NASA SBIR/STTR Technologies

Integrated Inflatable Ballute for Planetary Entry

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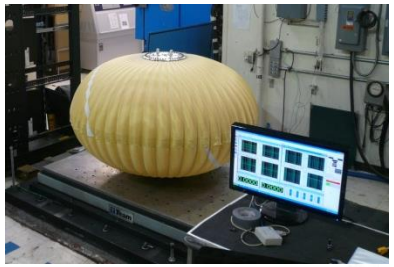
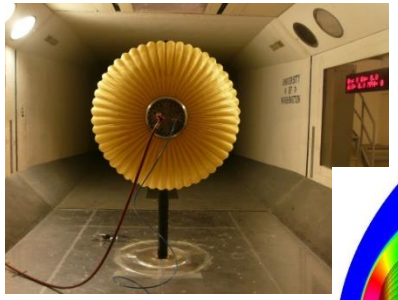
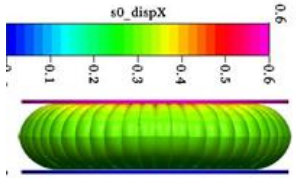
Identification and Significance of Innovation

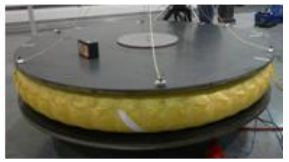
- NASA is conducting Entry, Descent and Landing Systems Analysis to determine enabling technology for planetary exploration.
- The proposed model is a hybrid mass-optimized pressure restraint inflatable structure, utilizing unique UHPV technology.
- The model employs an impervious cloth-reinforced barrier structure enveloped by an integrated array of high-tenacity tendons.
- The external grid of cordage tendons provides mass- and load optimized containment of the structure's global pressure loads.
- UHPV technology permits manufacture of robust inflatable pressure vessels with unprecedented accuracy and dimensional stability.
- Computational physics-based high-fidelity modeling and simulation are sed to investigate, understand and optimize the design against inflatable inherent instabilities



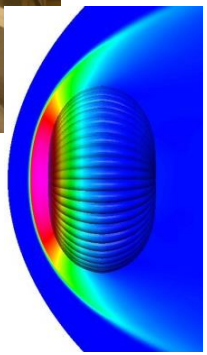




0.4psi



Experiment - 0.4psi



Development, design, fabrication, testing, and analysis of innovative UHPV-based IAD structure

Technical Objectives and Work Plan

- The overall objective is to develop, design, test, and demonstrate an integrated hypersonic inflatable structure for planetary entry complete with thermal protection hardware and load bearing, and conduct verification and optimization of the hardware design using an integrated coupled-physics analysis
- The work plan in this Phase II effort included;
  - Fabrication of three prototypes for testing and scalability demonstration
  - Conducted static load, dynamic vibration, and wind tunnel testing of the prototypes to assess the UHPV model performance.
  - Conducted pre-test and post-test computational high-fidelity analysis and simulations to support the testing and to verify the model stability, rigidity and scalability.
  - Demonstration of integrating a representative mock-up of a TPS shell with the IAD prototype and demonstrates the functionality of folding, packaging, and deployment of the integrated TPS/UHPV gas barrier/pressure shell

NASA and Non-NASA Applications

- Direct NASA applications with present and future inflatable structures programs, such as those seeking to provide deceleration and precision landing capability for large scale mass return from Earth orbit to Earth surface, or for missions to many of the potential atmosphere-endowed solar system destinations
- Other NASA applications include analysis of space-based inflatable structures such as telescopes and mirrors, satellite solar panels, inflatable decoys, lander airbags, and rover vehicles.
- Aeroelastic analysis of parachutes, parafoils, high-altitude endurance airplanes and airships, helicopter and motor vehicles crash airbags, launch vehicle payload fairing, and .stabilization and deceleration of ordnance with attached inflatable decelerators.

Firm Contacts

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