



2024 Human Lander Challenge (HuLC) Deliverables for Finalist Teams

This document contains specific information for Deliverables for Finalist Teams competing in [NASA's 2024 Human Lander Challenge \(HuLC\)](#).

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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)
 - 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 \(NTRS\)](#).

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.

Proposed Date	Description
April 26, 2024, by 5:00 p.m. ET	Deadline to review university’s listing on the draft 2024 HuLC Forum Agenda and notify robin.ford@nianet.org of any changes
Mon., May 20, 2024 Midnight ET	Deadline for Online Registration & Payment for the HuLC Forum (\$525/person)
Thurs., May 24, 2024 Midnight CT	Deadline to make reservations at the Huntsville Marriott at the Space & Rocket Center at the HuLC Group Rate
Wed., June 5, 2024 Midnight ET	Deadline to submit Technical Paper
Mon., June 24, 2024 Noon ET	Deadline to submit Presentation Chart Deck & Digital Poster
Mon., June 24, 2024 4:00 – 6:00 PM CT	Team Check-In, Poster Set Up, and Networking Event at HuLC Forum
June 25-27, 2024	2024 HuLC Forum in Huntsville, Alabama

Technical Paper Guidelines

Technical Paper Submission Deadline: 11:59 p.m. (midnight) EST on June 5, 2024

Technical Paper Formatting Instructions

- Papers should be single spaced and formatted as a single column.

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- 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.
- Please use fonts common to Macintosh and PC platforms, i.e., Times, Times New Roman, Helvetica, or Arial for text; Symbol for mathematical symbols and Greek letters.
- Font size should be at least 11pt (including in all tables, charts, and graphs).
- Technical papers must be submitted as PDF files.

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** (not included in the page count), which must include:
 - a. University name
 - 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** (not included in the page count) - Please download and use the HuLC [Quad Chart Template](#) found on the “Technical Paper” section of the [Resources page](#).
 - a. Quad charts must address:
 - i. The team’s major objectives and technical approach to the problem being addressed
 - ii. An image/graphic of the concept
 - iii. Key design details & innovations of the concept
 - iv. A summary of the schedule and cost for the proposed concept’s path to adoption
3. **Table of Contents** (not included in the page count)
4. **Body of Report** (10-15 pages)
 - a. Problem Statement and Background (challenge being addressed and overall approach)
 - b. Project Description
 - i. Adherence to design constraints and guidelines, including but not limited to:
 1. Ability to survive and operate in the harsh lunar environments (i.e., vacuum, extreme temperatures, etc.)
 2. Minimal landings required and no assumptions of pre-existing surface assets or infrastructure
 3. No additional risks posed to crew
 4. Non-toxic solutions

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5. Targeted for use on the Moon within 3-5 years
 - ii. Note any changes made since the proposal; provide detailed information about the work conducted in various trades, concepts, and mission constructs.
 - iii. Innovative approaches/capabilities/technologies
 - iv. Supporting engineering analysis and justification of assumptions
 - v. Verification and Validation of the solution
 1. Detail the solution verification and/or testing approach, including what tools or equipment was used to attempt to prove your analysis was correct.
 - c. Conclusions and key findings supporting the envisioned approach.
 - i. Defend your design/configuration/system/approach in terms of VALUE in the areas of technology readiness, system performance, affordability, programmatic implementation, and risk.
 - d. Realistic assessment of project schedule and milestones, as well as realistic development and annual operating costs (i.e., budget).
 - i. Note: A Realistic assessment of costs includes technology maturation, system development, mission infusion/adoption, integration, and operations (as appropriate).
 - e. Full concept/mission architecture timeline
- 5. Appendices**, if needed (not included in the page count)
- a. Appendices are to be used for references and calculations ONLY. Judges are not obligated to look at the appendices. Include important details in the body of your paper to ensure they are reviewed.

Submitting The Technical Paper (Due at 11:59 PM ET on June 5, 2024)

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 required or requested on the [Technical Paper Submission Form](#):

- University name
- University or industry partners, if any
- Project title
- Contact information for primary faculty advisor & two student team leads
- Contact info for any additional advisors, if applicable
- 2 – 3 sentence concept synopsis (600 characters or less)
- File upload for PDF technical paper document (Max 95 MB)
- PDF file upload 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.
- High Quality Photo/Graphics Upload:

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- 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 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 (with team members included in the photo).
 - The second upload should depict your team’s concept.
- 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.

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. Teams are responsible for the fabrication and transport of their prototypes to and from the Forum.

Prototypes are physical models ranging from a visual to a production prototype. 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 their 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 headset for development.

Shipping your Prototype:

Teams who plan to demonstrate a prototype during the Forum should contact Robin Ford at robin.ford@nianet.org no later than **5:00 p.m. ET on Thursday, May 23, 2024**, so we can make sure each team has enough room during their presentation and/or poster session.

- Please indicate the general size of your prototype (particularly if it is heavier than 20lbs or larger than a 3-ft cube); if your team requires access to a power outlet; and if you plan to ship your prototype to the hotel.
- If your team plans to ship your prototype to the hotel, your shipment must abide by the following rules:
 - Teams are responsible for making all their own shipping arrangements.
 - 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.

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- 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
- Neither the hotel, NIA, or NASA is responsible for shipping costs, damage, or loss of packages.

Presentation and Technical Poster Guidelines

Presentation Chart Deck and Digital Poster Submission deadline: 12 PM (Noon) EST on June 24, 2024

Each team will be given a 45-minute timeslot in the Forum agenda: presentations should be 20-25 minutes and will be 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 name
- Faculty advisor's name(s)
- 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.

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 will be penalized for scoring.**

Prototypes

For teams who have developed prototypes, the prototype's functions should be demonstrated within the team's final presentation and/or during the poster session at the HuLC Forum, either via video, virtual simulation, and/or by bringing the physical prototype/model to the Forum.

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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 should be formatted horizontally
- 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.
- 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.
 - This includes redirecting to a webpage, video, or any other content.
 - Whenever possible, all content should be included in the text or directly embedded within the PDF.

Submitting the Presentation and Digital Poster Files (Due at 12 PM EDT (noon) on June 24, 2023)

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 EST.

The following information will be required or requested on the Presentation and Digital Poster Submission Form:

- University name
- University or industry partners, if any

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- Project title
- Primary faculty advisor & student team lead contact information
- File upload for Chart Deck (.ppt, .ppx, .pptx) (Max 95 MB)
- File upload for Digital Poster (PDF) (Max 95 MB)

Final Scoring at the 2024 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)

A printable version of the [2024 HuLC Final Deliverables Scoring Matrix](#) can be found on the [Competition Details page](#).

Technical Paper Evaluation Criteria (70 Points Max)

- **Technical Credibility and Feasibility (Max 40 points)**
 - Has the team proposed a solution to PSI with system-level impacts, realistic assumptions, and rigorous technical analysis and design?
 - How thorough is the verification and validation for the proposed solution?
 - Has the Technical Paper demonstrated an understanding of the technical challenges and risks associated with development, verification, and validation of the proposed solution and defined mitigation plans for said risks?
 - Has a realistic assessment for project cost and schedule been included (including technology maturation, system development, production and operations)?
 - 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?
- **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?
- **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?

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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, mitigate, and/or manage the impacts of lunar PSI in the near term?
OR
 - At the time of the forum, has the solution demonstrated enough merit that NASA should consider exploring the concept further or consider investing in making the concept flight-ready?
OR
 - How feasible is the proposed solution in addressing risks posted by PSI in terms of technical maturity and potential to directly contribute to resolving HLS challenges associated with PSI?
- *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.

National Institute of Aerospace

HuLC Program Office

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<https://HuLC@nianet.org>