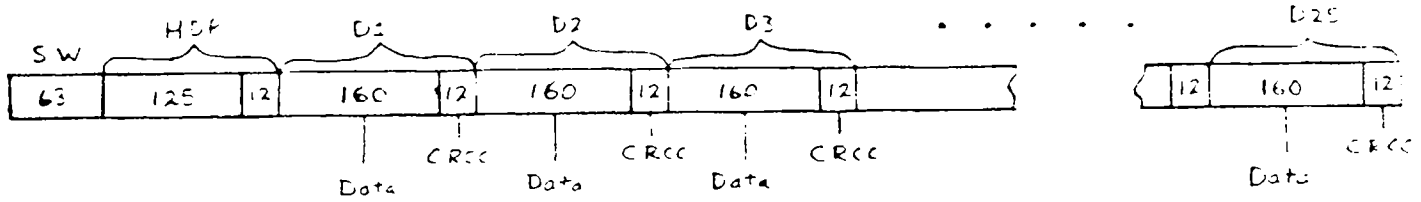PRELIMINARY VLBA FORMAT PROPOSAL #1

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data bits/sync block = 4000
data bits/error detect block = 160
error detect blocks/sync block = 25
bits/headr = 125
bits/sync word = 63
CRCC bits/data block = 12
CRCC bits/header = 12
bits/sync block including all overhead = 4500
-Resulting Data Rate Ratio = 4500:4000 = 9:8
-Sync Word: 63-bit Maximal Length Sequence
-Sync Detection: Correlation detection with two error threshold
-Data Editing Rule: Edit on non-zero syndrome only
-Monitor Statistics: -fraction of syndromes not equal to zero
                     -fraction of frames requiring resynchronization
-Data Conditioning: -Multiply data by PRS to improve match between
                     data spectrum and recorder response
                    -Multiply CRCC check bits by 11-bit Barker Code
                     to enhance sync error detect capability of CRCC,
                     and avoid the all zero code word problem

At 270 ips   #frames/s = 2000
                channel permutation interval = 0.5 ms
At 135 ips   #frames/s = 1000
                channel permutation interval = 1 ms
At 62.5 ips   #frames/s = 500
                channel permutation interval = 2 ms

It has been specified for the VLBA that the fraction of bits flagged invalid will be < 1.E-2. Since this spec is by far the most easily verified spec for the recording system, it should play a central role in determining whether the system is 'up' or 'down'. However, it can only be used in this way if it can be guaranteed that all other specs are met whenever it is. When the fraction of bits flagged invalid is exactly equal to the limit of the spec, i.e. 1.E-2, the proposed format will guarantee that

-Fraction of bits out of sync
 but flagged valid: < 1.2E-6
-Fraction of incorrect bits
 flagged valid (excluding bits
 out of sync):   < 6.1E-7

In addition, for this format:
-Sync detect failure rate: < 1E-2 when errors occur in bursts
                            of length > sync word
                         < 4.9E-5 when errors occur as
                            independent pairs
-Probability of false sync: = 8.8E-13 per frame or 1 per 18 years

What performance is required of the raw recorder channel to achieve the fraction of bits flagged invalid spec? Assuming errors occur as independent pairs

-Max raw channel BER for 2-level samples = 1.2E-4
-Max raw channel BER for 4-level samples = 5.8E-5

Assuming errors occur entirely as deep drop-outs

-Max raw channel BER for 2-level samples = 5.E-3
-Max raw channel BER for 4-level samples = 2.5E-3

PRIORITIES IN FORMAT DESIGN:

1. Security
2. Simple instrumentation

ADVANTAGES:

1. High degree of security in meeting specs
2. Easily determined channel monitoring statistics
3. Acceptable decoded random BER at max data discard rate
4. Acceptable decoded sync BER at max data discard rate
5. Acceptable channel permutation rate
6. Probability of false synch ~ 0
7. Data is run limited (at least statistically)
8. Gating of sync word detector not required
9. Single editing criterion
10. Requires the same frequencies for generation as Mark III format

DISADVANTAGES:

1. Requires reasonably good channel performance to pass max discard rate spec.
2. Cannot accurately determine BER from monitoring statistics, i.e. for extreme channel models there is a factor of ~42 variation in possible BER as determined from fraction of syndromes not equal to zero