NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) - REQUEST FOR INFORMATION (RFI): CENTENNIAL CHALLENGES EXTREME ENVIRONMENT CHALLENGE

This RFI is for informational/planning purposes only and the Government will not pay for the information received. This RFI is **NOT** to be construed as a commitment by the government to enter into any agreement or other obligation or to conduct an Extreme Environments Challenge ("Challenge"). NASA welcomes all segments of industry, academia, and government, including associations, innovators, and enthusiasts to reply. This notice is issued in accordance with the NASA Prize Authority, 51 U.S.C. 20144.

Many potential NASA planetary science missions are to destinations where scientific measurements will need to be conducted in extreme environments[1]. NASA is considering the use of a Challenge driven prize competition approach to accelerate development and demonstration of key technologies for these missions.

The purposes of this RFI are: (1) gather feedback on the competition being considered, the prize amounts and distribution structure, (2) to determine the level of interest in potentially competing in various phases of this Challenge, and (3) understand the applicability of the challenge capabilities for other terrestrial applications.

Responses should be submitted in Adobe PDF or Microsoft Word format and are limited to five (5) pages in length. Responses should include (as applicable): name, address, email address, and phone number of the respondent, business, or organization, with point of contact for business or organization. All responses are to be for general access by Government reviewers. Comments on the competition may be provided to the public.

Responses must be submitted in electronic form no later than September 10, 2013.to Dr. Larry Cooper, Centennial Challenges Program, NASA Headquarters, 300 E Street, SW; Washington, DC 20546–0001. E-mail address: HQ-STMD-CentennialChallenges@mail.nasa.gov. For general information on the NASA Centennial Challenges Program see: http://www.nasa.gov/challenges.

Introduction:

NASA's Centennial Challenges Program seeks to stimulate innovation in technologies that have value to NASA and the nation through open prize competitions that directly engage the public, academia, and industry. NASA is considering initiation of an Extreme Environments Challenge focused on finding innovative solutions to the problems surrounding the survival and operations of scientific probes in extreme environments, such as on the surface of Venus where temperatures approach 500° C, the atmospheric pressure is about 90 times that at the Earth's surface, and the atmosphere is corrosive. The approach being considered would entail a series of

[1] Extreme Environments Technologies for Future Space Science Missions, NASA, September 2007. (http://solarsystem.nasa.gov/scitech/display.cfm?ST_ID=2459)

competitions that would focus on 1) electronics and mechanisms, and 2) thermal management, and 3) power with a culminating systems integration competition.

I. Objectives

The Challenge being considered would be competed in a test facility located at the NASA Glenn Research Center. The Challenge testing would begin in 2015.

As currently envisioned, there would be a series of subsystem and component competitions followed by a competition that would integrate the subsystems and components into a full science probe system level demonstration. The environmental conditions would simulate operations on the surface of Venus. Currently anticipated minimum life requirements are in the 5-15 hour range and maximum in the 150 hour range.

- Phase 1: Electronics and mechanisms capability
  - Competitors are required to implement a set of electronic and mechanical components capable of performing a set of predefined activities consistent with a simple probe and do so for a set period of time. The probe will be subjected to a cold soak and then to Venus surface conditions. A predefined amount of power will be made available to participants' probes. The participants may use the provided power in any way they choose as long as they complete the set of predefined set of electronic and mechanical tasks while the subsystem is subject to the environmental conditions.
- Phase 2: Thermal management capability
  - Competitors are required to develop the capabilities to maintain a "controlled environment" for a notional scientific payload. The probe will be subjected to a cold soak and then to Venus surface conditions. The "controlled environment" will be defined as a preset volume, shape and include a internal heat source to simulate an electronics package, which must be maintained within a predefined range of pressures and temperatures and for a set period of time. A predefined amount of power will be made available to participants' probes. The participants may use the provided power in any way they choose.
- Phase 3: Power capability
  - Competitors are required to deliver power to meet a notional payload's needs to meet nominal operations for the required test duration. The probe will be subjected to a cold soak and then to Venus surface conditions.
- Phase IV: System capability

– Competitors design and build a "probe" using materials and systems of their choosing and design. The probe must be "representative" of the functions of a simple planetary probe. The specific requirements for the probe system will be defined considering the results of prior challenge phases. The probe will be subjected to a cold soak and then to Venus surface conditions.

Draft Challenge requirements and prize criteria are detailed in the attachment.

II. Eligibility to Participate

In the event that NASA decides to initiate one or more phases of an Extreme Environment Challenge, parties will be advised by notice in the Federal Register. At that time, all individuals or entities that wish to participate in the Challenge must register as members of a TEAM (hereafter "TEAM MEMBERS") and enter into an agreement with the designated challenge management organization. No TEAM MEMBERS may be from countries listed on the NASA list of designated countries. (The current list of designated countries can be found at http://oiir.hq.nasa.gov/nasaecp/).

Registration and participation in a Challenge does not entitle a participant to a NASA funded prize. To be eligible to win a NASA funded prize, the competitor must (1) register and comply with all requirements in the rules and enter into a team agreement; (2) in the case of a private entity, shall be incorporated in and maintain a primary place of business in the United States, and in the case of an individual, whether participating singly or in a group, shall be a citizen or permanent resident of the United States; and (3) shall not be a Federal entity or Federal employee acting within the scope of their employment.

It is anticipated that each Phase will be conducted separately. Competitors would be able to register for any or all Phases and may participate in different teaming arrangements in the phases as they wish.

NASA and other federal agencies may work with and provide technical support to participating teams as long as it is done on an equitable basis. That is, similar requests are dealt with in a similar fashion, be it access to facilities, testing, scientific consultation, or other services. This does not obligate NASA or other federal agencies to provide the support. These services may be at no cost or on a cost reimbursable basis. "

III. Information Sought

NASA seeks information on the following:

a. Competition Structure

- Are there aspects of the challenge competition metrics that should be added, modified, or deleted?
- Should the phases be run in series, overlapping, or should phases 1-3 be done in parallel?
- If done in series, what is the preferred order of the phases?

- What should be the timing of the competition phases? That is, how much time should be allowed before the first competition and how much time between subsequent competitions?
- What facilities/locations might be places to perform testing for each of the competition phases?

b. Competition Awards

- Are the award levels, structure, and challenge levels appropriately matched? That is, are the prize funds sufficient to attract a robust level of competitor interest?

c. Teaming Arrangements

- Should there be any Phase 4 restrictions on teaming arrangements among participants in the first three phases? The following situation could develop: There is one clear winner in Phase 1 and no one else is close. There are multiple strong, but different competitors in Phases 2 and 3. The Phase 1 winner holds a significant advantage in partnership formation for Phase 4 leading to loss of interest among competitors not selected for partnership. Suggestions on how to maintain size of pool of competitive technologies through all phases are requested.

d. Technology Development and Utilization

- Are there specific emerging breakthrough technologies that are applicable to the competition phases?
- For each phase (particularly the first three) are there specific non-space related applications for the capability?
- Are there ways to adjust the competition metrics, levels or phases that would assist with the synergy with non-space applicability?

e. Interest

- How interested are you in participating in these competitions? Which one or ones?

IV. FOR FURTHER INFORMATION CONTACT:

This RFI is seeking feedback on the competition phases, the prize amounts and distribution structure, and/or interest in competing in any or all phases of this Challenge. Comments must be submitted no later than September 10, 2013 to Dr. Larry Cooper at e-mail address: HQ-STMD-CentennialChallenges@mail.nasa.gov. For general information on the NASA Centennial Challenges Program see: http://www.nasa.gov/challenges. The point of contact is Dr. Larry Cooper, Program Executive, Centennial Challenges Program, NASA Headquarters 300 E Street SW, Washington DC 20546–0001.