

Operational Collision Avoidance at ESOC

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The European Space Agency's (ESA) Space Debris Office provides a service to support operational collision avoidance activities. This support currently covers ESA's missions Cryosat-2, Aeolus, the constellation of Swarm-A/B/C, seven Sentinels, as well as missions of third party customers.

In this work we describe the current collision avoidance process for ESA and third-party missions in LEO. We give an overview on conjunction event detection, collision risk assessment, orbit determination, orbit and covariance propagation, process control, and data handling. We pay special attention to the effect of warning thresholds on the risk reduction and manoeuvre rates, as they are established through risk mitigation and analysis tools, such as ESA's Debris Risk Assessment and Mitigation Analysis (DRAMA) software suite.

In order to handle the large number of Conjunction Data Messages and the associated risk analyses, a database-centric approach has been developed. All CDMs and risk analysis results are stored in a database. In this way, a temporary local "mini-catalogue" of objects close to our target spacecraft is obtained, which can be used e.g. for manoeuvre screening and avoidance manoeuvre planning.

The database is also used as the backbone for a web-based tool, which consists of the visualisation component and a collaboration tool that facilitates the status monitoring and task allocation within the support team as well as the communication with the control team.

Finally, we provide statistics on the identified conjunction events, taking into account the known significant changes in the LEO orbital environment, and share ESA's experience along with recent examples.