

Searching the Stars with Atlas IV

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Conference



Jet Propulsion Laboratory
California Institute of Technology

Searching the Stars with Atlas IV

Overview

Background

Motivation

Atlas IV

Next steps

References



<https://bit.ly/39DJfZy>

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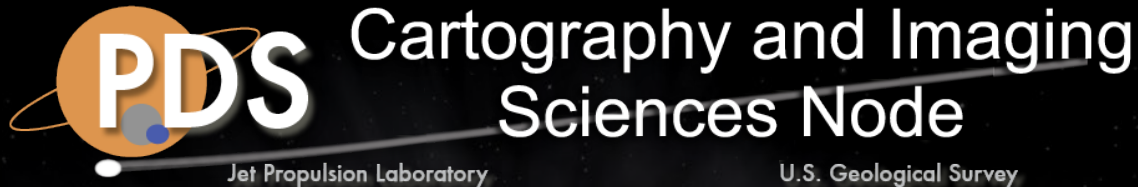
Next steps

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Searching the Stars with Atlas IV

Background

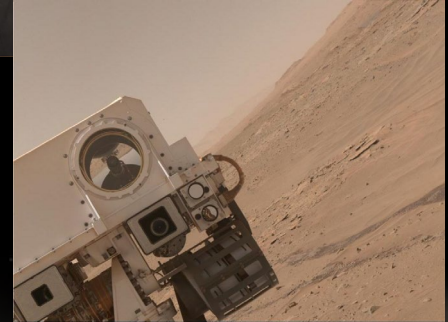
- “PDS Imaging Node” = Cartography and Imaging Sciences Node of the Planetary Data System
- One node, two facilities – USGS & JPL
- Home to upwards of 1PB of planetary digital archives



Searching the Stars with Atlas IV

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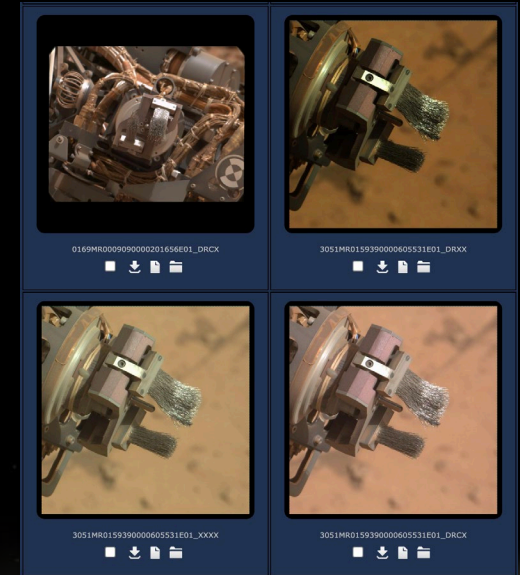
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- Diverse collection of products
 - Landers, rovers, orbiters, and probes
 - PDS3 and PDS4
 - Imagery, maps, and other products



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 - PDS3 and PDS4
 - Imagery, maps, and other products
- Over 1.2M images across 5 missions enhanced by ML processes



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Challenge: Enable users to effectively locate data they need to do their research

Partially solved with Atlas III

Searching the Stars with Atlas IV

Motivation

Atlas III

- Faceted search on hundreds of PDS3 keywords from multiple missions

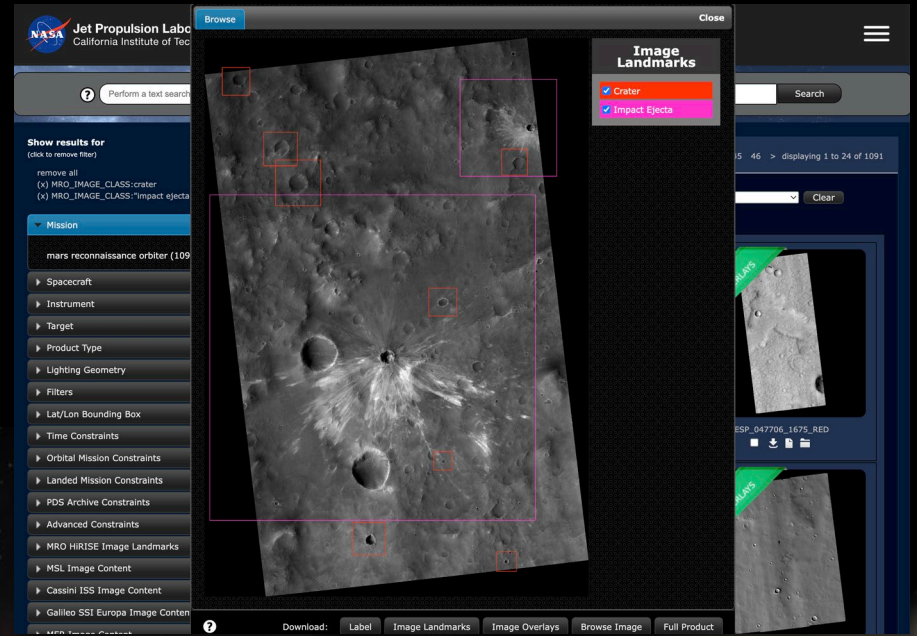
The screenshot displays the PDS Image Atlas interface. At the top, it features the NASA logo and the text "Jet Propulsion Laboratory California Institute of Technology" and "PDS Image Atlas". A search bar contains the text "Perform a text search like 'mars crater' or 'cassini rings', or a more advanced search like 'TARGET_NAME:enceladus'". Below the search bar, the page shows "Results: 24" and "Page: 1". A sidebar on the left is titled "Show results for (click to remove filter)" and "Narrow your search by selecting a facet below". The "Mission" facet is expanded, showing a list of missions with their respective PDS3 IDs: 2001 mars odyssey (3272713), cassini (996836), Chandrayaan-1 (21645), clementine (18906197), gallileo (20123), insight (158012), Juno (26736), kronos (2461), lunar orbiter (2991), lunar reconnaissance orbiter (4248401), magellan (22818), mars exploration rover (6505204), mars global surveyor (243227), mars pathfinder (17899), mars reconnaissance orbiter (2292061), mars science laboratory (17028937), messenger (1018792), new horizons (151792), phoenix (256433), viking lander (6585), viking orbiter (61693), and voyager (312225). Below the mission list are expandable sections for "Spacecraft", "Instrument", "Target", "Product Type", and "Lighting Geometry". The main content area shows a grid of image thumbnails, with the first row containing three thumbnails labeled "ESP_072399_2295_RED1_0", "ESP_072399_2295_RED1_1", and "ESP_072399_2295_RED2_0". Each thumbnail has a small icon for download, share, and zoom.

Searching the Stars with Atlas IV

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Atlas III

- Faceted search on hundreds of PDS3 keywords from multiple missions
- Download original products, as well as their browse imagery and label
- Report generator
- Powered by ML (feature bounding boxes, class faceting)



Searching the Stars with Atlas IV

Motivation

It's great, *but...*

- Availability and scalability concerns
- Security and performance expectations
- Downloading lots of data at once is a hassle
- Doesn't work on a phone
- Built nearly a decade ago using technologies that have since become outdated

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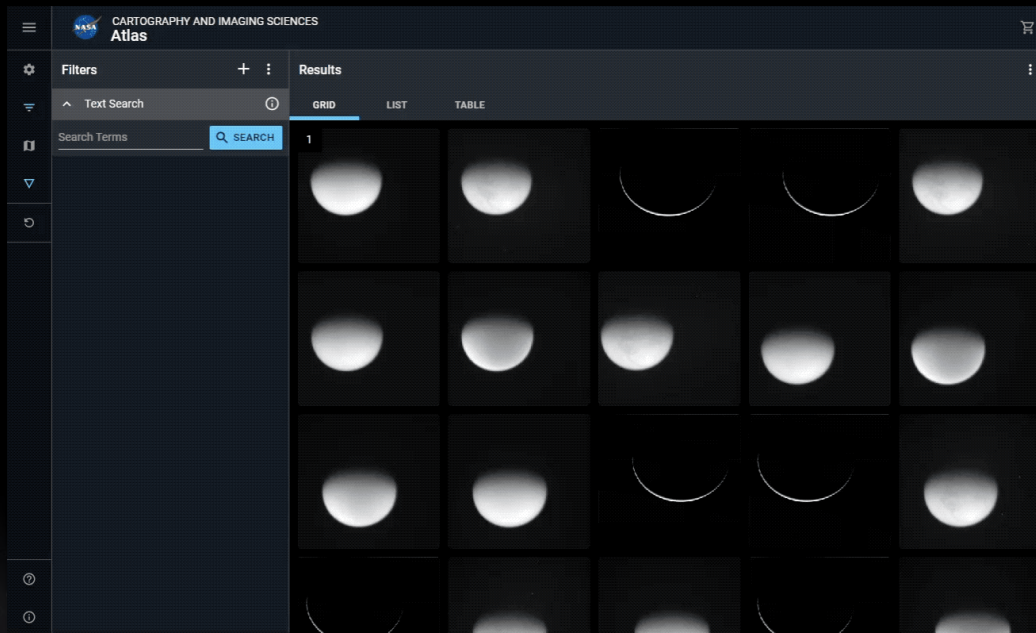
Atlas IV

- Single-page NodeJS, React, Redux, Webpack application
- Material UI
- Mobile friendly
- Enhanced filtering
- Improved geospatial search support
- Expanded file exploration functionalities
- Streamlined download process
- Tighter integration with machine learning classifiers

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Atlas IV

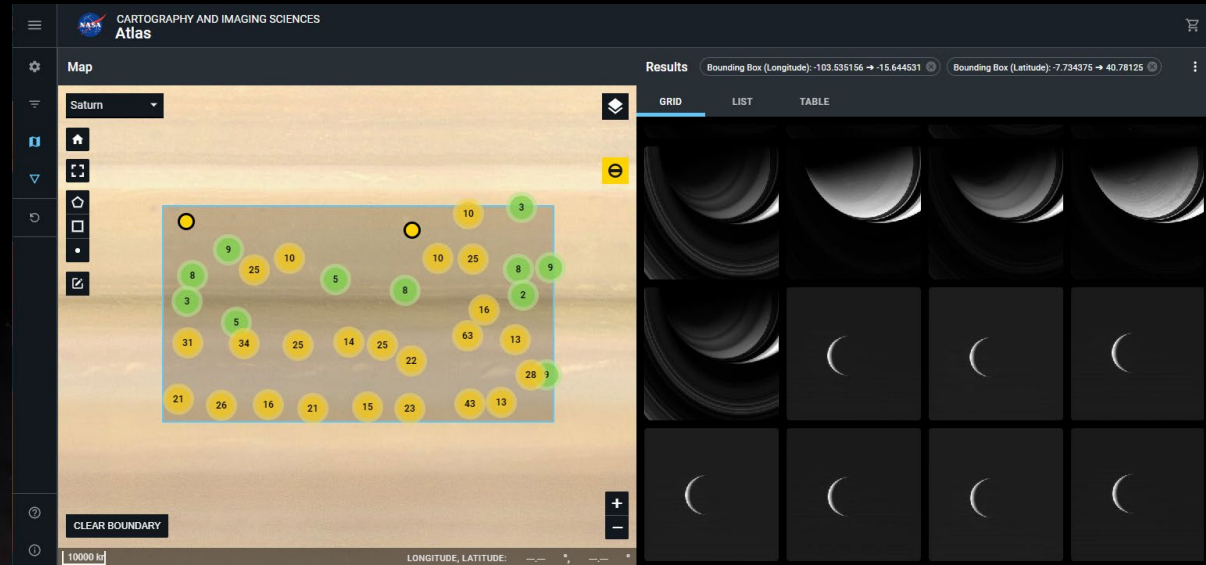
- Facets are addable
 - Scales better with the the 1k+ unique fields in our collection
 - Lowers cognitive load
- Facets are now categorized
 - Time
 - Spatial
 - Lighting
- Supporting documentation for fields parsed from PDS archival documentation
- Faceting is now powered by IMG's Search API



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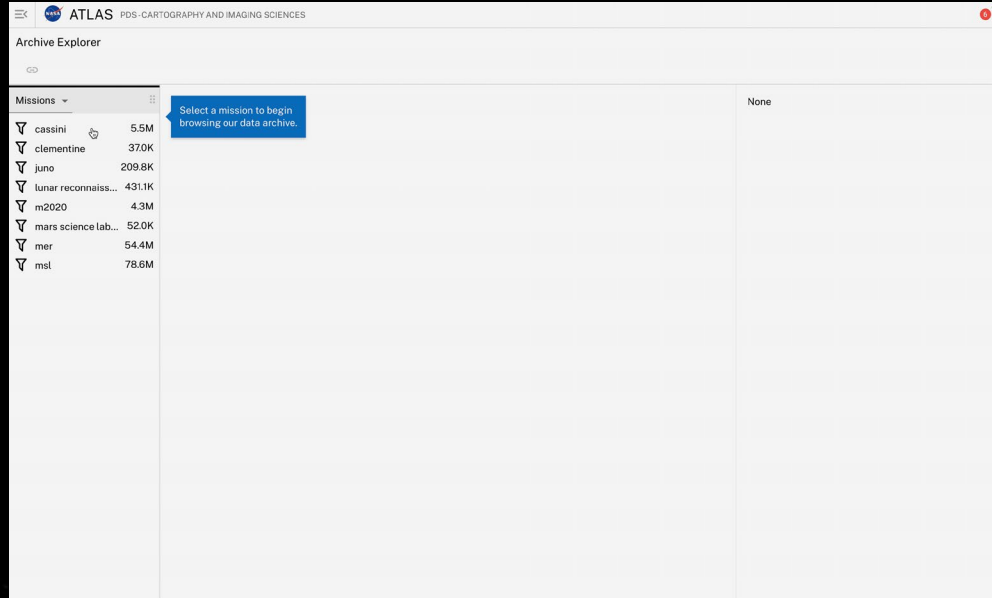
Atlas IV

- Geospatial search enabled via integration with CartoCosmos¹
- Supports
 - Bounding box drawing,
 - Nearly 30 planetary bodies,
 - Polar projections, and
 - A whole suite of basemaps and layers for each



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Atlas IV



File directory view

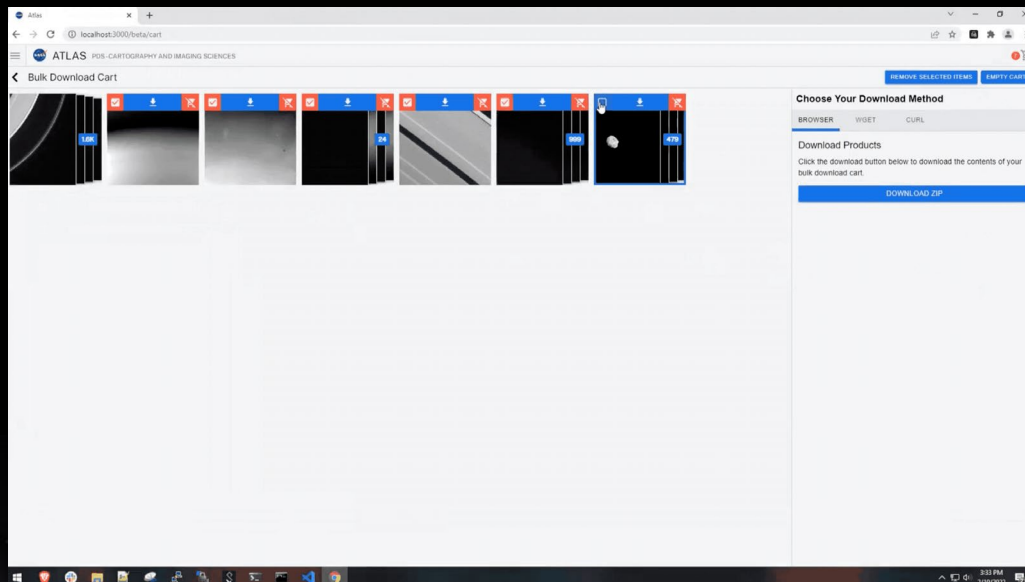
- Utilized IMG's Data Access API (virtualized paths)
- Provides a rich and reactive experience that integrates with the rest of Atlas IV
- Provides navigation, filtering, sorting, and basic search

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Atlas IV

Shopping cart

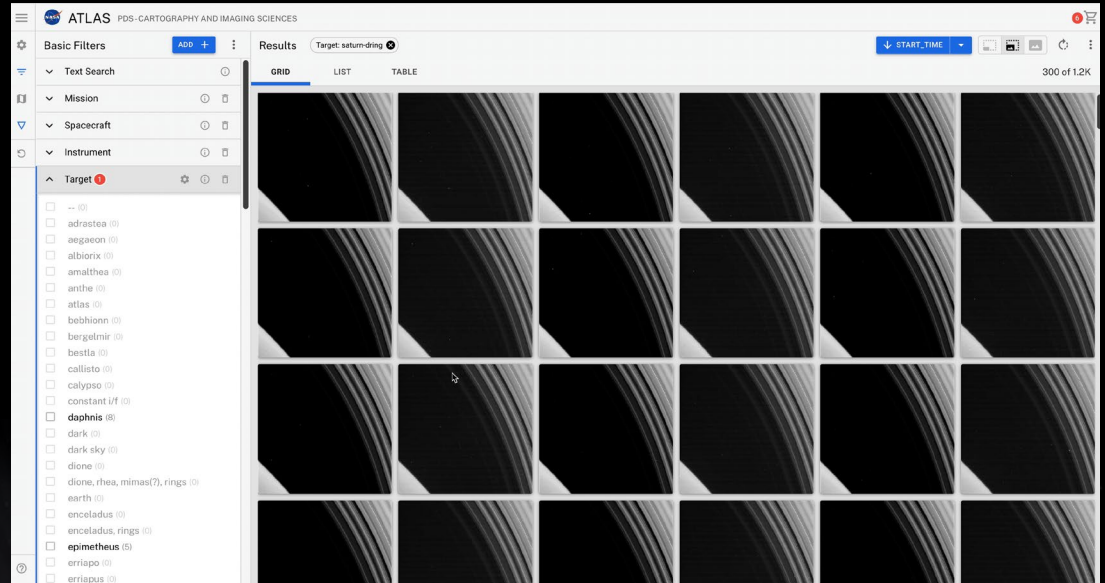
- Streamlines download of large counts of files
- Mark items as you're browsing, download later
- Remove items no longer wanted
- Streams to ZIP file (also curl and wget)
- Pause and resume transfer
- Status reporting
- JSON manifest



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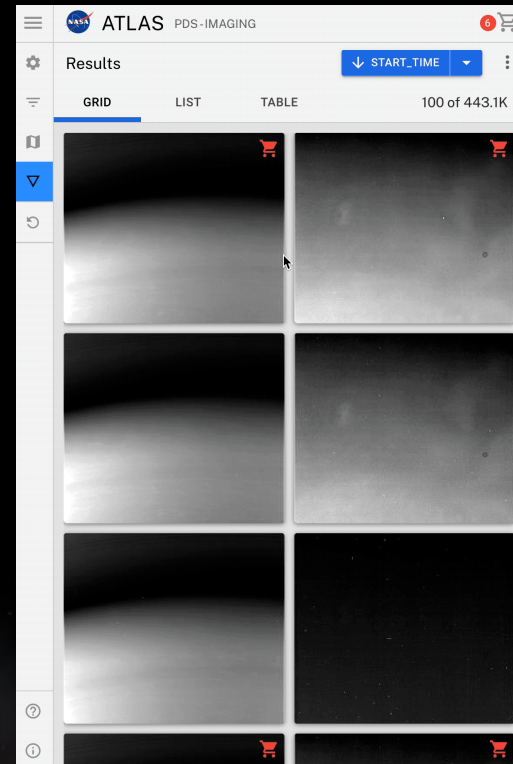
- Dedicated image pages
- Interactive zooming and panning
- Toggleable layers, including landmarks
- Simultaneous viewing of both image and label
- Interactive label with feedback loop



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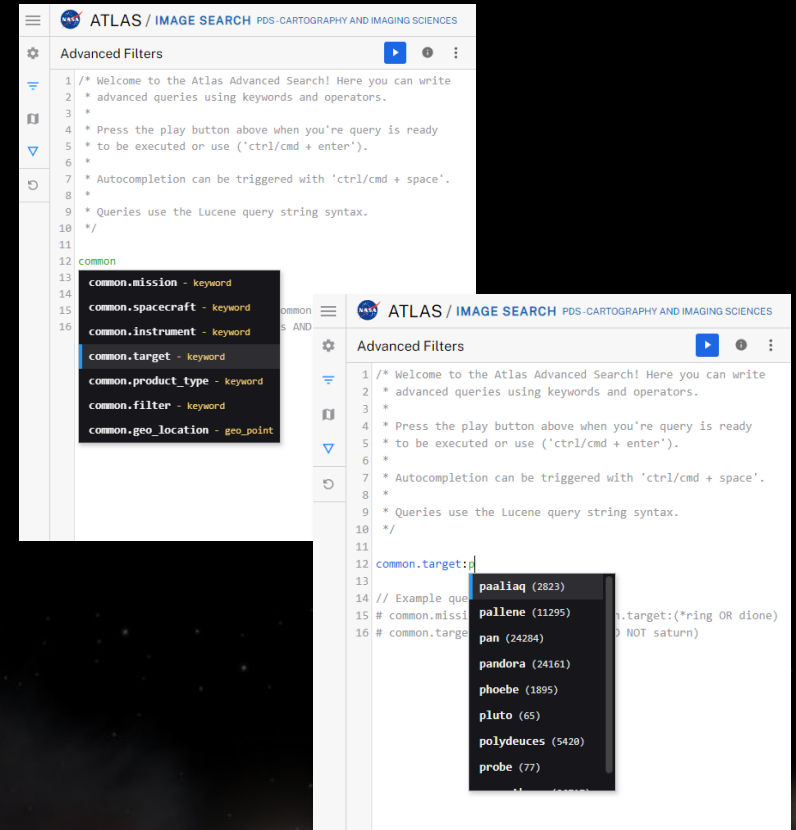
- Mobile friendly
- Extensive help for new users
- Closer integration with machine learning capabilities
- Highly extensible codebase for future improvement
- Virtualized, lazy-loaded, and infinite scrolling results
- Shared design system and tighter relationship with the main PDS Imaging site
- Light and dark mode



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Atlas IV

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- Advanced search with syntax highlighting and autocomplete



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- Support all data from Atlas III
- Full integration with PDS API
- DEMUD² classifier integration (novelty)
- Generate tiled versions of our browse imagery



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 Public beta early FY23 

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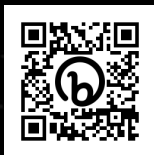
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References

- Cover slide graphic: “PIA23647: Tarantula Nebula Spitzer 3-Color Image”, retrieved from <https://photojournal.jpl.nasa.gov/catalog/PIA23647>
- Background graphic of all other slides: “PIA23647: Tarantula Nebula Spitzer 3-Color Image”, retrieved from <https://photojournal.jpl.nasa.gov/catalog/PIA25161>
- [1] <https://github.com/PlanetMap/CartoCosmos>
- [2] <https://github.com/wkiri/DEMUD>



More information on the IMG API and the cloud-first architecture it implements may be found here: <https://bit.ly/3QDPxc1>



Slides for this presentation: <https://bit.ly/39DJfZy>

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