

JULY 1980

NATIONAL RADIO ASTRONOMY OBSERVATORY
JULY PROGRESS REPORT
VLA PROGRAM
August 15, 1980

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

JULY 1980

SYSTEMS INTEGRATION DIVISION

The array was scheduled for 36 percent of the time; 22 percent went to astronomical programs and the remaining 14 percent went to tests. The average downtime for the month was approximately 7.6 percent.

First fringes were obtained using antenna 27 on July 10. The maximum number of antennas used for an astronomical observing program during the month of July was 24. Antennas 1, 2 and 6 are currently unavailable for observation. Antenna 26 was declared operational on July 22. Antenna 27 is in the shakedown stage. The test array consists of antennas 11, 17 and 21.

A total of 11 antennas were moved during the month to form the "C" configuration. The longest astronomically useable baseline is approximately 3.4 km.

ELECTRONICS DIVISION

In the Front End Area construction and testing of the last front-end, F.E. 28, was completed. The receiver will be installed on the antenna in early August. Front Ends 1, 2, 3, 4, and 6 still remain to have the paramp and cryogenics retrofits completed. The Front End IF retrofit is now complete on 19 antennas. AIL has had severe problems with the dielectric cracking in the paramp circulators and has shipped only one paramp in the last month.

In the local oscillator area the last B rack, No. 28, was installed on the antenna. Except for the backup Master LO System, this completes the construction work of the LO Group.

For the first time, during the month, the waveguide communication system was handling all 27 antennas. At the time of the reconfiguration to the "C" array it was necessary to provide increased attenuation in the waveguide path to each antenna. This attenuation was provided by installing a variable attenuator in the TE₁₀ waveguide at each D Rack. The TE₀₁ waveguide attenuators installed in the antenna waveguide at a few antennas were removed at this time. Since these TE₀₁ attenuators were mechanically unstable and poorly matched, an improvement in the phase stability at these antennas has been noted.

The last 3.47 km of 60 mm waveguide was tested on the North arm, between antenna stations AN8 and AN9. Attenuation at 50 GHz was 1.08 dB/km which is extremely good.

Testing of the B and D channel Delay/Multiplier system is progressing well. The system is now able to successfully Self-Test itself in continuum mode.

COMPUTER DIVISION

Since the delivery of the host processor by the DEC Corporation for the GRIDDER system has been delayed until February 1981, the two array processors have been installed on the SORTER system to allow software development to begin. The order for the third array processor has been placed.

A new controller for the PDP-11 tape drives was received at the end of the month. The manufacturer claims that this will solve the problems that we have had to date.

We have had many problems with the reliability of the interface between the DEC-10 and the MAPPER system and of the MAPPER programs themselves. We have begun the design of a new system for the MAPPER control program which should eliminate these difficulties. It is planned to provide both the user and the system programmers with superior error logging. In addition, the new procedure should allow the clean and self-calibration algorithms to be run in the same way as the standard mapping programs on this system.

Century Data Systems is unable to supply us with the controls which are required to run the T-302 disks on the PDP-11's. Another manufacturer has been found for these controls, and the unit which we received for evaluation has tested out satisfactorily.

ANTENNA DIVISION

Antenna Moves

The YLA was configured in the "C" array on July 2, 3, 7, 8 and 9. Eleven antennas were moved.

Major Overhaul

Antenna No. 2 was completed and moved to CN5 on July 9, 1980. Antenna No. 6 was moved into the AAB on July 10, 1980 and overhaul was started.

Annual Preventive Maintenance

Annual PM was completed on all antennas on the West Arm during normal non-operating periods.

Miscellaneous

Problems are still occurring with the Focusing Feed Mount translators on Antenna 21 thru 28. This has been traced to the gas diode lightning protectors. Steps are underway to correct this problem.

Pedestal Room Air Conditioners have been ordered for all antennas, with the first unit to be installed on Antenna No. 4 at major overhaul.

Retrofits to the Antenna Control Units for "Wind Auto Stow" is proceeding much more rapidly with the addition of a temporary electronics assembler.

The Antenna Assembly Building had asphalt added between the rails during July, and the Welding Shop in the AAB was completed.

Transporter No. 2 had a wheel bearing failure on July 2, 1980 and was repaired and back in service on July 9, 1980. Two antenna moves were completed using transporter No. 2. Main frame weld cracks developed and corrective action is underway by Logemann Bros. Co.

SITE AND WYE DIVISION

Waveguide Installation

Installed approximately 7,964 feet of waveguide. 1,708 feet on East arm and 6,256 feet on West arm and trenched approximately 1,380 feet on East arm and 7,940 feet on West arm.

Phase IV

Overall completion 100%. With only administrative details remaining before closeout.

Phase V

Overall completion of the total contract is 98%. Track rough layed to AW 9 and ballast is 98% complete. All ballast is in place on the North arm and antenna spur tracks. 100% of track materials have been layed out to AE9 on the East arm and 35% of the ballast is in place. Maintenance vehicle spur track is in operation. Electrical work is 99% complete.

P.O. S 11480 - Casco Fire Protection System

The sprinkler systems for the Tech., Service Bldg., Shop, Warehouse, Library Bldg. and VSQ 1 & 3 are complete and are in service. Work is 100% complete.

VSQ 3 and the Office-Library Building addition are 100% complete.

PROJECT MANAGEMENT

General

There has been no action on the Electric Utility rate case by the New Mexico Public Service Commission.

No date has yet been set by the U.S. Tenth District Court of Appeals on the Gross Receipts Tax case.

The New Mexico State Highway Department has begun the widening of 2.0 miles of highway NM-78 which is the main approach to the VLA Site.

The 1980 re-estimate of the cost of the VLA has been completed and is under review.

Governor Bruce King and a number of members of his cabinet visited the VLA Site on July twenty second.

A series of conferences have been held with officials of AIL Division of the Eaton Corporation in an attempt to improve deliveries of the last parametric amplifiers required.

Personnel

The personnel changes as of July 31, 1980 are as follows:

| Division | Budgeted 7/31/80 Level | 6/30/80 Level | Additions | Reductions | 7/31/80 Level |
|-------------------|------------------------------|------------------|-----------|------------|------------------|
| Site & Wye | 10 | 10 | 0 | 0 | 10 |
| Antenna Division | 16 | 16 | 0 | 1 | 15 |
| Electronics | 52 | 48 | 0 | 1 | 47* |
| Site Management | 6 | 5 | 0 | 0 | 5 |
| Computer Division | 18 | 17 | 0 | 1 | 16 |
| Operations Div. | 13 | 11 | 2 | 0 | 13 |
| Project Mgmt. | 26 | 24 | 1 | 1 | 24* |
| TOTAL | 141 | 131 | 3 | 4 | 130 |

*Does not include two part-time employees.

7/31/80

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 Contract- ing 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 Protec- tion Systems | Fire Protection System for VLA Site Buildings | 2/20/80 | 57,840 | 9/15/80 | |
| P.O. S-11481 | Century Data Systems | Disk Drives | 2/15/80 | 64,078 | 8/15/80 | |
| P.O. S-11478 | Digital Equipment Corp. | Computer Systems | 2/27/80 | 74,635 | 9/2/80 | |

7/31/80

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 Telescopes | 10/18/73 | \$ 18,156,054 | Complete | |
| VLA-256 | New Mexico State University | Archaeological Exca- vation | 9/20/77 | \$ 107,000 | Complete | \$91,245 invoice thru 2/29/80. Final reports expected in Sept. 1980. |
| P.O. S-07990 | AIL Division Cutler- Hammer | Parametric Amplifiers | 9/21/78 | \$ 212,800 | Complete by 1/21/80 | 13 sets received. 15 sets remain for completion of order. |
| P.O. S-08085 | AIL Division Cutler- Hammer | Parametric Upconverters | 10/23/78 | \$ 102,525 | 4/13/79 thru 8/13/79 | 12 units received. 6 units are at AIL for repair. 3 will ship in August. 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 | | Work complete - final paper work pending. |
| 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 JULY 31, 1980

TOTAL PROGRAM

| PROJECT 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 | 26,637,172 | 329,293 | 25,915,028 | 11,520,076 | 14,394,952 | 466,794 | 26,381,822 | 255,350 |
| 12000 | ANTENNA | 22,721,203 | 412,203 | 22,548,678 | 17,941,560 | 4,607,118 | 141,175 | 22,689,853 | 31,350 |
| 13000 | ELECTRONICS | 17,982,546 | 99,551 | 17,233,128 | 7,913,761 | 9,319,367 | 181,812 | 17,414,940 | 567,606 |
| 14000 | COMPUTER | 6,111,066 | 21,108 | 4,780,751 | 2,874,739 | 1,906,012 | 293,868 | 5,074,619 | 1,036,447 |
| 16000 | SYSTEMS INTEGRATION | 201,022 | --- | 201,022 | 200,965 | 57 | --- | 201,022 | --- |
| 17000 | PROGRAM MANAGEMENT | 2,098,809 | 9,480 | 1,951,074 | 1,782,795 | 168,279 | 2,359 | 1,953,433 | 145,376 |
| 18000 | COMMON COST | 2,100,371 | 35,556 | 1,909,366 | 1,699,308 | 210,058 | 8,629 | 1,917,995 | 182,376 |
| 19000 | CONTINGENCY/RESERVE | 400,000 | --- | --- | --- | --- | --- | --- | 400,000 |
| | SUB TOTAL | 78,252,189 | 907,191 | 74,539,047 | 43,933,204 | 30,605,843 | 1,094,637 | 75,633,684 | 2,618,505 |
| 30000 | RETIREMENTS | (67,979) | --- | (67,979) | (67,979) | --- | --- | (67,979) | --- |
| | TOTAL PROGRAM | 78,184,210 | 907,191 | 74,471,068 | 43,865,225 | 30,605,843 | 1,094,637 | 75,565,705 | 2,618,505 |

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 JULY 31, 1980

CY - 80

| <u>PROJECT NUMBER</u> | <u>DESCRIPTION</u> | <u>ALLOCATION</u> | <u>EXPENDED MONTHLY</u> | <u>TOTAL EXPENDED</u> | <u>TRANSFER TO FIXED ASSETS</u> | <u>BALANCE CONSTRUCT. IN PROGRESS</u> | <u>TOTAL COMMITTED</u> | <u>TOTAL EXPENDED & COMMITTED</u> | <u>NET BALANCE</u> |
|---------------------------|--------------------|-------------------|-----------------------------|---------------------------|---|---|----------------------------|---|------------------------|
| 11000 | SITE/WYE | 1,998,942 | 302,079 | 1,408,319 | 1,305 | 1,407,014 | 371,734 | 1,780,053 | 218,889 |
| 12000 | ANTENNA | 160,000 | 21,211 | 89,030 | 640 | 88,390 | 41,578 | 130,608 | 29,392 |
| 13000 | ELECTRONICS | 1,153,000 | 84,087 | 501,395 | --- | 501,395 | 92,149 | 593,544 | 559,456 |
| 14000 | COMPUTER | 1,291,000 | 19,043 | 162,198 | --- | 162,198 | 133,322 | 295,520 | 995,480 |
| 17000 | PROGRAM MANAGEMENT | 207,000 | 9,480 | 59,264 | --- | 59,264 | 2,360 | 61,624 | 145,376 |
| 18000 | COMMON COSTS | 401,063 | 35,556 | 210,058 | --- | 210,058 | 8,629 | 218,687 | 182,376 |
| 19000 | CONTINGENCY | 400,000 | --- | --- | --- | --- | --- | --- | 400,000 |
| | TOTAL PROGRAM | 5,611,005 | 471,456 | 2,430,264 | 1,945 | 2,428,319 | 649,772 | 3,080,036 | 2,530,969 |

Note: Project allocation for CY-80 consists of \$4,500,000 in new funding plus \$1,111,005 in prior year funds re-allocated in February, 1980.

NATIONAL RADIO ASTRONOMY OBSERVATORY
VLA PROGRAM

FINANCIAL STATUS REPORT
(in thousands)

As of: July 31, 1980

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---------------------|-----------------|------------------------|------------------------|-------------------|----------------------|----------------------|----------------|----------------------|------|
| Item | Program Ceiling | (A) Allocation to Date | | (C) | Un-Allocated Balance | Outlook (B) | | | Note |
| | | Allocated | Expended and Committed | Allocated Balance | | Estimate to Complete | Estimate Total | (Over) Under Ceiling | |
| Site and Wye | 27,860 | 26,930 | 26,675 | 255 | 930 | 255 | 26,930 | 930 | |
| Antennas | 20,400 | 22,721 | 22,690 | 31 | (2,321) | 31 | 22,721 | (2,321) | |
| Electronics | 17,000 | 17,999 | 17,431 | 568 | (999) | 568 | 17,999 | (999) | |
| Computer | 4,850 | 6,111 | 5,075 | 1,036 | (1,261) | 1,036 | 6,111 | (1,261) | |
| Systems Integration | 400 | 201 | 201 | - | 199 | - | 201 | 199 | |
| Program Management | 2,650 | 2,116 | 1,970 | 146 | 534 | 146 | 2,116 | 534 | |
| Common Cost | - | 2,100 | 1,918 | 182 | (2,100) | 182 | 2,100 | (2,100) | |
| Subtotal | 73,160 | 78,178 | 75,960 | 2,218 | (5,018) | 2,218 | 78,178 | (5,018) | |
| Contingency | 2,840 | 400 | - | 400 | 2,440 | 400 | 400 | 2,440 | |
| TOTAL | 76,000 | 78,578 | 75,960 | 2,618 | (2,578) | 2,618 | 78,578 | (2,578) | |

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 March 14, 1980.

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



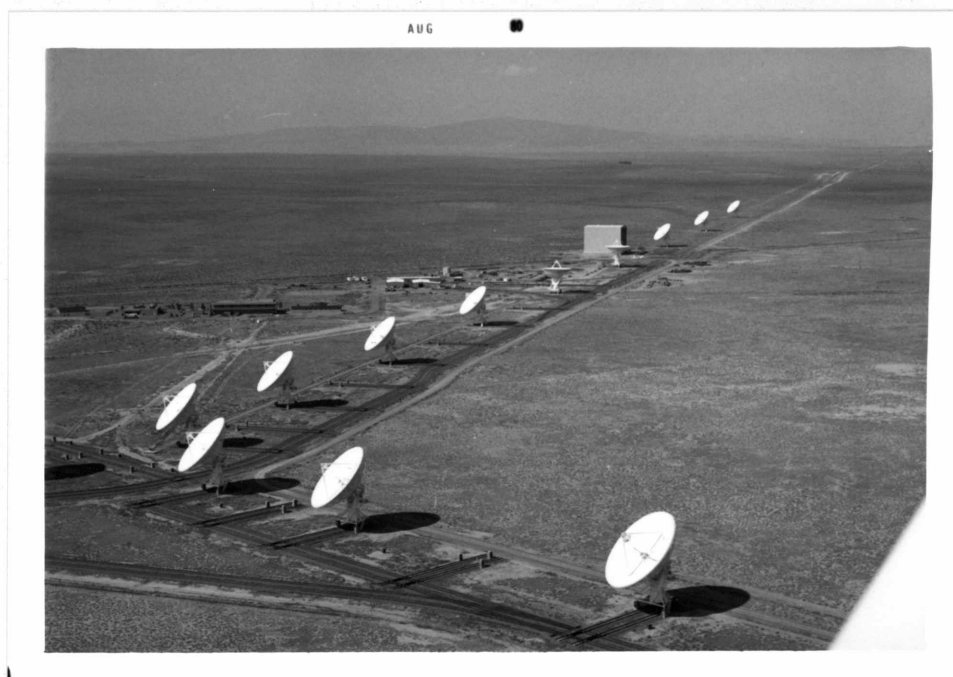
VLA Building Complex area showing new VSQ (right) and Office-Library Building addition (left).



View of Control Building with new Office addition on left.



Center of array in "C" configuration looking West.



Center of array in "C" configuration looking South.