VLB ARRAY MEMO No. 676

Interoffice

National Radio Astronomy Observatory

New Mexico
January 30, 1991

To: File

From: P. Napier

Subject: Decision to Use Only One Data Acquisition Rack at VLBA Sites

The purpose of this memo is to document the decision to reduce the number of Data Acquisition Racks (DAR) located at each VLBA Site from two to one. I have made this decision after discussions with senior project staff members.

The previous DAR configuration at a VLBA site was two DAR racks each containing four baseband converters and a formatter populated with half the possible number of boards. The new DAR configuration will be one DAR rack containing eight baseband converters and a formatter fully populated with boards as described in the attached memo of 22 October, 1990 by A. Whitney and A. Rogers. Both old and new configurations are able to supply a maximum data rate of 512 Mbit/sec which equals the current maximum recording capability at a site (two recorders both recording at 256 Mbit/sec). The total project cost saving of the new configuration compared to the old is approximately $450K. These funds are needed to pay for currently unbudgeted items, such as an increased supply of tape and increased spare equipment, which will make the VLBA more easily operated.

The original reasons for the two DAR configuration involved redundancy and expandability. The redundancy argument does not seem compelling because there are many other pieces of equipment at a VLBA site, of comparable complexity to pieces of the DAR, that are single point failures. If currently unnoticed reliability problems surface in the DAR we will do whatever is necessary to cure those problems. Notice that with the new DAR configuration there is still some useful redundancy in baseband converters and some formatter boards. The expandability advantage of the two DAR configuration lies in the fact that simply by adding three boards to each of the two formatters the data output rate can be expanded to 1024 Mbit/sec. It will still be possible to add the second DAR in the future and the cost will not be any more than it would be now. Since, to use this expanded data rate at some time in the future, a significant investment will be needed in recorder modifications, tape supplies and correlator hardware the cost of the second DAR should not dominate the cost of the upgrade. Finally, because of the rapid evolution of digital and tape recorder technology, when the expansion to 1024 Mbit/sec (or more) takes place in several years time, it is not obvious that the best expansion path will be to use a second DAR so it is unwise to spend the money now.

There are at least two technical problems which must be solved as a result of this decision (although they would both have to be solved anyway if two DARs are used to provide 1024 Mbit/sec). One problem is to ensure that the fully populated formatter is adequately cooled. The other identified problem is where to perform phase calibrator signal extraction. Possible solutions to this latter problem include locating the phase cal extractor in the formatter if the A/D converter board is modified as suggested in the attached memo by Whitney and Rogers, locating it in a bin in the C rack immediately adjacent to the formatter or locating it in a bin in a new empty rack located where the second DAR would have gone. D. Bagri and A. Thompson are responsible for deciding the best solution to these problems. A ground rule for the solution will be that a second DAR can still be added in the future.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886

Area Code 508
692-4765

October 22, 1990

TO: Peter Napier

FROM: A. R. Whitney, A. E. E. Rogers

SUBJECT: VLBA data-rate expandability

This memo is in response to our discussion in Socorro regarding the expandability of the VLBA date rate.

The current maximum data rate from a single VLBA formatter in the standard configuration is 256 Mbits/sec (32 tracks @ 8 Mbits/sec/track, ignoring 'system' tracks). The formatter does, however, contain three empty expansion slots, which can be populated with the necessary additional modules (1 each – A/D converter module, header control module, tape recorder driver module; see attached diagram) to augment the formatter data rate to 512 Mbits/sec; one 32-track headstack is required for each 256 Mbits/sec. This is the maximum that can be accomodated with a single formatter. Two formatters fully populated in this manner would, of course, bring the *total* maximum date rate to 1 Gbit/sec, with four headstacks required (most likely 2 headstacks on each of two recorders).

An increase beyond 512 Mbits/sec for a single formatter would require a redesign of all three of the above-mentioned modules. Note, in addition, that *all* formatter slots are filled when the data rate is expanded to 512 Mbits/sec in a single formatter; this leaves no room for the proposed phase-cal extractor board. Jim Levine indicated that he thought it would be possible to squeeze the functions of two A/D converter modules on a single board through the use of the recently-introduced 32-by-32 digital cross-point matrix. This would allow expansion of a formatter to 512 Mbits/sec and still leave room for the phase-cal module.

For the 'Mark IV' upgrade of the Mark IIIA system, we are planning to build a new formatter which will increase the maximum bit-rate/track to 16 Mbits/sec, so that 896 Mbits/sec can be recorded using 28 tracks on each of two headstacks. Increasing the VLBA-formatter bit-rate to 16 Mbits/sec/track would require a redesign of all three of the above-mentioned VLBA-formatter modules.

xc: J. I. Levine