**NASA CARA Prelaunch Analysis and Process**

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NASA implemented an official Procedural Requirement (NPR) 8079.1 in June 2023, establishing the minimum collision avoidance requirements and associated operational protocols for NASA space flight programs, projects, and spacecraft to protect the space environment by reducing the risk of collision to an acceptable level. Part of the requirement employs a two-fold approach to analyze the satellite design process with conjunction assessment and risk mitigation in mind, during the pre-launch process, led by the Conjunction Assessment Risk Analysis (CARA) Program for non-Human Space Flight (HSF) Missions. This presentation outlines CARA coordination with missions, informed by the NPR, that spans early mission development to operations.

CARA is an Agency-level resource that provides support to all NASA non-HSF missions. CARA protects the orbital environment from collision between NASA non-HSF missions and other tracked on-orbit objects. During the pre-formulation and formulation phases, NASA missions undergo a series of conjunction assessment analyses captured in the Orbital Collision Avoidance Plan (OCAP) prior to transitioning to the implementation phase (typically at the Preliminary Design Review (PDR) or equivalent).

The OCAP analyses consist of a thorough review of the spacecraft(s) orbit selection and placement, deployment, cataloguing performance, trackability, ephemeris generation, conjunction mitigation options, autonomous maneuvering, and risk assessment parameters which are performed by a dedicated CARA Analysis Team. The results of these analyses, CARA’s formal recommendations, and the mission’s methods for implementing them, are documented in the OCAP. The intent of engaging in this process so early in the mission design phase, is to ensure that conjunction assessment is considered from the outset, thus mitigating costly design changes and operational risks down the road.

NASA missions are also required to coordinate their operational processes and conjunction mitigation procedures with CARA in a Conjunction Assessment Operations Implementation Agreement (CAOIA). The aim of this process is to document the conjunction assessment screening process, conjunction risk assessment parameters, conjunction mitigation steps, flight dynamics operations concepts and maneuvers, and the communication and coordination process between the mission’s project manager and CARA. The intent of the CAOIA document is for it to be completed iteratively, and as missions update these elements, corresponding changes are made in the CAOIA.

With this process in place, the engagement and coordination between the missions and CARA from early in the design process into mission operations, helps to ensure that missions not only have a robust conjunction assessment concept of operations to reduce conjunction risk for space sustainability, but are also able to achieve their science goals and have a successful mission.

References:

*NASA Spacecraft Conjunction Analysis and Collision Avoidance for Space Environment Protection,* NASA NPR 8079.1 <https://ntrs.nasa.gov/api/citations/20050189209/downloads/20050189209.pdf>, June 27, 2023