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Thesis Announcement

Statistische Auswertung der Einflussbereiche von unkontrollierten Wiedereintritten

Statistical evaluation of the impact areas of uncontrolled re-entries

Time and again, objects of different sizes enter the Earth's atmosphere in an uncontrolled manner. As an example: only recently, a pallet, nine in total, of used ISS batteries which were released on 11 January 2021 re-entered the Earth's atmosphere in an uncontrolled manner. Even though such events usually make far-reaching headlines, there have fortunately been no catastrophic events resulting in human casualties. What is alarming, however, is the large level of uncertainty in predicting the time and point of impact of such debris particles, which results from a large number of different influencing parameters. With respect to the battery pack, ESA even stated on the expected day of re-entry (8th of March): "*The re-entry will occur between -51.6 degrees South and 51.6 degrees North. Large uncertainties, primarily driven by fluctuating levels of atmospheric drag, prevent more precise predictions at this time. The closer we get to the expected re-entry window, the better the concerned region can be geographically constrained*". This is a very unsatisfactory state that needs to be addressed.

In the context of this Master's thesis, an overview of uncontrolled re-entries in recent years shall be provided by means of a comprehensive literature review. Subsequently, a simulation infrastructure for simplified re-entry simulations shall be set up, allowing for a fast and efficient computation of re-entry trajectories. Lastly, the latter should be used to conduct a parameter study to analyse how corresponding boundary conditions affect the resulting emergence areas. The results will be statistically analysed in order to draw conclusions for further research effors.

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