



SPACE DATA
ASSOCIATION

An Overview of the Space Data Association and its Services

Jean-Luc Froeliger

Executive Director, Space Data Association

VP, Satellite Operations and Engineering, Intelsat



Introduction

According to the [United Nations Office for Outer Space Affairs \(UNOOSA\)](#), there are 4,857 satellites currently in orbit. The launch of LEO satellites will see that number increase at a staggering pace in the coming months and years.

Naturally that means that the risk of collision could potentially increase exponentially if left unchecked. Therefore, ensuring safety of flight is more important than ever, but is still achievable if all operators follow some basic guidelines. The Space Data Association was created to help the satellite industry improve safety of flight and foster the importance of cooperation.



Overview

The Space Data Association (SDA) is a formal, non-profit association of civil, commercial and military spacecraft operators that supports the controlled, reliable and efficient sharing of data that is critical to the safety and integrity of satellite operations.

The SDA offers:

- Direct support for operations.
- An operational data exchange to help ensure the safety of operations.
- Technical support to help secure the integrity of operations.
- Shared costs that optimize your participation and reduce individual costs.



Objectives

- Enhance safety of flight:
 - Maintain the long-term viability of satellites and their orbit regimes.



Objectives

- Improve the accuracy of collision avoidance predictions:
 - Expand satellite operator participation.
 - Adopt best practices across industry.
 - Provide necessary framework for full operations (legal, technical).
 - Address operational issues with current cross-industry conjunction coordination:
 - Reduce false alarms, missed events.
 - Minimize member time and resources devoted to CA.



Objectives

- Take advantage of other opportunities for data sharing:
 - RFI mitigation, including data for RFI geolocation.
 - Company contacts.
 - General operations data sharing.



Space Data Center (SDC)

The Space Data Center (SDC) is the processing center of the SDA, designed to reduce the risks of on-orbit collisions and radio frequency interference. It has three key mission areas:

- Collision avoidance monitoring (Conjunction Assessment)/ Maneuver Planning Validation / Flight Safety.
- Radio Frequency Interference mitigation / Geolocation support.
- Contact information (operations center) for participating satellites.



Space Data Center (SDC)

The SDC is operated by Analytical Graphics, Inc. To ensure reliable and secure operation, the SDC has:

- Geographically-separated redundancy.
- High-level data security and encryption.
- Best practice Information Assurance (IA), based on standards for high level computing systems.
- Use of Amazon Web Services for Cloud



SDA Members

The Space Data Association (SDA) members account for 273 GEO satellites, approximately 62% of all active GEO satellites

Conjunction Assessment Process:

SDA members provide their satellite ephemerides which includes planned maneuvers to the Space Data Center (for example: 30 minutes interval propagated for the next 10 days uploaded on a daily basis)

SDC forwards the operators ephemerides to JSpOC if the operator has an user agreement with JSpOC

SDC provides Conjunction Assessments in different ways:

- SDA members vs SDA members using member ephemerides (most accurate)
- SDA members with non members and debris using member ephemerides vs TLEs
- JSpOC CA results using member ephemerides vs SP for the entire catalog
- JSpOC CA results using JSpOC member ephemerides (for JSpOC members that are not SDA members)



SPACE DATA ASSOCIATION



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TURKSAT



Conjunction Assessment

Conjunction Assessment Process:

SDA members can decide the Alert Level Threshold for Conjunction Data Message (10km/7 days is typical)

Intelsat which operates 70+ satellites received an average of 265 CDM per year

- 78 cases go away when using more recent operator data
- 141 cases where Intelsat modify the burn plan (at no life time cost)
- 41 cases where Intelsat has to perform an additional collision maneuver (at a cost)



Limitations of Legacy Systems and Data

- Public Catalog
 - Covariance information (required by Probability of Collision P_c) largely unavailable
 - Object size information (required by P_c) largely unavailable
 - Inaccurate for maneuvering objects
 - Space object positional data (TLE, SP) can be one or more days old at SDC receipt and not cover required timespan
 - GEO catalog omits potentially hundreds of RSOs > 20 cm
 - Susceptible to cross-tagging & track mis-association
 - Planned sensor and procedural improvements offer minimal GEO improvement
 - Susceptible to weather-related outages



Where are we going from here?

- The current JSpOC system has its limitation
- The Space Data Association current SDC process, while an improvement over JSpOC, has room for improvement
- What commercial operators are looking for:
 - A framework for data sharing and cooperation
 - A better technical solution that rely on more sensors and a catalog of smaller objects
 - An independent calibration of operator's systems
 - The ability to detect maneuvers for non cooperative objects
 - A free service that provides visibility of the process and calculation used
 - A Global solution with a maximum number of operators participating



SDC 1.0 functional diagram

