NASA PDSIMG
Searching the Stars with Atlas IV

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Searching the Stars with Atlas IV
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Introduction
What is PDS IMG?

- Cartography and Imaging Sciences Node (IMG) of the NASA Planetary Data System (PDS)
- Home to upwards of 1 PB of digital image archives
- Diverse collection of images
  - Both orbital and landed missions
    - Over 20 million images taken from the surface of Mars
    - Nearly 5 million images taken of Mars's surface from orbit
    - Images of Jupiter, Saturn, and beyond
  - Original, raw experiment data and derived products
  - Differing coordinate systems

Introduction
Problem Statement

PDSIMG is home to well over 1000 TB of data!

How can we effectively and efficiently find the images and data we want?

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Introduction
Current Solution

- Atlas III provides effective and efficient search and access to PDS IMG's archive.

- However…
  - With an ever growing imagery collection and next-generation mission data, we need to ensure all our systems are highly available and scalable
  - Keep up with latest web technologies and design principles
  - Keep Atlas cohesive
  - Meet security and performance expectations
  - And Atlas III is almost a decade old now.

- To meet these needs, Atlas is undergoing its fourth iteration as Atlas IV.

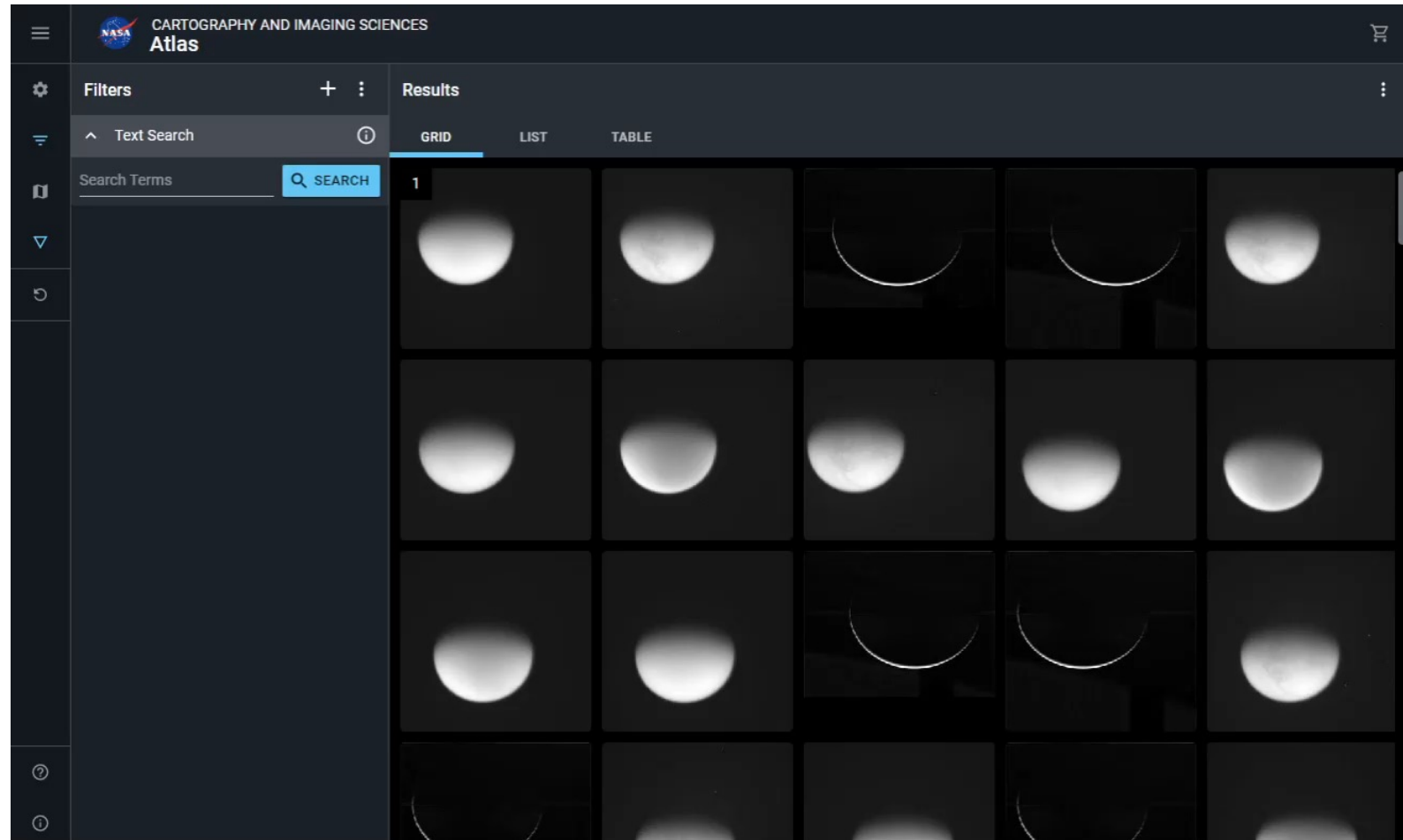Atlas III

Atlas IV
Overview

- Atlas IV boasts several improvements over its predecessor and even more features
  - Codebase redone in favor of modern web technologies
    - The previous JQuery-era web application is replaced with a single-page NodeJS, React, Redux, Webpack application
  - Redesigned using Material UI design principles
  - Mobile friendly
  - Enhanced Filtering
  - Improved geospatial search support
  - Expanded file exploration functionalities
  - Streamlined the download process
  - Each image has its own dedicated and informational page
  - Tighter integration with Machine Learning classifiers

- *Still a work in progress.*

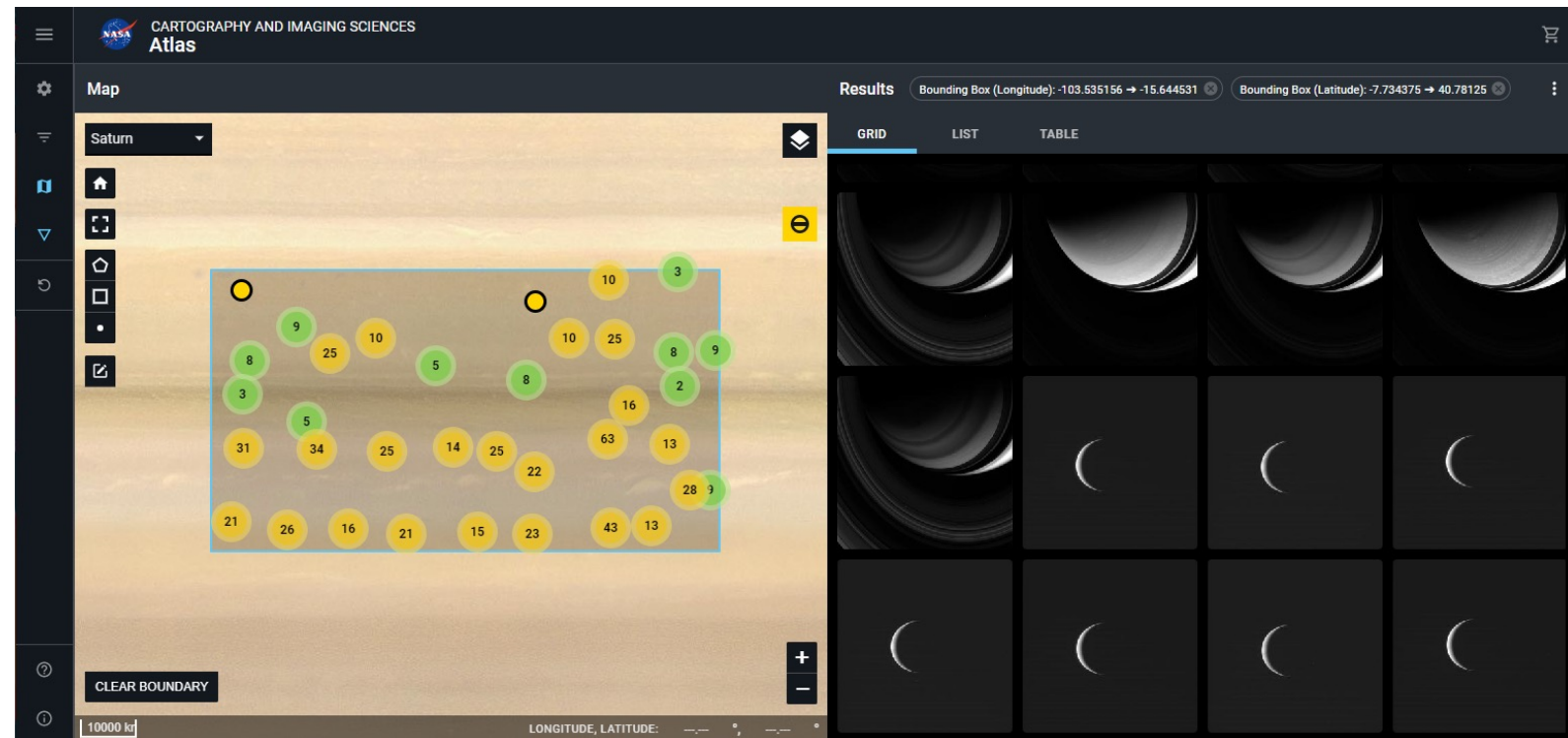Atlas IV

Atlas IV
Filtering

- Filters are addable
  - Scales better with the 1k+ unique fields in our collection
  - Lower cognitive load to begin searching
- Filters are now grouped categorically
  - Groups names include "Time", "Spatial" and "Lighting"
- Filters and fields will have supporting descriptions to help guide users to make more informed searches
- Filtering is now powered by ElasticSearch instead of Solr

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Atlas IV
Map

- User studies and interviews have shown that geospatial searching is a hotly desired feature for Atlas and one of the primary ways users want to search PDS IMG's data.

- To support this, we integrated a planetary mapping library called CartoCosmos developed by our USGS partners.

- It supports bounding box drawing, nearly 30 planetary bodies, polar projections and a whole suite of basemaps and layers for each.

- Atlas III only provided very limited and basic geospatial support and previously only offered three planetary bodies.

Atlas IV
File Explorer

- A file directory view to navigate our holdings that cannot adequately be searched for through facet or map-based queries.

- This replaces Atlas III's /data view which showed the file system in a raw and convoluted form.

- The File Explorer utilizes ElasticSearch on the backend. This enables virtualized paths that we can use enforce clear names and conventions in the file system.

- Provides a rich and reactive experience that integrates with the rest of Atlas IV.

- Not only provides navigation now but also filtering, sorting and search.

PDS Imaging Node: Data Archive

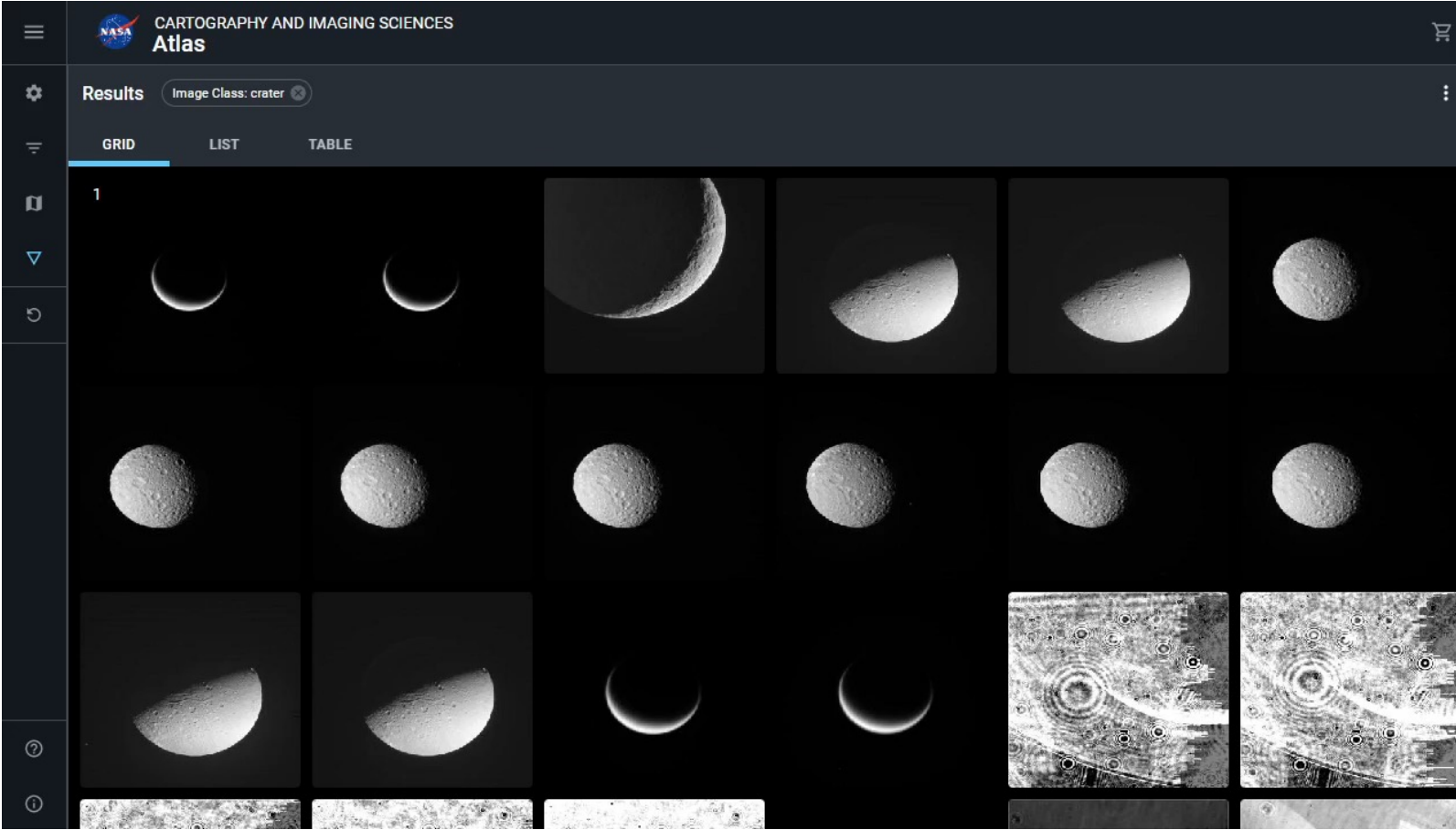| Name	Last modified
Parent Directory	
carto/	2015-11-10 15:01
cassini/	2021-02-04 23:10
clem1-l-h-5-dim-mosaic-v1.0/	2015-07-17 10:10
clem1-l-n-5-dim-nir-v1.0/	2015-07-16 13:02
clem1-l-u-5-dim-basemap-v1.0/	2015-07-17 10:04
clem1-l-u-5-dim-uvvis-v1.0/	2015-07-17 10:06
clem1-l_e_y-a_b_u_h_l_n-2-edr-v1.0/	2016-05-04 09:16
clementine/	2016-07-25 21:04
co-e_v_j-issna_isswa-2-edr-v1.0/	2007-07-12 09:22
co-e_v_j_s-vims-2-qube-v1.0/	2019-09-18 11:29
co-s-issna_isswa-2-edr-v1.0/	2019-09-18 11:29

Atlas IV
Downloading

- Introducing shopping cart capability to help support mass downloads
    - More intuitive
    - Lets users browse and select items they wish to download for later
    - Once done, they can remove items they no longer want and perform the bulk download

- Download from wget [2] and curl [3] will continued to be supported

- We are still in process of exploring download methods. Some ideas are:
    - Asynchronous downloads that later email users a one-time zip download link
    - Streaming data through the browser
    - Special download clients that offer features like automatic retries and file prioritizations.
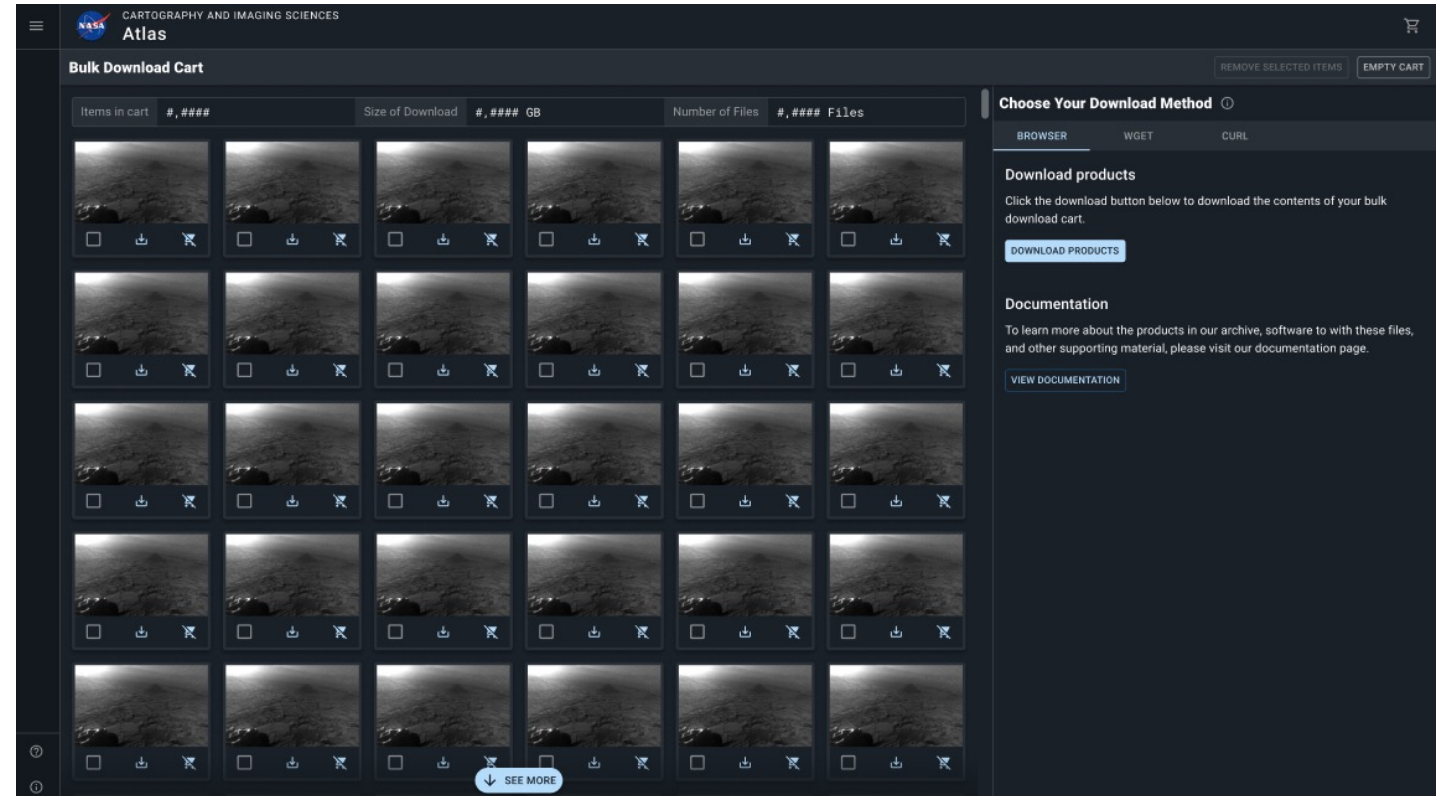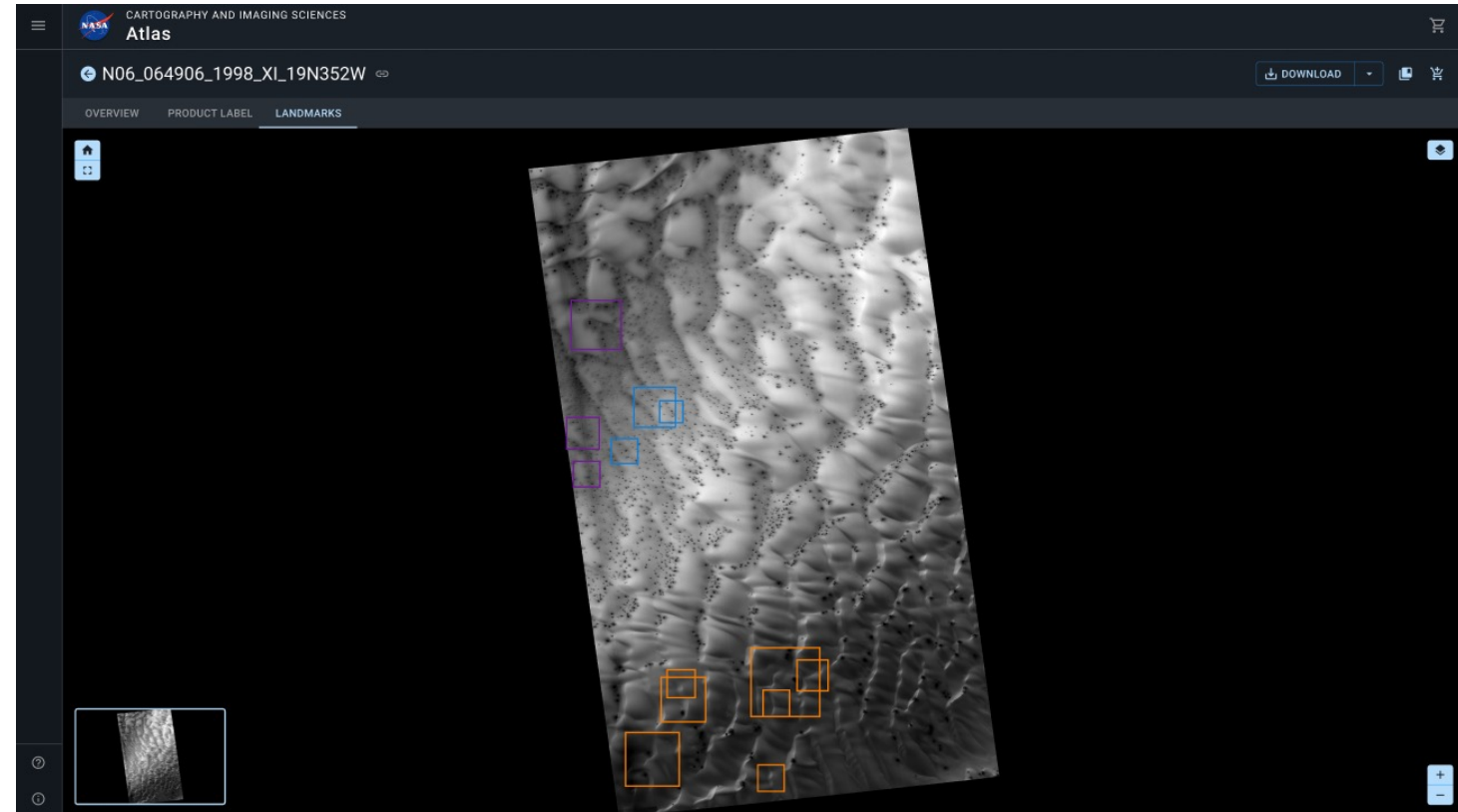
Atlas IV
Record Views

- Each image now has a dedicated page.

- The enables sharing imagery via URL.

- Imagery is interactive and can be zoomed in on and panned.

- Layers, such as landmarks, can be toggled on and off.

- Both image and metadata can be viewed simultaneously.

- The label is interactive and can be search and filtering upon.

- The record view is incredibly extensible with its tabbed view – supporting the future creation of refined and analytic views such as 3D context and orientation.

Atlas IV
Additional Features

- Mobile friendly

- Closer Integration with machine learning capabilities

- Extensive help to aid new users

- Highly Extensible codebase for future improvement

- Virtualized, lazy-loaded and infinite scrolling results

- A shared design system and tighter relationship with the main PDS Imaging site

Conclusion
+ Work to Go

- Atlas IV, while still in the works, is an evolutionary and revolutionary reimaging of its predecessor Atlas III.

- Atlas IV will:
  - Be compliant with modern web standards.
  - Rework filtering to be intuitive and scalable.
  - Feature geospatial capabilities at its core.
  - Revamp file exploration with new searching options, orderly hierarchies, and standardized naming conventions.
  - Download functionality will be robust and highly integrated.
  - Product images will be presented through dedicated pages and will enable tailored insights into the data.
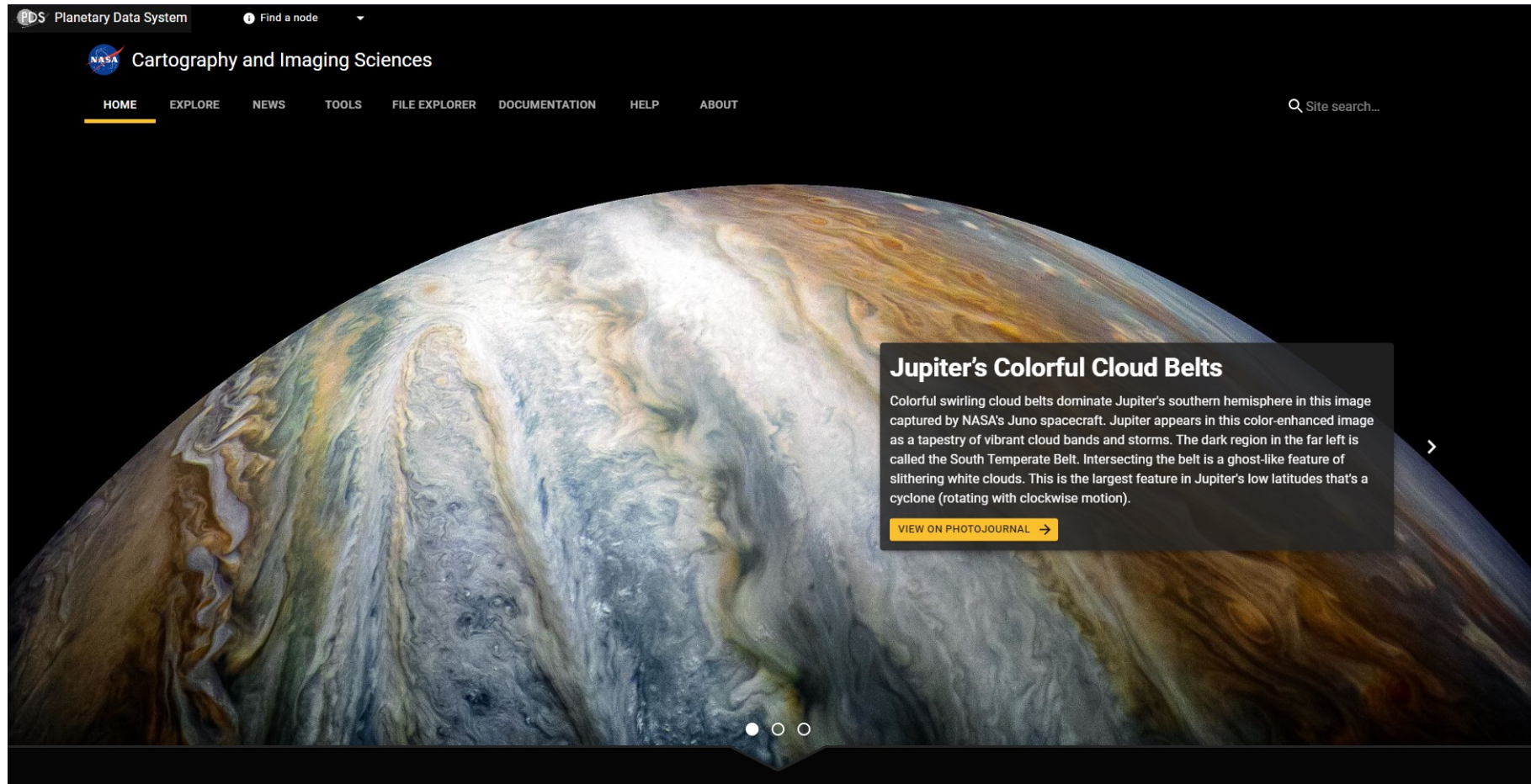
Conclusion
PDSIMG Website Preview

Atlas IV is part of a larger rework of PDS IMG for integration with ongoing web unification efforts.
1) Main site (pds-imaging.jpl.nasa.gov)   **2)** Backend API   **3)** ML Classification

References

[1] CartoCosmos https://ceias.nau.edu/capstone/projects/CS/2020/Carto Cosmos-S20/

[2] wget https://www.gnu.org/software/wget/

[3] curl https://curl.se/

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Backups

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Map Animation

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