VLBA Acquisition Memo # 14

NORTHEAST RADIO OBSERVATORY CORPORATION
HAYSTACK OBSERVATORY

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TO: VLBA Acquisition Group

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SUBJECT: Closure Errors from Bandpass Offsets

If VLBI stations observe with fixed local oscillators, without fringe rotation at the stations, the differential doppler shift or fringe rate produces non-overlapping bandpasses. At 89 GHz the fringe rate reaches 133 kHz (see VLB Array Memo 345, Page 6) which is 1.6% of an 8 MHz bandpass. The maximum phase closure errors which result from the bandpass offset have been estimated using the theoretical complex gains for a Butterworth filter and the 4 pole/ pair SSB network used in the MK III video converters. The worst case errors are approximately linear with bandpass offset (on the baseline with largest fringe rate) are as follows:

Poles In Filter	Low Frequency Cutoff %	Closure Error Deg%
7	0	0.17
9	0	0.17
7	4	0.012
7	2	0.043

Application of a low frequency cutoff (3% low frequency cutoff is used in the Haystack MK III Processor software) greatly reduces the closure error because the SSB network phase changes most rapidly at the low frequency edge of the bandpass. Even without a low frequency cutoff, however, the maximum closure error is less than 0.3 degrees for a 1.6% bandpass offset.