## VLB ARRAY MEMO No. 39

¥¥¥	***	LLL.	BBBBybbB			****
***	***	LLL	<b>BBBBBBBB</b>	BABB	AAAA	
TTT	YTY	Link	PROUNDER	BPBB	AAAA	
TVÝ	ývv.	LLL			AAA	
***	***	LLL		383	AAA	AAA
***	¥¥¥	հեն	BHB	658	A & A	AAA
***	***	LUL	555	BAB	AAA	***
***	¥¥¥	LLL	8By	888	AAA	
VVV	***	LLL	8 N B	688	AAA	
***	¥¥¥	L.L.L.	BBBBBBBBB	BBBB	AAA	***
TVT	YTT	لما مل	BBBBBBBBB	BBBB	AAA	AAA
VVY	***	LLL	BBBBBBBBB	BBBB	AAA	AAA
TTY	¥YY	LLL	888	888	ARARARA	
***	¥¥¥ *	LLL	BBB	BBB	AAAAAAA	
VV Y		L. Lake	BRB	688		
414	TAA	LLL	858	BBB	ALA	
VVV	YTT	LLL	888	ABA	AAA	
WWW.	111	LLL	BhB	# BB	AAA	
VVV		LLLLLLLLLLLLLLLL	SBBBBBBB	5858	AAA	
TTT		LELLLLLLLLLLLLL	BBBBBBBB	BBBB	AAA	
		LLLLLLLLLLLLLL	ABABABBB	BBBB	AAA	

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egTARTe USer CLARK 113,381 Job VLBA seq. 1858 Date 11-NoV-81 18:56:34 Nonitor TUPS18 7.41 VLA:4.6 +STARTe F11e: DSRC:VLBA.NEM<#55>[13,38] Created: 11-NoV-81 18:42:86 Printed: 11-NoV-81 18:56:57 QUEUE seitches: /File:Asci: /COpies:6 /gPAC:NG:1 /Limit:352 /FORMS:HURMAL

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1951 Remarks on the VLBA report--B. Clark--November 10, 1981 975 0100 Section 38. Configuration. 2113 308 The section is, in my opinion, about right in content, 1465 but could be improved in form. The primary burden of the section 0520 should be to justify ten antennas, and to justify the inclusion of 600 0703 Alaska, the most expensive site. The first of these is most easily defended on the basis of the 200km minimun spacing (itself deter-0869 mined by matching up to MTRLI spacings), and the 8000km/B argument 998 made in table III-1. The latter is not addressed, and probably 034 snould be. Can this be done adequately with a foreshortening argument, or to we need to go to the less perspicuous agrument about 1109 240 bow-tie shaped sidelobes? 309 In the main portion of the section, I would prefer a more 1400 1509 narrative style, with fewer numbered paragraphs. 630 1700 The last two columns of table III-1 should be dropped (their point can be made much more clearly in narrative), and I 1869 900 personally would prefer to see the number of phase closures, 1000 rather than their percentage. Amplitude closures are not enough 2110 different to justify inclusion. 269 300 Figures III-2 and III-3 do not state the limiting elevations. 2483

Figures III-6 occupy far too much space for the point they 600 are trying to make--they should be replaced by a paragraph of narrative, ØØØ50Remarks on the VLHA report--B. Clark--November 10, 1981ØØØ70ØØ100Section 3F. Local Oscillators.ØØ2003

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09300 I agree that for cost purposes, the hydrogen maser must be 84400 the oscillator of choice. However, I think the remarks on the satelite link could be softened a bit. It should be remarked that 00517 00639 the limiting factor is the ionospheric dispersion between uplink 00700 and downlink frequencies, which probably excludes the standard 00200 6GHz/4GHz uplink/downlink tranceivers. The use of a 12GHz/14Ghz 009996 system (proposed on the ESA L-sat, among others) would probably 61008 make the LO link sufficiently more stable than the radiosource 01100 radiation itself that it would be useable. The sentence "the 01260 cost and maintenance of the necessary ground stations is not 01300 negligible." is rather fatuous--compared to hydrogen masers it is.

So far as I know, the paragraph on the SCCO is about right, but anything more OVRO can tell us about it should be included.

01260 The section on phase calibration should be based much more 01940 heavily on self-calibration. These techniques work and are 02003 dramatically successful. Instead, the section starts off with 02100 a bunch of remarks directed to astrometry (surely a rather small, 02290 though not neglibible, part of the work to be expected from the 02300 array) and water vapor measurements (a technique which, unlike 02400 self-cal, has never been made to work, despite multiple attempts). The first half-dozen paragraphs of the section should be moved to 02500 02630 the end and prefaced by the remark that some small percentage of 02700 the work of the array requires the extension of phase calibration 02900 over a larger portion of the sky, and that if so, you have to 02900 worry about water vapor, ionosphere, polar motion, earth tides nutation, time and other such annoying concepts. 03000

A6950 Remarks on the VLRA report--B. Clark--November 10, 1981 1070 0110 Section 3G. The record system. 00210 りろいう (uncalled for remarks) 04:13 00520 It is far from clear to me what is meant when it is 10693 stated that MkIII will be adopted for costing purposes. What is 1760 MKIII anyway? Is it a transport or transport type? Is it a DOACS multitrack philosophy (ie feeding each track from an independent 00000 sampler)? Is it a system (including a computer with defined duties)? It apparently isn't a head stack--basing the array on the current 1000 1190 MkIII headstack is clearly madness. I am also not very happy with 01288 the sampler/track philosophy. The only justification is if the 1389 system is rather unreliable--it causes the minimum disruption to drop 400 bad tracks. Spreading the bits from a single, broadband sampler 01503 (actually you probably want to use up to four) among several tracks M 600 is a rather trivial technical problem, and the resulting simplicity 70% in the IF processing gear seems to me to be well worth having. 01660 It must seem strange to outsiders that we do a fourier transform 61963 to go from frequency to delay (for this is essentially what the 2001 "fringe fitter" is) and from delay to frequency (for spectral 2109 processing) in the same machine.

0050 Remarks on the VLBA report--8. Clark--November 10, 1981

Section 4A. The playback processor.

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0369 The point raised in section 1 is an extremely interesting 00400 one, and should be dealt with somewhere, probably in a section on 90560 operations. It is certainly the case that with current systems, 0693 and probably for the VLBA, the system is limited by the capabilities 0760 of the playback processor. In fact, the observing system must be 00800 operated at significantly less than its full capability, in order to 0903 avoid swamping the playback system. This may include ploys like the 1000 one proposed here, of running the system at half bandwidth most of 01100 the time, or one which I personally find more attractive, of simply 1283 turning off the array thirty or forty percent of the time. This, if 1250 well planned, should result in a substancial saving in operating cost. 01275 The only alternative to something like this is to go ahead and cost in 21375 two processors. This might let the system run at full capability most 1500 of the time. 1688

21700In section two, since the ECL and TTL technology correlators1800are quite competitive in cost, the requirements should be stated1900in terms of both lags (appropriate to the TTL) and in multiplications22007per second (appropriate to ECL), For instance the continuum2108requirements would be met by220945 (baselines) # 112 (MBits per polarization) # 4 (correlator)

45 (baselines) # 112 (MBits per polarization) # 4 (correlator polarizations) # 128 (20ns lags)

92469 This could be provided by 23040 complex correlators, about the same 2549 number as required by the TTL device (but permitting a much simpler 92696 fringe search algorithm).

The spectral line case (16 MBits of water with 512 spectral Channels) gives

0300745 (baselines) \* 16 (MBits) \* 1024 (complex lags)03100which could be provided by only 5770 correlators, if the data is03207played back as slowly as real time. In fact, the ECL philosophy leads03309directly to the fascinating table below, rather than to table IV-1.

Playback speed with 23040 complex correlators (112MB1t)

03700		512chan	1024chan	2048chan
3860	Bandwidth			
3988	112MHZ	1	_5	_25
34000	56MHz	2	ī	5
169	28MHz	4	2	i
1290	etc			

The table assumes that the record time tape can be run more slowly than the playback,

1800 1911 J Finally, I state here what I have stated elsewhere, that I am unconvinced of the utility of regarding the recorder output as a 85900 28\*8<sub>4</sub>Bit two dimensional bit array rather than as a 1\*224<sub>MB</sub>it stream, 5100 It seems to offer two advantages: 1) The system degrades gracefully 52193 if a track breaks, and 2) 4 MHz samplers are easier to design than 05300 100 HHz samplers. Against these must be balanced the cost and complexity 15488 of 280 IF processors (there are only 108 at the VLA, and only 56 8589 85639 of them are currently in use). Also charged against the Philosophy is the price of the FFT fringe fitting, which becomes a relatively 85710 trivial operation in lag space.

15:4 Remarks on the VLBA report--B. Clark--November 10, 1981 3 1 39 10200 Section 48. Postprocessing. 100 Mit 100 Mit I think the estimates in this section are about right. In my first 10500 reading of it, though, I thought the estimate that line mapping 16563 and cleaning were 256 times continuum also included the self-cal, Н 50 and I was guite upset until I went back and picked the sentence 19820 apart word by word, 10940 The estimates do not provide for any of the multiple reprocessing 1 99 which has been so hardfor us here at the VLA. On the other, the VLBA will awaken to an environment which includes a lot of distributed processing 11210 1000 power evolved for VLA requirements. I think it would not be inappropriate to keep the on site computer systems relatively modest as the

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Hy current inclination would be to think in terms of a VAX 51980 Sized system for preprocessing, and something rather larger for 51980 everything else. However, I suppose that the disclaimer included is 51980 sufficient.

draft calls for, and merely note that the VLBA will call for more

intensive use, and some expansion, of the VLA postprocessing network.

300.000 Somebody must think about how much disk we are going to need.
300.000 This will probably cost as much as the CPUs, so it shouldn't be
32504 glossed over.