Long-term Data Preservation Media

Permanent Data Storage
Preservation Media Requirements

• PERSISTENT
• Secure
• AFFORDABLE
• Minimal Maintenance
• Accessible
Why is Optical Persistent?

- **Longevity**
  - Highly stable under recommended storage conditions
  - Able to survive storage condition emergencies
  - Hardware failure does not lead to media failure

- **Materials**
  - Optical allows use of innovative, stable, non-ferris materials
  - Materials not sensitive to magnetic or electrical effects
  - Data encapsulated in advanced protective, long-life, cocoon
M-Disc Expected Data Life
100 GB BDXL Disc

- Under normal storage conditions (77F, 50%RH):
  - 95% confidence time to first failure: >1000 years

- Under harsh storage conditions (100F, 50%RH):
  - 95% confidence time to first failure: >180 years
## Durability

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Conditions</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea water resistance</td>
<td>• Sunk into the sea for 7 days</td>
<td>Perfect</td>
</tr>
<tr>
<td>Corrosive environmental gas resistance</td>
<td>• Corrosive gas atmosphere: 25° C, 75% RH, 96 h, H₂S: 12.5 ppm, SO₂: 25 ppm</td>
<td>Perfect</td>
</tr>
<tr>
<td>Light resistance</td>
<td>• Using solar simulator (Xe lamp energy 550 W/m², 3 weeks)</td>
<td>Perfect</td>
</tr>
</tbody>
</table>
| Temperature and humidity resistance | • 80° C, 80% RH, 750 h  
• -40° C, 250 h                         | Perfect |
| Chemical resistance              | • 20 times wiping test using sodium hypochlorite 1% solution, ethanol 77% solution | Perfect |

*MKM In-house tests*
Affordable Data Lifecycle

• What drives DATA lifecycle costs?
  • Infrastructure acquisition – am I only buying technology?
  • Or ownership? – The DATA is what I own and maintain.
  • Storage technology is a means to keep DATA alive

• Ownership dominates the data lifecycle cost
  • Maintaining storage environment
  • Regular media migration
  • Energy costs – operations and conditioning

• Preservation media and commodity storage serve different purposes
Data Migration: Optical vs HDD vs Tape

Migration/Remastering Costs of 5 PB
Cost of migration-event-erosion factored-in

Cum costs - 75 years

$40,000,000
$35,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0

Years

Disk
Tape
BluRay

David Merrill, Chief Economist HDS
Cost Breakdown: Optical vs Disk vs Tape

Breakdown of Costs for 5PB Stored for 75 years
Does not include media, capitalization, or subscription cost

David Merrill, Chief Economist HDS
# Preservation Media Comparison

<table>
<thead>
<tr>
<th></th>
<th>HDD</th>
<th>SSD</th>
<th>TAPE</th>
<th>Optical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent</td>
<td>✧</td>
<td>✧</td>
<td>✧</td>
<td>●●●●●</td>
</tr>
<tr>
<td>Secure</td>
<td>✧</td>
<td>✧</td>
<td>✧</td>
<td>●●●●●</td>
</tr>
<tr>
<td>Affordable (TCO)</td>
<td>✧✦</td>
<td>✧</td>
<td>●●●</td>
<td>●●●●●</td>
</tr>
<tr>
<td>Maintainable</td>
<td>✧</td>
<td>✧✦</td>
<td>✧✦</td>
<td>●●●●●</td>
</tr>
<tr>
<td>Accessible</td>
<td>✧✦</td>
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Thank You for Your Time