



**National Aeronautics
and Space Administration**

**October 1, 2003
NRA 03-OSS-04**

RESEARCH ANNOUNCEMENT

Operation of the Discipline Nodes of NASA's Planetary Data System (PDS)

NOI Due Date:
Proposal Due Date:

**October 30, 2003
January 8, 2004**

OMB Approval No. 2700-0087

RESEARCH ANNOUNCEMENT

**Operation of the Discipline Nodes of NASA's
Planetary Data System (PDS)**

**Soliciting Proposals to Become
Discipline Node Managers
of NASA's Planetary Data System (PDS)**

**Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001**

Table of Contents

1.0 INTRODUCTION AND BACKGROUND.....	1
2.0 INSTRUCTIONS FOR PREPARATION/SUBMISSION OF PROPOSALS.....	2
3.0 OSS EDUCATION AND PUBLIC OUTREACH PROGRAM.....	3
4.0 SUMMARY OF INFORMATION APPLICABLE TO THIS NRA	5
5.0 CONCLUSION	6
APPENDIX A: Overview of the PDS Discipline Nodes.....	A-1
1.0 OVERVIEW OF DISCIPLINE NODES OF THE PDS.....	A-1
1.1 Scope of the Planetary Data System.....	A-1
1.2 Structure of the Planetary Data System	A-1
1.3 Purposes and Responsibilities of Discipline Nodes	A-4
1.4 Operation of Discipline Nodes	A-5
1.5 Data Expected Over the Next Five Years	A-7
1.6 Program Management Information	A-8
2.0 ORGANIZATION AND CONTENT OF PROPOSALS	A-9
2.1 Introduction.....	A-9
2.1.1 <i>Scope of Proposed Discipline Nodes</i>	A-10
2.1.2 <i>Existence/Relationship of Subnodes and Data Nodes to Discipline Nodes</i>....	A-10
2.1.3 <i>Functional and Operational Support of the PDS</i>	A-10
2.1.4 <i>Research Enhancement</i>	A-11
2.1.5 <i>Management Approach</i>	A-12
2.2 Budget Details.....	A-12
3.0 PROPOSAL EVALUATION AND SELECTION.....	A-13
3.1 Evaluation Criteria	A-13
3.2 Evaluation and Selection Techniques	A-13
4.0 ADMINISTRATION OF FUNDING	A-14
APPENDIX B: Current Discipline Nodes and Points of Contact.....	B-1
APPENDIX C. Existing Discipline Node Infrastructure.....	C-1

OPERATION OF THE DISCIPLINE NODES OF NASA'S PLANETARY DATA SYSTEM (PDS)

SUMMARY OF SOLICITATION

1.0 INTRODUCTION AND BACKGROUND

This NASA Research Announcement (NRA) solicits proposals for Discipline Nodes of the NASA Planetary Data System (PDS) for a nominal period of performance of five years, starting on or about August 2, 2004. An opportunity for new participation in the PDS exists at this time because of the expiration of the last five-year grants awarded to the current PDS Discipline Node Institutions. Appendix A provides details of the research expertise and services to be provided by the Discipline Nodes. The current Discipline Node institutions (see Appendix B) are eligible to propose and compete for an additional term.

Participation in this solicitation is open to all categories of U.S. and non-U.S. organizations, including industry, educational institutions, nonprofit organizations, NASA centers, and other U.S. Government agencies. Participation by non-U.S. organizations in this program is encouraged subject to NASA's policy of no-exchange-of-funds (see further information in the *NASA Guidebook for Proposers* discussed in Section 2.0 below). The data maintained by the PDS is fully open to the international community in accordance with NASA's data policies.

Proposals to this NRA must request periods of performance of five years. Budget requests should be proposed on an annual basis, beginning August 2, 2004. Pending the submission of an adequate number of proposals of merit, NASA expects to select up to six proposals. The expected total level of funding available to be divided among these PDS members for the first full year is approximately \$4.5 M, which is expected to increase with inflation for the remaining years of the awards. Note that all budget figures are subject to change as a result of the annual Federal budget process.

Appendix A, Section 1 includes a general discussion of the scope of the Planetary Data System, including the functions of Discipline Nodes, their purposes and responsibilities, the support that will be provided by NASA, contributions as may be optionally provided from proposing institutions, transition of functions from existing Discipline Nodes to newly-selected Discipline Nodes, and additional management topics that the proposers should address.

Appendix A, Section 2 addresses the guidelines for organization and contents of proposals in response to this NRA. Appendix A, Section 3 describes how NASA will evaluate proposals to this NRA and summarizes the selection process. Appendix A, Section 4 describes how funds to the selected proposer organizations will be administered.

Appendix B provides points of contact within the current PDS Discipline Nodes, including available hyperlinks to the Discipline Node web pages, and Appendix C provides details on the infrastructure of the currently existing PDS Discipline Nodes.

NASA policy firmly states that safety is a top priority for all of its programs, where safety is defined as meaning the freedom from those conditions that can cause death, injury, occupational illness, damage to or the loss of equipment or property, or damage to the environment. NASA's safety priorities are to protect: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including employees working under NASA award instruments), and (4) high-value equipment and property. All proposers to this NRA are advised to propose accordingly.

The program covered by this solicitation has been certified as not being subject to the requirements of NASA Policy Guide (NPG) 7120.5B.

2.0 INSTRUCTIONS FOR PREPARATION/SUBMISSION OF PROPOSALS

The policies and procedures for the preparation and submission of proposals, as well as those for NASA's review and selection of proposals for funding, are now presented in a separate document entitled *Guidebook for Proposers Responding to NASA Research Announcements – Edition January 2003* (abbreviated as *NASA Guidebook for Proposers*) that is accessible by opening the single Web site portal for the submission of proposals to any of the NASA program offices at the World Wide Web URL <http://research.hq.nasa.gov/>, and linking through the menu item "Helpful References," or by direct access at URL <http://www.hq.nasa.gov/office/procurement/nraguidebook/>.

By reference, this *NASA Guidebook for Proposers* is hereby incorporated into this NRA, and proposers are responsible for understanding and complying with its procedures before preparing and submitting their proposals. Proposals that do not conform to its standards may be declared noncompliant and returned without review. The required proposal *Budget Summary* form is now incorporated into the *Cover Page/Proposal Summary* that is accessed from the Web (see Summary Information below). After the requested data are entered, both of these forms are printed for submission with the required hard copies of the proposal.

Additional guidelines for organization and contents of proposals in response to this NRA are provided in Section 2 of Appendix A.

OSS now requires the electronic submission of certain key elements of proposals through the World Wide Web (see below in Section 4, *Summary Information*). While every effort is made to ensure the reliability and accessibility of this Web site, and to maintain a Help Desk via E-mail and telephone, difficulty may arise at any point on the Internet, including the user's own equipment. Therefore, prospective proposers are urged to familiarize themselves with this site and to submit the required proposal materials well in advance of the deadline of this NRA.

3.0 OSS EDUCATION AND PUBLIC OUTREACH PROGRAM

Part of NASA's core mission is *to inspire the next generation of Explorers . . . as only NASA can*. In response to this mandate, OSS is committed to fostering the broad involvement of the space science community in Education and Public Outreach (E/PO) with the goal of enhancing the Nation's formal education system and contributing to the broad public understanding of science, mathematics, and technology. Progress towards achieving this goal has become an important part of the broad justification for the public support of space science. OSS' work is also a significant element of the overall NASA education program. Further details on the OSS and NASA education programs may be found at <http://spacescience.nasa.gov/education> and <http://education.nasa.gov>, respectively.

The PDS has a special responsibility for making the data products from NASA solar system exploration programs available to the education community in ways that are easily accessible and useful for education purposes. In addition, the PDS nodes are encouraged to develop and engage in E/PO efforts that are consistent with and support the overall OSS E/PO program.

In addition, after the selections are announced, each Discipline Node that is selected for funding is invited to contribute to the OSS E/PO program through the new avenues for E/PO participation OSS has developed (details may be accessed through the "Education" Web site indicated above). In particular, PDS Discipline Nodes may submit E/PO proposals under the following guidelines:

- An E/PO proposal may be submitted by a proposer whose PDS Discipline node proposal is selected for a funding award through this NRA (hereafter called the "parent" award);
- The cost cap for an E/PO proposal by an individual investigator is \$15K per year;
- An "Institutional Proposal" option is available that allows several OSS-funded researchers located at the same institution to collectively carry out a more ambitious, expansive E/PO program within a cost cap of \$50K per year, not to exceed \$125K over the nominal three year lifetimes of the parent awards;
- To ease the burden of NASA's administration of such small supplemental awards, the total period of performance for any E/PO award may not exceed that of its parent research award; and
- A selected Principal Investigator has two windows of opportunity to submit an E/PO proposal, either: (i) no later than 60 days after the date of his/her letter of selection for the new award (with the anticipation of starting the E/PO activity within the first half of the first year of the parent research award); or (ii) no later than 90 days in advance of the yearly anniversary date of their award (with the anticipation of starting the E/PO activity in conjunction with the next year's funding supplement for the parent award).

For further details and specific guidance and information on preparing and submitting a proposal for E/PO funding under this OSS NRA, reference the Web site at <http://spacescience.nasa.gov/education/scientists/guidelines/index.html>. Questions and/or comments and suggestions about the OSS E/PO program are sincerely welcomed and may be directed to Dr. Philip Sakimoto at 202-358-0949 (Philip.J.Sakimoto@nasa.gov), or to Dr. Larry Cooper at 202-358-1531 (Larry.P.Cooper@nasa.gov).

NASA EDUCATION AND PUBLIC OUTREACH
STRATEGIC GOALS, OBJECTIVES, AND FOCUS AREAS

Mission Statement: To Inspire the Next Generation of Explorers

Strategic Goal I: Inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.

Objectives	OSS Focus Areas
1. Improve student proficiency in science, technology, engineering, and mathematics using educational programs, products, and services based on NASA missions, discoveries, and innovations.	Provide opportunities for students to work directly with NASA space science missions, facilities, and data.
2. Motivate K-16+ students from diverse communities to pursue science and mathematics courses and ultimately college degrees in science, technology, engineering, and mathematics.	Provide new opportunities for participation in the space science program by an increasingly diverse population, including opportunities for minorities and minority universities to compete for and participate in space science missions, research, and education programs.
3. Improve science, technology, engineering, and mathematics instruction with unique teaching tools and experiences that are compelling to teachers and students.	Provide high quality educational materials and teacher training based on space science content and focused on national curriculum standards Provide exhibits, materials, workshops, and personnel at national and/or regional education and outreach conferences.
4. Improve higher education capacity to provide for NASA's and the Nation's future science and technology workforce requirements.	Provide higher education opportunities offered through OSS research awards and other NASA research and education programs.

Strategic Goal II: Engage the public in shaping and sharing the experience of exploration and discovery.

Objectives	OSS Focus Areas
1. Improve the capacity of science centers, museums, and other informal education institutions, through the development of partnerships, to translate and deliver engaging NASA content.	(a) Through partnerships with major science museums or planetariums, put on display or on tour major exhibitions or planetarium shows based on space science content. (b) Provide materials and technical expertise to support the development of exhibitions and programs at science museums and planetariums.
2. Engage the public in NASA missions and discoveries through such avenues as public programs, community outreach, mass media, and the Internet.	Seek out and capitalize on special events and particularly promising opportunities in the space science program to bring space science to and involve the public in the process of scientific discovery.

4.0 SUMMARY OF INFORMATION APPLICABLE TO THIS NRA

Solicitation Topic	Description/Details
<ul style="list-style-type: none"> Program Alpha-Numeric Identifier 	NRA 03-OSS-04
<ul style="list-style-type: none"> Date of NRA Issue 	October 1, 2003
<ul style="list-style-type: none"> Access to text 	Link through the menu listings <i>Research Solicitations</i> → <i>Current (Open) Solicitations</i> starting from the OSS home page at http://spacescience.nasa.gov/ .
<ul style="list-style-type: none"> Requirements for preparation and submission of proposals (including default page limits) 	"NASA Guidebook for Proposers Responding to a NASA Research Announcement (NRA)-2003" at URL http://www.hq.nasa.gov/office/procurement/nraguidebook/ as amended in Section 3 of this NRA.
<ul style="list-style-type: none"> Notice of Intent (NOI) to Propose: <ul style="list-style-type: none"> Desired Due Date Web site for electronic submission Late submission (up to 15 days prior to Proposal Deadline) 	<p>October 30, 2003</p> <p>Open appropriate menu listing at http://proposals.hq.nasa.gov (Help desk by E-mail to <proposals@hq.nasa.gov>.</p> <p>Submit information specified in Section 3.1 of <i>NASA Guidebook for Proposers</i> by E-mail to <proposals@hq.nasa.gov>.</p>
<ul style="list-style-type: none"> Submission of Printed Proposal (including printed <i>Cover Page</i> /<i>Proposal Summary</i> and <i>Budget Summary</i>): <ul style="list-style-type: none"> Required number Deadline Address for submission by U.S. Postal Service, commercial delivery, or private courier 	<p>Signed original proposal plus 20 copies</p> <p>4:30 p.m. Eastern Time, January 8, 2004</p> <p>NASA PDS Discipline Node NRA Office of Space Science NASA Peer Review Services Suite 200 500 E Street, SW Washington, DC 20024 Telephone: (202) 479-9030</p>
<ul style="list-style-type: none"> Selecting Official 	Director Solar System Exploration Division Office of Space Science

Solicitation Topic	Description/Details
<ul style="list-style-type: none"> Announcement of selections 	Goal: 150 days after Proposal Deadline <u>or</u> 30 days after passage of NASA Fiscal Year 2004 budget, which ever occurs last.
<ul style="list-style-type: none"> Initiation of funding for new awards 	Goal: 46 days after Announcement of Selections
<ul style="list-style-type: none"> Program Officer for further information 	Mr. William P. Knopf Solar System Exploration Division Code SE Office of Space Science National Aeronautics and Space Administration Washington, DC 20546-0001 Telephone: (202) 358-0742 E-mail: William.Knopf-1@nasa.gov

5.0 CONCLUSION

The NASA Planetary Data System has defined a clear mission for its future, developed a structure that has initiated new multidisciplinary research in planetary science, and begun to influence specific space missions. Through this solicitation, NASA expects to add new and innovative research to the existing research strengths of the PDS, while at the same time maintaining it's direction and momentum as a service to the research community at large. The PDS Teams selected will be asked to contribute to the continuing evolution of the PDS as an effective virtual institute and to the establishment of the broader discipline of planetary science. All interested and qualified scientists and their institutions are encouraged to submit proposals for this exciting program.

Colleen N. Hartman
 Director
 Solar System Exploration Division

APPENDIX A: Overview of the PDS Discipline Nodes

1.0 OVERVIEW OF DISCIPLINE NODES OF THE PDS

1.1 Scope of the Planetary Data System

The scientific community has requested, and the U.S. public expects, that data from NASA spacecraft be readily accessible for inspection, analysis, and interpretation. Accordingly, NASA has established discipline data systems (described on page A-3) for each of the scientific disciplines represented in the NASA Office of Space Science (OSS). The Planetary Data System (PDS) is the discipline data system for the OSS Solar System Exploration science theme.

The PDS archives, distributes, and makes available digital data from past and present NASA planetary space missions, ground-based observations, and laboratory measurements. PDS personnel work with planetary flight projects during all phases of a mission investigation: before launch to help project personnel design datasets and data production systems; during the active phases of the missions to ingest new datasets; and after the active phases of missions to ingest past datasets or newly derived datasets. The PDS also restores datasets from historical planetary missions and develops data labeling and formatting standards to improve archival accessibility and to reduce cost. PDS sponsors workshops to promote research employing PDS data, analysis software, and uniform presentation. Finally, the PDS member institutions support planetary research by the members of their staffs, including analysis of the scientific data, as well as research into advanced aspects of Information Technology. Whenever possible, the PDS calls on the science community to aid in the peer review of its activities, including the judgment of older datasets in need of attention.

1.2 Structure of the Planetary Data System

The PDS is a distributed information system that consists of a central service and coordinating node called the Central Node, connected electronically to several classes of distributed centers called Discipline Nodes, their associated Discipline Subnodes, and short-term Discipline Data Nodes.

The Central Node provides initial access into the Planetary Data System and serves as the interface to planetary flight projects, the National Space Science Data Center (NSSDC), and all other organizations and operations involved in the generation, processing, dissemination, and use of planetary data or its ancillary products. The PDS Project Manager at the Central Node coordinates the operation of the entire PDS, assisted by the PDS Management Council consisting of the Discipline Node Principal Investigators (PIs)/Managers, science advisers, and representatives of the Central Node staff.

Owing to its unique functions, the Central Node is specifically exempt from this solicitation and currently remains assigned to the Jet Propulsion Laboratory. Its principal functions are:

- System Management/Engineering
 - develop and run the PDS data system by maintaining a constant awareness of how the system as a whole is functioning at any given time;
 - perform system assessment (is it working the way it should? do new kinds of data require modifications?);
 - maintain the Master Catalog of all PDS holdings;
 - coordinate archiving standards and standards documents;
 - maintain the middleware that accesses all holdings, and provide documentation and support that allows others to develop interfaces to the PDS through its middleware;
 - maintain PDS Data Dictionary (to ensure that items like high level keywords have common meanings across all Discipline Nodes); and
 - provide configuration control and system backup.

- Missions
 - assign Discipline Nodes as Lead Node and Subnodes based on mission classification;
 - provide high level mission interface, such as archiving requirements and schedules;
 - act as a resource to lead Discipline Nodes and missions in the development of archive documents;
 - evaluate and approve mission Data Management and Archive Plans, ensuring conformity to PDS standards (this is also a requirement for the Lead Discipline Node, but the Central Node captures the knowledge and experience gained from all other missions); and
 - provide oversight of mission data product design, deliveries, and data ingestion over all missions in coordination with lead Discipline Nodes.

- General Operations
 - provide centralized archiving support, advice, and validation tools to the PDS Discipline Node's through the implementation and enforcement of PDS Standards; and
 - assess and improve the ease of accessibility to the PDS interfaces and facilities by people with disabilities.

- Infrastructure
 - assess new information formats (typically submitted from Discipline Nodes in response to Project needs);
 - maintain technology "awareness" for the PDS through the assessment of new information technologies for science data management;
 - assess new physical media candidates for data storage and distribution; and
 - assess data pipeline requirements.

- Science Community Support
 - maintain a high level web interface to all PDS holdings for community access.
- Education and Public Outreach (E/PO)
 - work with the NASA Solar System Exploration Education Forum to understand the needs of educators for the use of PDS data and to make such data easily accessible to educators;
 - serve as a liaison between the PDS and the NASA OSS E/PO Support Network of Education Forums and regional Brokers/Facilitators (see further description at <http://ssibroker.colorado.edu/Broker/Brokers/>); and
 - coordinate efforts of the Discipline Nodes in support of the above E/PO responsibilities.

Discipline Nodes are the research centers of the PDS and set the priorities for the PDS, curate discipline-specific data sets, conduct continuing research on those data sets, and provide access to the data for the entire planetary science community. A Discipline Node typically resides at a single institution. However, owing to the broad nature of most scientific disciplines, a Discipline Node may also involve a consortium of electronically connected Subnodes, each of which is responsible for curating a specific part of the discipline data, conducting research on those data, and managing appropriate Data Nodes (as defined below). Each Discipline Node has a Manager who is responsible for meeting the operational requirements of the Discipline Node, managing the research conducted there, and overseeing the Subnodes and Data Nodes. A more thorough description of the functions of Discipline Nodes is presented in Section 1.3.

The scope of planetary science dictates the need for several science-oriented Discipline Nodes to serve the community and to promote research. The currently existing Discipline Nodes represent one possible set that fits within the funding resources and is sufficiently comprehensive to meet the needs of the scientific community. These Discipline Nodes are:

- Atmospheric Science, including atmospheric composition, structure, evolution, meteorology, and aeronomy;
- Geosciences, including geology, geochemistry, geophysics, surface properties, and tectonics;
- Imaging, including very large imaging datasets, subsets of which are made available to users and other Discipline Nodes, as well as analysis tools and expert assistance;
- Planetary Plasma Interactions, including solar wind, magnetospheres, ionospheres, plasma tori, and radio science;
- Rings, including planetary rings;
- Small Bodies, including comets, asteroids, and dust; and

- Radio Science, including planetary atmospheric studies.

Additionally, the Navigation and Ancillary Information Facility (NAIF) at the NASA Jet Propulsion Laboratory, functions as a Discipline Node of PDS. NAIF is responsible for providing ancillary data (e.g., observation geometry) necessary for interpreting science instrument datasets returned from planetary spacecraft, as well as archiving and distributing Spacecraft/Planet/Instrument/C-matrix/Event (SPICE) files produced by projects, and providing the SPICE tool kit software to users. Owing to its unique nature, the NAIF is explicitly exempted from this solicitation and is currently assigned to JPL.

Data Nodes are temporary nodes established as needed by NASA and the cognizant Discipline Node to restore specific data sets from past missions for ingestion into the PDS, to provide access to specific instrument data during the active phase of a mission, or to conduct research on and/or to make significant enhancements to recently acquired data sets. Organizationally, a Data Node is responsible to its "parent" Discipline Node and is headed by a Lead Investigator. A more thorough description of the functions of Data Nodes is presented in Section 1.4.

1.3 Purposes and Responsibilities of Discipline Nodes

The purpose of a Discipline Node is to curate specific planetary data sets, to provide an environment that promotes active research through the analyses of these data by in-house and/or visiting scientists, and to furnish access, data, and assistance to scientists at their home institutions through electronic connection. The Discipline Node Institution employs scientists who are conducting active research on their data sets and are available to consult with others on questions regarding the use of the data. The major responsibilities of each Discipline Node are to:

- include and provide access to the data sets resulting from its assigned missions and as pertinent to its discipline focus (e.g., see list below in this Section);
- provide scientific and technical consultation to assist outside users in the access and use of curated data sets;
- aid in the verification of content and format of new data sets;
- participate in the management of the PDS and contribute to its technology development efforts;
- develop and disseminate data archive standards;
- curate datasets specific to the Node's areas of expertise;
- maintain catalogs and databases of planetary data curated by the Discipline Node;
- distribute data to the planetary science community as requested;
- ensure high speed broadband connectivity to all other PDS Discipline Nodes and the Central Node for cross-discipline correlative searches;
- sponsor and guide appropriate data restoration activities;
- work with the Central Node and the NASA Solar System Exploration Education Forum to understand the needs of educators for the use of PDS data and to make such data easily accessible to educators; and

- conduct continuing research efforts that utilize the data for which the Discipline Node is responsible.

Since NASA feels that these purposes can be achieved and these responsibilities met only through a combination of basic and applied research, proposals in response to this NRA are expected to present a credible plan of research using the data to be curated at the proposed Discipline Node, as well as demonstrate that these research personnel are committed to direct, prompt, and enthusiastic interface with outside researchers who request data sets.

The broad nature of each of the scientific disciplines suggests that it may be most efficient and appropriate to distribute the Discipline Node responsibilities among a number of institutions to ensure that each class of data is curated by individuals who have strong research interests in the data, who will use them in original research, and who are sufficiently knowledgeable to assist others in analyzing them. It also promotes the widest possible involvement of the planetary science community in the operation of the PDS. Accordingly, proposers to this NRA are encouraged to form consortia involving several institutions as may be appropriate as Subnodes or Data Nodes in order to offer Discipline Nodes with the breadth and expertise to address the identified scientific disciplines adequately.

Although access to a dataset may be provided by more than one Discipline Node, the basic data from any one flight mission investigation will be curated in its entirety by a single Discipline Node. All of the information pertinent to the description, history, and calibration of that investigation, its raw data and its unresampled calibrated data will be the responsibility of one Discipline Node, and change authority will be vested with that Node. Any changes to the data or ancillary information pertinent to that data falls under the change authority of the curating Discipline Node. For example, if the descriptive history could be updated to better explain the nature of the data, or if enhanced calibrations are made available then the Discipline Node has the authority to make these changes.

Consistent with their responsibility as curators, the Discipline Nodes establish contact with data suppliers from current and past missions and interact with them to prepare data for archiving to assure high quality products that have been peer reviewed or validated before release to the general science community. Within its area of expertise, each Discipline Node is responsible for all information relating to the description, history, and calibration of a given investigation's instrument, its raw data, and its unresampled calibrated data.

1.4 Operation of Discipline Nodes

Project activities at a Discipline Node are expected to be organized into Baseline and Mission Product areas. Baseline activities include:

- Support to Users. This activity emphasizes the research and science expertise within the Discipline Node, as well as the support the node provides to science users and

work requests from science users of PDS. It also incorporates the handling of requests for data, distribution, special processing, computer operations, and related staffing. In a typical month, experience shows that approximately 100 special requests are processed over the whole of the PDS, with some individual Discipline Node's handling 20 or more requests. Many of these require hours of expert scientific support and special processing to generate data products that are useful to the requesters. Current experience shows that over 7,500,000 files are downloaded monthly totaling more than 1100 Gb of data.

Users can access information about data and place orders for data at either the Central Node or one of the Discipline Nodes from their home institutions via the Internet. All data are available on line via the Internet, and most data are also available on physical media such as CD-ROMs or DVDs. Additional information is provided on the Discipline Node Web pages, which are listed in Appendix B of this NRA.

- Node Development. This activity involves the development of new catalogs, upgrades to node computer systems, and other activities that increase the capabilities of a particular node to respond to requests from the scientific community. In this regard, proposers to this NRA are encouraged to employ the most recent developments in Information Technology to carry out their proposed activities and may also propose to devote a portion of effort to the further development of appropriate data handling and management technologies.
- PDS System Support. This activity represents effort from the Discipline Node as part of the larger PDS Project and includes such activities as review of proposed new PDS standards, planning for PDS evolution, setting PDS-wide priorities, and node management. The Mission Product activities (see further below) include planning and ingestion of new datasets from active flight projects, as well as restoration and peer review of data from older missions or observations for possible future restoration. Most tasks within PDS require the coordination of the Central Node and one or more of the Discipline Nodes.

Mission Products activities include:

- Data Assimilation. Planetary data flow from flight projects and many other sources into the PDS nodes where they are checked for completeness and are entered into the PDS online catalogs. Long-term archive and distribution copies are sent to the National Space Science Data Center (NSSDC), and another copy is sent to the appropriate discipline node.
- Archival Storage of Data. Discipline Nodes are typically responsible for the storage of large numbers of CD-ROMs and DVDs in secure, environmentally safe locations. The quantities of such storage media are expected to grow dramatically over the next five years owing to the NASA planetary missions that are currently expected to enter their prime phases (see further in Section 1.5 below), which will require Discipline Nodes to store a minimum of 10,000 CD-ROM's and DVD's, as

well as accommodate future growth, as further outlined in the next section in this NRA.

1.5 Data Expected Over the Next Five Years

Current Missions. The PDS is currently archiving products from the Galileo, NEAR, Mars Global Surveyor, Mars Odyssey, Stardust, Voyager, and Ulysses missions (note: access to homepages for NASA's science missions may be made through the menu item "Missions" on the Office of Space Science homepage at <http://spacescience.nasa.gov/>).

Future Missions. Starting in 2003, the PDS expects to archive (at a minimum) altimeter, imaging, and ancillary data products from Mars Reconnaissance Orbiter (MRO), Mars Express, Mars Scouts, Mars Exploration Rovers, Deep Impact, Messenger, Dawn, Cassini, and New Horizons. Initial data deliveries to the PDS by these missions are currently scheduled to occur as provided in the table below.

Mission	First Data Delivery to PDS for Archive
Mars Reconnaissance Orbiter	2006
Mars Express	2004
Mars Scouts	2007
Mars Exploration Rovers	2004
Deep Impact	2005
MESSENGER	2004
Dawn	2007
Cassini	2005
New Horizons	2007

Estimates of CD or DVD quantities are given in the table below.

Discipline	Number of CD/DVD Volumes Expected
Atmospheres	2500
Geosciences	18000
Imaging [combined]	28000
Planetary Plasma Interactions	15000
Rings	100
Radio Science	6000
Small Bodies	300

Therefore, Discipline Nodes for these future missions must be prepared to accommodate 20-40 terabytes (TB) of data as a minimum using all possible media and means of distribution (e.g., hard drives, web access, DVDs, etc.).

While some future missions will not return data for archiving within the next five years, the PDS must expend resources during this period to prepare for access and distribution of large data sets and to help these projects plan for archiving high-quality data products. Missions in this category include Mars Science Laboratory, Muses C, and future Discovery and New Frontiers missions yet to be selected.

1.6 Program Management Information

NASA Furnished Support. NASA intends to sponsor as many as six Discipline Nodes of the Planetary Data System. Each Discipline Node will be selected for a five-year period of performance, beginning on or about August 2, 2004, and ending August 1, 2009, with the potential of renewal at the end of this period through competitive procurement. NASA will conduct interim evaluations of Discipline Node performance on an annual basis during this five-year period of performance.

Budgets submitted as part of proposals to this NRA may use the following guidelines for compensation of node personnel. For the current Discipline Nodes, this funding has generally been equivalent to half the salary for the Node Manager/PI and full salaries for up to four technicians and/or other support staff. The cost of communications necessary to operate the distributed node configuration may also be proposed, provided that these costs are established and justified.

Institutional Commitment. Discipline Nodes are expected to provide a focus in the community for discipline data management and data analysis activities and, therefore, will be recognized as centers of excellence. This prestige of recognition, coupled with the availability of data and research tools, should serve as a powerful drawing factor at university sites for students, faculty, and data analysis support. The host Discipline Node institution is encouraged but not required to contribute to this investment by, for example, helping to provide adequate facility space to house the necessary data processing and display hardware, storage media, documentation, hard copy products, work areas and desk space for the resident staff and visiting scientists, or secretarial support. Proposals which include an institutional commitment will be given added consideration in accordance with the Evaluation Criteria described in Section 3.1 of this Appendix.

Additional contributions that may be proposed may include data processing equipment and networking facilities not supplied by NASA. In such cases, the fractional portion of equipment or facilities directly committed to PDS activities should be specified. The commitment by institutions housing subnodes should be scaled to the anticipated activity level within the space allocated, including workspace for visiting scientists, and easy access to that space. To ensure long term stability of the PDS, any institutional commitments to provide any type of support must be for the entire length of the proposed period of performance.

Transition from Existing Node. Where relevant, proposals must discuss the orderly transition of operations, equipment, and data from an existing Discipline Node (see Appendix B). Special attention should be paid to the accommodation of service activities such as data catalog search and selection, data delivery, information transfer, and data set

expertise upon which the community may have come to depend. Proposals from institutions that are not currently a PDS Discipline Node must include a transition schedule, not to exceed three months in duration, that shows a minimum of interruption of service to the community. A list of the current PDS Discipline Nodes, Node Managers, mailing addresses and hyperlinks to the Discipline Node web sites is given in Appendix B, while Appendix C contains existing node-specific computer hardware, workspace square footage, and Full Time Equivalent (FTE) staffing figures for the current Discipline Nodes. This information may be used to properly scope facility and support estimates needed for the transition. Additional information is available from the PDS Central Node (webpage <http://pds.jpl.nasa.gov/>).

In addition, all Discipline Node solicitations must address the potential transition from their node, if awarded, to a replacement node, which may occur at the conclusion of their five year period of performance or sooner if deemed necessary by upon NASA review. Although the data curated by the PDS is freely available for unlimited use by the public, since all efforts to enable the data ingestion and public availability through the PDS are funded by NASA, the Discipline Nodes are contractually obligated to return all PDS related products to NASA upon request.

2.0 ORGANIZATION AND CONTENT OF PROPOSALS

2.1 Introduction

All parts of Section 2.3 of the *Guidebook* shall be included in proposals to this NRA. However, the contents of the Science/Technical/Management Section of the proposal should contain a discussion of the factors identified in Sections 2.1.1 through 2.1.5 below in this NRA in addition to (or as a part of) the factors identified in Section 2.3.5 of the *Guidebook*. Note that the page limitations given in Section 2.3.1 of the *Guidebook* are modified as follows:

Proposal Section	Page Limits
Scientific/Technical	40
Management	10
Budget Details	15

NASA desires but does not require to receive Notices of Intent (NOI) to propose to aid in planning for an orderly and prompt peer review that is free from conflict of interest and that contains the appropriate expertise. Notices of Intent may be submitted electronically through the Web site <http://proposals.hq.nasa.gov/proposal.cfm/> in accordance with the details in the *Guidebook*, Section 3.1. To be useful, such NOIs should be submitted prior to the date shown in Section 4 "Summary of Information Applicable to this NRA." Notices of Intent will be treated as competition-sensitive material, and they are in no way binding on the submitting individuals or institutions.

Note that in order to be able to electronically submit an NOI or the required Cover Page for a proposal, all investigators proposing to this NRA must be preregistered in the NASA Headquarters proposal database and receive a User ID and password. This requirement includes the PI, as well as all collaborating Co-Is. To register visit <http://proposals.hq.nasa.gov/proposal.cfm>. Early registration is advised, and a Help Desk is available via E-mail at proposals@hq.nasa.gov for assistance.

2.1.1 Scope of Proposed Discipline Nodes

Every proposal to establish a Discipline Node must: 1) define the scope of the science discipline to be addressed; 2) define the type of research proposed as appropriate for the Node and the portion that will be addressed, at least in part, by the Node personnel; 3) describe special processing, expertise, and other unique capabilities that will be provided to users; 4) discuss the relevance of the proposed Node to existing PDS structure or justify its appropriateness instead of, or in addition to, existing Nodes; 5) list as fully as possible data sets and ancillary datasets to be included in holdings and proposed in the future; and 6) describe current status and planned growth for system capabilities, data storage, user order handling, and coordination with user science community.

2.1.2 Existence/Relationship of Subnodes and Data Nodes to Discipline Nodes

While the overall structure of the principal Discipline Nodes is not expected to change radically, the structure of Subnodes within each Discipline Node is considered flexible. Therefore, proposals should demonstrate how any proposed Subnode structure would address the subdisciplines and functions, including those listed in Section 2.1.3 below, within their cognizance, how Subnodes would interact with their users to serve the community and promote research, and how the Subnodes would be connected electronically to allow data access and transfer.

Based upon performance requirements, unique Data Nodes may also be proposed under the leadership of relevant Discipline Nodes. Data Nodes are temporary nodes that exist to restore and provide access to specific datasets from active and past missions, or to make significant enhancements to existing datasets, for inclusion into the PDS. A Lead Investigator must be proposed to head each Data Node. Because they are key personnel, the Lead Investigator for a Data Node should also be identified as a Co-Investigator to the proposal, and their relevant information included as specified in Sections 2.3.8 and 2.3.9 of the *Guidebook*.

2.1.3 Functional and Operational Support of the PDS

A thorough understanding of the relationship between the functions of the proposed Discipline Node and those of the Planetary Data System as a whole is critically important. Therefore, proposals to this NRA must discuss the policies of the proposed Discipline Node regarding the following points:

- Maintenance of PDS standards, particularly as they relate to communications protocol; availability of electronic mail for user inquiries; user interface including log-

in procedures; development of nonproprietary software in a PDS-approved language that conforms to PDS documentation standards; generation or restoration of data sets in PDS format; use of standardized content and format for high level catalog entries; and use of standardized format in which data is to be delivered;

- Quality control and quality assurance of data sets, including the validation of science content and format as a result of analysis or restoration efforts at the Discipline Node or a proposed Data Node;
- Incorporation of budget and schedule reporting practices into the proposed operation;
- Interaction with near-term mission science Principal Investigators (PI's) and their teams for preparation of their data management plans, ingestion of their data sets and analysis tools, and possible involvement of mission investigations in the PDS as Data Nodes;
- Restoration of key data sets, including an assessment of the current status of needed data and the level of effort required to restore them at a Discipline Node or at a Data Node;
- Costs and fees associated with the reproduction and delivery of CDs and DVDs in response to community data requests;
- Access to the facility through remote channels and through site visits; times of day when the facility will be staffed, and when terminal, printers, and display devices will be accessible; and times of day when remote access will be available; and
- Access to the Discipline Node's scientific and technical expertise and training by users of the discipline data.

2.1.4 Research Enhancement

The extent to which planetary data analysis and research is promoted is a prime measure of success of the PDS. Such research will result in scientific progress and in the production of mature data sets that will be catalogued, archived, and distributed. Thus, while the PDS does not supply funding for specific data analysis activities, it does provide the means of conducting these analyses. Therefore, proposals, should address this topic and point out how the Discipline Node proposed would provide a focus for such research; how it would support remote users; what kinds of in-house research might be pursued using these data; what capabilities for research could be offered by them or a sponsoring institution in addition to those supplied by NASA; how the analysis capability might improve with time; how the node will support the development, documentation, and distribution of analytical software; and how the node will promote interactive and correlative analysis of data within the node and of data in this and in other Discipline Nodes.

2.1.5 Management Approach

A plan must be offered that describes how a Discipline Node PI/Manager will manage the node and accommodate growth or changes in direction of the scientific interests of the Discipline. If subnodes are proposed, the plan must define how these will be managed and how the composition of Subnodes will be adjusted over the long term to remain responsive to areas of increasing or decreasing activity or the potential loss of expertise. The management of Data Nodes, software management, use of PDS standards, and the management interface with the PDS Manager at the Central Node must also be developed and discussed.

Qualifications of the principal participants in the proposal must be documented in terms of their scientific accomplishments, their performance with regard to reducing and analyzing planetary data, and their experience and expertise in handling data sets and in data base management. Those who are proposed as PIs/Managers should also be shown to have had experience in the management of scientific and technical endeavors.

2.2 Budget Details

Actual funding allocations to the Discipline Nodes selected through this NRA will depend on the NASA budget. However, for the purpose of preparing proposals, the annual funding described below may be assumed.

Discipline	Nominal Funding [\$K/yr]
Atmospheres	500
Geosciences	1000
Imaging	1000
Plasma Interactions	700
Small Bodies	1000
Rings	150
Radio Science	140

Proposals should specify what would be provided to NASA for this level of funding, but, at a minimum, this should include the core functions of servicing to users and ingestion of new data into the PDS. Budgets for any proposed Subnodes and Data Nodes fall within these allocations. NOTE: Computer systems and other equipment also must be included within these allocations since equipment will not be funded separately nor will it be furnished directly by the Government.

Any costs for the purchase and/or usage of specific hardware or software, or any costs associated with the use of high performance networks essential for the proposed research, must be included in the proposed budget. This should include any cost associated with the purchase, installation, and maintenance of Polycom videoconferencing equipment for a designated conference room at the Lead Institution, and the costs associated with

desktop communication and collaboration tools proposed for the Discipline Node PI and associated proposal personnel.

Actual Node budgets will also be determined by the level of participation of each Node within the tasks of the project. For example, if the set of mission data planned for archiving in PDS for a given fiscal year includes more data from imaging instruments than from atmospheric instruments, it is likely that the "Imaging" Discipline Node budget for that year may be higher than the Atmospheres Node budget to reflect the larger workload. Future budgets will also take past performance of individual Nodes into consideration. Once selected, Nodes will be able to propose incremental additional funding related to unanticipated but well defined specific tasks, such as datasets to be restored from identified projects. Finally, proposals should clearly delineate how costs would be allocated between the following two major areas, and what specific activities are included:

- Baseline Costs (support to users; Node development; PDS system support); and
- Mission Products Costs (planning for and archival acquisition/storage of datasets from active missions; datasets to be restored).

3.0 PROPOSAL EVALUATION AND SELECTION

3.1 Evaluation Criteria

Appendix C, Section C.2 (Evaluation Criteria), of the *Guidebook for Proposers* shall apply with the following modification:

The following factors of nominally equal priority are added to item "(3) Evaluation of intrinsic merit includes consideration of the following factors":

- (v) plans for data ingestion from missions and restorations;
- (vi) provision of required level of science user support;
- (vii) understanding of PDS standards and operations;
- (viii) specifics plan for Node management and project coordination;
- (ix) demonstrated ability to plan and meet budget, schedule, and performance;
and
- (x) institutional commitments (optional).

3.2 Evaluation and Selection Techniques

Proposals will be evaluated in accordance with Appendix C, Section C.3 (Evaluation Processes) of the *Guidebook for Proposers 2003*, with the addition of the following details specific to this NRA:

All proposals will be subjected to a screening review by NASA to determine their responsiveness to this NRA. Proposals that obviously are not responsive to the intent of

this solicitation will be handled as correspondence and returned to the proposer. Proposals that are deemed responsive will be subjected to competitive review by the proposer's scientific and technological peers, with due regard to conflict of interest and protection of proprietary information. The primary purpose of the peer evaluation is to determine the scientific and technical merits of each proposal. Reviewers and/or review panels may also comment on such aspects of the proposals as uniqueness, capabilities of the proposer, institutional commitment to support, relevance to the program, managerial merits, and cost reasonableness and realism. A NASA panel will review the managerial merit of each proposal separately.

Following peer review, the Program Officer for this NRA identified in Section 4 "Summary of Information Applicable to this NRA.", will consider the peer evaluations together with other information such as relevance, competence of the proposer, program balance, and cost of the proposed work in the context of available funds to construct a selection recommendation plan that is scientifically and programmatically sound and affordable. The final selection is made by the Director, Solar System Exploration Division.

NASA may choose to select all or part of a proposal; in the case of a partial selection, the proposer will be given the opportunity to accept or reject the offer. In the event that a proposal is deemed meritorious for selection but in need of greater definition, NASA reserves the right to offer selection based on interim funding for PDS involvement while the proposal undergoes further development, with the understanding that a revised proposal will be submitted for independent peer review at a time to be determined in the negotiation for the Cooperative Agreement.

A follow-on NRA is expected to be issued in Fiscal Year 2007 as the awards established through this NRA expire.

4.0 ADMINISTRATION OF FUNDING

NASA anticipates that awards resulting from this NRA will be contracts conforming to the Federal Acquisition Regulations (FAR) and the NASA FAR Supplement. Funding of other government agencies and Federally Funded Research and Development Facilities (FFRDCs) will be accomplished through inter-agency fund transfer under a Memorandum of Agreement.

Specific resource arrangements established under this NRA will vary depending on the nature of the Principal Investigator's home organizations for the following organizations:

- NASA Centers and JPL:
 - (a) Necessary resources for any NASA personnel who may be part of a proposing team will be provided through NASA's internal funding procedures and not identified as a cost under the funding agreement with the Lead Institution.

However, the cost associated for any NASA participation, using currently specified requirements for full cost accounting, must be included in the total cost of the proposal for evaluation purposes.

- (b) The necessary resources for NASA or JPL-led proposals will be provided via NASA's internal funding procedures. If researchers from other institutions are included on a successful NASA or JPL-led proposal, then the necessary resources will be provided through the funding mechanisms given above, as appropriate.
- Non-U.S. Organizations: NASA's Office of External Relations will establish an appropriate agreement with the sponsoring non-U.S. agency(ies) based on the principle of no-exchange-of-funds.

APPENDIX B: Current Discipline Nodes and Points of Contact

Node	PI/Manager	Contact Information
Atmospheres http://atmos.nmsu.edu/atmos-home.html	Dr. Reta Beebe	Astronomy Department Department 4500 New Mexico State University PO Box 30001 Las Cruces, NM 88003
Geosciences http://wwwpds.wustl.edu/wwwpds/	Prof. Raymond Arvidson	Campus Box 1169 Washington University One Brookings Drive St. Louis, MO 63130-4899
Imaging (1)	Dr. Lisa Gaddis	Astrogeology Branch U.S. Geological Survey 2255 N. Gemini Drive Flagstaff, AZ 86001
Imaging (2) http://pds-imaging.jpl.nasa.gov/	Ms. Susan LaVoie	Jet Propulsion Laboratory 4800 Oak Grove Drive Pasadena, CA 91109
Planetary Rings http://ringmaster.arc.nasa.gov/	Dr. Mark Showalter	Mail Code 245-3 Ames Research Center National Aeronautics and Space Administration Moffett Field, CA 94035
Plasma Interactions http://www.igpp.ucla.edu/ssc/pdspipi/Welcome.html	Prof. Raymond J. Walker	Institute of Geophysics and Planetary Physics 6851 Slichter Hall University of California, Los Angeles Los Angeles, CA 90024
Small Bodies http://pdssbn.astro.umd.edu/	Prof. Michael F. A'Hearn	Department of Astronomy University of Maryland College Park, MD 20742
Radio Science	Dr. Richard Simpson	Center for Radio Astronomy Packard Building – Room 332 Stanford University Stanford, CA 94305

APPENDIX C. Existing Discipline Node Infrastructure

Node	FTE's	Workspace (sq. ft.)	Computer systems/hardware	
			Role	Description
Atmospheres	2.82	625	Web Server	Sun Ultra 10
			Workstation	Sun Ultra 1
			DE Workstation	Pentium
			Management	Laptop
			CD Writer	Sun Ultra 1
Geosciences	4.22	1250	Web Server	Sparc Server 1000
			Web Server	Pentium Win NT
			Staff machines	Intel-based PC's, Win
Imaging / USGS	1.97	1120	Web Server	Sun Sparc 20
			Web Server – MGS	Pentium Linux
			Photo Journal Server	Pentium Linux
			Map Maker Server	Pentium Linux
			Dev. Workstation	Pentium Linux
			Management	Laptop
			DVD Writer	Pentium NT
			CD Writer	Pentium Linux
Imaging/JPL	1.70	310	Web Server	Pentium Linux
			Web Server	Sun Ultra 2
			DB Server	Pentium Linux
			Photo Journal Server	Pentium Linux
			Dev. Workstation	Pentium Linux
			Management	Laptop
Planetary Rings	2.50	300	Web Server	Compaq Alpha
			Dev. Workstation	Compaq Alpha
			Dev. Workstation	Pentium Linux
			Management	Laptop
Plasma Interactions	4.14	1450	Web Server	Pentium Linux
			Jukebox Server	Pentium Linux
			Samba Server	Pentium Linux
			FTP Server	Pentium Linux
			Dev. Workstation	Pentium Windows
			DE Workstation	Pentium Windows
			Management	Pentium Windows
			DE Workstation	Pentium Windows
			Staging Disk	Pentium Windows
			Stack CD Recorder	Pentium Windows
CD/DVD Dup	CD/DVD Duplicator			

- continued -

APPENDIX C. Existing Discipline Node Infrastructure (continued)

Node	FTE's	Workspace (sq. ft.)	Computer systems/hardware	
			Role	Description
Small Bodies	3.85	1400	Web Server	Sun Ultra Model 250
			Dev. Workstation	Sun Solaris
			Management	Laptop
			Jukebox Server	Sun Ultra 5/10 Mod. 440