Jet Propulsion Laboratory
California Institute of Technology

Life Storage of Mission Data (LSMD)

Active Archival of Flight Engineering Data

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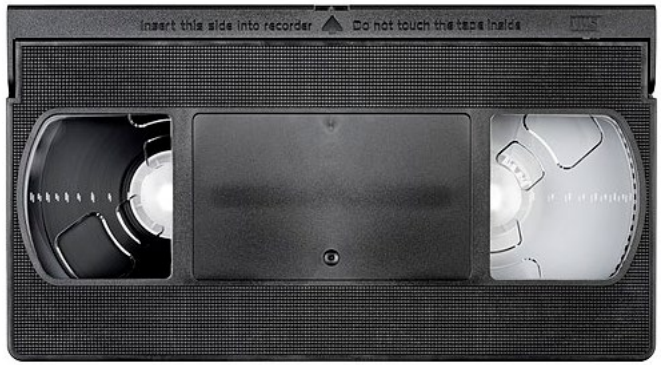
Data starting with Voyagers:

What else was going on in 1977?

- First test flight of Enterprise Shuttle

- Apple was incorporated
- Best Picture: Rocky

- VHS commercially available in US



Data Return Profile of JPL Spacecraft/Instruments:

	1970s	1980s	1990s	2000s	2010s	2020s
Spacecraft/ Instruments	8	7				
Data Volume	KBs	MBs				
						

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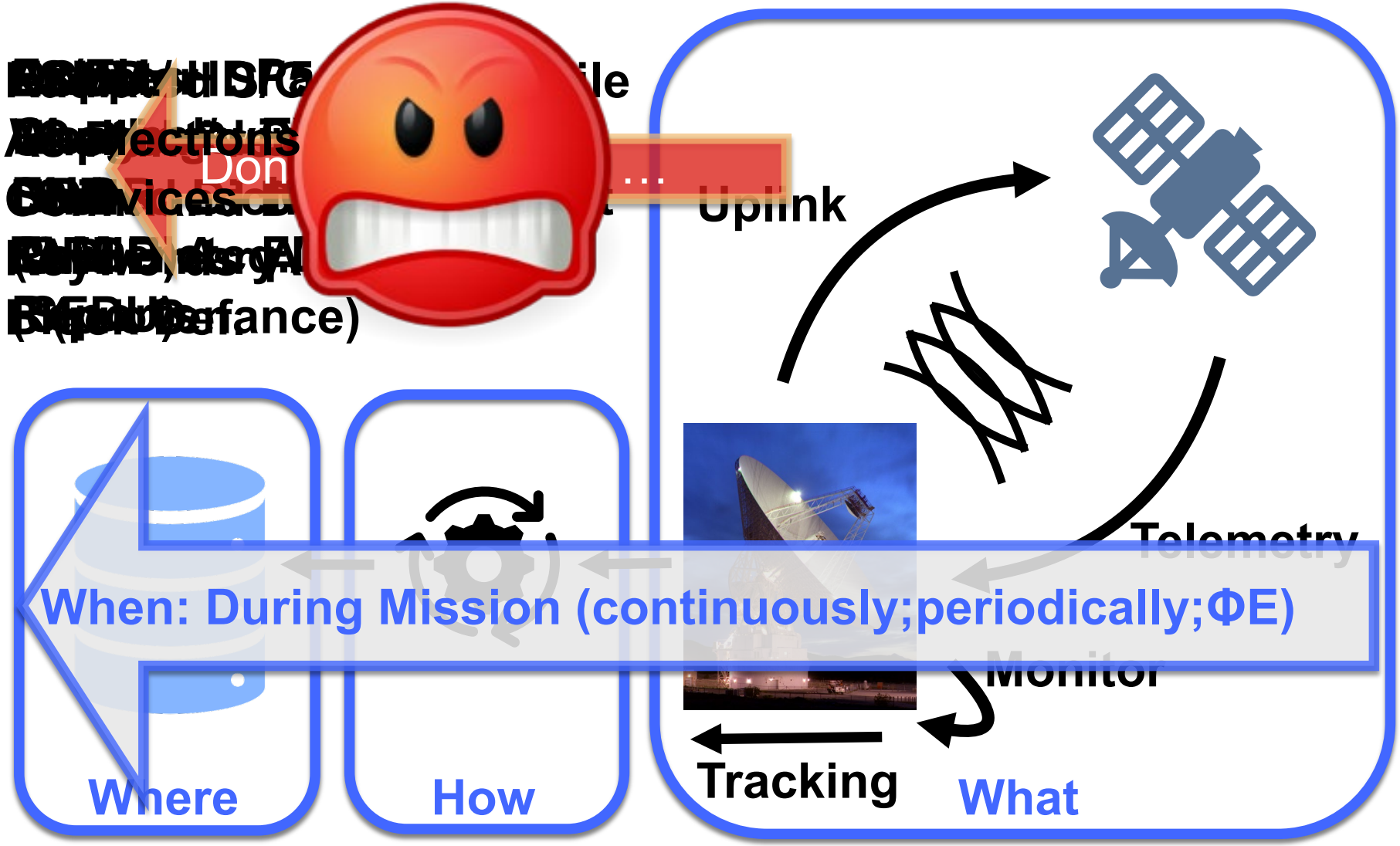
Spacecraft/ Instruments	8	7	21	32	31	¯_(ツ)_/¯
Data Volume	KBs	MBs	GBs	TBs	PBs	😱
						

Flight Engineering Data Artifacts



These data *want* to tell a story…

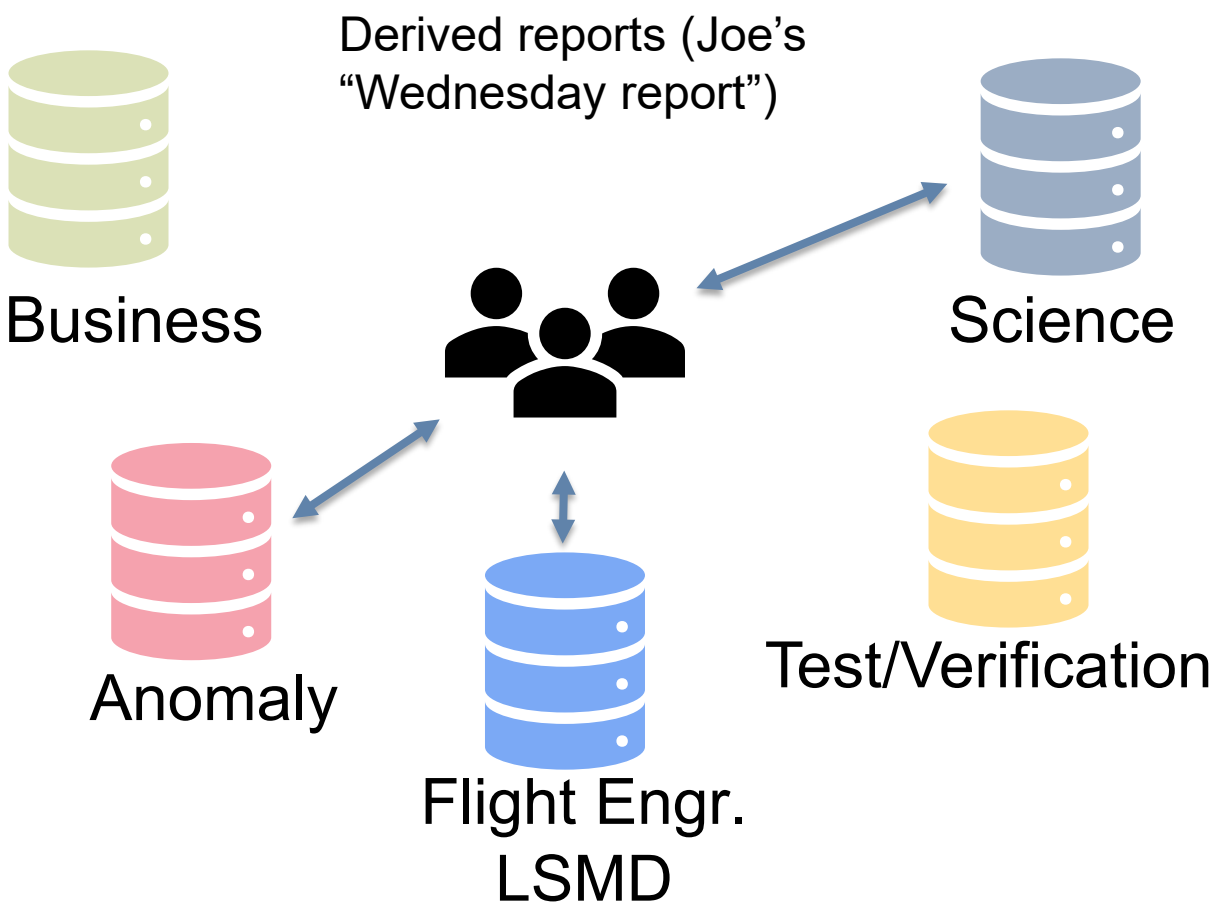
But first, there's some important hurdles to jump:

- Integrating multiple mission systems (silos, even silos within missions)
  - Relating differing schemas between missions (dictionaries become important as there are no standards at play)
- Rapidity of analysis for operations (tactical, strategic, …) so need scale
- Uniform understanding of data ("analysis ready data")
  - Different things to different people (reformatting, so need scale)
- Security/ITAR considerations
  - Proprietary period for on-going missions
- Fighting for the Future
  - Missions are focused on successfully operating and achieving mission goals
  - Active archives are focused on curating and serving findable, usable data for a broad spectrum of uninitiated users
- ATLO? Testbed? Reprocessing?
- Labeled data: the Holy Grail for ML data use

User Scenarios for these Data:

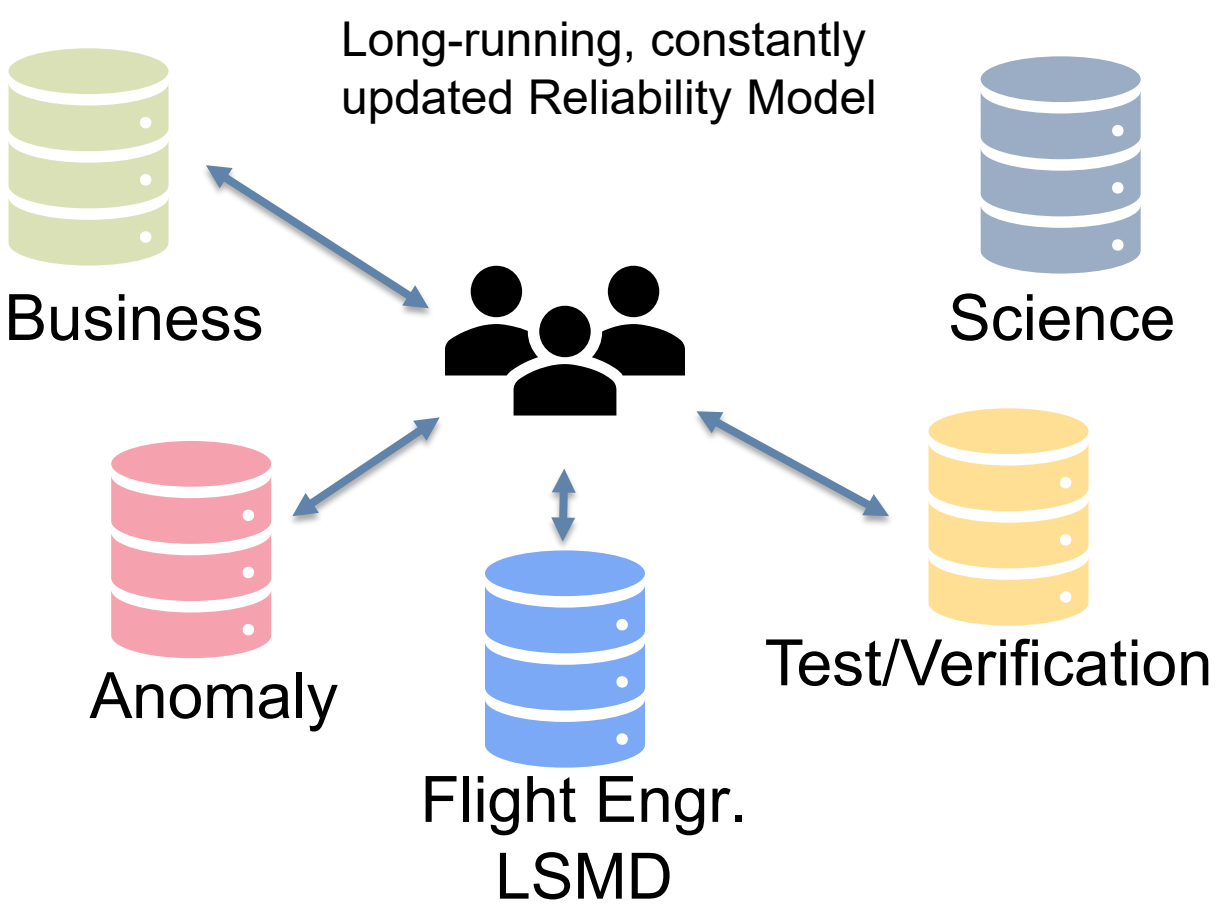
- **Line orgs:**
  - needing access to large number of archives on daily basis for multiple projects
  - needing infrequent access for line peer reviews and boards
- **Projects:**
  - Small projects with little/no support for data management
  - Small and flagship projects with high heritage
  - Flagship missions with significant operational complexity
  - Flagship missions in close-out
  - All projects past lifetime
- **Other:**
  - End users needing current and past project data for future mission design and other analyses
  - Individuals with datasets of use to wider JPL community (knowledge capture)

Distributed Federation of Archives Supports Users…



Mission Operators

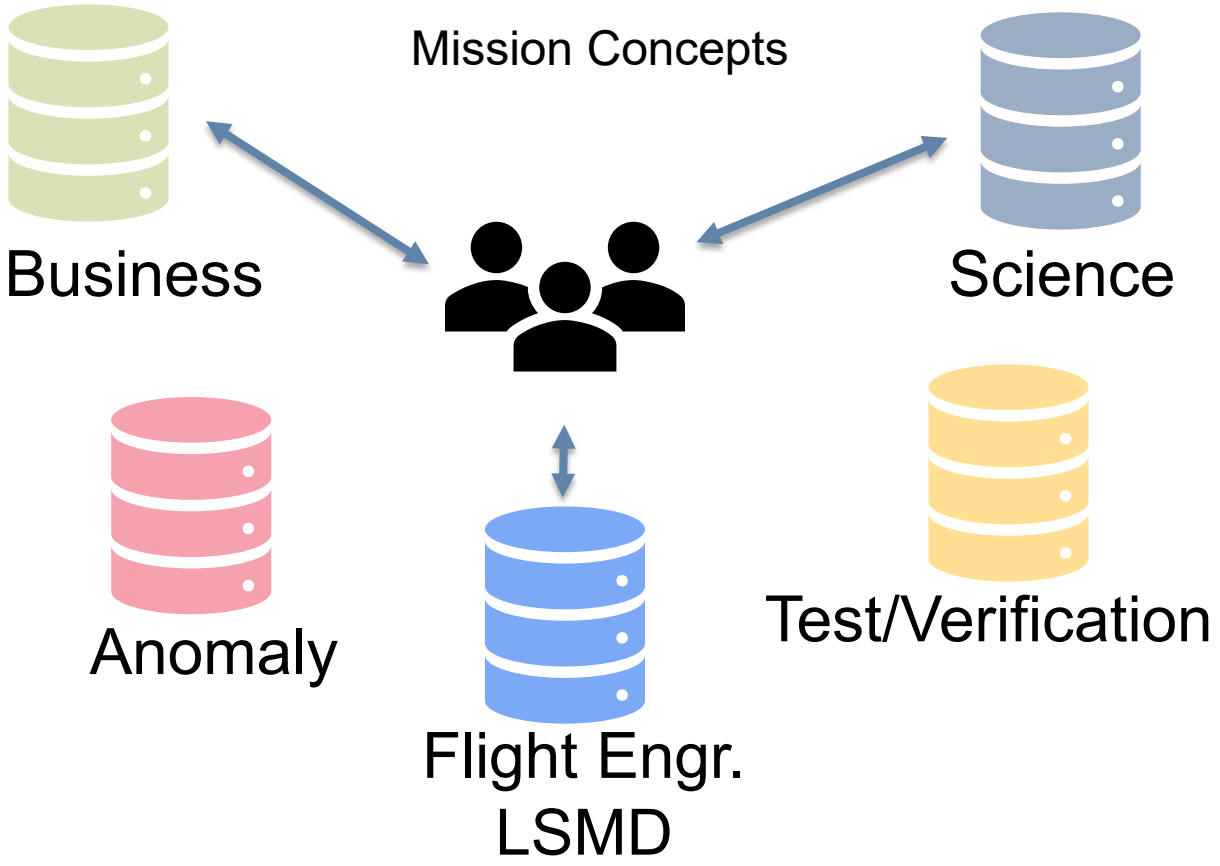
Distributed Federation of Archives Supports Users…



Mission Operators

Reliability Engr.

Distributed Federation of Archives Supports Users…



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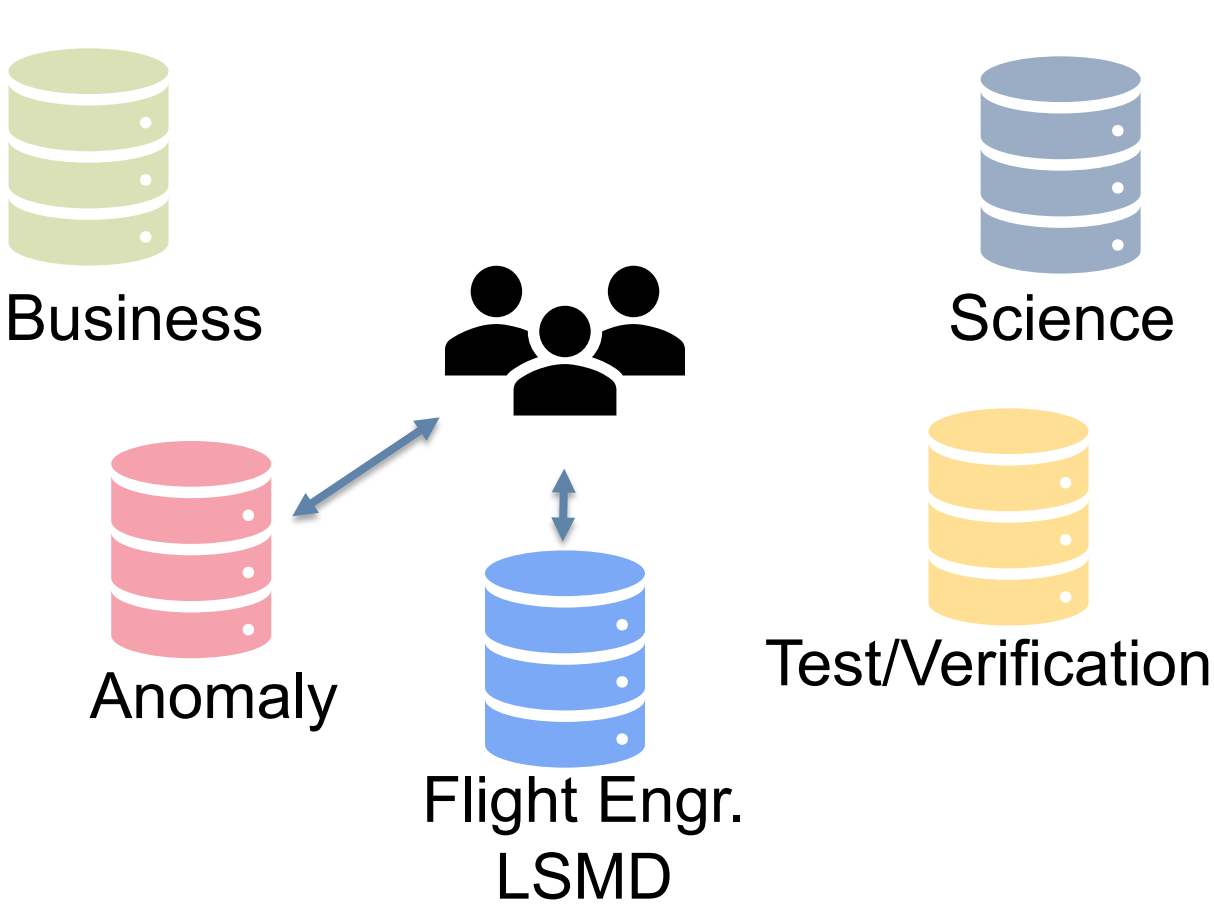
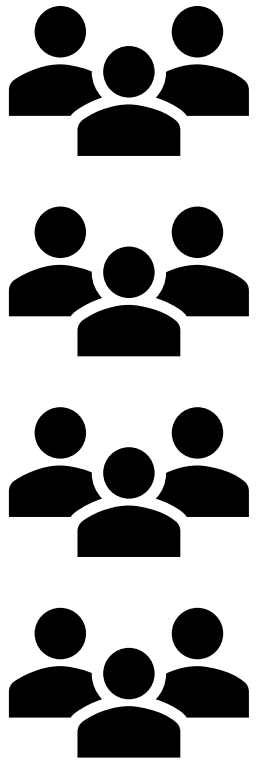




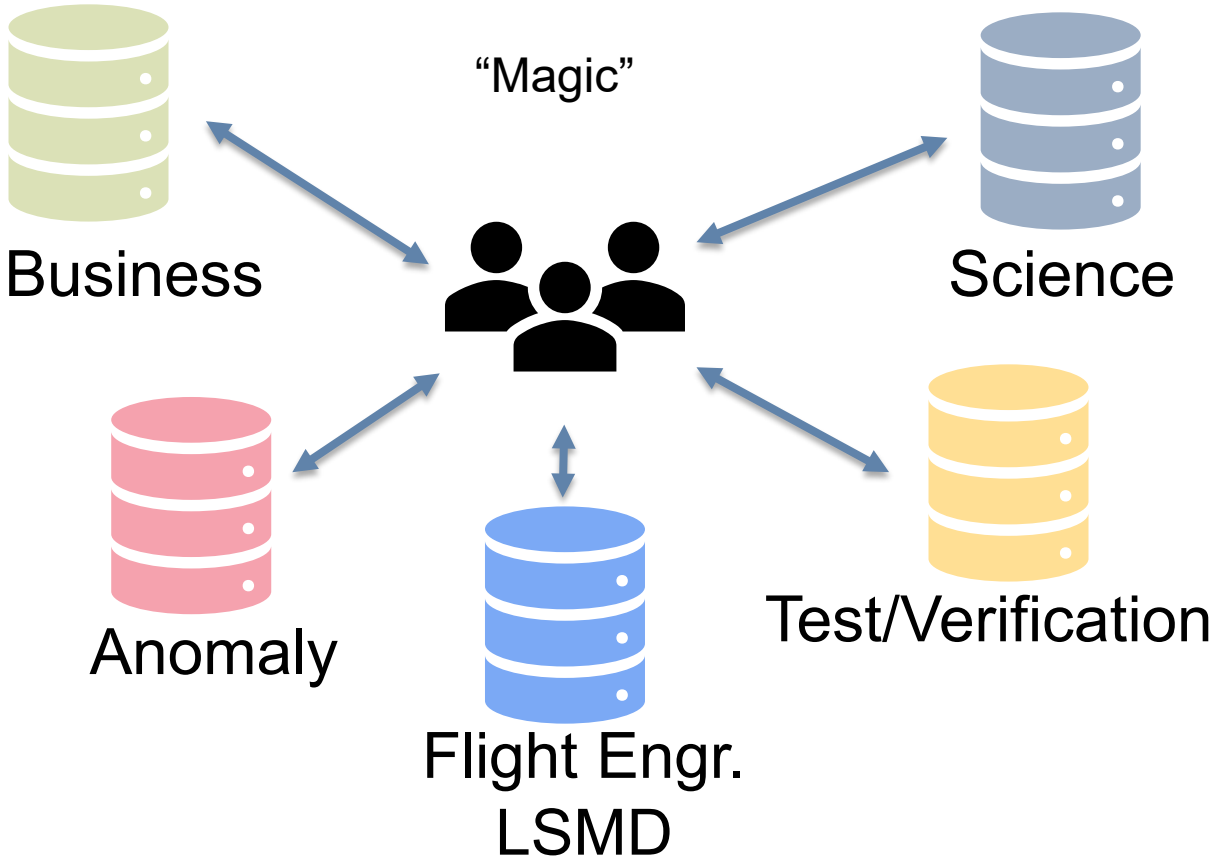
Mission Operators

Reliability Engr.

Mission Designers

History-driven Training

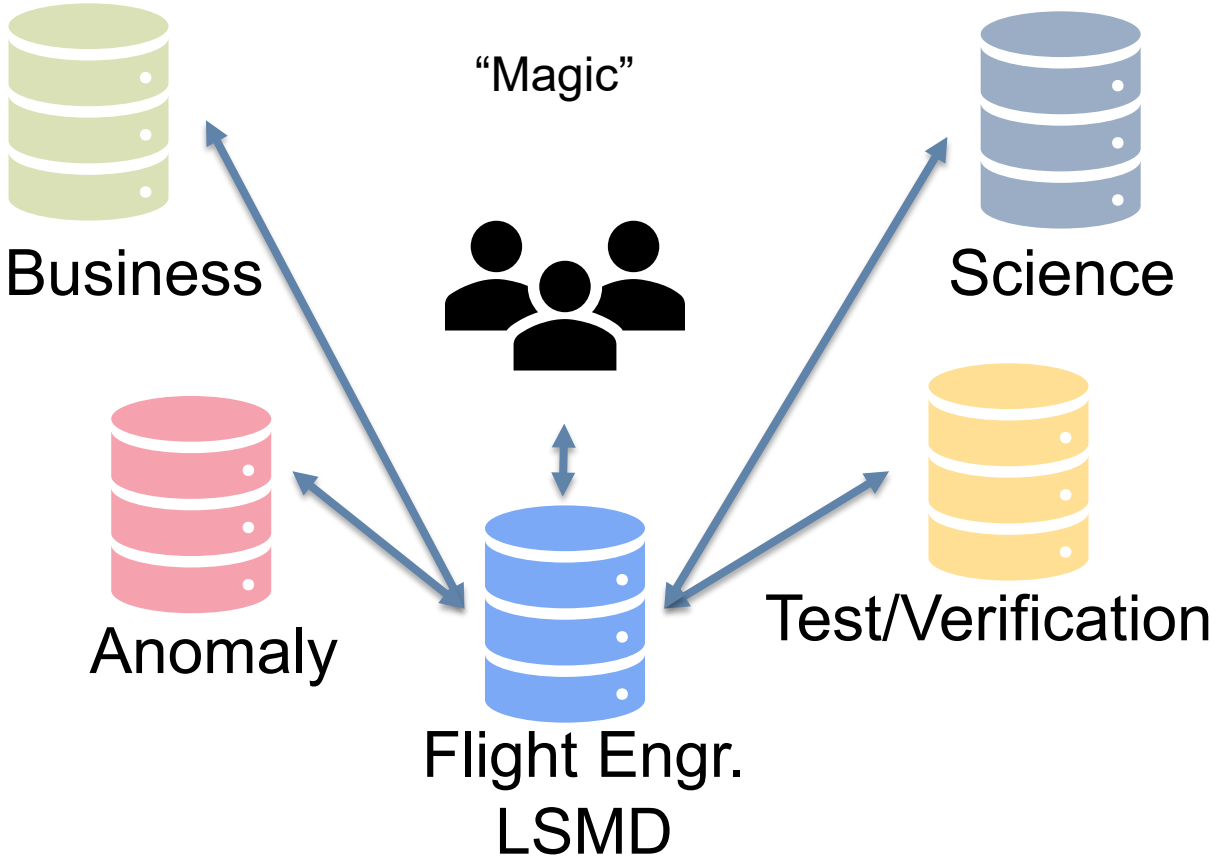
Distributed Federation of Archives Supports Users…



- Mission Operators
- Reliability Engr.
- Mission Designers
- History-driven Training
- Machine Learning

Distributed Federation of Archives Supports Users…

Enabled with Unifying APIs




Mission Operators


Reliability Engr.


Mission Designers

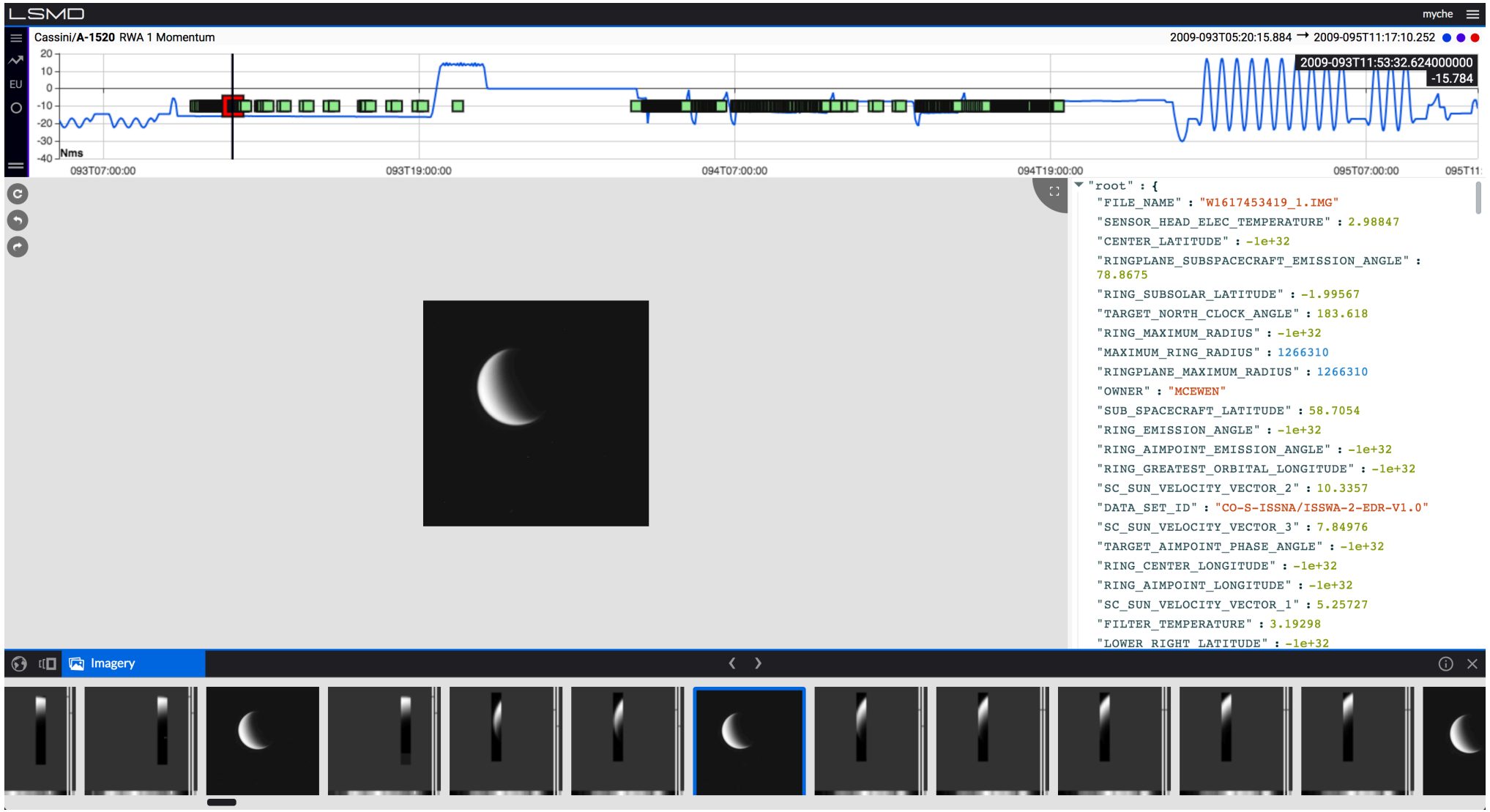

History-driven Training


Machine Learning

Long-term Archival Considerations:

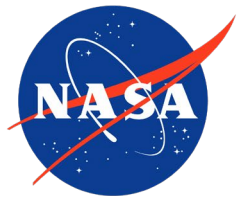
- By far, the most obvious characteristic to index is _time_
- Named events uniformity
- Relationship to other data within federated archives.
  - Science data
  - Visualizations
  - Contracts, business records, workforce
- Different end-users have different needs
- L0-L1-L2 progression for Flight Engr. Data just like Science data
- Get rid of errata (reprocessing should be practical)
- Allow data evolution

Using APIs to Integrate Archives



Lesson's Learned (so far…)

- Archiving as the mission operates is optimal:
  - data gaps/idiosyncrasies are more easily documented
  - regular, systematic deliveries can become automated
  - No large push-up at closeout
- Data wrangling for users unnecessarily consumes far too much time
- ATLO data is also important



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