INTERPRETIVE PROSPECTUS

for the

National Radio Astronomy Observatory

Green Bank, West Virginia

November 1968

"There will never be a plan so clearly defined as to go beyond the range of profitable discussion."

J. C. Merriam

by

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SUMMARY

Objectives of the interpretive program at the National Radio Astronomy Observatory include:

1. To provide visitors with opportunities to view and understand radio telescopes.
2. To increase visitor understanding of the National Radio Astronomy Observatory.
3. To increase visitor understanding of the science of Radio Astronomy and of astronomy in general.
4. To provide off-sites services which will accomplish Objectives 1 and 2 for those who do not visit the Observatory.

Objectives will be accomplished by:

1. Establishing interpretive themes to guide the interpretive program.
2. Continuing, with little modification, the present visitor tour of the Observatory.
3. Construction and manning of a visitor center which will include a view of the Observatory and audio-visual and tour operating facilities.
4. Creation of a staff of interpreters, to include a full-time director of interpretation and an assistant plus an expanded seasonal guide staff.

Additional on-site interpretation through wayside [illegible] interpretive signing.

Additional recommendations include:

1. That the visitor center be located along Lambert Road on the South boundary of the Observatory site, rather than on the Guillespie Property.
2. That tractor-trailer type mini-buses be used for tour transportation.
3. That a fee be charged for the tour.
4. That the National Park Service further assist the Observatory in planning the visitor center and exhibits, in the training of interpreters and in the monitoring of the established interpretive program.

SUMMARY OF INTERPRETIVE PROGRAM

Location	Interpretive Content	Medium or Media
Off-site, nearby	Directions to NRAO, tour information	Cooperative highway signing, leaflets to be distributed by other tourist attractions.
At Visitor Center parking lot	Entrance sign identifying NRAO and sponsors.	Sign
Visitor Center parking lot	Tour information: cost, bring cameras, schedules, duration, etc. Note: Content will vary seasonally.	Signs. If problem appears acute, a canned audio presentation could be regularly broadcast over loudspeakers in the lot.
Visitor Center with view of Observatory grounds.	Information Services, orientation to site and interpretive program, basic and in-depth coverage of interpretive themes. (Center also will provide other services including first aid, restrooms, snack bar (?), administrative offices, etc.)	Personal services, publications, exhibits, audiovisual programs, directional signing, special programs, sales operational radio telescope.
On-site	Primary: the telescopes Secondary: Other themes woven into talk.	Guided tour, supplemented by on-site exhibits at selected telescopes.
At selected telescopes. (For suggested individual content see [illegible])	Description of individual scope (i.e., construction details, measurements, basic operations, current status, etc.)	Wayside exhibit shelter with text, graphics, and audio message. (Can be used off-season without guided tour.)

SUMMARY OF INTERPRETIVE PROGRAM (Contd.)

Location	Interpretive Content	Medium or Media
Off-site	Public relations, presentation of interpretive theme materials, etc.	Personal appearances of staff, canned programs (movies, slides, publications) for schools, service clubs, etc. articles in popular publications, etc. If campgrounds are developed nearby by Corps, Forest Service, may find evening programs desirable either off-site or at visitor center

INTRODUCTION

This Interpretive Prospectus proposes a plan for the operation of the entire interpretive program for the National Radio Astronomy Observatory. Although the primary mission of the National Park Service study team was to develop plans for a visitor center, it soon became apparent that the functions of the visitor center depended upon the functions assumed by other portions of the interpretive program. Thus, this prospectus deals with all facets of interpretation and attempts to place each facet in proper relationship to all others.

What is presented here is a listing of ideas for the interpretive staff to build upon. It should not be considered as a straightjacket, but as a point of departure. It envisions further cooperation between the Observatory and the National Park Service, especially as the latter organization may help in the final planning of the visitor center.

The proposed program can develop gradually as visitation increases, which it assuredly will. A suggested development schedule is presented in section VIII.

Objectives of the Interpretive Program

Without interfering with the primary mission of the Observatory:

1. Through conducted tours and manned viewing areas, provide visitors opportunities to view the impressive radio telescopes both from afar and close up. Each viewing provides enjoyable enjoyment, creates a sense of wonder in the viewer and opens avenues for fulfilling objectives 2 and 3 below.

2. To increase visitor interest and understanding of the nature and functions of the National Radio Astronomy Observatory and of the instruments sited there.

3. To provide visitors a glimpse into the fascinating universe revealed by the science of radio astronomy and to relate its findings to the visitor, to the science of astronomy, and to the nation's space exploration program.

4. To provide for those who do not visit the Observatory opportunities for increased understanding of radio astronomy and of the Observatory and its programs.

3. Through achievement of the above objectives, to bring about increased interest in, appreciation of, and support for the National Radio Astronomy Observatory and the science of radio astronomy.

B. Visitors to the Observatory and participants in off-site general interpretive programs presented by the Observatory should be exposed to the following facts as a minimum:

1. The telescopes intercept naturally-produced radio emissions from space, most of which emanated from outside our solar system.
2. Radio astronomy aids optical astronomy in studying the extent, history, structure, composition, and processes of the universe, including the origins of the earth and of life itself.
3. Such studies give man facts and theories by which he can better understand and control the world and universe around him.
4. The National Radio Astronomy Observatory is operated by a group of universities using Federal funds.

C. Nothing herein is meant to imply that one of the objectives of the interpretive program is to

increase tourist visitation to the Observatory. All suggestions are predicated on the obligation to make the visitor's stay at the Observatory as meaningful as possible. This obligation accrues to any operation supported by public funds other than those where considerations of national security modify it. It is thus incumbent upon the Observatory to exert every reasonable effort to present its story to the public.

II. The Interpretive Program

Introduction

The suggestions given here are meant to outline a maximum, not necessarily an optimum, interpretive program. Only experience and "trying it on the dog" will allow management to outline a firm interpretive program.

The interpretive program proposed herein consists of two major elements - The Visitor Center and the Guided Tour. The visitor center will offer basic orientation, information services, and interpretation of the two major themes - the NRAO and Astronomy. Guided tours, originating at the visitor center, will afford the visitor a chance to view the radio telescopes, which are the main attraction of the area, as closely as possible. It is a basic tenet of interpretation that the most meaningful experience for the visitor involves contact with the real thing. At the same time, an effort must be made to give the visitor who does not take the tour a reasonable chance to learn about the Observatory and its operation. Thus, the visitor center should provide opportunities for learning

similar to, but not duplicating, those available on the tour.

But duplication will be necessary as it is assumed that it will take many different media to assure that at least one method of presentation of each major idea will catch the eye and interest of every Observatory visitor.

Keyword of the program will be <u>flexibility</u> - flexibility to respond to exciting new discoveries and to report them as they occur - flexibility to meet the needs of persons at all levels of comprehension - flexibility to meet the interpretive challenges offered by the upcoming expansion of Observatory facilities and programs.

A final caution. The intellectual quality and scientific interest of the American tourist should not be underestimated. The portion of school programs devoted to science is considerable and both children and their parents are exposed to science topics through television and other communications media. Programs of the Observatory should always maintain high standards of accuracy as well as quality of pre-

A. Interpretive Themes

1. Summary

a. Unifying Theme - Astronomy

b. Operating Themes - The Radio Telescopes

National Radio Astronomy Observatory

Radio Astronomy

Astronomy other than Radio Astronomy

2. Discussion: Just as the interpretive objectives give overall direction to the interpretive program, the selection of interpretive themes defines the subject matter to be presented. The unifying theme provides general boundaries. Thus, though it would be of interest to some visitors, it would be inappropriate to devote a portion of the interpretive program to a discussion of the Geology of the Observatory site or to a description of local mountain handicrafts. That these topics might be considered appropriate is possible, but adding them to the interpretive program would only dilute the presentation and make it less certain that the visitor leaves with an appropriate understanding of the Observatory and its functions.

The operating themes break down the unifying theme into workable units and are designed to make use of the facilities of the Observatory to achieve the interpretive objectives. While those operating themes should not be considered straightjackets they do indicate the direction of the interpretive program and variations from/or additions to the themes must be justified.

3. The Operating Themes

a. The Radio Telescopes

While the unifying theme will be astronomy, the dominant interpretive need at the Observatory is the explanation of the radio telescopes, their construction, operation and functions. The immediate presence and interest generating strangeness of the telescopes will be used as the vehicle for enlarging visitor understanding of the Observatory, of radio astronomy and of astronomy as a whole.

Questions to be answered:

What are the names of the various parts of the telescope?

How do the telescopes operate?

When do they operate?

What do they record? "see"

How far do they "see"?

Who operates them? (persons and organizations now and in the past)

Who uses them?

What are their dimensions and weights?

What was the original cost?

History of operation?

What are the special features of each telescope?

What are some of the results obtained with this telescope?

What are the kinds of projects best suited to this scope?

How do these scopes compare with radio telescopes elsewhere, including those in the USSR?

Could I build and operate a radio telescope?

b. National Radio Astronomy Observatory

Emphasis will be on the programs of the [illegible] and how these programs might affect

the lives of the visitor. An obvious example is to relate findings made here to our National space exploration program.

Questions to be answered:

What do you do here?

What is the purpose of the Observatory?

What results come from the work here?

Who operates it? (organizations and individuals)

What is the cost of operation?

Who pays for its operation?

How do programs here relate to our space efforts?

How many and what kind of telescopes are here?

Why was this site selected?

Where is the information gathered here studied?

What is project Ozma?

c. Radio Astronomy

Here the comparison between optical astronomy and radio astronomy will be the bridge used to create visitor understanding. Visitors are at least familiar with optical telescopes and can thus relate to explanations which begin with this common ground.

Again, the relationships to space exploration can be brought out and will be another common ground.

Questions to be answered:

What is radio astronomy?

How long has it been a science?

How is it related to general astronomy?

What questions have been answered by radio astronomy?

What do radio astronomers do?

How could I become a radio astronomer?

Where do the radio signals come from?

How are the radio signals generated?

How do the radio and optical universes compare?

What is a radio "star"?

How do astronomers study our atmosphere?

Do radio astronomers study the planets of our solar system? Our sun?

How do radio astronomers help our space program

d. General Astronomy

The approach will be based on the story of man's incessant quest for knowledge and his searching of the stars for clues to his own origins and

significance. What more mind-stretching subject is there? What greater challenge could be offered any interpreter? The wise interpreter will tread lightly, for the average earthling will be staggered by the infinite complexities and implications revealed by the searching telescopes. We must subtly enable the visitor to relate himself to the fascinating universe thus disclosed and help him to better understand his place in it.

Emphasis will be on the fact that astronomy is the only science that attempts to answer questions relating to the large time and distance scales inherent in the universe. There will be an exposition of the electromagnetic spectrum and the optical and radio windows which allow us to study the universe. Throughout, radio astronomy will be emphasized, especially as related to the operations at NRAO.

Questions to be answered:

What are some of the current theories explaining the nature of the Universe?

What are the kinds of astronomy other than radio astronomy?

How could I become an astronomer?

What does the science of astronomy include?

How old is the universe?

How big is the universe?

What does the universe look like?

How has the universe formed?

Are there other intelligent races in the universe?

How far is the closest star?

How does astronomy affect our lives?

B. The Visitor Center

1. General

The visitor center assumes great importance in the visitor services program of the Observatory. It is the visitor's first indication that his needs are being specially provided for; he knows he is being welcomed by its mere existence. Here is where he leaves his car, becomes aware of the services offered to him, has his questions answered, sees and hears answers to questions he has not yet thought of, embarks on a tour, and relaxes and refreshes himself before starting out on his journey once more.

Psychologically, the visitor center functions as the point at which the highway traveler (with the attendant frustrations of highway travel) becomes an Observatory visitor, and where he gains, hopefully, the receptive mood necessary to the success of the interpretive program.

The visitor center must also meet the needs of the person who, for whatever reason, does not take the guided tour.

Finally, it serves several administrative functions: it concentrates visitation (and thus decreases

interference with the Observatory mission); it provides efficient visitor-processing space; and it centralizes visitor services activities by providing work space for the interpretive staff and its impedimenta.

2. Location

a. One of the primary tasks assigned the Park Service study team was consideration of the visitor center site. Of the three days it was in the Observatory area the team spent the majority of the time in the field surveying potential sites both by car and on foot.

b. Factors which were kept in mind during this phase of the study include:

(1) Location of Center with regard to proposed relocation of Route 28.

(2) Location of access road and parking area so as to minimize auto generated static.

(3) The AUI owned Gillespie property.

(4) Possible tour routes from Visitor Center to Observatory

(5) View of telescopes from Visitor Center

c. The Gillespie Property - AUI owns a small tract of relatively level land about two miles east of the Observatory boundary. This land was purchased originally for residential purposes, but has recently been considered as the site for a visitor center.

(1) Advantages of this site include:

a. Its location on the proposed route of relocated 28.

b. Its distance from and relationship to the scopes is such that radio interference problems would be minimal.

c. The property is AUI owned.

(2) Disadvantages of this site include:

a. Distance from main source of visitor interest - the telescopes.

b. Lack of a view of the telescopes.

c. Length and complexity of tour access route. The latter factor includes such considerations as cost of acquisition of right of way, cost of construction of the necessary road surface (whether it be for busses or trains), the lack of interesting features along the route, the lack of

visual impact upon entering the Observatory grounds, and need to control undesirable private development along tour right of way and at and near the visitor center entrance.

(3) The study team felt that the disadvantages of this site far outweighed its advantages and an alternate site is proposed.

d. Proposed Visitor Center Site:

The proposed site is on the crest of a small hill contiguous to the south boundary of the Observatory grounds. (See appendix 4,5 for map and drawings which detail the proposal).

(1) Advantages:

a. Nearness to Observatory, also fact that site it is on is contiguous to Observatory property.

b. Hill effectively shields telescopes from radio noise generated by approaching and parking autos.

c. There is visual impact. View from the crest of the hill includes nearly the

whole observatory site and all of the present scopes.

d. Routing. No access problem for tour route.

e. Lack of need to protect from undesirable private development.

f. Ease of protection from vandalism. (Line of site from present administration building).

(2) Disadvantages:

a. Cost of acquisition of land and development of access.

b. Site is not on rerouted 28. (But see suggested access in Appendix 4 .)

(3) The team was quite pleased with this site from both aesthetic and operational viewpoints. In discussing this proposal with Mr. Findlay it was learned that this property has been under consideration and was favorably looked upon. It was thought that acquisition would be no great problem. It was also brought out that in the future a scope might be built directly beneath the site, which would provide an unparallelled opportunity for interpretation and might possible allow abandonment of the tour system.

3. Architecture and Landscaping

(Reports by the architect and landscape architect members of the planning team will be found in Appendix 4,5 .)

No attempt was made to provide a comprehensive visitor center plan as a result of the first brief study trip. Detailed recommendations would include the following considerations (and many more):

The importance of views of the scopes.

Parking - size, access, possible picnic area, signing, special parking for busses and cars with trailers.

Capacities of visitor use and staff areas

Possible future expansion

Routing of tour vehicles

Needs of physically handicapped, the extremely young and old, and foreign visitors.

Design for maximum interpretive use, i.e., designers must work closely with interpreters to assure consideration of interpretive needs.

We suggest that the final form of the building be decided by a competent and imaginative architect but caution should be exercized that the design does not

become an end in itself. The NPS would be able to provide more detailed planning considerations at a later time.

4. Functions

a. Reception - To create in the visitor the feeling that he is welcomed and should be at ease. This can be done through signing, decor, or by personal services. A registration book should be considered.

b. Orientation - Tell the visitor where he is, what there is to do, and how to go about doing it. This can be done through building arrangement, signing, personal services, publications, etc.

c. Information - At an easily identified and located information desk. Factors to be considered:

(1) Tour information - departure times, fees (if any), length, sign up (if needed), etc.

(2) Site information - handout describing site and operations (for winter visitors who may be walking into scopes a map would be desirable), in-depth information in publications, etc.

(3) General information - rest rooms, lost and found, first aid, lost children, etc.,etc.,etc.

Bulletin board should be provided but should be designed to fit in with decor and so that it won't become cluttered.

(4) Local recreational opportunities - personnel should be especially familiar with those facilities and services available on Federal lands in the surrounding National Forests. A supply of publications describing local recreational opportunities should be maintained.

(5) Travel information - personnel should be prepared to aid travelers to find shortest and most direct routes to major cities and recreational facilities. A supply of free maps should be on hand.

(6) Many NPS units also provide weather information, road conditions, etc.

(7) A public address system with inside and outside speakers would be located at the information desk. Information personnel would announce the start of tours, movies, demonstrations, etc.

d. Sales - may be combined with information function. Should include publications (see proposed list below), post cards, slides and site oriented souvenirs (e.g. books on astronomy, specially printed computer readouts,

telescope and astronomy related trinkets (jewelry miniatures, etc.) rather than the currently offered "mountain made" handicraft items. This could be concessioner-operated or an outlet of the employee recreation association, as at present.

e. Relaxation - Some kind of seating, either as a separate lounge or as individual seats scattered throughout the building, should be provided. Perhaps this could be on an outside terrace. Consider persons who may elect to remain at visitor center while other members of their party take the tour.

f. Refreshment - restrooms and a drinking fountain are minimal. For maximum service, these should be located both at the visitor center and adjacent to the parking lot. The study team also felt a snack bar or automated canteen would be desirable at the visitor center or parking lot. Perhaps such a facility could be operated by the present dormitory cafeteria staff, but consideration of a separate concessioner is warranted on the basis of similar National Park Service operations. A further incentive to a concessioner would be inclusion of book and souvenir sales.

g. Administration - Offices for the permanent staff, guide lounge, janitorial space, first aid room, staff workspace (e.g. for preparing slide programs, packaging mail orders, etc.), storage, toilet, sink, etc.

h. Tour Headquarters - assembly and processing area for those taking tour. May include ticket sales, registration, introductory talk, waiting room, etc.

i. Viewing - One of the main points in favor of the site selected is its magnificent view of the Observatory site and telescopes. This should be capitalized upon by designing access to the visitor center so that the visitor experiences the interest-generating visual impact immediately after or before entering the visitor center proper. An inconspicuous view identifier (exhibit) should be provided. A part of the view area should be designed so that visitors could use it when the visitor center was closed.

j. Interpretation

(1) This is the function that deals directly with the objectives of the interpretive program--it is the real reason for the facility. Thus the design of the building should be such as to maximize the possibilities for interpretation. Interpretation within the visitor center will be by four media: personal services, exhibits, audiovisual programs and publications.

(2) Personal Services - The human interpreter is the most versatile of interpretive tools. He (or she) can tailor the answer to a question to the needs of the visitor and his (or her) personal enthusiasm and interest can do more than anything else to light the spark in a visitor that spells the difference between success and failure of the interpretive program.

He will be needed to answer the wide variety of questions generated by the complex and esoteric programs of the Observatory. He will best be able, of all interpretive media, to respond to new discoveries and changing Observatory programs and to relate and integrate these into the interpretive program.

At the Visitor Center the personal interpreter will also be the demonstrator required to put life into the static displays, the view, and the exhibits. In many instances visitors will be conducted around the visitor center by a guide who will explain and operate the equipment on display. We note that both the Goddard Space Flight Center and the Los Alamos Laboratory provide guides for all visitors viewing their equipment and exhibits. We can, from the

viewing area, give a verbal tour of the Observatory site. And, it is hoped he will introduce any "formal" movie or slide programs presented.

It also will be the personal interpreter who will see that the needs of special groups or individuals are met. He guides the person with special interests to sources which can satisfy his needs.

There also will be a need for personnel to handle routine information needs of visitors, such as help with travel plans, suggestions for overnight accommodations, local directions, etc. Though such a need may not seem prominent at this point in time it will become obvious with increased visitation and the resultant increase in persons from out of state.

It is also envisioned that individual interpreters will be on "contact duty", i.e., assigned to rove about in the areas where visitors gather to see if they can answer visitor's questions or provide short informal talks as the occasion permits.

Behind the scenes, interpreters will be answering mail and telephone requests, preparing new programs or exhibits, writing or revising publications, and practicing their on-the-scenes roles. There also

may be some need for curatorial services in caring for specimens (models, equipment, etc.) in storage and on display.

(3) Exhibits

We do not envision the standard exhibit room with the ordinary case-panel-case arrangement. Rather we see exhibits and other interpretive functions intermixed and interrelated. Exhibits, as well as all other internal functions of the building, must be considered as they relate to the dominating feature of the building, the view of the Observatory grounds. Thus it is obvious that the building must be designed to meet the needs of the exhibits and not vice versa.

Exhibits at the NRAO should be relatively simple in design and capable of being easily and inexpensively changed to meet new developments and discoveries as they occur.

(a) The View - Here is the dominant "exhibit" in the visitor center. The building must be designed to incorporate the view and to relate it to the other interpretive functions. In the view area, feature identification exhibits will be needed.

On these the scopes will be named and briefly described (size, primary function, etc.) and prominent landscape features identified. A map or aerial view of the Observatory grounds would be located so as to be easily seen from the viewing area. Talks will be given at the viewing window. And persons leaving on tours would be briefed here before boarding the tour vehicles.

Also near the viewing area would be a display of photos and models of other radio telescopes in the U. S. and throughout the world. Answers to questions "Who has the biggest?", "What happened to the Navy's 600' scope?", and "What are the Russians doing?" would be woven into the label copy. A photo or model of the Orbiting Astronomical Observatory or Radio Astronomy Explorer - A would be appropriate here. On at least one photo or model identify major parts of a radio telescope; i.e., mirror (antenna), receiver and recorder.

(b) Operating Radio Telescope - The staff has suggested that it would be practical and desirable to locate and operate the historic Reber telescope near the visitor center. We propose that this be done and that a telescope operating console connected to the Reber unit be the primary exhibit. The scope and console will be displayed so that the visitor can see the scope move as the controls are actuated by a uniformed interpreter.

The console would not have to be complete, but could be a facade of cases with most of the "guts" missing. Units which should be maintained include pen and tape recorders, (with examples of their output), the clocks which register universal (siderial?) time, some VU meters and flashing colored lights (not just eyewash, but not necessarily functional either), a speaker through which radio noise could be heard, and perhaps an oscilliscope or other device to show fluctuations in radio reception.

It is suggested that the Reber unit be pointed at the sun and that this be the main story presented by the exhibit. It

must be cautioned, however, that the stress on the sun be not so great as to give the visitor the impression that radio measurements of the sun are the sole or even the main task of all radio scopes.

If, as suggested above, an interpreter demonstrates the equipment, the following points should be covered but not detailed. These topics can logically be inserted into the "pitch" describing the equipment. Coverage here would by no means be as extensive as that on the tours, but would cover the same ground so that those who do not take the tour are taken care of.

What is Radio Astronomy?

How and what do radio telescopes "see"?

(Explain how we hear radio waves and that man has no bodily organ sensitive to radio waves.)

What is the function of the operation at Green Bank?

How accurately can radio telescopes be pointed?

What is the effect of aircraft, weather

night and day, satellites, etc.

on observation?

Use in U. S. space effort.

This exhibit would also contain information on the radio sun and the differences between its active and quiet states. Depending on the emphasis desired, and keeping the caution advanced above in mind, further displays could explain the structure of the sun and introduce solar-terrestrial relationships.

An adjacent exhibit, a very minor one, will point out the possibilities of amateurs constructing and operating their own radio telescopes.

The Reber scope should be identified and its importance in the history of radio astronomy pointed out. Such identification could be on the scope itself or on a separate indoor panel, or both.

(c) Front Ends - Display of models (including a "cut-away") of obsolete or historical front ends. Include photos of assembly and explain developmental steps and function and nature of equipment. Explain role of empir[illegible]

(d) Size of the Universe - Simplified presentation of distances involved in radio and optical astronomy. Use a statement like, "If our sun were a dot this size (.) it would be 10 miles between it and the next star, Proxima Centauri." Or, "Interstellar space is as empty as a cubical building 60 miles long, 60 miles high, and 60 miles wide, containing a single grain of sand." Or, "Light leaving our nearest neighbor galaxy left there nearly 10 million years ago." (This could also be presented in the proposed access tunnel with a more meaningful scale involved).

(e) The Electromagnetic Spectrum - A diagram of the spectrum with explanation of the role of the atmosphere and Ionosphere in blocking various wavelengths. We envision a simple scale with views of the kinds of instruments which intercept the various wavelengths. Explain the "radio window". Perhaps an ultraviolet light display would work here.

(f) Current Events - An imaginative display of new discoveries and developments in astronomy

designed to capitalize upon the immediacy of the events. Most simple would be a cork wall for news clippings and copies of current papers. The material here will be coordinated with slide presentations in the "theatre" and the events posted will be mentioned in all personal services presentations. In the lounge area, additional copies of these reports will be available in loose leaf notebooks for those who wish to read the details. The bulletin board itself will be divided into subject matter areas by color or other design elements and should be designed so that it will remain neat in appearance at all times. It should, however, retain the feel of immediacy. One section of the board would contain information on current projects being pursued at NRAO; another section might list the astronomers currently working at the site; and so on. (See audiovisual below)

(g) Using large backlighted transparencies contrast the optical picture of the night sky with a radio frequency contour map of the night sky. Also contrast frequency maps

of areas of the Universe that are strong radio sources with optical views of the same area. This could be done by superimposition of one upon the other by various lighting techniques or by comparing them side by side. Copy would be brief, e.g. "Optical Telescope View" - "Radio Telescope Map".

(h) Introductory Panel - Gives name of Observatory with a brief statement of function and tells who operates (AUI, NSF, USA, etc.)

(i) Historic Radio Telescopes - Both the Reber scope and the replica of the Jansky scope will be placed near the visitor center. With appropriate landscaping, including walks and vistas of the Observatory grounds, these will be very effectively displayed. Each scope will have a brief identification exhibit noting reasons for its display. If possible, both should be visible from inside the visitor center.

(4) Audiovisual Programs

(a) General - One immediately thinks of movie when audiovisual is mentioned. Because of the changing nature of the Observatory program,

the proposed addition of new scopes, and the constant stream of new discoveries, movies are not the best of the audiovisual media for use at the Observatory. (The staff was lamenting that the present orientation film is out of date.) For at least the time being, slide shows may provide the versatility needed in audiovisual presentations for the Observatory. Slides and taped narrations are easily and cheaply changed, and if good footage exists, can even be effectively combined with movie sequences in a fixed a.v. installation.

In addition, slide programs can easily be prepared for off-site use by school and special interest groups and to be used by Observatory staff members on interpretive speaking assignments. In the former case, slides can be sent in response to mail order requests, either with tape recorded narrations or with one of a series of scripts keyed to the grade level of the viewing group.

(b) Planetarium - One of the more interesting possibilities for an unusual audiovisual approach is the creation of a radio astronomy

planetarium. This type unit, though, is only in the conjectural stage and would be extremely expensive to develop. Hayden Planetarium includes radio astronomy in their regular planetarium show. One might also question such an installation at Green Bank on the basis of the total use it would receive, as well as its place in the interpretive program. Would visitors be likely to devote the time necessary both to view the planetarium show and take the site tour? The likelihood seems remote now, but might not be so remote as more recreational facilities are developed near the Observatory. In any event, this prospectus recommends against installation of any planetarium.

(c) Suggested Programs

Orientation: This should last not more than 15 minutes and include:

--Introduction to NRAO and its functions.

--Introduction to Radio Astronomy as reflected by NRAO.

--Brief look at some of the telescopes and their operation.

-- Brief look at programs of research at NRAO including showing the administrative facilities and the lab at Charlottesville
-- Some significant discoveries of radio astronomy, e.g.,nonluminous gas clouds, confirmation of expansion of universe, discovery of new galaxies, confirmation of spiral nature of our galaxy and of our solar system's location in it.
-- Why Green Bank was selected for NRAO.
-- Are we alone? Brief look at search for other civilizations.

It is obvious that any one of these topics could make a whole program, but a few words and pictures should suffice to introduce each subject. More detail on most of these topics will be presented on the tour, by exhibits, in publications or in other audiovisual presentations. The purpose of this program is orientation and interest generation-not exposition.

It is desirable to have an interpreter introduce this presentation to give it added impact and interest. He should also be obviously available after the presentation to answer questions generated. He probably should not provide a close for the program, but merely be present when it is over.

Telescope Operation: A closed circuit television system will bring to the audiovisual area views of actual scope operations in progress during the visitor's stay at the Observatory. Such a system could show insertion of the program into the control console and resultant movement of the telescope. This could be interspersed with scenes of other current operations captured by a portable camera or with canned sequences of earlier events. It is realized that such operations lack drama, but the factor of currency, that "this is what is going on out there inside the telescope control room now", lends such a system some of the values obtained through

observation of the actual thing. It is especially desirable since observation of the real thing is not possible for the average visitor.

Other Programs: Several other programs should be available for showing between the Orientation program showings. The most important would be a film or slide show on Astronomy, featuring radio astronomy. Here is where many of the theme questions could be answered, but, again, 15 minutes should be the maximum length of this presentation.

As time progresses, other programs should be developed. Suggested titles include: Radio Astronomy, its History and Accomplishments, Construction of a Radio Telescope (use existing footage of the 140), The Search for Other Civilizations, etc. These should all be general in nature and designed for the lay audience. Other, more detailed programs will be developed for special interest groups such as astronomy classes, astronomy clubs, school groups, etc.

Some use might also be made of commercially produced movies such as How Vast is Space? (Atlantis) or How We Study the Sun (Film Associates).

(5) Publications

A wide variety of publications should be available at the visitor center. Some of these could be placed around the seating areas or in a small library for those who wish further information while on-site. Others will be provided as sales items or free handouts.

Although there are many books on the market which relate the specialized stories of the interpretive themes, at least a few publications will have to be produced by the Observatory staff for the use of the general public. One of these would be a general orientation booklet or folder similar to the one now available. (This would probably be the only free item.) Another would be an in-depth story of the observatory. As with the previous publication it should be designed so that it can easily be revised as facilities

change and new discoveries are made. This latter booklet should sell for less than one dollar.

In addition, two booklets on radio astronomy, one very general and the other more in depth (high school level) should also be prepared by the staff. Dr. Findlay's article in "Earth in Space" would do nicely for the former, but I know of nothing that would do for the latter. These also should sell for a dollar or less.

Many of the reprints of articles on work at the Observatory would be of great interest. A small selection of these should be kept to be sold at just above cost. Suggested current titles are listed below.

The booklet, "A Career in Astronomy" by the American Astronomical Society should be available at the sales desk.

Finally, there are many fine books available on the commercial market, a few of which should be offered at the Observatory. Suggested titles are found below.

Publications List:

Free Publications

3-fold folder on NRAO and telescopes

Single sheets on special events at the Observatory or on new discoveries in radio and general astronomy.

Observatory Produced Sales Publications

Booklet with in-depth coverage of the Observatory and its operations

Booklet at general level (up to high school) on radio astronomy as a science and as a career

Booklet with in-depth coverage of science of radio astronomy for advanced high school and above. (Aim at teachers)

Reprints of articles produced by Observatory staff or other astronomers:

Cameron, A. G. W., and Maran, Stephen P., "The Enigmatic Pulsars--Facts and Interpretation," Sky and Telescope, July, 1968.

Drake, Frank D., "How Can We Detect Radio Transmissions from Distant Planetary Systems?" Sky and Telescope, January, 1960.

Drake, Frank D., "Radio Emission from the Planets," Physics Today, April, 1961.

Drake, Frank D., "Project Ozma," Physics Today, April, 1961.

Emberson, Richard M., "National Radio Astronomy Observatory," Science, November 13, 1956.

Findlay, John W., "Protecting the Science of Radio Astronomy," Science, September 14, 1962.

Findlay, John W., "Radio Astronomy," Annals of the New York Academy of Sciences, June 26, 1964.

Findlay, John W., "The 300-Foot Radio Telescope at Green Bank," Sky and Telescope, February, 1963.

Heeschen, D. S., "Radio Galaxies," Scientific American, March, 1962.

Roberts, Morton S., "Recent Discoveries in Radio Astronomy," Physics Today, February, 1965.

Time Magazine, Science Section, Radio Astronomy, July 19, 1968.

Other Sales Publications

Alexander, Joseph H., and Brown, Larry W., "A Radio Telescope for Amateurs" Sky and Telescope, Vol. XXIX, No. 4 (April 1965), p. 212-214.

American Astronomical Society, A Career in Astronomy.

American Museum of Natural History, Hayden Planetarium, Series of Handouts for School Teachers and Children.

Asimov, Isaac, The Universe, Walker and Co., N. Y., 1966.

Bonnor, William, The Mystery of the Expanding Universe, McMillan, 1964.

Brown, R. Hanbury, and Lovell, A. C. B., The Exploration of Space by Radio, Chatham: W. and J. Mackay and Co. Ltd., 1957.

Clarke, Arthur C., "Tuning in the Universe," in Science Year 1966, World Book Encyclopedia.

Davies, R. D., and Palmer, H. P., Radio Studies of the Universe, Princeton: D. Van Nostrand Company, Inc., 1959.

Dawnes, Dennis M., "A Simple Radio Telescope." Sky and Telescope, Vol. XXIV, No. 2 (Aug. 1962), p. 75-76.

Degani, Meir H., Astronomy Made Simple, Doubleday, 1963.

Drake, F. D., Intelligent Life in Space, McMillan, 1962.

Findlay, J. W., Radio Telescopes, reprinted from IEEE Transactions on Military Electronics, Vol. MIL-S, Numbers 3 and 4, July-October, 1964.

Greenstein, Jessie L., "The Question of the Quasars," in Science Year 1966, World Book Encyclopedia.

Heeschen, D. S., "Radio Astronomy: A Large Antenna Array," reprint from Science, October 6, 1967.

Heywood, John, Radio Astronomy and How to Build Your Own Telescope, New York: Arco Publishing Co., 1964 (paperback).

Heywood, John, Radio Astronomy Simplified, New York, Arco Publishing Co., Inc. 1964 (paperback).

Kraus, John D., Radio Astronomy, McGraw-Hill, 1966.

Ley, Willie, Watchers of the Skies, Viking, 1963.

Life Magazine, The Universe.

Menzel, Donald H., A Field Guide to the Stars and Planets, Houghton Mifflin, 1964.

National Radio Astronomy Observatory, Annual Reports.

Odishaw, Hugh (editor), "Earth in Space," Voice of America, Forum Lectures, Chapter 23, The Radio Universe, by John W. Findlay, 1968.

Ovendon, Michael, Life in the Universe, Doubleday and Co.

Pfeiffer, John, The Changing Universe, New York: Random House, Inc., 1956.

Piddington, J. H., Radio Astronomy, London: Hutchinson and Co., Ltd. 1961.

Shapley, Harlow, Of Stars and Men.

Shapley, Harlow, View From a Distant Star, 1963.

Shklovski, I. S., and Sagan, Carl, Intelligent Life in the Universe, Delta Books, 1968 (paperback).

Small, Maxwell, "The New 140-foot Radio Telescope," reprint from Sky and Telescope, Vol. 30, No. 5., November, 1965.

Smith, A. G., and Carr, T. D., Radio Exploration of the Planetary System, Princeton: D. Van Nostrand Company, Inc., 1964.

Smith, F. Graham, Radio Astronomy, Baltimore: Penguin Books, Inc., 1960.

Steinberg, J. L., and Lequeux, J., Radio Astronomy, Translated by R. N. Bracewell, New York: McGraw Hill, 1963.

Sullivan, Walter, We Are Not Alone, New American Library, 1966.

Periodicals:

"About Two Radio Telescopes that Were Built by Amateurs," Scientific American, Vol. 206, No. 2

(Feb. 1962), p. 163-174.

Proceedings of the Institute of Radio Engineers, Volume 46, No. 1, January, 1958. (This issue contains 50 papers on radio astronomy).

Scientific American, *Popular Astronomy*, and *Sky and Telescope* Magazines carry articles on radio astronomy.

Book for children age 7 and up:

Asimov, Isaac. *Galaxies*, Follett Publishing Co., 1968.

C. The Guided Tour

1. General

Personal experience is the major key to visitor comprehension and appreciation of the Observatory's operations. The tour provides the visitor the opportunity to see the Observatory program in action and to give him contact with the real thing. All other means of interpretation are at best substitutes for such personal experience.

While it is felt that tours are the best medium for meeting interpretive objectives, it also is realized that tours cannot be proposed which would interfere with Observatory operations.

As part of the tour and supplementing the human guide will be outdoor exhibits at several points.

2. Content

The tour answers the question, "What do we do here?" Specifically, it gives the visitor insight into the programs of the Observatory; use of the scopes; staffing of the Observatory; differences between optical and radio astronomy;

reasons for choosing the site; costs of operations and scopes; design, construction, and dimensions of scopes; status of the Sugar Grove project; introduction to the interferometer; effects of weather on observations and on the scopes; project Ozma (at Tatel scope); plus giving brief glimpses into the overall science of astronomy. Guides should be given an outline of required topics based on the interpretive themes and then be allowed to develop their own presentation.

One other topic which should be considered is some form of help for photographers. I noted that many people had difficulty finding a good spot to shoot from. Perhaps desirable photo sites could be marked by a post and a booklet prepared giving photo hints.

3. The Tour Route

Before starting the tour visitors would be shown the orientation program and/or be given a brief talk at the viewing area. First stop would be the 300 foot telescope where visitors would be allowed to disembark. Next stop would

be to explain the interferometer. Since the prime location for showing this unit will vary with the spacing of the scopes, visitors will stay aboard the tour vehicle.

The route would then follow the Green Bank-Hosterman Road to 28 and thence to the main entrance to pass by the Jansky Lab and residence hall. Passengers would remain on-board in this area as well as while viewing the Little Big Horn.

A stop would be made at the 85 foot Tatel unit, but visitors would remain on-board.

A final stop would be made at the 140, and here, for the final time, passengers would be allowed to leave the vehicle. From the 140 the tour would return to the visitor center and the tour would end there.

When new scopes are built, it is hoped that at least one will be designed with visitor access and viewing areas. The study team was quite impressed by the arrangement in the 140 and wished that it had been set up to handle tours. As has been remarked upon elsewhere in this prospectus, nothing equals the chance to see the real thing, even though the real thing may lack drama and action.

4. Operational Considerations

a. Schedules

Present tour times seem quite adequate for current visitation. As numbers of visitors increase, either the number of persons per tour could be increased, or tours could be scheduled more often. The latter solution is generally preferable, as long waits for tours are not desirable from the point of view of visitor comfort and satisfaction and efficient space utilization. As visitation increases, regular schedules should be maintained, but additional unscheduled tours also should be made available when crowds dictate. Only time will show which times will be most popular and, therefore, when additional staff and vehicles should be on tap.

During the off-season, tours would be curtailed except on a reservation basis by special interest groups. Individual tourists could still be given guided tours of the visitor center and even allowed to walk in to the 85 and 140 scopes as they do now.

b. Vehicles

Although the study team did not make a definitive study of the types of vehicles available for use on the tours, it did take advantage of previous studies made by other groups within the National Park Service in making the following recommendations.

NOTE: Vehicles used on the Observatory site must be of the type which will not emit undue radio static. Diesel and steam units are examples of possible power sources which meet this requirement.

It is our recommendation that units specifically designed for sightseeing by tourists be used and that modified standard diesel busses will not meet the needs of the tour program. We especially recommend against the miniature railroad as it is likely to become a feature attraction bringing visitors to the site who merely wish to ride on the "train".

The following factors must be considered in selecting vehicles:

Capacity	Downtime	Air Conditioning
Visibility	Ease of access to vehicle	Interpretive features
Safety	Can it be reversed	

Ability to negotiate grades	Initial cost
Minimum and Maximum speeds obtainable	Adaptability to changing weather and visitor numbers

From experience elsewhere, the best unit seems to be a tractor-trailer arrangement with provisions for amplification of a tour narrative given by a live guide. Attached to the original copy of this prospectus is a study made for the National Capital Region of the National Park Service which outlines in more detail some of the considerations in selecting a tour vehicle.

5. Methods of Presentation

a. En route - While suggestions have been made that a timed or recorded tour narration be provided, it is our contention that there is no adequate substitute for a personal guide service of high calibre. The impersonality of a "canned" talk can destroy visitor interest and completely nullify any good that has been done by the remainder of the interpretive program. Thus the guide will be the key to the success of the entire interpretive program. In addition, such a service is particularly desirable where control of visitors is a requirement.

The guide plus driver combination is the ideal solution in conducted tours of this kind. This allows the guide to concentrate on the visitor (his reason for being there) without concern for driving or maintaining the vehicle.

Whenever the visitors leave the bus for an interpretive stop, the guide should dismount also. This provides an excellent opportunity for visitors to ask the guide questions.

As with any of the other presentations, informality and adaptability should be the bywords. A formal, stilted delivery is not consistent with the holiday mood of the visitor. Humor is to be encouraged, but held in check. Guides should be furnished an outline of topics they are expected to cover during the tour. They should then be allowed to make up their own talks in their own words avoiding the memorizing of all but the briefest of quotations. Guides must be able to capitalize on the unexpected (low-flying aircraft used to bring up the interference problem, for example) and to keep their talks as responsive as possible to the needs of each tour group.

b. At Stops

In addition to the guide's presentation, at each stop where visitors disembark there will be an on-site exhibit shelter. These will contain exhibits and an audio station and would provide variety as well as accent certain interpretive points. Content of these would vary, but as a minimum the scope's designation, dimensions, weights, cost, year of completion and special features would be given. To lend currency, an attractive bulletin board would give information on current uses of the scope, the names and affiliations of scientists using the instrument, etc. Photos of the unit under construction, showing it in its maximum positions, or shots of portions of its structure or interior would be featured. Identification of major components (dish, front-end, etc.) would also be helpful. Appendix 3 is a suggested treatment for the 140 foot scope.

It is again urged that in future telescope construction, consideration be given to providing a tourist viewing area of any interior operations.

D. Off-site Interpretation

1. Purposes

a. Public relations

b. Interpretation for those who do not visit the site.

c. Aid to education. May be used to interest students in careers.

d. Advertising - In the case of NRAO, programs should not be designed to encourage visitation to the site, but should mainly be aimed at "advertising" the operations and "products" of radio astronomy to bring about greater support of the science.

e. Finding the site: Cooperating with State officials, an adequate highway signing program should be developed to aid prospective visitors to locate the Observatory.

2. Audiences

a. Schools at all levels. Special emphasis on science clubs in high schools.

b. Youth groups (Boy Scouts, Girl Scouts, etc.

c. Service Clubs

d. Conventions

e. Public-at-large

f. As campgrounds are developed nearby by the Corps of Engineers and U. S. Forest Service, the NRAO will need to consider cooperating with these agencies in giving evening programs.

3. Methods

a. Distribution of movies

b. Preparation and distribution of tape-slide and script-slide programs. These would be most adaptable to school use by preparing several grade-level scripts to go with one set of slides. The taped presentation would be better suited to science and astronomy clubs.

c. Publications - Observatory produced interpretive publications will be given wide distribution to libraries, schools, astronomy clubs, etc. Staff members will be encouraged to submit interpretive articles to popular periodicals, newspapers and special interest publications such as Natural History, etc.

d. Personal Services - An organized program of public speaking engagements should be established and would be one of the main off-season duties of the professional interpreter on the Observatory staff. Perhaps a public speakers bureau could be established using other

Observatory staff members willing to present programs to the general public.

e. Media appearances - Opportunities exist to tell the Observatory story to vast audiences through tape recorded interviews (radio) and through personal interviews (Television). TV film crews should be interested in producing a show or shows on the Observatory and on radio astronomy.

E. Other Visitor Services

1. One of the results of an expanded interpretive program will be increased need for other services related to the increased visitation. Some of the more obvious of these needs are:

2. Signing: Signs play an important role in directing, informing and controlling the visitor. To be of maximum benefit signs should have a distinctive design, color scheme, and graphic symbols system to identify the signs as having to do with the visitor services program. It will be especially important that visitors are properly routed by signs to the visitor center rather than to the main business entrance of the Observatory. Seasonal changes in signing must be considered. Cooperation with state highway officials will be necessary to provide the optimum signing system on approach roads.

3. Maintenance: The maintenance staff will have to be increased to handle not only the new facility, but also to keep grounds clear of litter. One man would be assigned full-time to the visitor center to keep restrooms and other public use areas in spotless condition.

4. Emergency Services: Consideration must be given to having personnel trained in first aid and search and rescue. With increased visitation personal injuries and the possibility of lost children and adults will increase. An equipped first aid facility should be located in the Visitor Center. Since local law enforcement personnel are all but nonexistent, some thought should be given to having one or more staff members deputized to handle such things as traffic accidents on-site, vandalism, misbehaviour of visitors, etc. There will need to be close cooperation with state and county authorities in this regard.

5. Picnicing: Development of picnicing sites on the Observatory grounds should be discouraged, but there is no reason not to spot several tables around the visitor center parking lot. The need for picnic sites could be solved by alerting local Forest Service officials to the need.

III. Fees

The team was asked to consider the need for charging fees for interpretive activities. Considering the example set by the National Park System and the expressed desire of Congress that visitors to public facilities share the cost of their development and operation, such fees are justified and warranted. Certainly there should be a fee for the guided tour. This easily could be collected either at the parking area or visitor center with no increase in staffing. 50¢ per person, aged 16 years and over would seem a reasonable fee; those under 16, free.

IV. Staffing

A. National Park Service Assistance

During our preliminary talks on this project, the question was raised, "Could the National Park Service take over operation of the visitor services program at the NRAO?" If such an agreement were strongly desired by the Observatory the study team feels certain that something could be worked out. Details of such an assignment would have to be worked out, but assignment of one man on a reimbursable

basis is definitely possible, as it has been done with other agencies in the past. We feel our Division of Interpretation would be interested in furnishing such a person.

The National Park Service might also train a man selected by the NRAO. We feel this solution is less desirable than the former one as there would be no career ladder within the NRAO for an interpreter.

If the NPS were to provide personnel to operate the program, it would be understood that final content and qualifications of other interpretive personnel would be subject to the approval of the NRAO director.

B. Assumptions

Staffing levels are based on an annual visitation of 20,000 persons. A year 'round need is postulated, based on the need for supporting the summer program and providing for minor off-season visitation. The Visitor Center would remain open daily throughout the year. Guides will have no other duties (See suggestions, below, however) Tours will be given in the extended summer

season only, with 5 tours a day, with two guides and a maximum of 90 persons per tour.

One may wonder the need for a year-around staff. The decision to include one in this plan was based on the assumption that there would be a demand off-season for various interpretive services. Consider:

Preparation and revision of publications

Preparation and revision of audiovisual programs

Exhibit up-dating

Handling of weekend tourist type visitation

Giving of talks locally and as far a-field as necessary

Handling of teacher institutes (as proposed by NRAO Staff)

Distribution of interpretive materials by mail

Answering of correspondence

Recruitment of guides

Public Relations

Attendance at training courses

Annual Leave

C. Levels

Position	Suggested Federal Grade	Permanent Man Years	Seasonal Man Years
Director	11 or 12	1	0
Secretary	3 or 4	1	1/4
Guide	5	1	1 (3 persons)
Info-Recpt.	4	0	1 (3 persons)
Bus Drivers	4	0	1 (3 persons)
Maintenance	4	*	1/4
Protection	5	*	1/4
	TOTAL	3	3 3/4

* Off season could be handled by regular members of Observatory staff.

D. Uniforms - Uniforms are an asset to the interpretive program in that they positively identify the interpreter for the visitor. They also provide the interpreter some feeling of identity (Perhaps even security) and probably help him to exert control over groups of visitors. Uniforms may also help contribute to a feeling of esprit de corps among the interpretive staff. We suggest that a non-military style of uniform be considered, perhaps a blazer with insignia on the pocket for formal and off-season use and a distinctive trouser and shirt combination for summer wear. A uniform allowance would be paid and individuals expected to provide their own uniforms.

E. Training - The NPS could provide on-site training of seasonals at the start of the summer. Otherwise, the permanent staff would be responsible for training the guides and other seasonal personnel. The NPS could provide training guides and booklets as examples.

F. Recruitment - NRAO staff members felt that the guides should be persons with a good deal of background in astronomy. The NPS is now leaning in the direction of recruiting good interpreters, regardless of their academic background, and training them in the subject matter to be interpreted. There is a continuing debate as to the wiseness of this approach and pros and cons can be cited for each side. However, it <u>is</u> agreed that research oriented people often have difficulty becoming good interpreters. The Park Service is also finding (in agreement with such professional guide services as the ones at the United Nations and at Rockefeller Center) that women handle repetitive type jobs such as guiding and information desk duty better than men. In any event, those recruited for interpretive posts should have demonstrated an ability to work

with people and should have experience and academic instruction in public speaking. In addition, he or she must be a person able to communicate with clarity and human understanding, who can answer visitor's questions without hesitation, and one who is able to absorb complex concepts quickly and transform them into layman's language.

G. Other - It is generally felt that interpretive personnel should not be assigned more than half-time to formal talks or guided tours. Longer assignments to such tasks breeds canned monotony and disinterested interpreters. If current Observatory recruitment standards for guides are continued, it might be feasible to assign guides part-time to research or technician level tasks in the Observatory research programs. This would not only provide variety of employment, but might also serve as an inducement for employment by those who might not consider either type of assignment on a full-time basis.

V. Development Schedule

(The present interpretive tour will remain as the primary interpretive program until the new Visitor Center is completed. Dating of the proposed developments will depend on funding.)

A. Develop one or more temporary wayside exhibits. See Appendix #3 for suggested treatment at the 140 telescope. Other temporary outdoor panels could be easily developed for the 85-foot scope and for the Observatory entrance area. An additional interpretive sign might be placed on route 28 at a location where the view of the telescope is best.

B. Purchase new tour vehicles. From the comments of the Observatory staff it seemed that the need was urgent as the present units were near collapse.

C. Acquire Visitor Center Site. Negotiation for the site should be started as soon as possible. Give consideration to needs for an approach road and control of development around the visitor center approaches.

D. Hire an interpreter-manager. Such a position would be justified at this time to provide someone who could devote his full energies to

the planning of the new interpretive program and the handling of contacts between the Observatory and architects and exhibit designers. This person would be responsible for development of final guidelines for the designers, for development of exhibit copy (might write label copy himself), and for recruitment, training and supervision of guides.

A. Selection of architect and exhibit designer for visitor center. These persons must cooperate closely throughout development of the visitor center plan.

B. Presentation of interpretive plan to architect and designers. All designs should contribute to the realization of interpretive objectives. Imaginative solutions are required and planners should be given as much leeway as possible to assure the optimum results. The Observatory staff's interpretive-manager will be responsible for assuring that design meets interpretive needs.

C. Commence preparation of audiovisual program for orientation program. Producer will need graphic and informational input from Observatory staff

H. Support exhibit planners and producers. There will be a need for frequent interchange between Observatory staff and these firms. In addition to providing the required input (graphics, photos, references, specimens, etc.), an Observatory staff member must supervise both the planning and production of exhibits to assure that standards are met and that the results are accurate.

I. Commence preparation of new publications.

J. Commence preparation of new tour outline.

K. Commence preparation of new wayside interpretive devices.

APPENDIX #1

Scope of the Study

A. The Study Team

(1) Members: Donald F. Benson, Chief Architect, Philadelphia Service Center, National Park Service. Primary Responsibility: Development of building architecture plans and report.

Richard V. Giamberdine, Landscape Architect, Washington Service Center, National Park Service. Primary Responsibility: Site selection and plans for use of site selected

Keith A. Trexler, Staff Curator, Division of Museums, National Park Service. Primary Responsibility: Project Coordinator, Development of written interpretive program and assembly of prospectus.

(2) Contact: For further information please contact Keith Trexler at National Park Service, 5502 Port Royal Road, Springfield, Virginia 22151, phone AC 703, 321-8160. Office hours: EST, 8:45 a.m. to 5:15 p.m. Monday through Friday.

(3) Consultants: In addition to the team members mentioned above, other National Park Service employees were consulted. These include: Marc Sagan, Chief, Division of Planning and Interpretive Services: E.R. Swift, Chief, Branch of Exhibit Development; C.O. Harris, Chief, Division of Interpretation and Resources Management, National Capital Region.

B. Operations

(1) Initial Contacts - In April 1965 a meeting with Dr. R. M. Robertson of the National Science Foundation explored ways which the National Park Service might assist the

National Radio Astronomy Observatory in setting up an interpretive program. In June 1965 Marc Sagan visited the Observatory and concluded that the site had "the potential to offer visitors an experience just as interesti as stimulating and as significant as the experience re- by visitors in the National Parks." The National Park Service then offered its assistance in planning an inter- pretive program for the NRAO.

By the end of March 1968 formal arrangements had been completed and a study team selected.

(2) Field Trip: Members of the study team visited the Observatory 22-26 July 1968. During their visit they took the regular visitor tour, were given a special VIP type tour, talked with site director Findlay and members of his staff and spent a large portion of the time in the field surveying possible sites for the proposed visitor center. In additio some time was spent in the Observatory, library and photo lab.

(3) Post Field Trip: Members of the team met several times as a team and individually with other interpreters and architects. Several planetariums were visited and others were con- tacted by mail. Jodrell Bank Observatory replied that they had a very extensive visitor services program, but did not provide the promised details. The Library of Congress was used to locate pertinent background materials.

APPENDIX #2

Factors Influencing the Selection of Interpretive Means

A. Objectives of the Interpretive Program (see I)

B. Mission of the National Radio Astronomy Observatory (NRAO)

(1) The Observatory is dedicated to the study of space by radio telescopes.

(2) Its purpose is to provide scientists with large, precise, and relatively interference-free radio antennas, receivers and other equipment needed to detect, measure, and identify radio waves from outer space.

(3) The equipment used is quite costly and to be used most efficiently must be kept in operation 24 hours a day the year around.

(4) In no instance may the interpretive program interfere with the primary mission of the Observatory. Specific care must be taken that visitor impact will not disturb the instruments or the scientists and other workers engaged in their use. This is not to imply that special, non-interfering facilities may be made available primarily for interpretive purposes.

C. Radio Interference

The nature of scientific work at the Observatory requires that radio interference on or near the site be kept to a minimum. Since the most common source of such interference is the automotive ignition system, visitor automobile access to the site must be restricted and controlled. Location of visitor facilities, routing of exterior road systems, and methods of on-site touring are affected by radio interference considerations.

D. NRAO - AUI - NSF

Interpretive operations on the site will be controlled by Associated Universities Incorporated, operator of the Observatory, through the Director of the Observatory. The Observatory is largely supported through grants from the National Science Foundation, an agency of the Federal Government. The NSF may provide funds to support the interpretive program and will be involved in the approval of its inception and operation.

E. The Site

(1) Location - The Observatory is located just off state route 28, at Green Bank, West Virginia, in a relatively isolated valley of the Allegheny Mountains. It is approximately 200 miles west of Washington, D. C.,

175 miles west of Richmond, Virginia, and about 200 miles south of Pittsburgh, Pennsylvania. With an average elevation of 2,700 feet, the 2,600 acre site is within the Monongahela National Forest. Although state route 28 currently borders the Observatory, plans have been made to relocate it eastward.

(2) Weather - The area is characterized by a relatively mild climate with frequent summer rains. Since summer is the main visitor season, facilities must include shelter from rain. Winters include periods of snow, though roads usually are kept open to the site.

(3) Existing Facilities - The site includes three major radio telescope systems, plus several small, special purpose scopes. There is a laboratory building, dormitory, numerous residences, maintenance buildings and yards, and other miscellaneous structures. Paved roads link all of the major scopes and buildings. Utilities are available throughout the site. There is a paved airstrip 3,500 feet long. Present interpretive programs use a local high school building and tours are conducted in diesel buses.

(4) Staff - Permanent personnel number about 150, with 10 to 50 visiting scientists and students in residence for varying lengths of time.

(5) Ten-Year Expansion - A 1968 master plan calls for a 100% increase in number of telescopes in the next 10 years; 100% expansion of laboratory space and numbers of permanent employees; and a 150% increase in numbers of visiting scientists and students.

(6) Other - In addition to the site at Green Bank, NRAO has a laboratory at Charlottesville, Virginia where design work and computer analysis of telescope gathered data are carried on. A radio telescope located on Kitt Peak, near Tucson, Arizona, is also part of the NRAO. One scope, a part of the Green Bank operation, is located 42 miles from the site. AUI owns a 12-acre plot about two miles east of the Observatory site. Many visitors to NRAO ask about the proposed 600-foot radio telescope. To be built by the United States Navy, it would have been located at Sugar Grove, not at Green Bank. The Sugar Grove site does have one or more operating radio telescopes, but is closed to the public.

F. The Surroundings

(1) NRAO is located in the midst of countless outdoor recreational opportunities for the more than 20 million people who live within 200 miles of the Observatory. Present recreational use is limited by lack of overnight facilities, but new campgrounds and motels are in the offing.

(2) The U. S. Forest Service plans large scale development of the Spruce Knob-Seneca Rocks National Recreation Area, which is less than 50 miles north of the Observatory. In addition, the Service has recently completed a modern Visitor Center at Cranberry Mountain, an equal distance to the south. Future development in both areas includes new and expanded camp grounds and other recreational facilities. A scenic highway, possibly with overlooks facing the Observatory, is proposed for the ridge west of the telescopes.

(3) The U. S. Army Corps of Engineers' proposed development of the Greenbrier sub-basin would create one or more large water areas, one of which could abut Observatory property on the south. Corps' plans

call for "intensive recreational development" of the area. Other water impoundments are proposed adjacent to the sub-basin.

(4) The local county boasts 21 sites of varying recreational interest, including the Cass Scenic Railroad, a former logging line now handling 70,000 tourists per year. Nearby are two limestone caverns with privately operated tours. Ski resorts operate nearby and it is expected that winter use will increase in the near future.

G. Present Interpretive Program

(1) The Observatory has conducted tours for tourists each summer since 1966. Tours are given five times daily, Wednesday through Sunday, from early June through late August.

(2) Seven persons spent all or part of their time handling the tours during the 1968 season. Two were guides, two bus drivers, one handled registration and book and souvenir sales, and one introduced the movie shown before the tour, ran the projector, and acted as a general coordinator. The seventh person, a member of the full-time staff,

with part-time duties as public information officer, acted as overseer of the program. He also was responsible for recruitment and training of the guides, publicity and procurement of free and sales publications. Present operating budget is $16,000 per season.

(3) The typical visitor experience in 1968 was:

a. Arrival at the site. Signs or the entrance guard directed visitors to the temporary visitor center in the local high school.

b. After parking his car, the visitor entered the school, was greeted by the "clerk" who "registered" him by asking what state he was from. No charge was made for the tour. He was told of the time of the next tour, its duration, and the fact that photos could be taken. He then had the opportunity to look through the sales items and the free handout describing the Observatory.

c. Next was the showing of a 15-minute movie which described the Observatory site. This presentation was introduced by one of the staff who asked afterward if there were any questions.

d. The visitor then boarded one of two buses for a 45-minute tour of the Observatory site. Each of the two buses had a driver and guide. The guide narrated the tour through a microphone and speaker arrangement. The tour route included administrative areas and stops were made at several of the telescopes. Visitors were allowed to leave the bus at the stops and many of them used this as an opportunity to take photos and to ask questions of the guide. The buses returned the visitor to the high school building.

(4) Comments on the Tour - Overall, the program did its job of showing and explaining the telescopes. The movie provided a meaningful introduction to the site and both of the guides gave clear and easily understood presentations. With only minor improvements, the present tour could be used until the proposed visitor center is built.

Perhaps the number of stops where visitors are allowed to leave the bus could be reduced. We noted a decrease in the numbers of persons who got out at succeeding stops. Perhaps there should not be disembarkation at the Horn antenna stop.

The only really jarring note in the present interpretive program was the selling of native handicrafts along with the books on astronomy. Sale of the handicrafts does not seem consistent with the remainder of the program.

While visitors were encouraged to walk up close to the scopes, they were kept out of telescope operating rooms. As "special" visitors, the planning team was shown the interior of the 140-foot scope and was most impressed by the experience. We all felt that the average visitor should be afforded such an opportunity, but realize that present facilities do not permit this to be done.

Although the diesel buses (diesel to eliminate static electricity) seemed adequate to us, we were told that they were constantly on the verge of breakdown.

All of us remarked on the cleanliness and well-kept appearance of the area. Such an appearance goes a long way towards creating a favorable impression of the overall operation.

H. The Visitor

(1) In 1966 and 1967 more than 50% of the visitors originated in West Virginia. Other major states of origin were: Virginia, 8%; Ohio, 7%; and Maryland and Pennsylvania, 4% each.

(2) Total visitation for the 1966 and 1967 seasons was just over 12,000 persons per year. Average daily attendance is 200 persons with peak days (Sundays) exceeding 400.

(3) Most visitors arrive in family units in individual cars. They are casual drop-ins, many of them on vacation, many of them attracted to the area by the Cass Scenic Railway. Some few are repeat visitors to the site.

(4) Current visitor stay is about 1½ hours. This is lengthened when visitors eat their picnic lunch in the high school parking lot. Time limits are set by the visitor's need to find overnight accommodations.

(5) In addition to summer visitation there is some use of the site in the off-season by tourists. These persons are encouraged to walk to one of the scopes, but there is no interpretation at the site. Off-season also brings an average of one tour per week of special

science-oriented groups. These are handled by the permanent staff as extra duty.

APPENDIX #3

National Radio Astronomy Observatory

Suggested content for on-site interpretive shelter for 140 foot radio telescope

Title: 140 Foot Radio Telescope

Panel 1:

Art: Sketch of 140 foot 'scope with following identified:

Copy: Antenna

Focal Point with High Frequency Receiver ("Front-End")

Dish or Parabolic Reflector

Surface Panels (total of 60 solid aluminum sheets 1/4" thick)

Cables to Low Frequency Receiver ("Back-End")

Adjusting Jacks

Yoke (filled with high density concrete)

Gears Which Move Telescope (point out as many as necessary)

Support Housing

Operator's Room

Low Frequency Receiver ("Back-End")

Dimensions: (scale these off on drawings)

Height from focal point to ground in stow position

Width of dish

Height to observation deck

(in this regard it would be helpful to paint in contrasting color a 6-foot line on one of the dish supports to provide scale for visitors)

Weights:

Support Housing - 5,840 tons

Rotating Portion - 2,600 tons

Yoke - 675 tons

Panel 2:

Art: Photo of operator's console with operator in place

Copy: Trained telescope operators control movement of the 'scope, aid visiting scientists, and are responsible for keeping the 'scope operating properly.

Panel 3:

Art: Photo of 'scope in stow position

Copy: Here the telescope is shown in "stow" position. Usually this is the way the dish sits when the unit is being repaired or given preventative maintenance.

Panel 4:

Art: Photo of scope in any other position (perhaps two contrasting positions)

Copy: The 140 foot radio telescope is on an equatorial mount and can be moved to receive radio signals from almost any part of the sky.

Outline of Audio Message: TOTAL MESSAGE SHOULD NOT EXCEED TWO MINUTES

Welcome to NRAO

This is 140 foot radio telescope

Completed in 1965

Cost $15 million

Characteristics

Largest equatorially mounted radio telescope in the world - equatorial mount means _____.

Exceptionally stable

High tolerances

High pointing accuracy

Tooth to tooth error of large visible gears

Can withstand winds up to 140 m.p.h. (not expected at this site)

Uses

Used to study the structure and composition of the universe

Can be pointed to almost any portion of visible sky

24 hour operation

Can receive radio signals from the "ends" of the universe

Especially good for:

Precise measurements of output of radio sources

Precise mapping of radio sources

Precise location of radio sources

Etc. . .

Conclusion: An exceptional radio telescope which right now might be "listening" to radio "messages" from sources many billions of miles away which will reveal to man the nature of the universe.

APPENDIX 4

Preliminary Architectural Design

Interpretive Facility
Green Bank National Radio Astronomy Observatory

Pages 1--6

Drawing No. 981/41.901
Sheets 1--4

PRELIMINARY ARCHITECTURAL DESIGN
Interpretive Facility
Green Bank National Radio Astronomy Observatory
Green Bank, West Virginia

Architectural Theme

A. There is no unique regional style to serve as a reference point in materials or design. Rather, the architectural theme should:

1. Convey the spirit and feeling of the facility
2. Relate to the natural surroundings
3. Be the result of form following function and form relating to very special symbolic resources, such as, the parabolic shapes of a telescope antenna, or the spiral structure of the milky way as seen by radio telescopes
4. Be a balance between functionalism, creativity and economy.

Architectural Program (Based on site chosen)

The Interpretive Facility shall be housed in two structures, as follows, connected by walkways and pedestrian tunnel or by an inclined railway:

A. Visitor Reception Center

To be located adjacent to the visitor parking area on the lower slope of the hill. Structure to be of minimum size to afford the following services:

1. Visitor Reception, Information and Comfort Facilities

2. Terminal for access to Interpretive Facility

3. Mechanical plant, Office and Service Areas, space for vending machines.

B. Interpretive Center

1. Control and operation of the following interpretive media and facilities:

a. Audiovisual theater

b. Large exhibit area and expansive view over observatory grounds

c. Interpretive sales

d. Diesel bus tours through observatory grounds

e. Operable radio telescope

f. Comfort facilities

g. Offices, mechanical plant, storage and service areas

h. Guide ready room

i. First aid room.

Architectural Solution

A. Building Site and Access

Studies of the proposed site, transportation and building requirements indicated it was feasible to locate the interpretive center in two locations and that access could be

either by pedestrian tunnel through the hill or by railway over the hill from the parking area and Reception Center located at a lower level.

The scheme presented connects the Reception Center at a floor elevation of 2,635' with the Interpretive Center at a floor elevation of 2,680' via a graded walk and tunnel.

After investigating tunnel costs, we believe the proposal shown can be relatively inexpensively built on a cut and fill basis, its floor following the contour of the ground above and cost less than the simplest inclined railway.

By boring, the overhead vegetation and natural appearance of the area would be totally preserved, but we believe the cost would be prohibitive.

In any case, a pedestrian tunnel is preferable over any railway because of continuing maintenance, operational problems and costs inherent to a mechanical device.

If the tunnel cannot be afforded, bus access is a possibility.

B. Architectural Concept and Construction Techniques

Plan studies indicated that a round domed structure would work best with the proposed 360° audiovisual facility, the expansive view of the telescope installation and would relate very

well to the strongest symbolic resource extent, the parabolic telescope antenna. Also, a circle will enclose more space with less perimeter than any other geometric form. A steel framed dome encloses a large column free area especially popular for public assembly, and it is economical, the steel members being very lightweight. The most popular steel dome structure in use is known as the "Schwedler" type. The sections and elevations shown are conceived within the optimum economy range, for steel domes of this type, that is having a rise-to-span ratio of 0.13.

C. Visitor Reception Center Plan

Earlier studies for the visitor reception center envisaged a cafeteria and a much larger facility. However, it was determined that the costs of the entire plant was rising rapidly and that a more minimum facility could serve the needs. We recommend the plan shown which is essentially a reception and information center, but can be a terminal or waiting room if the tunnel is not built and bus transportation is used exclusively. Space for food and drink vending machines replaces the proposed cafeteria.

D. Interpretive Center Plan

The plan shown was arrived at in close coordination with exhibit specialists. The resulting building houses a unique audiovisual room departing completely from the typical fixed

seat movie-theater style auditorium first considered. This room is completely flexible and can be used as a regular theater with the main film shown from a typical projection room or it can have several movies, slides or transparencies on view simultaneously. This is made possible by the use of a perforated screen material that can be projected upon from the rear or the front. A circular access space backs the 360° screen emanating from each side of the main projection booth. Sliding doors and light control complete the flexibility. All viewing windows and doors to the outside light would have very dark tinted glass to ease light and glare control. Artificial light would be dimmer controlled.

E. Materials (tentative)

Framing:	Steel wall framing with steel framed dome
Foundations and Floor Slabs:	Reinforced concrete
Exterior Finish:	Stone; concrete; duranodic finish aluminum window and door framing. Tinted glass.
Interior Finish:	Some of same materials as above plus others keyed in color and type to complement or contrast with the exhibits to provide a smart eye-catching and inspiring facility.
Roofing:	Insulated decking over steel frame covered with appropriate plastic film such as Dupont Hypalon.

ESTIMATED COST
Interpretive Facility Buildings

Reception Center

1,500 Sq. Ft. @$40.	$ 60,000.00

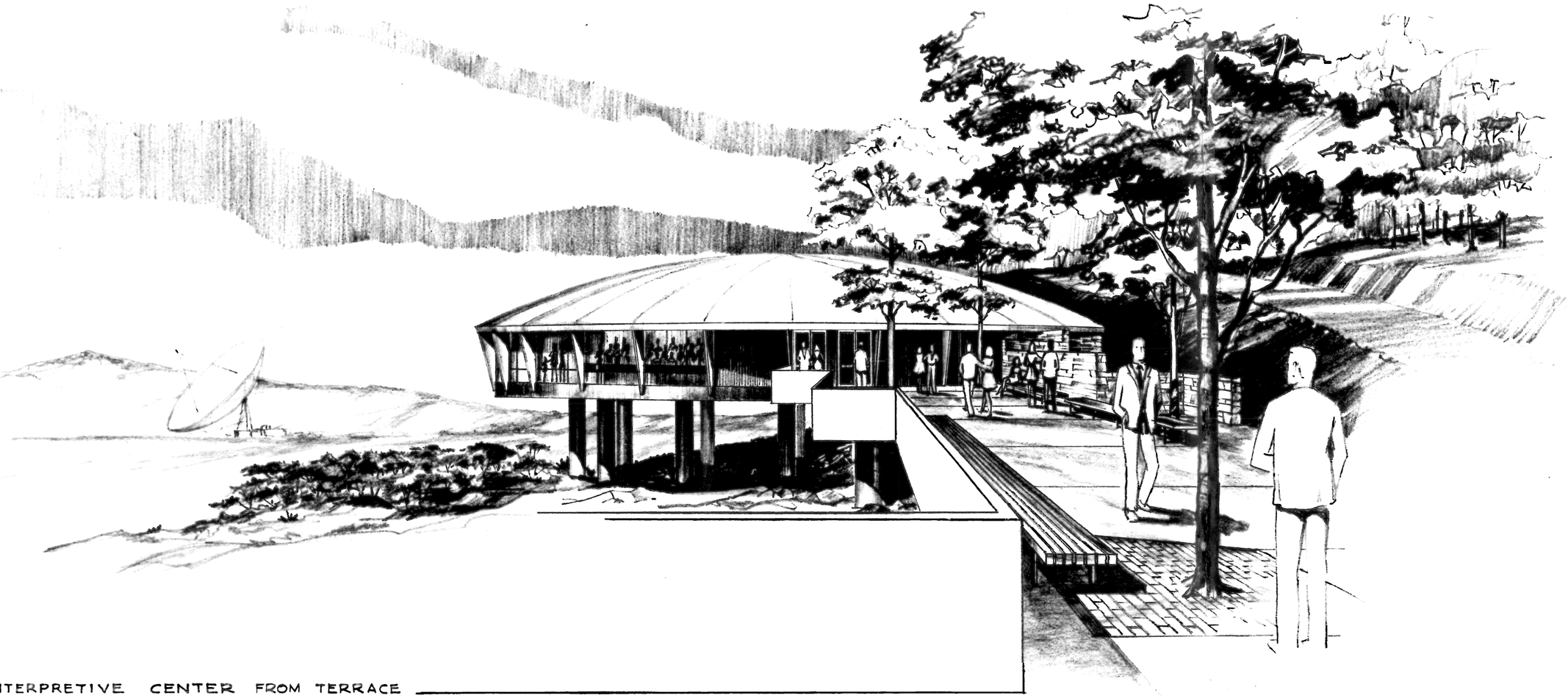
Interpretive Center

6,000 Sq. Ft. @$40.	$240,000.00
	$300,000.00

Furnishings

	$ 15,000.00
GRAND TOTAL	$315,000.00

Note: These estimates are for building costs only--does not include walks, terraces, roads, parking areas, moving and placing Reber Telescope, utilities or tunnel.



INTERPRETIVE CENTER FROM TERRACE

INTERPRETIVE FACILITY

GREEN BANK NATIONAL RADIO ASTRONOMY OBSERVATORY

GREEN BANK, WEST VIRGINIA

BASIC DATA

ORIENTATION

PREPARED
RECOMMENDED: CHAMBERLINE
DESIGNED: BILLINGSLEY
DRAWN: BENSON
CHECKED:

DATE	INITIAL

REVISED

SCALE

RECOMMENDED
DATE
APPROVED

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
DESIGN AND CONSTRUCTION
PREPARED BY
PHILADELPHIA PLANNING AND SERVICE CENTER
OFFICE

TITLE OF DRAWING: INTERPRETIVE FACILITY
LOCATION WITHIN PARK: GREEN BANK NATIONAL RADIO ASTRONOMY OBSERVATORY
NAME OF PARK: GREEN BANK, WEST VIRGINIA

REGION: SOUTHEAST
PCP NO.
SHEET 1 OF 4
DRAWING NO. 9851 — 41,721
DATE 11-12-68

INTERPRETIVE CENTER

SCALE · 1/8" = 1'-0"

PLAN

VIEW TO TELESCOPE SITES

REBER TELESCOPE

NORTH

VIEWING LOUNGE

EXHIBITS

TELESCOPE CONSOLE

VIEWERS

UP

EXHIBITS

SCREEN ABOVE

FOLDING DOORS

AUDIO-VISUAL ARENA
128 SEATS

PROJECTION ROOM ABOVE

INFORMATION & CONTROL

OFFICE

OFFICE

EXHIBITS

GUIDES

FIRST AID

EXHIBITS

MECHANICAL

EXHIBITS

LOUNGE

TOP OF WALL EL. 2690

ENTRANCE FROM TUNNEL

BENCHES

TERRACE

SEAT WALL

TERRACE

BUS LOADING

EXISTING LAMBERT ROAD

2660
2650
2670
2680
2675
2680
2680
2681
2684
2685
2680
2690
2681.5
2685
2690
2690
2690
2680
2690
2700
2700

FLOOR 2680
CEILING 2690
TUNNEL UNDER

FROM RECEPTION CENTER

REGION SOUTHEAST
PCP NO.
SHEET 2 OF 4
DRAWING NO. 081 41,001
DATE 11-12-68

BASIC DATA

PROJECTION GALLERY

VIEW TO TELESCOPE SITES

SECTION "AA"

VIEW TO REBER SCOPE

SECTION "BB"

SCOPE OPERATOR

VIEWERS

℄ OPERATOR TO SCOPE

REBER TELESCOPE

SLIDES

TRANSPARENCY

PERFORATED SCREEN

TRANSPARENCY

ORIENTATION MOVIE

SLIDES

TRANSPARENCY

PROJECTION BOOTH

VIEW IDENTIFIER

OTHER RADIO TELESCOPES (SLIDES & PHOTOS)

AERIAL VIEW WITH CALLOUTS

CASE WITH "FRONT ENDS"

ORIENTATION MOVIE

B

AUDIO-VISUAL ARENA

128 - 360° REVOLVING SEATS — SHADED SEATS WOULD NOT BE USED FOR ORIENTATION MOVIE

AERIAL VIEW WITH CALLOUTS

CURRENT EVENTS

TELESCOPE CONSOLE

VIEWERS

RADIO SUN

ELECTROMAGNETIC SPECTRUM

B

PROJECTION GALLERY ABOVE

PANEL - SCALE OF THE UNIVERSE

PANEL TO INTRODUCE NRAO-AUI-NSF

FOLDING DOORS

INFORMATION & CONTROL (PROJECTION ROOM ABOVE)

SEATING WITH TABLES

A

A

MAIN FLOOR

STAIRS TO PROJECTION ROOM & GALLERY

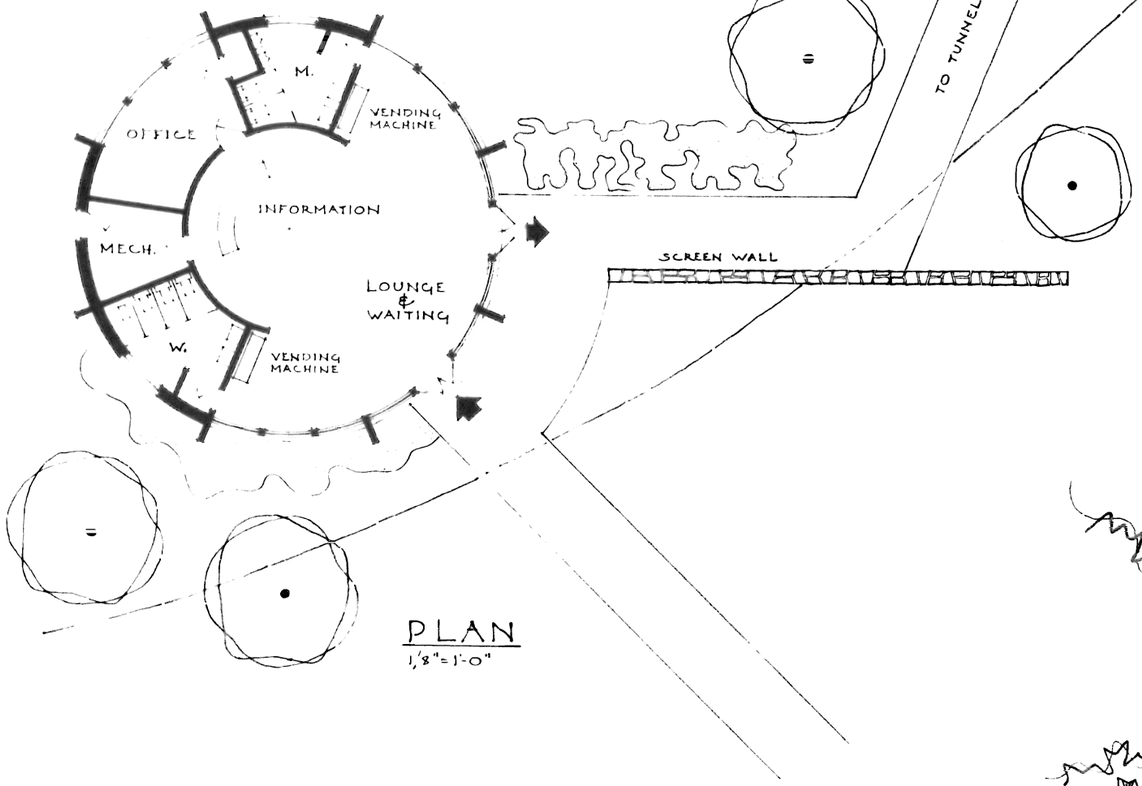
EXHIBIT PLAN

INTERPRETIVE CENTER

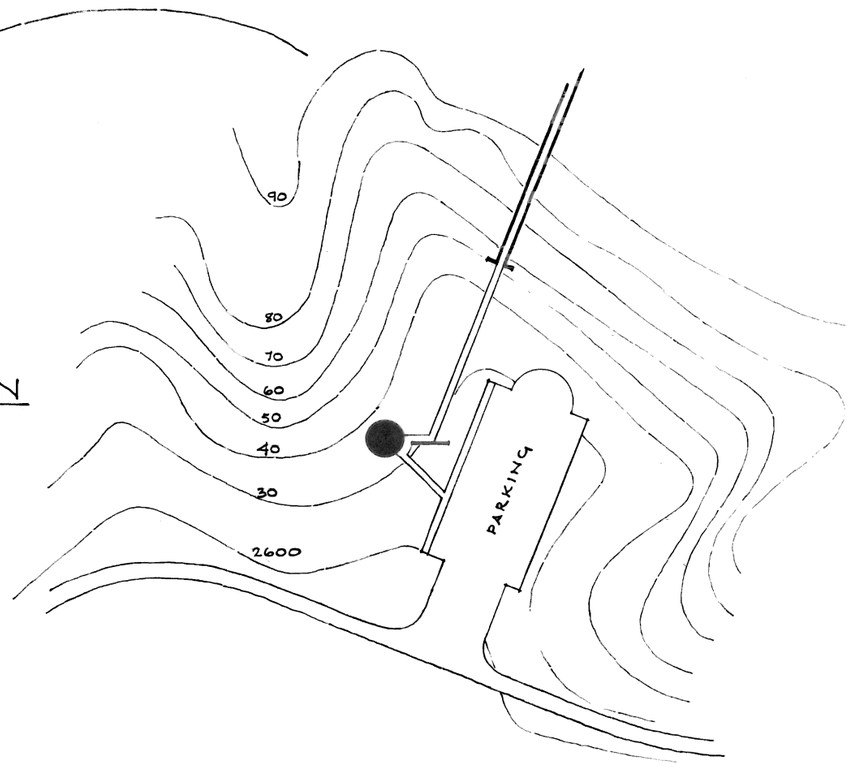
SCALE: 1/8"=1'-0"

BASIC DATA

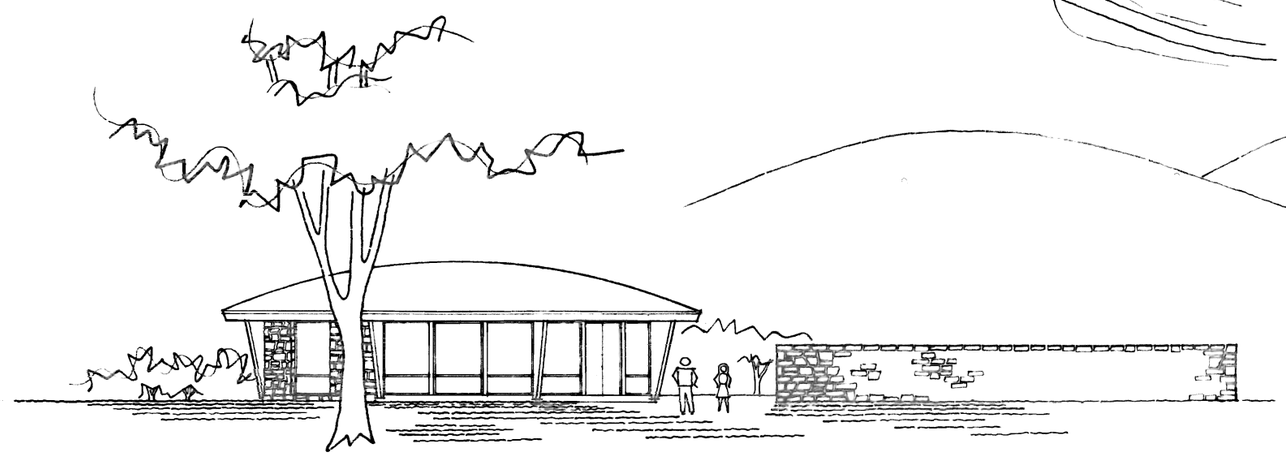
REGION	SOUTHEAST
REFER	
SHEET	3 OF 4
DRAWING NO.	961 41 901



PLAN
1/8"=1'-0"



SITE PLAN
1"=100'



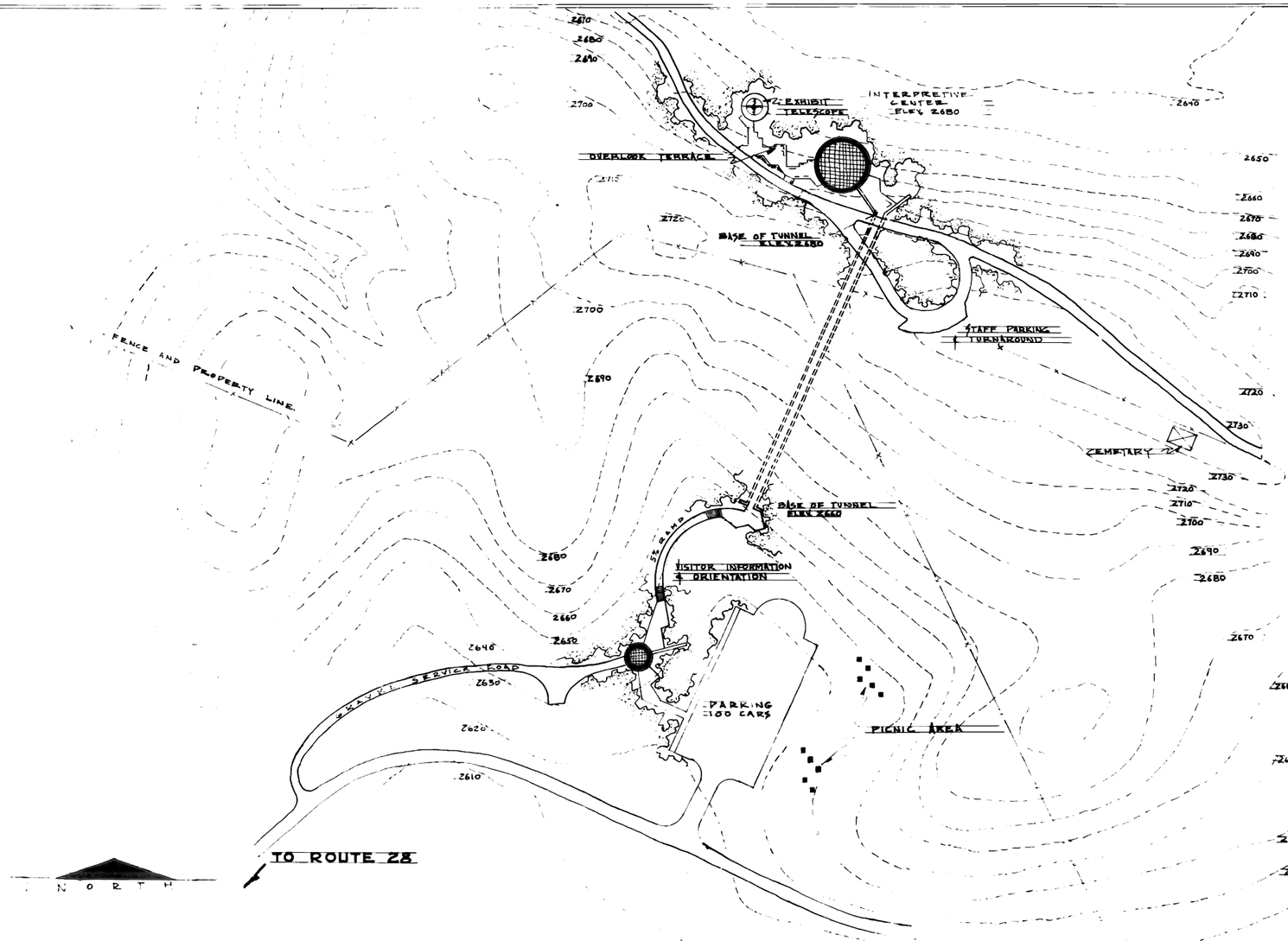
ELEVATION
1/8"=1'-0"

N

RECEPTION CENTER

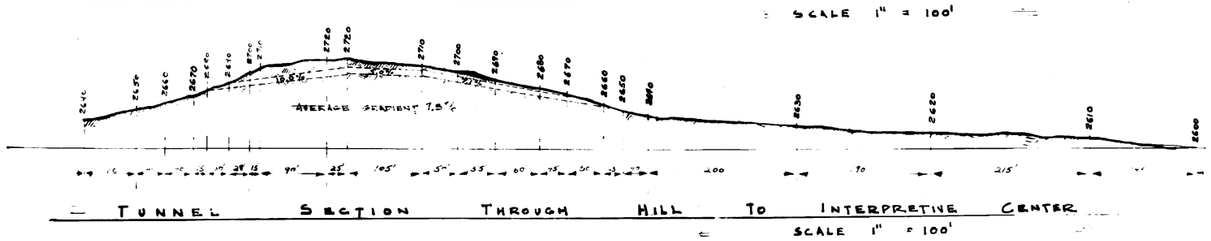
BASIC DATA

REGION	SOUTHEAST
PCP NO.	-
SHEET	4 OF 4
DRAWING NO.	981 41,901
DATE	11-12-68



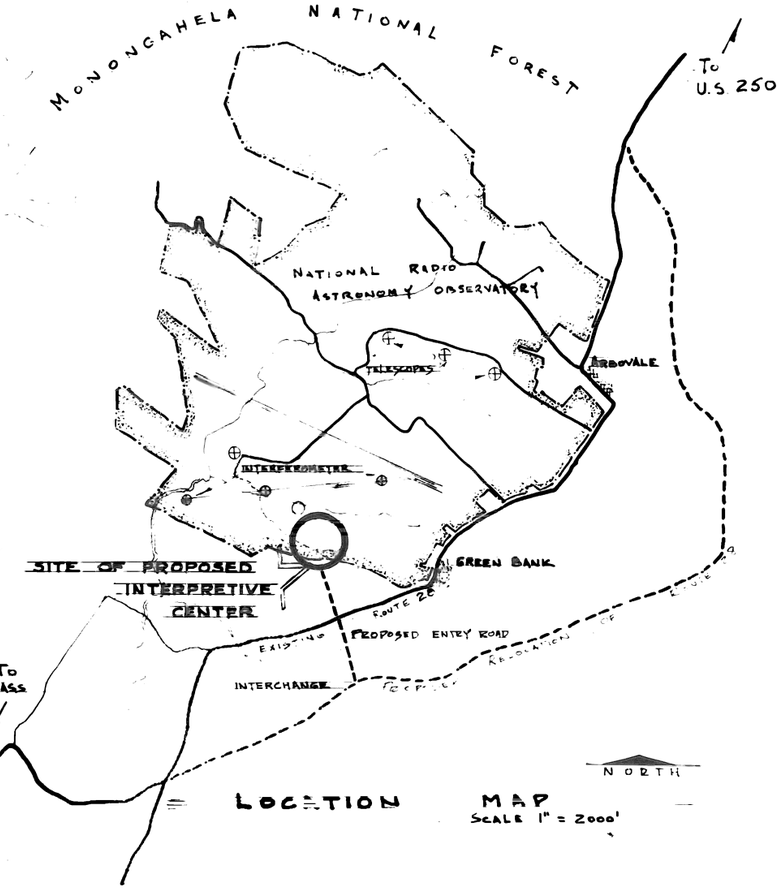
SCHEMATIC SITE PLAN

SCALE 1" = 100'



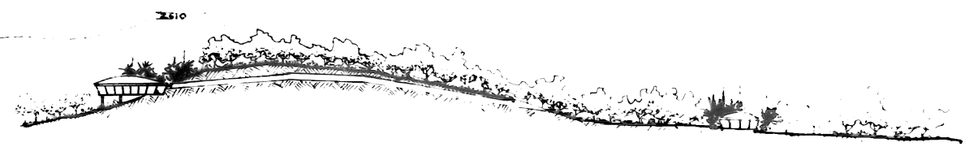
TUNNEL SECTION THROUGH HILL TO INTERPRETIVE CENTER

SCALE 1" = 100'



LOCATION MAP

SCALE 1" = 2000'



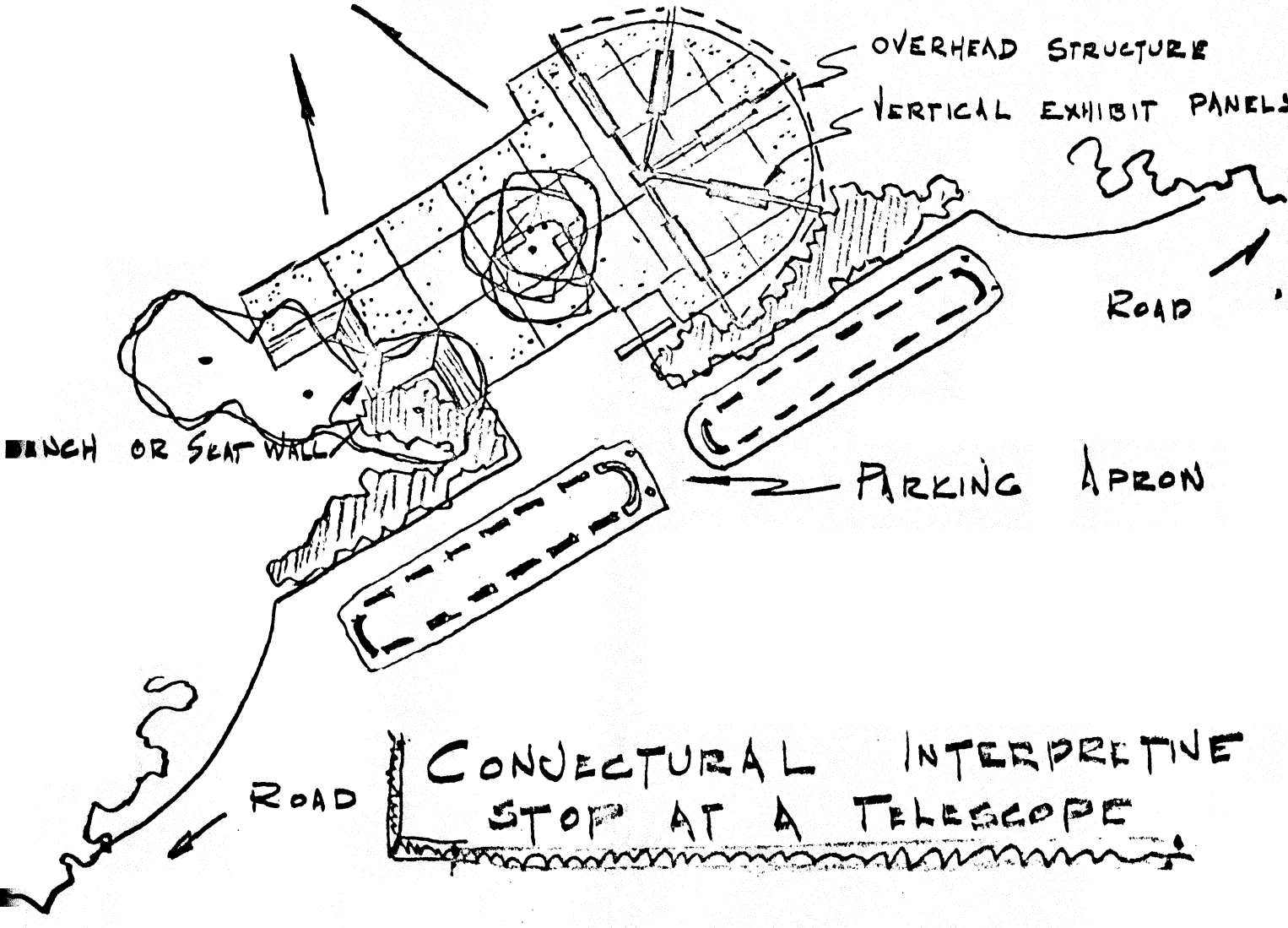
BUILDINGS WITH CONNECTING TUNNEL SECTION

SCALE 1" = 100'

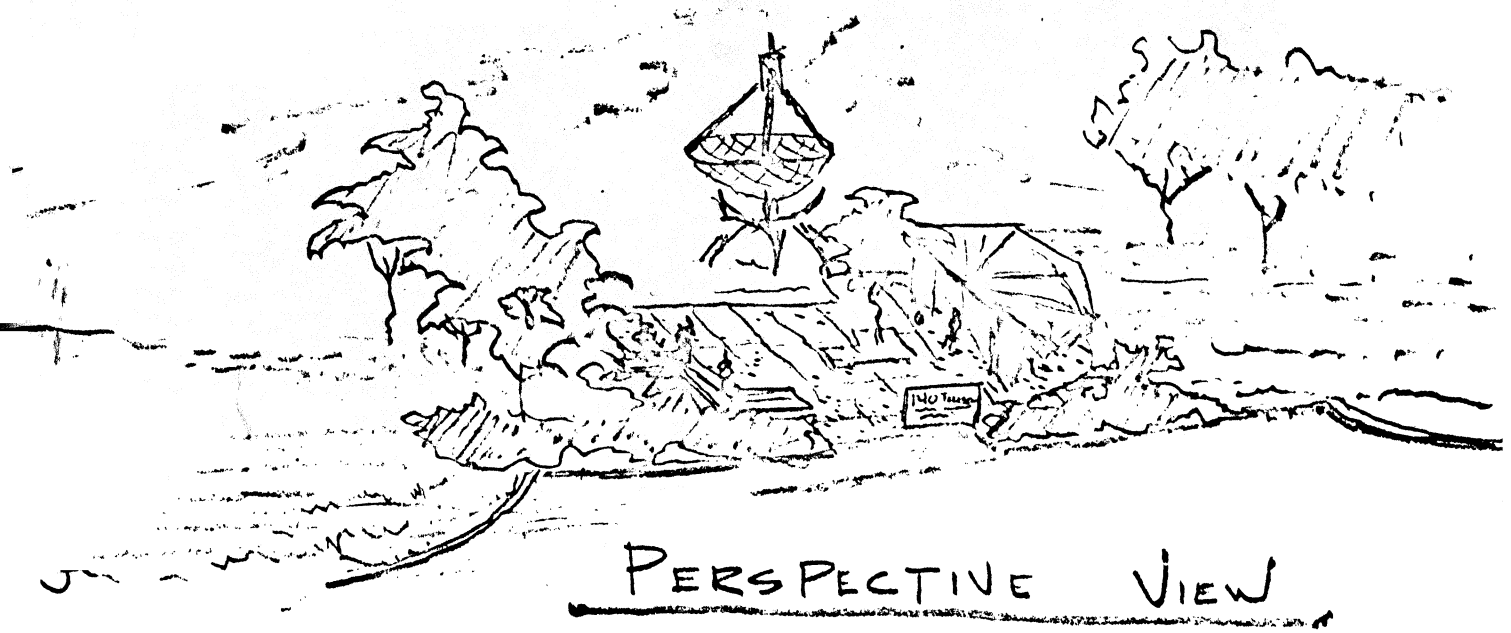
SCHEMATIC INTERPRETIVE SITE PLAN

NATIONAL RADIO ASTRONOMY OBSERVATORY GREENBANK, WEST VIRGINIA

RADIO TELESCOPE



CONJECTURAL INTERPRETIVE STOP AT A TELESCOPE



PERSPECTIVE VIEW

APPROXIMATION OF COSTS FOR

NATIONAL RADIO ASTRONOMY OBSERVATORY INTERPRETIVE OPERATION

		Cost
A.	Entrance Road from existing Route 28 to orientation center two lanes 18' wide 2' shoulders 6" gravel base, 3" asphalt paving, approximately 2500 lineal feet	$35,000.00
	(This item might possibly be constructed by the County or State at no cost to NRAO)	
B.	Parking lot 100 car capacity 6" gravel base, curbing, 3" asphalt paving	25,000.00
C.	Gravel service road to orientation center 4" crushed stone 1000 lineal feet	3,000.00
D.	Concrete walks, from tunnel entrance, orientation building, and parking lot, 7,500 sq. ft.	15,000.00
E.	Tour road to Visitor Center (single lane) including turnaround 6 car parking. 10' side, natural drainage 4" gravel base 3" asphalt paving, approximately 3,000 lineal feet	15,000.00
F.	Interpretive Center 6,000 sq. ft. @ $40.00	240,000.00
G.	Reception Center 1,500 sq. ft. @ $40.00	60,000.00
H.	Furnishings for Bldgs. above	15,000.00

			Cost
I.	AV-Exhibits - exclusive of moving Reber and Jansky scopes and of cost of console for radio telescope		
	8 - 4 x 8 panels w/ original art @ $1,000		$ 8,000.00
	Large case for model scopes and photos		4,000.00
	Photos and captions for above		3,000.00
	6 - 3' x 4' transparencies @ $1,000 ea.		6,000.00
		Total Exhibits	21,000.00
	AV Programs (2 @ $15,000 ea.)		30,000.00
J.	Tunnel	Cut and backfill	120,000.00
K.	Terrace	not including Reber telescope	14,400.00
L.	Plantings & Landscaping		20,000.00
M.	Utilities	Sewer, electricity (on site) water	45,000.00
		Total Construction	$658,400.00

OPERATING COSTS

		Annual
Director		$ 13,000.00
Secretary		6,000 00
Guide (full time)		6,000.00
Guide (seasonal)		7,500.00
Info. receptionist (seasonal)		6,000.00
Bus driver (seasonal)		6,000.00
Maintenance		1,500.00
Protection Specialist		1,500.00
	Salaries	$ 47,500.00
	Other personnel costs (about 7½%)	3,500.00
		51,000.00

BUILDING OPERATION

Annual Average of First Three Years of Operation

Operations:	Main Building:	$4158	Reception Center:	$1039
Maint. and Repair of Buildings and Eqpt:	Main Building:	2382	Reception Center:	595
	Total:	$6540		$1634

Grand Total: $8174 Annual Building Operation

LANDSCAPE ARCHITECTURE

APPENDIX V

LANDSCAPE ARCHITECTURE

(Appendix V)

General

Landscaping of the area must consider two basic themes or settings. First there is the all-pervading sense of natural beauty created by the valley and mountain backdrop. Imposed on this is the second theme, the telescopes. Their size, configuration and strangeness boldly interrupt the familiar landscape and provide the focus of attention. The dramatic contrast of these precisely engineered forms against the natural environment is the most emphatic visual message the visitor receives. This message must be considered in all future landscaping and construction at the Observatory and future planners should be alerted to the necessity of maintaining the balance between natural setting and man-made instruments.

The Visitor Center Site

The study team devoted a great deal of its time to a study of visitor center sites. As interpretive planners, our major concern was the selection of a site well related to the telescope area - one with an excellent view of the major telescopes, yet one that would meet the need for protecting the scopes from static generated by visitors'

autos. We found the 10,000 foot long east-west trending ridge on the south boundary of the Observatory to be nearly ideal in meeting these needs. It is high enough to give an excellent view of the telescopes, its bulk will screen out auto-generated static, and the topography provides opportunities for varied building design solutions.

Another plus for this site is that its development is not dependent upon relocation of State Route 28. All that is required is adequate highway signing to direct visitors to the center regardless of where the highway is located.

Our suggestion is that visitor services be centered in <u>two</u> buildings connected by a tunnel. Near the parking lot would be a modest structure with eating facilities (concession or vending machines), rest rooms, tour ticket sales and an information facility. The tunnel, approximately 560 feet long with an average grade of 7.3 percent, would lead to the main visitor center which houses exhibits, audiovisual presentations, etc. and a view of the telescopes. Alternate methods of crossing the ridge include an incline or funicular railway, bus access by road from the parking lot, and a surface trail.

We feel the tunnel is the best solution, considering visitor comfort and maintenance costs. It would commence at the

parking lot at elevation 2,660 and would pass through the ridge and emerge on the opposite side at elevation 2,860, the same elevation as the visitor center floor. The cheapest method of tunnel construction would be trenching to 15 to 20 feet, placing concrete or steel pipes in the trench, and then backfilling. This method would probably involve dividing the tunnel into three segments to conform to the ridge's profile. For the first 250 feet there would be a 7.1 percent grade, then 100 feet at 5 percent, and the final 200 feet at 10 percent. Whatever the final method of construction, care must be exercised that the natural cover be preserved or replaced.

Outside the visitor center a viewing terrace would extend the 100 feet to the Reber scope. Combined with the terrace would be an assembly area for bus tours and seating for those who wished to enjoy the view at their leisure.

In addition to the small building suggested earlier, the parking area should contain picnic facilities and comfortable outdoor seating.

Plant Materials

Native plant species adaptable to landscaping needs are found in great abundance throughout the area bordering the

Observatory. Owing to the diversity of altitude, rainfall, temperature, edaphic and other factors, the region contains more than three-fourths of species of plants occurring in the State. Major forest types include the following species that would be valuable in landscaping the site:

White Pine

Hemlock

Sugar Maple

Beech

Yellow Birch

Spruce

Balsam Fir

Scarlet Oak, Chestnut Oak and White Oak