

Timothy Cai

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[portfolio](#) | [linkedin](#)

ABOUT ME

I'm a highly motivated second year engineering student with a particular focus on realistic design and manufacture of hardware, electronics, and software systems. Proficient in project creation and completion. Aiming to obtain a position involving mechanical design in an active and lively environment that directly contributes to project development.

EDUCATION

Bachelor of Engineering - Mechanical

University of British Columbia | 3.48 GPA

Co-op Availability | May - December 2024 (8 months)

Sep 2022 - Apr 2027

Vancouver, BC

SKILLS

Design Skills CAD | CAM | Coding | Electronics Design | Rapid Prototyping | Data Analysis
Technologies Solidworks | FUSION360 CAD/CAM | C++ | Python | Arduino | Autodesk EAGLE | MATLAB
Fabrication Lathe | Mill | Waterjet | Shop Tools | CNC Programming | FDM/SLA Printing

EXPERIENCE

UBC Rocket

May 2021 - Present

Propulsion Lead

Vancouver, BC

- Led a 11 member team in the construction and static fire preparation of a 2.5kN kerosene/LOX rocket engine.
- Conducted post-hotfire failure analysis utilizing test stand data and engine first principles.
- Characterized engine injectors through use of computational fluid dynamics and real-world testing, optimizing geometry to improve atomization.
- Conducted multiple tests, from hydrostatic leak checks to high-pressure flows utilizing PLC based test stands.
- Tested and built multiple ignition systems, including a radial solid "R-Candy" igniter and a kerosene-LOX torch igniter.
- Completed a certification for the lathe, mill, and waterjet, as well as obtained experience with MIG/TIG welding.

DI Self-Composites Internship

Aug 2023 - Present

Mechatronics Engineer

Vancouver, BC

- Produced a comprehensive report detailing 7 potential motion system solutions for metal 3D printing.
- Utilized Solidworks to rapidly design and prototype a movement system capable of 200mm/s printing speed and 20,000m/s/s acceleration 20% under budget
- Independently manufactured the movement system with a combination of 5-axis CNC, 3D printing, waterjet, and other machines.
- Adapted existing softwares and wrote custom firmware to quickly produce a full-featured printing solution.

Team Zephyr Satellite Design Team

Sep 2021 - Jan 2023

Team Captain

Bologna, IT

- Led a team in the production of a CanSat for Canada's first satellite design competition, accomplishing first place at the Canadian CanSat Challenge and representing Canada at the ESA CanSat Competition.
- Raised 23,000 CAD in funding and produced outreach content for over 100,000 people.
- Delivered four papers on the RotaSat Mission for preliminary, critical design reviews and post-flight reports, receiving the Best Report award from the ESA.

Powertech Laboratories Internship

May 2023 - Sept 2023

Engineering Technician

Vancouver, BC

- Conducted the installation and upkeep of high pressure hydrogen component test facilities, working with DAQs and test stands.
- Proposed and undertook the design and manufacture of an intrinsically safe heating system to increase the heat testing capability of the gas cycle systems.
- Checked data sets for errors and designed visualization templates for the presentation of information to clients.

NOTABLE PROJECTS

Supersonic Certification Rocket

Aug 2022 - Present

Personal Project

Vancouver, BC

- Successfully designed, manufactured and flew a rocket to 2.8 kilometers at 1280km/hr (Mach 1).
- Received Level 2 Canadian Association of Rocketry certification.
- Met all system requirements through mass optimization, prototyping, and ground testing.
- Simulated and optimized internal couplers and structural components, reducing weight by 30%.

Thrust Vectoring Rocket

Oct 2020 - Sep 2023

Personal Project

Surrey, BC

- Utilized rapid prototyping skills to design a novel mechanical thrust vectoring framework for miniature active control rockets, achieving ± 3.5 degrees of stability in flight.
- Implemented a finite state machine with quaternion orientation and PID control for flight in C++.
- Designed and manufactured custom through-hole and surface-mounted flight and launch computers utilizing EAGLECAD.
- Programmed multiple simulations for control algorithm tuning in JavaScript and Python.
- Achieved first place at the national STEM fair and represented Team Canada at ISEF.

RotaSat Modular Cansat

Oct 2021 - Aug 2022

Hardware Lead

Bologna, IT

- Designed and simulated hardware for modularity and strength, fitting flight computers, cameras, recovery hardware, and active control components into a soft-drink sized form factor.
- Formulated and tested the first CanSat live video stream system, employing a combination of off-the-shelf components and custom electronics.
- Developed and manufactured the first aluminum CanSat reaction control wheel and achieved a desired pointing accuracy of less than ± 2.5 degrees through Zeigler Nichols tuning.

PUBLICATIONS

- **Timothy Cai**, "An Investigation into Active Control for Accessible Orbital Flight," 2023 *Canadian Science Fair Journal (CSFJ)*, *arXiv.org*, Ottawa, Canada.