

MARCH 1978

NATIONAL RADIO ASTRONOMY OBSERVATORY

MARCH PROGRESS REPORT

VLA PROGRAM

April 12, 1978

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

MARCH 1978

SYSTEMS INTEGRATION DIVISION

The following astronomical observing programs were scheduled this month:

<u>Name</u>	<u>Affiliation</u>	<u>Program Code</u>	<u>Program Short Title</u>
MARCH 2-6			
L. D'Addario W. Graf K. Price	NRAO (VLA) Stanford University Stanford University	AD-3	Spectrum of 3C11, all bands.
P. Kronberg	U. of Toronto	AK-3	2 & 6 cm maps of 3C303.
P. Kronberg P. Biermann	U. of Toronto U. of Bonn	AK-4	Maps of 6 cm, and if possible, 2 and 20 cm maps of M82 and NGC2146.
MARCH 13-20			
C. Bignell P. Napier N. Vandenberg	NRAO (VLA) NRAO (VLA) NASA-Goddard	AB-8	Polarization measurements of variable radio sources.
B. Balick T. Heckman W. Sullivan	U. of Washington U. of Washington U. of Washington	AB-4	Survey of the nuclei of nearby normal galaxies - 21 cm observations.
D. Gibson R. Hobbs	NMIMT NASA-Goddard	AG-13	Detection, spectrum and position of comet Bradfield (1978c).
MARCH 27-29			
E. Fomalont A. Bridle	NRAO (GB) Queen's University	AF-3	20 and 6 cm maps of 3C319.
P. Gregory R. Taylor	U. of B. C. U. of B. C.	AG-9	A highly variable radio star, position and spectrum.
E. Fomalont G. Miley	NRAO (GB) U. of C, Santa Cruz	AF-5	Preliminary 6 and 20 cm maps of 3C318.1.

MARCH 30-31

C. Bignell	NRAO (VLA)	AB-9	3C273.
P. Gregory	U. of B. C.	AG-9	A highly variable radio star,
R. Taylor	U. of B. C.		position and spectrum.
K. Lang	Tufts University	AL-4	Solar observations.

The array was scheduled for 320 hours of tests and observations (43% of the time). The downtime average for the month was 26%. Antenna No. 11 was declared operational on March 27. Antenna No. 3 was moved to station DE1 on March 23.

ELECTRONICS DIVISION

First fringes were obtained on Antenna No. 12 on March 27, 1978. In the Front-end area, construction of front-end 13 is complete awaiting installation on the antenna in early April. The coaxial switch inside the Dewar continues to be a reliability problem and investigations have begun into the possibility of replacing this mechanical switch with a PIN-diode switch.

In the Cryogenics area the NRAO Cryogenics Specialist, Howard Brown, visited the VLA Site on March 14-17 to review the status of the VLA cryogenic systems. His chief recommendations were as follows: extend and improve the working area available for cryogenics, use an improved method of helium pipe installation on the antennas, phase out the Air Products systems and replace them with CTI systems. These recommendations are beginning to be acted on.

In the L.O.-IF area, further laboratory testing was carried out on the new front-end IF system (modules F7, F8, F4). Successful tests included measurements of temperature stability on the F8 module and measurements of bandshape, ripple and signal level in all modules.

The current retrofit program has now been completed on all antennas except 2, 4, and 6. The program of detailed adjustment and measurement which follows the retrofit has been completed on Antenna Nos. 10 and 11. Five final version K-Ku L.O. (F3) modules received from Charlottesville should improve reliability for 1 and 2 cm observations.

The waveguide buried on the North Arm was retested. The high loss measured previously was verified. However, the total length of this run is sufficiently small so that the total increased loss is only 0.5 dB. Also, no evidence of unusual TE mode generation was found. In view of this, it was decided that the waveguide can be used as it is. The first of the final design couplers has been received from the manufacturer. The machining was very satisfactory and RF tests are proceeding to allow placing an order for the whole array in April.

In the Monitor and Control area the newly retrofitted Antenna and Central Buffers (modules M3 and M4) are performing very reliably. Construction of a special bench test set for exhaustively testing Data Set modules is under way.

Detailed examination of the schedule for the new digital correlator system shows that it will probably not be ready for first continuum observations until the middle of July 1978, although testing should begin earlier than this. Construction of the first part of the new correlator system (one half of the requirements for the whole array) is now 50% complete. The microprocessor that controls the Delay and Multiplier system has been powered up and partially tested.

COMPUTER DIVISION

Work is continuing on the software interface between the DEC-10 computer and the PDP-11 minicomputers. The PDP-11 Disk save-compress/restore utilities now work with a tape drive on the DEC-10 computer. Disk-to-disk transfers are now supported, so that early in April we can start work on actual map-making. To this end, we have installed the latest release of the array processor software in the 11/70.

After a hiatus work has resumed on program design for the map display system. There is currently only design activity, with no programs to show for it, except a couple of special routines to try out ideas.

The overflow problems associated with export tapes are now believed to be under control.

A major data access routine modification has been designed and is being installed to allow modification of data bases while they are still being extended.

Modifications and improvements are under way in the polarization calibration system.

The Modcomp "Repair" system will be shipped early in April. This is a CPU and set of peripherals which can be substituted into any slot in the system in case of failure.

The spectral line sorting system study group has nearly completed deliberations, and will produce a final report early in April containing the configuration we wish to implement. At this point procurement of this subsystem can begin.

We have started looking at film output devices for map output; we expect to purchase such a device this spring.

ANTENNA DIVISION

Progress during the month of March consisted of the following:

Antenna No. 14

Moved to maintenance foundation on March 2, and mechanical outfitting was started. At end of month outfitting was approximately 70% complete.

Antenna Nos. 15 & 16

Awaiting mechanical and electronic outfitting.

Antenna No. 17

Panel alignment was completed on March 9, 1978 with a measured rms at 0.0115 inches. The antenna was moved on March 17 to the Masterpad for final alignment and servo installation and checkout. Servo installation and checkout was completed on March 28, 1978. Natural frequency tests revealed a 2.3 Hz natural frequency in the elevation mode and 2.5 Hz in azimuth mode. At end of month only minor correction and touch-up painting remained prior to acceptance.

Antenna No. 18

Some delay experienced in receipt of structural material from fabricator. At end of month central hub of reflector assembled. Balance of structure in process of sandblasting and painting at fabrication plant with receipt scheduled for first and second week of April.

SITE & WYE DIVISION

Waveguide Installation

Installed 20 mm waveguide from the manholes to the antenna foundation at seven antenna stations on the east arm. Installed two intermediate manholes between AW6 and AW7. Trenched approximately 7,000 feet and completely installed and backfilled approximately 2,600 feet of 60 mm waveguide between AW6 and the first intermediate manhole. Installed approximately 1,000 feet of waveguide to line and grade between first and second intermediate manhole, also shaded approximately 600 feet.

Visiting Scientist Quarters and Library Office Building

Work is proceeding well on the buildings being prefabricated in Albuquerque. Contracts covering the foundation work for both buildings were awarded March 31, 1978.

PROJECT MANAGEMENT

Personnel

The personnel changes as of March 31, 1978 are as follows:

<u>Division</u>	<u>Forecast Level</u> <u>12/1978</u>	<u>Previous</u> <u>Level</u>	<u>Additions</u>	<u>Reductions</u>	<u>Present</u> <u>Level</u>
Site and Wye	9	7	2	1	8
Antenna	15	14	0	0	14
Electronics	49	48	0	1	47*
Computer	15	14	0	0	14
Systems Integration	8	7	0	0	7
Project Management	<u>26</u>	<u>25</u>	<u>1</u>	<u>1</u>	<u>25**</u>
Total	122	115	3	3	115

* Does not include one part-time person

** Does not include three part-time people

GENERAL

Davis-Bacon Wage Matter

The Special VLA Project Wage Determination was issued by the Department of Labor on March 10, 1978. Wages used were those paid during the Phase III VLA construction work, well below the Heavy Engineering Wage rates which the Department had instructed us to pay on October 29, 1976. Design has been completed on the revised and enlarged Phase IV, estimated to cost \$3,000,000, which will be issued for bid on April 3rd.

Archaeological Site

Work is proceeding on excavation. Within the general site the archeologists have found three specific areas of interest one of which is believed to be of Folsom culture which might date back 10,000 years. The other two are of the later Cochise culture, 4-6000 years old. The excavation of the older site will take place sometime in early May.

3/31/78

VLA PROGRAM
MAJOR SUBCONTRACTS AND PURCHASE ORDERS PLACED

<u>NUMBER P.O. SUBCONTRACT</u>	<u>VENDOR</u>	<u>ITEM DESCRIPTION</u>	<u>DATE PLACED</u>	<u>DOLLAR AMOUNT</u>	<u>DELIVERY DATE</u>	<u>CURRENT STATUS - ALL FIRM FIXED PRICE CONTRACTS EXCEPT WHERE NOTED</u>
VLA-5	BWH/CVA Joint Venture	E/A Title I and II	6/11/73	\$ 1,039,064		Title I - Completed Title II - Completed Title III - Completed Title IV - IFB VLA-313 issued 4/03/78.
VLA-6	E-Systems, Inc.	28 Radio Telescopes	10/18/73	\$ 21,256,850		Amendment #21 approved by NSF in amount of \$3,125,083
VLA-29	Sterling-Detroit	Focusing Feed Mounts for Antennas 17 thru 22	6/17/74	\$ 734,760		Delivery in progress.
VLA-53 Amend. #4	R. F. Systems, Inc.	Ku & K Band Feed Horns	2/16/78	\$ 57,636	4/30/78	Delivery in progress.
VLA-70 P.O. 52322, C.O. #5	Sumitomo Electric USA, Inc.	3000 pieces of wave-guide - 3000 each coupling sleeves	1/27/75	\$ 2,885,126		C.O. #5 approved by NSF on 11/1/77.
VLA-179 P.O. S-01046	AIL Division of Cutler-Hammer	Parametric Amplifiers	4/29/76	\$ 134,920		Delivery in progress.
VLA-233 P.O. S-02611	Silicon Systems, Inc.	Custom Integrated Circuits	12/12/76	\$ 206,375	7/15/78	Delivery will be completed on 7/15/78.
P.O. S-02998	AIL Division of Cutler Hammer	Upconverters	12/15/76	\$ 62,623	2/28/78	Five pieces have been received; six are on back order. Delivery will be completed by 2/28/78.
VLA-220 P.O. S-02243 Amend. #2	J. J. Gustincic	C-Band Feed Horns	1/25/78	\$ 41,050	4/30/78	Exercised option.
VLA-234	E-Systems, Inc.	Design Review of Transporter	2/17/77	\$ 37,253	6/30/77	Subcontractor began design review on 3/25/77. Work is approximately 98% complete.

VLA PROGRAM
MAJOR SUBCONTRACTS AND PURCHASE ORDERS PLACED

NUMBER P.O. SUBCONTRACT	VENDOR	ITEM DESCRIPTION	DATE PLACED	DOLLAR AMOUNT	DELIVERY DATE	CURRENT STATUS - ALL FIRM FIXED PRICE CONTRACTS EXCEPT WHERE NOTED
VLA-254 P.O. S-03651 Amend. #1	J. J. Gustincic	L-Band Feed Horns	2/16/78	\$ 58,600	4/30/78	On Schedule.
VLA-256	New Mexico State University	Archaeological Excavation	9/20/77	\$ 107,000	2/20/79 Completion	Work started 2/20/78.
VLA-258	Midstate Cartage Co.	Labor-Hour Subcontract	3/28/77	\$ 195,000	3/27/78	Approximately \$150,246 was spent effective 3/31/78.
VLA-304 P.O. S-05823	Altura, Inc.	Prefab Motel & Office Bldg.	1/16/78	\$ 92,000	3/31/78	Contractor progressing satisfactorily.
P.O. S-04382	Industrial Design Engr. Assoc.	Temporary Draftsman		\$ 13,950	4/28/78	Approximately \$10,820 spent effective 3/31/78.
P.O. S-04400	New Mexico Institute of Mining and Tech.	Labor-Hour Contract		\$ 10,000	5/31/78	Approximately \$3,240 spent effective 3/31/78.
P.O. S-04738	AIL Division Cutler-Hammer	Parametric Amplifiers	10/14/77	\$ 102,900	5/03/78	Delivery to start 5/1/78; to be completed 10/15/78.
P.O. S-04886	AIL Division Cutler-Hammer	Parametric Upconverters	9/23/77	\$ 79,702	7/15/78	Order has been accepted by AIL and work is in progress and on schedule.
P.O. S-05002	Modular Computer Systems	Back up Synchronous Computer System	10/17/77	\$ 95,383.20		Delivery is on schedule.
VLA-277 P.O. S-05376 Amend. #2	Wheeler Construction Co.	Crushed Stone		\$ 559,320	6/30/78	Delivery is on schedule.
VLA-283 P.O. S-05136	Fujikura Cable Works Ltd.	20 mm Waveguide		\$ 168,756	4/30/78	Order placed 11/4/77.

VLA PROGRAM
MAJOR SUBCONTRACTS AND PURCHASE ORDERS PLACED

<u>NUMBER P.O. SUBCONTRACT</u>	<u>VENDOR</u>	<u>ITEM DESCRIPTION</u>	<u>DATE PLACED</u>	<u>DOLLAR AMOUNT</u>	<u>DELIVERY DATE</u>	<u>CURRENT STATUS - ALL FIRM FIXED PRICE CONTRACTS EXCEPT WHERE NOTED</u>
P.O. S-05428	Digital Equipment Corporation	Equipment to Expand Graphics Display Systems	11/15/77	\$ 61,953	5/15/78	Delivery scheduled for completion on 5/15/78.
P.O. S-05841	DEC	Computer Maintenance	1/30/78	\$ 82,630	Cy '78	NSF approved 1/27/78. Monthly expenditure rate estimated at \$6,885.
VLA-295 P.O. S-05746	Spacekom, Inc.	Channel 2 thru 8 Mixers w/spare Diodes	1/10/78	\$ 55,200	4/15/78	NSF approved 12/30/77.
P.O. S-05708	Dennis Engineering	Temporary Services	12/30/77	\$ 8,951	6/30/78	NSF approved 1/16/78.
VLA-305 P.O. S-06435	Systron-Donner	VCO	3/8/78	\$ 9,850		Delivery on schedule.
VLA-307 P.O. S-06288	Duboc, Lane & Monckton, Inc.	Tool Room Lathe & Accessories	2/13/78	\$ 13,093	10/02/78	P.O. placed on 2/13/78.
VLA-310 P.O. S-06084	Structures, Inc.	Walkways & Platforms	2/08/78	\$ 13,895	Completed by 4/28/78	Delivery scheduled for completion by 4/28/78.
P.O. S-06024	Missouri Research Labs.	Labor-Hour Electronic Technicians	2/13/78	\$ 15,500	Completed by 4/30/78	NSF approved on 2/09/78 (approval received 2/13/78)
VLA-306 P.O. S-06053	Noor Mfg. Co.	Subreflector Supports	1/31/78	\$ 14,400	Completed by 9/01/78	Delivery starts 6/1/78; ends 9/01/78.
VLA-316	Midstate Cartage	Labor-hour	3/28/78	\$ 150,000	Completed by 3/27/79	NSF approved 3/22/78.
VLA-318	J & D Masonry	Masonry work	3/31/78	\$ 5,960	5/31/78	Construction - NSF notified of Award 3/31/78.
VLA-318-1	Seegee Engr.	Concrete work	3/31/78	\$ 4,393	4/14/78	Construction - NSF notified of Award 3/31/78.
P.O. S-06403	Hefner Brothers	R. R. Cross ties	3/02/78	\$ 104,000	5/31/78	Delivery on schedule.

VLA PROGRAM

PROCUREMENT ACTIVITIES INITIATED

<u>RFP NUMBER</u>	<u>ITEM DESCRIPTION</u>	<u>ESTIMATED COST</u>	<u>ISSUE DATE</u>	<u>BID DUE DATE</u>	<u>SUBMISSION TO NSF DATE</u>	<u>AWARD DATE</u>	<u>CURRENT STATUS</u>
VLA-5	Amendment No. 11 for Inspection Site Construction	\$ 49,086	----	-----	10/28/76	-----	Amendment No. 11 issued.
VLA-252 P.O. S-04741 Amend. #1	Cryogenic Refrig. System	\$ 16,490	-----	-----	1/27/78	3/07/78	NSF approved 2/22/78.
VLA-309	Rail Take up, Breckenridge	\$ 33,250	1/21/78	3/31/78	-----	4/06/78	Two proposals received; being evaluated.
VLA-317	Garage & Bus Shed	\$ 17,000	3/02/78	3/21/78	4/07/78	4/21/78	Proposals received & negotiations are continuing with the two (2) low bidders.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VERY LARGE ARRAY

STATUS AS OF MAR. 31, 1978

CY - 1978

<u>PROJECT NUMBER</u>	<u>DESCRIPTION</u>	<u>ALLOCATION</u>	<u>EXPENDED MONTHLY</u>	<u>TOTAL EXPENDED</u>	<u>TRANSFER TO FIXED ASSETS</u>	<u>BALANCE CONSTRUCT. IN PROGRESS</u>	<u>TOTAL COMMITTED</u>	<u>TOTAL EXPENDED & COMMITTED</u>	<u>NET BALANCE</u>
11000	SITE AND WYE	4,893,000	41,515	95,758	4,804	90,954	979,436	1,075,194	3,817,806
12000	ANTENNA	3,728,600	283,073	379,649	---	379,649	3,142,669	3,522,318	206,282
13000	ELECTRONICS	3,097,500	177,740	444,843	11,126	433,717	1,008,898	1,453,741	1,643,759
14000	COMPUTER	1,151,400	10,800	32,443	---	32,443	8,700	41,143	1,110,257
16000	SYSTEMS INTEGRATION	25,300	1,405	3,807	---	3,807	213	4,020	21,280
17000	PROGRAM MANAGEMENT	122,200	7,589	23,764	147	23,617	701	24,465	97,735
18000	COMMON COST	596,830	45,493	115,805	---	115,805	16,834	132,639	464,191
19000	CONTINGENCY	643,114	---	---	---	---	---	---	643,114
		<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	TOTAL PROGRAM	14,257,944	567,615	1,096,069	16,077	1,079,992	5,157,451	6,253,520	8,004,424
		<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

Note: Project allocation consists of \$12,500,000 in new funding plus \$1,757,944 in prior year funds re-allocated in CY - 1978.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VERY LARGE ARRAY

STATUS AS OF MAR. 31, 1978

TOTAL PROGRAM

<u>PROJECT NUMBER</u>	<u>DESCRIPTION</u>	<u>ALLOCATION</u>	<u>EXPENDED MONTHLY</u>	<u>TOTAL EXPENDED</u>	<u>TRANSFER TO FIXED ASSETS</u>	<u>BALANCE CONSTRUCT. IN PROGRESS</u>	<u>TOTAL COMMITTED</u>	<u>TOTAL EXPENDED & COMMITTED</u>	<u>NET BALANCE</u>
11000	SITE AND WYE	18,895,275	47,754	12,966,054	7,342,894	5,623,160	2,090,131	15,056,185	3,839,090
12000	ANTENNA	21,057,378	523,175	17,694,990	10,247,506	7,447,484	3,156,036	20,851,026	206,352
13000	ELECTRONICS	13,491,933	208,244	10,722,517	3,232,154	7,490,363	1,103,403	11,825,920	1,666,013
14000	COMPUTER	4,333,926	10,820	3,034,375	1,374,200	1,660,175	186,349	3,220,724	1,113,202
16000	SYSTEMS INTEGRATION	204,685	1,405	183,040	138,639	44,401	368	183,408	21,277
17000	PROGRAM MANAGEMENT	1,804,309	7,589	1,700,968	1,567,079	133,889	5,605	1,706,573	97,736
18000	COMMON COST	1,240,524	45,493	759,499	---	759,499	16,834	776,333	464,191
19000	CONTINGENCY/RESERVE	643,114	---	---	---	---	---	---	643,114
	TOTAL PROGRAM	61,671,144	844,480	47,061,443	23,902,472	23,158,971	6,558,726	53,620,169	8,050,975

Notes: Project allocation does not include the following amounts which were withheld by the NSF: 1) \$293,000 for the Army Corp. of Eng.; 2) \$15,700 for the ECAC Study; 3) \$15,111 for the NSF Ad Hoc Advisory Panel. Project allocation includes \$20,000 withheld by the NSF on Amendment No. 30.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA PROGRAM

FINANCIAL STATUS REPORT (in thousands)

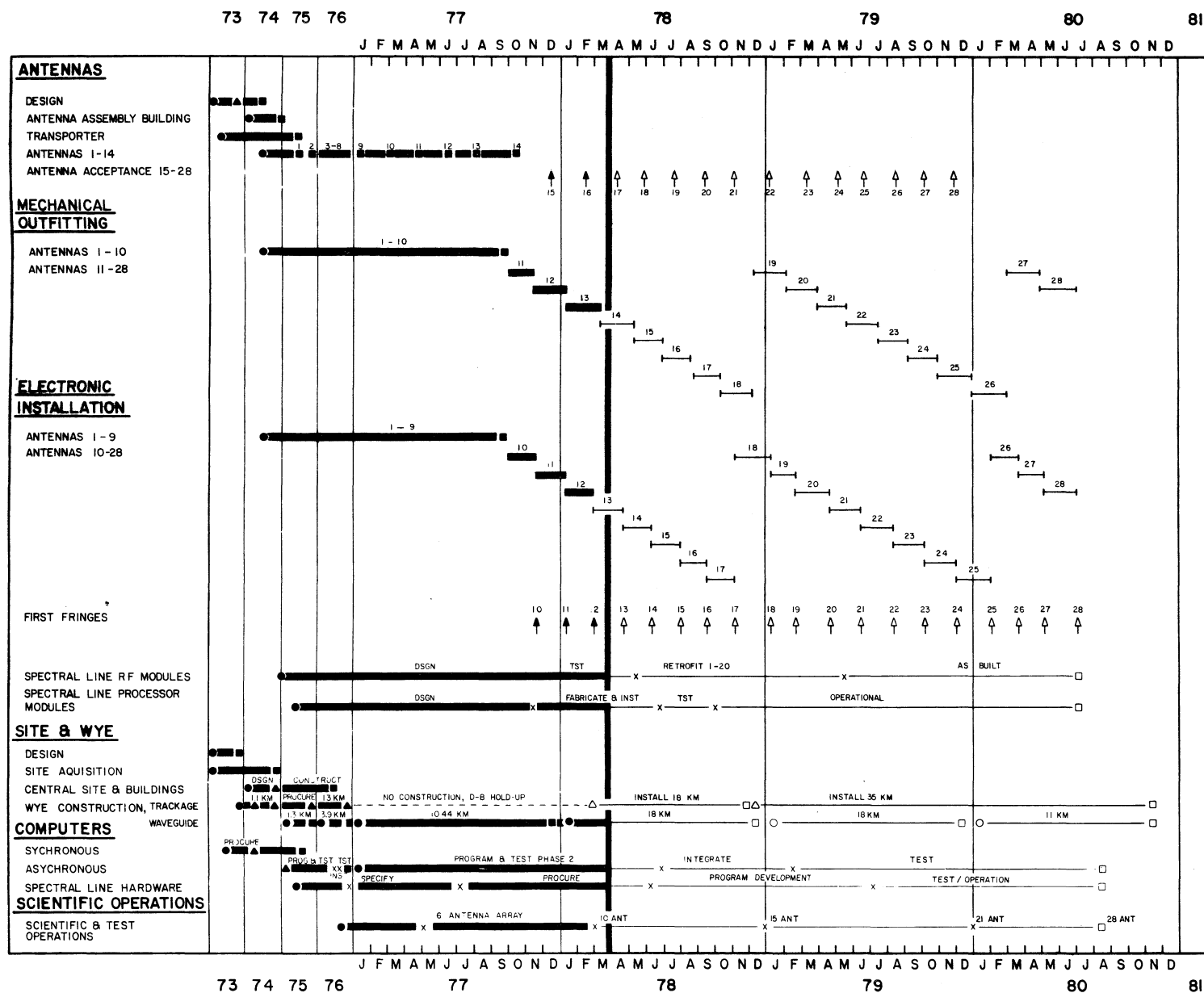
As of: March 31, 1978

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Item	(A) Program Ceiling	Allocation to Date			Un- allocated Balance	Outlook			Notes
		Allocated	Expended and Committed	Allocated Balance		Estimate to Complete	Estimate Total	(Over) Under Ceiling	
Site and Wye	27,860	18,895	15,056	3,839	8,965	12,047	27,103	757	
Antennas	20,400	21,057	20,851	206	(657)	1,264	22,115	(1,715)	
Electronics	17,000	13,492	11,826	1,666	3,508	5,399	17,225	(225)	
Computer	4,850	4,334	3,221	1,113	516	2,377	5,598	(748)	
Systems Integration	400	205	183	22	195	22	205	195	
Program Management	2,650	1,804	1,707	97	846	396	2,103	547	
Common Cost	-	1,241	776	465	(1,241)	1,185	1,961	(1,961)	
Subtotal	73,160	61,028	53,620	7,408	12,132	22,690	76,310	(3,150)	
Contingency	2,840	643	-	643	2,197	1,733	1,733	1,107	
TOTAL	76,000 (A)	61,671	53,620	8,051	14,329	24,423	78,043	(2,043)	

- Notes:
- (A) Includes \$293K for site acquisition, \$15.7K for ECAC Study, and \$15.1K for NSF Ad Hoc Advisory Panel
 - (B) Estimate to complete is as of August, 1977, and it excludes \$268K for airstrip
 - (C) Escalation included for future years for Site/Wye work (8%); NRAO labor (6%), certain antenna equipment items (6.5%), and certain electronic elements (6%). Antenna estimate is based upon the existing contract costs for fabrication of the antennas.
 - (D) The antenna estimate includes \$596K for Transporter #2.
 - (E) Allocated includes \$20K withheld by NSF on Amend. No. 30

NATIONAL RADIO ASTRONOMY OBSERVATORY VLA ACTIVITY SCHEDULE

UPDATE DATE: 3/28/78



REV. NO.	REV. DATE	DESCRIPTION