

# Searching the Stars with Atlas IV

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3<sup>rd</sup> 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>



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**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

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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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- Home to upwards of 1PB of planetary digital archives
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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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*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

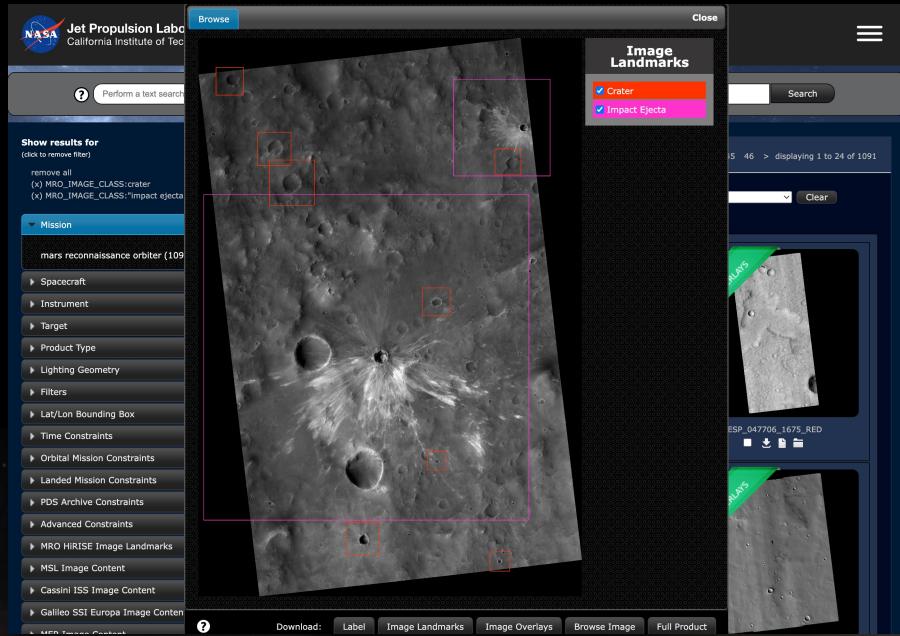
The screenshot shows the PDS Image Atlas interface. At the top, there's a search bar with placeholder text "Perform a text search like 'mars crater' or 'cassini rings', or a more advanced search like \*TARGET\_NAME:enceladus\*". Below the search bar is a "Show results for" section with a "Mission" facet expanded, listing various space missions with their counts: 2001 mars odyssey (3272713), cassini (996836), chandrayaan-1 (21645), clementine (1996197), galileo (20123), magellan (19912), juno (36736), lcross (2651), lunar orbiter (2991), lunar reconnaissance orbiter (4248401), magellan (19912), mars exploration rover (6505204), mars global surveyor (243227), mars pathfinder (17899), mars science laboratory (17028937), messenger (15179), new horizons (15179), phoenix (256433), viking lander (61693), voyager (312225). Other facets include Spacecraft, Instrument, Target, Product Type, and Lighting Geometry. The main area displays a grid of image thumbnails for the Juno mission, with labels such as ESP\_072399\_2295\_RED1\_0, ESP\_072399\_2295\_RED1\_1, and ESP\_072399\_2295\_RED2\_0.

# Searching the Stars with Atlas IV

## Motivation

### Atlas III

- Faceted search on hundreds of PDS3 keywords
- 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

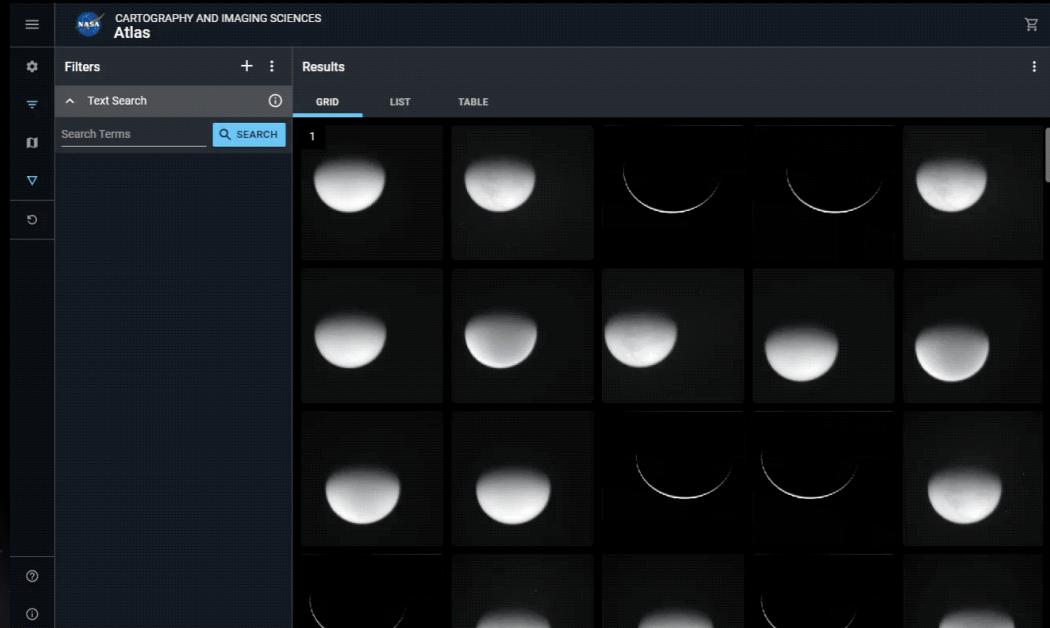
- Single-page NodeJS, React, Redux, Webpack application
- Material UI
- Mobile friendly
- Enhanced filtering
- Improved geospatial search support
- Expanded file exploration functionalities
- Streamlined download process
- Tighter integration with machine learning classifiers



# Searching the Stars with Atlas IV

## Atlas IV

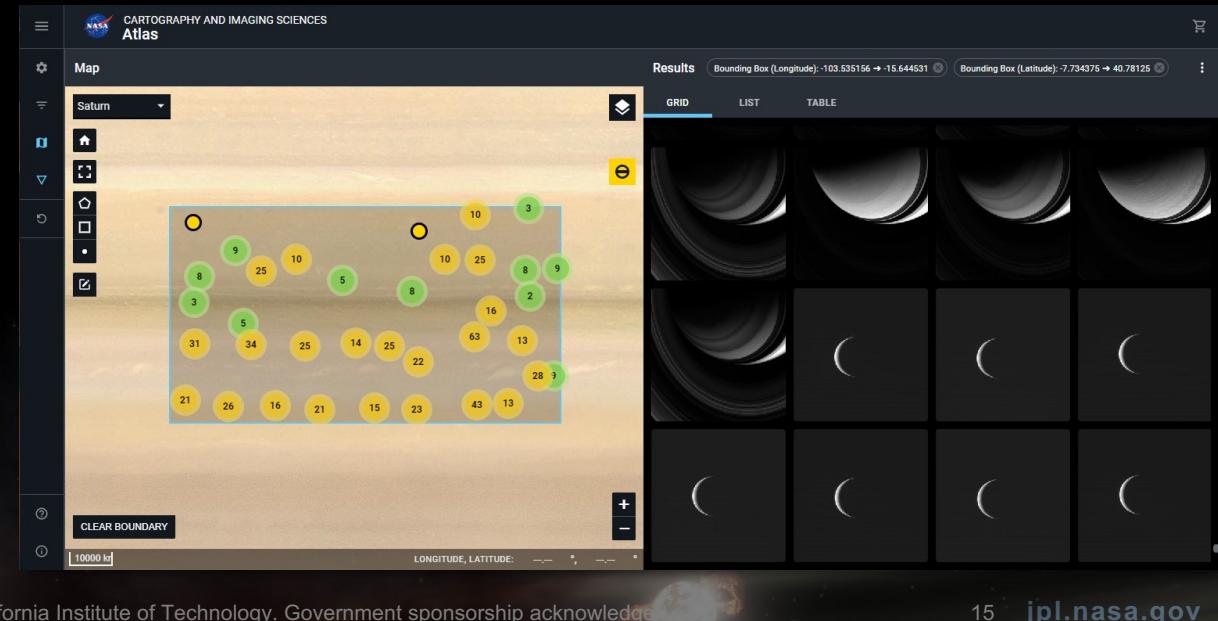
- Facets are addable
  - Scales better with the the 1k+ unique fields in our collection
  - Lowers cognitive load
- Facets are now categorized
  - Time
  - Spatial
  - Lighting
- Supporting documentation for fields parsed from PDS archival documentation
- Faceting is now powered by IMG's Search API



# Searching the Stars with Atlas IV

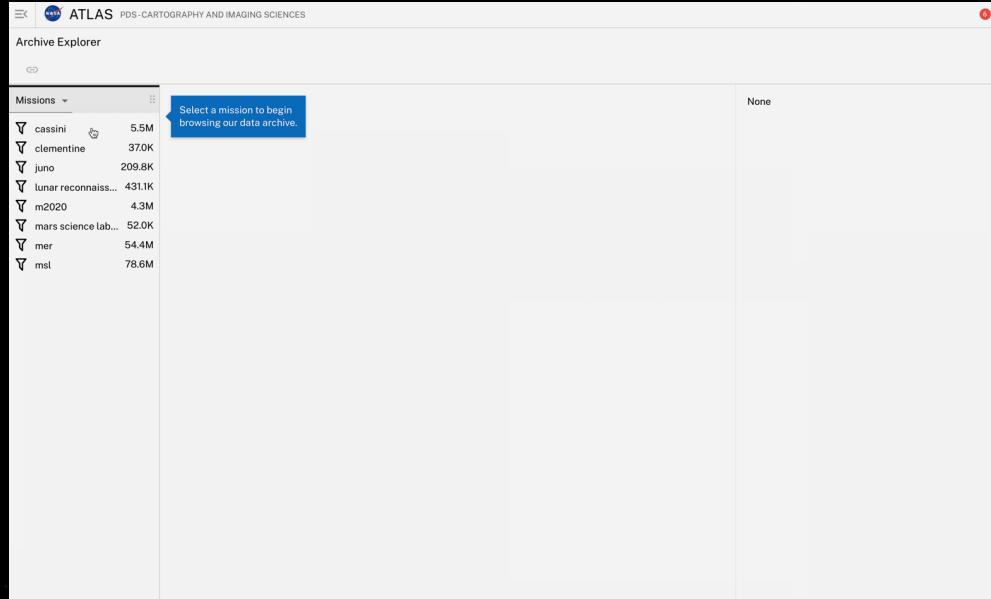
## Atlas IV

- Geospatial search enabled via integration with CartoCosmos<sup>1</sup>
- 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

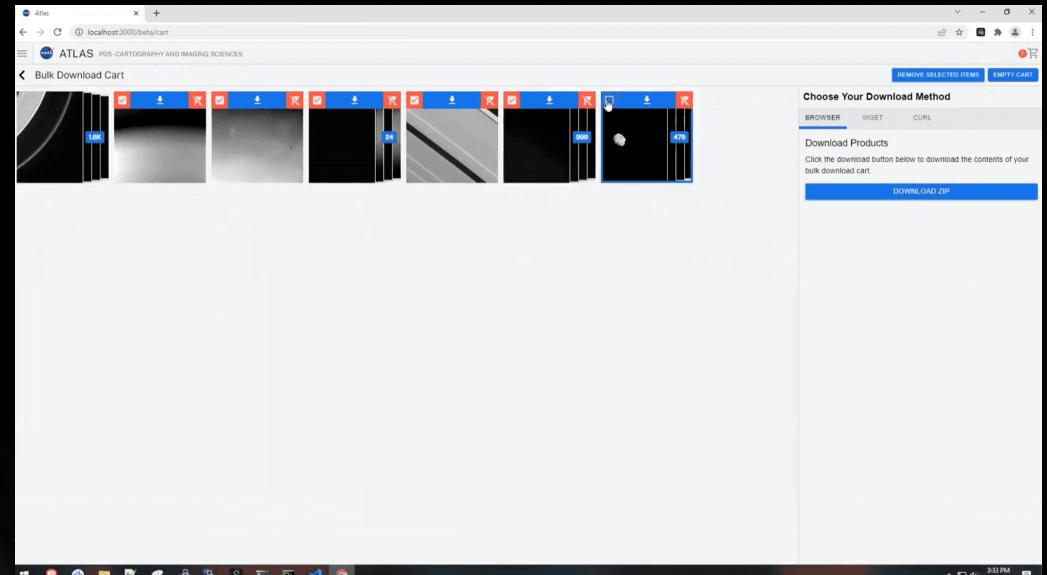


# Searching the Stars with Atlas IV

## Atlas IV

### Shopping cart

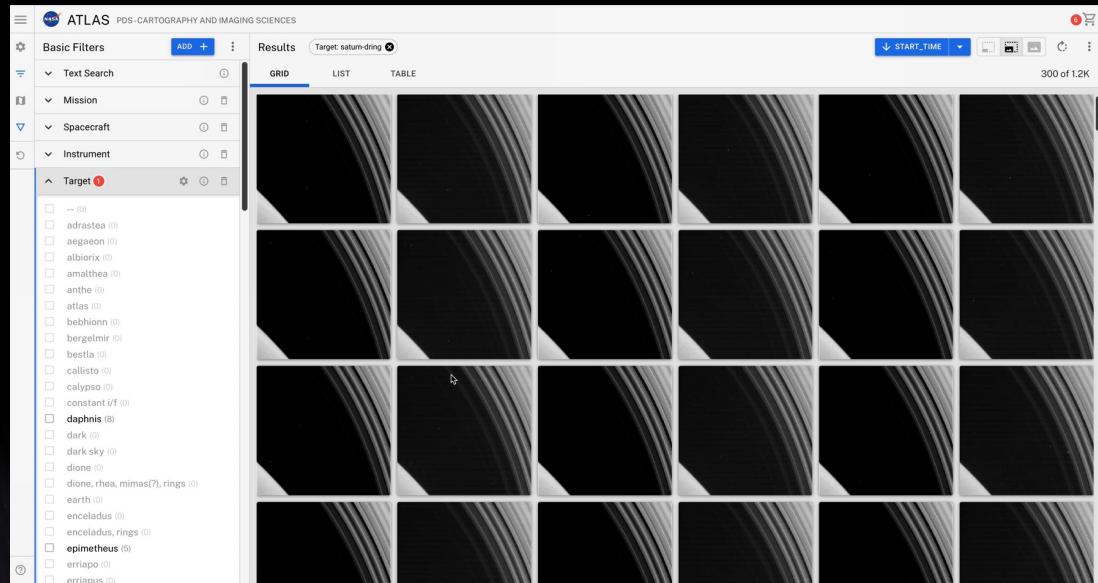
- Streamlines download of large counts of files
- Mark items as you're browsing, download later
- Remove items no longer wanted
- Streams to ZIP file (also curl and wget)
- Pause and resume transfer
- Status reporting
- JSON manifest



# Searching the Stars with Atlas IV

## Atlas IV

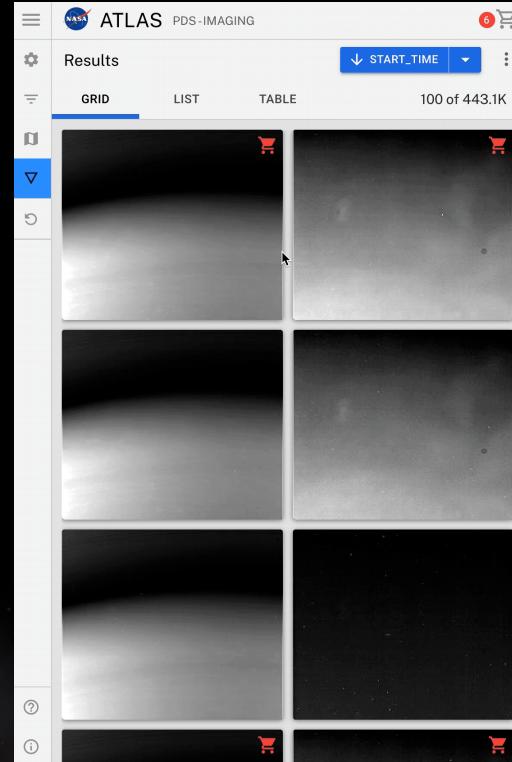
- Dedicated image pages
- Interactive zooming and panning
- Toggleable layers, including landmarks
- Simultaneous viewing of both image and label
- Interactive label with feedback loop



# Searching the Stars with Atlas IV

## Atlas IV

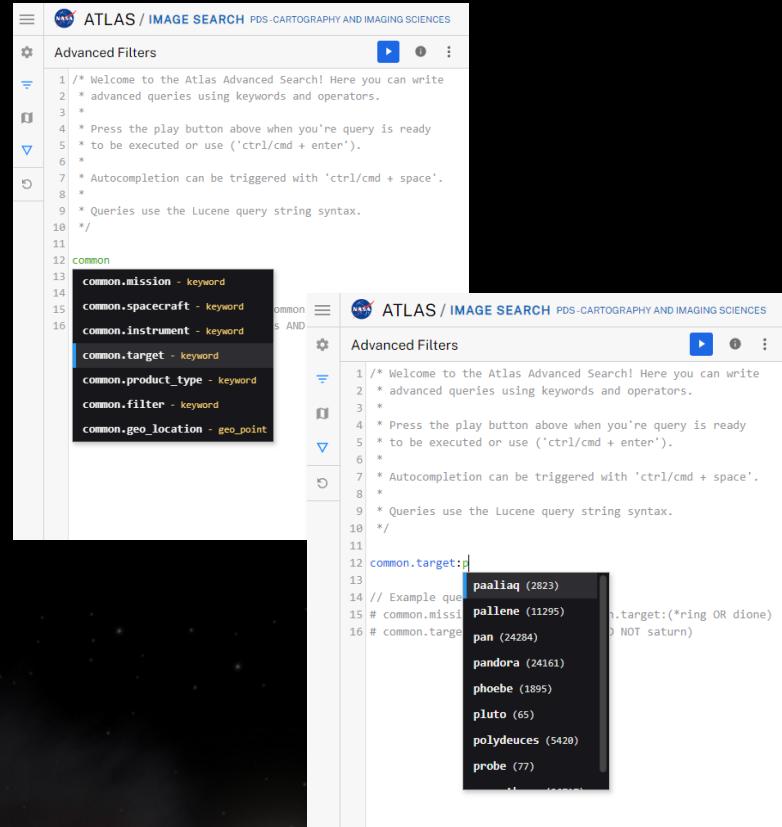
- Mobile friendly
- Extensive help for new users
- Closer integration with machine learning capabilities
- Highly extensible codebase for future improvement
- Virtualized, lazy-loaded, and infinite scrolling results
- Shared design system and tighter relationship with the main PDS Imaging site



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## 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
- Advanced search with syntax highlighting and autocomplete



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**Next steps**

*References*



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## Next steps

- Support all data from Atlas III
- Full integration with PDS API
- DEMUD<sup>2</sup> classifier integration (novelty)



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- Support all data from Atlas III
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😱 Public beta early FY23 😎

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*Background*

*Motivation*

*Atlas IV*

*Next steps*

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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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