



NATIONAL RADIO ASTRONOMY OBSERVATORY

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REF: VLA-GDSCC Telemetry Array Project

Dear Mr. Brown:

Here are six copies of the Quarterly Report for January-March 1986. 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

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NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA-GDSCC TELEMETRY ARRAY PROJECT

VLA-JPL VOYAGER 2 AT NEPTUNE

QUARTERLY STATUS REPORT

JANUARY - MARCH 1986

During this first quarter of 1986, JPL and VLA staff continued testing the two antennas operating at X-band. NRAO continued procuring materials for and constructing front-ends and receivers for 1986.

CDL

The Central Development Laboratory delivered in mid-February to the VLA the first of the production FET front-ends. The second unit was fabricated and tested and is being held for system evaluation of the first HEMT amplifiers. This unit will be sent to the VLA in mid-April. The following units should meet the delivery schedule put out by H. Dill on January 15, 1986.

Parts are on hand for four more units. Most of the parts needed for the remaining units have been ordered.

Testing of GE HEMT's continued. The HEMT's from wafer #546 and #495 exhibited noise temperatures as low as the original wafer #54, i.e. $T_{min} \sim 8.5K$ at 8.5 GHz and $T_a = 12.5K$. This demonstrated that the excellent results for the original wafer #54 can be repeated.

Construction of all-FET, three-stage amplifiers proceeded; typical values of minimum and average (across the band 8.0-8.8 GHz) noise were 22K and 25K, respectively.

A prototype version of a three-stage amplifier with GE HEMT #546.81 was built. It exhibited a minimum noise temperature of $T_{min} = 10.5K$ at 8.8 GHz and average noise temperature $T_{av} = 12.5K$ across the 8.0 - 8.8 GHz band.

TESTS

Each month JPL staff used four to six hours of array test time to examine the phase stability of the "phased-up" array of 27 antennas. They also measured the performance of the two X-band antennas in pointing at radio sources, in pointing and tracking the Voyager 2 spacecraft, in feed efficiency and in system noise at low elevation angles. JPL issued several test reports.

SCHEDULE

The third X-band system neared completion at the end of this quarter. In spite of some yet undelivered parts, it should be installed on antenna #24 by the end of April. By late May, JPL should be able to test a three element interferometer and a three

antenna auto-phased array at X-band. The current schedule has twelve front-ends delivered to the VLA and six of them installed on antennas in 1986.

FEEDS

VLA received from JPL two production feed horns. SN 001 was installed on the third X-band antenna #24 and SN 002 will go on the next antenna, #3, when it enters the barn for overhaul. Currently the first "preliminary" feed is in antenna #20, the "prototype" feed is in antenna #21 and "production" feed 001 is in antenna #24.

RECEIVER SYSTEM

The last orders for materials for the first set of eight receivers went out this quarter. By "scrounging" for substitutes for some undelivered parts, the VLA nearly completed the first receiver system this quarter. It should be installed on antenna 24 by the end of April, be tested and debugged by mid-May and be ready for JPL tests by late May.

ANALOG SUM

The JPL telemetry demodulating receiver will connect to the VLA at the output of an analog sum which combines the digitized phased-up baseband IF's from all 27 antennas for one IF channel. Tests by JPL of the first unit in March verified adequately low spurious signal levels in the 5 to 40 MHz range of the analog output. VLA will build four more units; one for each of the four IF channels plus one spare.

RELIABILITY OF ELECTRIC POWER

The power line monitor provided more data on voltage sags, spikes and dropouts on the VLA power source (Socorro Electric Cooperative). JPL and VLA continued planning for on-site diesel electric power generation which could substitute for commercial power during telemetry reception in 1989. New concerns arose this quarter about reliability of on-site power distribution because of two failures of buried cables feeding the arms of the wye. VLA and JPL started investigating a track-mobile diesel generator which could reduce antenna recovery time from many hours to three or four hours.

RELIABILITY REVIEW

In March, VLA and JPL discussed a draft review of VLA reliability affecting the 1989 reception of Voyager 2 telemetry. We established a common reliability formalism and set an availability goal of 98% and mean-time-to-recovery of 4 hours. Computer hardware, computer software, electric power source, site power distribution, human error, failure diagnoses and certain hardware in the common system appear to be the most critical areas. The purchase of a backup on-line computer is being considered. VLA will issue a Reliability Review document in April. VLA and JPL will continue to monitor downtime statistics and explore possible mitigations. We will continue periodic reviews.

FUNDS

Spending by CDL and VLA is on schedule but projections show a negative balance at the end of the project. In order to complete the purchase of materials for eight receiver systems in FY86, CDL transferred \$100K of its funds to VLA. Total funding for VLA in the Management Plan plus the \$100K from CDL appears to be inadequate to complete the receiver system because benefits, overhead and burden costs are higher than planned.

Furthermore, the distribution of VLA funds from FY87 through FY89 in the Management Plan and the NASA funding schedule creates problems. Inadequate funding in FY87 and excessive funding in FY89 causes a non-uniform rate of construction and makes it very difficult to complete construction by the end of 1988.

Therefore, NRAO may request that NASA:

1. Provide additional funds each year to cover higher benefits, overhead and burden.
2. Change the funding schedule to provide \$100K more in FY87 and less in FY89.
3. Add \$250K in FY87 if JPL decides adequate reliability requires a backup MODCOMP on-line computer.

Suggestions for a revised budget will be submitted to JPL.

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