

UPDATES TO THE PDS ORBITAL DATA EXPLORER FOR FASTER DATA DOWNLOADS. D. Scholes, J. Wang, L. E. Arvidson, F. Zhou, S. Slavney, E. A. Guinness, and R. E. Arvidson, Washington University in St. Louis, 1 Brookings Drive, Campus Box 1169, St. Louis, Missouri, 63130, scholes@wunder.wustl.edu.

Introduction: The Orbital Data Explorer (ODE, <http://ode.rsl.wustl.edu>) is a web-based search tool developed and maintained at NASA's Planetary Data System's (PDS) Geosciences Node (<http://pds-geosciences.wustl.edu>). ODE provides search, display, and download functionality for PDS archives of orbital data products from planetary missions to Mars, the Earth's Moon, Mercury, and Venus [1,2,3,4]. ODE includes access to archives at the PDS Geosciences and other nodes. Currently, 1.3 petabyte of PDS data are accessible through the ODE.

Primary ODE Functionality: ODE offers form- and map- based searches of cataloged data across multiple missions and instruments [5]. Searches are filtered by mission, instrument, processing level of the data, location, time, observation angle, and PDS product ID.

ODE supports a specialized granular query tool for subsetting science data of specified regions [6]. This tool supports queries of orbital laser altimetry and thermal emission spectrometer instruments including: MGS (Mars Global Surveyor) MOLA and LRO (Lunar Reconnaissance Orbiter) LOLA and Diviner.

ODE provides an MRO (Mars Reconnaissance Orbiter) coordinated observation search tool [5]. It allows users to find and view related products from HiRISE (High-Resolution Imaging Science Experiment), CRISM (Compact Reconnaissance Imaging Spectrometer for Mars), MCS (Mars Climate Sounder), and CTX (Context Camera).

ODE generates product type coverage KMZ (zipped file of Keyhole Markup Language, KML) files and shapefiles for use with GIS tools. Additionally, a Representational State Transfer (REST) interface (<http://oderest.rsl.wustl.edu/>, [7]) allows external users to access the ODE metadata and data products without using ODE web interfaces.

ODE maintains a shopping cart feature for requesting multiple PDS data products, which are organized for the user to download from one location.

ODE Data Inventory: ODE provides access to data from 13 planetary missions and over 50 individual instruments. Those missions include the ongoing MRO, Odyssey, ESA's (European Space Agency) MEX (Mars Express), and LRO missions, as well as a number of completed missions such as MGS, Viking Orbiter, Clementine, Lunar Prospector, Lunar Orbiter, Indian Space Research Organization's Chandrayaan-1, Magellan, GRAIL (Gravity Recovery and Interior Laboratory), and MESSENGER (Mercury Surface, Space

Environment, Geochemistry and Ranging) missions. ODE is updated for active missions as new and accumulating datasets are released by PDS. A total of 22.7 million PDS products are currently cataloged in ODE. A detail list of the current ODE holdings can be found at <http://wufs.wustl.edu/ode/odeholdings>.

Updates: Through a cooperative agreement with its host institution, Washington University in St. Louis, the PDS Geosciences Node has access to the Aspera (<http://asperasoft.com>) high speed data transfer software platform.

Aspera is powered by its proprietary FASP (Fast Adaptive Secure Protocol) data transfer protocol [8], which is built on the UDP (User Datagram Protocol) standard. FASP is tolerant of high latency networks, and it can more effectively utilize available bandwidth than traditional TCP connections, such as HTTP or FTP. The FASP protocol uses SSH authentication and on-the fly data encryption to ensure the privacy and integrity of transferred data.

The PDS Geosciences Node hosts a dedicated Aspera transfer server which has direct access to its PDS data holdings. As an advanced feature, Aspera Connect provides a web browser plug-in to facilitate high-speed file transfers between the transfer server and remote website users. The browser plug-in is compatible with all major operating systems (Windows, Mac OS X, and Linux) and web browsers. This data transfer technology has been integrated into ODE to allow users to more efficiently download PDS data files through the website.

ODE PDS product file download. The ODE website displays PDS product metadata on product detail pages. These pages display PDS Product ID, PDS label, standard PDS meta data, observing instrument and data set information, browse images, direct file links, related products, context map (where applicable), and the option to add the product to the ODE cart.

Functionality has been added to the product detail page to enable a single click download of all the displayed product's files through the Aspera Connect browser plug-in, as shown in Figure 1. The download includes PDS label, data files, browse images, referenced format files, and any derived files. The PDS product's files are saved to the local web browser's default download location in a directory named to match the PDS Product ID. Browse images, derived files, and referenced files are saved to corresponding subdirectories.

Aspera Browser Plug-in Option - New Option
 Only available for data hosted by the PDS Geosciences Node.
Note: Installing the browser plug-in will require restarting the browser.

[Download All Product & Derived Files with Aspera](#) [Aspera Download Help](#)

PDS Product Files		Derived Files
Product Files & Labels		KB
frt00009d1e_07_if164j_mtr3.hdr	Product Data File	15
frt00009d1e_07_if164j_mtr3.img	Product Data File	956,860

Figure 1. Single click option to download all product files from the product detail page

ODE backend cart processing enhancements. The ODE cart function allows users to request up to 40GB of PDS product files per cart request. The ODE website catalog includes many data sets that are hosted by other PDS nodes and data nodes. When a user requests remotely hosted files, the ODE cart process downloads the files from these sites via HTTP and organizes them into a downloadable package hosted by the PDS Geosciences Node.

In collaboration with the PDS Cartography and Imaging Sciences Node at JPL, a process has been implemented to transfer requested files from the JPL location to the Geosciences Node using Aspera technology. The process uses a combination of scheduled scripts and dynamic REST services to coordinate the transfer of the files through Aspera software. The process is designed to support deployment with additional data hosts in the future.

This update has significantly improved the speed of the data collection step in the order fulfillment process. Over a twentyfold improvement in speed has been achieved in this implementation. For example, the previous process could take 45 minutes to transfer 10GB of data to the Geosciences Node, while the new method can acquire the files from JPL in 2 minutes.

ODE cart request download page. An ODE user is sent an automated email after his or her cart request had been organized and prepared for download. In the past, the email included a direct FTP link to the cart request files. The new process emails the user a link to the new ODE cart request download page, in addition to the traditional FTP link to the cart request.

The new ODE cart request download page supports multiple download methods and offers faster options for users to retrieve requested PDS files. The download options of the page are shown in Figure 2.

The ODE cart request download page contains a single click link to download the entire user cart request using the Aspera Connect web browser plug-in. This option provides a convenient and fast download method for most users. The Aspera Connect browser plug-in employs the FASP data transfer technology to

better utilize the user's available bandwidth. HTTP and FTP links are provided on the page for users who prefer to download the files through a client application, a different web browser plug-in, a local script, or directly through the web browser.

Additionally, the page supports browsing and downloading specific directories and files of the cart request through the Aspera Connect web browser plug-in or using direct HTTP links. Multiple files can be downloaded simultaneously through this page.

Future Work: Newly released data from ongoing missions will continue to be added to ODE. We plan to coordinate Aspera-based data transfer connections with additional PDS nodes and data nodes to facilitate faster user cart order fulfillment. Additionally, we plan to post sample scripts to help users more easily download large ODE cart requests if the Aspera Connect browser plug-in is not preferred in their environment.

Contact Information: The PDS Geosciences Node welcomes questions and comments for additional ODE functions from the user community. Please send email to ode@wunder.wustl.edu.

Acknowledgment: ODE is developed and operated through funding provided to the PDS Geosciences Node from NASA. Ongoing cooperation of the mission science and operations teams as well as the PDS Atmospheres, Cartography and Imaging, and PPI Nodes are greatly appreciated. Aspera licensing is provided by Washington University in St. Louis through the Washington University Research Network (WURN) initiative.

References: [1] Bennett, K. et al. (2008), LPS XXXIX, Abstract #1379. [2] Wang, J. et al. (2009), LPS XL, Abstract #1193. [3] Wang, J. et al. (2010), LPS XLI, Abstract #2251. [4] Bennett, K. et al. (2013), 44th LPS, Abstract #1310. [5] Wang, J. et al. (2017), 48nd LPS, Abstract #1257. [6] Wang, J. et al. (2011), 42nd LPS, Abstract #1896. [7] Bennett, K. et al. (2014), 45th LPS, Abstract #1026. [8] Asperasoft.com (n.d.), Aspera FASP™ High Speed Transport, A Critical Technology Comparison

Download Options (hide)

Aspera - New option for fastest downloads	HTTP	FTP
Aspera is a high-speed data transfer tool. ODE provides a web browser plug-in, which is used for this download technique. If the plug-in is not installed, you will be prompted to allow the installation. Aspera Help	Download the files individually via HTTP or use a program, such as wget to download the files from our website. The interface below also provides HTTP links for downloading individual files. HTTP Help	FTP has been the traditional method for downloading files. This option is for users who prefer to use a client application. FTP Help

Aspera One Click - Download Entire Cart Request directory (20171227T001140922231)

HTTP Link - <http://ode.nsl.wustl.edu/odecartrequest/20171227T001140922231>

FTP Link - <ftp://geoftp.wustl.edu/20171227T001140922231> Username: geoftp Password: Odeuser1

Download Specific Directories and Files

Browsing: 20171227T001140922231/ Search current dire

Type	Name	Aspera Download	HTTP Download	Size
File	LROMRP_0003_part_0003.zip	Aspera	HTTP	8.66 MB
File	LROMRP_0003.zip	Aspera	HTTP	592.34 MB

Figure 2. Download options of the ODE cart request download page