

# Timothy Cai

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

## ABOUT ME

Highly motivated second year engineering student with a particular focus on realistic design and manufacture of hardware, electronics, and software systems. Extensive experience in project creation and completion.

## EDUCATION

### Bachelor of Engineering - Mechanical

University of British Columbia | 3.73 GPA

Sep 2022 - Apr 2027

Vancouver, BC

## SKILLS

**Design Skills** CAD | Coding | Electronics Design | Product Rendering and Animation | Rapid Prototyping

**Technologies** Solidworks | FUSION360 | C++ | Python | Arduino | Autodesk EAGLE | Keyshot | Keyshot

## EXPERIENCE

### DI Self-Composites

Aug 2023 - Present

*Mechatronics Engineer*

Vancouver, BC

- Produced a comprehensive report detailing potential motion system solutions for testing and production models.

### Powertech Laboratories

May 2023 - Sept 2023

*Engineering Technician*

Vancouver, BC

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

### UBC Rocket

May 2021 - Present

*Propulsion Lead*

Vancouver, BC

- Designed, modeled, and currently constructing a flight capable, 2kN ethanol/liquid oxygen rocket engine from the ground up.
- Analyzed and optimized engine injectors through use of computational fluid dynamics, optimizing pressure drop and impingement pattern.
- Operated multiple test stands to confirm test status for engines, from hydrostatic leak checks to high-pressure flows utilizing PLCs.
- 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 and TIG welding.

### Team Zephyr Satellite Design Team

Sep 2021 - Jan 2023

*Team Captain*

Bologna, IT

- Led a team of prospective engineers in designing a fully featured CanSat for Canada's first satellite design competition, accomplishing first place at the Canadian CanSat Challenge and finalist 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.

### Team Canada ISEF

Dec 2021 - Nov 2022

*Member*

Ottawa, ON

- Accepted as one of 10 Team Canada ISEF members, from an invitation-only group of 1,000 prospective International Science and Engineering Fair finalists.
- Achieved first place at the Canada-Wide Science Fair, with over 300,000 participants across Canada.
- Produced three scientific papers on the topic of scalable thrust vectoring frameworks.

## NOTABLE PROJECTS

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### Level 1-3 Certification Rocket

**Aug 2022 - Present**

*Solo Developer*

*Vancouver, BC*

- Successfully designed, manufactured, flew and recovered a rocket flown to 1 kilometer at Mach 0.5.
- Verified requirements were met and flight stability at the system level with FEA, CFD, and OpenRocket.
- Simulated and optimized the topology of internal couplers and structural components.

### Thrust Vectoring Rocket

**Oct 2020 - Sep 2023**

*Solo Project*

*Surrey, BC*

- Implemented a finite state machine with quaternion orientation and full state feedback control for flight in C++, achieving  $\pm 7$  degrees of stability in flight.
- Built a hardware framework for active control of model rockets. Utilized 3D-printing and CAD to design a novel mechanical thrust vectoring mount and parachute ejection system.
- Designed and manufactured custom through-hole and surface-mounted flight and launch computers utilizing EAGLECAD.
- Programmed multiple simulations for control algorithm tuning in JavaScript, Python, and Simulink.

### 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  $\pm 2.5$  degrees through Zeigler Nichols tuning.

## PUBLICATIONS

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