

# DAMAGE: debris analysis and monitoring architecture to the geosynchronous environment

Recent estimates by the European Space Agency (ESA) put the number of trackable objects in near-Earth orbit at more than 40,000. In addition, there are millions of objects in orbit that fall below the sensitivity threshold of ground-based instruments. This population of space debris poses a threat to the safety of satellites and the vital services they provide. Through the use of an evolutionary model, such as DAMAGE, it is possible to understand how the space debris threat can be reduced through the use of adaptation and mitigation (e.g. by changing the manufacture and operation of spacecraft), and remediation (e.g. targeting and removal of non-functional satellites). DAMAGE is used in this way to support the UK Space Agency in its role within the Inter-Agency Space Debris Coordination Committee (IADC), the world's leading inter-governmental forum for the discussion of space debris technical issues. Whilst DAMAGE is one of a few evolutionary models worldwide, it has unique capabilities that provide valuable insights into less well-understood issues.

As well as providing the means for the UK Space Agency to participate within IADC modelling studies (e.g. into the benefits of active debris removal), DAMAGE has been used to:

- Understand the consequences of fragmentation events in orbit, for ESA
- Investigate disposal options for navigation satellites, for ESA
- Quantify the effectiveness of debris mitigation measures, for the European Commission

## Technical advantages

- A three-dimensional model and visualisation of the near-Earth space debris environment
- Fast implementation and straightforward deployment on multiple computer cores
- A satellite failure model to assess the consequences of non-catastrophic impacts
- A flexible and capable model of debris removal

## Collaboration opportunity

DAMAGE is ready to be applied to a variety of space debris modelling challenges and is available as a service or research collaboration. For the cost of a studentship DAMAGE can be further developed to meet new requirements.

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