materials found on lunar or Martian surfaces). Teams will be asked to provide a digital core that represents their knowledge and understanding of where each overburden layers are, the general hardness of each different layer, and the thickness of each layer. The total internal depth of the simulated testbed will not exce meter. Teams may drill multiple holes. The water extraction and prospecting system is subject to mass, volume, and power constraints.

In addition to the test and validation portion of the project, teams will present their concepts in a technical poster session to a multi-disciplinary judging panel of sci and engineers from NASA and industry. Poster presentations will be based on the team's technical paper that details the concept's "paths-to-flight" (how the desi be modified for use on an actual mission on the Moon or Mars). This includes, but is not limited to, considerations for temperature differences, power limitation atmospheric pressure differences.

The paths-to-flight description will be broken into two distinct sections:

1. **Water extraction on Mars:** teams will discuss the significant differences between Mars and Earth operation environments and describe essential modifications would be required for extracting water from subsurface ice on Mars.
2. **Lunar prospecting for a digital core:** teams will discuss the significant differences between the Moon and Earth operational environments and describe esse modifications that would be required for prospecting on the Moon.

Based on initial proposals, up to 10 qualifying university teams will be selected to receive a $10,000 stipend to facilitate full participation in the competition, inc expenses for hardware development, materials, testing equipment, hardware, software, and travel to Langley for the competition. Final Scoring will be based o water extracted and collected each day, the accuracy of the digital core, adherence to NASA requirements, a technical paper capturing paths-to-flight, innovatio design, and the technical poster presentation. (http://specialedition.rascal.nianet.org/wp-content/uploads/2020/08/2021-MMIP-Challenge-Scoring-Matrix-8.11.20.pc

Top performing teams may be chosen to present their design at a NASA-chosen event. Subject to the availability of funds, such invitations may inclu accompanying stipend to further advance development of team concepts and to offset the cost of traveling to the event.

Covid-19 Statement: As the coronavirus (COVID-19) situation continues to evolve, NASA and NIA will closely monitor and follow guidelines from federal, stat community officials regarding the onsite competition at NASA LaRC next summer. Protecting the health and safety of team members, staff, and judges is our p priority.

Competition Tasks

Simulated Martian & Lunar Subsurface Ice Test Station

During the on-site portion of the competition, each team will be provided with their own workstation, which will include workbench style tables, chairs, wastebasket, and a test station with the simulated Martian/lunar subsurface ice. A lid/mounting platform with open access to the simulated overburden and subsurface ice will be located directly on top of the test station; this platform will be a staging area for the prototype system.

PB2145 / (35) Cube				
Capacity: (258) Gal/(993) liters/ 35 cu.ft.				
Box Weight: (164) lbs. / (74) KG				
Lid Weight: (38) lbs. / (17) KG				
Dimensions	External		Internal	
	cm	inches	cm	inches
Length:	123	48	110	43
Width	109	43	97	38
Height	120	47	101	40
Height w/lid	125	49		

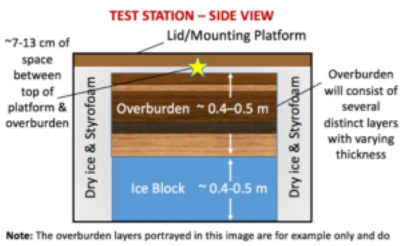
The test station is a large, plastic, insulated ice chest (Bonar ice chest, Model PB2145), consisting of:

The test station is a large, plastic, insulated ice chest (Bonar ice chest, Model PB2145), consisting of:

1. a layer of blocked ice at the bottom
   - this layer will consist of 2 separate ice blocks stacked on top of each other, with a thin layer of water between the two in an effort to facilitate one solid, froz block of ice
   - total ice block dimension = ~ 1 m x 0.5 m (L x W); depth will be between 0.4 m and 0.5 m
2. several layers of differing overburden materials (terrestrial materials of varying hardness that represent possible materials found on lunar or Martian surfaces)
   - Teams can expect to encounter distinct overburden layers and each of these layers will be made up of material taken from the following list (Note: not all o these materials will be used and some of these layers may be in the form of a single block of the same horizontal area as the ice block. Some of the mater may be found in more than one layer)
     - Dry, fluffy play sand with rocky inclusions (between 3"- 6" in diameter)
     - Clay mixed with 20% sand
     - Solid/consolidated stone (i.e., single block of stone)
     - Solid/consolidated aerated concrete (single block)
   - The hardest layer will have an unconfined compressive strength of no more than 25 MPa
   - The total overburden depth (not including the ice) will be between 0.4 m and 0.5 m. The range in depths is intended to simulate the variability in regolith overburden inherent in natural environments and the resulting needed adaptability of the water extraction and prospecting system.
   - The overburden will be filled to the top of the container, however, due to the thickly insulated lids, teams should allow ~7-13 cm of space between the top c mounting platform and the top of the overburden. Teams should expect minor variances in the distance between the mounting platform and the top of the overburden.
3. a lid, which also serves as the system's mounting platform;
   - the lid/mounting platform will have a hole cut out that is equal to the size of the ice blocks beneath it (i.e., the opening will not exceed 1 m x 0.5 m). This hc expose the entire viable drilling area, and only the viable drilling area, so that teams may drill multiple holes as desired without concern for penetrating the ice and/or foam insulation
   - Each team's system will sit on this mounting platform. Two 2'x4' wooden boards will be attached to the lid for mounting purposes (see diagram below)
   - Teams will design solutions that propose the best way to anchor their water extraction and prototyping system to this lid/mounting platform (if asked for anc approved in advance, NASA will assist in customizing your team's mounting platform on-site the first day of the competition)

Note: The overburden will be filled to the top of the container, however, due to the thickly insulated lids, teams should allow ~7-13 cm of space between the top c mounting platform and the top of the overburden.

(Click images to enlarge)



^ Competition Environment & Thermal Management

^ Onsite Competition Operations

^ Prototype Design Constraints & Requirements

^ Eligibility

^ Deliverables

^ Final Scoring

^ Development Stipend

^ Awards & Honors

^ Intellectual Property and Media Release