

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
CENTENNIAL CHALLENGES PROGRAM**

AIRSHIP 20-20-20 CHALLENGE

REQUEST FOR INFORMATION (RFI)

1. SUMMARY

The Centennial Challenges Program is NASA's flagship program for technology prize competitions (www.nasa.gov/challenges). The program is an integral part of NASA's Space Technology Mission Directorate, which is innovating, developing, testing, and flying hardware for use in NASA's future missions. The Centennial Challenges Program directly engages the public, academia, and industry in open prize competitions to stimulate innovation in technologies that have benefit to NASA and the nation. For more information about NASA's Space Technology Mission Directorate, visit: <http://www.nasa.gov/spacotech>.

The Centennial Challenges program is seeking input on a stratospheric airship challenge proposed to start in 2015. The challenge focuses on building and launching a lighter-than-air, powered, maneuverable airship operating in the stratosphere, while carrying a nominal payload for a pre-defined time period.

This RFI seeks: (1) to gather feedback on the competition being considered, the prize amounts and distribution structure; (2) to determine the interest level in potentially competing in this challenge; (3) to gauge potential interest from the science community in using airships as a scientific platform; (4) to understand the applicability of the challenge capabilities for other non-government applications; and (5) to determine the interest level in administering the challenge (as an allied organization) or partnering on payload development. Specific information sought is detailed in Sections 5-9.

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.

This RFI seeks feedback from potential challengers (Section 5), from people interested in using airships as a scientific platform (Section 6), from people or organizations interested in using airships as a commercial/non-scientific platform (Section 7), from organizations interested in partnering with NASA to administer the challenge (Section 8), and from organizations (or educational institutes) interested in partnering with NASA to develop and build the challenge payload (Section 9). Comments must be submitted in electronic form no later than 5:00pm Eastern Time December 1, 2014 to Mr. Sam Ortega at e-mail address: HQ-STMD-CentennialChallenges@mail.nasa.gov. Please use 202020 Challenge on the Subject line.

NASA welcomes all segments of industry, academia, and government, including associations, innovators, and enthusiasts to reply to this RFI. This RFI is for informational/planning purposes only and the Government will not be responsible for any cost associated with preparing

information in support of this RFI. This RFI is **NOT** to be construed as a commitment by the government to enter into any agreement or other obligation or to conduct a 20-20-20 Airship Challenge. This notice is issued in accordance with the NASA Prize Authority, 51 U.S.C. § 20144. Responses may be made available for public review and should not include proprietary information. Submitted information will be shared within NASA and with contractor personnel associated with the NASA Centennial Challenges Program. All responses are to be for general access by government reviewers.

For general information on the NASA Centennial Challenges Program see: <http://www.nasa.gov/challenges>. The point of contact is Mr. Sam Ortega, Program Manager, Centennial Challenges Program, NASA Marshall Space Flight Center.

2. BACKGROUND

NASA is considering a stratospheric airship challenge to incentivize the demonstration of a long duration scientific platform for both Earth and space sciences. In 2013, a Keck Institute study (*Airships: A New Horizon for Science*) demonstrated significant interest in airships as a science platform from the academic community and possible industrial partners. The final study report can be found at <http://kiss.caltech.edu/study/airship/final-report.pdf>.

There are few opportunities for space missions in astronomy and Earth science. *Airships* (powered, maneuverable, lighter-than-air vehicles that can navigate a designated course) could offer significant gains in observational persistence over local and regional areas, sky and ground coverage, data downlink capability, payload flexibility, and over existing suborbital options at competitive prices. We seek to spur a demonstration of the capability for sustained airship flights as astronomy and Earth Science platforms in a way that is complementary with broad industry interests.

3. CHALLENGE DESCRIPTION

This 20-20-20 Airship Challenge is currently contemplated as a two-tiered challenge that would provide opportunities to evaluate a wide range of innovative methods to launch an airship into the stratosphere, maintain altitude, and station-keep for a defined period of time.. This challenge would seek to engage the aerospace industry, educational institutions, and amateurs to provide solutions. The Challenge would award prizes for successful demonstration of a stratospheric airship that would be required to accomplish the following tasks (summarized in Table 1):

- Reach a minimum altitude of **20 km**.
- Maintain the altitude for **20 hours** (200 hours for Tier 2 competition)
- Remain within a 5 km diameter station area (and navigate between two designated points for Tier 2)
- Successfully return the **20 kg** payload (200 kg for Tier 2 competition) and payload data.
- Show Airship scalability for longer duration flights with larger payloads through a scalability review.

Table 1. Key Challenge Requirements		
	Tier 1	Tier 2
Altitude (km)	20	20
Duration (hr)	20	200
Payload mass (kg)	20	200
Station keeping diameter (km)	5	5
Path traversing	No	Yes
Airship scalability review	Yes	Yes

4. DRAFT CHALLENGE RULES AND COMPETITION STRUCTURE

Based upon responses to this RFI, NASA may develop detailed written challenge rules (“Rules”). The Rules would include specific milestones, entrance, review and acceptance criteria, and prize award criteria. The final Rules would be the official specification of the competition structure. A requirement is being considered that competitors must independently gain FAA approval for their airships and provide a location for demonstration.

Milestones and Phases

As currently envisioned, the challenge administrators and the competitors would provide the items described in the Table 2.

Table 2. Items provided by Challenge Administrator and Competitor	
Challenge Administrator	Competitor
<u>20 kg payload</u> ~75x60x30 cm (Contains: GPS, Inertial Measurement Unit (IMU), Pressure & Temperature sensors, data storage, and batteries) Provided at the time of the challenge demonstration.	<u>180 kg payload</u> (Additional payload mass selected by competitor for Tier 2 only)
<u>Interface Control Document (ICD)</u> (Defines payload integration to airship) Provided at the beginning of the challenge period.	<u>Communication and airship cut down system</u> (Required by FAA and not part of the 20 kg payload)
<u>Technical Requirements and Challenge Rules Document</u>	<u>Scalability Review package</u>

Competitors would provide a scalability design review package 3-6 months after the challenge initiation. This review would determine if airship designs could be scaled to payloads of greater than 200 kg, durations of longer than 200 hrs, and an ability to navigate the airship along a defined course. The competitors would need to pass this review in order to be eligible to compete in the Tier 1 competition. Competitors who fail or do not submit to the initial design scalability review may still compete in the Tier 2 competition. However, a scalability review at the time of the Tier 2 demonstration would be required to win prize money.

Tier 1: Within a specified time window, competitors would have to integrate the provided 20 kg payload with their airship and launch, reaching **>20 km** for **20 hours** with the **20 kg** payload, staying within a 5 km diameter area. The payload would have to be recovered intact by the competitor, and the design of the airship would have to have passed a review defining scalability to larger payloads, longer durations, and the ability to course-follow within some margin, as specified by the technical Challenge document and judged by the review panel.

Tier 2: Competitors would have to add 180 kg of payload to the provided 20 kg payload, with their added payload available for weight verification by the judges before the launch window specified. The airship would have to reach **>20 km** for **200 hours** with the full **200 kg** payload. During the flight the airship would be required to traverse a specified path within a defined margin, demonstrating a 5 km station at either end of the course. The payload would have to be recovered intact by the competitor, and the design of the airship would have to pass a review of scalability to larger payloads and longer durations, as specified by the technical Challenge document and judged by the review panel.

The preferred competition model for a Centennial Challenge is head-to-head competition at a single location (annually) to excite public engagement, build competitive momentum, and focus timelines; however there have been exceptions to this when simultaneous, local launches have prohibitively complicated logistics. If a distributed competition model were considered, competitors would have to contact the challenge administrators *at least* one month prior to their desired demonstration date at their own location. We invite you to comment on the risks and benefits of a simultaneous competition, near-simultaneous competition, and/or distributed competition models across multiple locations and/or times for both envisioned Tiers of this Challenge (see Section 5).

The Tier 1 and Tier 2 competitions would occur concurrently.

Awards

NASA suggests offering the following prizes:

- **Seed Money:** TBD \$ (\$200k to be shared between all successful teams with a maximum of \$20k per team) could be awarded to teams passing the scalability design review.
- **Tier 1 Award:** TBD \$ (\$1M) could be split between teams successfully completing Tier 1 within 3 years of the challenge initiation. A possible scenario for splitting the Tier 1 prize money is 4 prizes of \$500k, \$250k, \$125k, and \$125k, starting from the first to demonstrate to the fourth. In the event of ties, a scoring rubric could be used based on desired characteristics of the vehicle, beyond what is required.
- **Tier 2 Award:** TBD \$ (\$1.5M) could be awarded to the first successful demonstration of Tier 2 within 3.5 years of challenge initiation. At the conclusion of the Tier 1 competition period, unclaimed Tier 1 prize money could be added to the Tier 2 award, with a scoring rubric breaking ties.

5. INFORMATION SOUGHT from Competitors

a. Interest

- Are you interested in participating in this competition?
- Would the requirement that you must gain your own FAA approval for your airship impact you significantly?
- Are there other barriers that can be addressed in the timelines, requirements, and formulation of these challenges?

b. Competition Milestones and Phases

- Is the requirement of traversing a specified path in Tier 2 sufficient to demonstrate the full extent of the airship capabilities?
- Please comment on the minimum time window needed for launch. Are there other concerns regarding technical requirements, or aspects of the challenge competition Milestones and Rules that should be added, modified, or deleted?
- Please remark on the benefits/drawbacks of the preferred model of a simultaneous, head-to-head competition, at a centralized location versus allowing teams to compete at any time during the competition, with a 30 day notice of intent to launch, at self-selected locations?
- Are there metrics beyond the primary objectives of the Challenge that should be incentivized in the scoring rubric or with bonuses, such as stricter margins, sprint speed, additional flight duration, reusability of the airship, demonstration of additional payload capabilities e.g. pointing and measurement sensitivity, etc.?

c. Competition Awards

- NASA is considering up to \$2.7M in prizes. How could the award structure best incentivize participation and technical progress?
Is the prize money sufficient to incentivize potential competitors?
- Please comment on the award scenario being considered. Are there other alternative scenarios that would provide greater incentives to compete?

d. Competition Name

- Please suggest official names that best, succinctly, characterize this Centennial Challenge. Please provide comments on how the naming could increase the public interest in the prize competition.
- What other actions should be taken to increase public interest?

6. INFORMATION SOUGHT from Science Community

a. Technology Development and Utilization

- Are you interested in using airships as a scientific platform? What scientific goals would you hope to achieve with an airship? What technological requirements should the airship have and/or demonstrate in order to meet your scientific goals (e.g., altitude, station keeping or event tracking, payload capacity, platform stability, etc.)?
- Are you interested in potentially including a science instrument as additional payload for the Tier 2 competition?

7. INFORMATION SOUGHT from Commercial Community

a. Technology Development and Utilization

- Are you interested in using airships as a commercial platform? What commercial goals would you hope to achieve with an airship? What technological requirements should the airship have in order to meet your commercial goals (e.g., altitude, station keeping or event tracking, payload capacity, platform environment/stability, etc.)?
- Are there specific emerging breakthrough technologies that are applicable to the competition?
- Are there specific commercial space and/or non-space related applications for this capability?
- Are there ways to adjust the competition metrics that would assist with the synergy with commercial space and/or non-space applicability?

8. INFORMATION SOUGHT from Allied Organizations

a. Interest

- Are you interested in partnering with NASA to plan and execute the airships challenge as an “Allied Organization”?

b. Competition Name

- Please suggest official names that best, succinctly, characterize this Centennial Challenge. Please provide comments on how the naming could increase the public interest in the prize competition.
- What other actions could be taken to increase public interest?

9. INFORMATION SOUGHT from Partners for Payload development

a. Interest

- Are you interested in partnering with NASA to develop and build the 20kg payload? What can your organization (educational institute) provide to this partnership (expertise, hardware, public outreach opportunities, etc.)?

10. FOR FURTHER INFORMATION CONTACT:

This RFI seeks feedback on the competition phases, the prize amounts and distribution structure, and/or interest in competing in any or all Challenge phases. Comments must be submitted no later than 5:00pm Eastern Time December 1, 2014 to Mr. Sam Ortega at e-mail address: HQ-STMD-CentennialChallenges@mail.nasa.gov. Use 202020 Challenge on the Subject line.

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11. ELIGIBILITY TO PARTICIPATE IN CHALLENGES

In the event that NASA does initiate this challenge, NASA will post a public 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 and enter into an agreement with the designated challenge management organization. Teams foreign and domestic may compete in the challenge, although teams that include foreign nationals who are not permanent residents of the United States may not receive prize money for these competitions. The sole exception is for U.S based educational institutions, which may have up to 50% foreign national students on their teams. 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/>).

Teams cannot include any Federal entity or Federal employee acting within the scope of their employment. This includes any U.S. Government organization or organization principally or substantially funded by the Federal Government, including Federally Funded Research and Development Centers, Government-owned, contractor operated (GOCO) facilities, and University Affiliated Research Centers.

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 as determined by the subject federal agency in accordance with law and policy.

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.