

L R Burchill ✓

Record of Meeting at the National Science Foundation
January 31, 1958

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Present: National Science Foundation:

E. A. Eckhardt
Geoffrey Koller
A. J. Leigh
J. B. Luten
J. M. Mitchell
C. B. Ruttonberg
F. C. Sheppard
A. T. Uterman

Associated Universities, Inc.:

L. V. Berkner
L. R. Burchill
R. M. Emberson
C. F. Dunbar

1. Action of National Science Board

Waterman stated the position taken by the National Science Board at its January meeting with respect to the immediate future of the National Radio Astronomy Observatory as follows:

(a) The Board wishes the 85' and 140' telescopes to be completed in accordance with AUI's plans. The rest of the installation at Green Bank should be adequate for the full use of the two telescopes.

(b) Ancillary facilities, such as housing, etc., should be developed to a point where they are adequate to support the research program for the 140' and 85' telescopes, but no further.

(c) The Board is willing to consider the future development of the NRAO, including a very large antenna, but all determinations of this sort must be entirely separate from those with respect to present plans.

Berkner expressed the fear that there has been a change in NSF's basic philosophy. Berkner reaffirmed his opinion that NRAO should be a fully integrated institution, with all major facilities at Green Bank.

He then reviewed the results of the January 27, 1958 meeting at NSF at which Burchill, Callender, and Emberson represented AUI. He emphasized the evolution of the design of the 140' telescope and the superiority of the present design for short wave lengths, with respect to both angular positioning and minimum frequency. He further pointed out that E. V. Pliss Company can save a year in the delivery of the telescope, provided it can proceed without delay. If the 140' telescope is completed a year earlier than originally planned, the schedule for the laboratory building, the Works Area, and housing must also be advanced one year. It is his considered opinion that the reductions made as a result of the January 27 conference would seriously impair the programs for the 85' and 140' telescopes and for

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use of the site by visitors. He made the following comments with respect to the questions raised at the January 27 meeting concerning the need for a Residence Hall and Cafeteria at a proposed cost of \$583,000:

(a) Housing:

The need for some sort of housing, given the situation in Green Bank valley, is imperative, and includes both visitors and permanent staff. The shortage of housing makes it imperative for staff members to be provided with a place to live for a substantial period of time while they make their own arrangements, either to purchase or build. In addition, there will always be a need for housing some of the permanent staff, e. g. unmarried scientists, engineers and technicians, who could not reasonably be expected to make their own arrangements. Some of the existing houses are being remodeled and rehabilitated, but many will be needed for laboratories, offices, etc., and only five will be available for residential purposes. Berkner urged that the housing problem be regarded as analogous to that existing at a military installation, where, as a matter of course, quarters are provided for personnel. In his judgment, the temporary housing possible through renovation of existing structures on the site will fall far short of what is needed for the 85' and 140' telescope programs. Eckhardt and Luton agreed that the housing problem would be serious and asked Berkner's opinion on whether NSF should go to Congress for \$583,000 for a cafeteria and residence hall in anticipation of future needs, or wait at a later date with a demonstrated need based on experience. Berkner considers that the program proposed in the January 3, 1958 request should be pushed as rapidly as possible. If there is a core of Observatory housing available, it should be possible to meet the needs of the permanent staff as it is recruited, for the time being. The need for having certain key employees housed permanently on the site was recognized.

As to the cafeteria, Berkner conceded that the one now proposed was larger than would be required within the next few years. On the other hand, he pointed out that no lounge had been provided and he suggested that half or more of the cafeteria space be used for that purpose. The need for such space, as evidenced by experience at Brookhaven, can not be overemphasized. If at a later date more cafeteria space is required, a lounge might be provided in other construction, thus freeing additional space for the cafeteria.

Waterman asked about the prospects for financial support from other sources, e. g. the State or private enterprise. Berkner considers that the State may well furnish help on the public education and recreational aspects of the Observatory by providing parking areas, picnic grounds, etc. There is no reasonable likelihood of obtaining any assistance in acquiring housing. Similarly, the likelihood of interesting a private real estate developer seems slight. The experience at Brookhaven has been decidedly discouraging. AUI has had no success in obtaining privately housing there, and the obstacles seem to be even greater at Green Bank.

In the afternoon session, the discussion on housing was continued. Luton asked how AUI proposed that a permanent staff of 71 be housed. Burchill said that more than half of this number would be recruited locally. Difficulty would arise chiefly with the scientific staff and the supporting technicians and machinists. In his opinion, people appointed to the permanent staff will be able to make their own arrangements for housing, provided they can be assured of living quarters when they first arrive at the Observatory which they may occupy until they can make reasonable other arrangements. This plan has worked satisfactorily at Brookhaven. The sum of

\$82,000 mentioned in the January 3 request provides housing to be used by visitors and some temporary housing for use by members of the permanent staff while getting settled. Emberson also pointed out that the need for housing depended on the delivery schedule for the telescopes. It is essential that housing be available when the 140' telescope is ready for use. Luton asked if Burchill meant to indicate that the best answer AUI could give a prospective technician or scientist employee on the availability of housing was that he would have to build his own house to work at Green Bank for AUI. He pointed out that this did not seem to be a satisfactory solution to the housing problem, and that the provision of a cafeteria and residence hall would not provide a full solution to this problem either. The AUI representatives stated they had no better solution to the problem as yet, but that they were giving it further consideration.

(b) Works Area:

Concerning the Works Area building, Berkner referred to Item B-3 of the Summary Table of January 3 budget and said the title "Maintenance Building" was misleading inasmuch as many other activities would be located in the Works Area. The building, as originally planned, has three sections that provide for maintenance shops, shipping and receiving, storage, an electric power distribution center, a standby generator, and a high-ceilinged unobstructed room that could be employed for a variety of purposes, including short-wave model tests. On this last use, he pointed out that model testing would be a continuing program at the Observatory, because every new experiment might require a different RF arrangement in the telescope, and it would be more efficient to test out such devices on a scale model rather than in the telescope.

(c) Laboratory:

Berkner protested against the reduction of the allocation for the laboratory and administration building from \$776,000 to \$466,000. This requires the elimination of a wing and leaves only the center section. Advances in electronics involving such devices as masers, and other low temperature techniques, require that the NRAO have available at Green Bank the equivalent of a solid-state physics laboratory. Also, AUI has plans under way for the early conversion of the 85' and 140' telescopes to automatic data and processing. Requirements such as these would be in addition to those already recognized for space required by the astronomers and engineers working at Green Bank. He concluded that the central section of the laboratory would be adequate only for a short time and that the additional wing, included in the January 3 submittal and deleted on January 27, should be built now. He pointed out that before this structure was completed, it would be redesigned to insure that the floor space provided would take care of all known and anticipated requirements outlined above.

2. Local Taxes

Dunbar reported the result of his conferences in Charleston with the Attorney General and the Tax Commissioner, and the possible exemption of AUI from the West Virginia Sales and Use Tax. The prospect of a favorable ruling is sufficiently good to warrant omitting the figure of \$200,000 from the January 3, 1958 budget.

3. Navy Installation at Sugar Grove

Berkner expressed the belief that the Navy's proposal to establish a radio facility at Sugar Grove, West Virginia, would be fully supported by Congress. In addition, there is another program initiated by the Air Force, and still only in

the planning stage, calling for the construction of a large radio telescope, perhaps to be 300 feet in diameter. This instrument would be for military research. In Berkner's judgment, these developments in no way affect plans for the NRAO. It is essential that true scientific research in this country remain independent of military requirements. The universities on whose cooperation success of NRAO depends have never been able to cooperate effectively with the military services, in the way they have been able to cooperate with the national civilian laboratories, because the military programs take precedence over and dominate the civilian basic research.

In this connection, Berkner urged that the National Science Board take a strong stand in support of basic research. In its current budget requests, the Foundation has sought a five to one increase in allocations for education, as distinct from a two and one-half to one increase for research. There is no use training more scientists, unless there are satisfactory institutions at which they can work.

Berkner and Emberson described in more detail the Navy installation at Sugar Grove. It will be an institution operated primarily for military needs of the Navy, with little or no regard to the requirements of civilian scientists. For example, only ten per cent of the buildings to be constructed will be allocated to radio astronomy. The balance will be for highly classified military activities. Luton asked whether AUI had looked into the possibility of housing for the permanent staff in the town to be constructed by the Navy. Dunbar and Emberson said that they had not so inquired.

Emberson said that the Navy was solving its housing problem by constructing a town at Sugar Grove. However, there is no reasonable likelihood that this will help the housing problem at Green Bank.

Berkner and Emberson emphasized that unquestionably there would be some cooperation between the two institutions, by reason of the community of interests of the scientists. These informal relationships should be very helpful, to both the Navy and NRAO, as time goes on.

4. Schedule and Priorities

Mitchell suggested that priorities and timing for the various items in the budget be carefully considered. These points were briefly discussed by Waterman and Berkner. The latter again cautioned against limiting operations at Green Bank to an extent that would defeat the scientific objectives of the Observatory and force astronomers to rely on contracts with the Military Departments, and, in the hope of obtaining research time, to support the construction by these Departments of the larger radio telescopes needed for the prosecution of basic research.

Luton asked for a completion schedule for the telescopes and other buildings included in the January 3 submittal. Burchill and Emberson gave the following summary:

(a) 85' Telescope:

This should be completed and in operation July 15, 1958.

(b) 140' Telescope:

If the program proceeds without delay, this can be in operation in the late spring or summer of 1959. If a decision to go ahead is delayed much beyond March 1 the completion date will probably be in the spring of 1960.

(c) Works Area:

Construction is estimated to be a 9-10 months' task, depending substantially on the phasing of the work with respect to weather.

(d) Central Laboratory, Housing and Cafeteria:

These could be scheduled for completion for the summer of 1959.

(e) Temporary Housing:

This is a continuing program with renovation proceeding in series from one house to the next. Some of the houses that will be renovated will not be vacated by the present owners until July 1958.

Both Luton and Sheppard were of the opinion that money might be available by April, but that June or July would be more realistic. Luton requested a written statement confirming Berkner's description of the advanced position of Britain, Australia, The Netherlands and USSR in contrast to U. S. radio astronomy. Berkner pointed out that these countries, since World War II, have been actively sponsoring radio astronomy. In some respects, individually and collectively, they can be thought of as well ahead of the U. S., despite the fact that the initial discovery of, and many of the important contributions to, radio astronomy have come from the U. S.

5. Licenses and Radio Noise Protection

Berkner said it had been proposed, in connection with the protective zone to be established by FCC, that AUI act as the single point of contact for the review of applications for transmission licenses submitted to the FCC. He said that AUI would continue to retain Porter to prepare the actual documents that would be appended to the license applications for consideration by the FCC, and to appear at any hearings, if AUI objected to the issuance of a particular license. Porter estimates that there may be about 20 applications a year which will have to be considered. The cost of this work would be part of AUI's operating budget.

Emerson said that the Navy expected to establish a radio interference section at Sugar Grove in about a year, which would simplify the task of review and coordination of license applications.

6. Very Large Antenna and Space Station

Berkner discussed the very large antenna and space station. He reported on an informal discussion January 29 with Drs. Bronk, Klopsteg and Waterman. Berkner fully agrees that the very large antenna and space station be considered separately from the 85' and 140' telescope program. Waterman advised that Dr. Bronk was

establishing an ad hoc committee of the National Science Board that would meet February 10 or 11, perhaps in New York, to hear presentations by AUI and NSF on those matters. Berkner said AUI has initiated survey studies looking to the ultimate construction of a very large antenna. These studies can be financed largely from existing operating funds, because the total cost probably can be held to less than \$25,000. If additional assistance is required from NSF, the amount will be small. Emberson described the work being done by Hoesshon, Findlay and Carroll of the AUI staff, and Lilly at Yale. They are conducting informal studies of a fixed paraboloid with a movable mast. They are considering the relationship of the number and dimensions of flat panels approximating a perfect paraboloid to other factors; e. g., the over-all diameter and wave lengths. It must be determined whether the structure should consist of an excavation or whether it should be above ground. Feed problems are also important, and there is very little data obtainable in this or in any other country. Some work has been done in Great Britain on spherical problems. Consideration must also be given to the relative merits of an array, as opposed to a fixed structure moving as a unit, or to the fixed paraboloid scheme referred to above. Emberson said AUI would like to have the structural problems considered on a study basis by outside engineers; e. g., Blaw-Knox Company, Dr. Jacob Feld, Husband in England, and possibly Walter Bird, formerly employed by Cornell Aeronautical Laboratory, at Buffalo, New York. It is planned that these studies be completed late in the spring of 1958, and that engineering studies based on the most promising ideas be started in July 1958. At that time approximately \$250,000 will be necessary to support the program. Eckhardt and Berkner discussed the relationship of the 85' and 140' programs to the advance planning mentioned above. Berkner pointed out that the very large antenna and expensive equipment can not be duplicated at every large university in the country and that the "Instituto" solution seems to be the best available to us.

Berkner went on to discuss the space station for astronomical research. He mentioned the possibility that a space agency would be established soon. This agency would be responsible for the design, launching, and operation of satellites, but the scientists will have to assume responsibility for the design of the apparatus to be installed in the space station. He pointed out that the space station would not be limited by any atmosphere, and programs could be planned utilizing the entire spectrum from x-ray wave lengths, through optical wave lengths to radio wave lengths. He noted that the IAS had already started work looking to an optical observing station, and that the AUI Radio Astronomy Advisory Committee suggested that AUI start at once on such planning. If the NRAO established a group to work on satellite instrumentation for radio astronomy, other groups would be necessary to cover the fields of optical astronomy, communications, meteorology, etc. Luton discussed the respective roles of the Space Agency and NSF, and all agreed these activities would involve a greatly increased Federal activity in research.

7. 140' Telescope

Emberson said the point has been reached where it should be possible to prepare a definitive contract with E. W. Bliss Company, although there are still a number of questions to be settled. For example, there is no final design set on the drive and control, and so the sufficiency of the amount allocated for this by Bliss is not known. Brown, of Lombard Governor Corporation, has been serving as a consultant on the drive and control system, and rapid progress is being made. Bliss considers

that it has the assets necessary for the detailed engineering on all other points. This is planned to include a detailed engineering which will enable it to participate in the manufacture of large quantities of aircraft, and this may result in some saving of cost.

It is also planned to include a detailed engineering of the heavy machinery which could be applied to the production of aircraft.

REFERENCES

1. The aircraft industry is a highly competitive industry and it is essential that the manufacturer be able to produce aircraft in large quantities at a low cost. This requires a detailed engineering of the aircraft and its components. The manufacturer must be able to produce aircraft in large quantities at a low cost. This requires a detailed engineering of the aircraft and its components. The manufacturer must be able to produce aircraft in large quantities at a low cost. This requires a detailed engineering of the aircraft and its components.

1st James M. Mitchell

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April 28, 1958

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