UCSB HYPERLOOP

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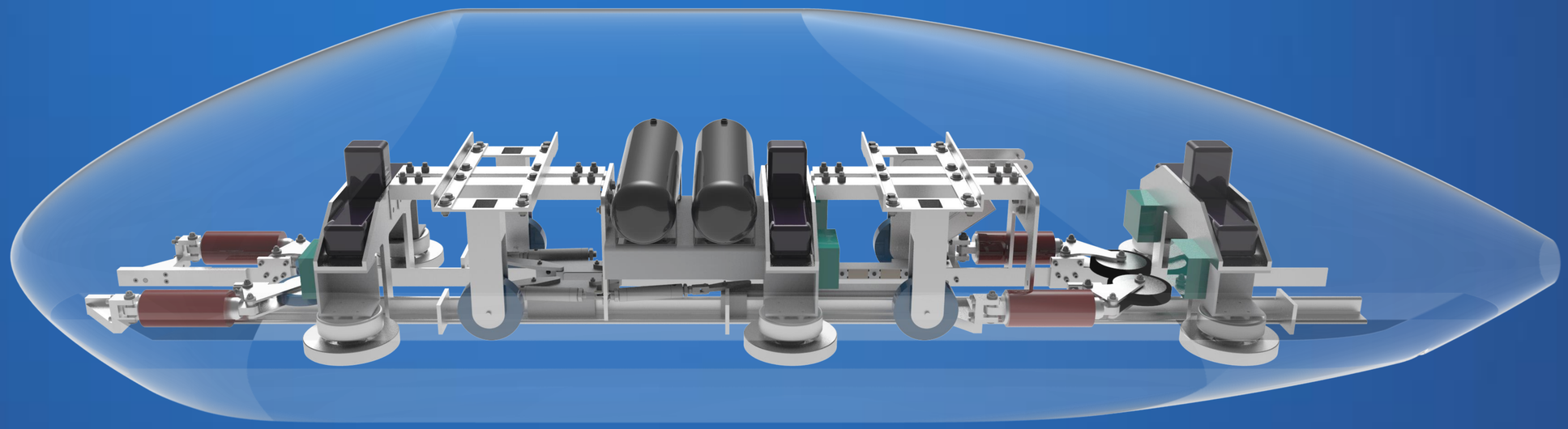


Abstract

The Hyperloop

In 2013, Elon Musk suggested a futuristic solution to the increasingly worsening transportation issue: the Hyperloop, a method of high-speed travel consisting of a levitating pod propelled through a low pressure steel tube to minimize drag and friction.

The Competition

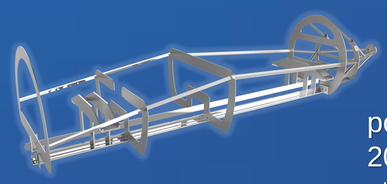
To help make this idea a reality, SpaceX created an international competition to test pod designs on a mile-long track. As one of the few teams selected to compete, the UCSB Hyperloop team is constructing a battery-powered, lightweight, and durable pod capable of reaching speeds of 218mph while magnetically levitating.

Competition Requirements

- **Data transmission via Ethernet connection (1Hz)**
  - **kinematics, attitude, temperature, power**
- **Remote pod-stop**
- **Levitation of entire pod for duration of test run**
- **Service propulsion system**
- **Mass < 11,000 lbs**
- **Dimensions fit within tube specifications**
- **Propulsion interface for SpaceX pusher**
- **Braking system**
- **Stabilization system**
- **Dummy passenger space**

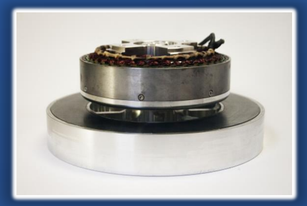
Mechanical Subsystems

- **Fiberglass Outer Shell**
- **Frame**
  - Steel rear frame
  - Aluminum base and shell frames
- **Pneumatic Braking**
  - Induction brakes for high speeds
  - Friction brakes for low speeds
- **I-beam Stabilization**



Electrical Subsystems

- **Power System – 3 LiPo battery banks**
- **Magnetic Levitation – 6 ArxPax HE 3.0 engines**
- **Control Station Application**
- **On-board Electronics**
  - Main system PCB
  - Consolidated telemetry board
  - Ranging sensors
  - Photoelectric sensors
  - Network access panel (provided by SpaceX)



Conclusion

- 30 weeks of work in total
- 23 senior multidisciplinary students
  - Engineers: 10 Mechanical, 5 Electrical, 5 Computer
  - 3-person Finance and Marketing team
- $55,000 raised (100% of budget)
- Progress:
  - All subsystems assembled

A comprehensive set of tests and further analysis on our pod will be performed before the final competition in Summer 2016. We have assembled a team of junior engineering students to assist us who are taking over the project next year. We are excited for next year's UCSB Hyperloop team as they continue to make great progress and innovations to our pod design and tackle the next Hyperloop Pod Competition!

Acknowledgments

We would like to express our deepest gratitude to the UCSB College of Engineering and SpaceX for giving us this amazing opportunity, to all of our faculty and industry advisors for their valuable support throughout this past year, and to our sponsors which have been generous and encouraging in all of our efforts.

UCSB HYPERLOOP
SUBSYSTEMS

UC SANTA BARBARA engineering

MECHANICAL SUBSYSTEMS

Fiberglass Outer Shell

- Low drag

Frame

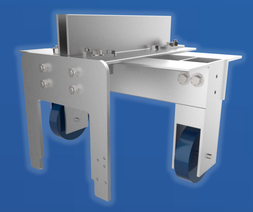
Shell frame and base frame
- Lightweight aluminum
- Support subsystems and shell

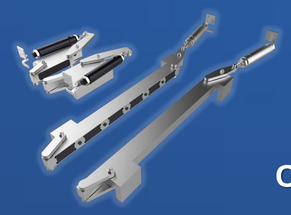
Rear shell frame
- 4130 steel tubing
- Withstands 2g acceleration with FOS = 8

Propulsion

SpaceX Pusher
- Accelerates at 2g
- Max speed of 218mph (351kph)

Motorized service wheels
- For transport and pod recovery



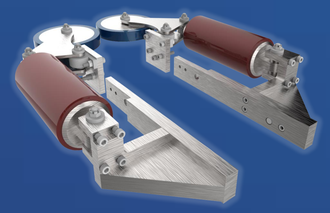


Braking

- Eddy current brakes – high speed
- Friction brakes – low speed (<23mph)

I-beam Stabilization System

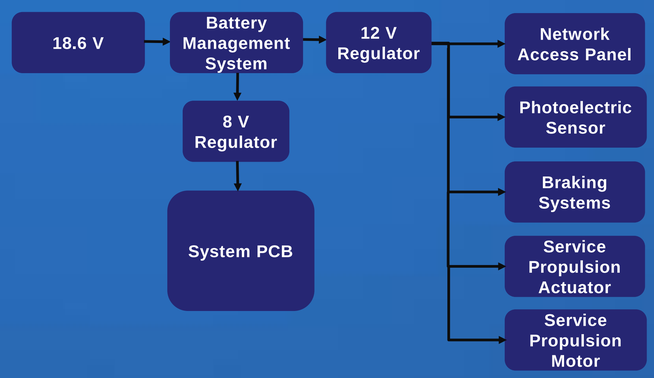
- Spring damper
- Custom wheels
- Handles high loads and vibrations



ELECTRICAL SUBSYSTEMS

Power System

- Lithium polymer batteries
- Battery Bank 1

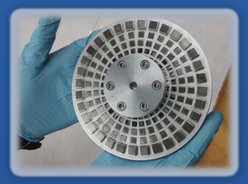


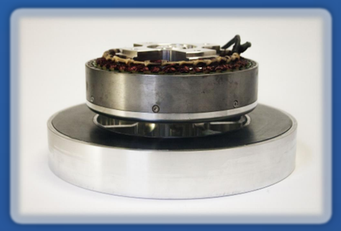
- Battery Bank 2 (for each pair of engines)

- Battery Bank 3

Magnetic Levitation

- 6 Arx Pax HE 3.0 engines





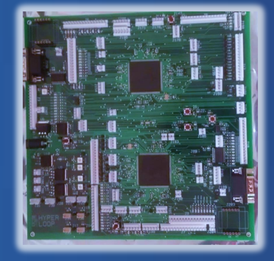
Control Station Application

- Mag-lev on/off
- Braking activation
- Emergency stop
- Telemetry monitoring

ON-BOARD ELECTRONICS

Main System PCB

- Actuation and control
- Communication
- Telemetry



Consolidated Telemetry Board

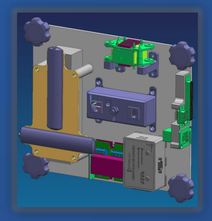
- Temperature
- Acceleration
- Pressure

Ranging Sensors

- 4 short-range on the bottom for roll and pitch
- 4 long-range on the sides for yaw

Photoelectric Sensor

- Recalibrate accelerometer for position



Network Access Panel (provided by SpaceX)

- Secure Ethernet link between pod and control station

Raytheon · Northrop Grumman · Ingersoll Rand · TENON Intersystems · TATTU · UC Santa Barbara economics · CalChamber California Chamber of Commerce · AS UCSB Associated Students