WEEF PROPOSALS

SUMMARY

F2020

Academic Equipment and Resources		
Proposal Title	**Pg. #**	**Requested**
ECE Lab PCB Design Utility Addition (ARES for Proteus)	1	$15,020.00
Orbbec Cameras for Nano Design Days	2	$4,073.59
Flow through Orifice Recirculation Upgrade	4	$2,420.86
Next Generation Lego Robot for Mechanical and Mechatronics Programming	6	$2,200.00
Ideas Clinic - Electric Vehicles	7	$12,500.00
Rome Campus audio tour equipment	9	$13,051.00
Ultimaker 3D Printers for Nano undergrad labs	11	$9,655.38
Book Binding and Portfolio Tools	13	$1,350.99
Design+Fabrication Lab Ceramic Printing Kiln	15	$2,800.00
CHE 180 Studio Equipment (IDEAS)	17	$3,000.00
Conductivity probes for counter-current washing cascade activity	18	$27,300.00
Ideas Clinic - High speed camera	20	$5,500.00
Portable CNC Router	22	$4,746.00
Aerial Drone	23	$54,040.00
3D Printer and Manual Clay Tools	25	$14,644.00
Database Server Machines	26	$20,000.00
	Total	**$ 192,301.82**
Miscellaneous		
Furniture for CPH nook	29	$7,500.00
Video Switcher Streamer	31	$875.00
	Total	**$ 8,375.00**
Student Teams		
UWAFT Vehicle Scales & Floor Jack	32	$3,800.00
University of Waterloo Nanorobotics Group Proposal	34	$3,109.82
Industry 4.0 WEEF Proposal	37	$3,000.00
F20 WAtonomous WEEF Proposal	38	$9,736.99
Midnight Sun Hardware Funding	40	$5,000.00
Waterloo Formula Electric Funds Proposal	42	$6,650.00
Waterloop F20 WEEF Proposal	43	$7,000.00
Waterloo Rocketry F20 WEEF Proposal	46	$8,000.00
UWFM Fall 2020 for 2021 Season	49	$9,065.00
Aura, Cambridge Festival of Lights 2020	51	$1,446.31
Weef F20 Proposal, Warg	53	$2,550.00
UWRT WEEF Proposal F2020	55	$8,021.00
Concrete Design Team Fall 2020 Proposal	57	$380.00
F20 WEEF Proposal Presentation by WatLock	58	$3,734.58
Funding for Indy Autonomous Challenge	60	$14,800.13
High Voltage Safety Equipment for Student Teams	62	$5,310.00
	Total	**$91,603.83**

ECE Lab PCB Design Utility Addition (ARES for Proteus)

ECE
ECE-298, ECE-498
Charles K. Pope ECE Lab Instructor, Hardware Specialist
kim.pope@uwaterloo.ca

Description of Proposal

Purchase of PCB Layout Utility to enhance existing Proteus tools for ECE courses.

Proposal Benefits

PCB Layout feature will enable the development of of student electronics designs for multiple courses (ECE-298, ECE-498 and others)

Estimated Equipment Lifetime

Perpetual Licensing will be acquired when purchased.

Implementation Schedule

The utility must be purchased in October-November of 2020 to allow course content development for the W2021 term

Additional Information

user support is included for first year of use.

s/w updates are included for first year.

will run on Windows OS computers only

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
ARES Utility for 200 seats (used with Proteus tool suite) in USD	8975	15020	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	8975	15020	0	0

Orbbec Cameras for Nano Design Days

Ideas Clinic/Nanotechnology Engineering
NE 131
Jenn Coggan NE Lab Manager, Teaching
jcoggan@uwaterloo.ca

Description of Proposal

This proposal is for funding to purchase a set of Astra Pro Orbbec cameras that will be used during Nano Design Days for the 1B class of nano students. The Design Days activities are run in partnership with the Ideas Clinic out of the Faculty of Engineering where each individual program steers the content to match their discipline. In the past 2 years (1B Winter 2019, 2B Spring 2019, 1B Winter 2020), Nano has run a Design Days activity where the students were tasked with the design, build and testing of a scanning tunneling microscope (STM). This was extremely successful with students providing overall positive feedback and mentioning that would like to see other activities during other terms.

The nano program has decided that the STM project was better suited to be in the 2B term so we are currently working on the development of a new 1B Nano Design Days. The new 1B project will be to create a glucose sensor using a lateral flow assay and a colourimetric test which uses a camera to detect a colour change on the test strip which can lead to the determination of the concentration of glucose in a sample. We are requesting $4073.59 of WEEF funding for 20 Astra Pro Orbbec cameras that will be used during Nano Design Days for the 1B students which are split into 26 teams of ~5 students. The camera allows for the image capture and image analysis on the sample and will be a major component of their overall design where they need to build an image box.

Proposal Benefits

The 3D Orbbec cameras were selected due to the fact the source code can be modified in order to have control upon the way the camera is running and processing images. The students will be able to perform image analysis using MATLAB that can utilize RGB pixel intensities to determine the concentration of glucose. These cameras also provide computer vision that enables a number of functions such as 3D measurement, environment perception as well as face and gesture recognition and human body tracking which could be useful for other projects.

The Ideas Clinic is familiar with this camera since they are currently being used for an autonomous vehicle activity and an industrial automation activity for other Engineering programs. The Ideas Clinic currently has 6 of these cameras but for each Nano team to have one for testing during Nano Design Days we require 20 more. They will be shared among other Eng programs when Nano is not using them.

Estimated Equipment Lifetime

The cameras are robust as seen through current use so hopefully 10 years or longer

Implementation Schedule

Purchase immediately for use in Winter 2021. We will be running the Nano Design Days remotely for this term.

Additional Information

The Engineering Ideas Clinic has previously supported all implementations of Engineering Design Days both in the development, and roll-out phases. They will match the WEEF funds for other necessary supplies for this project.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
20 Astra Pro Orbbec cameras	4073.59	3055.19	2036.80	0.00
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	4073.59	3055.19	2036.80	0

Flow through Orifice Recirculation Upgrade -

Chemical Engineering
CHE101 CHE390
Cheryl Newton Undergraduate Laboratory Instructor
c2pearce@uwaterloo.ca

Description of Proposal

In everyday life, materials are pumped to move from one place to another. Think about the water that comes out of your sink tap, shower, and gasoline from a gas pump. As well as, discharge of liquid from storage tanks or water towers. In chemical engineering processes moving liquids is a very important part of a processing unit. Being able to measure flow rate directly and indirectly is a key skill engineers must be able to do. An indirect way of measuring flow rate is using devices such as pitot tube, venturi, nozzle or orifice meters which are based on differential pressure across a restriction in flow path.

In the Chemical Engineering Undergraduate labs there are three orifice flow meters. The existing orifice flow meters are set up in series with water feed from domestic water lines. The three orifice flow meters are used simultaneously with water for undergraduate labs. One of the three orifice meters was updated with funding received from WEEF in Spring 2017 (S17-1128). The proposed improvement to the remaining to orifice meters is to add a tank and a pump to allow for fluid recirculation and use of liquid solutions other than water in the equipment. There will be a total of three centrifugal pumps and three plastic storage tanks.

The recirculation aspect of the equipment is very important to promote concepts such as water conservation and process flow to undergraduate students. Currently, there is no water circulation in the units, instead the water is sent to the sewer. Flow from the domestic water line is approximately 20 liters per minute. As a result, up to 33,000 liters per year of water is treated as waste from the current first year experiment.

Adding recirculation units to the orifice meters presents an opportunity to investigate different liquid conditions including type and temperature. The recirculation unit can be used in the existing experimental apparatus for the third year labs in addition to the current use in first year undergraduate labs. For the third year project labs a recirculation system will have students propose an experimental approach to study flow of different liquid types and conditions. The recirculation units will upgrade the equipment to adapt them for project based open-ended laboratories. Project laboratories promote skills in investigation, problem-solving, and self-directed learning which are indicative of real-world engineering projects for students.

Specifically, the proposed accessory will add:

1. Recirculation of liquid used in first year experiment. Less water waste.
2. Increased experimental options for first year laboratory by offering different fluid types.
3. Use of orifice flow meters for traditional third year laboratory experiments.
4. Experimental design options for students in third year project based laboratories.

Proposal Benefits

1. Use of the new equipment will increase laboratory efficiency and reliable data collection.

2. Less water waste compared to current equipment.

3. The operation capability of the proposed new equipment will offer potential for new and innovative laboratory experiments that will enhance student learning and comprehension.

Estimated Equipment Lifetime

The pumps and storage tanks 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 assembled and tested in one to two terms and will be ready for the laboratory courses in Spring 2021 or Winter 2022.

Additional Information

The department agrees to cover the cost of small accessories such as valves, fittings, and piping and provide any additional funding to fully upgrade the experimental setup. Equipment setup and testing will be done by the department.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Pump (each pump $686.11)	1372.22	686.11	0	0
Tank (each tank $524.32)	1048.64	524.32	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	2420.86	1210.43	0	0

Next Generation Lego Robot for Mechanical and Mechatronics Programming

Mechanical and Mechatronics Engineering
ME101, MTE121
Michael Cooper-Stachowsky
mstachow@uwaterloo.ca

Description of Proposal

Every semester mechanical or mechatronics engineering students take their first university programming course. A key component of these courses is the Lego robotics platforms, which teach the students how to integrate their programming knowledge into a device that affects the real world. Periodically, Lego updates the robots with exciting new features, and a new version has just been released. We'd like to purchase three kits for testing.

Proposal Benefits

Before we decide to purchase a large number of kits, we need to be able to test them to ensure that they meet our unique pedagogical goals. If successful, we will be decide to integrate the new kits into our curriculum, exposing our mechanical and mechatronics students to the next generation of robot, and challenging them further with our project.

Estimated Equipment Lifetime

Ten years, based on longevity of previous versions of the kit.

Implementation Schedule

Purchase upon receipt of funding. Testing and evaluation during W21, with decision on kit suitability by March 2021.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Lego Mindstorms Robot Inventor Kit (between 1 and 4 kits purchased and shipped)	550	1100	1650	2200
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	550	1100	1650	2200

Ideas Clinic - Electric Vehicles

Engineering Ideas Clinic
Chris Rennick, Engineering Educational Developer
crennick@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 an ideas clinic activity on electric vehicles. We are seeking $12,500 from WEEF for 2 Emrax electric motors. The Ideas Clinic is currently working with WatCar and a team of co-op students to develop the prototype version of this activity. This platform can then be used in technical electives across the Faculty of Engineering as well as future Design Days activities in 2nd and 3rd year. For this activity, we are seeking to build a benchtop motor/generator pair with the two Emrax motors to give students hands-on exposure to industry-grade motors, battery systems, and controllers.

Proposal Benefits

This unique equipment will allow the Engineering Ideas Clinic to hold high-impact Engineering Days events for students from across Engineering. In addition, this equipment can be used to directly support existing (and new) technical electives from across Engineering.

This platform, and the proposed activity using it, will allow students to experience the process of developing an EV drivetrain for an electric vehicle.

An estimated 500 students per year will directly benefit from the activities that this equipment will allow.

Estimated Equipment Lifetime

We expect a life of 10+ years from this equipment.

Implementation Schedule

The equipment will be purchased as soon as funding is granted. Development of other aspects of this activity are already underway.

Additional Information

The Engineering Ideas Clinic will match the contribution from WEEF dollar for dollar. These matching funds will be used to purchase the controller, power supply, and to construct the frame that will carry everything. The Ideas Clinic is also providing al

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Emrax E-motor ($6,250 each)	12500	6250	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	12500	6250	0	0

Rome Campus audio tour equipment

School of Architecture
ARCH-428-001, ARCH-446-001, ARCH-449-001, ARCH-492-001-19
Emily Stafford - Administrative Officer, Frauke Petretto Rome Prgram Manager
emily.stafford@uwaterloo.ca

Description of Proposal

Purchase of a wireless radio guide, integrated headset on a small radio that is worn directly on the ear. This system as well as having a frequency of free use all over the world, not needing the headset, will allow a significant saving in time and money. Warranty is for 24 Months.

Autonomy of 10 hours, excellent sound quality. After sales assistance in Rome.

Proposal Benefits

Every year 70+ Waterloo students come to Italy for a unique experience.

The program is organized in several field trips and walking tours in and around Rome and Italy. This experience with social distancing will no more be the same.

The audio guide would ensure the distancing and keep the learning experience! The system could be used in studio for lectures as well.

Estimated Equipment Lifetime

Warranty is for 24 Months

Estimated lifetime 5-7 years, batteries might use power earlier as very small

Implementation Schedule

To be purchased for Spring 2021 term for 4B Rome experience and will be used moving forward each year.

Additional Information

Option 1

80 MINI RECEIVER 2.4 Ghz Frequency 6,588.00 €

2 MINI RADIO TRANSMITTER 2.4 GHz frequency 207.40 €

2 Clip Microphone Light Plus 29.28 €

2 Microphone Neck Light 56.61 €

82 Lanyads for Mini with Whisper Logo 0.00 €

1 Charger Box 60

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Whisper model Mini, wireless radio guide including transmitters and receivers, rechargers, charger box, Travel kit and shipping.	13051	11729	10017	5736
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	13051	11729	10017	5736

Ultimaker 3D Printers for Nano undergrad labs

Nanotechnology Engineering
NE 100, NE 220L, NE 408, NE 409
Jenn Coggan NE Lab Manager, Teaching
jcoggan@uwaterloo.ca

Description of Proposal

This proposal is for funding to purchase a set of 3D printers for the Nanotechnology Engineering (NE) undergrad lab for student use across all levels of the degree program. We foresee high usage of these instruments from all nano students across all cohorts and have dedicated a new lab space for a set of six 3D printers from Ultimaker and the add-on Discov3ry Complete system. We are requesting WEEF funding for two Ultimaker3 printers and one Ultimaker 2+Discov3ry Complete systems to complement our current set of instruments.

Proposal Benefits

3D printers have become commonplace instruments for design, prototyping and experimental lab projects. The NE program currently does not have 3D printers available for students use and we want to change that by not only having them available but by bringing the learning into the curriculum. Due to the timing of when the Nano program budget was available 3 printers have already been purchased. We are asking for matching funds from WEEF to purchase the other 3 printers that are required for the program to run our NE 100 lab exercise. We also see the printers having high usage for the fourth year design projects and we hope to implement them for sample preparation for a second year materials characterization lab (NE 220L or NE 226L).

The ultimaker 3D printers were selected due to the fact they are open source, very well engineered and extremely reliable making them ideal for a teaching lab and student run hands-on projects. Adding on the Discov3ry Complete system allows a 3D printer to print not only plastics but also paste materials. Structur3D is an innovative young Kitchener based company founded by a University of Waterloo alumni from the Nanotechnology Engineering program, which can help serve as an inspiration and success story for students in the program. They will also be holding information sessions for the instructors and students on how to use and maintain the instruments which is an added bonus for all of us.

Estimated Equipment Lifetime

We hope to get ~10 years of lifetime from this equipment

Implementation Schedule

Immediate use and scheduled for NE 100 introduction Fall 2021

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
two Ultimaker3 printers and one Ultimaker 2+Discov3ry Complete systems	9655.38	3761.99	3085.80	0.00
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	9655.38	3761.99	3085.80	0

Book Binding and Portfolio Tools

School of Architecture (ARCH)
ARCH113, ARCH193, ARCH212, ARCH292, ARCH293, ARCH392, ARCH393, ARCH493, Portfolios
Senior WEEF Representative, School of Architecture (ARCH)
slhagan@uwaterloo.ca

Description of Proposal

At UWSA, documentation of student work is an essential part of the architectural design education. Throughout each study term, student-driven initiatives such as galt.publication and Design at Riverside compile student design projects in newsletters and magazines which must then be published and printed off-campus. Individual students are also expected to print collections of their works in a constantly evolving portfolio which they will then bring to co-op interviews. This is a proposal to bring creative/production autonomy back to the student body through the addition of a Pro-Bind 2000 Professional Thermal Binding Machine or a similar combination of book-binding tools.

Proposal Benefits

Each term, anywhere between 200 and 400 undergraduate students are expected to compile their design work in a portfolio which can cost around $50.00-$80.00 per student. These tools will allow students to print their work for a minimal, base material cost while removing the challenges associated with the 30-minute bus ride to Staples amidst studio deadlines and other co-op related stresses. The machine's ability to bind multiple booklets at once also provides flexibility for concentrated use during deadlines.

Providing access to student publications will also drastically reduce operating and printing costs, while potentially influencing the creation of a more diverse collection of publications and increasing print capacity.

Estimated Equipment Lifetime

5-10+ years

Implementation Schedule

Immediate upon return to in-person classes

Additional Information

The base proposal of the Pro-Bind 2000 provides the ability to thermally bind softcover books quickly and easily. The addition of the Hard Cover Book Crimper allows for the creation of hardcover books. The Electric Comb Binding Machine is a slightly less-

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Book Binding Machine	1054.00	1350.99	695.00	655.99
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	1054	1350.99	695	655.99

Design+Fabrication Lab Ceramic Printing Kiln

Architecture
arch684, arch570
Heinz Koller, Fabrication Lab Manager
hkoller@uwaterloo.ca

Description of Proposal

The School of Architecture continues to develop its stream of research focused on additive manufacturing and the 3D printing of components and structures of the built environment. As part of that investment, the Fabrication Labs would like to add a small bench top electric kiln to facilitate quick sample studies of ceramic printed components. The kiln will be used to

Explore and complete small scale experiments in many ceramic processes including:

- hardening
- drying
- annealing
- ceramic composition
- dehumidification
- glazing configurations
- and glazing configurations

Proposal Benefits

With the additive fabrication of ceramics, the processes mentioned above can be challenging because the amount of time and effort required to explore the effects of the materials and processes. The exploration process can be simplified and expedited significantly with smaller experiments carried out in a small kiln. Currently these exploratory studies are done in a very large kiln that must be loaded full and fired for longer periods of time. This results in wait periods that are far to long and impractical for effective developmental tests that are meant to be quick and fraught with failures. Cycle times for these tests can be greatly accelerated with individual and focused experiments using the small kiln. A conservative estimate suggests that the kiln could reduce cycle times by 70%. This will make a significant impact on development timelines and throughput.

Currently, this 3D ceramic printing technology is being used in both core classes and electives for both graduate and undergraduate students. These courses are expected to continue for the foreseeable future and this equipment will allow for a richer and more productive experience for those exploring 3D printing with ceramics.

Individual graduate students are also doing research in this field for their thesis work.

Estimated Equipment Lifetime

10 years

Implementation Schedule

The equipment would be purchased and installed directly upon funding.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
120Volt Bench Top Ceramic Kiln	2800.00	1900.00	1600.00	0.00
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	2800	1900	1600	0

CHE 180 Studio Equipment (IDEAS)

Chemical Engineering
CHE 180
Jason Grove, Lecturer
jagrove@uwaterloo.ca

Description of Proposal

Purchase stirring hotplates to facilitate IDEAS activities

Proposal Benefits

CHE180 is a new course that has been very well received by the initial cohorts of students. We are currently borrowing "spare" stirplates from the undergrad labs, which are at the end of their useful life. These require replacement with more modern, reliable units.

Estimated Equipment Lifetime

These last a long time 10+ years (the ones we are currently look decades old)

Implementation Schedule

Fall 2021

Additional Information

Plates would be available for capstone project use at other times

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Stirring hotplates at $500 ea. (options are simply different numbers)	3000	2000	1000	500
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	3000	2000	1000	500

Conductivity probes for counter-current washing cascade activity

Chemical Engineering
CHE200
Jeff Gostick, Associate Professor
jgostick@uwaterloo.ca

Description of Proposal

Counter-current cascades are a foundational principle in chemical engineering, and are the basis for separating chemicals from mixtures. The Chemical Engineering Department has several sophisticated laboratory installations that demonstrate this principle, including distillation, gas absorption, and liquid extraction, but these are large and automated devices, so students are somewhat insulated from the actual process. It is possible, however, to conduct 'washing' as a counter-current cascade by hand and at home, in a completely safe way (using only tap water and table salt). This proposal requests 50 hand-held ionic conductivity probes, which can be used to measure concentration of saltwater solutions. The goal of the lab will be to 'wash' sand that is mixed with salt using a counter-current cascade (in the form of mixing cups), and to measure the concentration of the washed sand at various points. These measurements can be compared to component and overall mass balances to validate the theoretical analysis developed in class. Students will still get to experience the fully featured labs mentioned above during their unit operations lab, but these probes will enable a 'take-home' activity that can be conducted at outset of the CHE200 lectures.

Proposal Benefits

Conducting a hand-based washing cascade to remove salt from sand will provide the students with an intimate familiarity and understanding of one the core principles in chemical engineering. Performing this experiment 'at home' will allow the students to make mistakes in a comfortable environment, experiment without judgement, and explore the process without time limits. Given the importance of counter-current cascades to chemical engineering, this simple experience will strengthen the student foundational knowledge, and provide a fun and novel activity as well.

Estimated Equipment Lifetime

The requested probes are designed for 'field use', so are particularly durable. They are in the form of a pen with a digital read-out built in, they are waterproof and drop-proof. The can also be re-calibrated using a 2-point calibration, so can be main

Implementation Schedule

The students taking CHE200 will be introduced to 'washing' and 'counter-current cascades' in the first lecture of the course. They will then be tasked with conducting a washing cascade as a 'take-home' lab activity, requiring them to 'sign-out' a probe f

Additional Information

Each student will conduct this experiment on their own, and requires about 1 week to do so. If we allow 2 weeks at the beginning of the term, and assume 100 students, approx 50 probes will be required. At a cost of approx $100 each, this proposal reques

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Hand-held ionic conductivity probes. Prices listed for 100 units.	9135	20458	27300	11899
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	9135	20458	27300	11899

Ideas Clinic - High speed camera

Engineering Ideas Clinic
SYDE 285 for pilot offering; more to follow.
Chris Rennick, Engineering Educational Developer
crennick@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 high-speed cameras. We are seeking $5,500 from WEEF for a Chronos 1.4 high speed camera with lens. This camera will enable the Ideas Clinic to make activities with new capabilities for students. Presently, the Ideas Clinic is pursuing a number of activities relating to materials, fatigue, and life cycle testing; as well as activities relating to sports technology. Both of these domains would benefit greatly from the addition of high speed footage to the experiment.

The initial launch of the materials activity will be in the winter 2021 term with SYDE, with more implementations under discussion. This camera would also be made available for use in technical electives across the Faculty of Engineering as well as future Design Days activities in 2nd and 3rd year.

To ensure the success of this project, and to make it as real as possible, the Ideas Clinic has partnered with Microsoft and ANSYS (two existing Ideas Clinic partners) on these activities.

Proposal Benefits

This unique equipment will allow the Engineering Ideas Clinic to hold high-impact Engineering Days events for students from across Engineering. In addition, this equipment can be used to directly support existing (and new) technical electives from across Engineering.

This platform, and the proposed activity using it, will allow students to experience destructive materials testing in new ways, while giving us more accurate footage to validate computational models that students build in activities.

An estimated 500 students per year will directly benefit from the activities that this equipment will allow, with many opportunities to expand the use of the camera to new domains.

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. Development began in January 2020. A pilot of this activity in SYDE 285 in winter 2021 is currently planned.

Additional Information

The Engineering Ideas Clinic will match the contribution from WEEF dollar for dollar. For this proposal, the Ideas Clinic will use these matching funds to purchase two additional high-speed cameras (of lower cost) so multiple angles of recording are poss

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
16GB Chronos 1.4 high speed camera and lens	5500	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	5500	0	0	0

Portable CNC Router

Engineering student Shops
0
Graeme Adair, Manager, SDC
graeme.adair@uwaterloo.ca

Description of Proposal

The Engineering Student Shops would like to add to it's expanding collection of non-metallic cutting equipment. We are seeking funding to purchase a Shaper, handheld CNC router and workstation.

Proposal Benefits

The Shaper handheld CNC router will enable students to accurately machine simple and complex geometries in wood and plastics, with very little machining and CNC experience. Its ergonomic two hand control and integrated dust management system make this tool extremely safe, as well as easy to use.

Estimated Equipment Lifetime

This piece of equipment is of professional quality and is expected to last for 20 plus years.

Implementation Schedule

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

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Shaper, Origin handheld CNC router and workstation	4746	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	4746	0	0	0

Aerial Drone

Civil and Environmental Engineering
See PDF Attachement
Mark Hummel - Field Survey and Water Resources Technologist
mark.hummel@uwaterloo.ca

Description of Proposal

Purchase an Aerial Drone with the capability to be upgraded in the future with cameras, sensors and survey grade GPS units.

Proposal Benefits

This equipment would push the boundaries of what the students would consider when it comes to surveying and modeling, showing them the capability of such a tool might spark some very exciting projects. I think it will also allow professors to use specific locations around the University and Southern Ontario to detail in their lectures and labs. Getting a 3D model of a local bridge and being able to reference it directly in a lecture from every angle. Or taking a survey of a section of UW campus and explaining the drainage patterns so students can relate the data directly to the things they see day to day.

Estimated Equipment Lifetime

Drone - 10-15 years

Battery - 4-5 years

Yearly maintenance

Implementation Schedule

While courses are being tunned for distance learning, this could be a perfect time to implement aerial photos and scans into lectures. Implementation would be ASAP.

Additional Information

L1 LiDAR option would prodive centimeter resolution topographic across a several kilometer range and give exact 3D replications of buildings and structures in software

Z5S option provides basic photogrammetry and aerial photography options

RTK GPS stati

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
DJI Matrice 300 RTK $15,073.07 - %50 cost covered by CEE	7536.54	0	0	0
Matrice 300 Attachment - Z5S Camera Payload 100% WEEF	5422.87	0	0	0
Matrice 300 Attachment - D-RTK GNSS Mobile Station 100% WEEF	5034.15	0	0	0
Matrice 300 Attachment - Zenmuse L1 LiDAR + RGB Payload - 100% WEEF	29493.00	0	0	0
DJI Phantom 4 RTK Mobile Station Combo ($13,106.87) - 50% covered by CEE	6553.44	0	0	0
Total	54040	0	0	0

3D Printer and Manual Clay Tools

School of Architecture: FabLab
ARCH 212, ARCH 193/292/293/393/493
Rebecca Zarins (On behalf of Heinz Koller)
razarins@uwaterloo.ca

Description of Proposal

Equipment for Architecture Digital Fabrication Lab and Workshop. The requested 3D printer will be used for student models in design and digital fabrication courses. Over the past few years, the school has been expanding its capacities in clay fabrication, with a new clay 3D printing set-up. This innovative set-up has resulted in an increasing interest in working with a variety of methods of clay production within the school. The pottery wheel and clay slab roller will expand Architecture's capabilities in this evolving production stream.

Proposal Benefits

3D printers have prototyping and model-making uses throughout the undergraduate program. The purchase of the proposed printers will increase the number of prints that students can produce at once. Currently, we only have one printer so it is not feasible to ask any given class to 3D print components. Both the 3D printer and clay equipment (pottery wheel and clay slab roller) will give students a more diverse and comprehensive set of tools for making models in design courses, which are a significant component of the undergraduate curriculum.

Estimated Equipment Lifetime

3D Printer: 5-10 years

Pottery Wheel: 10+ years

Clay Roller: 15+ years

Implementation Schedule

immediate

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
3D Printer	8955	5763	11526	0
Pottery Wheel	2333	1237	0	1237
Clay Slab Roller	785	785	0	785
0	0	0	0	0
0	0	0	0	0
Total	12073	7785	11526	2022

Database Server Machines

Paul Ward, Electrical and Computer Engineering
ECE 356
Database Systems
pasward@uwaterloo.ca

Description of Proposal

Modern database servers run on clusters of machines, each with one or more Xeon multi-core processors, tens-to-hundreds of gigabytes of memory, and tens-to-thousands of terabytes of disk storage, with several terabytes of that being SDD for performance reasons, but the majority HDD to provide the storage-capacity needed. These servers run appropriate database software (Oracle, DB2, etc.) to provide access to databases with sizes ranging from gigabytes to hundreds of terabytes. There are many problems that need to be addressed when dealing with databases on such a scale, broadly categorized into performance and correctness concerns. Our graduates need to be able to understand how to tackle these problems.

Current equipment for ECE356 course are inadequate. The department has no dedicated hardware for this course, providing access to shared general-purpose machines. The machines have insufficient processors and storage, with students limited to a gigabyte. Database servers need to be dedicated just for that task, without which performance labs are a meaningless exercise.

We are limited to toy problems in the database course, or using our own research equipment, which is technically a violation of the research grants under which such equipment was purchased. There are three alternatives available to us:

(1) Continue with the current, inadequate setup, which is serving our students poorly

(2) Use one of the cloud database systems (e.g., Amazon S3, etc.)

(3) Purchase equipment to be dedicated solely to the task of running as database servers

We are trying to avoid option 1.

Option 2 suffers from at least two defects: there is no funding available for cloud-based database servers. Worse, they would not work because they lack the necessary equipment control. Specifically, we must specify where tablespaces are stored, what the specific storage devices they are on, etc. While there are some scenarios where cloud systems enable this, the cost is higher than purchasing our own equipment. Further, cloud access is poor compared with on-campus machines with 10 Gbps networking.

Option (3) is the ideal, but requires funding. In particular, two things are required: (1) machines and (2) the setup of databases, associated labs, assignments, etc. The expected costs of these two are approximately equal, since the development of the databases will require on-the-order of $20,000 of developer time, and an appropriate set of machines would be about the same cost. It is our understanding that WEEF does not fund the development of software, etc. but will fund the cost of specific equipment, and it is the funding for purchasing these machines that we are making this request.

The broad specifications of the machines we are seeking to purchase is provided in the "additional information" section, in four configurations of costs ranging from $5k to $20k

Proposal Benefits

Students in the ECE 356 course would be able to do assignments, labs, and projects with a mix of databases ranging in size from several tens of gigabytes to several terabytes, including performance studies, data mining, etc. Performance analysis of different options of data-placement, clustering, index requirements and placements, the effects of different database server systems (e.g., PostgreSQL vs. MariaDB vs. MySQL, and likely also the commercial databases) would be possible.

Students would also be able to create their own databases that were in the tens of gigabytes in size, and possibly hundred of gigabytes. Currently they are constrained to tiny problem spaces that are not reflective of the industry that they are entering. Our graduates head to top-tier companies (FAANG, Microsoft, IBM, ...). They will be working with equipment at this level and beyond, with extremely large databases. Working on toy problems limits their abilities and understanding of what they will be facing, putting them at a competitive disadvantage relative to their peers from other global top-25 universities. Funding this equipment will remedy that deficiency.

Estimated Equipment Lifetime

5 years, likely more, but reliably 5 years

Implementation Schedule

Once funding is approved, the specific equipment can be identified, purchased, and installed within approximately two weeks.

The implementation of the specific databases and creation of the assignments is not part of this proposal, but will be started im

Additional Information

The specific equipment we want is a rack-mount server with at least eight 3.5" disk-bays. In addition to the case, power supply, etc., the server should be specified approximately as follows:

Processor: Xeon 1290P with 10 cores, capable of running 20 thr

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Two rack-mount high-performance servers, per the proposal description above. Cost not to exceed $10,000 per machine.	20000	15000	10000	5000
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	20000	15000	10000	5000

Furniture for CPH nook

First Year / Engineering Undergrad Office
Mary Robinson - Assoc Dir First Year Eng
mary.robinson@uwaterloo.ca

Description of Proposal

The nook outside of CPH-1325 was regularly used by students to relax, chat, charge phones and study. The

furniture that was there is old, dirty, and not well-suited for this use. In partnership with the Dean's Office and Plant Ops, we are looking to update the furniture to make it more inviting for students.

Proposal Benefits

Upgraded study and relaxing space for all Engineering students to use at any time of day. Reconfigurable furniture means that it can be adapted to the needs at that time. Additional power plugs to charge your phone or laptop in a convenient, safe location.

Estimated Equipment Lifetime

20 years+

Implementation Schedule

I'm working with Plant Ops and the Dean's Office to get the floor plan finalized and purchase orders issued for the furniture, once we have sufficient funding. Based on the E2 foyer project, total process can be < 6 months.

Additional Information

With input from WEEF and EngSoc, the furniture will be the favourites from E5/6/7 as identified by students. Exact cost is dependent on fabric and furniture style.

$1500(ish) = arm chair

$500(ish) = side table

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Chairs (up to 4 at $1500 each)	6000	4500	3000	1500
Tables (up to 3 at $500 each)	1500	1000	500	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	7500	5500	3500	1500

Video Switcher Streamer

Architecture Computing & Media
Fred Hunsberger, Multi Media Specialist
fhunsber@uwaterloo.ca

Description of Proposal

Proposal to purchase 4 port HDMI switcher / Streamer

This equipment would allow users to switch sources easily & stream content to the internet from any device that outputs HDMI.

Proposal Benefits

A video switcher / streaming device would allow a more seamless integration of sources, live and or prerecorded and does not require changes to be made to computer system preferences, the pro version allows a user to stream through the device software which is multifaceted with an excellent GUI.

Estimated Equipment Lifetime

5 Year

Implementation Schedule

January 2021, All School Meeting, various symposium and public lectures and the Spring Open House

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Video Switcher Streamer	875	435	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	875	435	0	0

UWAFT Vehicle Scales & Floor Jack

UWAFT EcoCAR Team
Timothy Er, Propulsion Systems Integration Manager
timothy.er@uwaterloo.ca

Description of Proposal

As part of UWAFT's competition requirements, the weight distribution between all 4 tires of the vehicle must be measured and recorded. As UWAFT does not have the equipment necessary to record this, the team is proposing for WEEF to support the team with obtaining this equipment. Included in this proposal is a request for a floor jack, which is also required for the corner weighing process, as well as for general work on the vehicle.

Lastly, the team would like to re-allocate the $1000 awarded in winter 2020 from computer accessories, towards a laptop. With the shift from desktops to laptops due to extensive remote work and in-vehicle testing, a laptop would serve the multi-purpose role that would cater towards our needs in the near future.

Proposal Benefits

The corner weighing scales not only permit the team to weigh the vehicle, which is a competition requirement, but it also allows further suspension development which is something that UWAFT aims to do in the future. Obtaining this critical equipment would benefit students in many ways, as UWAFT not only offers students the chance to gain experience through joining the team, but also for 4th year students to take a project on the team, as part of the unique-to-UWAFT ME599 course.

The laptop would benefit the team, as it can be brought to workshops and competitions to be used for remote work, and be used during in-vehicle testing which will be a focus for this year, since the vehicle is in a basic running state.

Estimated Equipment Lifetime

The scales and jack are expected to last 10+ years, or even more - from research online, a set of scales can last at least 10 years after seeing frequent use at the track. As UWAFT won't be using the scales quite as intensely, it should last that amount o

Implementation Schedule

UWAFT would be looking to purchase these scales almost immediately, at at latest before competition in May 2021. The team needs to conduct studies on vehicle mass in a variety of loading scenarios, and needs to verify that the vehicle meets competition re

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Intercomp Racing Scales	2400	2100	1800	1800
Floor Jack	400	300	300	0
Laptop (using re-allocated funds)	1000	1000	1000	0
0	0	0	0	0
0	0	0	0	0
Total	3800	3400	3100	1800

University of Waterloo Nanorobotics Group Proposal

University of Waterloo Nanorobotics Group
Victoria Li, Business and Marketing Director
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Description of Proposal

The University of Waterloo Nanorobotics Group (UWNRG) is an undergraduate robotics and research group devoted to the design and construction of next-generation technology that manipulates materials on a micro-scale.

The robots constructed by UWNRG have been successful in competing at the International Conference on Robotics and Automation (ICRA). This conference, hosted annually by the IEEE, provides a platform where we display our original robot designs. In our past competitive years, we have participated in the Mobile Micro-Robotics Competition as well as the Micro-Assembly Challenge. Despite facing tough competition from Ph.D. and Doctoral teams from world-class institutions such as ETH Zurich and the University of Texas at Arlington, our team has placed highly at these competitions. Just 3 years ago, at ICRA 2016 in Stockholm, Sweden, our team finished 2nd for mobility and 1st for micro-assembly. In 2018, we placed 2nd for the micro-assembly challenge and 3rd for the mobility challenge at ICRA in Australia with our Solenoid Actuated Microrobot (S.A.M.). S.A.M. uses solenoids and magnetic actuation to guide a small neodymium robot that will be able to accomplish various tasks and challenges put out by the organizers of ICRA.

Our robotics subteam is currently developing MAYA, a Microscopic Airborne YBCO Assembler. MAYA's completion will open up the possibilities for performing complex operations at a micro-scale. This has many potential applications such as automated surgeries, industrial micro-assembly, and targeted drug delivery. Our research subteam, Vision, has developed a system that reduces ethylene levels in hydroponic nutrient solutions. In this system, the plant experiences less stress which thereby promotes growth. All that is needed now is to implement this system. Currently, Vision is creating biosensors that will produce live feedback of the bacteria and nutrients present in our hydroponic system. Vision's research has much to offer to the agriculture industry and we have already received offers of partnership from professors who want to take our project to the next level.

Proposal Benefits

UWNRG is an exclusively undergraduate student group, providing students with an opportunity to get hands-on experience during their study terms. UWNRG also offers a unique co-op opportunity every year to 3-4 members, who are sent to the National Institute of Materials Science (NIMS) in Japan. They work under Dr. Genki Yoshikawa to research technology with a focus on nanorobotics, specifically MEMS devices and sensors. This co-op is not happening this winter due to the pandemic, but will resume afterwards. Members are taught to be innovative in their engineering design which has led our team to great success in the past. The access to high-quality labs on campus provides a unique opportunity to apply the nanofabrication techniques discussed in lectures. The technical teams challenge their members to innovate, testing and developing members' design philosophy. The business

and marketing teams allow students to develop skills beyond a technical skill set, such as communication and technical writing. Experience gained with UWNRG is quite broad and flexible, allowing our members to explore concepts and designs they are interested in. UWNRG teach our members the value of communication, collaboration, creativity, and innovation, setting our members up for a successful post-undergraduate career. These opportunities greatly benefit all the engineering students involved in UWNRG.

Estimated Equipment Lifetime

The COMSOL license will last permanently and perpetually since it is a software product. The potentiometer will last perpetually and until broken because it is a hardware equipment that is used in conjunction to measure voltage via angle changes so it wil

Implementation Schedule

We will use all of our materials for both subteams once we have funding for it since they are essential components to conduct our experiments.

Additional Information

COMSOL is requested because it allows for more smooth simulation as the remote desktop has speed drawbacks. The local installation allows for offline uses and since the license type can allow for 2 simultaneous users, and 4 installed machines, team member

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
COMSOL - This is requested because it allows for more smooth simulation as the remote desktop has speed drawbacks. The local in	2500.00	2225.00	2000.00	1775.00
Potentiometer - The potentiometer is used as part of the torsion balance to measure the angle changes for voltage calculation	230.00	172.50	115.00	57.50
Torsion Balance Fibers - The torsion balance fibers are responsible for translating the movement in the paddles to the potentiom	234.00	175.50	117.00	58.50
Raspberry Pi 32GB SD Card (w/ preloaded software) - The SD card acts as the hard drive for the Raspberry Pi and comes preloaded	33.00	24.75	16.50	8.25
Raspberry Pi 4 Model - The Raspberry Pi hardware acts as the processing computer for the IoT network sensor.	112.82	84.62	63.46	47.60
Total	3109.82	2682.37	2311.96	1946.85

Industry 4.0 WEEF Proposal

Industry 4.0
Allison Tao, Public Relations Lead
a4tao@uwaterloo.ca

Description of Proposal

We would like to receive funding for the Industry 4.0 competition to award the winners with a cash prize. The prize money would be able to attract attention from high school students and learn more about Management Engineering.

Proposal Benefits

The prize money will bring attention to the competition and provide a greater incentive for high school students to join. This will in turn bring attention to Management Engineering, which is a growing but little-known part of the engineering faculty. The competition allows high school students to be exposed to Management Engineering directly, as they may not be aware of it since it is not a well-known engineering program at Waterloo. Through the competition, the participants get the opportunity to experience and see what Management Engineering is all about.

Estimated Equipment Lifetime

It would be a one time usage as the prize for the top 3 winners.

Implementation Schedule

We would award the winners with the prize money on the day of the competition.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Prize money for the top 3 winners	3000	2500	1250	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	3000	2500	1250	0

F20 WAtonomous WEEF Proposal

WATonomous
Irfan Khan - Business member at WATonomous
inkhan@watonomous.ca

Description of Proposal

This year, the team is planning to build a full series of fully autonomous robo-taxi pickups and drop-offs at specified locations in the competition. In order to achieve this, the team will require a Carla Simulation Server, perception data annotations, rugged coolants, replacement RAM for the rugged, a radar PCB + components, a traffic light microcontroller and lastly, COVID safety equipment.

Proposal Benefits

All of the items mentioned in the proposal will help the team complete the objective of autonomous robo-taxi pickups with the car. The Carla Simulation Server will enable more than 10 developers to run Unreal Engine Carla instances. The perception data annotations will provide a more reliable traffic sign and traffic light detections and allow us to create our own unique datasets. The rugged coolant is required as our supply is running out and coolant is a crucial item for operating the vehicle safely. The server controlling our autonomous vehicle has corrupted ram sticks, so we need replacement RAM to safely operate the vehicle. The PCB + components are essential for regulating voltage to the RADAR sensors, allowing us to leverage RADARs for safer driving. A traffic light controller is required to coordinate multiple traffic lights in tandem. This allows us to test real-world intersection scenarios. Lastly, we require safety supplies such as masks and dividers to make sure precautionary measures are taken during the pandemic. A major safety item is a transparent divider between the driver and passengers in the autonomous vehicle. During autonomous operations, we need a minimum of two students in the vehicle - one driver, and one operator.

Estimated Equipment Lifetime

1. Carla Simulation Server - 10-15 years until the hardware becomes outdated.

2. Perception data annotations - Infinite until competition objectives related to perception change drastically

3. Rugged Coolant - 3 Years of replacement coolant

4. Replacement

Implementation Schedule

1. Carla Simulation Server - Will be purchased, assembled, and added to the university network ASAP after receiving funding. Hopefully will be being used by the team no more than 30 days after receiving funding.

2. Perception data annotations - Latest nex

Additional Information

The proposal submission wasn't being accepted as it mentioned that the numeric values for Item#1 Option#1, Item#5 Option#1, and Item#5 Option#2 weren't numeric. So we have mentioned the numeric values here and left these blanks empty.

Item#1 Option #1

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Carla Simulation Server	7517	6395	5344	3417
Perception data annotations	2000	1500	1000	0
Rugged Coolant	119.99	0	0	0
Replacement RAM for Rugged	100	0	0	0
COVID Safety Equipment	0	0	0	0
Total	9736.99	7895	6344	3417

Midnight Sun Hardware Funding

Midnight Sun Solar Car Team
Dhruv Hari - Sponsorship Lead
d2hari@uwaterloo.ca

Description of Proposal

Midnight Sun has been representing the University of Waterloo at international solar car competitions for over 30 years.

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 XIV will boast double the carrying capacity from our previous vehicle, improved efficiency, and a re-imagined user experience. With this project, we are striving to bridge the gap between solar cars and consumer-grade vehicles to demonstrate the potential of sustainable transportation.

We would like to request funding from WEEF to help in the acquirement of hardware parts as we move forward with manufacturing during COVID-19.

Proposal Benefits

These parts will be critical for the hardware team, which will be a major determinant in the success of our next vehicle. Thus by supporting the acquirement of these parts, WEEF is supporting our entire team.

Midnight Sun is one of the largest student design teams at the University of Waterloo, boasting more than 93 active members this term. Our members come from a wide range of departments including Electrical, Computer, Management, Software, Mechanical, Mechatronics and Systems Design Engineering.

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 team (in either the firmware, hardware, mechanical, strategy or business subteams), students from the Engineering faculty are able to learn and apply a variety of skills in real world situations. These include technical skills such as: Mechanical Design & Manufacturing, Embedded Programming, PCB & Electrical System Design, Financial Management and more. There are also many soft skills that can be learned on our team including problem solving, teamwork and communication.

Furthermore, after becoming the first Canadian team to finish the American Solar Challenge in the Multi-Occupant Vehicle Class, Midnight Sun has successfully promoted Waterloo engineering in international markets. With the development of our next vehicle, we plan to continue this promotion of both Waterloo and WEEF at the American Solar Challenge 2021.

Lastly, by supporting our team again, WEEF will qualify as a Diamond Tier sponsor which includes a logo on our vehicle, team jerseys and promotion at events.

Estimated Equipment Lifetime

The parts themselves will be useful to the success of our team for the entire lifetime of our new vehicle, MS XIV, which can stretch from anywhere from 3-5 years. Since this is a new process for our team, the knowledge gained by learning from industry pro

Implementation Schedule

September 2020 - November 2020 = Assembly of AFEs, Battery Connector Modules, and Controller Board

November 2020 - December 2020 = Powertrain (Driver controls, power selection, DCDC, Power Distribution, MCI) Integration Testing

January 2020 = Battery Bo

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
PCBs and PCB Components	3250	3200	3150	3100
Cables (HV Cables) + Misc. Cables (RCA Connectors) + Charger Adapter	650	0	0	0
Fans (Noctua)	500	0	0	0
Fuses	400	0	0	0
Telemetry - Pi Zeros	200	0	0	0
Total	5000	3200	3150	3100

Waterloo Formula Electric Funds Proposal

Waterloo Formula Electric
Anh Nguyen
ba2nguye@uwaterloo.ca

Description of Proposal

Waterloo Formula Electric is requesting funding to purchase supplies to construct our high voltage battery insulation, electrical control units, and vehicle frame materials.

Proposal Benefits

Waterloo Formula Electric greatly appreciates the funding that WEEF helps the team with, as demonstrated by the WEEF logo proudly displayed on the race car, the website, and on team wear. Based on the value of this sponsorship, the team will continue to display the WEEF logo in these places, as well as on team merchandise, our banner, and our social media pages.

Estimated Equipment Lifetime

Based on the Formula Hybrid competition schedule, we expect to use the battery built with these materials for the next two competition seasons (2021/2022 and 2022/2023).

The electrical control unit components will be used on our vehicle during the 2021 /

Implementation Schedule

After receiving funding confirmation, WFE will purchase the items and put them into service by February 2021.

We already have completed designs for the requested items, so they will be implemented as soon as possible.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
High Voltage Battery Supplies - GPO-2 Plastic Insulation	1000	800	600	500
ECU PCB Components	2000	1000	1000	500
Frame Tubing from VR3 Engineering	3500	2700	1750	1000
Nickel Sheet for Battery Bus Bars	150	150	100	100
0	0	0	0	0
Total	6650	4650	3450	2100

Waterloop F20 WEEF Proposal

Waterloop
YuAn Chen, Business member
sponsorship@waterloop.ca

Description of Proposal

Hyperloop is the transportation of the future, and it is being designed right here on the University of Waterloo's campus! Waterloop's mission is to design and build a working, full-sized, scalable Hyperloop pod by 2025. A Hyperloop is a levitating pod that carries passengers through an airtight tube at near-vacuum pressure, removing friction and air resistance; this allows the pod to travel at over 1,300 km/h. With Hyperloop technology, passengers will be able to travel from Toronto to Montreal in 30 minutes! After four years of hard work, Waterloop has completed four iterations of our pod design and is now on our fifth—Goose V.

With our Goose V model almost complete, we need a means to physically test our design. Currently there are no Hyperloop test tracks in Canada. Without a test track, Waterloop will not be able to validate our designs, fix any errors, and continue to innovate in a timely manner. As a result, the Hyperloop Test Track project was created.

During the Spring 2020 term, a group of our members came together and began to prepare a business case. This document outlined our building procedures for a Hyperloop test track, a timeline, a budget, and how a test track would benefit the University of Waterloo and surrounding KW region. This business case was completed in early September, and was submitted to the University of Waterloo for approval. We are hoping to begin building this track in April 2021 at a site about 15 minutes away from the University.

Proposal Benefits

The benefits of the Hyperloop test track are the most impactful. We will be creating the first Hyperloop competitive event outside of SpaceX, and the University of Waterloo will be home to one of only a handful of Hyperloop test tracks worldwide. To make good use of this track, we've founded the Canadian Hyperloop Consortium along with six other university teams; you can read our founding document at wloop.ca/chc. We intend to host competitive events, test and validate our own pod designs, collaborate with innovators and teams from other universities, and promote professional and government research interest in the concept, all gathering support toward a full-scale Hyperloop demonstration in 2025.

We plan to begin hosting events in mid-2021, inviting teams from around Canada and eventually from around the world to showcase their technology and race their pods, and continuously iterate on the design of the track to land on the most cost-efficient configuration for full-scale construction.

Besides our longer term mission, we have had, and continue to have, an impact across the University of Waterloo, with members from all faculties, but especially in Engineering where a majority of our

members are from. Whether it's laying out a test board design to evaluate a high power electrical component for our custom motor controller, simulating the magnetic effects of a change in linear induction motor geometry, writing a reliable embedded communication driver, or creating media and content to advance adoption of the Hyperloop concept, we're united in the pursuit of building teamwork and technical skills and learning amazing things together. Waterloop's team culture puts a heavy emphasis on nurturing the talent of younger members, and our team leads work hard to provide a strong mentorship experience.

Additionally, for all of our sponsors, Waterloop will provide our full sponsorship benefits to WEEF. The funding requested would qualify WEEF for the Transonic Tier, in which the agreed terms would include:

- Exclusive tickets to our pod unveil event (to be held in W21, depending on COVID-19 restrictions)
- 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

Estimated Equipment Lifetime

Linear induction motors are known to have an enduring life span, since they suffer no wear and tear from friction. In principle, there is no maximal lifespan of a linear induction motor; it can be used as long as desired. Each motor that the team builds w

Implementation Schedule

Sep 2020 - Proposal submission; Recruitment

Oct 2020 - Begin developing a network of potential sponsors

Nov 2020 - Continued growth of potential sponsorships; securing funding for the first phase of the test track project

Dec 2020 - Securing funding for t

Additional Information

Team Waterloop is grateful for the support that WEEF has shown over the years. The team will be happy to accept any partial funding. More information about our team, along with past and future initiatives, can be found on our website: https://teamwaterloo

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Test Track	4000	2500	1000	500
LIM (Linear Induction Motor)	2000	1000	700	300
General mechanical/electrical parts	1000	500	300	200
0	0	0	0	0
0	0	0	0	0
Total	7000	4000	2000	1000

Waterloo Rocketry F20 WEEF Proposal

Waterloo Rocketry
Delaney Dyment, Finance Lead
dldyment@uwaterloo.ca

Description of Proposal

Waterloo Rocketry is a student team specializing in the development of hybrid rockets. We compete annually at the Spaceport America Cup with more than 100 teams from across the globe. Our work comprises the design, manufacture, and testing of our rocket and all ground systems necessary to attain launch.

In 2019, we flew our new rocket Shark of the Sky (SotS) at our annual competition and finished second in our category 30K SRAD, the most challenging of the 6 categories. We attained an altitude of over 15,000 ft, which is the highest altitude the team has ever reached. Building on this success, our team is targeting a 30,000 ft apogee and successful recovery. Development this year includes a new liquid engine and accompanying systems, as well as upgrades to electrical systems and a new scientific payload.

We are requesting funding in the following categories:

1. Propulsion Development

Our student-developed engine is a fundamental system of our launch vehicle. In order to remain competitive at competition, as well as provide new opportunities to our members, we will be continuing improvement of our hybrid system as well as developing a more complex liquid engine.

2. Electrical System Upgrades

Our electrical systems are critical to the safe operation and success of our rocket. They allow us to control and monitor our recovery, propulsion, and payload systems. Our focus this year continues to be upgrading existing systems, as well as adding more enhanced capabilities in terms of tracking and data logging.

3. Ground Systems and Equipment (GSE)

In order to accommodate the new liquid engine, as well as increase the safety of our current procedures, we are looking to upgrade our current testing infrastructure. Intended upgrades this year include a new heating system for testing and upgrades to the shipping container we recently purchased for our new test site.

4. Payload Development

The 2021 rocket will contain a payload intended to monitor radiation in the upper atmosphere and test the radiation shielding capabilities of different materials. Funding for this category would be used to purchase sensors required to monitor the radiation, as well as equipment required to fabricate the shielding material.

Proposal Benefits

1. Propulsion Development

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.

2. Electrical System Upgrades

Robust and reliable electrical systems are critical to ensuring that our rocket is able to achieve the baseline objectives of launch and recovery. More sophisticated systems are necessary for control of advanced propulsion systems and flight data acquisition, essential for optimizing our vehicle and remaining competitive, as well as ensuring our operations run as safely and smoothly as possible.

3. Ground Systems and Equipment

GSE development makes up a significant portion of the team's activity and requires multiple dedicated members with diverse skill sets. We consistently update our GSE and testing equipment to ensure that we are performing tests in the safest way possible, and collecting accurate data.

4. Payload Development

The payload provides a unique and interesting challenge for team members, with a heavy focus in novel research and design. This experiment requires an interdisciplinary combination of mechanical, electrical, and software development in order to be successful.

Estimated Equipment Lifetime

1. Propulsion Development, 2. Electrical System Upgrades, 3. Ground Systems and Equipment (GSE)

Many components will either contribute to long term development, or be capable of being used in multiple vehicles. Their lifetime would last the span of multip

Implementation Schedule

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

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Propulsion Development	6000	5000	4000	3000
Electrical System Upgrades	500	400	300	200
Ground Systems and Equipment	1000	800	600	400
Payload Development	500	400	300	200
0	0	0	0	0
Total	8000	6600	5200	3800

UWFM Fall 2020 for 2021 Season

University of Waterloo Formula Motorsports
Sam Swift, Project Manager
uwfsae@gmail.com

Description of Proposal

The University of Waterloo Formula Motorsports Team designs, builds, and competes with a small open-wheel formula style race car in the Formula Society of Automotive Engineers design series. This proposal is intended to secure funding in order to better perform in all of our future seasons and secure more points at competition.

Proposal Benefits

The first item in our proposal is a request for E3 machine shop funding. We get a significant amount of our welding, machining, and grinding done in the E3 machine shop. Especiallly this year, when many of our machining sponsors may be having difficulties due to COVID, it is extremely important that we fully utilize our on campus resources. Additionally, we purchase many of the raw materials for the car from the E3 machine shop.

The next item in our proposal is a request for funding for our Aircraft Spruce order. We order a wide variety of components from Aircraft including AN fasteners, AN fittings, as well as steel and aluminum tubing. We use items from Aircraft Spruce on all the systems.

The next item in our proposal is a request for funding for our Summit Racing order. We typically place one order per year with Summit Racing with most of the parts focused on the powertrain and suspension subsystems. Some of these items include fuel pump, coolant pump, intake tubing, intercooler fan, and brake fittings as well as fuel lines and fittings.

We are requesting funding for a 3D printer. We would like to use this printer for rapid prototyping to make jigs and manufacture some final components for the car such as our steering wheel and all electronics housings.

We are requesting funding for half shafts for the 2021 car. These are crucial driveline components that connect our wheels to the differential. These components allow team members to gain a better understanding of mechanical design while working on our custom driveline.

We are requesting funding for 5.8oz 2x2 twill carbon fibre. This carbon fibre is used to manufacture our aero package. Working on the aero package, students to gain an understanding of both mechanical design and aerodynamics while working with advanced analysis methods such as CFD.

We are requesting funding for a new powertrain toolbox. This will be a replacement for the current powertrain toolbox which is 10 years old. This will benefit the team by being able to properly organize all powertrain specific tools and allow easier access to them.

We are requesting funding for a tubing bead roller. This is used to roll a bead onto the ends of aluminum cooling lines. This benefits not only with better thermal retention but also improves reliability by lowering the chances of leaking hot coolant.

We are requesting funding for a vise mounted sheet metal brake. Currently we have no way to accurately bend sheet metal without access to the student machine shop so this would allow us to improve our fabrication ability in the bay and at competition.

We are requesting funding for k-type exhaust thermocouples. This would allow us to accurately read the temperatures of our exhaust and allow us to more accurately tune our engine.

The last item we are requesting funding for is roll and heave springs. These springs are necessary to get the most out of our new custom roll-heave decoupled suspension.

Estimated Equipment Lifetime

Estimated Equipment LifetimeThe E3 machine shop funding is estimated to last us 1-2 years. The parts from the Aircraft Spruce order will last us 1-2 years. The parts from the Summit Racing order will last us 1-2 years. The 3D printer will last us a minimu

Implementation Schedule

All items will be purchased as soon as funding is confirmed. All of these items if funded will start to be utilized in the fall term.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
E3 Funding/Aircraft Spruce/Summit Racing	4800	4300	3300	1800
3D Printer	1200	1200	450	0
Half Shafts/ Springs /Carbon Fibre	1840	1840	1840	1840
Powertrain Toolbox/Tubing Bead Roller/Vise Mounted Sheet Metal Break	1075	615	615	0
K Type Exhaust Thermocouples	150	0	0	0
Total	9065	7955	6205	3640

Student Team
Proposal F20-128

Aura, Cambridge Festival of Lights 2020

School of Architecture / F_RMlabs
Adrian Chiu, Co-director of F_RMlabs
a23chiu@uwaterloo.ca

Description of Proposal

This year's rendition of Unsilent Night is incorporated into Cambridge's Festival of Lights and will be over a longer 40-day period. It is a public event which invites artists to create light based installations showcasing the intersection of art and technology which will be strategically placed all over the city. Unsilent night has historically attracted large crowds and F_RMlabs was personally asked to submit another installation proposal due to the success of our Unsilent Night 2019 installation, Unglitched. This installation proposal is the result of a collaboration between undergraduate and graduate students that began in September of 2020, and will be operating from November 23, 2020 to January 1, 2021. The team has been engaged in developing the design for an initial submission to the City of Cambridge, as well as preliminary fundraising and research thus far. Going forward into the next two months, we will be extensively prototyping with projection mapping techniques and software, micro-controllers, and various types of modes of web/mobile based interaction as well as fabricating the screen projection towers for the project.

Proposal Benefits

Benefits of funding this project is the experience and knowledge gained by students involved. The project provides a valuable opportunity for students to realize a design in the real world - from concept to construction in the span of a single term. As school has moved online, F_RMlabs provides a space for students to socialize about design regardless of year and collaborate on a project that they are passionate about while gaining experiential learning that goes beyond the school's curriculum. Through this collaboration, students are able to learn from each other on their own initiative on a variety of skills relating to technology, architecture and many administrative soft skills that are transferrable. The process of producing a built installation involves valuable skills that are essential to professional practice, but are difficult to incorporate into the curriculum such as securing funding and project management. It also provides an opportunity for students to explore interaction design, responsive design methods, and soft-architecture systems in the context of a built-work. Students are also given a unique interdisciplinary opportunity to work with digital interfacing and programming action-script for the micro-controllers, as well as projection mapping techniques and software; equipment that they otherwise would have difficulty incorporating into their own coursework.

Estimated Equipment Lifetime

Initial use of 40 days for the festival, but an afterlife of being donated to the school for students to use for years to come. We are in talks with the school to see how we can achieve this and ensure the projectors have a continued use at the universit

Implementation Schedule

Design proposal submitted to city: October 18

Design development, detailing: All of October

Prototyping: All of November until the 15th

Fabrication: November 16th -22nd

Festival Dates: November 23rd – January 1st

Takedown: January 2nd

Equipment afterlife

Additional Information

Our main need for funding is to buy projectors. While we need 8 projectors, we understand that WEEF has a limited fund and needs to distribute its money to a variety of different initiatives. Therefore, we are providing WEEF the option to fund just 6 of t

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Projector (It has been suggested that an exterior night time projection would require 3000~4000 Lumens)	1446.31	1084.73	723.15	361.58
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	1446.31	1084.73	723.15	361.58

Weef F20 Proposal, Warg

WARG
Weef F20 Proposal, Warg
uw.warg@gmail.com

Description of Proposal

The Waterloo Aerial Robotics Group (WARG) is a team of passionate students developing autonomous aerial vehicles capable of performing various tasks. WARG will be competing in the annual Unmanned Systems Canada Student Competition this May.

This term, WARG is rebuilding after a half year hiatus. But we're back with new management and new recruits and we're ready to give all it takes. We've adapted to the challenges brought to us by Covid-19 and have managed to move a large share of our work to being remote. It is integral then that the little time we have available to do in-person work is used as efficiently as possible. That is why our proposal will focus on tools that will vastly improve the development and debugging process.

The core items that WARG is requesting sponsorship for are a 3d printer, a logic analyzer, a hot air soldering station and a couple of STM debuggers/programmers.

The team aims to begin autonomous flight testing as soon as possible. To do so, we will need to bring up our PCBs. As they are made up of fine pitched SMD components, a hot air station would vastly speed up the process. The next barrier we'll face is the debugging of sensor drivers. This is known to be a time-consuming task that would be greatly sped up with a quality logic analyzer. Furthermore, as the team aims to maximize student learning, we would like to send an assembled circuit board, and ideally a logic analyzer to one of our members working far from Waterloo, so they can debug the drivers they developed. On the mechanical side of things, the 2 main components to be developed are a camera gimbal to support our computer vision efforts, and a grabber/dropper mechanism, as carrying packages is core to the upcoming competition. We believe that 3d printing is the fastest means of prototyping these items and unfortunately, the team's current 3d printer has been broken beyond repair for some time.

Proposal Benefits

WARG's priority is student learning, and we pride ourselves in designing and building many aspects of the system from scratch. From the custom designed board that runs the autopilot, the autopilot itself, our image processing suite, our network infrastructure systems including the ground station, it is sufficient to say that our members get the utmost raw exposure to everything it takes to build an unmanned aircraft. As such we give all our members the opportunity to work on any of the above projects, providing them with invaluable, applicable experience.

WARG has recently taken on a team of promising new members with whom we are eager to share our experiences in the aviation and design team world. This includes architecting an autonomous system from the ground up with a new vision system, radio communications, electronics, autopilot board, and

peripherals. We are already impressed with what we've output in the last few months and are excited about what's to come.

WEEF is currently in our highest sponsorship bracket. This proposal will allow WEEF to continue to be a "High Flyer" sponsor. Being a High Flyer means that a large WEEF logo will be added to our aircraft, website, and on team apparel.

Estimated Equipment Lifetime

If we invest into a quality 3d printer and logic analyzer, we would expect those items to last about 5 years. If we are also given funding for a (perhaps cheaper) logic analyzer to ship to our remote recruit, that one may last up to 2 years, depending on

Implementation Schedule

WARG will be purchasing all items as soon as possible; within the fall 2020 term.

Additional Information

WARG is willing to take partial funding for each of the items.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Hakko hot air soldering station	750	0	0	0
FDM 3D Printer	1200	800	500	0
Logic analyzer(s)	600	300	200	80
0	0	0	0	0
0	0	0	0	0
Total	2550	1100	700	80

UWRT WEEF Proposal F2020

UWaterloo Robotics Team
Vanessa Hu- Finance/ Business Lead
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Description of Proposal

The UW Robotics Team (UWRT) is one of UWaterloo's oldest design teams. Every year, we attend the University Rover Challenge. This is a competition held in the Mars Desert Research Station, where over 90 universities come to compete in building a Rover that could eventually work on Mars alongside astronauts. As of Oct 23, the 2021 competition is scheduled to occur, so we've already signed up for it, and are aiming to place in the top 10 this year. As such, there are many important parts that we need in order to facilitate the assembly of the 2021 Rover.

Proposal Benefits

UWRT consists of 55 undergraduate students from a range of years and programs, including eight different undergraduate programs. We give students invaluable hands-on experience that teaches them both practical robotics design, but also teaches them teamwork and self-driven learning. So many members have leveraged the skills they've learned in UWRobotics to find co-ops and succeed in them, which is something that we're really proud of!

Not only that, but Robotics is also dedicated to outreach and community engagement. We've participated in events put on by the SDC, by Eng Orientation, WiSTEM, Engineering Outreach, and more! In fact, right now, we're working on designing ak free workshop to teach robotics and software design to female and non-binary youth in grades 6-12, and we're really looking looking forward to that!

Estimated Equipment Lifetime

Electrical components: PCB (1 year), PCB components (1 year)

Firmware components: Ethernet cables (2 years), Evaluation board (3 years)

Mech components: Drive train (2 years), Arm mods (2 years)

Software components: USB adapters (3 years), Connector cable

Implementation Schedule

Electrical components: PCB (purchased Jan 2021, used before competition), PCB components (purchased Jan 2021, used before competition)

Firmware components: Ethernet cables (purchased Jan 2021, used during competition), Evaluation board (purchased Dec 202

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Electrical components: PCB and components	3500	3500	2500	1000
Firmware components: Ethernet cables and Evaluation board	556	205	136	80
Mech components: Drive train and Arm mods	3100	2300	1700	1000
Software components: USB adapters and Connector cables	865	763	509	200
0	0	0	0	0
Total	8021	6768	4845	2280

Concrete Design Team Fall 2020 Proposal

Concrete Design Team
Taylor Numan (2A Civil Engineering)
tnuman@uwaterloo.ca

Description of Proposal

The concrete design team is requesting money for the purchase of a printer for the bay. The proposal presents three options and presents the benefits of a printer for the team.

Proposal Benefits

Our bay needs a new printer, as our last one no longer meets the needs of the team. All concrete mixes pages are printed and distributed during construction.

All proposed printer options are compatible with refillable ink cartridges, which will be filled up at Costco.

The printer enables us to copy, scan, and print on legal and letter sized paper.

Estimated Equipment Lifetime

Printer - 4 years

Implementation Schedule

The printer will be purchased as soon as possible and placed in the bay.

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Printer	380	200	140	140
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	380	200	140	140

F20 WEEF Proposal Presentation by WatLock

WatLock
Alyssa Ang - Business Lead
waterlooairlockteam@gmail.com

Description of Proposal

WatLock is the only design team on the forefront of space habitation, specifically Mars colonization at the University of Waterloo. We are participating in the University of British Columbia's (UBC) Mars Colony Airlock Challenge. This is the first competition of its kind from the University of British Columbia with two-stages: a design proposal and prototype fabrication. During the design proposal stage, we received a Best Presentation Award and we intend to see our designs through till completion of a final product. We are currently in the second-stage which is set to occur in August 2021 where we will be presenting a physical prototype of our airlock.

The team consists of students in several faculties: Engineering, Math and Science. With the talent of our young innovators, we are determined to tackle the problems of space development. We are hoping to receive funding that will aid us in the journey of seeing our designs come into fruition.

Proposal Benefits

Students from the engineering faculty are interested in exploring the unknown and getting involved in the space industry as the opportunities for innovation are endless. Members of WatLock show these qualities and WatLock provides undergraduate students from multiple disciplines a space to communicate with like-minded individuals and work towards a common goal. We hope to provide students with the opportunity to design and innovate various projects on our team.We provide an open learning environment that incubates systematic thinking by involving several disciplines within our team. As one of the only teams involved in space engineering, students are encouraged to look beyond what is directly around them and be curious, a skill that they will use on future co-op terms. In the same manner, those on the mechanical and electrical teams participate in experiential learning through the creation of the physical airlock and make constant use of the iterative design process. While the business team students learn to collaborate with different aspects of the team to provide solutions to funding our structure as well as practice their communication skills, crucial to future co-op opportunities. We offer our students several opportunities to apply their academic knowledge, develop a deeper insight into systematic thinking, and build new skills like SolidWorks. By providing these opportunities we allow our students to build their resume.

This semester's active team of 34 members consists primarily of engineering students from various programs such as Mechatronics, Mechanical, Computer, Software, Nanotechnology, Architectural, Biomedical, Electrical, Management, Systems Design. Other faculties actively involved this term include the Math and Science faculty.

Through the creation of this airlock, the University of Waterloo will be able to compete at the University of British Columbia which acts as promotion for the university through the use of team apparel, posters, banners, and potentially; the airlock itself!

We hope to establish a strong relationship with WEEF to help fund our ambitions and ideas in space settlement. In the previous year, WEEF has contributed $5,160.00 previously to fund our projects. For acknowledgment, WEEF would be presented upon all of our future merchandise and marketing equipment including, posters, banners, t-shirts, websites as well as having the logo of WEEF upon the airlock itself. Our sponsors are not only important to us but to the community as well. In our social media promotion, we will acknowledge WEEF's importance to us and aim to raise awareness among the public about WEEF.

We believe that through your funding, it is our mission to represent you as a supporter of cutting-edge technology and to share the knowledge that we gain through events and competitions. In addition, you will also be updated on our latest events, design and competition details, including the mystery of what life on Mars would be like!

Estimated Equipment Lifetime

Our airlock can eventually be showcased to aspiring students encouraging them to start their own design team or join one as well as leave a legacy of the hard work put into the design and construction of a functioning airlock. With these possibilities in

Implementation Schedule

We plan on working with the sensors remotely during the online term as one of our solutions to progressing successfully during this online term. We plan to order the sensors whenever we receive notification of funding since shipping times under the circum

Additional Information

Thanks to WEEF, the WatLock team has participated in the first step of the UBC Airlock Competition and presented their design to the judges. Following this step, the design team would like to turn this design into reality and present the Airlock to those

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
CO2 Sensors	471.36	0	328.03	328.03
Honeycomb Panels	1500	1500	1500	1000
Aluminum 6061 stock	1500	1000	1000	750
Actuator	192.08	192.08	0	192.08
Actuator Brackets	80.14	80.14	0	80.14
Total	3743.58	2772.22	2828.03	2350.25

Funding for Indy Autonomous Challenge

Waterloo Autonomous Racing
Ben Zhang, Team Captain
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Description of Proposal

Waterloo Autonomous Racing (WATORACE) is a newly established team to participate in the Indy Autonomous Challenge (IAC). Unlike the AutoDrive Challenge that WATonomous participates in, IAC does not provide funding for purchasing the necessary hardware for participating in this competition. This proposal outlines some resources that would greatly ease the immediate computing resource constraints that the team is facing.

Proposal Benefits

Background: The organizers of IAC provides us with Azure virtual machines for testing our path planning and control software. However, these virtual machines are time-constrained and are on separate networks as our computers for running the autonomy stack, which makes development unnecessarily complex (communication between our stack and the virtual machine requires an external relay server, which we will describe below) and time-consuming.

Simulation server - for running the official Ansys VRXPERIENCE simulator. This will greatly speed up development because of the reduced latency to the organizer-provided time-constrained Azure virtual machines (because we can run our stack on the same network, or on the same computer). This will also allow us to run continuous automated testing or data collection scripts without worrying about running out of Azure credits.

AWS credits - for running communication bridges to the Azure virtual machines. The organizers provide us with 1 relay bridge between the virtual machine and our stack, which means only 1 developer can work on the stack at a time. Moreover, the provided relay bridge is flaky and sometimes gets overloaded. There is no way for us to restart the bridge because we don't have permissions to access the server that the bridge runs on. Having AWS credits will allow us to spin up our own relay bridges. This will not only allow up to 3 (limited by the number of virtual machines) developers to work simultaneously, but will also allow us to debug and restart the relay bridges when it stops working. Currently we are using the AWS free tier to run a low-powered relay bridge, which often gets overloaded. With more AWS credits, we will be able to spin up more higher-tier instances.

Domain registration - To establish an official branding for marketing, partnership and sponsorship purposes, we have purchased watorace.ca. Funding for domain registration will allow us to continue to pay for this domain.

For a detailed cost breakdown, please see the appendix in the presentation.

Estimated Equipment Lifetime

Simulation server - 10-15 years. (The lifetime of a server-grade computer). This item is also very adaptable for use by other student teams (e.g. WATonomous) in case of mergers after the competition ends.

AWS credits - Depends on the amount granted. Suppo

Implementation Schedule

Equipment will be purchased in Fall 2020 for working toward the 2021 competitions (January, February, May and October)

Additional Information

After speaking with Charles Zhang (WATonomous Team captain), we realized that it is possible for us to jointly acquire a computer (item 1 below) that we can share between the two teams (we already have some experience sharing computing resources because W

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Simulation server. We have a few options ordered by how closely it matches with the organizer-provided VMs.	14466.13	4278.97	3170.99	2906.58
AWS Credits - the funding amount is flexible.	300	200	100	50
watorace.ca domain registration	34	17	0	0
0	0	0	0	0
0	0	0	0	0
Total	14800.13	4495.97	3270.99	2956.58

High Voltage Safety Equipment for Student Teams

Sedra Student Design Centre
Peter Teertstra, Director, SDC
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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.

With the increased awareness and interest in sustainable energy there are a number of existing and new student teams who are working in on projects involving electric vehicles. The electrical systems in these vehicles have high voltage, battery operated power systems that pose a significant safety risk. In particular, students working on or near these projects can experience serious injury if the tools and equipment are not of the proper kind; purpose built for use in high voltage applications.

Some of the electric vehicle based student teams have access to a few high voltage tools, but these are typically old, poor quality, and not well maintained. There is no quality, complete set of high voltage tools and safety equipment that all student teams have access to.

The Student Design Centre is proposing to purchase a set of high voltage tools and equipment for use by student teams working on electric vehicles. This would include hand tools that are certified for high voltage work, safety equipment such as insulating blankets, PPE and rescue hook, and a spot welder for assembling battery packs from individual cells. The current teams that would have use for this equipment include UWAFT, Formula Electric, Watonomous, Midnight Sun and Waterloop.

Proposal Benefits

Having high voltage tools and equipment owned, maintained and administered by the Student Design Centre is of great benefit to the student team users. Tools and equipment would be regularly inspected and repaired/replaced when necessary, and annual certification of PPE would be paid for by the SDC. Scheduling would be performed by the SDC to ensure equal, fair access to all equipment for all teams. Training could also be provided for basic skills and safety procedures when working with high voltage systems.

Another benefit to student teams is that most are required to have a set of high voltage tools on hand when they attend their competitions. The cost of purchasing their own set of tools is prohibitive for most teams; however, having a second, shared set of tools that could be taken to competition would meet the safety requirement while allowing other teams to continue working in the SDC.

Estimated Equipment Lifetime

The high voltage tools and the spot welder are quality items that are expected to last at least 15 years. The PPE would need to be inspected and replaced on a regular basis, so lifetime is significantly shorter, perhaps 3 – 5 years.

Implementation Schedule

The equipment and tools would be purchased and used right away.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
1 square meter HV insulating blanket	1050	0	0	0
HV insulated PPE (4 pairs of gloves, 2 face shield)	1000	0	0	0
Rescue hook (1 required)	660	0	0	0
HV tools (sockets, wrenchs, pliers, tweezers, etc. 2 sets)	1600	0	0	0
Spot welder (for assembling battery packs)	1000	0	0	0
Total	5310	0	0	0