US/GR BK,

NATIONAL RADIO ASTRONOMY OBSERVATORY
SEPTEMBER PROGRESS REPORT
VLA PROGRAM
October 24, 1980

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

SEPTEMBER 1980

SYSTEMS INTEGRATION DIVISION

The array was scheduled for 54 percent of the time; 38 percent went to astronomical programs and the remaining 16 percent went to tests. The average downtime for the month was approximately 6.5 percent.

During this month a milestone was reached when the last antenna to be outfitted with electronics, Antenna 28, was declared operational on September 26. The maximum number of antennas used for an astronomical observing program during the month of September was 25. Antenna 1 was returned to observations on September 15 bringing the total number of antennas currently unavailable for observations to 3 (Antennas 2, 4, and 6). The test array consists of antennas 11, 17 and 21.

The longest astronomically useable baseline is approximately 3.4 km.

ELECTRONICS DIVISION

In the Front End Area, the retrofit of Front End 02 was completed and the front end was reinstalled on the antenna. Front ends 3, 4, and 6 remain to be retrofitted with AIL paramps and CTI cryogenics. The installation of the new Front End IF system is now complete on all antennas. AIL is now reliably delivering one paramp per week. The paramp contract with AIL has been renegotiated to reduce the number of paramps delivered by 20. These paramps have been replaced by cooled GaAsFet amplifiers. A recent survey of the reliability of front end cooled components gives 190,000 hours MTBF for paramps, 50,000 hours MTBF for Upconverters and 77,000 hours MTBF for cooled mixers. These statistics are derived from 950,000 device hours for paramps and 550,000 device hours for upconverters and mixers.

Several problems concerned with radio frequency interference are currently under investigation. The spurious signals at harmonics of 50 MHz that leak into the L Band Front End from the local oscillator system have now been sufficiently attenuated so that they will be undetectable in a continuum measurement with bandwidths greater than 6 MHz. A Forestry Service transmitter to be located on South Baldy

early in 1981 will transmit at 1796 MHz and will be aliased to 1404 MHz via the second harmonic response of the parametric upconverter. A prototype waveguide filter to be located between the feed and front end has been constructed and tested and has sufficiently low loss in-band and high enough attenuation at 1796 MHz. When the transmitter is turned on tests will be made to determine if the filter needs to be installed on all antennas. A high power television transmitter to be located on Sandia Crest in 1981 will have its third harmonic at 1413 MHz which is an important hydrogen frequency. Studies are being carried out to determine if this signal will interfere with observations at the VLA.

During the month the VLA took part in the VLBI network run. The special hardware needed for VLBI observations has been mounted in its own rack and appears to operate satisfactorily.

COMPUTER DIVISION

The software in the Array Processor, which collects data directly from the correlator, has been updated to allow integration for 10 seconds of continuum data. This integration used to be performed in CORA and CORBIN. The development is now under way to use these computers to store parially sorted data on the Century discs as an input to the SORTER system.

In order to allow users easier access to the status of the jobs being performed by the MAPPER system, a new program (PROBE) has been developed. This enables users to monitor the state of their own jobs and also the performance of the system as a whole.

The self calibration algorithum, which has been in use for the past few months, has now been made easily available to the observer by the implementation of a new program (SELCAL) on the DEC-10. This program submits requests to the MAPPER system in the same way as the program MAKMAP submits normal mapping requests.

ANTENNA DIVISION

Antenna Moves

Two antennas were moved.

Major Overhaul

Antenna No. 4, is partially painted and will be completed and returned to the AAB for the dedication.

Annual Preventive Maintenance

All antennas are complete, except those to be overhauled during 1980.

Transporter No. 2

Truck No. 3 suspension guides were realigned and the bearings replaced on axle No. 1. The bearing temperature was monitored during extensive (50 miles) operation and the axle appears to be satisfactory.

Miscellaneous

The drafting group was moved from the trailers to the Technical Services building.

Feed Heaters

Installation of feed heater was completed on all antennas.

Wind Auto Stow

Modifications to provide auto stow at winds in excess of 50 M.P.H. was completed on all antennas.

Pedestal Room Air Conditioning

The first unit was installed on Antenna No. 4 and is the prototype for determining installation procedures.

Wye - Com Antenna Functions

A new type of electronic relay has been installed on Antenna No. 6 for testing. These relays may replace the troublesome relays now utilized.

Focusing Feed Mounts

With each major overhaul of these units, more experience is furthering the analysis of failed bearings and parts. The unit removed from Antenna No. 6 was found to have extensive water & rust damage to the ball screws and their end bearings. This is significant in that this antenna has a long history of FFM problems.

SITE AND WYE DIVISION

Waveguide Installation

Installed approximately 1,360 feet of waveguide. Trenched approximately 1,020 feet on East arm. Waveguide installation is complete on West arm.

Phase IV

100% complete.

Phase V

Overall completion of the total contract is 99.5%. Track work is 100% complete with only a minor amount of fence work and clean-up remaining.

PROJECT MANAGEMENT

General

After a thorough review of all possibilities covering the upgrading of the DEC-10 asynchronous computer system at the VLA site it was determined that the existing DEC-10 KI CPU should be replaced with a KL CPU. The KL CPU will increase the capacity of our DEC-10 system by a factor of 3 to 3.3 times without changes of the existing software. The second portion of the plan is to add a DEC-VAX 11/780 to the system which will permit the removal of calibrator data from the DEC-10 and further increase its throughput.

Details of the plan and a request for approval was forwarded to the Foundation on September 26, 1980. Total cost of the upgrade is $850,000.

New Mexico Gross Receipts Tax

To our knowledge the appeal has not yet been scheduled for hearing before the Tenth District U.S. Court of appeals in Denver.

Personnel

The personnel Changes as of September 30, 1980 are as follows:

Division	Budgeted 12/31/80 Level	8/31/80 Level	Additions	Reductions	9/30/80 Level
Site & Wye	10	9	0	0	9
Antenna Division	17	17	0	0	17
Electronics	45	44	0	0	44*
Site Management	6	5	0	0	5
Computer Division	15	17	1	1	17
Operations Div.	12	13	0	0	13
Project Mgmt.	26	24	0	1	23*
TOTAL	131	129	1	2	128

*Does not include two part-time employees.

9/30/80

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-345 Amendment	G. C. Dean	Labor Hour (Waveguide Installation)	3/19/79	335,000	Two years completing 2/28/81	
VLA-346	Wm. A. Smith Contracting Co., Inc.	Phase V Construction	4/26/79	2,820,000	Sept. 1980	Work progressing satisfactorily.
P.O. S-09849	BWH/CVA Joint Ventures	A/E Service Phase V	5/16/79	39,000	Sept. 1980	
P.O. S-11638	DEC	Computer Maintenance	2/13/80	90,024	CY '80	Monthly expenditure rate estimated at $7,500.
VLA-354 P.O. S-11480	CASCO Fire Protection Systems	Fire Protection System for VLA Site Buildings	2/20/80	57,840	Complete	
P.O. S-11481	Century Data Systems	Disk Drives	2/15/80	64,078	9/20/80	
P.O. S-11478	Digital Equipment Corp.	Computer Systems	2/27/80	74,635	10/2/80	

9/30/80

VLA PROGRAM

MAJOR SUBCONTRACT 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-6 Amend. #21	E-Systems, Inc.	28 Radio Telecopes	10/18/73	$ 18,156,054	Complete	
VLA-256	New Mexico State University	Archaeological Excavation	9/20/77	$ 107,000	Complete	$96,870.95 invoice.
P.O. S-07990	AIL Division Cutler-Hammer	Parametric Amplifiers	9/21/78	$ 212,800	Complete by 1/21/80	11½ sets received.
P.O. S-08085	AIL Division Cutler-Hammer	Parametric Upconverters	10/23/78	$ 102,525	Complete	12 units received. 6 units are at AIL for repair. 3 will ship in Sept. to complete order.
P.O. S-08329	Contact Systems, Inc.	Various Wiring Modules	10/31/78 1/19/79	$ 30,486		On schedule. NRAO owes them additional components for assembly.
VLA-323	Logemann Bros.	Transporter	1/17/79	$ 788,758	Complete	
S-12394 VLA-355	Total Systems	Motel/Office	5/1/80	$ 123,500	Complete	Work complete. Final paper work pending.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VERY LARGE ARRAY

STATUS AS OF SEPTEMBER 30, 1980

TOTAL PROGRAM

PROGRAM NUMBER	DESCRIPTION	ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCT. IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	NET BALANCE
11000	SITE AND WYE	26,687,769	153,489	26,286,568	11,520,538	14,766,030	170,419	26,456,987	230,782
12000	ANTENNA	22,743,626	34,588	22,608,116	17,941,560	4,666,556	98,888	22,707,004	36,622
13000	ELECTRONICS	17,961,568	111,113	17,429,587	7,927,510	9,502,077	152,073	17,581,660	379,908
14000	COMPUTER	6,070,099	183,506	5,026,081	2,874,739	2,151,342	187,801	5,213,882	856,217
16000	SYSTEMS INTEGRATION	201,022	---	201,022	200,965	57	---	201,022	---
17000	PROGRAM MANAGEMENT	2,098,809	5,724	1,965,530	1,782,795	182,735	11,586	1,977,116	121,693
18000	COMMON COST	2,089,296	42,345	1,984,199	1,699,308	284,891	10,668	1,994,867	94,429
19000	CONTINGENCY/RESERVE	400,000	---	---	---	---	---	---	400,000
	SUB TOTAL	78,252,189	530,765	75,501,103	43,947,415	31,553,688	631,435	76,132,538	2,119,651
30000	RETIREMENTS	(67,979)	---	(67,979)	(67,979)	---	---	(67,979)	---
	TOTAL PROGRAM	78,184,210	530,765	75,433,124	43,879,436	31,553,688	631,435	76,064,559	2,119,651

Note: Project allocation excludes $325,811 withheld and paid directly to other agencies by the NSF in prior years.
Project allocation includes $4,500,000 for CY-1980 Funding.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VERY LARGE ARRAY

STATUS AS OF SEPTEMBER 30, 1980

CY - 80

PROGRAM NUMBER	DESCRIPTION	ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCT. IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	NET BALANCE
11000	SITE/WYE	2,129,777	140,641	1,728,644	1,767	1,726,877	170,419	1,899,063	230,714
12000	ANTENNA	274,389	34,588	140,219	640	139,579	98,888	239,107	35,282
13000	ELECTRONICS	1,226,464	110,938	694,968	---	694,968	152,073	847,041	379,423
14000	COMPUTER	1,451,513	183,506	407,528	---	407,528	187,801	595,329	856,184
17000	PROGRAM MANAGEMENT	207,000	5,724	73,721	---	73,721	11,586	85,307	121,693
18000	COMMON COSTS	389,988	42,345	284,891	---	284,891	10,668	295,559	94,429
19000	CONTINGENCY	400,000	---	---	---	---	---	---	400,000
	TOTAL PROGRAM	6,079,131	517,742	3,329,971	2,407	3,327,564	631,435	3,961,406	2,117,725

Note: Project allocation for CY-80 consists of $4,500,000 in new funding plus $1,579,131 in prior year funds re-allocated in August 1980.

NATIONAL RADIO ASTRONOMY OBSERVATORY
VLA PROGRAM

FINANCIAL STATUS REPORT
(in thousands)

As of: September 30, 1980

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Item	Program Ceiling	(A) Allocation to Date (C)			Un-Allocated Balance	Outlook (B)			Notes
		Allocated	Expended and Committed	Allocated Balance		Estimate to Complete	Estimate Total	(Over) Under Ceiling	
Site and Wye	27,860	26,981	26,750	231	879	231	26,981	879	
Antennas	20,400	22,744	22,707	37	(2,344)	37	22,744	(2,344)	
Electronics	17,000	17,978	17,598	380	(978)	380	17,978	(978)	
Computer	4,850	6,070	5,213	857	(1,220)	857	6,070	(1,220)	
Systems Integration	400	201	201	-	199	-	201	199	
Program Management	2,650	2,116	1,994	122	534	122	2,116	534	
Common Cost	-	2,089	1,994	95	(2,089)	95	2,089	(2,089)	
Subtotal	73,160	78,179	76,457	1,722	(5,019)	1,722	78,179	(5,019)	
Contingency	2,840	400	-	400	2,440	400	400	2,440	
TOTAL	76,000	78,579	76,457	2,122	(2,579)	2,122	78,579	(2,579)	

NOTES: (A) Includes $293K for site acquisition, $15.7K for ECAC Study, and $17.1K for NSF Ad Hoc Advisory Panel. Allocated and Expended includes $68K in assets which were retired in prior years.

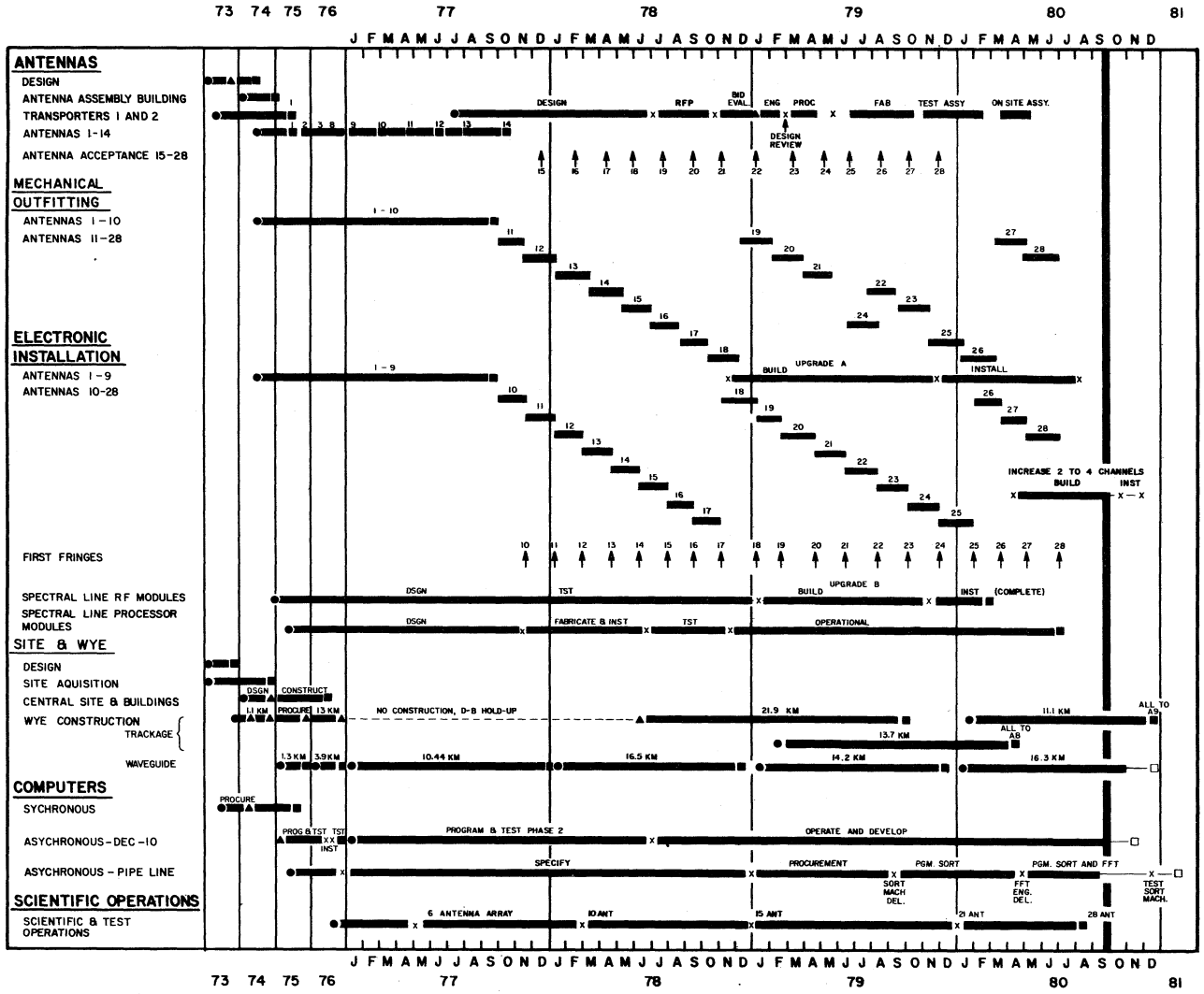
(B) Estimate to complete is as of August, 1980.

(C) Includes $4,500K in CY-80 Funding.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA ACTIVITY SCHEDULE

UPDATE DATE: 10/01/80



TASKS

UPGRADE A	RECEIVER FRONT-END FILTERS, MODULES F4, F7, F8. INSTALL 5 ANT/MO. (25 MODULES)
UPGRADE B	SPECTRAL LINE IF MODULES T3, T4, T5, T6. INSTALL 4 SYSTEMS (24 MODULES) PER MONTH. (COMPLETED 03/03/80)
INCREASE 2 TO 4 CHANNELS	ADDITIONAL MODULES OF ABOVE TYPES. TOTAL 224. INSTALL 36 PER MONTH.

ABBREVIATIONS

DSGN — DESIGN	TST — TEST
LAB — LABORATORY	PRELM — PRELIMINARY
INST — INSTALL	OPNS — OPERATIONS
ANT — ANTENNA(S)	PGM. — PROGRAM
	DEL. — DELIVERY

SYMBOLS

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

REV. NO.	REV DATE	DESCRIPTION
1	12/1/78	UPDATE PROGRAM PLAN '79
2	11/1/79	UPDATE PROGRAM PLAN '80
3	2/1/80	MISC. PLAN CHANGES.
4	9/1/80	SHOW BUILD & INST, 2 TO 4 CHAN