Cassini / Huygens Program
Archive Plan
for Science Data

PD 699-068
JPL D-15976

April 25, August 3, 2000

Initial Release
Version 10

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Archive Plan for Science Data, 699-068  V1

Pasadena, California
## Change Record for 699-068

<table>
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<th>Changes</th>
<th>Sections Affected</th>
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<tr>
<td>Draft 1</td>
<td>7/15/98</td>
<td>First version for review</td>
<td>All</td>
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<tr>
<td>Draft 2</td>
<td>8/1/98</td>
<td>Minor updates, Appendix A -- added definition of processing</td>
<td>All</td>
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<tr>
<td></td>
<td></td>
<td>Appendix C -- added Archive schedule</td>
<td></td>
</tr>
<tr>
<td>Draft 3</td>
<td>9/16/98</td>
<td>New organization -- Updated signature page, replaced references to SO and DOI with the new “Instrument Operations Team”, replaced references to MSO and Science Office with “Science Operations Office” Section 2, item 2 -- states that Cassini provides volumes to PDS CN who in turn provides copies to the relevant PDS DN. It should be noted that this is still listed as a TBD Incorporated PDS comments</td>
<td>All</td>
</tr>
<tr>
<td>Draft 4</td>
<td>10/5/98</td>
<td>Section 2, item 5 Added cruise archive policy &amp; included in delivery of cruise science in Archive schedule OTLs and MSOCs listed as archive contacts for each instrument</td>
<td>All</td>
</tr>
<tr>
<td>Preliminary</td>
<td>4/1/99</td>
<td>Changed document title Revised signature page Changed instances of “Cassini Project” to “Cassini Program” Updated applicable document listing</td>
<td>All</td>
</tr>
<tr>
<td>Preliminary V1</td>
<td>12/27/99</td>
<td>Updated Signature page Major changes to Roles and Responsibility section 2.0 Some changes to policy section 3.0 Review and comment on To be Supplied list Formatting changes</td>
<td>All</td>
</tr>
<tr>
<td>Preliminary V2</td>
<td>4/1/00</td>
<td>Incorporated updates throughout the document as requested by reviewers. Incorporated Huygens data in the plan. Updated distribution list. Updated archive policies.</td>
<td>All</td>
</tr>
<tr>
<td>Initial Release, Version 0</td>
<td>4/25/00</td>
<td>Clarified PDS CN and PDS DN roles and responsibilities throughout document. Updated table 1.5.2 data product levels to reflect CODMAC and PDS definitions. (see unresolved list) Clarified the project intent to archive level 1A and level 1B data products in section 6.</td>
<td>All</td>
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## Archive Plan for Science Data, 699-068 V1

<table>
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<th>Changes</th>
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<tr>
<td></td>
<td></td>
<td>Reorganized data set tables in appendices.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Added new issues to unresolved issues list.</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>Added High-Level Catalog documents to schedule.</td>
<td></td>
</tr>
<tr>
<td>Initial Release, Version 1</td>
<td>8/3/00</td>
<td>Higher level product archive.</td>
<td>6.4</td>
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1. Introduction

1.1 Purpose

The purpose of this document is to describe the Cassini / Huygens science data archive system which includes policy, roles and responsibilities, a description of science and supplementary data products or datasets, metadata, documentation, software, archive schedule, and methods for archive transfer to the NASA Planetary Data System (PDS).

1.2 Scope

This document is applicable to all science and supplementary data resulting from the Cassini Program orbiter and Huygens investigations. Separate agreements to be established through the Cassini Program Science Group (PSG) and Huygens Science Working Team (HSWT) will address data sharing and release policies. This document is subordinate to the Cassini Program Data Management Plan and Science Management Plan.

1.3 Applicable Documents

The Archive Plan for Science Data (APSD) is responsive to the following documents found on-line in the Master Controlled Document Library at http://cel.jpl.nasa.gov/cedr/home/mcdl.html


The following additional documents are referred to in the APSD. PDS documentation is available on-line from the PDS Website at http://pds.jpl.nasa.gov/ .

c) Planetary Science Data Dictionary Document, Revision D, 15 March 1996, JPL D-7116. (For the most current information, use the on-line data dictionary provided on the PDS web page.)
1.4 Document Change Control
The APSD is under change control once all parties sign it. All the parties on the signature page must approve each revision.

1.5 Terms and Definitions

1.5.1 Archive Terms Defined

For this document the following terms are defined.

**Active archive** - archive data set available at PDS Discipline Node during ongoing peer review.

**Archive** - a preservation of data for future use. Mission archives occur during the term of the mission, long-term archives are maintained at the PDS.

**Archive medium** - a physical device for storing data such as CD, DVD, tape, etc.. For PDS archives, the medium must be acceptable to PDS as described in the PDS standards reference.

**Data product** - data resulting from a scientific observation. Examples of data products include planetary images, spectrum tables, and time series tables. A data product is a component of a data set.

**Data set** - a labeled grouping of data products, metadata, documentation and software.

**Metadata** - a label or file that describes science data products.

**Volume** - one or several in a series of archive media containing data sets.

**PDS** - Planetary Data System. The primary organization within NASA responsible for the archive of planetary science data obtained from NASA sponsored missions. The PDS consists of a Central Node located at JPL and several Discipline Nodes located around the country.

**MIFT** - Mission Interface Team. Members include project, and PDS node personnel. The central node data engineer assigned to the project leads the team. The team plans the archive and develops the archive design. Regular meetings during production are used to coordinate peer review, and resolve issues.
1.5.2 Data Product Levels

The Cassini Program uses NASA levels for describing data products. The definition of each NASA level with examples and the CODMAC equivalent is in the below table. CODMAC to Nasa level mapping is described in chapter 6 of the PDS standards reference.

<table>
<thead>
<tr>
<th>NASA Levels</th>
<th>Product Description</th>
<th>Cassini Examples</th>
<th>CODMAC Equivalent</th>
<th>CODMAC Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw</td>
<td>Telemetry data stream as received at the ground station, with science and engineering data embedded.</td>
<td>Digital Original Data Records, Intermediate Data Records</td>
<td>Level 1 - Raw Data</td>
<td>Telemetry data with data embedded.</td>
</tr>
<tr>
<td>Level 0</td>
<td>Instrument science data (e.g., raw voltages, counts) at full resolution, time ordered, with duplicates and transmission errors removed.</td>
<td>Instrument, Science, &amp; Engineering Packets, Radio Science Subsystem (RSS) Archival Tracking Data File (ATDF)</td>
<td>Level 2 - Edited Data</td>
<td>Corrected for telemetry errors and split or decommutated into a data set for a given instrument. Sometimes called Experimental Data Record. Data are also tagged with time and location of acquisition.</td>
</tr>
<tr>
<td>Level 1A</td>
<td>Level 0 data that have been located in space and may have been <strong>reversibly</strong> transformed (e.g., calibrated, rearranged) in a reversible manner and packaged with needed ancillary and auxiliary data (e.g., radiances with the calibration equations applied). No resampling.</td>
<td>Multimission Image Processing System (MIPS) Unprocessed Data Record (UDR) (DN placed in image frame format), Radio Science Subsystem (RSS) Orbit Data File</td>
<td>Level 3 - Calibrated</td>
<td>Edited data that are still in units produced by instrument, but that have been corrected so that values are expressed in or are proportional to some physical unit such as radiance. No resampling, so edited data can be reconstructed.</td>
</tr>
<tr>
<td>Level 1B</td>
<td><strong>Irreversibly</strong> transformed (e.g., resampled, remapped, calibrated) values of the instrument measurements (e.g., radiances magnetic field strength).</td>
<td>MIPS Experiment Data Record (EDR) (calibrated DN in image frame format)</td>
<td>Level 4 - Resampled data</td>
<td>Data that have been resampled in the time or space domains in such a way that the original edited data cannot be reconstructed. Could be calibrated in addition to being resampled.</td>
</tr>
<tr>
<td>Higher levels</td>
<td>Geophysical parameters mapped into uniform space time grids.</td>
<td>Mosaics, contrast stretching, false color, movies, gravity fields, magnetic fields, reports and graphics.</td>
<td>Level 5 - Derived data</td>
<td>Derived results, as maps, reports, graphics, etc. NASA Levels 2 through 5.</td>
</tr>
</tbody>
</table>
2. Roles and Responsibilities

2.1 Project Scientist

Provide a forum, led by a member of the PSG, for program internal peer review of PI and TL proposed data sets to be archived in the PDS.

2.2 Principal Investigators (PIs), Team Leaders (TLs)

a) Generate, validate the science content and format, and archive reduced science data products, metadata, documentation, and algorithms and software used to generate data products. Metadata includes Instrument, Dataset, Reference, and Personnel high-level catalog templates, ancillary data, and data product labels.

b) Provide L1A and L1B data sets, with Radio Science producing L0 data sets to the project for PDS archiving. (The list of these data sets can be found in appendix A and B.)

c) Work directly with assigned PDS discipline nodes to define data set content and format. Discipline nodes have expertise in archiving specific types of data and will help define keywords and standard values for keywords in metadata such as a data set description file and data product label files.

d) Participate in Mission Interface Team (MIFT) meetings.

e) Report archive status to Instrument Operations (IO) monthly.

All of the above responsibilities, excluding the science validation of products, can be delegated to Operations Team Leads (OTLs).

2.3 Interdisciplinary Scientists (IDSs)

Archive any significant new science data products and associated metadata and supplementary products created from the investigation. These will likely be higher level products and few in numbers. IDSs will inform IO of archive plans.
2.4 Instrument Operations (IO)

a) Coordinate archive data set production schedule and Archive Plan for Science Data (699-068)

b) Receive archive submissions from instruments and coordinate peer review with PDS.

c) Act as agent between PDS, Project and PI and TL when necessary to resolve PDS format and delivery issues.

d) Participate in Mission Interface Team (MIFT) meetings.

e) Report archive status to program monthly.

f) Generate and validate selected SPICE data products as specified in appendix C.

g) Produce Instrument Host and Mission templates and provide to PDS.

2.5 Mission Support and Services Office (MSSO)

a) Provide catalog system for archive data sets. (System should be capable of generating reports.)

b) Perform project internal data set format validation prior to PDS peer review using PDS provided tools. Report status to IO.

c) Produce SPICE archive data sets volumes. The list of these data sets can be found in appendix C.

d) Work directly with NAIF PDS node to define SPICE archive volumes format.

e) Report SPICE archive data set volume production status to IO.

2.6 Spacecraft Operations (SCO)

Generate and validate selected SPICE data products as specified in appendix C.
2.7 Planetary Data System (PDS)

Central Node (CN):

a) Coordinate with the Cassini program to define and produce the archive and ensure they are compatible with PDS standards.

b) Maintain a database of all PDS holdings, which will be updated after Cassini archive volumes have completed the peer review process.

c) Distribute archive volumes to the NASA-supported science community, as funding permits.

d) Provide archive volume validation tools, consultation, and review of validation reports.

e) Provide training materials and instruction to archive volume producers.

f) Participate in peer review of archive volumes.

g) Lead Mission Interface Team (MIFT) meetings to discuss archive and PDS issues.

h) Provide copies of archive volumes to the NSSDC.

Discipline Nodes (DN):

a) Work with archive producers assigned to them to define archive format and content.

b) Provide peer review of archive volumes.

c) Maintain active archives of released Cassini products for access by the science community.

d) Provide archive volume validation tools.

e) Participate in Mission Interface Team (MIFT) meetings.

2.8 National Space Science Data Center (NSSDC)

Maintain a “deep archive” of the data for long-term preservation. The NSSDC will also be responsible for filling large delivery orders to the science community, and when requested by the relevant PDS node, making data available to foreign investigators, educators, and the general public.
2.9 Cassini PDS Archive Locations

The following is a list of PDS Discipline Node managers and contacts.

<table>
<thead>
<tr>
<th>PDS Node</th>
<th>Contact</th>
</tr>
</thead>
</table>
| Central Node | Valerie Henderson  
JPL | valerie.henderson@jpl.nasa.gov |
| Atmospheres Node Archive Manager | Lyle Huber  
Atmospheres Node Manager |  
New Mexico State University in Las Cruces | Lhuber@NMSU.edu  
Reta Beebe | rbeebe@nmsu.edu |
| Geosciences Node | Ray Arvidson  
Earth and Planetary Remote Sensing Laboratory at Washington University in St. Louis, Missouri | arvidson@wunder.wustl.edu |
| Imaging Node | Eric Eliason  
USGS Subnode | eeliason@sirius.wr.usgs.gov  
JPL Subnode | Sue LaVoie | Susan.K.LaVoie@jpl.nasa.gov |
| Planetary Plasma Interactions (PPI) | Ray Walker  
Institute of Geophysics and Planetary Physics (IGPP) at the University of California, Los Angeles (UCLA). | rwalker@gpp.ucla.edu |
| Rings Node | Mark Showalter  
Ames Research Center | showalter@ringside.arc.nasa.gov |
| Small Bodies Node | Mike A’Hearn  
University of Maryland | ma@astro.umd.edu |
| Navigation and Ancillary Information Facility (NAIF) | Charles Acton  
JPL | Charles.H.Acton@jpl.nasa.gov |
| Radio Science Subnode | Dick Simpson  
Stanford University | rsimpson@magellan.stanford.edu |
### 2.10 Cassini Principal Investigators and Team Leaders (PIs/TLs) Archive Contact

<table>
<thead>
<tr>
<th>Instrument</th>
<th>PI or TL</th>
<th>Instrument Team Archive Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPS</td>
<td>David Young, PI</td>
<td>Judy Furman</td>
</tr>
<tr>
<td>Cassini Plasma Spectrometer</td>
<td></td>
<td><a href="mailto:jfurman@swri.edu">jfurman@swri.edu</a></td>
</tr>
<tr>
<td>CDA</td>
<td>Eberhard Grun, PI</td>
<td>Sascha Kempf</td>
</tr>
<tr>
<td>Cosmic Dust Analyzer</td>
<td></td>
<td><a href="mailto:Sascha.Kempf@mpi-hd.mpg.de">Sascha.Kempf@mpi-hd.mpg.de</a></td>
</tr>
<tr>
<td>CIRS</td>
<td>Virgil Kunde, PI</td>
<td>Matt Elliott</td>
</tr>
<tr>
<td>Composite Infrared Spectrometer</td>
<td></td>
<td><a href="mailto:Matthew.H.Elliott@gsfc.nasa.gov">Matthew.H.Elliott@gsfc.nasa.gov</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paul Romani</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:Paul.N.Romani@gsfc.nasa.gov">Paul.N.Romani@gsfc.nasa.gov</a></td>
</tr>
<tr>
<td>INMS</td>
<td>Hunter Waite, TL</td>
<td>Dana Burket</td>
</tr>
<tr>
<td>Ion and Neutral Mass Spectrometer</td>
<td></td>
<td><a href="mailto:dana@swri.edu">dana@swri.edu</a></td>
</tr>
<tr>
<td>ISS</td>
<td>Carolyn Porco, TL</td>
<td>Daniel “Buck” Janes</td>
</tr>
<tr>
<td>Imaging Science Subsystem</td>
<td></td>
<td><a href="mailto:janes@pl.arizona.edu">janes@pl.arizona.edu</a></td>
</tr>
<tr>
<td>MAG</td>
<td>David Southwood, PI</td>
<td>Steve Kellock</td>
</tr>
<tr>
<td>Magnetometer</td>
<td></td>
<td><a href="mailto:S.Kellock@c.ac.uk">S.Kellock@c.ac.uk</a></td>
</tr>
<tr>
<td>MIMI</td>
<td>Tom Krimigis, PI</td>
<td>Don Mitchell</td>
</tr>
<tr>
<td>Magnetospheric Imaging</td>
<td></td>
<td><a href="mailto:Don.Mitchell@huapl.edu">Don.Mitchell@huapl.edu</a></td>
</tr>
<tr>
<td>Instrument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RADAR</td>
<td>Charles Elachi, TL</td>
<td>William K. Johnson</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:Williamt.K.Johnson@jpl.nasa.gov">Williamt.K.Johnson@jpl.nasa.gov</a></td>
</tr>
<tr>
<td>RPWS</td>
<td>Don Gurnett, PI</td>
<td>Bill Kurth</td>
</tr>
<tr>
<td>Radio and Plasma Wave</td>
<td></td>
<td><a href="mailto:wsk@space.physics.uiowa.edu">wsk@space.physics.uiowa.edu</a></td>
</tr>
<tr>
<td>Spectrometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSS</td>
<td>Arv Kliore, TL</td>
<td>Randy Herrera</td>
</tr>
<tr>
<td>Radio Science Subsystem</td>
<td></td>
<td><a href="mailto:Randy.Herrera@jpl.nasa.gov">Randy.Herrera@jpl.nasa.gov</a></td>
</tr>
<tr>
<td>UVIS</td>
<td>Larry Esposito, PI</td>
<td>David Judd</td>
</tr>
<tr>
<td>Ultraviolet Imaging Spectrograph</td>
<td></td>
<td><a href="mailto:David.Judd@asp.colorado.edu">David.Judd@asp.colorado.edu</a></td>
</tr>
<tr>
<td>VIMS</td>
<td>Robert Brown, TL</td>
<td>Rick McCloskey</td>
</tr>
<tr>
<td>Visual and Infrared Mapping Spectrometer</td>
<td></td>
<td><a href="mailto:rickm@pl.arizona.edu">rickm@pl.arizona.edu</a></td>
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</tbody>
</table>
## 2.11 Huygens Principal Investigator Archive Contacts

<table>
<thead>
<tr>
<th>Instrument</th>
<th>PI</th>
<th>Team Archive Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HASI</strong> Huygens Atmospheric</td>
<td>Marcello Fulchignoni</td>
<td>Jean-Pierre Lebreton</td>
</tr>
<tr>
<td><strong>Structure Instrument</strong></td>
<td>Dept de Recherche Spatiale (DESPA), Observatoire de Paris-Meudon,</td>
<td><a href="mailto:jlebreton@estec.esa.nl">jlebreton@estec.esa.nl</a></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
</tr>
<tr>
<td><strong>GCMS</strong> Gas Chromatograph and</td>
<td>Hasso B. Niemann</td>
<td>Jean-Pierre Lebreton</td>
</tr>
<tr>
<td><strong>Mass Spectrometer</strong></td>
<td>Lab for Atmospheres, NASA / Goddard Space Flight Ctr, Balitmore</td>
<td><a href="mailto:jlebreton@estec.esa.nl">jlebreton@estec.esa.nl</a></td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td><strong>ACP</strong> Aerosol Collector and</td>
<td>Guy M. Israel</td>
<td>Jean-Pierre Lebreton</td>
</tr>
<tr>
<td><strong>Pyrolyser</strong></td>
<td>Service d’Aeronomie du CNRS, Verrieres-le-Buisson, France</td>
<td><a href="mailto:jlebreton@estec.esa.nl">jlebreton@estec.esa.nl</a></td>
</tr>
<tr>
<td><strong>DISR</strong> Descent Imager and</td>
<td>Martin G. Tomasko</td>
<td>Jean-Pierre Lebreton</td>
</tr>
<tr>
<td><strong>Spectral Radiometer</strong></td>
<td>Dept of Planetary Sciences, Lunar &amp; Planetary Lab, Univ of</td>
<td><a href="mailto:jlebreton@estec.esa.nl">jlebreton@estec.esa.nl</a></td>
</tr>
<tr>
<td></td>
<td>Arizona, Tuscon USA</td>
<td></td>
</tr>
<tr>
<td><strong>DWE</strong> Doppler Wind Experiment</td>
<td>Michael K. Bird</td>
<td>Jean-Pierre Lebreton</td>
</tr>
<tr>
<td></td>
<td>Radioastronomisches Inst, Univ Bonn, Germany</td>
<td><a href="mailto:jlebreton@estec.esa.nl">jlebreton@estec.esa.nl</a></td>
</tr>
<tr>
<td><strong>SSP</strong> Surface Science Package</td>
<td>John Charles Zarnecki</td>
<td>Jean-Pierre Lebreton</td>
</tr>
<tr>
<td></td>
<td>Unit for Space Sciences, Univ of Kent at Canterbury, UK</td>
<td><a href="mailto:jlebreton@estec.esa.nl">jlebreton@estec.esa.nl</a></td>
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### 2.12 Cassini MSSO SPICE Archive Contact

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Team</th>
<th>Archive Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPICE</td>
<td>Greg Chin</td>
<td>TBD</td>
</tr>
</tbody>
</table>

### 2.13 PDS Discipline Nodes responsible for archiving Cassini data

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Primary Node</th>
<th>Other Nodes</th>
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<tbody>
<tr>
<td>CAPS</td>
<td>PPI</td>
<td>N/A</td>
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<td>CDA</td>
<td>Small Bodies</td>
<td>Rings, PPI</td>
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<td>Atmospheres</td>
<td>Rings</td>
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<td>Imaging</td>
<td>Rings, Geosciences, Atmospheres</td>
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<td>RSS</td>
<td>Radio Science subnode</td>
<td>All</td>
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<tr>
<td>UVIS</td>
<td>Atmospheres</td>
<td>Rings</td>
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<tr>
<td>VIMS</td>
<td>Imaging</td>
<td>Rings, Atmospheres</td>
</tr>
<tr>
<td>Ancillary data, primarily SPICE</td>
<td>NAIF</td>
<td></td>
</tr>
<tr>
<td>Huygens</td>
<td>Atmospheres</td>
<td>N/A</td>
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</tbody>
</table>
3. Archive Data Flow Diagram

Inputs

- Science and ancillary data
- Peer Review Reports
- Archive volume format validation reports
- Peer Review and final archive volumes

Processing

- PIs and TIs
- MSSO
- IO
- PDS Discipline Nodes
- PDS Central Node

Prepare Archive
- Work directly with assigned PDS discipline node assigned to define data set content and format in a SIS.
- Generate, validate, and submit archive volumes containing science data products (L1A & L1B, L0 for RS), product labels documentation, source code and ancillary data.

Prepare SPICE ancillary data archive
- Work directly with NAIF node define data set content and format in a SIS.
- Generate, validate, and submit archive volumes containing SPICE ancillary data, product labels and documentation.
- Validate format of science volumes.

Coordinate Archive Production
- Catalog physical archive volumes.
- Coordinate format validation of science volumes with MSSO.
- Deliver validated archive volumes to PDS for peer review.
- Report Archive production status.
- Resolve PDS archive generation issues.

PDS Central Node
- Support Peer Review
- Deliver final archive volumes to NSSDC
- Catalog volumes at central node.

Outputs

- Peer Review volumes
- Final archive volumes
- Peer Review volumes
- Final archive volumes
- Science volume validation results
- Archive Production Status
- Volumes for peer review volumes
- Peer Review Reports
- Final archive volumes
- Final archive volumes

Project Database

SAUL

CN & DN

IO and producer

DN CN

NSSDC
4. Archive Policies

The PDS standards version that was in place when the production of a volume set began will be used for all subsequent volumes in that set.

Archive datasets will be provided to PDS by the Project submitting two copies on CD-WO, (or other appropriate medium, possibly DVD), to the PDS Discipline Nodes (DNs). The PDS DNs will provide a timely peer review of products. After successful peer review PDS DN will provide with a copy of the final archive volume. CN will send one copy of the archive to the NSSDC for deep archive, thus ensuring availability of the data to the research community over the long term.

The Cassini program internal science data sharing policies will be developed by the PSG. There is no intention for the program to provide PIs, TLs, or IDSs CD-ROM volumes or electronic access to archived data outside of the PDS during the mission.

The Cassini validation period and delivery schedule to PDS is in accordance with SMP, Section 5.

Science Data products for all investigations generated during the cruise phase of the mission shall be delivered to the PDS no later than SOI+1 year. To meet this date, the development of the archive data structures in the form of detailed SISs are required by the project for submission to PDS at SOI-2 years. This will allow enough time to accommodate possible changes in processing software due to PDS non-compliant formats.

Ancillary data, such as SPICE files, that are used in the processing of archive products may be included on archive volumes. However, a complete, independent SPICE archive will be produced by the project.

Although not required, higher level products developed by PIs, TLs, and IDSs may be archived into the PDS, if resources are available to do so. The Cassini Program recognizes those higher level products, described in section 6, are valuable and should be preserved, however funding restrictions may preclude the complete archiving of these products.

The Cassini Program will provide a regular forum for discussing archive progress and issues with the PDS, PIs, and TLs.
5. PDS High-Level Catalog Templates

Documents created from PDS high-level catalog templates will accompany archive data sets. Included are: Mission, Instrument host, Instrument, Dataset, Reference, and Personnel documents, which are defined in JPL D-7669, Planetary Data System Standards Reference. IO will provide a draft version of the Mission and Instrument Host documents to PDS at SOI-1 year. Instrument, Dataset, Reference, and Personnel documents will be provided by archive producers. Updates to these documents will be provided at least every two years if new information is available and final versions 2 months prior to end of mission.

6. Science Data Archive Products

6.1 Documentation

Documents that are relevant to understanding the archive such as the Software Interface Specifications (SISs), which define the format and content of data files are negotiated with PDS well before data products are generated. Instrument status reports will be included on archive volumes delivered to PDS. It may also be appropriate to archive high-level project documents like the Navigation Plan with the PDS.

6.2 Level 0 Data

Level 0 data for Radio Science will be archived with the PDS.

The Cassini program has a requirement to store Level 0 telemetry data (including engineering and housekeeping packets as well as science packets), in the form of Raw telemetry frames, through End-of-Mission + 1 year, which is done by MSSO. There is no commitment to archive this Level 0 telemetry data to the PDS.

6.3 Level 1 Science Data Products

The Cassini Program is committed to archiving level 1A and level 1B products for all possible instruments. However, for some Radio Science experiments level 1 data are not available and in this case level 0 will be archived. Radio Science level 0 products do not always process into level 1. See table 1.5.2 for a description of level 1A and 1B data products. A detailed list is provided in Appendix A.

For the VIMS, ISS, and RADAR Facility Instruments, IO generates Level 1A products (and also Level 1B for Radar). These products are produced by IO according to TL-approved Software Interface Specifications (SISs) and Operational Interface Agreements (OIAs). TLs are encouraged to negotiate with IO to use PDS formats for these products. If non-PDS formats are used, the TL will be required to reformat to PDS standards for archive. Whatever format is negotiated, IO-produced products are
delivered to the TL for validation and archive volume generation. These volumes are submitted to the IO archive coordinator for submission to the PDS.

### 6.4 Higher Level Science Data Products

PIs, TLs, and Interdisciplinary Scientists (IDSs) generate higher-level science products.

Although not contractually required, it is expected that higher level data products developed by PIs, TLs, and IDSs in the course of doing their data analysis will be archived into the PDS. The Cassini Program recognizes that higher level products are valuable and should be preserved; therefore, a joint effort between the Cassini Program and PDS will be made to facilitate the generation of such products in PDS compliant formats, thereby minimizing any additional effort that might occur in accomplishing this objective.

Although not required, higher level products developed by PIs, TLs, and IDSs may be archived into the PDS, if resources are available to do so. The Cassini Program recognizes that higher level products are valuable and should be preserved however funding restrictions may preclude the complete archiving of these products.

### 6.5 Public Release Data Products

Public Release products will be generated during the Cassini mission in accordance with documented Cassini/JPL/NASA policies and procedures for public information and press releases. The JPL Photolab will maintain press release products with copies distributed to the Regional Planetary Image Facility (RPIFs). The JPL Public Affairs Office will also maintain press released products.

### 6.6 Ancillary or Supplementary Data Products

#### 6.6.1 SPICE Products and NAIF Toolkit

The Mission Services and Support Office (MSSO) is responsible for generating the archive of SPICE datasets. Final versions of SPICE (SPK, PCK, IK, CK, EK, SCLK, and LSK) files will be archived on CD-WO discs (or other appropriate medium, possibly DVD) in IEEE binary format with accompanying documentation and NAIF Toolkit software. Since the latest version of the NAIF Toolkit is always backward compatible, the latest version of the toolkit will be included on archive volumes. The toolkit will be archived for all Cassini supported operating systems.

#### 6.6.2 Uplink Data Products

The Mission Services and Support Office (MSSO) is responsible for the life-of-mission storage of Cassini Uplink products. Selected uplink products will be archived in PDS in the SPICE Ekernel format. If the SPICE Ekernel is not available for any reason,
uplink products will be archived in their place on CD-WO discs with appropriate SIS documentation, and will not be in PDS format.
### Appendix A: Science and Ancillary Data Sets to be Archived with PDS by Instrument Teams

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Science Data Product</th>
<th>SIS ID</th>
<th>NASA Level</th>
<th>PDS Format IMG, etc.</th>
<th>PDS Discipline Node</th>
<th>Produces data products</th>
<th>Creates archive and supplies to IO for delivery to PDS</th>
<th>Estimated Data Set Size</th>
<th>COMMENTS</th>
</tr>
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<tbody>
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<td>1B</td>
<td>Yes</td>
<td>PPI</td>
<td>CAPS</td>
<td>CAPS</td>
<td>CAPS PI</td>
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<tr>
<td>CAPS</td>
<td>Averaged survey data</td>
<td>H</td>
<td>Yes</td>
<td>PPI</td>
<td>CAPS</td>
<td>CAPS</td>
<td>CAPS PI Higher level product</td>
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<td>Metadata</td>
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<td>CAPS</td>
<td>CAPS</td>
<td>CAPS PI</td>
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<td>CDA</td>
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<td>CDA</td>
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<td>CDA</td>
<td>CDA PI</td>
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<td>CIRS PI</td>
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<td>CIRS</td>
<td>CIRS PI Higher Level product</td>
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<td>CIRS</td>
<td>CIRS PI</td>
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<tr>
<td>CIRS</td>
<td>Software for end-user to derive target footprints from C-kernels</td>
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<td>CIRS PI</td>
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<td>SIS ID</td>
<td>NASA Level</td>
<td>PDS Format IMG, etc..</td>
<td>PDS Discipline Node</td>
<td>Produces data products</td>
<td>Creates archive and supplies to IO for delivery to PDS</td>
<td>Estimated Data Set Size</td>
<td>COMMENTS</td>
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<td>ISS TL</td>
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<td>IO, ISS</td>
<td>ISS TL</td>
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<td>MAG</td>
<td>L1A data (duplicates removed, gaps filled, idiosyncrasies of onboard data processing unit fixed, data separated into files by type)</td>
<td>1A</td>
<td>Yes</td>
<td>PPI</td>
<td>MAG</td>
<td>MAG PI</td>
<td></td>
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<tr>
<td>MAG</td>
<td>software to convert L1A to L1B</td>
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<td>Yes</td>
<td>PPI</td>
<td>MAG</td>
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<td>N/A</td>
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## Archive Plan for Science Data, 699-068 V1

<table>
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<th>SIS ID</th>
<th>NASA Level</th>
<th>PDS Format IMG, etc..</th>
<th>PDS Discipline Node</th>
<th>Produces data products</th>
<th>Creates archive and supplies to IO for delivery to PDS</th>
<th>Estimated Data Set Size</th>
<th>COMMENTS</th>
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<td>MIMI</td>
<td>MIMI PI</td>
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<td>MIMI PI</td>
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<tr>
<td>RADAR</td>
<td>Decoded data (reversible, i.e. DN &lt;-&gt; EU)</td>
<td>1A</td>
<td>Yes</td>
<td>Geosciences</td>
<td>IO/ Radar</td>
<td>Radar TL</td>
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<td></td>
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</tr>
<tr>
<td>RADAR</td>
<td>Image calibrated records (SAR strips)</td>
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<td>Yes</td>
<td>Geosciences</td>
<td>IO/ Radar</td>
<td>Radar TL</td>
<td>product produced by IO (according to TL-approved SIS), delivered to Radar TL who in turn archives to PDS</td>
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<td>Instrument</td>
<td>Science Data Product</td>
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<td>RADAR</td>
<td>Altimeter calibrated records</td>
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<td>CRST</td>
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<td>RADAR</td>
<td>Detailed science applications; topographic studies, etc.</td>
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<td>Geosciences</td>
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<td>RPWS</td>
<td>RPWS PI</td>
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## Appendix B: Radio Science and Ancillary Data Products to be Archived with PDS

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<th>Experiment</th>
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<td>*produced by DSN, IO makes product available to RST. PDS labels generated by RST</td>
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GWE - Gravitational Wave Experiment  
GM - Gravity Field and Mass Determination Measurements  
OM - Occultation Measurements  
EI - Ephemeris Improvement  
SWS - Solar Wind Scintillation  
HGAC - High Gain Antenna Calibration
### Appendix C: Ancillary Data Sets to be Archived with PDS by Cassini Project

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## Appendix D. Archive Schedule

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**Legend**
- Data Collection Period
- Mission Event
- Archive submissions to PDS
- Final validated submission due to PDS for this phase

* Final validated submission due to PDS for this phase
# Appendix E: Acronyms

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<td>LSK</td>
<td>SPICE leapseconds data</td>
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<td>MIMI</td>
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<td>Multimission Image Processing System</td>
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<td>M&amp;DA</td>
<td>Mission Operations and Data Analysis</td>
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<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
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<td>MP</td>
<td>Mission Plan</td>
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<td>MSSO</td>
<td>Mission Science and Support Operations</td>
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</table>
**MSOC**  Mission and Science Office Coordinator  
**NAIF**  Navigation and Ancillary Information Facility  
**NASA**  National Aeronautics and Space Administration  
**NSSDC**  National Space Science Data Center  
**OSSA**  Office of Space Science and Applications  
**OTL**  Operations Team Leader  
**PCK**  SPICE target (planet, etc.) size, shape and orientation  
**PDMP**  Project Data Management Plan  
**PDS**  Planetary Data System  
**PI**  Principal Investigator  
**PPRD**  Program Policies & Requirements Document  
**RPIF**  Regional Planetary Image Facility  
**RPWS**  Radio and Plasma Wave Spectrometer  
**PSG**  Program Science Group  
**RST**  Radio Science Team  
**RSS**  Radio Science Subsystem  
**SAUL**  Science and Uplink Office  
**S/C**  Spacecraft  
**S/W**  Software  
**SCLK**  SPICE spacecraft clock coefficients  
**SFDU**  Standard Formatted Data Unit  
**SIS**  Software Interface Specification  
**SMP**  Science Management Plan  
**SOI**  Saturn Orbit Insertion  
**SPICE**  Spacecraft, Planet, Instrument, C-matrix, Events  
**SPK**  SPICE Spacecraft and target (planet, etc.) ephemeris  
**TL**  Team Leader  
**TM**  Team Member  
**UDR**  Unprocessed Data Record  
**UVIS**  Ultraviolet Imaging Spectrograph  
**VIMS**  Visual and Infrared Mapping Spectrometer
Appendix F: To be Resolved List

<table>
<thead>
<tr>
<th>Unresolved Items</th>
<th>Comments</th>
<th>Due Date</th>
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<tbody>
<tr>
<td>1. A commitment is needed from all teams to archive 1A and 1B products</td>
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<tr>
<td>2. A MSSO PDS rep needs to be identified.</td>
<td>Section 2</td>
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<tr>
<td>3. Should the SPICE data archive generation be allocated to another team?</td>
<td>It is currently allocated to MSSO. A team with more SPICE experience and expertise may be a better match.</td>
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<tr>
<td>4. Should Geosciences be listed as an &quot;other node&quot; for receipt of CIRS data?</td>
<td>(PDS node for surface data to icy satellites-down to the surface of Titan, or just real close.) Section 5.2</td>
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<tr>
<td>5. Is there a formal interface between Cassini &amp; Regional Planetary Imaging Facilities (RPIFs)?</td>
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<tr>
<td>6. SIS ID, data set formats and size is needed.</td>
<td>Appendix A</td>
<td></td>
</tr>
<tr>
<td>7. Clarify arrangement between CDA instrument and PDS Small Bodies Node (Dust Subnode). How is data delivered, what format, what is PDS responsibility?</td>
<td>Appendix A</td>
<td></td>
</tr>
<tr>
<td>8. include SIS ID, data formats and structure, volume id/ set names, etc. in Appendix A</td>
<td>Appendix A</td>
<td></td>
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<tr>
<td>9. Incorporate details on Huygens archive products and representatives.</td>
<td>Section 2.11</td>
<td></td>
</tr>
<tr>
<td>10. Will products that are press released or used in journal articles be archived? For example ISS and Radar Movies or videos.</td>
<td>Section 4</td>
<td></td>
</tr>
<tr>
<td>11. CIRS surface and rings data need to be included (John Pearl is lead CO-I @ GSFC for surfaces, Linda Spilker for rings)</td>
<td>Appendix A</td>
<td></td>
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<tr>
<td>12. Will the Cassini PSG develop a data release and sharing policy?</td>
<td>Section 4</td>
<td></td>
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<tr>
<td>13. Do we need a formal agreement with PAO to maintain press released products?</td>
<td>6.5</td>
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<tr>
<td>14. What other project documentation needs to be sent with data to the PDS?</td>
<td>Appendix C.</td>
<td></td>
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<tr>
<td>15. The SPICE archive is too vague. What has been done for other mission archives?</td>
<td>6.6.1</td>
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<td>16. Should it be required that all ancillary data used in preparation of an archive be sent to PDS?</td>
<td>4.</td>
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<tr>
<td>Unresolved Items</td>
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<td>--------------------------------------------------------------------------------</td>
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<tr>
<td>17. For CN to distribute archive volumes, distribution lists and artwork is</td>
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<td>required.</td>
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<td>18. NASA data level nomenclature is not well defined for planetary missions.</td>
<td>1.5.2</td>
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<tr>
<td>The table was updated based on inputs from several people. Reference: NASA NM1</td>
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<td>8030 or &quot;Issues and Recommendations Associated with Distributed Computation</td>
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<tr>
<td>and Data Management System for the Space Sciences&quot;, pages 31-32, produced by</td>
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<tr>
<td>the Committee on Data Management and Computation (CODMAC)</td>
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<td>19. TMOD's network simplification plan will cause ODFs and ATDFs to go away.</td>
<td>Appendix B</td>
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<td>What is the timeframe? After SOI?</td>
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<td>20. Does appendix A represent a list of products committed to be archived to</td>
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<td>PDS by PIs and TLs?</td>
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<tr>
<td>21. What does the IO-agent do? Who makes final decisions if an agreement is not</td>
<td>Section 2.4 and 4.</td>
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<td>reached?</td>
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<td>22. Appendix A does not mention the VIMS stellar occultation mode. Data obtained</td>
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<tr>
<td>in this mode should go to Rings or possibly Atmospheres.</td>
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<td>23. &quot;Level 1A data even with documentation and software are going to be much</td>
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<td>harder to sue than processed data. My experience has been that when PPI have</td>
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<tr>
<td>archived only level 1A data, documentation and software, the data are much</td>
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<tr>
<td>less useful than cases where the investigators have provided processed data as</td>
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<tr>
<td>well as level 1A data.&quot; - Ray Walker</td>
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<tr>
<td>Resolved Items</td>
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<tr>
<td>-------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
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<tr>
<td>1. policy concerning Cassini “validation period”</td>
<td>Defined in SMP, also see section 4.</td>
<td></td>
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<tr>
<td>2. Does Instrument Operations Team generate the program-wide catalog templates? Should there be a commitment to update catalog templates more frequently than every two years as written here?</td>
<td>See Section 2.4</td>
<td></td>
</tr>
<tr>
<td>3. Will sequence products be archived by PDS NAIF node, or is E-kernel sufficient?</td>
<td>See section 6.6</td>
<td></td>
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<tr>
<td>4. Add information about process for retaining control of archive production &amp; validation</td>
<td>See dataflow diagram in section 3.</td>
<td></td>
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<tr>
<td>5. Question: which nodes will archive ISS data other than the PDS Image node?</td>
<td>Section 2.13</td>
<td></td>
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<tr>
<td>6. What is NSSDCs role? Does NSSDC “fill large delivery orders to the science community”?</td>
<td>See section 2.8</td>
<td></td>
</tr>
<tr>
<td>7. Higher level products identified for archive in Appendix A -- is this consistent with PDMP archive policy? (i.e. are these the products generated for program requested publications? if not, who is supplier?)</td>
<td>See section 4.</td>
<td></td>
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<tr>
<td>8. Identify PDS node that will archive each of the ancillary products</td>
<td>See appendix A.</td>
<td></td>
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<tr>
<td>9. include Validation periods in Archive Schedule</td>
<td>Validation period is from the time data is acquired until the due date in Appendix C</td>
<td></td>
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<tr>
<td>10. include process/flow diagram showing archive from Teams of the Science Operations Office to PDS nodes</td>
<td>See section 3 dataflow diagram.</td>
<td></td>
</tr>
<tr>
<td>11. Is it true that MSSO or instrument team sends archive volumes to PDS CN, or do they get sent to DN s? Are templates sent direct to DN or to CN? Who forwards the volumes to NSSDC?</td>
<td>IO sends volumes to PDS DN. See data flow in section 2 and roles and responsibilities in section 2.</td>
<td></td>
</tr>
<tr>
<td>12. What is archive medium? CD-WO, DVDs, other?</td>
<td>See section 1.5.1.</td>
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<tr>
<td>13. policy concerning science data taken during cruise</td>
<td>See section 4. Also resolved in SMP.</td>
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<tr>
<td>14. do Level 0 records (i.e. science and housekeeping packets) get archived after life of mission? what is the requirement? where is this archive maintained (PDS, NSSDC, JPL organization?)</td>
<td>No requirement. see section 4. (Transfer frames are archived during the life of the mission, not packets)</td>
<td></td>
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<tr>
<td>15. Data set supplier needs to be identified for each dataset</td>
<td>See appendix A.</td>
<td></td>
</tr>
<tr>
<td>16. what needs to get archived to JPL archives? only documentation as described in section 4.1?</td>
<td>Covered in a separate document.</td>
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</tbody>
</table>
## Distribution List

<table>
<thead>
<tr>
<th>Name</th>
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<tr>
<td>A'Hearn, Mike</td>
<td>PDS Small Bodies Node, University of Maryland, Astronomy Dept., College Park, MD 20742-2421</td>
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<tr>
<td>Acton, Charles</td>
<td>PDS NAIF Node, JPL</td>
</tr>
<tr>
<td>Arvidson, Ray</td>
<td>PDS Geosciences Node, Washington University, 1 Brookings Drive, St. Louis, MO 63130</td>
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<tr>
<td>Beebe, Reta</td>
<td>PDS Atmospheres Node, New Mexico State Univ, Las Cruces, NM 88003</td>
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<tr>
<td>Bergstrahl, Jay</td>
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<td>Elliott, Matt</td>
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<td>Huber, Lyle</td>
<td>PDS Atmospheres Node, Department of Astronomy, MSC4500 New Mexico State Univ. P.O. Box 30001, Las Cruces, NM 88003-8001</td>
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<tr>
<td>PDS Rings Node, Ames Research Center, MS 245-3, Moffett Field, CA 94035-1000</td>
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### Archive Plan for Science Data

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<tr>
<th>Name</th>
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<tr>
<td>Simpson, Richard</td>
<td>PDS Radio Science</td>
</tr>
<tr>
<td></td>
<td>Adviser, Electrical</td>
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<tr>
<td></td>
<td>Engineering Dept.,</td>
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<td></td>
<td>Stanford University,</td>
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