VLBA TEST MEMO NO. 17

National Radio Astronomy Observatory *MEMORANDUM*

To: VLBA Project *Date:* April 25, 1988

From: Craig Walker

Subject: Test Coordination Meeting, Apr. 19, 1988

Those present: Napier, Clark, Bagri, Walker, Crane, Thompson, Romney, Egler, Peery, Rhodes, Granlund, and Rogers.

Napier noted quickly that the source of the large discrepancy between the subreflector surface measurements made by the manufacturer and at University of Arizona, that was mentioned in the last Monday meeting, has been found. There was an error in the azimuth values given by Arizona. The two data sets now seem to be in reasonable agreement although analysis is just starting.

The results of the temperature stability tests done at Pie Town (VLBA Test Memo No. 16) were discussed. There seems to have been an impression on the part of the site group that the tight specs for Room 104 (the electronics room) were driven only by the maser and that the maser's requirements had been relaxed. In fact, a number of items in that room are temperature sensitive, probably with very short time constants. See VLBA Test Memo 15 for some indications. Also note that the masers have a temperature sensitivity of 1×10^{-14} C^{-1} compared to a stability spec of 2×10^{-15} for times above 1000 sec. The time constant for this sensitivity is probably several hours. It is expected that the temperature sensitivity will limit the long term performance of the masers so their need for a stable environment should not be neglected.

The current setup at Pie Town has Rooms 104 and 103 (the computer room) tied together — the temperature sensor that controls the air conditioner is in the return air from both rooms. A number of people expressed concern about this because it defeats the original intent to make Room 104 very stable and insensitive to activity in the computer room (where tape changing occurs). It was agreed to test the system with the sensor in Room 104. Egler will see that the change is made. Stability tests will be made after the change during something approximating normal operations. There was additional concern that any temperature difference that might develop between the rooms could cause a problem if anyone does enter Room 104.

Bagri suggested that the temperature in the building be set at 23.5 C to avoid the region of poor performance of teflon cables at slightly lower temperatures.

Bagri summarized the temperature tests that have been done in the vertex room. These tests will need to be repeated when more of the final load is present. They will be discussed at future meetings.

The rest of the meeting was a discussion of the pulse calibration system proposed by Bagri and Thompson in VLBA Memo 622. Rogers noted that he likes the use of a higher frequency for the round trip phase measurement. He has some concerns about the step recovery diode suggested for the pulse generator. He suggests using a tunnel diode, the type used in the new NASA systems. A tunnel diode would require a gate circuit to suppress negative pulses and this device might cause problems with the phase lock loop unless the lock frequency is raised. Thompson and Bagri noted that the details of the design of the system had not been worked out fully yet.

There was some concern about the distribution of the pulse cal signals. One module would be used for all receivers. Short cables will be needed at the highest frequencies and some sort of good switch will be needed. Also, at least two receivers at a time will need to be fed for dual frequency observations.

For a variety of reasons, some related to spectral line observations at narrow bands and to signal strength concerns at the highest frequencies, it would be useful to have the frequency rail intervals be flexible. There seemed to be agreement that this

is desirable, that it should not affect the stability of the system, and that it should not be too difficult.

Napier expressed some concern that the calibration signal in one receiver might get into the other during dual band observations. A quick calculation suggested that such a signal should be 60 db down which should be ok.

There followed a discussion of where the signals should be detected. I expressed a desire to have simultaneous detection of all signals, probably in the correlator. Romney would rather not have the complication in the correlator and claimed that the detectors in the formatter are sufficient for our needs. Various numbers were thrown about. It seems clear that a proper analysis needs to be done.

Rogers promised a memo describing current equipment and practice. Romney promised to look into the use of the pulse cal in spectral line applications.

Romney noted that Ray Escoffier made a quick design of a detector for the correlator. It requires 50 chips per channel per rail and so would represent a significant expense, besides not fitting on the board where they would like to put it. Part of the problem arrises from the fact that the buffer used for decoding the tape and the one used for the station delays is the same. There is no undelayed signal available in the correlator so any phase cal detector would have to smooth out the delay steps caused by delay tracking.

Any change to the correlator design should be made by this summer so there is some urgency to settle on a detection scheme.

Rogers suggested that we should investigate the extent to which the correlator's fringe rotators can be used to detect rails at odd frequencies for special experiments. If possible, that would decrease the need for a fully flexible detector for normal experiments. Note that the detectors already built into the formatters are limited in the frequencies that they can detect.