GAVIN WORRELL

Engineering Portfolio

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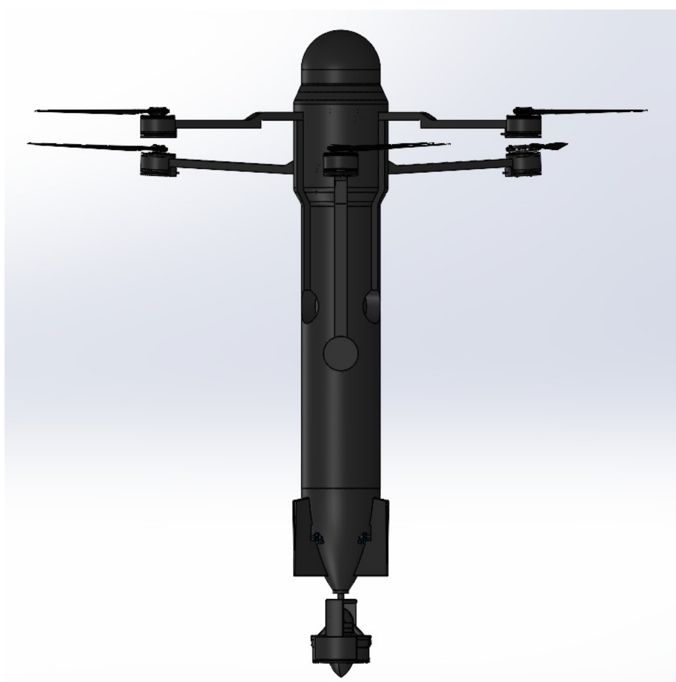
I'm a mechanical engineering student at the University of Colorado Boulder (4.0 GPA) who builds hardware rather than just studying it. This portfolio covers the projects I'm proudest of: a defense-tech startup I founded and lead as chief engineer, a gymnastics equipment company I built from age 16 into a six-figure operation with national-team contracts, and the engineering coursework where I learned to design real, physical systems as part of a team.

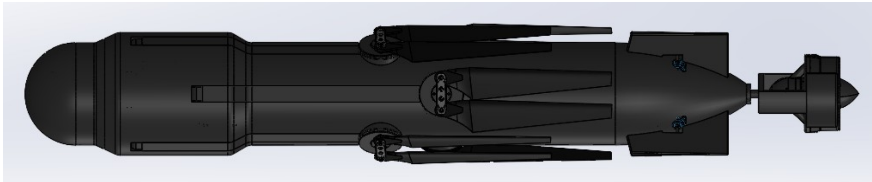
Liminal Stratum — Founder & Chief Engineer

Liminal Stratum is a defense technology startup I founded as a sophomore in college. I lead engineering as chief engineer while also serving as CEO, and I've recruited and onboarded five engineers across software/autonomy, mechanical, electronics, and CAD. We're developing a transmedium unmanned vehicle capable of air-to-water-to-air operation for anti-submarine warfare, sea mine clearance, and Navy ISR missions — a vehicle that has to perform in two physically different domains with no established design playbook to follow.

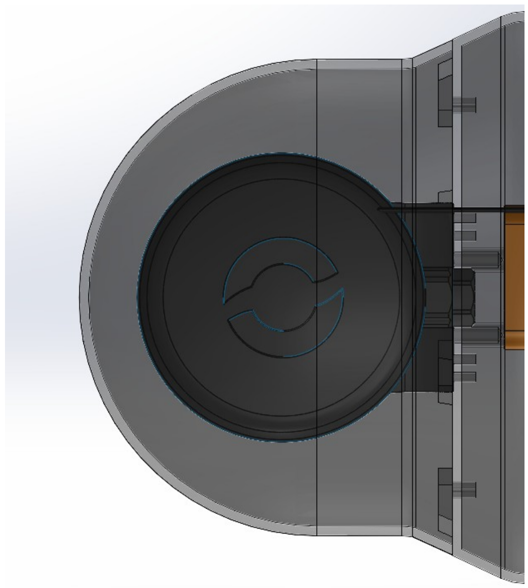
I own the CAD architecture and mechanical design of the vehicle's core systems: the hybrid airframe/hull structure, the propulsion system that transitions between air and underwater operation, watertight avionics enclosures, and the folding control-surface arms that fold for flight and deploy for underwater maneuvering. Alongside the engineering, I run the company's funding strategy — pursuing a NAWCAD BAA government development award while building a pipeline of defense-focused VC and angel investors.



Full-vehicle CAD model — arms deployed for underwater maneuvering



Horizontal swimming-mode profile view



Nose cone detail — sonar payload integration

Design & Engineering Process

The first real design decision was architectural: build one sealed airframe that does both jobs, instead of pairing a separate air vehicle with a separate underwater vehicle. A two-vehicle approach is the obvious way to solve transmedium flight, but it's heavier, harder to manufacture, and adds a second full set of failure points. I chose a single-airframe architecture instead, which meant every subsystem — structure, propulsion, avionics — had to be designed to survive and function in both domains rather than being optimized for just one.

That drove the rest of the mechanical design. The vehicle is VTOL, so it launches and recovers without a runway, catapult, or net — deployable from a vessel, a shoreline, or open ground. A set of rotor arms fold for efficient flight and reconfigure as the vehicle enters the water, and I isolated all of the sensitive electronics in a single dry, pressure-tolerant bay so the same avionics and flight controller govern behavior in both domains instead of handing off between two separate onboard computers. Propulsion is domain-specific by design — rotors optimized for stable, efficient flight, and a dedicated underwater thruster for low-noise submerged movement — with the air-to-water transition sequence itself designed to be fast and repeatable rather than a fragile, one-time event, though that's still a design target I have to validate once the physical prototype exists, not a proven result yet.

Navigation has to solve the same domain-switching problem. In air, the vehicle is designed to rely on GPS and inertial sensing for stable flight; the instant it goes underwater, GPS disappears, so the plan is to hand off to dead reckoning using its own inertial and motion data, then bring sonar online once submerged for object detection and underwater navigation. Making that handoff happen automatically and continuously — so the vehicle never loses track of its own position mid-transition — is one of the hardest open problems on the project. It's not solved yet: the autonomy software that will actually run that handoff is still being architected and written, and I'm working through the design of it alongside our software/autonomy engineer rather than treating it as a finished capability.

Major Milestones

I started with a first-pass business plan and CAD concept for the vehicle, then founded Liminal Stratum LLC as a Texas company to build it. From there, I built out the first full CAD model of the airframe, arms, and propulsion — and then substantially reworked that early geometry after running mechanical and hydrodynamic analysis on how the hull and folding arms would actually behave during the water-entry transition, which drove changes to the hull profile, arm hinge placement, and where the dry electronics bay sat inside the airframe. I carried that same analysis into the propulsion and sensor layout, adding the dedicated underwater thruster and the sonar-equipped nose cone once I'd worked out how they needed to integrate with the rest of the vehicle.

Alongside the engineering, I registered the company with SAM.gov to open the door to federal contracts, recruited and signed five engineers across software/autonomy, mechanical, electronics, and CAD, and built out the investor pitch deck and funding materials to start outreach to defense-focused VCs and angel investors. I also reviewed the Navy's BAA solicitation to align the technical roadmap toward a NAWCAD proposal. Right now, I'm 3D printing the first physical prototype of the outer body — the next step after CAD and analysis is validating the design against a real, physical part before moving into full assembly and testing.

Locked In Athletics — Founder & CEO

I founded Locked In Athletics at 16 after noticing a problem nobody else in the gymnastics industry had solved: no backpack on the market was actually built for how gymnasts train and compete. I designed a product from scratch, then built the manufacturing, sales, and marketing operation myself — from sourcing manufacturing partners in China and Mexico to running the brand end to end.

The company has scaled to over $50,000 in revenue in 2025 alone, with more than 500 backpacks sold and institutional contracts with the U.S. Air Force Academy and the Jamaican National Gymnastics Team. Winning contracts like that meant building real relationships with decision-makers I had no natural way into, which sharpened the networking and people skills I now rely on just as much as CAD.

Locked In Athletics backpack, current generation — full and compact sizes

Custom team bags produced for EVO USA / Jamaican National Gymnastics Team athletes

A production run of custom team backpacks, including the U.S. Air Force Academy order (embroidered “AF” logo)

Design & Manufacturing Process

The bag is built around a modular compartment system I designed and filed a provisional patent on in January 2025, aimed at a problem every gymnast has but no backpack actually solved: chalk from grips and chalk blocks contaminates everything else it touches. The design uses a hinged horizontal divider — a “trap door” — that isolates a chalk-only lower compartment from a clean upper one, a fully removable grip pouch that attaches with hook-and-loop fasteners so an athlete can carry just their grips to an event, and multiple removable vertical dividers that let the same bag reconfigure between separated, expanded, and fully open modes. PE board reinforcement keeps the structure from collapsing under real gym-bag loads.

Getting there took iteration, not one clean design. I built and photographed a first-generation version in early 2024, tested it with real gymnasts including my own teammates, then redesigned the compartment layout, strap system, and exterior materials into the current 2.0 version before sourcing manufacturing partners in China and Mexico to produce it at scale.

Version 1.0 prototype, built and tested in early 2024

Patented modular interior: removable dividers and chalk-isolating trap door (left); removable grip pouch (right)

Major Milestones

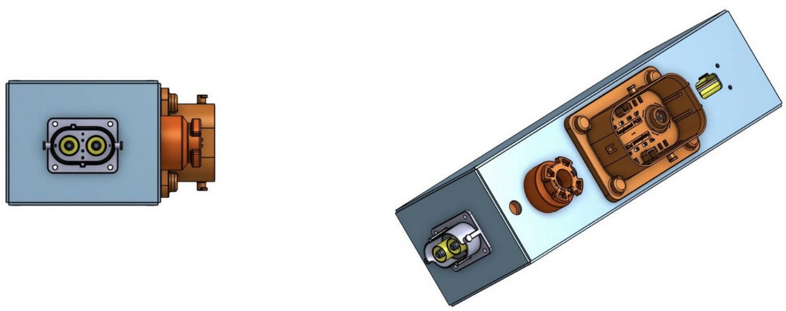
I founded Locked In Athletics at 16 after identifying the gap in gymnastics equipment, built an original business plan, and then built the first-generation 1.0 backpack myself and started testing it with real gymnasts, including my own teammates. That testing is what drove the redesign: I reworked the compartment layout, strap system, and exterior materials into the current 2.0 version, and filed a provisional patent on the modular, chalk-isolating compartment system that came out of that redesign.

From there, the business scaled alongside the product. I sold past 500 backpacks and over $50,000 in revenue, including institutional contracts with the U.S. Air Force Academy and the Jamaican National Gymnastics Team, then filed the full non-provisional patent application to lock down the design. I exhibited the redesigned 2.0 product at DevNationals 2026 to get it in front of gymnasts and gyms directly, and signed a manufacturing and distribution partnership agreement to scale production beyond what I could manage alone.

CU Boulder Engineering Projects

High-Voltage Junction Box — Formula SAE

On CU Boulder's Formula SAE team, I designed the high-voltage junction box that distributes power from the accumulator on our electric race vehicle, coordinating with the electrical and integration teams so my sealing and enclosure choices didn't create problems downstream. My process started from the failure mode rather than the happy path: I researched enclosure waterproofing and sealing approaches for wet operating conditions first, then designed the enclosure around maintaining electrical integrity under those conditions — treating a sealing failure on a live high-voltage system as a safety event, not an afterthought.



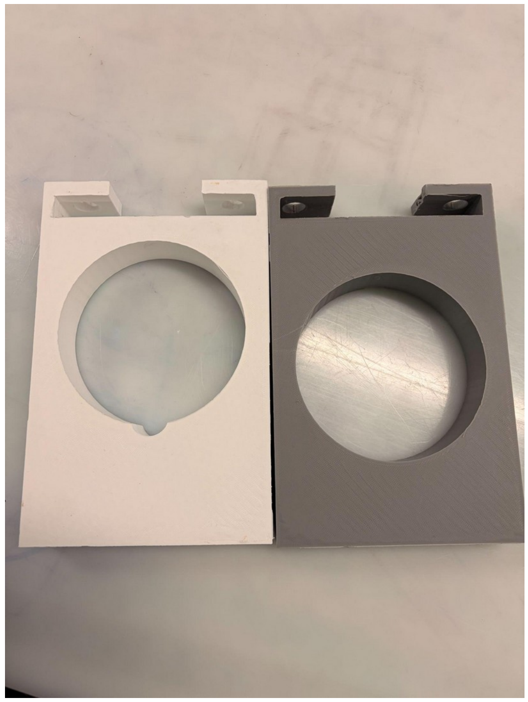
High-voltage junction box CAD model — sealed enclosure with connector plate (left) and exploded isometric view showing the connector and mounting detail (right)

Eddy-Current Braking System — GEEN 1400

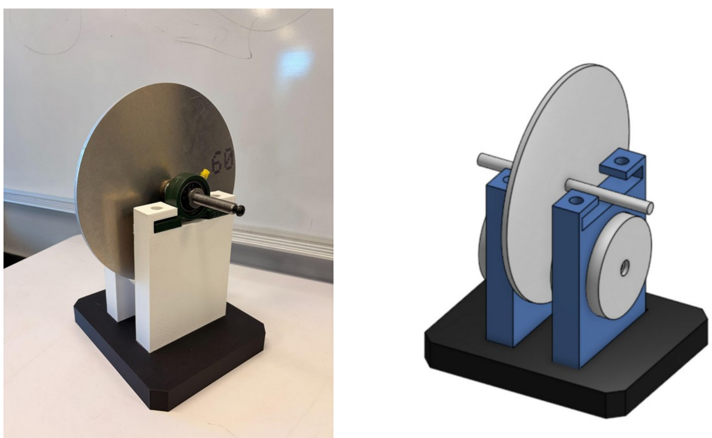
As part of a five-person engineering project team, I helped design, build, and test an eddy-current braking system aimed at reducing brake failure and overheating on semi-trucks during long descents. I engineered the electromagnet enclosure and integrated the aluminum rotor that generated braking force through induced eddy currents, while teammates handled the electrical and simulation sides. Using a weighted decision matrix to balance functionality, safety, cost, and appearance, we selected a design that moderated rotational speed while optimizing electromagnet placement.

Getting to that design meant rejecting two earlier concepts. The first mimicked a real disk brake, with electromagnets angled around the rotor in an elevated housing — closer to a production system, but it needed an independent support structure we couldn't justify for a prototype, so I redesigned the housing to mount directly to the rotor assembly, which cut cost and complexity while improving safety. We also debated how to spin the rotor at all: a motor was too expensive on top of the electromagnets, and a hand-crank risked adding friction that would contaminate our test data, so we settled on a screw driven by a handheld drill — cheap, simple, and it gave us a known, repeatable initial speed for the deceleration testing. We also nearly built it with a single electromagnet to save cost, until further research showed a second magnet on the opposite side of the rotor would raise braking force more than fivefold by inducing eddy currents on both faces at once — worth the added complexity.

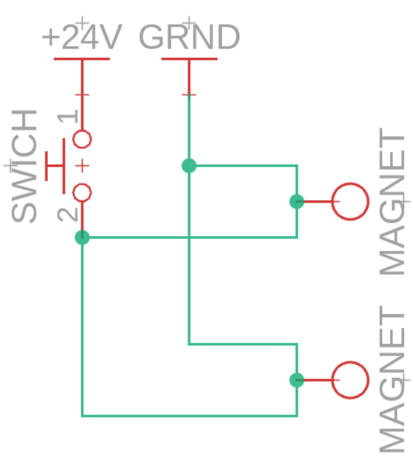
Testing the completed prototype, we measured angular deceleration with the electromagnets off and on, and found the electromagnetic braking system increased angular deceleration by a factor of 8.2 — proving out the core concept: a contactless, fully reusable braking assist that eliminates the heat buildup responsible for a large share of real-world semi-truck brake failures. Both CU Boulder projects reinforced the same lesson: good engineering happens at the interface between your system and everyone else's, not in isolation.



Completed eddy-current braking prototype — aluminum rotor, electromagnet mounts, and control switch



Electromagnet component (left) and 3D-printed magnet housing, two design iterations (right)



Electronics schematic — switch and dual-electromagnet wiring

Education & Skills

B.S. Mechanical Engineering, Minor in Business Finance — University of Colorado Boulder, Aug 2025 – May 2029. GPA: 4.0 / 4.0, Dean's List every semester. SAT: 1550 (99th percentile).

Software: SolidWorks, Onshape, KiCad, MATLAB, Adobe Illustrator, ArduPilot, ROS 2. Programming: C++, JavaScript. Hardware: 3D printing, high-voltage electrical systems, electromagnetics.