VLB ARRAY MEMO No. 211

April 14, 1983

Memo to: VLBA Electronics Monitor and Control Subgroup
From: Larry R. D'Addario
Subject: Issues to be addressed by the subgroup

We are charged with updating the information in Sections IV-F and VII-A.6 of the May 1982 proposal (the "Red Book"). We need to review that document, fill in a few details not discussed there, decide whether anything needs to be changed, and re-assess its impact on the budget. To do this, I think we will need to consider several technical issues, outlined below. The major experience which we have available to draw upon is the VLA monitor and control system (see VLA Technical Report No. 44, "An Overview of the Monitor and Control System," March 1980) and the Mark III system (see Mark III Documentation, Vol. 1, "Data Acquisition Electronics"). Although neither of these is likely to be quite right for the VLBA, it will be helpful if members of the subgroup are reasonably familiar with both of them.

BOUNDARY CONDITIONS

Let's assume that the job of the monitor and control system is to interface from a 4-wire telephone line to all of the antenna equipment. On the telephone end, we can assume the availability of sophisticated modems which include error detection and correction and which will provide full-duplex RS232 (or similar) signals at 2400 baud most of the time, and at higher rates for short periods. On the other end, let's specify that all control signals (commands) to equipment will be in the form of digital words of a fixed length; these may be interpreted either as numbers or as bit strings, depending on the equipment. Also, all monitor signals accepted from the equipment will be either voltages in the range −10 to +10 volts, or digital words.

With any luck, the following is a complete list of the equipment to be interfaced: front ends, clock oscillator (maser), local oscillator chain, IF conversion subsystem, data recording subsystem, antenna controller ("servo"), fringe verification buffer, and weather station. If there is anything else, we should try to think of it now, even though we still must leave room for unforseen devices. Some items in this list may be in the same room or in adjacent racks, and may later be combined for our purposes; but for now let's keep them separate.

TECHNICAL ISSUES

1. Volume of data. Table IV-7 of the Red Book gives estimates of required data rates, with no explanation of their derviation. We need to count up the bits more carefully, based on experience with the VLA and Mark III, so as to update and expand this table.

2. Multiplexing levels. The number of monitor and control points at each antenna certainly will preclude wiring all of them to a single box. In Mark III, all modules are connected to a single serial data bus; I'll call this multiplexing at the module level. In the VLA, each equipment rack is connected to a serial bus (with some provision for sub-multiplexing within the rack); I'll call this multiplexing at the rack level. What level of multiplexing (perhaps multi level) is appropriate for the VLBA antennas?

3. Internal transmission format. How will data be sent around within the monitor and control system at an antenna? We can assume digital transmission except for short runs (within a rack at most) of analog monitor signals. There are several options: bit serial or word serial; synchronous (with clock) or asynchronous; choice of word length. Should we adopt a "standard" format, such as asynchronous bit serial with 8-bit word, using start and stop bits for synchronization; or IEEE-488, which transfers 8 bits in parallel, using handshaking lines for synchronization?

4. Internal transmission protocol. Regardless of the physical format, the conventions for passing data must be defined. In Mark III, ASCII characters are used; certain characters are commands to the tranmission system, and data is passed as hexadecimal strings (usually). In the VLA, data is transmitted as 40 bit messages, consisting of a 16 bit address and 24 bits of monitor or control information. For the VLBA, we need not decide the fine details now, but we should have some idea of the kind of scheme we'll use because it strongly affects the complexity and cost of the system.

5. Fringe checking buffer interface. It will be convenient if this device looks like any other device (antenna controller, say) to the monitor and control system. However, since its output is expected to dominate the monitor data transmission rate, it might be worth considering whether a special interface arrangement is required.

6. Main controller specification. In between the communication port (modem) and the highest level multiplexing bus of the monitor and control system must be a device which, among other things, buffers the data and schedules its transmission. This may turn out to be anything from a VAX-11/730 computer to a dumb controller. I leave the question of what goes here until last because we may not be able to decide it without extensive interaction with the computer groups, and because it is largely separable from the other questions. Nevertheless, the budget for monitor and control in the Red Book is dominated by computer equipmnent, and we need to decide whether this is right.

MEETING

Let's get together to discuss these points on Tuesday, April 19, at 13:00 EST. Charlottesville participants should meet in the Ivy Road Conference Room; others by telephone.

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