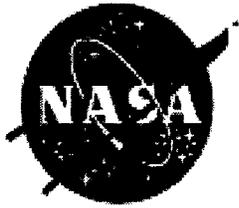


Providing Space Imagery to the Public on DVD
Speaker, Jason Hyon, Deputy Manager, Earth Science Data Systems

Jet Propulsion Laboratory, California Institute of Technology
jason.j.hyon@jpl.nasa.gov

NASA's Jet Propulsion Laboratory (JPL) has been in the forefront of DVD-ROM usage ever since the technology became commercially available. JPL has migrated a vast collection of imagery and data from its many planetary missions to DVD-R media. These data are then made available to the public through direct sales of DVD-ROM discs as well as online via Web-connected DVD-R jukeboxes. A scientist from JPL will discuss the "NEAR" archiving project that has resulted in thousands of CD-R discs being converted to DVD-R through the use of NASA's automated DVD-R production system. Further, they have recently developed a concept of "live" media to store data online and to migrate data to an archive medium when the data are off-lined. In this presentation, the speaker will illustrate a vital role that DVD-R plays and describe the system architecture, which supports the Mars Odyssey mission.



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DVD 2002 Conference

Providing Space Imagery to the Public on DVD

Jason Hyon
Data Distribution Lab
Jet Propulsion Laboratory,
California Institute of Technology
June 3, 2002



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- **CHALLENGE**

- Rising volume of data that needs to be safely distributed and archived
- Current technologies of CD and DVD no longer viable solutions
- Higher capacity media must be found

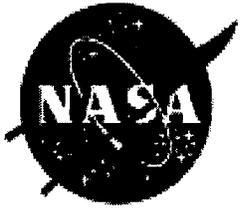


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- **AIM**
 - Research and evaluate new options for archiving PDS (Planetary Data System) data
 - Determine a viable solution



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- What makes an acceptable archival and distribution media?
 - The National Archives and Records Administration (NARA) and the National Institute of Standards and Technologies (NIST) determine the suitability of media for archiving.
 - They only publish that which has proven to be reliable which is a long-term process.
 - For example, the acceptance of CD-ROM took around 10 years.



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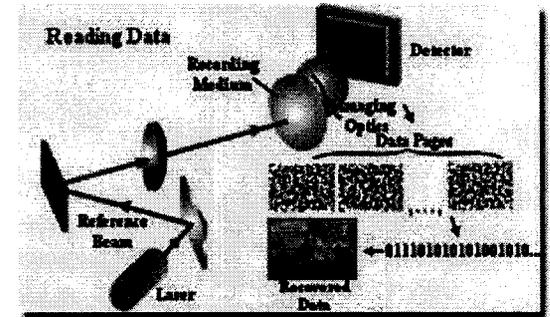
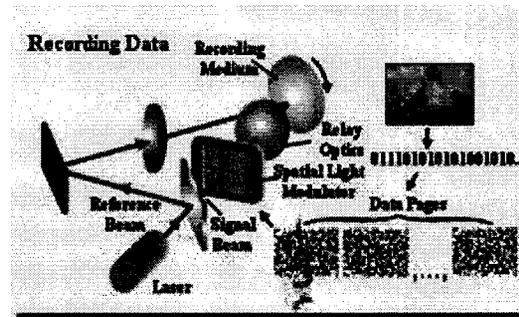
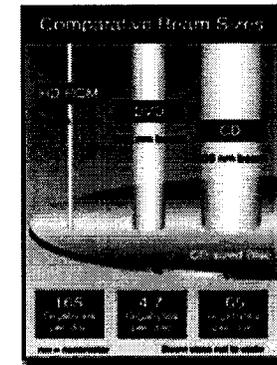
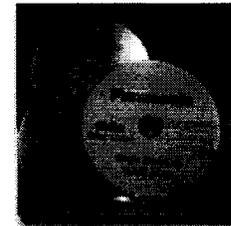
- What guidelines does the DDL use?
 - Must use an open standard (UDF/ISO 9660)
 - Should have multiple vendors of hardware and media
 - Must carry directory information
 - Must employ robust error correction with graceful degradation
 - Must provide the capability for easy migration to higher capacity media.
 - Should have some organization monitoring industry performance



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- What technologies are on the horizon?
 - High-Density DVD-ROM
 - Matsushita has recently exhibited the next generation optical disk drive with 50 GB capacity (dual layer) on a single side (100 GB dual side).
 - High-Density Read Only Memory (HDROM)
 - Norsam Technologies in conjunction with an IBM research group has developed a high-capacity storage technology storing 165 GB of data on a CD/DVD size disk.
 - Holographic Storage
 - Computer storage that uses laser beams to store computer-generated data in three dimensions.



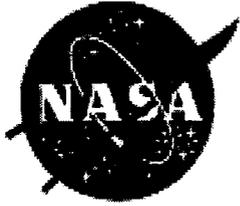


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- **BUT...**
 - None of these new technologies meet all of the requirements set forth by the DDL/PDS.
- **ALSO...**
 - Who will archive the data? What do they require for the medium?

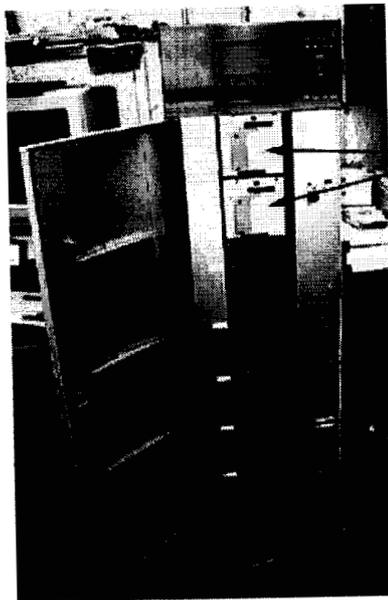


- There is no cost-effective archive solution
 - Size is limited and cost is high
 - Data transfer rate is slow
 - It needs special environment
- A concept of “live” media
 - Compatible physical format for next 5 – 10 years (upward compatible)
 - Compatible logical format for next 5 – 10 years (ISO/de facto)
 - Migration path is well defined
- What are they?
 - CD/DVD
 - Hard drives (RAID, JBOD)
 - *High density tapes with Jukebox*
 - **Combination of the above with rigorous system operations concept**



Automated DVD Archiving System **JPL**

- Pioneer DRM-7000 DVD jukebox with a 370 disc capacity, two CD/DVD readers and one DVD recorder.
- UI design allows for selection of volumes for conversion to DVD-R, for specification of the type of conversion to be performed and the specification of duplication requirements for the output volumes.



Pioneer DRM-7000 DVD Jukebox

Disc Cartridges (50 discs each)
Up to 10 can be installed

DVD Recorder

DVD Readers (2)

- SmartStor Archive 4.04 software with an application programming interface (API) package using Microsoft Active Server Pages.

Address: http://dvd-archive/dvd/www_all.asp?step=1

Welcome to the Automated DVD Archiving System

Slot Number	Volume Name	Load Checked	Unload Checked
1	MOPS_9008	LOAD	UNLOAD
2	DRG	LOAD	UNLOAD
3	DRG	LOAD	UNLOAD
4	DRG	LOAD	UNLOAD
5	Empty Slot (5)	LOAD	UNLOAD
6	Empty Slot (6)	LOAD	UNLOAD
7	Empty Slot (7)	LOAD	UNLOAD
8	Empty Slot (8)	LOAD	UNLOAD
9	Empty Slot (9)	LOAD	UNLOAD
10	Empty Slot (10)	LOAD	UNLOAD
11	Empty Slot (11)	LOAD	UNLOAD
12	Empty Slot (12)	LOAD	UNLOAD
13	Empty Slot (13)	LOAD	UNLOAD
14	Empty Slot (14)	LOAD	UNLOAD
15	Empty Slot (15)	LOAD	UNLOAD
16	Empty Slot (16)	LOAD	UNLOAD
17	Empty Slot (17)	LOAD	UNLOAD
18	Empty Slot (18)	LOAD	UNLOAD
19	Empty Slot (19)	LOAD	UNLOAD
20	Empty Slot (20)	LOAD	UNLOAD
21	Empty Slot (21)	LOAD	UNLOAD
22	Empty Slot (22)	LOAD	UNLOAD
23	Empty Slot (23)	LOAD	UNLOAD
24	Uninventoried Slot (24)	LOAD	UNLOAD
25	Empty Slot (25)	LOAD	UNLOAD

View Slots

- 1: <<> View All
- 2: <<> View Empty
- 3: <<> View Uninventoried
- 4: <<> View Blank Media

Mount / Dismount Disks

- 1: <<> Mail Slot
- 2: <<> Hyper Cartridge (up to 20 disks)

CD -> DVD

- 1: <<> Select CDs to copy
- 2: <<> Number of Copies per DVD
- 3: <<> Write DVD (Span/Truncate)

DVD -> DVD

- 1: <<> Select DVDs to copy
- 2: <<> Number of copies per DVD
- 3: <<> Write DVD

Validation

- 1: <<> PDS Content Validation
- 2: <<> CRC Validation only
- 3: <<> File size Validation only
- 4: <<> File size and CRC Validation

Back to Main **Full Screen View**



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- The system can be combined with a process control module to migrate data from online to near online or offline storage.
- The Automated DVD Archiving System consists of 3 major components.
 - Smart Store Archive eXtender API wrapper written in Microsoft Visual Basic
 - MS.NET Webservice.
 - Web Application front end



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- Smart Store Archive eXtender API wrapper written in Microsoft Visual Basic
 - Compiled into an out-of-process DLL (Dynamically Linked Library).
 - VB wrapper functions as a proxy between the Microsoft .NET Automated DVD Archiving System Web Service and the "C" API function calls to the DVD Jukebox.



- MS.NET WebService.
 - The Automated DVD Archiving System Web Service takes advantage of MS.NET C# ability to produce WebServices with ease.
 - It exposes the methods and functionality of the underlying "C" APIs
 - adds convenience methods to handle communications and data transfers from Client Web Applications to the underlying "C" APIs.



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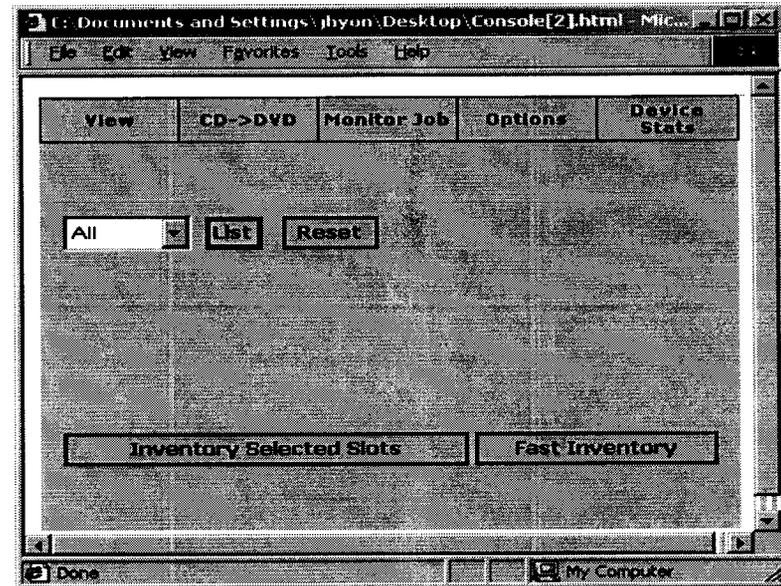
- Web Application front end.
 - A Web Application is the user interface which may access and call methods that have been published through the Web Service.
 - The implementation language used for the Web Application is also C# for its ease of use in constructing Web Applications through the Microsoft Visual Studio .NET development environment.



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The automated DVD archiving system provides both API and Web interface to control and to process jobs.



Completed conversion and validation of the NEAR CD-ROMs to DVD-R. 67 DVDs have been produced and made available online for the NEAR data analysis team.

