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August 31, 1989

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Ref: VLA-GDSCC Telemetry Array Project

Dear Mr. Brown:

Here is the Quarterly Status Report for April - June, 1989.

Sincerely yours,

Bill Brundage

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VLA-Voyager Preparation
Manager

WB/pl

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NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA-GDSCC TELEMETRY ARRAY PROJECT

VLA-JPL VOYAGER 2 AT NEPTUNE

QUARTERLY STATUS REPORT

APRIL - JUNE 1989

Prepared by:

William D. Brundage

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

Approved by:

Richard A. Perley
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SUMMARY

During this second quarter of 1989, JPL and VLA staff continued testing the VLA and VGTA operations at X-band. NRAO devoted 98.5 hours of VLA observing time to VLA tests and to VGTA system tests and observations. Having completed construction and installation of receiver systems, NRAO concentrated on debugging, constructing spare hardware, improving reliability, and supporting VGTA tests and observations.

RECEIVER SYSTEM

The correlator group nearly completed the spare Analog Sum Switch and spare power level monitor. The digital group tested the spare Serial Line Controller, which is the interface between the array and the Online control and monitor system.

An attempt to explain transients in the phased array output power which occurred at the end of the data gap only while observing a strong radio source, led to the discovery that all antennas initiated phase switching 0.25 millisec after the end of the data gap instead of within the data gap. As this flaw certainly contributed to the excessive bit error rates associated with the VLA data gap, NRAO corrected the causitive wiring error in each antenna. Subsequently, JPL confirmed a significantly lower bit error rate at 21.6 kbps.

ON-LINE SYSTEM

The VLA on-line programmers completed the remaining software requirements, including additional displays of performance data, and periodic updating of refractive pointing corrections. They also fixed a bug which caused Voyager signal drops when antennas occasionally switched phase incorrectly for one waveguide cycle. As part of the configuration freeze, the last software update occurred on June 8 and passed JPL testing on June 12.

POWER SYSTEM

Several more failures in the old buried power cables occurred this quarter, which certainly justified the installation of new cable throughout the modified C-array configuration. The VLA entered this array June 1 and will remain in it until the final VGTA operation on September 27. Fused disconnects protect the C-array from additional cable failures which may occur outside the modified C-array. VLA staff made several repairs of infant mortality failures in the diesel generator system, and added audible-visual alarms to alert the VLA operator to generator faults.

INTERFERENCE

The VLA frequency coordinator notified the White Sands Missile Range, Kirtland AFB, and the National Center for Atmospheric Redearch (NCAR) of the NASA/JPL need for restrictions on X-band emissions in the vicinity of the VLA during the April - September VGTA operations. NCAR will fly 9375 MHz weather radar east of the VLA during July and August for research into the formation of thunderstorms. After tests showed HEMT amplifier damage occurs at 2 watts peak power, NRAO determined that the VLA X-band amplifiers would be undamaged if the NCAR aircraft comes no closer than ten miles to any VLA antenna. NCAR agreed to this distance and to no emissions during VGTA operations. In June NRAO began monitoring X-band RFI at the VLA, and will continue through August. We have experienced no significant RFI to date, and do not expect any.

OPERATIONS

NRAO worked closely with JPL operations staff to develop procedures and knowledge for effecient VLA/JPL operation and rapid diagnosis and correction of VLA failures. To further enhance reliability and minimize down time, NRAO staff cover nine critical areas at the VLA for the ten hours of each VLA - Voyager operation, beginning April 26 and continuing through September 27.

RELIABILITY

To maximize availability of the Voyager telemetry signal at the VLA/JPL interface and the number of usable VLA antennas, and to minimize VLA downtime, NRAO concentrated on completing and testing backup equipment and honing our response to all VLA problems and failures that could inpact VGTA operations. We constructed and/or tested backup units for:

- CPU board in the correlator computer SPECTRE
- analog sum switch module
- analog sum switch power monitor module
- serial line controller (interface between on-line system and VLA electronics system)
- IAT clock for the on-line system
- weather station (ambient temperature and dew point)
- overhauled spare chiller for the Control Building air conditioner
- planned to put the 28th antenna in hot standby instead of overhaul during August.

During 4034 minutes of scheduled VGTA operations this quarter, the uptime and availability of N VLA antennas was:

N ant	27	26	25	24	23	22	21	20
Upminutes	694	2151	2752	3132	3132	3358	3578	4034
Availability	.17	.53	.68	.78	.78	.83	.89	1.00

A buried power cable fault caused a loss of the five antennas outside the north arm C-array during the May 17/18 VGTA operation, and consequently depressed these availability numbers. This cannot happen again since the VLA reconfigured from the B/C hybrid array to the Voyager modified C-array on June 1.

The Voyager signal at the VLA-JPL interface was down only for nominally one minute each time Voyager changed between the 8415 and 8420 MHz frequencies. Since the VLA inherently loses signal to change frequency and to re-phase on Voyager, we could say the Voyager signal availability was virtually unity.

Because of little thunderstorm activity this June, we have no test yet of the over head ground wire (OHGW) lightning protection system. When storms inevitably occur in July and August, surge counters on the OHGW and an electric field activated video camera (installed by NMIMT Langmuir Lab) will record strikes and prove its effectiveness.

PUBLIC EDUCATION

As JPL has increased its public education and media awareness efforts with the approaching flyby, so also has NRAO-VLA. With the aid of JPL, we have provided New Mexico media, schools and universities with information packages. In late June, NRAO and JPL hosted a VLA open house. The Friday open house for media generated so much publicity around New Mexico, that approximately 2000 visitors swarmed over the VLA during the public open house the next afternoon. Perhaps the most popular event both days was the Voyager-at-Neptune briefing both days. NRAO also hosted other media and writer/photographer visitors at the VLA. In addition, various NRAO staff gave talks to local groups and wrote articles for publications.

NRAO VLA and Array Operations Center (AOC) staff, and JPL operations staff, and many visitors, have enthusiastically viewed near real-time images on SSTV monitors located at the VLA and AOC. We plan public viewing of SSTV and NASA Select TV in Socorro during August.

FUNDS

NRAO allocated the NASA fiscal year (FY) funds on a calendar (CY) basis according to this schedule (in $k):

CY	1985	1986	1987	1988	1989	Supp 89	TOTAL
	890	1978	1712	1297	666	390	6933

In May we requested of JPL supplemental 1989 funding of $390k to cover unplanned expenses in wages, benefits, and overhead for 1988 and 1989. JPL reviewed the request and forwarded it to NASA in June.

A fiscal statement for the project from inception through 1989 June 30 follows. It includes total expenditures and commitments (E & C), and balance relative to allocations. The total allocation equals total funds. Total funds equal $6543k of NASA funds received plus $936k of JPL donated equipment.

In addition, it shows estimated E & C at the end of the project, September 1989. Estimated VLA wages exceed the allocation by $80k, mostly because of extra efforts on software and electrical systems. Common costs (overhead) exceed the allocation by $147k because they are a fixed percentage of wages. This has increased significantly as NRAO re-analysed its overhead rate for 1988 and 1989. Costs for repairing the generators and for reliability improvements have been and will be greater than planned. Including a small contingency, estimated total E & C exceeds current funds by $390k, the supplemental amount requested.

WB/pl

Budgt89 SUMMARY FISCAL STATEMENT IN $k VOYAGER
INCEPTION THRU DATE

DATE: 1989 JUNE 30	ALLOCATION IT Sep89 $k	E&C ITD $k	BALANCE ITD $k	Est E&C IT Sep89 $k	Est BAL IT Sep89 $k
				IT 1989	
VERY LARGE ARRAY					
WAGES	1090	1066	24	1170	-80
BENEFITS	296	264	32	293	3
COMMON COSTS	1037	1008	29	1184	-147
TRAVEL	46	44	2	46	0
OFFICE LAB ADDITIONS	28	29	-1	29	-1
2 DEV'L RECEIVERS	157	157	0	157	0
CRYOGENICS & VACUUM	100	91	9	100	0
CRYO COMPRESSORS	222	219	3	220	2
RCVR INSTALLATION M & S	639	615	24	619	20
EQUIPMENT (TEST & TOOLS)	150	157	-7	158	-8
JPL DONATED EQUIP	936	936	0	936	0
BACKUP ON-LINE COMPUTER	250	255	-5	255	-5
RELIABILITY IMPROVEMENTS	63	51	12	68	-5
POWER GENERATION M&S	108	103	5	110	-2
RECABLE M&S	209	207	2	207	2
CONTINGENCY	50	0	50	44	6
PUBLIC EDUCATION	15	8	7	14	1
VLA TOTAL	5396	5208	187	5610	-214
CENTRAL DEVELOPMENT LABORATORY					
WAGES	657	647	10	647	10
BENEFITS	173	164	9	164	9
COMMON COSTS	428	422	6	422	6
TRAVEL	26	20	6	20	6
MATERIALS & SERVICES	450	430	20	430	20
EQUIPMENT (TEST & TOOLS)	356	346	10	346	10
CONTINGENCY	-7	0	-7	54	-61
CDL TOTAL	2083	2029	54	2083	0
ADJUSTMENT FOR CY88 OVERHEAD	0	0	0	176	-176
NRAO TOTAL	7479	7237	241	7869	-390
NASA FUNDS	6543			6543	
JPL DONATED EQUIP	936			936	
TOTAL FUNDS	7479			7479	
BALANCE = TOT FUND-NRAO TOT	0			-390	

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

NOTE: Allocations per NASA funding schedule 5, $6543k IT FY89.