Interoffice

VLB ARRAY MEMO No. 26

National Radio Astronomy Observatory

Charlottesville, Virginia

May 20, 1981

To: K. Kellermann

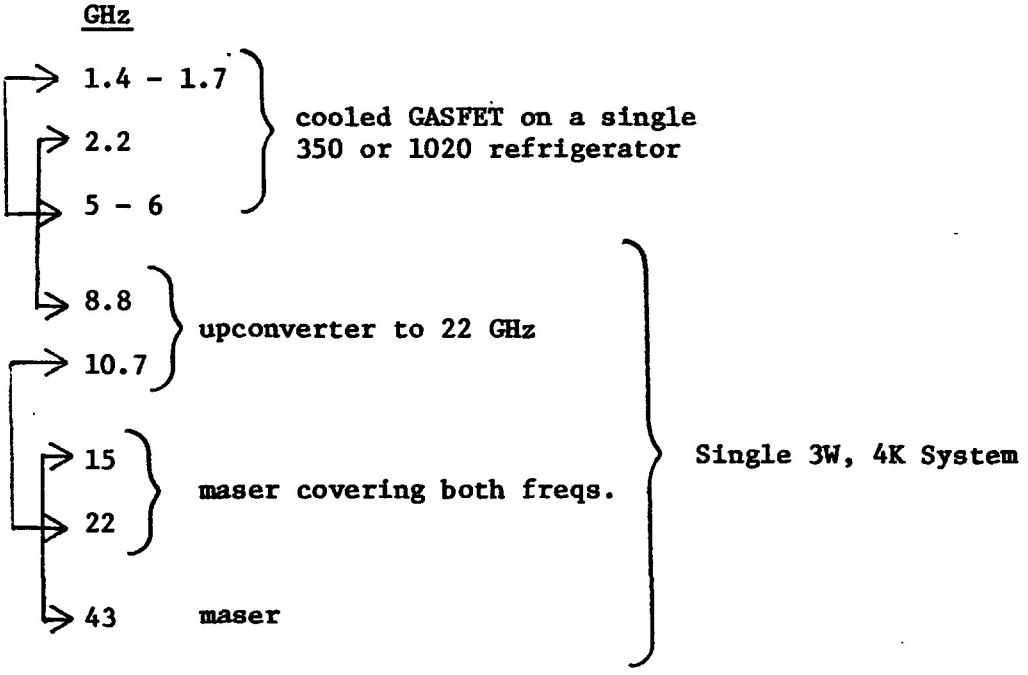
From: M. Balister

Subject: VLBA Receiver

You asked me to look into the cost increase of using an upconverter/ maser combination instead of cooled GASFET amplifiers at 8.8, 10.7 and 15 GHz.

At the current time this would certainly give the best performance; however, I expect the gap to close somewhat during the next several years.

For the best performance today I would propose the following dual channel receivers:



The arrowed lines show how the dual frequency feeds are arranged. This shows that mechanically the arrangement would be reasonable, the 20K system would be close to one pair of feeds and the 4K system would be close to the other pair. The only cross connection would be at 8.8 GHz where the waveguide losses would not be too high. This would fit in with P. J. Napier's feed arrangement. The performance of this receiver would be close to that given in the VLBA proposal:

GHz	NOISE TEMP. K
1.4 - 1.7	35
2.2	35
5-6	40
8.8	30
10.7	30
15	45
22	50
43	75

As you can see from the updated Table VI-3, I estimate the increase of cost to be 44 k$. The smaller than expected increase in cost results from the fact that I have backed off somewhat on many independent cryogenic systems for reliability. It seems most convenient because of feed locations to have two dewars, one at 20K and the second at 4K. Since the compressor appears to be the least reliable component in a cryogenics system, a spare compressor that can be used for either system may be sufficient to improve the overall system reliability.

The most questionable part of this proposed receiving system is whether the thermal load at 4K can be kept within the current capability of the NRAO/JPL refrigerator. I think this would be possible; however if not, the cost would increase a further 50-75 k$ to cover added costs of a second 4K refrigerator, dewar, etc.

cc: P. J. Napier
S. Weinreb

TABLE VI-3

FRONT END COSTS

Cryogenic Costs		Materials k$	Labor (Man Months)	
20K Cryogenics				
Refrigerators	1 x 5K	5k		
Compressors	1 x 6K	6k		
4K Cryogenics				
Refrigerator and Compressor		50k		
4K and 20K He Lines				
6 lines (one spare)		12k		
Total Cryogenics				73k
300K Front End Costs				
327 and 610 GASFET's Dual Pol.		4k	2	
Local Oscillator		1k		
Mixer IF Amplifier		1k	2	
Labor		11k		
Total 300K Front Ends				17k
20K Front End Cost				
Dewar, input lines, etc.		10k	6	
GASFET Amplifiers at 1.4-1.7, 2.2 and 5-6				
3 frequencies x 2 Polariz		6k	3	
Mixer/IF Amplifiers (6)		6k		
Local Osc. System		10k	3	
Labor		34k		
Total 20K Front Ends				66k
4K Front End Costs				
Upconverters (2)		40k		
Dewar, input lines, etc.		30k	12	
Dual channel masers 22, 43 GHz		20k	12	
Solid state pumps for maser and upconverters		30k	6	
Local oscillator system		20k	6	
Mixer/IF		10k		
Labor		102k		
Total 4K Front Ends				252k
Miscellaneous				
System Noise Calibration		15k		
Phase Calibration		15k		
Power supplies, etc.		10k		
Total Miscellaneous				40k
TOTAL FRONT END SYSTEM PER ANTENNA				448k