Development and Analysis of the Automated Object Reentry Survival Analysis Tool’s Parametric Study Wrapper

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The NASA Orbital Debris Program Office (ODPO) Safety Group at the Johnson Space Center analyzes reentering spacecraft at the end of their missions. The program primarily used by ODPO in this effort is the Object Reentry Survival Analysis Tool (ORSAT). ORSAT utilizes shape primitives as well as a variety of other parameters (material, size, thickness, aerodynamic mass, orbit inclination, etc.) to simulate the reentry process and ultimately, to determine if a spacecraft could be hazardous to the population on the ground.

The NASA ODPO plans to automate the ORSAT process to run multiple ORSAT input files either concurrently or consecutively. This type of automation program will provide several benefits. First, there is a need to run large parametric studies for ORSAT analysts to gain a greater understanding of reentering object’s sensitivity to certain input variables. Secondly, a database of pre-run ORSAT cases will be used to develop a survivability model, which could be made available to spacecraft developers as a design for demise (D4D) tool.

The recently completed Automated Object Reentry Survival Analysis Tool (AutoORSAT) Wrapper is currently being used to build a survivability database, the first step in developing a survivability model. Already, the data that AutoORSAT has produced provides a greater understanding of the sensitivity of variables such as the initial temperature of the spacecraft, spacecraft breakup altitude, and the aerodynamic mass of spacecraft.