AUGUST 1976

NATIONAL RADIO ASTRONOMY OBSERVATORY

AUGUST PROJECT REPORT

VLA PROJECT

September 17, 1976

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROJECT

AUGUST 1976

SITE AND WYE

Subcontract VLA-149; Wye Construction; Burn Construction Company, Inc.; $2,913,000

1. All main line trackage has been constructed on the ballast and all main line trackage on the west arm through BW-9 has been aligned and raised to final grade. Antenna station spur lines have been constructed, aligned and raised to final grade on the west arm through DW-9.

2. All antenna station foundation tie beams and pedestals have been poured except for the pedestals at station AW-8. Backfilling around all foundation tie beams is complete.

3. All electrical work is complete on the east arm except for ground rods and antenna ground connectors. Electrical work is progressing on the north arm and is estimated at 75% complete.

This contract is estimated at 93% complete.

Subcontract VLA-65; George A. Rutherford, Inc.; $2,395,400

1. Additional punch list work has been performed during the month on the control building mechanical systems and controls. Lacking for 100% completion is final test and balance work on the water systems.

This contract is estimated at 99.7% complete.

P.O. 02171; Don's Evergreen's and Landscaping; $16,282.95

1. All trees and shrubs have been planted. All gravel has been delivered and spread over plastic cover at all places, except the small areas north of the control building.

This order is estimated at 99% complete.

Waveguide is completely installed, including manholes from CW-9 to the control building.

Twelve hundred feet of trench from BW-5 has been trenched and eleven hundred feet of waveguide has been coupled, set to line and grade, and partially backfilled.

On August 10, 1976, approximately four inches of rain fell on the VLA Site in about ninety minutes, flooding the central portion of White Lake. Over 200,000 gallons of water topped the dikes surrounding the waveguide trench and flooded it to depths up to seven feet. Fortunately no water entered this section of waveguide.

ANTENNA DIVISION

Antenna No. 5

Outfitting continued on maintenance pad and is complete except for touch-up painting.

Antenna No. 6

Panel setting completed on August 12 with final RMS measured as 0.0106 inches. On August 16 the antenna was moved to the master pad for final alignment and servo tests. Antenna azimuth lean was adjusted on August 19, 1976 to 15 arcsec. On August 27 the servo tests were completed and resonant frequency was measured as 2.4 cycles/second in elevation and 2.35 cycles/second in rotation. Acceptance of the antenna will be September 2 on completion of painting and minor mechanical adjustments.

Antenna No. 7

Pedestal is finished through installation of elevation wheel and counterweight. The reflector structure is complete and ready for installation on the pedestal, except for painting. Anticipated mating date is September 7.

Antenna No. 8

Trial assembly of the reflector base triangle is complete in Hobbs. Trial assembly of the yoke arms and elevation wheel is completed and ready for painting. Reflector structure is on hand at the Site.

Antenna No. 9

Trial assembly of reflector started in Hobbs.

SYSTEMS INTEGRATION DIVISION

Two observing sessions were conducted this month using Antennas 1 and 2.

Run No. 1

2.5h	down - F3 module both antennas
1h	pointing adjustments
1h	phase correction system tests
2.5h	pointing A2
30h	6 cm observations on calibrators
3h	2 cm observations on calibrators

Run No. 2

2h	down - front end A1
3h	delay adjustments
35h	pointing observations A2

The first session was our last operating from the trailer. The second was our first operating from the control building.

Single dish testing started on Antenna No. 4. The subreflector was found out of alignment. After corrective work, efficiency measurements appear normal.

ELECTRONICS DIVISION

The major event in the electronics division this month was the move of equipment and personnel to the newly completed control building. Office equipment and materials were moved in on August 2, and electronics lab equipment on the following day. The last observing run from the electronics trailer was made on August 2-3 and the prototype electronics and computer were moved out of it on August 4. Of the electronics division, only the front end and cryogenics groups remain in the service building, because of its proximity to the antenna maintenance foundation. Cabling in the control building was largely completed in advance of the move. The twelve-antenna delay and multiplier system was in the screened room before the move, but could not be fully tested until the special control rack which interfaces it with the computer became available from the two element system.

Testing of the reassembled equipment occupied most of the month, and at the same time the waveguide group completed the connection from the control building down the west arm as far as CW9. Control of Antenna No. 2 at this foundation was achieved on August 26 and at approximately 1615 MDT on that day the first astronomical record was obtained at the control building, a single-dish scan of 3C273. On August 30 the 40-hour weekly observing runs recommenced and the first fringes were obtained at approximately 1915 MDT on 3C345 at 6 cm wavelength. This was one week ahead of the scheduled first run from the control building.

The prototype of the new 18-21 cm feed was delivered and assembled at the Site by J. J. Gustincic. Pattern tests made on it in California indicate slightly better performance than was obtained with the 3 cm wavelength model. Preparations were made for testing the feed on Antenna No. 2. Single-dish tests on Antenna No. 4 were partially completed after a readjustment of the mounting of the subreflector.

Cooldown tests of front end No. 5 continued and failure of an up-converter required its replacement with the spare unit. Replacement of the copper tubing in the cryogenics compressors with more reliable stainless steel was commenced and almost completed on one unit.

Preparation of the electronics for Antenna No. 3 was almost complete as the month ended. Installation of waveguide on Antenna No. 5 was completed. The delay and multiplier system presently contains cards for up to six antennas and these have been tested for satisfactory operation. Breadboard tests of new versions of modules L2 and L3 of the local oscillator system were commenced. These are the only two modules for which extensive redesign appears desirable.

Design of the spectral processor is continuing with investigation of the possibility of using one or more custom-designed integrated circuits. Design and specification of the IF filters for spectral line observing is also in progress.

COMPUTER DIVISION

Asynchronous Subsystem

During August the data line scanner necessary to expand the number of terminal access lines to the DEC-10 was added to the system, bringing the number of available lines to 16. The RFP for the addition of 128K of core to relieve serious performance problems was prepared and negotiation with DEC for the associated upgrading of the two data channels was begun.

Judy Myers joined the group as program librarian replacing June Thomas who remained in Charlottesville at the time of the move to the Site.

A faster SAIL version of FILRDB to put run data in a data base was completed except for further debugging dependent upon extensive use. Most of the planned experimental system of defined operators to do pre-synthesis processing was completed. This gives interim capabilities to extract data from the run data base, do flagging and editing, solve for baseline errors and correct data for these errrors, solve and correct for time errors, analysis data for point source fluxes and position offsets, shift reference positions, do empirical amplitude and phase calibration, and plot or list data on terminals or line printer. This temporary system will be put into effect the week of September 6.

Significant process was made on the problem of segmenting CANDID to reduce the size of the program that need be resident in core at any one time. Various time conversion operators were completed together with a number of generalized array operators: SUM, AVG, MIN, MAX, AND MINMAX. In collaboration with electronics and operations staff a monitor data base was designed and portions of the program to put data into this data base written. The system was designed so that asynchronous system programs, synchronous system programs, and array operators will use a single master file of information concerning the monitor data points to generate programs or documentation that they need.

Synchronous Subsystem

During August the modcomp computer system was moved to the control building, and operation was restored. The software was revised to handle the 12 element correlator, and a third antenna was logically connected to the system. An initial version of a program which assists observers to prepare his observation list has been added to the program system.

PROJECT MANAGEMENT

In August, 1976 there were a total of $225,000 procurements written. Of this total, there were 190 purchase orders totaling approximately $132,000 and Subcontracts totaling $93,000 written.

The take up of rail at Crab Orchard has been completed and all usable material received for storage at the Site.

Personnel

The personnel changes as of August 31, 1976 are as follows:

Division	Previous Level	Additions	Reductions	Current Level
Site and Wye	7	0	0	7
Antenna	9	1	0	10
Electronics	38	1	1	38
Computer	13	1	1	13
Systems Integration	3	0	0	3
Project Management	23	1	0	24*
Total	93	4	2	95

*Includes one part-time person

p8-76-1 Landscaping at Cafeteria and Control Building

p8-76-2 "L" Band Feed Manufactured by J. J. Gustincic

VLA PROJECT
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/CVR Joint Venture	E/A Title I and II	6/11/73	$ 1,028,269		Title I - Completed Title II - Completed Title III - Work in progress in conjunction with VLA-149. Fixed price plus cost reimbursables.
VLA-6	E-Systems, Inc.	28 Radio Telescopes	10/18/73	$17,549,422	3/1/77	NRAO has taken possession of Antenna Nos. 1, 2, 3, 4, and 5. Antenna 6 will be accepted 9/1/76.
VLA-53	R. F. System	K and Ku Band Feed Horns	1/26/76	$ 109,168	6/7/76 7/19/76 11/15/76	K Band Feeds for Antennas 3 through 5 have been received. Ku Band Feeds for Antennas 3 through 5 have been received. Final Ku Band Feed due for shipment 9/9/76. K and Ku Band Horns for Antennas 7 through 10 due for delivery 11/15/76.
VLA-70 P.O. 52322	Sumitomo Electric USA, Inc.	4373 pieces of waveguide 4480 each coupling sleeves	1/27/75	$ 1,446,634	1/15/77	2313 pieces of waveguide and 2350 coupling sleeves have been received. 1000 pieces of waveguide and 1030 each coupling sleeves have cleared customs and will be coated approx. 9/30/76.
VLA-134 P.O. 53578	Air Products and Chemicals, Inc.	Helium Compressors and Cryogenic Refrigerators	8/15/75	$ 139,545	11/1/76	Delivery of units for Antennas 7 through 10 will be completed by 10/30/76. Units retrofitted with ss tubing after fabrication.
VLA-149	Burn Construction Co., Inc.	Site Construction Phase III	9/25/76	$ 2,979,600	10/25/76	Work is Approx. 93% complete.
P.O. 53880	N. M. Tech.	Labor Hour Contract	9/1/75	$ 15,000	8/31/76	Approx. $8,139 spent effective 8/31/76.
VLA-160 P.O. S-00120	Wutzke RR Tie Co.	20,000 Used Cross Ties	10/17/75	$ 109,000	12/31/75	18,435 ties have been delivered for stockpiling.
P.O. S-00271	Timber Mtn. Forrest Products	20,000 Used Cross Ties	10/17/75	$ 115,000	12/31/75	13,530 ties have been delivered for stockpiling.

VLA PROJECT
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-174	Lawrence Hefner	Provide Labor and Equipment	1/26/76	$ 62,400	2/28/77	Approx. $29,594 spent effective 8/31/76.
P.O. S-00815	Deluna Bluebird Bus Sales of N.M.	Coach	3/25/76	$ 53,626	8/1/76	Coach was delivered 8/10/76.
VLA-177 P.O. S-00985	Fujikura Cable Works Ltd.	Waveguide Coupling Components	3/5/76	$ 134,985	6/11/76 10/1/76	Partial shipments are on schedule.
P.O. S-00986	Hitachi Shibaden Corp. of America	Waveguide Adaptors	3/25/76	$ 47,800	6/30/76 10/1/76	Four have been received. Balance of 36 were shipped from L. A., Calif. on 8/31/76.
P.O. S-01147	Fujikura Cable Works Ltd.	Rotary Joints	3/30/76	$ 7,660	10/30/76	Two received July 12, 1976. Request NSF approval to purchase 8 additional units under option on July 15, 1976.
VLA-179 P.O. S-01046	AIL Div. of Cutler Hammer	Parametric Amplifiers	4/29/76	$ 62,320	10/12/76	Two due 9/2/76 and 6 due 10/12/76.
P.O. S-01134	Digital Equip. Corp.	Eight Line Comm. Group	4/5/76	$ 5,060	8/30/76	Delivered 8/10/76.
VLA-191 P.O. S-01162	Longwill-Scott Inc.	Rail Take Up Crab Orchard, Ill.	4/7/76	$ 118,385	7/31/76	Work was completed 8/27/76.
P.O. S-01749	Computer Products Unlimited Inc.	CRT Terminal	6/25/76	$ 2,965	7/30/76	Terminal was delivered 8/13/76.
P.O. S-01753	Modular Computer Systems, Inc.	CRT Terminals and Interface	6/25/76	$ 4,000	7/30/76	Terminals and interface will be shipped 9/3/76.
P.O. S-01946	Industrial Design Engineering Assoc.	Labor Hour Contract for Temporary Draftsman	7/21/76	$ 9,100	1/26/77	Draftsman is working in drafting section at 2015 Ivy Rd., Charlottesville, Va. $1,047 spent effective 8/31/76.
P.O. S-1984	J.J. Gustincic Consulting Eng.	Consultant Agreement	8/2/76	$ 4,000	12/31/76	Consultant on K. Ku and C Band Horn. $600 spent effective 8/31/76

VLA PROJECT
PROCUREMENT ACTIVITIES INITIATED

RFP NUMBER	ITEM DESCRIPTION	ESTIMATED COST	ISSUE DATE	BID DUE DATE	SUBMISSION TO NSF DATE	AWARD DATE	CURRENT STATUS
VLA-211	VLA Wye Communication System	$260,000	5/6/76	6/22/76	8/30/76	9/1/76	Specifications have been revised. Awaiting final proposal from Mountain Bell.
VLA-220	C Band Feed Horn for Antennas 2 through 10	$ 54,000	7/20/76	8/11/76	8/16/76	8/30/76	Purchase Order S-02245 awarded to J. J. Gustincic for $47,925.00.
VLA-223	Rail Take-up Hill AFB Utah	$ 58,203	8/9/76	9/9/76	9/15/76	9/30/76	Proposals solicited from 10 companies.
VLA-226	Prefabricated Mobil Motel Unit	$ 30,000	8/13/76	8/30/76	9/15/76	9/30/76	Proposals solicited from 19 companies.
VLA-227	Motor Vehicle for operation on RR Track and Ground	$ 12,000	8/25/76	9/28/76	8/26/76	10/15/76	Proposals solicited from 13 companies.

CY - 1976

VERY LARGE ARRAY

Status as of August 31, 1976

Project Number	Description	Allocation	Monthly	Expended	Committed	Total	Balance	Outstanding Obligations Pending	Net Balance
11000	Site and Wye	4,807,000	368,586	3,499,023	1,070,731	4,569,754	237,246	40,994	196,252
12000	Antenna System	7,794,000	37,864	1,907,369	5,702,328	7,609,697	184,303	48,252	136,051
13000	Electronic System	2,876,000	194,984	1,396,373	521,186	1,917,559	958,441	230,402	728,039
14000	Computer System	720,000	45,640	378,480	154,546	533,026	186,974	67,791	119,183
16000	Systems Integration	112,000	11,718	47,201	6,329	53,530	58,470	17,262	41,208
17000	Project Management	672,000	114,676	416,938	22,903	439,841	232,159	86,965	145,194
	Contingency	105,000	---	---	---	---	105,000	---	105,000
	Total VLA	17,086,000	773,468	7,645,384	7,478,023	15,123,407	1,962,593	491,666	1,470,927

TOTAL PROJECT

VERY LARGE ARRAY

Status as of August 31, 1976

Project Number	Description	Allocation	Monthly	Expended	Committed	Total	Balance	Outstanding Obligations Pending	Net Balance
11000	Site and Wye	11,572,406	706,902	10,179,982	1,159,268	11,339,250	233,156	40,994	192,162
12000	Antenna System	13,303,344	37,864	7,414,990	5,702,965	13,117,955	185,389	48,252	137,137
13000	Electronic System	7,464,934	208,684	5,976,440	522,621	6,499,061	965,873	230,402	735,471
14000	Computer System	2,528,589	45,640	2,108,538	179,940	2,288,478	240,111	67,791	172,320
16000	Systems Integration	158,000	11,718	93,752	6,337	100,089	57,911	17,262	40,649
17000	Project Management	1,568,961	114,676	1,309,970	23,404	1,333,374	235,587	86,965	148,622
	Contingency	105,066	---	---	---	---	105,066	---	105,066
	Total VLA	36,701,300(1)	1,125,484	27,083,672	7,594,535	34,678,207	2,023,093	491,666	1,531,427

(1) Total Project Allocation does not include $283,000 withheld by NSF for Army Corp. of Engrs. and $15,700 for ECAC study.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA--FINANCIAL STATUS REPORT
(in thousands)

As of: August 31, 1976

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Allocation to Date				Outlook			
Item	Project Ceiling	Allocated	Expended and Committed	Allocated Balance	Unallo-cated Balance	Est. to Complete	Est. Total	(Over) Under Ceiling	Notes
Site and Wye	27,860	11,572	11,339	233	16,288	16,384	27,723	137	
Antennas	20,400	13,303	13,118	185	7,097	8,096	21,214	(814)	
Electronics	17,000	7,465	6,500	965	9,535	10,658	17,158	(158)	
Computer	4,850	2,529	2,289	240	2,321	3,056	5,345	(495)	
Systems Integration	400	158	100	58	242	184	284	116	
Project Management	2,650	1,569	1,333	236	1,081	1,544	2,877	(227)	
Subtotal	73,160	36,596	34,679	1,917	36,564	39,922	74,601	(1,441)	
Contingency	2,840	105	---	105	2,735	3,522	3,522	(682)	
Total	76,000	36,701	34,679	2,022	39,299	43,444	78,123	(2,123)	

Notes: (1) Basic estimate is that of August, 1975.

(2) Escalation included for future years at 6% for site and wye work; National Radio Astronomy Observatory labor, and minor antenna equipment items. Antenna estimate is based on the existing contract costs for fabrication of the antennas. No future escalation has been included for electronics or computer purchased equipment.

(3) Estimate excludes the following deferred items: Transporters #2 and #3, $615 K; Air Strip, $268 K.

Explanation to Accompanying Statement

Column (2) - Project Ceiling: Original estimates

Column (3) - Allocated: Funded by NSF and included in total funds provided in Contract C-780.

Column (4) - Expended and Committed: Actual cash paid out and orders written and accepted by vendors.

Column (5) - Allocated Balance: Column 3 less Column 4. (Current funds available for expenditure and commitment.)

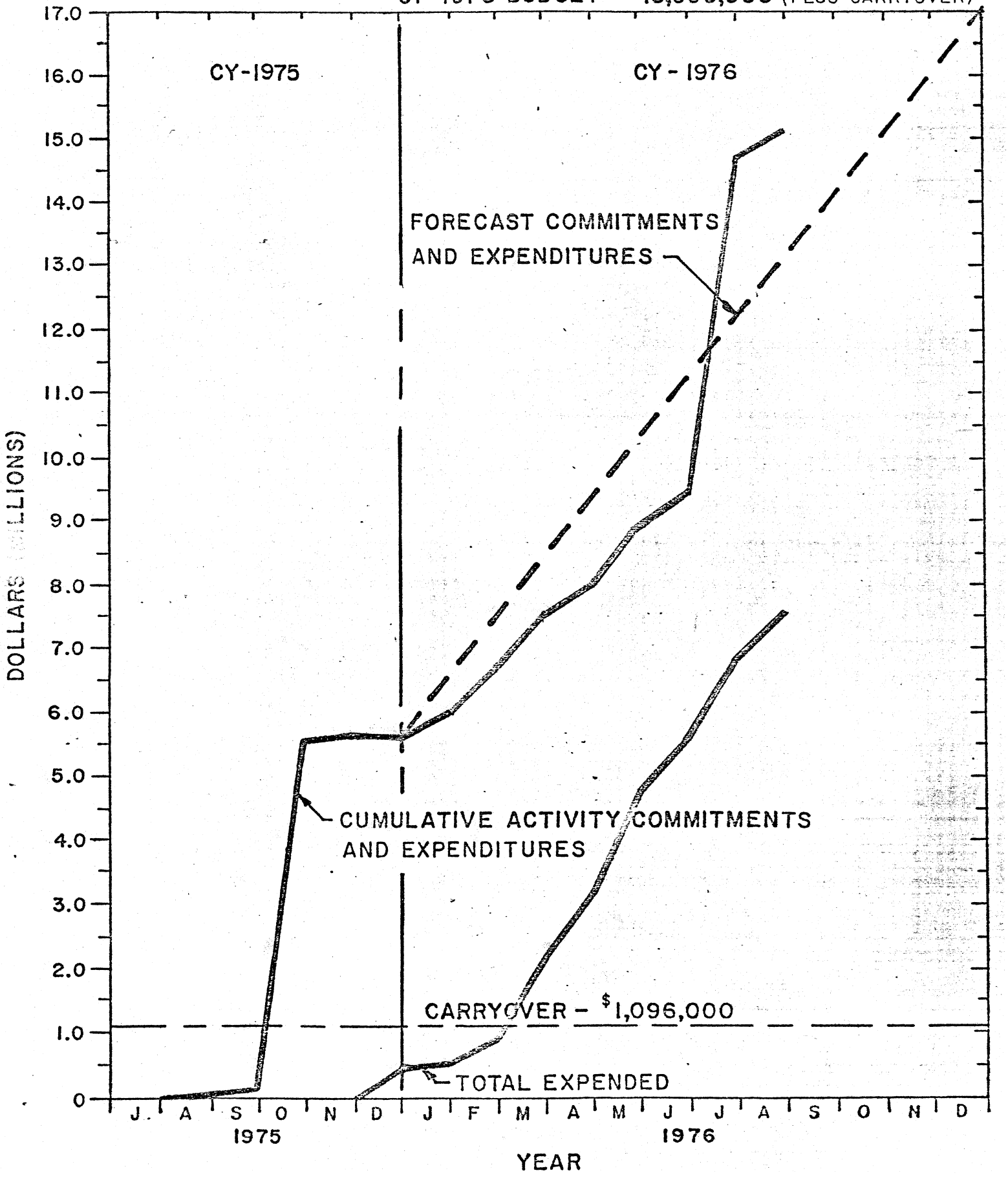
Column (6) - Unallocated Balance: Column 2 less Column 3. (Funds due from NSF to fund the total project as originally estimated.)

Column (7) - Estimate to Complete: Original estimate updated to take into account current or known costs.

Column (8) - Estimated Total: Column 4 plus Column 7.

Column (9) - (Over) Under: Column 2 less Column 8.

VLA-NRAO
PROJECT REPORT
EXPENDITURES AND COMMITMENTS
CY-1976 CUMULATIVE ACTIVITY

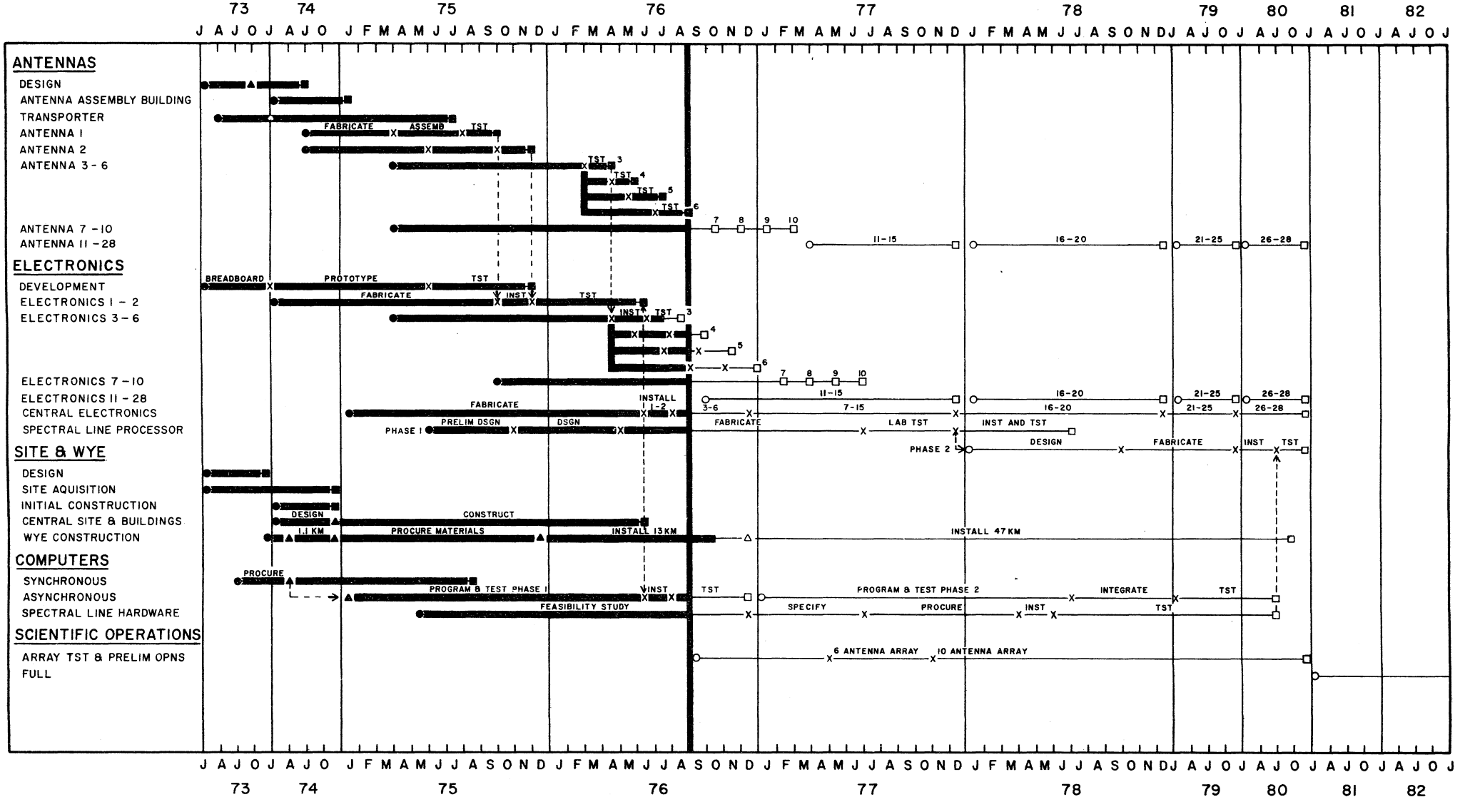


NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA ACTIVITY SCHEDULE

11/15/75

UPDATE DATE: 9/1/76



ABBREVIATIONS

ASSEMBLE - ASSEMB	CH-VILLE - CV	INSTALL	- INST	PRELIMINARY - PRELIM	
COMPLETE - CMPL	DESIGN	- DSGN	INTEGRATE	- INTG	SELECT - SLCT
CONTRACT - CNTR	DETAIL	- DTL	OPERATIONS	- OPNS	TEST - TST

SYMBOLS

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

REV. NO.	REV. DATE	REVISION
1	12/4/75	WYE CMPL 10/80