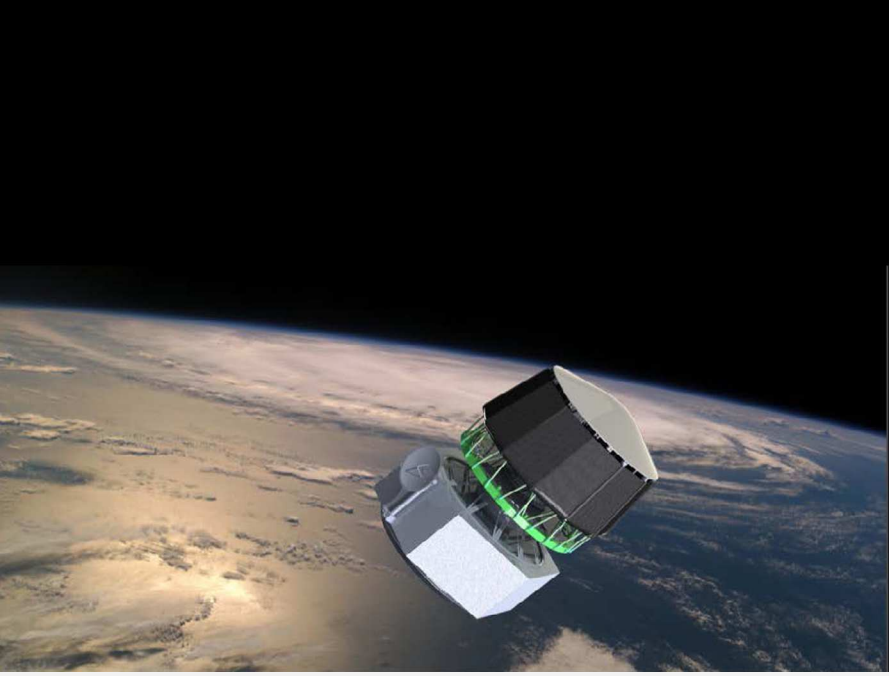


National Aeronautics and Space Administration

technology solution

Aeronautics

Transformable Hypersonic Aerodynamic Decelerator

Transformable and Reconfigurable Entry, Descent and Landing Systems and Methods

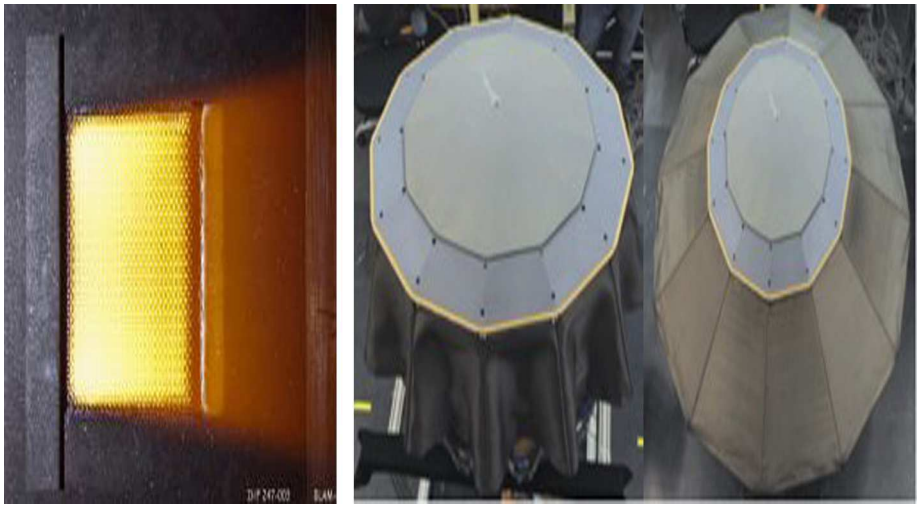
NASA has developed a game changing deployable aeroshell concept for entry, descent and landing (EDL) of large science and exploration-class payloads.The Adaptable, Deployable Entry Placement Technology (ADEPT) concept is a mechanically deployable semi-rigid aeroshell entry system capable of achieving low ballistic coefficient during entry suitable for a variety of planetary or earth return missions. It leverages Ames expertise in Thermal Protection systems (TPS) material and entry system design, development and testing. The deployable decelerator systems offer a lighter-weight solution to current rigid, high ballistic coefficient aeroshells. The deployable feature of ADEPT allows each mission to utilize an entry system design that fits within existing launch vehicle systems and later transforms into a low ballistic coefficient configuration for EDL. Consisting of rigid ribs and a TPS, deployment can be done for inspection in Earth orbit by extending the ribs and stretching the TPS in between (in a method similar to an opening umbrella) and thereby reducing the mission risk.

BENEFITS

- Light weight
- Easily deployable
- Aerodynamic surface can be actuated
- Design can be scaled to fit any size craft or payload
- Support packaging within the launch shroud
- Facilitate redirection
- Accommodate a retro-propulsion system
- Offers a compact entry system solution during the EDL mission segment.
- A single ADEPT can perform both aerocapture and atmospheric EDL.

THE TECHNOLOGY

The invention allows the deployment of a large aerodynamic decelerator relative to the size of its launch vehicle, which is controllable and can be transformed into a landing system. A structure composed of a radial assembly of ribs and struts in a four bar linkage arrangement fits inside a launch vehicle shroud, expands into a deployed size, and permits rotation about a pivot point along the vehicle axis. The mechanism that deploys the decelerator surface, doubles as the actuation/control mechanism, and triples as the payload surface leveling system. The design permits the use of conformable thermal protection systems at the central part and a flexible TPS, 3-D woven carbon fabric, as skin in the majority of the regions of the aeroshell entry system. The fabric handles both the heat and mechanical load generated during entry. This system is very mass competitive with other lightweight systems such as inflatable and rigid decelerators and is believed to be more reliable and testable at sub-scale. Once the payload reaches its destination, the decelerator structure leverages atmospheric drag to slow the craft from hypersonic travel speeds to an appropriate landing velocity. The decelerator can be actuated during descent to generate lift and steer the payload to its intended destination. Retro propulsion engines provide the final deceleration just before landing, and the decelerator structure is inverted to act as a landing platform and help minimize the impact of landing load.



Blam-fabric test closeup and ADEPT Stowed and Deployed GTA

APPLICATIONS

The technology has several potential applications:

- Human and heavy payload Mars missions
- Robotic missions to Venus and Mars
- Small satellite retrieval missions

PUBLICATIONS

Patent No: 8,733,706

More Information

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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