THE IO GIS DATABASE AS AN EXAMPLE OF A PLANETARY SPATIAL DATA INFRASTRUCTURE.

D.A. Wiliams[1], [1]School of Earth and Space Exploration, Arizona State University, Tempe, AZ 85287-1401 (David.Williams@asu.edu).

Introduction: During production of the U.S. Geological Survey (USGS)-published, global geologic map of Jupiter's volcanic moon Io [1, http://pubs.usgs.gov/sim/3168/], construction began on a digital Io database. This database, built in ArcGIS™ and containing the geologic map shapefiles and the combined *Galileo-Voyager* Io global mosaics produced by the USGS for my mapping project [2], was intended to become a digital Geographic Information Systems (GIS)-compatible archive of all usable Io data collected during and after NASA's *Galileo* Mission to Jupiter. Since 2011, I and others have been adding, as time and resources permit, additional Io datasets to the database, including Io observations obtained by Earth-based telescopes fitted with Adaptive Optics (AO) [3]. Now we have received a 1-year grant from NASA's Planetary Data Archiving, Restoration, and Tools (PDART) program to complete the database and publish it both in ArcGIS™ and in Arizona State University's Java Mission planning and Analysis for Remote Sensing (JMARS) GIS system [4]. This abstract describes our project.

Objective: The objective of this project is: 1) to produce a single, geospatially co-registered database of all usable *Galileo* and post-*Galileo* data of Io to serve as a research tool to promote future studies and to aid observation planning for future Io missions, and 2) present one example of a possible data component for an Io Planetary Spatial Data Infrastructure (PSDI) to aid the planetary community in development of PSDIs for other planetary objects. The concept of our database is shown in **Fig. 1**. We will order the data as follows: 1) Image data (*Galileo-Voyager* mosaics and their ancillary data, *Galileo* SSI regional mosaics, *Galileo-Voyager* DEM, *New Horizons* images); 2) Geologic maps (Regional SSI maps, *Voyager* map I-2209 [5], *Galileo-Voyager* map SIM 3168), 3) Spacecraft hot spot data (NIMS NITED database [6], and older hot spot data [7]), 4) Earth-based adaptive optics telescopic observations (chronological order, oldest to youngest), and 5) interior heat flux model maps. It is important to note that, once the data are ingested as their own layer with corresponding attribute (data) tables, the layers can be turned on and off and re-ordered at will. This feature enables users to focus on the types of science they are most interested in, and irrelevant data/layers can be ignored. This is a powerful capability in both ArcGIS™ and JMARS.

Perceived Impact:
NASA's MAPSIT advisory/assessment group is developing a roadmap and recommendations for the planetary science community on how to preserve past mission data, and to place it into usable planetary spatial data infrastructures (PSDIs) to enable cartographic and scientific research of NASA planetary data for generations to come. Unlike the Moon and Mars, which have terabytes of data from multiple missions going back to the 1960s, Jupiter's moon Io has a relatively small amount of data available for scientific study, that can be easily managed and manipulated using current GIS tools. By assembling all workable Io data into a single geospatially registered database, this project will create a tool to promote additional Io science prior to the next mission, enable accurate and detailed target evaluation for observation planning for a future Io mission (e.g., *Discovery*-class *Io Volcano Observer*: McEwen et al. [8]; *New Frontiers*-class Io Observer (e.g., FIRE: Suer et al. [9])), and provide the planetary community with one example of how to structure a PSDI for a small body with relatively limited data. This would be useful, for example, to the small bodies community in attempting to design PSDIs for asteroids, comets, dwarf planets, and outer planet moons.

References:
[1] Williams, D.A. et al., 2011. *USGS SIM 3168*, 1:15M; [2] Becker, T. and Geissler, P.E., 2005. LPSC *XXXVI*, Abstract #1862; [3] e.g. Cantrall, C. et al., *Icarus, 312*, 267-294, 2018; [4] Christensen, P.R. et al., 2009. *Eos, Trans. AGU*, Fall Meeting Abstr. #IN22A-06; [5] Crown, D.A., et al. 1992. USGS *Misc. Invest. Series Map I-2209*; [6] Davies, A.G., et al. 2012. *Icarus, 221*, 466-470; [7] Lopes, R.M.C., and Spencer, J.R., 2007. *Io After Galileo*, Springer-Praxis, 309 pp.; [8] McEwen, A.S. et al. 2014. *Acta Astronautica, 93*, 539-544; [9] Suer, T.A., et al. 2017. *Adv. Space Res., 60*, 1080-1100.
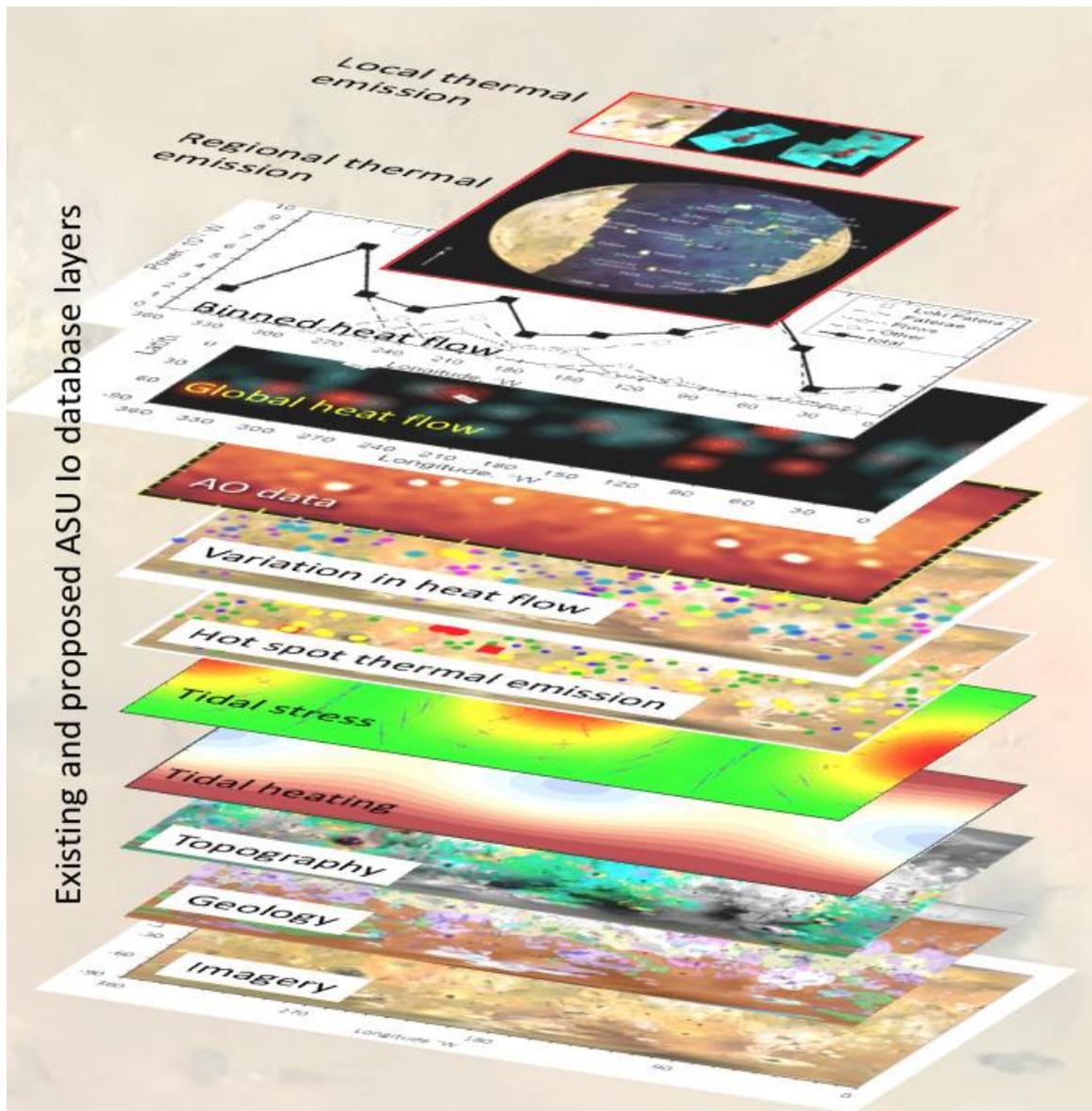
Figure 1. Concept model for Io GIS database. By placing all Io data in a geospatially co-registered format, mission/instrument data at the base and various model results at the top, it will be possible for current and future Io researchers to track information about Io's volcanic features/regions in space and time. *In both ArcGIS and JMARS, layers of information can be turned on and off and reordered at will, so that users can focus on the types of information and studies pertinent to their research.* Once the database is built, additional layers of information can be added fairly easily. Figure produced by A.G. Davies, NASA Jet Propulsion Laboratory.