UPDATES TO THE PDS ANALYST'S NOTEBOOK. T. C. Stein, F. Zhou; McDonnell Center for Space Sciences, Dept. of Earth and Planetary Sciences, Washington University in St. Louis, 1 Brookings Drive, CB 1169, St. Louis, MO 63130, tstein@wustl.edu, feng.zhou@wustl.edu.

Introduction: The Planetary Data System (PDS) Analyst's Notebook (AN) [1] is a dynamic web application containing peer-reviewed, publicly available data delivered by the instrument teams, supported by documentation describing context for the observations, processing methodology, and data formats (an.rsl.wustl.edu). Notebooks are accessible for NASA landed missions, including Mars 2020 Perseverance rover, Mars InSight Lander, Mars Science Laboratory Curiosity rover, Mars Exploration Rovers Spirit and Opportunity, Mars Phoenix Lander, and the lunar Apollo and LCROSS missions.

Data and documents from ongoing missions are incorporated into the AN when released to the PDS archive. New features and capabilities are added at the request of users. This abstract summarizes updates to the Notebook during 2023.

Notebook Summary: The content within the AN is organized into sections, mirroring the structure of a physical notebook. These sections include Mission, Sol, Search, Maps, Sample Science (Mars 2020 only), Resources, User Management, and Help.

Users can customize their experience through a complimentary account, ensuring a synchronized experience across various devices and browsers. This account efficiently manages the user's viewing history, image annotations and measurements, personalized bookmarks, and data orders. The account name and password remain consistent across all Notebooks that support accounts. Data and documents can be conveniently ordered using a cart paradigm akin to common e-commerce websites.

Notebook Updates: The AN is updated regularly commensurate with scheduled data releases to the PDS archive. During 2023, data were added from completed mission InSight Lander (data acquired July 1, 2022–December 15, 2022); MSL Curiosity rover (data acquired sols 3548–3902); and Mars 2020 Perseverance rover (data acquired sols 540–899). Data release status can be accessed from the AN Home tab.

MER Map. The MER map has been enhanced with a refreshed color basemap, Digital Elevation Model (DEM), and elevation contours (Figure 1). The Spirit color basemap is made from a CRISM MTRDR and HiRISE orthoimage using the ArcGIS and ENVI pansharpening tool. The Opportunity color basemap is created by fusing HRSC data with the HiRISE basemap using the "Create Pansharpened Raster Dataset" function in ArcPro v3.

The DEM for Spirit is derived from the available HiRISE DEM. However, for Opportunity, the existing HiRISE DEMs do not cover the entire traverse. The remaining area is covered by a custom HiRISE DEM using the Ames Stereo Pipeline (ASP) [2].

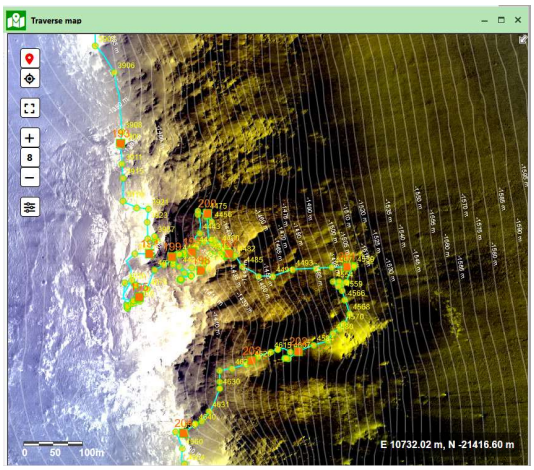

Figure 1. MER Opportunity AN map showing elevation contours (white), rover waypoints, and drive traverse overlaying a HiRISE basemap.

Target selection on map. The mapping tool has been enhanced to incorporate an overlay displaying the locations of science targets (for MER and MSL) and sample science points (for Mars 2020) along the traverse routes. Originally designed for MSL, this tool now enables users to select targets and sample science points directly from the map. Additionally, the tool provides links to access existing details about each target, along with related data, facilitating a more comprehensive exploration of the scientific information associated with the mapped locations.

Map content download. Rover drive telemetry data and maps for Curiosity, Opportunity, Perseverance, and Spirit rovers can be downloaded by following a link in the Resources tab. The links also are available from the Traverse map settings panel.

Measurement tool. The AN facilitates image analysis through the incorporated Image Viewer. Within this tool, measurement features enable precise location and distance measurements most single frame stereo pairs (Hazcam and Navcam for Mars 2020, MER, and MSL; Pancam for MER; and SSI for Phoenix) and for some mosaics. Data values are extracted from companion XYZ archive data. Identified locations can be exported in Excel spreadsheet and Shapefile formats for use outside the Notebook.

The measurement tool for the Mars 2020 AN is expected to be released in the first quarter of 2024 (Fig. 2).

Hazcam and Navcam stereo pairs with XYZ data will be supported. Measurements using Mastcam-Z will be restricted to the first 89 sols of the mission because XYZ data have yet to be released for later sols.

Document search. The Sol document free text search now includes faceted filters for InSight, Mars 2020, MER, MSL, and Phoenix missions. These documents, encompassing Mission Manager and Documentarian reports, offer valuable insights into science operations, shedding light on the rationale and methodology behind specific observations. Note that reports remain unaltered, except for grammar and spelling corrections, as well as the removal of spacecraft and instrument-sensitive material.

Data migration. The MSL Project is in the process of converting their data processing pipelines to product PDS4-copmliant archives. Previously released data also will be migrated to PDS4. Status is available in the MSL AN Resources tab, along with a list of products derived from mission archives by individual investigators that are not yet incorporated into the AN.

MSL target table. The MSL Curiosity Rover Science targets table (accessible from the Mission tab) is updated to show each target's location in easting, northing, and elevation, and as local X, Y, Z. All values are in meters.

Framework updates. Updates to the AN framework for support of PDS4 format continue. Additional updates have been made to improve security, performance, and data release integration functions, and map and database services updates are in progress.

Future Development: Planned map service updates include expanding user settings to allow for personalization of the map appearance. In addition, sample science dossier and science targets will be added to the Perseverance map and search functions when released by the science team. Support for Mars 2020 mosaics in the AN Image viewer has recently begun.

Future mission support: The Three Forks Depot Sample Record Inventory archive, being prepared at the Earth and Planetary Remote Sensing Laboratory at Washington University as part of the Mars Sample Return archive [3], will be incorporated into the AN when available. Archive data will include localization and contextual information for samples dropped at the Three Forks Depot.

AN development in support of Dragonfly Mission surface science and science operations began in late 2023.

Notebook functionality is driven by suggestions from mission teams and the user community, and feedback continues to be sought. User support is available within the AN from the Help section's feedback form, by email to an@wunder.wustl.edu, or using the PDS Geosciences Node forum.

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References: [1] Stein, T.C. et al. (2010), LPS XLI, Abstract #1414. [2]. Beyer, R. A., et al. (2018), doi: 10.1029/2018EA000409 [3] Christian, J. R., et al. (2024) LPS LV, this volume.

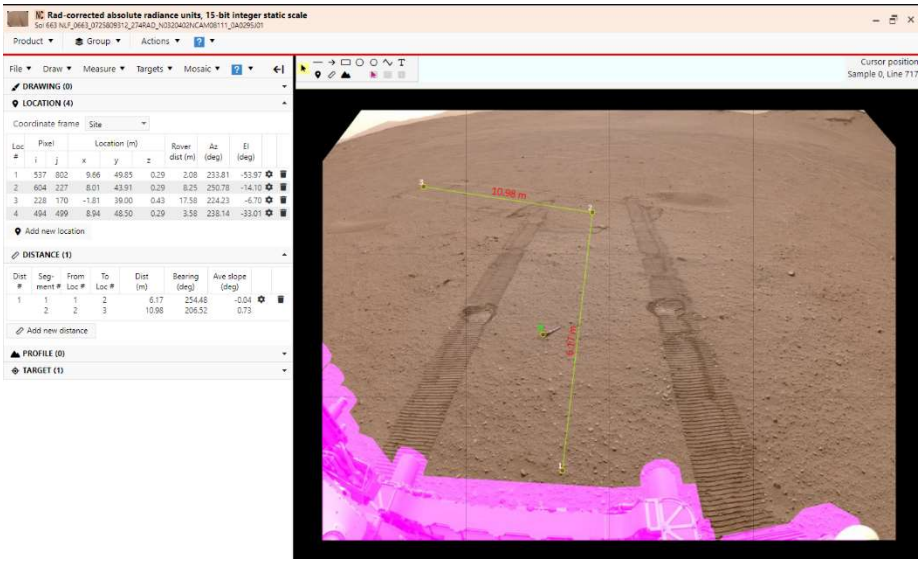

Figure 2. Screen capture of the Mars 2020 Perseverance Analyst's Notebook location and distance measurement of nlf_0663_0725809312_274rad_n0320402ncam08111_0a0295j01. The purple highlight indicates areas without XYZ data.