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Project Portfolio

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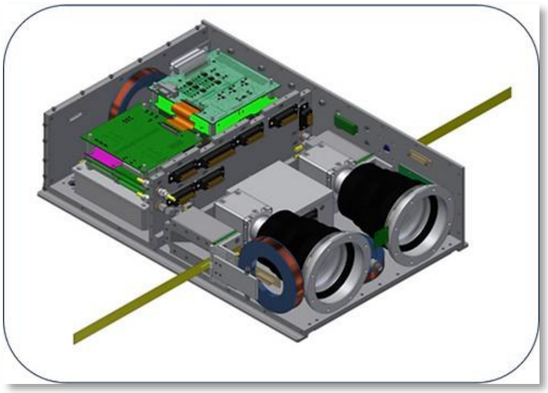
GLADOS (Glint Analyzing Data Observation Satellite)
Mission Operations & Control Room, UBNL

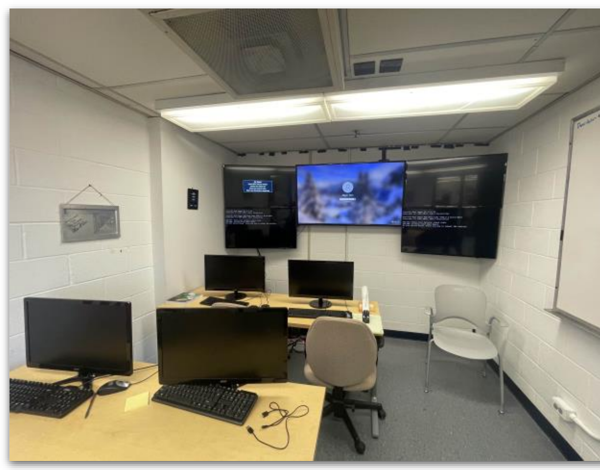


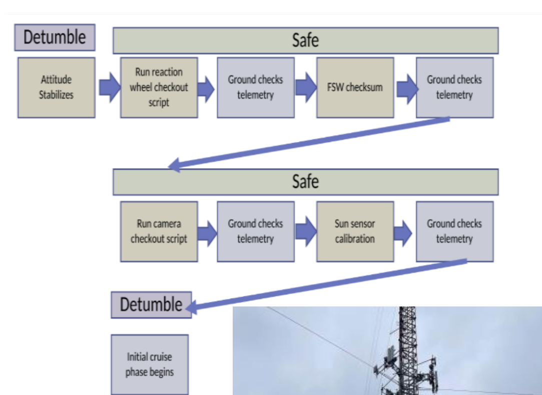
What?

- GLADOS is a 6U CubeSat mission to **characterize GEO objects** through optical glint analysis
- Needed a mission control room and ops framework to **support post-launch operations**

How?

- Built a mission control testbed with **OpenC3 COSMOS** to simulate telemetry and commands.
- Wrote **exception-handling guides** so operators can respond to subsystem faults
- Modeled subsystem failure paths in **Simulink** to prepare operators for anomalies

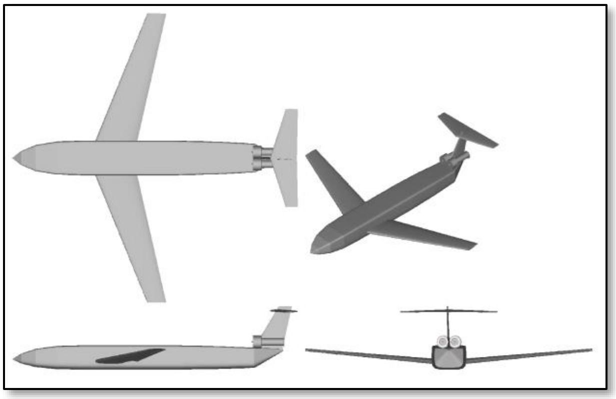


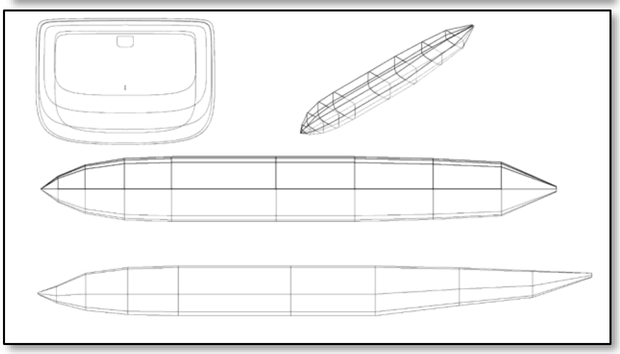


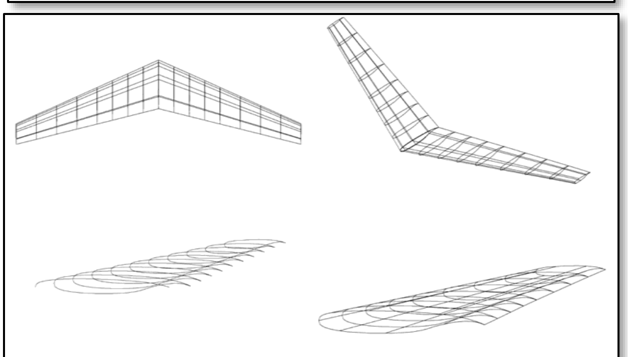
The Results

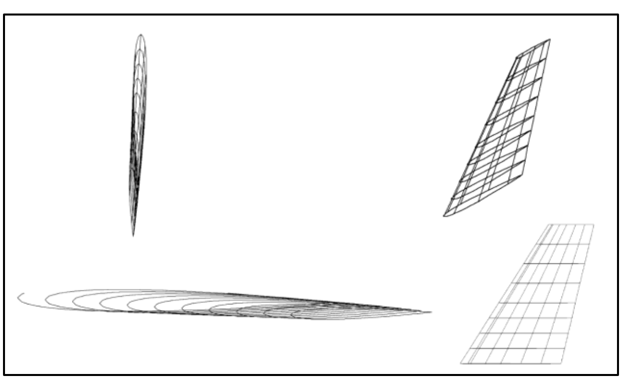
- Delivered a **functioning mission control** environment with validated telemetry links
- Produced training docs and procedures that prepare mission control staff for **launch readiness**

Private Jet Concept Design









What?

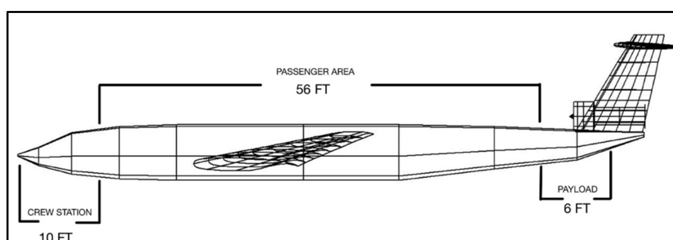
- Designed a long-range **business jet** concept under FAA FAR Part 25 Regs.
- Mission target**: ~5,000 nm range**, Mach 0.8 cruise, 8-16 passengers

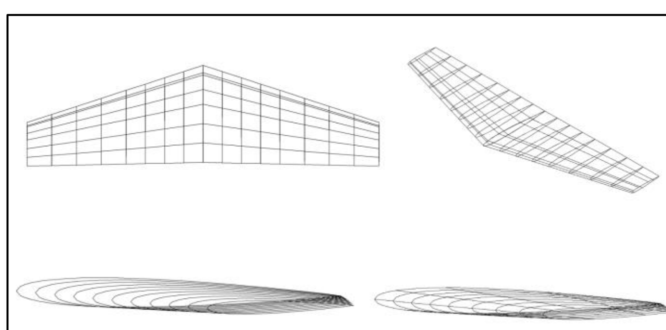
How?

- Selected an **80 ft fuselage** with rear-mounted turbofans for efficiency and comfort
- Applied a Whitcomb **supercritical wing** to reduce drag in transonic cruise
- Calculated **weights, thrust, and wing loading** with iterative MATLAB scripts

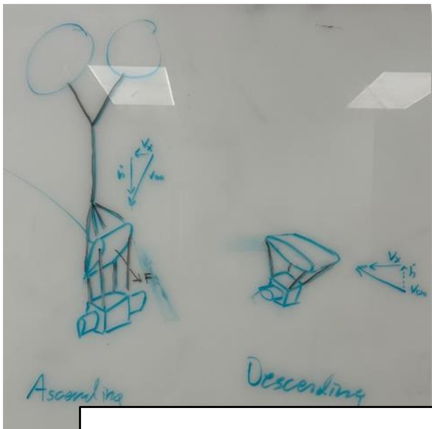
The Results

- Produced a **complete jet configuration** meeting FAR Part 25 performance criteria
- Refined the design through **trade studies** on payload, range, and aerodynamic efficiency



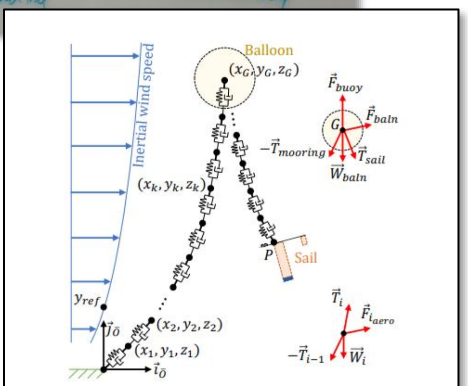


High-Altitude Balloon with Sail
Autonomous Altitude and Heading Control



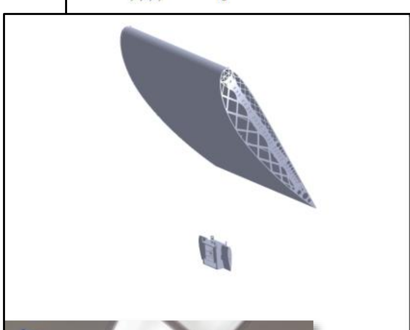
What?

- Concept for a **paraglider-style sail** to improve stability and autonomous control of balloon flight paths
- Aimed to **reduce unpredictability of high-altitude balloon trajectories** while maintaining lightweight design



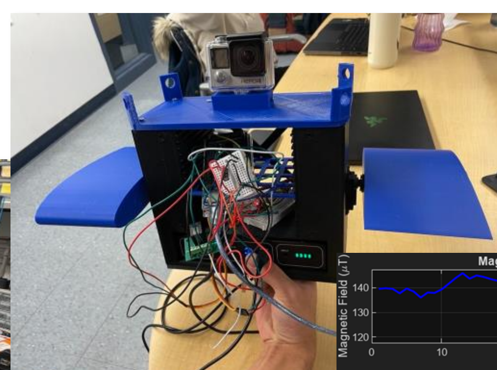
How?

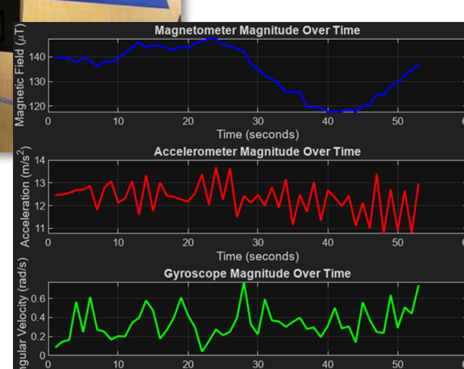
- Designed a 25 ft^2 airfoil sail and payload aeroshell in **SolidWorks**
- Integrated GPS, magnetometer and IMU sensors with **Arduino in control loop for autonomous wing actuation**
- Tested **sensor fusion and servo response** during ground trial at UB's Walter Kunz Track



The Results

- Built an autonomous prototype capable **of adjusting orientation and directional bias**
- Validated sensor and control performance in testing, demonstrating **readiness for flight trials**





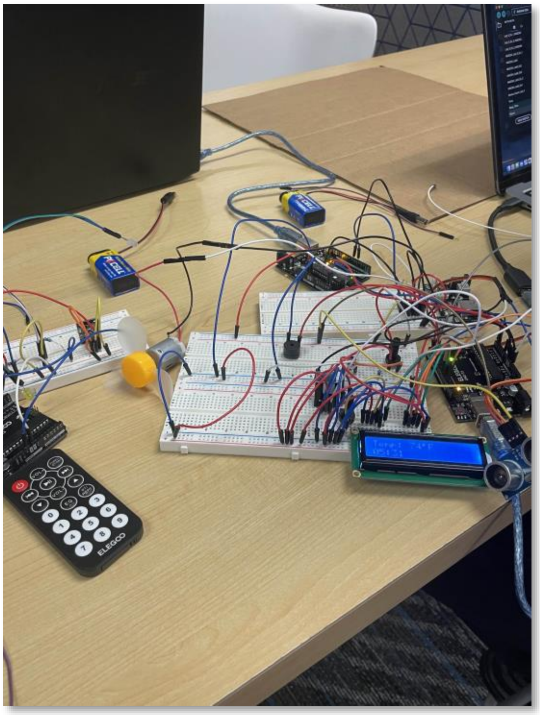
Car Dashboard Mechatronics Simulator

What?

- **Microcontroller-based** simulator of a car dashboard system
- Aimed to replicate multiple vehicle subsystems for **embedded systems** practice

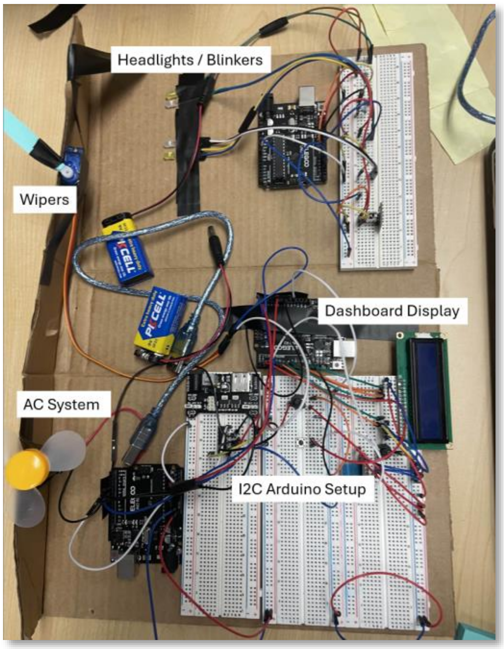
How?

- Networked multiple **Arduinos over I^2C** to handle sensors and actuators
- Programmed IR remote, wipers, AC, and lighting controls into **a unified system**
- Integrated LCD display with real-time sensor and clock data

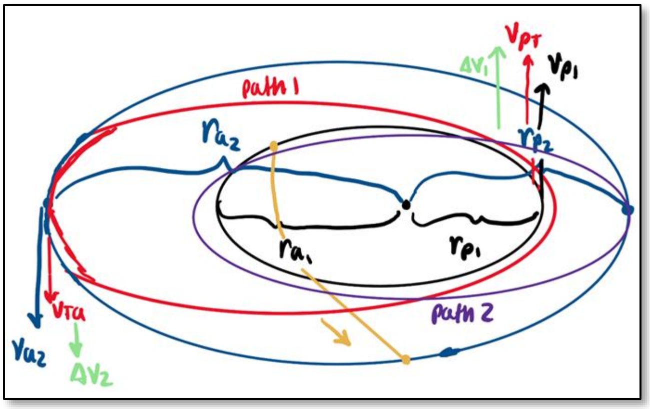


The Results

- Built a working prototype demonstrating **embedded system integration**
- Showcased real-time interaction across sensors, actuators, and user inputs



Spacecraft Rendezvous Orbit and Inspection Analysis

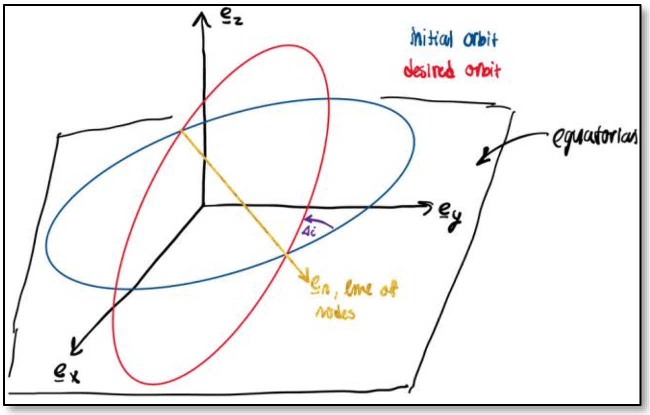


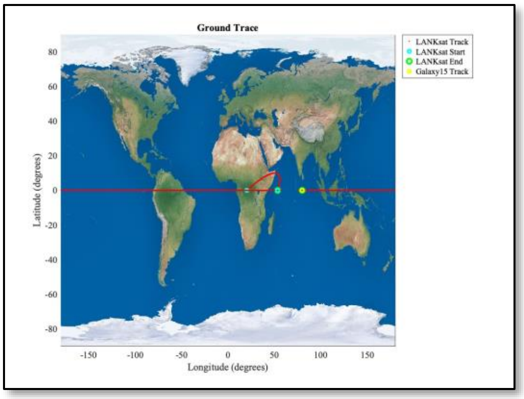
What?

- Designed a **mission profile** to inspect a malfunctioning GEO satellite
- Required safe rendezvous maneuvers and **sustained relative motion** for close

How?

- Planned **orbital transfers and plane change maneuvers** for alignment with the target satellite using MATLAB
- Modeled **Natural Motion Circumnavigation** (NMC) trajectories to maintain safe inspection ranges (50-150 km)
- Simulated relative motion, ground tracks, and sun-angle constraints **to ensure continuous observation**





The Results

- Produced a **validated inspection mission** profile achieving rendezvous and bounded relative motion
- Confirmed feasibility with **acceptable ΔV (~1.83 km/s)** and safe conditions for sensor operations