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Technology Paper

Perpendicular Recording: Powering New Levels of Disc Drive Capacity

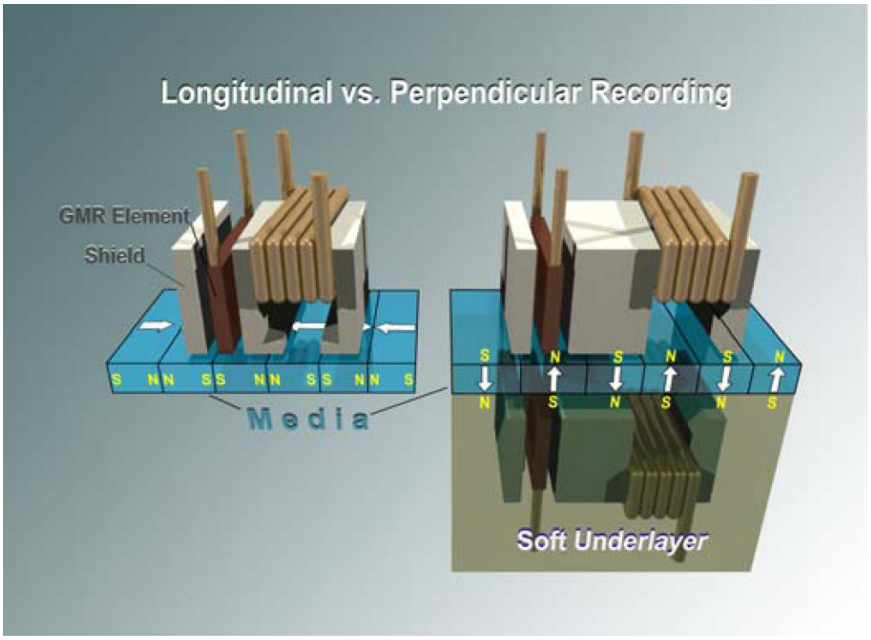
As the volume of business and personal data continues to grow apace, technologists remain focused on increasing the amount of information that can be stored on computer disc drives. By increasing the areal density, or the amount of information that can be placed within a given area on a disc drive, technologists have increased the capacity of disc drives by more than 50 million times since their introduction in 1957. A key by-product of this rising density has been a reduction in hard drive cost since fewer platters, heads and mechanical parts are necessary.

Historically, areal density has increased more than 100 percent, or doubled, every year, though that rate has dropped to about 40 percent recently because of growing challenges in increasing areal densities of longitudinal recording—a technology that has been used for nearly 50 years to record information on disc drives.

Increasing Areal Density

To increase areal densities in longitudinal recording and boost overall storage capacity, the data bits must be shrunk and packed more closely together. However, if the bit becomes too small, the magnetic energy holding the bit in place may also become so small that thermal energy can cause it to demagnetize, a phenomenon known as superparamagnetism. To avoid superparamagnetism, disc media manufacturers have been increasing the coercivity (the field required to write a bit) of the media. However, the fields that can be applied are limited by the magnetic materials making up the write head.

In perpendicular recording, the magnetization of the disc, instead of lying in the disc's plane as it does in longitudinal recording, stands on end, perpendicular to the plane of the disc. The bits are then represented as regions of upward- or downward-directed magnetization. (In longitudinal recording, the bit magnetization lies in the plane of the disc and flips between pointing in the same and opposite directions of the head movement.) The media is deposited on a soft magnetic underlayer that functions as part of the write field return path and effectively produces an image of the recording head that doubles the recording field, enabling higher recording density than with longitudinal recording.



Seagate has demonstrated a recording areal density with perpendicular recording of 245 Gbpsi (Gigabits per square inch) with a data rate of 480 Mbits per second—more than double the 110 Gbpsi used in today's highest areal density disc drives—and 500 Gbpsi, which will increase the capacity of today's drives five-fold, is possible with the new technology.

At 500 Gbpsi, a 3.5-inch disc drive could store two terabytes of information, a 2.5-inch drive in a laptop could hold 500GB and a 1-inch drive, such as those in MP3 players, could store as much as 50GB of data.

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