UCSB HYPERLOOP

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STABILITY
- Pod travels along central I-Beam
- Pair of stability wheels keeps pod on track, prevents rotation around y-axis (yaw)

Figure 1: SpaceX Track Cross Section
Figure 3: Braking System and I-Beam, Red Keep-Out Zones

BRAKING
- Rubber pads clamp onto central I-beam, can slow from a speed of 200 mph in 17 seconds
- Two pairs of brakes, each pair can stop pod on its own

Figure 2: Pod Motion Along Test Track
Figure 4: Payload Mounted to Cart (Blue)

HYBRID DESIGN
- Wheels provide best stability at operating speed
- Cart/Payload design:
  - Cart: stable, rigid outer frame, has stability wheels, brakes, and drag racing wheels
  - Payload: Moves vertically along linear bearings, MagLev engines support the weight of electronics and battery banks

Figure 5: An example of a wheel

MAGNETIC LEVITATION
- Motion of magnets generates eddy currents in conductive surface, which creates an opposing magnetic force that lifts pod
- Utilizes Halbach arrays, maximizes field strength below pod, minimizes interference with electronics

Figure 6: Halbach Array Magnetic Field

THERMAL CONSIDERATIONS
- Heat is sunk into aluminum frame, thermal jackets
- Subsystems individually tested to ensure performance in low pressure environment

Figure 7: Magnetic Levitation Motor Thermal Profiles

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ELECTRONICS
- Powered by lightweight lithium polymer batteries. Batteries source 3.8 kilowatts of power to MagLev engines and subsystems
- Sensor array records pod temperature, power consumption, position, and subsystem status
- Wirelessly transmits information through web app

Figure 9: Hyperloop Pod
Figure 10: Subsystem Boards and Power Distribution Mounted in Pod

CONTROL SCHEME
- Each subsystem has state machine, ensures all behavior is controlled and characterized
- Braking has most safety checks, only deployed after time/distance threshold surpassed and no longer accelerating

Figure 8: Magnetic Levitation Motor Thermal Profiles

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Cart: stable, rigid outer frame, has stability wheels, engines support the weight of electronics and
Payload: Moves vertically along linear bearings.

Figure 9: Braking Subsystem Control Scheme

Figure 11: Braking Subsystem Control Scheme