to the tandem facility when this laboratory closes down in four years. The estimated cost of the facility remains at $5.8M (escalated to FY 1980 dollars), without contingency. Operating costs associated with a user program, are predicted to increase by $150K/year. If the project is funded in FY 1982, the plan calls for shut-down of the present accelerator in October 1983 and operation of the new facility in July 1984. Research with the new facility will cover both light-and heavy-ion nuclear physics.

II Recommendations and Their Impact

II. 1. Recommendations for Facility Construction in FY 1982

As its highest priority, the Subcommittee strongly recommends that funding for both the University of Washington and Yale University projects be initiated in fiscal 1982, in an amount consistent with the capital expenditures suggested by the Long Range Plan and that the remainder of the funding for these projects be allocated in fiscal 1983.

The facilities proposed by the University of Washington and Yale University are technically sound, cost effective, and well justified in terms of a balanced national program in nuclear science. The Subcommittee judges that these facilities will substantially strengthen and expand the nuclear science programs at two leading universities that have played a significant role in nuclear science and in graduate education.

The Subcommittee's recommendation to construct the 18 MV folded tandem electrostatic accelerator proposed by The University of Washington at an approximate cost of ($9M in 1980 dollars) is exclusive of the construction costs for the accelerator building that is expected to be supplied by the State of Washington. The Subcommittee's recommendation for conversion of the Yale 14 MV MP tandem Van de Graaff accelerator to a 20 MV facility is at an approximate cost of $6M in 1980 dollars. Both of these estimates do not include an allowance for contingencies.

The Committee examined the question of obligating both facilities in FY 1982 with support spread over FY 1982 and FY 1983 and is convinced that a workable plan can be established that will not impede the construction of these facilities.

These two facilities, although differing in the characteristics and the research they will support, are dedicated to both light and heavy ion nuclear physics. Thus, the above recommendation adheres to the spirit of the Long Range Plan that calls for a light heavy ion upgrade in FY 1982 and a light or heavy ion upgrade in FY 1984.

Although it was recognized that recommendation of these facilities does not imply acceptance of the implied increases in operating funds, it was established that the increases in both cases were within the expected capabilities of the funding agencies.

Although the Subcommittee found the proposal submitted by the American University and the University of Virginia to be scientifically and technically sound, the Subcommittee is unable to recommend funding for this proposal owing to the large operating costs and the uncertainty in the future availability of end station A at SLAC.

Similarly, the Subcommittee determined that the facility proposed by the Brookhaven National Laboratory is technically feasible and will provide opportunities in research for a wide community of university users. However, the Subcommittee does not recommend funding for this project in FY 1982 because of the unexplored impact of the substantial increase in operating

funds for the project and uncertainty with regard to the role of this major heavy-ion facility in the national picture. The Subcommittee invites further organized discussion of this question by Brookhaven, the nuclear community, and the Nuclear Science Advisory Committee.

For many of the same reasons stated in 1979, the Subcommittee is unable to recommend funding for the proposal from the University of Colorado. Although there are positive aspects to the proposal, such as the innovative storage ring and the fast-neutron beam capability, it is felt that the proposal has not changed substantially from the one submitted in 1979 and acceptance is not justified.

The Subcommittee decided that the booster proposal from Florida State University was technically feasible and cost effective based on the presumed availability of the basic linac elements from the Argonne Laboratory. However, the Subcommittee feels that the Florida State Laboratory has not yet acquired the necessary technical background and expertise to undertake a construction project in this area of high technology. Substantial dedication on the part of the laboratory personnel will be needed to insure the success of this project. Thus it was decided not to recommend funding for this project at this time.

II. 2. Fiscal Impact of the Recommendations

In arriving at its recommendations the Subcommittee was guided by the plan for facility construction as laid out in the Long Range Plan of the parent Committee. The pertinent recommendations of this plan can be found in Table II, page 132 of the Long Range Plans:

Excerpt from Table II
of the Long Range Plan

FY	Facility	Estimated cost (M$)
1982	Light-heavy up grade	$7
1983	Heavy-ion upgrade	7
1984	Light-or heavy-ion upgrade	7

As stated in the Long Range Plan, these projections "should not be considered as rigid. It will be necessary to revise the details of both the budget and construction schedule each fiscal year after a review of the specific proposals that are submitted for consideration is made." As pointed out "revision may be required because of the possible impact of scientific and technological advances which make different goals important and accessible." The Subcommittee also felt that full advantage should be taken of the opportunities and desirable features presented to the nuclear community by the proposals themselves. Within the context of these guidelines it is felt that the Subcommittee's priority recommendation is eminently suited to the Long Range Plan both in spirit and in actual execution. The Washington and Yale facilities will be devoted to both light--and heavy-ion physics which should

provide adequately for the capabilities intended in the light-heavy upgrade and the light-or heavy-upgrade of the Plan in FY 1982 and 1984, respectively. Funding of these projects over two consecutive fiscal years should leave open the possibility of funding a heavy-ion facility in the third year.

With regard to the funding of these proposals within the context of the funding scenario of the Long Range Plan, the Subcommittee was guided by the major recommendation in Table II that $20M/year (with appropriate escalation for inflation) be provided for construction over the period FY 1982-1989. It was recognized that for FY 1982 some $12M has already been committed to the MSU and ANL projects and some $6M for MSU in FY 1983. It was then estimated that these commitments of $18M, together with the funding obligation for Yale and Washington of $15M spread over FY 1982-83, would leave about $7-8M (depending on the increase for inflation in the actual allocations) for construction needs in FY 1983. Although not spelled out in this report, the Subcommittee satisfied itself, on the basis of detailed knowledge of the costs for various parts of the Washington and Yale proposals, that a workable plan could be found for funding <u>both</u> projects over a two year span without impeding the progress of construction and installation.

With regard to the impact of the recommendations on operating funds, the Subcommittee noted that in the Long Range Plan's projections for operating funds, provision is made for start-up and operation of new and upgraded facilities. Within this context the approximately $600K per year incremental operating costs projected for the Washington and Yale projects should be accommodated entirely within the Plan's real growth in operating funds. However, the agency representatives voiced a word of caution. It was pointed out that: because the real growth funds cannot be spent more than once, because of the need for incremental annual operating costs for the Michigan State and Argonne projects (heavy-ion construction projects previously recommended and now being funded), and because light-ion and heavy-ion research are <u>each</u> projected by the Plan for a decreasing fraction of the <u>total</u> Federal effort in basic nuclear research, it is entirely possible that detailed implementation of the Long Range Plan will require reduction and/or termination of support of some existing light-ion and heavy-ion research facilities. Clearly, this particular aspect of the yearly recommendations made by the Facilities Subcommittee must be closely watched by the Nuclear Science Advisory Committee with an eye toward recommending appropriate solutions at the proper time.

III Summaries and Evaluations of the Proposals Considered by the 1980 Facilities Subcommittee of the DOE/NSF Nuclear Science Advisory Committee

III. 1. AMERICAN UNIVERSITY AND UNIVERSITY OF VIRGINIA

The objective of this proposal is to build a new injector and energy compression system at the Stanford Linear Accelerator Center to provide a high current, high resolution electron beam for nuclear physics measurements in the range 0.4-2.9 GeV. The injector would be inserted at the appropriate place along the linac. The group from the American University, the University of Virginia, and the University of Bonn plans to measure the elastic and inelastic charge and magnetic structure functions of ^{2}H, ^{3}H, ^{3}He, and ^{4}He.

These experiments will extend the knowledge of nuclear form factors to regions of momentum transfer that probe the short distance behavior of the nucleon-nucleon interaction and the role of underlying nucleon constituents in nuclear structure. SLAC is the only electron accelerator in the world with the energy, current, and momentum resolution that is required to perform these measurements.

The measurements will cover three ranges of nuclear excitations: elastic, threshold and quasi-free, and deep inelastic. The momentum transfer will extend to 12 fm^{-1}. Angular distributions will permit cross sections to be separated into longitudinal and transverse components. Much of the running time will be a angles (155°) where the study of magnetic scattering is emphasized. The existing spectrometers in end station A at SLAC will be used. A coincidence measurement will be needed for one phase of the experiment: elastic scattering from deuterium.

The proposed injector would be a copy of the existing electron source at SLAC. This source is estimated to cost $840K. The energy compressor consists of a set of magnets at the end of the accelerator to disperse the electron beam, pass it through an rf field phase to compress the momentum spread by a factor of 10 to 30, and then magnets to refocus the beam on the scattering target. This device is estimated to cost $370K. These costs are FY 1980 dollars and include a 20% contingency. The construction of these devices would be carried out by SLAC personnel over a period of 18 months.

Although the AU/UV proposal to the NSF and DOE for $1210K is for construction, the group notes that the SLAC management will charge for setup and running time for nuclear physics experiments that the group is planning in end station A. The SLAC charges for runs on the hydrogen and helium isotopes could cost as much as $2300K depending on

efficiency of scheduling. It was also noted that operations at SLAC end station A will be suspended in April, 1980 until the end of the fiscal year because of budget pressures at SLAC. A decision on the future of end station A will be made by the SLAC management at the end of calendar year 1980.

The views of the Facilities Subcommittee concerning this proposal were the following. The physics of few nucleon structure functions was judged to be of high merit and the measurements deemed essential to the advancement of the understanding of nuclear interactions at high momentum. The technical feasibility of building and operating the injector and compressor were judged satisfactory. The ability of the experimentalists from the American University, the University of Virginia, and the University of Bonn to carry out the proposed measurements was recognized.

However, the Subcommittee is concerned with the uncertainty of the future of SLAC end station A. It appears that the possibility exists that a construction investment by the agencies could be lost or not fully recognized by a full measurement program. Although the proposed measurements are essential they are not urgent. Given the unfavorable circumstances, such as high operating cost, under which they would be performed it is prudent to delay the few nucleon structure-function measurements until a more suitable electron accelerator is available.

The Subcommittee recommends that the present proposal not be funded and that support of such experiments be considered at a more favorable time.

III. 2. BROOKHAVEN NATIONAL LABORATORY

Brookhaven proposes to convert an existing 2600 ton magnet yoke and coil assembly, which was recently transferred from SREL, into an intermediate energy heavy-ion afterburner, injected by the BNL double MP tandem. The total capital cost of $10.78M (FY 1980) includes about $6.5M to convert the SREL magnet into a variable energy isochronous cyclotron of maximum rigidity, about four Tesla-meter (K = 850 MeV), with transport components to conduct the beam from tandem to cyclotron and from cyclotron back to existing experimental areas. The bulk of the rest of the cost involves a building addition to house the cyclotron vault, beam transport sections, a control room, and office and storage space totaling about 18,000 square feet which will cost about $4.0M. Additional equipment needs for the early research program are estimated at $2-3M but are not part of the present proposal. Incremental operating costs for the accelerator are stated as $1.5M/year including about $0.5M/year for electrical power. This would make an annual operating budget for the composite facility of about $3.0M per year excluding research costs. Construction time is estimated at three years.

The cyclotron design features an innovative pole tip with inclined shim gap to reduce significantly the field shape variations as the hill fields are raised to a maximum 22 kG. With this tip design and with the small hill gap made possible by a dee-in-valley geometry, the total magnet power is held below 300 kW over the full excitation range. Two opposing dees at 140 kV operate on harmonics 2-6 and 10 or more, with five fixed dee stem shorting positions in combination with tuning panels to cover the 10.5-21 MHz frequency range at power levels of 125 kW/dee. The beam is injected through a valley with an adjustable stripper location for centering. Extraction is accomplished with the aid of the $\nu_r = 1$ resonance, after several hundred turns. A steam bakeout procedure is expected to give a base pessure 10^{-8} Torr with eight hour pumpdown.

The beam from the tandem is momentum-analyzed, rebunched, dispersion- and emittance-matched to the cyclotron, with attention paid to decoupling of tuning adjustments. On exiting the cyclotron, the beam is conducted back to the present target rooms. The switchyard arrangement permits stand-alone tandem operation during cyclotron maintenance and reduces interference with the present user program during construction.

The Brookhaven group has invested a considerable effort in the detailed design of the proposed facility -- they estimate an approximate cost for R and D of $0.5M so far. There are, however, a few loose ends that still remain to

be resolved, especially with regard to operational aspects. There is little information on cyclotron diagnostics or on procedures for beam centering, pulsing of rf systems, etc. The tolerance of the bunching system to voltage distribution jitter or longitudinal emittance in the tandem beams needs to be examined. The manner in which intensity varies with energy, the limits set by source output or stripper lifetime, and realistic assessments of transmission losses should be explored. These concerns do not, however, override the overall assessment by the Subcommittee that the technical feasibility is in large measure established.

A vigorous and still expanding user program is presently underway on the MP tandems at BNL. This program is effectively managed by BNL and enthusiastically supported by the users. The location of BNL makes it accessible to a large number of university research groups in the northeastern United States. Groups at MIT and Stony Brook have been especially active users; together they account for about half the beam time of outside users. Hence, the proposed facility could be viewed as contributing strongly to education inasmuch as it provides ready access to a forefront facility for several excellent university programs. Most of the universities in the area with large nuclear science programs also operate in-house facilities and view BNL as an important enhancement of their in-house capability.

The Brookhaven double MP tandem electrostatic accelerator came into service in 1970. Research equipment available includes an aging but well equipped Sigma 7 data acquisition computer; QDDD, time-of-flight, energy-mass, and electron spectrometers; two scattering chambers; a number of gamma-ray stations; and radioactivity and atomic physics equipment. A wide variety of heavy-ion beams are available in two operating modes. In one mode the two tandems are coupled together with a terminal ion source in the first. In the second mode the first tandem operates in a stand alone mode while the second is fed by a source near ground potential. About 37 elemental species have been accelerated.

With the proposed afterburner the BNL facility would be able to provide beams with energies ranging up to 150 MeV/amu for light ions such as ^{16}O and up to 18 MeV/amu for uranium. Both energy and mass ranges are quite broad, with the lower end of the energy range overlapping with the capability of existing tandem accelerators. Performance calculations are based on an intensity corresponding to 1% of DC intensity after two strippings and rf bunching.

The scientific staff at Brookhaven that would be associated with the upgraded facility includes 21 members of the present tandem accelerator staff, four scientists from the BNL

chemistry department, and six nuclear theorists. In the present tandem operating mode, half of the beam time is reserved for the local group. The plan for the upgraded facility includes a procedural change to "full user mode" with a uniform policy of competitive beam access under guidance of a Program Advisory Committee. There is no provision for split beam operation with the upgraded facility. Since beam time on the present tandem is oversubscribed, the proposal must be viewed as extending the characteristics of beams that are already heavily used rather than as a means of providing new beam time to accommodate a larger number of users.

This proposal provides for a versatile and effective facility for the investigation of intermediate energy heavy ion physics. This area is basically unexplored at the present time and is of great interest to a large number of heavy ion researchers. One or two facilities in the world are under construction, which will allow research in this area to begin. In the U.S. MSU Phase II will operate over an energy range comparable to the one projected in the BNL proposal.

The Subcommittee recommends a deferral of action on the proposed BNL facility for the following reasons:

1. The $1.5M increment in the operating budget for the upgraded facility would have a substantial impact on other parts of the national program in nuclear science, within the context of the Long Range Plan of the Nuclear Science Advisory Committee and within a funding scenario of "constant level of scientific effectiveness." Moreover, there would be increased needs for research support of the more complex experiments that can be anticipated to become necessary in the exploration of the upper energy regime of the proposed facility. The present proposal does not address this question. It is important to reach a thorough understanding of the equipment needs and expanded research costs for a new facility in this energy region. In the context of the known total cost, it will then be necessary to arrive at a plan to accommodate such a new facility within the national program and to assess the impact before a definite recommendation can be made.

2. The great interest and current excitement in higher energy heavy-ion research has been evidenced in the recent actions of the Nuclear Science Advisory Committee and the Federal agencies. The opportunity presented by the BNL proposal invites a detailed discussion of the optimal balance between available resources and others that might be required to

investigate this science effectively. These discussions should involve the heavy-ion research community, and the Nuclear Science Advisory Committee, as well as the proposers of this facility. The funding of this proposal in FY 1982 would require a substantial modification of the Long Range Plan. Deferral of the proposal at this time will allow the community the necessary time to discuss these complex questions.

III. 3. FLORIDA STATE UNIVERSITY

FSU proposes the addition of a 12 MV superconducting LINAC booster, modeled after the Argonne facility, for its existing 9 MV tandem. The proposed addition provides a significant energy boost for ions between Li and Ni with an output energy of 320 MeV for the optimal case, A = 40. A further upgrading of the accelerator would be feasible later at linear additional cost. The present proposal requests funds of $1890K for the accelerator and $660K for new instrumentation. A significant component in the latter request is the development and construction of a new type of polarized ion source for heavy ions. In addition Florida State has already committed itself to a contribution of $630K for a new building that will house the proposed accelerator and target area, as well as some ancillary equipment. The proposed facility would require annual operating funds of $770K from NSF/DOE of which $200K may be considered as an increment arising from the upgrading. All these figures are in FY 1980 dollars. No fixed construction schedule is given in the proposal, but it is stated that the booster is expected to be operational in 1982 if funding in FY 1982 is approved. This estimate appears to be based on significant preparations made possible by state funding.

This proposal is very cost effective. In part this is due to the fact that an existing accelerator is being extended and to the substantial contribution from the State of Florida. In addition, Argonne National Laboratory appears willing to provide the major new accelerator components at cost and most other components would be built in-house at FSU. On this basis the cost estimated for the project and their performance projections are realistic. Although the FSU staff at present lacks experience in some of the technology needed to implement this proposal, it is reasonable to assume that this expertise can be acquired from ANL and elsewhere. However, the dedication of more than one senior group member at FSU to this project would surely be needed.

The proposed upgrading will significantly increase the research potential of an important university facility in the southeastern U.S. The FSU nuclear laboratory has in the past, and continues to have, strong support from the State of Florida, and some regional use of the accelerator by other groups can be expected. The Subcommittee also notes that the University has committed a faculty position in experimental nuclear physics for the Fall of 1980.

It is the opinion of the Subcommittee that the proposed upgrading, both in cost and scope, is very well matched to the needs of the FSU laboratory. However, the Subcommittee felt that the proposal would be substantially improved and its success better insured if the laboratory would acquire greater expertise in this area of high technology. In particular, it would be desirable if one or two members of the laboratory could acquire hands-on knowledge of these skills. The Subcommittee is therefore not able to recommend funds for this project for FY 1982.

The Subcommittee hopes that the FSU staff would continue on their present development plan and acquire greater expertise in linac technology, fast pulsing, and cryogenic techniques. Use in an experimental program of the new fast buncher, now under construction at FSU and supported by state funds, will provide the laboratory experience with the nature of the problems to be addressed in the proposed facility. It is also hoped that the Laboratory will acquire greater knowledge and experience in the technology of polarized heavy ion sources -- expertise that will be vital in the development of the proposed new type of polarized heavy ion source. With increased experience in these areas FSU would be able to present a stronger proposal a year or two from now.

III. 4. UNIVERSITY OF COLORADO

The University of Colorado resubmitted a proposal made in 1979 for construction of an open four-sector cyclotron. This accelerator would utilize the present cyclotron, suitably modified, as an injector to provide high current (up to 100μ A) light ion beams. Protons and deuterons (polarized as well as unpolarized), ^{3}He, ^{4}He, and Li beams would be accelerated. Proton energies would extend up to 75 MeV, deuteron energies to 50 MeV, and He and Li energies would follow from the value of $K = AE/Q^2 = 100$ MeV. Design and construction time is estimated at five years.

It is contemplated that the two cyclotrons would be coupled through an intermediate storage ring that could be used to yield a large increase in instantaneous beam intensity and to adjust the duty cycle to optimize various experiments. Also incorporated in the proposal is building construction for a new experimental area, offices and shops. A special feature of the experimental area is a 180 meter long time-of-flight path for neutron studies. The proposed facility is specifically for light ion experimentation and is focused strongly towards studies with neutrons.

The proposal requests federal funding in the amount of $11.3M in FY 1978 dollars or approximately $13.6M in FY 1980 dollars, including contingency costs. In addition, some $4.3M (FY 1978 dollars) will be sought from the State of Colorado for building construction and supplies. When the new accelerator becomes operational, the DOE budget for operating expenses is projected to increase by $0.8M over the $0.7M needed for the present facility in 1980. The new laboratory, which is intended as a national light ion accelerator facility, would be administered with an emphasis on the user mode, adapting some of the organizational concepts of the Joint Institute for Laboratory Astrophysics which is also located at Boulder.

Although the response to the evaluation of the proposal made by the Nuclear Science Advisory Committee last year has not been extensive, the Subcommittee notes that design and feasibility studies have progressed and some staffing changes have recently been made to assist the project. The need for an excellent fast-neutron beam facility is recognized in the Subcommittee, but this aspect of the proposed facility has not been extensively developed in the proposal.

Although, in the judgment of this year's Facilities Subcommittee, the storage ring concept proposed for the University of Colorado might yield an interesting and innovative device for nuclear studies, the Subcommittee

concluded that the detailed technical design of the accelerator has still not progressed sufficiently to assure success of the project, if it were funded at this time. While the Subcommittee accepts the premise that there is a need for a national facility especially suited to nuclear reaction studies with fast neutrons, it is not satisfied that the present design constitutes an optimal means to achieve this purpose, that the relation of this project to existing facilities has been sufficiently explored, and that the potential community of users has been adequately identified. Therefore, the Subcommittee does not recommend that this construction project be funded.

III. 5. UNIVERSITY OF WASHINGTON

The University of Washington has resubmitted a proposal with considerable revision for a nuclear research facility that attempts in a realistic way to respond to the main conclusions of the FY 1981 Facility Construction Report of the Nuclear Science Advisory Committee that "The serious disadvantage of this proposal (for FY 1981) is its relatively high capital cost." This response involved a reduction in maximum voltage for a folded tandem electrostatic accelerator from 20 MV to 18 MV and a reduction in cost (without contingency) to $8.90M (in 1980 dollars). This cost reduction is in large part due to the possibility that the University, through the State of Washington, will provide the $3.50M needed for the construction of the accelerator building.

The research program envisaged with the proposed accelerator is a balanced mix of heavy-ion and light-ion studies salted with forays into nuclear astrophysics and accelerator radiochronology. Investigations of rapidly rotating nuclei highlight the heavy-ion program while nuclear parity violation experiments and radiative capture experiments are examples of the light-ion program.

In addition to the strong possibility of funding of the accelerator building by the University, the institutional support pledged to this project includes underwriting the initial architectural design of the building, providing $50K/year for five years to support associated technical staff, released of two man-years of faculty time from teaching, creation of two tenure-track faculty positions for nuclear experimentalists, and provision of campus land for the building and for connections to campus utilities. These commitments by the University are firm, contingent only on federal funding of the accelerator proposal.

The technical feasibility of this proposal hinges on an 18 MV electrostatic accelerator to be purchased from the National Electrostatics Corporation. This accelerator is a scaled down version of the 25 MV Oak Ridge-Holifield and 20 MV JAERI (Japan) machines. The column structure for the proposed Washington tandem would be identical in diameter to the JAERI column but with two fewer 1 MV sections. Although definitive performance figures do not yet exist for the ORNL and JAERI tandems, the preliminary results available indicate that the proposed 18 MV machine will achieve its rated potential. In addition, it was established that NEC accelerators now in existence, but designed for lower potential, are operating at their rated specifications. Experience on installation of these two accelerators, however, suggests that the proposed four year project schedule may be overly optimistic.

The reduction in performance associated with lowering the terminal potentials for the present proposal from 20 to 18 MV is mitigated by retaining the future possibility of using one of the existing FN tandems as an injector. The cost of this option is not included in the proposal, but was estimated to involve about $0.4M in additional costs.

A significant emphasis in this proposal is on the use of polarized, light-ion beams. The Subcommittee notes that funding for the polarized source is not included as part of the proposal, but will be requested separately. The Subcommittee offers its strong encouragement to the University to pursue the early funding of this polarized source. It is also noted that the need for other incremental ancillary equipment for the new facility has not been fully developed in the proposal. Such equipment will need to be carefully evaluated in the light of recommendations in the Long Range Plan and the capabilities of the funding agencies.

The project schedule has been arranged so that the use of the existing FN tandems may be retained until the last few months of the construction period. Additional operating costs for the new accelerator were estimated at about $500K per year. These costs are associated in part with providing operating support staff to facilitate the outside user program.

The Subcommittee retains some reservations over the proposed "extended faculty" concept for accommodating outside users. While considered an interesting approach, if it is implemented the Subcommittee recommends that it be reviewed in a few years to establish its effectiveness.

It is the unanamous opinion of the Subcommittee that this facility will significantly enhance the natonal program of the university based research in nuclear physics. The facility will strengthen and expand the physics program at the University of Washington, a program that has played a significant role in education in nuclear science. It will make possible precision and (often) lengthy experiments with light and moderately heavy ions. It is likely that significant progress in nuclear physics will result from such experiments and the University has a history of successfully carrying them out. The diversified interests of the staff should result in a balanced program involving investigations such as non-equilibrium processes with heavy ions, capture reactions with polarized particles, nuclear resonances, and parity violation in nuclei.

This proposal shares the Subcommittee's top recommendation for FY 1982 construction.

III. 6. YALE UNIVERSITY

Yale University resubmitted a proposal for conversion of its 14 MV MP tandem Van de Graaff accelerator to a 20-22 MV facility. This proposal from Yale was substantially the same as the one considered by the 1978 and 1979 Facilities Subcommittee and included in their priority listing for FY 1980 and FY 1981 construction. Since the project has not been funded, Yale resubmitted the proposal with significant modifications for consideration by the 1980 Facilities Subcommittee.

The research emphasis of this proposal is on the extension of current programs at Yale to regions of higher energy and ion mass, while preserving the high precision characteristics of the available beams and the ability to perform light-ion studies. Also, the addition of fast pulsing instrumentation and a light-ion, polarized beam capability is planned.

As presently perceived, the future research program will span the researach areas of light and heavy ions. It will involve experiments such as the search for the beautiful symmetries predicted by the interacting boson model and reveal the spectroscopy of high-spin states. The fascinating high spin yrast traps that give rise to metastable nuclear states will be explored. The proposed time-of-flight facility, together with the increased capability of the accelerator, will greatly enhance the studies of fast neutrons, complex heavy-ion spectra, capture reactions, and lifetimes of high-spin states. The addition of the polarized beam capability to the new facility will provide a new dimension for the study of basic nuclear interactions such as $d(\vec{d},n)$ and $t(\vec{d},n)$. The important studies of atomic phenomena revealed in collisions of heavy ions will be continued.

The proposal calls for the purchase of equipment from High Voltage Engineering Corporation (HVEC) to convert Yale's existing MP tandem accelerator, which has a maximum operating voltage of 13-14 MV, into an Extended STU (ESTU) configuration which would have an operating voltage rated at 20 MV. The major modifications to be made are: 1) replacing the present 18 foot diameter pressure tank with a 25 foot diameter tank rated at 175 psi; 2) increasing the number of accelerating sections on each side of the terminal from four to five; 3) replacing the present 72" tubes in each accelerating section with new 88" tubes; 4) providing a new insulating gas mixture of $SF_6/N_2/CO_2/H_2O$ in the proportions 40/47/13/0.15; 5) installing a rotating shaft mechanical power system in parallel with the existing Pelletron charging chains; 6) enlarging the terminal; 7) adding a new 90 momentum-analyzing magnet to accommodate beams of higher rigidity; 8) installing a

pulsed ion beam capability with TOF resolution of < 1 ns; 9) installing a commercial polarized ion source capable of providing 1 A of a polarized and momentum analyzed proton beam on target; and 10) adding a K = 300 beam switching magnet in the experimental area.

The major difference between the present proposal and that submitted in 1979 is related to the expected transfer of research capability at the Yale electron accelerator to the proposed tandem accelerator facility. With the anticipated closing of the Electron Accelerator Laboratory (EAL) in about four years, Professor Frank Firk will join the ESTU staff and institute a research program in light ion physics using the proposed beam pulsing and polarized beam capabilities. Other changes include arrangements for increased use of the laboratory by off campus users with increased technical staff and office space (from the EAL) becoming available to support this activity, and an improved beam handling capability for experimental areas. In addition, it is anticipated that the laboratory's program will be strengthened by the present acquisition of a second data analysis computer and, in a separate proposal, a request for funds to construct a large solid angle single gap spectrometer. Other costs for new ancillary equipment appropriate to the new facility will need to be carefully examined within the context of the Long Range Plan and the resources of the funding agencies.

The technical features of the present proposal appear to be of sound and conservative design, but we note that the extended accelerator tube concept has not yet been completely tested. The advantages of the new insulating gas mixture proposed by Yale have been confirmed by measurements at Minnesota and Brookhaven. It is the Subcommittee's opinion that the proposed facility will achieve stable, research-quality operation at the design goal of 20 MV terminal voltage.

Since HVEC will engineer and manufacture the needed new components, the responsibility for these aspects of the conversion does not rest with Yale personnel. The local laboratory staff will, however, have the responsibility for acceptance and installation of the components and the operation of the complete ESTU system. The Subcommittee believes that there is adequate technical competence and prior experience at Yale for this work to be successfully completed in a timely fashion. The proposal states that research will continue on the present accelerator until all the major new components for the conversion have been delivered. The estimated nine months interruption of research while the conversion takes place appears to be realistic.

From the perspective of the overall national program, the proposed facility would strengthen the in-house capabilities for both light-ion and heavy-ion research by one of the significant university groups in nuclear science, one which has traditionally supported a substantial program of graduate education. The facility would provide beams at energies intermediate between those of present tandems and those from the 25 MV tandem being constructed at Oak Ridge-Holifield and the linac booster tandem system being developed at Argonne.

Institutional support for this project is coming from Yale University in the form of staff appointments and facility expansion. The transfer of senior staff from the Electron Accelerator Laboratory to the Wright Nuclear Structure Laboratory staff is a significant expansion of the experimental research activities at this facility. The recent appointment of nuclear theorists to both a senior and junior faculty position in the physics department significantly strengthens the nuclear physics research capability of Yale University. Finally, the transfer of both office space and ancillary equipment from the EAL to the tandem lab will play an important role in accommodating enhanced user activity at this facility. It is stated that a substantial user program will be welcomed to the extent that operational support is available.

The estimated cost of the proposed facility is $5.8M in FY 1980 dollars. This amount does not include any contingency allowance. The incremental operating costs resulting from this project are related to the addition of perhaps three to four technical persons to the support staff as required by the increased off-campus utilization of the facility. The Yale group estimated this to be $150K per year. This figure looks reasonable on the basis of the present operating budget.

The time schedule given in this proposal, based on funding in FY 1982, calls for shutdown of operations of the present accelerator on October 1, 1983, completion of installation on April 1, 1984, and resumption of research with the new facility on July 1, 1984.

It was noted by the Subcommittee that the Wright Laboratory possesses a strong scientific staff that has produced innovative research and educated many young physicists. The program has been a broad one, which, in addition to its contributions to the study of nuclear structure and reaction mechanisms, has contributed to the investigation of problems in astrophysics, atomic and molecular physics, and materials science. In the Subcommittee's opinion the Yale proposal provides a highly cost effective enhancement of the national program in physics and the overall national program in nuclear science.

This proposal shares the Committee's top recommendation for FY 1982 construction.

IV. Appendixes

IV. 1. Membership of the 1980 Facilities Subcommittee which was a Committee of the Whole of the 1980 Nuclear Scince Advisory Committee

S. S. Hanna, Stanford University, Chairman
F. Ajzenberg-Selove, University of Pennsylvania
J. B. Ball, Oak Ridge National Laboratory
P. D. Barnes, Carnegie-Mellon University
J. Cerny, Lawrence Berkeley Laboratory
H. Feshbach, Massachusetts Institute of Technology
W. A. Fowler, California Institute of Technology
G. T. Garvey, Argonne National Laboratory
W. Haeberli, University of Wisconsin
D. C. Hagerman, Los Alamos Scientific Laboratory
E. M. Henley, University of Washington
J. R. Huizenga, University of Rochester
E. Merzbacher, University of North Carolina
J. S. O'Connell, National Bureau of Standards
P. Paul, State University of New York at Stony Brook
R. E. Pollock, Indiana University
D. Robson, Florida State University

IV. 2. Agency Representatives at the Meetings of the Subcommittee

J. E. Leiss, Department of Energy
C. R. Richardson, Department of Energy
E. Ritter, Department of Energy
N. F. Lane, National Science Foundation
W. S. Rodney, National Science Foundation
H. B. Willard, National Science Foundation
C. P. Browne, National Science Foundation

IV. 3. Agenda of the Combined Meeting of the Facilities Subcommittee and the Nuclear Science Advisory Committee, February 7-9, 1980.

Thursday, February 7 Room 540, NSF, Washington, D.C

	Closed Session
9:00 am - 10:00 am	Procedures, ground rules, priorities, conflicts of interest, etc.
	Open Session
10:00 am - 10:30 am	DOE Plans, FY80 and FY81 Budgets
10:30 am - 11:00 am	NSF Plans, FY80 and FY81 Budgets
11:00 am - 12:30 pm	Report of the Chairman
12:30 pm - 1:30 pm	Lunch
1:30 pm - 3:30 pm	Proposal from Brookhaven National Laboratory
3:30 pm - 5:30 pm	Proposal from the University of Colorado

Friday, February 8 Room 540

	Open Session
9:00 am - 11:00 am	Proposal from Yale University
11:00 am - 1:00 pm	Proposal from the University of Washington
1:00 pm - 2:00 pm	Lunch
2:00 pm - 4:00 pm	Proposal fromm Florida State University
4:00 pm - 6:00 pm	Proposal from American University and University of Virginia

Saturday, Feburary 9 Room 543

	Closed Session
9:00 am - 1:00 pm	Discussion of proposals and preliminary recommendations

IV. 4. Agenda of the Combined Meeting of the Facilities Subcommittee and the Nuclear Science Advisory Committee, March 26-28, 1980

Wednesday, March 26 Room 543, NSF, Washington, D.C.

Closed Session

8:00 pm - 11:00 pm	Discussion of projects under consideration for funding.

Thursday, March 27 Room 543

Closed Session

9:00 am - 12:00 n	Continuation of the discussion of projects under consideration for funding.
12:00 n - 1:30 pm	Lunch

Open Session

1:30 pm - 2:00 pm	Minutes, Chairman's remarks
2:00 pm - 4:00 pm	Presentation of a Proposal for a National Nuclear Computer Center at the University of Maryland.
4:00 pm - 6:00 pm	Instrumentation Subcommittee -- Final Report.

Friday, March 28 Room 543

Open Session

9:00 am - 10:00 am	Ongoing Programs and Laboratory Operations Working Group -- Revised report and discussion.
10:00 am - 10:30 am	Resolution on Research and Development
10:30 am - 12:00 n	Role of the Universities Subcommittee -- Discussion.

Closed Session

12:00 n - 1:00 pm	Continuation of the discussion of projects under consideration for funding

1:00 pm - 2:00 pm	Lunch
	<u>Open Session</u>
2:00 pm - 3:00 pm	Consideration of the 1980 Facilities Subcommittee Recommendations and the covering letter of transmittal.
3:00 pm - 4:00 pm	Manpower Subcommittee -- Discussion.
4:00 pm - 5:00 pm	Consideration of future activities for 1980.