National Aeronautics and Space Administration

BIG IDEA CHALLENGE

Call for White Papers!

The BIG Idea Challenge is a university-level design competition sponsored by NASA's Game Changing Development Program and managed by the National Institute of Aerospace (NIA). To participate, university teams of 3-5 students will submit white papers on ideas for generating lift using Hypersonic Inflatable Aerodynamic Decelerator (HIAD) technology. Selected teams will later submit full technical papers on their concept, and up to four teams will be selected to present their concept to a panel of NASA judges at the 2016 BIG Idea Forum at the NASA Langley Research Center, April 18-19, 2016.

Breakthrough, **I**nnovative & **G**ame-changing Idea Challenge

Important Dates

- Notice of Intent Deadline – Oct 9, 2015
- White Paper Deadline – Nov 15, 2015
- 1st Selection Notifications – Nov 30, 2015
- Technical Paper Deadline – Mar 6, 2016
- Finalists Selected – Mar 15, 2016
- 2016 BIG Idea Forum – April 18-19, 2016

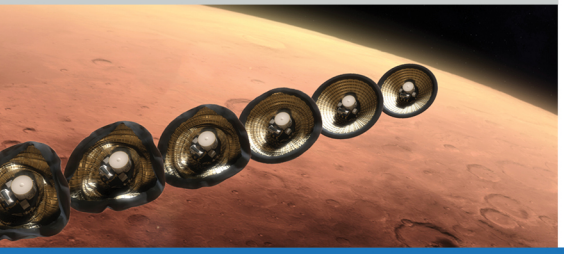
Eligibility

The BIG Idea Challenge is open to teams of undergraduate and graduate students studying in fields applicable to human space exploration at an accredited U.S.-based university. Teams may include senior capstone students, clubs, multi-university teams, or multi-disciplinary teams.

Stipends/Awards

Qualifying teams will receive a $6,000 stipend to facilitate full participation in the 2016 BIG Idea Forum.

The winning team will be awarded with offers to participate in future internships with the Game Changing Development Program team at the NASA Langley Research Center in VA.



Background Info for the 2016 BIG Idea Challenge Theme

NASA is actively developing the technologies and capabilities required to send humans to Mars in the 2030s. Current state-of-the-art technology for landing payloads on the surface of Mars is around one metric ton. In order to safely deliver humans to, and return them from the surface of Mars, ongoing studies indicate landed usable payload masses of 15 - 30 metric tons in a single vehicle may be required. Due to Mars' thin atmosphere, large aeroshells will be required to provide enough aerodynamic drag to decelerate and deliver masses of this scale.

NASA is developing and flight testing a new class of relatively lightweight deployable aeroshell technology that could enable more than 20 metric tons to be safely delivered to the surface of Mars. NASA is investing in Hypersonic Aerodynamic Inflatable Decelerator (HIAD) technology because it is a leading candidate to enable large aeroshells. HIAD articles of up to 20 m in diameter may be required for this application. The HIAD can be stowed efficiently in an Earth departure vehicle and then deployed exo-atmospherically prior to Mars entry. Enhancing HIAD drag with lift remains an area of interest for NASA. **Future human Mars missions will require lift to mitigate deceleration loads on the crew, to loft the vehicle, and to extend the timeline for EDL events and to enable precision landing.**

Current technology development efforts have focused on manufacturing and testing axisymmetric HIAD structures. Such axisymmetric geometries require flying at angle of attack (via center of gravity offset or control surfaces) to generate lift. However, the HIAD inflatable structure offers opportunities for a new paradigm in the design of nontraditional fore-body entry vehicle shapes that can be readily constructed using pressurized soft goods.

The BIG Idea Challenge seeks novel and robust ideas and applications for generating lift using HIAD technology.

The BIG Idea invites teams and their faculty advisors to work together to design and analyze potential concepts and systems to provide the ability to achieve a modulated lift-to-drag (L/D) ratio of 0.2 to 0.5 during hypersonic entry. Concepts can engage new approaches such as shape morphing and pneumatic actuation to dynamically alter the HIAD inflatable structure.

For all BIG Idea Projects, attention should be given to the following:

- Design simplicity
- Low system mass
- Minimal time required to vary lift-to-drag (L/D) over its full range
- Unique combinations of existing innovative capabilities/technologies

Breakthrough, Innovative & Game-changing Idea Challenge

Design Guidelines and Constraints

Guidelines

Teams will design and analyze potential concepts and systems to provide the ability to achieve a modulated lift-to-drag (L/D) ratio of 0.2 to 0.5 during hypersonic entry. The time required to achieve a prescribed lift magnitude and direction should be a design consideration as short response time may be required by some guidance and control algorithms. For instance, based on previous studies, if bank maneuvering is utilized for control, the required bank rate is 20 deg/sec and the required acceleration is 5 deg/sec^2. If a method other than bank control is employed, other parameters may be important.

Constraints

Design concepts should:

- be extensible to aeroshell diameters of 15 to 20 meters
- generate modulated lift-to-drag ratio from 0.2 to 0.5
- possess a smooth outer mold line to avoid localized heating
- be aerodynamically stable over flight regime from 6.5 km/s to 0.6 km/s

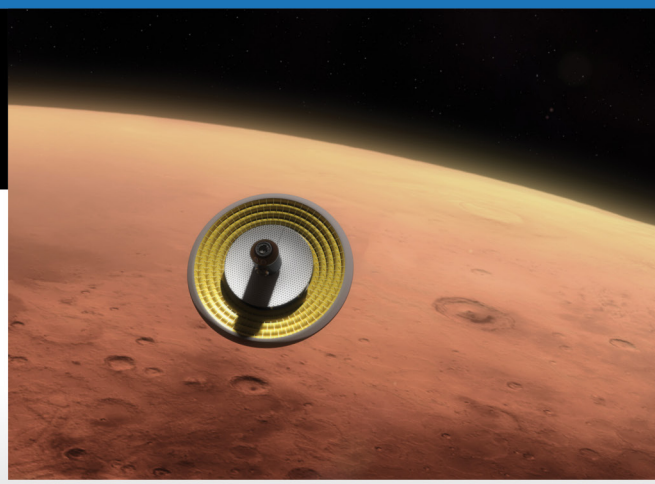
The Game Changing Development Program is a part of NASA's Space Technology Mission Directorate. *The Program advances space technologies that may lead to entirely new approaches for the Agency's future space missions and provide solutions to significant national needs. The program will focus efforts in the mid Technology Readiness Level (TRL) range of (3-5/6) generally taking technologies from proof of concept through component or breadboard testing in a relevant environment. The program employs a balanced approach of guided technology development efforts and competitively selected efforts from across academia, industry, NASA, and other government agencies. The program strives to develop the best ideas and capabilities irrespective of their source.*

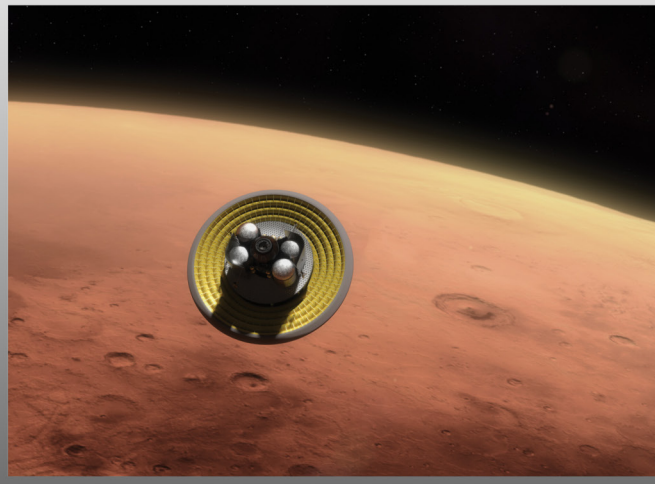
gameon.nasa.gov

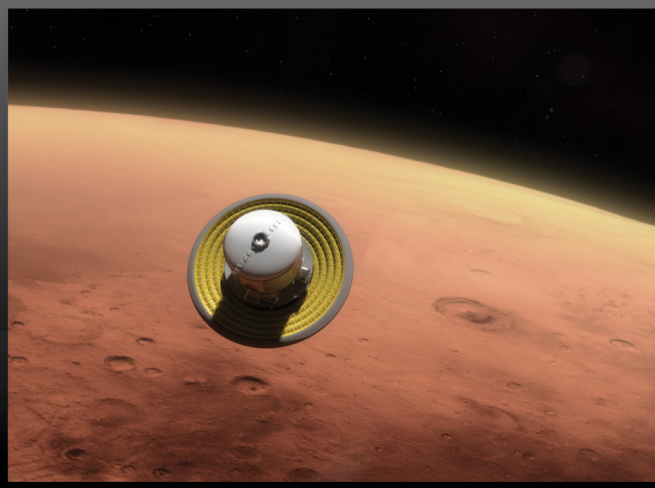
BIG IDEA CHALLENGE

For more information, visit

BIGidea.nianet.org







National Aeronautics and Space Administration (NASA)
and the National Institute of Aerospace (NIA)

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