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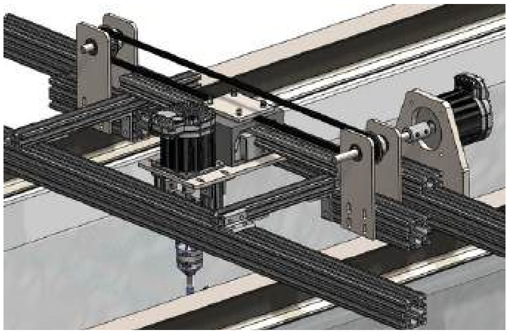
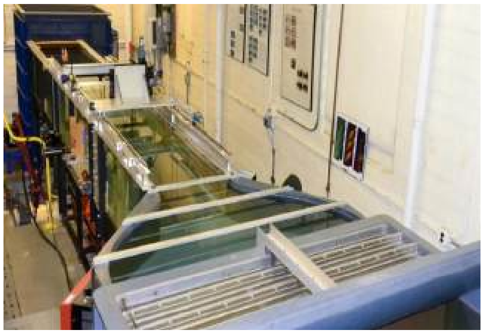
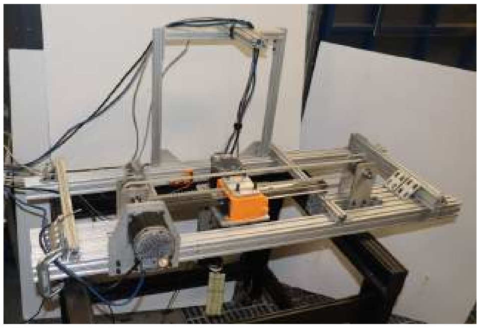
PITCH AND HEAVE SETUP FOR BIO-PROPULSION STUDIES







What?

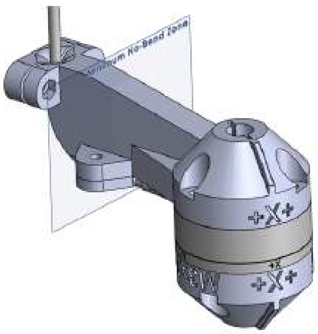
- Design a setup to mimic robotic swimmers, leading investigations into their hydrodynamic performance and development of quiet underwater vehicles, a part of a $7.5M U.S. DOD-funded MURI project.

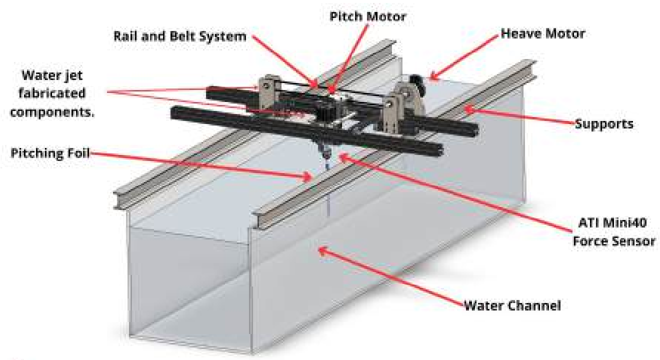
How?

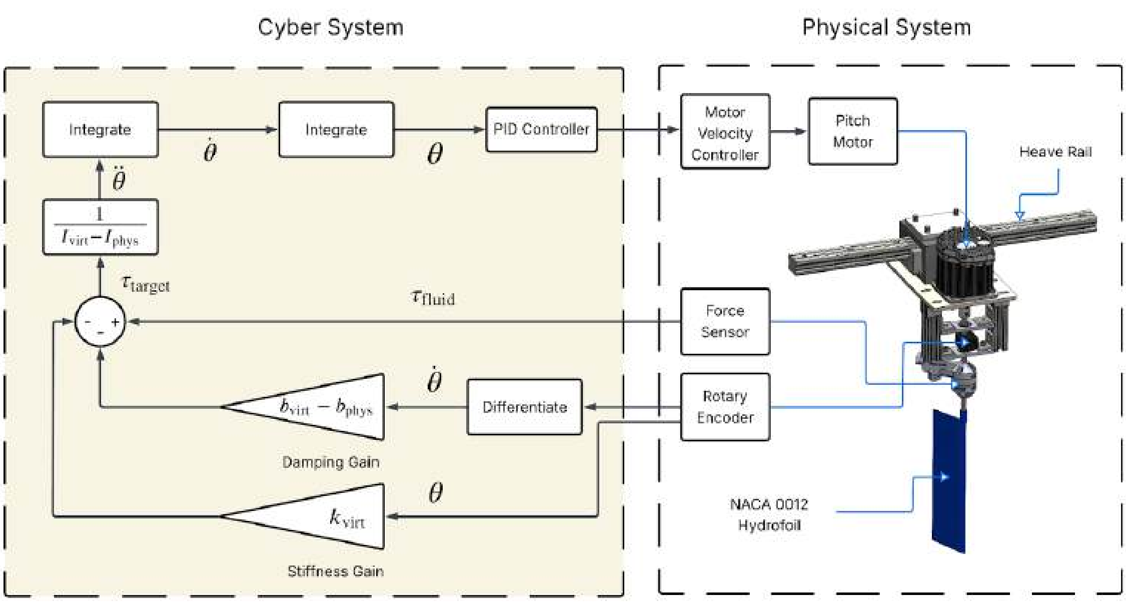
- Designed and built the setup using SOLIDWORKS, CNC, waterjet cutting, and 3D printing.
- Applied GD&T to all drawings.
- Integrated systems such as PIV system, 6-axis force sensor, NI DAQ data acquisition card, high-torque motors.

Results

- Gathered and analyzed 35 data sets using MATLAB and NI DAQ for tests.
- Improved movement accuracy to 98.2%, a 1.75x increase over previous designs.
- Reduced operational noise by 32% through optimized control systems.







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CARBON FIBER SUSPENSION SYSTEM FOR FORMULA SAE

What?

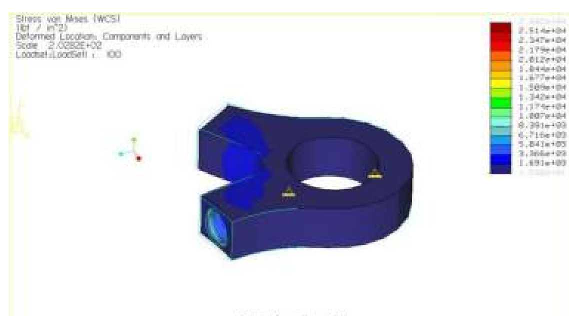
- Designed and manufactured a carbon fiber–aluminum hybrid suspension control arm for a Formula SAE vehicle.
- Replaced steel members to reduce mass while maintaining required load capacity.

How?

- Modeled geometry in SolidWorks and conducted FEA to evaluate stress and deflection under braking and cornering loads.
- Machined aluminum end joints and bonded them to carbon fiber tubes using structural epoxy.

Results

- Reduced component mass compared to steel baseline.
- Measured strain and load response were consistent with FEA predictions.
- Component sustained expected loads without material failure or joint separation.



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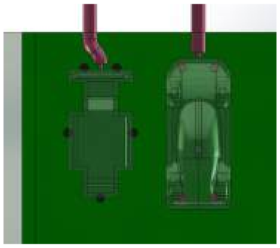
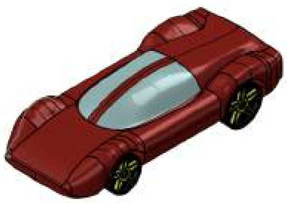
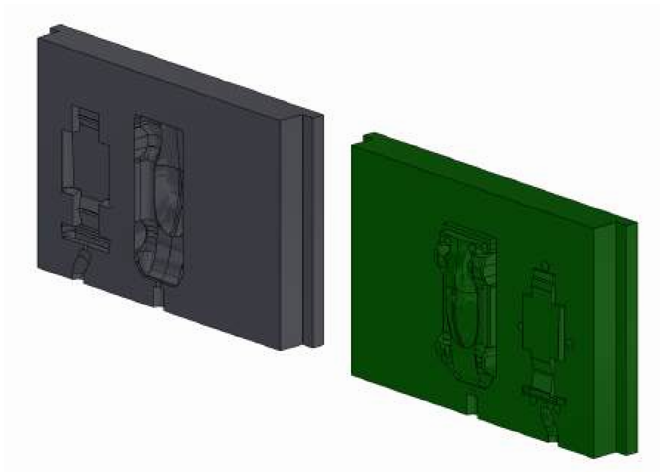
RACE CAR INJECTION MOLDING PROJECT







What?

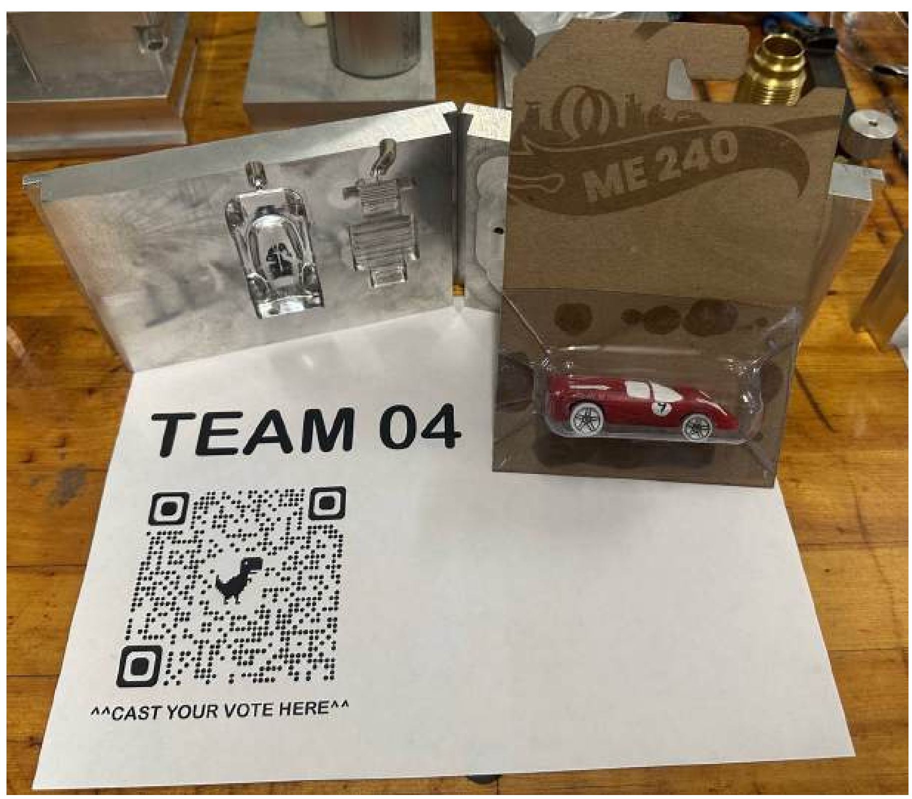
- Designed and manufactured a two-part aluminum injection mold for a race car body component.
- Developed a complete molding workflow including part design, gating, and runner system.

How?

- Modeled part and mold assembly in SolidWorks.
- Fabricated mold using CNC machining and waterjet cutting.
- Applied GD&T to ensure dimensional accuracy and proper part ejection.
- Conducted molding trials and evaluated part quality and repeatability.

Results

- Successfully produced molded race car components with consistent geometry and surface finish.
- Achieved proper mold alignment and clean part release.
- Validated manufacturability through multiple successful production cycles.



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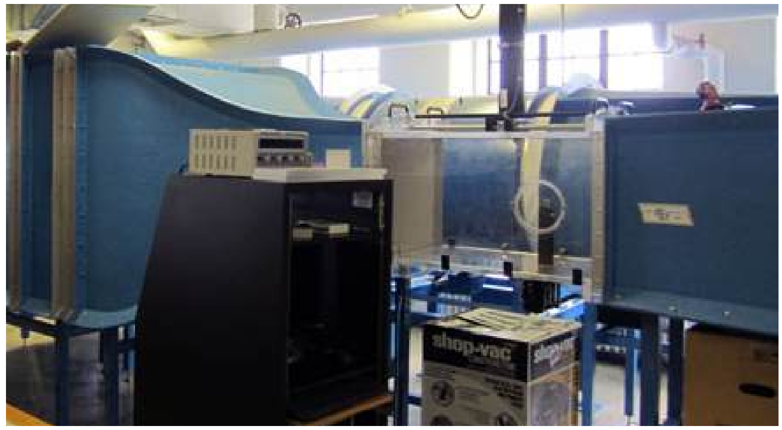
WIND TUNNEL DRONE TESTING - AEROTARGETS INTERNATIONAL



What?

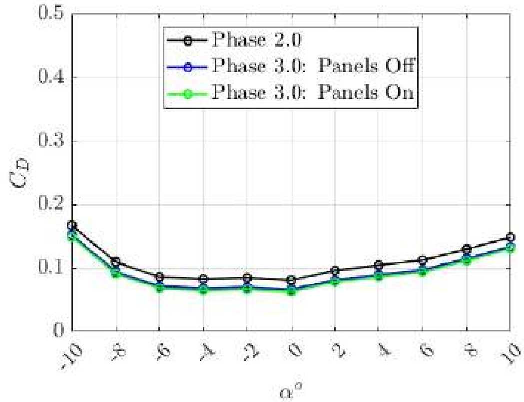
- Scaled down a military-use drone to perform tests in a wind tunnel to evaluate performance characteristics.
- Splited experiment into 3 phases focusing on (1) preliminary aerodynamic stability studies, (2) a scaled up model at a higher Re used for extensive drag tests with panels off and (3) with panels on.

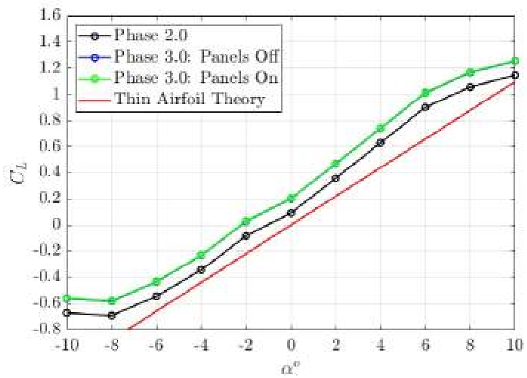
How?

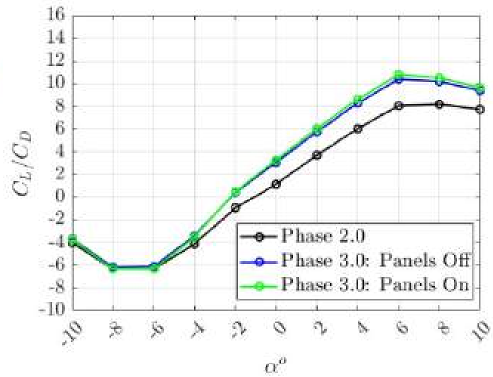
- Build a 4-bar linkage structure that allows change to all angles needed.
- Used SolidWorks to scale down and alter model for compatibility with force sensor / wind tunnel.
- Utilized an NI DAQ card and MATLAB to acquire and process data.

Results

- Phase 1 revealed that the model is dynamically stable in both pitch and roll motions around its CG and weakly stable in yaw.
- Phase 2 and 3 showed a lower drag coefficient, increasing its L/D ratio.
- Communicated with AeroTargets engineers to recommend fuselage design modifications, achieving a 10% drag reduction.







AEROTARGETS INTERNATIONAL

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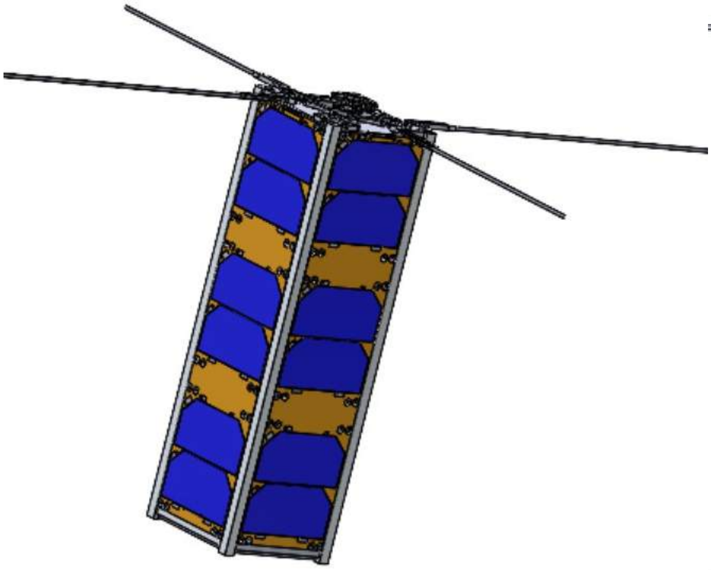
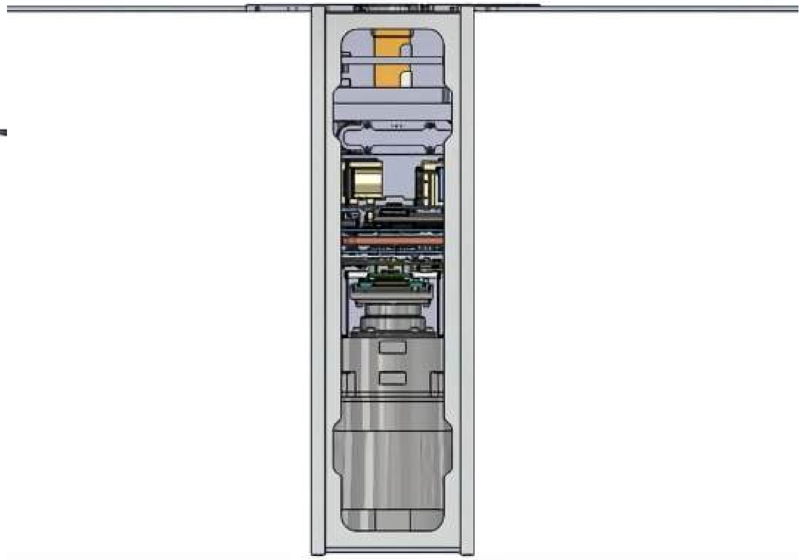
OSPREY CUBESAT - LEHIGH UNIVERSITY'S FIRST NANOSATELLITE





What?

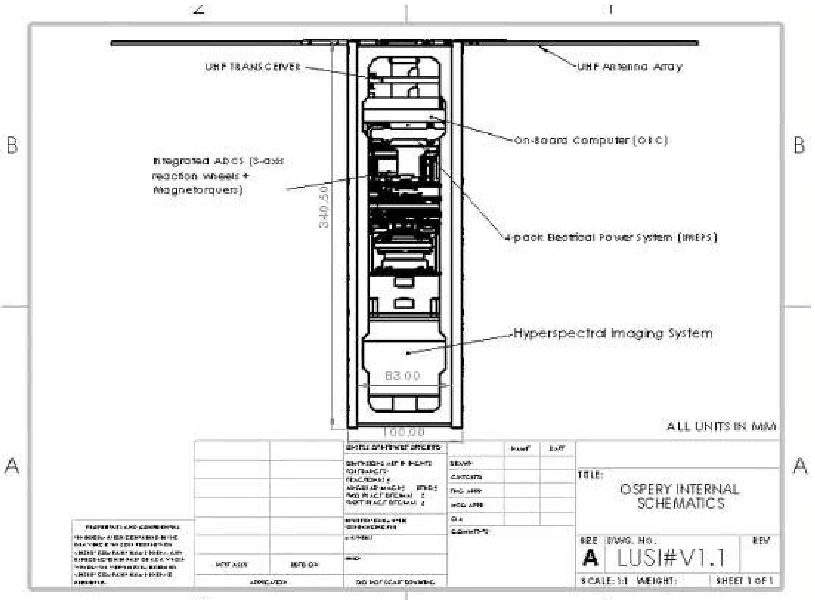
- Designed and led the development of Lehigh University's first CubeSat, OSPREY, a 3U satellite using a VS/SWIR camera system to detect ocean plastic within a 1-square-meter area for ocean trash monitoring.

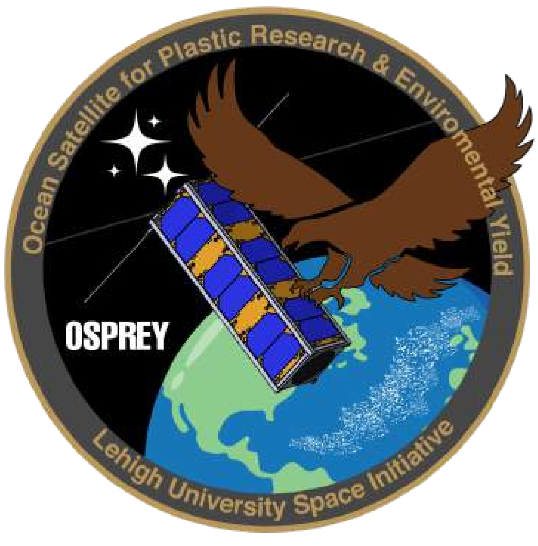
How?

- Lead CAD modelling in SolidWorks, optimizing the center of mass and moments of inertia.
- Used GD&T principles, applied material selection, mass budgeting, to ensure tolerance and compliance with NASA standards.
- Managed a team of 6 students and coordinated with other sub-teams to integrate deployable solar cells and antenna systems

Results

- Raised $150,000 in funding from Lehigh alumni and sponsors.
- Optimized the mass budget by 23% and increased payload volume by 33%.
- Successfully submitted a proposal for NASA's 2024 CubeSat Student Launch Initiative.





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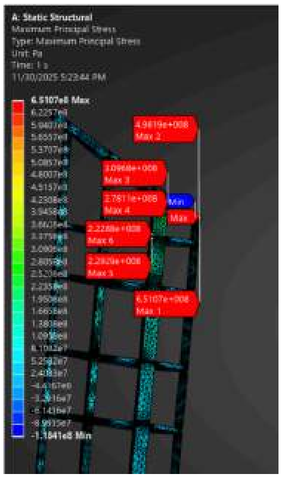
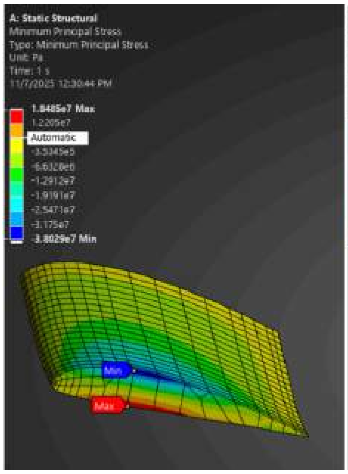
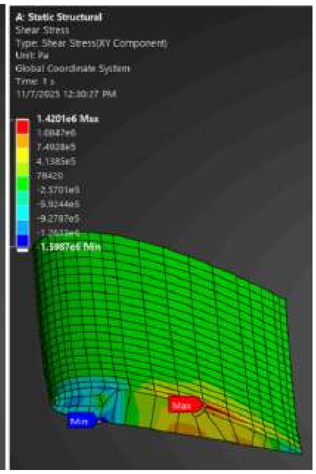
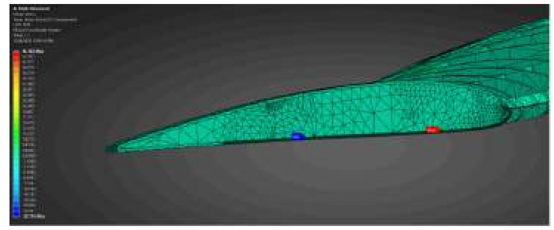
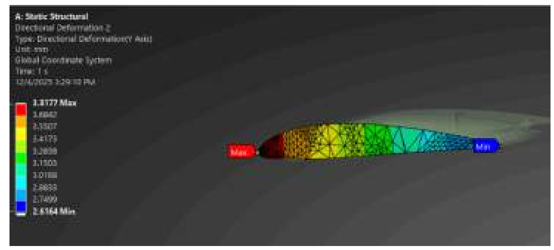
AEROELASTIC WING DESIGN - LEHIGH UNIVERSITY











What?

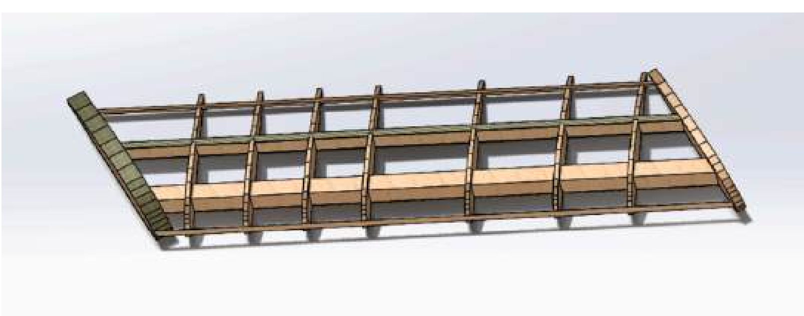
- Designed and analyzed three Gottingen 398 balsa wood wing models (straight, swept-forward, rib & strut).
- Evaluated torsional stiffness, aeroelastic coupling, and divergence speed under a 100 N/m distributed lift load.
- Fabricated rib–strut structure using a laser cutter and reinforced critical regions with carbon fiber epoxy.

How?

- Modeled geometry in SolidWorks.
- Performed structural analysis using ANSYS Workbench FEA to extract deflections and stresses.
- Computed twist, torsional stiffness, shear center, and divergence speed in MATLAB.
- Conducted wind tunnel testing.

Results

- Showed that aggressive weight reduction (to 0.247 N) led to a ~98% stiffness drop, lowering divergence speed to 26.2 m/s.
- Identified the base shear interface as the critical failure location during wind tunnel testing (~90 mph).
- Established quantitative relationship between mass reduction, stiffness penalty, and aeroelastic stability.



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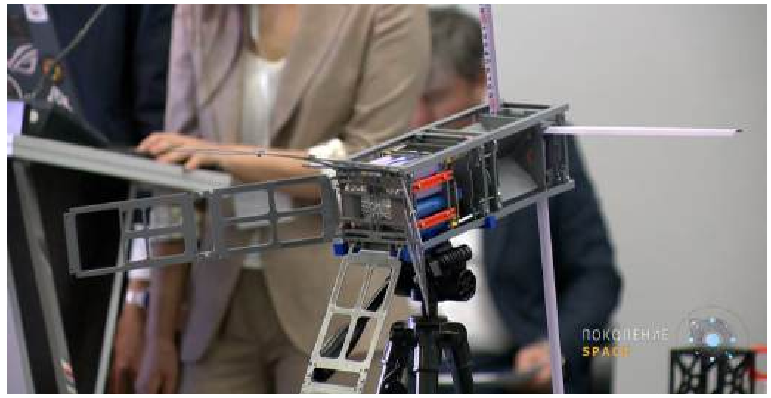
SKILLSAT STARTUP



What?

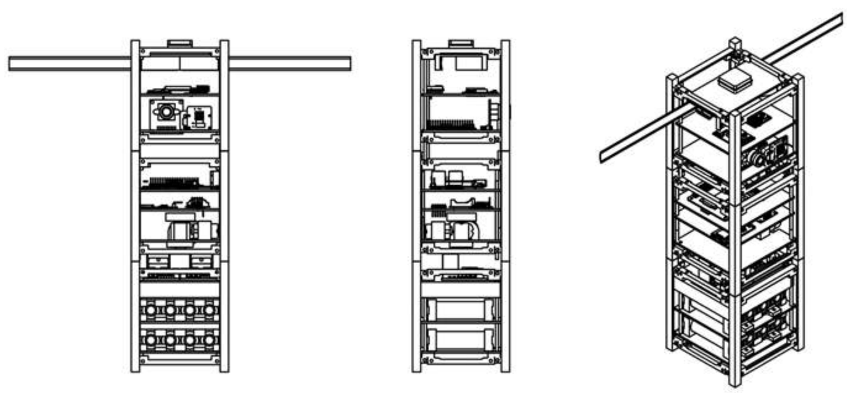
- Founded SkillSat, an EdTech startup to manufacture STEM kits that teach students to build stratospheric satellites.

How?

- Used Arduino and Raspberry Pi as the base for satellite systems.
- Utilized additive manufacturing to prototype 25+ designs.
- Applied DFA and DFM principles to reduce production costs by 44%.
- Tested prototypes at the National Space Center of Kazakhstan.

Results

- Launched satellites to Near Space (40 km+) via stratospheric balloons.
- Raised $15K in funding and distributed 80+ kits to 240+ students across 25+ schools.
- Recognized as a Top-3 SpaceTech and Top-15 EdTech Startup by Forbes Kazakhstan.



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