

Searching the Stars with Atlas IV

Kevin Grimes

kevin.m.grimes@jpl.caltech.edu

23 June 2022

3rd Planetary Science Informatics and Data Analytics
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>



Searching the Stars with Atlas IV

Overview

Background

Motivation

Atlas IV

Next steps

References



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



Cartography and Imaging
Sciences Node

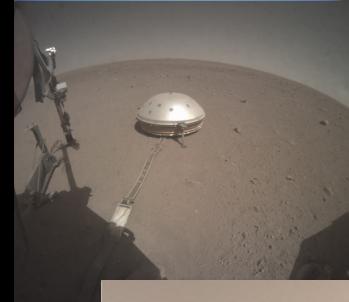
Jet Propulsion Laboratory

U.S. Geological Survey

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



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
- Diverse collection of products
 - Landers, rovers, orbiters, and probes
 - PDS3 and PDS4
 - Imagery, maps, and other products
- Over 1.2M images across 5 missions enhanced by ML processes



Searching the Stars with Atlas IV

Overview

Background

Motivation

Atlas IV

Next steps

References



Searching the Stars with Atlas IV

Motivation

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

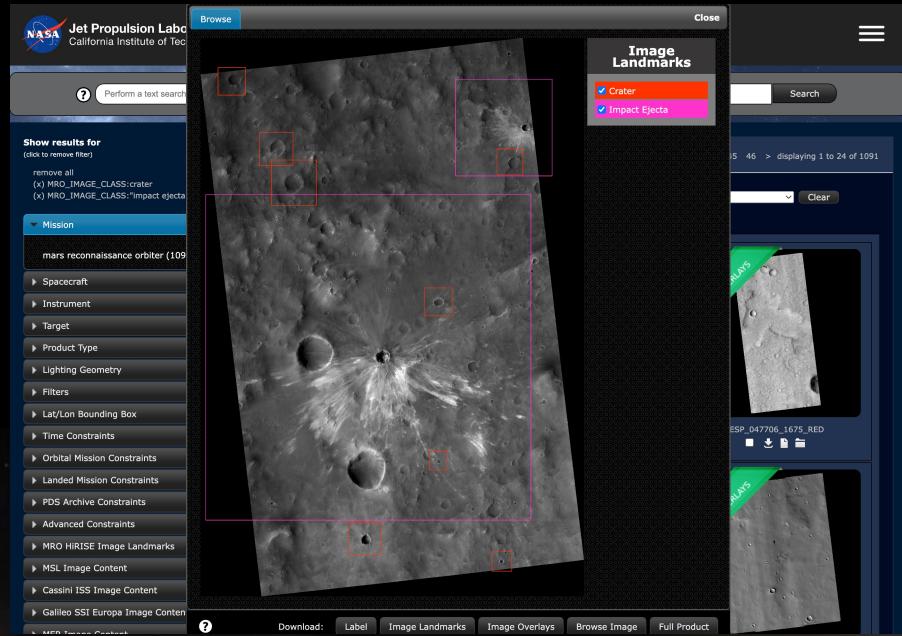
The screenshot shows the PDS Image Atlas interface. At the top, there's a search bar with placeholder text "Perform a text search like 'mars crater' or 'cassini rings', or a more advanced search like *TARGET_NAME:enceladus*". Below the search bar is a "Show results for" section with a "Mission" facet expanded, listing various space missions with their counts: 2001 mars odyssey (3272713), cassini (996836), chandrayaan-1 (21645), clementine (1996197), galileo (20123), magellan (10912), juno (36736), lcross (2651), lunar orbiter (2991), lunar reconnaissance orbiter (4248401), magellan (10912), mars exploration rover (6505204), mars global surveyor (243227), mars pathfinder (17899), mars reconnaissance orbiter (2292061), mars science laboratory (17028937), messenger (15179), new horizons (15179), phoenix (256433), viking lander (61693), voyager (312225). Other facets like "Spacecraft", "Instrument", "Target", "Product Type", and "Lighting Geometry" are also listed. The main area displays a grid of image thumbnails for Juno images, with labels such as "ESP_072399_2295_RED1_0", "ESP_072399_2295_RED1_1", and "ESP_072399_2295_RED2_0". Navigation controls at the bottom include "Thumbnail View", "List View", "Add field to sort by: START_TIME", and buttons for "Hide Missing Browse", "Select All Images", "On Page", and "In Query".

Searching the Stars with Atlas IV

Motivation

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 facetting)



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

Searching the Stars with Atlas IV

Overview

Background

Motivation

Atlas IV

Next steps

References



Searching the Stars with Atlas IV

Atlas IV

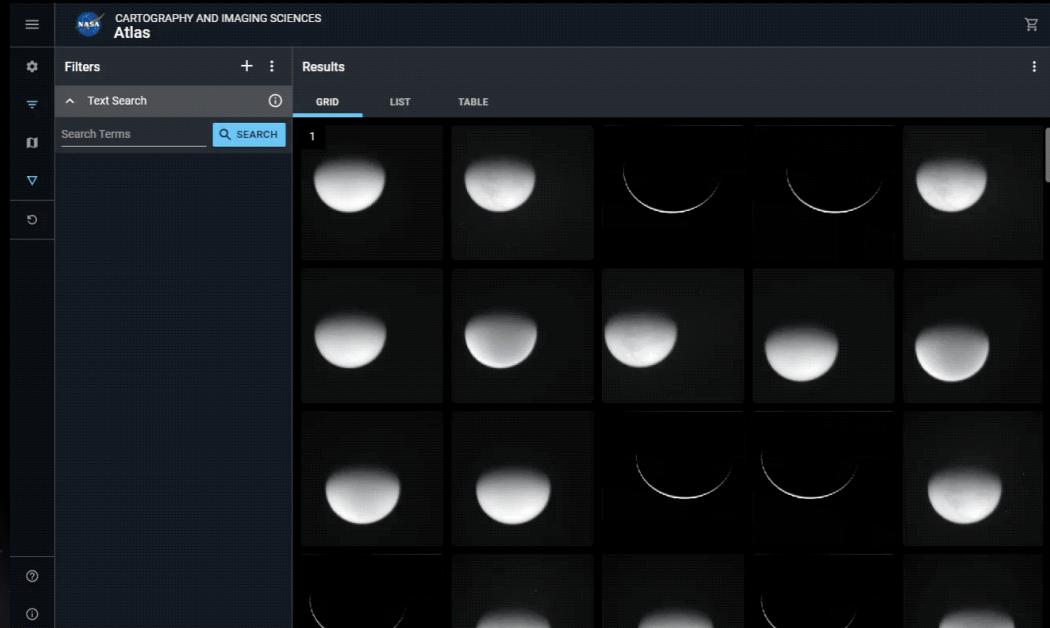
- Single-page NodeJS, React, Redux, Webpack application
- Material UI
- Mobile friendly
- Enhanced filtering
- Improved geospatial search support
- Expanded file exploration functionalities
- Streamlined download process
- Tighter integration with machine learning classifiers



Searching the Stars with Atlas IV

Atlas IV

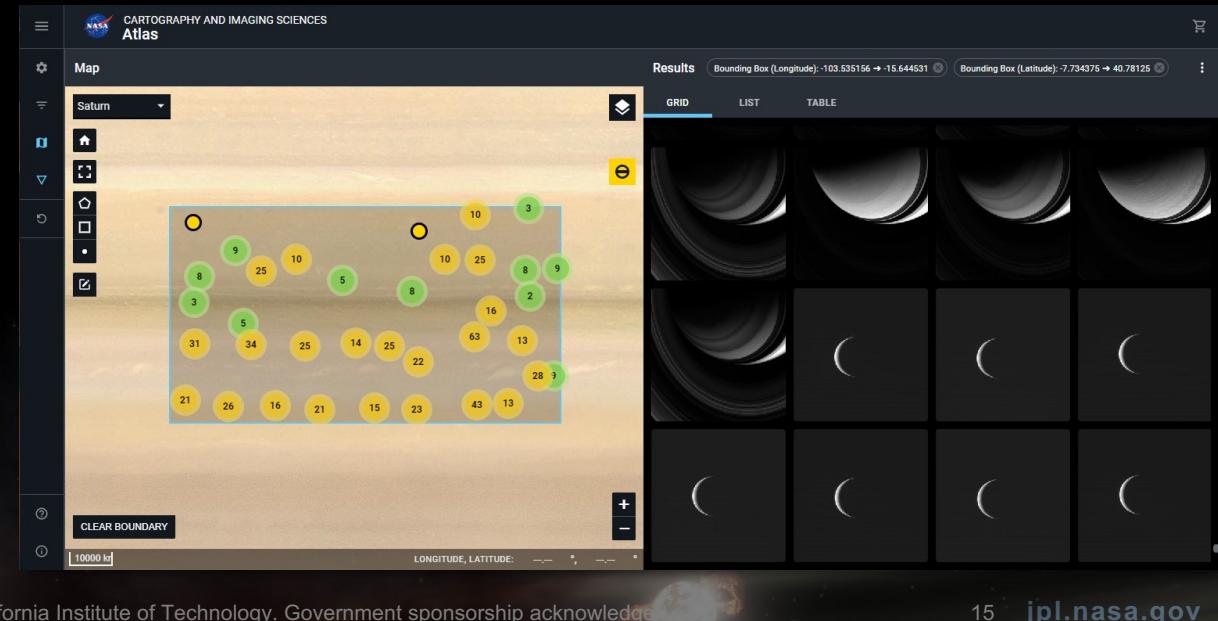
- Facets are addable
 - Scales better with the the 1k+ unique fields in our collection
 - Lowers cognitive load
- Facets are now categorized
 - Time
 - Spatial
 - Lighting
- Supporting documentation for fields parsed from PDS archival documentation
- Faceting is now powered by IMG's Search API



Searching the Stars with Atlas IV

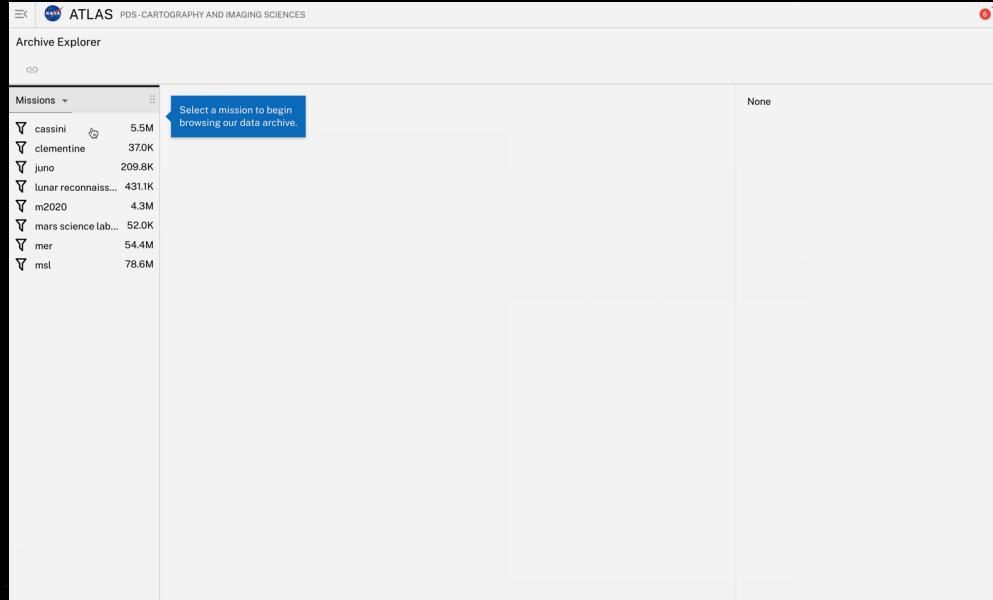
Atlas IV

- 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



Searching the Stars with Atlas IV

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

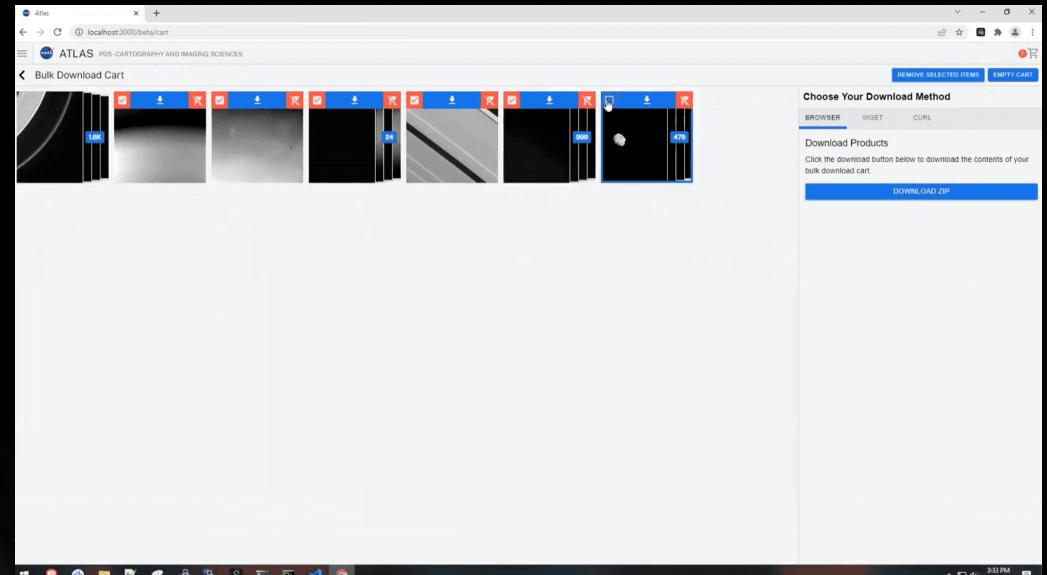


Searching the Stars with Atlas IV

Atlas IV

Shopping cart

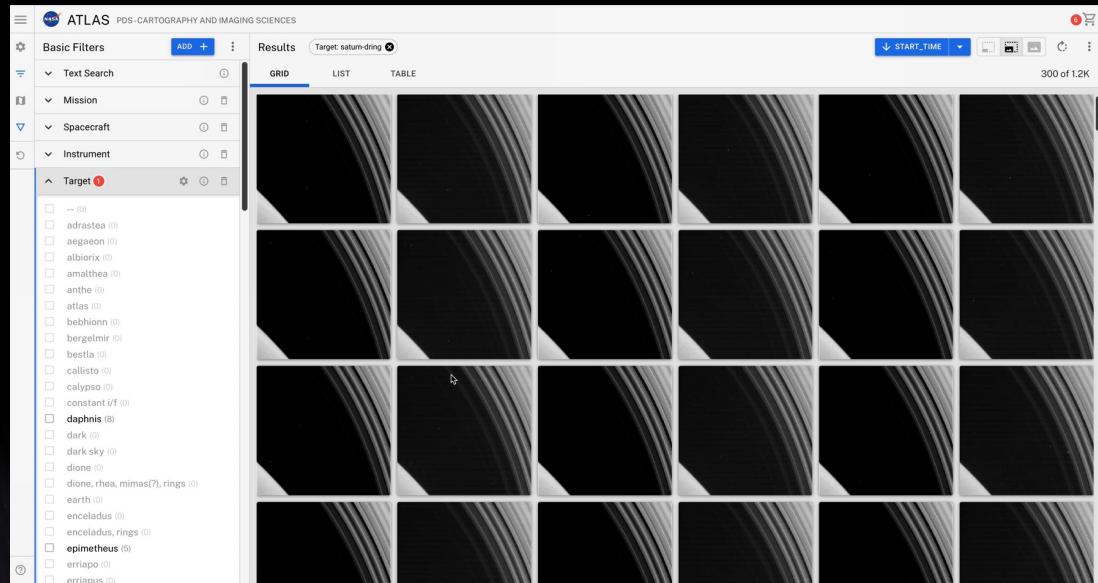
- Streamlines download of large counts of files
- Mark items as you're browsing, download later
- Remove items no longer wanted
- Streams to ZIP file (also curl and wget)
- Pause and resume transfer
- Status reporting
- JSON manifest



Searching the Stars with Atlas IV

Atlas IV

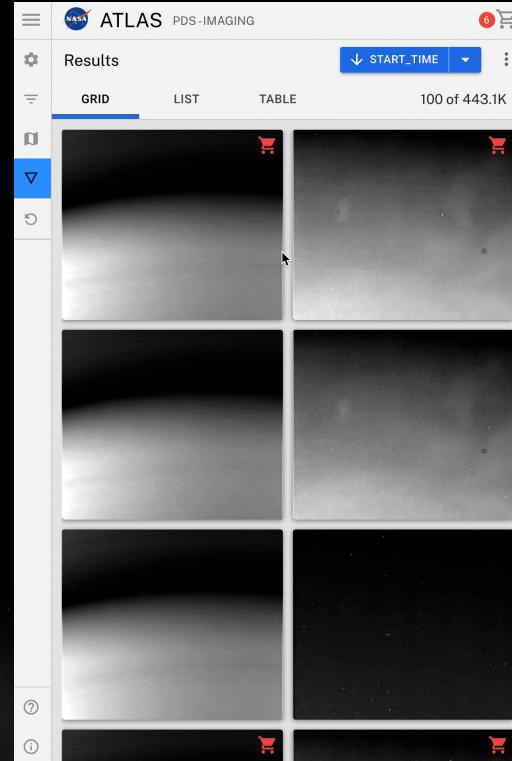
- Dedicated image pages
- Interactive zooming and panning
- Toggleable layers, including landmarks
- Simultaneous viewing of both image and label
- Interactive label with feedback loop



Searching the Stars with Atlas IV

Atlas IV

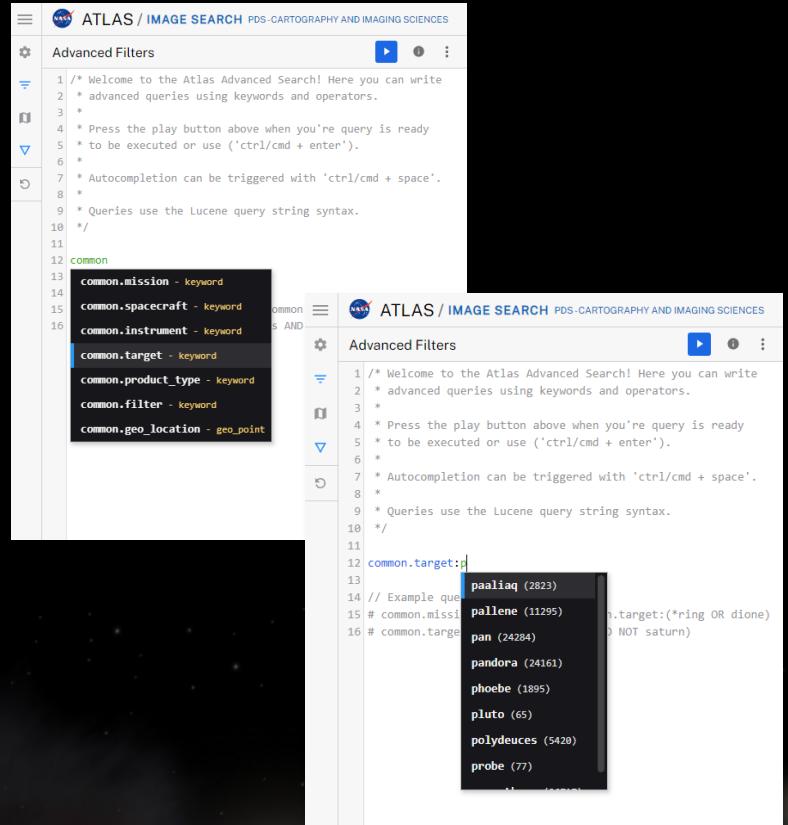
- Mobile friendly
- Extensive help for new users
- Closer integration with machine learning capabilities
- Highly extensible codebase for future improvement
- Virtualized, lazy-loaded, and infinite scrolling results
- Shared design system and tighter relationship with the main PDS Imaging site
- Light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



Searching the Stars with Atlas IV

Atlas IV

- 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
- Advanced search with syntax highlighting and autocomplete



Searching the Stars with Atlas IV

Overview

Background

Motivation

Atlas IV

Next steps

References



Searching the Stars with Atlas IV

Next steps

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



Searching the Stars with Atlas IV

Next steps

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

😱 Public beta early FY23 😎

Searching the Stars with Atlas IV

Overview

Background

Motivation

Atlas IV

Next steps

References



Searching the Stars with Atlas IV

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>

Contact me: kevin.m.grimes@jpl.caltech.edu





Jet Propulsion Laboratory
California Institute of Technology

jpl.nasa.gov