SPACE DEBRIS SYMPOSIUM (A6)
Mitigation and Standards (4)

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# AN ASSESSMENT OF CUBESAT COLLISION RISK

**Abstract**

In their 2011 paper, Oltregge and Leveque encouraged the CubeSat community to take leadership roles in space debris assessment, ensuring that debris guidelines and standards are met and by implementing effective debris mitigation strategies. However, common misconceptions about the role of CubeSats in the evolution of the space debris environment remain today. To provide some clarity on this issue, the University of Southampton has developed a database of CubeSats, containing their launch history and relevant physical parameters, and has used this database to investigate the CubeSat collision risk as part of ongoing work for the European Union Framework 7 Alignment of Capacity and Capability for the Objective of Reducing Debris (ACCORD) project. The database contains information about 197 CubeSats launched between June 2003 and January 2014. An analysis of the CubeSats within this database has been performed using the University's Debris Analysis and Monitoring Architecture to the Geosynchronous Environment (DAMAGE). Firstly, the orbital lifetime of the 107 CubeSats in the database that are still on orbit has been estimated using the DAMAGE propagator. This has been done to understand the level of compliance with the "25-year rule". Secondly, the probability of collisions between these CubeSats and the population of objects larger than 10 cm has been estimated for a 200-year projection of the low Earth orbit (LEO) environment. This collision probability has been compared with the corresponding collision probability associated with other, key spacecraft, including Envisat. Finally, a CubeSat launch traffic model, based on a repeating cycle of CubeSat launches from 2005 to 2013 has been used within DAMAGE to assess the impact of on-going CubeSat launches on the LEO population into the future. Results show that, if current launch activity is repeated, over two-thirds of CubeSats launched in the future are likely to remain on-orbit for longer than 25 years. Whilst these satellites are relatively small, they were nevertheless involved in close approaches and collisions with other resident LEO spacecraft and debris in the DAMAGE projections. To prevent these predictions from becoming reality, some effort is needed to engage with the growing CubeSat community and encourage them to contribute to and, ultimately, lead on sustainable practices and debris mitigation activities for these small satellites.