# Q&A Session #2
November 8, 2023

The Human Lander Challenge is sponsored by NASA's Exploration Systems Development Mission Directorate's (ESDMD) Human Landing System (HLS) Program Office and managed by the National Institute of Aerospace.

AGENDA

- Welcome & Introductions
- Context for the Challenge
- General Remarks
- Questions
- Programmatic Remarks
- Wrap Up

NIA PROGRAM TEAM

National Institute of Aerospace
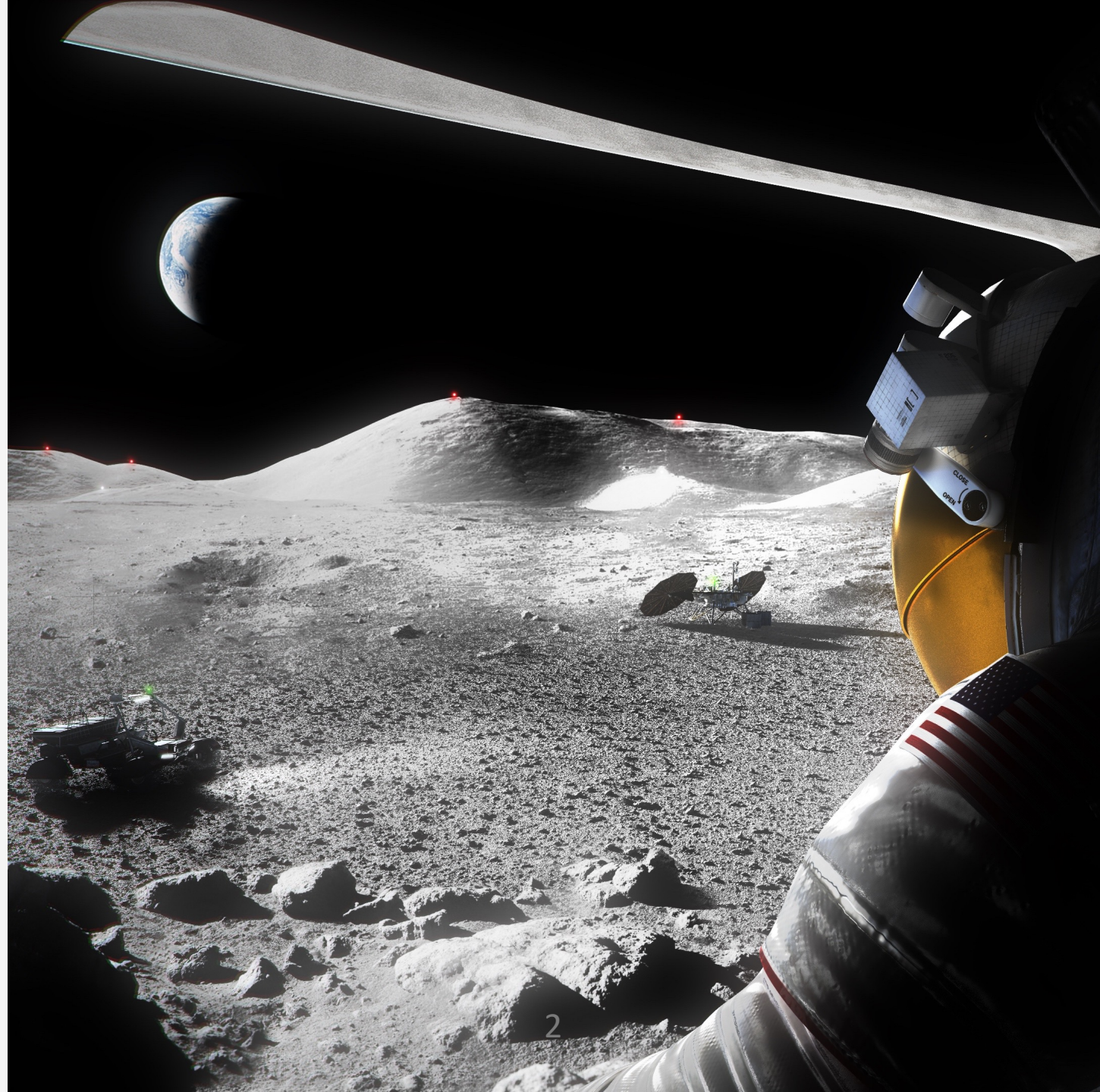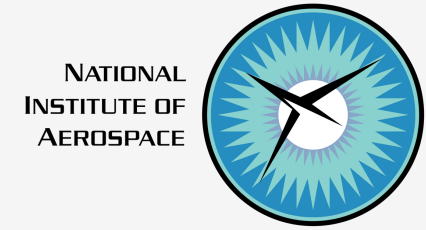
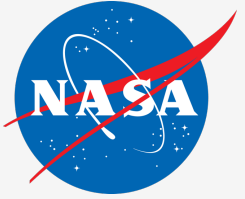**Robin L. Ford** **Victoria O'Leary** **Genevieve Ebarle** **Stacy Dees** **Shelley Spears**

NASA SPONSORS

Esther Lee
Judges' Chair
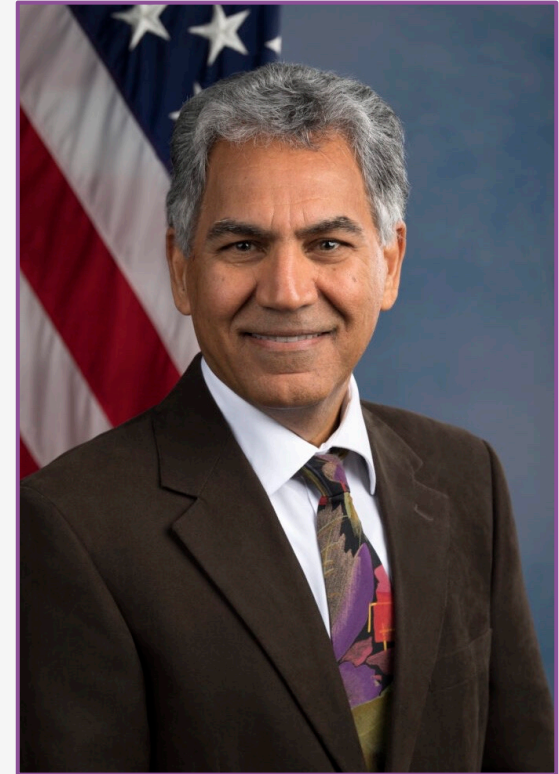NASA's Langley Research Center

Ashley Korzun
Technical Lead
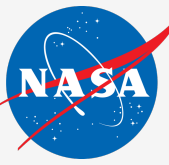NASA's Langley Research Center

Jamshid Samareh
Sponsor
NASA's Langley Research Center

JUDGES

Wesley Chambers
NASA's Marshall Space Flight Center

Lora Dishongh
NASA's Johnson Space Center

Samantha Shine Harris
NASA's Marshall Space Flight Center

Mark E. Lewis
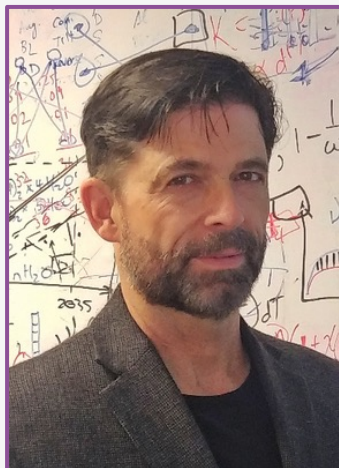NASA's Kennedy Space Center

Manish Mehta
NASA's Marshall Space Flight Center

Philip Metzger
University of Central Florida
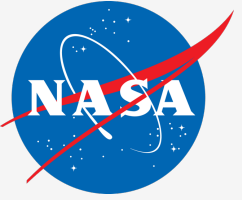
Michelle Munk
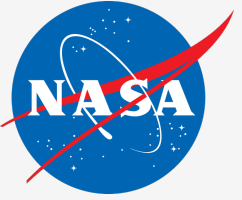NASA's Langley Research Center

Matt Simon
NASA's Langley Research Center

CONTEXT FOR THE HuLC COMPETITION

- Why is NASA sponsoring this competition and what do we hope to get out of it?

- Overview of the Competition Background & Purpose

2024 THEME: MITIGATING THE IMPACTS OF LUNAR PLUME-SURFACE INTERACTION (PSI)

Teams are invited to submit proposals for **innovative, systems-level solutions to understand, mitigate, and manage the impacts of lunar PSI that can be implemented** within 3-5 years.

The potential solutions teams can propose to could include, but are not limited to, the following categories:

- Trade Studies on Landing Trajectories that Minimize PSI
- Reduction / Mitigation of Erosion (Cratering) and Ejecta during Descent, Landing, and Ascent
- Development of PSI Flight Instrumentation / Measurement Methods and Concepts
- Tracking Dust During Descent, Landing, and Ascent
- Instrumentation Performance Through the Dust Cloud During Landing
- HLS Asset Safety (ejecta damage, excessive lander heating, etc.)
- PSI Modeling and Validation

View the complete HuLC Challenge Guidelines PDF

TECHNICAL QUESTIONS RECEIVED IN ADVANCE: HLS PROPRIETARY INFORMATION

o **What does the landing sequence for the HLS look like (e.g., Time frame Positioning, Path)?**
  - Please use publicly available information from NASA and the Human Landing System (HLS) selected providers for characteristics on design and operations of their landers. Trajectories and design details will not be provided but can be approximated through your own flight mechanics simulations.

o **What are the ways in which the lander can receive data given to it by our device?**
  - Teams may assume either wired connections or radio interface to transfer data into the lander. The radio receiving the data onboard the lander would be designed to work with all the payloads on the mission.

TECHNICAL QUESTIONS RECEIVED IN ADVANCE: HLS PROPRIETARY INFORMATION
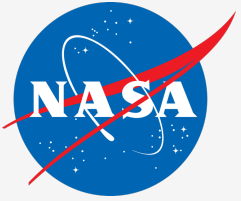
o **Are there restrictions on the type or amount of onboard power sources a device deployed onto the lunar surface can use?**
  - There are no restrictions on the type or amount of onboard power sources a device deployed into the lunar surface can use. Please keep the design constraint of "minimal barriers to NASA adoption" in mind.

o **Can proposed design solutions be implemented to the exterior of the lunar lander? If so, how much space can we use on the outside of the lander?**
  - Yes, please include in the proposal how much space is needed and how it would work.

TECHNICAL QUESTIONS RECEIVED IN ADVANCE: HLS PROPRIETARY INFORMATION
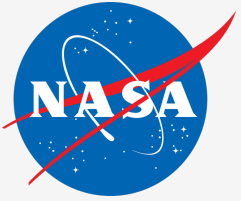
- **Where might a device be attached on the Human Lander so that it could be deployed during the Lander's descent phase? (e.g., What are the specifications of these points of attachment?)**
  - Please use publicly available information on the Human Landing System (HLS) program from NASA to learn more about the two selected lander providers and general characteristics of those systems. Device attachment locations should be carefully considered how it will interfere with the lander operation and other subsystems.

TECHNICAL QUESTIONS RECEIVED IN ADVANCE: STANDARDS & OTHER LUNAR DUST RESOURCES
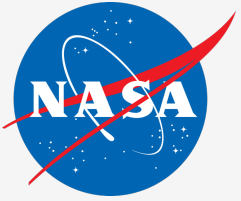
- **Are there any NASA-adopted industry standards we should be aware of?**
  - NASA has a great deal of standards that are constantly being updated for designing, building, testing, and deploying – too many to list here. We recommend doing an internet search, and using the NASA NTRS system to do some research on the specific area you're interested in.

- **Are there any simulations that our team could get a hold of that detail how the surface regolith may respond to the plume of the rocket engines?**
  - Teams should perform a literature search to understand plume-surface interaction effects. Two places to start are this white paper: [2102.12312] Understanding and Mitigating Plume Effects During Powered Descents on the Moon and Mars (arxiv.org) and this presentation: An Overview of Plume-Surface Interaction Testing and Research - NASA Technical Reports Server (NTRS). A detailed description of plume effects during the Apollo landings is found here: https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2010JE003745.

TECHNICAL QUESTIONS RECEIVED IN ADVANCE: STANDARDS & OTHER LUNAR DUST RESOURCES
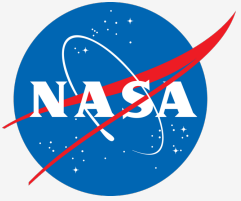
o **How fine is lunar dust?**

- Characterization of the lunar environment, including dust and regolith, is available in SLS-SPEC-159, Cross-Program Design Specification for Natural Environments (DSNE), available from the NASA Technical Reports Server here: SLS-SPEC-159, Cross-Program Design Specification for Natural Environments (DSNE) - NASA Technical Reports Server (NTRS). The Lunar Sourcebook is another valuable resource which is available here: Lunar Sourcebook (usra.edu). Lunar soil is known to have particles as fine as 0.02 microns, which is extremely fine. A paper that measured the ultra-fine particles in lunar soil (finer than 1 micron) is here: https://www.researchgate.net/profile/Kenneth-Kihm/publication/228342547_Characterization_of_Lunar_Dust_for_Toxicological_Studies_I_Particle_Size_Distribution/links/565b44f208aefe619b24339d/Characterization-of-Lunar-Dust-for-Toxicological-Studies-I-Particle-Size-Distribution.pdf

# TECHNICAL QUESTIONS RECEIVED IN ADVANCE: OUT OF SCOPE
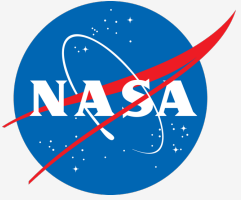
o **What are the requirements for physical and data interfaces with the rocket and any other onboard systems?**

  - Interfacing with the rocket is beyond the scope of this challenge.

o **Is NASA interested in PSI only during landing and takeoff? Does it anticipate additional lunar transport facilities that carry valuable resources from near-by lunar surface to these 13-candidate landing zones?**

  - PSI is the focused topic for this competition. Additional lunar transports that does not experience PSI is beyond the scope of this challenge.

o **Are there any protocols or standards for data encryption and security for communication between the Human Lander and a device deployed onto the lunar surface?**

  a. Data encryption and security is beyond the scope of this challenge.

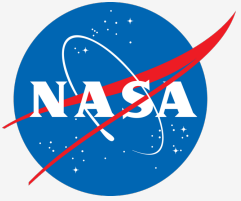# TECHNICAL QUESTIONS RECEIVED IN ADVANCE: OTHER CLARIFYING QUESTIONS
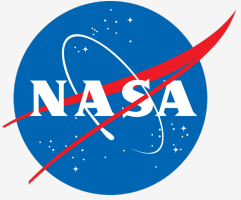
o **Should our design be limited to implementation on HLS, or should we consider other applications such as CLPS missions?**
  - Designs can be considered for HLS and/or CLPS applications.

o **In the Proposal Evaluation Criteria section, what do you mean by "solution to PSI with system-level impacts?" Does the "system" refer to lunar assets already present in those regions, or does it refer to various components of PSI mitigation strategy we propose?**
  - "System" refers to the lunar assets and/or the whole lander. Consider presenting the impact of the design solution to how it may affect other subsystems in the vehicle or overall lander performance.

TECHNICAL QUESTIONS RECEIVED IN ADVANCE: OTHER CLARIFYING QUESTIONS
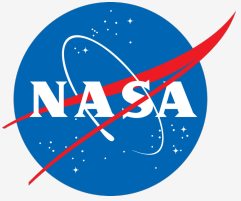
o **Under Pg. 9 in the competition Guidelines document, it states, "Proposals should include - "Realistic technology assumptions, including realistic NASA technology Readiness Level Definitions and justifications where appropriate." It is not clear what the document in the link explains about. How should we use it in our proposal?**

- We encourage you to read more about NASA Technology Readiness Levels (TRLs) at the following links to aid your proposal justification:
  - ✓ NASA Technology Readiness Levels
  - ✓ Technology Readiness Level (TRL) as the foundation of Human Readiness Level (HRL)

PROGRAMMATIC QUESTIONS RECEIVED IN ADVANCE

o **Do prototypes (physical prototypes that require hardware/experimental setups) need to be completed by the March 4 proposal submission deadline?**
  - No. Prototypes are optional, and finalist teams who design/build prototypes should plan to bring them to the onsite Forum in June to demonstrate during their presentation and the poster session.

o **Since the NOI is non-binding, can I add/remove/replace team members and mentors?**
  - Absolutely! You can make most changes without contacting us, but if your team leads or primary faculty advisor change, please send their updated name, email, and phone number to HuLC@nianet.org so we can update your team's contact information.

PROGRAMMATIC QUESTIONS RECEIVED IN ADVANCE
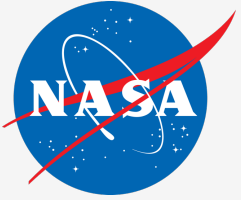
o **If we have any queries along the way, until the deadline, whom can we contact?**

- If you have any additional questions, please reach out to the HuLC Program Team at HuLC@nianet.org and we will get a response for you from the appropriate person. All questions and their answers are ultimately posted to the HuLC FAQs webpage. We try our best to remove information that could give away a team's unique concept or design.
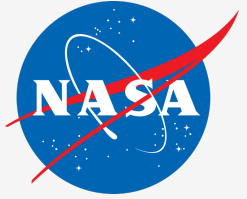
ADDITIONAL QUESTIONS?
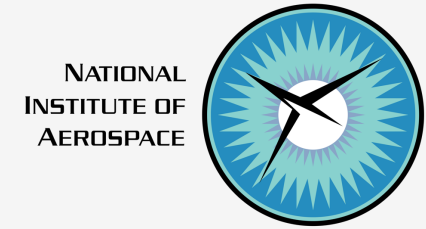
Please use the "raise the hand" function to ask questions or enter them in the chat.

We will call on participants to unmute your mic and ask questions, one at a time.

HvLC
HUMAN LANDER CHALLENGE

PROPOSAL & VIDEO EXPECTATIONS

- **What are we looking for in the 5 to 7-page proposal?**
  - Clearly articulate the innovation and design being proposed
  - YOU are selling your proposed concept to the judges!
    - Include enough details to give them confidence that your proposed concept has merit
  - Budget Assessment
    - A realistic budget assessment (including an assessment of cost margin) and an explanation of your assumptions. Use of NASA **costing tools** is strongly encouraged.
  - Balance of Innovation and Feasibility
  - Find a balance between sound technical analysis and revolutionary concepts. Innovation will be rewarded, and is highly desired, but not at the expense of fundamentals.
  - Reminder: Faculty advisors must sign the proposal for submission to be valid

- **What are we looking for in the 2-minute video?**
  - The intent is for the video to augment each team's proposal by including animation, graphics, or other creative ways of showcasing unique aspects of their proposed concept.
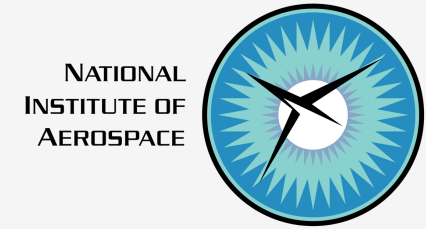
RESOURCES
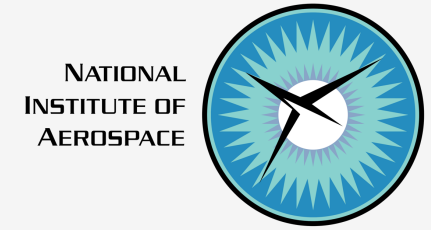
Please check out our extensive **Resources** page on the website for useful tools and information that will support your proposal development.
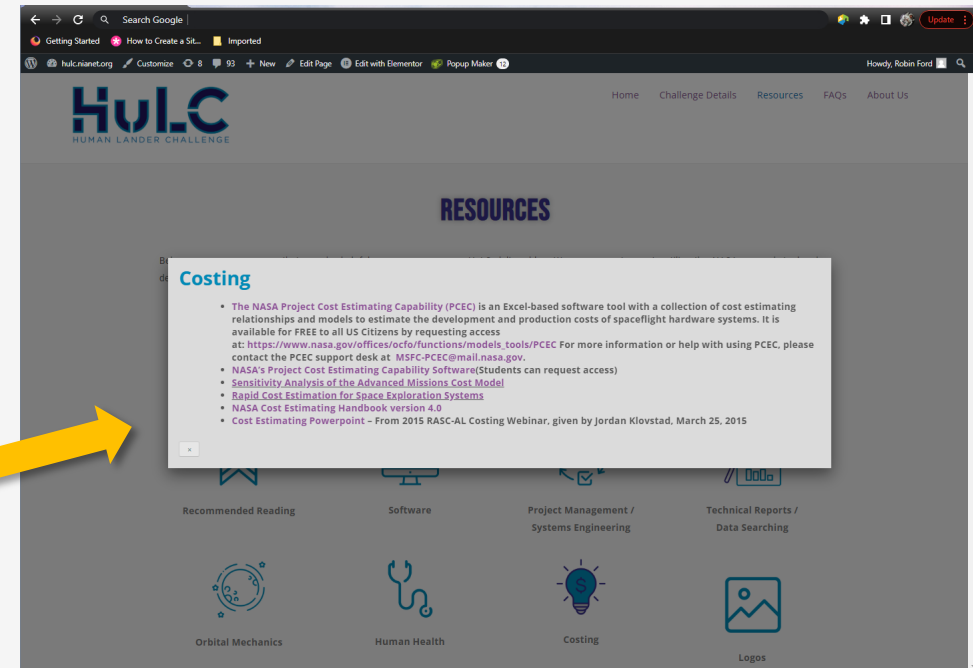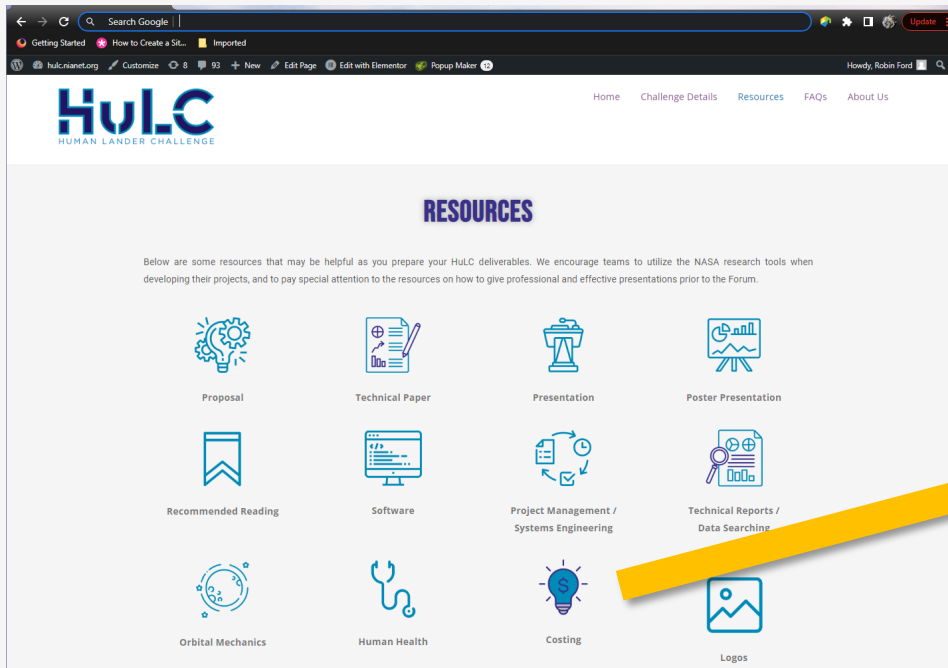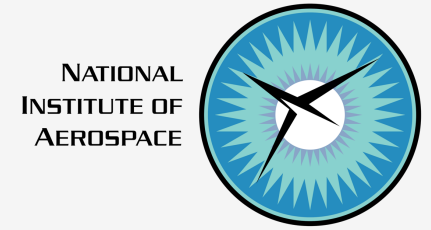
PROGRAMMATIC REMARKS

- Eligibility requirements:
  - **At a minimum, teams must contain one (1) faculty advisor at an accredited U.S.-based academic institution, and two (2) students from that institution** who work on the project and present at the HuLC Forum in June 2024. There is no limit to the number of students who participate throughout the year on a team.

  - A faculty advisor is **strongly encouraged** to attend the Forum with each team.

- Multi-disciplinary teams are encouraged!

Next Deadline:
⬇

Proposal & Video Submission Deadline (March 4, 2024)

Teams Notified (March 29, 2024)

Technical Paper/Demo Deadline (June 5, 2024)

Presentation & Digital Poster Deadline (June 24, 2024)

FAQs

- **Are international students allowed to participate?**
  Eligibility is limited to universities in the United States. **Foreign universities** are not eligible to participate in the HuLC competition.

  Foreign Nationals attending the proposing U.S.-based university can fully participate on a HuLC Team, and at the HuLC Forum, with several notable exceptions. *Please refer to Page 7 of the **Challenge Guidelines*** *for full information.*

- **Can we work with industry, either formally or informally?**
  Working with industry in a small capacity is acceptable, as long as this remains a student project with the students doing the bulk of the work. Teams can work with industry to receive mentorship, sponsorships, donations (cash or materials/supplies), or in-kind use of testing facilities.

- **Can we have a technical advisor who works for NASA?**
  No. Teams are not permitted to use technical advisors who work for NASA, either as civil servants or contractors.

For a complete list of FAQs, visit https://hulc.nianet.org/faqs.
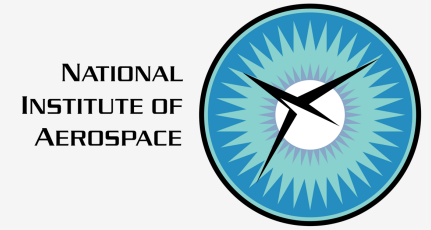
FUTURE QUESTIONS?

Email all questions to: HuLC@nianet.org

• Each question will be responded to directly, as well as posted on the website (FAQs) for everyone to see.

• **Please do not contact the judges directly!**

We encourage you to visit the website frequently for updates: https://HuLC.nianet.org

View the complete HuLC Challenge Guidelines PDF

** Guidelines Change Log **
located on Page 2 at the bottom of the TOC

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HUMAN LANDER CHALLENGE