

Space Shuttle Debris Transport Assessments

Space Operations Mission Directorate

The Space Shuttle Program, one of the most visible NASA programs, is the end result of one of the modern world's most complex engineering efforts. Balancing the requirement for a lightweight structure against the harsh environments encountered during launch and reentry is a challenging task. These factors, combined with the presence of high-speed debris, add to the complexity and have required probabilistic risk assessment to quantify the associated risks.

Characterizing the wide range of potential debris sources that can impact the Space Shuttle launch vehicle is another challenging task. Our software tools support prelaunch, inflight, and postflight shuttle debris evaluations. Prior to launch, these tools are used to determine if unusual ice and foam defects pose a threat to the vehicle. During flight, damaged or protruding pieces of insulation on the Orbiter can be assessed to help determine if on-orbit repairs are required.

Simulating the release and transport of debris, and comparing the impact conditions to the Shuttle thermal protection system's impact capability requires a large number of simulations that must be performed in a relatively short time. NASA's supercomputing resources provide the computational power and storage needed to simulate the shuttle ascent and entry flowfields, and predict debris impact conditions and damage.

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Simulation of the impact conditions of a thermal protection tile plug during reentry. Reynaldo Gomez, NASA /Johnson

