HDD futures

Topics:  Where are we going:
         What does it mean:
         What is changing:

Dave Anderson
Director,
Systems Storage Architecture
Seagate Technology
Areal Density Growth: Accelerating!

Hard Disc Drive Areal Density Trends

- GMR Heads: 100+% CAGR
- MR Heads: 60% CAGR
- Inductive Heads: 27% CAGR

Future: ???

 Mb/sq.”

100,000
10,000
1,000
100
10
1

**Where is this Technology Going:**

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<tr>
<th>Magazine Date</th>
<th>Retail 1 GB Disc Drive</th>
<th>Discs</th>
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<tr>
<td>Windows 7/93  p. 425:</td>
<td>$1349.00</td>
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<tr>
<td>PC Computing 9/94  p. 318:</td>
<td>$729.00</td>
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<td>April 1995 at Computer City:</td>
<td>$369.00</td>
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<td>PC Magazine 11/96 p. 386</td>
<td>$169.99</td>
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<td>PC Computing 11/97  p. 366</td>
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<tr>
<td>Computer Shopper 6/00 p. 310</td>
<td>$90.00*</td>
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* 8+GB

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$/MB

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*Seagate*

Information, the way you want it.
Disc Drives: Big Changes in the Future

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Actuators: Single Stage  vs. Dual Stage
Motors: Ball Bearing  vs. Fluid
Heads: Horizontal; Ferrite, TF, MR, GMR  vs. Vertical/Light/Assist, Load/Un. HD Text
Tribology: Smoother, Closer, Lube, Laser  vs. Glass, Patterned, Vertical, Plastic
Media: Aluminum, Particulate, TF  vs. None
STW: Granite  vs. Intelligent, Network
Interface: Proprietary, ESDI, ATA, SCSI, FC  vs. Cost, Manageability
Metrics: Capacity, Size, Cost, Reliability, Performance  vs.
Disc Storage: A New Appreciation

Running fast - hard for any technology to intercept
Investment level needed is exorbitant
Most candidates have faded rather than closed the gap

Storage now recognized as the most important IT resource
More dedicated effort to manage
More architectural focus
SAN, NAS, mirroring

Uptime key
Backup/restore unworkable (if you have to restore)
Disc becoming the new backup (tape still used for archive)
Disc recovery faster, Backup to disc more certain
Disc can be used to recover from human errors
Fast Recovery From Human errors

Barracuda 180 makes lots of copies easy!

» Low DM/GB
» Reliable, Fast
» High storage density: 1.8 TB / 3u rack unit
Other things are changing

Interface set to be challenged on several fronts
- **SCSI** - 320, 640 easier than thought, but SE will become a problem
- Fibre Channel - 2 Gb deploying, 4 Gb underway
- iSCSI - lot of interest as a SAN
- InfiniBand - interest as a SAN
- Serial ATA - Will replace parallel ATA

More intelligence in storage devices:
- **NAS** - viewed as storage as much as a server
- **DAFS** - NFS for SAN
- **OSD** - (Object Based Storage) Let storage do more