

## FUTURE HEAD/MEDIA TECHNOLOGIES IN RIGID DISK DRIVES

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Magnetic recording is still considered to be a leader in storage industries in general. The rigid disk drive, in particular, has an advantage over tape, optical, magneto-optical, or flash memories, because of high areal density and fast access time with reasonably low cost per Mbyte. However, to be competitive in the market and to keep an edge over other storage devices, head and media in rigid disk drives require better performance per cost and more aggressive improvement in areal density, as shown in Fig. 1, than before.

In this review paper, the future trend in head/media technologies of the rigid disk drive has been reviewed. Thin film media and thin film inductive/MR heads will be mainly discussed, since they are expected to be dominant in the future high-end drives over other technologies, such as particulate media or MIG heads.

Thin film media: There are two major requirements in thin film media to increase areal densities; low flying height and low media noise. New texture, alternative substrates, and durable overcoat/lube are being developed to lower flying height with increased reliability.

To reduce media noise, the coercivity of thin film media increased up to 1800 Oersteds, and alloy system changed from binary to quaternary in nineties. As media is getting thinner, defect control becomes an important factor for media technology. Multilayer and microstructural control should be needed to reduce the media noise further in the future.

Heads: Fig.1 shows that the growth rate of areal density increased from 30% to 60% per year, mainly due to MR (magnetoresistive) technology. Because readback response is independent of the velocity for MR sensor, it fits well with the small-form factors. Discovery of GMR (giant magnetoresistance) materials, with magnitude of  $\Delta R/R$  in the order of 50%, offer great promises as a new read sensor in the future.

Thin film inductive heads keeps on evolving by increasing number of turns, and by reducing gaps between poles. Newly introduced multi-via heads, laminated poles, or planar silicone heads are considered to extend the life of conventional thin film heads. It is also critical for sliders to reduce the size of air bearing for low flying height, and to improve the design for constant flying height over the radius of disk.

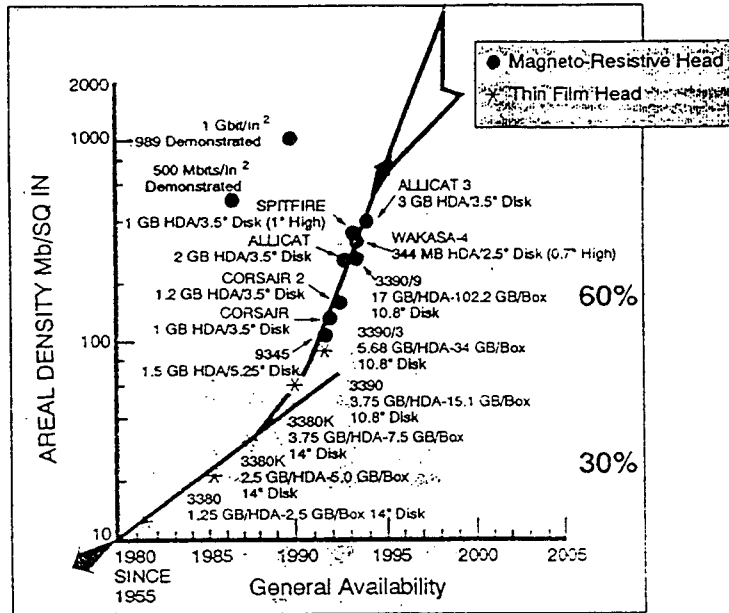


Fig.1: Evolution of real density of rigid disk drives [1].

[1] L. Procker, I. Sanders, and V. Viswanathan; Media Technology HEAD/MEDIA TECHNOLOGY REVIEW, November, 1993.