NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
CENTENNIAL CHALLENGES PROGRAM

Break the Ice Lunar Challenge
Phase 1 Competition Rules
1/22/2021

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Revision Tracking Log

Status (Baseline/Revision)	Document Revision	Effective Date	Description
Baseline		11/18/2020	Document Baseline
Revision	A	12/18/2020	Updated the dates in section 4.1 and 4.2 to match with timeline table Updates to section 4.2.1 and table 4 "Environmental conditions" to match section 2.1
Revision	B	1/22/2021	Updated the language under NASA Water Extraction Plant Power Utilization Specifications in Section 3.2.5

1. Definition of Terms

Centennial Challenges Program: A NASA program that was initiated to use prizes to generate revolutionary and innovative solutions to problems of interest to NASA and the nation. The program seeks innovations from diverse and non-traditional sources and engages the public in the process of advanced technology development. This Centennial Challenge, the Break the Ice Lunar Challenge, is referred to throughout this document as the "Challenge."

Ensemble: Ensemble is a company that provides challenge operations services. NASA has contracted with Ensemble to support the administration and promotion of this Challenge.

Excavation: The use of a tool or tools to remove in-situ material from a predetermined location and deposit this material into equipment for conveying and/or processing.

Icy Regolith: In-situ regolith with a temperature between 40 kelvin and 70 kelvin that contains volatile material with varying percentages of water content by weight.

Judging Panel: A panel of professionals and subject matter experts from government, academia, and industry who will evaluate and score Phase 1 submissions.

Mission Scenario: A hypothetical scenario similar to a real-world lunar excavation mission.

Ombudsman: A liaison between the competitors and the judging panel when disputes and/or questions arise following the announcement of scores and/or winners.

Permanently Shadowed Region (PSR): A general term describing a location on the lunar surface that does not receive any direct illumination or heat from the Sun and therefore is always dark and cold.

Regolith: Granular lunar material that contains no volatile material and has a maximum grain size of 1 mm.

System Architecture: A concept for design, deployment, operation, and maintenance of assets required to support the Mission Scenario.

Team: Individual(s) or organization(s) who have registered to compete in the Challenge.
Eligibility Requirements Document: A document that all teams must sign in order to participate in the Challenge.

Team Leader: The person selected by each Team to interact with the Challenge contractor. The Team Leader will be responsible for compliance with the rules, and Centennial Challenges Program will issue prize payments to the Team Leaders of the winning Teams.

Vacuum: The lack of any atmospheric pressure. While the atmosphere on Earth is normally defined as 1 bar (~760 torr), the atmosphere in a vacuum chamber on Earth may be as low as 1x10^-6 torr. On the lunar surface, the pressure can be as low as 1x10^-12 torr.

2. Challenge Background and Objectives

As NASA works to extend human exploration of the solar system, a sustained presence on the Moon will be critical for developing and testing the technologies and systems needed for future missions to Mars and beyond.

In situ resource utilization (ISRU)—the development of lunar materials for life support, fuel, energy, manufacturing, and construction—is necessary to limit the delivery of supplies from Earth.

One of the most important of these resources is water. Water supports all life on Earth, and will be critical to supporting human exploration beyond Earth. On the Moon, water is trapped in icy regolith at the lunar poles, including inside permanently shadowed regions (PSRs).

2.1. Technology Gaps

NASA has identified a number of key technology gaps related to excavation of icy regolith and delivery of water that could be addressed through a Challenge, including:

- Excavation of large quantities of icy regolith
- Delivery of large quantities of water
- Hardware and equipment that is lightweight and energy efficient
- Hardware and equipment that is reliable and durable
- Hardware and equipment that operates well in extreme lunar environmental conditions, including:
    - Extreme cold and permanent or near-permanent darkness
    - Vacuum conditions
    - Dust levels found on the lunar surface
    - Reduced gravity

The Break the Ice Lunar Challenge seeks to incentivize innovative approaches for excavating icy regolith and delivering water in extreme lunar environmental conditions. The Challenge seeks to incentivize solutions for maximizing water delivery while minimizing energy use and the mass of equipment required to be transported to the lunar surface.

3. Challenge Overview and Technical Goals

3.1. Competition Overview

The Break the Ice Lunar Challenge will have up to two phases, totaling no more than 36 months, and a total prize purse of up to $5 million.

Phase 1 of the Break the Ice Lunar Challenge is focused on incentivizing new ideas and approaches to a system architecture for excavation and movement of icy regolith and water on the lunar surface.

The Challenge describes a hypothetical Mission Scenario and asks Teams to design a system architecture addressing necessary hardware, concept of operations, lunar environmental conditions, and specific performance analyses, as well as supporting materials that address credibility and feasibility of the system architecture.

In Phase 1, Teams will have approximately seven (7) months to register and submit a system architecture (see Phase 1 Submission below). Phase 1 will last a total of nine (9) months, including approximately two (2) months of judging (see Competition Calendar below).

Prize purses for Phase 1 will total up to $500,000 (see Table 1). Teams are eligible for a prize purse if they meet or exceed a minimum score (see Section 4.3).

Table 1. Phase 1 Prize Purses

Phase 1 Prize Purses	
1st Place	$125,000
2nd Place	$75,000
3rd Place	$50,000
Up to ten (10) Runners Up ($25,000 each)	$250,000
Total	**$500,000**

All prize purses, including Runners Up, will be determined based on teams' overall scores.

Following Phase 1, NASA may initiate a Phase 2 of the Challenge, which is expected to focus on designing and building excavation hardware components and/or systems that would be tested in simulated lunar conditions. If initiated, Phase 2 would last approximately 27 months with a total prize purse of up to $4.5 million.

3.2. Mission Scenario

The Mission Scenario described below is a hypothetical scenario similar to a real-world lunar mission. Teams will design a system architecture to excavate icy regolith and deliver water based on the locations and sites, environmental conditions, terrain, icy regolith specifications, and hypothetical NASA assets described below.

The Mission Scenario takes place in and around a permanently shadowed region (PSR) near the lunar South Pole. In this scenario, the mission will last 365 Earth days.

The Mission Scenario includes three NASA assets: a NASA Power Plant, NASA Power Distribution, and a NASA Water Extraction Plant. These assets are described in detail in Section 3.2.5. Teams are not required to use these assets.

Teams' architectures must:

1. Excavate icy regolith at the Excavation Site
2. Extract water from that icy regolith using the NASA Water Extraction Plant or their own method
3. Deliver that water to the Delivery Site

Although there is no minimum mass of water that must be delivered, NASA is most interested in system architectures that can deliver at least 10,000 kilograms (kg) of water over the duration of the mission. Teams that address this 10,000 kg goal are expected to be scored as having met expectations for the scoring criteria "Estimated Mass of Water Delivered" (see Table 4).

System architectures must include:

- A description of all hardware needed to complete the mission
    - Note: While automation and Guidance, Navigation, and Control (GNC) systems will be necessary for future missions on the Moon, automation and GNC systems are not required elements of this competition. Manual operation of all equipment in the system architecture is acceptable.
- A detailed concept of operations, addressing:
    - Movement of hardware from the starting location at the Delivery Site to the Excavation Site
    - Excavation of icy regolith
    - Movement of icy regolith from the Excavation Site to the NASA Water Extraction Plant, including how the material will be protected from sublimation or other losses; alternatively, Teams may describe their own method and location for water extraction
    - Delivery of water to the Delivery Site

    - Information on roads, berms, or other elements that must be constructed to support their architecture (if any)

- An environmental analysis describing how equipment is expected to perform in extreme lunar environment conditions with regard to temperature, dust, reduced gravity, and vacuum

- Performance analyses, including:

    - Analysis of the landed mass of each piece of equipment that would need to land on the lunar surface to complete the mission, plus total landed mass, including the mass of the NASA Water Extraction Plant, if the Team is using that NASA asset in their system architecture (see below)
    - Analysis of the mass of water (in kilograms) delivered during the mission
    - Analysis of the energy used by each piece of equipment during the mission, plus total energy consumed
    - Ratio of total water delivered to total landed mass
    - Ratio of total water delivered to total energy consumed

Teams are not required to use the three NASA assets described below in Section 3.2.5. In calculating mass, Teams are not required to include mass associated with the NASA Power Plant and NASA Power Distribution. However, if Teams are using the NASA Water Extraction Plant, they must include the production rate, energy use, and mass based on the specifications described below.

The total landed mass and volume of the system architecture is not limited in Phase 1 of this Challenge. However, Teams are encouraged to consider the constraints of delivering the hardware associated with their system architecture to the Moon. Below are hypothetical mass and volume specifications regarding lunar landers that may be available to transport equipment to the Moon. Although these benchmarks are hypothetical, Teams should consider them as they develop their system architecture.

Hypothetical mass and volume specifications regarding lunar landers:

- Lunar landers with the capacity to land 9,000-12,000 kg of landed mass
- Lunar landers that fit within a rocket fairing with the following internal specifications:
    - Main section:
        - Length: 10.45 meters
        - Diameter: 6.35 meters
        - Volume: 331 cubic meters
    - Nose section:
        - Length: 7.15 meters
        - Diameter: narrows from a maximum of 6.35 meters
        - Volume: 127 cubic meters

3.2.1. Location and Sites

The lunar surface is significantly cratered due to meteoroid and asteroid impacts and volcanic activity. Lunar craters range in size from tiny indentations to the enormous South Pole-Aitken basin, which is nearly 2,500 km in diameter and contains numerous smaller craters. The polar regions have both crater ridges that are exposed to sunlight continuously and depths that are permanently in shadow and extremely cold. In this Mission Scenario, excavation of icy regolith will take place inside PSRs, where water and other volatile substances are naturally preserved.

Specific locations for the mission are described below. The specifications of the locations are representative of the locations, terrain, and distances for various excavation missions under consideration by NASA.

- Mission Area: The total area of operations for the mission. The Mission Area measures 24 km^2, centered at approximately 89.58 degrees South and 151.96 degrees West, which is approximately 11 kilometers from the lunar South Pole. Figures 1 and 2 illustatrate the Mission Area.

- Excavation Site: A location inside the PSR where icy regolith will be excavated; this site measures 132,500 m^2, centered at 89.57 degrees South and 160.77 degrees West, which is 3.27 kilometers from the Delivery Site. The NASA Water Extraction Plant is located 200 meters from the center of the Excavation Site. Figure 3 illustrates the Excavation Site and the NASA Water Extraction Plant.

- Delivery Site: A high and flat spot within the Mission Area with a relatively constant amount of sunlight measuring 97,875 m^2, 89.56 degrees South and 144.19 degrees West, which is 3.27 kilometers from the center of the Excavation Site. Teams will begin and end the mission at the Delivery Site. Figure 4 illustrates the Delivery Site.

Figure 1. Mission Area (outlined in green) with 100 Meter Terrain Contour Lines.

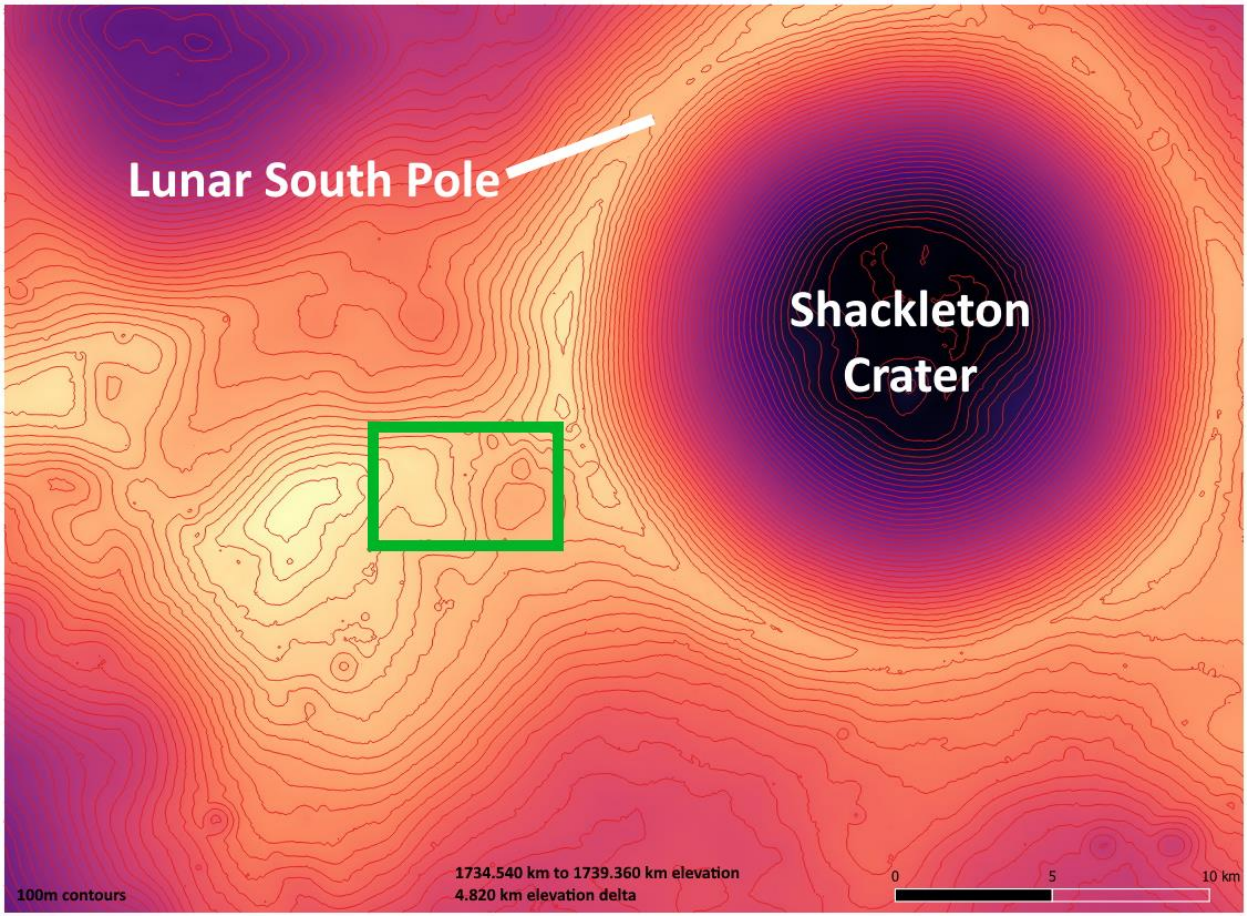


Figure 2. Mission Area with Excavation and Delivery Sites (outlined in green)

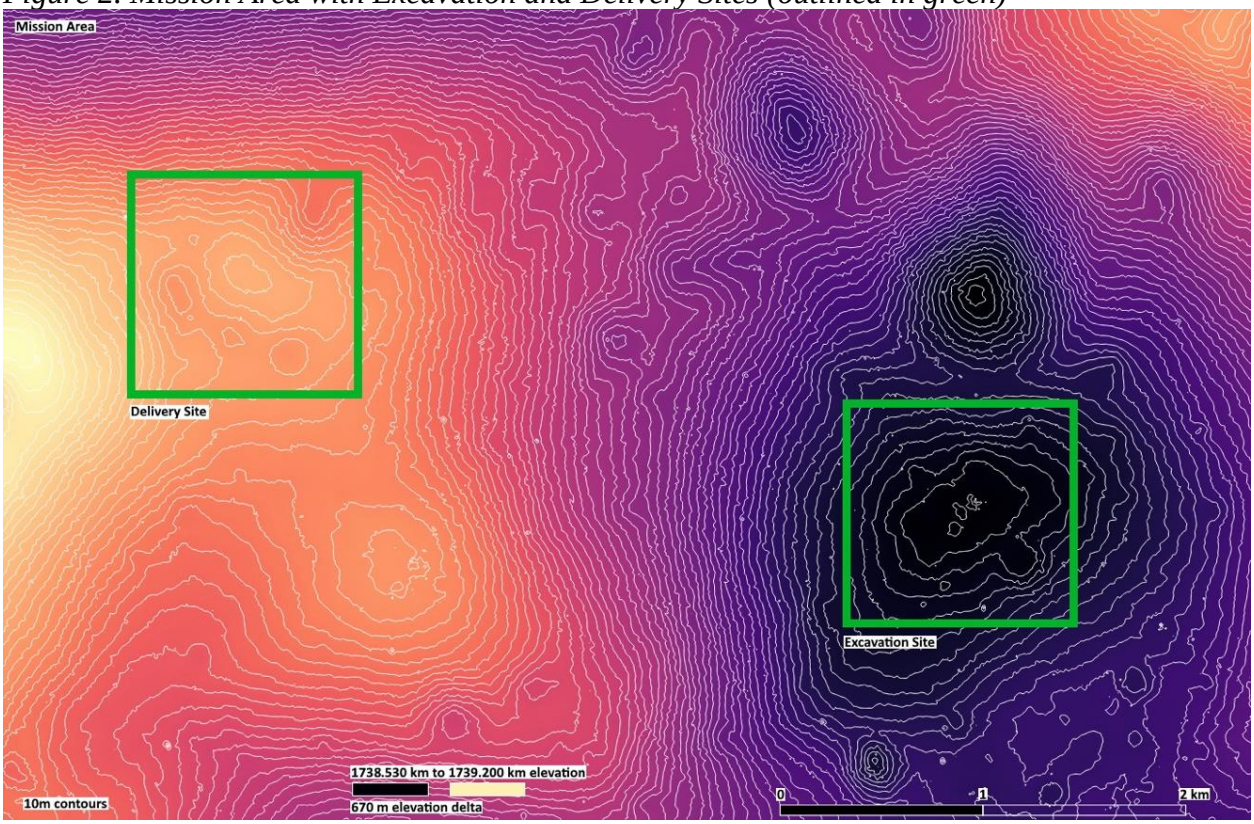


Figure 3. Excavation Site (outlined in green) and Water Extraction Plant (shown by green X) with 2 Meter Terrain Contour Lines.

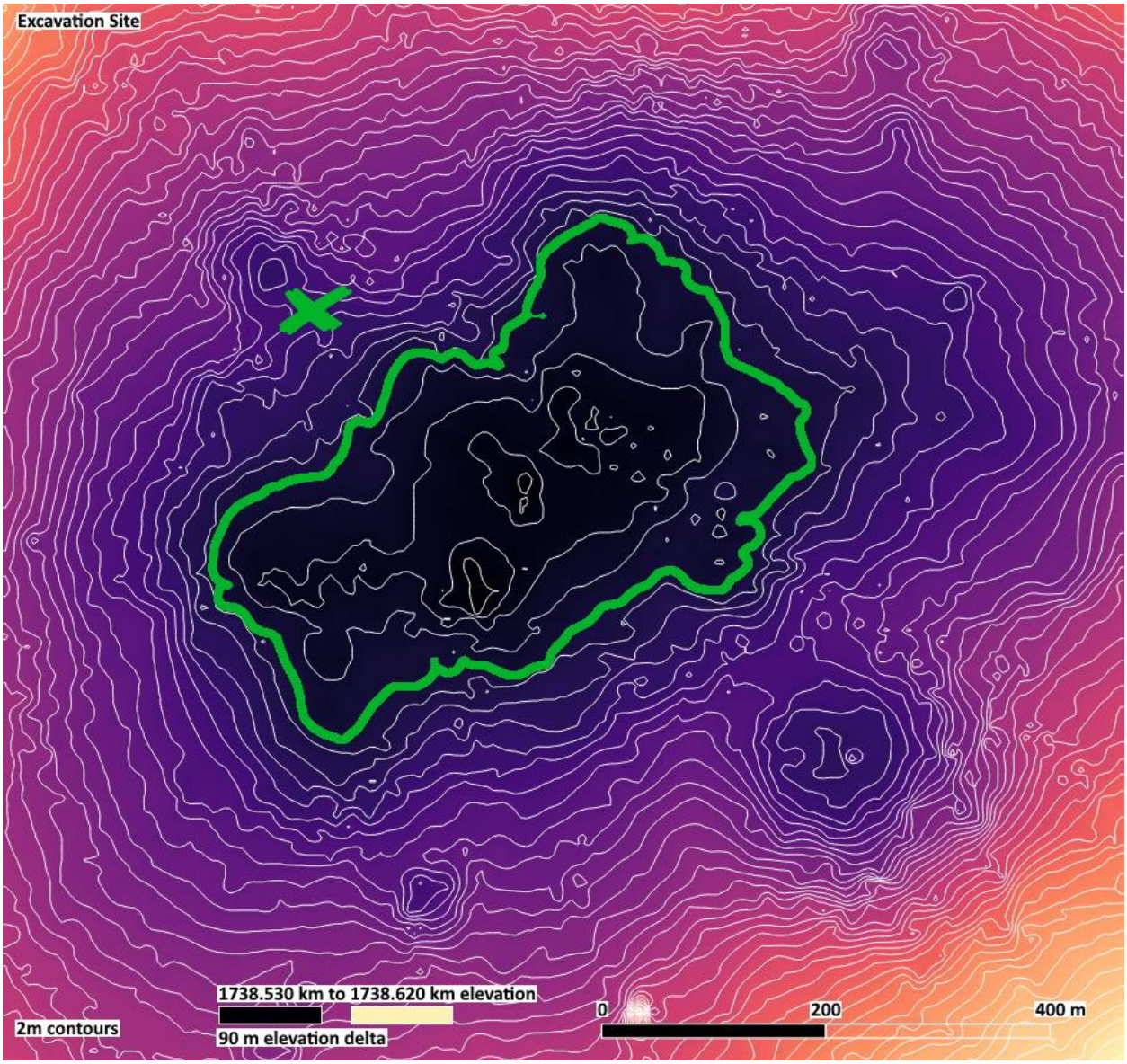
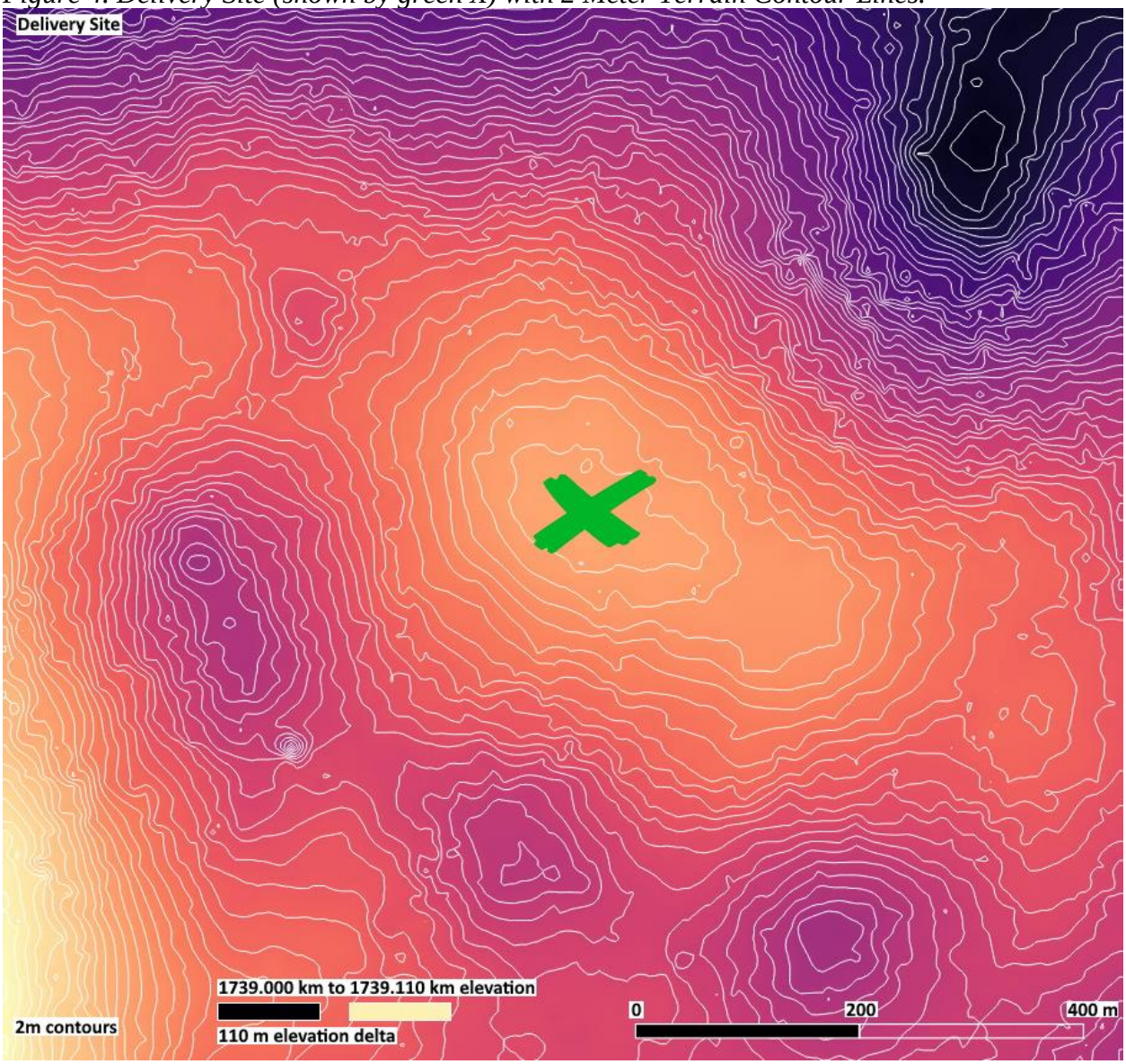


Figure 4. Delivery Site (shown by green X) with 2 Meter Terrain Contour Lines.



3.2.2. Environmental Conditions

Teams must address the following environmental conditions in the system architecture. Teams may assume that these environmental conditions are present and consistent across the Mission Area, except with regard to the Temperature Ranges, as noted.

- **Temperature Range at the Delivery Site:** Surface temperature ranges from 50 K to 200 K, with a summer average temperature of approximately 130 K and winter average temperature of approximately 80 K. Lighting conditions include a very low sun angle of 1.54 degrees maximum, which results in sunlight in this area for approximately 60 percent of a 365 Earth day mission.

- **Temperature Range at the Excavation Site**: Surface temperature is estimated to range from 40 K to 100 K, with a summer average temperature of approximately 75 K and winter average temperature of approximately 55 K. The Excavation Site is in permanent darkness.

- **Dust:** Fine lunar dust, defined as particles smaller than 20 microns in size, is present in the entire Mission Area. This dust is very abrasive to equipment and electrostatically charged; it can travel long distances when disturbed.

- **Reduced Gravity:** Gravity on the Moon is 16.6 percent of Earth's gravity, or 1.62 meters per second squared.

- **Vacuum:** Atmospheric pressure is 2.28×10^{-12} torr, which is essentially a hard vacuum.

3.2.3. Terrain

The slope and terrain between the Excavation Site and the Delivery Site is shown in Figure 2. The total elevation change between the two sites is approximately 450 meters.

Additional terrain data is available from the following sources:

- Lunar Orbiter Laser Altimeter (LOLA) Digital Elevation Model (DEM) Layers and Data Sets: https://trek.nasa.gov/moon/
- Lunar Reconnaissance Orbiter (LRO) Lunar Orbiter Laser Altimeter (LOLA) Layers: https://quickmap.lroc.asu.edu/

3.2.4. Icy Regolith Information

Teams will assume the following hypothetical information for the icy regolith present at the Excavation Site:

1. The icy regolith profile shown in Figure 5

2. Bulk density:
    - 0-20cm at 0% H_2O = 1.47g/cm^3
    - 20-100cm at 4% H_2O = 1.79g/cm^3
    - 100-350cm at 10% H_2O = 1.85g/cm^3

3. Porosity:
    - 0-20cm at 0% H_2O = 46.5%
    - 20-100cm at 4% H_2O = 34.9%
    - 100-350cm at 10% H_2O = 32.7%

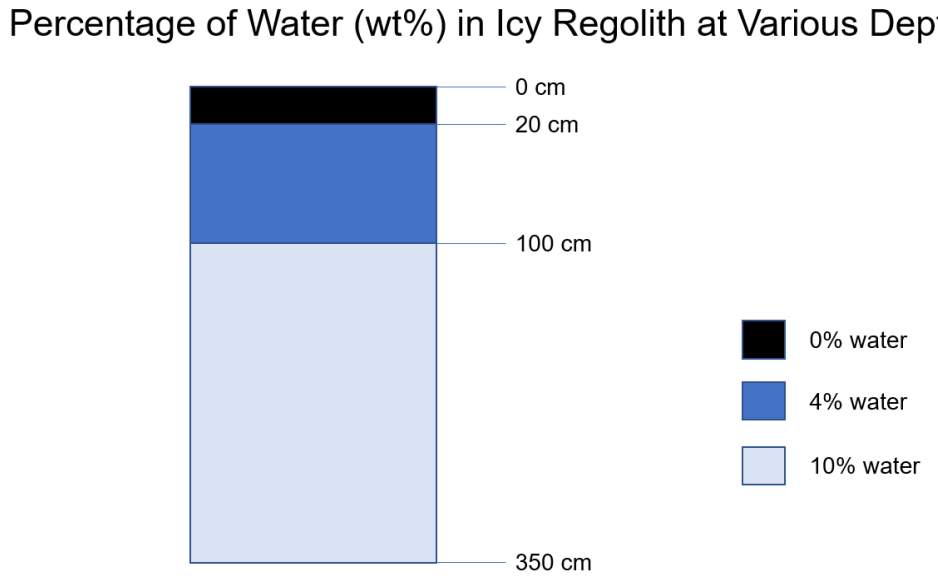
4. Compressive Strength:
    - For regolith with 4% H_2O: 1.5-2 MPa

- For regolith with 10% H_2O: 20-35 MPa

5. Tensile Strength:
   - For regolith with 4% H_2O: 0.40-0.55 MPa
   - For regolith with 10% H_2O: 10-12 MPa

Teams should use this information and the specifications of the Team's water extraction method (either the NASA Water Extraction Plant provided or the Team's own method) to estimate the mass of water delivered to the Delivery Site. Teams should address how they will protect material during transport from losses due to sublimation or other factors. If the material is not protected, Teams must determine the appropriate losses.

Figure 5. Hypothetical Icy Regolith Profile



3.2.5. NASA Assets

Teams may assume that NASA will provide the following assets:

- NASA Power Plant with the following characteristics:
  - Located at the center of the Delivery Site
  - Provides 10 kW electrical power at 120 VDC
  - Provides continuous power regardless of lighting conditions

- NASA Power Distribution from the power plant up to 4 km

- NASA Water Extraction Plant with the following specifications:
  - Mass flow: Input from an excavator into the water extractor at a rate of 100 kg/hr of icy regolith (either granular icy regolith with 4% water content or hard icy regolith with 10% water content)

- Power utilization:
  - Consumes energy at a rate of 2.5 kW when extrcating water from 4% (wt) regolith
  - Consumes energy at a rate of 1.4 kW when extracting water from 10% (wt) regolith

- Landed mass: 700 kg

3.3. Competition Calendar

The following is an overview of the expected timeline for Phase 1 of the Challenge.

Table 2. Competition Calendar.

PHASE 1	
Expected Date	**Description**
November 18, 2020	• Phase 1 opens
December 2020–January 2021	• Webinars to support registered Teams and potential Teams in developing their system architectures • Promotional activities and/or other support for registered Teams • Judging Panel Summit (virtual) to brief judges on roles/responsibilities and Challenge rules
June 18, 2021	• Deadline for registration and for Teams to submit their system architectures
June–July 2021	• Administrative review of the system architectures to verify compliance with rules • Judging Panel may conduct virtual interviews with Teams
July–August 2021	• Judging Panel reviews and scores the system architectures • Judging Panel Summit (virtual) to determine Phase 1 winners
August 13, 2021	• Phase 1 winners announced
PHASE 2 (if initiated)	
Expected Date	**Description**
August–October 2021	• *Phase 2 registration opens*
November 2023	• *Phase 2 winners announced*

4. Phase 1 Registration, Submission, and Judging

4.1. Registration

All interested Teams must register for the Challenge by the June 18, 2021, deadline and meet the eligibility requirements in order to participate in the Challenge.

For this Challenge, the registration process will be administered by the Challenge contractor, Ensemble. Registration will take place through the official Challenge website: https://breaktheicechallenge.com/. Additional details regarding the process for registration will be available on the Challenge website.

4.2. Phase 1 Submission

All registered Teams must submit their system architectures by the June 18, 2021 deadline.

Teams will deliver their Phase 1 Submission through the Challenge website (https://breaktheicechallenge.com/). For some submission elements, Teams will fill out a form field with a character limit; for other elements, Teams will upload one or more attachments. The limits for submission elements are summarized in the table below.

4.2.1. Submission Elements

- **Submission Title**: This title may be displayed on the competition website post-submission.

- **Team Information**: Teams must submit a Curriculum Vitae and headshot for each Team Member.

- **Technical Abstract**: Teams must provide a brief summary description of the system architecture. The Technical abstract should provide a concise and compelling overview of the Team's submission.

- **Intellectual Property**: Teams must explain who owns the intellectual property of the proposed system architecture. If the architecture is built on existing or off-the-shelf technology, Teams should detail the permissions (if applicable) they have to use that technology. If a Team is part of an organization, the submission should indicate which Team Members own the intellectual property.

- **Team Video Pitch**: Teams must submit a short video to introduce the Team and pitch their system architecture. In the video, Teams should address:

    - Introduce yourself and your organization and/or Team
    - How are you addressing NASA's key technology gaps?
    - What are the key elements of your proposed system architecture?
    - What is unique about your proposed system architecture?

    - How would you measure success and achieve broad and meaningful impact?

- **System Architecture Report:** A detailed narrative and supporting illustrations, computer models, data, or other materials describing the following elements:

    - All hardware needed to complete the mission, including:
        - Equipment that interfaces with the icy regolith, including its maintenance requirements
        - The shape and material composition of the impacting portion of the equipment
        - Note: While automation and Guidance, Navigation, and Control (GNC) systems will be necessary for future missions on the Moon, automation and GNC systems are not required elements of this NASA Centennial Challenge. Manual operation of all equipment in the system architecture is acceptable.

    - Concept of operations, addressing:
        - Movement of hardware from the starting location at the Delivery Site to the Excavation Site
        - Excavation of icy regolith
        - Movement of icy regolith from the Excavation Site to the NASA Water Extraction Plant, including how the material will be protected from sublimation or other losses; alternatively, Teams may describe their own method and location for water extraction
        - Delivery of water to the Delivery Site
        - Information on roads, berms, or other elements that must be constructed to support the architecture (if any)

    - Environmental Analysis: How equipment is expected to perform in the extreme lunar environment conditions with regard to temperature, permanent or near-permanent darkness, dust, reduced gravity, and vacuum

    - Performance Analysis addressing:
        - Analysis of the mass of each piece of equipment that would need to be landed on the lunar surface to complete the mission, plus total landed mass
        - Analysis of the mass of water (in kilograms) delivered during the mission
        - Analysis of the energy used by each piece of equipment during the mission, plus total energy consumed
        - Ratio of total water delivered to total landed mass
        - Ratio of total water delivered to total energy consumed

- **Excavation Plan** (a drawing or a three-dimensional digital model) illustrating or modeling:
    - An area of regolith excavation
    - The sequence of excavation operations
    - The path of equipment between the Excavation Site and the Delivery Site

- **Mission Animation** (may include narration or captions) showing the system architecture under operation and including the following elements:
  - Minimum of 60 seconds showing set up of all equipment from the starting location
  - Minimum of 60 seconds detailing the excavator design and digging implement interactions with the regolith at depth
  - Minimum of 60 seconds showing long-term operations of overall system architecture

- **Legal and other required documentation**, as described in the Overview of Challenge Rules and Requirements in Section 5

Table 3. Summary of Submission Element Formats & Limits

Phase 1 Submission Element	**Form Field Character Limit**	**Narrative Page* Limit**	**Limit on Additional Attachments (such as data files, illustrations, video, etc.)**
Submission Title	~5 words/ 30 characters		
Technical Abstract	~250 words/ 1,500 characters		
Intellectual Property	~50 words/ 300 characters		
Team Information			25 pages* in Portable Document Format (PDF)
Team Video Pitch			Maximum of two (2) minutes uploaded to YouTube. A public YouTube link must be provided.
Legal and other required documentation	~100 words/500 characters		25 pages in Portable Document Format (PDF)
System Architecture Report		25 pages in Portable Document Format (PDF)	

Phase 1 Submission Element	Form Field Character Limit	Narrative Page* Limit	Limit on Additional Attachments (such as data files, illustrations, video, etc.)
Excavation Plan			For drawings, a maximum of five (5) sheets in PDF with a size no smaller than 11" x 17" and no larger than E Size. Digital models should be submitted in a format which can be reviewed in a freely available 3D model viewer software which would be accessible to the judges.**
Mission Animation			Maximum of five (5) minutes, uploaded to YouTube. A public YouTube link must be provided.

*For purposes of the Phase 1 Submission, a "Page" is defined as Letter size paper (8.5 x 11.5 inches) with 12 point font (Times New Roman) and one-inch margins.
**Recommended file types are: IGES, STEP, STL, and IFC.

4.3. Phase 1 Judging

Following the Phase 1 submission deadline, the Judging Panel will review the submissions and discuss, evaluate, and rank the Teams. Judges will assess submissions on the criteria described below.

The System Architecture, Excavation Plan, and Mission Animation will be scored separately. Teams may receive a maximum of 300 points:

- Maximum of 200 points for the System Architecture;
- Maximum of 50 points for the Excavation Plan; and a
- Maximum of 50 points for the Mission Animation.

The Judging Panel will assign points as described in the tables below. Teams must score a minimum of 100 points total in order to be eligible for a prize purse.

NASA may choose to recognize (with non-monetary awards) Teams that credibly assert the best performance on key performance goals, including (but not limited to):

- Largest mass of water delivered
- Lowest energy use
- Best performance in lunar environmental conditions
- Lowest landed mass

Table 4. Submission Criteria, Description, and Scoring

Criteria	Description	Maximum Points
System Architecture General Criteria & Scoring		
Completeness	Does the submission address all requirements?	20
Scientific and Technical Merit	Does the submission demonstrate a clear understanding of NASA's technology gaps and addresses means to close those gaps?	50
Feasibility of the Design	Does the submission present a compelling case that implementation is feasible? Has the Team made realistic assumptions and considered potential implementation risks? Does the submission include promising excavation hardware that could be designed and built in Phase 2?	30
System Architecture Key Performance Goals & Scoring		
Estimated Mass of Water Delivered	What is the estimated mass of water delivered? How credible is the estimate?	25
Estimated Energy Use	What is the estimated energy use? How credible is the estimate?	25
Estimated Landed Mass	What is the estimated landed mass? How credible is the estimate?	25
Addresses Environmental Conditions	How well does the architecture address the required environmental conditions? (Temperature Range at the Delivery Site; Temperature Range at the Excavation Site; Permanent or near-permanent darkness, Dust Mitigation; Vacuum; Gravity)?	25

Total Points Possible	**200**

Excavation Plan Criteria & Scoring		
Completeness	Does the submission address all requirements?	10
Scientific and Technical Merit	Does the submission demonstrate a clear understanding of NASA's technology gaps and addresses means to close those gaps?	10
Feasibility of the Design	Does the submission present a compelling case that implementation is feasible? Has the Team made realistic assumptions and considered potential implementation risks? Does the submission include promising excavation hardware that could be designed and built in Phase 2?	30
Total Points Possible		**50**

Mission Animation Criteria & Scoring		
Completeness	Does the submission address all requirements?	10
Accuracy	How accurately does the animation represent the system architecture?	10
Fidelity	Is the animation of high fidelity with regard to the level of granularity and production value?	10
Engages the Public	Does the submission tell a compelling story about the potential for industrial activities and a sustained presence on the Moon?	20
Total Points Possible		**50**

Table 5. Scoring Table with Hypothetical Scores

Criteria	Improvement Needed	Meets Expectations	Exceeds Expectations	Exceptional	Perfect
System Architecture Report	**40**	**60**	**110**	**175**	**200**
Excavation Plan	**15**	**20**	**35**	**45**	**50**
Mission Animation	**15**	**20**	**35**	**45**	**50**
Total Score	**70**	**100**	**180**	**265**	**300**

Following the announcement of scores, Teams may file an appeal through the Ombudsman. A Team Leader must submit any appeal in writing to the Ombudsman within one (1) day of the release of scores to the Team Leader and prior to prizes being awarded. All correspondence relating to an appeal will be conducted through the Ombudsman. The Ombudsman will act solely as the mediator between the Teams and the Judging Panel, if any appeals are raised. No Team Members will approach the Judging Panel with an appeal or attempt to sway the judges' decision. The Ombudsman's decision of the appeal will be rendered before the award of prizes and will be considered final.

5. Legal Requirements

5.1. In General

Teams are responsible for understanding and complying with all Challenge rules and requirements as stated below and detailed in the Eligibility Requirements Document. The following sections below summarize key elements of the Eligibility Requirements Document. Teams should review the Eligibility Requirements Document for additional details.

5.2. Eligibility

NASA welcomes applications from individuals, groups of individuals, and/or organization or entities that meet the eligibility requirements provided below.

In order to participate in the Challenge, each individual, whether acting alone or as part of a Competitor Team must identify their nationality.

- No individual competitor shall be a citizen of a country on the NASA Export Control Program list of Designated Countries List Category II: Countries determined by the

Department of State to support terrorism. The current list of designated countries can be found at http://oiir.hq.nasa.gov/nasaecp. Please check the link for latest updates. This includes individuals with dual citizenship unless they are a U.S. citizen or a lawful permanent U.S. resident (green card holder).

- While China is not a Category II designated country, pursuant to Public Law 116-6, Section 530, NASA is prohibited from participating, collaborating, or coordinating bilaterally in any way with China or any Chinese-owned entity. Team members who are citizens of China but not affiliated with a Chinese entity may be permitted to participate on a Team.

- Subject to the conditions set forth herein, foreign nationals and foreign national teams can participate in the Challenge. However, they are not eligible for a cash prize, and must acknowledge acceptance of this by signing and submitting a Foreign Participant Acknowledgement Form.

- A competitor team-designated lead shall be responsible for both compliance with the rules (including prize eligibility rules) and the actions of all members of the team.

In order to be eligible to win a prize:

1. Individuals must be U.S. citizens or permanent residents of the United States and be 18 years of age or older.
2. Organizations must be an entity incorporated in and maintaining a primary place of business in the United States.
3. Teams must be comprised of otherwise eligible individuals or organizations and led by an otherwise eligible individual or organization.
4. Team leader must be a U.S. citizen or permanent resident.

A Team may include foreign nationals and be eligible to win prize money as long as the foreign national signs and delivers a disclosure (separate form) wherein he/she discloses his/her citizenship and acknowledge that he/she is not eligible to win a prize from NASA, AND

1. The foreign national is an employee of an otherwise eligible U.S. entity participating in the Challenge,
2. The foreign national is an owner of such entity, so long as foreign citizens own less than 50% of the interests in the entity,
3. The foreign national is a contractor under written contract to such entity, OR
4. The foreign national is a full time student, during the time of the Challenge, of an otherwise eligible entity which is an accredited institution of higher learning, AND the student is during the Challenge in the United States on a valid student visa and is otherwise in compliance with all local, state, and federal laws and regulations regarding the sale and export of technology.

Team Members must furnish proof of eligibility (including proof of citizenship or permanent resident status, for individuals, and proof of incorporation and primary place of business, for entities) which proof must be satisfactory to NASA in its sole discretion. A Team's failure to comply with any aspect of the eligibility requirements shall result in the Team being disqualified from winning a prize from NASA.

U.S. government employees may enter the competition, or be members of prize-eligible teams, so long as they are not acting within the scope of their Federal employment, and they rely on no facilities, access, personnel, knowledge or other resources that are available to them as a result of their employment except for those resources available to all other participants on an equal basis.

U.S. government employees participating as individuals, or who submit applications on behalf of an otherwise eligible organization, will be responsible for ensuring that their participation in the Competition is permitted by the rules and regulations relevant to their position and that they have obtained any authorization that may be required by virtue of their government position. Failure to do so may result in the disqualification of them individually or of the entity which they represent or in which they are involved.

Teams will be ineligible to win a prize if any Team Member is a 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. No U.S. government funds may be used to participate in the Challenge. Any such entity or individual shall obtain prior written approval from their cognizant ethics officer that such participation does not violate federal personnel laws or applicable agency policy. A copy of this approval to participate in the Challenge shall promptly be provided to Ensemble.

Current employees, consultants, and students of Ensemble may only participate as Team Members when the Team is not competing for a prize from NASA. Participation of such parties as Team Members on a Team will make a Team ineligible for any prize award.

5.3. Insurance and Indemnification

Each Team Member agrees to assume any and all risks and waives claims against Ensemble and the U.S. Government and its related entities, except in the case of willful misconduct, for any injury, death, damage, or loss of property, revenue, or profits, whether direct, indirect, or consequential, arising from each Team Member's participation in the Challenge, whether such injury, death, damage, or loss arises through negligence or otherwise. For the purposes of this section, the term "related entity" means a contractor or subcontractor at any tier, and a supplier, user, customer, cooperating party, grantee, investigator, or detailee.

Team agrees to obtain any and all insurance policies and coverage required by its local, state, or Federal governments to conduct any and all virtual activities related to or required by participation of Team and the Team Members in the Challenge. In addition, Ensemble requires that each Team obtain liability insurance in the amount of $5,000 USD minimum that covers

each Team Member or otherwise demonstrate financial responsibility for that amount. The Team's liability insurance shall provide coverage for all claims by (A) a third party for death, bodily injury, or property damage, or loss resulting from an activity carried out in connection with participation in the Challenge, with the Federal Government and Ensemble named as an additional insured under the Team's insurance policies; and (B) the Federal Government, Ensemble, and its contractors for damage or loss to Government or Ensemble property resulting from or related to Challenge activities. The Team and all Team Members agree to indemnify the Federal Government and Ensemble against third-party claims for damages arising from or related to Challenge activities.

Proof of insurance in such form as reasonably required by Ensemble shall be provided to Ensemble, no later than ten (10) days prior to the Submission Deadline as outlined in Exhibit C of the Eligibility Requirements Document. Alternatively, if Team intends to fulfill this requirement by demonstrating financial responsibility in the requisite amount, Team shall submit to Ensemble in writing such information as demonstrates to Ensemble, in Ensemble's reasonable discretion, that Team has sufficient financial responsibility to cover the potential claims cited in the requisite minimum amount as outlined in Exhibit C of the Eligibility Requirements Document.

5.4. Use of Names, Trademarks, and Insignias

Team may not use the name, trademark or insignia of Ensemble, its contractors, collaborators, or NASA on its printed materials related to the participation of Team in the Challenge without Ensemble's or its contractor's, collaborator's, or NASA's prior written consent, whichever Party is applicable.
Team agrees that unauthorized use of such names, trademarks, and insignias shall result in elimination from participation in the Challenge if Team continues unauthorized use after being notified to cease and desist by Ensemble or NASA, as applicable.

5.5 Delay, Cancellation or Termination

The Competitor Team acknowledges that circumstances may arise that require the Challenge to be delayed indefinitely or cancelled. Such delay or cancellation, and/or the termination of the Challenge, shall be within the full discretion of NASA, and the Team accepts any risk of damage or loss due to such delay, cancellation, and/or termination.