PLANETARY SPATIAL DATA INFRASTRUCTURE FOUNDATIONAL DATA PRODUCT KNOWLEDGE INVENTORY. J. Laura, B. Archinal, M. T. Bland, L.R. Gaddis, J.J. Hagerty, T.M. Hare, and J.A. Skinner, Jr. U.S. Geological Survey, Astrogeology Science Center, Flagstaff, AZ (jlaura@usgs.gov).

Introduction: Spatial Data Infrastructure (SDI) is both the theoretical collection of data, standards, policies, data access mechanisms, and users that frame issues of spatial data management and access to support planetary science as well as the implementation of said systems [1]. Earth-focused SDIs exist to reduce the burden for spatial data expertise across the research science and decision support domains, making data discoverable and highly interoperable for non-spatial data experts. Two models for SDI development have been described [2]: (1) a product-based view and (2) a process-based view that describes the iterative path from community organization to potential adoption of an SDI. Herein, we describe the process-based view for developing a Planetary Spatial Data Infrastructure (PSDI) and present initial results of a planetary foundational data products knowledge inventory.

To realize a PSDI, it is necessary to develop a summary of the available data, data custodians and owners, and metadata and access mechanisms. To that end, a knowledge inventory can be envisioned as a literature review of the available geospatial infrastructure. This review is an ideal method to identify not only stakeholders that must be engaged, but also the strategic knowledge gaps that exist for planetary bodies.

Data Products: Laura et al. [1] identify two classes of spatial data products: foundational and framework. Foundational data products are identified as those products that impact the widest possible scope of planetary science and are used in the derivation of, or in conjunction with, framework data products to support science objectives and decision making (e.g., topical science studies or engineering constrained landing site selection, respectively). The three sub-themes of foundational data products are: (1) geodetic control, (2) topography, and (3) orthorectified images. Framework data products have non-inclusively been classified into themes such as geology, compositional, and geophysical.

Defining Foundational: We have performed a knowledge inventory for all planetary solid bodies, many moons, and some small bodies within the Solar System (***Table 1***). In performing the knowledge inventory, the previous definitions of geodetic control and orthorectified images [1] were identified as being inadequate for this process. The IAU Working Group on Cartographic Coordinates and Rotational Elements has defined a geodetic reference frame for most bodies. In practice, we see that a data product that serves as a proxy for the defined reference frame is required for the creation of other geometrically controlled products. In other words, the usability of a geodetic coordinate reference frame is significantly enhanced when that frame is represented by some data product.

We identify four classes of base image products: (1) non-controlled, non- orthorectified (2) non-controlled, orthorectified (3) semi-controlled, orthorectified, and (4) geometrically-controlled and orthorectified bases. We define control as an act of rigorously registering a product to a geodetic reference frame with resultant spatial and semantic accuracy documented. Semi-controlled products may not have associated accuracy data and non-controlled products are not tied to any reference frame. The act of ortho- rectification removes topographic induced error from the resultant data products. *Therefore, the only image base products that can be considered **foundational** are those that are both rigorously controlled and orthorectified as only these products allow for the assessment of spatial efficacy.* The other three classes (1-3) are usable as framework data products for a range of science applications and decision making tasks, if the potentially broad error bounds on positional accuracy and feature morphology are understood.

Conclusion: Our initial knowledge inventory supports development of PSDIs by identifying foundational data products, knowledge gaps, and missing foundational data products. We do not intend the presented table or full table (http://bit.ly/psdi_data) to be all inclusive. Rather, we perceive this list to be the beginning of a community-based discussion on the development and implementation of PSDIs. If a product is omitted or mislabeled, please contact the corresponding author.

References: [1] Laura et al. (2017) doi:10.3390/ijgi6060181 [2] Rajabifard (2003) doi:10.1080/1365881050043222

Table 1: Selected Solar System foundational data products and possible knowledge gaps (red).

NAIF	Body	Product Name	Product Type	Producer	Coverage
199	Mercury	Messenger MDIS (Control)	Geodetic Control	USGS	global
199	Mercury	Messenger MDIS Global DEM	Topography	USGS	global
199	Mercury		Controlled Orthorectified		
299	Venus		Geodetic Control		
299	Venus	Magellan SAR Altimeter	Topography	JPL	>90%
299	Venus		Controlled Orthorectified		
301	Moon	Lunar Orbiter Laser Altimeter	Geodetic Control	Goddard / NASA / JPL	global
301	Moon	LOLA Derived DTM	Topography	Goddard / NASA / JPL	global
301	Moon		Controlled Orthorectified		global
301	Moon	LROC NAC Orthomosaics	Controlled Orthorectified	ASU / USGS / UA / JPL	<0.5%
499	Mars	MDIM 2.1 (Control Network)	Geodetic Control	USGS	global
499	Mars	Mars Orbiter Laser Altimeter	Topography	NASA Goddard	± 88°
499	Mars	High Resolution Stereo Camera	Topography	HRSC Team / DLR	global
499	Mars	CTX Derived DEM	Topography	USGS	> 1%?
499	Mars	HiRISE Derived DEM	Topography	UA / USGS	> 0.5%?
499	Mars	Mars Digital Image Mosaic 2.1	Controlled Orthorectified	USGS	global
499	Mars	THEMIS Day IR Orthomosaic	Controlled Orthorectified	USGS	± 60°
499	Mars	THEMIS Night IR Orthomosaic	Controlled Orthorectified	USGS	± 60°
499	Mars	High Resolution Stereo Camera	Controlled Orthorectified	HRSC Team / DLR	Regional
499	Mars	CTX Orthomosaics	Controlled Orthorectified	USGS	< 1%?
499	Mars	HiRISE Orthomosaics	Controlled Orthorectified	UA / USGS	< 0.5%?
501	Io	USGS Control Network	Geodetic Control	USGS / RAND	global
501	Io	Global DEM	Topography	White (2014)	
501	Io	Galileo SSI / Voyager Mosaic	Controlled Orthorectified	USGS	global
502	Europa	Photogrammetric Control Network	Geodetic Control	RAND	global
502	Europa		Topography		
502	Europa	Photomosaic Map of Europa	Controlled Orthorectified	USGS	global
606	Titan		Geodetic Control		
606	Titan		Topography		
606	Titan		Controlled Orthorectified		