THE PROBLEMS OF A LARGE ACCELERATOR LABORATORY*

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When I accepted the very kind invitation of R. S. Livingston to speak this evening, I was not sure whether I would be engaged in reporting the history of an interesting exercise, even possibly attending a wake, or whether I would be cheerful about the world and the future of experimental accelerator physics in this country.

I want to cover two topics this evening. First, I will enumerate those events and groups that make me optimistic, and then give you some of the background and discussion that went on in the National Academy committee on the site evaluation assignment.

This meeting, which has been running for the last two days, is a demonstration that our country, the Congress, the Executive Department, and the administrators of our universities are prepared to continue the support of nuclear physics and to provide the very costly instruments necessary to probe this area of science. This is a scientific area whose impact on our immediate technological needs as a society is not demonstrable. One can, with some assurance, state that with time this scientific area will produce technologies that will be useful to society. The immediate benefits are cultural in character. We will attain greater understanding of the physical world we live in. We will feel more at home with nature. And new problems will arise that will require further speculation and experimentation to elucidate the external world. Historically, increases in accelerator energy have always yielded unexpected rewards of scientific knowledge. During the last few months, events have occurred and actions have been initiated to ensure continued work on new and improved particle accelerators and measuring instruments, and the commitment as a nation to proceed thoughtfully with a machine construction that will go to higher and higher particle energies. This 200 BEV accelerator — and for the moment let us call it 200 BEV — will ensure an instrument for American physics in a new energy region, a region in which no one is prepared to predict what events will occur. We will be able to continue to be in the forefront in the elementary particle physics area. How well we do will depend on this community, the designers and builders of the particle accelerator, and whether we continue to have good taste in physics and can match ideas in both experiment and theory to the availability of the instrument.

Our country has displayed great confidence in this community of scholars. This display of confidence is based on a number of factors, and I should like to review these factors with you. I will not put them in the order of their importance nor in chronological occurrence.

First, a nonprofit corporation was formed, the University Research Associates (URA). It is functioning, it has a council of presidents, a board of trustees, a chairman and president, and it is spending money. This corporate body at present has a membership of over 40 universities from all parts of the country. To be a member of URA, each university — public and private — has been asked to pledge $100,000, not a trivial sum, not a trivial commitment. This is more than a monetary commitment because with the commitment all these universities give public recognition to the importance of elementary particle physics in their academic communities, an intellectual discipline necessary for the training of our young people.

In addition to the action symbolized by URA, let us not forget that in the Atomic Energy Commission there was deep understanding of the importance of the continued growth of nuclear physics in this country and that such growth depends on having a variety of particle accelerators, and that a need existed for a machine of greater and greater energy. It is true that there were a number of committees of physicists who had written reports during the last decade, but those reports needed an understanding and thoughtful audience that would be prepared to take action. That was the Atomic Energy Commission.

Let us not forget either the role of the President and his advisers in recommending the construction of this new national high energy facility and laboratory. This action by the President is occurring at a time when there are great technological needs to correct some of the deficiencies in our society and during a period of increased military expenditures and commitments. It is good for us to have action that demonstrates that this Administration considers research as part of our Great Society. It is a long range commitment. Results will not be forthcoming for a number of years. The country as a whole is involved. The electorate through its representatives in Congress, specifically the Joint Committee, has indicated its appreciation of this field of science, and that our future strength in science depends on the continued availability of costly instruments to probe the unknown. All the necessary action — the authorization, the actual appropriation — has yet to be taken, but the reception in Congress has been most encouraging.

And, finally, a very important ingredient in the evolution of this national policy was the dedication of the Berkeley group, their commitment to proceed with a design and to demonstrate in this process the deep interest of this community of scholars to their field of endeavor and that people are prepared to give their professional lives to realize the objective of having accelerators of higher and higher energies. There are

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groups who deserve recognition who have labored on higher and lower energy machines which added to the public appreciation of the vitality of this field.

The great endeavor to engineer, build, and use this national facility, which will contain the world's largest accelerator for some period of time and represent a great engineering enterprise during the construction period, places a responsibility on us, and I am sure all of us are prepared to discharge this responsibility of building the best possible machine, doing first-rate physics with it, and continuing to make important contributions in elementary particle physics, both experimental and theoretical. And I have no concern that we will let our patrons down in this area. But I do have a concern regarding how we keep the electorate, how we keep our patrons, how we keep the Joint Committee and the Congress, informed on the progress of the work. We must somehow communicate to them the excitement, the intellectual ferment, involved in this undertaking. We want our enthusiasm to be catching so that there is continued interest in and some understanding and appreciation that bright people, young people, are willing to dedicate their professional lives and make long term professional commitments in this area. This will be a continuing task and it is a responsibility to discharge that we as a group owe to the rest of the country.

For the rest of my talk I want to give you some inkling of the considerations discussed and the thinking that went on at the meetings of the National Academy of Sciences Site Evaluation Committee, whose report was issued a year ago. The report is a public document, and my remarks are based on the feeling that many of you have not read it.

The principal question was, how do you build a new institution, a very large one — the ultimate number of people that has been discussed is 2400, that will have intellectual integrity, that will attract the best men in the country, that will have taste in our science, that can be made available to all who want to make a contribution in this area? Availability to all comers who are qualified, and the need for a viable laboratory, present a partial conflict in the sense that the laboratory must have an in-house capability in order to make it useful. Thus the thinking evolved that about one-fourth or one-third of the machine time be for those who are permanently attached to the national facility, and three-fourths or two-thirds for the itinerant experimenter. Availability to the outside user imposed the requirement that it should be easy to get to the laboratory. We rejected the notion of equality in accessibility to all users. The ideal situation really is that a person can carry his teaching load and yet be able to get away from his home institution for a day or two to supervise his experimentation and his graduate students at this national facility, and the time consumed getting back and forth should be at a minimum or reasonable. And if one looks at those departments of physics that do have groups in high energy physics, one concludes that the Weston site certainly meets this requirement. This observation can be expanded to include those universities that in the future will build up groups in high energy physics.

Another concern articulated in the report to the Atomic Energy Commission was proximity to universities. This has three aspects. It was the consensus that theoreticians like to be associated with universities and be close to them. And this laboratory needs theoreticians — first-rate theoreticians. Also that some experimentalists like a similar association. And that the engineering and supporting staffs should have the opportunity to continue their development if they so choose, and they too require proximity to universities or technical schools. It was felt that the laboratory might not be able initially to acquire in residence men with a variety of technical and scientific experience, which is so valuable even for even such a trivial thing as having a conversation or a bull session on problems that arise from time to time. For example, a problem in metallurgy may come up. One would like to have some elucidation on such a problem by having a man within easy reach. Fortunately, Weston is within driving time of half an hour, an hour, or two hours of a number of institutions that basically can provide the backing for all the problems I have enumerated. Theoreticians can get to these universities, experimentalists can get to these universities, experimentalists who want to give courses can get to these universities, the technical men can upgrade themselves. And there is a variety of people with skills and knowledge in residence in this large group of universities around Weston.

It is well to point out that the universities in the immediate proximity of the site selected have a responsibility to make the staff of this new national facility welcome, to take them to their bosoms and make a fuss about them. They are capable of discharging this; they are capable of being indifferent; they are capable of being hostile. But one looks to these universities to act with wisdom and responsibility. One looks to the administrations of these universities. They have a great opportunity and I have a firm conviction that they will respond to this opportunity. Proximity to Argonne also has its plusses — again you will notice that this is mentioned in the report. This national laboratory will be a long time in the construction phase. The experimentalists who are part of the permanent staff should be associated comparatively early in the construction phase so that there will be very good interaction between the user and the builder. To attract the experimentalist, you will have to provide him experimental tools. Proximity to Argonne makes this comparatively easy.

The group was also very much concerned about the magic number 200 BEV, a number that evolved from discussions of the Ramsey Committee and became frozen as the Berkeley group went into detailed preliminary design studies. Yet the machine will not be with us for a long time to come. We were not sure how technology would evolve. We foresaw the possibility of storage rings. We wanted to give the designers greater freedom on

energy. And those are the reasons we leaned toward 5000 acres.

A final word about Weston. It is near a large city with good museums, a good orchestra, and good opera. It is a city that was the home of some of our great poets, and the beginning of American architecture – Sullivan, Frank Lloyd Wright – as well as some of our great social reformers – Allcott, and our contemporary Adlai Stevenson.

Let us roll up our sleeves and help in building a great intellectual center for physics in America.