



## Space Access Grand Challenge CFD-in-the-Loop Monte-Carlo Flight Simulation for Space Vehicle Design

- Space vehicle flight testing is extremely sparse leading designers to rely on statistical processes to predict and certify design performance.
- Monte Carlo Flight Simulation is broadly used to perform the statistical analysis.
- Development of aerodynamic databases can take years involving wind tunnel test, CFD, empirical data, and engineering judgment.
- Efficient flight simulation using direct coupling of CFD to the flight simulator for Monte Carlo analysis would be a game-changer for space vehicle design and development.
  - Requires computationally efficient CFD.
    - Fast, robust, and reliable algorithms.
  - And possibly CAD-to-solution capability.
    - Automated control surface motion, mesh adaptation/optimization.
    - Specified accuracy may be key to efficiency.

