VLB ARRAY MEMO No. 166

Interoffice

National Radio Astronomy Observatory
Very Large Array

11th January 1983

To: Bob Burns

From: Gareth Hunt

Subject: VLBA Antenna Control Computer

As requested, here is a proposed configuration for the VLBA antenna control system... I have used DEC's PDP-11 architecture as an example, simply because it is the one with which I am most familiar. This may well not be the final choice and the recent offerings by Hewlett-Packard, IBM, Motorola, etc. should be investigated before making the final decision. In addition, prompted by Marty Ewing's memo (VLB array memo no. 131), I have also estimated the cost of an equivalent DEC personal computer. The figures quoted in the table are the current prices from DEC; for most of their equipment GSA customers, such as NRAO, are entitled to a 15% discount. The maintenance costs quoted are for so-called basic service with one day response 8 hours a day and 5 days a week. To change from this service to 24 hours a day and 7 days a week the charge increases by about 70%.

One of the most important questions is that addressed by Marty: can we install a fully redundant computer system at a VLBA antenna? In the red book $30k was budgeted for the computer and an additional $6k for spares. The total budget for a redundant system is $36k, since we can use the second system for spare parts. From the two tables it is clear that, at present prices, a redundant system is eminently affordable using personal computers, whereas using standard micro-computer systems it is equally obviously not.

The main questions about the personal computers are technical ones:

1a) is it possible to link a real-time task into the operating system?
1b) are there sufficient software tools available to produce such a task?
1c) is there sufficient networking capability to the central computer?
1d) is it possible to control the computer (re-booting, task loading, etc.) from a remote computer?

Assuming that these questions are not answered to our satisfaction, we must begin to look at the micro-computers again. To reduce the cost of a system other questions must be addressed:

2a) is a high level language needed at the antenna?
2b) will access to such a language at a central facility be sufficient?

2c) can we persuade DEC to change their licensing policy for multiple copies of software? (Maybe other companies will be more flexible.)
2d) do we need a video terminal with graphics or will a cheap one be adequate?

I assume that the maintenance will take the form of module swapping performed by an on-site technician, any defective module being then shipped away for repair. If the system has redundancy then initial diagnosis can proceed at leisure after a switch-over, otherwise immediate maintenance will be necessary. In either case the following questions arise:

3a) will computer maintenance (i.e. diagnosis of difficult problems) be performed by the technician on site?
3b) if not, can we survive on a per-call basis, or is 5-day/8-hour service necessary, or do we need 7-day/24-hour coverage?

DIGITAL EQUIPMENT - PDP-11/23 CONFIGURATION

	Purchase Price	Annual Maintenance
SM-RXMMB-CK:	22,400	2,964
PDP-11/23 plus		
256 kbyte memory		
RS232C port with modem control		
LA120 printer		
2 ea. RL02 discs (20 Mbyte)		
RSX-11M copy licence		760
Options:		
Floating point	225	0
DZV11-C 4-port RS232 asynch.	900	120
VT100-AA terminal	1,945	252
Software:		
DECNET-11M	3,200	625
FORTRAN 77	4,370	275
	33,040	4,996

Notes:

a) The software costs here are all for copy licences. The primary licence for all these systems is already held by NRAO for their systems at the VLA. A primary licence increases the cost of one system by $10,100 ($5,000 for RSX-11M, $2,800 for DECNET, and $2,300 for FORTRAN).

b) If video graphical displays are important a VT125 could be substituted for the VT100 at an additional cost of $1,850.

c) The DZV11 is included as the hardware for DECNET. This is (almost) the cheapest option; to provide DECNET on a synchronous line with DDCMP protocol costs about $2,200 per line. DECNET support for asynchronous lines is provided under the RSX operating system but not under VMS.

d) BASIC and other language processors are available for approximately the same cost as for FORTRAN.

DIGITAL EQUIPMENT - PROFESSIONAL 350 CONFIGURATION

	Purchase Price	Annual Maintenance
Professional 350:	4,995	528
PDP-11/23 CPU subset		
256 kbyte memory		
B/W monitor		
RS232C port with modem control		
Printer port		
P/OS (subset of RSX-11M+)		
Options:		
LA50 printer	850	168
Winchester disc (5 Mbyte)	3,500	168
Floating point	225	0
Real time interface	595	96
Extended bit map for graphics	895	120
Software:		
Communications	195	?
UCSD P	600	?
PASCAL (or FORTRAN, etc.)	375	?
	12,230	1,080

Notes:

a) The inclusion of the real-time interface and the graphics option is to cover all eventualities; they may not be needed.

b) The LA100 printer is superior to the LA50; the additional cost would be about $1,800.

c) PASCAL is more expensive than FORTRAN. If both are required the additional cost is $250; if the latter only is preferred the price is reduced by $125.

d) The DECNET network software has not yet been announced for the DEC personal computers. An Ethernet is connection is available, but this is only for local networks.

e) Software update service for P/OS is included in the maintenance contract. Software updates for application packages and compilers are not available from DEC. They may take the form of a purchase for each new software release.