



National Environmental Satellite, Data,
and Information Service

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Maneuvering into the Future: Open-Architecture Data Repository Demonstration

by NOAA's Office of Space Commerce

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What is the SSA Challenge?

- DoD currently tracks about 29,000 objects – the number is steadily increasing
 - We expect over 50,000 new satellites in orbit by the year 2030
- Increase in commercial launches, operations, and manned spaceflight will impact the future space operating environment
- DoD's priority is national space defense
- Human space flight planned for the future
- Space Environment becoming congested and contested
 - New missions like satellite servicing, space tourism, and commercial space stations
- Global concern





How OADR supports SSA

- Space tracking data repository
- Platform to promote commercial space industry collaboration
- Secure data ingest to ensure data integrity measures, standards, and quality
- Capability to safeguard proprietary or sensitive data
- Cloud-based SSA Safety Information
- Improved SSA coverage/accuracy by integrating commercial data
- Orbital debris information through near-real time maneuver planning to operators



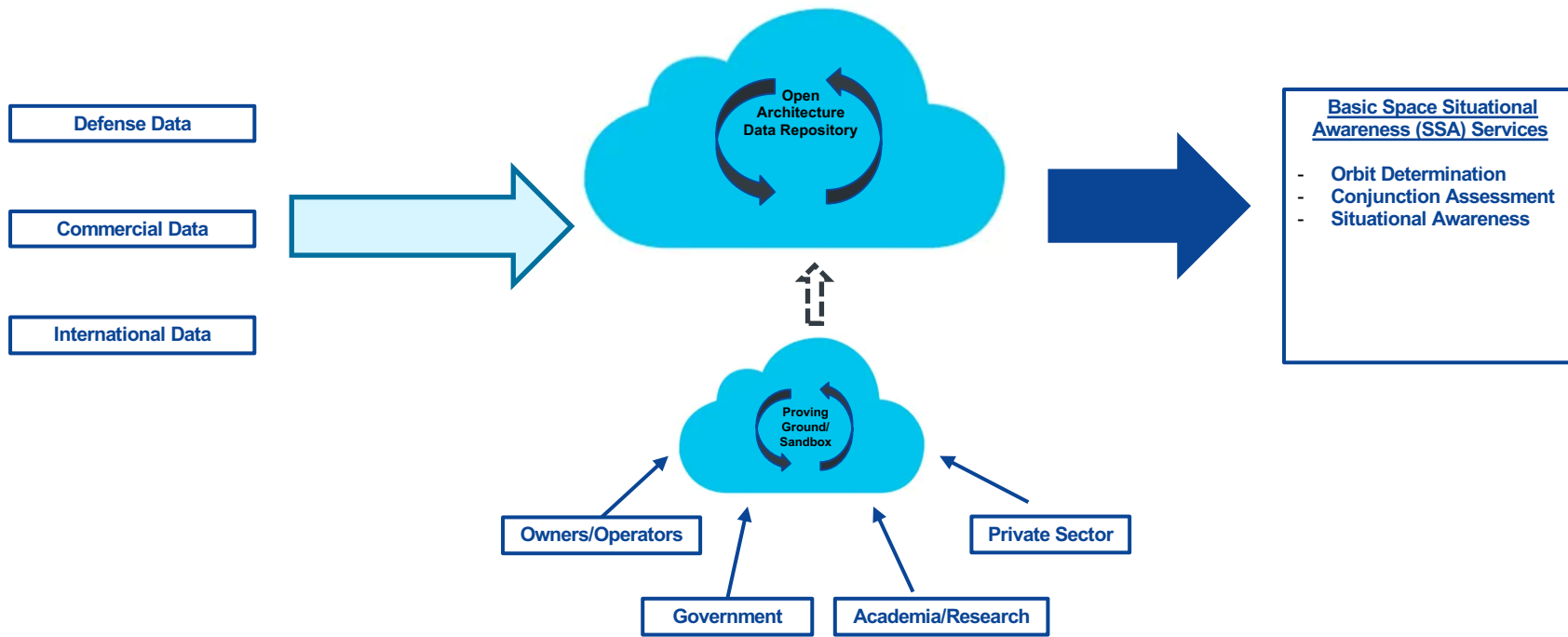
OADR Prototype Agenda

- Design and architecture
- Types of data tested
- How the OADR works
- Examples of SSA products
- Proving Ground/Sandbox



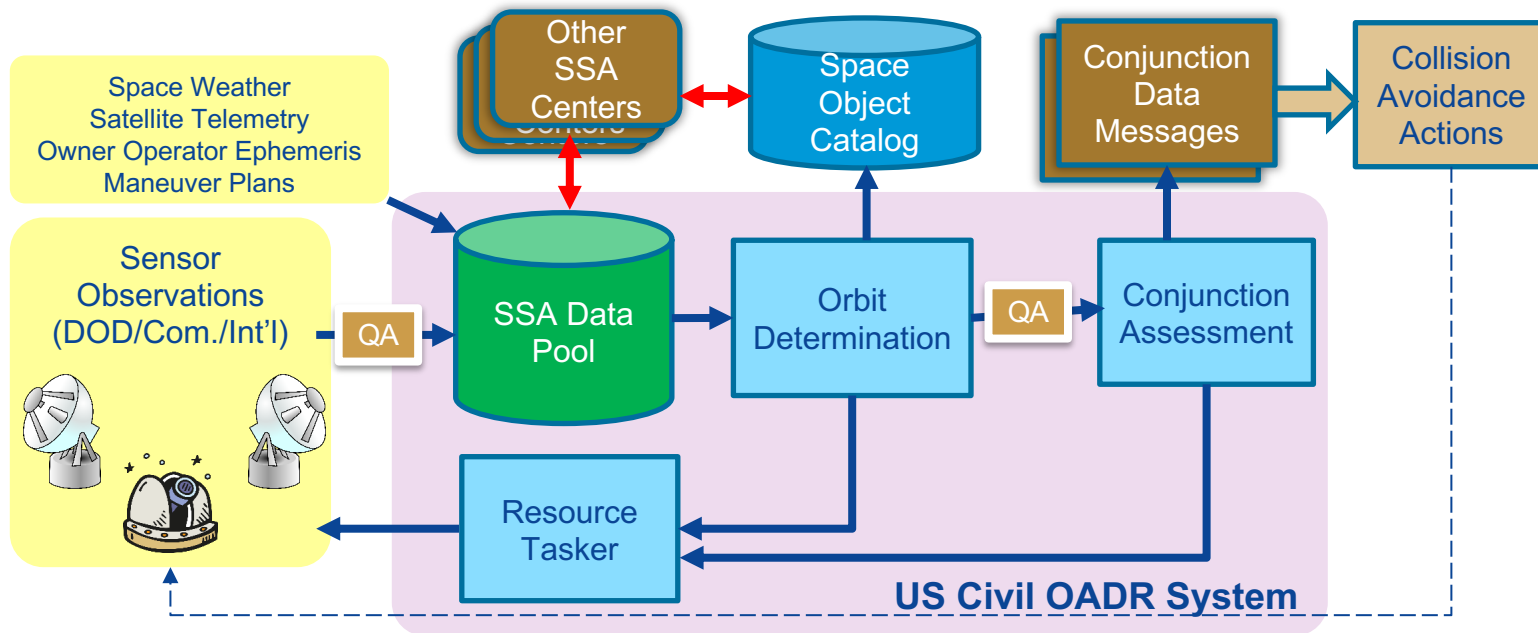


OADR Prototype Overview





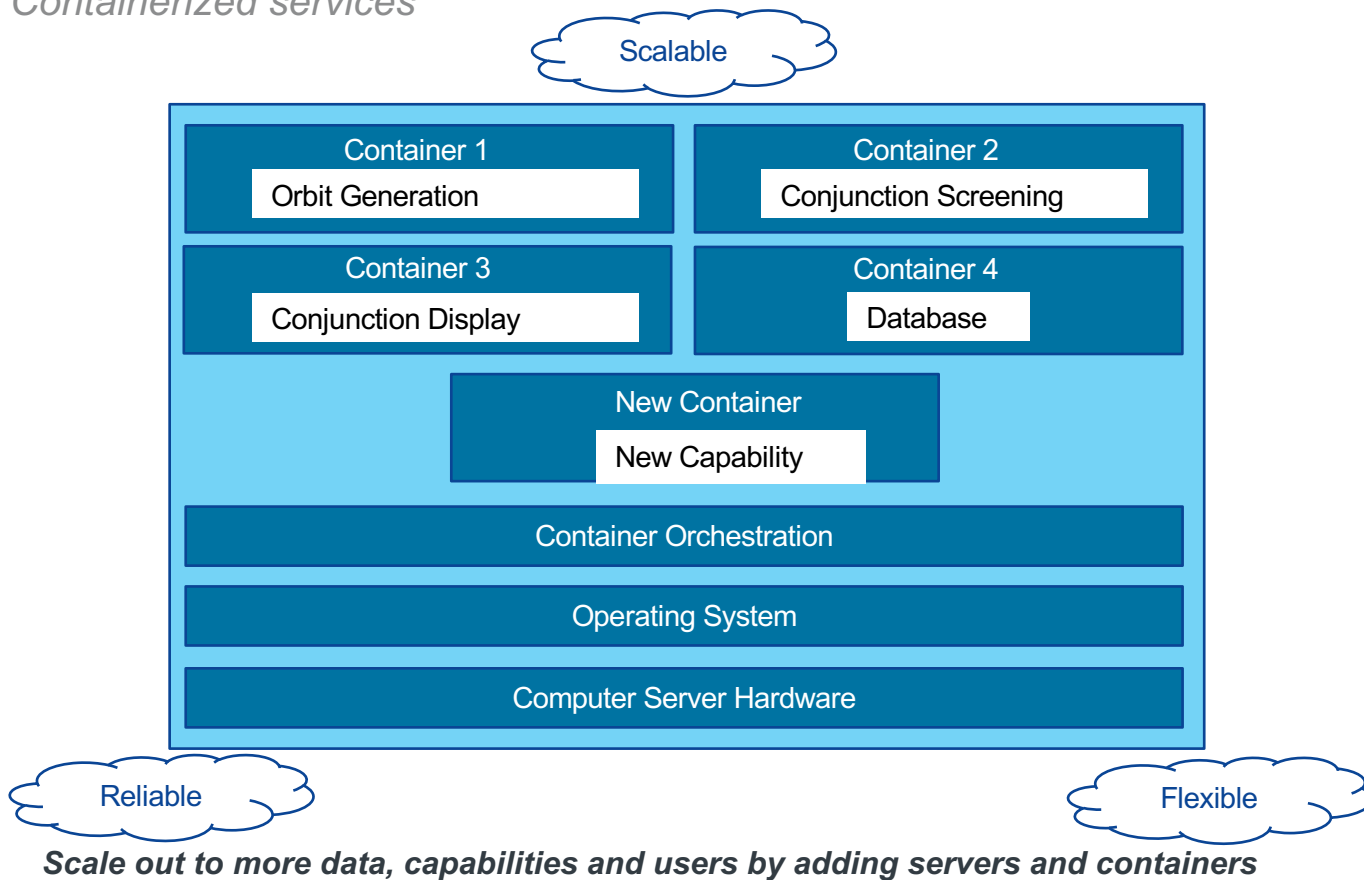
Notional SSA Safety Process





OADR Cloud Software Architecture

Containerized services



Scale out to more data, capabilities and users by adding servers and containers





Advantages of a Containerized Microservice Architecture

Containers package software with libraries and operating system required to execute

- Portable to any computer
- Efficient
- Allow developers to create and deploy software applications faster
- More secure and reliable
- Avoid cloud vendor lock-in

Microservices break a complex software application into small, specialized services that communicate over a common interface

- Can update one part of software without affecting the whole application
- More reliable
- Faster development, testing and deployment

This is the industry standard way to develop modern data systems in the cloud.



OADR Prototype Data System



Data Scientist

Analyze / process data at scale



Data Librarian
Set up and manage data workflows, templates, and triggers

Batch Data



Realtime Data

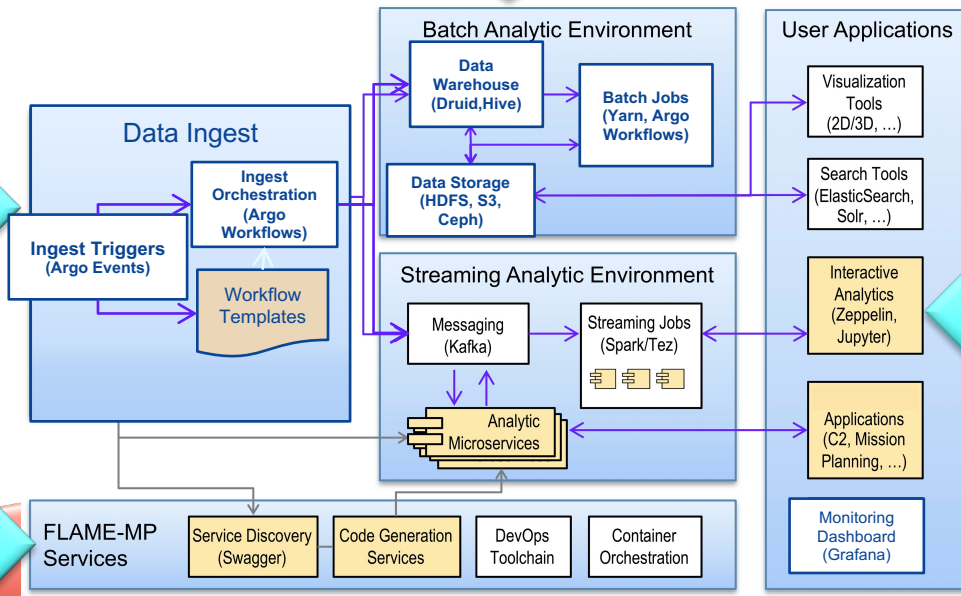


Integrated CI/CD pipelines

DevOps Engineer



Can be deployed to any cloud provider or on-prem



Consume data products



Mission User(s)

Develop and deploy apps / analytics



Analytic Developer





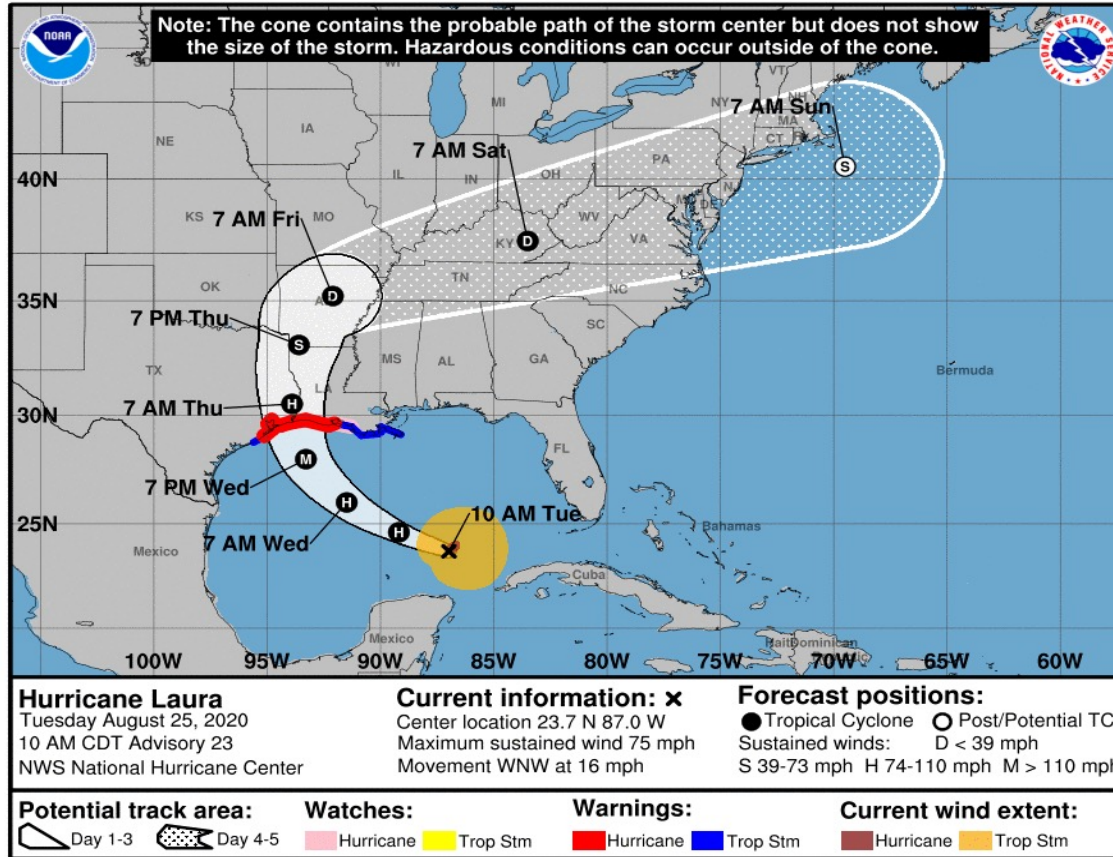
OADR Data

- Department of Defense SSA Data
- Commercial SSA Data
- Fused DOD + Commercial Data Orbit Solutions



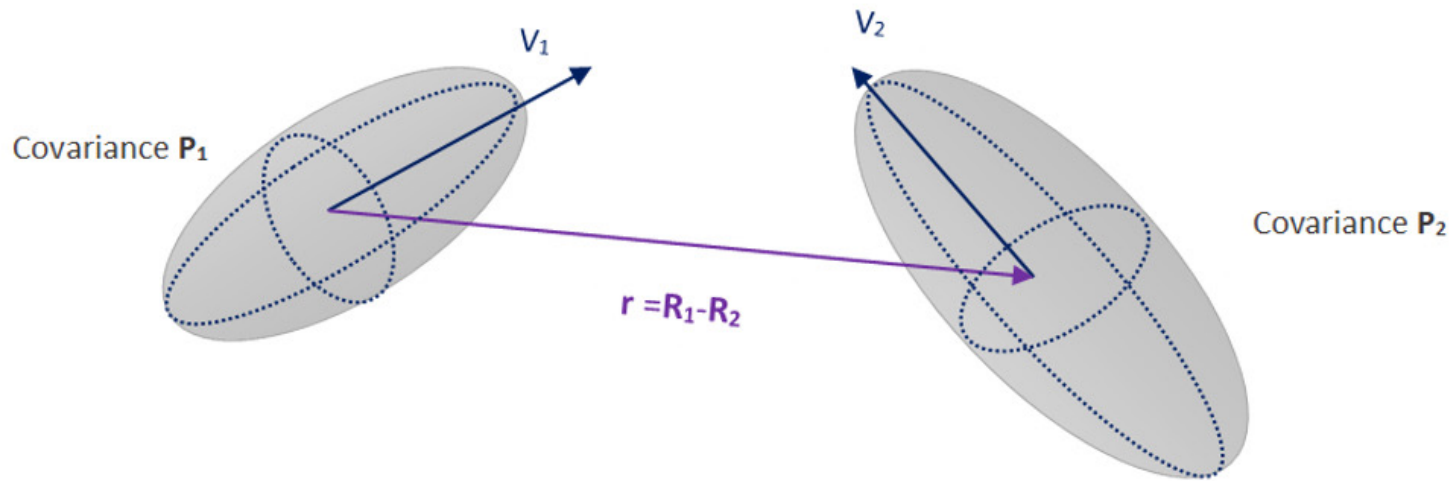


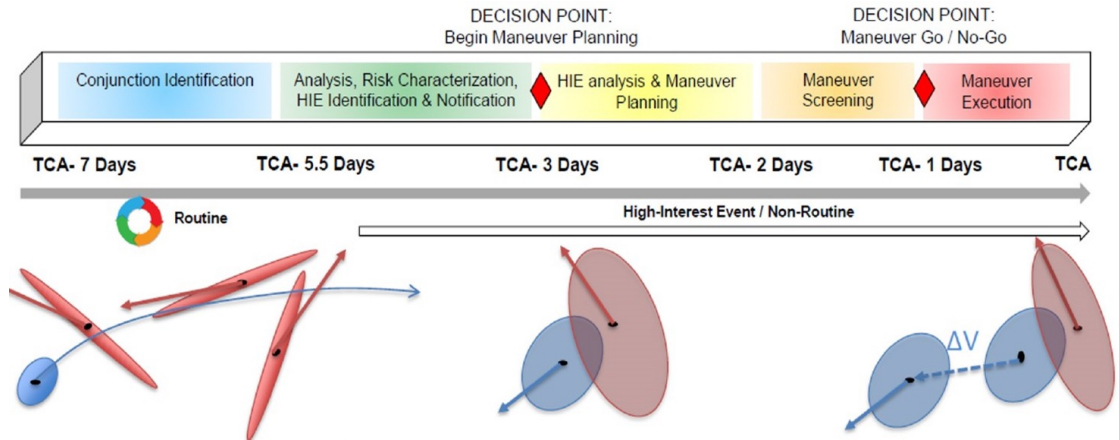
A conjunction warning notification is similar to a hurricane





Satellite Probability of Collision





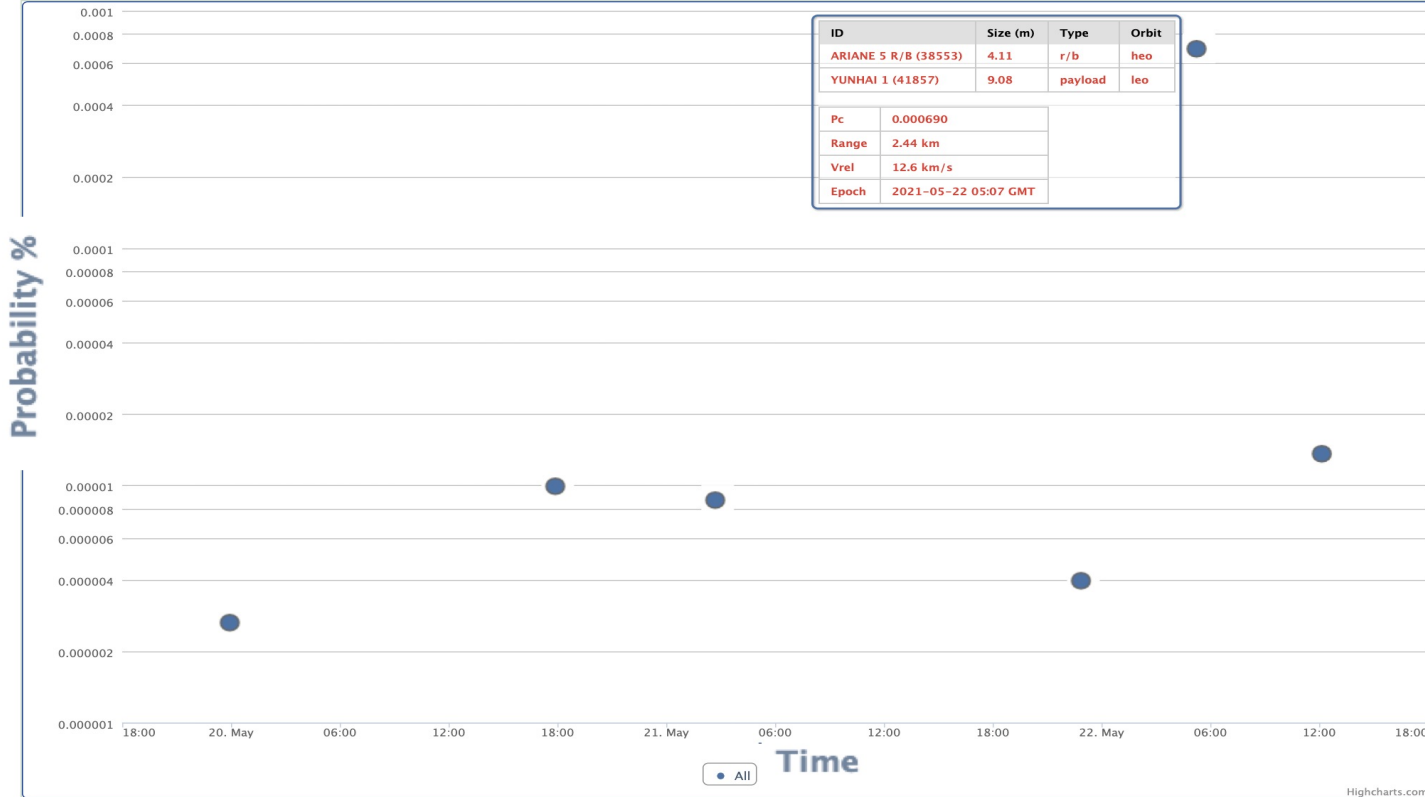


Open Architecture Data Repository

Conjunction Summary



Conjunction Summary (Probability of Conjunction vs. Time)



Number Conjunctions: 6 Number Conjunctioning Objects: 12 Current Sieve Id: 2373 Data Used: EPHEMERIS Orbit: HEO

Highcharts.com



Conjunction Data Message (CDM)



ID	Size (m)	Type	Orbit
THORAD AGENA D DEB (19423)	0.0000100	debris	leo
OCO 2 (40059)	6.00	payload	leo

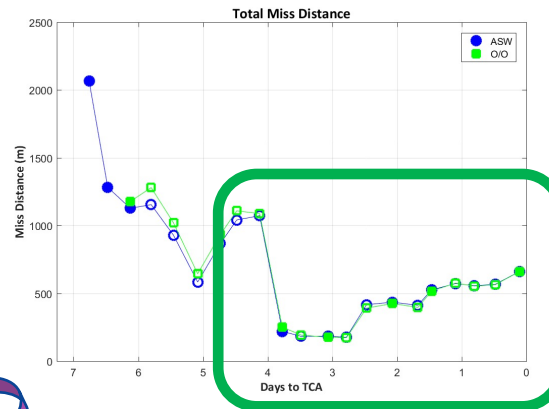
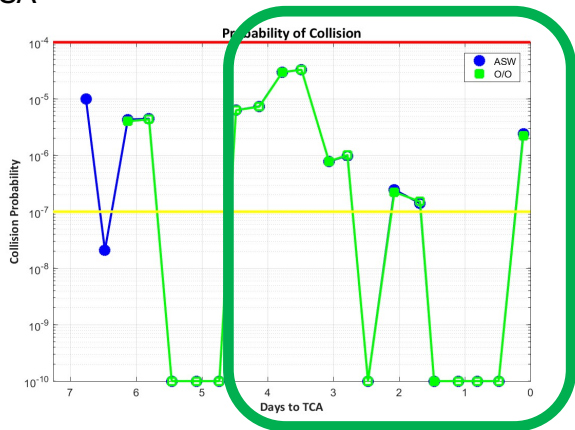
Pc	0.0000426
Range	0.258 km
Vrel	14.7 km/s
Epoch	2021-05-06 17:26 GMT



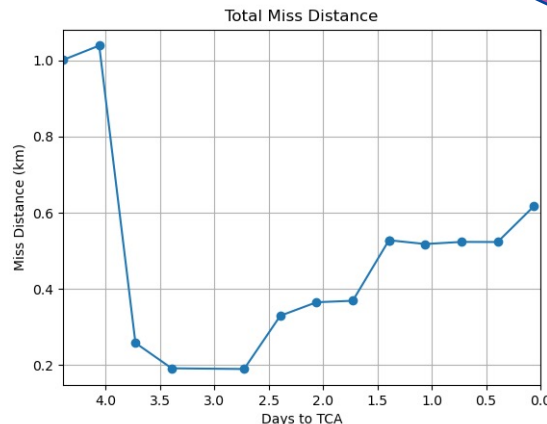
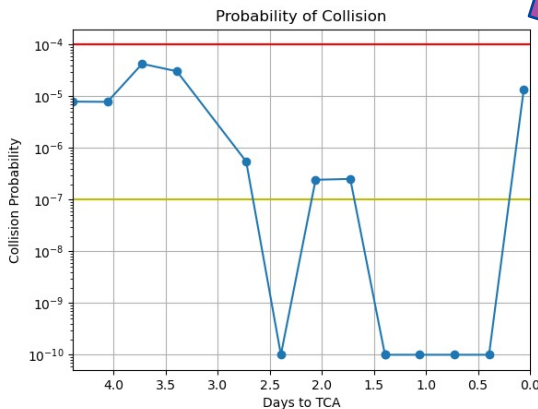


OADR Matches NASA Results

NASA



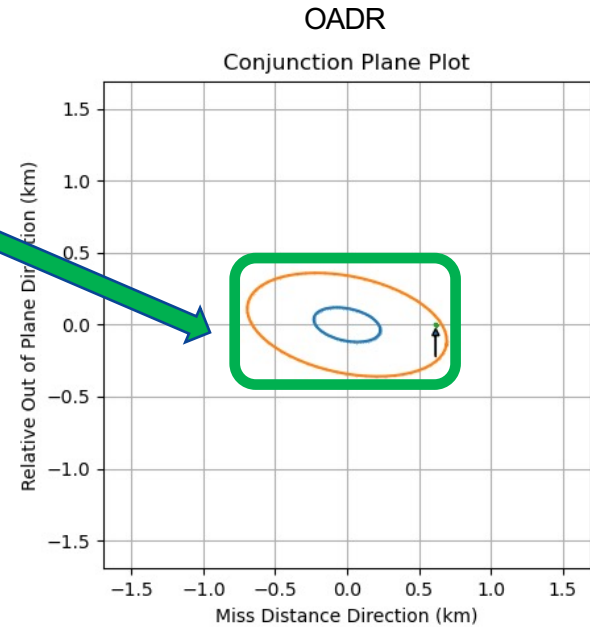
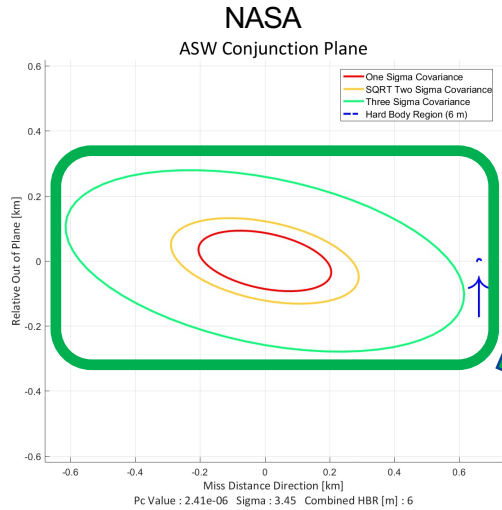
OADR



Example: OCO-2 vs. THORAD AGENA Debris



OADR Matches NASA Results





OADR Summary

- Cloud based, open, scalable architecture*
 - *Allows easy, periodic technology upgrades*

- Meets the needs of commercial owner/operators*
 - *Provides comprehensive SSA products to the operator*
 - *Transparency will engender trust of the community*

- Promotes safe satellite operations*
 - *Produces comprehensive on-orbit collision notifications*

- Tested with real-world data from the DoD*
 - *Also tested with data from multiple sources*

- OADR output matches DoD results, validated by NASA*

