THE ROLE OF THE NASA REGIONAL PLANETARY IMAGE FACILITY NETWORK IN A PLANETARY SPATIAL DATA INFRASTRUCTURE (PSDI). J. J. Hagerty[1], J. R. Laura[1], A. Hayes[2], R. Jaumann[3], P. Schultz[4], J. Spray[5], T. Watters[6], and D. A. Williams[7], [1]USGS, Astrogeology Science Center, Flagstaff, AZ; [2]Cornell Univ., Ithaca, NY; [3]DLR, Institute of Planetary Research, Berlin, Germany; [4]Brown Univ., Providence, RI; [5]Planetary and Space Science Centre, University of New Brunswick, New Brunswick, Canada; [6]Center for Earth and Planetary Studies, Smithsonian Institution, Washington, DC; [7]School of Earth and Space Exploration, Arizona State Univ., Tempe, AZ; email: jhagerty@usgs.gov.

Introduction: NASA's Regional Planetary Image Facilities (RPIFs) are planetary data and information centers located throughout the United States, in Canada, and overseas. The U.S. locations are currently co-funded by NASA and their host institutions [1]. A network of these facilities was established in 1977 to "maintain photographic and digital data as well as mission documentation". Each center's general holdings contain images and maps of planets and their satellites taken by NASA Solar System exploration spacecraft. These planetary data centers, which are open to the public, are primary reference centers for browsing, studying, and selecting planetary data including images, maps, supporting documentation, and outreach materials. Experienced staff at each of the facilities can assist scientists, educators, students, media, and the public in obtaining materials for their own use [2].

The network of RPIFs has expanded to nine U.S. centers and seven centers in other countries. The first RPIF to be established outside of the U.S. was in the United Kingdom in 1980, at University College London, and since then centers have been set up in Canada, France, Germany, Israel, Italy, and Japan. Through its longevity and ability to adapt, the RPIF Network has leveraged its global reach to become a unique resource covering 60 years of international planetary science.

Historically the Network nodes have had an institutional focus, whereby they provided resources to local and regional clients, and communicated with other nodes only when the need arose. Using this methodology, the nodes of the Network have combined to serve an average of ~65,000 people per year since 2000. However, with the advent of simpler and more wide-ranging forms of data transfer and data sharing, our current aim is to allow the nodes to operate together to provide the global planetary science community and the public with greater access to planetary spacecraft data. Each node of the Network has unique capabilities and resources that meet one or more of the above criteria; however, by linking the nodes through a collaborative Network, it is now possible to provide a more diverse set of materials to a wider array of users, especially to those in the planetary science community.

The current and future capabilities of the Network feed directly into and strongly complement aspects of an ongoing initiative to develop and implement a community driven Planetary Spatial Data Infrastructure (PSDI) [e.g., 3]. In the remainder of this abstract, we will briefly describe PSDI and identify several ways in which the RPIFN can fill critical roles within a PSDI.

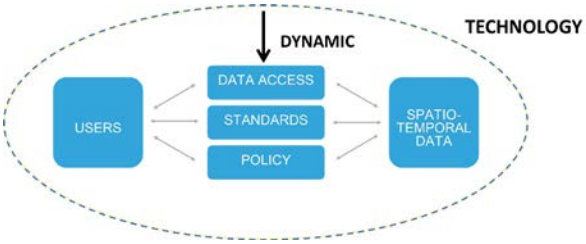

Figure 1. Elements of a spatial data infrastructure modified from [4]. The RPIFN resides in the middle stack, helping to join users and data.

Planetary Spatial Data Infrastructure: A PSDI encompasses aspects of users, policies, standards, data access mechanisms, and the planetary spatial data ([4, 5], **Figure 1**). PSDI is both a theory defining what elements are required to support effective use of spatial data and the implementation of that theory.

***Users*:** An effective PSDI removes the burden of data processing from the user, and improves data access, discovery, and usage so that users can focus on the science.

***Policies*:** An effective PSDI requires policies to ensure that community standards support the collection and sharing of data, and to ensure longevity and evolution of infrastructural service that can take advantage of innovative technologies.

***Standards*:** To ensure data usability, the development, codification, and adoption of data formatting and delivery standards to support data interoperability and use in widely available tools is essential.

***Data*:** Spatial data encompassed by a PSDI can be divided into two categories: *foundational* and *framework*. Foundational data are wide reaching and support a range of scientific and decision-making processes; these include a geodetic coordinate reference frame, geodetically controlled, orthorectified images and topography designed to provide the highest level of accuracy supported by the data [3]. Framework data are those products of critical importance to a smaller subset of the research community. Framework data may be used for a specific scientific objective, such as geologic or thematic mapping of a planetary surface to identify resources or units of interest.

***Data Access*:** Effective data access is fundamental to enhancing data discovery. However, access mecha-

nisms depend on the use of standard, interoperable formats by data providers. Often access services are designed for a single user community for a limited time (e.g., for a mission science team during a mission). However, existing NASA-funded resources (e.g., the Planetary Data System, PDS [6] and the Network), can be leveraged to provide improved access to planetary spacecraft data. Specifically, we believe that our five-year vision (described below) will provide a valuable resource to the planetary science community that has been needed for several years.

Five-Year Plan: The role of this Network is evolving as key historical planetary data sets are converted to digital files and are made available online. The goal of the Network is to serve as a valuable resource for specialized knowledge and services that will make it possible to remove the barriers associated with locating, accessing, and exploiting planetary science data, particularly science-ready data products. The goal of the Network is to provide support and training to a broad audience of planetary data users, thus increasing the discoverability and use of planetary spacecraft data.

The Network nodes will continue to serve as reference centers that are needed for preserving and accessing derived products from past, present, and future Solar System exploration missions. In an effort to meet the global planetary science community's evolving needs, we aim to achieve the following primary goals:

1. Maintain and improve the foundation that has been established over the past four decades so as not to lose critical, historical information and to meet the Federal mandate for data discovery and transparency [i.e., 7]. This goal will be aided by a systematic effort to scan and digitize fragile materials as a means of increasing access and preserving the materials. It should be noted that due to the vast volume of materials in our collections, the digitization of all files will require a time-intensive and concerted effort.
2. Help users to locate, access, visualize, and exploit planetary science data. In an effort to make this possible, Network personnel are being trained in the use of common planetary data sets and processing tools such that they can assist researchers with locating and using planetary data. Many of the facilities have begun to establish Guest User Facilities that allow researchers to use and/or be trained on GIS equipment and software as well as other specialized equipment like SocetSet/GXP workstations. We also anticipate that virtual reality technology and experiences will continue to evolve and will potentially become integral tools in exploring and understanding the Solar System. In fact, virtual reality may be the most practical means for allowing future researchers to interact with and analyze data in multiple dimensions. As such, we envision the Network serving a key role in developing and providing access to virtual reality laboratories (i.e., having lab space at each of the globally distributed nodes) where planetary scientists, students, and the public can virtually interact with other planetary surfaces. Three dimensional (3D) printing will also likely be closely tied to virtual reality experiences such that users can print aspects of their virtual experiences for further future evaluation. As such, we will also continue to build and improve upon innovative 3D printing capabilities to provide a long lasting and portable tangible aspect to virtual exploration experiences.
3. Improve the connection between the Network nodes while also leveraging the unique resources of each node. To achieve this goal, each facility will develop and share searchable databases of their entire collections, enhanced by the development of robust metadata, which in turn will dramatically increase discoverability through the creation of an aggregated virtual clearinghouse.
4. Communicate more effectively and regularly with the planetary science community in an effort to assess community needs and to make potential users aware of resources and services provided by the Network. For example, a collaboration between the Cornell, ASU, and USGS nodes will offer a Planetary ArcGIS™ workshop at this meeting.

By achieving these goals, we will further support existing users and introduce new users to data products from past, current, and new missions. The underlying premise of data needs for users of the Network (whether hard copy or digital) is that research and discovery does not end with each mission, but continues for generations to come. As such, the Network provides the bridge between generations as one phase of exploration ends and another begins.

In summary, through a variety of new initiatives described herein, our Network is staging itself to become a potentially valuable part of a fully realized PSDI [e.g., 3]. By leveraging our expertise and resources within the Network, we seek to improve the discoverability, access, and dissemination of science-ready planetary data products [e.g., 3, 6]. The ultimate goal is for the RPIFN to serve as a formalized conduit for engaging the global planetary science community to determine (and thus help meet) their spatial data needs.

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