Metropolitan Aerospace & Combustion Hub

Sponsorship Package

2022 - 2023

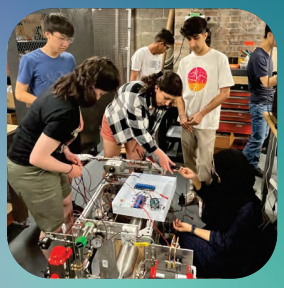
Contents

About Us

MACH is an engineering design team from Toronto Metropolitan University. Founded in 2017 as Ryerson Propulsion Group with the goal of building a liquid engine for a suborbital sounding rocket, we are aiming to be one of the first teams in Canada to test and fly a bipropellant liquid rocket engine.

As a student design team, MACH offers more than just yearly competitions. Our primary goal is to provide a unique and challenging real-world engineering experience to our members. By taking on one of the most challenging projects in the aerospace sector, we offer a unique opportunity to participate in a research, design, manufacturing, and testing process rarely found outside of cutting-edge space

About Us



Renaming to Metropolitan Aerospace and Combustion Hub in 2022, the team has refined its focus towards practical engineering, novel research, and community collaboration. Safety and learning remain the team's cornerstones, offering unique and challenging opportunities for Canadian students in one of the most difficult fields in engineering. Despite severe material and budgetary limitations for a project of this scope, MACH strives to use industry standard components and practices to maintain safety and integrity.

Our Team

Umar Shabbir
Team Director

Yiwei Luo
Technical Director

Mykola Sydorenko
CD Lead

Ben Kubica
CD Lead

William Pirie
CD Lead

Shivesh Maraj
PM Lead

Rui Fernandes
PM Lead

Rochelle Suarez-Tapanes
PM Lead

Georgia Jovanovic
T&C Lead

Kai Stewart
T&C Lead

Daniel Ibanescu
T&C Lead

Mark Paul
T&C Lead

Jack Sinclair
Safety Lead

Liana Farzaneh
Bizdev Lead

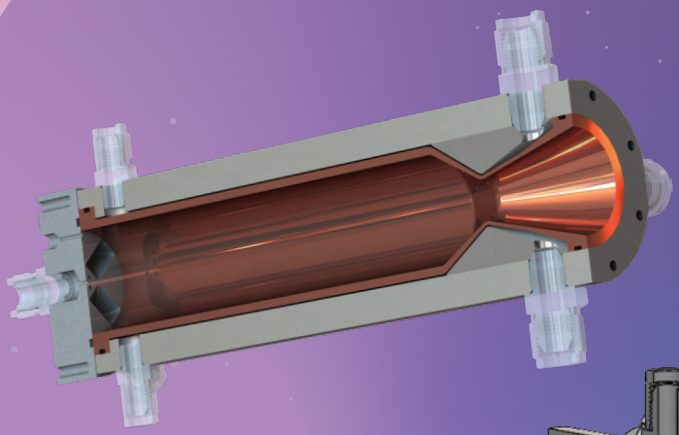
Laxan Puveendran
Finance Lead

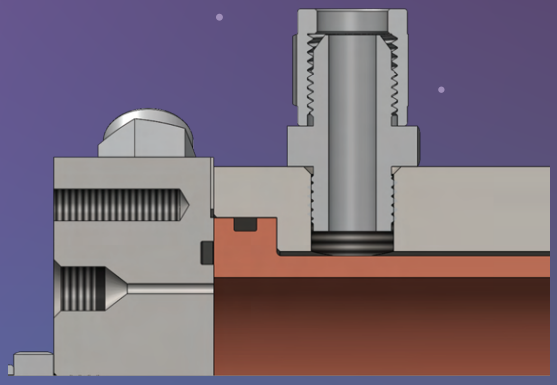
Our Projects

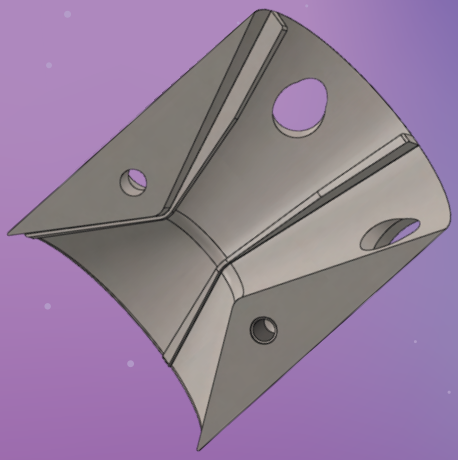
Along with our original goal of flying a liquid rocket engine, we've also expanded our interests into novel combustion research. As such, we are concurrently working on two student researched and developed (SRAD) liquid engine projects - Borealis and GAR-E.

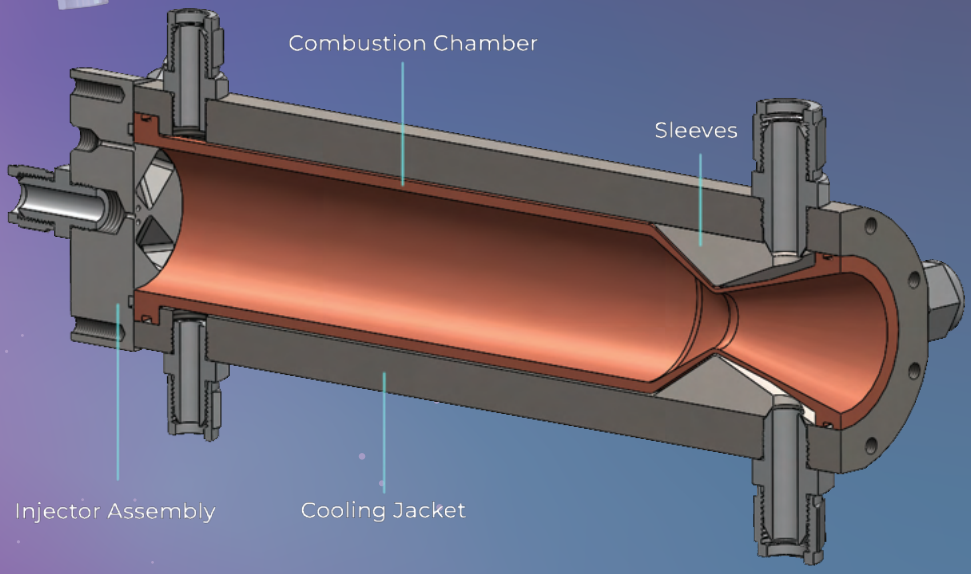
Both engines are pressure-fed, bipropellant liquid engines. Due to safety and cost considerations, we use ethanol for fuel and nitrous oxide as oxidizer, a relatively uncommon combination we've been calling EthaNOS. Our propellant & electronics systems are just as critical to the success of our rocket engines. Both these systems use industrial or scientific grade hardware, following design & operational practices from the likes of NASA & Rocketdyne. Our systems are all highly modular, allowing us to test different engine, tank, and electronic components with minimal modifications to the overall system.

Borealis Engine



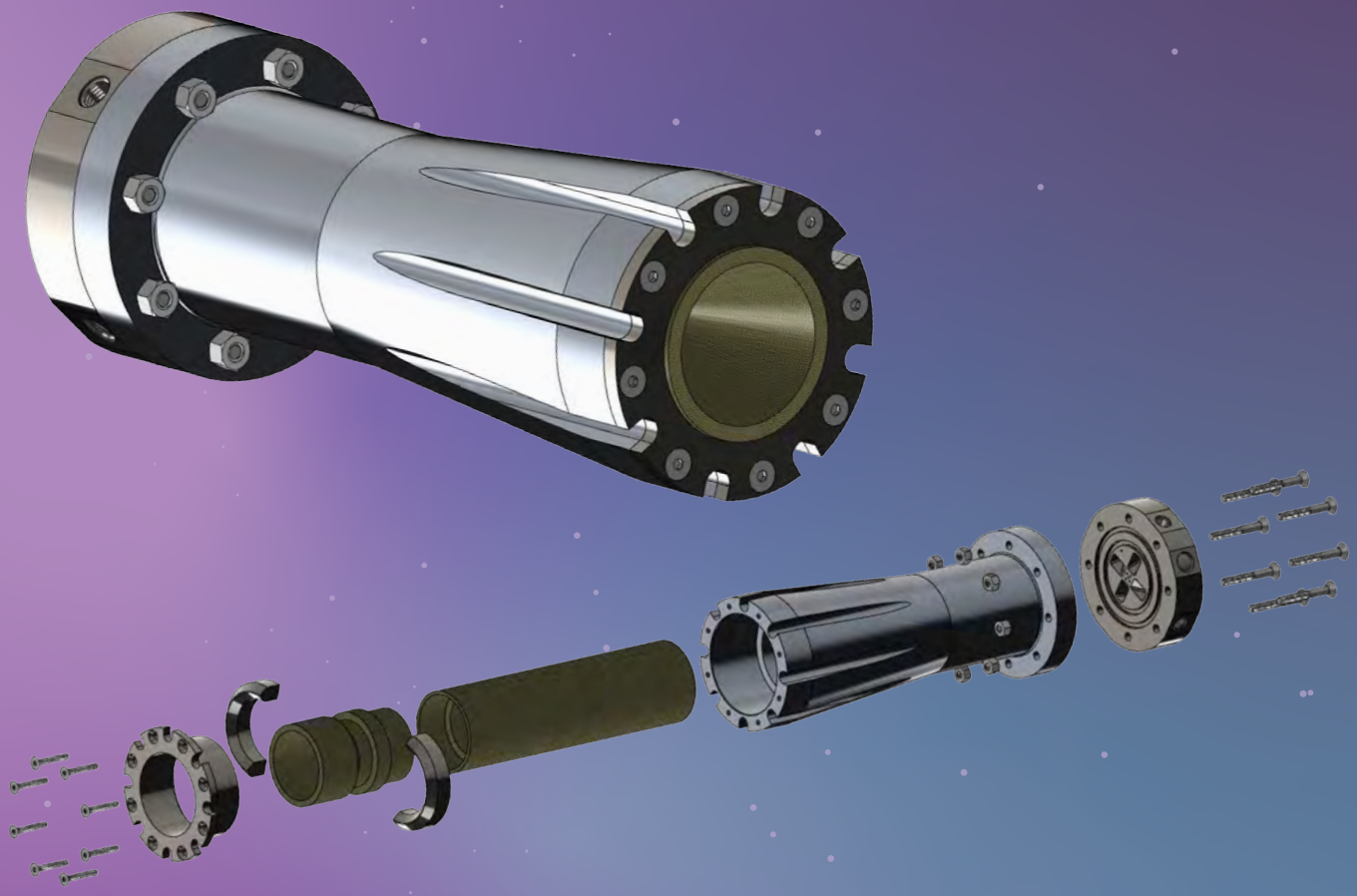






The Borealis is a reusable, semi-regeneratively cooled, instrumentation engine. It will collect laboratory-quality sensor data for novel combustion research and development of future engines. The design is focused around safety and modularity, allowing different cooling, injector, and other configurations to be easily and comparatively tested.

GAR-E



The Garolite Ablative Rocket-Engine, affectionately known as GAR-E, is an extremely low cost, rapidly iterative engine design. GAR-E allows us to build a series of prototypes to quickly and cheaply develop our flightweight systems. The design is a refocusing of our efforts into flight hardware, allowing us to easily test upscaled designs needed for flight.

Milestones

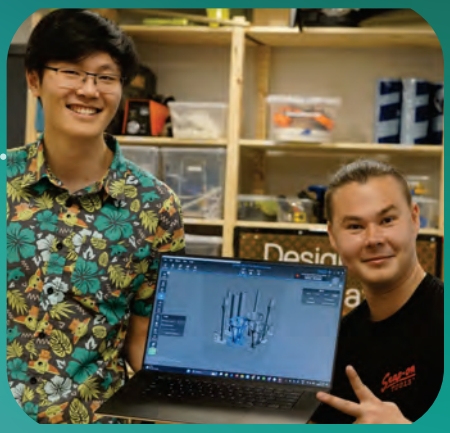
Despite the difficulties of the pandemic over much of our team's history, we've accomplished a great deal in pursuit of our goals and within the community. Over the past several years, we're proud to have:

- Designed, produced, and hot-fired a 3D-printed propane rocket
- Helped set up and hot-fire a LR-101 liquid rocket engine, which helped bring the Mercury astronauts to space
- Published & presented a research paper on our design methodology at the 2022 CI/CS Conference
- Participated in & assisted with Launch Canada 2022, the first rocketry competition ever held in Canada
- Hosted numerous open-access rocketry workshops & outreach events
- Developed connections & frequent consultation with industry experts including Adam Trumpour, Chris Hobbs, and Dan Steinhaur

Progress

Since returning to in-person collaboration, MACH has been busy turning our designs into hardware. Over just the last few months, MACH has:

- Manufactured the Borealis combustion chamber, began machining for most components
- Fully assembled our propellant system, preparing for testing & tuning
- Acquired most electronic components, currently under integration
- Finalized test stand & supporting subsystems, securing manufacturing
- Secured a safe & accessible testing site in Welland, ON
- Published comprehensive documentation on our system design & testing methodology, validated by industry veterans

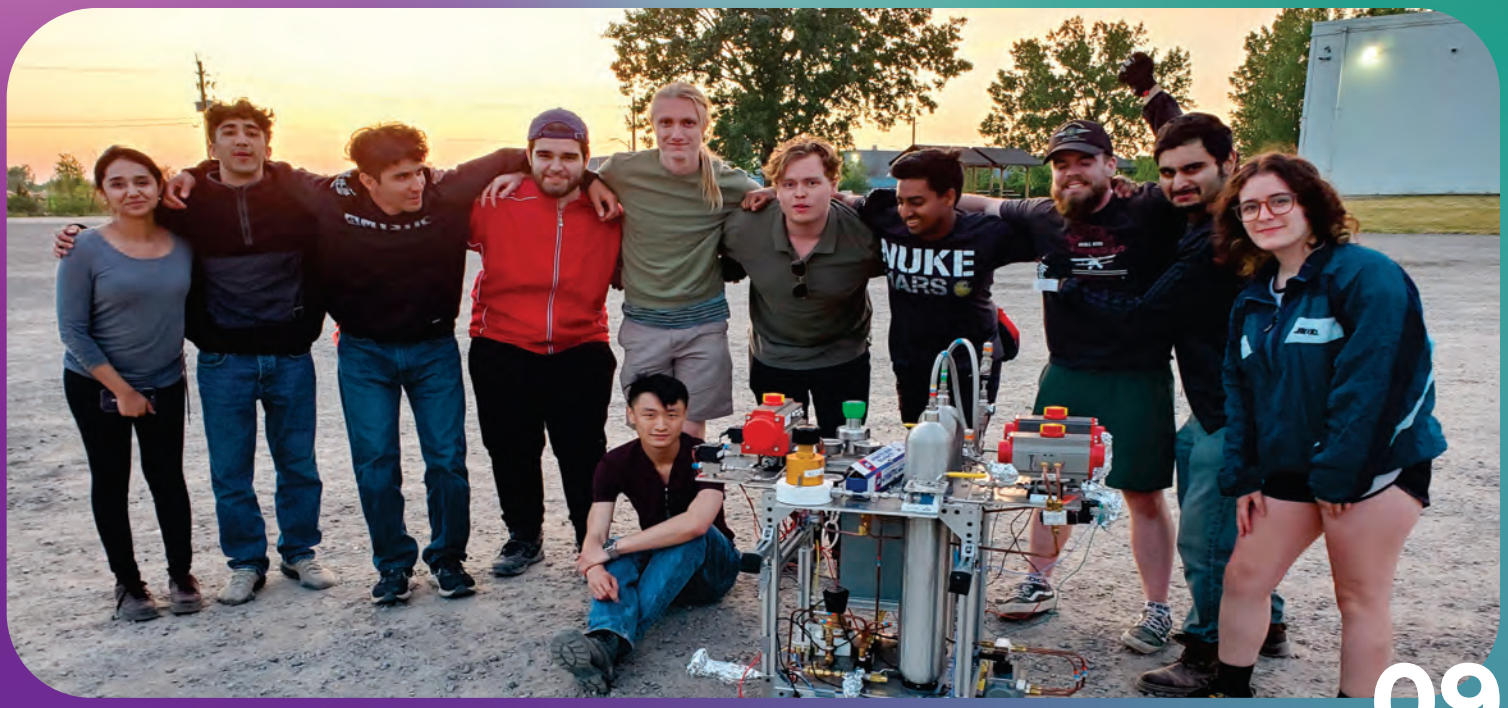


Our Upcoming Goals

Despite limited resources and many technical challenges, we will overcome them and keep pushing forward. With your support, we are determined to:

- **Hot fire**
- **Write IDP for LC**
- **Attend SAGM**
- **fill the COO role**
- **start up the Structures and Recovery subteams**
- **Preliminary and Advanced Design phases completed by December.**

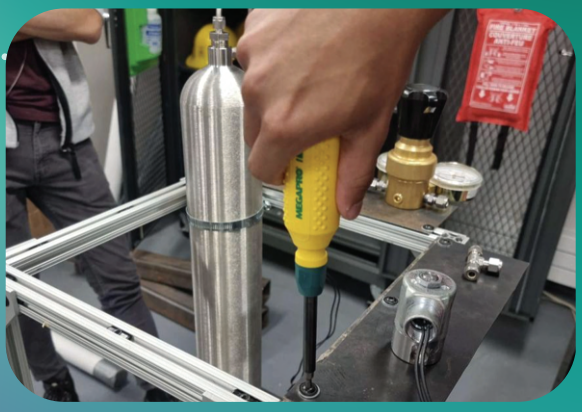
Fall 2023	Fall 2023	Fall 2023	Fall 2023	Fall 2023
Hot Fire & Write IDP for LC	Attend SAGM	Fill the COO role	Start up Structures and Recovery subteams	Preliminary design phases completed by December

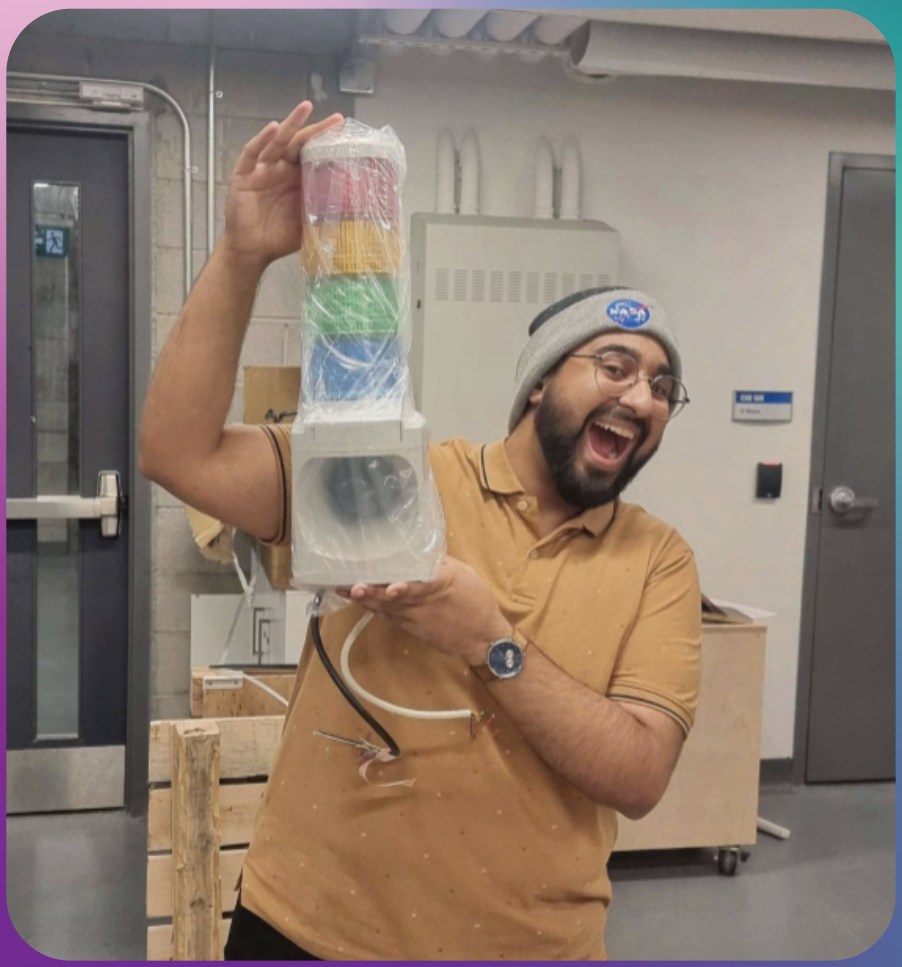


Sponsorship

Rocketry is a very high-risk, very expensive, and very difficult endeavor. This is particularly true for complex SRAD projects of the kind we specialize in. Historically, liquid rockets could only be built by large companies with hundreds of full-time employees, millions in monetary investment, and years or decades of time.

MACH is developing the same technologies from the ground up, with a team of incredibly dedicated students in our limited free time, driven by caffeine addictions and an unbelievable amount of passion.





With very limited financial, material, and experiential support available on campus, we are highly reliant on external sponsorships to continue what we're doing and take on even bigger projects.

Sponsorship

Our partners provide us with:

- Operational funding & monetary support
- In-kind donations of parts, equipment, and tools
- In-kind donations of raw materials, such as metal stock and fluids
- In-kind donations of machining & manufacturing support
- In-kind donations of access to workspaces, transportation, and more
- Industry expertise, insight, & design reviews

Though the above are directly critical to the success of our project with our limitations, we are always open to other sponsorships that are also important to the operation of the team. If you or your organization is interested in helping us out in any other way, please feel free to contact us and ask!

Sponsorship

Interstellar
$5000+

- Any special requests such as access to media and research data
- Have their logos displayed on the test stand, dramatically lit by the fiery glow of a rocket engine
- Plus all the perks of Interplanetary and Orbital tiers

Interplanetary
$3000 - $4999

- Updates on the team's progress & design reviews at any time
- Invitations to our exciting hot-fire tests
- Recruitment from our large, diverse, and incredible team
- Plus all perks of the Orbital tier

Orbital
$500 - $2999

- Logos prominently displayed on our website
- Logos placed on team apparel worn during competitions and day-to-day
- References and exposure in our social media & outreach

Current Sponsors

MACH's progress is a testament to the sponsors making it all happen. Without their generosity and support, we would not be where we are today. We would like to give a huge thanks to these organizations.

Toronto Metropolitan University

MUES

kulite
A Small Business
under NAICS 336413

IBZ Innovation Boost Zone

JAKŠA SOLENOID VALVES

ALTAIR

SIMPLE PATH FARMS

RED ROCKET COFFEE

HOSKIN SCIENTIFIC

LAUNCH CANADA

RETRACTABLE MEGAPRO ORIGINAL EST. 1994 CARTRIDGE

Stein Industries Inc.
Engineered Electrical Apparatus & Systems

FLOWNEX®
SIMULATION ENVIRONMENT

TeXtreme®

Swagelok
Swagelok Central Ontario | Atlantic Canada

SOLIDWORKS

DFZ

Aqua Environment
Designing and Manufacturing High Pressure Components Since 1976

Load Cell Central

DISHON LIMITED

AEA American Earth Anchors

vibrant performance

MARS SOCIETY OF CANADA

Get in Touch

Email
mach@torontomu.ca

LinkedIn
Metropolitan Aerospace & Combustion Hub

Website
mach-tmu.space

Instagram
@mach-tmu