NATIONAL RADIO ASTRONOMY OBSERVATORY
POST OFFICE BOX O SOCORRO, NEW MEXICO 87801-0387
TELEPHONE 505 772-4011 TWX 910 988 1710

February 8, 1988

Donald W. Brown
TDA Engineering
MS 264-803
JPL/Caltech
4800 Oak Grove Drive
Pasadena, CA 91109

Ref: VLA-GDSCC Telemetry Array Project

Dear Mr. Brown:

Here is the Quarterly Status Report for October-December, 1987. I leave to you the distribution of copies within JPL.

Sincerely yours,

Bill Brundage

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

WDB/sb

cc: W/Report

M. Balister	C. Bignell
L. Beno	E. Callan
J. Campbell	W. delGiudice
J. Desmond	M. Dinius
R. Ekers	R. Ferraro
R. Gonzalez	D. Heeschen
P. Hicks	G. Hunt
S. Lagoyda	R. Latasa
P. Lilie	G. Martin
P. Napier	K. Sowinski
R. Sramek	G. Stanzione
P. VandenBout	R. Stidstone
D. VanHorn	D. Weber
H. Winchell	

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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

OCTOBER - DECEMBER 1987

Prepared by:

William D. Brundage

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

Approved by:

R. A. Sramek

Richard A. Sramek
VLA Deputy Site Manager

SUMMARY

During this third quarter of 1987, JPL and VLA continued testing all antennas operating at X-band. NRAO continued constructing front-ends and receivers for installation in 1987 and 1988. One more antenna became operational at X-band, for a total of 15. When NASA authorized FY88 funds for NSF/NRAO, NRAO ordered the materials needed to complete construction and installation in 1988. NASA authorized committing existing funds, pending additional funding from NSF and NASA, for replacing critical VLA power cables in 1988.

FEEDS

The antenna group installed support towers and feed horns on three antennas this quarter. They also ordered the remaining eight support towers, which will be delivered in early 1988.

COOLED FRONT-ENDS

The Central Development Laboratory (CDL) delivered three more cooled front-ends (#24 thru #27) to the VLA this quarter. Two more front-ends (#28 and #29) are nearly ready for shipment. Front-end #9 is back for repair and #30 will be shipped to the VLA in February. The latest receivers use GE HEMTs and have a typical Tr <= 13 Kelvin at 8.4 GHz.

RECEIVER SYSTEM

The front-end (FE), cryogenics (CRYO), local oscillator (LO), and digital control system (DCS) groups completed and installed the fourteenth and fifteenth production receiver systems this quarter. The upgraded VLA receiver front-ends in Rack-A, which contains the new bandswitches, must be installed before an X-band receiver becomes operational. Now the front-end and cryo groups install an upgraded Rack-A with or before the X-band installation. Also the cryo group installs a backup cryogenic compressor.

The DCS group finished construction of Analog Sum #2 this quarter and began constructing the Analog Sum Switch. Construction of Analog Sum #3 will begin next quartter.

The LO group placed permanent mountings for the 108 IF bandpass filters and will install the remaining 81 filters when provided by JPL in mid 1988.

NEW ON-LINE SYSTEM

The new on-line system continued operating this quarter in parallel with the old system. The new system took partial control of the array in mid November. The old system hardware was removed in late December. The new system will be up and in total control of the array in early January. VLA and JPL continued using the new display of X-band front-end monitor data, which will evolve according to users' needs. Additional new dispays will become available in mid Jauary.

The computer programmer, provided by JPL via the DSN Telos Software Support contract, conrinued to assisted with software development. He will continue until the end of February.

TESTS

In the months of November and December, JPL used seven to eight hours of array test time to examine the phase stability of the "phased-up" array as a function of signal-to-noise ratio (SNR) and the gain and integration parameters in the autophasing algorithm. Simulations of the current autophasing algorithm on normal synthesis array data demonstrated that autophasing robustness in removing atmospheric phase fluctuations is independent of baseline length, provided delay between acquisition of phase data and application of phase corrections is sufficiently short.

The global phase solution algorithm (ANTSOL) proved operational in the new on-line system. It will be the core of global autophasing to be tested in January. JPL determined the optimal algorithm which the VLA programmers will attempt to implement next quarter.

JPL continued measurements of the performance of up to fifteen X-band antennas in pointing at radio sources, in tracking the Voyager 2 spacecraft in a phased-up array, in aperture efficiency, and in system noise temperature at low elevation angles.

POWER GENERATION

VLA completed its part of installing the on-site diesel electric power generation system which will substitute for commercial power during telemetry reception in 1989. The two 1400 kW generators, exhaust system, and building are in place. The building electrical contractor finished work in this quarter. Much JPL work remains to be started or completed. The high voltage contractor began preliminary design and switch gear modification. Generator electrical system installation and high voltage installation will begin in March. System testing will begin in May 1988.

SCHEDULE

The fifteenth X-band system became operational this quarter. All receiver frontends utilize lower noise HEMT amplifiers. We expect sixteen antennas to be operational at X-band by the end of next quarter. The schedule has a total of 20 operational antennas by mid 1988, and all 28 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 mostly on schedule.

RELIABILITY

Following the Reliability Review No. 1, VLA continued to monitor downtime statistics and explore possible mitigations. We will issue another review in March 1988.

Several CTI 22 cryogenic refrigerators in the cooled front-ends had failed after only 3000 hours running time. Since early 1987, the CRYO group replaces carbon bushings in all refrigerators with polyamide bushings of Envex or Vespel, expecting to extend the MTBF. Several units with modified displacer couplings so far indicate improved MBTF.

Concerns continued this quarter about reliability of on-site power distribution cables feeding the arms of the wye. The National Science Foundation (NSF) has not yet responded to the VLA report on the problem, which included a cable replacement schedule and cost estimate. NRAO-VLA funding in 1987 only allowed adding a redundant cable between the site switch-gear and the Control Building.

FUNDS

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

FY	1985	1986	1987	1988	1989	TOTAL
	891	1977	1712	1114	610	6304

In November NASA transfered to NSF $1114k for FY 1988. NRAO began committing the new funds in December.

JPL and NASA considered special funding 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. Folowing NASA authorization in November to use current funding, VLA began ordering materials and services to begin cable replacement in February. NASA will provide, in the first quarter of 1988, at least $194k of the estimated $214k cost to replace these cables.

A fiscal statement for the project from inception thru 1987 December 31 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.

Budget88 SUMMARY FISCAL STATEMENT IN $k VOYAGER
INCEPTION THRU DATE

DATE: 1987 DECEMBER 31	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	762	521	241	762	0
BENEFITS	207	132	75	207	0
COMMON COSTS	726	493	233	726	0
TRAVEL	80	31	49	75	5
OFFICE LAB ADDITIONS	28	27	1	28	0
2 DEV'L RECEIVERS	157	157	0	157	0
CRYOGENICS & VACUUM	71	69	2	71	0
CRYO COMPRESSORS	323	177	146	323	0
RCVR INSTALLATION M & S	657	586	71	657	0
EQUIPMENT (TEST & TOOLS)	120	57	63	120	0
JPL DONATED EQUIP	686	686	0	686	0
BACKUP ON-LINE COMPUTER	250	255	-5	255	-5
RELIABILITY IMPROVEMENTS	15	9	6	15	0
POWER SYSTEM	76	100	-24	76	0
CONTINGENCY	25	0	25	0	25
VLA TOTAL	4183	3300	883	4158	25
CENTRAL DEVELOPMENT LABORATORY					
WAGES	714	582	132	714	0
BENEFITS	222	150	72	222	0
COMMON COSTS	462	379	83	462	0
TRAVEL	41	19	22	25	16
MATERIALS & SERVICES	474	416	58	420	54
EQUIPMENT (TEST & TOOLS)	284	343	-59	354	-70
CDL TOTAL	2197	1889	308	2197	0
NRAO TOTAL	6380	5189	1191	6355	25
NASA FUNDS	5694				
JPL DONATED EQUIP	686				
TOTAL FUNDS	6380				
BALANCE = TOT FUND-NRAO TOT	0				

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