

JULY 1978

VLA LIBRARY

NATIONAL RADIO ASTRONOMY OBSERVATORY

JULY PROGRESS REPORT

VLA PROGRAM

August 18, 1978

PROPERTY OF THE U.S. GOVERNMENT
NATIONAL RADIO ASTRONOMY OBS
VLA LIBRARY
AUG 21 1978

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

JULY 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>
D. Sramek D. Weedman	NRAO (VLA) Dyer Observatory	AS-5	Search for optically selected QSO's 6, 21 cm.
R. Perley K. Johnston	NRAO (VLA) NRL	AP-5	Structure of weak or compact halos in 3C345, 3C371, 3C418 and 4C39.25. 6 cm.
D. Gibson	NMIMT	AG-3	Time scale of variations in radio emission from Antares and Beta Lyrae. All bands.
T. Willis R. Strom	NRAO (VLA) Dwingeloo	AW-5	Hot spot in the giant radio galaxy 3C236.
R. Hjellming	NRAO (VLA)	AH-3	Search for radio emission from X-ray objects. All bands.
H. Zirin K. Marsh G. Hurford R. Hjellming	Cal Tech Cal Tech Cal Tech NRAO (VLA)	AZ-3	Observing solar impulsive outbursts.
K. Johnston A. Wolfe R. Brown	NRL U of Pittsburgh NRAO (GB)	AJ-14	Monitor variations of 3C446. All bands.
R. Hjellming H. Schnopper	NRAO (VLA) Center for Astrophy. MA	AH-12	Monitor variations of III ZW2. All bands.
D. Gibson	NMIMT	AG-1	Search for radio emission from late-type subgiants. 6 cm.
P. Schwartz J. Spencer K. Johnston	NRL NRL NRL	AS-8	Confirmation and study of stellar radio sources detected at Arecibo. 6 and 2 cm.

R. Mushotzky	HEA-Goddard Space Flt Ctr	AM-4	Observations of Cen A, during X-ray observations HEAO and OSO-8. All bands.
R. Becker	HEA-Goddard Space Flt Ctr		
P. Serlemitsos	HEA-Goddard Space Flt Ctr		
R. Perley	NRAO (VLA)		
D. Florkowski	U of Florida	AF-7	Observations of Wolf-Rayet binary HN193793 and related objects. 20, 6 and 2 cm.
S. Gottesman	U of Florida		

The array was scheduled for 54% of the time. The downtime average for the month was 8%. By the end of the month Antenna Nos. 1 through 14 were located at stations DW8, BW8, DE1, CW8, DW2, BW6, DE4, AW5, AW6, DE3, DE8, CE8, CE6 and CW6. The maximum baseline was 11.5 km. Antenna Nos. 5 and 11 were removed from the operational array, and Antenna Nos. 13 and 14 were not declared operational yet.

ELECTRONICS DIVISION

The first fringes were obtained with Antenna No. 15 on August 8, 1978. For Antenna No. 16 the pacing item in the completion of the electronics is the front-end upconverters, with which AIL is experiencing difficulty in repeating previously-attained specifications. Testing of the prototype F7 and F8 modules, which will enable the IF filters at the antenna to be implemented, has been completed. Units are available for two antennas and installation of these into the test subarray, Antenna Nos. 3 and 5, will begin in the latter half of August.

Antenna No. 5 has been retrofitted with a C.T.I. cryogenics system. This action was taken when the Air Products system on the antenna failed and proved very difficult to repair. The extension of the Technical Service Building to provide an improved cryogenics and front-end facility is well under way and will be completed at the end of September.

In the waveguide area, measurements were made on the recently installed waveguide between stations AW7 and AW8. The length involved is 3.5 km and the average attenuation is 1.01 dB per km at 50 GHz. With this excellent performance the average attenuation of the 17 km now completed on the west arm is 1.08 dB per km at 50 GHz, which is 0.1 dB per km lower than the average for the first 5.5 km installed. Sixty-four couplers with 90° sector angle were received from Bogue Machine Shop in Albuquerque during July. Testing of these units has shown that the electrical performance meets specifications and the unwanted TE₀₂-mode coupling is about 2 dB lower than that for units with the original mechanical design now in use in the array. It is planned to replace the old couplers in the west arm with the new ones during the latter half of August, and this change should reduce the leakage rate of the pressurizing nitrogen. Pressurization of the waveguide on all three arms is being maintained.

Fabrication of electronics remains on schedule in almost all areas although there are some late deliveries of mixers for the modems. Design and development of the new IF system for spectral line observations is progressing and preliminary tests of the single sideband mixer show that the required performance can be achieved. An improved design for the mixer has been completed and a prototype unit is in construction. The modules which include the amplifiers and filters, T4 and T5, are now in the hardware design stage.

The spectral processor has just reached the stage at which it will function in the continuum mode. This part of the hardware includes the samplers, delay units, correlators and integrators. The first astronomical tests are planned for the latter half of August.

COMPUTER DIVISION

Software for transferring disk files from the PDP-10 to the PDP-11's is nearly complete. Programs have been written to prepare disk files in the format for the map-making procedure, and the software, in the 11, to make the maps has been started.

The DEC-10 job control language processor, MIC, has been activated. This will make the use of batch processing easier and, by encouraging the use of overnight batch jobs, may help relieve the daytime congestion.

A great deal of work has gone into the support software for the new spectral line correlator, both in assisting the test process and in readying the system for the first astronomical tests in August.

A final set of studies and checks for the spectral line data sorting system has been completed and we are beginning the procurement process for a 2½/GByte disk system.

ANTENNA DIVISION

Work of the Antenna Division during the month of July reached the following status:

Antenna No. 16

Mechanical outfitting completed on July 7, 1978. L-band feed installed July 24, and the antenna was moved from the maintenance pad to station DN4 on July 25, 1978. This is the first antenna on the north arm.

Antenna No. 17

Antenna was moved to the maintenance pad on July 25, 1978 and Mechanical outfitting is approximately 10% complete at the end of the month.

Antenna No. 18

Moved from the master pad to station CE7 on July 18, 1978 and is awaiting outfitting.

Antenna No. 19

All material is on hand. The pedestal and reflector were mated on July 17, 1978. Panels have been installed and the antenna is 90% complete.

Antenna No. 20

Reflector assembly is approximately 50% complete. Torque box and bearing housing are in trial assembly. Remaining material is being painted.

Antenna No. 21

Pedestal is 75% complete. Yoke is 50% complete. Transition is 25% complete. Reflector is complete and ready for trial assembly.

SITE AND WYE

Waveguide Installation

Lightning protection zinc ribbon completely installed and backfilled completed to AW8. Trench approximately 5200 feet past BE8 on east arm. Installed approximately 4460 feet of waveguide with 2800 feet to line and grade from BE5 past BE8.

Garage Building

Goar Construction, under Contract No. VLA-317, delivered the steel frame, siding, and roofing for the building on July 31, 1978, and will commence erection in early August.

Cryogenic Facility Tech Service Building Addition

DuraBilt Products, Inc., under Contract No. VLA-320, completed the concrete footings and floor slab for the cryogenics facility on July 22, 1978. The steel frame, siding, and roofing were delivered on July 31, 1978, and erection commenced on the same day.

Phase IV

Pacific Railroad Constructors moved onto the Site and established a base camp at the old Phase III camp location off old Highway 60. The excavation subcontractors (Round Place Construction) started reworking and subgrade on the west arm and excavated for antenna stations AW9, BN5, BE5, BE6, and BE8. Ballast has been partially installed to AW7 and track is being fabricated in 33 foot sections and is partially installed to station 422+50.

PROJECT MANAGEMENT

General

Take up of railroad trackage at Morganfield, Kentucky has been completed and the material received at the Site.

An RFP package for the fabrication of an additional antenna transport vehicle has been issued to 19 firms and is due on September 29, 1978. Prior to issue an ad was run in the Commerce Business Daily and letters sent to 64 firms soliciting their interest.

Personnel

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

<u>Division</u>	<u>12/1978</u>	<u>6/30 Level</u>	<u>Additions</u>	<u>Reductions</u>	<u>7/31 Level</u>
Site and Wye	9	9	0	0	9
Antenna	15	14	0	0	14
Electronics	54	45	4	1	48*
Computer	16	13	3	1	15
Systems Integration	9	7	2	0	9
Project Management	<u>27</u>	<u>27</u>	<u>1</u>	<u>1</u>	<u>27**</u>
Total	130	115	10	3	122

* Does not include one part-time person

** Does not include two part-time people



p7-78-1

Exterior View Completed Shell of the Cryogenic Addition
to the Service Building. Taken 8/04/78



p7-78-2

Interior View of the Shell of the Cryogenics Addition
to the Service Building prior to the Partition Work.
Taken 8/04/78



p7-78-3

Exterior View of the Frame of the Garage Building.
Taken 8/04/78

7/31/78

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-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 4/04/78
VLA-5	BWH/CVA Joint Venture	Amendment #11 issued	4/06/78	\$ 9,086		
VLA-5	BWH/CVA Joint Venture	Amendment #12	5/01/78	\$ 42,534		
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. (Mounts for Antennas 7-22 complete by 8/01/78 - for numbers 23-28 by 8/01/79.)
VLA-53 Amend. #4	R. F. Systems, Inc.	Ku & K Band Feed Horns	2/16/78	\$ 57,636	9/01/78	Extended delivery schedule being negotiated. Partial Delivery 8/14/78; Balance 9/01/78.
VLA-70 P.O. 52322, C.O. #5	Sumitomo Electric USA, Inc.	3000 pieces of waveguide - 3000 each coupling sleeves	1/27/75	\$ 2,885,126	8/15/78; 10/31/78; and 12/31/78	First 1000 pieces arrived Oakland port 8/10/78; Standard pipe protection to coat week of 8/28/78.
VLA-220 P.O. S-02245 Amend. #2	J. J. Gustincic	C-Band Feed Horns	1/25/78	\$ 41,050	8/31/78	Exercised option for 7 each additional C-Band Feed Horns, 3 ea. received 7/21/78; balance due on or before 8/31/78.
VLA-233 P.O. S-02611	Silicon Systems, Inc.	Custom Integrated Circuits	12/12/76	\$ 206,375	9/15/78	Delivery will be completed on 9/15/78.
VLA-234	E-Systems, Inc.	Design Review of Transporter	2/17/77	\$ 37,253	9/15/78 (est.)	Work is approximately 98% complete. Small amount of documentation still required.

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-256	New Mexico State University	Archaeological Excavation	9/20/77	\$ 107,000	2/20/79 Completion	Work started 2/20/78. Excavation completed on 5/12/78.
P.O. S-04400	New Mexico Institute of Mining and Tech.	Labor-Hour Contract		\$ 10,000	5/31/79	Approximately \$7,830.00 spent effective 7/31/78.
P.O. S-04738	AIL Division Cutler-Hammer	Parametric Amplifiers	10/14/77	\$ 102,900	Complete by 10/15/78	Delivery to start 5/01/78; to be completed 10/15/78. Additional quantities being negotiated. Negotiations scheduled for completion by 8/31/78.
P.O. S-04886	AIL Division Cutler-Hammer	Parametric Upconverters	9/23/77	\$ 79,702		Technical problems being investigated by AIL. No firm delivery scheduled as yet.
VLA-277 P.O. S-05376 Amend. #2	Wheeler Construction Co.	Crushed Stone		\$ 559,320	9/30/78	75% complete. Expected completion date is 9/30/78.
VLA-283 P.O. S-05135	Fujikura Cable Works Ltd.	20 mm Waveguide	11/04/77	\$ 168,756		Delivery on schedule. First increment scheduled for delivery on or about 5/10/78.
P.O. S-05814	DEC	Computer Maintenance	1/30/78	\$ 84,742	Cy '78	Monthly expenditure rate estimated at \$7,000.
VLA-295 P.O. S-05746	Spacekom, Inc.	Channel 2 thru 8 Mixers w/spare Diodes	1/10/78	\$ 55,200	9/15/78	Delivery complete except items 6 & 7; problems with high frequencies components have been solved and delivery is expected to be complete by 9/15/78. Option to be exercised by 8/15/78.

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-307 P.O. S-06288	Duboc, Lane & Monckton, Inc.	Tool Room Lathe & Accessories	2/13/78	\$ 13,093	10/02/78	All items received on 7/17/78 except item #5 which will be delivered with- in 30 days.
P.O. S-06024 Amend. #1	Missouri Research Labs.	Labor-Hour Electronic Technicians	4/28/78	\$ 34,435	8/31/78	Contract will be completed on 8/31/78 and will not be renewed.
VLA-316	Midstate Cartage	Labor-Hour	3/28/78	\$ 150,000	Completed by 3/27/79	Total expenditure thru 7/31/78 is \$56,683.49.
VLA-317	Paul Goar Construction	Construction of Garage	5/03/78	\$ 17,000	8/15/78	Contractor has delivered building. 95% complete.
P.O. S-06894	Kelly Services Inc.	Non-personal services	6/20/78	\$ 5,206	1/19/79	Work being performed as scheduled.
P.O. S-06827	C.T.I. Cryogenics	Cryocooler	5/23/78	\$ 139,860	2/15/80	Delivery on schedule. First unit due 8/20/78.
VLA-320	Dura-Bilt Products	Service Building Addition	5/17/78	\$ 48,335	9/25/78	Contractor progressing satisfactorily. Shell erection completed 8/10/78.
VLA-321	Allen Avionics	L.C. Filters	7/18/78	\$ 2,400	8/18/78	Total with all options is \$74,220; to NSF for approval on 8/17/78.
VLA-322	Dicomed Corp.	Color Image Recorder	8/02/78	\$ 86,887	12/01/78	NSF approved on 7/28/78; Director approval on 8/1/78.
VLA-325	Pacific Railroad Constructors, Inc.	Phase IV Construction	6/23/78	\$2,916,080	9/16/79	Work has commenced.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VERY LARGE ARRAY

STATUS AS OF JULY 31, 1978

CY-78

PROJECT NUMBER	DESCRIPTION	ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCT IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	NET BALANCE
11000	SITE/WYE	4,965,000	136,124	638,104	8,002	630,102	3,881,159	4,519,263	445,737
12000	ANTENNA	3,749,500	130,993	940,223	13,332	926,891	2,667,215	3,607,438	142,062
13000	ELECTRONICS	3,709,100	220,843	1,486,318	23,945	1,462,373	921,401	2,407,719	1,301,381
14000	COMPUTER	1,127,200	12,706	95,895	50	95,845	6,648	102,543	1,024,657
16000	SYSTEMS INTEGRATION	22,600	3,217	12,688	1,133	11,555	263	12,951	9,649
17000	PROGRAM MANAGEMENT	121,000	9,567	59,157	416	58,741	2,699	61,856	59,144
18000	COMMON COSTS	605,527	40,757	314,824	---	314,824	15,997	330,821	274,706
19000	CONTINGENCY	156,017	---	---	---	---	---	---	156,017
TOTAL PROGRAM		14,455,944	554,207	3,547,209	46,878	3,500,331	7,495,382	11,042,591	3,413,353

Notes:

Project allocation consists of \$12,698,000 in new funding plus \$1,757,944 in prior year funds re-allocated in CY-1978. In May, 1978, \$82,000 in allocation transferred from Contingency to Site and Wye for Cryogenic facility. As of June 30, 1978, CY-78 funds were re-allocated to reflect revised estimates plus new funds received. In June, 1978, \$200,000 in new funds were made available under Amendment No. 32. In addition, \$18,000 of the \$20,000 in funds withheld under Amendment No. 30 were made available with the remaining \$2,000 being used for the NSF Ad Hoc Advisory Panel.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VERY LARGE ARRAY

STATUS AS OF JULY 31, 1978

TOTAL PROGRAM

PROJECT NUMBER	DESCRIPTION	ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCT. IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	NET BALANCE
11000	SITE AND WYE	18,967,275	136,124	13,698,971	7,346,091	6,352,880	4,799,081	18,498,052	469,223
12000	ANTENNA	21,078,278	142,809	18,268,003	10,260,838	8,007,165	2,667,797	20,935,800	142,478
13000	ELECTRONICS	14,103,533	223,447	11,836,096	3,244,973	8,591,123	936,079	12,772,175	1,331,358
14000	COMPUTER	4,309,726	12,706	3,267,619	1,374,250	1,893,369	8,054	3,275,673	1,034,053
16000	SYSTEMS INTEGRATION	201,985	3,217	191,927	139,771	52,156	306	192,233	9,752
17000	PROGRAM MANAGEMENT	1,803,109	9,567	1,736,362	1,567,349	169,013	6,969	1,743,331	59,778
18000	COMMON COST	1,249,221	40,757	958,518	---	958,518	15,997	974,515	274,706
19000	CONTINGENCY	156,017	---	---	---	---	---	---	156,017
TOTAL PROGRAM		61,869,144	568,627	49,957,496	23,933,272	26,024,224	8,434,283	58,391,779	3,477,365

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) \$17,111 for the NSF Ad Hoc Advisory Panel.

In May, 1978, \$82,000 in allocation transferred from Contingency to Site and Wye for Cryogenic facility.

As of June 30, 1978, CY-78 funds were re-allocated to reflect revised estimates plus new funds received.

In June, 1978, \$200,000 in new funds were made available under Amendment No. 32. In addition, \$18,000 of the \$20,000

in funds withheld under Amendment No. 30 were made available with the remaining \$2,000 being used for the NSF Ad Hoc Advisory Panel.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA PROGRAM

FINANCIAL STATUS REPORT (in thousands)

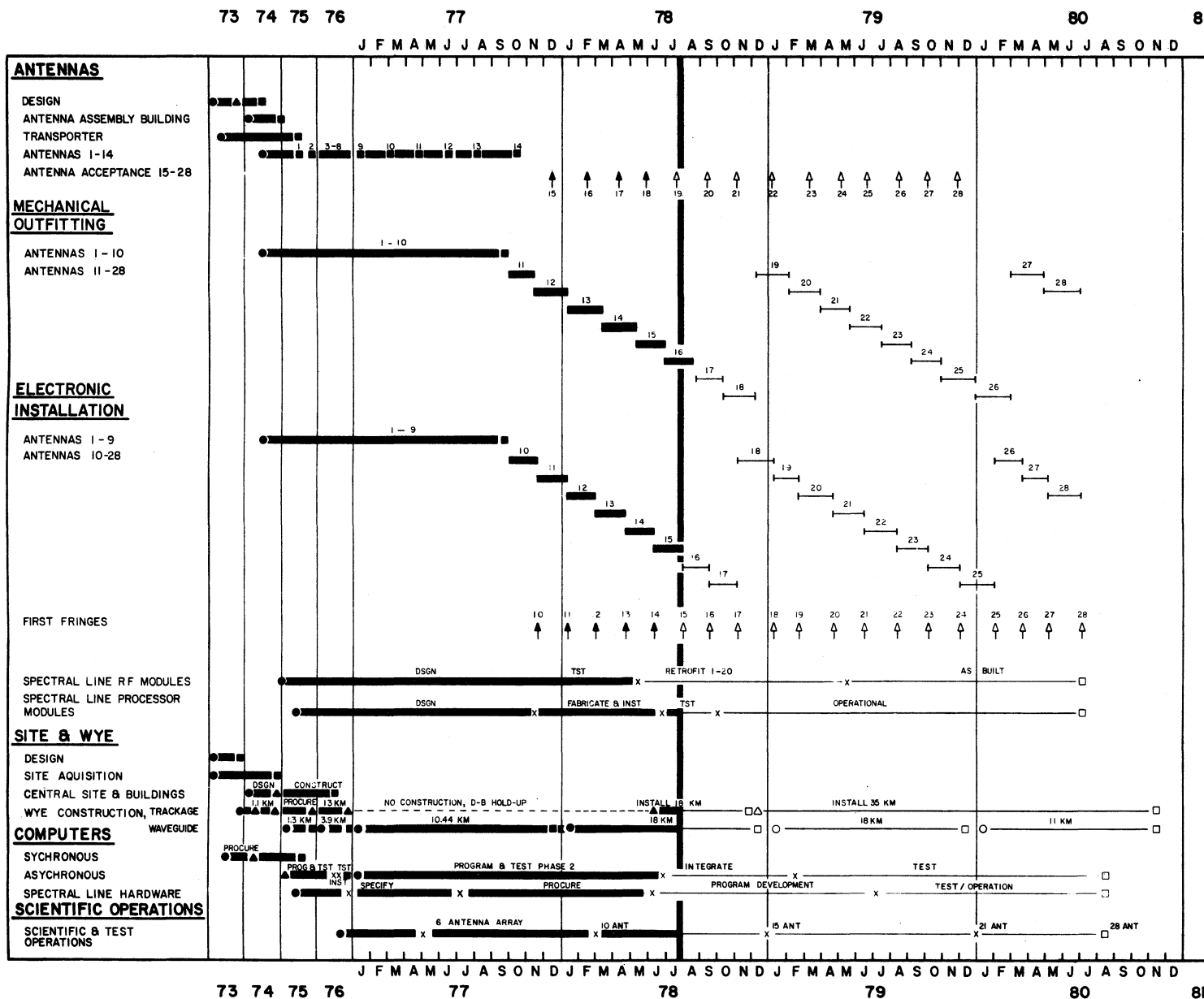
As of: July 31, 1978

(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	18,967	18,498	469	8,893	8,605	27,103	757	
Antennas	20,400	21,078	20,936	142	(678)	1,179	22,115	(1,715)	
Electronics	17,000	14,104	12,772	1,332	2,896	4,453	17,225	(225)	
Computer	4,850	4,310	3,276	1,034	540	2,322	5,598	(748)	
Systems Integration	400	202	192	10	198	13	205	195	
Program Management	2,650	1,803	1,743	60	847	360	2,103	547	
Common Cost	-	1,249	975	274	(1,249)	986	1,961	(1,961)	
Subtotal	73,160	61,713	58,392	3,321	11,447	17,918	76,310	(3,150)	
Contingency	2,840	156	-	156	2,684	1,733	1,733	1,107	
TOTAL	76,000 (A)	61,869	58,392	3,477	14,131	19,651	78,043	(2,043)	

- Notes:
- (A) Includes \$293K for site acquisition, \$15.7K for ECAC Study, and \$17.1K 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 \$200K in new funds received from the NSF on Amend. No. 32.

NATIONAL RADIO ASTRONOMY OBSERVATORY VLA ACTIVITY SCHEDULE

UPDATE DATE: 7/31/78



REV. NO.	REV DATE	DESCRIPTION