



BIG IDEA CHALLENGE



2020 Call for Proposals: Capabilities to Study Dark Regions on the Moon

The BIG Idea Challenge is a university-level design competition sponsored by NASA's Space Technology Mission Directorate and Office of STEM Engagement and managed by the NIA. **To participate in this challenge, teams of 5-20 students from Space Grant-affiliated universities will submit robust proposals for sample lunar payloads that can demonstrate technology systems needed for exploration and science in the Permanently Shadowed Regions (PSRs) in and near the Moon's polar regions.** Selected teams will receive awards ranging between **\$50,000 and \$180,000** to bring their ideas to life.

Breakthrough, Innovative & Game-changing Idea Challenge

Context for the 2020 BIG Idea Challenge Theme

Although it is Earth's closest neighbor, there is still much to learn about the Moon, particularly in the Permanently Shadowed Regions (PSRs) near the lunar polar regions that have remained dark for billions of years. NASA plans to land humans on the Moon by 2024 with the Artemis program. But before astronauts step on the lunar surface again, rigorous science and exploration activities on the Moon will be conducted to reduce technical and programmatic risk for the human missions. These robotic precursor missions will further investigate regions of interest to human explorers, including the Moon's polar regions, and will provide information to the engineers designing modern lunar surface systems. NASA is engaging the university community for ideas to help achieve some of these activities through the 2020 BIG Idea Challenge, which is asking university teams to submit proposals for sample lunar payloads that can demonstrate technology systems needed to explore areas of the Moon that never see the light of day.

2020 BIG Idea Challenge Proposal Categories

NASA seeks innovative ideas from Space Grant-affiliated universities for a wide variety of concepts, systems, and technology demonstrations supported by solid engineering rigor that will address near-term technology capability requirements to support NASA's exploration objectives for the Permanently Shadowed Regions (PSRs) in and near the Moon's polar regions. Teams of students and their faculty advisors are invited to propose unique solutions with supporting original engineering and analysis in response to one of the following areas:

- **Exploration of PSRs in lunar polar regions**
 - NASA is seeking proposals for concepts that will help us gain knowledge about the lunar environment. This information could include, but is in no way limited to:
 - Characterizing the regolith/ surface consistency within the PSR
 - Locating and characterizing lunar water, or other hydrogen-rich deposits
 - Identify water concentrations - understanding how water ice mixed with the regolith
 - Thermal environment of the regolith in a PSR
- **Technologies to support lunar in-situ resource utilization (ISRU) in a PSR**
 - NASA is seeking proposals for concepts that can demonstrate the ability to use resources found in the lunar environment. These could include, but are in no way limited to:
 - Collecting icy regolith
 - Transporting and storing collected water
 - Water purification
 - Demonstrating electrolysis in the relevant environment
- **Capabilities to explore and operate in PSRs**
 - NASA is seeking proposals that include ways to enable getting into (and out of) the PSR. These could include, but are in no way limited to:
 - Innovations in mobility systems
 - Innovations in navigation systems
 - Innovations in power systems
 - Innovations in communications systems
 - Innovations in sensing systems

To provide realistic design parameters, teams will be asked to design their concepts based on the lunar surface delivery capabilities of the commercial providers selected under NASA's Commercial Lunar Payload Services (CLPS) contract. Proposals should have a strong concept of operations strategy, include low-cost power options, and have the capability to operate in the extreme darkness, cold and vacuum of lunar PSR environments. Designing an innovative concept that can survive in this environment will be no easy task, so multidisciplinary teams of varied skill sets are highly encouraged.

NEW THIS YEAR! Unique to this challenge is that selected finalist teams will be required to perform and provide results for robust, high-fidelity proof-of-concept testing. Teams are encouraged to be creative and design their own accurate and realistically simulated testing scenarios that demonstrate readiness to support potential near-term lunar missions.

Design Assumptions

Proposing teams should clearly identify their assumptions and provide rationale to support them. Below are some recommended assumptions, but teams can adjust them if a good rationale to do so is provided.

- The payload should be targeted for a 2023 launch date
- Any surface delivery to the moon will likely contain multiple payloads
- It is expected that landers developed for use through the CLPS contract will provide the capability to fly over a PSR and land within 100 meters of the rim of the crater that is in permanent shadow where water ice has accumulated
- Minimize mass!

For more information on the 2020 BIG Idea Proposal Categories, including design requirements and guidelines, please visit <http://bigidea.nianet.org>.

Proposed designs must consider:

- Value
- Mobility
- Communications capability to transmit the data to Earth
- Power needed to gather and transmit the data
- Environments in a lunar PSR
- Readiness to support a near term lunar mission

All BIG Idea projects should give special attention to:

- Innovative design
- Potential Stakeholders/Funders (i.e. Exploration, Science, Commercial)
- Use of technologies that could be ready for use on the Moon in the early 2020's
- Effective packaging for launch and Moon landing
- Credible fabrication and material selection
- Creative low-cost operational approaches
 - The design package must include a Concept of Operations (ConOps) that clearly describes the complete lifecycle, including all design assumptions and address fabrication, transport, deployment, and operations.

Award Funding for Finalist Teams

A wide range of award sizes is expected (in the range of \$50,000 - \$180,000), depending on the scope of the work proposed. Each team will submit a detailed and realistic budget in their proposals, not to exceed \$180K. We anticipate funding several larger-scope awards (typically \$125-\$180K) and several smaller-scope awards (typically \$50K - \$124K). **Proposers are encouraged to request what is actually needed to conduct the proposed work.**

BIG Idea Challenge Funding is to be used for full-participation in the competition, including (but not limited to) the purchase of hardware/software, creation of analog testing environment, stipends for student research that directly supports the proposed activity, and travel to the culminating design review (2020 BIG Idea Forum).

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<http://BIGidea.nianet.org>

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Important Dates

- Notice of Intent Deadline: September 27, 2019
- Proposal and Video Deadline: January 16, 2020
- Selection Notifications: February 14, 2020
- Mid-Project Review Deadline: May 12, 2020
- Technical Paper Deadline: September 17, 2020
- 2020 BIG Idea Forum: October 6 – 8, 2020

Eligibility

The 2020 BIG Idea Challenge is open to teams of undergraduate and graduate students at **accredited U.S.-based colleges and universities officially affiliated with their state's Space Grant Consortium.** Non-Space Grant affiliated universities may partner with a lead Space Grant University; however, the Space-Grant affiliated university must submit the proposal on behalf of the team. Teams must contain a minimum of 5 U.S.-citizen students and are limited to a maximum of 20 students total. Please see the BIG Idea website for full eligibility requirements.

The Game Changing Development Program is a part of NASA's Space Technology Mission Directorate, advancing space technologies that may lead to entirely new approaches for the Agency's future space missions and provide solutions to significant national needs.
gameon.nasa.gov

The 2020 BIG Idea Challenge is sponsored by NASA through a unique collaboration between the Space Technology Mission Directorate (Game Changing Development Program) and the Office of STEM Engagement (Space Grant Consortium), and is managed by the National Institute of Aerospace (NIA).

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