

PHOENIX ANALYST'S NOTEBOOK: A HOLISTIC TOOL FOR ACCESSING INTEGRATED MISSION DATA AND DOCUMENTS. T. C. Stein¹, R. E. Arvidson², D. M. Scholes³, and V. M. Heil-Chapdelaine⁴,

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Introduction: The Phoenix Analyst's Notebook (<http://an.rsl.wustl.edu>) provides access to the Mars Phoenix Lander Mission [1] data archives by integrating sequence information, engineering and science data, observation planning and targeting, and documentation into web-accessible pages to facilitate "mission replay." This provides context needed by scientists to understand observations made by the nondeterministic mission. The Phoenix Notebook was validated by use during mission operations and is now available through the Planetary Data System (PDS).

Populating the Notebook: Data and documentation were transferred each day during the active mission (05/22/08 to 11/02/08) from the mission Science Operations Center (SOC) at the University of Arizona to Washington University and were ingested into a science team version of the Notebook. The public version of the Analyst's Notebook is comprised of peer-reviewed, released data and is updated coincident with PDS data releases as defined in the mission archive plan [2]. The first two releases (December 23, 2008, and February 22, 2009) covered sols 0 to 90. The final release, which will include sols 0 to 152, is scheduled for April 29, 2009.

Data. The Phoenix Notebook contains publicly released, peer-reviewed data from all science instruments: Atmospheric Structure Experiment (ASE), Microscopy, Electroscopy, and Conductivity Analyzer (MECA), Meteorology Station (MET), Robotic Arm (RA), Robotic Arm Camera (RAC), Surface Stereo Imager (SSI), and Thermal and Evolved Gas Analyzer (TEGA), and Telltale Wind Experiment. The data are provided by the instrument teams and are supported by documentation describing data format, content, and calibration.

Both Operations Products Generation Subsystem (OPGS) and Science data products are included in the Notebook. The OPGS versions were generated to support mission planning and operations on a daily basis. They are geared toward researchers working on machine vision and engineering operations. Science versions of SSI, RAC, and MECA Optical Microscope (OM) observations are provided for those interested in radiometric and photometric analyses.

Documents. Two types of documents are included in the Notebook: data set documentation and sol (i.e., Mars day) documents. The sol documents are the mission manager and documentarian reports that provide a view into science operations—insight into why and

how particular observations were made. The reports have not been edited except for grammar and spelling, and to remove spacecraft and instrument sensitive materials.

Data set documents contain detailed information regarding the mission, spacecraft, instruments, and data formats.

Science Plans. Observation planning and targeting information is extracted from each sol's tactical science plan. This information includes instrument settings such as filters used and sensors selected, as well as observation parameters such as distance to target.

Navigating through the Notebook: A number of methods allow user access to the Notebook contents.

Sol Summaries. The Sol Summaries are the primary interface to integrated data and documents, allowing the user to specify the sol to view (Fig. 1). Data, documents, planned observations, and features are grouped for easy scanning. Detailed information is displayed as items are selected by the user.

Data products are displayed in order of acquisition, and are grouped into logical sequences, such as a series of SSI images. Sequences and the individual products that comprise them may be viewed in detail, manipulated, and downloaded. Graphs of Meteorology Station (MET) data may be viewed. Color composites and anaglyph stereo images may be created on demand. Data may be downloaded as zip or gzip files, or as multiband ENVI image files.

Features and targets information is also available in the sol summaries. Locations are identified through use of context images as well as position offset within the lander frame.

Mission Summaries. A number of timelines and summaries of mission data are presented in the mission summaries. A mission overview and dig summary are included. Coordinated Observations—concurrent data collection by the Phoenix, Mars Reconnaissance Orbiter, and Mars Express missions—are listed along with links to the data.

Searching. Three methods for searching through data and documents are available within the Notebook. Free text searching of data set and sol documents are supported. Data are searchable by instrument, acquisition time, data type, and product ID. Results may be downloaded in a single collection or selected individually for detailed viewing.

Resources. Data set documents and references to published mission papers are contained in the Re-

sources. In addition, links to related web resources are listed.

Online Help. Guidance is provided as through a series of searchable help pages. Topics include release notes, mission phases, landing site, coordinate frame, instruments, data processing, and data product file naming and structure.

Future Development: Effort is being made to provide a better end-user experience by improving the interactive features and increasing the speed of the interface. A number of Notebook functions are based on previous user suggestions, and feedback continues to be sought. (User feedback should be submitted to an@wunder.wustl.edu or to the online user forum.)

Analyst's Notebooks are under development for the Apollo lunar data and the Mars Science Laboratory

mission. The Mars Exploration Rover Notebooks for Spirit and Opportunity [3] are online at <http://an.rsl.wustl.edu>.

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The Phoenix Analyst's Notebook is available at <http://an.rsl.wustl.edu>.

References: [1] Smith, P.H. et al. (2008) JGR, 113, doi:10.1029/2008JE003083. [2] Arvidson, R.E. (2008) Phoenix Project Archive Generation, Validation and Transfer Plan, Jet Propulsion Laboratory Document D-29392. [3] Stein, T.C. et al. (2005) *LPS XXXIV*, Abstract #1246.

The screenshot shows the Phoenix Analyst's Notebook interface. At the top, there's a navigation bar with 'Home', 'Sol Summaries', 'Mission Summaries', 'Search', 'Resources', and 'Help'. The main content is divided into several sections:

- SOL SUMMARY REPORTS:** A search box for 'sol or select from list' with '30' entered. Below it, a list of categories: 'Documents (Uplink) - Sol 30', 'Features and Targets - Sol 30', and 'Products - Sol 30'. The 'Products - Sol 30' section lists various data products with icons and brief descriptions.
- SEQUENCE MENU:** A vertical menu on the left with options: 'Sequence Overview', 'Image Processing', 'Sequence Download', 'Data Set Documents', and 'Help'.
- Product Details:** A large section titled 'SSI - Radiometrically-corrected RDR calibrated to absolute radiance units' for 'SS 030 RAD 898867896_13700L1 T1'. It shows '15 products from activity 1370'. Below this, a table lists individual products in a grid format, each with a small thumbnail image and a label like 'L1 R1', 'L2 R2', etc.

Fig. 1. Phoenix Analyst's Notebook Sol Summaries web page.