

# Chapter 11. Media Formats for Data Submission and Archive

This standard identifies the physical media formats to be used for data submission or delivery to the PDS or its science nodes. The PDS expects flight projects to deliver all archive products on magnetic or optical media or by electronic delivery, as negotiated with the science nodes.

**Archive Planning** - During archive planning, the data producer and PDS will determine the medium (or media) to use for data submission and archiving. This standard lists the media that are most commonly used for submitting data to and subsequently archiving data with the PDS. Delivery of data on media other than those listed here may be negotiated with the PDS on a case-by-case basis.

**Physical Media for Archive** - For archival products only media that conform to the appropriate International Standards Organization (ISO) standard for physical and logical recording formats may be used.

1. The preferred data delivery medium is the Compact Disk (CD-ROM or CD-Recordable) produced in ISO 9660 format, using Interchange Level 1, subject to the restrictions listed in Section 10.1.1.
2. Compact Disks may be produced in ISO 9660 format using Interchange Level 2, subject to the restrictions listed in Section 10.1.2.
3. Digital Versatile Disk (DVD-ROM or DVD-R) should be produced in UDF-Bridge format (Universal Disc Format) with ISO 9660 Level 1 or Level 2 compatibility.

Because of hardware compatibility and long-term stability issues, the use of 12-inch Write Once Read Many (WORM) disk, 8-mm Exabyte tape, 4-mm DAT tape, Bernoulli Disks, Zip disks, Syquest disks and Jaz disks is not recommended for archival use. WORM disk formats are proprietary to the specific vendor hardware. Helical scan tape (8-mm or 4-mm) is prone to catastrophic read errors. Bernoulli, Zip, Jaz, Syquest and other vendor-specific storage media are prone to obsolescence.

**Electronic Transfer and Storage of Archive** – The ISO and UDF-Bridge standards mentioned above are specifically for CD-ROM, CD-R, DVD-ROM, and DVD-R media as noted. PDS recognizes that electronic delivery of archives is becoming as common a practice as delivery on physical media, and therefore is pursuing a more comprehensive standard. Pending the results of this investigation, the following restrictions apply to archival products delivered and stored electronically.

Notes:

1. File names are restricted to 40 characters total length, as described in Section 10.1.3. This exceeds the limit imposed by the ISO 9660:1988 standard.
2. Directory names are restricted to 31 characters total length, as described in Section 8.2

This is the same restriction as the ISO 9660:1988 standard.

3. The total length of directory path and file name must not exceed 255 characters.
4. Delivery of files on a “data brick”, that is, a computer hard drive that can be mounted directly onto a computer or network, is considered an electronic delivery.

## **11.1 CD-ROM Recommendations**

### **11.1.1 Use of Variant Formats**

The use of Extended Attribute Records (XARs), Rock Ridge Extensions or Macintosh Hybrid Disk Extensions on archival CD-ROMs is discouraged because these extensions can cause errors with CD-ROM drivers on some systems.

### **11.1.2 Premastering Recommendation**

PDS recommends that CD-ROMs be mastered using a single-session, single-track format. Other formats have been found to be incompatible with some readers.

## **11.2 DVD Recommendations**

### **11.2.1 Use of Variant Formats**

The official volume structure for DVD media is UDF. DVD volumes should not be produced using ISO 9660 only. While current operating systems support ISO 9660 on DVD volumes, there is no guarantee that future operating system upgrades, set-top boxes or other new devices will continue to support ISO 9660 formatted DVD volumes.

### **11.2.2 Premastering Recommendation**

PDS recommends that DVD-ROMs or DVD-Rs be mastered using a single-session, single-track format using the UDF-Bridge format.

### **11.2.3 Recommended DVD Formats**

There are currently three "variants" of DVD media:

- DVD-5 - single sided, single layer (4.7 GB)
- DVD-9 - single sided, double layer (8.5 GB)
- DVD-10 - double sided, single layer (9.4 GB)

Currently, only the DVD-5 is approved by the PDS for archiving data. A waiver may be obtained for using the DVD-9 format if the archive consists of very large quantities of data (e.g., cost considerations may warrant using this format). The DVD-10 format is not recommended.

### 11.3 Packaging Software Files on a CD or DVD

The ISO 9660 Level 1 standard requires all pathnames and directory names to be in uppercase, and to be limited to eight characters with a three-character file extension for file names. In some cases it may be desirable to include software packages on an ISO 9660 Level 1 archive product that do not conform to these naming standards. The recommended method for packaging software is to use a “Zip” utility in accordance with the PDS standards for archiving data using Zip compression. See the *Zip Compression* chapter for more information.

### 11.4 Software Packaging Under Previous Versions of the Standard

Under previous versions of the Standards – prior to the adoption of the Zip standard (see the *Zip Compression* chapter) – archive products that included software specifically intended for the Mac and SUN operating systems used the following conventions:

#### 1. Mac Software

In this case the Mac files must be prepared in a particular format, as other platforms do not recognize the resource and data fork files that come with Mac applications. (For an example of properly formatted Mac software, see the NIHIMAGE software on the Magellan GxDR and Clementine EDR CD-ROMs.) The Mac utility “STUFFIT” is used to prepare the files by compressing them and encoding them using the BINHEX utility. Users will also need this STUFFIT utility in order to unpack the software for use. The procedure and software requirements should be described in a text file included on the CD-ROM (in the appropriate SOFTWARE/DOCUMENT subdirectory – see the *Volume Organization and Naming* chapter in this document).

**Example** – *Text Documenting HQX Files*

#### Macintosh Software

This directory contains software that can be used to display the GXDR images on a Macintosh II computer with an 8-bit color display.

NOTE: Because of the way this CD-ROM was produced, it was not possible to record this display program as a Macintosh executable file. Anyone who is unfamiliar with the Macintosh STUFFIT utility should contact the PDS operator, 818-306-6026, SPAN address JPLPDS::PDS\_OPERATOR, INTERNET address PDS\_OPERATOR@JPLPDS.JPL.NASA.GOV

The file IMAGE.HQX contains the NIH Image program, along with several ancillary files and documentation in Microsoft WORD format. It was written by Wayne Rasband of the National Institutes of Health. The program can be used to display any of the image files on the GXDR CD-ROM disks.

The Image executable and manual are stored in BINHEX format, and the utility STUFFIT or UNSTUFFIT must be used to: 1) decode the BINHEX file IMAGE.HQX into IMAGE.SIT, using the 'DECODE BINHEX FILE...' option in the Other menu; and 2) use 'OPEN ARCHIVE' from the File menu to extract Image 1.40 from the STUFFIT archive file. There are also several other files in the archive file which should be unstuffed and kept together in the same folder as the Image executable is stored.

The STUFFIT software is distributed as shareware. STUFFIT, Version

1.5.1, is available by contacting:

Raymond Lau	MacNET:RayLau Usenet:raylau@dasys1.UUCP
100-04 70 Ave.	GENie:RayLau
Forest Hills, N.Y. 11375-5133	CIS:76174,2617
United States of America.	Delphi:RaymondLau

Alternatively, STUFFIT CLASSIC, Version 1.6, is available by contacting:

Aladdin Systems, Inc.  
Deer Park Center  
Suite 23A-171  
Aptos, CA 95003  
United States of America

## 2. SUN Software

The problem in this case is preserving the SUN file names, since case is significant in file names on that platform. Since the ISO standard requires all file and directory names to be uppercase, a disk premastered as an ISO CD may encounter problems in the case-sensitive SUN environment. Specifically, some CD readers mounted on SUN systems show file names as uppercase regardless of the format prior to mastering. If build routines (“make” files, for example) refer to lowercase file names, the corresponding files will not be found.

A method for dealing with this situation is to store the entire original directory structure and contents in a compressed, encoded archive (a compressed “tar” file, for example), and document the procedures and utilities needed to restore the files in the appropriate file. This is equivalent to the STUFFIT approach described above for Mac software.