UPDATE ON THE NASA-USGS PLANETARY SPATIAL DATA INFRASTRUCTURE INTER-AGENCY AGREEMENT. L. Keszthelyi, J. Hagerty, S. Akins, B. Archinal, M. Bailen, M. Bland, K. Edmundson, R. Fergason, T. Hare, R. Hayward, M. Hunter, J. Laura, S. Sides, M. Velasco. U.S. Geological Survey, Astrogeology Science Center, Flagstaff, AZ (laz@usgs.gov).

Introduction: The phrase *planetary spatial data infrastructure* (PSDI) encompasses a very broad array of activities conducted across the international planetary science community [1]. The data management plans of individual NASA research and analysis grants, the cartography plans of spaceflight missions, the International Astronomical Union, the NASA Planetary Data System (PDS) and its equivalents in other countries, and a host of commercial, academic, and government entities are all key players in this long-term endeavor to provide scientists with the ability to work with data that have a spatial component. This abstract is intended to explain the role of the NASA-USGS PSDI Inter-agency agreement (PSDI-IAA) within this much larger environment. As discussed here, the work funded via the PSDI-IAA is only imperfectly encapsulated within the concept of PSDI.

History: The PSDI-IAA is an evolution of the long-standing NASA Planetary Cartography Program that was housed within NASA's now defunct Planetary Geology and Geophysics Program (PG&G). This program has existed, in one form or another, for well over 30 years. All the functions the USGS carried out under PG&G continue, but new tasks have been added.

Oversight: One key evolution has been the elimination of the external review panel that was the primary oversight mechanism under PG&G. Instead, quarterly and annual reviews are conducted directly between the USGS and NASA. The USGS has developed internal processes to track the progress on each deliverable and assign a status for each task that NASA has directed the USGS to complete. The details of these mechanisms are largely standard project management practices and of little importance to the broader community.

The more interesting problem is the selection of new tasks to take on under this agreement. The expectation has been that the USGS and NASA would make these decisions largely on the basis of community input via the Mapping and Planetary Spatial Infrastructure Team (MAPSIT). MAPSIT ([2] http://www.lpi.usra.edu/mapsit/) is a community advisory group organized to identify strategic PSDI needs for space science and exploration. It is intended to operate in a manner analogous to the NASA Planetary Science Division assessment groups (such as MEPAG, OPAG, SBAG, etc.). While MAPSIT has been slower to stand-up than originally hoped, it still remains the avenue to provide community input on what tasks are high priority items to be completed under the NASA-USGS PSDI-IAA.

Current and Near-term PSDI-IAA Tasks: The inter-agency agreement directs the USGS Astrogeology Science Center to fill certain key needs for NASA planetary exploration, especially as related to PSDI for research and analysis. The work package is determined annually and reviewed quarterly. For FY17 and FY18, the PSDI-IAA has 6 themes: Infrastructure and Data Access (15-16% of funding), Standards (20-21%), Software Development and Tools (35-37%), Products (7-9%), Community Engagement (12-14%), and Management and Personnel (7-9%). The tasks often cross theme boundaries so the level of effort on each type of work is only approximately matched by the dollar amounts in each theme. Note that there currently is not a one-to-one correspondence between the PSDI-IAA themes and SDI themes [1].

Infrastructure and Data Access. This theme includes the following tasks: (1) Database/Dataset Searching Web Services which aims to provide data to a variety of web services via a standard protocol; (2) DPW Management and Development which maintains the hardware and software for the digital photogrammetric workstations that produce digital topographic models of planetary surfaces; (3) MRCTR GIS Lab and Mapping Standards which maintains a guest facility for geologic mappers to work at the USGS in Flagstaff and works to develop and promulgate international GIS standards for planetary science; (4) USGS Regional Planetary Information Facility (RPIF) which is in a slow transition to becoming a network of locations to obtain expert assistance in accessing and working with digital planetary data; (5) New Centralized Map-based Search Portal on Main Astrogeology Website which failed to be completed in FY17; and (6) Astrogeology Geologic Materials Collection starting in FY18 to maintain drill core and other geologic materials from key terrestrial analog sites in a state that is easy for researchers around the globe to access.

Standards. This theme has the following tasks: (1) Planetary Geodesy which coordinates with the IAU Working Group on Cartographic Coordinates and Rotational Elements to provide the community with internationally agreed upon coordinate systems for all planetary bodies; (2) Planetary Geologic Mapping Program Coordination which guides NASA planetary geologic mappers through the process of producing and publishing USGS series map products for planetary bodies; and (3) Planetary Nomenclature which coordinates with the IAU Working Group for Planetary System Nomenclature to provide internationally agreed upon names for features on planetary bodies.

Software Development and Tools. This theme includes the following tasks: (1) Automated Image Matching to Support Control Network Generation which is researching new matching methods in FY17 and is transitioning to application to generating CTX controlled mosaics on a regional scale; (2) Camera Model Architecture which is researching the use of the Community Sensor Model standard to allow planetary data to work with a wide variety of tools developed for Earth remote sensing; (3) Maintenance and Support of the Integrated Software for Imagers and Spectrometers which keeps the infrastructure in place to develop, support, and maintain the widely used ISIS3 package [3]; (4) Integrated Photogrammetric Control Environment (IPCE) which aims to bring a major improvement in the usability of the tools used to apply rigorous photogrammetric control to products from the full variety of planetary data [4]; (5) SOCET GXP Conversion which is migrating planetary stereogrammetry from the deprecated SOCET SET software to current SOCET GXP software. In FY18 we plan to add the following tasks: (1) Git for Integrated Software for Imagers and Spectrometers to bring the ISIS3 software repository up to USGS required standards and (2) Improve ISIS3 Control Networks to Handle Larger Data Sets which is necessary for products we expect to produce in FY19 and beyond.

Products. This theme includes the following tasks: (1) Completion of the USGS' Enceladus Cartographic Package which adds key supplementary information to the recently completed controlled image mosaic for Enceladus [5]; (2) MESSENGER Image and Topographic Maps of Mercury which will produce for Mercury the type of product that has proven to be very popular with researchers and the public for the Moon; (3) THEMIS Controlled Mosaics of Mars which will complete a multi-year effort in FY18; (4) Creation of a Global Shape Model for Enceladus which is a logical extension of the controlled image mosaic; and (5) Updated Global Basemap and Renewed Photogrammetric Results for Europa to provide the best basis for planning the future Europa Clipper and Europa Lander missions.

Community Engagement. This theme has the following tasks: (1) USGS Review Panel Attendance which covers the full-cost accounting requirements for USGS staff to serve on NASA review and advisory panels; (2) USGS Planetary Spatial Data Infrastructure Community Engagement which includes the administration of MAPSIT activities; and (3) ISIS3 Workshops to restart in FY18.

Management and Personnel. This theme includes the following tasks: (1) NASA-USGS PSDI IAA Implementation which is the internal management of the cornucopia of PSDI-IAA work; (2) PSDI Human Capital Maintenance which provides funding for postdocs and graduate students to obtain real-world experience working on PSDI activities; and (3) Software Committee to incrementally improve the USGS software development processes. Tasks (1) and (3) will be funded by the USGS but the progress on their deliverables will be monitored by NASA. Task (2) has focused on Ohio State University and Northern Arizona University but can be expanded to include other institutions.

Future Directions: By the time of the meeting we should be able to report on the FY19 plans. At this time, the expectation is that the relative effort towards generating products will increase at the expense of software development. This will happen naturally as the SOCET GXP and IPCE activities transition from software development to the use of the new tools to create cartographic products. Longer-term, we are looking to better support data collected from terrestrial analogs and active spaceflight missions.

References: [1] Laura, J.R., et al., (2017) ISPRS Int. J. GeoInf. [2] Lawrence, S., et al. (2016) *LPI* XLVII, Abstract #1710. [3] Sides, S.C., (2017) LPSC 48, Abstract #2739. [4] Edmundson, K.L., et al. (2015) LPSC 46, Abstract #1454. [5] Bland, M.T., et al. (2016) LPSC 48, Abstract #2342.