MEMORANDUM

FYI

Date: May 2, 1988

To: M   A   , F   B   , GS/OS Team

From: J   O. A

Subject: Macintosh versus IIgs Sector Sizes and Two-to-One Interleave

The timing differences between 800K GCR sectors created by a Macintosh or UniDisk 3.5 drive are generally 'known about'. However, precise details have generally been glossed over. The intent of this memo is to clarify as much as possible the exact differences between the Macintosh 800K GCR format and a IIgs 800K GCR format.

The difference arises from the frequency of the FCLK signals used in the Macintosh (and UniDisk 3.5) versus the Apple IIGS FCLK frequency.

System or Drive	FCLK freq	2usCell time	8-bit Nyble*	Sector Size	Sector Time
UniDisk 3.5	7.8336	2.04248366	16.3398693	762	12450.98
Mac Plus	7.8336	2.04248366	16.3398693	762	12450.98
Mac SE	7.8336	2.04248366	16.3398693	762	12450.98
Mac II	15.6672	2.04248366	16.3398693	762	12450.98
Apple IIGS	7.15909	1.955555804	15.64444643	792	12390.40

(* a 'nyble' is an FCLK frequency-dependant 8-bit 16-sector GCR encoded disk byte)

The Apple IIGS formatter compensates for the smaller faster disk nybles by writing 30 extra (16 us) self-sync nybles between sectors. These extra nybles cause the spacing of sectors on the Apple IIgs format to be spaced around the track almost exactly the same as the 'original' UniDisk 3.5 and Macintosh sectors.

The important factor concerning interleave is **not** obvious from the above information. The data field of a sector contains 716 nybles and thus when a data field is written by an Apple IIgs it is faster and smaller than the same 716 nyble data field written by the Macintosh.

THEREFORE, since the spacing between address fields is the same there is more time between 2:1 interleave sectors written by the Apple IIgs. How much time you ask?

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System or Drive	FCLK freq	2usCell time	8-bit Nyble*	Data Field	Field Time
UniDisk 3.5	7.8336	2.04248366	16.3398693	716	11699.35
Mac Plus	7.8336	2.04248366	16.3398693	716	11699.35
	7.8336	2.04248366	16.3398693	716	11699.35
Mac II	15.6672	2.04248366	16.3398693	716	11699.35
Apple IIGS	7.15909	1.955555804	15.64444643	716	11201.42

Time Difference	= 497.93
less spacing difference	60.58
	437.35

Thus an operating system has substantially more cycles between Apple IIgs sectors than between the slower and longer Macintosh sectors.

At 2.5Mhz the Apple IIgs has approximately 1093 more fast machine cycles after the data field completes before the next logical sector arrives.

All these numbers are 'nominal' and the ±1.5% motor speed variations must be factored into to these numbers (The drive spec says ±2.5% but the drives are manufactured to ±1.5% according to disk engineering).

The UniDisk3.5 generates sectors with the same timing as the Macintosh and so a 'mixed' format volume with both fast and slow sectors can be created within the Apple IIgs system enviornment. The bottom line is an operating system should make 2:1 interleave with not less than 5% time margin (5% covers the range of spec motor speed variation for the drives).