2025 Human Lander Challenge (HuLC) Deliverables for Finalist Teams

This document contains specific information for Deliverables for Finalist Teams competing in NASA's 2025 Human Lander Challenge (HuLC).

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CHANGE LOG:

- *Any changes made to this document after first publication will be recorded here.*

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Deliverables for Finalist Teams

Teams selected to receive funding and attend the onsite Forum are responsible for the following Project Deliverables, all of which must be releasable to the public with no copyrights asserted:

- 10-15-page Technical Paper
- Technical Poster (for Poster Session conducted during HuLC Forum)
  - Both paper and digital poster files will be required. Teams must submit a digital poster file AND bring a full-size printed poster for display during the Forum's poster session.
- 25-minutes presentation, with an additional 20-minutes of Q&A at the HuLC Forum.
- (Optional) Prepare a Prototype / Capability Demonstration to present at the HuLC Forum

Technical papers, presentations, and posters will be posted and archived on the HuLC Website, and technical papers may be submitted through NASA's Technical Report Server (NTRS). All work published to the HuLC website may be referenced by others, including future HuLC participants.

Submitting teams pledge that the team is the sole author of the submission, that the submission is wholly original, that it does not infringe on any copyright or any other rights of any third party of which the team is aware, and that the electronic proposal and video submission are free of malware. Teams may not have any portion of their submissions created by non-team members, which includes the use of tools such as Generative AI.

Dates and Deadlines

All deadlines must be met by 11:59 p.m. (midnight) ET on the date specified below, unless otherwise indicated.

Date	Description
March 3, 2025	*Deadline to Submit a Proposal Package*
April 3, 2025	*Teams Notified of Selection Status*
May 12, 2025	Deadline to Register and Pay for the HuLC Competition Forum
May 12, 2025	Deadline to Make a Hotel Reservation at the HuLC Group Rate
May 28, 2025	Deadline to Submit a Technical Paper & Optional Prototype Demo Info
June 3, 2025	Teams Notified of Prototype Approval Status
June 20, 2025	Deadline to Submit Presentation Chart Deck and Technical Poster Files
June 23, 2025	Team Check-In and Networking Event at the 2025 Human Lander Challenge Forum
June 24-26, 2025	2025 Human Lander Challenge Forum in Huntsville, AL

Technical Paper Guidelines

Technical Paper Submission Deadline: 11:59 p.m. (midnight) ET on May 28, 2025

Technical Paper Content

Finalist teams will develop a 10-15 page technical paper that includes the following sections, at a minimum, in order:

1. **Cover Page** (excluded from page limitation), which must include:
   a. University/College name (Including any partners)
   b. Project title
   c. Full names of all team members with Academic Level (graduate or undergraduate) and Major
   d. Faculty/Industry advisor's full name(s)
   e. Graphic Representation or Image of your concept

2. **Quad Chart** (excluded from page limitation) - Please download and use the HuLC Quad Chart Template found on the "Technical Paper" section of the *Resources* page. Quad charts must address:
    a. The team's major objectives and technical approach to the problem being addressed in their chosen cryogenics category
    b. An image/graphic of part or all of the concept
    c. Key design details and innovations of the concept
    d. A summary of schedule and cost for the proposed solution's path to adoption
3. **Table of Contents** (excluded from page limitation)
4. **Body of Report** (10-15 pages)
    a. Summary Statement/Executive Summary (Max of 150 words): An updated overall summary of the innovative solution, including the project title, a synopsis of the specific cryogenic challenge being addressed, an overview of the proposed solution, and a statement of the impact the innovative solution will have on lunar exploration goals.
    b. Project Description
        i. Describe in more detail the specific cryogenic challenge, the solution to the challenge, and the objectives it is trying to achieve.
        ii. Adherence to design constraints and guidelines, including but not limited to:
            1. Minimal barriers to NASA adoption (e.g., low mass, small size, low power, etc.)
            2. No additional risks posed to crew
            3. Ability to survive launch loads
            4. Must have a mission operational life of multiple months
            5. Targeted use on the Moon near-term (within 3 to 5 years)
        iii. Note any changes made since the proposal; provide detailed information about the work conducted in various trades, concepts, and mission constructs.
        iv. Innovative approaches/capabilities/technologies
        v. Supporting original engineering analysis and justification of assumptions
    c. Verification and Validation of the solution
        i. Detail the solution verification and/or testing approach, including what tools or equipment was used to attempt to prove your analysis was correct.
        ii. Detail any obstacles or issues with development, and how they were mitigated.
    d. Realistic technology assumptions, including realistic NASA Technology Readiness Level Definitions and justifications where appropriate
    e. Mass and size estimates (as appropriate)
    f. Proposed path-to-flight project timeline for Development, Test, and Evaluation (DT&E) of proposed solution – assuming a mission to the Moon in the next 3-5 years
        i. Detail any scaling of the technology and test results that will be required and the methodologies that are planned to scale the results for full scale applications.
    g. A realistic budget assessment (including an assessment of cost margin and annual operating costs) and **an explanation of the assumptions**. Use of analogs and NASA costing tools is strongly encouraged.
        i. Note: A Realistic assessment of costs includes technology maturation, system development, mission infusion/adoption, integration, and operations (as appropriate).
    h. Full concept/mission architecture timeline
    i. Conclusions and key findings supporting the envisioned approach.
        i. Defend your design/approach/concept in terms of VALUE in the areas of potential mission / system impacts, technology readiness, affordability, programmatic implementation, and risk.

5. **Appendices,** if needed (excluded from page limitation)
    a. Appendices are to be used for references and calculations ONLY. There is no preference in citation format, but references must be formatted uniformly and correctly. Providing a link alone is not acceptable.
    b. **Judges are not obligated to look at the appendices.** Include important details (figures, images, graphs, charts, etc.) in the body of your paper to ensure they are reviewed.

Technical Paper Formatting Instructions

- Papers should be single spaced and formatted as a single column.
- Margins should be a standard 1" (2.54 cm) all the way around (top, bottom, left, and right).
- 10 pages minimum; 15 pages maximum
    - The Cover Page, Table of Contents, Quad Chart, and Appendices do not count toward the minimum or maximum page limits.
        - **Quad Chart** (please use the HuLC Quad Chart Template found on the "Technical Paper" section of the *Resources* page)
    - **Appendices are to be used for references and calculations ONLY.** There is no preference in citation formatting, but references must be formatted uniformly and correctly. Just listing a link to the source is not acceptable.
        - Note: **Judges are not obligated to look at the appendices.** Include important details in the body of your paper to ensure they are reviewed.
- Use fonts common to Macintosh and PC platforms, e.g.: Aptos, Times, Arial for text; Symbol for mathematical symbols and Greek letters.
- Font size should be at least 11pt (including in all tables, charts, and graphs). **Any text smaller than this, including text in graphics or charts, may not be reviewed by the judges.**
- Technical papers must be submitted as PDF files.

Submitting The Technical Paper (Due at 11:59 PM ET on May 28, 2025)

To upload your team's Technical Paper (.pdf file), please visit the *Challenge Details* page on the HuLC website to visit the Technical Paper submission form. No revisions can be accepted after submission, so please proof your Technical Paper file very carefully before submitting it. If there are any technical problems with the content of your paper (for example, your file was corrupted), we will try to contact you immediately, so it is important that you provide us with up-to-date contact info on the submission form.

Late submissions will not be accepted, and the submission form will close promptly at midnight. Files must be submitted by the deadline using the online form. ***Revisions to these files will not be accepted after the deadline – no exceptions.***

The following information will be collected on the Technical Paper Submission Form:

- Lead University/College name
- University/College or industry partners, if any
- Project title
- Contact information for primary faculty advisor & two student team leads
- (Optional) Contact info for any additional advisors, if applicable (optional)
- 2 – 3 sentence concept synopsis (600 characters or less)

- PDF Technical Paper file (Max 100 MB)
- PDF file for Faculty Advisor Approval Attestation using the provided template
  - *Note:* Submissions without a valid Faculty Advisor Approval Attestation will be deemed non-compliant and will not be reviewed.
- Two High Quality Photo/Graphics
  - Each team must upload two high-quality photos or graphics (minimum 300 DPI), for use when mentioning your team's participation in HuLC. These photos/images may be used by NASA, or on websites, in news releases, in social media posts, in promotional material, in NASA reports, etc.
    - The first upload should demonstrate some sort of testing and/or group work (with team members in the photo)
    - The second upload should depict your team's concept (CAD/graphics are OK)
  - Although only 2 images will be required when submitting the technical paper, additional optional upload fields will be available on the Technical Paper submission form for teams who want to share more than 2 photos or images. We encourage teams to submit a group photo in addition to the other required images.
  - *Prototype Demonstration Information (see below: Requesting Approval to Bring Prototype to the Forum)
    - *Required only if bringing a prototype to the Forum

Optional Prototype/Capability Demonstration

For the final Forum presentation, the HuLC competition finalist teams are encouraged to bring prototypes or conduct capability demonstrations to show the key features of their proposed concepts, when appropriate. The prototype or capability demonstration should be incorporated into the team's presentation and/or poster session. This can be accomplished via video, virtual simulation, and/or by bringing the physical prototype/model to the Forum. Teams are responsible for the fabrication and transport of their prototypes to and from the Forum.

NASA values and prioritizes safety.
Teams must follow proper safety precautions when developing AND presenting their prototype.

A wide range of prototypes are viable, acceptable, and anticipated. Prototype examples include (but are not limited to):

- A visual prototype (e.g., 3D printed model) can demonstrate the size and shape of the final concept (or a scaled version of the concept). Visual models may not have the final concept functionalities, materials, or mass.
- A bench prototype is a simple model which shows the basic functions of the proposed concept. It may not have the same feel and look of the final product. Teams may use items found in hardware store to create bench models.
- A presentation prototype model is a functioning version of the proposed concept. The model is for demonstration only and not for production.
- A pre-production prototype uses the final production materials and techniques. The primary purpose of a pre-production model is to test and verify the final product.
- A virtual reality (VR) prototype can turn 3D designs into interactive simulations, allowing users to experience a full-scale model of the concept in operation. VR requires a computer, software, and usually a headset for demos.

Requesting Approval to Bring Prototype to the Forum

Teams who plan to bring a prototype to the Forum will need to **complete the "Optional Prototype Demonstration Information" section on their technical paper submission form**. Please be prepared to answer the following questions about your proposed on-site prototype demonstration:

- Is your team shipping your prototype to the hotel?
- Briefly describe how/what you plan to demonstrate?
- Do you require a table to display your prototype?
- Does your prototype require access to a power outlet?
- What are the general dimensions of your prototype, in inches?
- What is the general wight of your prototype, in pounds/ounces?
- Please identify any potential safety risks posed during an on-site demonstration at the Forum AND their mitigation plans.
    - Note: Teams may not be allowed to demonstrate their prototypes onsite if there are safety concerns.
    - Examples of risks with mitigation plans include:
        - "Prototype is a static 3D-printed model and does not pose any hazards."
        - "Prototype has sharp edges with foam covers in place when a team member is not present."
        - "Prototype utilizes abrasive/carcinogenic lunar simulant. Simulant is fully contained, and a HEPA filter is in place for the vacuum."

NASA and NIA will assess this information to ensure any safety concerns have been properly addressed prior to approving the team's request to bring a prototype. Teams will be notified by June 3rd if they are approved to bring a prototype. If approved, the information you provide will also help us ensure each team has enough room during their presentation and/or poster session.

Teams should have a back-up plan to present their prototype via video in their presentation and poster session, in the event that their prototype is delayed, damaged, lost in shipping, or not approved for demonstration during the Forum. Teams who present their prototypes this way may still qualify for prototype bonus points.

Shipping your Prototype

If your team plans to ship your prototype to the hotel, your shipment must abide by the following:

- Teams are responsible for making all their own shipping arrangements.
- Neither the hotel, NIA, or NASA is responsible for shipping costs, damage, or loss of packages.
- The hotel does not accept freight deliveries or deliveries on pallets. Attempts to deliver packages via freight or on a pallet will be *rejected* and returned to sender.
- The hotel does not accept packages that require them to pay shipping costs.
- Deliveries in Huntsville can be limited on weekends. Please take this into account when requesting delivery.
- Deliveries should be made to the attention of someone whose name is listed on your hotel reservation, and "HuLC."
    - Example: "Attn.: Jamie Park, HuLC, [*University Acronym*]"
- The Marriott charges a handling/storage fee for packages shipped to the hotel. Charges are the responsibility of each team and will be added to the room charges of the individual noted above. The fees are as follows:
    - $75 for packages 50+ lbs., per package, per day
    - $150 for packages 100+ lbs., per package, per day

Presentation and Technical Poster Guidelines

Presentation Chart Deck and Digital Poster Submission Deadline: 12 PM (Noon) ET on June 20, 2025

Each team will be given a 45-minute timeslot in the Forum Agenda, to include a 20-25-minute Forum Presentation, followed by a 20-25-minute Q&A Session with the judges.

The expectation is that presentations will be given by the student team members. Teams may choose who speaks and who doesn't speak during the presentation. However, we encourage all student team members to stand together at the front of the room during the presentation to be available to answer questions, even if they are not presenting.

Presentation Chart Deck Formatting Instructions

Each presentation file must have a cover slide that includes:

- Project title
- University/College name & any partners
- Faculty advisor's name(s) (and any additional industry advisors)
- Team members' names

Slide Readability

The presentation room may be very large - please ensure the font in your chart deck is large enough for those to see from the back of the room. Emphasize slide readability, especially for significant figures/calculations. Take advantage of high contrast options and avoid black screen backgrounds. Dark videos/animations and black backgrounds do not show well in the presentation room and should be avoided. If you are using fonts NOT common to Macintosh and PC platforms (i.e., Times, Times New Roman, Helvetica, or Arial), you **must** embed any special fonts used within the chart deck.

Presentations should reflect Technical Papers

Presentations should reflect the technical papers. If errors were discovered after the technical paper was submitted, teams should take this time to address them. **Significant information discussed during the presentation that was not included in the technical paper may be penalized for scoring.**

Technical Poster

Finalists will be required to present technical posters describing their project. Teams must submit a digital poster file and bring a full-size printed poster for display during the Forum's Poster Session. The Poster Session gives teams an opportunity to expound on important concepts in their presentations. It also allows the judges to follow up on presentations by asking additional questions for further clarification.

Printed Poster Guidelines

Each team will be given one 6' table on which to display their printed posters during the Forum's poster session. One free-standing tri-fold foam/cardboard poster board (48" x 36") will be made available for each team to use at no charge. Thumbtacks and double-sided tape will also be available to secure posters to the tri-fold boards.

⇒ **Teams are responsible for printing and bringing their own posters to the forum, and posters should be exactly 48" x 36."**

Digital Poster Guidelines

Each team is also required to submit the digital file of their poster. Digital posters will be displayed on the HuLC Website, and as such, will need to follow some standard guidelines:

- Posters must be 48" x 36" (9600 pixels x 7200 pixels)
- Posters must be formatted horizontally (landscape)
- Poster file size limit is 100MB
- Poster file should be submitted as a PDF file
- Images and graphs should be clear, legible, and appropriately sized for the poster

- Images and graphs embedded within the poster should be "print-ready," with a minimum DPI of 150 whenever possible (300 DPI preferred)
- Links or redirects in the body of the poster can be used sparingly, but they shouldn't be used to add/supplement important information to the Technical Paper. Content should be included in text or embedded in the PDF.

Submitting the Presentation & Poster Files (Due at 12 PM (Noon) ET on June 20, 2025)

To upload your team's Presentation and Digital Poster files, please visit the *Competition Details* page on the HuLC website to access the online presentation and digital poster submission form. Presentations and digital poster files must be submitted by the deadline using the online form. Late submissions will not be accepted, and the submission form will close promptly at 12:00 PM Eastern (noon). ***Revisions to these files will not be accepted after the deadline – no exceptions.***

Teams that do not submit a presentation by the deadline will be barred from presenting, and their stipends may be subject to return to NIA. Teams are encouraged to submit their final presentation files prior to travel. **Late submissions will not be accepted**, and the submission form will close promptly at Noon ET.

The following information will be collected on the Presentation and Digital Poster Submission Form:

- University/College name
- University/College or industry partners, if any
- Project title
- Contact Information for the Primary Faculty Advisor and Student Team Lead(s)
- Contact Information for a Forum-Attending Team Lead (Optional; only if different from above)
- PDF Digital Poster file (Max 100 MB)
- Presentation Chart Deck file (.ppt, .ppx, .pptx) (Max 95 MB)
- (Optional) Link to Presentation File Download - Teams may submit a link to download their presentation file for use during the Forum, with notable restrictions:
    - Teams are still required to submit a PDF version of their presentation that is under 100MB for archival purposes on the HuLC website.
    - Maximum file size for linked files is 250MB. If a linked file is larger than 250MB, then the 100MB upload will be used instead - no exceptions.
    - Presentation files must be created in Powerpoint will be ***downloaded*** from the team's provided link for offline use. We cannot play forum presentations from a browser (ex.: no Google Slides).
- (Optional) We welcome you to share news features or media links where the team has been featured! This is not a scored element. You may also share news or articles with us at any time at HuLC@nianet.org.

Final Scoring at the 2025 HuLC Forum

The judging panel is comprised of NASA and industry experts who will evaluate and score the competition between participating teams. Design projects will be evaluated and judged based on adherence to the guidelines and constraints, and the published evaluation criteria. **Final scoring considers the technical paper, presentation, and poster session.**

Final Scoring Matrix (115 points max)

Also available as a PDF of the 2025 HuLC Final Deliverables Scoring Matrix.

Technical Paper Evaluation Criteria (70 Points Max)

- **Technical Credibility and Feasibility (Max 40 points)**
  - Is the proposed solution appropriate for application and operation in cislunar space/ lunar environments?
  - Is the proposed solution described in a manner that demonstrates that the solution can be implemented as designed or intended (aka is the solution feasible) and meets the objective that is described?
  - Has the team demonstrated an understanding of the technical challenges and risks associated with development, verification, and validation of the solution, and defined mitigation plans for said risks?
  - Has the team demonstrated understanding and provided adequate technical evidence in support of their design/configuration/system/approach in terms of VALUE in the areas of technology readiness, system performance, affordability, programmatic implementation, and risk?
  - Has a realistic assessment for project cost and schedule been included (including technology maturation, system development, production and operations)?

- **Innovation (Max 20 points)**
  - Have any new or novel concepts, materials, capabilities, technologies, approaches and/or applications been demonstrated to support the Human Landing System (HLS) via the team's research, engineering analysis, or capability demonstrations?
  - Is the technology approach unique from what is in the open literature in how it was applied to the Human Landing System

- **Technical Management (Max 10 points)**
  - Is the development and implementation plan adequate and thorough, with a path-to-adoption schedule and milestones clearly defined and reasonable?
  - How well did the team adhere to the HuLC requirements and constraints (and did the team provide adequate justification for exceeding any established constraints)?
  - How well written, organized, and communicated is the proposed solution?
  - Has the team drawn adequate conclusions about their design solution or approach?

Presentation Evaluation Criteria (15 Points Max)

- Quality of presentation – including clarity and structure of the presentation slides, presentation delivery, and consistency with technical paper (Max 5 points)
- Quality of response to questions during presentation Q&A session (Max 5 points)
- Presence of teamwork and integration (Max 5 points)

Poster Session Evaluation Criteria (15 Points Max)

- Aesthetics & creativity – visually compelling; creative use of color, graphics, images, and/or photos (Max 5 points)
- Organization of components clearly present information provided in technical paper (Max 5 points)
  - *Note to the teams from the judges: When it comes to the Technical Poster, Less is More!*
- Engagement with judges and other participants (including responses to questions) (Max 5 points)

Bonus Points (Max 15 points)

- *Max 10 Points:*
  - Does the solution help NASA understand, manage, or implement cryogenic systems? *OR,*
  - At the time of the forum, has the solution demonstrated enough merit that NASA can consider exploring the concept further or consider investing in making the concept flight-ready? *OR,*
  - Does the solution address risks posed by cryogenics in a manner that can directly contribute to resolving HLS challenges associated with CFM?
- *Max 5 Points:*
  - Quality of Prototypes or Capability Demonstrations presented at the Forum.

Contact Information

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

For HuLC inquiries, please contact the NIA HuLC Program Team at HuLC@nianet.org.

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