EMERSON VARGAS NIÑO

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CORE EXPERIENCE

SPACE FLIGHT LABORATORY — ***Toronto, ON***

Senior Research Associate – Spacecraft Engineer — ***Aug 2022 – Present***

- GNC engineer responsible for design, on-orbit operations and testing functions across 45+ small satellites in 10+ missions
- Developing & testing resistojet propulsion system; created Python simulation of propellant phase change inside heat chamber in 1 month
- Conducted on-orbit commissioning, conjunction assessment, collision avoidance, formation flying and GNC calibration for 20+ spacecraft
- Owned GNC hardware for 35+ spacecraft end-to-end, led acceptance & calibration tests, achieving 100% on-orbit success

Research Associate – Spacecraft Engineer — ***Aug 2021 – Jul 2022***

- Developed a Python-based spacecraft simulation framework to optimize attitude trajectories and sensor placements, increasing yearly useful satellite observations by 35% for 6 orbiting spacecraft
- Developed on-orbit calibration methods & cut average GNC commissioning time by 40% via automation of GNC & data processing tasks
- Developed hardware and software automation tools, leading to a 60% reduction in GNC hardware acceptance campaign duration
- Developed and validated a Python & STK tool to devise deorbiting strategies, informing all SFL spacecraft designs from 2023 onwards

Graduate Researcher — ***Sep 2018 – Jul 2022***

- Advanced attitude trajectory algorithm from TRL-1 to TRL-9 by integrating it into flight code written in C, validating it via simulation and deploying it on-orbit to 2 spacecraft, resulting in 30% increase in star tracker availability during target-tracking
- Developed dynamic set-point determination technique for reaction wheel angular momentum using numerical optimization, achieving 10% average reduction in pointing error and 20% increase in momentum margin for attitude maneuvers on 10 active spacecraft
- Led qualification and acceptance testing of deployable solar panel system on 15+ spacecraft, achieving TRL-9 and 100% on-orbit success
- Conducted studies and designed solutions to overcome lifetime and efficiency challenges in monopropellant and Hall thruster programs

LAUNCH CANADA — ***Toronto, ON***

Rocket Turbopump Project – Analytical Team Lead — ***Oct 2022 – Present***

- Leading 5+ members to execute projects, including pump CFD simulations and cooling jacket design, to aid a turbopump design

Liquid Rocket Bootcamp – Rocket Team Lead — ***Jun 2021 – Nov 2021***

- Managed 5+ member team through 3 cold flow tests and a 35-second hot fire test on a 1,000 lb thrust LOX-kerosene engine
- Responsibilities ranged from propellant line fabrication and propellant handling to data analysis, updating P&ID diagrams and procedures

UNIVERSITY OF TORONTO AEROSPACE TEAM — ***Toronto, ON***

Liquid Rocket Propulsion Lead — ***May 2020 – Aug 2021***

- Spearheaded the University of Toronto's first liquid rocket engine project, leading a remote team of 14 students in designing a 110 lbf thrust N_2O-ethanol engine, from project inception to completion of the preliminary design within 10-month timeframe
- Developed a Python-based rocket simulation, including the propulsion system and 3-DOF flight dynamics, successfully validating apogee predictions against alternative tools and leveraging numerical optimization to achieve 15% reduction in vehicle mass
- Achieved record 93% year-to-year member retention during COVID-19 by enacting a positive culture and effective leadership strategies

Hybrid Rocket Propulsion Lead — ***Jul 2017 – Apr 2020***

- Led 20+ member team in the design and implementation of a 1,400 lbf thrust N_2O-paraffin hybrid rocket engine which propelled the rocket DEFIANCE to 21,000 ft, securing 1st place in the Advanced Flight category at the 2022 Launch Canada competition
- Designed engine's injector, creating MATLAB and OpenFOAM CFD simulations, executed on HPC cloud clusters, achieving 3.9% error in simulating two-phase N_2O mass flow. Results published in the AIAA Propulsion and Energy Forum proceedings and used as a resource in Stanford's graduate-level Advanced Rocket Propulsion course
- Developed and validated rocket structural loading models at max-Q using Python and OpenFOAM CFD simulations, executed on the Niagara supercomputer, leading to 12" reduction in propellant tank length to ensure 2x safety factor during flight

Propulsion, Avionics, Airframe Member — ***Sep 2014 – Jun 2017***

- Designed, analyzed, manufactured & tested components for 4 rockets, and aided 3 successful hot-fire and cold-flow test campaigns

SPACEPORT TORONTO X VIENNA — ***Toronto, ON***

Liquid Rocket Engine Lead — ***May 2018 – Apr 2020***

- Led international team of 10+ students from two universities in designing a 1,900 lbf thrust N_2O-ethanol liquid rocket engine for a rocket aimed at reaching space (390,000 ft apogee), from the team's inception to completion of the preliminary design phase
- Defined requirements, led trade studies, directed system and component design, and conducted propulsion system MATLAB simulations

AEROSPACE COMPUTATIONAL ENGINEERING LABORATORY — ***Toronto, ON***

Aerospike Nozzle Capstone Project – Project Lead — ***Sep 2017 – Apr 2018***

- Led team of 4 on the design, analysis and integration of a N_2O-cooled aerospike nozzle into a small-scale hybrid rocket engine
- Developed optimization-based design process to reduce heat loads and maintain thrust, presenting results at CASI ASTRO conference

SPACECRAFT DYNAMICS AND CONTROL LABORATORY — ***Toronto, ON***

Undergraduate Researcher — ***Sep 2017 – Apr 2018***

- Created 6-DOF spacecraft simulation with environmental disturbances in MATLAB to study B-dot and optimal magnetic-impulsive control

ZEBRA TECHNOLOGIES — ***Mississauga, ON***

Systems Engineering Intern — ***May 2016 – Aug 2017***

- Supported the life cycle of 5+ mobile computing and robotics solutions, encompassing design, prototyping, ensuring compliance with program requirements and completion of test procedures, alongside providing software support for the requirements management tool

Internet of Things (IoT) Lead — ***May 2016 – Aug 2017***

- Managed 6-person team to develop 5 IoT-based solutions, deploying them to a local campus serving 100+ users. One solution, an interconnected hub designed to enhance meeting productivity, was deployed across Zebra campuses worldwide and used by 200+ users

CUSHION: AN INTERACTIVE MEDIA WOMB — ***Toronto, ON***

Hardware & Software Lead — ***May 2016 – Oct 2016***

- Designed and built hardware and software for interactive electronic art installation at Nuit Blanche, attracting 7,000+ visitors in 12 hours

HUMAN FACTORS AND APPLIED STATISTICS LABORATORY — ***Toronto, ON***

Undergraduate Researcher — ***May 2015 – Nov 2015***

- Organized and conducted statistical analysis on distracted driving video & numerical data, co-authoring final report for industry partner

ADDITIONAL EXPERIENCE

PUEBLO SCIENCE — ***Toronto, ON***

Orienting Committee Member — ***May 2023 – Present***

- Invited member due to exceptional contributions, shaping organizational strategy and implementing innovative ideas at Pueblo Science

STEM Education Specialist — ***Jul 2020 – Present***

- Top-requested STEM instructor, developing & delivering engaging classes to 100+ grade 5-9 students in remote Indigenous communities
- Creating coding and electronics STEM curriculum modules for hundreds of rural grade 7-11 students across the Global South

UNIVERSITY OF TORONTO AEROSPACE TEAM — ***Toronto, ON***

Mentor — ***Sep 2021 – Present***

- Facilitated team in overcoming challenges in the design, testing, construction, and launch of hybrid and liquid rockets

STEM Outreach Communicator — ***Sep 2014 – Aug 2021***

- Delivered STEM talks and workshops to hundreds of youth at venues including Ontario Science Centre, Science Rendezvous, TEDxYouth

Business Development Officer — ***Jun 2015 – Apr 2016***

- Managed and expanded a sponsorship portfolio valued over $110K USD in cash contributions and $11M USD in in-kind donations

External Relations Director — ***Jan 2015 – Jun 2015***

- Led visibility campaign, boosting social media engagement by 4000%, contributing to a $26K USD yearly funding referendum success

VISIONS OF SCIENCE — ***Toronto, ON***

STEM Clubs Facilitator & Interim Program Facilitator — ***Oct 2020 – May 2021***

- Developed and delivered weekly, hands-on STEM programs to 30+ students aged 8-12 from marginalized low-income communities, earning recognition as top 10% facilitator; chosen as interim program facilitator to lead 10+ volunteers to deliver engaging programming

OPERATION SPACE — ***Remote***

Advisor — ***May 2018 – Aug 2018***

- Advised 30+ international student team on avionics and structural design for 2-stage solid rocket that achieved 51,000 ft apogee

EDUCATION

UNIVERSITY OF TORONTO — *Toronto, ON*

MASc Aerospace Science & Engineering – ***GPA***: 3.95/4.00 – Fully-funded tuition & stipend from UofT Student Fellowship — *Aug 2022*
Thesis: Microsatellite Development, Testing and On-Orbit Operation

BASc Mechanical Engineering – Streams: Mechatronics, Solid Mechanics & Design — *May 2018*
Thesis: Optimal Hybrid Attitude Control for Detumbling Spacecraft
Capstone: Design and Analysis of a Nitrous Oxide Cooled Aerospike Nozzle for a Hybrid Rocket Engine

SKILLS & INTERESTS

Languages *Fluent*: Python, MATLAB, LaTeX. *Intermediate*: C++, C, Bash/Shell | *Fluent*: Spanish, English. *Novice*: German, French
Tools GNU/Linux, STK, OpenFOAM, ANSYS (Fluent and Mechanical), SolidWorks, Pointwise, Git, high-performance computing
Fabrication Lathe & mill (3 George Brown College certificates), soldering, 3D printing, composite layups (carbon fiber & fiberglass)
Interests Continuing education courses, backcountry backpacking, scuba diving (PADI certified), rock climbing, skateboarding, swimming, running, meditating, photography, violin, guitar, world citizen (visited 30+ countries, lived in 6)