Against the Grain

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# Optical Disc Archiving and International Standards

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## Introduction

Optical discs such as BD-R, DVD-R, or CD-R have been used for many archival occasions from private archive, software back-up, or to store digitized archives, because of the unique features such as authenticity or long lifetime expectancy. However, the most remarkable feature, that the data conditions can be monitored by measuring the error rate and ISO standard defines the safe level of error rate, is not widely known. In other words, data conditions become visible, and archival suitability at the data creation and during storage can be accurately estimated when the operation follows the ISO guideline. The author explains advantages of using optical discs for archiving and how to get the most out of supporting guidelines in this article.

## Archive Capability of Optical Discs

| | Optical Disc | HDD | Magnetic Taps ( LTO) |
|---|---|---|---|
| Capacity | CD-R: 700MB<br>DVD-R: 4.7GB-8.5GB<br>BD-R: 25GB-100GB | 3TB | 3TB |
| Transfer Rate [MB/s] | 10 | 200 | 300 |
| Random Access [msec.] | 200 | <10 | 8000 |
| Lifetime [year] | 30 | 5 | 10 |
| Security | Best ( Write-once) | Poor | Better |
| Energy Consumption | Best ( Off-line ) | Poor | Better |
| Disaster Management | Best | Poor | Poor |

**Table 1: Compares the Characteristics of Commonly Used Media for Archiving.**

As the table shows, optical discs employ noticeable benefits as archival medium in terms of authenticity (write-once), long life expectancy, low energy consumption, and disaster recovery, which are great capabilities of offline and redundant archives.

Furthermore, the risk of technology obsolescence should be low. Optical discs specifications are clearly defined in the international standard. This de jure standardization of the formats enables optical media to be manufactured by many manufacturers and to build a large infrastructure worldwide. As the below chart shows, playing/recording infrastructure are super large as those drives are used both on PC and audio/visual equipment. The size of optical drive infrastructure is more than five times larger than it was in VHS. Shipment of the drives/players is not sharply declining even after tablet PC was introduced in the market in 2008. The optical disc technology is still appreciated by the server manufacturers and medical equipment builders because of the benefits already mentioned.

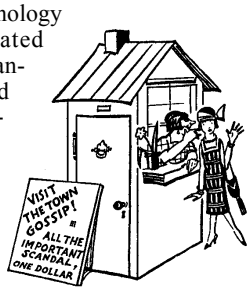
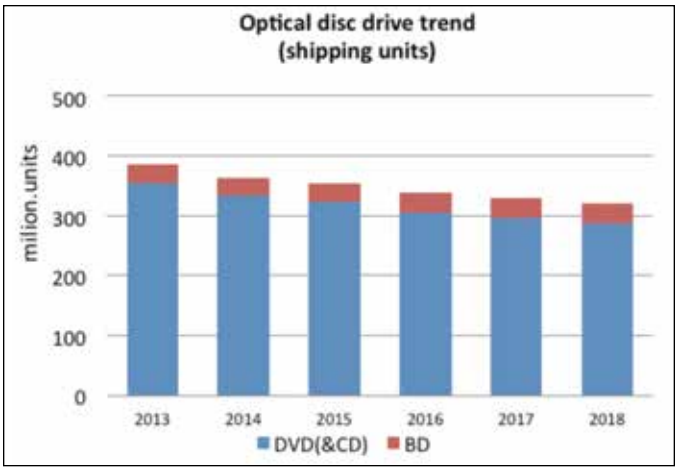



**Figure 1: Estimation of Shipping Units of Optical Drives, Players, and Recorders.**




*Data source: BOC (Holdings)Ltd

## How to Implement These Benefits in the Actual Archiving Activity

As explained in the above, even though optical discs have some benefits as an archival medium, unfortunately, discussions to determine the life expectancy of optical discs have been focusing on the materials to be used (the materials with higher resistance against corrosion), such as gold or engraving technologies, to be used on a reflective layer of the product. Obviously material selection is one of the vital factors; however, the more important facts we need to emphasize are overall characteristics of the media to achieve the stable writing quality in writers where discs spin at very high velocity and how to secure the compatibility with these writers. In other words, how to achieve the good level of writing quality (=low error rate) is extremely important. In addition, "the good error rate" can be controlled very easily at minimum cost and without skilled engineers by considering the following:

1. For the lowest possible initial occurrence of error rate, specially tuned up drive and media are recommended. Figure 2 shows the initial recording characteristics of DVD-Rs with drives randomly sampled from the market. The fact is that more than 60% of the combination between media and drive do not satisfy the "good error rate."

**Figure 2: Initial Error Rate: Sampling of Drives and Media From the Market.**

| Disc from various manufacturers | Drive_A | Drive_B | Drive_C | Drive_D | Drive_E | Drive_F | Drive_G | Drive_H |
|---|---|---|---|---|---|---|---|---|
| Disc_A | Very Good | Good | Good | Poor | Good | Very Good | Poor | Poor |
| Disc_B | Very Good | Very Good | Good | Good | Poor | Poor | Poor | Good |
| Disc_C | Poor | Very Good | Good | Good | Very Good | Good | Poor | Good |
| Disc_D | Very Good | Poor | Good | Good | Good | Poor | Poor | Good |
| Disc_E | Poor | Very Good | Poor | Very Good | Poor | Good | Good | Very Good |
| Disc_F | Poor | Very Good | Poor | Poor | Poor | Good | | |
| Disc_G | Very Good | Very Good | Very Good | Very Good | Very Good | Very Good | Very Good | Very Good |
| Disc_A | Good | Good | Good | Very Good | Poor | Very Good | Good | Very Good |
| Disc_B | Very Good | Very Good | Good | Very Good | Poor | | | Very Good |
| Disc_C | Very Good | Very Good | Very Good | Very Good | Poor | Good | Very Good | Very Good |
| Disc_D | Poor | Very Good | Poor | Poor | Poor | Good | Very Good | Very Good |
| Disc_E | Good | Poor | Poor | Poor | Poor | Good | Good | Very Good |
| Disc_F | Good | Very Good | Very Good | Very Good | Poor | Very Good | Poor | Poor |
| Disc_G | Poor | Poor | Poor | Poor | Poor | Very Good | Very Good | Very Good |
| Disc_H | Poor | Good | Very Good | Poor | Poor | Very Good | Very Good | Very Good |
| Disc_I | Poor | Poor | Poor | Very Good | Poor | Poor | Poor | Very Good |
| Disc_J | Very Good | Poor | Good | Very Good | Poor | Poor | Poor | Very Good |
| Disc_K | Poor | Very Good | Very Good | Poor | Poor | Very Good | Poor | Very Good |
| Disc_L | Good | Poor | Poor | Poor | Poor | Poor | Poor | Very Good |

Very Good : <140(PIEsum8)
Good : 140~280(PIEsum8)
Poor : >280(PIEsum8)

*Data source: JVC internal test

*continued on page 32*

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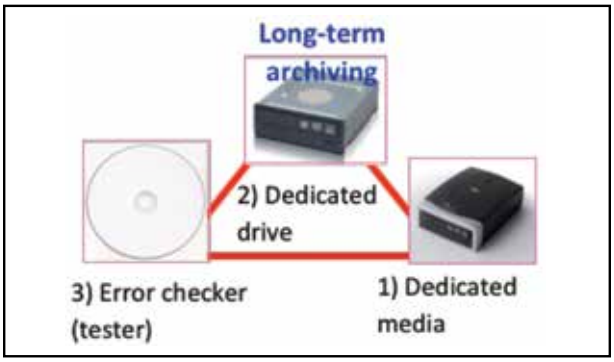
2. For the selection of the media, it is recommended to use the one that has passed the life expectancy test = ISO/IEC10995, ISO/IEC16963. This recommendation is stated within ISO/TR17797: Electronic archiving-Selection of digital storage media for long-term preservation.
3. Good error or bad error? How do users know the data is good or bad? These values are clearly defined in ISO/IEC29121, and the error rate can be measured by using an error checking device. The initial occurrence value and the value during storage can be known by using this device.

## JVC's Approach

Our approach is to provide end users with a disc archive solution that meets ISO/IEC29121 guidelines and which tells you what error rate would be suitable for archiving. Moreover, the turnkey solution, whatever the company size is, can be easily implemented into any workflow.

**Figure3: Ideal Archiving Operation Using Optical Discs.**




1. **Dedicated Media:** Up to now, users have had to rely on what manufacturers say about the lifetime expectancy. For improved transparency of the claims, **JVC** makes use of ISO/IEC10995 life expectancy tests conducted by an independent lab. Overall characteristics and raw materials are uniquely designed and tuned up for long-term archiving.
2. **Dedicated Drive:** As explained, the drive plays an important role in disc archiving = continually achieving the ISO-defined error rate. The special drive optimizes recording quality with the ISO certified discs.
3. **Error Checking Device:** This is developed for complete error management from the writing stage to migration. Understanding error rate means understanding your data condition. Safety values are defined in ISO/IEC29121, and users can easily understand the condition of the data and estimate the migration timing.

As you can see, optical discs may not be suitable for back-up of ultra-huge data; however, this would be a useful solution if the project size and tier of the archive process are considered. Writing quality = safety level and migration timing are supported by ISO standards, and this mechanism will contribute to users' transparent archiving activities. The data condition is no longer invisible.

## Reference Notes

1. JIS for "Document Management — Long-Term Preservation for Electronic Imaging Documents" was revised (JIS Z 6017). *Ministry of Economy, Trade and Industry*, September 20, 2013.

2. **Japan Image and Information Management Association (JIIMA)**, "Blu-Ray DiscTM Inspection Standard for Long-Term Storage of Digital Documents and Handling Guidelines."

3. **Japan Image and Information Management Association (JIIMA)**, "Guideline for Archiving with Shelf-Stable Optical Disks."

4. **Takao Ihashi** and **Toshio Suzuki**, **Tokyo City University**, *Journal of the Center for Information Studies*, 12:16 (2011).

5. BOC(Holdings), Ltd, BOC data for optical drive trend (2014).

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# Tools and Apps from AVPreserve

by **Chris Lacinak** (President and Founder, AVPreserve) Visit: *http://www.avpreserve.com/avpsresources/tools/*

**AVCC** — A free, open-source Web application developed by **AVPreserve** and funded by **Library of Congress**, METRO (*http://metro.org/*) and **AVPreserve**. AVCC is focused on enabling collaborative and volunteer-driven efforts to inventory and describe AV collections in order to gain the intellectual control necessary to make decisions about collection management and obtain funding. Data entry is controlled to promote quality, and there are several built-in reports and graphs that make it easy to get key metrics and documentation. *http://www.avpreserve.com/tools/avcc/*

**MediaSCORE/MediaRIVERS** — A free, open-source media preservation prioritization Web application created in collaboration between **AVPreserve** and **Indiana University**. MediaSCORE (Media Selection: Condition, Obsolescence, and Risk Evaluation) enables a detailed analysis of degradation and obsolescence risk factors for most analog and physical digital audio and video formats. MediaRIVERS (Media Research and Instructional Value Evaluation and Ranking System) guides a structured assessment of research and instructional value for media holdings. *http://www.avpreserve.com/tools/mediascore-mediarivers/*

**Catalyst** — a new solution developed by **AVPreserve** to perform large-scale, item-level inventories of AV collections with increased quality, value, oversight, and optimization of resources. Images of items are used to enable remote description, quality control, and collection management. Taking advantage of automated processing and minimal datasets, even a small team can work through hundreds or thousands of items a day. Catalyst data can be exported to generate reports for preservation planning and selection, or to become the basis of a finding aid or more complete catalog record. *http://www.avpreserve.com/tools/catalyst-inventory-software/*

**Fixity** — A simple, free, and open-source cross-platform desktop application created by **AVPreserve**. Fixity enables automated fixity monitoring and reporting for stored files of any kind. Schedule routine scans to take place and receive detailed reports via email showing whether files have been added, moved, renamed, changed, or removed. Fixity can be used with any files. *http://www.avpreserve.com/tools/fixity/*

**MDQC** — A simple, free, and open-source cross-platform desktop application created by **AVPreserve**. MDQC stands for Metadata Quality Control and enables quality control on batches of files based on technical and embedded metadata within them. MDQC can be used with any files. *http://www.avpreserve.com/tools/mdqc/*

**BWF MetaEdit** — A free, open-source, cross-platform desktop tool created by the Federal Agencies Digitization Guidelines Initiative (FADGI) and developed by **AVPreserve**. This tool permits embedding, editing, and exporting of metadata in Broadcast WAVE Format (BWF) files. It can enforce metadata guidelines developed by the Federal Agencies Audio-Visual Working Group, as well as specifications from the European Broadcasting Union (EBU), Microsoft, and IBM. *http://www.avpreserve.com/tools/bwf-metaedit/*