



# NATIONAL RADIO ASTRONOMY OBSERVATORY

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August 8, 1988

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4800 Oak Grove Drive  
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Ref: VLA-GDSCC Telemetry Array Project

Dear Mr. Brown:

Here is the Quarterly Status Report for April-June, 1988.

Sincerely yours,

*Bill Brundage*

William D. Brundage  
VLA-Voyager Preparation  
Manager and Project Engineer

WDB/sb  
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cc: W/Report

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NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA-GDSCC TELEMETRY ARRAY PROJECT

VLA-JPL VOYAGER 2 AT NEPTUNE

QUARTERLY STATUS REPORT

APRIL - JUNE 1988

Prepared by:

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## SUMMARY

During this second quarter of 1988, JPL and VLA continued testing all antennas operating at X-band. The first of five NDPP system tests occurred in late June. NRAO continued constructing and installing receiver systems. Four more antennas became operational at X-band, for a total of 22. JPL nearly completed installation of the power generation system. Several small control functions remain. VLA began a high priority effort to work around and fix an intermittent signal level drop problem originating in the on-line control system. Following review of the VLA Revised Budgetary Estimate, NASA provided to NSF additional funding for replacing critical VLA power cables in 1988. Trenching and power cable installation continued this quarter.

## RECEIVER INSTALLATION

The Central Development Laboratory (CDL) technician trained VLA technicians on internal repair of the cooled front ends (CFE). They repaired two CFE.

The front-end (FE), cryogenics (CRYD), local oscillator (LO), and digital control system (DCS) groups completed and installed the 19th, 20th, 21st, and 22nd production receiver systems this quarter. The cryo group has installed a total of 25 backup cryogenic compressors.

The correlator (COR) group continued construction of the Analog Sum Switch this quarter and nearly finished constructing Analog Sum #3.

The LO group installed the remaining 81 IF bandpass filters this quarter.

## ON-LINE SYSTEM

The new on-line system took total control of the array in early January. The old system Modcomp computers and peripherals were donated to JPL early this quarter. New displays of monitor data and performance data continued to evolve according to users' needs.

In a May letter, JPL revised their on-line system requirements as four critical items needed by May 13 for the NDPP tests, four not so critical items needed by August 15, and five final items needed by October 15. VLA programmers tested a sub-optimum autophasing algorithm in May. The optimum algorithm will be available in August.

The potentially serious problem of intermittent signal drops became a high priority item for the VLA programmers. Additional software error messages and hooks installed last quarter led to a software work-around which seems to dramatically reduce the frequency of occurrence. Now the root of the problem seems to be in critical timing tasks. NASA offered to help in any useful way, but we could suggest nothing helpful until further efforts provide a better understanding of the root cause. This effort will remain a very high priority until the cause is fixed.

#### POWER GENERATION

JPL nearly completed installing the on-site diesel electric power generation system which will substitute for commercial power during telemetry reception in 1989. System testing revealed bugs in the controllers which automatically synchronize to and disconnect from the utility, and synchronize to and reconnect to the utility. JPL solved the disconnect bugs, but abandoned auto-reconnect in favor of manual reconnect, at least temporarily. The generators successfully powered the entire VLA site with glitchless disconnect from and reconnect to the utility during the June 30 NDPD test. Only a few minor items remain, along with formal training of VLA operators and formal acceptance tests, which will occur next quarter.

#### POWER CABLE REPLACEMENT

NASA provided special funding to NSF so that VLA can complete replacement of buried power cable by December 1988, at least to the end of the C-array, which will be used during most of the Voyager telemetry reception in 1989. NRAO expects to receive the funds from NSF early next quarter.

During this quarter, VLA completed installing the feeder cables from the switch gear to the center of the wye, and also from the center to the end of the D-array. Trenching from the end of D-array into C-array began. We are back on schedule and should finish recabling the modified C-array by the end of July.

#### RELIABILITY

Following the Reliability Review No. 1, VLA continued to monitor downtime statistics and explore possible mitigations. We began this quarter a detailed availability analysis specifically for VGTA operations, and expect to issue it next quarter.

The CRYO group's program of modifying the displacer coupling has extended seal lifetimes and MTBF in the cryogenic refrigerator of the CFEs.

Another part of this quarterly report discusses concerns about the on-line system.

## SCHEDULE

The nineteenth through twenty second X-band systems (antennas #15, #16, #18, & #27) became operational this quarter. We expect two more antennas to become operational at X-band by the end of next quarter. The schedule has all 28 antennas operational by the end of 1988.

The VLA Implementation Plan contains summarized schedules for the X-band system installation, back-up cryo-compressor installation, analog sum and switch construction, new on-line system implementation, power generation system implementation, power cable replacement, and array configuration. We are slightly behind the schedules for analog sum and switch construction, but we should catch up to schedule next quarter.

## FUNDS

In February, NRAO submitted to JPL a revised budgetary estimate for 1988, including the buried power cable replacement for Voyager and other adjustments reflecting actual cost experience. JPL requested that NASA provide an additional \$183k in funding. NSF has received these additional funds, and we expect NRAO to receive them early next quarter.

Spending by CDL and VLA is mostly on schedule relative to this revised budgetary estimate and funding schedule, which is (in \$k):

FY	1985	1986	1987	1988	1989	TOTAL
	890	1978	1712	1297	610	6487

A fiscal statement for the project from inception thru 1988 June 30 follows. It includes total expenditures and commitments (E&C), and balance. Total allocations equal total funds plus the \$183k expected next quarter. In addition it shows estimated E&C at calendar year end, and estimated balance at year end. Recabling M&S is \$29k over our original estimate.

Budget88

SUMMARY FISCAL STATEMENT IN \$k  
INCEPTION THRU DATE

VOYAGER

DATE: 1988 JUNE 30

	ALLOCATION IT Dec88 \$k	E&C ITD \$k	BALANCE ITD \$k	Est E&C IT Dec88 \$k	Est BAL IT Dec88 \$k
-----IT 1988-----					
<u>VERY LARGE ARRAY</u>					
WAGES	835	622	213	835	0
BENEFITS	226	160	66	226	0
COMMON COSTS	795	591	204	795	0
TRAVEL	65	33	32	65	0
OFFICE LAB ADDITIONS	28	27	1	28	0
2 DEV'L RECEIVERS	157	157	0	157	0
CRYOGENICS & VACUUM	99	71	28	99	0
CRYO COMPRESSORS	221	218	3	221	0
RCVR INSTALLATION M & S	648	607	41	648	0
EQUIPMENT (TEST & TOOLS)	145	82	63	145	0
JPL DONATED EQUIP	936	936	0	936	0
BACKUP ON-LINE COMPUTER	250	255	-5	255	-5
RELIABILITY IMPROVEMENTS	15	18	-3	20	-5
POWER GENERATION M&S	78	79	-1	79	-1
RECABLE M&S	182	211	-29	215	-33
CONTINGENCY	30	0	30	0	30
PUBLIC EDUCATION	6	0	6	6	0
<u>VLA TOTAL</u>	<u>4716</u>	<u>4067</u>	<u>649</u>	<u>4730</u>	<u>-14</u>
<u>CENTRAL DEVELOPMENT LABORATORY</u>					
WAGES	652	599	53	652	0
BENEFITS	172	155	17	172	0
COMMON COSTS	425	391	34	425	0
TRAVEL	23	19	4	23	0
MATERIALS & SERVICES	450	431	19	450	0
EQUIPMENT (TEST & TOOLS)	353	343	10	353	0
CONTINGENCY	22	0	22	0	22
<u>CDL TOTAL</u>	<u>2097</u>	<u>1938</u>	<u>159</u>	<u>2075</u>	<u>22</u>
<u>NRAO TOTAL</u>	<u>6813</u>	<u>6004</u>	<u>808</u>	<u>6805</u>	<u>8</u>
NASA FUNDS	5694			5694	
JPL DONATED EQUIP	936			936	
<u>TOTAL FUNDS</u>	<u>6630</u>			<u>6630</u>	
BALANCE = TOT FUND-NRAO TOT	-183			-175	

E&amp;C = EXPENDED &amp; COMMITTED

IT = INCEPTION THRU

ITD = INCEPTION THRU DATE

Est = Estimated

NOTE: Re-Allocated per Revised Budgetary Estimate of 88 Feb 26