JOSHUA TOWLE

Aerospace Engineering Undergraduate

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PROFESSIONAL SUMMARY

First-year Aerospace Engineering student at UC Berkeley with several years of hands-on experience in embedded systems, custom PCB design, and experimental rocketry. Experienced in ESP32 and Arduino development, sensor integration, and mechanical prototyping, with a strong interest in autonomous aerospace systems and hardware development.

EDUCATION

B.S. Aerospace Engineering
University of California, Berkeley
Expected Graduation: May 2030

TECHNICAL SKILLS

- **Embedded Systems:** ESP32, Arduino, I²C, microcontroller programming
- **Electronics:** KiCad, custom PCB design, soldering (SMD and THT), circuit assembly, sensor integration
- **Mechanical:** CAD, 3D printing, CNC fabrication, rocket simulation

ENGINEERING PROJECTS AND RESEARCH

CUSTOM ESP32 AVIONICS BOARD

Independent Engineering Project | KiCad, ESP32, I²C, PCB Design **June 2025 - Jan 2026**

- Designed and iterated on custom ESP32-based rocket avionics PCBs in KiCad, integrating MPL3115A2, ADXL345, and MCP9808 over I²C to measure pressure, temperature, and acceleration.
- Developed a configurable recovery-control architecture using sensor measurements to identify flight events, including apogee, and control parachute deployment circuits through N-channel MOSFETs.
- Coordinated PCB fabrication through JLCPCB and personally assembled multiple hardware revisions for experimental rocketry applications.
- Collaborated with Pieter, an electrical engineer based in Sweden, throughout the development process, incorporating technical feedback in the new iterations. PCB was successfully bench-tested and incorporated into a rocket.

CUSTOM PCB PHOTOLITHOGRAPHY AND FABRICATION SYSTEM

Independent Engineering Project | PCB Fabrication **June 2025 - Now**

- Developed a custom PCB fabrication process by modifying an MSLA resin 3D printer to project circuit trace patterns onto UV-sensitive photoresist film applied to copper-clad fiberglass substrates.
- Utilized sodium hydroxide (NaOH) for photoresist development, ferric chloride ($FeCl_3$) for copper etching, and acetone for final cleaning and removal of residual resist.
- Completed mechanical fabrication using a Dremel rotary tool for precision drilling of component holes, producing functional custom PCBs for independent electronics projects without relying on commercial PCB manufacturers.

EXPERIMENTAL VIBRATION RESEARCH

Independent Research | Collaboration with Caltech Graduate Student **June – August 2025**

- Led an investigation comparing the vibration response of four PLA infill patterns (rectilinear, gyroid, honeycomb, and grid) using custom 3D-printed cantilever specimens.
- Designed a vibration-testing structure using a CNC spindle motor, Arduino Uno, and ADXL345 triaxial accelerometer interfaced over I²C for data acquisition.
- Developed a Python analysis script using NumPy, SciPy, pandas, and Matplotlib to perform Fast Fourier Transform (FFT) analysis, calculate RMS acceleration, and estimate natural frequencies and damping ratios.
- Co-authored the 20-page research manuscript with a Caltech mechanical engineering PhD candidate; submitted to the National Journal of High School Science and received revision requests.

CUSTOM CNC MACHINE

Independent Engineering Project | CAD, Motor Control, Electronics **August - December 2025**

- Independently designed and built a custom CNC machine by repurposing 3D-printer components
- Developed a custom motor-control configuration by adapting external stepper motor drivers to interface with an Arduino CNC shield running GRBL firmware.
- Custom CNC was capable of cutting acrylic for subsequent engineering projects, completing over 100 hours of development and testing.

ZEPHYR HIGH-POWER ROCKET DEVELOPMENT

Independent Aerospace Project | CAD, 3D Printing **June 2026 - Now**

- Designed and developed two iterations of a 4-inch-diameter high-power rocket platform for Level 1 and Level 2 certification objectives.
- Modeled and fabricated a custom avionics bay using CAD and additive manufacturing to accommodate flight instrumentation and altitude tracking.
- Conducted flight simulations and evaluated fin geometry to inform aerodynamic design improvements across successive iterations.

NEEDLEPOINT — MINIMUM-DIAMETER ROCKET

Independent Aerospace Project | Rocket Simulation, Composites **June 2026 - Now**

- Designed a minimum-diameter high-power rocket targeting Mach 1 using an H-class motor and onboard flight avionics.
- Fabricated a custom 3D-printed nose cone and avionics bay, reinforcing the rocket's cardboard airframe with fiberglass and epoxy.
- Conducted preflight simulations and parachute deployment testing to evaluate recovery-system readiness.

PROFESSIONAL EXPERIENCE

PRIVATE ENGINEERING & ROBOTICS TUTOR

Independent / Private Tutoring **June 2023 - present**

- Provide individualized, hands-on robotics instruction, teaching foundational DC electronics, soldering techniques, mechanical assembly, and electronic component integration.
- Mentor a student through the development of a mini-sumo competition robot, including assembly of a four-wheel-drive chassis, DC gear motors, and DRV8833 dual H-bridge motor drivers.
- Develop structured engineering lessons and maintain a project notebook documenting component selection, fabrication progress, technical challenges, and planned testing.
- Bring over four years of mathematics and technical tutoring experience, including work with Glendale Unified School District and more than 20 private students.

AEROSPACE SURPLUS FACILITY — TECHNICAL SUPPORT

Norton Space Props **January - November 2025**

- Assisted with inventory management, organization, and maintenance of historical aerospace components and engineering equipment.
- Interacted with visiting engineers and gained exposure to aerospace hardware, component identification, and reverse-engineering concepts.

BICYCLE MECHANIC

Cstreet Bikes **June - August 2026**

- Diagnosed, serviced, and repaired high-performance mountain bikes, with mechanical assembly, component replacement, and drivetrain maintenance.
- Assisted customers with technical questions, repairs, and retail transactions.

ENGINEERING ACTIVITIES

SPACE ENTERPRISE BERKELEY (SEB) — CARBON FIBER & PROPULSION DEVELOPMENT

Engineering Team Member | UC Berkeley **Fall 2026 - present**

- Contribute to the carbon fiber composites team, assisting with CAD design and fabrication of female molds used to lay up composite rocket structures.
- Support liquid rocket engine assembly by installing and fitting cryogenic-system hardware and participating in leak testing of propulsion components.
- Participated in a team trip to a remote testing facility, supporting solid rocket launch operations and liquid rocket engine testing.
- Collaborate with multidisciplinary student engineering teams on hands-on aerospace hardware fabrication, assembly, and testing.