Executive Summary

U.S. transportation sector, which includes cars, trucks, planes, trains, and boats, emits 1.9 billion tons of CO2 annually [1]. The Hyperloop is a clean and sustainable alternative form of transportation, relying solely on electric power while being able to travel up to 760 MPH, about 3 times the speed of a high-speed passenger train. Established in 2015 at the University of California Irvine, HyperXite is a team of undergraduate students endeavoring to build a small-scale Hyperloop pod.

As such we require a vehicle that will allow us to easily transport our 300kg pod to different locations in addition to serving as a workstation to service and assemble the vehicle during the building stages.

Requirements/Constraints

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Attributes</th>
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<tbody>
<tr>
<td>Shall support and transport a 300 kg pod</td>
<td>Height adjustability</td>
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<tr>
<td>Shall align the HX Pod with the I beam track</td>
<td>Easy to utilize</td>
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<tr>
<td>Shall cost less than $600</td>
<td>Easily manufactured</td>
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<tr>
<td>Must be less than 5 ft in Width</td>
<td>Easy to service a vehicle on chassis</td>
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<td>Must be less than 7 ft in Length</td>
<td>Height adjustability</td>
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<td>Must have a minimum working vertical clearance of 12 inches</td>
<td>Height adjustability</td>
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<td>Abides by a factor of safety of 2 according to EH &amp; S standards</td>
<td>Height adjustability</td>
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Key Features of Project

- **Concept Selection**
  - Compared multiple iterations of each component
  - Cost vs functionality
  - Custom vs Existing design

- **Simulation Iteration**
  - Verified PDS and yielding
  - Max stress and displacement
  - Risk Mitigation

- **Design**
  - Refining model based on simulation results
  - Adding gussets
  - BOM integration
  - Gray Box Diagram

- **Manufacturing**
  - In house via Machine Shop and Welding
  - Inventory Data Sheet
  - System verification plan

- **Stress Analysis/Iteration**
  - Combined stresses and displacement
  - InCREASE load and examine joints for deformation

- **Simulations**
  - Simulated 2980 N load to simulate 300kg pod on PTV
  - Similar Displacement of around 1mm

- **Decision**
  - Choose the first iteration of chassis as it provided greater room to service the pod while on the Pod Transport Vehicle

Procedure

1. Intended Vehicle Operation, Pod Serving, and LM Integration Procedure
2. List of Beam Lengths and Quantity
3. Result of Common Failure Point
4. Key Features & Final Design
5. Final Design

Conclusion/Lessons Learned

MAE 151A Team Contribution:
- Full Product Design and Manufacturing

Future Improvements:
- Hydraulic Lift and Support System
- Easier fail-safe implementation and actuation
- Can be utilized on uneven terrain
- More compact system

Impacts:
- Supports further testing of scaled hyperloop pods
- Allows for safe transportation, service, and assembly of pods

Final Design

The final design consists of a main structure of 1” x 1” square, steel tubes that support the I-beam the pod rests on. Components of this main chassis include four wheel mounts for swivel casters, four jack points, and two sections of handlebars to safely steer the PTV. The vehicle is designed to allow room to perform maintenance on as well as transport the pod.

References


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