

## UPDATING MAGELLAN VENUS DATA TO PDS4 ARCHIVING STANDARDS

E. A. Guinness, D. V. Politte, R. E. Arvidson, P. K. Byrne, and T. C. Stein, Dept. of Earth and Planetary Sciences, McDonnell Center for the Space Sciences, Washington University in St. Louis, 1 Brookings Drive, Campus Box 1169, St. Louis, Missouri, 63130; guinness@wustl.edu.

**Introduction:** The Magellan data archive at the Geosciences Node consists of twelve datasets that together comprise a data volume of about 750 Gbytes with over 700,000 files (see: [pds-geosciences.wustl.edu/missions/magellan](https://pds-geosciences.wustl.edu/missions/magellan)). The PDS Geosciences Node is restoring its collection of Magellan Venus datasets in 2022-2023 using the PDS4 archiving standard. The restoration of Magellan datasets will make these data more accessible and useful to science investigators and will support science from upcoming missions to Venus, VERITAS and DAVINCI, as well as the ESA EnVision Mission.

**Magellan Mission to Venus:** The Magellan spacecraft operated at Venus from 1990 to 1994. The main experiments for geologic mapping were Synthetic Aperture Radar (SAR) imaging, altimetry and radiometry measurements, along with radio science experiments. The mission phases were divided into 243 Earth-day mapping cycles. The first three mapping cycles concentrated on collecting radar imaging and altimetry data. The fourth and fifth cycles were devoted to mapping the planet's gravity field. The final cycle lowered the spacecraft orbit to collect better gravity data near the poles. The mission ended when the spacecraft dropped into the Venusian atmosphere.

**Magellan Datasets:** The Magellan archive consists of several image datasets, tabular datasets of altimetry and surface properties, and models of the gravity field. Image datasets include F-BIDRs (Full-resolution Basic Image Data Record – 75 m/pixel) and C-BIDR (Compressed Basic Image Data Record – 225 m/pixel) SAR data, which are along-orbit-track images that span nearly pole to pole. F-MIDR (Full-resolution Mosaic Image Data Record) and Cx-MIDR (Compressed Mosaic Image Data Record) products are mosaics derived from the F-BIDRs and C-BIDRs, respectively. Cx-MIDRs have three different levels of resolution reduction. The GxDR dataset is a set of four global maps derived from altimetry and radiometry data, namely topography, slope, and microwave reflectivity and emissivity. Tabular datasets include the ARCDR (Altimetry and Radiometry Composite Data Record) data with altimetry and radiometry stored in along-orbit-track format, surface properties datasets, and line-of-sight spacecraft accelerations used to derive the planet's gravity field. Models of the gravity field are stored as spherical harmonic coefficients.

### Issues with the Original Magellan Archiving:

The Magellan Mission was one of the first planetary missions to archive its data to the PDS. PDS standards were in early stages of development at that time, however. Much of the documentation on data processing and storage formats only exist in paper form. In addition, some datasets were created on VAX computers using VAX storage formats, which are no longer in common use. Image mosaics were divided into small 1024 sample by 1024 line framelets because of the limited storage and display capabilities available in the 1990s. In addition, BIDRs were delivered to PDS on 9-track tapes. About 10% of the tapes were unreadable and then transferred to CD-WO. Some, but not all, of these tapes were redelivered to PDS. Read errors were encountered on almost all the tapes. Such reading issues were captured in errata files.

**Data Improvements and Status:** The restoration of Magellan data archives is in some sense a project of "data archaeology" given the current use of obsolete formats and limited digital documentation. The restoration effort will include the use of simpler data storage formats, more uniform and robust metadata, and XML for metadata in labels, enabling a variety of standard software tools to access the metadata. Some Magellan data products will be reformatted to meet PDS4 data standards. For example, any binary data that was originally stored using VAX binary format will be converted to IEEE formats. For the F- and Cx-MIDR and GxDR image products, the original 1k x 1k pixel frames of each mosaic will be merged into a single mosaic. Browse products will be generated, where appropriate, and stored in a commonly used format such as JPEG or PNG. Currently, we are focusing on the image datasets (BIDRs, MIDRs, and GxDRs). These have the largest data volume and number of files. We are designing the updated BIDRs to deal with their unique format (a few hundred samples and up to 200,000 lines). Each long BIDR will be divided into several images that cover standard latitudes bands. The small framelets of the MIDRs and GxDRs are being reassembled back together into their original mosaic format. As a dataset is updated to PDS4 standards, it will be ingested into the Geosciences Node Orbital Data Explorer (ODE) service for Venus ([ode.rsl.wustl.edu/venus](https://ode.rsl.wustl.edu/venus)), so that users can search, browse, and download the updated data.