WHOI OBS Media Selection

Alan Gardner, Woods Hole Oceanographic Institution
WHOI OBS Baler 14

• >70 Quanterra Baler 14s in operation
• ~1/2 are lightly modified “desktop balers”
• Other 1/2 are “field balers” repackaged to fit into a desktop baler case
• Operationally both types are 100% equivalent
WHOI OBS Baler 14

• As of December 2015 all B14s had original 20GB HDD
• Hitachi Endurastar J4K3020 (or older)
• Low rotational speed single platter automotive drive
• Very few drive failures seen
• No data loss due to failure
• Extremely reliable!
Desire to upgrade

• Higher capacity for longer recording (50GB max)
• Aging drives
• Power savings
• Altitude restrictions

Beartooth Pass
10,947ft
~330mBar

By Phil Armitage - http://www.philarmitage.net/beartooths/beartooths02.html, Public Domain
Risks to upgrade

• Hard to beat current reliability
• Hard to match current track record
• Need large run to avoid batch variations
• Few current vendors provide IDE interface
Quanterra sourced 50GB HDD

• HGST J4K50 – updated version of previous 20GB HDD
• Quanterra: seems very reliable, albeit with less of a track record than the 20GB
• Rated to 5000m altitude – OK for all US mountain passes, though still below our target 500mBar vacuum
Quanterra sourced 50GB HDD

• HGST J4K50
• Automotive HDDs no longer manufactured
• <10 remaining at Quanterra
• Doesn’t address power
Hard disk drives vs solid state drives

**HDD**
- Magnetic storage / spinning platter
- Shock while operating may damage
- Requires air to balance platter
- Motor requires high peak current
- Old technology – well tested, but no longer manufactured

**SSD**
- Flash memory / no moving parts
- Resilient against shock
- Operates at any air pressure
- Lower power? At least lower peaks?
- Newer – less track record, but many current vendors
## Solid State Drive comparison

<table>
<thead>
<tr>
<th><strong>Single Level Cell (SLC)</strong></th>
<th><strong>Multi Level Cell (MLC)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Each flash cell is either “on” or “off”, i.e. one bit</td>
<td>• Each flash cell stores one of 4 levels, i.e. two bits</td>
</tr>
<tr>
<td>• Inherently more reliable</td>
<td>• More prone to bit error</td>
</tr>
<tr>
<td>• Longer lasting (10x write cycles)</td>
<td>• Fewer write cycles</td>
</tr>
<tr>
<td>• Older technology</td>
<td></td>
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</tbody>
</table>
## Solid State Drive comparison

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<thead>
<tr>
<th>Single Level Cell (SLC)</th>
<th>Multi Level Cell (MLC)</th>
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<tbody>
<tr>
<td>• Very rarely used</td>
<td>• Ubiquitous</td>
</tr>
<tr>
<td>• Controllers less stable</td>
<td>• Firmware tested in millions of units</td>
</tr>
<tr>
<td>• Much more expensive</td>
<td>• Cheap (~5x cheaper per GB)</td>
</tr>
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<td></td>
<td>• Current wear levelling and garbage collection routines minimize the impact of lower cycle life</td>
</tr>
<tr>
<td></td>
<td>• Quanterra has recommended MLC drives for the Baler 44s for years now</td>
</tr>
</tbody>
</table>
Where we are now

• 12 balers have 50GB HDDs from Quanterra
• 2 balers have trial 256GB MLC SSDs from Supertalent
• ~1.5 months total runtime between both SSDs in accelerated write testing
Where we are now

• 1 SSD cloned in house from 50GB HDD using USB-IDE enclosure and Clonezilla Live
• 1 SSD cloned by Quanterra
• No issues seen so far
• Power comparison is favorable
Baler 14 drive current comparison in S81, Q2007, B06393, 2016-03-03 to 04
The future

• More testing (have already written 50GB to one drive and 35GB to the other)
• Trial drives are commercial temp!
• Need large (50pc) order for industrial temp

### Physical Specifications

<table>
<thead>
<tr>
<th></th>
<th>DuraDrive ET3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Factor</td>
<td>2.5&quot;</td>
</tr>
<tr>
<td>Capacity</td>
<td>32-512GB (MLC), 16-64GB (SLC)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>100.2 x 69.85 x 9.5 mm</td>
</tr>
<tr>
<td>Interface</td>
<td>IDE/PATA</td>
</tr>
<tr>
<td>NAND Flash</td>
<td>MLC/SLC</td>
</tr>
<tr>
<td>Power Supply</td>
<td>5V ± 10%</td>
</tr>
<tr>
<td>Package</td>
<td>Complete metal housing</td>
</tr>
</tbody>
</table>

### Environmental Specifications

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<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>Shock (Operating)</td>
<td>1500G</td>
</tr>
<tr>
<td>Vibration (Operating)</td>
<td>16G</td>
</tr>
<tr>
<td>Operating Temperature (Industrial)</td>
<td>-40°C ~ 85°C</td>
</tr>
<tr>
<td>Operating Temperature (Commercial)</td>
<td>0°C ~ 70°C</td>
</tr>
</tbody>
</table>