

MAPSIT: Making Data Accessible and Usable



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Planetary Advisory Committee, March 2020

Summary of Activities

- Roadmap – Planetary Spatial Data Infrastructures
- Decadal Survey White papers – data accessibility and usability



MAPSIT Roadmap: Rationale

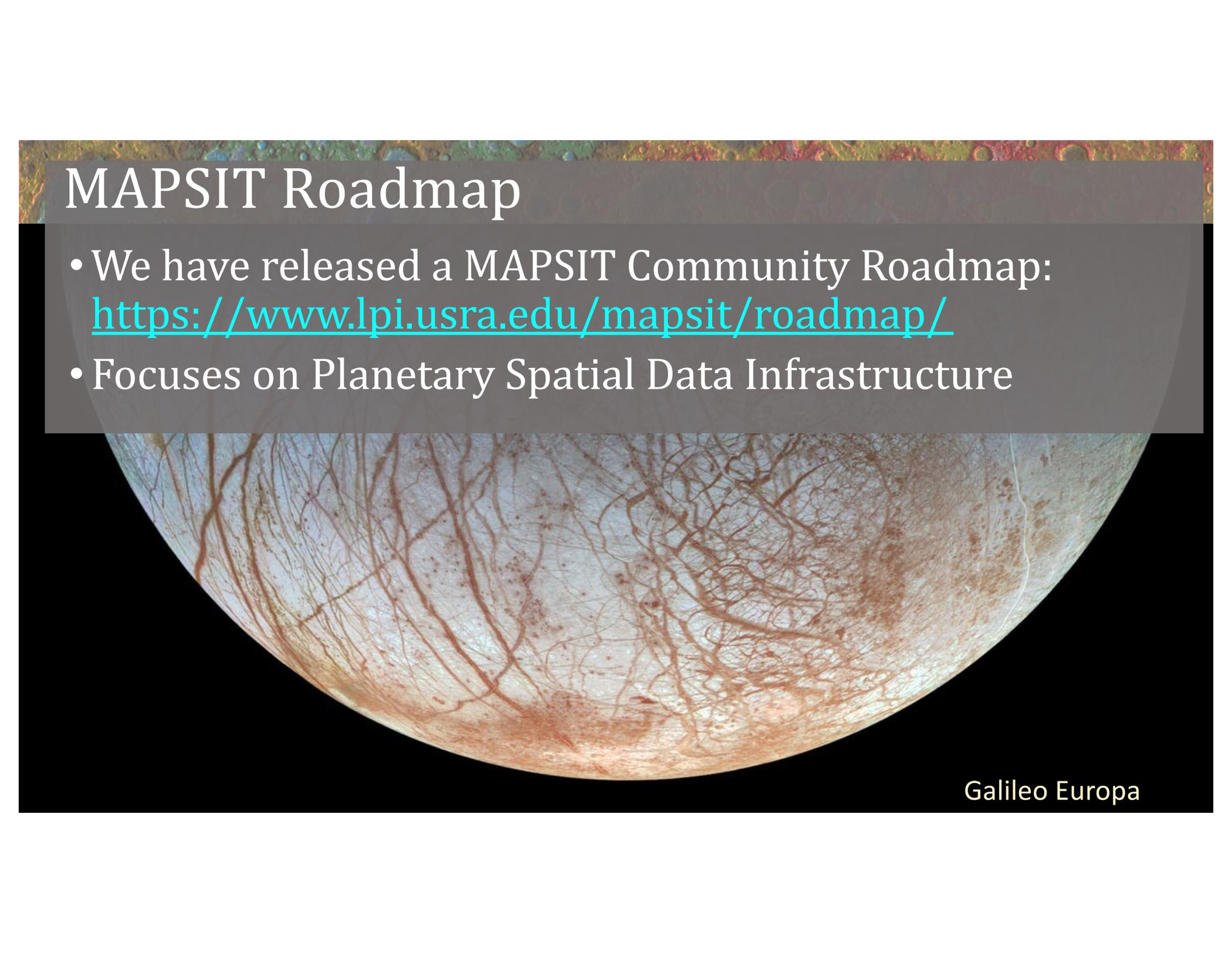
- Spatial data contribute significantly to the success of NASA endeavors *if they are correctly acquired, accessible, and usable.*

Galileo Europa

MAPSIT Roadmap: Rationale

- Spatial data contribute significantly to the success of NASA endeavors *if they are correctly acquired, accessible, and usable*.
- Often, spatial data are *not readily interpretable* to users outside mission science teams or they are processed in ways that are *non-standard*.

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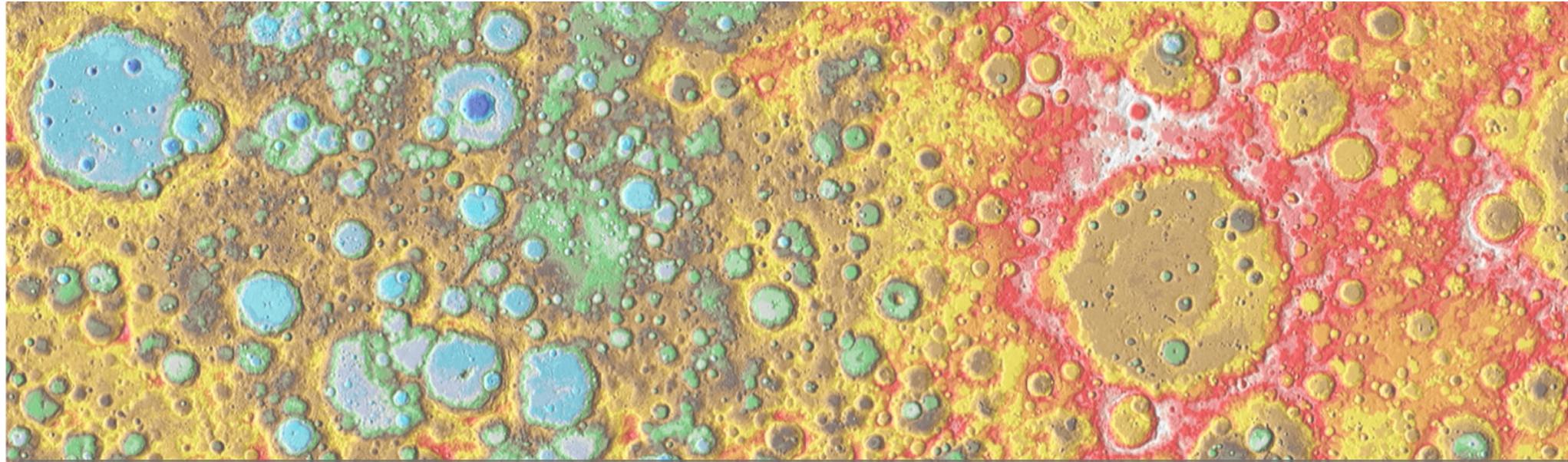
MAPSIT Roadmap

- We have released a MAPSIT Community Roadmap: <https://www.lpi.usra.edu/mapsit/roadmap/>
- Focuses on Planetary Spatial Data Infrastructure

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What is a Planetary Spatial Data Infrastructure?

- A **plan** and a **structure** for obtaining and organizing data in a standardized way to make them **discoverable, accessible and usable**.
 - NOT just a collection of data
 - NOT just an application, like ArcGIS, a Trek, etc.
- A planetary SDI should be built around **USER** needs.
 - How should we obtain data so that it can give us the most information?
 - How should it be organized? What products are prioritized?
 - What technologies are needed for processing and use?



- PSDIs require **FOUNDATIONAL DATA PRODUCTS** – provide basic positional information on which all other data can be placed. These are **controlled** and **registered** to the body.
- Not all bodies have these products made automatically by missions.
- This one: Lunar Reconnaissance Orbiter (LRO) WAC Color Shaded Relief Map of the Lunar far side, created from the Global Lunar Digital Terrain Model (100 m/pixel) and LOLA 30-m gridded DTM. ([lroc.sese.asu.edu](http://roc.sese.asu.edu)).

A Planetary Spatial Data Infrastructure - how?

- Assume a planet with mission/s past/future
- Committee of data gatherers, users, stakeholders
 - Agree upon ways to obtain/process data and create foundational data all can use
 - Agree how to keep/serve data long term
- Europa as case study

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Earth and Space Science

RESEARCH ARTICLE
10.1029/2018EA000411

Framework for the Development of Planetary Spatial Data Infrastructures: A Europa Case Study

Special Section:
Planetary Mapping: Methods,
Tools for Scientific Analysis and
Exploration

J. R. Laura¹, **M. T. Bland¹**, **R. L. Fergason¹**, **T. M. Hare¹**, and **B. A. Archinal¹**

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See Laura et al. (2018) ESS doi:10.1029/2018EA000411 for a theoretical framework for a PSDI with Europa as an example

A Europa Planetary Spatial Data Infrastructure

- *Policy/Standards*

- Committee of OPAG, Europa Clipper, MAPSIT
- What products are needed from existing data, how do we collect and integrate new data, how to serve it, roles and responsibilities

- *People*

- *Enablers* = NASA
- *Suppliers* = anyone who has spatially enabled data products to contribute (old/new missions, outside of missions)
- *Developers* = maintain technical solutions like analysis tools, data services
- *Marketers* = NASA, missions, scientists
- *Users* = Anyone who uses the products

See Laura et al. (2018) ESS doi:10.1029/2018EA000411 for a theoretical framework for a PSDI with Europa as an example

A Europa Planetary Spatial Data Infrastructure

- *Data and Formats*

- Do an inventory to identify critical gaps and spatial efficacy
- All data that exists should be spatialized to existing orthomosaic base
- New data (to be obtained) must work spatially with previous

- *Access*

- Organizations and teams should be engaged as custodians
- So far: Raw on PDS, ASU RPIF V1,2 mosaics, USGS orthorectified via PDS annex
- **Develop an E-PSDI clearinghouse to make available spatially enabled data**

See Laura et al. (2018) ESS doi:10.1029/2018EA000411 for a theoretical framework for a PSDI with Europa as an example

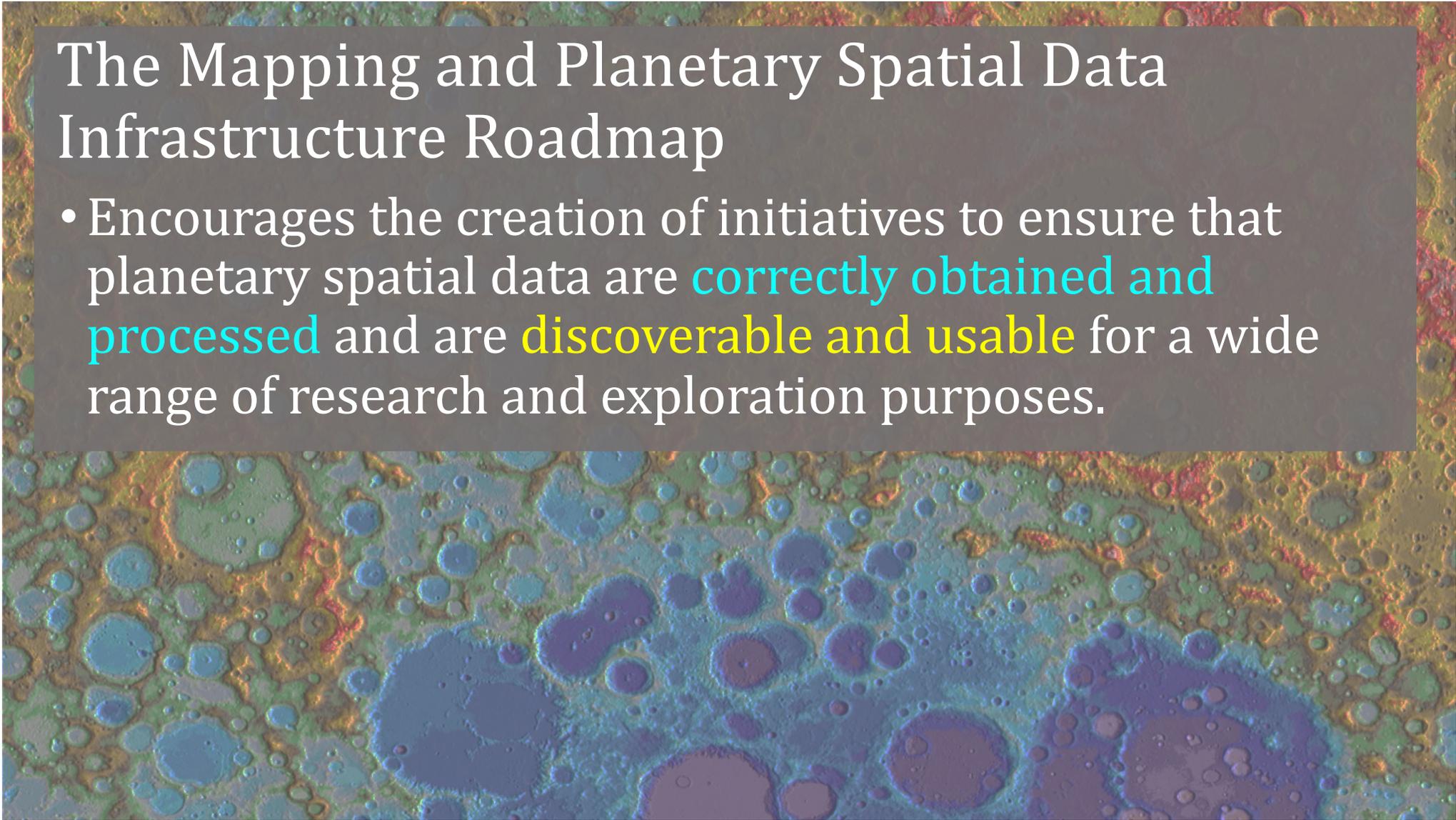
A Europa Planetary Spatial Data Infrastructure

- *Policy and Standards*
- *People*
- *Data and Formats*
- *Access*

Galileo Europa

The Mapping and Planetary Spatial Data Infrastructure Roadmap

- Encourages the creation of initiatives to ensure that planetary spatial data are **correctly obtained and processed** and are **discoverable and usable** for a wide range of research and exploration purposes.



The Mapping and Planetary Spatial Data Infrastructure Roadmap 2019-2023 (SHORT summary)

- **Finding I:** High-quality data should be obtained and foundational data made – these are key to registering all data for a specific body.
- **Finding II:** Data that are ready-to-use and that conform to standards should be made – these broaden the reach of information.
- **Finding III:** Future efforts should ensure that data are easily discoverable, accessible, usable, and conform to evolving standards.
- **Finding IV:** PSDI(s) should be developed – this helps data reach beyond a single application or community.
- **Finding V:** Additional data tools, technologies and expertise should be developed following community priorities.

Summary of Activities

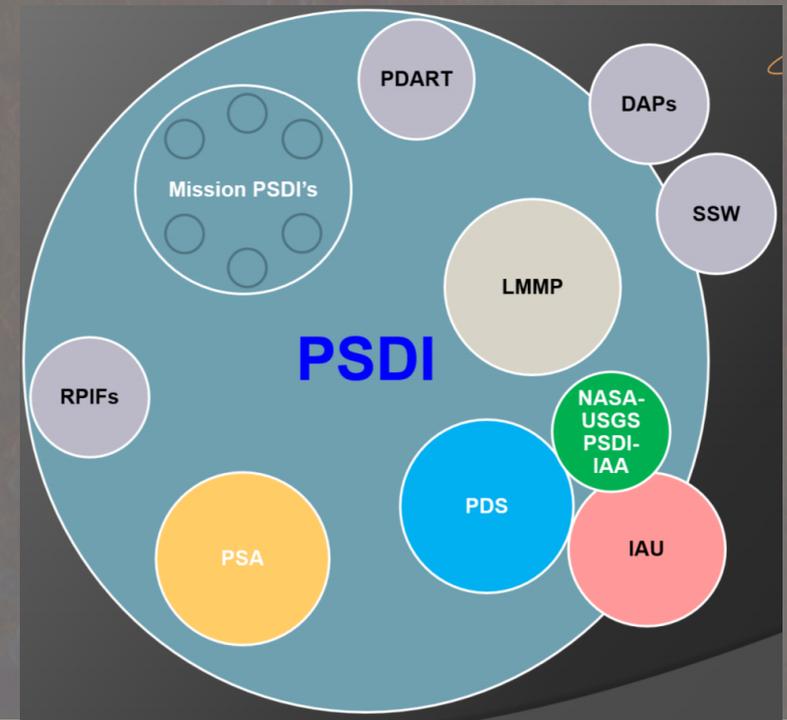
- Roadmap – Planetary Spatial Data Infrastructures
 - On our website
- Execute the roadmap by **building PSDIs**, start with Europa
 - Don't delay starting this process for other bodies
 - Who should do these activities, how should they be funded? – NASA the steward, community can all help
- Decadal Survey White papers
 - Based on the Roadmap, focusing on data accessibility and usability



extras

Doesn't NASA's PDS serve all data needs?

- The Planetary Data System (**PDS**) is tasked with long-term preservation of data
 - An element of the PSDI initiative
- Typically data stored within the **PDS archive** are **not spatially enabled** for immediate use by non-expert researchers.
- Instead, adequate metadata are provided with the image data that **enable the user to create** spatially enabled products.
- **Significant expertise is required** to perform these operations and interpret the spatial correctness of the products.



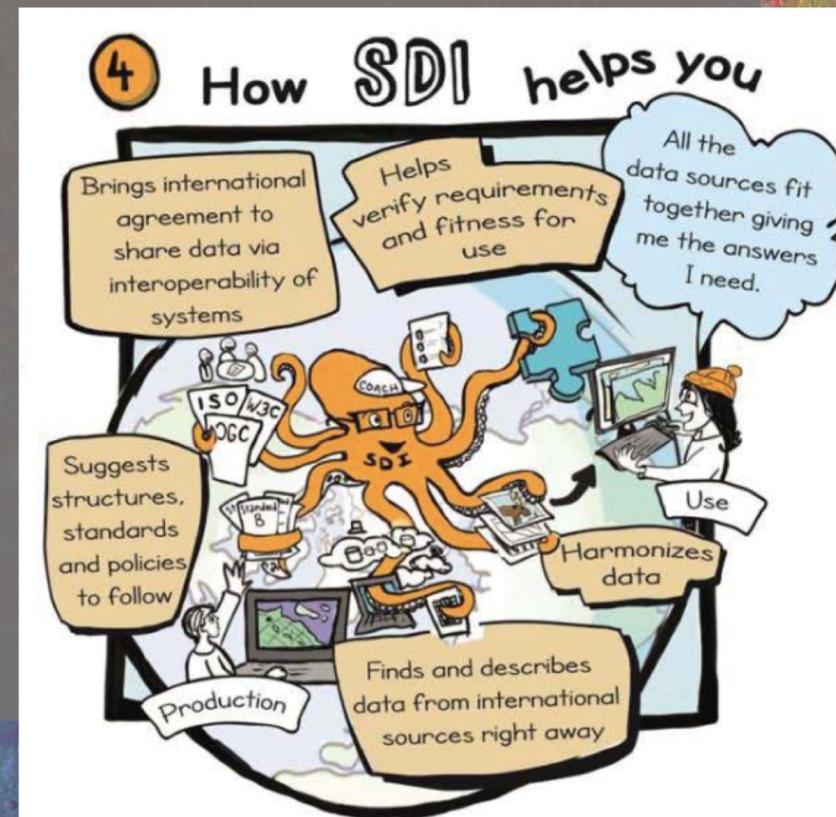
See Gaddis et al., 2017:

https://astropedia.astrogeology.usgs.gov/download/Docs/PlanetaryDataWorkshop/Presentations2017/Thursday/Humphreys/PDS_and_PSDI_Gaddis_6.15.17_v3.pdf

Don't we already have online applications?

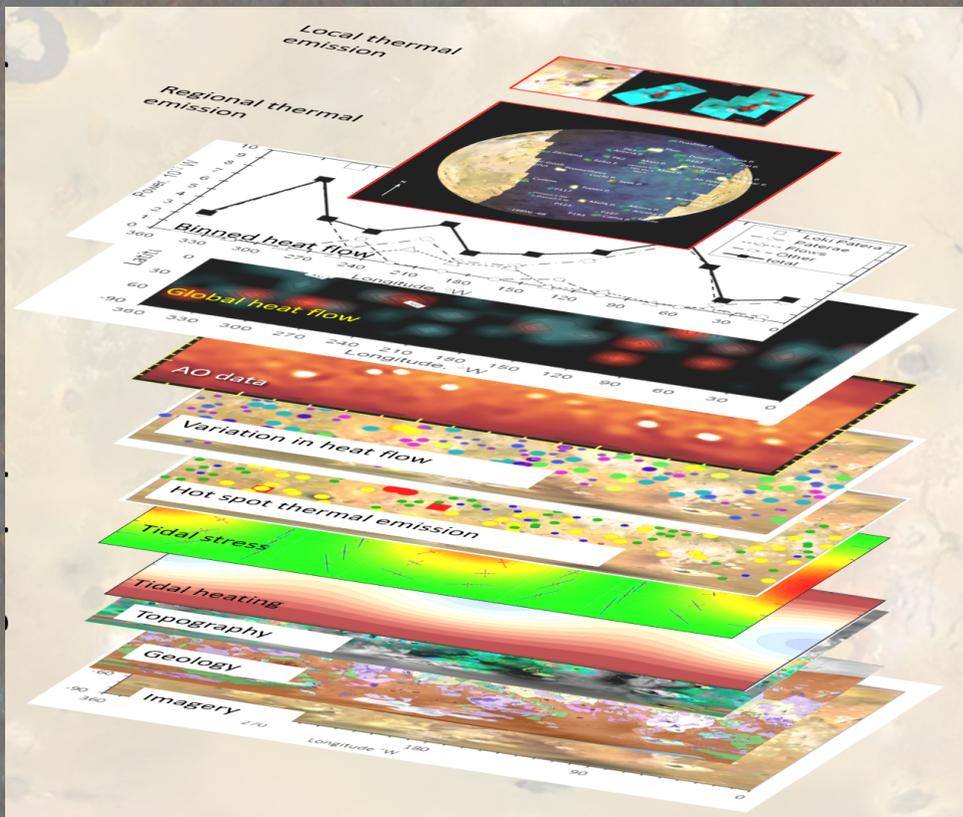
- PSDIs are **more dynamic** than most data servers and tools
- Often the controlled, foundational data need to be created and registered to the body, so that the popular web-based tools or GIS-based applications can work
 - *Anyone can contribute to this effort!*

Lots of Earth-based SDIs



Types of Integrated Data: Io example

Existing and proposed ASU Io database layers

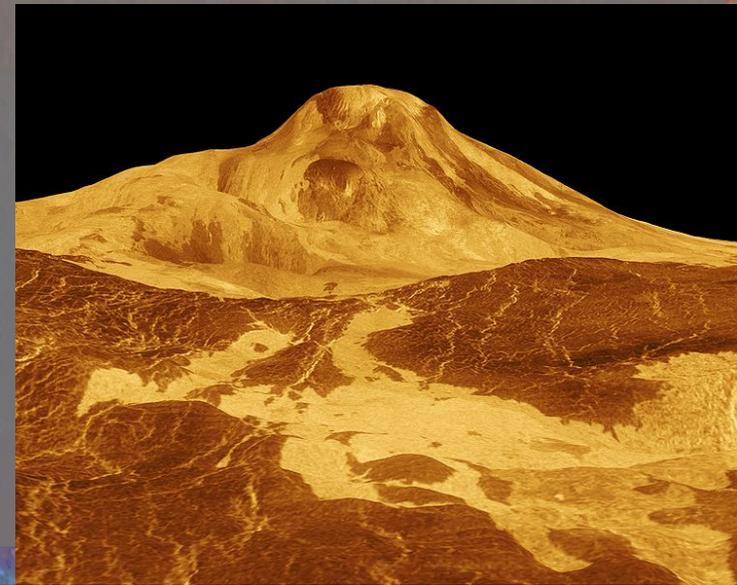


- Foundational (base) data
 - Geodetic Coordinate Reference Frames - subject to refinement as knowledge improves
 - Elevation (Topographic) data
- Overlain data
 - Orthorectified orthomosaics
 - Spectral compositional maps
 - Geologic maps at various scales

See Williams et al., 2019: <https://www.hou.usra.edu/meetings/lpsc2019/pdf/1053.pdf>

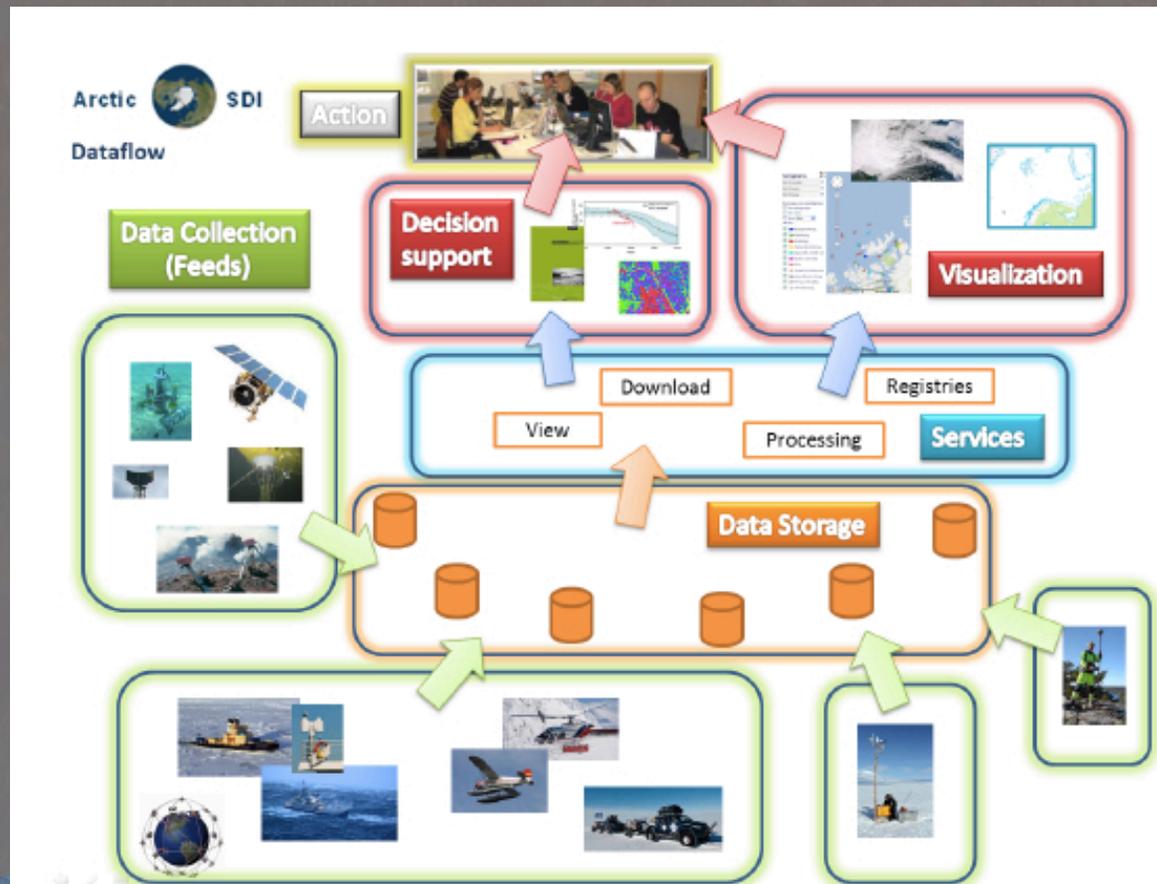
Planetary Foundational Data Examples

- Geodetic Coordinate Reference Frames
 - IAU defined lat/lon and ephemeris
 - Planetary is special: geodetic coordinate reference frames are iteratively defined as data improves. Laser altimetry (e.g., LOLA) for the Moon)
- Elevation Data
 - Mars DTM from MOLA, Magellan DEM, MLA from MESSENGER for Mercury
- Compositional maps from spectra
 - Clementine iron and titanium maps for the Moon
- Orthorectified Orthomosaics
 - Global Io Voyager/Galileo basemap
- Geologic maps at various scales (Mars 1:24K to 1:25M)
- As a non-spatial expert - **these data sets should all just work and be readily accessible**



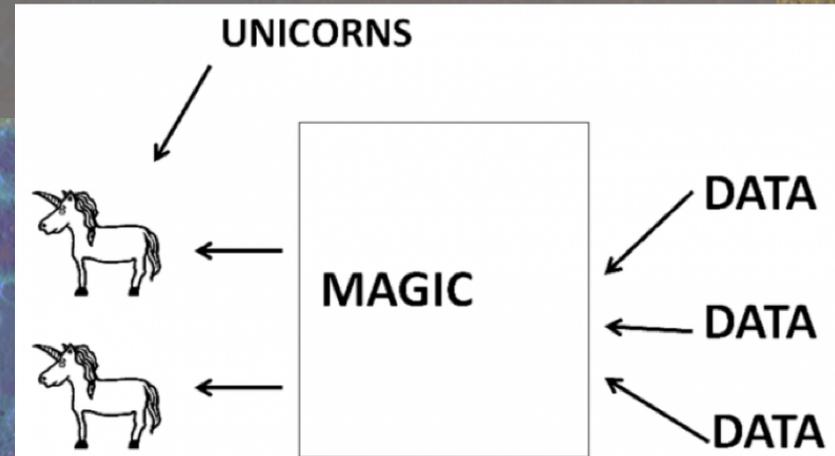
SDI Example – Arctic SDI

- Data from 12 different organizations – required heavy **standardization and foundational data**
- Available in **widely used** geospatial formats
- **Search enabled** by tight data/information coupling
- Data **available** to all kinds of users



What is Planetary Spatial Data Infrastructure?

- A **plan** for obtaining and organizing data in a standardized way to make them **discoverable, accessible and usable**.
 - NOT an application, like ArcGIS, a Trek, etc.
 - A structure around which data are **obtained** and **served**
- Most users want the data to **just work** – a PSDI should enable this!



What is Planetary Spatial Data Infrastructure?

- A theoretical concept developed in the terrestrial community
- For planning, not a canned solution
- **Goals are to improve data**
 - Discoverability
 - Accessibility
 - Usability
- Broader than just data
 - Data sets and products
 - Technologies (access, processing, use, preservation)
 - Human resources (training and continuity of knowledge, outreach)
 - Standards

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Article

Towards a Planetary Spatial Data Infrastructure

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*See Laura et al. (2017) ISPRS
Int. J. Geo-Inf., 6, 181,
doi:10.3390/ijgi6060181 for a
theoretical framework for a
Solar System-wide PSDI*