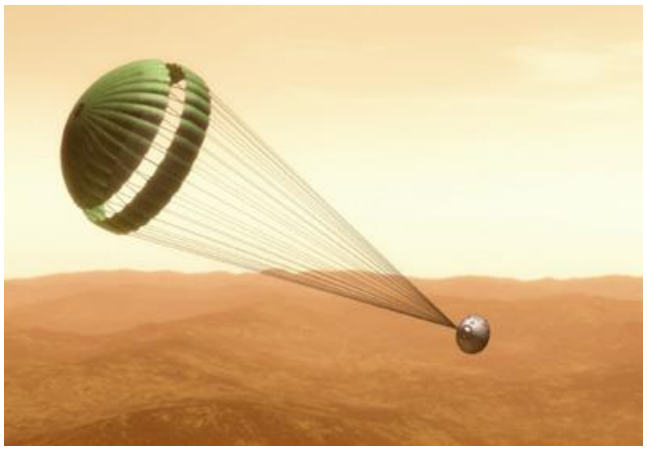
Alternative Spacecraft Deceleration Technology



Name of Technology:
Parachute Systems and Modeling

Participating NASA Centers:
LaRC (Lead); ARC, JPL, JSC

Technological Area:
Z7.03 Entry and Descent System Technologies

Vision for the Technology:
A deployable and reusable deceleration system is needed for spacecraft on deep space exploration and Earth return missions. The deceleration system would reduce the velocity of the spacecraft from hypersonic speeds to landing on Mars and/or Earth. NASA needs a repeatable system that is more reliable and predicable than parachutes.

Challenges:
NASA's workhorse technology for landing has always been parachutes, however these are typically made specifically for that mission. Repeatability of manufacturing and predictable behavior at large scale are significant challenges that NASA faces. Parachutes continue to be a source of problems to both NASA and its commercial partners.

Currently, the State-of-the-Art (SOA) technology is the Mars Science Lab (MSL) parachute at a diameter of 20.5 m. It is deployed when the vehicle is at Mach 2. The testing and qualifying expense for a parachute for Mars cost $40-50M.

Utilizing parachutes continue to have open risks, schedule challenges, and high-cost impacts.

NASA Seeks to Meet the Following Specs:

Successful closure of this gap will be determined through:

- Outperform parachutes
  - Models predict flight performance within +/- 10%
- Elimination of mission risk items
- Prolonged/expensive testing campaigns

Overview of Student Project:
NASA seeks innovative spacecraft deceleration system that can be deployable and reusable to Mars and return to Earth missions. Hypersonic velocities must be reduced for landing on surfaces. Both manned and unmanned spacecraft require this capability to be reliable and repeatable.

Innovative Areas Student Projects Can Address:

- ❖ Design deployable hypersonic deceleration technologies for spacecraft
- ❖ Develop a multi-technology design to decelerate a spacecraft from hypersonic speeds

Project Phases

I. Conceptual and feasibility study with characteristics

II. Proof of Concept/CFD modeling/ Possible Lab environment testing

This technology spec sheet was produced by
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Research Funded by NASA on this Topic:

Proposal Number: 22-1- Z7.03-2439
GasPak: A High Output, Clean Gas Generator for Large Volume Deployable Aerodynamic Decelerators

Proposal Number: 21-1- Z7.03-2654
Flexible Gas Barrier to Reduce Hot Gas Ingress at Surface of Hypersonic Inflatable Aerodynamic Decelerator

Proposal Number: 18-1- Z7.03-1414
Mars Entry and Earth Return Re-Entry Drag Brake Decelerators

Proposal Number: 10-1 X9.02-8810
Petal Brake Hypersonic Entry System

Proposal Number: 09-1 X9.02-9443
Integrated Inflatable Ballute for Planetary Entry

Proposal Number: 07-1 A2.04-9327
Nonlinear Aerodynamic ROM-Structural ROM Methodology for Inflatable Aeroelasticity in Hypersonic Atmospheric Entry

Proposal Number: 03-S1.02-9523
Attached Inflatable Forebody Decelerator for Spacecraft Aerocapture

Proposal Number: 171 Z7.03-8642
Flexible, Phase Change Fabric for Deployable Decelerators

References:

Z7.03 Entry and Descent System Technologies

S1.04Entry, Descent and Landing

Z7.01Supersonic Parachute Inflation Materials Testing, And Instrumentation

X9.02Advanced Integrated Hypersonic Entry Systems

X2.01Advanced Materials

MSL Parachute Test (SRC-000994)