VISUALIZING LUNAR VERTEX IMAGE DATA WITH THE SMALL BODY MAPPING TOOL. R. J. Steele[1], E. S. Cheung[2], I. Y. Doku[2], and A. R. Johnson[2], [1]The Johns Hopkins University Applied Physics Laboratory, 11101 Johns Hopkins Road, Laurel, MD, 20723 (sbmt@jhuapl.edu), [2]University of Maryland, Baltimore County.

Introduction: Spacecraft missions return massive amounts of valuable data, but those data can be hard to access, visualize, and analyze. Most asteroids, comets, Kuiper belt objects, and small moons present additional challenges because two-dimensional map projections severely distort features on irregularly shaped bodies. Local views of irregular surfaces, such as those obtained from landed missions, produce similar challenges. The Small Body Mapping Tool (SBMT) developed at the Johns Hopkins University Applied Physics Laboratory addresses these challenges [1,3].

The SBMT allows users to find, access, and analyze spacecraft data in a contextual way for irregular bodies. It lets users search for and project spacecraft data onto shape models to help them do their science in three dimensions without worrying about map projection issues or sorting through Planetary Data System (PDS) archives. Alternatively, users can use the SBMT as a starting point to pinpoint the data they need and then download the raw data from the PDS. The Tool includes a diverse suite of bodies and data types (images, spectra, altimetry data) and supports co-registration of these data products.

The Small Body Mapping Tool is publicly available as a free download at sbmt.jhuapl.edu. It works on Mac, Linux, and Windows operating systems and has a user-friendly graphical interface that has been improved substantially over the last year. The SBMT is written in Java and uses the Visualization Toolkit (VTK), an open-source, freely available software system for 3D computer graphics, rendering, and visualization [2]. Anyone can access datasets for 12 asteroids, 5 comets, and 19 satellites. Datasets and added features for active missions (e.g., DART) are currently restricted to team members, but will be made public once all data products in the SBMT have been archived with the PDS.

Lunar Vertex Updates: For Lunar Vertex, the SBMT will receive updates in three areas: distortion models for images, visualizing images from a landed position, and preparing the SBMT for Lunar Vertex.

Distortion Models. While data used in the SBMT is typically defined as "analysis ready", meaning the user has to do nothing extra to load and visualize data in the tool, Lunar Vertex introduces an opportunity to add distortion modeling capabilities to the existing image framework within the tool. This framework uses a pipeline methodology that allows developers to define operators that can work on pixel-level data, and multiple operators can be strung together to apply a series of operations to the image. Figure 1 shows an early effort to apply a distortion correction to a ground-calibration image from one of the Lunar Vertex camera-sensor pairings.

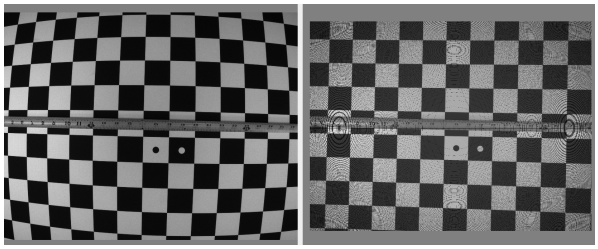

Figure 1. An initial attempt at applying a distortion correction to a ground-calibration image. The raw image is on the left, and the corrected image is on the right.

Landed Visualization. To date, the SBMT has been used with orbital data. We will show that the current projection techniques used in the SBMT carry over to landed spacecraft, assuming that proper pointing and alignment information is provided for the tool to know where the cameras are pointed.

Preparing the SBMT for Lunar Vertex. From a landed perspective, the lunar surface is irregular. Luckily the SBMT has the ability to load in local digital terrain maps (DTMs) and use them as the surface upon which data will be rendered. These DTMs, supported by existing data such as basemaps and images from prior missions, will provide scientists the context they need to understand the new data from Lunar Vertex.

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References: [1] Ernst et al., 2018, *LPS 49*, #1043. [2] http://vtk.org [3] Steele et al., 2021, 5th Planetary Data Workshop.