VLB ARRAY MEMO No. 60

NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, West Virginia

MEMORANDUM January 22, 1982

To: VLB Working Group

From: Richard J. Lacasse

Subj: Cost of Alternative Data Digitization Electronics

The Data Digitization Electronics (DDE) must handle up to four, 12.5 MHz wide, IF signals to produce data at up to 100 Mbits/sec. A system permitting unattended operation for at least 24 hours is also very desirable, to minimize operating costs.

The existing MKIII system, with a few modifications, would be suitable for this application. The modifications include an IF distributor upgraded to handle four IF's and automated video converter patching. They also include Video Converter and Formatter modifications appropriate for the slightly reduced bit rate specification. Also, the recorder must be upgraded for a factor of 10 or 20 increase in bit density. The first two modifications are technically straightforward. Work at two institutions is in progress to realize the third modification. Multiple recorders are required to accommodate 24-hour unattended operation. Using 12,000 foot reels of tape instead of the standard 9,200 foot reels, and assuming a factor of 20 improvement in density, four recorders would be required for 24-hour operation. With only a factor of 10 improvement in density, eight recorders would be required.

A second system, based on multiple video cassette recorders, is described in the text of this report. It is similar to the MKIII system in basic architecture. However, a cost savings is realized by using fewer video converters (four) with broader bandwidth ($\leq$ 12.5 MHz). A further cost savings is realized

in the IF distributor since patching to various permutations of 14 video converters is not required. The appropriate IF signals are routed directly to the video converters by the IF switching matrix in the Vertex Cabin. For purposes of comparison this system is dubbed MKIII.1.

Cost of alternative recorder implementations is covered in another section. Therefore, a cost comparison of only the electronics required to translate four IF's into four bit streams is covered here. This comparison is detailed in Table 1. The significant differences are the following. A 30 K savings is realized in Video Converters in the MKIII.1 system since four instead of fourteen are required. The MKIII.1 system includes a Formatter in the recorder, so all that is required in the DDE are a Sampler and Clock. The 13 K for the MKIII IF Distributor includes the cost of the upgrade mentioned above. Both systems require an IF Processor to switch the nineteen receiver IF's into four and to select the band of interest from the broadband receiver output. The MKIII.1 IF Processor is more expensive since it includes some of the functions of the MKIII IF Distributor. A Decoder is included in the MKIII.1 recorder, and so is not included in this cost estimate.

A fair comparison must also include manpower and spares costs. These are detailed in Tables 2 and 3, respectively. Table 2 shows that the MKIII.1 design effort time is more than compensated by the reduced assembly and test time. Spares costs are similar.

RJL/cjd

TABLE 1

Cost Comparison of MKIII and MKIII.1 Data Digitization Electronics

MKIII	MKIII	MKIII.1
Video Converter ($3 K each)	$ 42 K	$ 12 K
Formatter	6 K	-- *
Sampler	--	1 K
Clock	--	1 K
IF Distributor	13 K	--
IF Processor	28 K	36 K
Delay Calibrator	2 K	3 K
Counter	1 K	--
5 MHz Distributor	2 K	2 K
Rack, Supplies, Connectors, etc.	11 K	10 K
Decoder	4 K	-- *
TTY Distributor	1 K	1 K
Totals	$110 K	$66 K

* Part of recorder.

TABLE 2

Comparison of Manpower Requirements for the MKIII and MKIII.1 Systems

Item	Time (Man-Months)	
	MKIII	MKIII.1
Design and Document	2	14
Procurement	1	1
Assembly and Test (per unit)	15	8
Total (one unit)	18	28
Total (ten units)	153	95

TABLE 3

Comparison of Spares Costs for MKIII and MKIII.1 System

Item	MKIII	MKIII.1
Video Converter	$ 3 K	$ 3 K
Formatter	6 K	--
Sampler	--	1 K
Clock	--	1 K
IF Distributor	13 K	--
IF Processor	28 K	36 K
Delay Calibrator	2 K	3 K
Counter	1 K	--
5 MHz Distributor	2 K	2 K
Supplies, Connectors, etc.	3 K	3 K
Decoder	4 K	--
TTY Distributor	1 K	1 K
Total	$63 K	$50 K
Assembly and Test Time (Man-Months)	22	20