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ESA'S COLLISION RISK ESTIMATION AND AUTOMATED MITIGATION (CREAM) PROJECT –  
STATUS, RESULTS AND FUTURE EVOLUTION

**Abstract**

Collision avoidance is an integral part of spacecraft operations today. It is essential for safeguarding own assets as well as preventing the proliferation of orbital debris. At the European Space Agency's (ESA) Space Debris Office we provide operational collision avoidance support to ESA and third-party missions for around 20 years. While the service is specifically tailored to the needs of missions in low-Earth orbits, also special cases such as missions in highly eccentric orbits, or Earth fly-bys of interplanetary exploration missions are covered.

However, there are developments which challenge the way collision avoidance is currently carried out, e.g., more spacecraft and constellations being launched as well as increasing catalogues. These result in an increase of known conjunction events and in particular between two active spacecraft requiring coordination between the operators.

The ESA Member States have put forward the optional Space Safety Programme at the Space19+ Council meeting at Ministerial level end of 2019. The Programme groups activities that contribute to the chain of activities in the risk management process, when addressing the three segments Space Weather, Planetary Defence, and Space Debris and Clean Space.

In Space Debris and Clean Space, the Programme aims at a Europe capable of monitoring and safely managing its space-related traffic; equipped with (automated) systems free from causing damage. In support of the latter, a cornerstone component is included into the Programme: "Collision Risk Estimation and Automated Mitigation (CREAM)". The ESA Member States have extended the Space Safety programme at the Council meeting at Ministerial level end of 2022 including a second period of CREAM.

The main objectives of CREAM are to reduce manpower efforts and increase automation, to shorten the time between decision and time of closest approach, and to decrease the number of false alerts. Activities have been started aiming to enhance automation in manoeuvre decision and design process, to enable late access to spacecraft via inter-satellite links or large ground station networks offered as a service (thus allowing to take late decisions) and to support tool-assisted manoeuvre coordination between spacecraft operators as well as the monitoring of such platforms.

We present the status and outcomes of these CREAM activities and related activities of ESA's technology programmes. We also present the planned way ahead for the second period of CREAM following the 2022 Council meeting.