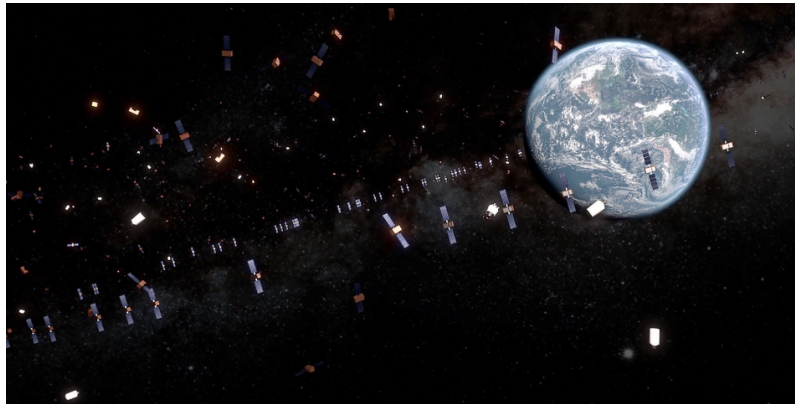


Space Debris Risk Assessment and Mitigation Analysis Workshop



Thursday 23 June 2022 - Friday 24 June 2022

ESA/ESOC

Scientific Programme

People

The workshop is being organised by ESA's Space Debris Office (SDO), with Xanthi Oikonomidou and Vitali Braun as the workshop chairpersons. We are receiving significant support in the organisation by Lucía Ayala Fernández from TU Braunschweig. We further appreciate the support during brainstorming and the collection of ideas by Patrick O'Keeffe (Institute for Security Policy at Kiel University (ISPK)), Bayrem Zitouni (OHB) and Valentin Eder (Space Analyses).

Thank you to everyone involved in the organisation and all the participants for providing their ideas, for all the discussions and feedback we received already!

The Workshop

After a successful first edition of the modelling workshop in March 2021, we would like to continue in a similar fashion this year. In the 2022 edition of this workshop, we would like to reach out again and take stock of the community activity, concerning working with DRAMA & MASTER and measurements & model validation,

facilitate and further improve exchange related to space debris mitigation and risk analyses, as well as associated debris mitigation compliance verification tasks, including among others collision avoidance, impact risk thresholds and orbital lifetime assessments,

introduce the new Debris Mitigation Facility and launch a user forum.

The workshop will consist of dedicated presentations and talks; breakout group sessions with strong focus on open discussions; and guided sessions on use-cases in space debris mitigation practices.

As a result of the on-going stakeholder interaction, the workshop will provide an opportunity to discuss with users on various aspects on how analyses are performed, what may be still missing, and which developments to take in view of the evolving space sector. We invite everyone directly or indirectly affected by the modelling efforts and involved in activities ranging from the studying of the space debris environment, over mission design to policy decisions to participate!

Concept

We believe that addressing space debris modelling and mitigation activities through a participative process is more likely to be accepted as a reference solution by the community. At the same time, when stakeholders with various knowledge, skills and resources are facilitated to give creative and critical input which is then translated into action, a culture of shared responsibility and ownership is being established, further reinforcing the consent on models and methodologies applied by the community.

The event will be in hybrid format and additional meeting information (incl. connection details) will be provided at a later point. Please specify your attendance preference (on-site presence at

ESA/ESOC in Darmstadt or virtual participation). Please notice that attendance on-site is subject to Covid-19 restrictions and capacity limits. Registered participants with on-site attendance preference will be informed if such measures apply. For online participants, we will aim to accommodate as many time zones as possible. Participation in the workshop is free of charge.

Round tables

The round tables will consist of small group discussions about a specific topic. A moderator will be present in each group to guide the discussion. The following round tables are currently planned, along with the foreseen objective:

June 23

Re-entry Modelling: understand whether our current abilities to model destructive reentry are aligned with what community members expect, primarily in mission design but also other areas. Identify what should be primarily focused on in our roadmap, bearing in mind that our tool (DRAMA/SARA) is not a CFD simulation but rather provides a good first estimate of the on-ground casualty risk.

Collision Avoidance: understand if current collision avoidance practices are reflected well in DRAMA/ARES and if not, what needs to be developed.

Damage Assessments: understand if damage assessments in DRAMA/MIDAS cover the most relevant analyses and if not, what needs to be developed.

Disposal Analyses & Remaining Lifetime Assessments: understand if disposal analyses in DRAMA/OSCAR cover the most relevant analyses and if not, what needs to be developed

Risk Perception & Governance: certain assessments are based on accepted risk (or probability) thresholds, like when to conduct a collision avoidance manoeuvre or whether an uncontrolled re-entry is warranted given the assessed casualty risk. How do we understand risk? How does our understanding of those risk thresholds evolve, how reasonable are the current ones in our context?

Risk & Reward: how, when and why to communicate space debris topics to the public

June 24

Debris Mitigation Facility (DMF) Q&A: discuss the new features upcoming in DMF, how they might impact established analyses, potential improvements and roadmap

Global Space Industry Trends: understand how current trends can be translated to a model that allows a projection or better assessment of the future environment (this feeds back mainly into all kind of analyses in ARES and MIDAS)

Impact of Large Constellations: understand how the deployment of large constellations is shaping/changing the environment and how these changes impact our way of performing risk assessment and mitigation analyses.

Data Collection & Sharing: with various existing databases (such as DISCOS, ESTIMATE, UCS, TLE catalogue) how do these enable mitigation and risk analyses - and what is missing here to further facilitate such analyses?

Responsible & Sustainable Behaviour: understand what responsible behaviour means, who is carrying it and which information is required to assess it for those who are exposed to the risk of irresponsible behaviour.

Background

Every satellite put into orbit today is exposed to the space debris environment for the time it is being operated but also during the ensuing disposal phase, which may add many more years of on-orbit presence. The environment is only expected to grow in terms of object numbers, especially in orbital regions that are already strongly affected by space debris pollution today. This means that space missions will be more difficult to operate by today's standards (e.g. having to address more close encounters) and collisional breakup events, mainly between non-operational objects, are more likely to occur with time. This trend is exacerbated with the dramatically increased launch activity over the last four years and the deployment of large satellite constellations.

Space debris risk assessments targeting primarily the share of lethal non-trackable objects are informed by space debris models, such as the European Meteoroid and Space Debris Terrestrial Environment Reference (MASTER) model. In order to assess compliance with those recommendations, a set of software tools has been developed since the early 2000s and bundled under the Debris Risk Assessment and Mitigation Analysis (DRAMA) suite, which relies significantly on MASTER's background population. The DRAMA (and MASTER) user community has grown considerably within the past few years. In the exchange with engineers, operators, students, regulators and many more, a vision has been drafted by ESA's Space Debris Office (SDO) team on how all those different perspectives and use-cases can be aligned towards a state-of-the-art application as a next evolutionary step in the space debris mitigation process. Through the creation of a single framework combining the different DRAMA tools; a move towards digital engineering; maximum compatibility with latest standards; and enabling as well as strengthening the community's connection, the Debris Mitigation Facility (DMF) idea was born.

ESA has always played a major role in leading many of the research activities related to space debris mitigation, at the same time recognising the significant contributions by other institutions and the coordination efforts primarily by the Inter-Agency Space Debris Coordination Committee (IADC). With space activities mostly conducted by public entities for many decades, ESA and other agencies developing space debris models, associated debris risk and mitigation analysis frameworks, as well as compliance verification means, were most of the time assuming the role of the customer and the user simultaneously. Over the past two decades the roles have shifted significantly, especially in view of the on-going commercialisation of space, and many new entities to get involved in space activities. Continuing the maintenance and the development of the MASTER and DRAMA model and tool suite, the Space Debris Office has recognised that it remained the customer while the user roles have been distributed all over the globe.