DRAMA Clinics 2025e2
Re-entry modelling and risk assessments (SARA)

Space Debris Office

13/06/2025

Python SARA Wrapper

"how to configure and execute SARA from Python scripts, and interpret the results"

- The statistical module for SARA active in the DRAMA GUI is limited to a few parameter assessments
- Both DRAMA 3.1.X and 4.Y.Z provide a python API to SARA, allowing the user to define their own statistical model for analysis, tailored to the spacecraft needs.

- Full worked out cubesat example: https://debris-forum.sdo.esoc.esa.int/t/example-scripts-for-performing-monte-carlo-uncertainty-analyses-using-sara
- Guidelines on which uncertainties can be considered (but not all necessarily apply): https://sdup.esoc.esa.int/documents/download/Design-for-Demise-Verification-Guidelines-v1.pdf Section 4.2.4
    - Easily accessible in DRAMA: drag, heating, material components, component break-up
    - Full commercial option for DRAMA (and other re-entry risk models): http://www.belstead.com/padre.html

SARA Uncertainties

“Discussion on running monte carlo analysis in SARA to check how sensitive the results are to uncertainties (as discussed in the PADRE report). Particularly in respect to the best way to set it up with respect to the guidelines. For example the PADRE report talks about having 25% uncertainty on the emissivity but I have to add this individually to each metal present in my model. Some other uncertainties it recommends don’t appear to be options at all in the drop down lists.”

➔ Emissivity variation per element can be done, question is if it is needed for the example in mind.

➔ The Drop-down list is not complete, but the python interface is (with modification as per example).

“I’m finding my PC takes around 1 minute per run so if I put in too many conditions I end up with scenarios that would take weeks to run.”

➔ The run-time is mostly driven by amount of connected-to elements, and will reduce when all possible combinations have been computed and cached

➔ The python API has multi-processor use built in.

Where to get help?

A first place of calling for the users, by the users:

https://debris-forum.sdo.esoc.esa.int/

Specific queries requiring detailed understanding of underlying tools or spacecraft design details:

space.debris.support@esa.int

ESA or ESA-related project support, contact with your Technical Officer:

Vitali.braun@ext.esa.int or Stijn.Lemmens@esa.int