Resolving the fundamentals of parachute fluid and structural mechanics

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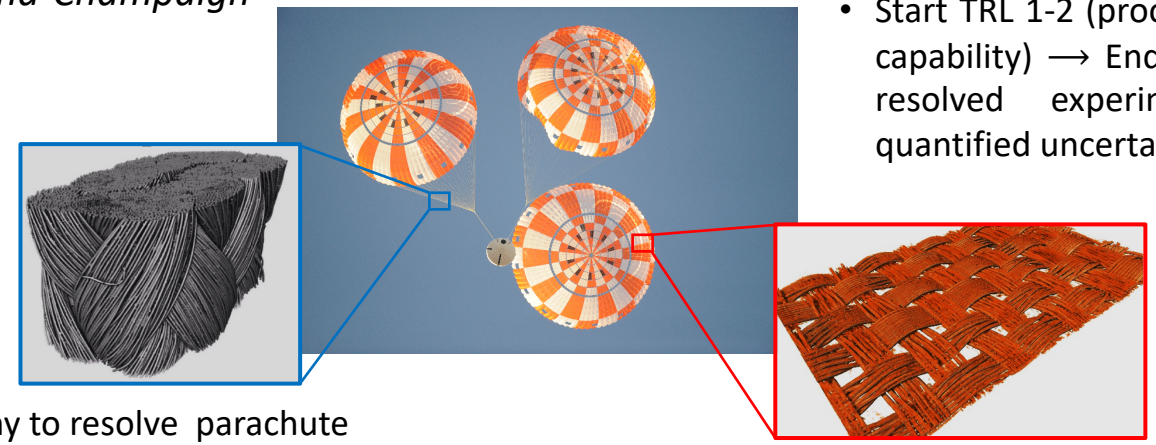
Research Objectives

- Develop a comprehensive experimental database for validation of Fluid-Structure Interaction computational models
- Innovation by combining resolution of fluid dynamics, material mechanics and loads at relevant scales
- Surpass the state-of-the-art by resolving multi-scale material response and provide wind tunnel experiment with well resolved flow and material properties
- Start TRL 1-2 (proof of concept capability) ⟶ End TRL 3 (fully resolved experiments with quantified uncertainties)



Technical Approach

- *In-situ* x-ray micro-tomography to resolve parachute response to mechanical loads at multiple scales
- Accurate quantification of 3D strain fields, anisotropic mechanical properties, fiber-scale statistics, fabrics porosity and permeability
- Subsonic wind tunnel experiments to resolve dynamics of single and clustered parachute system
- Supersonic wind tunnel experiments to resolve parachute/wake interactions
- Laser diagnostics and high-speed imagery for full resolution of parachute flow and material dynamics
- Rigorous quantification of uncertainties

Potential Impact

- Comprehensive experimental data enable validation of computational models towards predictive design capabilities
- Experiments improve understanding of FSI flow and material physics leading to improved analysis tools
- Experiments enhance understanding of parachute material response and enable development of new/improved solutions
- Improvement of material and flow analysis capabilities has broader impact to other EDL sub-systems