NATIONAL RADIO ASTRONOMY OBSERVATORY

CALENDAR YEAR 1977 PROGRAM PLAN

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Table of Contents

Section	Page
I. Introduction	. 1
II. Scientific Program	. 1
III. Research Instruments	. 2
IV. Equipment	. 6
V. Operations and Maintenance	. 7
VI. Construction	. 10
VII. Personnel	. 10
VIII. Financial Plan	. 12

<u>Appendix</u>

Α.	NRAO Scientific Staff Programs	13
Β.	NRAO Permanent Scientific Staff with Major Scientific Interests	19
С.	NRAO Organizational Chart	20
D.	NRAO Committees	21

NATIONAL RADIO ASTRONOMY OBSERVATORY

1

CALENDAR YEAR 1977 PROGRAM PLAN

I. INTRODUCTION

The National Radio Astronomy Observatory is funded by the National Science Foundation under a management contract with Associated Universities, Inc. The role of the Observatory as a center for basic research in radio astronomy is implemented both by the operation of its major telescope systems and by research and development in the fields of advanced electronics and data processing systems.

During this year operations with the completed portion of the VLA will begin. A summary of the research planned for this instrument, as well as for the 300-foot meridian telescope, the 140-foot fully steerable telescope, the four-element interferometer, and the 36-foot millimeter-wave telescope is included in the next section of this Program Plan. More than 60 percent of the observing time required for this research will be used by visiting investigators.

Section III of the Plan presents a program for the development of new research instrumentation for use on the telescopes. A new feature of this year's plan is the application of masers to the Green Bank telescopes; these devices offer the potential of providing extremely sensitive radiometers over a wide range of frequencies.

Subsequent sections give the detail of the expenditures required for operations and maintenance of the Observatory. A summary of the allocation of funds is given in Section VIII, the Financial Plan.

Appendices to this Plan include a summary of the scientific program of the NRAO permanent staff, a list of the staff and their principal research interests, an organizational chart for the NRAO, and a list of the various committees associated with the NRAO.

II. SCIENTIFIC PROGRAM

The observing proposals which have already been submitted for CY 1977 span a wide range of investigations, from studies of the sun, planets, and comets to attempts to measure the diffuse matter in clusters of galaxies.

All such proposals, whether by visitor or staff, are sent for evaluation to referees who are not on the NRAO staff. The programs that are run on the telescopes represent the best of these proposals. It is anticipated that approximately 250 observers will use the NRAO telescopes in 1977.

A major part of the effort in galactic studies will be devoted to the exploration of the relationship between stars, gas, and dust both in regions of star formation and for highly evolved stars such as planetary nebulae. Further observations using the large number of molecular species now detected offer the possibility of determining the physical conditions in dust clouds, globules, and circumstellar envelopes, and may as well provide information about the mechanisms by which complex molecules are formed in interstellar space. The mapping of the distribution of gas and dust in the galaxy will be continued, using CO as a tracer, and the kinematics of the gas in the region of the galactic center will be measured using several molecules such as CO, CS, and CH. A number of programs involving the continuum emission from supernovae remnants, pulsars and radio stars will be undertaken; it is expected that the increased sensitivity of the VLA will make it particularly attractive in the measurement of the radio counterparts of X-ray sources and in the attempt to determine the types of stars which characteristically emit strong radio waves.

The research effort in the field of hydrogen in external galaxies will be continued, with a view towards describing the integral properties of normal galaxies, searching for intergalactic neutral hydrogen, determining the extinction parameters due to dust within our own galaxy and the self-absorption of hydrogen in other galaxies, and observing in as much detail as is possible the nearby normal spirals which may serve as guides in better understanding the Milky Way. Maps of the distribution of the continuum emission, including the polarized component, will be made of selected radio galaxies and quasars in an effort to understand the source of the energy in these objects. Of particular importance are radio galaxies in certain clusters of galaxies; the development of the radio sources may be influenced by intracluster gas. Finally, very long baseline interferometers will be used to study the rapid changes in the angular structure of compact sources, and to search for compact nuclei in extended radio sources.

The program of the NRAO staff, which comprises approximately 30 percent of the total program, is described in greater detail in Appendix A.

III. RESEARCH INSTRUMENTS

The primary research instruments at the National Radio Astronomy Observatory consist of the 140-foot telescope, the 300-foot telescope, and the four-element interferometer, all in Green Bank, West Virginia; the 36foot millimeter-wavelength telescope at Kitt Peak, Arizona; and the Very Large Array, under construction at the Plains of St. Augustin, New Mexico. Operation with the completed portion of the VLA will be undertaken in CY 1977. The funds (in thousands of dollars) needed to equip the other four instruments are summarized in the following two tables.

Item 1.	Other Observing Equipment	655.0
Item 2.	Research Equipment	200.0
Item 3.	Test Equipment	48.0
	Total	903.0

The estimated funds for research instruments will provide auxiliary instrumentation and equipment to maintain and improve the capabilities of the telescopes, including new systems development and modifications and upgrading of existing systems. The ability of the NRAO to maintain an active research and development program in electronic and computer hardware is essential if the Observatory is to continue in its role as the nation's principal center for research in radio astronomy. Because of rapid and unpredictable changes in "state-of-the-art" electronics hardware and unforeseen short notice requirements of the scientific community, it is desirable that flexibility within the general area of the program be maintained. The following table shows the planned distribution of funds for the "Other Observing Equipment" account. The NRAO continually updates this table as scientific priorities change. These estimates provide funds for the completion of already started projects, new development, and funds for items of continuing and general development.

Item

1. Other Observing Equipment

(See attached table, page 4.)

A. Other Observing Equipment: Items to Complete

The items expected to be completed in 1977 include:

1. <u>120-160 GHz Receiver</u> - Cooled mixers for a 120-160 GHz receiver will be designed in a similar manner to the presently available 80-120 GHz receiver. These mixers will be incorporated in a receiver in CY 1977.

B. Other Observing Equipment: New Development Items

The following new items are planned for 1977:

1. Other Observing Equipment (in thousands)

	Estimate To Complete (k\$)	Estimate New Development (k\$)	Estimate Continued Development (k\$)	
140-Foot Telescope				
Maser, upconverter system Correctable subreflector Autocorrelator Maser 26-40 GHz		60	130 20 35	
300-Foot Telescope 300 foot low-noise system		60		
<u>36-Foot Telescope</u> 120-160 GHz receiver 1-1.5 mm receiver Varactor downconverter	25	50	25	
Other VLBI Diode and Josephson development			180 70	
Subtotal	25	170	460	
TOTAL				655

1. <u>Maser 26-40 GHz</u> - A maser covering at least 26-32 GHz and possibly up to 40 GHz is on order. This will enable full use to be made of the 140 foot improved high-frequency performance resulting from the correcting subreflector.

2. <u>Very Low Noise Receiver for the 300-Foot Telescope</u> - Dual-channel upconverter-maser system will give very low noise temperature in the frequency range 500-5000 MHz.

3. 1-1.5 mm Receiver - Development of mixers and local oscillators for the 1-1.5 mm wavelength range.

C. Other Observing Equipment: Continuing Development Items

1. <u>Very Low Noise Receiver for the 140-Foot Telescope</u> - Continue development of dual-channel upconverter-maser system which will give very low noise temperature eventually covering frequency range 8-25 GHz.

2. <u>Correcting Subreflector</u> - The 140-foot telescope will be improved for operation in the 1 to 3-cm wavelength range by the development and installation of a subreflector which is programmed to correct astigmatism.

3. <u>1024-Channel Autocorrelator</u> - The present 413-channel autocorrelator at the 140-foot telescope is one of the most heavily used instruments at NRAO. It will be replaced with a unit providing 20 percent more sensitivity (through 3-level quantization), 2.5 times more channels, and a larger bandwidth.

4. <u>Varactor Downconverter</u> - Varactor downconverter from 115 GHz to maser at 25 GHz is expected to give considerable improvement in noise temperature for millimeter observations at Tucson.

5. <u>VLBI</u> - The development of a Mark III VLBI recording terminal and the start of the development of a processor. The system will be compatible with the VLBI system being developed at Haystack.

6. <u>Diode and Josephson Junction</u> - Development work on Schottky diodes and Josephson junctions will continue. Both these developments are important for further improvements of millimeter receivers.

Item

2. Electronic Research Equipment

Items funded under this part of the program are the numerous smaller experiments and development projects. These funds are made available in

response to visitor and staff requests for minor modifications to existing observing equipment and relatively inexpensive "off-the-shelf" new items.

Item

3. Electronic Test Equipment

These funds are used to add to and update the Observatory's general bank of test equipment for use in the laboratories and also for monitoring and testing the complex observing systems on the telescopes. Included in this category are \$10k for test equipment for the VLA, to be used to maintain the operating electronics.

Millimeter-Wavelength Instrumentation

All the items listed under the 36-foot telescope are part of the Observatory's continuing effort to develop instrumentation in the millimeterwave region. The cooled-mixer radiometers now on the telescope and in construction represent a significant increase in sensitivity. For future systems, the approach using a maser as an intermediate frequency amplifier appears to be promising.

The NRAO submitted in 1975 to the National Science Foundation a proposal for the construction of a 25-meter millimeter-wave telescope which will provide the increase in sensitivity and surface accuracy required to undertake investigations in a wide range of fields including continuum emission from extragalactic sources, the physics and chemistry of the interstellar medium, and star formation. A small working group is continuing to study such aspects of the design of this telescope as the enclosure fabric, the surface panel tolerance, and the techniques that might be used to set and measure the surface.

IV. EQUIPMENT

No major equipment acquisitions are planned for 1977. The distribution of funds (in thousands of dollars) in the various equipment accounts is as follows:

Item 1.	Maintenance, Shop and Repair Equipment 25	i.0
Item 2.	Office and Library Furnishings and Equipment 10).0
Item 3.	Living Quarters Furniture	i.0
Item 4.	Building Equipment 10	0.0
Item 5.	Scientific Services and Engineering Equipment 10	1.0
	Total	.0

Item

1. Maintenance, Shop and Repair Equipment

Funds planned in this account provide for the replacement and/or acquisition of items for the shops at Green Bank, Charlottesville, and Tucson, and for the Green Bank maintenance division. Items included in this account are: tractors and mowers, replacement trucks and other vehicles, machine shop equipment, and several auxiliary items and accessories to be used with existing equipment.

2. Office and Library Furnishings and Equipment

These funds provide for replacement, updating and acquisition of typewriters, adding machines, desk calculators, desks, chairs and other office furnishings for the Green Bank, Charlottesville and Tucson sites.

3. Living Quarters Furnishings

These funds provide for replacement of household appliances and furnishings, such as beds, chairs, tables, lamps, draperies, carpets, etc., used in the residences at the sites.

4. Building Equipment

These funds provide for items that are generally attached to and become a part of the buildings. Included are such things as small air conditioners, small heating units, water heaters, etc.

5. Scientific Services and Engineering Equipment

These funds provide for small equipment additions in the darkroom, public education, and engineering divisions. Items such as cameras, film processing units, projectors, measuring equipment, etc., are included in this amount.

V. OPERATIONS AND MAINTENANCE

In addition to maintaining and operating the four major telescopes that were in use during 1976, the NRAO will begin operations during CY 1977 with the completed portion of the VLA. It is expected that the observing sessions during the early part of the year will concentrate on determining the characteristics of the instrument, while the first six antennas are being integrated into the array. Towards the end of the year ten antennas and 13 km of the track system and associated observing stations will be available, thus giving a powerful system for the study of radio stars and the mapping of extragalactic sources.

An amount of \$700k is allocated for operations with the VLA during CY 1977. Principal elements of the budget are salaries, wages, and benefits for 15 persons (\$281k), travel (\$7k), computer maintenance (\$80k), miscellaneous materials, supplies, and services (\$267k), and test equipment (\$10k). An additional \$135k is provisionally assigned as the operating share of the Common Costs. Common Costs are those general administrative and other nontechnical support costs required for both construction and operation. Such costs include accounting, purchasing, personnel services, general maintenance, administrative services, etc. These costs are distributed (charged back) to either construction or operating activities on the basis of the direct salaries and wages incurred during the year for these activities. The total Common Cost in CY 1977 is estimated to be \$826k.

The following table provides the details of the distribution of operating funds used for materials, supplies and services.

All Other Materials, Supplies and Services (in thousands of dollars)

1.	Directors Office
2.	Research Group 2.0
3.	Scientific Services
	Includes planned expenditures for library books,
	periodicals and other supplies for the Green Bank
	and Charlottesville libraries and also includes
	cost of preprints and reprints, darkroom and scien-
	tific drafting materials and supplies.
4.	Electronics Division
	Includes expenditures for general electronics and
	laboratory supplies at Green Bank, Charlottesville
•	and Tucson, including receivers and electronics
	equipment maintenance, materials and supplies,
	e.g., helium, wire, tubes, resistors, small tools,
	special parts, etc., and radio noise control and
	suppression costs.
5.	Computer Division
	Includes cost of tapes, cards, paper, maintenance
	agreement: outside programming assistance for the
	computer division.
6.	Engineering Division.
•••	Includes cost of engineering and drafting supplies.
	small A/F studies and telescope improvement studies
	smart tyre sociates and berescope improvements sociates.

	7.	Tucson Operations Division Includes reimbursement to KPNO for services, general maintenance of telescopes, building rental and of- fice upkeep, vehicle rental and supplies, postage, telephone etc	185.0	
	8.	Fiscal Division Includes cost of audit service, tax assistance, general office supplies, e.g., blank checks, records, cards, tapes, paper, etc.	27.0	
	9.	Business Management Division (CV) All Charlottesville general office supplies, freight (in and out), Xerox rental, office machine service agreements, GSA auto rental, legal services, outside printing, personnel recruitment, etc.	105.0	
	10.	Telescope Operations Division (GB) Includes costs of maintaining the telescopes, e.g., painting, cryogenics, oil, grease, spare parts, special cabling and wiring, etc.	100.0	
	11.	Plant Maintenance (GB) Includes cost of maintaining the Green Bank physical plant, e.g., electrical, water and sewer systems, materials, and supplies for the auto shop, paint shop and carpentry shop and general equipment main-	160.0	
		tenance. Costs of maintaining the buildings, houses, control buildings, grounds, roads and airstrip. Also includes cost of materials and supplies for safety and security and cost upkeep of the ambulance and fire-fighting equipment.		
1	12.	Central Shops Includes costs of general machine shop supplies, metals, welding materials, etc.	25.0	
· · ·	13.	Administrative Services (GB) Includes cost of operating the cafeteria and resi- dence hall, e.g., food for resale and other cafeteria supplies, linen and laundry service, freight and express (in and out), office machine service agreements, Xerox rental, GSA vehicle rental, purchasing office supplies, warehouse supplies (not stock items), darkroom and printing supplies, office supplies, etc., all for Green Bank.	110.0	
	14.	VLA Operations—Materials, Supplies & Services Includes computer maintenance, supplies for the operations groups in electronics, computer and array operations, tapes, cards; also included is \$117k for spare parts and motors for the antennas and replacement components for the electronics.	267.0	
1	15.	VLA OperationsCommon Costs	135.0	

VI. CONSTRUCTION

The construction of the Very Large Array (VLA) will continue in 1977 with new funds in the amount of \$12,500,000. A detailed description of this program will be found in the VLA Project Plan submitted separately.

VII. PERSONNEL ·

A. Personnel Services and Benefits (Level = Full-Time at December 31)

	<u></u>					· · · · · · · · · · · · · · · · · · ·
Patrician	l ovol	1976 Salarias	Ponofito	Level	1977 Solonios	Ponofita
category	LEVEI	Salaries	Denetitus	Level	Jaiaries	Denerrus
<u>Operations</u>	·					
Scientific & Engineering	63	1,317,000	268,900	73	1,508,100	316,500
Technical	72	1,017,000	207,700	83	1,259,100	264,400
Administrative & Clerical	58	1,009,200	206,100	58	1,100,00Q	230,400
Operations & Maintenance	51	553,300	113,000	52	613,800	128,700
Total Operations	244	3,896,500	795,700	266	4,481,000	940,000
VLA Common Cost	0	0	. 0.	29	345,300	74,000
VLA Construction	111	1,421,000	300,000	77	1,185,100	253,600
Total Personnel	355	5,317,500	1,095,700	372	6,011,400	1,267,600

B. Personnel Levels at December 31, 1977

	Green Bank	Charlotte	sville	Tucson	New Mexic	co Total
Operations						
Scientific & Engineering	23	35	•	6	9	73
Technical	43	18		13	9	83
Administrative & Clerical	. 30	24		4	-	58
Operations & Maintenance	50 ·	. 2	•		· _	52
TotalOperations	146	79		23	18	266
· ·						
VLA Common Cost		· ·			•	
Scientific & Engineering	۰ <u>ــــــــــــــــــــــــــــــــــــ</u>	-		-	1	1
Technical	-	· –		-	-	-
Administrative & Clerical	_			-	16	16
Operations & Maintenance	-	-		-	12	12
TotalCommon Cost		-		-	29	29
VLA Construction						
Scientific & Engineering		1		-	29	30
Technical	-	6		-	37	43
Administrative & Clerical	-	1		· –	3	4
Operations & Maintenance		-	:	. - .	- .	-
TotalConstruction		8		-	69	77
Total Personnel	146	87		23	116	372

APPENDIX B

NRAO PERMANENT SCIENTIFIC STAFF WITH MAJOR SCIENTIFIC INTERESTS (December 1, 1976)

Brown, R. L.	Theoretical Astrophysics; Interstellar Medium
Burton, W. B.	Neutral Hydrogen; CO; Galactic Structure
Clark, B. G.	VLA Development; VLB; Interferometry
De Young, D. S.	Theories of Extragalactic Radio Sources; High Energy Astrophysics
Findlay, J. W.	Absolute Flux Density Measurements; Telescope Design
Fomalont, E. B.	Interferometry; Extragalactic Radio Sources; Relativity Tests
Gordon, M. A.	CO; Galactic Structure
Hjellming, R. M.	VLA Development; Radio Stars
Jones, T. W.	Theoretical Astrophysics; Nonthermal Sources; Galactic Nuclei
Kellermann, K. I.	Spectra and Structure of Extragalactic Sources; VLB
Leung, C. M.	Radiative Transfer in the Interstellar Medium
Liszt, H. S.	Molecular Lines; Galactic Structure
Owen, F. N.	Continuum Emission and Radio Spectra of Galaxies and Clusters
Roberts, M. S.	Extragalactic Research
Rudnick, L.	Extragalactic Radio Sources; Cosmology
Shaffer, D. B.	VLB; Extragalactic Radio Sources
Turner, B. E.	Molecular Lines; OH
von Hoerner, S.	Cosmology; Star Clusters; Antenna Design
Wade, C. M.	Astrometry; Interferometry; VLA Development

VIII. PRELIMINARY FINANCIAL PLAN - 1977 (in thousands of dollars)

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		(a) Actual Exp. 1976	(b) Comm.Carried to 1977	(c) Uncomm. Funds Carried to • 1977	(d) New Funds 1977	(e) Exp.& Comm. (b,c,d) 1977
I. S	CIENTIFIC RESEARCH					
Α.	<u>Operations</u>					
	Personnel Comp. Personnel Benefits TravelDomestic TravelForeign Comm. & Utilities Computer Rental Bldg. Rent & Maint. Mgmt. Fee	3896.5 795.7 242.7 15.0 267.4 459.8 128.0 145.0	· · ·		4481.0 940.0 250.0 22.0 290.0 475.0 135.0 165.0	4481.0 940.0 250.0 22.0 290.0 475.0 135.0 165.0
•	& Serv. Misc. Revenue	1300.3 <110.9>	209.0		1627.0 <110.0>	1836.0 <110.0>
	Subtotal	7139.5	209.0	-0-	8275.0	8484.0
В.	Equipment		•			
	Research Equipment Operating Equipment	684.7 57.7	357.0 10.0	228.0 10.0	675.0 50.0	1260.0 70.0
	Subto ta l	742.4	367.0	238.0	725.0	1330.0
Tot	alScientific Research	7881.9	576.0	238.0	9000.0	9814.0
II. C	CONSTRUCTION	· · ·		<u></u>		
· O	Yery Large Array Other	16528.3 90.0	8855.2	<5923.0> -	12500.0	15432.2
Tot	alConstruction	16618.3	8855.2	<5923.0>	12500.0	15432.2
Total		24500.2	9431.2	<5685.0>	21500.0	25246.2

* \$7.0M of the CY 1977 VLA funds were made available in CY 1976, and commitments were made against these funds.

Note: This is a preliminary plan based on estimated 1976 figures. The final Financial Plan, reflecting actual year-end figures, will be submitted early in 1977.



APPENDIX D

NRAO COMMITTEES

Visiting Committee

This Committee is appointed by the AUI Board of Trustees and formally reports to the AUI Board on an annual basis. Its function is to review the performance of the Observatory and advise the Trustees on how well it is carrying out its function as a national center, the quality of the scientific work, and the adequacy of its instrumentation and facilities.

The current membership of the Committee is:

E. J. Blum	Meudon Observatory
R. D. Ekers	Kapteyn Laboratory, Groningen
W. A. Fowler	California Institute of Technology
C. Heiles	University of California, Berkeley
F. J. Kerr	University of Maryland
V. C. Rubin	Department of Terrestrial Magnetism
E. E. Salpeter	Cornell University
R. W. Wilson	Bell Laboratories

NRAO Users' Committee

This Committee consists of users, and potential users, of NRAO facilities from throughout the scientific community. It advises the Director and Observatory staff on all aspects of Observatory activities that affect the users of the telescopes--development of radiometers and auxiliary instrumentation, operation of the telescopes, the computer and other support facilities, and major new instruments. This Committee is appointed by the NRAO Director and meets twice a year.

The present membership of this Committee is:

Β.	Balic	:k	University of Washington
Α.	H. Ba	irrett	Massachusetts Institute of Technology
J.	J. Br	roderick	Virginia Polytechnic Institute & State University
Β.	F. Bu	irke	Massachusetts Institute of Technology
F.	0. C1	ark	University of Kentucky
Τ.	A. C1	ark	Goddard Space Flight Center
J.	J. Co	ondon	Virginia Polytechnic Institute & State University
Μ.	M. Da	ivis	Arecibo Observatory
W.	A. De	ent	University of Massachusetts

J. R. Dickel University of Illinois Observatory J. N. Douglas University of Texas, Austin F. D. Drake Cornell University W. C. Erickson University of Maryland University of Virginia S. J. Goldstein C. Heiles University of California, Berkeley D. R. Johnson National Bureau of Standards F. J. Kerr University of Maryland California Institute of Technology G. R. Knapp H. C. Ko Ohio State University University of Maryland M. R. Kundu A. E. Lilley Harvard College Observatory C. H. Mayer Naval Research Laboratory University of Chicago P. Palmer University of California, Los Angeles K. W. Riegel A. G. Smith University of Florida L. E. Snyder University of Illinois Observatory P. Solomon State University of New York, Stony Brook G. W. Swenson University of Illinois University of Massachusetts J. H. Taylor P. Thaddeus Institute for Space Studies G. L. Verschuur University of Colorado J.F.C. Wardle Brandeis University University of Colorado J. W. Warwick G. Westerhout University of Maryland D.R.W. Williams University of California, Berkeley R. W. Wilson Bell Telephone Laboratories W. J. Wilson University of Texas, Austin B. Zuckerman University of Virginia

VLA Advisory Committee

The VLA Advisory Committee will periodically review the status and progress of the VLA. Its particular concern is with the broad elements of the Project, and especially those that directly influence the scientific capabilities and performance characteristics of the array. It will advise on broad aspects of design, scientific emphasis, and priorities, as well as on general progress, to assist the Director and the Project staff in assuring that the scientific and technical specifications are met and that the VLA will be as responsive to the needs of radio astronomy as is possible.

When scientific observing commences, this group may also advise on the observing programs to be carried out.

The Committee is appointed by the NRAO Director. It is composed of scientists whose interest encompass all areas of radio astronomy and

22 -

technology of concern to the VLA. An attempt is also to maintain, in the membership, reasonable geographic distribution and representation of the major radio astronomy centers. The Committee generally meets two or three times a year, depending on the nature of current Project activities and their rate of progress.

The current membership of the Committee is:

B. F. Burke	Massachusetts Institute of Technology
J. N. Douglas	University of Texas, Austin
F. D. Drake	Cornell University
R. D. Ekers	Kapteyn Laboratories, Groningen
C. Heiles	University of California, Berkeley
M. R. Kundu	University of Maryland
A. T. Moffet	California Institute of Technology
A.E.E. Rogers	Haystack Observatory
G. W. Swenson	University of Illinois

VLA Steering Committee

The Steering Committee is the principal technical review committee for the Project. Its principal function is to continuously review technical designs, construction plans, etc., to assure that they are consistent with overall performance goals and that staff or contractor technical decisions do not unknowingly affect the system's performance. In addition, the Committee advises on technical matters such as systems design, components design and selection, etc.

The Committee is appointed by the Director. It is composed principally of NRAO scientists and engineers who are thoroughly familiar, both with the scientific requirements and uses of the VLA and with the techniques and instrumentation employed in the VLA.

The current membership of the Committee is:

- W. R. Burns
- R. L. Brown
- B. G. Clark
- L. R. D'Addario
- E. B. Fomalont
- E. W. Greisen
- D. S. Heeschen
- V. Herrero
- R. M. Hjellming

- D. E. Hogg
- H. Hvatum
- J. H. Lancaster
- F. N. Owen
- P. J. Napier
- L. Rudnick
- A. R. Thompson
- N. Vandenberg
- C. M. Wade

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- L. Rudnick
- A. R. Thompson N. Vandenberg
 - C. M. Wade

					•
	Green Bank	Charlottesville	Tucson	New Mexico	Total
Operations					
Scientific & Engineering	23	35	6	9	73
Technical	43	18	13	9	83
Administrative & Clerical	30	24	4	-	58
Operations & Maintenance	50	2	-	-	52
TotalOperations	146	79	23	18	266
VLA Common Cost					
Scientific & Engineering	-	-	-	1	1
Technical	-	-		-	_
Administrative & Clerical	-	-	-	16	16
Operations & Maintenance	-	-	-	12	12
TotalCommon Cost	-			29	29
VLA Construction					
Scientific & Engineering	-] :	· -	29	30
Technical	-	6	-	37	43
Administrative & Clerical	-	1	-	3	4
Operations & Maintenance	-	-	-	-	. –
TotalConstruction		8	-	69	77
Total Personnel	146	87	23	116	372

	1976			1977		
Category	Level	Salaries	Benefits	Level	Salaries	Benefits
<u>Operations</u>						
Scientific & Engineering	63	1,317,000	268,900	73	1,508,100	316,500
Technical	72	1,017,000	207,700	83	1,259,100	264,400
Administrative & Clerical	58	1,009,200	206,100	58	1,100,000	230,400
Operations & Maintenance	51	553,300	113,000	52	613,800	128,700
Total Operations	244	3,896,500	795,700	266	4,481,000	940,000
VLA Common Cost	0	0	0	29	345,300	74,000
VLA Construction	111	1,421,000	300,000	77	1,185,100	253,600
Total Personnel	355	5,317,500	1,095,700	372	6,011,400	1,267,600

	(a) Actual Exp. 1976	(b) Comm.Carried to 1977	(c) Uncomm. Funds Carried to 1977	(d) New Funds 1977	(e) Exp.& Comm. (b,c,d) 1977	
I. SCIENTIRIC RESEARCH						
A. Operations						
Personnel Comp. Personnel Benefits TravelDomestic TravelForeign Comm. & Utilities Computer Rental Bldg. Rent & Maint. Mgmt. Fee Other Mat., Supp. & Serv. Misc. Revenue	3896.5 795.7 242.7 15.0 267.4 459.8 128.0 145.0 1300.3 <110.9>	209.0		4481.0 940.0 250.0 22.0 290.0 475.0 135.0 165.0 1627.0 <110.0>	4481.0 940.0 250.0 22.0 290.0 475.0 135.0 165.0 1836.0 <110.0>	
Subtotal	7139.5	209.0	-0-	8275.0	8484.0	
B. <u>Equipment</u>						
Research Equipment Operating Equipment	684.7 57.7	357.0 10.0	228.0 10.0	675.0 50.0	1260.0 70.0	
Subto ta 1	742.4	367.0	238.0	725.0	1330.0	· · ·
TotalScientific Research	7881.9	576.0	238.0	9000.0	9814.0	
II. CONSTRUCTION						
Very Large Array Other	16528.3 90.0	8855.2	<5923.0> -	12500.0	15432.2	
TotalConstruction	16618.3	8855.2	<5923.0>	12500.0	15432.2	
Total	24500.2	9431.2	<5685.0>	21500.0	25246.2	

* \$7.0M of the CY 1977 VLA funds were made available in CY 1976, and commitments were made against these funds.

Note: This is a preliminary plan based on estimated 1976 figures. The final Financial Plan, reflecting actual year-end figures, will be submitted early in 1977.