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**Innovation, Novel Solutions and New Devices: The Engines that Drive the Magnetic Storage Industry; Choosing the Right Combination**

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Magnetic storage technology aims to achieve recording densities  $> 10^{12}$  bits/in<sup>2</sup> in the foreseeable future. The dimensions of the magnetic domains and sensor minimum feature sizes at this density will be  $\sim 15 - 25$  nm. These nanoscale dimensions present major challenges for both the materials utilized for magnetic recording, and to the sensors employed to reliably detect the minute magnetic fluxes emanating from such nanoscale domains. These include fundamental physical limits of material properties on account of the reduced dimensionality, as well as nanofabrication challenges to attain the required nanometer feature sizes with the stringent dimensional tolerances required. Since its invention in 1954, the storage density in magnetic recording has incremented by  $10^9$  and the cost of storage, measured in \$/MB, has undergone a price reduction of the same order. Impressive as these accomplishments are, is the fact that the fundamental engineering principles of the technology today are essentially the same as when it was invented. This is in spite of numerous efforts to replace it with new alternative technologies or by dire predictions by its own practitioners of its impending death based on perceived limitations. In this talk the state-of-the art and challenges facing the HDD industry in its efforts to continue incrementing the storage density will be discussed. I will illustrate how advances in materials engineering, new physical phenomena and breakthroughs in nanofabrication have facilitated such an impressive technology evolution. Moreover, the key ingredients for said innovations to be implemented as technology solutions will be discussed..