NATIONAL RADIO ASTRONOMY OBSERVATORY

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November 14, 1988

Donald W. Brown
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Ref: VLA-GDSCC Telemetry Array Project

Dear Mr. Brown:

Here is the Quarterly Status Report for July-September, 1988.

Sincerely yours,

William D. Brundage

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

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cc: W/Report

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UNDER CONTRACT WITH THE NATIONAL SCIENCE FOUNDATION

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA-GDSCC TELEMETRY ARRAY PROJECT

VLA-JPL VOYAGER 2 AT NEPTUNE

QUARTERLY STATUS REPORT

JULY - SEPTEMBER 1988

Prepared by:

William D. Brundage

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VLA-Voyager Preparation
Manager and Project Engineer

Approved by:

Richard A. Perley
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SUMMARY

During this third quarter of 1988, JPL and VLA continued testing all antennas operating at X-band. Four of five NDPP system tests occured successfully in July. NRAO continued constructing and installing receiver systems. Two more antennas became operational at X-band, for a total of 25. JPL nearly completed installation of the power generation system. Several small control functions and acceptance tests remain. With the assistance of consultants from Modcomp, Inc., VLA found and fixed a bug in the On-line computer operating system which caused an intermittant signal level drop. No spontaneous signal drops occured in subsequent tests. VLA completed replacing critical power cables from the switch gear through the end of the C-array.

RECEIVER INSTALLATION

The Central Development Lab (CDL) has completed the 31st and nearly completed the 32nd cooled frontend (CFE). Although these exceed the 30 CFEs required for VGTA, all X-band CFEs will be in a common pool for both VLA and VLBA antennas and thus available as backups for VGTA. CDL will supply VLA with spare parts, including lower noise HEMT amplifiers than those currently in some of the CFEs. These amplifiers could be retrofitted in some of the higher noise CFEs that need service for other reasons. Improvements in performance would be in the range 3 to 8 Kelvin (10 to 25% in system noise temperature).

The front-end (FE), cryogenics (CRYO), local oscillator (LO), and digital control system (DCS) groups completed and installed the 24th and 25th production receiver systems this quarter. The cryo group has installed backup cryogenic compressors on all 28 antennas.

The correlator (COR) group constructed the Analog Sum Switch and added some monitoring capability to help detect and characterize signal drops. They also completed Analog Sum #3 and will start constructing Analog Sum #4 next quarter. Also next quarter, they will interface the Switch to the On-line System and modify software in the correlator controller to allow glitchless selection/de-selection of antennas in the Analog Sum.

ON-LINE SYSTEM

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. At the end of this quarter, VLA programmers have completed five items and partially completed four other items. They will finish these next quarter.

The efforts by VLA programmers and a Modcomp consulting team have cured the basic cause of signal drops. They found and corrected a coding error in the Modcomp MAXNET32 operating system which

caused occasional errors in task scheduling. Because of the circumstances of the coding error, NRAO views the $18 000 invoice from Modcomp as unreasonable, and we are negotiating it. Tests in late August and on September 15 detected no spontaneous signal drops in the analog sum total power and the Voyager carrier power when using the current version of global autophasing.

New displays of monitor data and performance data continued to evolve according to specifications in the draft JPL Document 1220-3, "VGTA System Requirements NRAO-DSN, VLA Interface Definition".

POWER GENERATION

JPL completed installation of the on-site diesel electric power generation system which will substitute for commercial power during telemetry reception in 1989. System testing revealed intermittants in the auxilliary contacts in both of the Hatch-modified switch gear which caused problems in auto-reconnect to utility power. VLA fixed the contacts. The generators succesfully powered the entire VLA site many times with glitchless disconnect from and reconnect to the utility. JPL and VLA started formal acceptance tests in September and will finish in early October. JPL will review the results and issue a report early next quarter. Only a few items remain on the punch list.

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 received the funds from NSF in early September.

On August 12, VLA completed installing all the cables through the C-array and beyond on the west arm to BW5 (the modified C-array). Complete - job closed!

RELIABILITY

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

The modified displacer coupling has extended seal lifetimes and MTBF in the CTI-22 cryogenic refrigerators of the X-band CFEs. However, the MTBF still is less than that of the larger CTI-350 and CTI-1020 refrigerators whitch we use in other VLA and VLBA CFEs. The CRYO group continues to try alternative seals and vendors.

Next quarter, the On-line group will test a backup serial-line-controller and a backup IAT clock. They also continue to investigate a backup CPU board for SPECTRE, the computer for the correlator and the array processor.

SCHEDULE

The twenty fourth and twenty fifth X-band systems (antennas #19, & #7) became operational this quarter. We expect two more antennas (#13 & #22) to become operational at X-band by the end of next quarter. The 28th antenna will be operational by January 19, 1989.

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, new on-line system implementation, and power generation system implementation, 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 NRAO received them in early September.

Spending by CDL is on schedule and VLA exceeds 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	666	6543

A fiscal statement for the project from inception through 1988 September 30 follows. It includes total expenditures and commitments (E&C), and balance. Total allocations equal total funds. In addition it shows estimated E&C at calendar year end, and estimated balance at year end .

The VLA estimated balance at year end is a negative $70k. This will present no problem if FY89 NASA funds reach NRAO by the end of November. Several events cause the year end estimated negative balance. Recabling M&S is $25k over our original estimate (allocation). Power generation is $12K over our original estimate. Unexpected labor for additional On-line system software, a JPL operator, and for recabling caused wages and common costs to exceed our original estimate by $49k and $45k, respectively.

Based on the schedule for 1989 VGTA Tests and Operations, we estimated an additional $56k would be required in FY89 funds for VLA personnel to be on-site to provide high reliability and immediate response to failures. In early September, JPL requested this additional FY89 funding from NASA.

Budget88 SUMMARY FISCAL STATEMENT IN $k VOYAGER
INCEPTION THRU DATE

DATE: 1988 SEPTEMBER 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	
VERY LARGE ARRAY					
WAGES	835	807	28	884	-49
BENEFITS	226	198	28	226	0
COMMON COSTS	795	759	36	840	-45
TRAVEL	65	38	27	50	15
OFFICE LAB ADDITIONS	28	27	1	28	0
2 DEV'L RECEIVERS	157	157	0	157	0
CRYOGENICS & VACUUM	99	73	26	89	10
CRYO COMPRESSORS	221	219	2	221	0
RCVR INSTALLATION M & S	648	603	45	632	16
EQUIPMENT (TEST & TOOLS)	145	112	33	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	87	-9	90	-12
RECABLE M&S	182	207	-25	207	-25
CONTINGENCY	30	0	30	0	30
PUBLIC EDUCATION	6	15	-9	6	0
VLA TOTAL	4716	4511	204	4786	-70
CENTRAL DEVELOPMENT LABORATORY					
WAGES	652	627	25	652	0
BENEFITS	172	160	12	172	0
COMMON COSTS	425	409	16	425	0
TRAVEL	23	20	3	23	0
MATERIALS & SERVICES	450	430	20	450	0
EQUIPMENT (TEST & TOOLS)	353	343	10	353	0
CONTINGENCY	22	0	22	0	22
CDL TOTAL	2097	1991	106	2075	22
NRAO TOTAL	6813	6502	311	6861	-48
NASA FUNDS	5877			5877	
JPL DONATED EQUIP	936			936	
TOTAL FUNDS	6813			6813	
BALANCE = TOT FUND-NRAO TOT	0			-48	

E&C = EXPENDED & COMMITTED
IT = INCEPTION THRU
ITD = INCEPTION THRU DATE
Est = Estimated

NOTE: Allocations per NASA funding schedule 4, $5877k IT FY88.