

Genesis

Project Data Management Plan

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Genesis Project Data Management Plan

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CHANGE LOG

DATE	SECTION	CHANGE
8/7/00	All	First draft
9/18/00	Most	Second draft
11/2/00	6.x 4.0 2)	Added new section on sample handling Changed time to public release to 3 months
12/9/00	Several Several, including signature page, text, Table 1 and Figure 2	Fixed minor formatting problems and misc errors Accepted all minor changes proposed by M. Neugebauer and most changes proposed by D. Jarrett. Also made a few other "minor" corrections.
1/11/01	2.4, pr. 2, sen. 2 4.0, item 2	Revised statement of data to be produced Clarified schedule of archive production
1/31/01	Sig. Pg.	Changed program mgr. to program scientist-W.E.
2/6/01	6.2	JSC made a few minor changes, marked on the document (the addition of a comment about one data product, a curation catalog, we will provide and the shortening of subsequent sentences).K.Cyr
2/15/01	6.2	I added two words to the JSC changes. D. Burnett

ACRONYMS

AIE	Ancillary Information Element
CAPTEM	Curation and Analysis Planning Team for Extraterrestrial Materials (at JSC)
Co-I	Co-Investigator
DM&A	Data Management and Archive Team
EDR	Experiment Data Record
GDS	Ground Data System
IPT	Integrated Product Team
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
LANL	Los Alamos National Laboratory
LMA	Lockheed Martin Astronautics
MMO	Mission Management Office (part of TMOD)
NAIF	Navigation and Ancillary Information Facility
NSSDC	National Space Science Data Center
PCAR	Planning, Control and Recovery Team
PI	Principal Investigator
SPICE	Spacecraft, Planet. Instrument, C-matrix, Events
TDS	Telemetry Data Server
TMOD	Tracking and Mission Operations Directorate

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1.0 INTRODUCTION

1.1 Purpose

This document provides a high-level plan for the generation, validation, and transfer to NASA archives of the Genesis digital archives, documentation, and related algorithms and software. The second purpose is to delineate plans for the release of selected data through Press Conferences and the posting of a subset of data and documentation that shows interesting and timely results on the Internet. The third purpose is to outline plans for curation and distribution of returned samples.

1.2 Scope

This plan covers production and archival of Level 0 (packet), Level 1 (raw) and Level 2 (derived) science data and related Level 6 ancillary data to be acquired during the Genesis Mission. It also addresses curation of returned samples.

Specific activities addressed in this plan are:

1. Reduction of telemetered science packet data (i.e., packetized Level 0 data) to Level 1 Experiment Data Records (EDRs), with associated documentation.
2. Generation of SPICE Level 6 ancillary data for use with allied software from the Navigation and Ancillary Information Facility (NAIF).
3. Generation and validation of archive volumes containing Level 0 packet and engineering data, Level 1 EDRs, and SPICE kernels¹, along with associated documentation.
4. Delivery to the PI, Co-Is and National Space Science Data Center (NSSDC) of validated Genesis archives.
5. Release of limited data to the general public through news conferences and through the posting of data on the Internet.
6. Science Team production and archival of Level 2 derived data products.

¹ "Kernel" is simply a special name for a file. The terms "kernel" and "kernel file" both refer to SPICE ancillary data files.

7. Curation and distribution of returned samples.

This document does not address the production, use or disposition of project data other than the science and ancillary data and samples mentioned previously.

1.3 Contents

This plan begins with overviews of the Genesis Mission and the Ground Data System (GDS). This is followed by a description of the data release policies, archive collections, sample handling and roles and responsibilities for organizations and personnel associated with the generation, validation, archiving and sample curation of Genesis data.

1.4 Applicable Documents and Constraints

This Genesis Project Data Management Plan is responsive to the following NASA HQ and Project documents pertaining to the management and archive of project data:

Announcement of Opportunity, Discovery Program, AO-96-OSS-02, September 20, 1996.

OSSA Program Directive, Science Data Management Policy, March 5, 1992.

2.0 THE GENESIS MISSION

2.1 Mission Overview

Genesis is the fourth NASA Discovery Mission. Prof. Donald Burnett of the California Institute of Technology is Principal Investigator (PI). The Jet Propulsion Laboratory manages the project for NASA. The spacecraft and sample return capsule are built by Lockheed Martin Astronautics (LMA) and the science instruments are provided by Los Alamos National Laboratory (LANL). JPL, LMA and LANL partner in operation of the mission. The Co-Is at LANL and JPL participate in the data analysis, preparation and archival of derived digital data products, and the operation—during the mission lifetime—of an on-line data display/access mechanism.

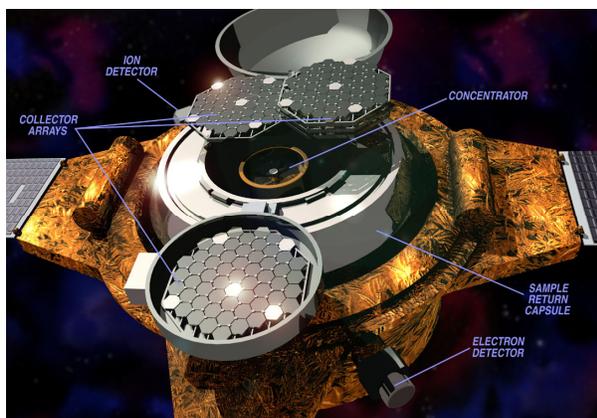


Figure 1. Genesis Spacecraft

The spacecraft has two in-situ digital science instruments to provide on-board control of solar wind collection and contextual science data supporting interpretation of the returned solar wind particles.

Genesis will return extremely pure samples of the solar wind ions. All samples will be returned to Earth for detailed analysis in specialized microanalysis laboratories around the world. Extensive discussions and justification of the science value of this mission can be found in the original Genesis Discovery Proposal and on the Genesis homepage:

<http://genesis.jpl.nasa.gov/>

2.2 Ground Data System

The Genesis Ground Data System is provided by a combination of LMA Spacecraft Operations, JPL's Mission Management Office (MMO), and Genesis Project teams at JPL. Because of the simplicity of the science and engineering instruments providing science data (minimal commanding and monitoring), low data rates and a small science team, Genesis will not provide a Science Operations and Planning Computer (SOPC) to the PI or Co-Is. Instead, a Genesis Data Management and Archive Team (DM&A) function will be provided by the JPL Navigation and Ancillary Information Facility (NAIF) to extract science channelized and packetized telemetry, convert these data to Level 1 Experiment Data Records, produce the SPICE kernels and associated software, and provide the interface to the PI/Co-Is for these products. DM&A will also produce the Level 1 and ancillary archival data volumes.

The DM&A Team will work with the LANL Co-I team to define EDR file formats and contents with

the intent of achieving substantial similarity with data products produced by similar instruments on other spacecraft, such as ACE and Ulysses. This approach will allow science team use of these data with minimal revision to existing software.

The Co-I team at LANL is responsible for retrieving the EDRs and SPICE kernels from the Genesis project database for use at the home site to produce higher-level (derived) archival products and science results. Production and archival of derived science data products (Level 2 or higher) is conducted by LANL under auspices of the Genesis Science Integrated Product Team, managed by the PI.

The science-oriented downlink data flow is depicted in Figure 2.

2.3 Experiment Overview

The solar wind monitors used to control the particle collection mechanism (collectors) are treated as science instruments. Data from these monitors will be returned to Earth on approximately a weekly basis and will be examined by Co-Is at LANL and JPL. These investigators will track the performance of the instruments and the on-board algorithm for determination of the solar wind regimes, and will request modifications to the algorithm if necessary. Requests for unscheduled instrument calibrations and associated data downlink may also be made.

The monitor data will be used to calculate (1) the total fluence of hydrogen and helium on each set of collectors as a function of energy, and (2) an estimate of any mass fractionation correction to be made to the analyses of concentrator target materials. The monitor data will also be used to place the returned samples in the context of solar-cycle and other variations in the solar wind. These calculations and analyses will be published as a Project Document and distributed to all Genesis Investigators and to the sample curatorial facility at Johnson Spaceflight Center for forwarding to those who receive Genesis samples for analysis. The document will be published within six months of the return of the samples to earth.

2.4 Science Data Processing Overview

Unprocessed monitor data and allied ancillary and housekeeping data will be provided by the project Data Management and Archive (DM&A) team

(a.k.a. Ancillary Information Element, or AIE) to the Co-I team as Experiment Data Records (EDRs). These data will also be written to a permanent archive medium (CD-R or DVD) and provided to the science team and the National Space Science Data Center (NSSDC).

Derived results will be provided to the NSSDC on a continuing basis throughout the mission. The data provided will include one-dimensional proton density, alpha density and proton temperature, three-dimensional proton velocity and an indicator of the presence of bi-directional electron streaming. The data will be provided at both full temporal resolution (nominally 2.5 minutes) and as hourly averages. Accompanying these data will be relevant observing geometry conditions, such as spacecraft location relative to the earth and sun. Also to be provided are documentation concerning the instrument design, performance, and calibration. All of these data will be provided to the NSSDC via electronic file transfer.

3.0 PUBLIC INFORMATION RELEASE POLICY

Public information release includes press conferences and written material concerning both mission operations and scientific analyses occurring during the active life of the flight project. Specific policy statements for Public Information Release for the Genesis Mission are described below.

1. Information concerning spacecraft and instrument anomalies may only be released by the Genesis Project Manager, in coordination with LMA, the NASA Discovery Program Office and the Principal Investigator.
2. Information concerning normal mission status (non-anomalous conditions) excluding science results, may be released by the PI, the Genesis Project Manager, the project's public outreach officials, the JPL Public Information Office, the NASA Discovery Program Office, LMA's Genesis Program Office and LANL's Genesis Program Office, or designees thereof. The broad dissemination of such information is highly encouraged as long as due care is taken to ensure the information is correct and is reasonably current.
3. Information concerning scientific results may be released during press conferences and press releases organized by the Genesis Project

and JPL's Public Information Office, in coordination with the NASA Discovery Program Office and the Principal Investigator.

4. Before data are deposited in the NSSDC, information concerning scientific results from a given study may only be released by the PI or by Co-Is with prior concurrence of the PI. The Genesis Project Manager must receive, in advance of the release, a copy of the release material, a schedule for the release, and a statement of the mechanisms for release. The intent is not to require concurrence for the release, but only to make sure that the PI, Genesis Project, the Jet Propulsion Laboratory Public Information Office, and the NASA Discovery Program Office are informed of the releases before they happen.

4.0 DATA RIGHTS AND RELEASE POLICY

Prompt release to the space science community of validated digital data products and the ancillary information needed to interpret those data is of paramount importance to all NASA missions. The Genesis science team commits to the timely validation of Level 1 and associated ancillary data provided by DM&A, and to the timely production, validation and archival of derived data products.

1. Approval for archive production of Level 1 EDR data and associated SPICE and other ancillary data shall be regularly given, covering three month chunks and provided no later than three months after receipt at LANL of the last data comprising the three month set.
2. Preliminary production, validation and archiving of derived Level 2 data products shall be done for three-month chunks of data and shall be completed within three months of receipt from DM&A of EDR and SPICE data for the subject period of time. Certification of the preliminary data products by the Science Team will occur within six months of preliminary validation. All data will be certified within six months of the end of mission.
3. All data delivered to the NSSDC must meet NSSDC archive standards. Once deposited with the NSSDC the data may be freely distributed by the NSSDC to other investigators and the general public in accordance with NSSDC data distribution policy.

5.0 DIGITAL ARCHIVE COLLECTIONS

Table 1 summarizes the digital archive collection components, and Table 2 summarizes the suppliers of these data.

5.1 *Science and Engineering Data Packets*

Instrument raw science data will consist of data packets produced by the instruments, together with engineering information defining the operational state of the instruments. Unchannelized science instrument packet data and channelized engineering telemetry will be accessed within the firewall on the Telemetry Data Server (TDS) by Genesis Data Management and Archive during EDR production. The TMOD/MMO will produce "safed" archive volumes containing packet data and relevant engineering data. These will be stored at the JPL NAIF facility in the unlikely event that science packet data must be reprocessed into EDRs, or that other engineering data must be examined.

5.2 *Standard Science Data Products*

Standard Data Products are those Level 1 data objects generated from science packets. Science Standard Data Products will be generated by DM&A from science packet data, and will be validated by the Instrument Team. Standard Products are sometimes called operational products in other missions, since they are produced routinely using well-defined procedures.

5.3 *SPICE Data Products*

Navigation and other ancillary data in SPICE formats will be generated from appropriate sources using well-defined procedures. Such products are sometimes referred to as Level 6 data.

Small Forces Files, while not SPICE products, will be included in this archive collection.

This SPICE collection will not include the SPICE Toolkit; that is archived by NAIF separately and asynchronously relative to any particular mission. It is available from NAIF directly or via the Central Node of the Planetary Data System. (The SPICE Toolkit is also safed at the NSSDC.)

5.4 *Derived Science Data Products*

Derived data products are products derived from Level 1 (EDR), calibration data and SPICE products. They are produced during the course of scientific research. Derived Data Products will be delivered directly to the NSSDC via electronic file transfer by the investigator who produced the product, under auspices of the Science Integrated Product Team. This collection will include a document of monitor data analysis. It will also include all pertinent calibration data, whether from ground (pre-launch) or flight, and descriptions of how to apply these calibration data.

6.0 SAMPLE HANDLING

6.1 *Early Science Return*

Allocations of samples for early science return studies shall be completed five months after recovery of the Genesis payload on Earth.

Publication of early science return shall be carried out by eighteen months after recovery of the Genesis payload on Earth.

6.2 *Allocation of General Samples*

Following recovery, the canister containing the collector arrays and the concentrator shall be taken to the receiving and curatorial facility at Johnson Space Center (JSC), the designated NASA Center for curation of extraterrestrial materials.

Materials for study shall be provided to PIs (both US and non-US) from the NASA Planetary Materials and Geochemistry Discipline Science programs by the Curatorial Facility of the Johnson Space Center (JSC) based on recommendations of a Sample Allocation Committee (SAC). The SAC will be a subcommittee of the general allocation committee now known as CAPTEM.

This process follows well-developed procedures with deep heritage going back to Apollo lunar sample allocations. In addition to SAC operation, these procedures cover the selection of SAC members, the frequency of meetings, etc. The SAC also serves as a monitoring and advisory committee to the JSC Curatorial Facility on issues relating to minimizing contamination during the handling and storage of collector materials

Prior to the first allocation of samples for general studies, the JSC Curatorial Facility shall make available a catalog characterizing the returned collectors. PIs requesting samples may use the catalog to facilitate their selection of requested samples.

Allocation of samples (through the SAC process) for the first round of general studies shall be completed twelve months after touchdown of the Genesis payload on Earth. Subsequent allocation of samples (through the SAC process) shall be completed at least yearly.

7.0 ROLES AND RESPONSIBILITIES

In this section the roles and responsibilities for personnel and organizations involved in Genesis archive generation, validation, transfer, and distribution are summarized.

7.1 *Oversight of Archive Process*

The Project Manager and PI provide an oversight function for implementation of the Project Data Management Plan.

7.2 *Planning, Control and Recovery Team (PCAR)*

Under auspices of the Planning, Control and Recovery Team elements TMOD/MMO is responsible for producing and delivering to NAIF the archive volumes containing Level 0 packets and engineering files. This collection need include only those items needed to produce the Level 1 products. These volumes will only be safed at JPL/NAIF.

Using the packet data provided by TMOD/MMO and operations files produced within the PCAR operations the DM&A will produce separate archive volumes containing Level 1 EDRs and Level 6 SPICE files. The science Co-I team is responsible for validating the EDR archive collection and advising DM&A of any corrections needed. DM&A is responsible for validation of the SPICE data, although the LANL Co-I team is expected to contribute to this validation through use of these data.

The DM&A archive products will include Software Interface Specifications (SISs) for the EDR and SPICE files. It will also include appropriate project documents.

DM&A will deliver a complete set of the archival data specified above to the PI, the Co-Is, and the NSSDC (excepting safed data).

7.3 *PI and Science Team*

The PI and Co-I team at LANL are responsible for validation of the EDR data supplied by DM&A. They are also responsible for contributing performance and similar information to the SPICE

Experimenter's Notebook (ENB), which will be included in the DM&A-produced archive.

The PI and Co-Is are responsible for production of derived digital data products (Level 2 or higher), calibration data, instrument descriptions, and instrument performance. These will be provided directly to the NSSDC under cognizance of the PI.

7.4 *National Space Science Data Center*

The National Space Science Data Center will maintain a "deep archive" of the EDR data for long-term preservation, and will host the derived data on its space physics data display/access server. The NSSDC will distribute the derived digital data products to the science community and the general public in accordance with its current operating policies.

7.5 *Johnson Space Center Curatorial Facility*

The Sample Curatorial Facility at the Johnson Space Center has responsibility for receiving, storing, and distributing the samples according to the directions of the Sample Allocation Committee (SAC). The SAC operates under the auspices of the NASA Planetary Materials and Geochemistry Discipline Program and the Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM), a standing committee of scientists who advise NASA on the care and use of lunar samples. CAPTEM checks for favorable peer review and appropriate sample selection.

8.0 ACKNOWLEDGEMENT

M. Neugebauer (JPL) contributed portions of this document and other portions were taken from the Genesis Discovery Proposal, to which many authors contributed.

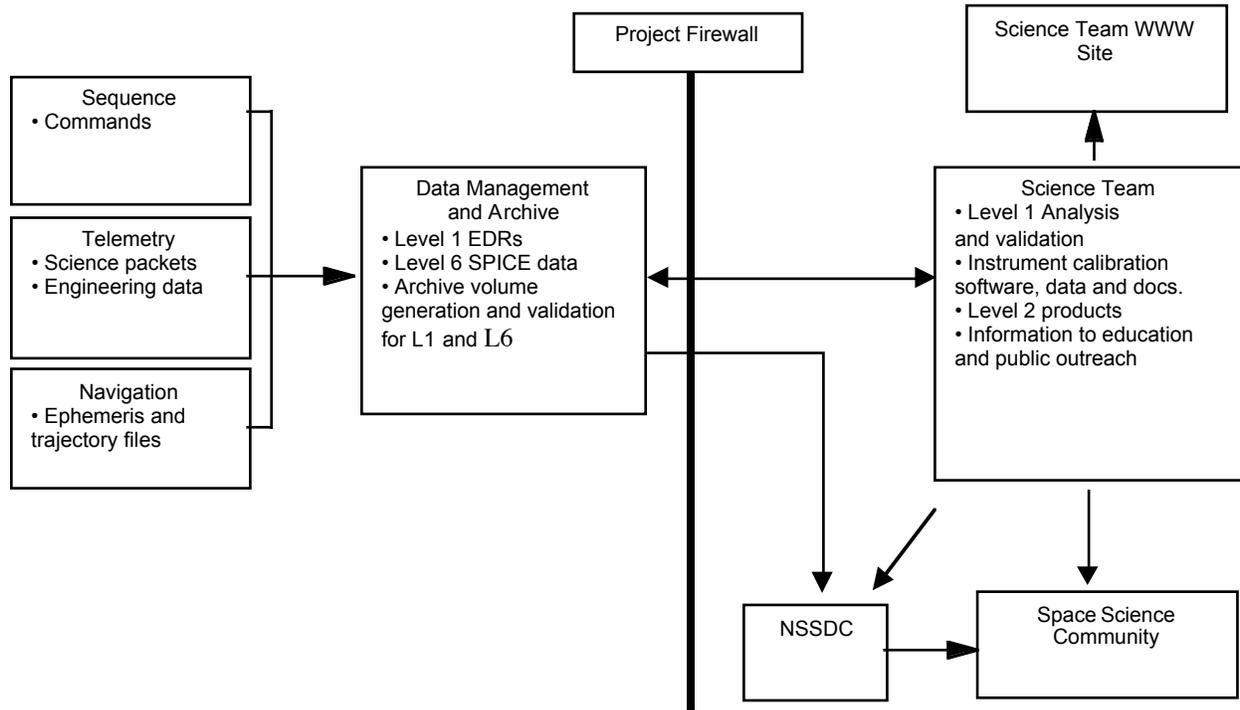


Figure 2. Genesis Downlink Science and Ancillary Data Flow

TABLE 1. Components of Genesis Digital Archive Collections**Level 0 Packet and Engineering Data ("Safed" data, not archived with NSSDC)**

- Archive Collection and Volume Software Interface Specification Documents
- Level 0 Science Packet Data Products
- Engineering File Data Products

SPICE Archive Collection

- SPICE Kernel Software Interface Specification Documents
- SPICE Kernels
- Small Forces Files

Science Standard Data Products Archive Collections

- EDR Software Interface Specification Document
- Level 1 EDRs
- Archive quality project documentation

Science Derived Data Products Archive Collections

- Level 2 reduced data
- Archive quality documentation for the Level 2 data

TABLE 2. Genesis Archive Collection Component Suppliers**TMOD / TCDM**

- Level 0 packet and engineering data archive

PCAR/Data Management and Archive Team (DM&A)

- Level 1 EDRs
- SPICE kernel files (except SPK)
- Small Forces File
- Project documentation
- Experimenter 's Notebook contributions

PCAR/Spacecraft Team (SCT)

- Experimenter's Notebook contributions

PCAR/Navigation Team (NAV)

- SPK files
- Experimenter 's Notebook contributions

PI and Science Integrated Product Team

- Experimenter's Notebook contributions
- Report on monitor operations and results
- Derived digital data products (Level 2 or higher)

APPENDIX I — Glossary of Selected Terms

Archive Collection — Data Products, supplemental data, software, and documentation that are logically linked to facilitate their use and administration.

Archive Volume — A volume represents a single unit of media such as a CD-ROM or DVD. Within each volume is a directory structure, listing the subdirectories and files contained on that volume.

Data Product — A labeled grouping of data resulting from a scientific observation. A product label identifies, describes, and defines the structure of the data. Examples of data products are images, spectrum tables, and time series tables.

Data Set- A logical grouping of data products.

Experiment Data Record -- Level 1.0 data product produced from instrument packet data, with appropriate metadata.

Science Packets — Level 0 (raw) data for a given instrument in packetized form.

Derived Data Products -- Derived from Level 1.0 products by use of data analysis, data transformation in space, spectra and/or time. Examples include dust models, 3-dimensional topography models and map products.

Standard Data products— Reduced data record generated in standard or predefined way using well-understood procedures. Processed in "pipeline" fashion.