ACTIVITY - NASA- BIG IDEA – LUNAR DUST DESIGN CHALLENGE

http://bigidea.nianet.org/2021-challenge/

Figure 1- http://bigidea.nianet.org/2021-challenge/ check out the actual NASA version of this activity.

Overview –

NASA is committed to landing American astronauts, including the first woman and the next man, on the Moon by 2024. Through the agency's Artemis lunar exploration program, we will use more innovative and cost-effective new technologies and systems to explore more of the Moon than ever before. We will collaborate with our commercial and international partners to establish sustainable missions by 2028.

The Moon's environment presents unique challenges, and lunar dust is one of the principal limiting factors in returning to the lunar surface for missions of any extended duration. Lunar dust is difficult to shield against and remove as it is extremely abrasive, highly cohesive, small in size, and may be electrostatically charged. In addition to threatening astronaut health, lunar dust issues have also resulted in incorrect instrument readings, vision and optical system obscuration, performance reduction, altered thermal properties, and equipment failure. High-velocity dust ejected by descent engine exhaust can cause damage to the lander, as well as nearby surface assets, which will have negative consequences as NASA strives for sustainable lunar exploration. *Many terrestrial industries such as mining, food, and cosmetics, have created unique dust mitigation technologies.* NASA would like to explore these innovations as potential solutions to lunar dust issues.

For future lunar exploration missions, dust will also inevitably be introduced into habitable spaces, where, under lunar gravity, certain particle sizes can be a health hazard to humans. No single technology completely solves the challenges of dust, but rather a suite of technologies will be required to address them. To enable sustainable human operation of the Moon in the coming decade, NASA is looking for near-term, innovative and viable solutions for dealing with the Moon's abrasive dust.

Activity –

Teams of 1-4 people (an individual is a team of 1 person) will submit a 3,000 characters (including spaces) document providing a high-level overview of the proposed project and impact of the related research. Proposals will respond to one of the following categories:

A. **Landing Dust Prevention and Mitigation** - to preclude or protect from plume/surface interactions which may result in damaged landers and nearby surface assets.

B. **Spacesuit Dust Tolerance and Mitigation** - to limit dust adherence to spacesuits and other deleterious effects to its subsystems.

C. **Exterior Dust Prevention, Tolerance, and Mitigation** -to protect lunar surface systems or preclude dust from entering habitats and landers

D. **Cabin Dust Tolerance and Mitigation** - to clean habitable volumes and their interior surfaces, which helps prevent dust from making it back to Gateway and Orion when the lander returns to lunar orbit from the surface

The proposal must include the following sections:

1. **Summary Statement**
   - An overall summary of the innovation, including a title of the project, and names of all team members.
2. **Problem Statement and Background**
   - Challenge being addressed and overall approach (specifically refer to A, B, C, or D above)
3. **Project Description**
   - What technology are you going to develop or implement, and why is it important?

Optional BONUS Sections:

- How does your proposed technology fit in NASA's planned lunar architecture? (see NASA's Plan for Sustained Lunar Exploration and Development)?
- Adherence to the Design Constraints and Guidelines
- Verification on Earth
  - Proposers must describe HOW their technology could be demonstrated on Earth to provide confidence it can work in a lunar environment. If selected, teams will need to demonstrate a working technology. It is up to each team to determine the best way to accomplish this, and provide details on how verification testing will be conducted. Physics-based modeling may support verification but is not a sufficient replacement for hardware testing.
  - For the testing, will you accomplish a realistic simulated environment? If so, how? What have you considered from the DSNE?
- Path-to-flight
  - A brief discussion on the concept's anticipated path-to-flight for a mission to the Moon by 2026. Based on significant differences between on- and off-Earth operations, the path-to-flight description must address the critical modifications that would be made to the design for use on the Moon.
- Timeline
- Detailed budget
  - Budget should include all relevant costs, not to exceed $180,000.

Submit.

Each person needs to submit a copy of the team proposal, with all the team-members' names to the D2L dropbox. See Schedule.

End of Activity ----------