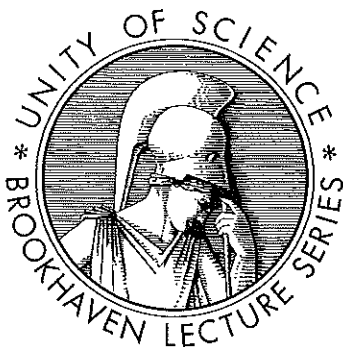


Early History of Associated Universities and Brookhaven National Laboratory

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BROOKHAVEN LECTURE SERIES

Number 55, March 30, 1966

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Printed in the United States of America
Available from
Clearinghouse for Federal Scientific and Technical Information
National Bureau of Standards, U.S. Department of Commerce
Springfield, Virginia 22151
Price: Printed Copy \$3.00; Microfiche \$0.65

February 1967

1750 copies

INTRODUCTION

It gives me a particular personal pleasure to introduce tonight's lecturer, Professor Norman Ramsey. Just 15 years ago, almost to the day, I, as a graduate student, somewhat spring feverish, stopped at his office in Harvard's Lyman Laboratory to chat and to find out what was new. Professor Ramsey, with characteristic enthusiasm, told me about an elegant neutron beam experiment he and Bill Cohen proposed to do at a new laboratory somewhere on Long Island. I don't remember much else except that I soon found myself on a rickety train bound for a most improbable place called Patchank or Yaphogue and a new career.

Norman Ramsey was educated at Columbia and Cambridge, England. Indeed, he has a bachelor's, a master's, and a doctor's degree from each institution. When he returned to Columbia in the late 1930's, he joined Professor I.I. Rabi in Rabi's Atomic Beams Laboratory, the laboratory which produced so much of the fundamental data of nuclear physics in the era before the great accelerators. Ramsey's doctoral thesis dealt with the first application of molecular beam techniques, and he was an active member of the group which first discovered the electrical quadrupole moment of the deuteron, a discovery which had immense significance for our knowledge of nuclear structure. With the advent of World War II, the course of Professor Ramsey's career was sharply altered. His service to the Government was most distinguished during those years. During the first half of the war, he was associated with MIT's Radiation Laboratory, doing research on radar, for which he later received the Presidential Order of Merit. During the second half, he was associated with the Manhattan project, as leader of the bomb delivery group at Los Alamos. At the war's close, when he was barely 30 years old, Professor Ramsey returned to New York to become an active faculty member at Columbia and first chairman of the Physics Department at Brookhaven. In 1947, he left New York for Harvard, where he has been Professor of Physics and an inspiring teacher for almost 20 years.

Dr. Ramsey's career has been as strongly marked by government service as it has by scientific and educational excellence. He has served as scientific advisor to NATO, as a member of the AEC's General Advisory Committee, as a trustee of AUI, and recently as a trustee of the Carnegie Endowment for International Peace. At Cambridge (Massachusetts) his interests in physics have ranged from very high energies to very low. He has been Director of the Harvard Nuclear Laboratory, and of the Cambridge Electron Accelerator Project, while maintaining an atomic and molecular beams laboratory on the Harvard campus. His work with beams, which perhaps lies closest to his heart, is characterized by great elegance and great accuracy. Recently, the hydrogen maser was invented in his laboratory. This device, which will make possible atomic clocks with an accuracy of one part in 10^{13} , extends Professor Ramsey's energy range to about 10^{26} eV.

His most recent enthusiasm has been for an experiment now under way at Brookhaven to estimate the electric dipole moment of the neutron, a beams experiment which, without benefit of tons of lead shielding, battleship armor plates, and unrifled naval guns, will tell us much about the future of weak interactions. The wide extent and significance of his research was cited in 1960 when he was awarded the AEC's Lawrence award for "Outstanding Contribution to Experimental Nuclear Physics, Including the Interaction of Nuclei and Studies of Atomic and Molecular Beams."

It is an honor to introduce Dr. Norman F. Ramsey, Professor of Physics at Harvard, who will speak about the early history of Brookhaven and will perhaps explain why Brookhaven National Laboratory is not at Brookhaven, New York.

NOEL CORNGOLD

Early History of Associated Universities and Brookhaven National Laboratory

In giving this talk I am violating two of my basic principles. One is never to allow anyone else to select the title of the talk I am to give and the second is almost always to talk on physics. However, when Mrs. Goldhaber asked me to give a talk on the early history of Associated Universities and of Brookhaven National Laboratory I agreed to do so. The reason that I was willing to violate my principles in this case is that the founding of AUI and of BNL has proved to be far more important than recognized at the time. The history of this founding is therefore well worth recording and discussing. Not only have Brookhaven Laboratory and AUI been great successes themselves, but they have also been models for other similar organizations. CERN was directly modeled after Brookhaven and CERN has become perhaps the most successful international cooperation that has been yet achieved. Organizations on the AUI pattern have been established in various locations for many purposes including astronomical research, high energy research, city planning and development, etc. Currently a new organization on the AUI pattern is being established for the operation of the new 200-BeV accelerator. This organization, University Research Association, called URA for short, is now in a stage of development analogous to that of AUI during some of the periods I shall describe. The founding of AUI is cited by the Harvard economist, Carl Kaysen, as one of the evolutionary steps in the development of the corporation as a way in which American society organizes itself to achieve its goals.

With the recent publication of the books on President Kennedy there has been a considerable controversy as to whether the participant in an event can also be a good historian. Without attempting to join in this controversy I should like to emphasize at the outset that I am not attempting to give a well-balanced objective historical discussion in this talk. If I did so, I believe that the talk would not only be less interesting but it would, in the long run, be less relevant. Instead, I shall give a personal and, in part, anecdotal history from the point of view of one participant – although, where

possible, I have checked my remarks against the documents of that time. My remarks throughout will reflect my own view of the events and I shall leave it to a future historian to balance my account of the events with those of other participants.

INITIAL CONCEPTION

Insofar as I know, the idea that grew into Associated Universities, Inc. (AUI) and Brookhaven National Laboratory (BNL) arose in discussions between Rabi and myself at Columbia University during the period from October to December of 1945, shortly after Rabi returned to Columbia from the MIT Radiation Laboratory and I returned from Los Alamos. I wish I could claim that these discussions originated in a flash of genius and in a vision of AUI and Brookhaven as the important institutions they are today. Instead, I must admit that the idea grew from a mood of discouragement, jealousy, and frustration. In particular, Rabi and I both felt that physics at Columbia University had made enormous contributions to the war effort but that the University was coming out in this period with little scientific benefit in return. In particular, the earliest United States work on fission and nuclear reactors was that done at Columbia by Fermi, Szilard, Zinn, Dunning, and others. However, during the course of the war this activity had been transferred to other locations. As a result many universities emerged from the war with strong nearby nuclear science research laboratories whereas Columbia did not. In particular, the reactors at Clinton Laboratory near Oak Ridge, Tennessee, and at Argonne Laboratory near Chicago, would be immensely valuable assets to the nearby institutions. Likewise the University of California at Berkeley was emerging from the war with its strong Radiation Laboratory.

In the fall of 1945 Rabi and I discussed at length how we could best make a nuclear reactor available to Columbia. Our initial thought was for the Physics Department to attempt to build its own reactor. However, with the then complications of

reactors and the contemplated size of our department, this could not be done without diverting almost the entire research activity of the department from other basic research to that associated with reactors. We also were concerned about similar problems pertaining to high energy accelerators, but at the time this was less dominant in our thinking. As a result of many discussions we came to the conclusion that the best alternative was to call together a number of institutions in the New York area to see if all of us could not cooperate in the establishment of a reactor and perhaps a high energy facility. We discussed this with other members of the Physics Department at Columbia and with Dean Pegram. Since there was general agreement, Dean Pegram then called a meeting of 21 major research institutions between Philadelphia and New Haven, including two industrial organizations: Bell Telephone Laboratories and the Standard Oil Development Corporation.

The meeting was held on January 16, 1946, and it was voted unanimously that the groups represented were interested in sponsoring the establishment of such a laboratory. A committee headed by Dean Pegram of Columbia was instructed to write a letter transmitting a proposal to General Groves, head of the Manhattan District of the Corps of Engineers, which was the predecessor of the Atomic Energy Commission. This letter emphasized the importance of there being a regional laboratory in the nuclear sciences in this area. The letter did not specify what facilities were contemplated. In particular, in no place were high energy accelerators discussed. The letter was transmitted to General Groves on January 19th. General Groves' reply, dated January 22nd, arranged for a conference on February 8th between Colonel K.D. Nichols, General Groves' representative, and the representatives of the sponsoring institutions.

By the time the meeting with Colonel Nichols took place, word of the action of the New York group had reached the Cambridge, Massachusetts, area and the scientists at MIT and Harvard urged General Groves also to establish a nuclear sciences regional laboratory in the vicinity of Cambridge, Massachusetts. At the meeting with Colonel Nichols the representatives of the sponsoring institutions in the New York area were told that the Manhattan District was definitely interested in the proposals and was willing to hear more specific proposals. However, it was also clearly stated that the Manhattan District could not see its way clear

to establishing more than one new laboratory, when the Manhattan District was so soon to be succeeded by an Atomic Energy Commission. The representatives were therefore told that if the New York group and the Cambridge group could get together and unanimously agree upon a single proposal there would probably be support by the Manhattan District. However, if this could not be done the representatives were clearly told there would be no point in bothering General Groves and the Manhattan District further in this matter. It was also pointed out to the group that it was unlikely that a new Atomic Energy Commission when it was established would be able to see its way clear to founding a new laboratory for some years. It was obvious that the Cambridge and the New York groups must agree or neither group could have its desired facility.

With this clear and partially disappointing statement on the part of the Manhattan District, the two regional groups agreed that they should meet together. It was also agreed that the number of participating institutions should be diminished below that of the original New York meeting. On February 16, 1946, representatives of six universities and two industrial laboratories met together and agreed that in spite of anticipated difficulties in agreeing upon a site the groups should notify General Groves of their willingness to act together in proposing a single laboratory for the northeastern region.

The February 16, 1946, meeting was a remarkable one in many ways. Not only did the two groups with divergent desires agree that they should work together for a single laboratory but they also agreed on the dominant nature of the laboratory. Most of the ideas agreed upon at that meeting have continued to the present with modest modifications. The progress made at this meeting was so great that I have added the summary of this meeting as Appendix B to the present report. I shall also read here excerpts from the summary since it so clearly indicates the status of thinking at that time.

- “
- “2. It was agreed by all present that every effort should be made to obtain a chain reacting pile in an accessible location in the northeastern part of the United States.
 - “3. There was considerable discussion as to whether we should request contemplated expansion of the Clinton Laboratory to be made in this area

instead of at Clinton. It was agreed that we should formally only request that a major pile be located immediately in northeastern United States.

"4. The problem of joint action for the purpose of obtaining very high energy particles was discussed. It was agreed that such action would probably soon be required but further discussion in the meeting was deferred for the following reasons:

- a. Several institutions already have projects for the production of particles in the 100-MeV region.
- b. Development work leading to higher energies is already proceeding. The work has not yet reached the stage of being held up for lack of joint action, though this stage may soon be reached.
- c. Organizational plans for such joint action can be best made later after the status of a pile in this area is clarified and plans for its organization are formulated.

"5. The conditions which must be met by any location for a chain reacting pile in this area were discussed. These include:

- a. The site should be accessible in an overnight trip from all major laboratories between Washington and Boston and it should be almost as accessible from Ithaca, Schenectady, Rochester, and Pittsburgh.
- b. A large area will be required - 10 square miles is a reasonable estimate.
- c. Power and water must be available.
- d. Access to the sea may be helpful.
- e. Housing must be considered.
- f. The site must be near to a satisfactory community with associated schools and medical facilities.
- g. Climate and general conditions must be satisfactory.
- h. Procurement of labor and materials must be satisfactory.
- i. A good institution of higher education must be nearby so that members of the laboratory may also study for degrees." [Was this in anticipation of the establishment of Stony Brook University?]

The summary of this meeting continues with two additional pages of equally relevant agreements but these are dominantly concerned with the drafting of the letter to be written to General Groves. The final form of the letter to General

Groves which originated from the February 16, 1946, meeting was mailed on March 3, 1946. It is interesting to note that in this letter it was proposed that the laboratory "should be operated by a single institution as the contractor, preferably a single university, but that the scientific direction should be in the hands of a board representing the sponsoring institutions and appropriate Government agencies." Although no single institution was chosen at that time it was the general presumption that it would probably be Columbia University.

As informal discussions with the Manhattan District proceeded it became apparent that an arrangement that involved participation by several institutions would be more effective. Also it was decided that the two industrial laboratories should withdraw as sponsoring institutions and three universities should be added, bringing the sponsors to the same nine institutions now represented in AUI. Dean Pegram in a letter addressed to the presidents of the universities on March 18, 1946, stated that it was now "desirable to move promptly towards effecting more formal arrangements among the (nine) universities to organize a group or committee to take the responsibility of carrying forward with the Manhattan District the necessary plans and work preliminary to the establishment of the laboratory." The presidents of the nine universities were requested to designate representatives to attend a meeting, "preferably at least one scientist and one administrative officer who could represent authoritatively the general policies of each institution."

INITIATORY UNIVERSITY GROUP

On March 23 the following men representing the nine universities were asked to assemble at Columbia:

R.F. Bacher (Cornell)
 G.A. Brakeley (Princeton)
 E.E. Day (Cornell)
 L.A. DuBridge (Rochester)
 J.R. Dunning (Columbia)
 R.D. Fowler (Johns Hopkins)
 G.B. Harnwell (Pennsylvania)
 G.A. Kistiakowsky (Harvard)
 P.F. Macaulay (Johns Hopkins)
 G.B. Pegram (Columbia)
 E.C. Pollard (Yale)
 I.I. Rabi (Columbia)
 N.F. Ramsey (Columbia)
 J.C. Slater (MIT)
 H.D. Smyth (Princeton)
 W.W. Watson (Yale)
 J.R. Zacharias (MIT)

Dr. DuBridge was elected chairman of the meeting and I was elected secretary. After preliminary discussions the following resolution was unanimously passed.

Resolved: "that Columbia University, Cornell University, Harvard University, Johns Hopkins University, Massachusetts Institute of Technology, University of Pennsylvania, Princeton University, University of Rochester, and Yale University, being interested in promoting and establishing in the northeast of the country a Government research laboratory for nuclear science and in cooperating with other institutions of this region in the operation of such a laboratory, do now join for the furtherance of these interests in an association of representatives of these universities to be known as the Initiatory University Group."

The Initiatory University Group was often called by the letters IUG for short - fortunately it was not pronounced *ugh*. It established a Planning Committee which consisted dominantly of the scientists who were invited to attend the original meeting except that Van Vleck substituted for Kistiakowsky. Subcommittees were formed on matters of Contract, Site, Reactors, Electronuclear Machines, Personnel Policy, and Security.

By this time it had become apparent that some staff would be required and an interim arrangement was made whereby Columbia University could charge some Initiatory University Group expenses to its existing contract with the Manhattan District. As secretary of the Initiatory University Group it became my task to hire the first employee. This employee was Mrs. J.B.H. Kuper who is still active in the Laboratory. Incidentally, the first assignment I gave Mrs. Kuper after she was hired was to figure out how she could possibly be paid. By the 3rd of April a formal supplement had been made to the Columbia Manhattan District contract for the expenses of IUG.

As can be seen the first three months of this undertaking were ones of tremendous achievement. Within this period we progressed from a first initial meeting to a formal organization with rather clear objectives and with the ability to spend at least small sums of money. The next three months were also ones of intense activity, primarily by the various subcommittees. To shorten this report I shall deal in detail with only two of

these subcommittees. These were the Subcommittee on Contract of which H.D. Smyth was chairman and the Subcommittee on Site of which I was chairman.

The Subcommittee on Contract soon recommended that a new corporation be formed under the laws of the state in which the laboratory was to be located. Mr. J. J. McCloy, formerly Assistant Secretary of War and subsequently High Commissioner to Germany, was engaged as legal counsel to draw up articles of incorporation.

One controversial matter during this period was the question as to whether each university should underwrite the project with any of its own funds. It was originally proposed that each university should do so to the extent of \$100,000. The Manhattan District, however, indicated at the time that from its point of view there would be no advantage to such an underwriting. So the universities happily withdrew this offer. Later the Manhattan District representatives indicated that it would be helpful if the universities did underwrite the project to some extent with their own funds. This change caused considerable irritation to the universities but all save one - Harvard - agreed that they would contribute \$25,000 per institution. In order to achieve the required unanimity the other representatives on the Initiatory University Group argued eloquently against Kistiakowsky, the Harvard representative. They expressed consternation and surprise that Harvard University, the richest of the nine institutions, should be the one institution unwilling to make its contribution. To this, George Kistiakowsky made the simple reply, "How do you think it got that way?"

Another problem was that of a name for the proposed corporation. Illustrative of the wide range of names considered was one made up of the initials of the nine founding universities. This was the name "Pyjohmitch Corporation." Finally, after consideration of many alternatives, the name "Associated Universities, Incorporated" was adopted.

Another difficulty was that of the state in which the organization should be incorporated. It was agreed that the incorporation should be in the state which contained the site of the laboratory but this site had not yet been selected. Since more prospective sites were in New Jersey than in any other state, Associated Universities first incorporated in that state and one meeting on July 10th

was held as a New Jersey corporation. By this time, however, it was apparent that the final site would be in New York State and Associated Universities, Inc. was established as a New York Corporation on July 18, 1946.

A major problem in this period was that of the selection of a director. Initially Professor Wheeler Loomis was selected as director and he accepted the appointment – but a few weeks later, in June, the new organization was plunged to despair by his resigning.

As might be expected, the most difficult problem on which to achieve agreement was that pertaining to the choice of site. In fact, during the early summer the problems of site and director were so severe that the committee would put itself successively into what it defined as the “S” state or “D” state when it considered the site or director problem.

The basic site requirements were laid down in the February 16th document which I read a short while ago. These site requirements were in part mutually contradictory. The requirements of “convenient accessibility to all research institutions in the northeast region” were somewhat incompatible for 10 square miles of land. It was agreed that the ideal site would be 10 square miles of land located at Grand Central Terminal in New York City, but such a site was clearly an impossibility. As a compromise it was agreed that the site could be within one hour’s drive from some major station on the coastwise lines of the Pennsylvania or New Haven Railroad, so scientists traveling by train during the evening would be able to spend one full day at the laboratory and still be at their own university on the days immediately preceding and following. This one hour drive criterion incidentally caused me to receive my first ticket for speeding. One of my duties as chairman of the Site Committee was to demonstrate that the different sites considered really were within one hour’s drive from the railroad station, but no specification was given as to the speed and it had to be quite fast for most of the sites. Unfortunately, there was no way in which I could be reimbursed for this speeding fine by the Initiatory University Group.

The sites seriously considered for the new laboratory were obtained by suggestions from the university representatives, from my studies of maps of the various areas concerned, and from suggestions from the Manhattan District conveyed by Major Van Horn, the army liaison officer with the

Site Committee. As might well be imagined, each university chiefly advocated a site which was close to its own institution. After some initial elimination 17 sites remained and were seriously considered. One, Fort Devens, was in the Boston area. Two were in the vicinity of New Haven, and the remaining sites surrounded New York City – most of them being in New Jersey. For a time it appeared most likely that a New Jersey site would be selected despite the unattractive name of one of the most favorable New Jersey sites – Great Swamp. Had this site been named for one of the attractive nearby villages – Green Village – it might have received more favorable consideration.

Despite the initially large number of sites under consideration the criteria on sites were successively changed by the IUG and by the Manhattan District in such ways that eventually no site satisfied all the requirements. In particular, the IUG agreed that the site should be “as near as possible to New York City” since transportation from Cornell to other areas at that time was almost impossible. Furthermore, the Manhattan District changed its site criteria and added the requirement that the drainage of the site must not be into sources of drinking water because of the possibility of the concentration of radioactive waste. This last criterion eliminated almost all of the New Jersey sites and most of the New York State sites north of New York City. The list of potential sites was further reduced by later indications from the Manhattan District that the site preferably should be on Government owned land or at least the land should be purchasable on the open market, since the Manhattan District in its closing days would be unwilling to institute eminent domain proceedings which would have to be completed by its successor, the Atomic Energy Commission. With these added restrictions the site that most nearly satisfied the requirements was David’s Island, or Fort Slocum, an island approximately 3000 ft long and 1500 ft wide, about a mile from shore off New Rochelle. This island was much smaller than specified by the initial requirements, but these were placed dominantly for protection in case of a reactor accident; the water surrounding Fort Slocum effectively replaced such a safety separation. The Site Committee, therefore, tentatively agreed upon Fort Slocum as its first choice. But shortly after this, the Manhattan District, which had originally favored Fort Slocum, decided against it on the grounds that population density was too high in the direction to which the prevail-

ing winds blew. Furthermore, it became apparent that the island might not be available on Government surplus, after all. In retrospect, it is interesting to note that this site was too small even for a 35-GeV accelerator, but an accelerator of such a size was then beyond our powers of imagination.

The negative decision of the Manhattan District with regard to our preferred site and the resignation of our newly appointed director reached us almost simultaneously and marked the all-time low of the project. For a period of several weeks I believe that only Marietta Kuper and I had any hopes that there ever would be a laboratory and neither of us was very hopeful. The entire group felt that the project had lost its initial momentum and was approaching a desperate state such that if a positive development did not soon take place the entire project would be abandoned. We had all been accustomed to the relatively rapid rate of Government decisions which took place during the war. A slowing down of the project for even a month or two appeared almost fatal.

(At this point I should like to inject an editorial digression to emphasize how our ability to make national decisions on nuclear research facilities has been slowed down in recent years. The 200-BeV accelerator was first proposed over five years ago and three years ago our GAC/PSAC Committee recommended that the 200-BeV accelerator be built *as soon as possible*. Still, final authorization and appropriation for this accelerator appears to be several years in the future. In contrast to this seven or more year period, the entire elapsed time between the first letter to the Manhattan District and the establishment of a working laboratory at Brookhaven was less than one year. Nevertheless to the participants then the progress appeared painfully slow and a delay of less than two months appeared to place the entire project in jeopardy.)

With the additional restrictions applied by the Manhattan District there remained two out of the original seventeen sites provided the requirement for one hour driving time to New York City was relaxed. These were Camp Upton – the site of Irving Berlin's World War I musical comedy, *Yip, Yip, Yaphank* – and Fort Hancock, on Sandy Hook peninsula near Red Bank, New Jersey. The engineering firm of Stone and Webster was asked to make an engineering study of both sites. This study strongly favored the Camp Upton location. The Site Committee, consequently, recommended with reservations the Camp Upton site. This site

was then visited by the Planning Committee of the Initiatory University Group. Although the Planning Committee was pleased by the size of the site and the existence of various facilities, such as the swimming pool which one could never hope to build with Government funds, it was rather appalled by the appearance of the site. Not only was the land flat but it was covered with ugly barracks from both World Wars I and II and with an even uglier ex-prisoner of war stockade. The housing in the immediate vicinity of the laboratory appeared sufficiently unattractive that there was a genuine worry that it would be impossible to attract a strong staff to the location. At this point I recalled that my wife, as a girl, had spent a number of her summers in the village of Bellport, and had always described those summers with pleasure. Consequently the Planning Committee drove to the village of Bellport to look at the housing there. Finally, on the town dock of Bellport we agreed that the Camp Upton site would probably be satisfactory and that it was the only site we could procure sufficiently rapidly to assure the existence of the laboratory at all. George Kistiakowsky summarized the views of those present when he said that we could agree to this site on the basis of "equalization of disappointment." With this major decision made, the doldrums of the project were over. At the same time the Initiatory University Group came to its end to be replaced by Associated Universities, Inc.

ASSOCIATED UNIVERSITIES, INC.

On July 10, 1946, in the only meeting of Associated Universities, Inc. as a New Jersey corporation, the Board of Trustees officially voted to request the Government to make available the site of Camp Upton for the establishment of the new laboratory. Subsequently, on July 30, at the first meeting of Associated Universities, Inc. as a New York corporation this request was confirmed by the Trustees with the additional recommendation that the target range on the north side of Route 25 should be included as well.

From July to December 1946 was a period of steady growth and development of Associated Universities, Inc. Never again were the discouraging depths of May and June repeated. On the first of August, 1946, Professor P. M. Morse of MIT was appointed Director for the new laboratory.

Contract negotiations were undertaken with the Manhattan District to develop a final contract for the operation of the laboratory. A number of major disagreements had to be resolved. The Manhattan District wished maximum security restrictions and the Trustees wished minimum. The Manhattan District strongly believed that the accelerators in the laboratory should be built entirely by prime contract to industry whereas the Trustees even more strongly believed they should be built by the laboratory staff and by subcontract to industry. The Manhattan District preferred maximum control and regulation by the United States Government and the Trustees preferred maximum independence for the laboratory. Eventually compromises were reached on these disagreements and a contract was ready for signature in December. However, by that time the Atomic Energy Commission was about to be formed and its chairman, David Lilienthal, requested the opportunity to review the contract before it was signed. On January 7, 1947, a letter contract was issued by the Atomic Energy Commission for the operation of the laboratory by Associated Universities, Inc., and on January 31, 1947, a final contract for the operation of the laboratory was signed by the Atomic Energy Commission and by representatives of Associated Universities, Inc.

During the same period of time the plans for the laboratory and its functions developed extensively. By December of that year it was agreed that there should be a physics department, a chemistry department, a biology department, a medical research department, and an engineering department. It was further agreed that there should be a graphite pile, some hot laboratories, and at a later time a high flux pile and a fuel processing plant for the high flux pile. Whereas in the early period of the planning of the laboratory there was less emphasis on accelerators, plans for these became firm by December 1946. At that time it was planned that there should be a 60-in. cyclotron in the chemistry department, possibly a 12-MeV Van de Graaff in the physics department, a 700-MeV synchrocyclotron, and/or a 1 to 2-BeV synchrotron. Further it was anticipated that in the more distant future there should be a super-high energy accelerator.

During the summer of 1946 as secretary of the organization I had frequent occasions to write documents referring to the new laboratory. I found that my writing became somewhat cumbersome

because of the lack of a suitable name, other than the "new laboratory to be built on the site of Camp Upton." Therefore, I decided I should select a name for the laboratory and wrote down a long list of possible names. In selecting these names I was influenced by our desire to improve relations with our neighbors at the site and I consequently hoped it would help if we adopted some local name. The names I considered, therefore, included Upton Laboratory, Yaphank Laboratory, Long Island Laboratory, Middle Island Laboratory, Atlantic Laboratory, Northeast Laboratory, Suffolk Laboratory, and Brookhaven Laboratory. I then presented the list to my wife and asked her to select the name that she thought would be most attractive when we recruited new staff for the laboratory. She pointed out that Yaphank Laboratory would exclude all veterans of World War I who had been inducted at Yaphank, and Upton Laboratory would do likewise for World War II veterans. She finally chose Brookhaven Laboratory because it was literally correct yet delightfully misleading. The site was in the Town of Brookhaven but the name had a misleading association with quiet, shady streams which might make the laboratory site sound more attractive to potential new recruits than it actually was. Since we still had problems in our relations with the Federal Government it occurred to me as an afterthought to increase the sense of Federal participation by including the word "National" in the laboratory name even though this was not the previous Manhattan District custom. Therefore, I began using the phrase Brookhaven National Laboratory in my reports. The title, Brookhaven National Laboratory, was finally adopted officially by the Trustees in September 1946. In recent years I have sometimes been amused by the great emphasis the Atomic Energy Commission has placed upon the distinction between National Laboratories and the other laboratories it supports, since I know the accidental way in which this terminology was first introduced.

During the last half of 1946 the nucleus of the Brookhaven staff was housed in the Physics Department at Columbia University. One of the principal activities during this period was the recruitment of new staff members and the planning of the future program. Dr. Lyle Borst of the Clinton Laboratory was placed in charge of the development of the first reactor and Dr. Clarke Williams was employed in the reactor group. Dr. M.S.

Livingston of MIT was asked to head the Accelerator Department and I was asked to head the Physics Department. Robert Patterson was employed as assistant director in charge of personnel and J.B.H. Kuper was employed to head what was then the Electronics Section of the Physics Department.

Finally, on January 13, 1947, the small nucleus moved from Columbia to the Brookhaven site to begin operations. This move took place just three days less than one year after the first conference of the metropolitan representatives at Columbia met to consider the possibility of some sort of regional laboratory.

At this point I should like to inject a short musical interlude to help convey the spirit of the times. The organization of AUI inspired Art Roberts in 1946 to write the song, *Take Away Your Billion Dollars*, sometimes referred to as the *Brookhaven Song*:

Upon the lawns of Washington the physicists assemble,
From all the land are men at hand, their wisdom to exchange.
A great man stands to speak, and with applause the rafters tremble.
"My friends," says he, "you all can see that physics now must change.
Now in my lab we had our plans, but these we'll now expand,
Research right now is useless, we have come to understand.
We now propose constructing at an ancient Army base,
The best electronuclear machine in any place, - Oh

It will cost a billion dollars, ten million volts 'twill give,
It will take five thousand scholars seven years to make it live.
All the generals approve it, all the money's now in hand,
And to help advance our program, teaching students now we've banned.
We have chartered transportation, we'll provide a weekly dance,
Our motto's integration, there is nothing left to chance.
This machine is just a model for a bigger one, of course,
That's the future road for physics, as I hope you'll all endorse."

And as the halls with cheers resound and praises fill the air,
One single man remains aloof and silent in his chair.

And when the room is quiet and the crowd has ceased to cheer,
He rises up and thunders forth an answer loud and clear:

"It seems that I'm a failure, just a piddling dilettante,
Within six months a mere ten thousand bucks is all I've spent.

With love and string and sealing wax was physics kept alive.
Let not the wealth of Midas hide the goal for which we strive - Oh

"Take away your billion dollars, take away your tainted gold,

You can keep your damn ten billion volts, my soul will not be sold,
Take away your army generals; their kiss is death, I'm sure.

Everything I build is mine, and every volt I make is pure.

Take away your integration; let us learn and let us teach,

Oh, beware this epidemic Berkelitis, I beseech.
Oh, dammit! Engineering isn't physics, is that plain?

Take, oh take, your billion dollars, let's be physicists again."

It is a tribute to the success of Brookhaven Laboratory that 10 years later Art Roberts moved to a national laboratory and wrote a sequel to *Take Away Your Billion Dollars* which ends

"Give us back our billion dollars, better add ten billion more,

If your budget looks unbalanced, just remember this is war.

Never mind the Army's shrieking, never mind the Navy's pain.

Never mind the Air Force projects disappearing down the drain.

In coordinates barycentric, every BeV means lots of cash,

There will be no cheap solutions, - neither straight nor synchroclash.

Oh, if we outbuild the Russians, it will be because we spend.

Give, oh give, those billion dollars, let them flow without an end."

BROOKHAVEN NATIONAL LABORATORY

Once we had moved to the laboratory site, developments at Brookhaven occurred far too rapidly to be recorded in a brief historical account. I will, therefore, review the first six months of the existence of the Laboratory with the aid of some photographs which show various aspects of the early history of Brookhaven. But first I will describe a few problems and incidents of this period.

The first complaint to the laboratory about radiation damages to outsiders occurred even before the site was officially occupied. After months of disuse the central heating system at the site was started and smoke for the first time in months emerged from the chimney. A nearby resident observed the smoke and wrote in to complain that she had seen smoke coming from the atomic furnace of the laboratory and it had made her arthritis much worse. Unless these radiations were turned off she would consult a lawyer and sue the laboratory for damages.

A few weeks later we had the first case of radiation sickness. A piece of harmless uranium glass was delivered to the stockroom and unpacked by a gullible stockroom assistant. The other stockroom employees thought they could have a good time at his expense so they pointed out the word "uranium" on the package and told him that he had undoubtedly been subjected to an overdose of radiation. Within a matter of minutes he was actively sick and had to be placed under medical treatment to cure his psychosomatic illness.

During this period of time the problem of recruitment of new staff was a very difficult one. The size of the laboratory staff was still far subcritical and many scientists felt it would never be a success. Although we failed to persuade most of the scientists we approached to join our new enterprise we did succeed in hiring a number of very good people during this period. I have always felt grateful to those scientists like Hartland Snyder, Lee Haworth, Ken Green, Ed Salant, Dick Dodson, and others who were willing to take a chance on the new organization by joining it while it was still in its pioneering subcritical size. By the summer of 1947 the laboratory had passed from the subcritical to the supercritical size, and its future was assured.

During 1947 one of the most important and difficult tasks was that of three groups learning to work

together: the Atomic Energy Commission, the Trustees of AUI, and the Brookhaven staff. Between the Brookhaven staff and the Trustees there was, in general, mutual respect and agreement except for an initial tendency on the part of the Trustees to be excessively concerned with small details of Brookhaven management. In 1946 almost all the details and plans had to be made by the Trustees themselves. After there existed a Brookhaven staff, it was a somewhat difficult transition for the Trustees to acquire confidence in the Brookhaven staff and to allocate to that staff its full responsibility. Fortunately, however, the difficulties were soon resolved and on the average the relations between the Trustees and the Laboratory staff have been excellent with each recognizing the important contributions of the other.

With the Atomic Energy Commission there were greater difficulties but these, too, eventually became dominantly resolved. The most difficult problem with the AEC at that time pertained to security. Two of the most distinguished present members of the Brookhaven staff seriously suffered from AEC security at that time. After they left their former jobs and moved to Long Island, for several months the AEC refused to allow the laboratory to pay them any salary and refused even to allow them to work at the laboratory site without salary.

Now in conclusion, just as I summarized the Initiatory University Group era with the audio aid of Art Roberts' song - *Take Away Your Billion Dollars* - I should like to summarize the first 6 months of activity at the Brookhaven site with the visual aid of some early Brookhaven photographs. These illustrate developments in three key areas, (1) site, (2) staff, and (3) equipment.

Figure 1 shows the fire tower which was on Mt. Rutherford, the highest hill and the one on which the graphite reactor is now located. Figure 2 shows a view of the laboratory site from that fire tower with the array of army barracks then present. By contrast Figure 3 shows the present view from almost the same location. Figure 4 shows Commissioner Pike at the ground breaking ceremony for the reactor on top of Mt. Rutherford. Unfortunately, the first major engineering activity of the Laboratory was to diminish the height of the highest hill in this section of Long Island.

Now, as to personnel and staff, Figure 5 shows the Trustees at their first meeting on the Brook-



Figure 1. Fire tower formerly located on Mt. Rutherford, the present site of the graphite reactor.



Figure 2. Early view of laboratory site looking south from the fire tower.

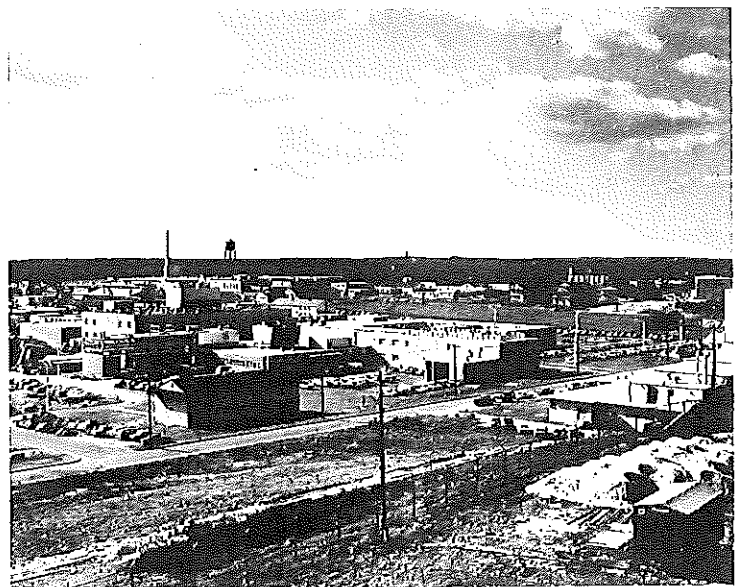
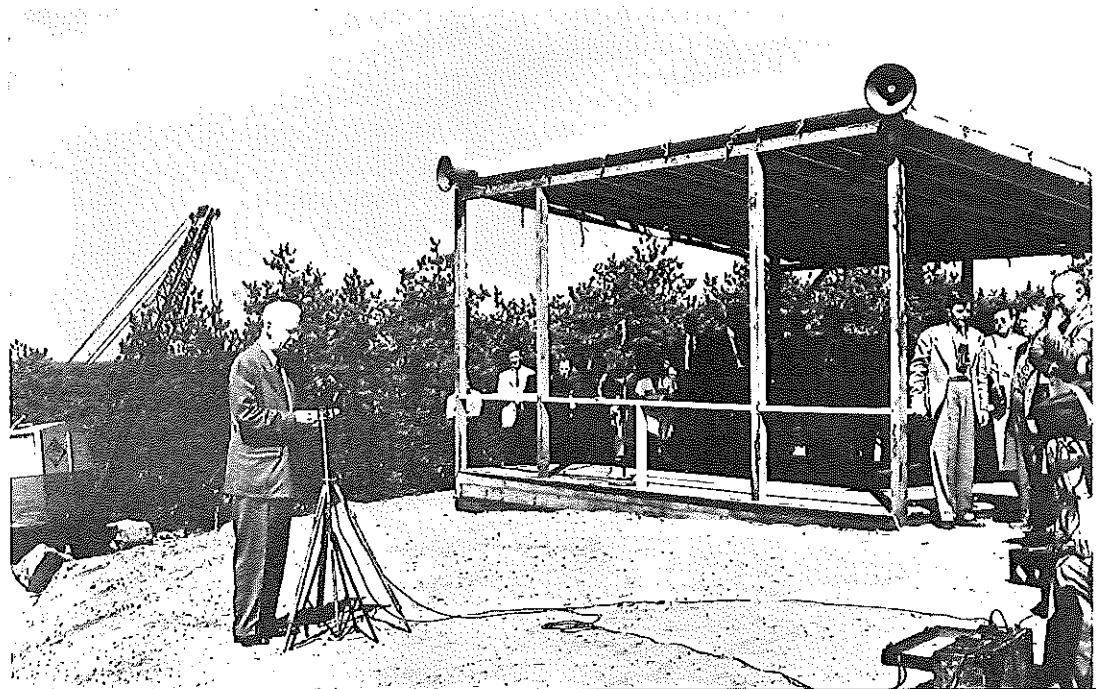


Figure 3. A recent picture of the same view as in Figure 2.

Figure 4. Commissioner Pike at ground breaking ceremony for graphite reactor.



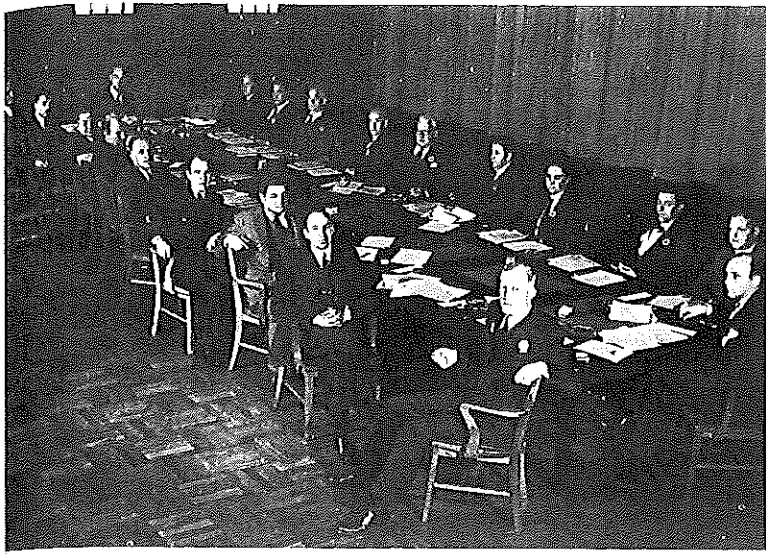


Figure 5. AUI Trustees at their first meeting in the Brookhaven Laboratory site.



Figure 6. Entire Physics Department in January 1947.



Figure 7. First scientific seminar at Brookhaven.

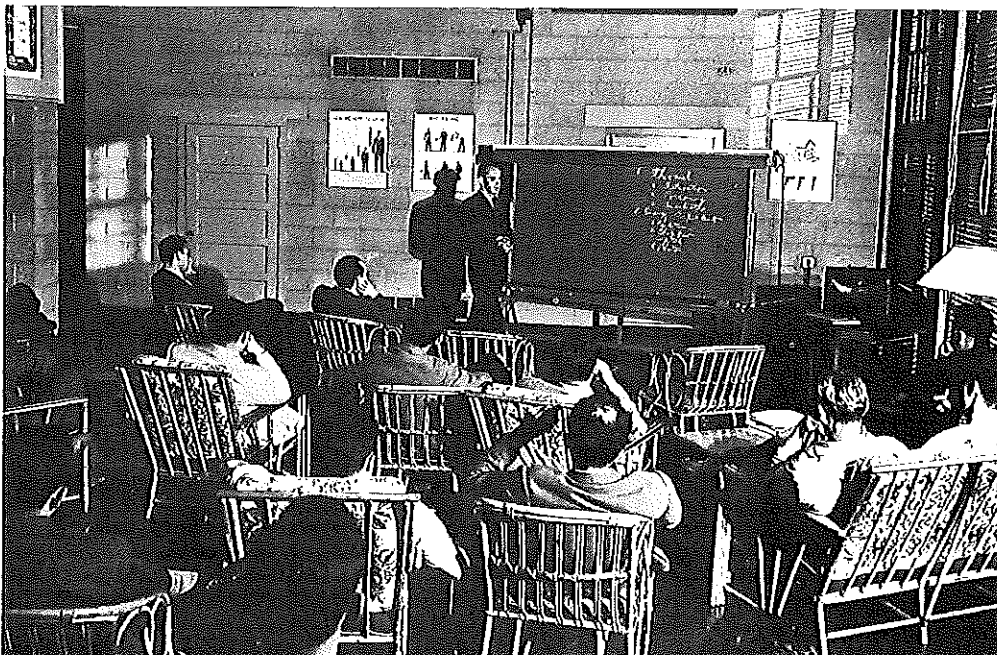


Figure 8. Seminar during first summer.

Figure 9. The entire library at Brookhaven in January 1947.

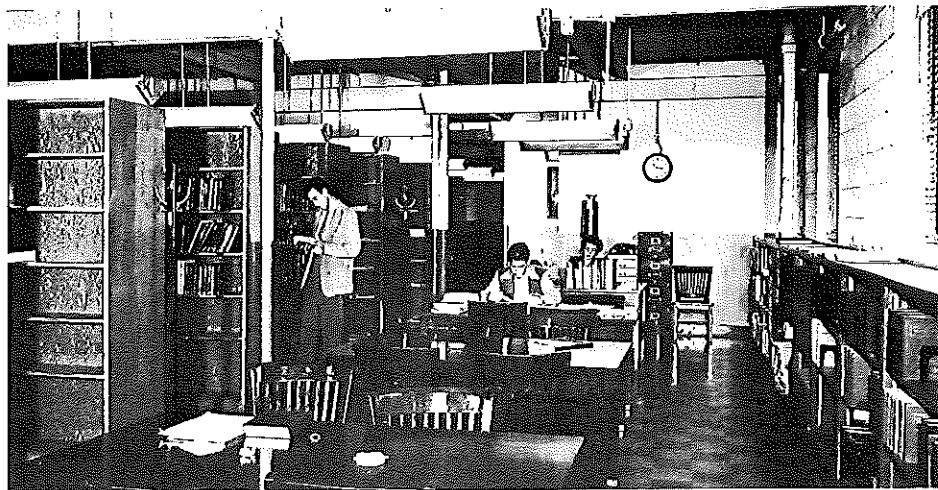
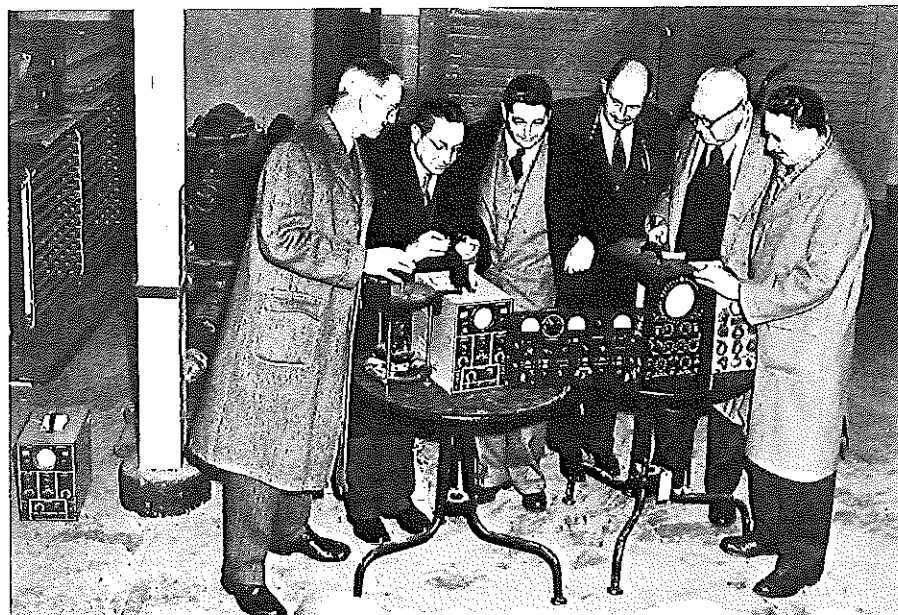


Figure 10. Library later in its new location. Note empty shelves.

Figure 11. Executive Committee of AUI admiring the totality of the electronic equipment at Brookhaven.



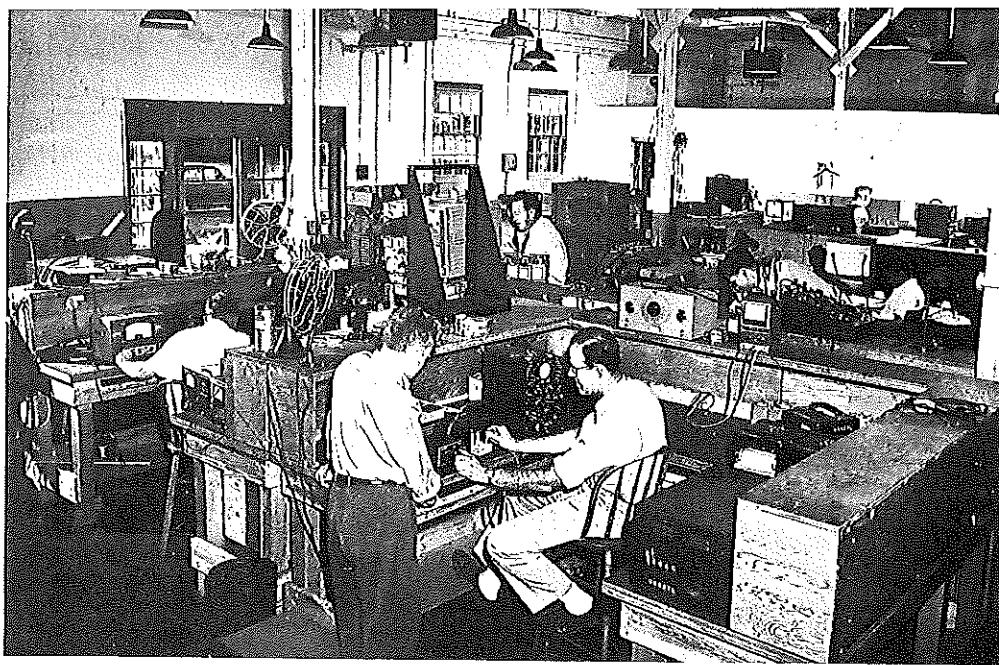


Figure 12. Electronics laboratory a few months later.

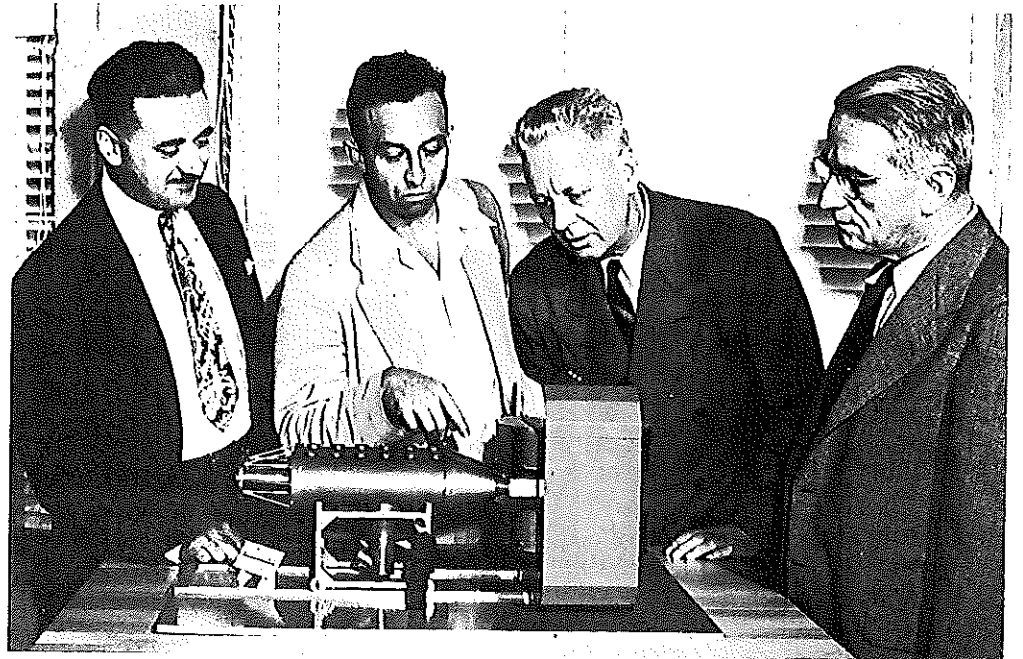


Figure 13. Model of 700-MeV cyclotron once planned for Brookhaven.

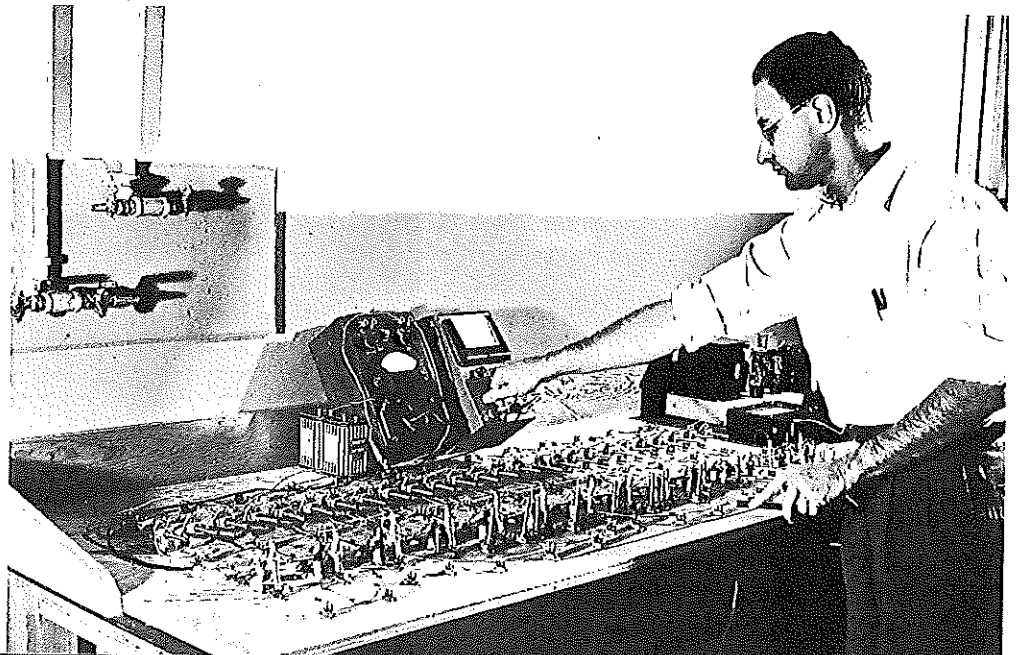


Figure 14. First Brookhaven computing machine.

haven Laboratory site. Figure 6 shows the entire Physics Department during the month of January 1947. The man with the dark hair in the middle is myself as Chairman of the Department and on the right-hand side is Kuper, who then headed the Electronics Section of the Physics Department. My secretary is between us and we had two administrative assistants on the left of the photograph. No other physicists were shown in the picture because at that time there were no other physicists in the Department. A little later we had the first scientific colloquium at Brookhaven and a picture taken at this time is shown in Figure 7. Scientists from all disciplines participated in the colloquium, since otherwise it would have been impossible to have an audience. In fact, a large fraction of the administrative personnel attended as well. For example, Marietta Kuper's smiling countenance can be seen in the front row. Phil Morse, the Director of the Laboratory, wearing the light colored shirt is in the front row; as the speaker at the colloquium, I am sitting next to him. This was one of the rare instances when we recognized an historic occasion at the time, so we asked John Garfield to photograph this meeting. He actually had considerable trouble with the camera and only after quite a delay did he obtain a successful picture. He then announced "History is satisfied, science can now proceed." Finally, in Figure 8, there is a photograph of a physics seminar in the summer of 1947 by which time there were even a reasonable number of physicists to listen to and participate in the seminar.

Now, as to equipment. We recognized the importance to a new laboratory of books and a library. Figure 9 shows the entire Laboratory library during the early period of 1947. Later the library moved to a separate building that can be seen in Figure 10; the most conspicuous characteristic of this library were the shelves empty of books. The next picture, Figure 11, I consider in many ways to be the most entertaining. The six assembled scientists represented the top level of Associated Universities and Brookhaven Laboratory. It included Dr. Morse, the Director, on the right and five members of the Executive Committee of AUI, including Mr. Brakeley, then the President, Mr. Maccauley, Professor Zacharias, Professor Rabi, and Mr. Reynolds. They are all looking with rapt attention and enthusiasm at the entire array of electronic equipment in Brookhaven National Laboratory. You can well imagine the impossibility of

now getting the AUI Trustees to look with similar interest at such an insignificant amount of electronics equipment.

Figure 12 shows the electronics laboratory at Brookhaven at a slightly later stage of development. Figure 13 shows Dr. Livingston and Dr. Morse looking at a model of the 700-MeV cyclotron which was being designed for Brookhaven Laboratory. This cyclotron was abandoned when Columbia University obtained a contract to build the Nevis cyclotron at which time the Columbia representatives on the Board of Trustees abruptly switched from being the strongest advocates of the 700-MeV cyclotron to the strongest opponents. Finally, to show how far-sighted we were in these early days, the last picture, Figure 14, shows we recognized the importance of computing machines. One of the first activities of the Electronics Division under Dr. Kuper was to construct a computing machine and it is here shown in its entirety.

The events in my report all occurred during the first year and a half following the initial conception of the laboratory and they overlap the first six months of operation at the Brookhaven site. The tremendous and well-known achievements since then are a great tribute to the Laboratory staff, to the visiting scientists, to AUI, and to the AEC. I only hope that the successes of AUI and of Brookhaven National Laboratory in the future exceed even those of their first twenty years.

APPENDIX A

DOCUMENTATION

Detailed documentation on the founding of Associated Universities, Inc. and Brookhaven National Laboratory can be found in the *Final Report of Work by Columbia University under Contracts W-7405-eng-50, W-31-109-eng-15, and AT-30-1-GEN-71*. This report is dated January 15, 1948, and is available at Brookhaven National Laboratory. Since the names of the participants in many events described in this lecture can be found in this *Final Report*, they will not be repeated here. This report also lists most of the major documents on file concerning the founding of AUI and includes copies of some of the most important ones. Since it omits the summary of the particularly significant February 16, 1946, meeting, a copy is added here, as Appendix B.

APPENDIX B

MEMORANDUM

TO: Those Present

FROM: N.F. Ramsey

SUBJECT: Summary of Meeting at Columbia University, February 16, 1946.

1. The following were present: K.T. Bainbridge, J.R. Dunning, R.D. Evans, J.B. Fisk, G.B. Harnwell, G.B. Kistiakowsky, I.I. Rabi, N.F. Ramsey, L.M. Ridenour, J.C. Slater, H.D. Smyth, W.E. Stephens, J.H. Van Vleck, W.W. Watson, M.G. White and J.R. Zacharias.
2. It was agreed by all present that every effort should be made to obtain a chain reacting pile in an accessible location in the northeastern part of the United States.
3. There was considerable discussion as to whether we should request the contemplated expansion of the Clinton Laboratory to be made in this area instead of at Clinton. It was agreed that we should formally only request that a major pile be located immediately in the northeastern United States.
4. The problem of joint action of the universities represented for the purpose of obtaining very high energy particles was discussed. It was agreed that such action would probably soon be required but further discussion in the meeting was deferred for the following reasons:
 - a. Several institutions already have projects for the production of particles in the 100-MeV region.
 - b. Development work leading to higher energies is already proceeding. The work has not yet reached the stage of being held up for lack of joint action, though this state may soon be reached.
 - c. Organizational plans for such joint action can be best made later after the status of a pile in this area is clarified and plans for its organization are formulated.
5. The conditions which must be met by any location for a chain reacting pile in this area were discussed. These include:
 - a. The site should be accessible in an overnight trip from all major laboratories between Washington and Boston and it should be almost as accessible from Ithaca, Schenectady, Rochester, and Pittsburgh.
 - b. A large area will be required - 10 square miles is a reasonable estimate.
 - c. Power and water must be available.
 - d. Access to the sea may be helpful.
 - e. Housing must be considered.
 - f. The site must be near to a satisfactory community with associated schools and medical facility.
 - g. Climate and general conditions must be satisfactory.
 - h. Procurement of labor and materials must be satisfactory.
 - i. A good institution of higher education must be nearby so that members of the laboratory may also study for degrees.

6. Harnwell, Rabi, Slater and Smyth were elected to form an executive and drafting committee to represent those present until a less temporary committee can be established.
7. It was agreed that the drafting committee should prepare a proposed letter for signing by many of the major research institutions in the northeastern part of the United States. Two copies of this draft should be sent to all who attended the present meeting in order that they may obtain approval by their respective universities. After this approval is obtained, Columbia, Harvard, MIT, Pennsylvania, Princeton and Yale will sponsor an invitation to be signed by Dean Pegram that other institutions in this area sign the letter to General Groves. The executive committee and the sponsoring institutions should decide later whether a meeting will be required to obtain the support of the other institutions. If such a meeting is held, Saturday, March 2nd, appeared to be a suitable date.
8. The following points were suggested for consideration by the drafting committee in the preparation of the letter:
 - a. Request that a major pile be located immediately in northeastern United States.
 - b. State that the signing research institutions are prepared to cooperate by forming an association to undertake the following:
 - (1) Cooperate in setting up contractual arrangements.
 - (2) Help in the location of a site.
 - (3) Train personnel of the laboratory.
 - (4) Offer part-time service of skilled research men who are on the university staffs.
 - (5) Provide courses of instruction in the industrial uses of atomic energy and related phenomena.
 - (6) Assist in obtaining the fullest uses of the pile facilities for the public welfare.
 - (7) Make available to the pile laboratory facilities of the numerous university and industrial laboratories in this area.
 - c. The letter might include some of the general considerations on the selection of a site as listed in paragraph 5.
 - d. The letter should include the most pertinent points in Slater's memorandum and in the previous letter sent by the metropolitan group to General Groves.
9. It was agreed that the institutions offering Ph.D. degrees in this area should be invited to sign the letter.
10. The status of industrial laboratories as signers of the letter was discussed at length and referred to the executive committee for decision. It was agreed that if industrial organizations were included, they should be limited to those with important research laboratories which had already contributed in a major way to the work of the Manhattan District, namely: Kellogg, Bell Telephone Labs, Carbide and Carbon, Westinghouse, General Electric, Eastman, Monsanto, Standard Oil Development and Dupont.
11. It was agreed that
 - a. Rabi should notify General Nichols immediately of the present agreements and of the plans for formulating a joint request for a pile laboratory in this area.
 - b. Rabi should notify Cornell by phone of the present decisions and plans.
 - c. Conant and Compton should tell General Groves that plans for joint action by the northeastern universities are proceeding rapidly.

N.F. RAMSEY

