# NASA Conjunction Assessment Update

**Lauri K. Newman**

**NASA Conjunction Assessment Program Officer**

**HQ Science Mission Directorate**

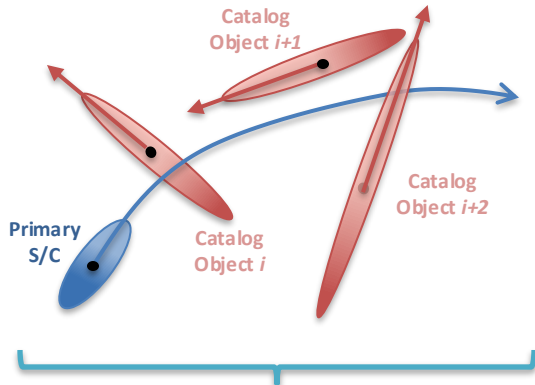**Office of the Deputy Associate Administrator for Programs**

**Aug 6, 2024**

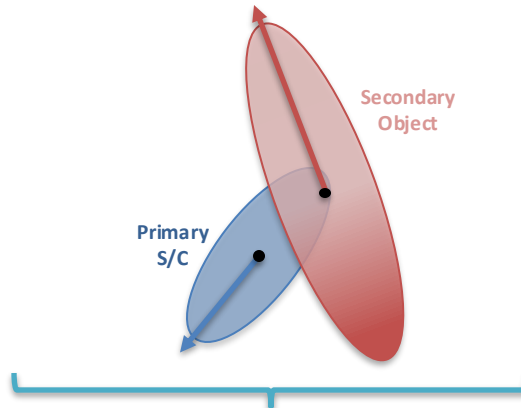NASA **Conjunction Assessment Risk Analysis**

# Conjunction Assessment: Basic Definitions and Responsibilities



**Conjunction Assessment (CA)** is the process of identifying close approaches between two orbiting objects; sometimes called **conjunction screening**.

The **18th Space Defense Squadron (18 SDS)** at Vandenberg Space Force Base (VSFB) maintains the high accuracy catalog of space objects. Orbital Safety Analysts (OSAs) at VSFB screen protected assets against the catalog, perform tasking requests, and generate close approach data.

**CA Risk Analysis (CARA)** is the process of assessing collision risk and assisting satellites in planning maneuvers to mitigate that risk, if warranted.

The NASA **CARA** program performs risk assessment for all NASA operational non-HSF satellites, and some partner missions.

JSC **Flight Operations Directorate (FOD)** performs risk assessment for all NASA Human Spaceflight (HSF) program assets and is the O/O for maneuver decisions and execution.
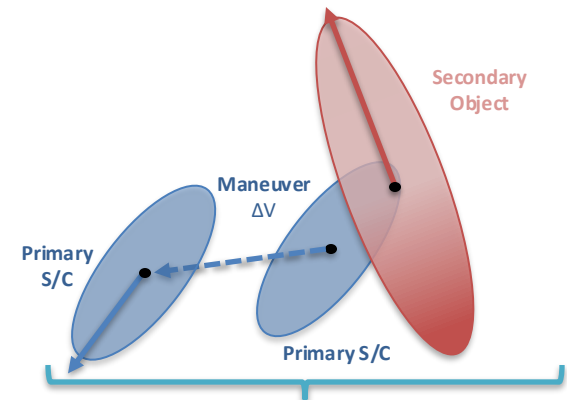
**Collision Avoidance** is the process of executing mitigative action, typically in the form of an orbital maneuver, to reduce collision risk.

Each satellite **Owner/Operator (O/O)** – mission management, flight dynamics, and flight operations – is responsible for making maneuver decisions and executing the maneuvers.

Required for all NASA spacecraft (NPR 8079.1)

# Non-Earth-centered CA

- **Deep space shared environments are growing increasingly crowded, with many more missions planned in coming years**
- **Due to the lack of passive tracking capability in deep space:**
  - Keeping these environments safe is reliant on self-reported ephemeris and uncertainty data from mission teams.
  - The consequences of creating debris is higher than at Earth due to the inability to track debris objects in these environments
- **The Multimission Automated Deep-space Conjunction Assessment Process (MADCAP) at the Jet Propulsion Laboratory is used to perform conjunction assessment at Mars, the Moon, and Sun/Earth libration points.**
  - Contact david.s.berry@jpl.nasa.gov
- **MADCAP prevents collision by screening ephemerides against each other.**
  - No other CA method exists for these environments (no catalog of objects)
- **MADCAP service is free to commercial and international entities**

**Sharing ephemerides with MADCAP is critical for safety in these environments**

# COLA Gap

- **Conjunction Assessment requires that objects in space be catalogued in order to know where they are**
  - DOD performs this, but it takes time after launch before they are tracked well enough to put them in the catalog

- **The time between when a spacecraft is separated from the launch vehicle and the time it is put in the catalog is called the "COLA gap"**
  - Conjunction Assessment can't be preformed during this time, jeopardizing the spacecraft, its neighbors, and the environment
  - Typically 1 day to 2 weeks

- **Small spacecraft are vulnerable because they are often launched in groups, making it hard for trackers to find and catalog individual spacecraft**

- **Plan for this time during your design and development phase. Consider mitigations:**
  - Beacon with ground processing
  - GPS with rapid activation
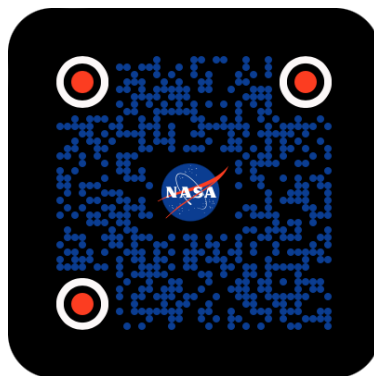
# News and Updates

- **Check out the "State-of-the-Art Small Spacecraft Technology Report" on the S3VI website for a new section on Conjunction Assessment**
  - Section 12 lists technology solutions and orbit determination service providers for smallsats
- **Conjunction Assessment video playing periodically on the hyperwall**
- **Paper on the use of maneuver automation with conjunction assessment on Tuesday at 5 pm in the Orbital Debris, SSA & STM session at the Aggie Recreation Center**

# Resources

- **NASA is committed to refining and sharing appropriate best practices**
  - **Best practices document available to the public**
  - **NASA tool sets with test data available to the public**
- **NASA spacecraft are required to follow best practices**
  - **Requirements documented in NID 7120.132/NPR 8079.1**
- **Accompanying FAQ:**
  **https://www.nasa.gov/sites/default/files/atoms/files/faq-nid-and-hbk-collision-avoidance.pdf**



**NASA CA website**



**NASA CA Handbook**



**CARA Tool Repository**

# Questions?