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Structures and Mechanisms Design Concepts for Adaptive Deployable Entry Placement Technology

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System studies have shown that large deployable aerodynamic decelerators such as the Adaptive Deployable Entry and Placement Technology (ADEPT) concept can revolutionize future robotic and human exploration missions involving atmospheric entry, descent and landing by significantly reducing the maximum heating rate, total heat load, and deceleration loads experienced by the spacecraft during entry [1-3]. ADEPT and the Hypersonic Inflatable Aerodynamic Decelerator (HIAD) [4] share the approach of stowing the entry system in the shroud of the launch vehicle and deploying it to a much larger diameter prior to entry.

The ADEPT concept provides a low ballistic coefficient for planetary entry by employing an umbrella-like deployable structure consisting of ribs, struts and a fabric cover that form an aerodynamic decelerator capable of undergoing hypersonic flight. The ADEPT "skin" is a 3-D woven carbon cloth that serves as a thermal protection system (TPS) **and** as a structural surface that transfers aerodynamic forces to the underlying ribs [5]. This paper focuses on design activities associated with integrating ADEPT components (cloth, ribs, struts and mechanisms) into a system that can function across all configurations and environments of a typical mission concept: stowed during launch, in-space deployment, entry, descent, parachute deployment and separation from the landing payload. The baseline structures and mechanisms were selected via trade studies conducted during the summer and fall of 2012. They are now being incorporated into the design of a ground test article (GTA) that will be fabricated in 2013. It will be used to evaluate retention of the stowed configuration in a launch environment, mechanism operation for release, deployment and locking, and static strength of the deployed decelerator. Of particular interest are the carbon cloth interfaces, underlying hot structure, (Advanced Carbon-Carbon ribs) and other structural components (nose cap, struts, and main body) designed to withstand the pressure and extremely high heating experienced during planetary entry.

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http://www.nasa.gov/offices/oct/game_changing_technology/game_changing_development/HIAD/index.html
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