OCTOBER 1978

NATIONAL RADIO ASTRONOMY OBSERVATORY

OCTOBER PROGRESS REPORT

VLA PROGRAM

NOVEMBER 16, 1978

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

OCTOBER 1978

SYSTEMS INTEGRATION DIVISION

The array was scheduled for 58 percent of the time; 45 percent went to astronomical programs and the remaining 13 percent to tests. The average downtime for the month was approximately 12 percent.

The sixteen antennas currently outfitted with electronics are located at stations DW8, BW8, DE1, CW8, DE2, BW6, DE4, AW5, AW6, DE3, DE8, CE8, CE6, AW7, DE2, and CE9. These stations are positioned approximately 0.5, 512, 0.08, 1.6, 0.04, 3.2, 0.1, 7.7, 10.5, 0.09, 0.5, 1.6, 1.0, 13.6, 0.7, and 1.9 km respectively from the array center. Antenna 14 was moved to station AW7 on October 11 with the result that our longest astronomically usable baseline is now approximately 14.5 km. The total number of operational antennas is 13 (1 through 13). Antennas 5, 7 and 10 are presently decommissioned for electronic retrofits. Antennas 14, 15 and 16 are in the shakedown stage. The test array consists of antennas 3, 5 and 11.

ELECTRONICS DIVISION

New suppliers have been found for the C- L-band and for the L-band circular polarizer. The need to find new suppliers for these feed components will delay the installation of the L-band circular polarizers until approximately April, 1979 but should not affect the schedule for the L- and C-band feeds.

In the front end area the front end was completed and installed on Antenna 16 and first fringes were obtained on 6 October. An analysis of the reliability over the past year of front end cooled components gives the following estimates of Mean Time Between Failure (MTBF). AIL paramps, 1 failure in 400000 device hours, MTBF = 400000 hrs. AIL upconverters, 5 failures in 200000 device hours, MTBF = 400000 hrs. K-band mixer diodes, 2 failures in 200000 device hours, MTBF = 100000 hrs. Ku-band mixer diodes, 5 failures in 200000 device hours, MTBF = 400000 hrs. Extrapolating this performance to the final 27 antenna systems predicts 1 failure of a cooled component every 12 days. Investigations into improving the upconverter and mixer reliability are continuing.

The new laboratory facility for the cryogenics and front end groups was completed and occupied during the month. A review of the reliability of the CTI cryogenics systems currently operational on antennas shows that in the 11300 compressor hours accumulated to date on 4 antennas, no cryogenic failures have occurred. This is a very significant improvement over the reliability obtained with the Air Products systems.

In the waveguide area final-design couplers have now been installed on all except five of the antenna stations on the West arm.

Redesign of the phase detector in the F2 (upconverter pump) and F3 (17-20 GHz LO) modules is now complete. This redesign was needed to prevent the phase detector generating L-band interference by radiating harmonics of the 200 MHz reference signal. This new design will be retrofitted into all existing modules. Design work and testing on the new front end filter scheme (modules F4, F7, F8) and on the new baseband system (modules T3, T4, T5, T6) is progressing.

The new spectral processor was finally brought into operation at the end of the month. The problems of spurious correlation which have delayed the commissioning of the processor were traced to problems of crosstalk between the long wirewrap runs involved in the integrator portion of the processor. The crosstalk was reduced to an acceptable level for astronomical purposes by shielding some of the wirewrap runs and by changing some of the logic types. However, the remaining very low level crosstalk will make it difficult for the processor to test itself and a long-term solution of replacing the wirewrap boards with multilayer printed circuit mother boards is currently under investigation.

COMPUTER DIVISION

The PDP-11/70 mapping software is working, but severely restricted. The most severe restriction is to 128 x 128 map sizes. This restriction is expected to be lifted early in November. The convenient user interface to the DEC-10 data bases is expected to be ready in November.

The Dicomed film writer has been installed and a software driver has been written to interface to it. Work has started on a software interface from this driver to the IMPS map data base.

The new correlator was installed in the system on a permanent (barring emergencies) basis at the end of the month. Work can now begin on reorganizing the CORA/AP relationship to make way for the first spectral line system work.

We have ordered the large disk system for the spectral line sorting system and have recommended that we interface the Modcomps to the sorting system by purchasing additional Calcomp controllers in a dual port configuration, and building, here, an interface to the Modcomp II correlator handling computers.

ANTENNA DIVISION

Antenna No. 17

Mechanical outfitting completed on October 4, with installation of subreflector and on October 5, the antenna was moved to station DN4 to await electronic installation.

Antenna No. 18

Moved to maintenance station on October 5 and mechanical outfitting started. At end of month, outfitting approximately 45 percent complete.

Antenna No. 19

Awaiting mechanical outfitting.

Antenna No. 20

Moved to master pad on October 3 and servo installation, final alignment and acceptance testing started. Servo tests completed on October 17 showing a natural frequency of 2.3 Hz elevation and 2.55 Hz in azimuth. Alignment and mechanical inspection completed and the antenna was accepted on October 20. The antenna was moved on October 26 to station CE9 to await outfitting.

Antenna No. 21

Reflector assembly approximately 90 percent complete on assembly jigs at end of month. Pedestal assembly complete through installation of month. Pedestal assembly complete through installation of elevation wheel.

Miscellaneous

Surface panels through Antenna 25 now on Site. Antenna 14 moved on October 12 to station AW7 making the SW baseline now 13.64 km (8.5 mi.) long.

SITE AND WYE DIVISION

Waveguide Installation

Trenched approximately 4,600 feet. Installed approximately 4,850 feet of waveguide, 4,900 feet set to line and grade and backfilled. Installed zinc ribbon to AW8 and from BE9 to AE5.

Cryogenic Facility Tech Service Building Addition

DuraBilt Products, Inc., under Contract No. VLA-320, has completed the Service Building addition.

Landscaping at the Library and VSQ

Landscaping at the Library and VSQ is 100 percent complete.

Phase IV

Pacific Railroad Construction has completed trackage to AW7 and has completed approximately 80 percent of the trackage work to AW8. Round Place Construction has completed 90 percent of the clearing and grubbing work to AE8 and has completed 95 percent of the excavation work between CE9 and BE9, as well as 15 percent of the excavation work between BE9 and AE8. The removal and

recompaction work is in progress. Removal and recompaction work is complete at all 22 antenna stations. All culverts have been installed and backfilled. All piers have been drilled, belled, and filled with reinforced concrete. Antenna foundation concrete tie beams have been poured at AW9, BN7, and AN5. All antenna foundation station 15 KV transmission power cable has been installed.

PROJECT MANAGEMENT

General

A contract has been awarded to Arizona Railroad Co. for the take up of 4500 feet of railroad trackage at Fort Huachuca, Arizona.

Personnel

The personnel changes as of October 31, 1978 are as follows;

Division	12/1978	9/30 Level	Additions	Reductions	10/31 Level
Site and Wye	9	9	0	0	9*
Antenna	15	14	0	0	14
Electronics	54	50	1	0	51**
Computer	16	16	0	1	15
Systems Integration	9	7	1	0	8***
Project Management	27	27	0	0	27****
Total	130	123	2	1	124

* Does not include one part-time employee
** Does not include one part-time employee
*** Does not include one part-time employee
**** Does not include three part-time employee

p10-78-1 (4A) Aerial View to Northwest of East Arm of Wye Showing Waveguide Excavation on left, Track Excavation and Grading on right. Rail and the Stockpile near Antenna Station BE7.

Taken 9/15/78

p10-78-2 (14A) Aerial View to Southwest Showing Antennas at Center of Wye and along Southwest Arm.

Taken 9/15/78

10/31/78

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 Amend. #12	BWH/CVA Joint Venture	E/A Title I and II	6/11/73	$ 1,090,684		Title I - Completed Title II - Completed Title III - Completed Title IV - VLA-325 Supervision
VLA-6 Amend. #21	E-Systems, Inc.	28 Radio Telescopes	10/18/73	$ 18,156,054		Delivery in Progress.
VLA-29 Amend. #5	Sterling-Detroit	Focusing Feed Mounts thru Antenna 28 plus spares	6/17/74	$ 1,002,380		Delivery in progress. (Mounts for Antennas 23-28 complete by 7/13/79). Amend. #5 issued 11/9/78.
VLA-53 Amend. #4	R. F. Systems, Inc.	Ku & K Band Feed Horns	2/16/78	$ 57,636		Complete.
VLA-70 P.O. 52322, C.O. #5 C.O. #6 C.O. #7	Sumitomo Electric USA, Inc.	3000 pieces of waveguide 3000 each coupling sleeves 1060 pieces of waveguide 3000 pieces of waveguide and 3900 pieces of coupling sleeves.	1/27/75 9/27/78 11/03/78	$ 3,215,847	12/31/78; 4/30/79; 7/31/79; 10/31/79 and 1/31/80	2000 pieces received. Next 1000 pieces to arrive Oakland port by 12/31/78.
VLA-220 P.O. S-02245 Amend. #2	J. J. Gustincic	C-Band Feed Horns	1/25/78	$ 41,050		Complete.
VLA-233 P.O. S-02611	Silicon Systems, Inc.	Custom Integrated Circuits	12/12/76	$ 206,375	9/15/78	Complete except for 468 each of Item 4.
VLA-234	E-Systems, Inc.	Design Review of Transporter	2/17/77	$ 41,581	Complete	Amendment #3 issued 11/6/78, closing out subcontract at $41,581.

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-256	New Mexico State University	Archeological Excavation	9/20/77	$ 107,000	2/20/79 Completion	$76,332 invoiced thru 9/30/78. Final reports due 2/20/79.
P.O. S-07698	New Mexico Institute of Mining and Tech.	Cost Reimbursement Blanket Order		$ 3,000	12/31/78	Follow on to P.O. S-04400.
P.O. S-04738	AIL Division Cutler-Hammer	Parametric Amplifiers	10/14/77	$ 102,900	Complete	
P.O. S-04886	AIL Division Cutler-Hammer	Parametric Upconverters	9/23/77	$ 79,702		Nine units still due.
P.O. S-07990	AIL Division Cutler-Hammer	Parametric Amplifiers	9/21/78	$ 197,600	Complete by 1/21/80	
P.O. S-08085	AIL Division Cutler-Hammer	Parametric Upconverters	10/23/78	$ 102,525	4/13/79 thru 8/13/79	
VLA-277 P.O. S-05376 Amend. #4	Wheeler Construction Co.	Crushed Stone		$ 659,328	Complete by 12/01/78	
VLA-283 P.O. S-05136	Fujikura Cable Works Ltd.	20 mm Waveguide	11/04/77	$ 168,756	Complete	
P.O. S-05814	DEC	Computer Maintenance	1/30/78	$ 84,742	Cy '78	Monthly expenditure rate estimated at $7,000.
VLA-294 P.O. S-05722 Amend. #1	Hughes A/C Co.	Gunn Diode Oscillators	8/30/78	$ 48,805	12/07/78	

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-295 P.O. S-05746 Amend. #2	Spacekom, Inc.	Channel 2 thru 8 Mixers	1/10/78	$ 100,500	12/29/78	Option exercised to provide remaining mixers for program.
VLA-316	Midstate Cartage	Labor-Hour	3/28/78	$ 150,000	Completed by 3/27/79	Total expenditure thru 10/31/78 is $105,190.
P.O. S-06827 Amend. #2	C.T.I. Cryogenics	Cryocooler	5/23/78	$ 239,760	2/15/80	Delivery late. Two units received.
VLA-320	Dura-Bilt Products	Service Building Addition	5/17/78	$ 49,825	9/25/78	Complete 10/20/78.
VLA-321	Allen Avionics	L. C. Filters	7/18/78	$ 2,400	8/18/78	Total with all options is $74,220; First option date is 12/01/78.
VLA-322	Dicomed Corp.	Color Image Recorder	8/02/78	$ 86,887	12/01/78	Contractor progressing satisfactorily.
VLA-325	Pacific Railroad Constructors, Inc.	Phase IV Construction	6/23/78	$ 2,916,080	9/16/79	Work progressing satisfactorily.
VLA-326 P.O. S08191	California Computer Products, Inc.	Data Storage Subsystem	11/12/78	$ 159,784	1/12/79	
VLA-340 P.O. S-08227	Digital Equipment Corp.	Computer System	11/6/78	$ 101,938	2/09/79	
P.O. S-08269	Superior Electric Co.	Motors & Translators	10/26/78	$ 30,643	1/29/79	
P.O. S-08222	Structures, Inc.	Transition & Towers for K, Ku and C-Band Horns. L Band Towers	10/19/78	$ 23,955	Complete by 6/01/79	
P.O. S-06084 C.O. #1	Structures, Inc.	Walkways & Platforms	9/27/78	$ 33,740	Complete by 3/15/79	

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
P.O. S-08230	Structures, Inc.	Feed Support Structures	10/23/78	$ 26,855	Complete by 6/01/79	
P.O. S-06387 Amend. #2	Milliflect	Subreflectors	10/23/78	$ 61,200	Complete by 8/01/79	
P.O. S-08329	Contact Systems, Inc.	Various Wiring Modules	10/31/78	$ 19,709	Complete by 7/19/79	

VLA PROGRAM

PROCUREMENT ACTIVITIES INITIATED

RFP NUMBER	ITEM DESCRIPTION	ESTIMATED COST	ISSUE DATE	PROPOSAL/BID DUE DATE	SUBMISSION TO NSF DATE	AWARD DATE	CURRENT STATUS
VLA 323	Transporter		8/09/78	10/31/78	12/22/78	1/12/79	Two quotations received. Negotiations with both companies scheduled for week of 12/4/78.
VLA-344	Crushed Stone	$700,000	11/14/78	12/01/78			

NATIONAL RADIO ASTRONOMY OBSERVATORY
VERY LARGE ARRAY
STATUS AS OF OCTOBER 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 AND WYE	5,336,200	34,828	1,689,169	16,211	1,672,958	3,465,971	5,155,140	181,060
12000	ANTENNA	3,752,500	15,590	1,215,366	13,332	1,202,034	2,546,761	3,762,127	(9,627)
13000	ELECTRONICS	3,710,920	130,711	2,318,662	37,772	2,280,890	865,952	3,184,614	526,306
14000	COMPUTER	967,760	14,189	213,545	50	213,495	8,531	222,076	745,684
16000	SYSTEMS INTEGRATION	22,600	1,984	18,905	1,133	17,772	663	19,568	3,032
17000	PROGRAM MANAGEMENT	121,000	12,366	90,272	4,926	85,346	146	90,418	30,582
18000	COMMON COSTS	605,527	19,479	466,168	---	466,168	9,817	475,985	129,542
19000	CONTINGENCY	206,341	---	---	---	---	---	---	206,341
	TOTAL PROGRAM	14,722,848	229,147	6,012,087	73,424	5,938,663	6,897,841	12,909,928	1,812,920

Notes: Project allocation consists of $12,873,000 in new funding plus $1,849,848 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. In September, 1978, $175,000 in new funds were made available under Amendment No. 33 and $160,000 in allocation was transferred from the Computer Div. to Site/Wye for additional waveguide procurement.

NATIONAL RADIO ASTRONOMY OBSERVATORY
VERY LARGE ARRAY
STATUS AS OF OCTOBER 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	19,291,250	36,680	15,158,559	7,144,010	8,014,549	3,940,960	19,099,519	191,731
12000	ANTENNA	21,080,862	14,589	18,542,229	10,246,032	8,296,197	2,547,260	21,089,489	(8,627)
13000	ELECTRONICS	14,076,128	134,522	12,673,862	2,862,763	9,811,099	875,121	13,548,983	527,145
14000	COMPUTER	4,140,338	14,229	3,385,318	1,363,608	2,021,710	9,336	3,394,654	745,684
16000	SYSTEMS INTEGRATION	200,894	996	197,156	128,759	68,397	706	197,862	3,032
17000	PROGRAM MANAGEMENT	1,799,110	9,001	1,764,112	1,575,819	188,293	4,416	1,768,528	30,582
18000	COMMON COST	1,249,221	19,479	1,109,862	643,693	466,169	9,817	1,119,679	129,542
19000	CONTINGENCY	206,341	---	---	---	---	---	---	206,341
20000	CY-79 FUNDING	3,700,000	---	---	---	---	---	---	3,700,000
	TOTAL PROGRAM	65,744,144	229,496	52,831,098	23,964,684	28,866,414	7,387,616	60,218,714	5,525,430

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 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.
In September, 1978, $175,000 in new funds were made available under Amendment No. 33. As of October 31, 1978, the NSF advanced $3,700,000 in CY-79 funds.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA PROGRAM

FINANCIAL STATUS REPORT
(in thousands)

As of: October 31, 1978

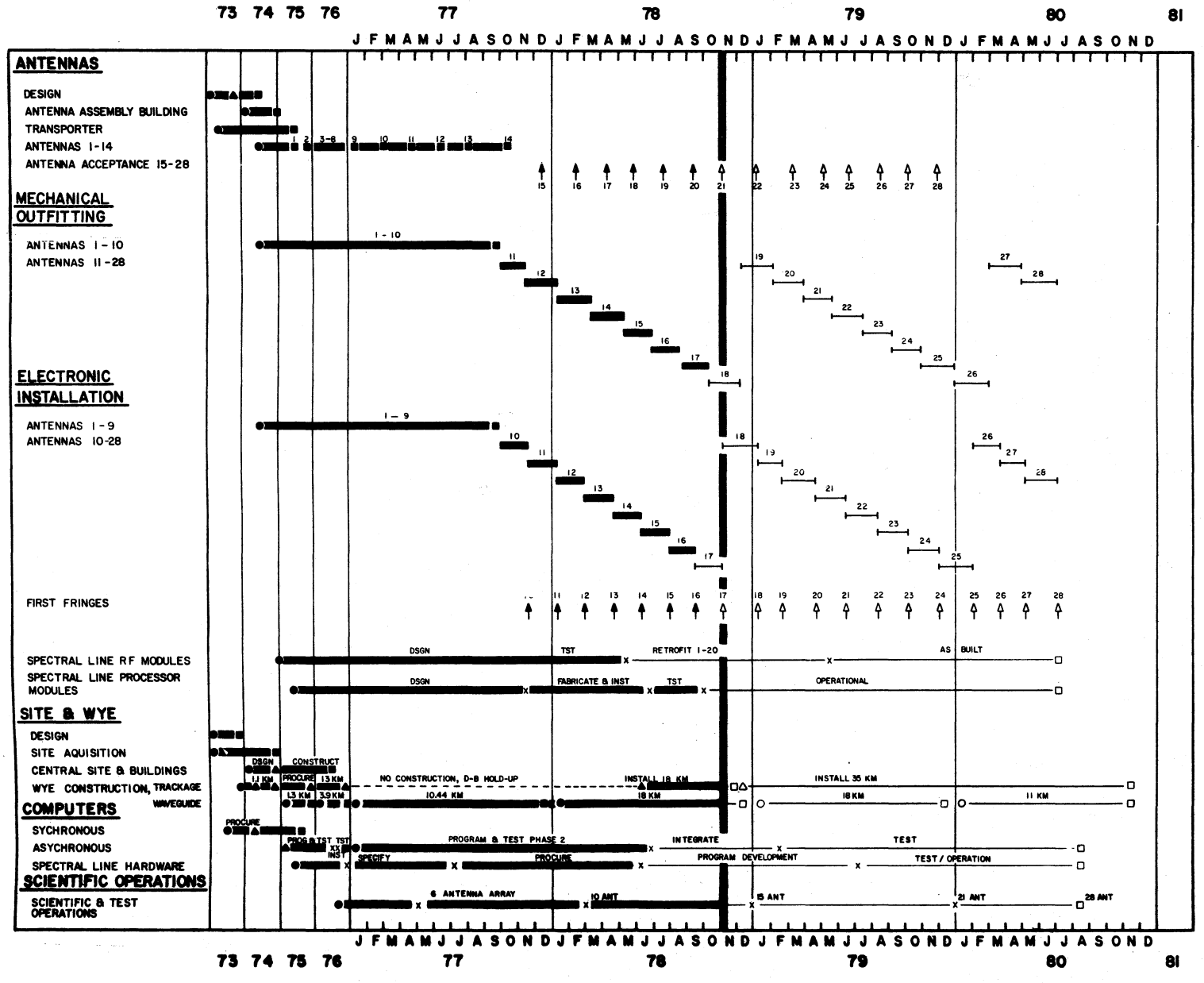
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(1
	(A)	Allocation to Date				Outlook			
Item	Program Ceiling	Allocated	Expended and Committed	Allocated Balance	Un-allocated Balance	Estimate to Complete	Estimate Total	(Over) Under Ceiling	Not
ite and Wye	27,860	19,291	19,100	191	8,569	8,003	27,103	757	
ntennas	20,400	21,081	21,089	(8)	(681)	1,026	22,115	(1,715)	
lectronics	17,000	14,076	13,549	527	2,924	3,676	17,225	(225)	
omputer	4,850	4,140	3,395	745	710	2,203	5,598	(748)	
ystems Integration	400	201	198	3	199	7	205	195	
rogram Management	2,650	1,799	1,768	31	851	335	2,103	547	
ommon Cost	-	1,249	1,120	129	(1,249)	841	1,961	(1,961)	
ubtotal	73,160	61,837	60,219	1,618	11,323	16,091	76,310	(3,150)	
ontingency	2,840	207	-	207	2,633	1,733	1,733	1,107	
OTAL	76,000 (A)	62,044	60,219	1,825	13,956	17,824	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.
(F) Allocated includes $175K in new funds received from the NSF on Amend. No. 33.
(G) The above statement does not reflect the $3,700K advanced by the NSF for CY-79 commitments and expenditures

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA ACTIVITY SCHEDULE

UPDATE DATE: 10/30/78



ABBREVIATIONS

DSGN – DESIGN	TST – TEST
LAB – LABORATORY	PRELM – PRELIMINARY
INST – INSTALL	OPNS – OPERATIONS
ANT – ANTENNA(S)	

SYMBOLS

○ START OF A PHASE	△ CONTRACT AWARD
X END OF AN ACTIVITY	□ END OF A PHASE
⇩ SCHEDULED	⇧ COMPLETED

REV. NO.	REV DATE	DESCRIPTION