



SMALL PAYLOAD RIDESHARE SYMPOSIUM  
2017

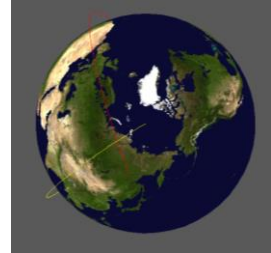
AHSEN ABBASI

REAL-TIME OPERATIONS MANAGER

# SSA AND COLA BEFORE 2009

- Initial posture of space community
  - Big sky theory
  - ‘Space has a lot of space’
- 2007 Chinese Anti-Satellite Missile Test
  - Large Debris field
  - Intentional
- Feb 10, 2009 16:56z
  - Defunct Cosmos 2251 collided with Iridium 33

# BEFORE AND AFTER



JSpOC

Commercial Operators

Analytic  
General Perturbations  
SGP4

TLE

No covariance  
Insufficiently accurate  
Not actionable  
Suitable for awareness

Available before and after 2009

Available to commercial operators after 2009

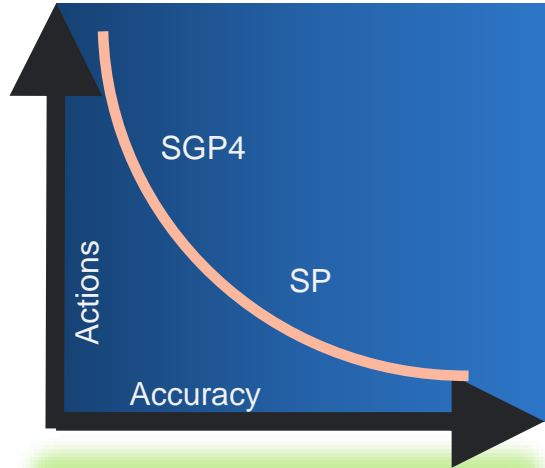
Numerical Integration  
Special Perturbations

CDM

Covariance  
Sufficiently accurate  
Actionable

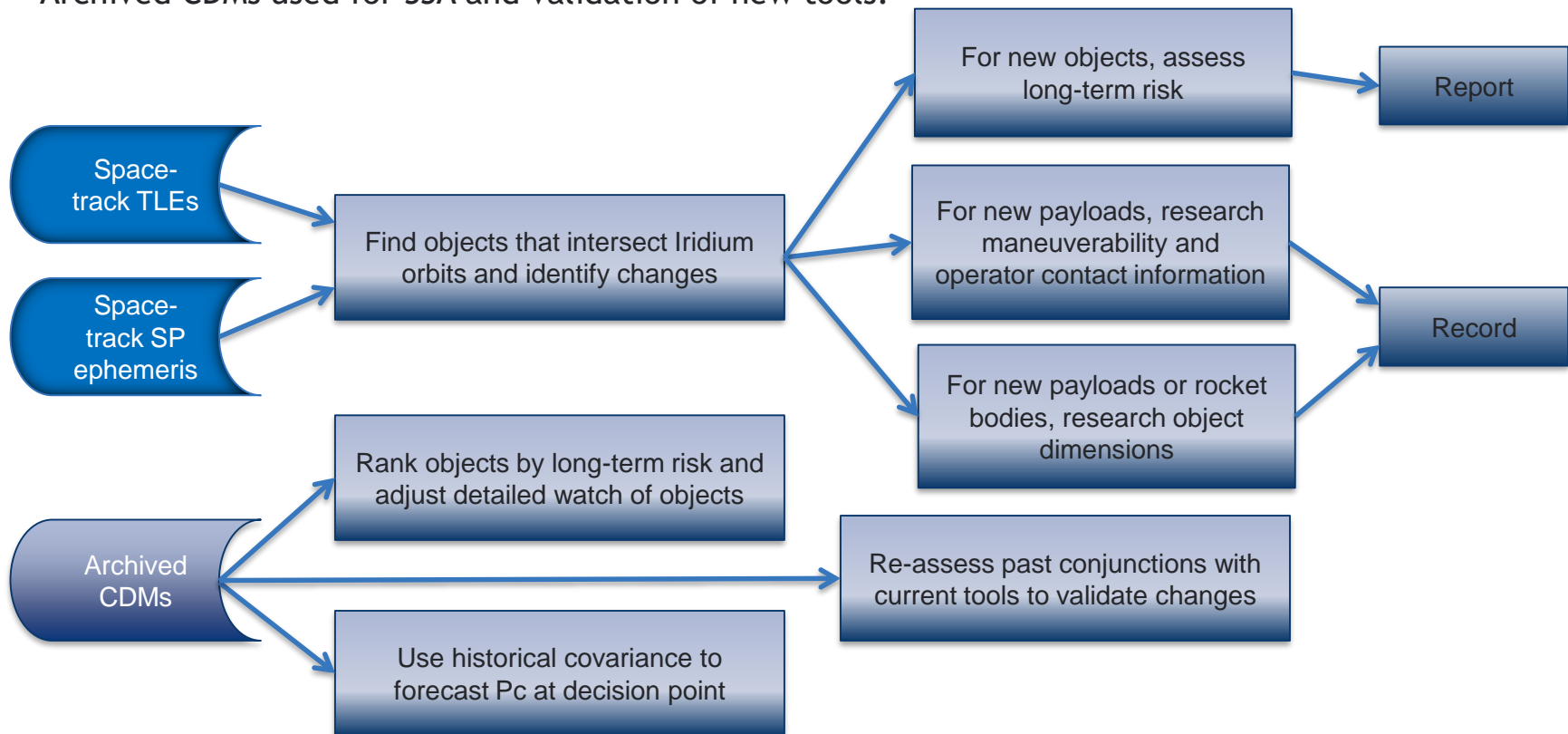
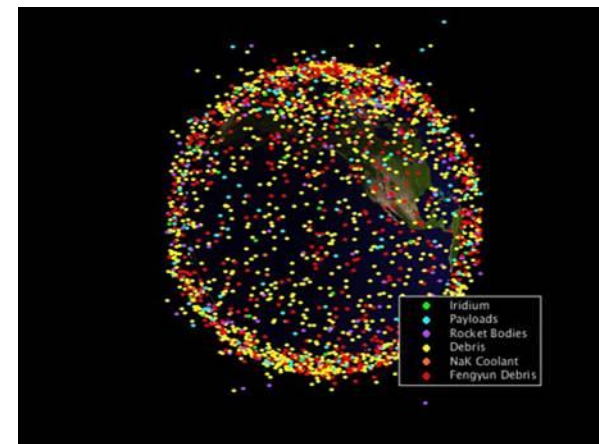
Ephemerides

Numerical Integration  
Special Perturbations



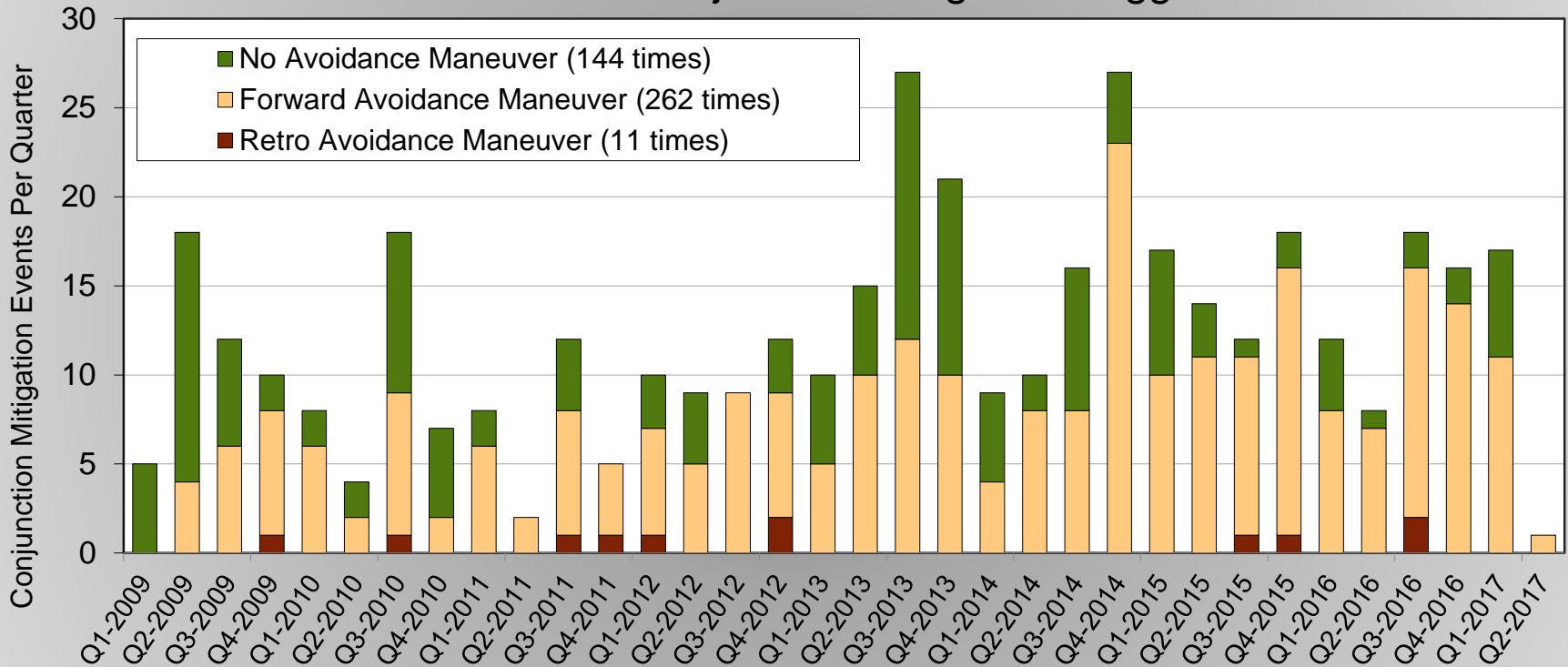
# SITUATIONAL AWARENESS PROCESS

- For awareness, Iridium® identifies all public objects that intersect the Iridium® mission shell.
- New objects entering the shell are examined:
  - Dimensions of non-debris objects found for future Pc calculations;
  - Nodal analysis for objects with periods close to Iridium to understand times/frequency of future conjunctions.
- Archived CDMs used for SSA and validation of new tools.



# CONJUNCTIONS MITIGATED OUTSIDE OF THE NOMINAL STATION-KEEPING PROCESS

## Iridium Conjunction Mitigation Trigger Events



# IRIDIUM IS AN ACTIVE ADVOCATE OF SPACE SAFETY

- Iridium participated in the creation of the Conjunction Data Message (CDM) CCSDS international standard.
- Iridium advocated the use of the NASA Goddard 95% capture screening volume standard for all owner/operators.
- Iridium shares its ephemeris and maneuvers with the Space Data Association.
- Iridium shares its ephemeris and maneuvers with individual owner/operators on an as needed basis.
- Iridium is a member of the Commercial Integration Cell, and routinely supports JSpOC process improvement initiatives before they are rolled out to the wider operator community.
- Iridium sits on a 7 member Conjunction Assessment Technical Advisory Council (CATAC) initiated by NASA Goddard CARA and the French CNES in 2016 to:
  - Define best practices and provide recommendations;
  - Identify worst practices;
  - Outline where research is needed.
- Iridium is willing to share lessons learned with the larger owner/operator community to ensure good stewardship of the environment that we all operate in.

**Good stewardship in space is a necessity**

# YOU ARE NOT ALONE

- The resources to support analysis and space situational awareness are vast;
  - Joint Space Operations (JSpOC) and the Joint Functional Component Command for Space (JFCC Space)
    - Commercial Operators Talks (COT) to support sharing best practices between commercial O/O and USG.
    - Space Sharing Agreements and supporting improvements in data delivery
    - Supporting awareness of owner/operator assets as well as the objects that intersect an O/O orbit.
  - Conjunction Assessment Technical Advisory Council (CA TAC):
    - A group of government and industry experts in the area of satellite conjunction assessment (CA) whose goal is assisting the broader industry in providing technical guidance on CA-related issues and assessment of CA practices.
  - Center for Orbital Debris Education and Research (CODER)
    - Collaboration, research and education to address critical issues in orbital debris policy, mitigation and remediation
  - NASA has some of the key technical background for analysis of events and how a particular regime can be modeled

Industry, government and academia provide 3 pillars of support and all should be employed to increased owner/operator awareness



## RECOMMENDATIONS AND WAY FORWARD

- **Be responsible, act responsibly:** Each owner/operator must be responsible for their space assets and remain cognizant of the shared space we all must utilize
- **Contribute, challenge and learn:** The industry of SSA has grown along with the increased utilization of space. Space 2.0 will require additional knowledge of the operations teams. Resources are there – use them
- **People, Policy and Procedures:** SSA isn't easy and isn't, necessarily, hard.
  - Requires a team that understands the needs of the mission and how forecasts can be used to maintain mission requirements balanced by the needs of safe SSA
  - Understand your risk profile and continuously review.
  - Develop tools for visualization and characterization of conjunctions.
  - Support international policy for safe operations including positional knowledge, maneuverability and End of Life safe disposal
  - Communicate freely and share best practices where appropriate

With new entrants in the space industry, incorporation of conjunction awareness and maneuverability capabilities needs to be part of their operational DNA



# SUMMARY

- Since 2009, a CA/COLA process evolved from changing ad hoc interfaces into stable, effective standards and efficient screenings.
  - Full state vectors, covariance, and fit statistics
  - 95% capture volumes
  - Ability to pre-screen maneuvers
  - Updates every 8 hours
- The CDM is an international standard achieved by the agreement of subject matter experts from around the world:
  - Specifically setup to allow obfuscation of non-critical information from sources like the JSpOC, while
  - Allowing additional helpful optional fields or chosen limits of obfuscation by future sources of SSA data
- A future SSA system should use existing standards such as the CDM, OPM, and OEM, so that existing clients can avoid unnecessary interface changes, re-tooling of existing efficacious software, and vendor lock.
- Iridium is willing to work with a possible civil agency, as we have done with the JSpOC, to make SSA services a success.



**iridium**<sup>®</sup>  
Everywhere

