2022 Canadian Hyperloop Competition

Final Design Package Guidelines

The purpose of this document is to give teams further explanation and guidelines on how to interpret the rulebook and which documents shall be submitted to fulfill the requirements.

It shall give an overview on how to structure the final design package, yet all criteria are outlined in the rulebook as well.

If applicable, it may be indicated that a certain requirement is only relevant for the quality of engineering (awards) yet not the eligibility to compete on the track.

Based on the final design package CHC officials need to be able to figure that the developed system does not pose a threat to humans or infrastructure.

Units are to be provided in SI standards and metric

The format of the final design package is a formal report submitted in a pdf file format. While CHC does not require any rigid formatting conventions, we would like the reports to include the following elements in order:

- Title page
    - Report Title
    - Team Name
    - Submission Date
- Executive Summary
- Table of Contents
- List of Figures
- List of Tables
- Main body with appropriate headings and sections
- Appendices (if any required)
- References (IEEE style)

Please make sure to include page numbering in your document, as well as in-text citations for any references you have. If possible, also try and include cross referencing for figures and tables.

Changelog

1.0	CHC	Initial release
1.1	CHC	Addition section 3.0

1.0 About the team

Please provide a short introduction about your team. This should include information such as when the team was founded, how many events were attended to date and the accomplishments of the team.

2.0 Infrastructure

Please list all infrastructure that you would like to request. We cannot guarantee such infrastructure will be provided, however we will do our best to accommodate such requests.We encourage all teams to provide their own infrastructure as needed.

This could include

- Power
- Network close/far
- Clearance Zones (battery, pneumatics, springs)
- Workshop (components, tools, 3D printers, etc.)
- End of the track requirements for safe stopping

3.0 Top-level design summary

Show how the pod is composed of subsystems, overall Interactions high level. Show and list relevant capabilities. Shall give CHC as well as the jury an understanding of what you built.
Give status updates for all subsystems as well as the overall pod. Status may be Designed - Manufactured - Assembly - Tested.
Please provide a table containing the following information:

- Pod mass
- Pod length
- Pod levitation type (e.g. stationary magnets, rotating magnets wheels, air bearings, etc.)
- Pod primary/secondary braking types (e.g. magnets, friction)
- List of hazardous systems/materials on Pod (e.g. battery, magnets, high-pressure bottles)
- Pod method(s) for acceleration
- Maximum speed at which Pod can maintain control while levitating
- Maximum speed at which Pod can maintain control while not levitating (e.g. on wheels; if no wheels are on Pod, the answer is zero mph)
- Maximum acceleration at which Pod has been structurally designed
- Maximum acceleration for which Pod can maintain control

4.0 Subsystems

4.1 Structural

Please ensure that the dimensions and weight of the pod are within the specified limit and a safe factor of minimum 2 is kept in mind while designing the structure. Ensure that positive locking mechanisms are employed for all fasteners. Proper diagrams and proof of simulations are a part of the documentation.

4.2 Guidance

Please have backed up numbers about your system, diagrams, and state applied safety factors. Refer to the rulebook. Ensure that the Guidance system ensures that the pod is moving safely on the track and will not be derailed. Also ensure that every part that comes in contact with the track does not damage it in any shape or form. Proper diagrams and proof of simulations are part of the documentation to prove that the system is safe to operate.

4.3 Powertrain

For mechanical transmission devices, make sure any rotating components part of power transmission are enclosed in a solid body to prevent part dislocations. Also, identify the potential damage that could occur in the event of a part dislocation with force calculations.

For linear induction motor designs, ensure that there is sufficient clearance on the track. Through testing, also confirm that your design prevents shorts with the track. Look at how the magnetic fields may potentially interact with the track and devices on the pod.

Note: For LIM-powertrains make sure to show there is sufficient to the track, so short circuit are prevented

.4.4 Cooling

Ensure calculations proving that the cooling system satisfies the required need is a part of the document. Please have the simulations and detailed explanation about the mechanism used for cooling as a part of the documentation. For use of coolant other than water, make sure that any spillage for this coolant can be cleaned by your team itself.

4.5 Pressurized Systems

Ensure all pressure systems are certified and are safe for operation.Please note automatic and/or manual release valves are a part of the circuit.A pneumatic/hydraulic circuit diagram explaining the working system implemented should be the part of this document.

4.6 Braking

Ensure that the parts coming in contact with the track have hardness less than 85HB (Brinell hardness). It is recommended to include a safety buffer distance as a part of the pod trajectory in scenarios of inefficient braking.Ensure that brakes are actuated in any case of any power failure or other malfunction in the pod's systems.If pressurized systems are used they must comply with the rules for pressurized system in the rulebook.

4.7 Battery

Make sure your team is compliant with the battery specifications outlined in the rulebook. Safety features and battery should be tested to make sure it is operating within design specifications. Also, outline how your high voltage and low voltage systems are separated.

4.8 Electrical and Wiring

Ensure the pod's wiring is correct, and that any IMDs are working properly.

4.9 Software, Controls and Comm

For this section, it is vital to thoroughly explain the operations of the pod for the total time it is active on track; identify what happens, when it happens, and why it happens. Also, explain any contingencies that are in place in case of power or communication loss on the pod. Outline any error handling as well as any diagnostics procedures. We need to be able to verify that the pod is always in a safe state.

5.0 Safety

Please outline the biggest risks for the pod itself as well as people. Outline how you mitigate them. Follow a clear top-down approach that shows all risks have been assessed. State how you came up with a certain risk evaluation and how this affected system design.

6.0 Non-prototype research

Feel free to showcase all your work that has not directly translated to the pod development yet you think is significant and shall be assessed by CHC and jury.

7.0 Preliminary testing plan

Closer to the event a detailed testing requirement document will be released - the “testing and safety documentation”. At this point, it is expected that teams provide a short overview on how they will test their system to make sure it is safe.