PDS Archive of InSight Deployment Phase Camera Images and Mosaics. H. E. Abarca[1], R. G. Deen[1], C. M. De Cesare[1], S. S. Algermissen[1], N. T. Toole[1], J. N. Maki[1], G. A. Hollins[1], A. W. Tinio[1], Y. Lu[1], P. Zamami[1], A. Trebi-Ollenu[1], S. Myint[1], O. Pariser[1], N. A. Ruoff[1], J. R. Hall[1], and P. M. Andres[1], [1]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91109, hallie.e.gengl@jpl.nasa.gov.

Introduction: The first set of image data from the two cameras on NASA's InSight Lander, the Instrument Context Camera (ICC) and the Instrument Deployment Camera (IDC) [1], will be delivered by JPLs Multimission Image Processing Lab (MIPL) to the PDS Cartography and Imaging Sciences Node this year as part of InSight PDS Release 1. This will cover Landing (Nov 28, 2018) through the end of the Instrument Deployment and Science Transition Phase (March 31, 2019). This release will occur in two phases. In May of 2019, all raw images will be released. This will be followed by a second phase in June of 2019 which will contain processed results: derived products, mosaics, and terrain meshes.

Raw Data: From landing through March 31st we have collected over 1250 unique IDC images and over 450 unique ICC images. Most of these IDC frames were acquired to aid in the deployment of the instruments, SEIS [2] and HP3 [3], onto the surface of Mars, a mission phase supported by the ISSWG (Instrument Site Selection Working Group) [4]. For every image, the raw unrotated JPEG, correctly rotated VICAR formatted "EDR", and JPEG/PNG formatted browse images will be available in the archive [5].

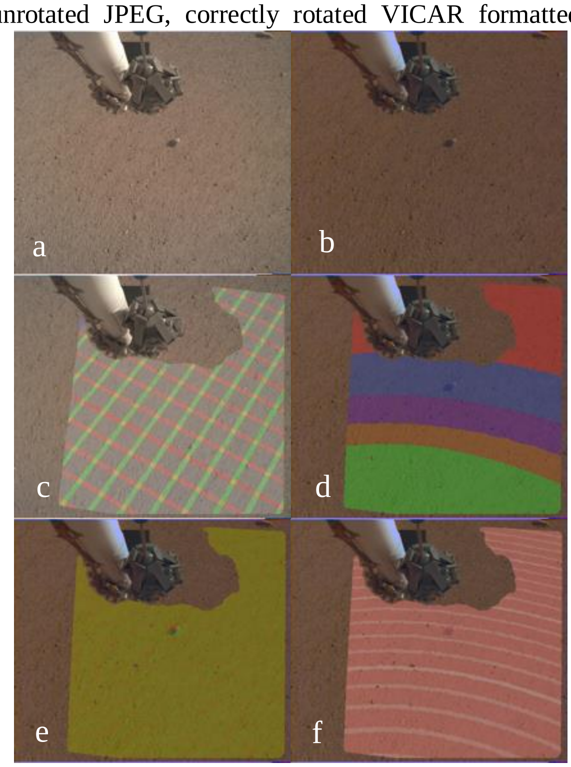

Figure 1: Example of single-frame stereo products. a) Raw image, b) radiometrically corrected, c) XYZ, d) workspace, e) surface normal, f) range

Calibrated and Derived Data: For each raw image that is downlinked, the MIPL pipeline creates a number of processes, calibrated, and derived products [4,5]. These include radiometrically and color corrected products. For the InSight Mission these color products have proven to be essential for proper scene interpretation and hardware monitoring.

Stereo images pairs get additional processing, including stereo disparity, XYZ coordinates, surface normal, range, and slope information, as well as a number of products specifically designed to assist with InSight instrument deployment [4]. In all, a total of 67 products are created per image pair [5]. These provide unique information about the surrounding terrain for understanding of the deployable workspace.

The IDC is not a traditional stereo camera, it is mounted on the arm, and stereo is achieved by moving the arm [4]. This creates significant error in the stereo analysis results if not corrected. The workspace mosaics were therefore subject to an extensive pointing correction and bundle adjustment campaign. This reduced the error in the workspace mosaics considerably, from 5.0 to 1.9 mm on average [6]. These corrected mosaics, along with the supporting ancillary files (tiepoints, correction parameters, etc.) will be included in the release.

All InSight-specific instrument placement products, and many standard multi-mission products were also generated for the workspace mosaics. While these data products are also available as single frame data, the mosaicked versions are more useful as they have been

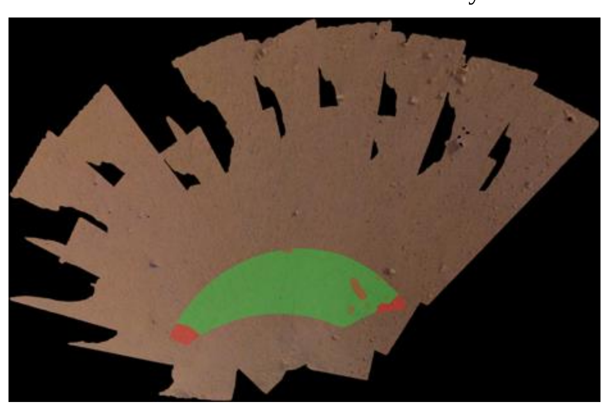

Figure 2: InSight orthorectified workspace mosaic showing goodness map overlay for SEIS

seam corrected and computed over the entire workspace, rather than the relatively narrow 45 degree field of view of the IDC – which, due to the proximity to the terrain, covers a very small section of ground.

PDS4: InSight is one of the first missions to develop its PDS archives using the newly adopted PDS4 standard [7]. PDS4 differs from PDS3 in a variety of ways, but the most significant differences can be seen in how data are organized within the archive, and how metadata are represented in PDS label files.

In PDS4, data are typically delivered to the PDS in the form of a "bundle". The bundle contains Collections, which group related products together [8]. The InSight cameras bundle includes a number of "collections" containing different types of data:

- calibration: calibration products
- data: image, mosaic, and mesh products
- browse: browse images
- document: documentation files such as the Software Interface Specification (SIS) [5] and example PDS4 labels
- miscellaneous: Apache Velocity [9] templates used to produce PDS4 labels
- xml_schema: the set of PDS4 XML Schemas referenced by InSight's PDS4 labels

Every data product in the PDS Archive is accompanied by a PDS label file, which contains metadata. PDS4 metadata labels are written in XML (eXtensible Markup Language), which is an international standard that provides both syntax and structure for describing data.

The operations products, however, use VICAR labels [5] to store their metadata. In order to convert this to XML, the PDS Generate tool [10] is used, along with a set of Velocity templates. They convert the VICAR labels used in operations products to PDS4 labels. Importantly, they are multi-mission in nature, and will be reused on future missions [11].

InSight utilized the APPS pipeline [12] to automate the collection of data products for bundle generation. The APPS pipeline was directly fed data products as they were tactically generated, validating their PDS4 labels and storing the results in a database. This database was later queried before bundle generation, allowing operators to see which products failed validation as well as ultimately generate the bundle for delivery to the PDS Cartography and Imaging Sciences Node.

Future Work: Looking forward to future PDS releases, the bulk of the imaging for science monitoring phase will primarily be atmospheric and workspace monitoring. In addition, a full 360 degree "science panorama" is being acquired at several different times of day, and thus lighting conditions, that will fill in all gaps in the existing coverage of the area surrounding the lander.

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Figure 3: Sol 14 270 degree afternoon horizon panorama