L. R. Burchill

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RADIO ASTRONOMY PROJECT

Record of Meeting at the National Science Foundation
December 17, 1957

Present: National Science Foundation:

E. A. Eckhardt
Geoffrey Keller
A. J. Leigh
J. B. Luton
J. M. Mitchell
C. B. Ruttenberg
A. T. Waterman

Associated Universities, Inc.:

L. V. Berkner
L. R. Burchill
F. J. Callender
C. F. Dunbar
R. M. Emberson
J. W. Findlay
D. S. Heeschen

1. Distribution of October Booklet:

It was tentatively agreed that in distributing the booklet prepared for the October 17, 1957 ceremony at Green Bank reference should be made to both NSF and AUI. NSF will provide a list to supplement that prepared by AUI. (The decision to refer to NSF as well as AUI was later reversed.)

2. Next Meeting:

The following schedule of meetings was tentatively agreed to, all to be held in Washington at NSF:

January 14, 1958 (subsequently cancelled)
January 31, 1958
February 28, 1958

3. Financing:

Waterman gave the following account of the action taken by the National Science Board at its December meeting. This action was described as follows:

(a) 140' Telescope: The National Science Board recognized that the 140' Telescope should be completed as presently designed and that every effort should be made to secure necessary additional funds in accordance with cost estimates submitted by AUI.

(b) The Board also approved seeking additional funds for the completion of all other facilities, essential to carry out the original plan for the Observatory and to make efficient use of the two telescopes (85' and 140') and the quiet site.

(c) The Board took no action with respect to funds for future development of the Observatory.

At the meeting of the Board, Waterman emphasized the need for advance planning and for recognizing that an institution like the National Radio Astronomy Observatory must not be static if it is to fulfill its true purpose. In his judgment, a strong case can be made to the Board when plans for future growth are more fully developed. In the meantime, however, AUI must limit itself to planning within the framework of funds presently available.

4. 140' Telescope Contract:

It was agreed that AUI might appropriately contract with E. W. Bliss Company for detailed engineering on the 140' Telescope, but must make no commitment with respect to fabrication and erection of the instrument.

5. Future Plans:

Berkner said he was under pressure from the AUI Trustees and from the Radio Astronomy Advisory Committee to begin at once to plan for the next piece of observing equipment. The consensus is that this should be a very large antenna (probably over 1000' in diameter) of limited steerability which would be good for work down to 21 centimeters. In Berkner's judgment, an instrument of the sort under consideration would cost substantially less than $10,000,000. It is the consensus that the instrument should be a paraboloid or its equivalent rather than an array. Experience indicates that the latter apparatus is of limited use for observing over wide frequency bands. Survey studies are already being conducted by Heeschen working with Lilley at Yale University (as well as by Findlay and Carroll) looking to the design of a fixed antenna with a movable mast. Whatever funds are required for this highly preliminary work can be found in the present operating budget. In addition, Berkner would like to have a study made of a movable reflection mast system. At the present time, he is contemplating an expenditure of about $20,000, which is more than can be handled from the operating budget. Some supplementary funds will be required for this purpose. Berkner hopes to start this work in February and complete it early in April. By May 1958, Berkner hopes to be in a position to contract for a preliminary design and cost estimate for whatever type instrument appears most promising. This phase will involve an expenditure of about $250,000.

Mitchell said the NSF would need approval from the Science Board for an expenditure of this sort, and he would prefer not to consider this third stage at the present time. Waterman's view is that proceeding with studies is highly desirable, but that substantial expenditures for design, and of course for construction, must await action by the Board.

There followed a general discussion on the state of the art and whether progress in electronics might make it unnecessary to construct such a large antenna. Berkner said that unquestionably there will be rapid improvement in receivers during the next few years, but in his opinion the resolution gain which a large antenna can achieve will never be achieved in any other way. Heeschen supported this view and expressed the opinion that the ratio between signal and noise can be reduced only by a large antenna.

Eckhardt asked why, if plans were being made for a much larger instrument, it was necessary to invest such a large sum in the 140' telescope. Berkner pointed out that, because of its greater precision, the 140' telescope will do work which the larger instrument cannot do. Moreover, a very large instrument, even if funds were immediately available, could not possibly be completed before 1961. The 140' instrument will be a useful research tool for 20 years. It will provide a proving ground for developments in electronics, and will serve to train personnel.

6. Site Development:

With respect to site development, Waterman emphasized that the National Science Board wishes to consider only construction costs necessary in connection with presently planned equipment, i.e. the 85' and 140' telescopes, even though ultimate savings might be achieved by allowing for future growth now. The future development of the Observatory must be limited, for the time being, to planning and studies.

Berkner said that AUI was prepared to give a detailed justification of its site development program as outlined at the 11/22 meeting. In his judgment, it is highly important to carry out these plans so that the Director, whom he hopes will be chosen by the latter part of 1958, will find a going concern when he takes office. He said that several names are under consideration. Care is being taken to keep potential candidates aware of the development of the Observatory.

Emberson called attention to the schedule headed "Summary - Funding of Capital Items based on Full Utilization of 140' Telescope" attached to the minutes of the November 22, 1957 meeting and marked Exhibit "A". This shows a total expenditure, after deduction of $250,000 (engineering for large antenna) of $5,910,000. The so-called deferred items in Exhibit "D " attached to the same record total $568,700 making a total expenditure of $6,478,700. The figures in these exhibits cover the telescopes and all presently foreseeable construction. The furniture and equipment included is only that needed for immediate use. Some of the construction items are definitely in contemplation of a large antenna and are included for construction at this time for reasons of economy. It would be difficult to specify just which of the deferred items could be omitted, but some saving can certainly be effected.

The best justification for the construction program is to be found in the staff growth schedule chart, copy of which was exhibited at the meeting and is attached hereto with some minor modifications. Heeschen explained the figures on the chart with respect to the research staff. In his judgment, there should be three astronomers attached to the Observatory by July 1, 1958 to complete the equipment development needed for the 85' telescope and to begin developing equipment for the 140' telescope. By July 1, 1959 the prospect of the 140' telescope will have become definite, and there undoubtedly will be an increase in the number of visitors. Heeschen estimates that 15 visitors at any one time will probably be the maximum number up to the end of FY 1960. He emphasized, however, that the advantages of the site will have a stimulating effect on the study of radio astronomy at the universities. Already appreciable growth is taking place at Arizona, the University of California (Berkeley), Maryland, Pennsylvania, Rensselaer Polytechnic Institute, Virginia and Yale. Berkner also pointed out the likelihood of foreign scientists coming to Green Bank to use the equipment. With reference to the chart, Heeschen said that the final column showing figures for 1962 contemplated the construction of a large antenna.

Findlay explained the estimates for engineers and technicians appearing on the chart. In his opinion this build-up will be necessary even without a large antenna. The technicians will help the astronomers as well as the engineers.

Berkner expressed the view that, leaving out of consideration any large antenna and looking only at presently planned equipment, a staff of about 100 by the end of FY 1961 would be necessary. This figure includes visitors.

Findlay emphasized the desirability of scientific research essentially as in a physics laboratory, as distinct from astronomical research, and said the former should go forward even without a large antenna.

In response to questions from Luton and Keller, Heeschen said that the permanent staff might be expected to use about 40% of the available telescope time with the remainder for visitors. However, this ratio does not make possible the reduction of the supporting staff, and particularly the technicians. In Heeschen's judgment, it will always be necessary to have experienced technicians working with the visitors to protect the equipment. The problem of adjusting time between visitors and permanent staff will always exist. About six programs can be carried on at one time on each telescope, making a total of twelve. For effective observation, a staff of 71, including the Director and Deputy Director and visitors, is necessary. If any substantial amount of equipment development is to be carried on at the site, the staff would increase to 100.

A discussion of possible economies which might be effected in the site development plan proposed by AUI then ensued. The NSF staff urged AUI to base these estimates on only the 85' and 140' telescopes, with no anitcipation of any larger installation. The various items in the proposed plan which was submitted at the November meeting were considered in detail, and Dr. Emberson indicatedthat the same savings might be effected, in addition to omitting the $250,000 provided for development of a large antenna. The proposed omissions are as follows:

Wing 1 of the Laboratory	$260,000
Wing 2	250,000
Auditorium	146,000
Residence Building (Phase 2)	111,500

This would have the effect of reducing the Laboratory to the central section only, and might well result in higher total costs ultimately. However, it would effect a saving of over a million dollars.

7. Contract with E. W. Bliss Company: Mitchell and Luton described inquiries which had been received from Senator Martin of Iowa in regard to certain phases in the negotiations with E. W. Bliss Company. It was the consensus that a meeting with the Senator should be arranged, at which representatives of both NSF and AUI would be present, for the purpose of providing him with full information on the entire matter.

Mitchell asked what the value of the detailed engineering drawings made by Bliss would be if Bliss did not undertake the fabrication and erection of the 140' telescope. Emberson and Dunbar said it would be difficult to say just how valuable

the drawings would be to another fabricator. They will be prepared with an eye to Bliss's own shop practices, and about all that can be said is that they will be of less value to another contractor than Bliss, but probably would be of some use if the basic method of fabrication -- i.e., welding -- were the same.

Accepted on behalf of the National Science Foundation

/s/ James M. Mitchell

Prepared and submitted on behalf of Associated Universities, Inc.

/s/ Charles F. Dunbar
Charles F. Dunbar
Secretary

Date March 11, 1958

NATIONAL RADIO ASTRONOMY OBSERVATORY
Staffing Pattern
January 1958 - July 1960

Description	Jan. 1958	July 1958	July 1959	July 1960
Office of the Director				
Director	0	0	1	1
Secretary	0	0	1	1
Deputy Director	1	1	1	1
Secretary	1	1	1	1
SUB-TOTAL	2	2	4	4
Astronomical Research				
Staff Astronomers	2	3	4	6
Visiting Astronomers	1	1	7	14
Librarian	0	1	1	2
Secretary	1	1	2	4
SUB-TOTAL	4	6	14	26
Equipment Development and Engineering Services				
Engineers-Electronic and Mechanical	2	3	4	5
Technicians and Machinists	1	2	6	15
Secretary	1	1	2	2
SUB-TOTAL	4	6	12	22
Site Management				
Manager	1	1	1	1
Secretary	1	1	1	1
Engineer	0	0	1	1
Draftsman	0	0	0	1
Clerk	0	1	1	1
Others (including groundkeepers, janitors, housekeepers, mechanic, electrician, carpenter, plumber, painter, machinist, riggers (for telescope)).	1	6	10	15
SUB-TOTAL	3	9	14	20
Business Management				
Business Manager	1	1	1	1
Assistant Business Manager	0	0	1	1
Secretary	0	1	1	1
Others (including bookkeepers, payroll clerk, procurement clerk, supply clerk, duplicating clerk, typists, file clerk, 2 lecturers and guides)	1	2	7	10
SUB-TOTAL	2	4	10	13
TOTAL	15	27	54	85