AUGUST 75

NATIONAL RADIO ASTRONOMY OBSERVATORY

AUGUST PROJECT REPORT

VLA PROJECT

SEPTEMBER 18, 1975

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROJECT

AUGUST 1975

SITE AND WYE

The pre-bid meeting for Phase III construction (Solicitation VLA-149) was held at New Mexico Tech on August 7, 1975. Addendums 2 and 3 were prepared and transmitted on August 12 and on August 22, 1975 respectively. Bids were received on August 28, 1975 with a low bid, out of twelve bids received, of $2,913,000 from Burn Construction Company, Inc.

Subcontract VLA-65; George A. Rutherford, Inc.; $2,386,000

1. The second floor slab of the Control Building is complete with the pouring of the electronics room portion. The remaining west end of the observation deck has been completed. The upper level central core walls have been completed and all masonry walls are approximately 90% complete. The roof above the computer and control rooms and the front office/lobby has been started.

2. Soil and roof drain piping is 70% complete; and domestic water is 40% complete. The cold water, hot water, and chilled water circulating pumps have been installed in the mechanical equipment room east. Installation of fire sprinkler piping has begun.

3. The underground electrical feed from the switchgear to the maintenance spur transformer and to the wye is complete, as is the service between the Control Building 750 KVA transformer and the cafeteria 500 KVA transformer. Conduit has been buried between the control and cafeteria buildings for the fire alarm system and for telephone service.

4. Patio slabs for the Cafeteria Building are poured. The built-up roofing and flashing are complete. Ninety percent of the hollow metal frames and 50% of the drywall is installed in the interior.

5. The packaged heat pump units, the broiler exhaust/makeup air unit, and the evaporative cooler are installed on the cafeteria roof, and metal screening is being fabricated around the rooftop equipment. Soil and roof drain and domestic water piping are each 95% complete. Eighty percent of the fire sprinkler system and 75% of the mechanical ducts and insulation are installed.

6. The 75,000 gallon water reservoir has been erected next to the pump house and is ready for painting.

This contract is estimated at 42% complete.

ANTENNA DIVISION

Antenna No. 1

During the month of August the following work was accomplished with the antenna on the master pad:

Panel adjustment and alignment was completed with a final setting RMS of 0.0147 inches referred to the design shape. The elevation encoder was set and aligned. The elevation gear was aligned and kirksited and the elevation and azimuth reducers aligned and final set.

On August 11 the servo subcontractor, Electrospace Systems, arrived on the job and started connecting servo drives and position indicating systems. Limit switches were set and inductosyn fine readout position was set. Servo acceptance tests completed on Friday, August 29. The inductosyn and data box was removed from Antenna No. 1 and returned to National Precision Laboratories for correction of malfunctions.

Antenna No. 1 is complete except for the items of the Discrepancy List.

Antenna No. 2

The reflector structure is completely assembled and is undergoing touch-up painting. The pedestal is complete through the yoke arms, and the elevation wheel and elevation bearings have been installed and aligned. The offset of elevation axis to the center of rotation of azimuth axis has been measured as 0.030 inches. The elevation gear has been installed and the counterweight installation started. The surface panels received on site.

Transporter

The operating controls are complete and have been checked out. Final painting of transporter is complete. Acceptance tests on transporter have been completed and a discrepancy list submitted.

SYSTEM INTEGRATION DIVISION

The #1 subreflector drive was mounted on Antenna No. 1. Bearing contamination with dust required a complete cleanup on the brake assemblies. The focus motion was driven from the vertex room with a test setup using temporary cables laid from the vertex to the apex along the ladder leg. This was done to permit the contractor to perform the fine alignment of the drive.

The #2 subreflector drive wiring is now 75% complete.

Dr. C. Wade was on site between August 18 and August 27, 1975, to conduct preliminary optical pointing tests. The antenna test trailer containing the Stand Alone Calculator Pointing Theodolite Support was installed, together with temporary time and voice communication wiring from the vertex room to the test trailer. On the nights of August 25 and 26, the first star pointing tests were conducted with good preliminary results.

ELECTRONICS DIVISION

The subreflector for the first antenna was received on August 27, 1975. The rms surface accuracy is .0074 inches compared with the specification of .007 inches which should reduce the efficiency at the shortest wavelength by less than 1%.

Work is continuing at Structural Technology on the 18-21 cm feed, the efficiency of which is below specification. The parametric amplifiers that failed in the first front end have now all been replaced and the unit is working again. Testing of the No. 2 front end is continuing and on the last cool-down a radiation shield of aluminized mylar was used in the dewar with the result that the temperature reached was several degrees below the previous best value of 18°K. This lower temperature should result in longer times between maintenance for the cryogenic system.

The 20 mm diameter waveguide has been installed at CW-5 from the manhole to the base of the antenna foundation. Testing of the 1.25 km of buried waveguide has continued using both a swept CW signal to examine the detailed frequency response and the pulsed reflection technique to determine the attenuation. Results are within specification. Orders have been placed for fabrication of the 60 mm diameter couplers which will be required for Antennas 3 through 6.

System testing of the local oscillator and IF sections of the electronics in the electronics trailer is continuing. Despite some component failures, the system has been kept running with the antenna and control station racks for Antenna No. 1 communicating through a simulated waveguide link. Monitor and control data has been transmitted in both directions over this link with satisfactory reliability. The interface between the monitor and control system and the oscillator system has been checked out and further testing of this nature with other parts of the system is in progress.

Construction by the group in Charlottesville of units for antennas 3 through 6 is progressing on schedule. For the IF Receiver and Fringe Generator modules construction of all units is virtually completed and testing is in progress. For five other module types mechanical assembly and sub-assembly of printed circuit boards is complete. All mechanical module parts have been inspected and brought up to standard where necessary, and those required for construction at the site have been shipped out from Charlottesville.

COMPUTER DIVISION

Asynchronous Subsystem

The dominant task during August was the continued implementation of the re-designed CANDID/SAIL interface and the data base. The new design was completed in June to provide a considerably improved CANDID-data base interface, and implementation should be essentially completed in September.

The final stages of the procurement of the initial mini-based graphics system were completed and orders placed at the end of the month. The system will be based on a PDP11/40 with 28K core memory and 2.4 million 16-bit words of cartridge disk storage. User input to the system will be via a keyboard and data tablet control of the cursor on any CRT in the system. The output devices will be: a COMTAL raster scan CRT, with 128 gray scale or pseudo-color levels and an overlay; refresh-type line graphics CRT based on a DEC GT40 system; and a Versatec electrostatic printer-plotter with 200 dots per inch to provide hard copy capabilities for software development purposes. Following the decision to base the basic graphics routines on the OMNIGRAPH system developed by the National Institutes of Health Computer Division, a TEKTRONIX 4012 storage tube terminal of the type easily usable with this system was obtained to allow rapid initial software development in the DEC-10 before transference to the PDP11/40; this will also provide a complete graphics routines package in the DEC-10 that will eventually be used with spooled output graphics equipment like the film recorder and XY-plotter, with most of the needed software ready years earlier than originally planned.

A number of basic SAIL routines were developed to permit graphical displays on the TEK 4012 and the ADDS terminals in graphics mode. Some of these were used together with a preliminary package of VLA simulation routines to allow studies of what antenna configurations would be desirable for the early VLA antennas.

Synchronous Subsystem

During August the debugging and extension of the programming system continued. In particular, the on-line software necessary for the single dish testing operations is nearly complete, though not yet error-free. Two small on-line routines, which turn the thermal calibration on and off, must yet be added, and one or two off-line data reduction routines must be completed.

System testing in which the software is mated to the electronics devices it will monitor or control, has continued during August, especially in the areas of the digital communication system and the multiplier/delay line system.

PROJECT MANAGEMENT

During the month of August the purchasing group placed approximately 250 orders for miscellaneous materials for supplies and equipment amounting to about $150,000. In addition a portion of the option with Sumitomo Electric for waveguide, 5,000 meters at $328,000, was exercised; orders amounting to a total of $88,000 were placed for the Graphic Display System of the Asynchronous Computer; a contract let amounting to $77,000 for cryogenic refrigerators for the next series of antennas; $67,000 in orders placed for the components for the IF-LO Modems for antennas 3 through 6; a consulting agreement with an experienced retired railroad expert to augment our present consultant on rail take-up activities; and the public bid opening for site construction, Phase III was held.

Rail take-up at Redstone Arsenal continued and shipments are being regularly received at the site. Bids have been received on rail take-up at Sunflower Ordnance Depot and an award will be made as soon as rail rates are obtained from GSA.

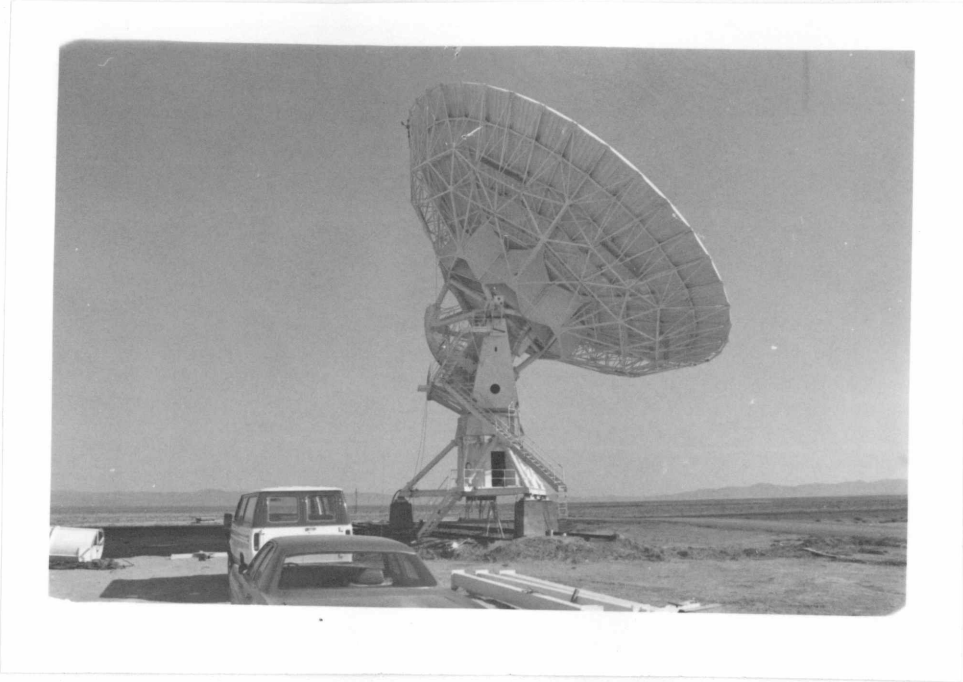
Seven new staff members joined the VLA Project in New Mexico this month. Two, Robert S. Runyon an electronics draftsman and Rey Serna a senior technician are with the electronics division; two, Larry Carlisle a mechanical draftsman and Donald Krieger a transporter operator joined the antenna division; and three, James L. Guin, Isidro M. Lopez, and Rudy Latasa, security guards and Maintenance trainees joined the project management group.

Personnel

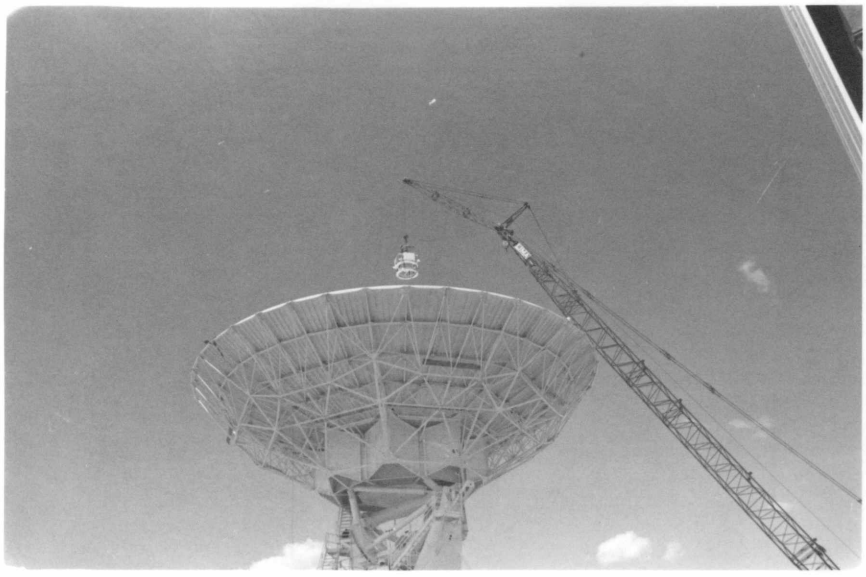
The personnel changes as of August 31, 1975 are as follows:

Division	Previous Level	Additions	Reductions	Current Level
Project Management	18	3	2	19*
Site and Wye	6	0	0	6
Antenna	5	2	0	7
Electronics	34	2	3	33
Computer	15	0	0	15*
Systems Integration	2	0	0	2
TOTALS	80	7	5	82

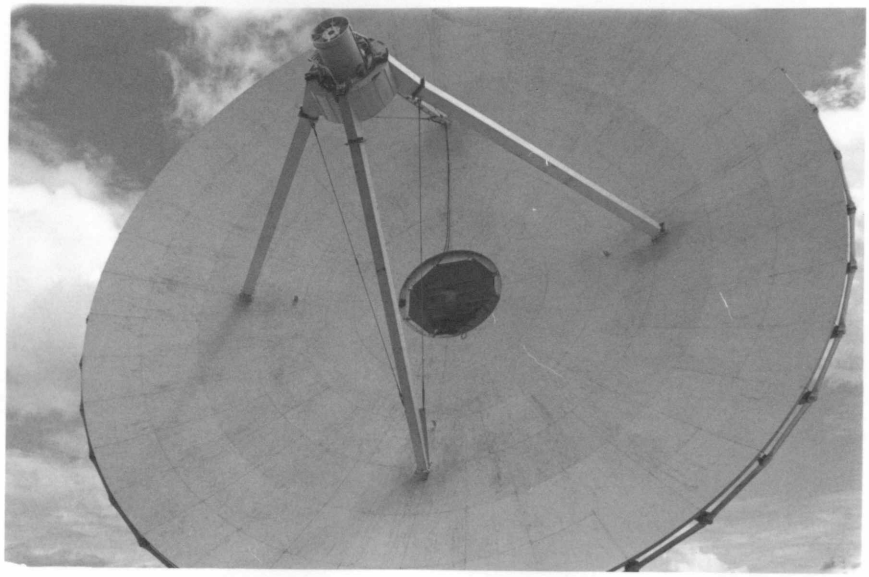
*Includes one part-time person.



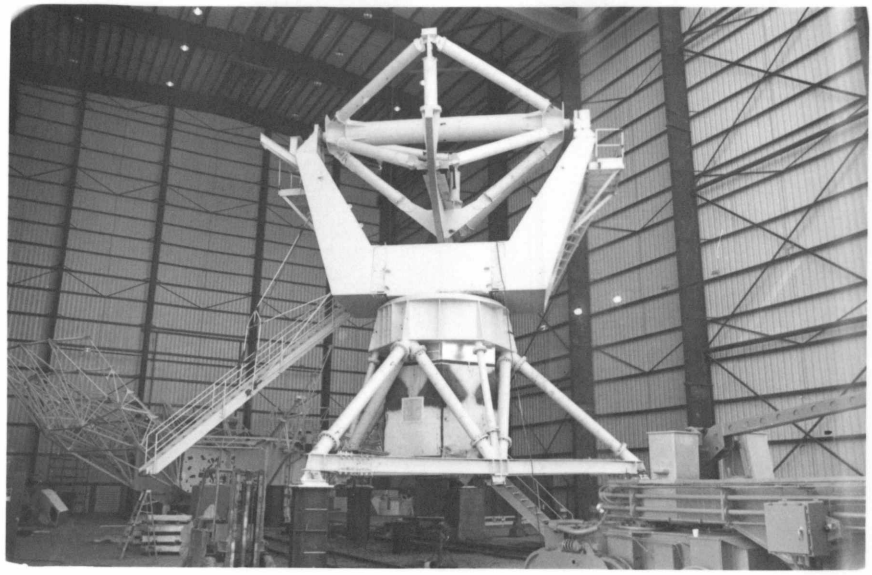
p8-75-1 Antenna #1 Undergoing Servo Testing



p8-75-2 Installation of Focusing Feed Mount on Antenna #1



p8-75-3 Face of Dish of Antenna #1 without Feeds but with Focusing Feed Mount and Subreflector Transition installed



p8-75-4 Antenna #2 Under Fabrication

p8-75-5 Control Building

p8-75-6 Cafeteria Building

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	6/17/73	$ 981,461	3/15/74 4/30/75 1/15/75	Title I - Completed. Title II - 99% Completed. Title III - Work in progress in conjunction with VLA-65. Fixed price plus cost reimbursables.
VLA-6	E-Systems, Inc.	28 Radio Telescopes	10/18/73	$17,518,591	8/9/75	NRAO is assembling front-end components on Antenna No. 1. Antenna No. 1 is acceptable except for a number of minor discrepancies. Antenna No. 2 is being assembled. Work is underway on Antennas No. 3 through 10.
VLA-10	E-Systems, Inc.	Antenna Transporter	1/30/74	$ 393,396	7/1/75	Transport is operational. Minor work left to be done.
VLA-14	Comtech Lab, Inc.	Parametric Amplifiers	3/13/74	$ 221,000	7/15/75	10 each additional parametric amplifiers purchased on Amendment No. 1. 3 each have been accepted. Balance to be shipped by 9/21/75.
VLA-16	AIL	Up-converters	3/14/74	$ 98,063	7/1/75	8 additional units purchased under Amendment No. 3 have all been delivered and accepted.
VLA-29	Sterling-Detroit	Focusing Feed Mounts	6/17/74	$ 86,174	3/1/75	The units for Antennas No. 1 and 2 have been received.
VLA-44	Digital Equip. Corporation	Asynchronous Computer	6/17/74	$ 990,869	2/15/75	Major part of system delivered 12/16/74. DEC has had trouble with their supplier of FFT. DEC has received FFT but are having trouble debugging system. Delivery is promised by 9/15/75.

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
P.O. 52439	A and K Railroad Materials, Inc.	Cross Ties	7/25/75	$ 105,600	9/15/75	Option exercised for 10,000 additional cross ties 6,600 of these have been received.
VLA-65	Geo. A. Rutherford Inc.	Site Construction, Phase II	12/16/74	$2,388,594	6/1/76	Work began week of February 24, 1975 and is progressing on schedule. Change Order No. 1 issued for $1,994 on Aug. 26, 1975.
P.O. 52322	Sumitomo Electric USA, Inc.	1313 pieces of waveguide, 1350 each coupling sleeves	1/27/75	$ 757,552	9/30/75	660 pieces of Item I and 675 each of Item 2 have been received. Option 1 for 1000 additional pieces of Item I and 1030 pieces Item 2 has been exercised.
P.O. 52432	Hitachi Shabaden Corp. of America	3 ea. Waveguide Signal Distributors	2/7/75	$ 230,000	12/15/75	Drawings were approved 8/7/75.
P.O. 52727	Lawrence Hefner	Labor Hour contract and equipment rental	3/26/75	$ 37,480	3/30/76	Blanket Purchase Order to cover the period beginning April 1, 1975, and ending March 30, 1976. Total expenditure increased to $37,480 by Change Order No. 1. Approx. $14,831 spent effective 8/31/75.
P.O. 52942	DeLuna Bluebird Bus Sales of New Mexico	Bus for Site	5/14/75	$ 50,160	10/1/75	Delivery is on schedule.
P.O. 53093	Sun Valley Charter	Bus leased until Bus on P.O. 52942 is delivered	5/19/75	$ 4,175	10/15/75	Bus is being used to transport personnel to and from VLA Site. $3,550 spent effective 8/31/75.
P.O. 53637	Faron Gutierrez	Labor hour for carpenter work	6/16/75	$ 5,000	6/5/76	Carpenter is building steps and skirting or trailers. Approx. $3,387 spent effective 8/31/75.
P.O. 53431	Tektronix, Inc.	Computer Display Terminal	7/29/75	$ 5,343	8/25/75	Unit has been received and accepted.

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-134 P.O. 53578	Air Products and Chemicals, Inc.	Helium Compressors and Cryogenic Refrigerators	8/15/75	$77,085	10/17/75	First unit will be shipped 10/17/75 with one per week each week until order is completed.
VLA-137 P.O. 53821	Comtal Corp.	Rasterscan Subsystem	8/29/75	$24,950	11/30/75	Vendor has not had time to receive order.
VLA-138 P.O. 53822	Summagraphics Corp.	Data Tablet Digitizer	8/29/75	$ 4,154	11/1/75	Vendor has not had time to receive order.
VLA-139 P.O. 53823	Versatec Corp. c/o BFA Corp.	Electrostatic Printer Plotter	8/29/75	$ 9,288	11/1/75	Vendor has not had time to receive order.
VLA-140 P.O. 53824	Digital Equipment Corp.	Interactive Line Drawing Subsystem	8/29/75	$49,598	11/1/75	Vendor has not had time to receive order.

VLA PROJECT
PROCUREMENT ACTIVITIES INITIATED

REP NUMBER	ITEM DESCRIPTION	ESTIMATED COST	ISSUE DATE	BID DUE DATE	SUBMISSION TO NSF DATE	AWARD DATE	CURRENT STATUS
VLA-149	Site Const. Phase III	$4,000,000	7/15/75	8/28/75	9/5/75	9/30/75	Twelve bids were received on August 28, 1975.
VLA-151	Railroad Rail Accessories	$ 100,000	7/25/75	8/22/75	9/15/75	9/30/75	Five purchase orders issued within NRAO contractual authorization. Total cost $44,280.

NATIONAL RADIO ASTRONOMY OBSERVATORY

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VLA--FINANCIAL STATUS REPORT
(in thousands)

As of: 8/31/75

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Allocation to Date				Outlook			
Item	Project Ceiling	Allocated	Expended and Committed	Allocated Balance	Unallocated Balance	Est. to Complete	Est. Total	(Over) Under Ceiling	Notes
Site and Wye	27,860	7,241	5,914	1,327	20,619	23,540	29,454	(1,594)	(1)
Antennas	20,400	5,311	5,015	296	15,089	16,145	21,160	(760)	
Electronics	17,000	4,833	4,169	664	12,167	12,835	17,004	(4)	
Computer	4,850	1,885	1,692	193	2,965	3,158	4,850	0	
Systems Integration	400	98	29	69	302	371	400	0	
Project Management	2,650	828	752	76	1,822	2,076	2,828	(178)	
Subtotal	73,160	20,196	17,571	2,625	52,964	58,125	75,696	(2,536)	(1)
Contingency	2,840	623	0	623	2,217				
Total	76,000	20,819	17,571	3,248	55,181	58,125	75,696	304	(1) (2)

Basic estimate is that of August 1974 updated where costs have become known. Escalation included for future years at 6% for site and wye work, National Radio Astronomy Observatory labor, and certain antenna items. Antenna estimate is based on existing contract costs which include 5% per year escalation. No future escalation has been included for electronics or computer purchased equipment.

(1) Allocated Total Column (3) Includes $1,000,000 in Deferred CY-1975 Funds

(2) Allocated Total, Column (3) Sum of $20,819,000 Includes $108,000 Currently Withheld by the NSF and DOES Not Include $3,000,000 Authorized by Amendment #12 to NSF-C-780 Dated 7/22/75

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.

TOTAL

VERY LARGE ARRAY

Status as of August 31, 1975

Project Number	Description	Allocation	Expended Monthly	Expended	Committed	Total	Balance	Outstanding Obligations Pending	Net Balance
11000	Site and Wye	7,241,406	266,205	3,521,681	2,391,846	5,913,527	1,327,879	36,893	1,290,986
12000	Antenna System	5,311,344	20,714	2,533,330	2,481,380	5,014,710	296,634	291,663	4,971
13000	Electronic System	4,832,934	224,274	3,383,465	785,041	4,168,506	664,428	211,745	452,683
14000	Computer System	1,884,589	41,079	1,422,574	269,181	1,691,755	192,834	90,676	102,158
16000	Systems Integration	98,000	7,638	28,268	1,122	29,390	68,610	12,951	55,659
17000	Project Management	827,961	51,829	683,957	68,159	752,116	75,845	89,888	(14,043)
	Contingency	623,066	---	---	---	---	623,066	---	623,066
	Sub-Total	20,819,300 (1)	611,739	11,573,275	5,996,729	17,570,004	3,249,296	733,816	2,515,480
	1976 Funding	3,000,000 (2)	---	---	---	---	3,000,000	---	---
	Total VLA	23,819,300	611,739	11,573,275	5,996,729	17,570,004	6,249,296	733,816	5,515,480

(1) Includes $1.0 M in Deferred CY-1975 Funds Received on (NSF-C-780) Amendment #13 8/14/75

(2) Unallocated CY-1976 Funds Received on (NSF-C-780) Amendment #12 7/22/75

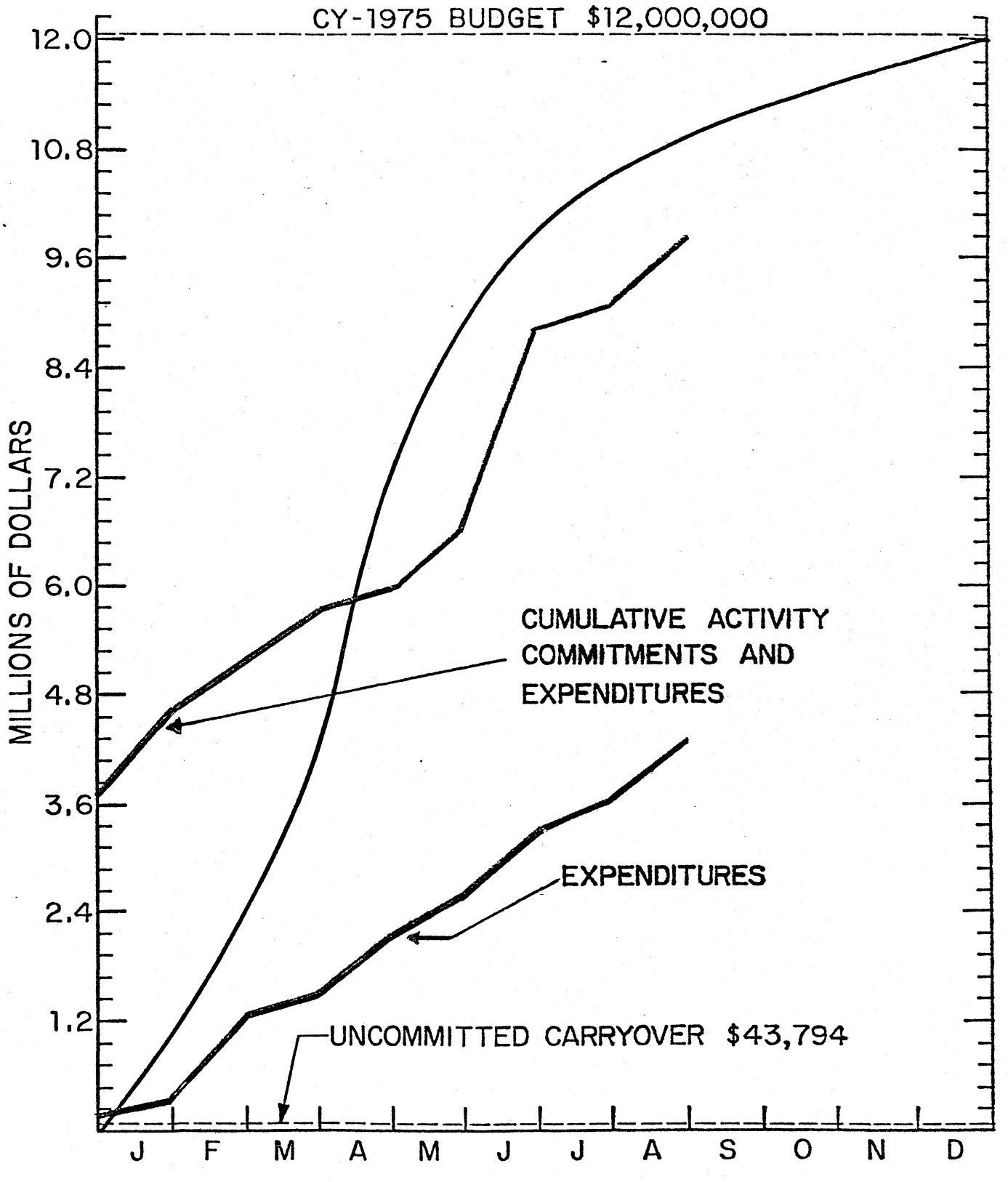
CY 1975

VERY LARGE ARRAY

Status as of August 31, 1975

Project Number	Description	Allocation	Expended Monthly	Expended	Committed	Total	Balance	Outstanding Obligations Pending	Net Balance
11000	Site and Wye	5,399,614	266,205	1,710,589	2,377,938	4,088,527	1,311,087	36,893	1,274,194
12000	Antenna System	2,544,000	19,172	129,961	2,116,467	2,246,428	297,572	291,663	5,909
13000	Electronic System	2,557,000	213,417	1,126,373	754,160	1,880,533	676,467	211,745	464,722
14000	Computer System	1,442,000	41,079	981,434	266,924	1,248,358	193,642	90,676	102,966
16000	Systems Integration	98,000	7,638	27,599	1,122	28,721	69,279	12,951	56,328
17000	Project Management	421,000	51,829	290,719	68,140	358,859	62,141	89,888	(27,747)
	Contingency	623,066	---	---	---	---	623,066	---	623,066
	Total VLA	13,084,680	599,340	4,266,675	5,584,751	9,851,426	3,233,254	733,816	2,499,438

VLA-PROJECT REPORT
EXPENDITURES AND COMMITMENTS
CY-1975 CUMULATIVE ACTIVITY

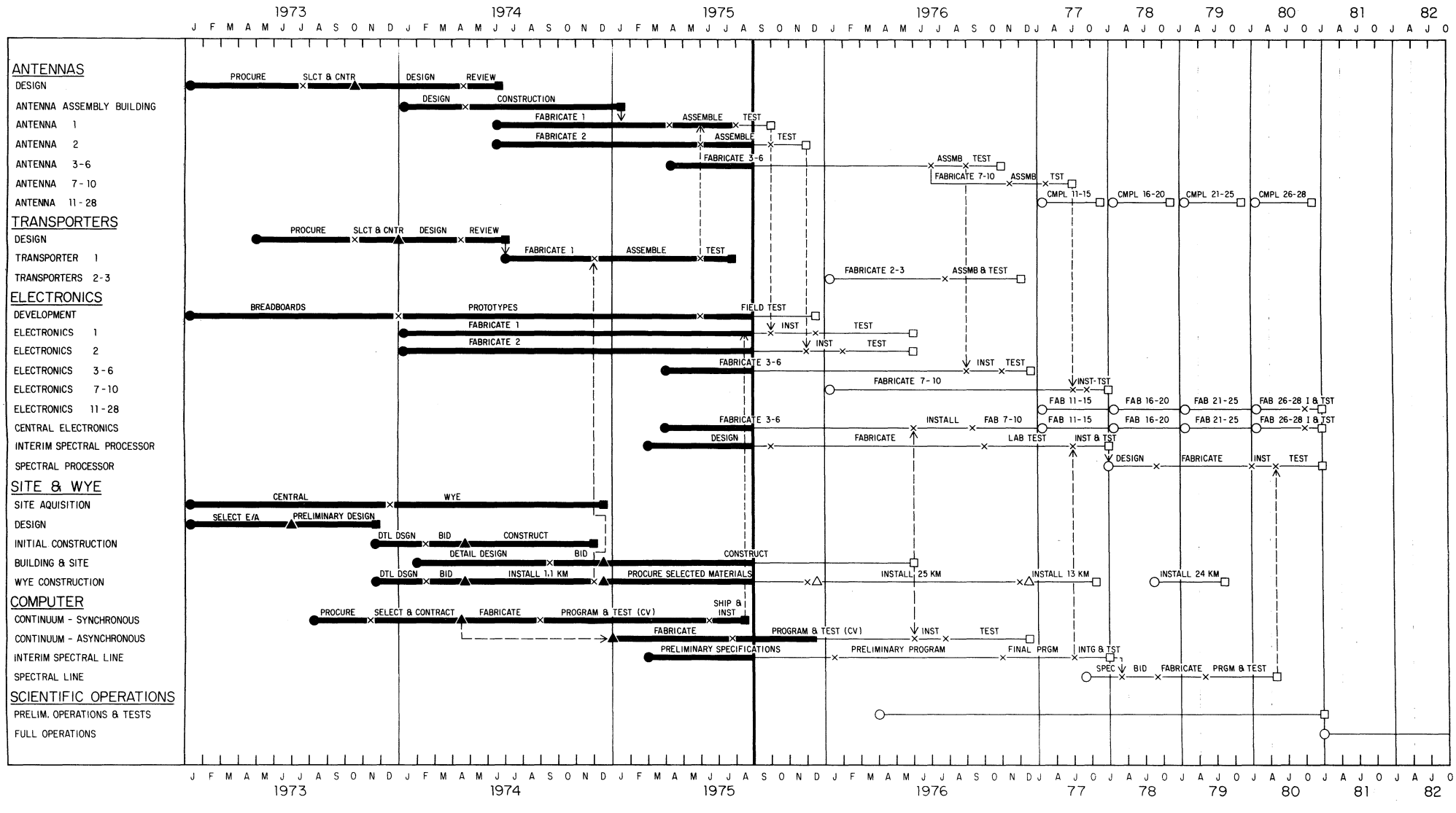


NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA ACTIVITY SCHEDULE

11/15/74

UPDATE DATE: 01 SEPTEMBER 1975



ABBREVIATIONS

ASSEMBLE - ASSMB	CH-VILLE - CV	INSTALL	- INST	PROGRAM - PRGM	
COMPLETE - CMPL	DESIGN - DSGN	INTEGRATE	- INTG	SELECT - SLCT	
CONTRACT - CNTR	DETAIL - DTL	NEW MEXICO - NM		TEST - TST	

SYMBOLS

○ START OF A PHASE △ CONTRACT AWARD

× END OF AN ACTIVITY □ END OF A PHASE

REV. #	REV. DATE	REVISION
1	4-1-75	ANTENNA DELIVERY SCHEDULE REVISED