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# ASSUMPTIONS AND UNCERTAINTY IN RE-ENTRY PREDICTION SOFTWARE

**Abstract**

Accurately modelling the re-entry trajectory of spacecraft through the atmosphere and predicting the impact location of resulting debris is important from a scientific, political, environmental, and social perspective. With an increasing number of launches each year, there is more and more debris returning due to sustainable space practices. Current computational re-entry modelling techniques make use of simplifications and assumptions to reduce computational cost, often at the expense of an accurate prediction. These assumptions and simplifications create significant uncertainty in resulting risk calculations for any re-entry, and are present in all re-entry modelling tools to various degrees.

An up to date comparison of re-entry modelling tools is presented, specifically regarding their limitations based on assumptions used. Where some tools have compromised on fidelity to reduce computational cost and required inputs, others minimise assumptions to increase output accuracy. Analysis is presented through use of an example trajectory based on UNSW Canberra's M2 satellite - a 6U cubesat set to re-enter as a disposal strategy in 2025.

Recommendations are made to as to potential modelling method adjustments that may increase fidelity within the logistical restrictions that are often imposed on real-life re-entry modelling. This research has applications in launch and re-entry legislation, as detailed disposal details (including re-entry survivability prediction) is required for safe and sustainable space practice.