WEEF PROPOSALS

SUMMARY

W2022

	Academic Equipment and Resources		
Proposal	Proposal Title		Requested
F237	Ideas Clinic - Electric Vehicles		10500
F238	Ideas Clinic - Materials testing		6250
F239	A Redox Flow Battery Unit for Undergraduate Teaching Lab		19433
F247	Thermal Imaging Camera		630.25
F253	Balances for Chemical Engineering Undergraduate Labs		2843.71
F254	Microscopes for ChE UG Labs		7000
F255	New educational mobile robots TurtleBot3		6140
F256	Tools for engineering student shops		7500
F259	Design+Build Equipment		3115
		Total	$ 63,411.96
	Miscellaneous		
F243	Furniture for Elder's Space - Cambridge		5200
F244	Indigenous Signage in Engineering Buildings		6000
F245	E7 Pool Table		1543
		Total	$ 12,743.00
	Student Teams		
F240	Winter 2022 - Waterloo Formula Electric Funds Proposal		4260
F241	WEEF Winter 22 WARG Proposal		1190
F242	UWFM Winter 2022 Funding Proposal		9500
F246	WATOLINK VR + BCI Development		5478.24
F248	Pickup Truck for Student Team Use		15000
F249	SSDC High-Voltage Test Room Proposal (UWAFT)		13848
F250	Concrete Design Team - W22 WEEF		400
F251	UWaterloo Robotics Team W2022 WEEF Proposal		11150
F252	UW Orbital - Canadian Satellite Design Challenge (CSDC)		5516.75
F260	Waterloo Rocketry Winter 2022 WEEF Proposal		13250
F261	Waterloo iGEM Funding Request for Equipment and Reagents		4278.5
F262	W22 WATonomous WEEF Proposal		23065
F263	SSDC WEEF Proposal W22		5374.64
F264	Waterloop WEEF Proposal W22		7900
F258	WEEF W22 Funding Proposal (midsun)		5000
F265	VEX U Robotics 2022 Winter		875
		Total	$ 126,086.13
	Reallocation Requests		
F257	F20 & W21 WATonomous WEEF Reallocation Proposal		2480
		Total	$ 2,480.00

Academic Equipment and Resources
Proposal F-237

Ideas Clinic - Electric Vehicles

Engineering Ideas Clinic
ME 101, ECE 198
Chris Rennick, Engineering Educational Developer
chris.rennick@uwaterloo.ca

Description of Proposal

The Engineering Ideas Clinic is working to bring real-world problems and equipment to undergraduate students. We firmly believe that "bringing the real-world into the classroom" will reinforce the theory you are learning in lecture, show you the context of that material, and will provide an opportunity for you to integrate all the knowledge you are learning.

To continue bringing meaningful, hands-on activities to students, the Ideas Clinic needs to continue purchasing equipment. As we move forwards, the Ideas Clinic is pushing into domains that until very recently only existed in research labs, and in work terms.

This proposal is seeking WEEF's support for the components to build 3 more, 1/3-scale electric vehicles. We are seeking $10,500 from WEEF for these 3 cars. The Ideas Clinic has employed 5 co-op students over the past 3 terms designing this platform, and we are now ready to scale the activity. These platforms can then be used across the Faculty of Engineering.

The car we have designed is constructed using reconfigurable and re-usable parts and operates at low voltages and powers (36Vdc drive system). The car is also small and light enough that it can be moved around by a single person; total vehicle weight without batteries is in the neighbourhood of 200 lbs.

Proposal Benefits

This unique equipment will give students a platform to learn concepts related to electric and autonomous vehicles. This platform has been designed to be simple to put together, take apart, and reconfigure, and has been designed with student safety foremost in mind. This platform will be available for any courses from first to fourth year, with the first deployment in ME 101 in the spring 2022 term (during their Design Day activity). We are also working with the ECE 198 instructors to have this project be an option for that course in fall 2022.

An estimated 600 students per year will directly benefit from the activities that this equipment will allow.

Estimated Equipment Lifetime

We expect a life of 5+ years from this equipment.

Implementation Schedule

Construction of the first car using fall 2021 funding has already started. Ordering the components for these 3 cars will happen as soon as funding is secured.

Additional Information

This project received $3,500 in funding in fall 2021. Thank you WEEF for your support!

Through a partnership with Magna International, the Ideas Clinic will provide the salaries for any and all co-op students, and/or grad students required to develop the platform as well as any additional costs that may arise as the project progresses.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Total cost per car = $3,500. 3 * $3500 = $10,500	10500	0	0	0
Total	10500	0	0	0

Academic Equipment and Resources
Proposal F-238

Ideas Clinic - Materials testing

Engineering Ideas Clinic
ME 219, ME 220, MTE 219
Chris Rennick, Engineering Educational Developer
chris.rennick@uwaterloo.ca

Description of Proposal

The Engineering Ideas Clinic is working to bring real-world problems and equipment to undergraduate students. We firmly believe that "bringing the real-world into the classroom" will reinforce the theory you are learning in lecture, show you the context of that material, and will provide an opportunity for you to integrate all the knowledge you are learning.

To continue bringing meaningful, hands-on activities to students, the Ideas Clinic needs to continue purchasing equipment. As we move forwards, the Ideas Clinic is pushing into domains that until very recently only existed in research labs, and in work terms.

This proposal is seeking WEEF's support for a set of custom, low-cost materials testing devices. We are seeking $6,250 from WEEF for 25 of these devices which can conduct torsion testing of materials. The Ideas Clinic is currently employing two co-op students who are continuing the development of these platforms. These platforms can then be used across the Faculty of Engineering.

Proposal Benefits

This unique equipment will allow students to experiment with material properties like yield strength, and fatigue in the classroom so that you can "feel" what this means with your own hands. This will not replace existing labs in these courses, but will supplement instruction in the classroom.

An estimated 600 students per year will directly benefit from the activities that this equipment will allow.

Estimated Equipment Lifetime

We expect a life of 5+ years from this equipment.

Implementation Schedule

The equipment will be purchased as soon as funding is granted.

Additional Information

We received $6,250 in funding in the fall 2021 term for tension testing machines. Thank you WEEF!

The Ideas Clinic will provide the salaries for any and all co-op students, and/or grad students required to develop the platform.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Mechanical components for machine $250 each x 25 devices	6250	0	0	0
Total	6250	0	0	0

A Redox Flow Battery Unit for Undergraduate Teaching Lab

Chemical Engineering
ChE 490, ChE 491
John Zhang
m78zhang@uwaterloo.ca

Description of Proposal

This proposal is for the purchase acquisition of a redox flow battery unit for our undergraduate teaching lab. The proposed equipment below will be essential for the construction and implementation of multiple open-ended lab projects on advanced energy storage systems for our senior students in two unit operation lab courses. Specifically, the proposed equipment unit includes:

1. A redox flow battery test fixture including electrical plates, flow fields, heaters, and ion-exchange membrane.

2. Two peristaltic pumps required for pumping and controlling the flow rates of electrolytes for the two electrode sides.

3. A temperature measuring device and k-type thermocouples, allowing the operation and test of the flow battery at various temperatures and making the battery unit versatile for various undergraduate projects including capstone design projects.

Proposal Benefits

1. The flow battery assembly of the start-of-the-art process provides students with an excellent opportunity to reinforce their understanding and applications of fundamental concepts to the energy storage technology for renewable energy.

2. The targeted equipment and apparatus will also allow students to build and test their own flow batteries as part of the open-ended lab projects in lab course or in their capstone design projects.

3. The duel peristaltic pumps and flexible flow paths allow students to visualize flow battery design and operations, motivating and enhancing student learning through direct observation.

4. At least 280 undergraduate students will benefit from the equipment in ChE 490 and ChE 491, and other lab courses in ChE program.

Estimated Equipment Lifetime

All equipment in the list has proven quality and should serve our purposes for many years to come.

Implementation Schedule

The equipment can be assembled and tested as soon as they are available and will be ready for the laboratory courses in the Fall term of 2022.

Additional Information

Our department agreed to cover the cost of other accessories and provide any additional funding to complete the experimental setup. We greatly appreciate it if WEEF can cover the cost of this essential equipment unit.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Redox Flow Battery Test Fixture	6066.00	6066.00	6066.00	6066.00
Two Peristaltic Pumps	12297.00	12297.00	6148.00	
Temperature Sensors	850.00			
Membrane	220.00			
Total	19433	18363	12214	6066

Student Team
Proposal F-240

Winter 2022 - Waterloo Formula Electric Funds Proposal

Waterloo Formula Electric
Bao Anh Nguyen - Team Lead
anh.nguyen@uwaterloo.ca

Description of Proposal

Waterloo Formula Electric is a team of highly motivated undergraduate students based in the Sedra Student Design Centre. We compete annually in the international Formula SAE Electric competition, organised by the Society of Automotive Engineers. We are a team of over 80 students tasked with developing a new vehicle from the ground up, and our goal this year is to improve upon previous seasons by placing 1st.

This scope of this proposal aims to secure funding to support the manufacturing and testing of our car, emphasising safety and learning opportunities for students. Materials outlined in our proposal are meant to ensure the longevity of the team and high quality tools that can be shared amongst other engineering students.

Waterloo Formula Electric is requesting $4260 to purchase components for our mechanical, electrical, tractive, and composites components.

The components for the mechanical subteam include welding supplies such as helmets and adapters as well as floor jacks. These items are critical for safety during assembly, testing and maintenance on the car.

Electrical components consist of wire harness materials which are necessary to test our car safely, as well as teaching new members skills in car debugging.

Tractive components include segment and enclosure materials, organisational bins, and a server rack. The segment and enclosure materials will allow the team to conduct more testing and give more learning opportunities. The server rack will let us move expensive equipment safely and efficiently for testing and competition. The organisational bins requested have been requested from WEEF in the past, and have helped tremendously in the cleanliness and safe upkeep of our workspaces.

Composites materials requested will be used to manufacture new composite parts in addition to process testing as a learning initiative for newer members returning to campus.

Proposal Benefits

Electric cars are a sustainable alternative in a rapidly growing auto industry. WEEF funding would represent the University's long-term interests in environmentally friendly solutions in the automotive world.

Our team members consist primarily from the Faculty of Engineering, with a focus on the MME and ECE departments, with the support of students from Management, Systems, Chemical, Nanotech, and more. Our team is a catalyst in the professional development of engineering students through hands-on

design, manufacturing, and leadership. Members gain relevant experience through communication and project management tools such as Jira and Confluence, but also learn technical knowledge from industry level tools such as Star-CCM+ and Solidworks.

These skills are highly sought after by automotive companies, such as Tesla Motors, Lucid Motors, GM, and TMMC, as communicated through various recruitment events and outreach. We also provide opportunities for students to build long lasting connections with upper year students, alumni, and industry sponsors. The requested funding will allow team members to perform tasks more efficiently and drive growth in the future years of our team.

Our team switched over from a hybrid vehicle to a fully electric vehicle in Fall of 2016. As a hybrid team, we had many accomplishments during this competition season such as:

Placed 1st in 2021 Formula Hybrid Design Events - Electric Class

Placed 2nd in the 2021 Formula Hybrid Competition Electric Class

Placed 4th in 2021 PM Events - Electric Class

The requested funding will allow team members to perform tasks more efficiently and drive growth in team results and subsequently membership. WEEF funding enables our team to build stronger connections with more student design teams through the sharing of tools and other materials.

Waterloo Formula Electric greatly appreciates the support received from WEEF in past years, and we're proud to display WEEF as a platinum sponsor on the race car, website, and team wear. Based on this sponsorship, we would continue to advocate for WEEF through all our marketing and social media channels.

Estimated Equipment Lifetime

The mechanical tools used for welding and car maintenance will last us 10 years with proper handling.

Electrical components will last us 2 competition seasons

Tractive materials will last us up to 3 competition seasons depending on future car architectures. The organisational bins and server rack will last 5 years.

Composites materials will last 1-2 seasons depending on the use frequency.

Implementation Schedule

All of the items above are critical to the safety and development of our vehicle and will be ordered immediately as soon as the funding is released. We are aiming to purchase these by the middle of April 2021.

Additional Information

Student Team
Proposal F-240

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Mechanical Components	1550	1550	1550	1550
Electrical Components	350	350	350	150
Tractive Components	1760	1160	660	660
Composites	600	300	300	0
Total	4260	3360	2860	2360

Student Team
Proposal F-241

WEEF Winter 22 WARG Proposal

Waterloo Aerial Robotics Group
Jennifer Luo - Business Team Lead
jennifer.shijia.luo@uwaterloo.ca

Description of Proposal

The attached proposal outlines a short description about our mission and purpose at Waterloo Aerial Robotics Group. It also contains our funding request breakdowns for Winter 2022.

Proposal Benefits

We are currently in the process of creating our aircraft for this upcoming 2022 Unmanned Systems Canada Student Competition, where we will be representing the University of Waterloo. With your support, we can achieve the goals that we set out for this year's competition. We have three distinct operations that require funding:

RC Communications and Control

Mechanical Tooling

Firmware Tooling

These processes require funding for the prototyping, manufacturing, and designing stages. If received, these findings will allow us to continue with the development of our project, and supplement student learning, which has always been this team's top priority.

Estimated Equipment Lifetime

The requested tool chest and PCB boards are estimated to last our members at least four years; while the lithium batteries are estimated to last one to two years depending on usage.

Implementation Schedule

As of February 2022, We have a design prototype that is able to preform its basic intended functions . We are expected to be able to fully assemble our aircraft, given that we may acquire the necessary equipment by early April, in times for the competition taking place on May 6th.

Additional Information

Please feel free to visit our Instagram page at @uwarg for the latest updates of our current progress. Our team is dedicated to spreading accessible, educational contents regarding Canada's Aerial industry.

Note Regarding the proposal PPT: Please use the "Present" option when viewing as some animations will not show up otherwise.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Husky 36-inch Tool Chest- Used for organization and safekeeping of our mechanical tools	800	700	610	520
PCB Components - To replace our old zeropilot1 and ensure our member have enough components going forward to bring our board con	240	190	100	75
Turnigy 5000mAh 6S 40C LiPo Pack - To power our aircrafts	150	100	88	75
Total	1190	990	798	670

Student Team
Proposal F-242

UWFM Winter 2022 Funding Proposal

University of Waterloo Formula Motorsports
Alex Chen, Business Team Member
a337chen@uwaterloo.ca

Description of Proposal

Founded in 1987, the University of Waterloo Formula Motorsports Team is a student-led team that designs and builds formula-style race cars to compete in the Formula Society of Automotive Engineering (FSAE) series annually.

The purpose of this proposal is to secure funding in order to improve our performance at future seasons and secure more points at competitions.

Proposal Benefits

The first item of interest our team is requesting funding for is Machine shop funding for $3000. This item would cover upright costs from the E3/5 shop for CNC machining, manually machining material (chassis jig plate) and welding (Chassis and other components) services. Our team frequently utilizes machine shop services therefore it would be beneficial to allocate funding to cover these costs.

The next category we are requesting is Pneumatics, Powertrain, and Electrical Components for $1500. This funding will be used to purchase a Motec LTC, an E throttle valve, and replacement wheel speed sensors or damper potentiometers. We want to purchase a new LTC to replace our current LTC which is 5 years old and nearing the end of its lifetime. A newer LTC will provide more accurate engine readings, allowing us to better tune the engine, thus improving performance at competitions.

Aside from a new LTC, we also want to purchase an E throttle valve to improve the efficiency of our engine, and replacement wheel speed sensors or damper potentiometers as Both items are essential for data collection and vehicle testing.

Another significant funding option that we are requesting is Engine and Engine Components for $2500. We have recently switched from a 4 cylinder engine to a single cylinder motorcycle engine, therefore it would be beneficial to have either spare components or ideally, a spare engine. Possessing spare engine parts will allow us to fix the engine quickly should anything go wrong (Eg. Testing accidents, general wear and tear). We plan on purchasing engines or engine components from Tri City Cycle, a motorcycle engine parts supplier.

Another item we are requesting funding for is Carbon Fibre, Composites, and Masks for $2000. Carbon fibre sheets are used to construct the significant portions of bodywork on the car, therefore it would be beneficial to possess additional funding to cover this cost. Another potential item that we are interested in purchasing with this funding, are new 3M gas masks as the masks currently in use are aging and unsafe for use.

Student Team
Proposal F-242

Estimated Equipment Lifetime

Machine Shop Funding: 1 year

Motec LTC: 5 Years

E throttle Valve: 2-3 Years

Wheel Speed Sensors: 2-3 Years

Damper Potentiometers: 2-3 Years

Spare Engine/Engine Components: 3 years

Gas Masks: 3 years

Carbon Fibre and Resin: 2 Years

Implementation Schedule

Machine shop funding will be expended throughout the year whereas the other requested items will be purchased immediately after funding is approved as they are intended for use in the construction, assembly, and/or testing of the 2022 vehicle which competes in May.

Additional Information

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Machine Shop Funding	3000	3000	3000	3000
Pneumatics, Powertrain & Electrical Components	1500	1000	1000	0
Resins and Composites	2500	2000	500	500
Spare engine/components	2500	2500	2500	2500
Total	9500	8500	7000	6000

Miscellaneous
Proposal F-243

Furniture for Elder's Space - Cambridge

Engineering Deans Office
Mary Robinson - Assoc Dean Outreach, Equity & Diversity
mary.robinson@uwaterloo.ca

Description of Proposal

(Re)building relationships with the Indigenous Peoples of this land is a long-term goal for the faculty of Engineering and as such, spaces in both the Waterloo and Cambridge campuses need to be adapted to be more welcoming to Indigenous ways of knowing and being.

Proposal Benefits

The Indigenous spaces are available to all students. These spaces can be used for meeting with the Elder-in-residence or to learn more about the history of the settler relationship with Indigenous Peoples in Canada. This space is especially important for Indigenous students, staff and faculty to meet with the Elder and/or perform ceremony such as smudging.

The majority of the cost associated with renovating the space is being covered by the Engineering Dean's Office, but furniture, signage and/or art could be provided by WEEF.

Estimated Equipment Lifetime

20+ years

Implementation Schedule

The renovation of the Elder's space on the Waterloo campus (E7-1326A) is underway. The room has been painted, new blinds installed, and furniture is on it's way (thanks to WEEF #212 from Fall 2021 & the Dean's Office). Elder Bill is happy with the progress to date.

This funding is primarily intended for the Elder's space in Cambridge.

Additional Information

This is a first step in responding to the TRC's Calls to Action, to educate settlers on the history of Canada and make space, in a good way, for Indigenous Peoples.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Chairs (up to 4 at $500 each)	2000	1500	1000	500

Miscellaneous
Proposal F-243

Table - similar to wooden, 48" diameter table in Waterloo	700			
Wooden bench/seat (based on estimates from E7 benches)	2000			
Art/Prints (such as Robert Griffing, Haudenosaunee artist - https://www.lordnelsons.com/gallery/frontier/griffing)	500	1000	2000	
Total	5200	2500	3000	500

Miscellaneous
Proposal F-244

Indigenous Signage in Engineering Buildings

Engineering Deans Office
Mary Robinson - Assoc Dean Outreach, Equity & Diversity
mary.robinson@uwaterloo.ca

Description of Proposal

(Re)building relationships with the Indigenous Peoples of Canada is a long-term goal for the faculty of Engineering.

Acknowledging the land that we occupy through a physical land acknowledgement is an important first step.

Proposal Benefits

The Engineering buildings are a tribute to the Western worldviews that built them, but do nothing to acknowledge the land that they occupy. This signage will be an important first step towards reconciliation.

Estimated Equipment Lifetime

as long as the Engineering buildings are standing.

Implementation Schedule

The signage could be installed in phases as funding comes available. There could be delays as any wording or imagery is finalized, in consultation with Elder Bill Woodworth and the Indigenous Advisory Circle at UWaterloo.

Additional Information

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Signage (x7) + installation	6000	4000	2000	1000
Total	6000	4000	2000	1000

Miscellaneous
Proposal F-245

E7 Pool Table

ECE and SYDE 2025
Prabhjyot Singh
jeff.zhu@uwaterloo.ca

Description of Proposal

By popular demand from peers, we would like to request funding for a pool table to be added to E7 for use of all engineering students.

Proposal Benefits

High impact: the pool table will be used by hundreds, if not thousands of students over 5 to 10 years.

Mental health: de-stress and socialize over billiards, with an inclusive alternative (or complement) to ping pong.

Estimated Equipment Lifetime

5 to 10 years (depending on model)

Implementation Schedule

After funding is secured, we will order, have it shipped, and assemble with a team of students (~late April to early May).

Additional Information

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Billiards Table (4 different models)	1439	2329	1348	650
Supplemental Cues and Backup Supplies	104	0		
Total	1543	2329	1348	650

Student Team
Proposal F-246

WATOLINK VR + BCI Development

WATOLINK
Avery Chiu, Co-founder
avery.chiu1@uwaterloo.ca

Description of Proposal

WATOLINK offers students an opportunity to develop brain-computer interface applications involving action-classification via EEG signal analysis and inference. Our team is currently developing a mind-controlled speech interface that we will submit to the NeuroTechX Student Competition in 2022.

Later on, we may start to develop our own sensor technology and BCI hardware. The efforts of this team could eventually go towards graduate research and could scale towards longer term projects involving speech rendering to make telepathy and brain-controlled applications involving audio generation and mind-to-AI communication commercially viable.

Current Goals:

Get a working prototype of a SSVEP based mind-speech system ready for January 2022.

Have a fully functional SSVEP mind-speech system ready for April 2022.

Obtain awards from Neurotech Industry Players like Neuralink, Facebook

Reality Labs, and more from the NeuroTechX competition in 2022.

Start a long-term project pushing the boundaries set by current non-invasive BCI solutions by working on novel sensor technology and developing more ambitious software applications.

Proposal Benefits

Allows us to perform research on BCI applications involving VR and develop our project for brain signal communication in the metaverse

Allows for centralized development, drastically speeding up dev time and allows us to train models whenever we want without needing to wait on a cloud service.

Estimated Equipment Lifetime

VR headset kit (4 years)

Student Team
Proposal F-246

Development Laptop (4 Years)

Implementation Schedule

VR headset kit (Winter 2022 - Spring 2022)

Development Laptop (ASAP)

Additional Information

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
VR Headset and controllers	2089.37	1490.47	1070.11	1070.11
Development Laptop	3388.87	3276.99	3276.99	
Total	5478.2399999999998	4767.46	4347.0999999999995	1070.1099999999999

Academic Equipment and Resources
Proposal F-247

Thermal Imaging Camera

MME
Brian Shillingford - Mechanical Engineer
brian.shillingford@uwaterloo.ca

Description of Proposal

Mechanical and Mechatronics students have access to the Mechatronics Equipment Surplus System (MESS) where they can sign-out equipment for their course projects. We are looking to add a thermal imaging camera to the inventory to give students the opportunity to easily measure the temperature generated in their designs.

Proposal Benefits

Having a thermal imaging camera will allow students to safely and effectively measure the temperature of critical design components. For example:

- fluid temperature in a heat exchanger

- electrical circuits

- solder

Estimated Equipment Lifetime

The expected equipment lifetime for the camera is 10+ years.

Implementation Schedule

Immediately

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Thermal Imaging Camera: UNI-T UNi690B	630.25	630.25	630.25	630.25
Total	630.25	630.25	630.25	630.25

Student Team
Proposal F-248

Pickup Truck for Student Team Use

Sedra Student Design Centre
Peter Teertstra, Director, SDC
peter.teertstra@uwaterloo.ca

Description of Proposal

The Sedra Student Design Centre includes a number of shared-use resources, including physical spaces for fabrication and testing, and equipment used by student teams. The student teams have access to 3 vehicles and a number of trailers as part of a fleet of vehicles administered by the SDC. For teams that have large projects, two pickup trucks and two large, enclosed trailers are available to haul the team's equipment to their competitions.

One of the pickup trucks in a 2007 GMC Silverado 3500 which has been in service at UW since it was purchased new from a dealer in 2008. The truck has 220,000 km so reliability for long distance trips is becoming a concern. Also it has a large displacement gasoline-powered engine which is very expensive to operate, particularly when towing a trailer.

The Student Design Centre is proposing to purchase a new pickup truck to be used by the student teams for transporting their projects. The specifications are as follows: new (current model year) 1500 series pickup truck, crew cab (4 doors) to accommodate five, diesel engine for improved fuel economy and reduced maintenance costs.

The anticipated cost for a vehicle (after dealer and manufacturer sponsorship) is approximately $60,000. The anticipated trade-in or resale value for the 2007 GMC is $15,000. The funds to be provided by WEEF is $45,000 distributed over a 2 or 3-year period.

The SDC and the Dean of Engineering Office have started discussions with General Motors Canada about possible sponsorship of this purchase. In 2017 General Motors provided substantial sponsorship towards the purchase of a pickup truck, and a similar arrangement is being proposed.

Proposal Benefits

Having vehicles and trailers owned and maintained by the University and administered by the Student Design Centre is of great benefit to all student team users. As these are considered commercial vehicles, there is a requirement for annual inspections and certifications which is paid for by the SDC. Regular preventative maintenance, including replacement of tires and small repairs, are also paid for by the SDC and performed by the UW Vehicle Shop. Insurance is administered and paid for by the SDC. Scheduling is performed by the SDC to ensure equal, fair access to all vehicles and trailers for all teams. Truck and trailer training is provided to all student team drivers to ensure they know how to tow and back up a trailer prior to their trip.

Another benefit to student teams is that having vehicles and trailers available to transport projects greatly reduces the cost associated with attending competitions. Regular, annual competition

destinations for the SDC trucks/trailers include New Mexico, Utah, California, New Hampshire and Michigan.

Estimated Equipment Lifetime

The truck would be undercoated to reduce corrosion damage. The expected service life of the truck is 15 – 20 years.

Implementation Schedule

The goal is to purchase the truck when sufficient funds have been raised. In Fall 2021 WEEF provided $7500 funding towards the purchase of the truck.

Additional Information

Costs (approximate, based on information from Autotrader and Kijiji)

2021 Chevrolet Silverado 1500 pickup truck	$60,000
Funded by a partnership between	
WEEF	$45,000
Resale or trade-in values for 2007 GMC	$15,000
TOTAL	$60,000

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
45,000, divided into equal allocations over 1, 2 or 3 years	15000	7500	5000	5000
Total	15000	7500	5000	5000

Student Team
Proposal F-249

SSDC High-Voltage Test Room Proposal

UWAFT: University of Waterloo Alternative Fuels Team
ME559
David Gillespie
haocheng.zhang@uwaterloo.ca

Description of Proposal

Many of the Teams in the Sedra Student Design Centre (SSDC) work with various high-voltage systems and equipment. UWAFT, for example, uses a high-voltage battery in their eco-car Chevrolet Blazer, and many of the car's systems require high-voltage for testing. However the SSDC lacks the HV infrastructure to allow them to test the car's high-voltage systems. The only way for UWAFT to perform HV tests on the vehicle is to take it to a test track and drive the vehicle in circles. These time-consuming tests are of limited value, since they are not repeatable, and necessarily lack the rigour of a more controlled testing environment.

UWAFT, on behalf of the teams in the SSDC, proposes WEEF fund the remaining cost of purchase and installation of a high-voltage power pack. The power pack would be installed inside a room already provided by Dr. Peter Teertstra (Director of the SSDC), to become the new SSDC high-voltage testing room. We have researched options and with input from Waterloop, Midnight Sun, and Formula Electric, we are requesting the following be purchased from Keysight Technologies Canada Inc:

1) A regenerative power supply, model RP7963A, with 3-year extended warranty, $28,378.95

2) BenchVue Advanced Power Control and Analysis - single instrument connection. Perpetual transportable software license, $3,202.29

Beyond the above amounts, we believe we will require a further $300 for installation costs such as plugs/wires etc. for a total of $31,881.24

Last year, WEEF funded a proposal by Dr. Teertstra for high voltage equipment: Proposal F20-142

1 square meter HV insulating blanket

HV insulated PPE (4 pairs of gloves, 2 face shield)

Rescue hook (1 required)

HV tools (sockets, wrenches, pliers, tweezers, etc. 2 sets)

Spot welder (for assembling battery packs)

Total $5310

Our current proposal builds upon the capabilities provided by the above items and will benefit many SSDC teams aside from UWAFT. Midnight sun, Waterloop, and Formula Electric have all given their support for this proposal, as all three will greatly benefit from HV testing space inside the SSDC.

We are asking for $13, 848 to complete the funding to purchase the above for the proposed SSDC high voltage room.

Proposal Benefits

Many teams within the SSDC would benefit from this proposal. The following are just some of the key benefits sited by the teams supporting this proposal:

- Midnight Sun would be able to use the power-pack and software for testing batteries and motors, as well as running solar-panel and battery simulations. All of these currently entail significant time and effort and data gathered using the proposed power pack and software would be much more useful and efficient.

- Formula Electric would use the power-pack and software for charging and load-testing on their batteries, simulating their endurance event to better understand the characteristics of their batteries and get more reliable performance. This is key to their team's success. This represents significant improvements in their analysis capability, allowing them to get key information before on-track testing and letting them iron-out software issues much earlier in the build-process. Efficiencies would be felt at every step.

- UWAFT would use the power pack and software to perform repeatable tests on our battery pack and HV powertrain, enabling accurate data collection and model development. With a better understanding of how our HV components perform, we can create better torque control strategies for our vehicles. Last year we experienced a battery failure; without a source of power we couldn't test on our HV system at all and had to borrow from other research groups. If we had access to a HV bench we could have continued testing on our HV powertrain while the battery was being repaired.

Currently the only way for us to perform tests on our HV system is to drive around at a test track. This requires a lot of time investment to coordinate for limited testing.

- Waterloop would use the power supply for testing of their linear induction motor and battery packs. The information they gather using the software would be important as the team continues scaling up their prototype to larger, higher voltage designs.

Beyond the above mentioned teams, the high-voltage power pack and software will continue to be useful for years to come. UWAFT's new competition vehicle will be entirely electric and the team will require the HV testing equipment in this proposal to credibly compete. In the future, as electric vehicles become more and more the norm in our economy, This HV equipment will continue to pay dividends to the teams of the SSDC.

Estimated Equipment Lifetime

We estimate the proposed equipment will have a useful life of at least 10 years, based upon our research.

Implementation Schedule

Dr. Teertstra will handle the installation of the proposed equipment and the implementation of the new high-voltage testing room in the SSDC.

Additional Information

This is a second WEEF application, the first being f-214 from last semester, seeking funding for this high voltage power pack. We gratefully received over $18000 in funding, but were advised by the director of the SSDC to seek additional funding this round to purchase a new power pack, as opposed to a used one, citing reliability and warranty issues with used machines.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Regenerative Power Supply, Model RP7963A, computer controlled variable output high voltage power supply	13848	13848	13848	13848
Software license: BenchVue Advanced Power Control and Analysis - single instrument connection. Perpetual transportable				
Total	13848	13848	13848	13848

Student Team
Proposal F-250

Concrete Design Team - W22 WEEF

Concrete Toboggan and Canoe Team
Devon Hendrie - Co-Captain
devon.hendrie@uwaterloo.ca

Description of Proposal

1 Laminator

2 Cut-resistant gloves

3 Dehumidifier & Environmental Sensor

4 Compressed air spool

5 Patch Embroidery Machine

Proposal Benefits

1 Laminator - To laminate safety placards, standard operating procedures, and other team signage for extended use

2 Cut-resistant gloves - To protect your hands - the gloves wear out over the years and current gloves have some holes

3 Dehumidifier & Environmental Sensor - Controlling the humidity of the bay when storing materials, curing concrete, and evaporating standing water. Monitor pressure, humidity, and temperature, 20-day memory and bluetooth connection to phone

4 Compressed air spool - Wall-mounted retractable spool to store our compressed air hose

5 Patch Embroidery Machine - Creating embroidered patches - this is an expensive machine and we would gladly share it with EngSoc and other teams when they design their patches! Due to supply chain issues this year we were unhappy with the price and quality of third party vendors. We expect this investment to pay for itself in savings after just two years of making competition patches for GNCTR and CNCCC.

Estimated Equipment Lifetime

1 Laminator 5 years

2 Cut-resistant gloves 3 years

3 Dehumidifier & Environmental Sensor 8 years

4 Compressed air spool 25 years

5 Patch Embroidery Machine 10 years

Implementation Schedule

Gloves would be purchased as soon as funding is approved to purchase for usage while sanding our canoe starting April 10. Laminator is also a priority to protect our team safety information and other commonly used reference sheets. Other items

Additional Information

We would be happy to discuss purchase of the patch embroidery machine with other teams and EngSoc. I believe there is a strong case for it and can provide teams with immense cost savings, but it is an item that should be first discussed and shared with everyone. It's not a mission-critical item, just wanted to propose it to see if other teams also have an interest in it.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Cut-resistant gloves	300	300	300	300
Laminator	100	100	100	100
Dehumidifier & Environmental Sensor	0	300	300	300
Compressed air spool	0	0	300	300
Patch Embroidery Machine	0	0	0	1500
Total	400	700	1000	2500

Student Team
Proposal F-251

UWaterloo Robotics Team W2022 WEEF Proposal

UWaterloo Robotics Team
Anna Fyfe, Finance/Business Lead
anna.fyfe@uwaterloo.ca

Description of Proposal

The University of Waterloo Robotics Team (UWRT) consists of over 50 students who aspire to design, build, and program the robots of tomorrow. The team competes at the University Rover Challenge held by the Mars Society with the challenge to design and build the next generation of Mars rovers that will one day work alongside human explorers in the field. The team has been accepted to the competition for the past three years out of an application pool of over 90 universities, placing 33rd globally in 2019, 22nd in 2018, and 15th in 2017. Due to the COVID-19 pandemic, UWRT was unable to compete in both the 2021, and 2020 competitions. However, in 2020 the team placed 21 in the final System Acceptance Review with a score of 85 out of 100.

There are several different electrical components and tools that we would like to purchase that are critical in building our rover. First there are electrical components such as wires and PCBs that we would use, as well as more tools used for soldering. Specifically, we would like to purchase an ESD and grounding mat to be used by the electrical subteam.

On the mechanical side of the team, we require many different tools and components in order to continue manufacturing our rover. This includes stock material like carbon fiber tubing, and transition components such as gears and gearboxes. Motors are another item that we are requesting funding for as they are a crucial part of the rover.

Our third item request is for software components/tools, which include purchasing a camera for the rover. The cameras will be used in order for us to implement an autonomous robot, as per the specifications of our competition. These cameras are very important to the success of the rover and the team.

Our last item that we would like to request is for firmware components/tools, which include motor controllers for the rover. These will allow us to properly drive and navigate our rover.

Proposal Benefits

The UWRT has proven to be a great educational ground for undergraduate students interested in robotics for 18 years as one of the most iconic student teams in Waterloo. With WEEF's funding, UWRT can continue to participate in university events put on by organizations such as the SDC, WiSTEM, and Engineering Outreach. A truly multidisciplinary group, UWRT builds robots that could not be imagined by a single type of engineering, emphasizing teamwork, collaboration, and system integration.

Estimated Equipment Lifetime

Student Team
Proposal F-251

Electrical Components

- Misc Electrical Components (Wire, PCBs etc): 1 year

- ESD Mat & Grounding Mat: 5+ years

- Soldering Tools & Equipment: 3 years

Mechanical Components

- Various Tools: 5+ years

- Stock Material: 1 year

- Transmission Components: 2-3 years

- Gears/Gearboxes: 2 years

- Motors: 2 years

Software Components

- Cameras: 2 years

Firmware Components

- Motor Controllers: 3 years

Implementation Schedule

Will all be purchased ASAP to finish the rover.

Additional Information

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Electrical Components/Tools	2400	1850	1350	1350
Mechanical Components/Tools	5750	4250	3500	3000
Software Components/Tools	1500	1250	1250	1000
Firmware Components/Tools	1500	1250	1000	1000
Total	11150	8600	7100	6350

Student Team
Proposal F-252

UW Orbital - Canadian Satellite Design Challenge (CSDC)

UW Orbital
Rain He, Finance Lead, 3A Accounting and Financial Management
h64he@uwaterloo.ca

Description of Proposal

UW Orbital's mission is to become a launchpad for Waterloo students' careers in SpaceTech. By incorporating technical hands-on experiences in problems relevant to the modern space industry, and providing students with access to a professional network of Canadian space companies, we are aiming to create a long-lasting space community within Waterloo. Currently, we are competing in the Canadian Satellite Design Challenge (CSDC), building a 3U CubeSat satellite. Our CubeSat has two missions, the first being a "Selfie-Sat" camera as required by CSDC, and the second is a partnership with a KW company named QEYnet to carry a prototype of an infrared laser beacon. We are requesting funding of which will be used towards materials, tools, and equipment associated with prototyping, testing, and construction of our CubeSat. Our success in participating in the CSDC will become a key stepping-stone towards jump-starting UW Orbital's vision of ultimately building a permanent space-oriented community for students at the University of Waterloo.

Proposal Benefits

1. Benefits to WEEF

UW Orbital is sponsored by various companies and endowment funds, either monetary or in-kind, and we aim to recognize all of their support towards our project. WEEF's funding would greatly benefit our team and would boost its sponsorship status to our Silver Tier, which include perks such as:

- Logo on team apparel

- Representing WEEF at the CSDC and in the UW SDC by having WEEF's logo on our team banner

- Dedicated posts on social media to acknowledge WEEF's support

- WEEF's logo and link will be placed on the sponsor page of our website

- Logo on team presentations and team videos at outreach events

2. Benefits to Engineering Students

The majority of members of UW Orbital are from the Faculty of Engineering. Through our CubeSat development, engineering students participating in any of our subteams benefit from garnering invaluable technical and hands-on experience unique to the space industry. For example, the Mechanical team works to construct the CubeSat frame and conducts Finite Element Modeling (FEM) and thermal analysis. The Command and Data Handling (CDH) team manages the primary microcontroller and applies embedded development using software such as C++ and FreeRTOS. Our

other subteams include Communication, Attitude Determination and Control Systems (ADCS), Electrical Power Systems (EPS), Payload, and Business.

Aspiring students will also have access to a professional network of mentorship and resources to support their endeavours. For example, in Fall 2021, we invited Sohrab Haghighat, the CEO and founder of SpaceRyde, to a fireside chat to share his experience in the SpaceTech industry and respond to students' questions. Another fireside chat was hosted a few weeks ago with Martha Lenio, NASA's mission commander for the 2014 HI-SEAS mission to talk about her experience in simulated space travel. We also partnered with UW EngSoc for a resume critique for engineering students to help them with their co-op job search.

Combining both technical and hands-on experience with a professional network will allow any aspiring UW student, especially engineering students, to succeed in their future careers in fields such as space, science, and technology.

Estimated Equipment Lifetime

Pelican Transport Case - 10 years

EPS, CDH, ADCS and camera components - 2 years competition cycle

Implementation Schedule

Pelican Transport Case - Electrostatic discharge safe case for transporting CubeSat to competition venues (required in Winter 2023), and for storage of components in a clean room (beginning Fall 2022 and beyond).

EPS - expected to be purchased in the winter 2022 or spring 2022 terms. It is used to support our Electrical Power Systems (EPS) sub-team's current work on MPPT, BMS, Load Switch, and Solar Panel boards.

CDH - expected to be purchased in the winter, spring, and fall 2022 terms. It is used by our Command and Data Handling (CDH) subteam to build the CubeSat's On Board Computer (OBC).

ADCS - expected to be purchased in the spring 2022 term. It is used to support our Attitude Determination and Control System (ADCS) subteam to control the orientation of our CubeSat.

Optics & Camera - expected to be purchased in the spring 2022 term. It is used by our Payload subteam to test out our primary and secondary payload. The secondary payload involves the development of a novel pointing algorithm for our CubeSat, which uses a camera as an additional attitude sensor.

Additional Information

UW Orbital greatly appreciates WEEF's support in our team last term. We would be glad to accept any partial funding over no funding. To learn more about our team, our mission, and our project, please visit our website: https://www.uworbital.com/

Student Team
Proposal F-252

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Pelican Transport Case	450	400	250	150
Electrical Power Systems (EPS) Components	1365	1050	840	630
Command and Data Handling (CDH) Components	2470	1900	1520	1140
Attitude Determination and Control Systems (ADCS) Components	438.75	337.50	270	202.50
Optics and Camera	793	610	488	366
Total	5516.75	4297.5	3368	2488.5

Academic Equipment and Resources
Proposal F-253

Balances for Chemical Engineering Undergraduate Labs

Chemical Engineering
CHE 490 CHE 491 CHE 290
Cheryl Newton, Undergraduate Laboratory Instructor
cheryl.newton@uwaterloo.ca

Description of Proposal

In the Chemical Engineering Undergraduate (ChE UG) labs, we have a large selection of bioprocessing equipment including a 7 L Eppendorf bioreactor, GE healthcare ion exchange chromatography, and a Martin Christ freeze dryer. This bioprocessing lab requires two new balances for operation efficiency to meet student laboratory needs. A higher capacity balance (6.2 kg) with 2 decimal spots is required for solution preparation during student lab sessions. This will replace a lab balance with a lower capacity and 1 decimal readability. As well, an analytical balance is required to use with the Karl Fisher titrator we received in March 2022 using WEEF funds from Fall 2021. The Karl Fisher titrator is an analytical tool used to determine residual water content of biological samples after freeze-drying. An analytical balance is used to measure small amounts of sample (1-5 g) with an accuracy of 4 decimal spots (1 mg). There is currently no suitable balance available in the lab space to use with the Karl Fisher titrator.

In addition, we are requesting two new analytical balances and one higher capacity balance to replace ones that have reached their end of life. The balances will be used in second year chemical engineering courses to meet student requirements.

Specifically, the proposed accessories will add:

1. New balances for Bioprocessing lab for UG students
2. Replacement balances for UG students in DWE 1518

Proposal Benefits

1. Use of the new equipment will increase laboratory efficiency and reliable data collection.
2. Use of new equipment will integrate the Karl Fisher titrator into the Bioprocessing Lab for student labs.
3. Use of new equipment will increase hands-on time available for students during lab session.
4. Balances are available for capstone design projects.

Estimated Equipment Lifetime

The equipment will be purchased from reputable retailers and the equipment should have a useful life of 10 or more years, with appropriate maintenance and care.

Implementation Schedule

The equipment can be ordered in one term and will be ready for the laboratory courses in Fall 2022 or Winter 2023.

Additional Information

The department agrees to provide some additional funding to fully upgrade the experimental setup. Equipment setup continuous maintenance will be done by the department.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
High capacity (6.2 kg, 10 mg) balance for Bioprocessing Lab (DWE 1520)	2843.71	2843.71	2843.71	2843.71
Analytical balance for Bioprocessing Lab (600g, 1 mg) (DWE 1520)	0	1755.30	1755.30	1755.30
Analytical balances for UG Lab (320g, 1 mg) $1169.23 each (DWE 1518)	0	0	2338.00	2338.00
Precision balance for distillation column (DWE 1518)	0	0	0	1095.87
Total	2843.71	4599.0100000000002	6937.0100000000002	8032.8800000000001

Academic Equipment and Resources
Proposal F-254

Microscopes for ChE UG Labs

Chemical Engineering
ChE290 and other labs, if needed
Jennifer Moll, Lab Instructor
jennifer.moll@uwaterloo.ca

Description of Proposal

Replace the remaining old microscopes that are nearing end of useful life with modern versions (preferably with digital camera option that makes sharing/discussing images with others more practical).

Proposal Benefits

Benefits of Replacing Microscopes: current microscopes are showing age (>30 yrs old/stages drift or knobs are difficult to turn/optics need re-alignment). New microscopes have attractive features (image capture, output to screen, measurement options):

- easier, faster means of collecting lab data (i.e. can collect more data during lab time by snapping image of cell count slides that can be assessed after lab session).

- provides easy means for TA or labmates to share/discuss observations during lab as image is projected to a video screen (as opposed to having to give verbal directions on where one should look inside the microscope view).

- students can capture microscope images with digital camera = enhances lab reports

- could complete counts from images using software (available free online)

Estimated Equipment Lifetime

20 years

Implementation Schedule

Will purchase in spring for F22 ChE290.

Additional Information

ChE dept will match funding from WEEF. Goal is to purchase 4 more digital microscopes/replace 8 more traditional microscopes for lab with 50-50 funding between WEEF and dept. WEEF allocated ~40% of requested funding in F22, this proposal is for remainder to complete purchase but would accept any funding and request remainder in S22 WEEF term.

Cost Breakdown

Academic Equipment and Resources
Proposal F-254

Item	Option 1	Option 2	Option 3	Option 4
Microscopes (with digital cameras/viewscreens $3K- 6K ea or traditional style $800-$2K ea, price depends on resolution)	7000	5000	3000	2000
Total	7000	5000	3000	2000

New educational mobile robots TurtleBot3

Mechanical and Mechatronics Engineering (MME)
MTE544,ME597
Yue Hu, Assistant Professor
yue.hu@uwaterloo.ca

Description of Proposal

Autonomous Mobile Robots, code MTE544 for Mechatronics Engineering in the Fall term and code ME597c for Mechanical Engineering in the Winter term, is a 4th year technical elective course that serves as an introduction to various aspects of robotics, especially wheeled mobile robots. The course is lab-heavy, involving hands-on sessions with real mobile robots where the students can learn to implement robot controls, mapping, localization, and planning using ROS (Robotic Operating System), the most popular interface for robots existing.

The course has used TurtleBot2 for the past decade, which is a mobile robot of about 35cmx35cmx42cm and weighs 6.3 kg. This version of the robot is outdated, as it is no more produced, spare parts are hard to find, and the operating system it relies on is no more supported and cannot be upgraded.

This proposal aims at purchasing TurtleBot3 Burger units for the lab sessions to continue offering up-to-date platforms for the students to practice and learn with the most recent robotic hardware and sensors. The TurtleBot3 is upgraded in hardware and is also the model currently supported by the ROS simulator, Gazebo, so students will be able to port developments carried in simulation directly on the real robot. Moreover, TurtleBot3 Burger is much smaller in size, it is 14cmx18cmx20cm (about ¼ of the size of TurtleBot2) and weighs only 1 kg. The small size and lightweight make the robot extremely portable and easy to set up in smaller environments, which greatly helps in finding a suitable location for conducting the lengthy lab sessions within the Engineering facilities. TurtleBot3 also offers the flexibility of adding additional sensors and parts for possible future extensions (e.g. sensors upgrade, adding computing modules, etc.).

Proposal Benefits

The robots will benefit students of MTE544, ME597c, and ME640.

A total of 46 students attended MTE544 in Fall2021 and 31 attended ME597. In previous years, MTE544 has always had class sizes of about 80 students but has seen a drop in numbers due to the lack of a regular faculty teaching the course. However, from Fall2021, regular faculties (myself and Prof. Soo Jeon) will be teaching it regularly, so the course is expected to have an increase in class size back to 80. While not directly related to undergraduate studies, master students attending ME640 may also benefit from the robots for practical hands-on sessions, especially MEng students who have little to no access to robots otherwise. The RoboHub has already offered to store and maintain the units within their facility.

Estimated Equipment Lifetime

The previous TurtleBot2 are still after 10 years, so potentially TurtleBot3 will be operational for at least 10 years.

Implementation Schedule

If funded, the equipment will be purchased immediately, set-up and testing will occur during Spring 2022, and the robots will be ready to be used by students in Fall 2022.

Additional Information

To have sufficient units for students to work in smaller groups in different sessions, the target number of units to be purchased is 10 units in total.

MME department will be able to fund part of the units (~3), possible costs for extra parts, and replacements.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
TurtleBot3	5940	5120	4200	3480
Estimated shipping costs	200	200	200	200
Total	6140	5320	4400	3680

Academic Equipment and Resources
Proposal F-256

Tools for engineering student shops

Sedra student design centre
Graeme Adair, Manager Sedra student design centre
graeme.adair@uwaterloo.ca

Description of Proposal

We are seeking funds to upgrade two key pieces of our sheet metal working equipment, the foot shear and box and pan brake. Our current equipment is over 30 years old and has accumulated enough damage that it no longer makes sense to repair it.

Proposal Benefits

Theses new pieces of equipment will allow students to make clean cuts and bends on 16 gauge or thinner material. Better performing equipment will allow students to fabricate more professional looking parts.

Estimated Equipment Lifetime

Over 30 years

Implementation Schedule

Immediately

Additional Information

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Tennsmith 36" 16ga foot shear	4100	0	0	0
4' 16ga box and pan brake	3400	0	0	0
Total	7500	0	0	0

F20 & W21 WATonomous WEEF Reallocation Proposal

WATonomous
Anson He, Business Director
jw4he@uwaterloo.ca

Description of Proposal

WATonomous was established in April 2017 when our team was elected to represent the University of Waterloo in the SAE AutoDrive Challenge, a competition to transform a stock Chevrolet Bolt EV into a level 4 autonomous vehicle. WATonomous ended the final year of competitions with a phenomenal 2nd place overall finish. This accomplishment was only possible through the hard work and collaborative effort of our team members, who stem from a multitude of programs, almost one-third of which are from math faculty programs!

For the Winter 2022 term, WATonomous plans to focus on improving two aspects of our autonomous vehicle, Bolty: Dynamic Interactions and System Robustness. Dynamic interactions incorporate the decisions a driver would make based on the actions of other road users, such as dealing with pedestrians and cyclists or performing unprotected left turns. Systematic robustness involves improving the safety and redundancy of the vehicle in harsh environments, such as driving in GPS-denied environments like tunnels, for example, or poor lighting conditions sunrise and sunset).

This reallocation proposal includes changes for the following WEEF F20 and WEEF W21 allocations listed below:

WEEF F20: Perception Data Annotations ($1000)

WEEF W21: Y4 Shipping Costs ($1290)

WEEF W21: Caster with 3-3/4" x 2-5/8" Mounting Plate ($160)

WEEF W21: Rope with Hook ($30)

Due to changes in circumstances and priorities, WATO no longer needs to purchase the above items that have been allocated in the past. Thus, we are hoping to reallocate the funding to the new items discussed in this proposal.

Please view the reallocation budget including a side by side comparison of the old allocations and new reallocations here:

https://docs.google.com/spreadsheets/d/1UergHqR9-npdxF6nxouhbhgK7NAgbVW459YvkJr1MfU/edit?usp=sharing

Proposal Benefits

All of the items mentioned in the proposal are crucial to our success.

Server Upgrades

Reallocation
Proposal F-257

In our current compute cluster of 11 machines, we have a broken PSU (Power Supply Unit) that needs to be replaced. We will need to purchase a 1300W PSU to replace it.

Networking Upgrades

Over the last 5 years, WATonomous has built a compute cluster to support our development and simulation needs for competitions. We have been expanding our compute cluster to handle more concurrent developers and more sophisticated simulation software. As a part of the compute cluster, there is a set of network switches that provide 10Gbps networking between cluster machines. Currently, we are making very good use of our 10G cluster connection for cluster-wide file sharing. We would like to retrofit our machines to have dual-10G connections for redundancy and increased performance. To do this, we need to purchase 20 SFP DAC cables and 5 2x10G SFP+ network adapters.

Estimated Equipment Lifetime

1. Server Upgrades - 1x 1300W PSU: 10 Years

2. Networking Upgrades (1) - 20x SFP DAC Cables: 10 Years

3. Networking Upgrades (2) - 5x 2x10G SFP+ Network Adapter: 10 Years

Implementation Schedule

1. Server Upgrades - 1x 1300W PSU: Immediate purchase and utilization upon receiving funding

2. Networking Upgrades (1) - 20x SFP DAC Cables: Immediate purchase and utilization upon receiving funding

3. Networking Upgrades (2) - 5x 2x10G SFP+ Network Adapter: Immediate purchase and utilization upon receiving funding

Additional Information

I would like to emphasize that we have already been allocated funding for the F20 and W21 items listed in the proposal description, and we are asking for that unspent funding to be reallocated to the new items proposed.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Server Upgrades - 1x 1300W PSU	360	270	180	90
Networking Upgrades (1) - 20x SFP DAC Cables	640	480	320	160
Networking Upgrades (2) - 5x 2x10G SFP+ Network Adapter	1480	1110	740	370

Total	2480	1860	1240	620

Academic Equipment and Resources
Proposal F-259

Design+Build Equipment

Architecture
arch492
Heinz Koller Fabrication Labs Manager
heinz.koller@uwaterloo.ca

Description of Proposal

Acquisition of a kit of tools to provide the students adequate resources for an on-site build project.

Proposal Benefits

Currently students on build projects must be tethered to an electrical outlet. This is becoming more challenging as the projects are becoming more complex. Many projects cannot be built within direct proximity of electrical outlets. While in some cases, corded tools can still be used, these cords can present safety hazards when running throughout the jobsite and in inclement weather. The kit of cordless tools will allow more work to be performed on-site as opposed to being carted back and forth from the shop while also providing more flexibility and improving jobsite safety.

Estimated Equipment Lifetime

5-10 Years

Implementation Schedule

Immediately (ASAP)

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
DEWALT 20V 6 Tool Combo Kit	1500.00	0	0	0
DEWALT 20V Cordless Framing Nailer Kit	875.00	0	0	0
DEWALT DCK300P1 20V 3-Tool Woodworking Kit	740.00	0	0	0
0				
Total	3115	0	0	0

Student Team
Proposal F-260

Waterloo Rocketry Winter 2022 WEEF Proposal

Waterloo Rocketry
Denis Tyan Finance Team Member
dtyan@uwaterloo.ca

Description of Proposal

Waterloo Rocketry is a student design team developing hybrid and liquid rockets. We compete annually at the Spaceport America Cup with more than 150 teams from across the globe, and this year we are also entered to compete in the inaugural Launch Canada competition. Our work comprises the design, manufacture, and testing of all flight and ground systems required to test and launch the rocket.

Here are some of our most recent accomplishments:

(2018) Unexploded Ordnance: 1st place in the 10K Student Researched and Developed (SRAD) Hybrid / Liquid category

(2019) Shark of the Sky: 2nd place in the 30,000 ft SRAD Hybrid / Liquid category, Team sportsmanship award.

(2021) Kraken of the Sky (Virtual Spaceport America Cup): 2nd place in the 30K SRAD Hybrid / Liquid category, Dr. Gil Moore Award for Innovation, Top 10 Finalist in the SDL Payload Challenge.

Our current projects include finalizing our hybrid-powered rocket for the 2022 competition , developing a Rogallo wing glider payload, and 360° view launch footage onboard the rocket. We are also manufacturing and preparing to test our new, more complex liquid engine.

Moving forward, we hope to represent WEEF with pride through success at the 2022 Spaceport America Cup.

Proposal Benefits

Propulsion:

Many of our current plumbing components are not rated to sustain the pressures we plan to work with in development of the liquid engine. Replacing these components makes our plumbing system more reliable and longer lasting, and is critical to test the engine safely. Upgrading our system will allow us to increase the sophistication and performance of our propulsion system, which is necessary for achieving better designs and launching more advanced and powerful rockets. Funding for this category will be used to purchase fittings that will be robust and long-lasting. Our propulsion system provides incredible learning opportunities and unique challenges for team members to take on and is one of the systems that sets our team apart. Development of a liquid engine, continuing this year, is a completely new challenge for the team and presents a number of new and diverse learning opportunities. Many components will either contribute to long term development, or be capable of being used in multiple vehicles.

Media: Footage of our systems serves 2 main purposes. The first is to allow us to analyze the systems during tests from a close up point of view that isn't possible otherwise, due to required minimum safe distances. For example, the footage taken at our most recent engine test, which ended unsuccessfully, allowed us to determine the failure mode of the engine's nozzle. Test footage is also a valuable tool for recruitment and outreach, allowing us to show potential new members what they could work on if they join the team, and generally teach people about rocket science!

3. Recovery

In order to consider a launch a success, it is crucial to safely recover the rocket. The recovery subsystem is continually pushing technological boundaries, such as our new reefed parachute this year, which exposes team members to new and complex challenges. Finally, with recovering the entire system after launch there will be a lot of cost saving for the next cycle in terms of technology and materials.

Safety:

Safety is paramount to the team, and as we begin to work with liquid engines, we need new specialized equipment. Many of the materials that the team works with have the potential to be extremely dangerous to the team members working with them. We implement a number of engineering controls, such as specialized system training, but one of the most important ways to keep our members safe is the correct use of PPE.

Avionics:

Our modular system, RocketCAN, was first flown in 2019 and has since been significantly expanded to gather more data about the rocket's flight and allows us to control new systems. While the minimum RocketCAN system has largely been built, we are requesting funding to continue developing new additions to the system. These new projects allow us to give members new and interesting opportunities to learn while helping to improve the reliability and safety of the rocket.

Estimated Equipment Lifetime

Propulsion/Plumbing: We are confident the components lasting up to 5 years and serving the span of multiple rockets.

Media: The estimated life of this equipment is 3-4 years minimum.

Recovery: Recovery electronics and material are expected to last for the lifespan of our vehicle (2-3 years).

Safety: Much of the more expensive equipment such as gloves and welding helmets are expected to last at least 5 years.

Avionics: Equipment has an expected lifespan of at least 5 years.

Implementation Schedule

As the in person portion of the competition was delayed the past 2 years, most projects are currently in the fabrication phase and will be ready to purchase materials and/or equipment as soon as funding is approved.

Additional Information

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Plumbing/Propulsion	8500	7250	6000	4000
Media	500	400	300	100
Recovery	750	600	450	300
Safety	1500	1200	1000	800
Avionics	2000	1750	1500	1000
Total	13250	11200	9250	6200

Student Team
Proposal F-261

Waterloo iGEM Funding Request for Equipment and Reagents

Waterloo iGEM
Ethan Zhang, Finance Lead
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Description of Proposal

The UW International Genetically Engineered Machine (iGEM) team is dedicated to solving real life problems using the power of synthetic biology. The team is divided into three sub-teams: Lab & Design, Math & Modelling, and Human Practices. The project that our team is currently working on will be showcased at an international competition (the Giant Jamboree) in November.

Our design process follows the engineering practices of continuous building, implementing and testing, with our solutions being deeply rooted in genetic engineering, process modelling and prototyping. As such, we provide a unique experience for students across different disciplines, particularly those in nanotechnology and biomedical engineering, to collaboratively solve real-world problems in biology through software computations, mathematical modelling, and hardware prototypes. Waterloo has always been very strong in the engineering department, and through iGEM, students are exposed to further diversity in terms of the reach of engineering.

Proposal Benefits

In order to optimize the student experience, we need access to the equipment and materials for testing and prototyping, and we also want to allow students the opportunity to apply what they learn in the classroom to develop promising synthetic biology systems using both biology and mathematics. At the end of the year the team will present their project to an international audience at a competition hosting over 300 teams from around the world and we hope to continue our streak of success in this new year.

Estimated Equipment Lifetime

- Lab coats are all reusable; in fact, they can be used for several years to come. With a total of 17 lab members plus helpers from other sub-teams, we will then need around 20 lab coats to ensure all members are covered.

- Eppendorf Pipettes, Protein Electrophoresis Cell and the Vortex Mixer are all also reusable.

- Taq Polymerase is a consumable, but 500 units could be used for a few years worth of experiments.

Implementation Schedule

Lab coats can be immediately used during experimentation. The remaining items will all be used starting with lab training, which is around the end of the winter term to the beginning of the spring term. They will be heavily used during experiments in the spring term towards the middle of the fall term, when the

competition season is over. All equipment and remaining reagents will be carried over to next year, where they will continue to be used.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
20x Lab Coats (University Print)	499.80	0	0	0
1x 4-Pack Set of Eppendorf Pipettes (Fisher Scientific)	1556.00			
1x Protein Electrophoresis Cell (Bio-Rad)	1490.00	979.00	747.00	
1x Vortex Mixer (Fisher Scientific)	546.70	350.73		
1x 500 Units of Taq Polymerase (ThermoFisher)	186.00			
Total	4278.5	1329.73	747	0

Student Team
Proposal F-262

W22 WATonomous WEEF Proposal

WATonomous
Ashwin Sureshchandra - Internal Sponsorship Core Member
asureshchandra@uwaterloo.ca

Description of Proposal

WATonomous was established in April 2017 when our team was elected to represent the University of Waterloo in the SAE AutoDrive Challenge, a competition to transform a stock Chevrolet Bolt EV into a level 4 autonomous vehicle. WATonomous ended the final year of competitions with a phenomenal 2nd place overall finish. This accomplishment was only possible through the hard work and collaborative effort of our team members, who stem from a multitude of programs, almost one-third of which stems from math faculty programs!

For the Winter 2022 term, WATonomous plans to focus on improving two aspects of our autonomous vehicle, Bolty: Dynamic Interactions and System Robustness. Dynamic interactions incorporate the decisions a driver would make based on the actions of other road users, such as dealing with pedestrians and cyclists or performing unprotected left turns. Systematic robustness involves improving the safety and redundancy of the vehicle in harsh environments, such as driving in GPS-denied environments like tunnels, for example, or poor lighting conditions sunrise and sunset).

Proposal Benefits

All of the items mentioned in the proposal are crucial to our success.

Retrofitted GPU Farm: By retrofitting two of our machines to be GPU machines, we will be able to increase our training efficiency and developer productivity. This will require a more powerful PSU and mining frame for each machine, as well as multiple extension cables.

AWS Deepracer Vehicle:By purchasing two mini vehicle platforms, we will be able to test our path planning algorithms in a cost and time effective manner. We will be able to test our algorithms without the real-word risks or the overhead costs that are incurred when operating our autonomous vehicle, Bolty. Furthermore, we wish to participate in the international AWS DeepRacer competition, hosted by Amazon, in which we would be competing against the world's best miniature AV teams.

Server Upgrades: Due to significant RAM bottlenecks for our workloads, we need to upgrade the RAM in our servers to support more complex RAM-bound workloads, such as reinforcement learning training and MATLAB simulations. We also require extra SSD and HDD storage since our storage server is almost full.

GPU Upgrades: By purchasing additional GPUs, we will be able to train our deep learning and reinforcement learning algorithms faster.

Motors for Mobile Platform: Motors are necessary to move the Guided Soft Targets (GST). Brushless motors are the best options for our team, as they produce less heating, do not generate friction, and provide a better overall performance.

Batteries for Mobile Platform: A large array of battery cells is needed to power the brushless motors for an entire day at the track.

Compute Platform and Over-air Communication Hardware for Mobile Platform: We need to communicate with the GST over-air to program trajectories. We also need a computation platform on the GST to execute closed loop control over the trajectories, which require accurate localization sensors.

Fabrication Materials (Metal) for Mobile Platform: We need materials and machining costs to construct the body frame of the GST.

Fabrication Materials (Foam) for Entity Mounted on top of Mobile Platform: We need materials and printing costs to construct an appearance similar to a vehicle for camera classification on top of the GST robotic platform.

With the funding, WATonomous can improve the efficiency of our development, the quality of our testing, and ultimately the experience we provide to the many current and future engineering students on our team.

Estimated Equipment Lifetime

Retrofitted GPU Farm: 10 years

AWS Deepracer Vehicle: 5 years

Server Upgrades: 5 years

GPU Upgrades: 5 years

Motors for Mobile Platform: 10 years

Batteries for Mobile Platform: 10 years

Compute Platform and Over-air Communication Hardware for Mobile Platform: 10 years

Fabrication Materials (Metal) for Mobile Platform: 10 years

Fabrication Materials (Foam) for Entity Mounted on top of Mobile Platform: 10 years

Implementation Schedule

Retrofitted GPU Farm: Immediate purchase upon receiving funding, and will be utilized immediately

AWS Deepracer Vehicle: Immediate purchase upon receiving funding, and will be utilized immediately

Server Upgrades: Immediate purchase upon receiving funding, and will be utilized immediately

GPU Upgrades: Immediate purchase upon receiving funding, and will be utilized immediately

Motors for Mobile Platform: Immediate purchase upon receiving funding, and will be utilized immediately

Batteries for Mobile Platform: Immediate purchase upon receiving funding, and will be utilized immediately

Compute Platform and Over-air Communication Hardware for Mobile Platform: Immediate purchase upon receiving funding, and will be utilized immediately

Fabrication Materials (Metal) for Mobile Platform: Immediate purchase upon receiving funding, and will be utilized immediately

Fabrication Materials (Foam) for Entity Mounted on top of Mobile Platform: Immediate purchase upon receiving funding, and will be utilized immediately

Additional Information

We would like to request funding for the projects if possible and would be happy to receive partial funding for the projects if full funding cannot be provided. If there are any specific funding items within the projects that WEEF cannot fund, WEEF can veto those items and any funding for the project will only be spent on items that WEEF approves. However, we would like to emphasize that receiving funding for a project as opposed to individual funding items would be very helpful for WATonomous. Due to the fluctuating prices of items, we would really benefit from determining which items to purchase and when to purchase them to guarantee the best possible price.

If funding for projects cannot be provided, please fund items based on the provided priorities in the spreadsheet (i.e. fund all items with priority 1 before funding priority 2).

Note that we are requesting the same items from both MEF and WEEF in hopes of acquiring full funding from the sum of both funds. We have also requested the Retrofitted GPU Farm funding item from EngSoc.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Compute and Research Hardware	14674	11006	7337	3669
Mobile Platform	8391	6293	4196	2098
Total	23065	17299	11533	5767

Student Team
Proposal F-263

SSDC WEEF Proposal W22

Joint proposal by Waterloop, UW Orbital, Prof. Teertstra, WARG, Midnight Sun
Waterloop x UW Orbital x Midnight Sun x WARG Joint Proposal
djadhwanijadhwani@uwaterloo.ca

Description of Proposal

UW Orbital and Waterloop are mainly submitting this proposal, but we are also collaborating with Prof. Teerstra, the Midnight Sun Solar Car Team, and Waterloo Aerial Robotics Group.

UW Orbital is a student design team participating in the Canadian Satellite Design Challenge, a 2 year long competition involving teams across Canada. UW Orbital's primary payload is a camera that will be used to provide ham radio operators with images of their area. The goal for this payload is to further amateur radio education. UW Orbital is also launching a prototype for an infrared laser beacon as part of their partnership with QEYnet. The team is working to develop a long-lasting space community at the University of Waterloo by facilitating mentorship and creating opportunities for students to learn.

Waterloop is a student design team developing hyperloop pod prototypes. They are dedicated to building a full scale hyperloop pod by 2025 to demonstrate the feasibility of hyperloop technology in Canada. In fall term, they unveiled Goose 5, which demonstrated contactless propulsion - a key component in hyperloop technology. Now in winter, they are revising the pod to prepare it for the Canadian Hyperloop Conference and European Hyperloop Week this upcoming spring term. After that, the team will be working on their next pod iteration, Goose 6 (G6), which will demonstrate levitation - a state needed to gain hyperloop level speeds. The G6 pod will be a huge step towards their goal of a fully functioning hyperloop pod. Waterloop focuses on pushing the boundaries of transportation as we know it. The team strives to enable the technical and practical possibility of hyperloop transportation as a way to bring our world closer together.

This proposal is also being supported and endorsed by other SSDC teams, including the Waterloo Aerial Robotics Group, which builds autonomous drones, and the Midnight Sun team, which is building a solar powered vehicle.

UW Orbital and Waterloop are partnering together to request funding for a thermal camera and a hot air station for the SSDC. The thermal camera will be very useful as it will allow teams to acquire thermal analysis for PCBs, batteries, propulsion systems, cooling systems, and more. It could be used for various projects, such as cars, rockets, and CubeSats. The camera will help teams detect electrical, mechanical, and construction issues. It has built in Wi-Fi for easy file uploads and will provide 320 x 240 pixel infrared resolution for clear images.

We are also requesting funding for a hot air station for the SSDC, which will be stored in the 3D Print Centre and has been supported by Prof. Teerstra. This will provide a consistent soldering and rework station for teams to use. It will be useful for fixing soldering on PCBs. The station will include an integrated vacuum pick up system, facilitating a clean workstation, and a visual indicator for reflow. Although the SSDC already provides a hot air station, an additional hot air station would be beneficial to all teams.

Proposal Benefits

Benefits to WEEF

Waterloop's business and sponsorship team works on building contacts with various companies that help sponsor us by providing materials we might need at discounted rates, in exchange for marketing their brand on our website and pod (depending on the agreed upon terms). Our sponsors may also provide support in the form of technical materials, software, and marketing. We believe that WEEF's funding assistance will help our business team greatly.

Waterloop provides perks for all of our financial sponsors. The funding requested will qualify WEEF for the Transonic Tier, in which the agreed terms would include:

Exclusive tickets to our Green Technology event

Exclusive tickets to our next Pod Unveil event

WEEF logo displayed on the Waterloop website

Dedicated social media exposure acknowledging WEEF's support of Waterloop

Logo on presentation materials

Logo on pod shell

Approval of funding for this proposal would greatly benefit UW Orbital and would boost WEEF's sponsorship status to our Silver Tier, which includes perks such as:

Logo on team apparel

Representing WEEF at the CSDC and in the UW SDC by having WEEF's logo on our team banner

Dedicated posts on social media to acknowledge WEEF's support

WEEF's logo and link will be placed on the sponsor page of our website

Logo on team presentations and videos at outreach events

WARG and Midnight Sun will also be providing benefits listed within their respective sponsorship packages.

Benefits to Engineering

As one of the largest student design teams at UWaterloo, with 124 members, Waterloop values the culture of mentorship, innovation and learning. By nurturing and developing the talent of many members from all faculties, especially the Faculty of Engineering, where the majority of our members are from, we become the stepping-stone for many generations of students on their path to success. Through funding from WEEF, the research, design, and construction of the Goose VI pod will provide a unique and rewarding experience that students will really value.

The majority of members of Orbital are from the Faculty of Engineering. Through our CubeSat development, engineering students participating in any of our subteams benefit from garnering

invaluable technical and hands-on experience unique to the space industry. Aspiring students will also have access to a professional network of mentorship and resources to support their endeavors. Combining both technical and hands-on experience with a professional network will allow any aspiring UW student, especially engineering students, to succeed in their future careers in space and STEM.

In regards to this particular proposal, all design teams in the SSDC will share the thermal camera and hot air station. Not only does this help to deepen the sense of community between the teams but having proper equipment will also allow teams to improve the success of their projects. Additionally, engineering students will be able to expand their scope of practical, technical, and hands-on skills as they use the equipment. The faculty of engineering will also benefit from strong social media exposure as teams continue to represent the university and the faculty.

Estimated Equipment Lifetime

Hot air station: The hot air station will be useful for many years across all the teams in the SSDC. UW Orbital in particular will be using it for multiple design cycles, and it will be extremely helpful for Waterloop as we prepare for competitions next term. For the actual equipment lifetime, we estimate that it will be useful for the next 10+ years, or until it breaks.

Thermal camera: The thermal camera will also be used across all the teams in the SSDC to perform thermal analysis on PCB boards and structural components such as CubeSats, cars and rockets, for the next 5-10+ years, or until it breaks.

Implementation Schedule

The hot air station that we are requesting funding for would be used every term for PCB bringup, assembly and rework for both Waterloop and UW Orbital, whereas the thermal camera would also be used for every term for both UW Orbital and Waterloop's thermal analysis requirements.

Additional Information

Waterloop is grateful for the support that WEEF has shown over the years. The team will be happy to accept any partial funding over no funding. More information about our team, along with past and future initiatives, can be found on our website: https://teamwaterloop.ca.

UW Orbital greatly appreciates WEEF's support in our team last term. We would also be glad to accept any partial funding over no funding. To learn more about our team, our mission, and our project, please visit our website: https://www.uworbital.com/

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Hot air station	1269.64	1923.75	0	0
Thermal Camera	4105	2704	930	

Total	5374.6400000000003	4627.75	930	0

Student Team
Proposal F-264

Waterloop WEEF Proposal W22

Waterloop
Waterloop WEEF Proposal W22
djadhwanijadhwani@uwaterloo.ca

Description of Proposal

Waterloop is the University of Waterloo's hyperloop student design team. Our mission is to have a full scale prototype by 2024 to demonstrate the feasibility of hyperloop technology in Canada.

HAs hyperloop is a new mode of transportation it is constantly being innovated on and improved. This concept is growing in popularity, it uses a levitating pod to carry passengers in a vacuum tube. This allows for high speed travel, at top speeds of over 1,000 km/h. With this technology, passengers will easily be able to travel far distances such as Toronto to Montreal within 30 minutes.

In November of 2021, the team revealed our 5th iteration of our pod, Goose 5, which featured the technology of contactless propulsion. Additionally, the team is currently refining the pod design for the upcoming Canadian Hyperloop Competition and European Hyperloop Week competitions this Spring. While improving our current pod, our team continues to pursue its goals of innovation through our next generation of pod, Goose 6 (G6), which will feature levitation, contactless propulsion, and a carbon fibre monocoque frame.

The funding provided by WEEF will be used to purchase crucial equipment that is necessary for our G6 pod and to improve our current pod for our upcoming competitions. The pod will require a new printed circuit board that will manage the power system for the device, mechanical components such as fasteners, and pneumatic components to help the pod stay on track, and parts for our newly designed Linear Induction Motor (LIM) to allow a full demonstration of levitation.

Proposal Benefits

Benefits to WEEF

Waterloop's business and sponsorship team works on building contacts with various companies that help sponsor us by providing materials we might need at discounted rates, in exchange for marketing their brand on our website and pod (depending on the agreed upon terms). Our sponsors may also provide support in the form of technical materials, software, and marketing. We believe that WEEF's funding assistance will help our business team greatly.

Waterloop provides perks for all of our financial sponsors. The funding requested will qualify WEEF for the Transonic Tier, in which the agreed terms would include:

Exclusive tickets to our Green Technology event

Exclusive tickets to our next Pod Unveil event

WEEF logo displayed on the Waterloop website

Student Team
Proposal F-264

Dedicated social media exposure acknowledging WEEF's support of Waterloop

Logo on presentation materials

Logo on pod shell

Benefits to Engineering

As one of the largest student design teams at University of Waterloo with over 124 members, Waterloop values the culture of mentorship, innovation and constant learning. By nurturing and developing the talent of many members from all faculties, especially Engineering where the majority of our members are from, we become the first stepping-stone for many generations of students on their path to success. The process of being a part of a proprietary development provides students with insight into manufacturing as well as research, design and development basics that can be brought into future co-op or professional endeavors. Having experienced students going into the workplace will not only reflect well on Waterloop, but the University as well. Through funding from WEEF, the research, design, and construction of the Goose VI pod will provide a unique and rewarding experience that students will really value.

Moreover, having a stable design team like Waterloop will ensure the University of Waterloo generates a reputation as a leader in hyperloop research, design, and development in Canada, attracting new students and investors to the university itself, and garnering attention through our accomplishments.

Estimated Equipment Lifetime

For all of our equipment we expect to use it for next term in all of our competitions, as well as in future terms, since they're all components that we can disassemble and reuse.

Implementation Schedule

The electrical tools that we are requesting funding for would be used this term (Fall 2021),whereas the mechanical components would be used over the next year and a half for prototyping and within the final version of the G6 pod.

Additional Information

Waterloop is grateful for the support that WEEF has shown over the years. The team will be happy to accept any partial funding over no funding. More information about our team, along with past and future initiatives, can be found on our website: https://teamwaterloop.ca.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
guidance: pneumatics, springs, air cylinders	1200	1000	900	800

thermals: cooling fans, heat flux sensors	500	300	200	100
battery: grepow battery cells, power distribution unit parts	2000	1800	1700	1300
testing magnetic field (gauss), raw materials (electrical steel for motor core, copper for coils)	3200	2800	2300	2000
Motor Controller (transformers, HV parts, boards, IGBTs) + WE HAVE MORE ITEMS, WE'LL TALK ABOUT IT IN OUR PRESENTATION!	1000	800	500	300
Total	7900	6700	5600	4500

Student Team
Proposal F-258

WEEF W22 Funding Proposal

Midnight Sun Solar Car Team
Yanshen Zhou - Midnight Sun Project Manager
yanshen.zhou@uwaterloo.ca

Description of Proposal

Midnight Sun has been representing the University of Waterloo at international solar car competitions for 34 years. With a post-pandemic future looking bright, Midnight Sun strives to continue providing experiential learning opportunities to all engineering students with the start of a new design cycle aiming to compete at the 2024 American Solar Challenge.

Building a solar car from scratch requires constant review and iteration to ensure our end product profoundly rises up to the engineering challenge that solar car racing poses. Once completed, MS XV will mark the team's return to single-occupancy vehicles in over a decade. With this project, we are striving to build a robust and holistically-sound vehicle with an emphasis on designing for manufacturability and assembly.

We would like to request funding from WEEF to help in the acquirement of battery cells as we begin to design and manufacture our next vehicle.

Proposal Benefits

Funding to purchase bulk battery cells for the solar vehicle's battery pack will allow our Battery Box team to move forward in their design cycle. The Battery team is already testing with sample cells this term and have done extensive research for the quantities associated with the type of battery cells that would be purchased based on the results from sample cell testing.

This purchase will also mark the first steps to manufacturing for the whole vehicle, as the battery box will be the first mechanical component to be designed and manufactured. As a result, it will be a confidence-booster for the entire team to see a physical component of our next vehicle being constructed. The battery cells will also allow for bulk testing to take place, which will help promote in-person activities and allow for productive engagement amongst members that had unfortunately ceased during the pandemic.

Midnight Sun consists of more than 75 active members from predominantly engineering programs including Electrical, Computer, Management, Software, Mechanical, Mechatronics, Nanotechnology, and Systems Design Engineering, making it one of, if not, the largest student design team at the University of Waterloo. We are proud to support the success of students around the engineering faculty by providing a practical learning environment for them to thrive and explore skills outside of the classroom. By joining our mechanical, electrical, business and strategy subteams, each member is able to learn and apply a variety of skills to a unique project, which can then follow them as they enter the workforce and advance their careers.

Technical skills that our members learn include Mechanical Design & Manufacturing, Embedded Programming, PCB & Electrical System Design, Financial Management, Project Management and more. Furthermore, the members pick up and develop numerous soft skills including problem solving, leadership, teamwork and communication.

After becoming the first Canadian team to finish the 2018 American Solar Challenge in the Multi-Occupant Vehicle Class, Midnight Sun has successfully promoted Waterloo Engineering in international markets. Most recently, Midnight Sun has been involved in outreach activities with the University, such as the eSTEM series with Renison College and Green Tech Event with Waterloop. With the development of MS XV, we plan to continue this promotion of both Waterloo and WEEF at the American Solar Challenge in 2024. Our original goal was to attend ASC 2022. However due to the ongoing COVID-19 situation, we have shifted our design focus to competing at ASC 2024.

WEEF has continued to support our team for countless terms and allowed several generations of the team to push the boundaries of solar transportation. Your support in our current design cycle will ensure that WEEF will stay a Diamond Sponsor for our team, where the perks will include your logo on our vehicle, team jerseys and promotion at events.

Estimated Equipment Lifetime

The battery cells will be all the cells we plan on purchasing for this design cycle, carrying us through to competition, which is set to be in July of 2024.

Implementation Schedule

With SSDC occupant limits being lifted and sample cell testing already in-progress, this funding will be used by the end of Spring 2022 once sample cell testing has been completed and the Battery team has a decision made on the type of battery cells to purchase in bulk.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Battery Cells that will make up the battery pack - the main source of power of the solar vehicle.	5000	5000	5000	5000

Total	5000	5000	5000	5000

Student Team
Proposal F-265

VEX U Robotics 2022 Winter

VEX U Robotics
Alex Su, Team Lead
alex.su@uwaterloo.ca

Description of Proposal

VEX U is a university-level competition that enables over 300 post-secondary institutions all over the world to compete at an international level. The rules of the competition are similar to VEX EDR, however, VEX U offers more flexibility in the robot design, electronics, and manufacturing process. In particular, students have the opportunity to customize circuitry, boards, and sensors to enhance the functionality of the robot. Additionally, the machining of steel, aluminum and composite materials, and 3D printing of plastics is permitted, allowing for a more versatile robot. Students who are familiar with high school robotics, as well as newcomers will be provided with opportunities to succeed and learn about things outside of the curriculum. Along with greater technical skills, we aim to form students into members of a team, and productive members of our community. VEX U competitions have historically been held mostly in Mexico and the United States. However, in recent years Canadian teams have the opportunity to compete domestically as a competition will be held at the University of Waterloo each year. This event will allow Canadian teams to qualify for the World Championship held in Dallas, Texas which will be broadcasted on ESPN/CBS. We are led by a core of students

with a background of success, having won the VEX U World Championship 2021 In

Dallas. In recent

years we also received 3x Design Award and 3x Robot Skills Champion, 1x Robot Skills 2nd place, 1x Robot

Skills 3rd place. We are ranked 1st in World Skills ranking out of

all the universities teams over the world in 2021 season.

Proposal Benefits

The existence of this team would come with many benefits. For instance, it would benefit undergraduate engineering education, as well as the University as a whole. This team would further the educational experience of engineering undergraduate students by providing a competitive, educational, and fun environment to learn about robotics. The current robotics teams can seem daunting to new students, as they demand a large time commitment as well as the requirement to do a lot of additional learning, outside of meeting the already strenuous academic requirements. The teams are also easily scalable unlike others, if more students are interested in joining, we can simply register more teams and share the parts between robots. This would allow all students to participate in all aspects and will not feel left out. They would have the opportunity to implement their own design since the cost of additional robots is lessened. This team would also act as a good opportunity for students to get their first hands-on experience, a valuable characteristic that co-op employers look for. Not only would this

benefit students in their search for co-op placements, but it would increase the University's reputation of producing students that have applied experience. Another way this team would benefit the University's reputation is through the competitions. Good performances at competitions can bring international recognition to the University. At the very least, just having a presence at competitions builds the reputation of the University. Lastly, we are in the process of gathering the resources needed to host a VEX High School Competition on campus, which would attract high school students to the campus and giving professors/lecturers the chance to talk to students with potential interest to the university

Thank you greatly for your support, we were able to kickstart our rookie year from your generous support. You are a Platinum sponsor. We appreciate your consideration in sponsoring the universities' VEX U team.

Platinum ($2000+)

- Recognition in official team name announced at competition

- Company name in social media, press releases, brochures

- Large logo on robots

- Premium logo on website, team banner and jersey

Gold ($1000+)

- Company name in social media, press releases, brochures

- Medium logo on robots

- Large logo on website, team banner and jersey

Silver ($500+)

- Company name in social media, press releases, brochures

- Medium logo on website, team banner and jersey

Bronze ($300+)

- Company name in social media, press releases, brochures

- Small logo on website, team banner and jersey

Blue ($100)

- Small logo on website, team banner and jersey

Estimated Equipment Lifetime

The initial start-up cost for a VEX U team was high mainly because of the long term assets we need to operate the team, such as storage, tools and electronics. However, it soon became clear that the majority of this cost exists in the first few years. Past the first few years, there is minimal recurring cost,

with only a few hundred dollars required for replacement parts and game elements. The majority of the components that our team requires to compete can be used for multiple years. For instance, the pneumatics are easily reusable and expected to last well over 9000 cycles, which equates to many years of normal usage. Robot belts and chains can last many seasons as they are reusable and will not break under normal wear and tear. The majority of the components from the initial purchase are all being used for multiple seasons. As a result, the recurring cost of running a VEX U team is substantially less than the upfront investment required to start one.

Implementation Schedule

In order to be ready for competition, our team must have two competition-ready robots (the university competition requires a 15" and 24" robot).We will be designing, programming and tuning our robots so that they are ready for the competition. The requested funding will be used very soon after it is allocated.

Additional Information

More information about the items we are requesting funding for:

We are planning to utilize the SMC pneumatics system for additional functionality. SMC provides an affordable pneumatics system with high performance. The expected life span of the pneumatics system is very long as pneumatics system is not subjected to physical damage. They are also reusable across many years and can be used in different applications.

We would like to thank you for your time and consideration of our proposal for funding. We hope you see the many benefits that a VEX U team would bring not only to engineering undergraduate students but to the University itself. We are excited by the prospect of continuing the VEX U team and hope you share our enthusiasm.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Pneumatics	500	400	350	300
Robot Belts/ Chains	375	350	300	250
Total	875	750	650	550