NATIONAL RADIO ASTRONOMY OBSERVATORY

FEBRUARY PROGRESS REPORT

VLA PROGRAM

March 14, 1978

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

FEBRUARY 1978

SYSTEMS INTEGRATION DIVISION

The following astronomical observing programs were scheduled this month:

Name	Affiliation	Code	Program Short Title
FEBRUARY 2-6			
R. Mushotzhy R. H. Becker P. J. Serlemitsos R. A. Perley	NASA-Goddard NASA-Goddard NASA-Goddard NRAO (VLA)	AM-1	Spectra of Centaurus A.
K. J. Johnsont E. B. Fomalong C. M. Wade	NRL NRAO (GB) NRAO (VLA)	AJ-5	Astrometry: This session will concentrate on southern sources.
F. H. Briggs B. H. Andrew	U. of Pittsburgh Herzberg Institute	AB-12	6 cm brightness distribution of Mars.
FEBRUARY 9-13			
R. M. Hjellming D. E. Hogg H. Hvatum	NRAO (VLA) NRAO (CV) NRAO (CV)	AH-10	Instantaneous spectra of compact thermal objects associated with stars. Coordinated with GB Interferometer.
FEBRUARY 23-27			
F. N. Owen L. Rudnick J. O. Burns	NRAO (CV) NRAO (CV) NRAO (CV)	AO-2 AO-6 AR-3	Observe various extended objects in clusters of galaxies, mostly head-tail objects.
K. J. Johnson D. Sadeh	NRL Tel-Aviv Univ.	AJ-10	Simultaneous x-ray and VLA observations of MK 501.

The array was scheduled for 336 hours of tests and observations (50% of the time). The downtime average for the month was 16%.

Antenna No. 11 produced first fringes on February 1. By the end of the month, Antenna Nos. 1 through 11 were located at stations DW8, BW8, DW3, CW8, DW2, BW6, DE4, AW5, AW6, DE3, and CW5. Antenna Nos. 3, 5, and 10 are operational at the 6, 2, and 1.3 cm bands. Antenna Nos. 1, 2, 4, 6, 7, 8, and 9 are operational at the 6 cm band.

ELECTRONICS DIVISION

Tests of the L-Band circular polarizers on Antenna Nos. 4 and 6 show an average baseline instrumental polarization of 6.3% across the range of L-Band observing frequencies (1.35 - 1.73 GHz). Further tests will determine how much of this instrumental polarization is due to the polarizers themselves and how much is due to other crosstalk mechanisms.

Construction and testing of front end 12 has been completed, ready for installation on the antenna in early March. A program of level adjustment and tuning checkout is in progress on all operational front ends.

First attempts have been made to investigate the phase stability of the instrument at Ku- and K-Band frequencies. Initial tests show that, for much of the time, the atmospheric contribution to phase stability at Ku- and K-Band is very significant, making it difficult to determine the instrumental behavior.

The waveguide system was pressurized for the first time on February 14. The manifold-regulator system for introducing the nitrogen gas into the waveguide works well. Initially there were numerous leaks at various couplers and flanges in the waveguide. By month's end the pressure in the waveguide was holding a 2 psi (equivalent to approximately 4 ft. of water) at a flow rate of approximately 600 cfh. This leak rate corresponds to a hole in the waveguide only 0.25 inches in diameter. The leak rate will be further reduced during March, although lowest leak rates will probably not be achieved until the final couplers are installed in August, 1978. To allow the antenna waveguide to be pressurized, a waveguide window has been installed in the 20 mm waveguide in the antenna vertex room. These windows, which were developed by VLA engineers, have return losses better than 40 dB over a 10% bandwidth.

Bids are currently being evaluated for 87% of the final 60 mm waveguide couplers needed in the system. The production quantity will be ordered in April after a single evaluation coupler supplied by the vendor has been tested. A TE02 mode filter has been constructed for use in 20 mm waveguide and operates successfully for channels 2 through 10. After it has been scaled for correct operation for channels 1 through 10, it will be installed in the Control Building to prevent TE_{02} mode generated by the waveguide distribution box from propagating to the antennas. Finally, in the waveguide area, the loss of the 2.4 km waveguide run on the East arm has been measured and is within specification.

In the monitor and control area a special purpose recording data tap has been completed for use in the main electronics room in the Control Building. This 8 channel tap has a built-in recorder and operates independently of any of the data taps intalled in the D racks.

Construction of the new correlator system is proceeding on schedule. Sufficient custom-made integrated circuits are now in-house to complete the whole project. This comprises over 8000 correlator IC's and over 16000 integrator IC's. The 5 racks comprising the final correlator system for 27 antennas with 2 IF's each has been assembled and located in place in the screened room. Half of the printed circuit boards for these racks are now complete. First continuum use of this new system is planned for mid-May, 1978.

COMPUTER DIVISION

Work is continuing on the software interface between the DEC-10 computer and the PDP-11 minicomputers. The low-level interfaces on both sides are complete. Work is now underway on slight modifications to the DEC-11 utilities (disk save/compress, for instance) so that they can be used with resources on the DEC-10, which will result in considerable saving of resources in not having to provide a second device for system maintenance.

VISPLT has been rewritten (nearly complete at the first of the month, and was installed during February), and the revised version has attracted much favorable comment from observers.

The database filler has been revised so that it automatically stores data in the proper place (usually), resulting in much less operator intervention required.

The shared memory between the Modcomps "MONTY" and "BOSS" appears to be working reliably and well. Software is being modified to take advantage of it.

Work is under way to eliminate some overflow problems associated with expert tapes (problems which would also strike us when we move more of our operations into 16 bit computers).

A study group has been set up (Chairman, J. Hudson) to formulate configuration and specifications for the the spectral line system sorting system to be purchased this year.

ANTENNA DIVISION

Antenna No. 13

Mechanical outfitting continued on maintenance foundation and was completed on February 28.

Antenna Nos. 14 & 15

Awaiting mechanical and electronic outfitting.

Antenna No. 16

Servo tests completed on February 8 with the antenna satisfactorily meeting all requirements. Natural frequency tests revealed a 2.3 Hz natural frequency in elevation mode and a 2.15 Hz in azimuth. The antenna was accepted from E-Systems on February 14, 1978 after completion of touch-up painting and minor corrections on checklist.

Antenna No. 17

Antenna mated on February 14, and panel installation started. At the end of the month panel installation complete and final alignment under way.

Antenna No. 18

First shipments of structure on Site. Assembly of reflector started third week of February.

Miscellaneous

Servo systems for Antenna Nos. 25, 26, 27, and 28 were given factory acceptance tests on February 14 through February 17 and are ready for shipment to Site. Surface panels for antennas through Antenna No. 21 are now on Site. Modified stairways were installed on Antenna Nos. 4, 6, and 13 in February.

SITE AND WYE DIVISION

Waveguide Installation

Installed 20 mm waveguide from the manholes to the antenna foundations at four locations on the West arm and six on the East arm. Cleaned and reclaimed approximately 450 60 mm couplings that had been tried before, but wouldn't work due to damaged threads or foreign material in the alignment barrel or threads.

Due to the unfavorable weather 60 mm waveguide installation was postponed until the arrival of more favorable weather.

Trackage

During the month nine cattleguards have been constructed and installed across the mainline. Six were installed on the West arm, two on the North arm and one on the East arm.

PROJECT MANAGEMENT

An RFP has been issued on the take up of 3.5 miles of track at the Breckenridge Job Corps Center in Kentucky. Because of the amount of snow on the ground, the RFP due date has been extended twice and is now scheduled for the end of March.

Personnel

The personnel changes as of February 28, 1978 are as follows:

Division	Previous Level	Additions	Reductions	Current Level
Site and Wye	8	0	1	7
Antenna	14	0	0	14
Electronics	46	3	1	48*
Computer	13	1	0	14
Systems Integration	7	0	0	7
Project Management	25	0	0	25**
Total	113	4	2	115

* Does not include on part-time person
** Does not include three part-time people

GENERAL

Davis-Bacon Wage Matter

As of February 28th the final wage determination had not been received from the Department of Labor. However, on February 22nd, the legal firm of Steptoe & Johnson advised that Mr. Merkin of the Department of Labor informed them that the special Phase IV VLA Project Determination would be based on the Phase III work without considering any other construction jobs in Socorro and Catron Counties.

Archaeological Site

The archaeologists of the State University of New Mexico moved onto the Ake property accompanied by VLA personnel on February 20th without any opposition from the landowner. This work is proceeding well altho recent snowstorms have impeded the work to some extent.

2/28/78

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 - Work in conjunction with VLA-149 is complete. (Title IV IFB scheduled for release upon receipt of revised Davis-Bacon rates.
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	7/01/77	Work to start 2/20/78.
VLA-258	Midstate Cartage Co.	Labor-Hour Subcontract	3/28/77	$ 195,000	3/27/78	Approximately $146,555 was spent effective 2/28/78.
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 $9,653 spent effective 2/28/78.
P.O. S-04400	New Mexico Institute of Mining and Tech.	Labor-Hour Contract		$ 10,000	8/31/77	Approximately $3,240 spent effective 2/28/78.
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	Added quantities approved by NSF on 2/28/78.
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

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-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.
VLA-291 P.O. S-05837	Eagle-Picher	Prefab Metal Parts	1/26/78	$ 59,989	As requested	NSF approved 1/17/78.
VLA-293 P.O. S-05622	Metalcrafts Div.	Prefab Metal Parts	11/29/77	$ 41,738	50% 1/31/78 50% 2/28/78	Delivery on schedule.
P.O. S-05780	Dennis Engineering	Temporary Services	12/30/77	$ 8,951	3 months	NSF approved 1/16/78.
VLA-307 P.O. S-06288	Duboc, Lane & Monckton, Inc.	Tool Room Lathe & Accessories	2/13/78	$ 13,093	10/2/78	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.
P.O. S-06055	Kelly Services	Temp. Clerk C.V.	2/22/78	$ 1,328	3/31/78	NSF approved 2/16/78.

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-5	Amendment No. 11 for Inspection Site Construction	$ 49,086	------	------	10/28/76	------	Amendment No. 11 is being held until contract for Site Construction Phase IV is awarded.
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-305	3200 MHz Oscillators	$ 10,000	12/19/77	1/06/78	-------	3/08/78	Bids received under evaluation. Evaluation received 2/28/78.
VLA-309	Rail Take up, Breckenridge	$ 33,250	1/12/78	3/31/78	-------	-------	Bid due date extended twice due to unusually severe weather at job site.
VLA-316	Labor-Hour Equip.	$ 150,000	2/21/78	3/07/78	3/15/78	3/27/78	

NATIONAL RADIO ASTRONOMY OBSERVATORY
VERY LARGE ARRAY
CY - 78
STATUS AS OF FEB. 28, 1978

PROJECT NUMBER		ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCTION IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	NET BALANCE
11000	SITE/WYE	4,893,000	13,622	54,276	4,804	49,472	764,148	818,424	4,074,576
12000	ANTENNA	3,728,600	19,382	96,576	---	96,576	3,392,351	3,488,927	239,673
13000	ELECTRONICS	3,097,500	165,507	266,977	6,355	260,622	1,011,370	1,278,347	1,819,153
14000	COMPUTER	1,151,400	10,789	21,643	---	21,643	8,861	30,504	1,120,896
16000	SYSTEMS INTEGRATION	25,300	1,662	2,402	---	2,402	38	2,440	22,860
17000	PROGRAM MANAGEMENT	122,200	7,596	16,175	---	16,175	550	16,725	105,475
18000	COMMON COSTS	596,830	42,839	70,312	---	70,312	23,482	93,794	503,036
19000	CONTINGENCY	643,114	---	---	---	---	---	---	643,114
	TOTAL PROGRAM	14,257,944	261,397	528,361	11,159	517,202	5,200,800	5,729,161	8,528,783

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 FEBRUARY 28, 1978

TOTAL PROGRAM

PROJECT NUMBER		ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCTION IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	NET BALANCE
11000	SITE AND WYE	18,895,275	124,139	12,918,300	7,212,534	5,705,766	1,881,453	14,799,753	4,095,522
12000	ANTENNA	21,057,378	19,758	17,171,815	10,247,506	6,924,309	3,645,820	20,817,635	239,743
13000	ELECTRONICS	13,491,933	281,577	10,514,273	3,227,383	7,286,890	1,140,972	11,655,245	1,836,688
14000	COMPUTER	4,333,926	17,170	3,023,555	1,374,200	1,649,355	187,275	3,210,830	1,123,096
16000	SYSTEMS INTEGRATION	204,685	2,004	181,635	138,639	42,996	194	181,829	22,856
17000	PROGRAM MANAGEMENT	1,804,309	7,611	1,693,379	1,566,933	126,446	5,454	1,698,833	105,476
18000	COMMON COST	1,240,524	42,838	714,006	---	714,006	23,483	737,489	503,035
19000	CONTINGENCY/RESERVE	643,114	---	---	---	---	---	---	643,114
	TOTAL PROGRAM	61,671,144	495,097	46,216,963	23,767,195	22,449,768	6,884,651	53,101,614	8,569,530

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: February 28, 1978

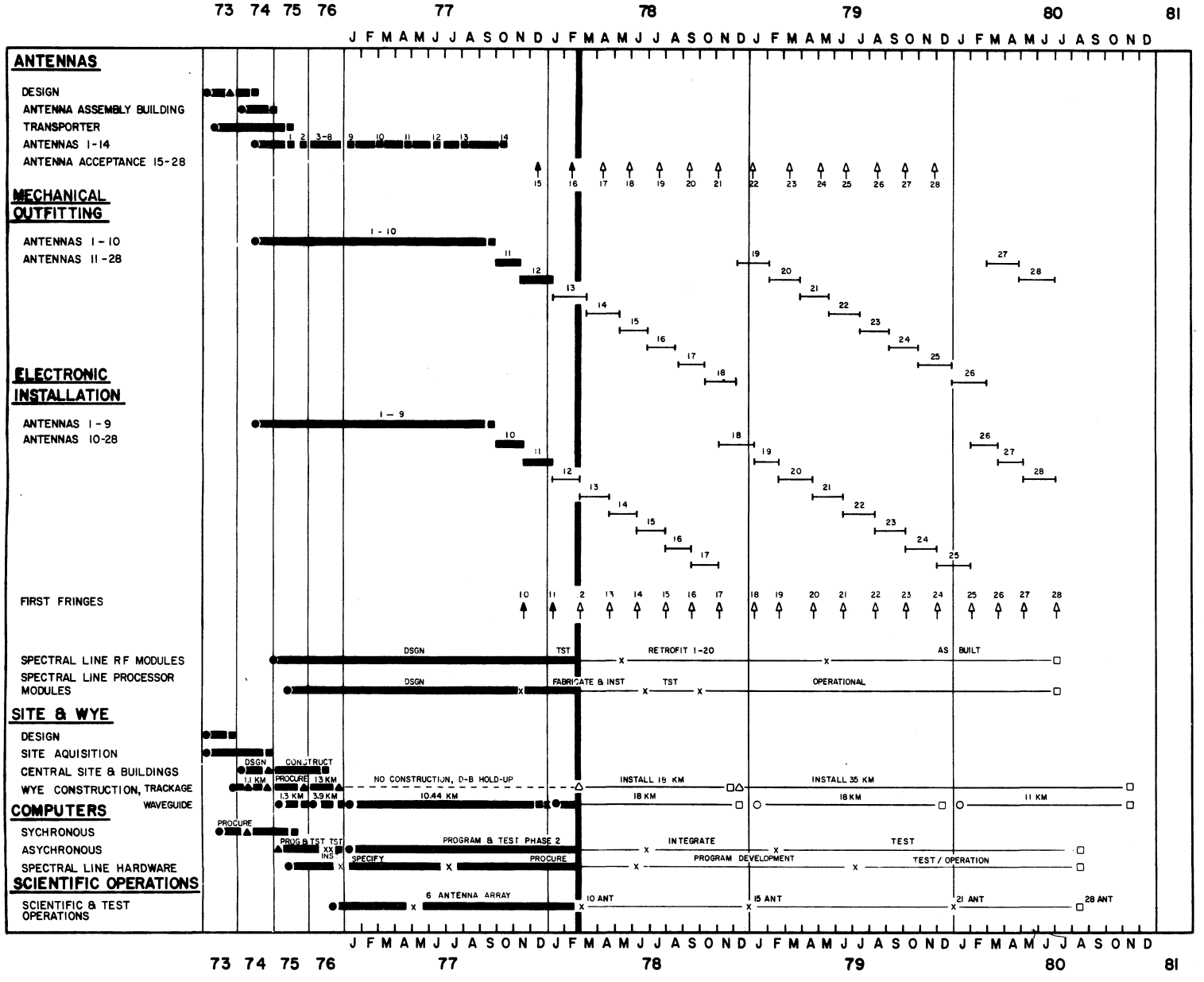
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	(A)	Allocation to Date				Outlook			
Item	Program Ceiling	Allocated	Expended and Committed	Allocated Balance	Un-allocated Balance	Estimate to Complete	Estimate Total	(Over) Under Ceiling	Notes
Site and Wye	27,860	18,895	14,800	4,095	8,965	12,303	27,103	757	
Antennas	20,400	21,057	20,818	239	(657)	1,297	22,115	(1,715)	
Electronics	17,000	13,492	11,655	1,837	3,508	5,570	17,225	(225)	
Computer	4,850	4,334	3,211	1,123	516	2,387	5,598	(748)	
Systems Integration	400	205	182	23	195	23	205	195	
Program Management	2,650	1,804	1,699	105	846	404	2,103	547	
Common Cost	-	1,241	737	504	(1,241)	1,224	1,961	(1,961)	
Subtotal	73,160	61,028	53,102	7,926	12,132	23,208	76,310	(3,150)	
Contingency	2,840	643	---	643	2,197	1,733	1,733	1,107	
TOTAL	76,000 (A)	61,671	53,102	8,569	14,329	24,941	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: 2/24/78



ABBREVIATIONS

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

SYMBOLS

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

REV. NO.	REV DATE	DESCRIPTION