NASA's 2027 Human Lander Challenge Q&A Session Summary Document

NASA's 2027 Human Lander Challenge Q&A Session will be held on Monday, Nov. 16, 2026, from 3 – 4:30 p.m. EST. Questions and answers from that session are included below.

If you have additional questions, please reach out to HuLC@nianet.org for a response. Questions received after the Q&A, and their responses, will be posted to the FAQs Webpage for public awareness.

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QUESTIONS RECEIVED IN ADVANCE: HARDWARE CATEGORY

1. **Are teams expected to develop both an antenna-system concept and a predictive propagation model, or may a solution emphasize one area while still addressing the complete communication system?**
    a. Teams are not necessarily expected to develop both. However, the recommendation is to provide a solution that demonstrates how your system addresses challenges posed by terrain, regolith, dust, and thermal extremes. Think of "how am I addressing the problem?" and "how can I demonstrate my solution?"

2. **Is it acceptable to use primarily existing antenna/RF technology if the innovation comes from its system-level application, environmental protection, mobility, or propagation modeling?**
    a. Yes, using existing technology is appropriate, as long as your innovation is clearly highlighted.

3. **Besides accounting for the ability to transport our system to space and its survivability in the space environment, are there additional physical hardware requirements that our design must meet?**
    a. No, but clearly state your assumptions, needs, and/or limitations. Take into consideration having minimal barriers for NASA adoption (e.g., low mass, small size, low power, etc.). Refer to the HuLC Recommended Reading on the Resources webpage.

4. **For a mobile surface relay intended to overcome terrain shadowing, should the relay primarily extend local communications between surface assets and the human landing system (HLS) lander, interface directly with LunaNet/LCRNS, or may teams select and justify either architecture? Which communication links should teams prioritize: surface-to-surface, surface-to-orbit, surface-to-Earth, or a combination of these links?**
    a. In all lander RF communication systems, crew voice communications are always given the highest priority. General link prioritization can be driven by operational criticality, lunar topography/geometry, and link availability. Justify the architecture you choose. Refer to the HuLC Recommended Reading on the Resources webpage for content regarding communication prioritizations.

5. **We are using off-the-shelf Raspberry Pi computers. Would this phase's proposal need to include a plan for space rating those or moving to other hardware that's on a known to work devices list or would the focus stay on configuring the network architecture?**
    a. A plan addressing space rating could be appropriate rather than using known devices. All these options are not mutually exclusive.

6. **Are there reference mass, power, volume, or delivery assumptions that teams should design against, such as delivery by an HLS or CLPS (Commercial Lunar Payload Services) lander?**
    a. Proposals should provide innovative, system-level solutions to understand, establish, and optimize lunar communications systems primarily revolving around HLS crewed and cargo landers.

7. **Is there a specific range for data transmitting speed or bandwidth size that would be preferred for this mission and will power consumption be a significant factor to consider for the communications from larger nodes like a main habitat? Or smaller nodes?**

a. Refer to the HuLC Recommended Reading on the Resources webpage for information regarding speed or bandwidth requirements. Bandwidth, range, and latency requirements can be determined by mission needs and capabilities such as the number of astronauts, rovers, habitats, or lunar landers for lunar communications. Clearly state your assumptions. It is good practice to address power consumption.

8. **For teams utilizing software-heavy solutions/tools, what is the limit for power consumption and also for processing speed/delay on a lander that we can acceptably assume?**
    a. Limits can be determined by mission needs and capabilities such as bandwidth, range, and latency requirements and the number of orbital and/or surface assets. Clearly state your assumptions based on references and analysis.

9. **What level of model accuracy is expected when predicting quantities such as received power, path loss, coverage area, link margin, or communication availability?**
    a. Predictive models may provide a "reasonable margin" of accuracy. Research previous studies, review NASA standards, and remember to state your assumptions. Recommendation is to clearly state the validation methods for your models.

10. **Should teams independently select and justify their communication frequency, data rate, transmitter power, antenna gain, link margin, and allowable outage duration?**
    a. Yes.

11. **Would regolith-simulant testing with before-and-after optical-link measurements support Phase 1 validation, and what vacuum, thermal-cycle, radiation, or other environmental evidence is expected?**
    a. Regolith-simulant testing would be an acceptable demonstration of hardware capabilities. Focus on link optimization and mitigating the effects of space and/or lunar environments.

12. **Can a solution target the operating conditions of a specific lunar region, such as the south pole, while accounting separately for environmental survival requirements? Or should teams demonstrate functionality across the full temperature range?**
    a. Both of these options are acceptable. Keeping alignment with the recommended assumption of 3 to 5 years targeted use, immediate needs are in the lunar South Pole region. However, proposals are not strictly excluded from targeting other lunar regions, provided the proposed mission architecture directly justifies the alternative site. State your assumptions.

13. **The guidelines specify at least 30 continuous days of uninterrupted surface coverage. With this, how should teams evaluate temporary line-of-sight obstructions and handoffs? Can we assume other communication assets in place as backups?**
    a. 30 continuous days of uninterrupted surface coverage is a design constraint (or target) to emphasize extended surface operations, particularly with crew members, or astronauts. Consider reducing line-of-sight obstructions or handoffs with backups.

14. **What physical effects should the predictive model include beyond line of sight and free-space path loss, such as terrain diffraction, multipath, regolith properties, dust accumulation, antenna orientation, or temperature-dependent performance?**
    a. An end-to-end predictive model should address physical effects, such as the examples listed above. Consider designs that mitigate signal interference.

15. **If surface communication hardware is stowed during landing and deployed only after touchdown, should it still be designed for direct exposure to landing- or ascent-plume-driven regolith, or may teams address only post-landing deployment?**
    a. Consider how plume-surface interactions (PSI) may or may not interfere with post-touchdown deployment and link reliability and/or performance. Explore and state your methods of mitigating direct exposure to landing- or ascent-plume-driven regolith if teams only address post-landing deployment.

16. **Should the predictive model function as an offline design tool, a real-time operational tool for antenna pointing and relay placement, or both?**
    a. There are unique benefits to having predictive models function in either or both use cases.

17. **What forms of model validation are considered sufficient, such as comparison with published research, analytical calculations, RF testing over representative terrain, or scaled laboratory experiments?**
    a. Prototypes or laboratory experiments are entirely optional for teams. Teams are not expected or required to build or bring models, and proposals are not evaluated based on whether a physical model is provided. Model validation can be accomplished through computer-aided or in-lab simulations and testing, if preferred. Using published research and analytical calculations should strengthen your model validation and conclusions drawn.

18. **Which NASA datasets or models should teams use for lunar dust deposition, electrostatic behavior, optical-surface degradation, and resulting communications losses?**
    a. Teams are encouraged to research their own models based on published research such as that which is found in Chapter 5.0 Communications Antennas and Electronics in Lunar Dust Mitigation: A Guide and Reference: First Edition (2021). An example of a NASA dataset publicly available is LADEE Lunar Dust Experiment (LDEX) Data. Unique team conducted analysis can be substituted for NASA provided datasets or models.

19. **For the 30-day operating requirement and ideal five-year hardware life, what combination of short-duration testing, accelerated testing, environmental analysis, and comparison with existing systems is considered sufficient verification?**
    a. Use best judgement for meeting the constraints of uninterrupted surface coverage for at least 30 continuous days and ideal hardware lifespan of at least 5 years. Recommendation would be researching NASA standards on qualification by similarity such as NASA-STD-7002, Payload Test Requirements, or producing and suggesting a tailored Verification and Validation approach using a combination of the above. See also the response to Question #17.

QUESTIONS RECEIVED IN ADVANCE: SOFTWARE CATEGORY

1. **Are specific communications protocols, data-transfer standards, or RF frequencies required or recommended for lunar communications designs?**
    a. There are various communication standards that students can reference, but none are prescribed. Refer to the HuLC Recommended Reading on the Resources webpage for information regarding existing analysis.

2. **Since the goal is to deploy within 3-5 years, do you prefer that we stick closely to established frameworks like LunaNet and standard 3GPP protocols, or is NASA looking for teams to propose new, custom compression and modulation methods for lunar terrain? Can proposed solutions assume that the plan for LunaNet is still current and rely on, or possibly interact with, architecture like LunaNet or similar architecture to be implemented?**
    a. Either option is acceptable. Adjustments are permitted from the targeted use of 3-5 years if accompanied by strong engineering rationale such as proposing new, custom compression and modulation methods that may require more time.

3. **Which hardware/software interfaces and interoperability requirements should teams prioritize to ensure compatibility with current or planned NASA systems?**
    a. Interfaces change based on mission scope. Recommendation is to optimize interfaces between targeted orbital relays and/or surface assets like astronauts, rovers, habitats, and other lunar landers on the lunar surface. Proposals should primarily revolve around HLS crewed and cargo landers. Clearly state your assumptions. Refer to the HuLC Recommended Reading on the Resources webpage for content regarding mission requirements.

QUESTIONS RECEIVED IN ADVANCE: ARCHITECTURE CATEGORY

1. **If our design uses off-lander elements like surface relay towers or small sat constellations alongside hardware on the lander itself, how will the judges balance the mass/power penalty on the solution against the extra cost and complexity?**
    a. Proposals should primarily revolve around HLS crewed and cargo landers and be designed for deployment on or integrated with NASA/commercial HLS. Take into consideration how you are transporting and deploying surface or orbital relays and how that could integrate with HLS.

2. **May teams assume lunar relays, LunaNet services, and Earth ground stations will be available within 3–5 years, or must they model the full surface-to-Earth path?**
    a. Yes, however, timeline adjustments are permitted if accompanied by strong engineering rationale. Be sure to clearly document ground rules and assumptions.

3. **Would the challenge require the use of NASA recommendations or constraints for the architecture, or would a system using exclusively layer 2 meet the challenge's requirements?**
    a. Proposals should research, but are not required to use, NASA recommendations or constraints for the architecture.

4. **Are satellites planned to be placed in the Moon's orbit? If so, what frequency and which orbit does NASA plan to operate these in?**
    a. Research into NASA Lunar Communications and Navigation Systems (LCRNS) publications are available on the HuLC Recommended Reading on the Resources webpage for content regarding orbits.

5. **For our proposal, how much end-to-end architecture, link-budget analysis, and lander/surface-network integration detail is needed to demonstrate meaningful system-level communications benefits?**
    a. Proposals should clearly highlight and demonstrate integration efforts between HLS landers and the team's proposed concept.

6. **Would an optical-aperture dust-mitigation solution fit HuLC's lunar communications scope if it quantifies end-to-end benefits, or should concepts prioritize RF propagation or network architecture?**
    a. Innovative concepts that go beyond the potential solutions areas included in the Challenge Description and Proposal Subtopics are acceptable as long as the proposed communications systems primarily revolve around HLS crewed and cargo landers.

QUESTIONS RECEIVED IN ADVANCE: MISCELLANEOUS

1. **Is there a target TRL that we should aim for in our proposed concept?**
    a. Proposals should reflect the actual Technology Readiness Level (TRL) of their concept and indicate a maturation plan to obtain Flight Qualification.

2. **Are teams expected to address communications across multiple mission phases, or is it acceptable to focus on one specific scenario, such as communications between a lunar lander and a rover operating behind terrain obstructions near the lunar south pole?**
    a. Teams have the flexibility to focus on any mission phase(s) in their proposal. The proposal should clearly document any ground rules and assumptions made.

3. **(A) Which NASA standards or recommended practices should teams follow, and (B) how much does demonstrated compliance influence judging?**
    a. NASA has developed several technical volumes and handbooks. Some core resources would be NPR 7120.5, NPR 7123.1 and the 7000 series handbooks/standards. Refer to the HuLC Recommended Reading on the Resources webpage for the libraries to find these resources.

    Judging is based solely on the published evaluation criteria. The 2027 HuLC Phase 1 Scoring Matrix (found on page 13 of Guidelines) is a valuable resource for teams to review to understand exactly how the proposals will be evaluated, including point-value assessment for each evaluation criteria. Compliance is included as part of the Technical Management criteria, specifically "Adheres to all HuLC Guidelines."

4. **Is there a preferred lunar region, landing site, or terrain dataset that NASA recommends teams use as a reference case for surface communication and propagation analysis? If not, should teams select a representative site and justify that choice?**
    a. Keeping alignment with the recommended assumption of 3- 5 years of targeted use, immediate needs are in the lunar South Pole region. However, proposals are not strictly excluded from targeting other lunar regions, provided the proposed mission architecture directly justifies the alternative site. State your assumptions. There are several NASA lunar terrain data sets available online such as found in the NASA Open Data Portal.

5. **How detailed must cost estimates and technology-readiness-level progression be to demonstrate credible implementation within 3–5 years?**
    a. NASA has developed cost modeling tools that are informed by Technology Readiness Levels (TRLs). Those tools are available to the public.

6. **For a distributed or mobile communication system, what is meant by "uninterrupted surface coverage for at least 30 continuous days?" Can individual nodes reposition or temporarily go offline as long as the overall communication service remains continuous?**
    a. 30 continuous days of uninterrupted surface coverage is a design constraint (or target) to emphasize extended surface operations, particularly with astronauts. It is acceptable for individual nodes to reposition or temporarily go offline as long as continuous communication is maintained with the HLS crewed lander.

7. **What level of environmental fidelity is expected for testing and validation when fully reproducing lunar conditions may not be feasible? Are combinations of simulation, benchtop testing, and subsystem testing acceptable if their limitations are justified?**
    a. Use best judgement on the level of environmental fidelity teams can produce. Using a combination of simulations and testing is acceptable. Clearly state your assumptions and limitations.

8. **Given existing dust shields and link monitoring, what evidence would best establish our project's innovation: novel control logic, superior measured performance, architecture, or another new capability?**
    a. All proposals and solutions presenting novel innovations are acceptable. Potential areas include, but are not limited to, the subtopics listed in the Challenge Description and Proposal Subtopics in the Phase 1 Guidelines.

QUESTIONS RECEIVED IN ADVANCE: PROGRAMMATIC

1. **Are we expected to have a tested physical hardware solution by the end of Phase 1/for Phase 2 or is a simplified model/simulation enough?**
    a. Models and simulations are acceptable. Physical prototypes or laboratory experiments are entirely optional for teams. Teams are not expected or required to build or bring models, and proposals are not evaluated based on whether a physical model is provided.

2. **Is a physical prototype required by the March proposal and video deadline, or are simulations and engineering analysis acceptable? Does prototype maturity affect judging? Are physical models allowed at the Forum?**
    a. Physical prototypes are not required at any stage of the competition. Teams may support their proposals with simulations, engineering analyses, renderings, or other technical evidence, and these approaches are fully acceptable.

       Prototype maturity is not a judging criterion, and teams are not evaluated based on whether they have built a physical model. At the Forum, teams may choose to use physical models, simulations, videos, graphics, or other visual aids to help communicate their concepts, but none of these materials are required.

3. **In the guidelines it states if any information other than calculations and references are in the appendices of the proposal it may be disqualified. Would having simulations in the appendix be means for a disqualification?**
    a. Yes. Simulations should be included in the body of the proposal or in the 2-minute video if they're important enough to include in your submission.

4. **It is common practice to spell out all acronyms the first time they are stated within a paper. Is it an expectation that NASA also be included under this precedent?**
    a. No – the judges will know what you mean by "NASA."

QUESTIONS RECEIVED ON-CALL

1. **Hardware Category: Should deployment of the network be considered as if there is no infrastructure before landing on the lunar surface, as if we're building it from scratch, or as if there are already a set of nodes established in a lunar base station?**
    a. There may be some nodes that are available already on the lunar surface or in orbit. State your assumptions. Also, look into LCRNS and see if that's something you'd like to implement in your proposal. Mission scopes can change, so it's challenging to definitively say if infrastructure will be there ahead of time – it depends on when you're targeting to be on the surface within that 3–5-year requirement.

2. **Hardware Category: How much data should we expect to be moving back and forth (bandwidth)?**
    a. That's completely dependent on what capabilities you're looking for. If you're looking to transmit ultra-high-fidelity video, your bandwidth needs will increase. Needs are also dependent on what other lunar surface assets require – like suits and habitats – so make a calculated estimation on how many of those assets will require bandwidth. Review the HLS RF ConOps, because there is information in there that might point you in the right direction.

3. **Software Category: What is the protocol for submitting key files in simulations used (GitHub, zip containing files), or should we just include brief explanations in text? What avenue should be utilized during the proposal submission?**
    a. If you have key information from simulations that you'd like to include in your proposal, it needs to be included in the body of the proposal text or in the required proposal video. Additional project files or links will not be accepted.

4. **Hardware Category: Is it safe to assume that the data transfer speed currently available for communications on the moon is in the resources link that was sent (HLS RF ConOps)?**
    a. Not necessarily. Do some research into what you would safely assume is the data transfer speed that is required, but I would also look at the type of technologies you're looking at. RF, depending on what band you use, has different speeds. 3GPP, cellular wireless, and Wi-Fi can also have different speeds. So, I would definitely do some research on the technology that you're going to use and use that for your proposal.

5. **Hardware Category: What is the expectation for power supply? Should we plan to have the module generate its own electricity or have it run off a rechargeable battery system when away from the habitat?**

a. Either system is acceptable. If you generate your own power, consider the power regeneration tools you're using, whether it's solar or other systems. It's also acceptable to use any system that is going to be available on the surface. Finally, look at NASA's latest project into nuclear and see what sort of power options we're looking at. Your selection will depend on what component you are using, and if it's going to be mobile or permanent.

6. **Architecture Category: Are we able to assume that you can use the Chinese satellites already in orbit around the moon for communication?**
    a. No.

7. **All Categories: NASA is currently developing an FSPR, or Fission Surface Power Reactor for LSP. Could we assume that will be in place within 3–5-years to five years, or should we should rely on other power sources?**
    a. Yes, you can have that as an assumption. Whether or not a specific technology planned within 3-5 years actually happens is outside of your proposal's control, but you can include those assumptions in your proposal.

8. **Architecture Category: Can we assume that direct-to-device orbital assets will be in place in the next 3-5 years, or can we only rely on HLS lunar orbital assets?**
    a. Yes, you can make that assumption - just make sure you clearly state it in your proposal.

9. **Hardware Category: Will we be given any specific thermal data or profiles to use for analysis of the system?**
    a. For HLS specifically, probably not. I would recommend looking at the natural environment spec sheet that SLS posted (DSNE) and do your own analysis and research in that area.