MAY 1977

NATIONAL RADIO ASTRONOMY OBSERVATORY

MAY PROGRESS REPORT

VLA PROGRAM

JUNE 14, 1977

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

MAY 1977

SYSTEMS INTEGRATION DIVISION

The following observing sessions were conducted this month:

May 9-11

Program AB-3, Balick, Heckman (University of Washington).

Survey of Seyfert galaxies for nuclear emission.

Program AH-5, Hjellming (NRAO) and Gibson (NMIMT).
Periodic monitoring of CYG X-1.

40 hours of observations and tests with 6 antennas.

May 12-16

Program AH-2, Hjellming, Clark and Brown (NRAO).
Observations of stellar objects for instantaneous spectra.

Program AH-6, Hjellming, Vandenberg (NRAO).
Follow history of Nova Vulpecula 1976 and Nova Cygni 1977.

88 hours of observations and tests with 6 antennas.

May 23-25

Program AB-5, Balick (University of Washington), Bignell, Hjellming (NRAO).
Mapping of planetary nebula.

Program AH-5, See May 9-11.

Program AH-3, Hjellming NRAO).
Search for radio emission from compact x-ray objects.

40 hours of observations and tests with 6 antennas.

May 26-30

Program AK-2, Kellermann, Crane, Shaffer, Geldzahler (NRAO).
Spectra of compact nuclei of radio galaxies and quasars.

Program AH-5, See May 9-11.

Program AB-5, See May 23-25.

88 hours of observations and tests with 6 antennas.

At the end of the month Antennas 1 thru 7 were located at stations DW8, BW8, DW3, CW8, DW2, BW6 and CW5.

Antenna #7 produced first fringes on May 10, and continued to undergo checkout through the rest of the month with some use made of it for observing although it is still not considered operational.

The antenna downtime average for the month was 16%.

ELECTRONICS DIVISION

The front-end was installed on Antenna #7 and the first fringes were obtained on May 24. This antenna is now equipped with all feeds including the new design 18-21 cm feed. During the construction and testing of front-end #8, three AIL parametric amplifiers have shown problems. One developed an out-of-band gain spike and two others developed low gain features in the middle of the passband. A front-end engineer will visit AIL in early June to determine the cause of these failures. Mechanical construction of front-end #9 is complete.

In the cryogenics area compressors with modified agglomerators, and orifices instead of capillary lines, have been installed on Antennas #2 and #6. Work is continuing on outfitting all other Air Products compressors. The cryogenic system on Antenna #7 is the Cryomech type, and this has now been running for 700 hours without giving any problems.

Tests on the new design L2 and L3 modules on Antennas #3 and #5 are continuing. Details of most remaining changes in other modules are now being finalized for incorporation in the present procurement cycle. An investigation is being made of the reliability of the connections made by the OMQ coaxial connectors used on most of the modules. It appears that a substantial improvement in the reliability should be obtainable by using connector collars which better match the thickness of the panel on which they are mounted, and by using a better mechanical arrangement for aligning the modules in the bins. Procurement and assembly by the Charlottesville group is proceeding on schedule.

Attenuation measurements have been made on the three test sections of waveguide on the north arm. The rms values of the radius of curvature measured with the mechanical mouse were found to be 861, 918 and 1000 meters for the sections installed in concrete, in conduit, and by direct burial, respectively. The section in concrete shows a value of attenuation of 2.1 dB per km at 50 GHz, and such a high value would not be expected to result solely from the slightly lower radius of curvature for this section. The reason for the higher loss is still being investigated.

In the monitor and control system the m.o.s. shift register circuits in the Central and Antenna Buffer modules, which have proved to have very poor reliability, are being replaced. This requires a design modification which is now under test. Preparations are almost complete for placing a wiring contract for bringing the early Data Set modules up-to-date with the final design.

For the spectral processor a first test batch of the integrator custom i.c. (VLA-2) is expected to be received in the first weeks of June. Artwork for most of the multilayer boards required has been completed by Collins Radio and Diceon, although the latter company is behind schedule on some boards. Design of a microprocessor for the control section of the spectral processor is well advanced.

New staff members who have recently joined the electronics group in New Mexico are Gene Spaulding in the IF group, David C. Hudson in the Front-End group and Paul A. Harden in the general electronics area. Ruth E. Saunders, Cheryl W. Slocum, Alice S. Shiflette and Selena Morris joined the Charlottesville construction group earlier this year.

COMPUTER DIVISION

The fixed head disk communication area between the MODCOMP and DEC-10 is now in standard use for transmitting correlator data to the DEC-10 in real time. The standard DEC-10 listing/plotting/processing programs work reasonably well on this real-time data.

Two array processors, from Floating Point Systems, have been delivered (one for the new combined correlator system and one for map making) but are not yet installed.

Polarization processing has proceeded to the point that we can evaluate the calibration technique we have implemented. Work is continuing on looking at other calibration techniques.

The on-line scan averaging program is now in a more or less final form. It is expected that in the far future this will be replaced by programs in the DEC-10 computer.

An automatic calibration system has been started.

A program to provide a "visibility export tape" for calibrated data has been written - a sample tape has been sent to Charlottesville to verify that it meets the agreed stardard format.

ANTENNA DIVISION

Antenna No. 9

Mechanical outfitting continued on maintenance pad and approached completion at end of the month.

Antenna No. 10

Moved to station CW7 and outfitting has started.

Antenna No. 11

Panel alignment was completed on May 6 with an rms of 0.010 inches Elevation gear was aligned, kirksited, and on May 12 the antenna was moved.

to the Master Pad for final alignment, servo tests and finish painting. At the end of the month these items were completed with servo tests showing a natural frequency of 2.3 in elevation and 2.35 in azimuth.

Antenna No. 12

Antenna #12 pedestal assembly started on May 12 in the assembly building. Reflector assembly started on May 6. At the end of the month pedestal assembly was complete through the yoke arms and elevation wheel, reflector structure complete with the exception of finish painting. Mating of structure to take place first week of June.

An Improved air conditioning system was installed on Antenna #1 on May 16 and has been functioning satisfactorily.

SITE AND WYE

Subcontract VLA-167; Paul D. Goar Construction; $169,466

Completed roofing and siding of lean-to. Installed roll-up door along with concrete door aprons. This contract is 100% complete.

Waveguide

The third test section (direct burial waveguide or compacted bedding) was completed during the month. Trenching was completed between BW9 and AW5 along with 1900 feet between BW8 to BW9. Approximately 4200 feet of waveguide has been set to line and grade in trench between BW9 and AW5 and 2800 feet has been bedded, compacted and shaded. Between BW8 and BW9 1000 feet of waveguide has been coupled in the trench.

PROJECT MANAGEMENT

During the month of May, 1977, we placed 221 purchase orders and subcontracts totaling $204,034.

Personnel

The personnel changes as of May 31, 1977 are as follows:

Division	Previous Level	Additions	Reductions	Current Level
Site and Wye	8	0	0	8
Antenna	14	0	0	14
Electronics	43	2	0	45*
Computer	15	0	0	15
System Integration	5	0	0	5
Project Management	28	0	1	27**
Total	113	2	1	114

* Includes one temporary person
** Includes three part-time people

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/CVR 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.
VLA-6	E-Systems, Inc.	28 Radio Telescopes	10/18/73	$ 18,131,767	3/01/77	NRAO has taken possession of Antennas Nos. 1 through 10. Antenna 11 is ready for acceptance except for minor deficiencies.
VLA-29	Sterling-Detroit Co.	Focusing Feed Mounts	11/03/76	$ 524,032	8/01/77	Three units were accepted the week of April 1, 1977. Three units will be accepted the week of 6/06/77.
VLA-53	R. F. System	K and Ku Band Feed Horns	1/26/76	$ 154,388	9/30/77	All K and Ku Band Horns for Antennas 7-10 have been received. Work has begun on horns for A11 - A15.
VLA-70 P.O. 52322	Sumitomo Electric USA, Inc.	5373 pieces of waveguide 5185 each coupling sleeves	1/27/75	$ 1,801,827	1/15/77	4313 pieces of waveguide and 4380 coupling sleeves have been received. First shipment under C.O. No. 4 is at coating company.
P.O. 53880	N. M. Tech.	Labor Hour Contract	9/01/75	$ 15,000	8/31/76	Approx. $14,223 spent effective 5/31/77.
VLA-167	Paul D. Goar Construction Co.	Prefab Metal Maintenance and Warehouse Bldgs.	1/06/76	$ 169,466	3/30/77	Amendment No. 1 issued for construction of Lean-to-type addition to maintenance building. Work on addition about 99% complete.
VLA-177	Fujikura Cable Works, LTD.	Waveguide coupling Components	3/21/77	$ 217,879	7/15/77	Amendment No. 1 has been accepted by vendor. Delivery is on schedule.

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-179 P.O. S-01046	AIL Div. of Cutler Hammer	Parametric Amplifiers	4/29/76	$ 134,920	10/12/76	Paramps for A7 - A11 have been received. Vendor has begun work on paramps for A11 - A15.
P.O. S-01946	Industrial Design Engineering Assoc.	Labor Hour Contract for Temporary Draftsman	7/21/76	$ 19,000	1/26/77	Draftsman is working in drafting section at 2015 Ivy Rd., Charlottesville, Va. $15,300 spent effective 5/31/77.
P.O. S-01984	J. J. Gustincic Consulting Engr.	Consultant Agreement	8/02/76	$ 4,000	12/31/76	Consultant of K, Ku and C Band Horn. $600 spent effective 5/31/77.
VLA-211 P.O. S-02412 P.O. S-02524	Executone Systems of New Mexico Inc.	VLA Wye Comm. System	10/05/76	$ 72,980.83	3/30/77	Order was completed in May, 1977.
VLA-220 P.O. S-02245	J. J. Gustincic	C-Band Horns for A11 - A15	2/08/77	$ 74,550	4/30/77	Delivery will be completed 6/30/77.
VLA-229 P.O. S-02717	Digital Equipment Corp.	128K words of Main Memory and two Data Channels	11/30/76	$ 83,760	1/30/77 3/31/77	128K words of memory received 4/04/77. Delivery of data channels will be 6/30/77.
VLA-233 P.O. S-02611	Silicon Systems, Inc.	Custom Integrated Circuits	12/12/76	$ 164,000	9/15/77	Delivery is on schedule.
P.O. S-02998	AIL Div. Cutler Hammer	Upconverters	12/15/76	$ 62,623	6/15/77 to 8/15/77	Delivery is on schedule.
P.O. S-01742	Digital Equipment Corp.	Maintenance on DEC-10 System	1/07/77	$ 67,560	6/30/77	Maintenance is performed daily at VLA Site.
VLA-240 P.O. S-03093	Eagle Picher Industries, Inc.	Fabricated Metal Parts	1/07/77	$ 67,092	4/17/77	Approximately half of order has been delivered. Scheduled for completion 6/30/77.

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-03306	Modular Computer Systems, Inc.	Host Computer for Array Processor	1/28/77	$ 62,075	4/30/77	Computer received complete except for two small items on 4/30/77. These items were received 5/26/77.
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 80% complete.
VLA-244 P.O. S-03351	Floating Point Systems	Two High Speed Array Processors	2/08/77	$160,582.40	5/15/77	One Array Processor was received 5/03/77. One Array Processor was received 5/20/77.
VLA-245 P.O. S-03633	Sandia Detroit Diesel, Inc.	Install Emergency Standby Power Generators	3/31/77	$ 50,563.36	5/15/77	Work is in progress. Switch gear and wiring will be installed week of 6/06/77.
VLA-254 P.O. S-03651	J. J. Gustincic	L-Band Feed Horns for A7-A14	3/31/77	$ 81,000	6/30/77	Delivery will be completed approx. July 15, 1977.
VLA-255 P.O. S-03591	Digital Equipment Corp.	Host Computer for High Speed Array Processor	4/12/77	$126,000	8/30/77	Delivery is on schedule.
VLA-258	Midstate Cartage	Labor Hour Subcontract	3/28/77	$100,000	3/27/78	Approx. $19,211 was spent effective 5/31/77.
P.O. S-04046	Modular Computer Systems, Inc.	Update and expand Synchronous Computer	5/12/77	$ 51,200	9/15/77	Delivery is on schedule.

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.

CY - 1977

VERY LARGE ARRAY

STATUS AS OF May 31, 1977

	ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCTION IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	BALANCE	OUTSTANDING OBLIGATIONS PENDING	NET BALANCE
SITE AND WYE	2,822,883	253,355	357,375	23,361	334,014	530,937	888,312	1,934,571	32,232	1,902,339
ANTENNA	4,134,500	186,584	482,875	2,463	480,412	3,426,032	3,908,907	225,593	145,352	80,241
ELECTRONICS	3,835,500	404,063	1,242,996	15,267	1,227,729	981,955	2,224,951	1,610,549	402,980	1,207,569
COMPUTER	1,053,000	157,291	253,856	90	253,766	212,272	466,128	586,872	130,020	456,852
SYSTEMS INTEGRATION	67,000	3,306	13,671	216	13,455	554	14,225	52,775	18,108	34,667
PROJECT MANAGEMENT	100,000	7,895	41,115	---	41,115	---	41,115	58,885	47,112	11,773
COMMON COST	691,000	56,055	253,047	---	253,047	16,838	269,885	421,115	421,115	---
CONTINGENCY/RESERVE	395,000	---	---	---	---	---	---	395,000	---	395,000
TOTAL	13,098,883	1,068,549	2,644,935	41,397	2,603,538	5,168,588	7,813,523	5,285,360	1,196,919	4,088,441

TOTAL PROJECT

VERY LARGE ARRAY

STATUS AS OF May 31, 1977

	ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCTION IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	BALANCE	OUTSTANDING OBLIGATIONS PENDING	NET BALANCE
SITE AND WYE	14,490,882	261,314	11,971,244	3,301,671	8,669,573	564,044	12,535,288	1,955,594	32,232	1,923,362
ANTENNA	17,361,508	318,549	13,706,568	3,063,389	10,643,179	3,427,638	17,134,206	227,302	145,352	81,950
ELECTRONICS	10,919,724	426,636	8,304,459	1,944,311	6,360,148	1,013,528	9,317,987	1,601,737	402,980	1,198,757
COMPUTER	3,449,871	158,491	2,641,399	926,623	1,714,776	218,935	2,860,334	589,537	130,020	459,517
SYSTEMS INTEGRATION	193,031	3,331	139,482	59,055	80,427	762	140,244	52,787	18,108	34,679
PROJECT MANAGEMENT	1,700,284	9,611	1,607,698	960,464	647,234	11,763	1,619,461	80,823	47,112	33,711
COMMON COST	691,000	56,055	253,047	---	253,047	16,838	269,885	421,115	421,115	---
CONTINGENCY/RESERVE	395,000	---	---	---	---	---	---	395,000	---	395,000
TOTAL	49,201,300(1)	1,233,987	38,623,897	10,255,513	28,368,384	5,253,508	43,877,405	5,323,895	1,196,919	4,126,976

(1) Project Allocation does not include $283,000 withheld by NSF for Army Corp. of Engineers or $15,700 for ECAC Study. $50,000 withheld by NSF on Amendment #24 is included in the total allocation.

NATIONAL RADIO ASTRONOMY OBSERVATORY
VLA PROGRAM

FINANCIAL STATUS REPORT
(in thousands)

As of: May 31, 1977

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		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	14,491	12,535	1,956	13,369	14,215	26,750	1,110	
Antennas	20,400	17,361	17,134	227	3,039	5,015	22,149	(1,749)	(6)
Electronics	17,000	10,920	9,318	1,602	6,080	7,986	17,304	(304)	
Computer	4,850	3,450	2,860	590	1,400	2,544	5,404	(554)	
Systems Integration	400	193	140	53	207	93	233	167	
Program Management	2,650	1,700	1,620	80	950	348	1,968	682	
Common Cost	-	691	270	421	(691)	1,801	2,071	(2,071)	
Subtotal	73,160	48,806	43,877	4,929	24,354	32,002	75,879	(2,719)	
Contingency	2,840	395	---	395	2,445	2,273	2,273	567	
TOTAL	76,000(1)	49,201(2)	43,877	5,324	26,799	34,275	78,152	(2,152)	

Notes:
(1) Includes estimate of $283K for site acquisition and $15.7K for ECAC Study withheld by NSF.
(2) Total allocation includes $50K withheld by NSF on Amendment 24 to Contract C-780.
(3) Basic Estimate is that of August 1976.
(4) Estimate excludes the Airstrip: $268K.
(5) Escalation included for future years at 6% for Site/Wye work, National Radio Astronomy Observatory labor, minor antenna equipment items and certain electronic equipment. No future escalation has been included for computer purchased equipment.
(6) Includes $525,000 for Transporter #2.

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.

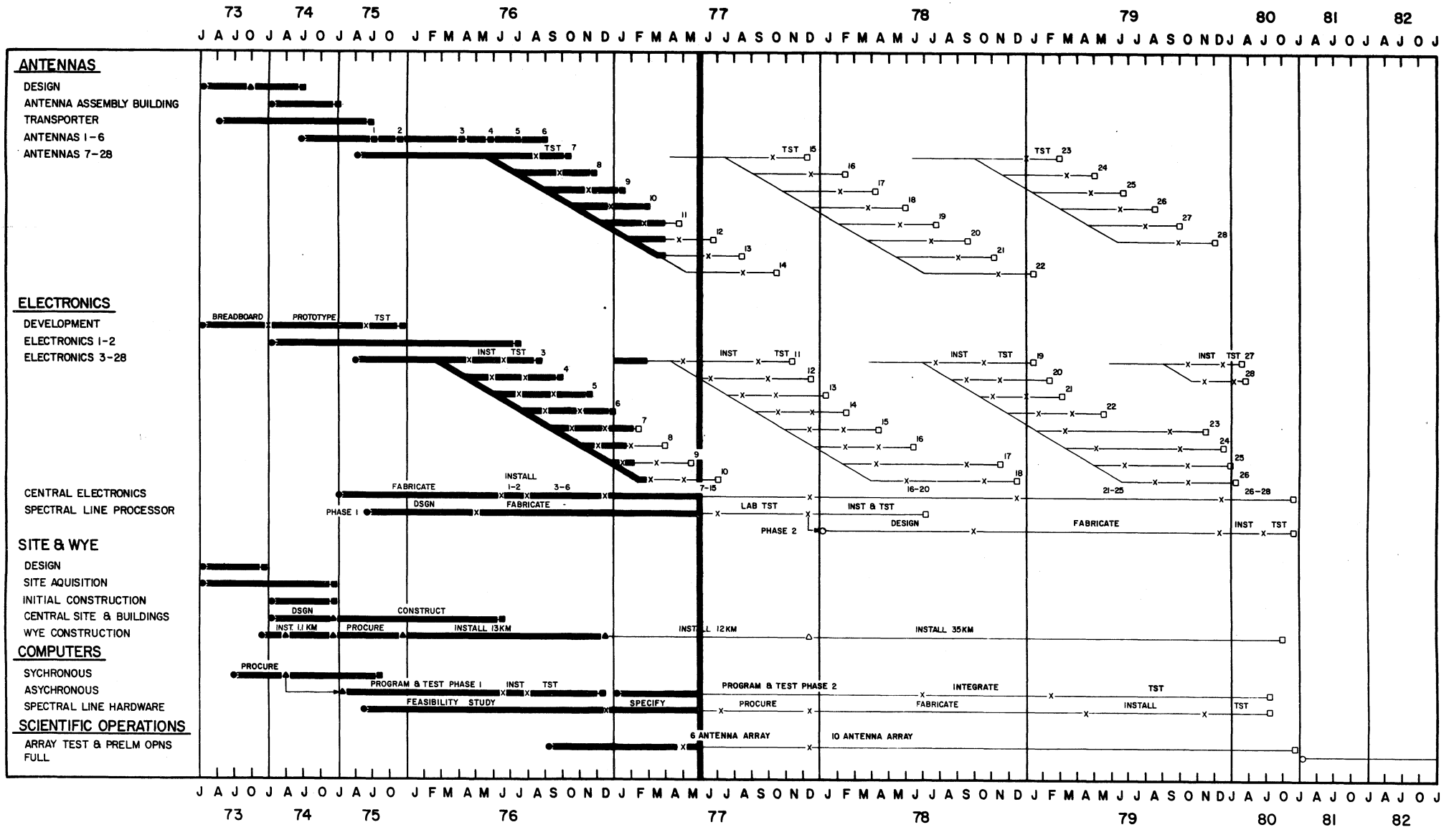
Column (9) - (Over) Under: Column 2 less Column 8.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA ACTIVITY SCHEDULE

11/15/76

UPDATE DATE: 6/1/77



SYMBOLS

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

ABBREVIATIONS

DSGN - DESIGN	TST - TEST
LAB - LABORATORY	PRELM - PRELIMINARY
INST - INSTALL	OPNS - OPERATIONS

REV. NO.	REV. DATE	REVISION