

JULY 1975

NATIONAL RADIO ASTRONOMY OBSERVATORY

JULY PROJECT REPORT

VLA PROJECT

AUGUST 11, 1975

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROJECT

JULY 1975

SITE AND WYE

Phase III construction, consisting of a base bid of approximately 3.5 miles of double railroad track, 40 antenna foundations and approximately four miles of buried wye power lines and power at the 40 antenna stations, was sent out for bid on July 15, 1975 (Solicitation VLA-149) with a due date of August 28, 1975. Addendum No. 1 was prepared and transmitted on July 25, 1975.

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

1. Second floor slab for the Control Building is complete with the exception of the portion under the electronic equipment room. Slumpblock has been laid for the digital equipment room and the office/lobby area while masonry work is beginning for the computer room. Approximately 70% of the observation deck is poured. The exterior stair wing slumpblock walls are complete.
2. The steam convertor and a heat exchanger have been delivered and stored in the mechanical equipment room east.
3. Branch electrical circuits have been installed in the completed masonry and concrete sections of the Cafeteria and Control Buildings. Panels are being installed in the Control Building core walls and in the Cafeteria Building.
4. The lightweight insulating concrete roof deck has been poured over the precast tees of the Cafeteria Building. The built-up roofing over the concrete deck is approximately 75% complete. The precast fascia panels have been welded in place.
5. The metal stud system has been erected in the interior of the Cafeteria. Approximately 25% of the mechanical ducts have been set in the ceiling cavity and insulated. The sprinkler piping is being installed. Water lines are 80% complete. Roof drain piping is 90% complete.

6. Concrete pads have been poured and secondary electrical feeds installed for transformers at CW-5 and CW-9. The primary underground feeder has been laid from the primary switchgear site to the wye at CW-5, and from the switchgear to the control building. The permanent power to the master pad from the antenna building has been installed.

This contract is estimated at 30% complete.

Waveguide Installation - Stations CW5 - CW9

Waveguide has been laid and set to line and grade complete to CW-5. Zinc grounding strips are in place between CW-5 and CW-9. Cadwelding is complete at CW-5 and CW-6 except for welding to the antenna grounding system.

ANTENNA DIVISION

Antenna No. 1

During the month of July panel installation and rough setting was accomplished in the assembly building. Panel installation complete on July 16. On July 18 the antenna was moved from the Antenna Assembly Building to the master foundation. During the remainder of the month alignment of azimuth bearing, elevation shaft, and azimuth inductosyn was accomplished. Electrical cabling was started and installation of control cabinets and air conditioning ducts continued. The feed legs were installed on the antenna and prepared for installation of AUI feed mount. Datum plane for panel setting was established and alignment of collimation axis to elevation axis was checked. Panel drilling for installation of targets and installation of targets was completed at end of month.

Antenna No. 2

Assembly continued on reflector No. 2, status at end of month reached approximately 60% complete. Pedestal installed on assembly foundation and erection completed through bearing support. Azimuth bearing and gear installed. All four gear reducers arrived on site on July 31. Stiffness tests on the modified azimuth gear boxes were conducted at Philadelphia Gear Plant on July 15 and 16 which revealed an average stiffness of 4.26×10^6 ft. lbs. per radian against the specified 5.0×10^6 . Antenna performance calculations indicate that this reduction of stiffness will not degrade performance appreciably but tests conducted during servo tests will be a final determinant. All other equipment and hardware for Antenna No. 2 is on hand.

Transporter

The transporter was used on July 18 to move Antenna No. 1 to master pad. During this move some temporary controls were used. In the remaining period of time the design controls and circuits have been completed and the transporter will be ready for acceptance testing by the second week of August.

Antenna 3 - 10

Contracts have been placed or are in the finalization stage for equipment for Antennas 3 - 10. Structural steel has been purchased and delivery to the Fabricator at Hobbs is about 85% complete. Fabrication has started at Hobbs.

SYSTEM INTEGRATION DIVISION

The subreflector drive wiring was completed with the unit scheduled for mounting on the telescope in early August.

The test pointing computer components were assembled in the test trailer and checked out. The automatic weather station was assembled, and testing by the factory engineer is expected on August 5. Tentative specifications for the array telephone and radio communication system have been drawn, and we await the response of the telephone company and mobile radio equipment vendors.

ELECTRONICS DIVISION

July was the first month of operation after the move which brought most of the Electronics group out from Charlottesville to New Mexico. The first weeks were largely occupied in settling into the new offices and laboratories, unpacking equipment and setting it up in the Electronics trailer. Some system testing was begun, but this has gone a little more slowly than was hoped, largely because the systems engineers who had taken the lead in this area did not move out to New Mexico. Procurement of electronics for antennas 3 - 6 has not been greatly affected by the move and is continuing as before.

In the front end area, testing of the first system is complete and the second front end has been assembled and is about to be turned on. Failure of the parametric amplifiers resulting from the stripline in the circulators shorting to ground has caused some interruption in the testing. This has now occurred in five of the six stages in the first front end and these have all been returned to Comtech and have been modified.

A visit to three cryogenics manufacturers by our engineers has enabled further evaluation to be made of the bids received for systems

3-6, and it has been decided to use Air Products units but also to purchase one Cryomec unit for evaluation. The subreflector for antenna #1 is expected to be shipped by Structural Technology by August 6 and progress is continuing on optimization of the 18-21 cm feed design.

Tests of the 1.25 km of waveguide, for which installation was completed this month, show attenuation within specifications over the 26 - 60 GHz range with values of 2.35 and 1.31 db per km at 26.5 and 50 GHz respectively. Tests of the 20 mm waveguide for the antennas are progressing.

In the local oscillator area some system testing has started. It appears that the temperature in the electronics testing trailer presently varies by 4 - 6° C. from day to night and this will probably have to be improved for detailed testing of phase stability. Design of the linear phase detector to replace the line stretchers (Module L 12) was commenced this month.

The phase lock circuit in the modems has been modified to overcome a temperature problem. Orders have been placed for the major items for the modems of systems 3 - 6.

COMPUTER DIVISION

Asynchronous Subsystem

Work on the implementation of the data base, CANDID, and CANDID/SAIL interface proceeded during July and is nearly complete.

Formal specifications for CANDID utility operators were completed. Operators for synthesis processing were designed, and first versions of the specifications for these operators were written. Preliminary work on the design of presynthesis operators was begun.

Bids were received from several companies in response to RFP's sent out for graphics and I/O equipment in June and are presently being evaluated.

Synchronous Subsystem

Reassembly and checkout of the Modcomp computer system was completed during July at the site. Simulation studies continue, including simulated data from the correlator recorded on magnetic tape and various commands examined on the digital communication system data tape. The latter include antenna pointing commands (qualitative correct) and lobe rotator commands.

PROJECT MANAGEMENT

The first shipments of rail from Redstone Arsenal have arrived at the site and work on this take-up is proceeding. An additional small quantity of rail has been inspected at Eglin Air Force Base and transfer will be requested.

Personnel

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

<u>Division</u>	<u>Previous Level</u>	<u>Additions</u>	<u>Reductions</u>	<u>Current Level</u>
Site and Wye	6	0	0	6
Project Management	18	2	2	18**
Antenna	6	1	2	5
Electronics	31	3	0	34**
Computer	14	1	0	15*
Systems Integration	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
TOTALS	77	7	4	80

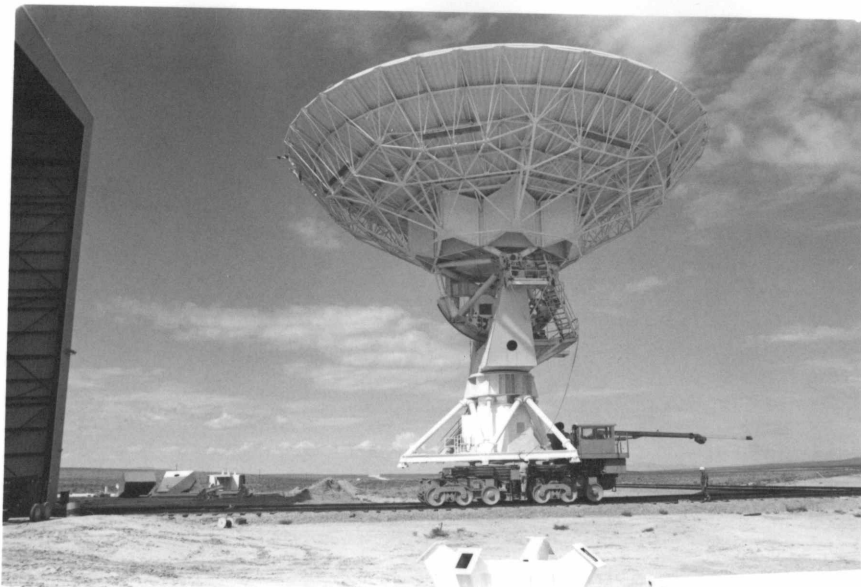
* Includes one part-time person.

** Includes two part-time people.



p7-75-1

Antenna #1 in Assembly Building,
Complete with Panels Ready for Move



p7-75-2

Antenna #1 on Transporter Moving
Away from Assembly Building 7/18/75



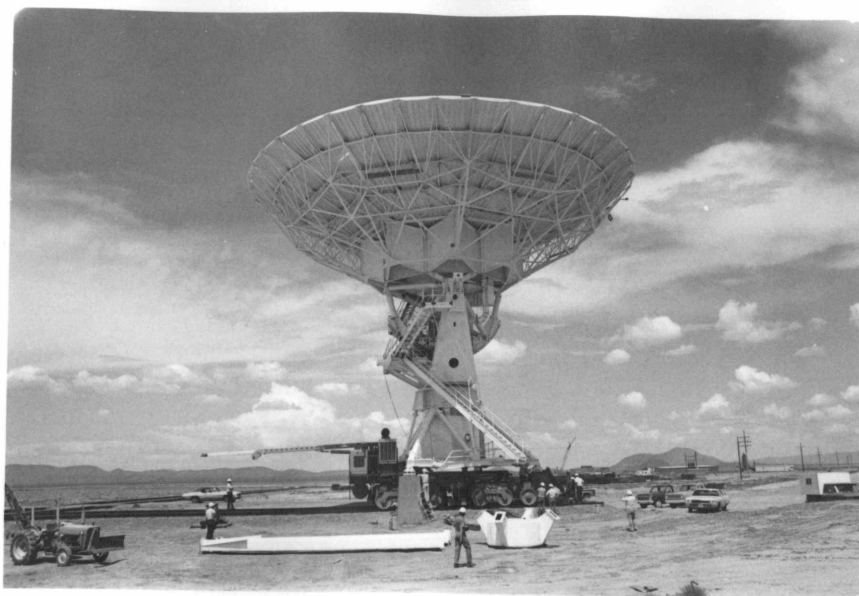
p7-75-3

Antenna #1 on Transporter
at Intersection with Main Tracks



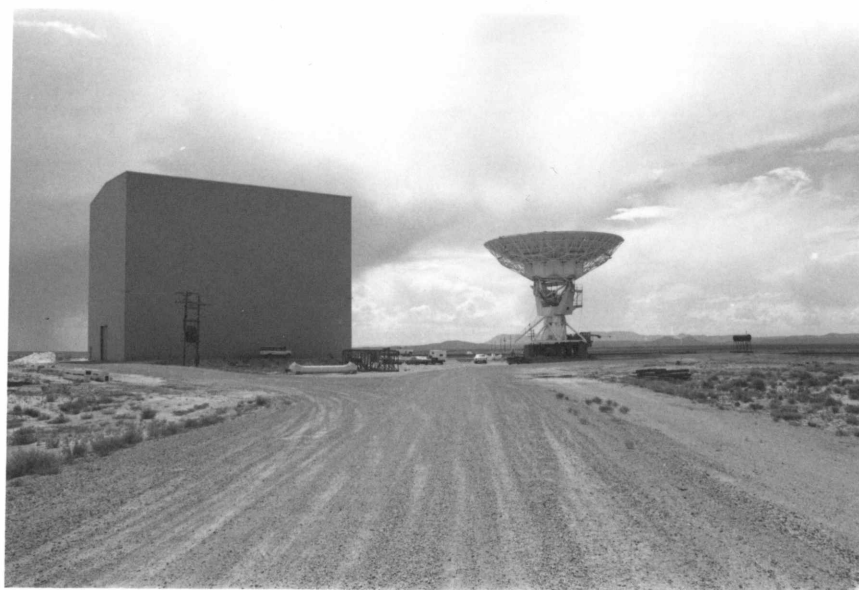
p7-75-4

Antenna #1 on Transporter Turning
on Tracks to Make Turn onto Main Track



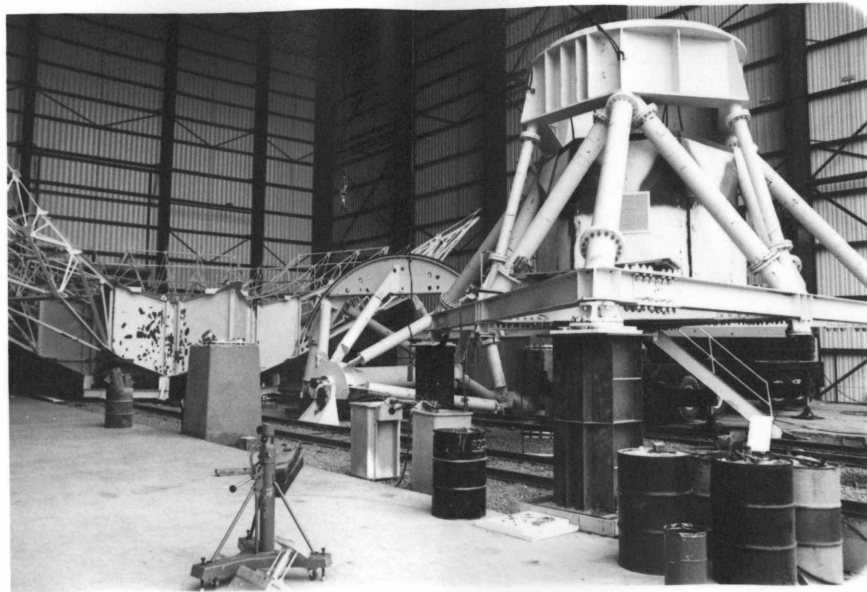
p7-75-5

Antenna #1 Being Off Loaded from
Transporter unto Master Foundation Pad



p7-75-6

Antenna #1 on Master Foundation Pad Near
Assembly Building as Afternoon Thunderstorm Approaches



p7-75-7

Antenna No 2
Partially Assembled Pedestal in Foreground
and Support Structure in Rear



p7-75-8

Control Building from South



p7-75-9

Cafeteria Building,
Control Building in Background



p7-75-10

Waveguide Installation in Manhole CW-5

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	Antenna No. 1 is on the master pad and is nearing completion. 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	Transporter 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 ampli- fiers purchased on Amendment No. 1. 3 each shipped 7/31/75. Balance to be shipped 8/31/75.
VLA-16	AIL	Up-converters	3/14/74	\$ 98,063	7/1/75	8 additional units purchased under Amendment No. 3. Two units deli- vered 7/9/75, 2 ea. 7/19/75, 2 ea. by 8/1/75, 2 ea. by 8/11/75.
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 and should make delivery on rest of system by 8/15/75.
VLA-52 P.O. 51770	NMIMT	Equipment and equip- ment operators and Computer Services	9/6/74	\$ 9,500	8/15/75	Blanket Purchase Order awarded for Sept. 1, 1974. \$1,297 spent effective 7/31/75.

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
VLA-62 P.O. 51771	John Pariss	Cross Ties	8/27/75	\$ 70,000	11/29/74	Order was cancelled after delivery of 4,246 cross ties. \$29,722 spent effective 7/31/75.
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 at a total price of \$50,600.
VLA-65	Geo. A. Rutherford Inc.	Site Construction , Phase 2	12/16/74	\$2,386,600	6/1/76	Work began week of February 24, 1975 and is progressing on schedule.
P.O. 52322	Sumitomo Electric USA, Inc.	1313 pieces of wave- guide, 1350 each coupling sleeves	1/27/75	\$ 429,975	9/30/75	Order accepted 2/10/75 by vendor, work is in progress. Duty Free Entry has been arranged. First shipment due at Port of Entry 8/7/75.
P.O. 52432	Hitachi Shabaden Corp. of America	3 ea. Waveguide Sig- nal Distributors	2/7/75	\$ 230,000	12/15/75	Order accepted 2/13/75 by vendor, work is in progress. Duty Free Entry has been arranged.
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. \$12,480 spent effective 7/31/75.
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 personnd to and from VLA Site. \$2,300 spent effective 7/31/75.
P.O. 53637	Faron Gutierrez	Labor hour for carpenter work	6/16/75	\$ 5,000	6/5/76	Carpenter is building steps and skirting for trailers. Approx. \$2,000 spent effective 7/31/75.
P.O. 53431	Tektronix, Inc.	Computer Display Terminal	7/29/75	\$ 5,343	8/25/75	Delivery is on schedule.

VLA PROJECT
PROCUREMENT ACTIVITIES INITIATED

<u>REP NUMBER</u>	<u>ITEM DESCRIPTION</u>	<u>ESTIMATED COST</u>	<u>ISSUE DATE</u>	<u>BID DUE DATE</u>	<u>SUBMISSION TO NSF DATE</u>	<u>AWARD DATE</u>	<u>CURRENT STATUS</u>
VLA-134	Cryogenic Refrigeration System	\$ 80,000	5/29/75	6/30/75	7/30/75	8/15/75	P.O. 52578 submitted for approval 7/30/75.
VLA-137	Rasterscan Subsystem	\$ 24,330	6/9/75	7/15/75	8/15/75	8/30/75	Bids being evaluated.
VLA-138	Data Tablet Digitizer	\$ 4,150	6/9/75	7/15/75	8/15/75	8/30/75	Bids being evaluated.
VLA-139	Electrostatic Printer Plotter	\$ 11,875	6/9/75	7/15/75	8/15/75	8/30/75	Bids being evaluated.
VLA-140	Interactive Line Drawing Subsystem	\$ 47,415	6/9/75	7/15/75	8/15/75	8/30/75	Bids being evaluated.
VLA-146	26-52 GHz Mixers	\$ 45,000	6/9/75	7/11/75	8/15/75	8/30/75	Bid summary showing low bid of \$34,800 mailed to NSF 7/31/75.
VLA-149	Site Const. Phase III	\$4,000,000	7/15/75	8/28/75	9/15/75	9/30/75	33 bid packages out.
VLA-151	Railroad Rail Accessories	\$100,000	7/25/75	8/22/75	9/15/75	9/30/75	Several orders will probably be awarded from this RFP. If any exceed \$50,000 they will be submitted for approval.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA--FINANCIAL STATUS REPORT (in thousands)

As of: 7/31/75

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Item	Project Ceiling	Allocation to Date			Unallo- cated Balance	Outlook		(Over) Under Ceiling	Notes
		Allocated	Expended and Committed	Allocated Balance		Est. to Complete	Est. Total		
Site and Wye	27,860	6,241	5,458	783	21,619	23,996	29,454	(1,594)	4
Antennas	20,400	5,311	4,997	314	15,089	16,163	21,160	(760)	1-2
Electronics	17,000	4,833	3,849	984	12,167	13,155	17,004	(4)	
Computer	4,850	1,885	1,654	231	2,965	3,196	4,850	0	
Systems Integration	400	98	22	76	302	378	400	0	
Project Management	2,650	828	714	114	1,822	2,114	2,828	(178)	
Subtotal	73,160	19,196	16,694	2,502	53,964	59,002	75,696	(2,536)	
Contingency	2,840	623	0	623	2,217	 	 	 	1
Total	76,000	19,819	16,694	3,125	56,181	59,002	75,696	304	3

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.

- Notes:
1. \$42,000 moved from Electronics to Contingency following reallocation of CY 75 Program.
 2. Potential savings of \$130,000 realized in procuring modems. Estimate to complete reduced.
 3. Allocated column (3) sum of \$19,819,000 includes \$108,000 currently withheld by the NSF and does not include \$3,000,000 authorized by Adm #12 to NSF-C-780.
 4. Expended & committed column (4) decreased by \$62,451.00 due to cancellation of two orders.

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 PROJECT
VERY LARGE ARRAY
Status as of July 31, 1975

<u>Project Number</u>	<u>Description</u>	<u>Allocation</u>	<u>Month Expended</u>	<u>Total Expended</u>	<u>Total Committed</u>	<u>Total</u>	<u>Balance</u>	<u>Outstanding Obligations Pending</u>	<u>Net Balance</u>
11000	Site and Wye	6,241,406		3,255,476	2,202,540	5,458,016	783,390	45,955	737,435
12000	Antenna System	5,311,344		2,512,616	2,484,544	4,997,160	314,184	304,370	9,814
13000	Electronic System	4,832,934		3,159,191	689,451	3,848,642	984,292	239,338	744,954
14000	Computer System	1,884,589		1,381,495	272,218	1,653,713	230,876	98,638	132,238
16000	Systems Integration	98,000		20,630	974	21,604	76,396	16,188	60,208
17000	Project Management	827,961		632,128	82,275	714,403	113,558	97,198	16,360
	Contingency	623,066		---	---	---	623,066	---	623,066
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	Total VLA	19,819,300		10,961,536	5,732,002	16,693,538	3,125,762	801,687	2,324,075

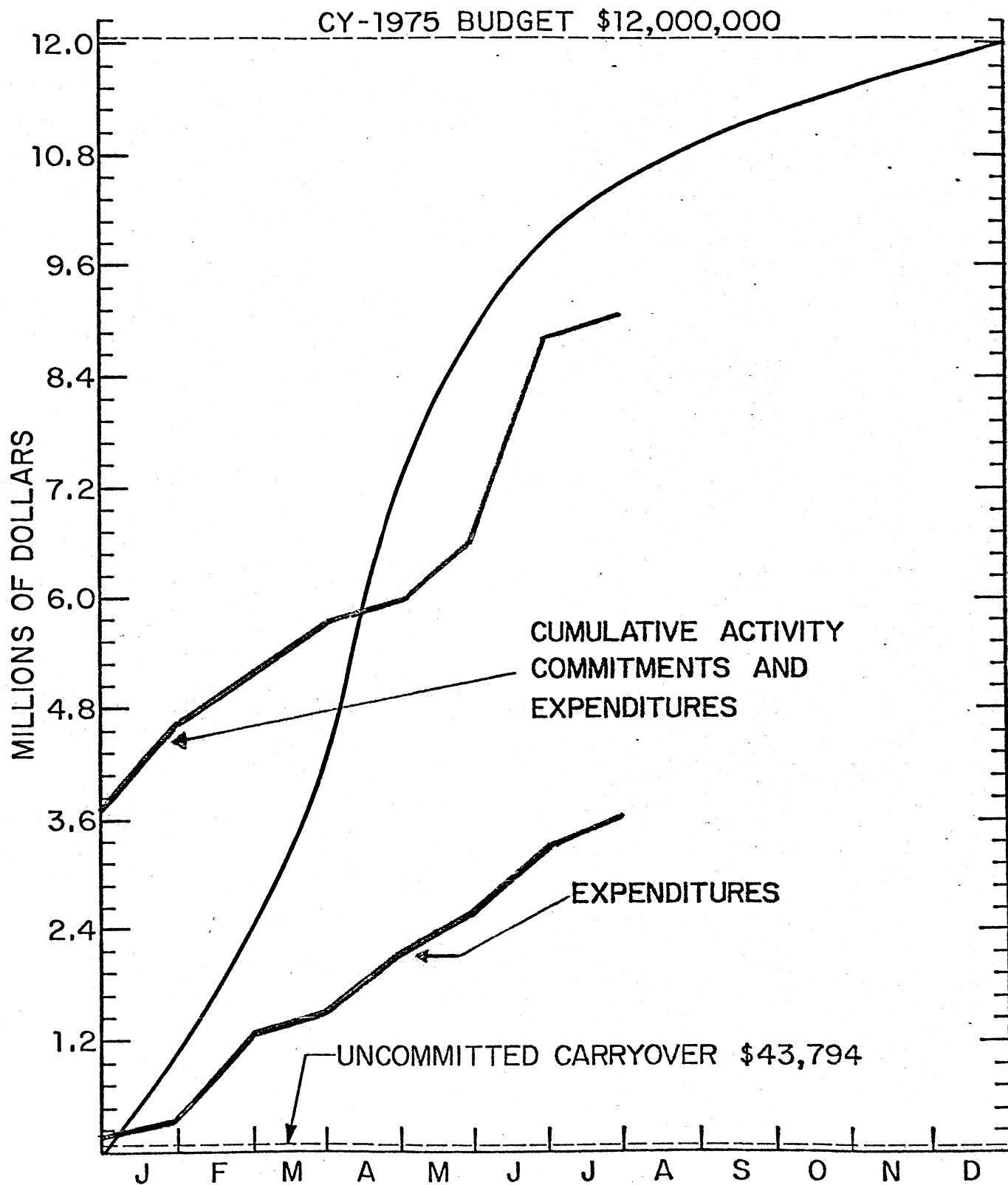
CY-1975

VERY LARGE ARRAY

Status as of July 31, 1975

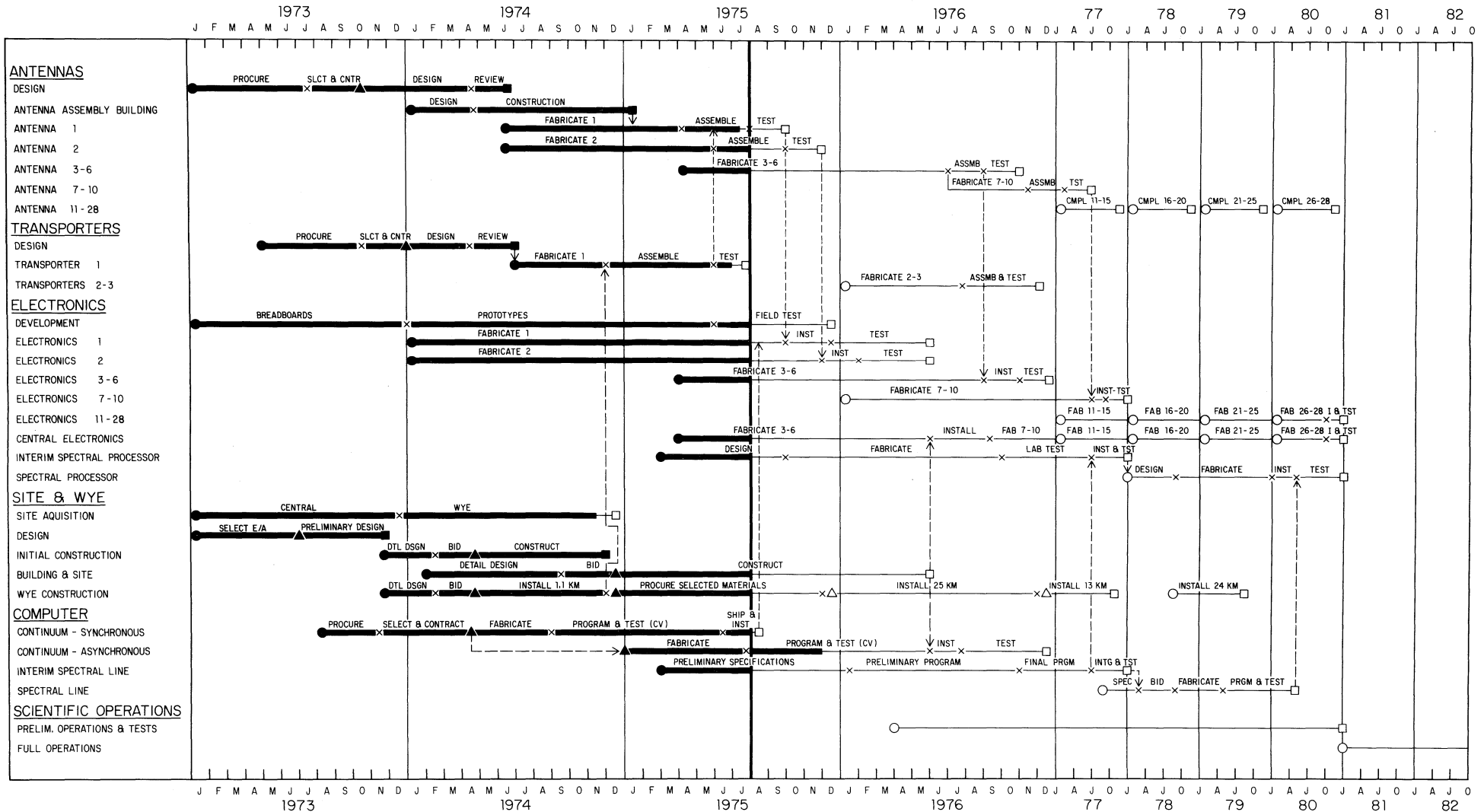
<u>Project Number</u>	<u>Description</u>	<u>Allocation</u>	<u>Monthly Expended</u>	<u>Total Expended</u>	<u>Total Committed</u>	<u>Total</u>	<u>Balance</u>	<u>Outstanding Obligations Pending</u>	<u>Net Balance</u>
11000	Site and Wye	4,399,614	232,953	1,444,384	2,188,632	3,633,016	766,598	45,955	720,643
12000	Antenna System	2,544,000	13,118	110,789	2,118,089	2,228,878	315,122	304,370	10,752
13000	Electronic System	2,557,000	75,425	912,956	648,205	1,561,161	995,839	239,338	756,501
14000	Computer System	1,442,000	25,570	940,355	269,961	1,210,316	231,684	98,638	133,046
16000	Systems Integration	98,000	3,988	19,961	974	20,935	77,065	16,188	60,877
17000	Project Management	421,000	32,792	238,890	82,256	321,146	99,854	97,198	2,656
	Contingency	623,066	---	---	---	---	623,066	---	623,066
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	Total VLA	12,084,680	383,846	3,667,335	5,308,117	8,975,452	3,109,228	801,687	2,307,541

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



NATIONAL RADIO ASTRONOMY OBSERVATORY
VLA ACTIVITY SCHEDULE
11/15/74

UPDATE DATE: 01 AUGUST 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

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