Operational and Technical Updates to the Object Reentry Survival Analysis Tool

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The Object Reentry Survival Analysis Tool (ORSAT) has been used in the NASA Orbital Debris Program Office for over 25 years to estimate risk due to uncontrolled reentry of spacecraft and rocket bodies. Development over the last 3 years has included: a major change to the treatment of carbon fiber- and glass fiber-reinforced plastics (CFRP and GFRP, respectively); improved estimation of the heating of components within a parent body; a new model for computing casualty area around an impacting debris object; and a newly-implemented scheme to determine the breakup altitude of a reentry object. Software also was written to automatically perform parameter sweeps in ORSAT to allow for uncertainty quantification and sensitivity analysis for components with borderline demisability.

These updates have improved the speed and fidelity of the reentry analysis performed using ORSAT, and have allowed for improved engineering understanding by estimating the uncertainty for each component's survivability. A statistical model for initial conditions captures the latitude bias in population density, a large improvement over the previous inclination-based latitude-averaged models. A sample spacecraft has been analyzed with standard techniques using ORSAT 6.2 and again using all the updated models; we will demonstrate the variation in the total debris casualty area and overall expectation of casualty.