

ASSOCIATED UNIVERSITIES, INC.  
10 Columbus Circle  
New York 19, New York

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January 22, 1958

MEMO TO: L. V. Berkner F. D. Drake  
L. R. Burchill C. F. Dunbar  
F. J. Callender J. W. Findlay  
J. J. Carroll D. S. Heeschen  
M. L. Westman

THIS COPY FOR

FROM: Richard M. Emberson

SUBJECT: Agenda for the AUI Staff Meeting at Green Bank  
on January 30, 1958

1. The following is the tentative agenda for the AUI Staff Meeting at Green Bank on January 30, 1958. Some items will be merely status reports on activities that have been continuing for some time. Other items involve new material and the persons indicated have been previously designated as being responsible for the assembling of the documentation for other materials requiring proper consideration. Insofar as possible draft documents should be circulated in advance of the meeting.
2. In brief discussions at Brookhaven on January 17, Dr. Berkner covered the following points:
  - 2.1 Assuming that we will continue indefinitely with a meeting at the NSF the last Friday of every month, we will plan for all NRAO staff members to meet at Green Bank for the last Thursday of the month.
  - 2.2. In order to simplify scheduling of activities at Green Bank, a regular mid-month date will be set when persons from the New York and Brookhaven offices will plan definitely to visit the NRAO.
  - 2.3 With respect to Item 6 of the Agenda, it was suggested that copies of the Brookhaven and Cornell Standard Practice Instruction (SPI) Manuals be obtained.
  - 2.4 A personnel review for NRAO should be completed for the March meeting of the AUI Trustees Executive Committee.

ASSOCIATED UNIVERSITIES, INC.  
Radio Astronomy Staff Meeting  
January 30, 1958

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TENTATIVE AGENDA

- ✓ 1. Review of first bi-monthly letter to NSF - Draft by JWF, DSH, et al.,
2. Site Acquisition Problems -
  - ✓ 2.1 Report of Corps of Engineers Activities - FJC
    - 2.1.1 Total costs to date
    - 2.1.2 Schedule of access to land
  - ✓ 2.2 Easement or Covenant Agreement - FJC, CFD
3. Radio Interference Protection - CFD, JWF, FJC
  - ✓ 3.1 Local building code or zoning
  - ✓ 3.2 FCC action
  - 3.3 CAA action
    - ✓ 3.3.1 New VOR station at Manning Knob
    - ✓ 3.3.2 Restricted or prohibited zone
  - ✓ 3.4 Specifications for monitoring truck
    - 3.4.1 NSF attitude on vehicle procurement - FJC
4. 85-foot Telescope Program
  - ✓ 4.1 Ivy Contract for building and foundation - FJC, MLW
  - ✓ 4.2 Telescope design and construction
    - ✓ 4.2.1 Status of over-all job - JJC
    - ✓ 4.2.2 Change orders (base; feed support) - FJC, CFD
    - ✓ 4.2.3 Contract amendment (Southern horizon) - CFD
    - ✓ 4.2.4 Procurement of lead - FJC, JJC
  - ✓ 4.3 Addition of Precision Indicators - FFD, JWF
  - ✓ 4.4 AIL - 21 cm Receiver - JWF, DSH
  - ✓ 4.5 Order for TWT Receiver from Ewen-Knight - CFD, FDD, JWF
  - ✓ 4.6 RF-feed procurement from Jasik - JWF

## 5. 140-foot Telescope Program

✓ 5.1 Status of contract negotiations - CFD

✓ 5.2 Foundation problems - JJC

✓ 5.2.1 Access

✓ 5.2.2 Disposal of rain water

✓ 5.2.3 Provision of studs, etc.

5.3 Polar Shaft

✓ 5.3.1 Extension of Franklin Institute Contract - CFD

5.4 Drive and Control

✓ 5.4.1 Amended specifications

✓ 5.5 AUI Staff and Consultants

## 6. Other organizational and administrative matters

✓ 6.1 Status report on plan for site management - LRB, FJC, MLW

✓ 6.2 NRAO appointment policy - FJC

✓ 6.3 Manual for visitors

✓ 6.4 Interim organization and staff assignments

✓ 6.5 Exhibits

✓ 6.5.1 Reber telescope

✓ 6.5.2 Ewen-Purcell Horn

✓ 6.5.3 Travelling Exhibit

✓ 6.6 Tax exemption

6.7. Income Tax

## 7. NSF Affairs

✓ 7.1 Mitchell/Luton/Keller interests

✓ 7.2 Status of budget request

✓ 7.3 Attitude toward VL Antenna program

## 8. Very Large Antenna Program

✓ 8.1 The Heeschen-Lilley Proposal

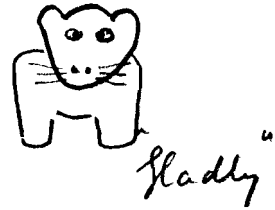
✓ 8.2 Other possible studies

## 9. Other Pending Contracts or extensions

✓ 9.1 Monongahela Power

✓ 9.2 Bids for on-site distribution

✓ 9.3 Bowman (power; 140-foot control)



Dr. Heesken

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ASSOCIATED UNIVERSITIES, INC.  
10 Columbus Circle  
New York 19, New York

April 9, 1958

MEMO TO: Addressee

FROM: Richard M. Emberson

SUBJECT: Minutes of the January 30, 1958 NRAO Staff Meeting

1. Herewith are the minutes of the January 30 meeting at Green Bank. I prepared a draft of the minutes soon after the meeting, but failed to complete them and make the usual distribution -- a tribute to the burden normally carried by our Secretary.
2. A few items in these minutes are obsolete, but they are recorded as of January 30, for reference purposes. Item 1.2 should not be taken for planning purposes because the last-Friday-of-the-month AUI-NSF staff meetings were cancelled on April 1. Dr. Berkner proposes that there be quarterly meetings, starting next September. The next NRAO staff meeting will be at Green Bank on Thursday, May 1, and we hope the NSF staff may join us there on May 2. A Washington AUI-NSF meeting is also tentatively scheduled for June 24 or 26.

Copies to all present plus C.F. Dunbar

Minutes of AUI Radio Astronomy Staff Meeting

Green Bank, West Virginia

January 30, 1958

Those present were:

L.V. Berkner	F.D. Drake
L.R. Burchill	R.M. Emberson
F.J. Callender	J.W. Findlay
J.J. Carroll	D.S. Heeschen
M.L. Westman	

The agenda previously distributed was amended by several matters concerning personnel.

0.1 Mr. Westman has formally submitted his resignation to be effective no later than the end of February. Dr. Berkner expressed the thoughts of all present in wishing Mr. Westman the best of success at Brigham Young University, and thanking him for the contributions he has made in the early phases of the establishment of the Observatory at Green Bank.

0.2 Dr. Heeschen reviewed his plans for going to Jodrell Bank on March 2nd, returning early in May. If possible, he will plan to spend approximately a week in Pasadena and at Mount Palomar prior to going to England. In view of the report Dr. Findlay had brought back concerning the status of 21-cm electronic equipment at Jodrell Bank, and more recent correspondence from Professor Lovell, it appeared highly desirable that Dr. Heeschen take with him certain critical electronic apparatus. He and Dr. Findlay were of the opinion that most of these requirements could be met from the supplies now at Green Bank. Concerning the return of the equipment to the United States, the consensus was that prior to his departure, Dr. Heeschen would have to evaluate the cost of disentangling the U.S. components from the British electronic equipment, and the cost of shipping these components back to the United States, as compared to the value of these components once they were returned to Green Bank.

0.3 The suggestion that Grote Reber might come to Green Bank in the summer of 1958 as a visiting astronomer was reviewed. Mr. Schauer of the Research Corporation had advised informally that they would be willing to support Mr. Reber in a continuation of his low frequencies research program, and presumably there would be a fifty-fifty split of salary and other expenses. Dr. Berkner suggested that administrative procedures might be simplified if Mr. Reber were put on the NRAO rolls as a full time visiting astronomer,

ACTION  
REQUIRED,  
FJC,RME

and that AUI then bill the Research Corporation for one-half of his salary and for such apparatus, equipment and other expenses as were directly connected with the low frequencies research program. It was suggested that a draft letter be prepared and discussed with Mr. Schauer and other representatives of the Research Corporation before contracting further with Reber.

1.1 Dr. Findlay had prepared draft No. 1 of a bi-monthly letter to the NSF on activities at Green Bank. After review, Dr. Berkner suggested the following changes:

1.1.1 that during the calendar year 1958, the reports be issued on a quarterly basis rather than bi-monthly;

1.1.2 that Mr. Callender should become the Editor for the report;

1.1.3 that the report should cover the scientific activities included in the section as drafted by Dr. Findlay, as well as the administrative and construction activities. With relation to the scientific section, there should be discussions of research programs underway at the Observatory, and after the 85-foot and 140-foot telescope programs are in operation, there should be a summary of the activity on the big instruments. Also, there should be an appendix of abstracts and titles of publications. With respect to the non-scientific activities at Green Bank, reference should be made to the AUI staff meetings, to the AUI-NSF meetings (covered in separate minutes), and to the contracts and other significant documents that have been completed during the report period.

1.2 Concerning general administrative activities at Green Bank, Dr. Berkner said that we should plan, on an indefinite basis, to have a staff meeting on the last Thursday of each month preceeding the meeting with the NSF staff on the last Friday of each month. He also asked Mr. Burchill and Dr. Emberson to visit Green Bank in the middle of each month.

ACTION  
LRB, FJC

1.3 Dr. Berkner suggested that a first draft of a salary review for the Green Bank personnel be ready for the March staff meeting. He urged also that work proceed with the preparation of a Standard Practice Instruction book, properly indexed, and kept in a loose leaf folder under hard covers. The Visitors Manual, which had been discussed at previous staff meetings, would essentially be a section of this book, as well as sections on appointment policies, procurement procedures, etc.

1.4 After discussion, there was agreement that the Observatory had reached a sufficient level of activity to justify the procurement of dictating, duplicating, mimeograph machines, and other such equipment.

2.1 Mr. Callender reported on the status of the site acquisition:

Paid - Land	\$124,060
Optioned - Not Paid	45,525
Condemned	187,301
To be Condemned	100,652
Acquisition costs, 11/30/57	<u>66,137</u>
Sub Total	\$523,675
Estimated Costs of Easements	\$ 80,000
Additional Administrative Costs	17,000
Reserve for Court Judgments (1)	<u>29,325</u>
Total	\$650,000

(1) In excess of condemnation price

Note: Total land to be acquired was estimated at 2,100 acres; actual acreage acquired totals 2,650 acres.

2.2 In view of the fact that the Corps of Engineers have closed their Marlinton office, the Observatory will provide them office space when they return to proceed with the Easement Program. All of the necessary changes and title searches have been completed, and the draft easement has been resurrected and is now under review by the NSF and members of the AUI staff. It has been suggested that a schedule be established by groups for the payments in obtaining easement, for example, one rate would apply to small plots in the villages of Green Bank and Arbovale, and another schedule would apply to the larger plots in the farm areas. As soon as AUI and NSF agree on the wording of the easement document, the Corps of Engineers will proceed. If reasonable estimates are made of their administrative costs, it is expected that the total fund of \$650,000 will have procured the site and, also through the easement, will have provided a buffer zone of at least 3 miles radius about the 140-foot telescope.

ACTION  
FJC, RME

3.1 Mr. Callender reported that there is no building code for zoning in Green Bank or Marlinton. It is his understanding that zoning power rests with the state, not with the county. The present State Legislature is considering a bill that would give zoning power to the counties.

Dr. Berkner suggested that a solution might be to buy the road-front property from the High School northward past Arbovale. He suggested that an estimate be obtained of the cost. He also urged that a report be obtained from Messrs. Dunbar and Porter concerning the possibilities in the near future of zoning to protect the Observatory.

3.2 The FCC has requested that some mechanism be devised for the pre-coordination of transmitting license applications prior to submittal to the FCC. Dr. Berkner suggested that Dr. Findlay should undertake the technical staff work at Green Bank, and that Mr. Porter should draft, in the proper legal form, whatever comment we would wish to attach to the license application. The question was raised whether or not the FCC ruling would apply to amateurs. All agreed that the amateurs should be handled with care, because they could be helpful if they were enthusiastically behind our operations, and they could be very troublesome if they develop an antagonistic attitude. In this relation Dr. Heeschen reported that amateurs are causing more and more trouble at Agassiz Station. Mr. Drake reported that 50 per cent of the time Agassiz Station trouble is caused by amateurs, one in particular. Dr. Findlay commented that all the electrical equipment at Green Bank should be designed so that the intermediate frequencies (IF-bands) were between and not overlapping the 30 megacycle band assigned to fixed amateur stations, and the 36 megacycle band assigned to mobile stations.

3.3 Dr. Findlay reported that the CAA had moved the proposed VOR station from Buckeye to Manning Knob. This station will operate at 140 mc/s, and will be at slightly greater airline distance than the equipment at the Elkins Airport. The Elkins equipment is occasionally picked up at Green Bank, but to date has caused no serious difficulties. Mr. Porter has suggested that we proceed with action to request a prohibited or restricted zone about Green Bank. He thought the CAA might be favorably inclined to make the restricted zone coincide with the Radio Astronomy Quiet Zone established by the FCC.

3.4 Dr. Findlay reported that Jansky & Bailey were prepared to proceed with the engineering design and specifications for a monitoring truck; the initial cost of the truck and equipment should be aimed at a total cost of \$20,000. Dr. Berkner mentioned the usefulness of the truck and its equipment, not only at Green Bank, but at other radio astronomy observatories. Mr. Callender and Dr. Findlay pointed out that some equipment might be obtained from the \$130,000 budget item that could be used either in the laboratory or in the truck, thereby making the truck a more



useful device. Dr. Findlay had no cost estimate from Jansky & Bailey, but he was of the opinion that the preparation of detailed engineering plans would be rather expensive, but would be worth doing because it would permit us to get firm bids on the construction of the truck. The question of truck procurement has been raised with the NSF, and no opinion has been given as to whether or not such a specialized vehicle comes under the normal vehicle procurement regulations. To be on the safe side, Mr. Sheppard is putting an additional vehicle authorization into the current bill. Dr. Berkner said that dump trucks, mobile cranes and other like equipment should be provided for in the appropriations bill. At this point, Mr. Carroll reported that he had estimates ranging from \$3,000 to \$6,000 on mobile cranes of lengths that could be used for servicing the focal equipment of the 85-foot telescope. Dr. Berkner suggested that it might be worth putting more into this equipment to provide a lifting capacity of 1,000 pounds and a height sufficient to reach the focus of the 140-foot telescope. It was mentioned that this crane or platform might also be employed to support beacons or similar equipment that might be involved in test pattern measures. For this reason, Dr. Berkner favored a self-propelled vehicle rather than a towed trailer of fixed installation.

ACTION:  
FJC to explore further with NSF authorization of mobile equipment

4.1 Mr. Callender reported that the contract on the 85-foot control building, plus the agreed change orders, had now been finished by the Ivy Construction Co. Blaw-Knox has promised foundation drawings on or about February 1. The quantities of material have changed little from the redesign to permit later installation of tracks and boggies to move the telescope. Mr. Carroll reported that the Pittsburgh Testing Laboratory had completed its studies at Green Bank, confirming his earlier estimates; the soil will carry 7,000 lbs. per square foot, with the maximum settlement of 3/8 inch. The estimated differential settlement between the north and south piers of the 85-foot telescope would be of the order of 1/10 of an inch. This would correspond to an angular rotation of the telescope of 3 minutes of arc. Any such motion can be easily compensated by the adjustments provided by Blaw-Knox. Dr. Berkner urged that we proceed at once with the Ivy Construction Co. to get work started as promptly as possible at Green Bank.

4.2 Mr. Callender reported that 60,000 lbs. of lead was in transit for the 85-foot telescope counterweight. Of this amount, 20,000 lbs. is known to be bar stock; the remainder may have to be melted and cast in a more useable form. The total lead so far procured amounts to 110,000 lbs., and only 15,000 lbs. additional are required. Blaw-

Knox has indicated they will not need this lead before April 1. Mr. Burchill cautioned that this lead has been shipped on Government bills of lading, and that sooner or later we would have to pay for this transportation. Therefore, an appropriate amount of money, taken from the telescope fund of \$310,000, should be earmarked for lead transportation. Mr. Carroll reported that Blaw-Knox had decided to do the aluminum work in their own shop, rather than to sub-contract it to the Washington Aluminum Co. All of the components are about ready to go into the Blaw-Knox shop. Shipment to Green Bank would be in mid-April, with erection to start by May 1. Mr. Callender reported that the necessary papers were being prepared to cover the change in the base design and the provision of two additional legs for the focal feed support. Dr. Berkner asked that all efforts be made to obtain some observational results with the telescope prior to his departure for Europe July 12. He further suggested that the dedication of the telescope be postponed until October.

4.3 Dr. Findlay reported on the progress he and Mr. Drake had had with respect to the precision indicators for the 85-foot telescope. They have decided to provide automatic equipment for recording the position of the telescope and the receiver signal strength. The simplest position equipment would provide an electric typewriter to record these data. It is estimated that the position indicator and recording equipment will cost approximately \$50,000. Dr. Heeschen pointed out that the precision clocks and indicators would cost about \$25,000, and the automatic print-out system would cost an additional \$25,000. He agreed that this latter equipment would be required, but suggested that if we ran short of funds, its procurement might be postponed. Dr. Findlay noted that the \$530,000 budgeted for electronic equipment should cover these items, particularly as all the components were commercially available, and no development work was involved. Mr. Drake was of the opinion that the position indicating and automatic read-out devices would have much value on the 85-foot telescope, even after the 140-foot telescope was in operation. He agreed that the 85-foot telescope experience would be helpful in the final design of equipment for the 140-foot telescope. He did not believe it reasonable to assume that we would have to remove the equipment from the 85-foot telescope in order to have these capabilities on the 140-foot telescope. Mr. Burchill raised the question of whether or not some higher speed and more versatile equipment should be ordered than the electric typewriter. For example, a 5-column punch tape can be used on standard machines such as those manufactured by IBM and Remington Rand, as well as on special machines such as the

MANIAC, now under construction at Brookhaven. Dr. Findlay replied that the system would accommodate both the typewriter and the more elaborate devices, but he thought it would be preferable to start with the simplest arrangement. He said that he was working closely with Mr. Brown of Lombard Governor and Mr. Carroll, to make sure that the inductosyn and other equipment could be mounted easily on the 85-foot telescope.

4.4 Dr. Findlay reported that work seems to be going ahead smoothly on the AIL 21-cm receiver. All of the commercial components, such as power supply, have been secured. None of the special components have yet been assembled in final form at AIL. Dr. Berkner suggested that the Hycon-Eastern stable oscillator be investigated as a possible time reference and source for beat frequencies. Dr. Findlay reported that he was getting a quotation on this equipment which operates at 1 mc/s. He continued that he had no reason to feel that AIL would fall behind their promised delivery. Meanwhile, he and Dr. Heeschen will assemble an experimental receiver at Green Bank. Thus, if there should be any unanticipated difficulties, there would still be some sort of receiver ready in July.

4.5 Mr. Carroll reported that Blaw-Knox believes union labor difficulties can be avoided if there be a clear separation between the electrical work and the construction work at the site. They are proposing that the polar axis and declination axis drive assemblies be completely mounted and wired at the factory. These pads would then be mechanically lifted into place at Green Bank, at which point AUI would assume responsibility for the interconnections between the pads on the telescopes, the control components to be located in the small shed (to be supplied by AUI) beneath the telescope, and the control desk in the near-by building. Dr. Emberson suggested that Dr. Findlay work out the details of these arrangements with Blaw-Knox. It seemed clear that we should assume responsibility for connecting the console in the control building to the shed below the telescope, but it was not clear that we should be responsible for wiring between the pads of the telescope and the shed. Dr. Berkner urged that the shed be made large enough to accommodate any filtering subsequently found to be necessary. Dr. Findlay estimated that the shed would cost \$1,000 and interconnecting cables might cost \$5,000.

ACTION  
JWF

4.6 As a matter of record, an order has been placed with Ewen-Knight Corp. for a traveling-wave-tube receiver to operate in the 3 to 4 cm band. In this connection, there was some discussion concerning Fred Haddock's worries of competition between his programs and the programs at Green Bank. It would not appear that a TWT receiver could be procured for

work at 5 to 6 cm for a period of from 6 to 8 months after the 3 to 4 cm receiver would be available. If through some misfortune the 85-foot telescope had a small loss (3 db) at 5 cm, and a large loss (14 db) at 3 cm, there would be considerable advantage in the employment of a 5-cm receiver. In view of the procurement situation, however, it was agreed that we should proceed as now planned with the 3-cm receiver, that Mr. Drake would proceed to plan for his precision position measuring program, that any member or visitor at Green Bank should be free to explore ideas as might be possible with the observational equipment at Green Bank, and that any findings infringing directly on programs known to be underway at other places should be communicated immediately to the interested individuals. Dr. Berkner further suggested that Dr. Heeschen discuss these problems with Fred Haddock and others, and draft a policy memo that would govern during the initial observing period at the Observatory.

ACTION  
DSH

4.7 Dr. Findlay reported that Henry Jasik has worked out the technical design for a horn feed that would work in two operating bands: 1170 - 1440 mc/s, and 7500 - 10,200 mc/s. It is estimated that the electronic components would cost approximately \$6,000 and the mechanical drive assembly would cost \$3,200. If ordered by March, this feed could be ready for delivery May 1.

At this point there was a luncheon recess. After lunch, Dr. Berkner mentioned that the Cassegrainian arrangement, which has been used for centuries in optical telescopes, might be promising for the 85- and 140-foot telescope, because it would permit shortening the length of the focal feed supports, and also because special equipment such as might be required for a maser receiver should be located at the vertex of the paraboloid, rather than at the focus. Dr. Findlay advised that he was aware that some radio telescopes had been designed in this Cassegrainian configuration, and he would continue to follow this possibility.

4.8 Dr. Emberson reported that Mr. Dunbar had looked into the matter of duty on the import of a 12-foot parabolic reflector. It appears that there is no way to avoid duty payment, which would amount to 27%. With reference to the Buy American phrase in our contract, it will be necessary to supply the NSF with a statement giving the cost factor of the foreign equipment as compared with U.S. supplied, and the technical reasons for the purchase of non-United States material. It was agreed that we should proceed with the preparation of such a document for the NSF, and then for the procurement of the 12-foot reflector from England.

ACTION  
FJC

5.1 After a brief status report on the 140-foot telescope program, Dr. Berkner urged that we attempt to negotiate a contract with E.W. Bliss before he left on February 10. Mr. Burchill cautioned that he felt that in a contract that would be lump-sum, any changes in the telescope design, or improvements or ideas, would be "extras" to the lump sum.

5.2 Mr. Carroll reported on the foundation problems, particularly that access to the interior through the elevator, stairway, and windows, seemed adequate for any present, or anticipated, requirements. In order that Darin & Armstrong may proceed with the foundation, it is desirable that we provide final specifications for the interior of the building.

ACTION  
FJC

Dr. Emberson raised the question of proceeding with Irving Bowman & Associates. After considerable discussion, it was agreed that Mr. Callender should have an informal discussion with Mr. Bowman, explaining that we are not completely satisfied with the work that has been done, and exploring means of proceeding more expeditiously with respect to the 140-foot interior and any necessary revisions on the laboratory, dormitory and works area buildings. Dr. Berkner urged that we consider terrazzo flooring for the interior of the 140-foot telescope building, instead of asphalt or vinyl tiling. It was agreed that Drs. Heeschen and Findlay would re-check their requirements for the 140-foot control room, in order that Bowman would be able to provide the necessary conduits, air ducts, cable ways, etc. Dr. Berkner agreed that rain water should be permitted to run over the side of the platform at selected positions, but relatively small interior drains should be provided to take care of small amounts of water on the platform. He reversed his prior position concerning a walk-way around the platform for tourists and other visitors, and asked that we look into possible arrangements to utilize the existing area on the top of the platform.

ACTION  
JWF, DSH

5.3 Dr. Emberson reported that The Franklin Institute was proceeding with the final design of the polar shaft bearings, that there was agreement in principle on the details of the contract extension, and that wording was being revised to make sure that there would be no further mis-understanding of the relationship of The Franklin Institute, AUI, and E.W. Bliss.

5.4 Dr. Findlay reported on the status of the 140-foot drive and control program as explained in his memo dated January 29. The decision to go to hydraulic motors would appear to offer a great amount of flexibility in the system. It appears very doubtful that the complete system could be procured for the \$250,000 allowance. It was suggested that some items might be postponed. On the other hand, there was considerable argument for completing the system at one time. This might involve \$100,000 to \$150,000 worth of contingency money.

5.5 Dr. Emberson pointed out that in addition to the full-time radio astronomy staff, we had Ned Ashton, Tom Brown, Mike Karelitz and The Franklin Institute as consultants. To date, there has been no luck in the recruitment of a full-time mechanical engineer.

6.1 Dr. Berkner said he was worried about the shortage of technicians and other specialists at Green Bank. He raised the question of whether or not AUI should select promising high-school students and enter into a contract with them for a two-year period, with the idea that part of the first year would be spent at a technical school. Dr. Findlay reported that he would also like to recruit an electronic specialist, that is a man of higher level than a good technician, having in mind someone with the capabilities of Mr. Campbell at Ewen-Knight. It was agreed that such an individual would be useful at Green Bank, and could be accommodated in the personnel budget. Dr. Findlay was authorized to explore the possibilities at a salary level of approximately \$700 per month. Dr. Berkner went on to discuss housing problems at Green Bank. He said as a matter of policy he would hate to have visitors keep away from Green Bank because the permanent staff felt it necessary to occupy housing at the site. On the other hand, he recognized that procurement of technicians and specialists would be very difficult if we could not offer them something in housing. He suggested that Dr. Findlay look into the possibilities of the two-year contract training program versus straight-out recruitment, and report at the next meeting.

ACTION  
JWF

6.2 Mr. Burchill reported that he, Mr. Callender and Mr. Westman were reviewing possibilities with respect to the site management. Dr. Berkner commented that when the grass begins to grow in the spring, we must have some arrangements for keeping it cut and suggested, therefore, that we hire a consultant to review our problem and suggest a procedure. Mr. Callender commented that whatever solution was attempted, we should keep control of the entire site. With this in mind, he thought we might ask the County Agent, or the Conservation Corp representative, to draft a plan of operation for the Observatory. Dr. Berkner agreed that such a group might be called in to study the administrative organization, advise some course of procedure, estimate the probable income from farm operations, and establish the proper rate of rentals. He asked that a report on this item be ready for the March staff meeting.

ACTION  
FJC

6.3 There was more discussion on the NRAO appointment policy and Visitors' Manual (see Item 1.3 above). In addition to the Manual, Dr. Berkner thought we should have a pamphlet prepared that could be sent to prospective scientific visitors. This

pamphlet should contain general information on transportation, housing, and other arrangement of interest to prospective visitors, in addition to those of a technical nature. It was noted that the arrangements for the installation of the DTM equipment by Harry Wells, and the possibility that Grote Reber would join the staff in the summer of 1958, were early indications that more formal arrangements would be necessary if we are to handle visitors in an efficient manner.

6.4 Mr. Dunbar had submitted draft No. 4 of a proposed statement on the organization and staff assignments at the Observatory. This fourth draft was adopted with the understanding that it would be revised when experience indicated that changes were necessary.

6.5 Exhibits of scientific and public interest at the Observatory were discussed with the understanding that the erection of the Reber telescope would be postponed until he joined the staff in the summer of 1958. The Ewen-Purcell horn, which was used in the first observation of the celestial hydrogen line at 21-cm, is now at the National Science Foundation, and will be shipped to Green Bank when we are ready. Dr. Berkner thought that the Observatory might prepare a traveling exhibit costing approximately \$1,000, in addition to any components that might be available from other programs, for example, the models of the telescope. Mr. Burchill estimated that a traveling exhibit might cost of the order of \$5,000 per year, if one included transportation of the exhibit, plus an appropriate share of the salary of the man to go with the exhibit. In view of the above estimate, it was agreed that it might be preferable to have the National Science Foundation sponsor a traveling exhibit of radio astronomy, for which we would take technical responsibility. Mr. Callender was to explore this at the appropriate staff levels with the National Science Foundation.

ACTION  
FJC

6.6 Concerning the possibility of tax exemption in the State of West Virginia, Mr. Dunbar was in Charleston that day with Mr. Currence, conferring with the appropriate State officials.

6.7 In view of the rulings by the Internal Revenue Commission that full accounts of travel and similar reimbursements would have to be submitted with future income tax returns, it was agreed that Mr. Burchill and Mr. Callender would review the present voucher system with the goal of simplifying the system and insuring that the individuals concerned are properly covered.

ACTION  
LRB,FJC

7 In a brief review of our relationship with the National Science Foundation, it was pointed out that three Science

Foundation members, Messrs. Mitchell, Luton and Keller, have responsibilities and there is an indication that some responsibility is being shifted from Mr. Mitchell to Mr. Luton. It was still our understanding that Mr. Mitchell was the contact on matters of policy or decisions binding the NSF. Dr. Berkner reported that he had talked with Drs. Waterman and Bronk concerning our request for a supplemental appropriation. He hoped to resume these conversations on January 31, with the goal of an early solution to any remaining differences. It was his understanding that the NSF would recommend a supplemental on the basis of \$5.5 million as against the \$4.2 million proposed by the staff. Dr. Findlay reported that the estimated cost of the precision indicator for the 85-foot telescope exceeded the available electronic budget by approximately \$15,000. It was Dr. Berkner's opinion that work on the precision indicator should proceed, and he urged Dr. Findlay to visit Dr. Towne at Columbia University to inquire about the possibility of employing a young PhD. who would work on masers and similar problems at Green Bank. Dr. Berkner indicated that the National Science Board was establishing a sub-committee on radio astronomy, and that it might be desirable for us to appear before this sub-committee to discuss the Very Large Antenna appropriation.

8 Concerning the Very Large Antenna, Dr. Heeschen reported that several studies had been discussed that would be of value in future investigations concerning large paraboloids. On the suggestion of Dr. Lilley of Yale, Dr. Heeschen had written to Professor Ferris at the University of South Carolina concerning a study to determine the optimum utilization of flat panels in approximating paraboloids. This study would have as parameters the diameter,  $F$  ratio, surface tolerance of the paraboloid, and the minimum operating wavelength. Dr. Heeschen also hoped to have studies underway on how best to support such flat panels in order to hold them to a parabolic form. Dr. Findlay is having informal conversations with Dr. Jasik, Mr. Kelleher, formerly of the NRL, and Mr. Sletton of Air Force Cambridge Research, concerning feeds and other Rf problems for fixed paraboloids. Dr. Emberson reported interest had been expressed in the various aspects of the Very Large Antenna program by Dr. Van Atta (on the use of arrays rather than reflecting surfaces), Dr. Feld, Mr. Husband and Blaw-Knox (on structural problems), and Mr. Bird (on possibility of utilizing air-supported structures). In addition, Mr. Reber planned to devote some time to the Very Large Antenna problem. Dr. Heeschen suggested that some attention should be given to cylindrical paraboloids as proposed by Dr. Swenson of the University of Illinois, and to fixed parabolic segments, as proposed by Professor Kraus of Ohio State. It was estimated that the separate investigational studies would cost of the



order of \$5,000 each, and that the exploratory phase of the program would be of the order of \$25,000 to \$30,000.

9 Mr. Callender reported that the contract with the Monongahela Power Co. had been signed, and that invitations for bids for on-site power distribution system would be ready for review early in February. There was considerable discussion concerning the work that had been done for us by Irving Bowman & Associates, and there was agreement that more effective utilization was needed in the future by limiting IB&A attention to those projects that were clearly going ahead. It was true that in the past Mr. Bowman and his associates had been confused by their attendance at our staff meetings, where we discussed the pros and cons of many alternatives. Apparently, when they returned to their office in Charleston, they attempted to work on many of the items that were discussed, not realizing that final decisions had not been made. Mr. Callender reported that there was a possibility that the local telephone company would be put up for sale, in which case it could be hoped that the new owner would make improvements in the service. He was advised that a daily log should be kept of operating difficulties, if any relief was to be sought through the State Public Service Commission.

There was some brief discussion, with no decision, concerning the replacement of Mr. Westman. The meeting adjourned with a resolution expressing the sentiments of all present, thanking Mr. Westman for his services in the early stages of the NRAO, and wishing him every success at Brigham Young University.