NATIONAL RADIO ASTRONOMY OBSERVATORY

JANUARY PROGRESS REPORT

VLA PROGRAM

February 16, 1978

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

JANUARY 1978

SYSTEMS INTEGRATION DIVISION

The following astronomical observing programs were scheduled this month:

Name	Affiliation	Program Code	Program Short Title
JANUARY 5-9			
F. N. Owen S. R. Spangler S. Mufson W. D. Cotton	NRAO (CV) NRAO (CV) NASA-Huntsville MIT	AO-5	Multifrequency observations of a sample of about 100 variable or flat spectrum sources.
F. H. Briggs B. H. Andrew	Cornell Herzberg Institute, NRC	AB-12	6 cm brightness distribution of Mars.
R. Mushotzhy R. H. Becker P. J. Serlemitsos R. Perley	NASA-Goddard NASA-Goddard NASA-Goddard NRAO (VLA)	AM-1	Spectrum of Centaurus - A.
JANUARY 16-17			
B. F. Burke A. D. Haschick	MIT MIT	AB-10	21 cm surveys of selected regions in search of objects with flux greater than 10 mJy.
JANUARY 19-23			
Programs AB-10 and AB-12 same as above.			
W. Jaffee J. J. Caldwell T. C. Owen	NRAO (CV) State U. of NY State U. of NY	AJ-3	Brightness distribution of Titan at 6, 2 and 1.3 cm.
JANUARY 30-31			
Programs AB-12 and AM-1 same as above.			
M. R. Kundu A. P. Rao	Maryland Maryland	AK-9	6 cm observations of solar active region in conjunction with X-ray sounding rocket observations.
D. M. Gibson	NMIMT	AG-1	6 cm search for emission from normal subgiants.

The array was scheduled for 252 hours of tests and observations (34% of the time). The downtime average for the month was 16%. Antenna No. 10 was declared operational and is now located at station DE3.

ELECTRONICS DIVISION

Efforts to understand the cause of the frequency dependence of the instrumental polarization at C-Band on some antennas has continued. Measurements of the isolation between the AB and CD channels inside the front end Dewar on Antenna No. 4 show worst case isolations of -43 dB which is not sufficient to explain the observed levels of polarization Investigations are continuing.

Front end 11 was installed on the antenna and first fringes were obtained on February 1, 1978. Ordering the components for the construction of front ends 16-21 is complete.

Three production run refrigerator-compressor systems were received from Cryogenics Technology Inc.; these systems will be used on front ends 13, 14 and 15. During the period November 30, 1977 to January 30, 1978, the MTBF (mean time between failures) for the cryogenics systems on Antennas Nos. 1 through 10 was 2198 hours. This represents an improvement over the previous six months for which the MTBF was 1525 hours.

In the waveguide area preparations for pressurization are complete except for the installation of waveguide windows at the antennas. A double window, using two layers of 3-mil thickness mylar spaced a quarter wavelength apart, has been designed for the 20 mm waveguide. This will withstand pressures over 60 psi and has very low reflection. Improved techniques for measuring the TE_{02} mode generation of various components have been devised and measurements made on the signal distributor units and the sector couplers. An experimental TE_{02} mode filter is under development.

Retrofits covering most of the required local oscillator modifications have now been completed on Antenna Nos. 10, 7 and 8, and as the month closes work is in progress on Antenna No. 1. On Antenna No. 10 the modules were carefully adjusted after the changes, and observational tests have shown that the phase stability is fully satisfactory at 6 cm wavelength. Antenna No. 7 and 8 are awaiting similar adjustment and testing. Testing of the phase stability in the 18-21 cm band is in progress using the engineering test array which consists of Antenna Nos. 3 and 5. The phase stability is at least as good as the 6 cm, but it is too early to say whether it scales with frequency in the desired manner.

In most areas procurements for the 1978 construction program are well under way, and construction by the Charlottesville group continues to remain close to schedule. Progress towards completion of documentation of the electronics continues, and manuals for four more of the modules are in reproduction or final stages of writing. A recording-tap unit

has been developed and mounted in a small mobile rack together with an eight-channel pen recorder. This will be used mainly in the central electronics room and will allow simultaneous recording of as many as eight analog monitor functions, selectable from any of those covered by the monitor and control system. It should be a great help in testing all parts of the electronics system.

COMPUTER DIVISION

Work is continuing on the software interface between the DEC-10 computer and the PDP-11 minicomputers. The 10-side low level interfaces to the various devices we intend to support are working. Work remains to be done on higher level (user) interfaces. The 11-side software is in a state of rapid flux.

The revised version of VISPLT is now working on the Tektronics graphic terminal; the line printer plot support is nearly complete.

The CLEAN algorithm is now working on the current map format.

We have made an experimental connection enabling the memories of two Modcomps ("Boss" and "Monty") to be shared. It seems to work, but had to be dismantled for observing; we do not want to permanently install it until we have demonstrated its reliability (it also requires some software changes). We are doing this ourselves because the Modcomp version of this connection appears unnecessarily expensive.

A number of invisible, internal modifications are going on, in both the Modcomp and DEC computers, to let us handle the data from the increasing number of antennas. Most of the DEC programs were written under the assumption that there were ten or fewer antennas; rather than simply increasing the number of antennas, we are modifying things so that we have more efficient disk storage when only a few antennas are used together as a subarray. A few Modcomp programs were written with the assumption that there were 11 or fewer antennas (tape output format changes at that point; multiple records are written to keep the buffer size required reasonably small).

ANTENNA DIVISION

Progress during the month of January consisted of the following:

Antenna No. 12

Mechanical outfitting was completed on January 30 and the antenna moved on January 31 to station CW6.

Antenna No. 13

Moved on January 31 to maintenance foundation and mechanical outfitting was started.

Antenna Nos. 14 & 15

Awaiting mechanical and electronic outfitting.

Antenna No. 16

Panel installation and alignment completed on January 12. Panel setting check revealed on rms of 0.008 inches. On January 24 the antenna was moved to the Master Pad for final alignment, servo installation and acceptance testing.

Antenna No. 17

Reflector assembly started on January 4 and by end of month was approximately 80% complete. Pedestal assembly started on January 24 and by end of month had extended through the yoke arms.

Miscellaneous

The position indicator system subcontractor during the second week of January replaced unsatisfactory oscillators in the inductosyn and weather proofed connector cables in their equipment.

SITE AND WYE DIVISION

Waveguide Installation

1,500 feet of trenching was completed on the west arm between AW6 and AW7 and 600 feet of waveguide was installed. 20 mm waveguide was installed at DN1, DW1, DE3, CE8, BW7 and BW9. Due to inclement weather, it was necessary to stop the installation of 60 mm waveguide until the arrival of more favorable construction weather.

Approval was received and a contract awarded on January 16, 1978 covering the construction of the second Visiting Scientist Quarters building with six single rooms and a 2400 square foot office-library building.

PROJECT MANAGEMENT

It has been determined that the excess rail at Aberdeen Proving Ground and Indian Head, Maryland is too expensive for use on the VLA Program. The high cost resulted from the extensive Site rehabilitation required, the current low price of steel scrap and the high transportation costs. The present price of relayer rail on the commercial market is lower than that of the Maryland rail. By not using this rail the VLA Program will have to locate about 6 more miles of track to complete the Wye requirements.

Personnel

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

Division	Previous Level	Additions	Reductions	Current Level
Site and Wye	8	0	0	8
Antenna	14	1	1	14
Electronics	48	1	3	46*
Computer	13	0	0	13
Systems Integration	7	0	0	7
Project Management	25	1	1	25**
Total	115	3	5	113

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

GENERAL

Davis-Bacon Wage Matter

The decision of the Department of Labor Wage Appeals Board was issued January 9th and received January 13th. It was quite favorable in that it: (1) Ruled out the use of the Building and Heavy Engineering Wage Rates; (2) Instructed the Department to make a special wage survey for the VLA; (3) Affirmed the validity of the Phase III wages used and instructed the Department to utilize these wages in their survey; (4) Limited the survey to Socorro and Catron Counties; and (5) Instructed the Department to issue its determination as soon as possible. Of some concern is that the decision instructed the Department to survey "heavy construction projects similar to Phase IV" and permitted it to go to adjacent counties" if sufficient classifications or wage information to provide an adequate survey" cannot be obtained.

At the end of the month the survey is still underway using mostly union sources. We have sent in data on several small projects in Socorro County. Steptoe & Johnson is following the matter closely.

Archaeological Site

Due to the press of other work and winter conditions the New Mexico State University archaeological team has been forced to push the start date of the excavation back to February 20th. No problems are foreseen.

Access Road to the VLA Site

At its January 17th meeting the New Mexico State Highway Commission accepted the last 0.4 mile of the access road and will pave it for us during the late Spring.

1/31/78

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 - Work in conjunction with VLA-149 is complete. (Title IV RFP scheduled for release approx. 3/1/78.)
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-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	2/28/78	Delivery will be completed on 2/28/78.
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-256	New Mexico State University	Archaeological Excavation	9/20/77	$ 107,000	7/01/77	Work to start 2/20/78.

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-258	Midstate Cartage Co.	Labor-Hour Subcontract	3/28/77	$ 195,000	3/27/78	Approximately $133,480 was spent effective 1/31/78.
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 $8,997 spent effective 1/31/78
P.O. S-04400	New Mexico Institute of Mining and Tech.	Labor-Hour Contract		$ 10,000	8/31/77	Approximately $2,788 spent effective 1/31/78.
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	1/02/78	Delivery is on schedule.
VLA-277 P.O. S-05376 Amend.#1	Wheeler Construction Co.	Crushed Stone	1/11/78	$ 441,560	4/30/78	Contract option exercised on 1/11/78.
VLA-283 P.O. S-05136	Fujikura Cable Works Ltd.	20 mm Waveguide		$ 168,756	4/30/78	Order placed 11/4/77.
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 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	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 PROGRAM

PROCUREMENT ACTIVITIES INITIATED

RFP NUMBER	ITEM DESCRIPTION	ESTIMATED COST	ISSUE DATE	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-53 Amend. #4	K & Ku Band Feed Horns	$ 57,636	-----	------	1/27/78	2/15/78	Exercised option.
VLA-252 P.O. S-04741 Amend. #1	Cryogenic Refrig. System	$ 16,490	-----	------	1/26/78	2/15/78	Exercised option.
VLA-305	3200 MHz Oscillators	$ 10,000	12/19/77	1/06/78	-------	-------	Bids received under evaluation.
VLA-307	Tool Room Lathe and Accessories	$ 13,092	12/30/78	1/12/78	-------	-------	Two bids received. Only one considered responsive. No decision made on award.
VLA-309	Rail Take-up, Breckenridge	$ 33,250	1/12/78	2/24/78	-------	-------	Bid due date extended twice due to unusually severe weather at job site.
P.O. S-06055	Clerical Services	$ 1,328	-------	-------	1/26/78	2/10/78	Labor-hour contract, temporary clerk Charlottesville.
P.O. S-06024	Electronic Tehnician Services	$ 15,500	-------	-------	1/24/78	2/10/78	Labor-hour contract, electronic Tech.
VLA-254 P.O. S-03651 Amend. #1	L-Band Feed Horns	$ 58,600	-------	-------	1/20/78	2/15/78	Awaiting NSF approval.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VERY LARGE ARRAY

CY-1978

STATUS AS OF JAN 31 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 AND WYE	4,893,000	41,899	41,899	1,245	40,654	753,630	795,529	4,097,471
12000	ANTENNA	3,728,600	77,194	77,194	---	77,194	3,364,554	3,441,748	286,852
13000	ELECTRONICS	3,097,500	101,470	101,470	---	101,470	910,050	1,011,520	2,085,980
14000	COMPUTER	1,151,400	10,854	10,854	---	10,854	8,779	19,633	1,131,767
16000	SYSTEMS INTEGRATION	25,300	740	740	---	740	126	866	24,434
17000	PROGRAM MANAGEMENT	122,200	8,579	8,579	---	8,579	---	8,579	113,621
18000	COMMON COSTS	596,830	27,473	27,473	---	27,473	20,516	47,989	548,841
19000	CONTINGENCY	600,000	---	---	---	---	---	---	600,000
	TOTAL PROGRAM	14,214,830	268,209	268,209	1,245	266,964	5,057,655	5,325,864	8,888,966

Note: Project allocation consists of $12,500,000 in new funding plus $1,714,830 in prior year funds reallocated in CY-1978.

NATIONAL RADIO ASTRONOMY OBSERVATORY
VERY LARGE ARRAY
STATUS AS OF JAN 31. 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	18,938,386	70,609	12,794,161	3,681,826	9,112,335	1,996,811	14,790,972	4,147,414
12000	ANTENNA	21,057,378	167,641	17,152,056	10,247,506	6,904,550	3,618,399	20,770,455	286,923
13000	ELECTRONICS	13,491,933	232,445	10,232,696	3,210,337	7,022,359	1,166,703	11,399,399	2,092,534
14000	COMPUTER	4,333,926	37,809	3,006,385	1,374,200	1,632,185	193,575	3,199,960	1,133,966
16000	SYSTEMS INTEGRATION	204,685	790	179,631	138,639	40,992	620	180,251	24,434
17000	PROGRAM MANAGEMENT	1,804,309	8,727	1,685,769	1,566,933	118,836	4,919	1,690,688	113,621
18000	COMMON COSTS	1,240,527	27,473	671,168	---	671,168	20,516	691,684	548,843
19000	CONTINGENCY/RESERVE	600,000	---	---	---	---	---	---	600,000
	TOTAL PROGRAM	61,671,144	545,494	45,721,866	20,219,441	25,502,425	7,001,543	52,723,409	8,947,735

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: January 31, 1978

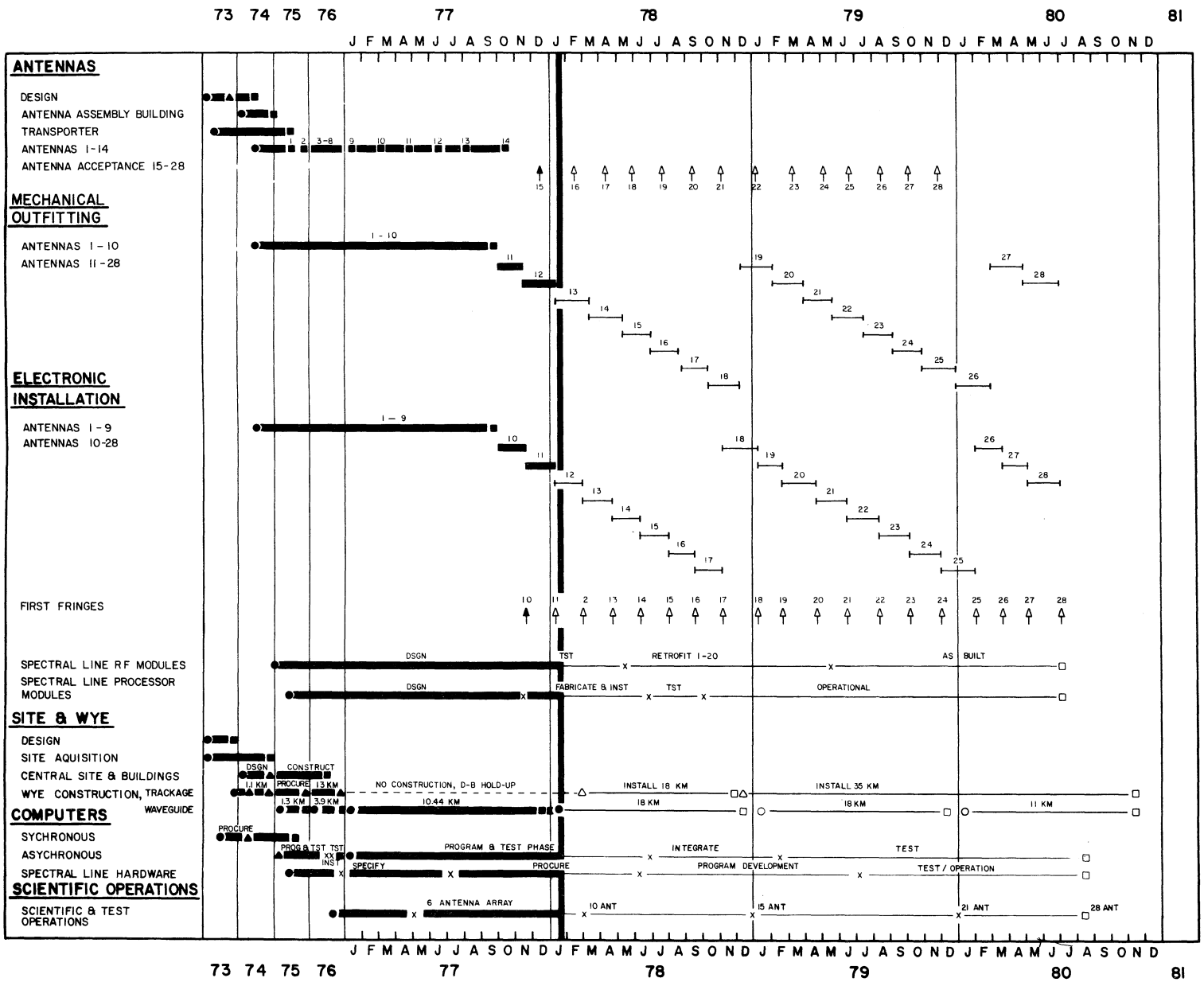
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Item	(A) Program Ceiling	Allocated	Expended and Committed	Allocated Balance	Un-allocated Balance	Estimate to Complete	Estimate Total	(Over) Under Ceiling	Notes
Site and Wye	27,860	18,938	14,791	4,147	8,922	12,312	27,103	757	
Antennas	20,400	21,057	20,770	287	(657)	1,345	22,115	(1,715)	
Electronics	17,000	13,492	11,399	2,093	3,508	5,826	17,225	(225)	
Computer	4,850	4,334	3,200	1,134	516	2,398	5,598	(748)	
Systems Integration	400	205	180	25	195	25	205	195	
Program Management	2,650	1,804	1,691	113	846	412	2,103	547	
Common Cost	-	1,241	692	549	(1,241)	1,269	1,961	(1,961)	
Subtotal	73,160	61,071	52,723	8,348	12,089	23,587	76,310	(3,150)	
Contingency	2,840	600	-	600	2,240	1,733	1,733	1,107	
TOTAL	76,000 (A)	61,671	52,723	8,948	14,329	25,320	78,043	(2,043)	

Notes:
(A) Includes $293K for site acquisition, $15.7K for ECAC Study, and %14.1K for NSF Ad Hoc Advsory 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: 1/20/78



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