WEEF PROPOSALS

SUMMARY

W2020

Academic Equipment and Resources		
Proposal Title		Requested
Wood workshop shop equipment ----------1		$ 11,488.00
Upgraded Robotic Manipulators ---------- 3		$ 30,000.00
New HVAC Lab Rig ---------- 5		$ 24,999.00
Electronics Workshop Upgrade ---------- 6		$ 3,525.00
New Prototyping Workshop ---------- 7		$ 2,266.97
UWSA Digital Fabrication Lab, Ultimaker S3 3D Printers ---------- 9		$ 25,565.60
Introducing strain gauges to Civil Engineers ---------- 11		$ 6,106.49
GPUs for WEEF lab ---------- 13		$ 13,510.21
CHE 181 Studio Equipment (IDEAS) ---------- 15		$ 17,289.00
Musagetes Architecture Library Computer Upgrades ---------- 16		$ 2,797.76
YSI Pro Plus Multimeters ---------- 18		$ 11,352.00
Ideas Clinic - Life Cycle Testing ---------- 20		$ 5,000.00
	Total	$ 211,489.01
Miscellaneous		
Camera and JYW equipment, and speaker ---------- 22		$ 2,266.94
Furniture for E2 Foyer ---------- 25		$ 5,000.00
TEDxUW 2020 Conference ---------- 27		$ 3,530.00
	Total	$ 10,796.94
Reallocations		
DeltaWasp Clay Printer ---------- 29		$ 6,106.49
Reallocating ---------- 31		$ 120.00
Student Teams		
UW VEX U - Winter 2020 ---------- 32		$ 2,797.76
UW IEOM WEEF Proposal ---------- 35		$ 445.00
Midnight Sun Hardware Component Funding ---------- 38		$ 3,800.00
Waterloo International Genetically Engineered Machine Sponsorship ---------- 40		$ 12,565.00
University of Waterloo Nanorobotics Group (UWNRG) ---------- 43		$ 4,092.00
UWFM W20 Proposal ---------- 46		$ 5,832.00
Hummingbot W20 WEEF Funding Proposal ---------- 48		$ 120.00
Waterloo Formula Electric (updated) ---------- 50		$ 2,324.67
UWSA Maker Lab 3D Printer Repairs ---------- 52		$ 119.69
Waterloop: WEEF Winter 2020 Proposal ---------- 54		$ 8,000.00
WEEF Proposal Winter 2020 ---------- 57		$ 3,800.00
Waterloo Rocketry W20 WEEF Proposal ---------- 62		$ 7,600.00
WEEF Funding Proposal W2020 ---------- 65		$ 2,440.00
UW Concrete WEEF W2020 Proposal ---------- 67		$ 1,745.00
Waterloo Submarine Racing Team ---------- 69		$ 655.00
UWaterloo IISE WEEF Sponsorship Proposal ---------- 71		$ 900.00
Cold Saw for UW Steel Bridge Design Team ---------- 74		$ 2,994.54
WEEF W20 UWAFT Proposal ---------- 75		$ 7,000.00
	Total	$ 67,230.66

Wood workship shop equipment

E5 Student Machine Shop
supports various academic courses
Peter Teertstra, Director, SDC
peter.teertstra@uwaterloo.ca

Description of Proposal

The Engineering Student Shops are fabrication spaces intended for undergraduate Engineering students to work on academic and student team related projects. The primary facility is the E5 Machine Shop, which provides a wide variety of machine tools and equipment suitable for both novice and experienced users. The E5 Machine Shop is fully staffed at all times, allowing individuals to be trained on the use of both conventional milling machines and lathes, as well as CNC milling machines. The other Student Shop facilities are the E7 Project Shop, a fully equipped shop that is used as an overflow during peak times, the E5 Woodworking Shop, a dedicated fabrication space for large, non-metallic projects such as molds for composite parts, and the E5 Paint Room.

Given the number of different shop locations it can be difficult to provide supervision to allow students access to any particular space, particularly during non-peak hours such as evenings or weekends. During these times all students are typically limited to the using the E5 Machine Shop only. This is a problem when students wish to use woodworking equipment, such as the miter saw, band saw, sander, etc.

There is an opportunity for the E5 Machine Shop to expand into an adjoining room, which is no longer being used as a student team workbay in the Student Design Centre. A proposal has been made and accepted to create an extension to the E5 Machine Shop intended for non-metal fabrication. This new shop would provide space for up to 10 students to work on projects using equipment specifically suited for working with wood, plastics, and other non-metallic materials.

Equipment that will be purchased includes a miter saw, band saw, sander, fixed and portable dust collection systems, a router table and various hand tools. This equipment will be specially sourced and configured to work with non-metallic materials including wood, plastics, and composites.

Proposal Benefits

Expanding the E5 Machine Shop facility will benefit students in many ways. This equipment and supporting tools will be specifically selected for working with wood and other non-metallic materials, enhancing the quality of the end-products. The additional 10 work spaces will relieve some of the overcrowding that occurs in the E5 Machine Shop, particularly during the Winter term when significant project deliverables (such as Capstone Design projects) occur. Student safety is greatly improved since the saw dust and other flammables are separated from the metal cutting machinery.

Estimated Equipment Lifetime

All the equipment in this proposal will be administered by the Manager and Instructors responsible for the Engineering Student Shops. The equipment that is being presented in this proposal is of professional quality, and is expected to have a lifetime well in excess of 20 years.

Implementation Schedule

The equipment will be purchased as soon as funding is approved. The space will be set up over the Spring 2020 term, and the goal is to open the facility at the start of the Fall 2020 term.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Dust Collector, Band Saw, Mitre Saw, Metal Sander, Spindle Sander	8588	8588	0	0
Portable Dust Collector - Festool 48 HEPA	1200	0	0	0
Router Table - Steel City	1400	0	0	0
Orbital Sander - Festool	300	0	0	0
0	0	0	0	0
Total	11488	8588	0	0

Upgraded Robotic Manipulators

Mechanical and Mechatronics Engineering
ME 597, Future MTE TE
Eugene Li, Mechatronics Engineer in Training
eugene.li@uwaterloo.ca

Description of Proposal

Robotic manipulators have become a common sight in manufacturing settings and are being increasingly used in surgical robotics and other human machine interactions. ME 547 (Kinematics and Control of Robotic Manipulators) is a fourth year technical elective that has been taught at UW for well over 20 years. The course allows the participants to directly program and control a highly articulated robotic manipulator. The course made use of two robots designed and built by the company CRS. However, CRS was bought by another company in 2004 and no longer exists. Unfortunately these dated robots have now failed and cannot be repaired. The company Quanser, who has designed and produced much of the equipment used in controls courses throughout engineering, are releasing a new robotic manipulator the QArm. This manipulator will provide a similar reliable interface for learning about the kinematics, dynamics and control of robotic manipulators with the high level of on-going support that Quanser has provided over the years, while still controllable with platforms such as MATLAB, Python or ROS.

By purchasing these new robots we will be able to ensure continued reliable access to robot manipulators for students. Without these new robots, any existing robotic manipulators cannot continue to be used in other courses or projects, restricting the exposure for many students to demonstrations or limited access.

Proposal Benefits

By purchasing a new robot we will be able to support the existing manipulators course for the foreseeable future. This will keep the course open to all ME, MTE, SYDE and BME students. The course will also use familiar interfaces that can be controlled by MATLAB or other familiar software systems. In addition, a digital twin of the robot will be provided so that users can run accurate simulations outside of the lab environment.

Estimated Equipment Lifetime

The specified robot is intended to work continuously for 10 years with minimal maintenance. We expect with our more limited implementation that it will be in use for 15-20 years.

Implementation Schedule

The QArm will be released in April 2020. Quanser has agreed to provide a beta version of the robot prior to this date so that any concerns can be addressed prior to release. Once a stable version of the robot is available it will be purchased and implemented, reading for the Winter 2021 offering of the course.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Quanser QArm	15000	30000	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	15000	30000	0	0

New HVAC Lab Rig

MME + CEE (ArchE)
ME599/CIVE497/ME760
David Mather, lecturer
dwmather@uwaterloo.ca

Description of Proposal

Purchase new lab rig to provide hands-on opportunity for students to study operation and behavior of fan and duct systems. This will provide a new lab in the special-topics course “HVAC Energy Efficiency” (ME599/CIVE497/ME760).

Proposal Benefits

Provide a new course lab for use by both undergraduate and graduate students. Typical course enrollment is 90 students. (Other courses may also make use of the rig.)

Estimated Equipment Lifetime

15+ years

Implementation Schedule

Purchase: May-Jun 2020.

Delivery: Sept-Oct 2020.

Testing: Nov-Dec 2020.

In-use: Jan 2021

Additional Information

WEEF allocated an initial $15001 for this project in Fall 2019.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
New HVAC Lab Rig	22999	24999	17999	14999
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	22999	24999	17999	14999

Electronics Workshop Upgrade

Systems Design Engineering (SYDE & BME)
SYDE 192L, SYDE 292L, BME 294L, BME 393L, BME 489
Chris McClellan, Design Instructor
chris.mcclellan@uwaterloo.ca

Description of Proposal

Systems Design Engineering has a great Electronics workshop. In it we have 9 workbenches, complete with a power supply, oscilloscope, function generator, DMM and soldering iron. However, since 7 of those workbenches have antiquated oscilloscopes, and since oscilloscopes are such an integral part of working with electronics, it's like we only have 2 workbenches. We would like to upgrade the 7 oscilloscopes with modern 2 channel, 70MHz versions, where all the knobs work.

Proposal Benefits

Students will no longer have to fight over the 2 prized workbenches. And less fighting means more working.

Estimated Equipment Lifetime

10+ years.

Implementation Schedule

ASAP

Additional Information

The SYDE department will match WEEF's contribution.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Oscilloscope (2 Ch, 70MHz) (7,4,2,0)	3525.20	2014.40	1007.20	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	3525.20	2014.40	1007.2	0

New Prototyping Workshop

Systems Design Engineering (SYDE & BME)
SYDE 263L, BME 261
Chris McClellan, Design Instructor
chris.mcclellan@uwaterloo.ca

Description of Proposal

Students come to UW with a diverse background of abilities and experiences. However, the majority lack hands-on skills. In Systems Design Engineering we have a strong emphasis on Design, and the ability to build, create and problem solve are the foundation to good Design. To this end, we're going to create a Prototyping Lab that will focus on electro-mechanical design and prototyping. We're going to have 16 workbenches. Each workbench will have an oscilloscope, DMM, function generator, 2 power supplies, computer, soldering iron and a complete set of hand tools. We'll also be adding 68 lockers and 84 cubbie holes for project storage. This will cost upwards of $200,000.

We're hoping WEEF will help us purchase the 16 electronics suites we need. Each suite is comprised of an oscilloscope, DMM, differential power supply and high current power supply. The total cost is $51,131.20. The SYDE department will match WEEF's contribution.

Proposal Benefits

Not only are we adding more hands-on prototyping to our curriculum, which requires more prototyping resources, the number of students requiring these resources has doubled with the addition of BioMed. We badly need this Prototyping Lab.

The core courses this will benefit:

SYDE 263L (Prototyping Workshop)

BME 261 (Prototyping, Simulation and Design)

Plus the lab courses:

SYDE 192L, 292L

BME 294L, 393L, 489

Plus the design courses:

SYDE 161, 162, 361, 361, 461, 462

BME 161, 162, 261, 361, 362, 461, 462

Estimated Equipment Lifetime

10+ years.

Implementation Schedule

ASAP

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Electronics Suite	25565.60	12782.80	6391.40	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	25565.60	12782.80	6391.40	0

UWSA Digital Fabrication Lab, Ultimaker S3 3D Printers

School of Architecture (ARCH) Digital Fabrication Lab
ARCH113, ARCH193, ARCH212, ARCH292, ARCH293, ARCH392, ARCH393, ARCH493, Thesis Work
Senior WEEF Representative, School of Architecture (ARCH) (on behalf of David Correa, Architecture Assistant Professor)
cmhrabi@edu.uwaterloo.ca

Description of Proposal

The UWSA Digital Fabrication Lab is an increasingly used resource for students across all levels of the degree program. The D.Lab supplies tools needed to create scale models of architectural designs, full-scale constructions, or other objects such as furniture, and light fixtures. The D.Lab currently operates one high-quality resin-based 3D printer, which has seen greatly increased use during the past few terms. With the growing interest and further usage of the printer, we are seeing a need for additional 3D printers. This proposal is for the purchase of three “Ultimaker S3” 3D printers.

Proposal Benefits

The demand for the current 3D printer at the School of Architecture is high and as the implementation of 3D technologies/digital fabrication in the core curriculum grows, it is becoming increasingly difficult for students to find the time to complete their project work on the current printer. The additional printers would alleviate demand on the current printer and eliminate the delay of finishing projects. Increased access to 3D printers would allow students to experiment with these technologies more freely, expanding the possibilities of their design coursework and workflow. The Ultimaker S3 was chosen as it is a highly reliable printer with a shallow learning curve. Designed for ease of use while producing professional-quality results. Sold from Shop3D Canada, based in Mississauga.

Estimated Equipment Lifetime

The estimated lifetime of these printers is 7 years.

Implementation Schedule

Immediate.

Additional Information

Each printer costs 5,763.00 CAD, including tax. The item options listed below change based on quantity of printers, starting at the requested quantity of 3.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Ultimaker S3 3D Printer	17289.00	11526.00	5763.00	0.00
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	17289	11526	5763	0

Introducing strain gauges to Civil Engineers

Electrical and Computer Engineering Department/Ayman El-Hag and Michael Stachowsky
GENE123
Electrical Circuits and Instrumentation
ahalhaj@uwaterloo.ca

Description of Proposal

Students from Civil/Environmental/Geotechnical/Architectural Engineering are required to take GENE123 (Electrical Circuits and Instrumentation) in their first year. Last year this course was offered to approximately 300 first year students.

The course content and lab experiments have been changed completely since the winter-2019 term and transformed from a classical electrical circuit course into an instrumentation course that serves the purpose of the aforementioned disciplines. The change was well received by the students and reflected in their positive comments in the course evaluation. The course deals with the three parts of the instrumentation system, i.e. sensor, conditioning circuit and data acquisition (DAQ). We introduced sensors in both the course content and the Lab but the sensors covered in the Lab are more general sensors and not specific for Civil Engineers. One of the most important sensors to Civil engineers is the strain gauge. We are intending to build 70 kits with strain gauges installed in them to teach the students how to use the strain gauges to measure deflection in structures. The skeletons of the kits were already done. We need to install the strain gauges with all electrical wiring. A GENE123 TA will be utilized to install the strain gauges.

Proposal Benefits

The proposal aims to introduce instrumentation to the civil engineering students. A total of around 300 students took the course last year during both the winter and summer term and it is expected to have the same number of students each year. Moreover, the idea of introducing instrumentation in the lab for the first year students can be extended also to other disciplines that deals with strain gauges like mechanical and mechatronics engineering management students.

Estimated Equipment Lifetime

The life time of the strain gauges will be around 20 years as there is only passive components.

Implementation Schedule

We hope to get the fund to start in the summer of 2020.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Components for the strain gauge kit	4500	3500	3000	2500
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	4500	3500	3000	2500

GPUs for WEEF lab

Engineering Computing

The WEEF lab is used for teaching multiple courses in eight engineering undergraduate programs.

Olga Vechtomova, Associate Dean, Computing
ovechtom@uwaterloo.ca

Description of Proposal

Engineering Computing is applying for $64,260 to purchase 140 graphics processing units (GPUs) as part of the WEEF lab computer hardware upgrade.

WEEF lab has 140 computers, which are used extensively in the teaching of core Engineering courses. The lab is booked solidly five days a week for the teaching of courses in eight different engineering programs, as well as general (GENE) first-year engineering courses offered to multiple engineering programs. It is one of only two labs in the Faculty of Engineering (alongside Multimedia lab) that are used exclusively for teaching, and that play an important role in the education of engineering students at Waterloo. In the past four months, 1400 undergraduate Engineering students logged in to the computers in the lab.

The computers in the WEEF lab were last upgraded in August 2014 by Engineering Computing. The current computer hardware in the lab is at the end of its lifecycle, and is no longer adequate to support the modern versions of software packages used by the students in the lab. Specifically, the current GPUs in the lab are not recognized by Solidwords, which is one of the most used software packages in the lab. In total, over 20 software packages are used regularly in the lab, including Autodesk, Matlab, Solidworks, RStudio and Unity, that students in many engineering programs are required to learn.

Proposal Benefits

As a leading Engineering Faculty in Canada and internationally, we aim to give our students the best possible learning experience and educate them in the latest software packages and technology. The useful lifespan of a computer hardware is approximately five years. Afterwards its technical specifications (e.g. memory, GPU, CPU speed) are too low to support the current versions of operating systems and software packages. Since many applications (e.g. Autodesk, Solidworks, Unity) have heavy graphics-processing requirements, GPUs are essential components of workstations in this lab. Also, given very intensive use, hardware becomes unreliable, with more and more instances of hardware failures. This becomes unacceptable, since the classes are always full and even one faulty computer in a class is problematic, as a student would not receive the same level of educational experience as his/her classmates. Furthermore, back-to-back scheduling of most classes means that Engineering Computing staff cannot perform work on the faulty computer as soon as the problem arises, as they cannot interrupt an ongoing class.

Estimated Equipment Lifetime

The expected useful lifetime of the GPUs under the expected load in the WEEF lab is 5-6 years.

Implementation Schedule

The WEEF lab is scheduled for upgrade in April 2020. Engineering Computing plans to replace all 140 computer workstations during the month of April before the start of the Spring2020 term.

The total estimated cost of the WEEF lab computer upgrade is $164,780 (unit price of $1,177.00 × 140 units). The GPU portion of this cost is $64,260 ($459 × 140). This proposal is requesting funding for the GPU portion of the upgrade. The remaining cost will be paid for by the Faculty of Engineering.

Additional Information

Solidworks 2020 GPU recommendations:

Standard assemblies: NVIDIA Quadro P1000 or AMD Radeon Pro WX 4100 ($360 mark) WX 5100 ($499 mark)

Large assemblies with simple parts: NVIDIA Quadro P2000 or AMD Radeon Pro WX 7100 ($720 mark)

Large assemblies with

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
140 GPUs (Radeon Pro WX 5100 100-505940 8GB). Estimated price per unit: $459.	64260	51408	38556	25704
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	64260	51408	38556	25704

CHE 181 Studio Equipment (IDEAS)

Chemical Engineering
CHE181
Jason Grove, Lecturer
jagrove@uwaterloo.ca

Description of Proposal

Equipment for the CHE 181 Chemical Engineering Design Studio.

We have implemented two new studio courses in 1st year. For this second course, students are designing and building an instrument to measure the equipibrium between a gas and its aqueous solution.

Proposal Benefits

This funding will help support our new Studio courses. The department and IDEAS Clinic have already contributed with substantial time and effort (faculty and coop student time) plus equipment purchase.

Estimated Equipment Lifetime

5-10 years.

The equipment should last a long time, but we expect some wastage over time.

Implementation Schedule

Courses is happening Winter and Spring 2020

Additional Information

The equipment needed comprises multiple units of relatively inexpensive items (e.g., arduinos, tap sets, force-sensitive resistors). Therefore the options are provided just as different levels of expense

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Misc. equipment	4000	3000	2000	1000
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	4000	3000	2000	1000

Musagetes Architecture Library Computer Upgrades

School of Architecture (ARCH) Musagetes Architecture Library
ARCH113, ARCH126, ARCH173, ARCH193, ARCH212, ARCH292, ARCH293, ARCH392, ARCH393, ARCH493, Thesis Work

Cian Hrabi, Senior WEEF Representative, School of Architecture (ARCH) (on behalf of Alfredo Sordo, ACM Support Specialist)
cmhrabi@edu.uwaterloo.ca

Description of Proposal

The University of Waterloo School of Architecture Musagetes Library is a heavily used resource for students across all levels of the degree program. The library provides print books, textbooks, periodicals, and magazines for rent - as well as providing GIS and modeling resources for students. The current set of computers in the library are too old to be upgraded and are not capable of handling current GIS and 3D modeling software which is used extensively by architecture students. The proposal requests funding for 7 computers, all-in-one Dell workstations which include monitors, for the Musagetes Library.

Proposal Benefits

The proposal benefits all members of each architecture class. The library at our Cambridge campus is heavily used and in order to maintain sufficient academic support across the entire Bachelor of Architectural Studies and Master of Architectural Studies Programs, an adequate computer system is crucial. The computer systems cannot be low-end because of the applications that need to run on them, so students are able to do their work.

Estimated Equipment Lifetime

The estimated lifetime of these computers is 5 years due to eventually being outdated.

Implementation Schedule

Immediate.

Additional Information

Each requested Dell Workstation costs $1,930.03 CAD, including tax. The following item options are in descending order of workstation quantity, beginning at the requested quantity of 7 computers.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Dell All-In-One Workstations (monitor included) x7 – tax incl.	13510.21	11580.18	9650.15	7720.12
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	13510.21	11580.18	9650.15	7720.12

YSI Pro Plus Multimeters

CEE
ENVE 330, CIVE 375
Mark Merlau, Lab Technologist
mmerlau@uwaterloo.ca

Description of Proposal

YSI Pro Plus Multimeters can be used to measure several water quality parameters in the laboratory and/or field. These parameters include Temperature, Conductivity, Specific Conductance, Salinity, Total Dissolved Solids, Dissolved Oxygen, pH, ORP, Barometric Pressure, Ammonium, Chloride, and Nitrate. The Pro Plus can also work with other YSI cables and sensors such as the Pro Series BOD Probe.

The Pro Plus Multimeter features a rugged design and can withstand the harshest field conditions. This proposal is for 2 Pro Plus kits, 2 Flow Cells, and 2 Calibration Solutions. The kits consist of a handheld meter, 4-port cable, and sensors (Conductivity/Temperature, pH, ORP, DO).

Proposal Benefits

The YSI Pro Plus Multimeters will benefit approximately 205 students per year. They will be used primarily in the ENVE 330 course, but will also be made available for undergrad Field Trips and Capstone projects.

Estimated Equipment Lifetime

Approximately 12 years.

3-year instrument warranty, 2-year cable warranty.

Implementation Schedule

Immediately upon receipt - Spring 2020.

Additional Information

The YSI Pro Plus Multimeters were part of a successful WEEF purchase in the past (2012). The units we purchased have been quite reliable and are still being used today.

The CEE department will provide partial funding up to 25%.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
YSI Pro Plus Kit, Qty. 2	9784	7338	4892	3669
Flow Cell Quatro, Qty. 2	1252	939	626	469
ORP Calibration Solution, Qty. 2	316	237	158	119
0	0	0	0	0
0	0	0	0	0
Total	11352	8514	5676	4257

Ideas Clinic - Life Cycle Testing

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 a life cycle testing ideas clinic activity. We are seeking $5,000 from WEEF for 5 bench-scale machines. The Ideas Clinic is currently employing a co-op student who has developed the prototype of this platform. 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. To ensure the success of this project, and to make it as real as possible, the Ideas Clinic has partnered with Skyjack and ANSYS (two existing Ideas Clinic partners).

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 industrial automation equipment and controllers, machine vision, neural networks, and control systems.

An estimated 1500 students per year will directly benefit from the activities that this equipment will allow

Estimated Equipment Lifetime

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

Implementation Schedule

The equipment will be purchased as soon as funding is granted. Prototype development is ongoing.

Additional Information

The Engineering Ideas Clinic will match the contribution from WEEF dollar for dollar. The Ideas Clinic is also providing all the labour (co-op students, grad students, and connections to industry) to develop this platform.

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Actuators	250	0	0	0
Structural frames	250	0	0	0
Instrumentation (strain gauges, etc)	500	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	1000	0	0	0

Camera and JYW equipment, and speaker

Waterloo Engineering Orientation Team
Roxane Fruytier, OTeam member
engoteam@uwaterloo.ca

Description of Proposal

Every year, over 1600+ first-year students join the Faculty of Engineering and around 300 upper-year Engineering students volunteer their time to welcome them. For first-year students and leaders alike, many memories are created during Orientation Week, and those moments are captured by the Media team (thousands of high-quality pictures and many videos summarizing the week). As a way to continue providing high-quality media content to first-year students and leaders, the Waterloo Engineering OTeam (formerly known as EngFOC) is seeking WEEF's support to acquire a new camera and a camera stabilizer: we would like a DJI Ronin S (essential or standard) or a glide cam rig.

Furthermore, we would also like to acquire three new kiddie pools to replace the current three that we own (they are filled with holes and as a result unusable). The kiddie pools will be used at Junkyard Wars, an event which happens on the second day of orientation.

Lastly, as part of Waterloo Engineering Orientation, an Ask Me Booth (also known as Toolbox) is set up in CPH courtyard to help first-year students find their way on campus. In order to improve the experience of Toolbox volunteers and attract the attention of first years, we would like to acquire a Bluetooth speaker.

Proposal Benefits

Engineering Orientation currently owns two cameras a Canon T3i and T5i. By granting us our request for a Canon T7i (the newest DSLR), we will be able to continue taking quality pictures and also allow Media team candidates who do not own any camera equipment to be part of the media team. In addition, with more cameras, the Media team will be able to capture even more unique moments of OWeek. The T7i is much lighter and has a better battery life than its predecessor which is convenient as orientation days are long, the sensor is also much better allowing for better pictures when lighting is poor. The T7i also has a higher shutter speed allowing more action shots.

As well, the DJI Ronin S (essential or standard) or a glide cam rig would help the Media team record higher quality videos. Many of the recap videos are taken in the action, which can lead to blurry and unstabilized videos without the use of proper equipment. The Ronin S will allow for more control over the glide cam since it is a three axis motorized gimbal. Glide cams are more difficult and time consuming to calibrate as it's hard to make it point in the correct direction. Looking at the Ronin S standard kit versus essentials kit, the standard kit offers more accessories, like a focus wheel and cables that allow the gimbal access to camera functions. These extra features help our filming go more smoothly, especially since most of our cameras don't have the best autofocus when it comes to filming.

For Junkyard Wars, we require three kiddie pools. These pools are essential for three of the activities we run during this event. First, the boat challenge (teams are tasked with building a boat out of junk) uses

the kiddie pool to assess how well the boat made by students float. Second, for the bridge challenge (teams are tasked with building a bridge that can sustain the most weight) the kiddie pool is placed under the constructed bridge to see how well it sustains the weight. Lastly, for the water transport challenge, we require a kiddie pool as we need quick access to a water source in order to test if the first-years' inventions are able to transport water without leaking any of it.

The CPH courtyard is a high traffic area which makes it a prime location to help first-year students find their way or answer their questions; most students living in UWP and CMH will go through the CPH courtyard to get to class or attend orientation programming. By acquiring a wireless speaker, we will be able to make Toolbox shift more enjoyable to upper-year engineering students who volunteer their time and encourage first-years to seek help by getting their attention. In addition, the speaker can be integrated into our programming as we often look at ways to innovate and improve our events.

Estimated Equipment Lifetime

We expect a life expectancy of 5+ years for all the equipment except for the kiddie pools. We expect the life expectancy of the kiddie pools to be 3+ years.

Implementation Schedule

The camera equipment, kiddie pools as well as the wireless speaker will be purchased as soon as funding is granted.

Additional Information

Our Flickr account in numbers since 2011:

- 53 500+ pictures

- 15 000 000+ views

If we receive any funding, we will:

- Add the WEEF logo on our website and social media platforms

- Link to the WEEF website on the Engineering Orientation website and socia

Miscellaneous
Proposal F-42

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
New Camera (Canon T7i)	809.99	809.99	809.99	809.99
Glide Cam Rig	0	0	0	202
DJI Ronin S (Standard or Essential)	929.99	929.99	679.99	0
3 Kiddie/Snapset Pools	105	105	105	105
0	0	0	0	0
Total	2064.98	1844.98	1594.98	1116.99

Miscellaneous
Proposal F-51

Furniture for E2 Foyer

Engineering Undergraduate Office
Mary Robinson - Associate Director First Year Engineering
mary.robinson@uwaterloo.ca

Description of Proposal

The foyer outside of E2-1772 is regularly used by students to relax, chat, charge phones and study. The furniture there is old, dirty, and not well-suited for it's use. In partnership with the Deans' Office, we've gotten the wall repaired, have some money for new furniture and are working with Plant Operations to finalize the floor plan.

Proposal Benefits

Upgraded study and relaxing space for all Engineering students to use at any time of day or night. 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 Operations and the Deans Office to get the floor plan finalized, purchase orders issued for the furniture, and work orders issued to get things installed.

Additional Information

With input from WEEF and EngSoc, the furniture selected will be the favourites from E5/6/7 as identified by students.

$5000(ish) = big grey table + 4 chairs with electrical

$1500(ish) = arm chair

$500(ish) = side table

Installation costs are unknown at t

Miscellaneous
Proposal F-51

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Furniture & installation	5000	4000	3000	2000
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	5000	4000	3000	2000

TEDxUW 2020 Conference

TEDxUW
Alan Pang, Finance Director
finance@tedxuw.com

Description of Proposal

TEDxUW, operated under a license from TED, is an annual event that brings together the world's leading thinkers and doers to share ideas worth spreading that impact any discipline – technology, science, business, humanities, entertainment. TEDxUW's main goal is to tackle humanity's most challenging questions and inspire individuals to transform their lives and ultimately the world, through introducing a broad spectrum of ideas in an innovative and unique approach. It has inspired hundreds of delegates including students and professors at Waterloo by providing participants with a platform to think critically and share their discoveries with others that share similar interests. Founded in 2011, this will be the eighth time TEDxUW brings together leading minds from all across the University and community. TEDxUW 2020 will provide our delegates with an environment to network with each other, share their ideas, and broaden their horizons. The conference will be recorded and published on TED's website, giving it the potential to reach millions across the world.

Our theme for 2020 will be 'Press Play'. Previously, we've had 'Making Waves', where we shared innovative and though-provoking ideas and 'Defying Conventions' and 'Interconnectedness of Things' where we presented new, horizon broadening views. The goal of 'Press Play' is to inspire everyone to take action as part of our mission to help tackle humanity's most challenging questions.

Proposal Benefits

Our exec team this year consists of 2 engineering students, including our co-chair who is studying electrical engineering. According to our historical event metrics, Engineering students consistently account for about a quarter of total attendees each year, making it overall the most represented faculty among delegates. This illustrates the high value Engineering students place on our conference and the large number of future engineers who will have been influenced by our conference. Student delegate faculty breakdown for 2018 are as follows: 23% Engineering, 29% Science, 18% Arts, 13% Math, 17% others; for 2017: 24% Engineering, 18% Science, 23% Arts, 16% Math, 19% others.

TEDxUW is an unparalleled opportunity for Engineering students to be exposed to new fields and hear new ideas directly from the minds that devised them. It is a valuable event that will create a tremendous impact on students and the faculty as a whole and is worthwhile for all Engineering students to attend. In past years, we've had sponsors such as Microsoft, Velocity, and Deloitte, and students will have the opportunity to network with them to learn about their companies during our event. In 2018, we had the pleasure to feature Harleen Kaur, CEO of Ground, as a speaker. Harleen is an ex-NASA engineer who helped build and launch 5 satellites and the first ever female and youngest ever VP of Rolls-Royce. We also featured Navid Nathoo, founder of The Knowledge Society, a human accelerator that develops 13-17 year old innovators in fields such as Brain-Machine Interfaces, Quantum Computing, and Genetic Engineering. Other past speakers includes Tanner Philip, an employee at Kik Interactive who helped

develop an ecosystem of digital services powered by cryptocurrency; and Bruce Taylor, Chemical Engineering graduate at the University of Waterloo who addressed ways to conserve resources, reduce pollution, and use sustainable methods to develop water purification systems. TEDxUW is a cross-faculty, cross-industry conference. Our array of quality talks by a diverse selection of speakers will not only help Engineering students become familiar with other fields but also pique interest in engineering for other students.

TEDxUW is an excellent starting point for participants to begin their quest to tackle humanity's most challenging questions. This year's conference aims to provide Engineering students with the opportunity to explore a variety of industries and dive beyond their comfort zone. Our speakers' stories of challenge, innovation, and growth will inspire attendees to 'Press Play' on their future as part of TED's mission to share "ideas worth spreading".

Estimated Equipment Lifetime

All swag items and program guides will be distributed to attendees. Photobooth will be returned to the rental company. Decor will be expended (balloons) or retained for future events (table linen, sponsor signs).

Implementation Schedule

May 30, 2020

Additional Information

TEDxUW sincerely hopes to establish a partnership with the Waterloo Engineering Endowment Fund (WEEF), which will benefit Engineering students in a multitude of ways. The process of acknowledging WEEF's contribution is flexible and can be further discuss

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Swag items such as stickers, pens, notebook, water bottle	2000	1500	1000	500
Balloons and decor	150	100	75	50
Photobooth	800	500	300	100
Program guides	80	60	30	0
0	0	0	0	0
Total	3530	2510	1605	750

Reallocation
Proposal F-44

DeltaWasp Clay Printer

School of Architecture (ARCH) Digital Fabrication Lab
Cian Hrabi, Senior WEEF Representative, School of Architecture (ARCH)
cmhrabi@edu.uwaterloo.ca

Description of Proposal

The University of Waterloo School of Architecture fabrication lab received funding in Spring 2019 – approved proposal #S19-1531, for a ceramic kiln. At the end of that term, the School received external sponsorship to cover the full cost of the kiln and thus did not spend the WEEF allocation for this piece of equipment. Already in the few courses it has been integrated into students have shown a great interest into this new technology. With the growing interest and further usage of the printer we are seeing a need for an additional clay printer. This proposal is for the purchase of a Delta WASP 2040 Clay printer.

Proposal Benefits

The demand for the current 3D clay printer at the School of Architecture is quite high and as the enrolment in the elective courses focusing on 3D technologies grows, it is becoming increasingly difficult for students to find the time to complete their project work on the clay printer as the usage rate is so high. If we were to have a second 3D clay printer, this would alleviate scheduling restraints and eliminate the delay of finishing projects. With the recent publications and media attention from the first class to use the printer many other students are looking forward to the expansion of the use of the printer in a broader range of courses.

Estimated Equipment Lifetime

The printer will have a lifetime of 7 years with the possibility of replacing the elements and extending that further.

Implementation Schedule

Immediate.

Additional Information

Reallocation
Proposal F-44

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Clay Printer, as described above.	6106.49	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	6106.49	0	0	0

Reallocating

E5-2003 Bay Improvements

Nicholas Pfeifle, Captain
nspfeifl@uwaterloo.ca

Description of Proposal

We found that upgrades to the safety equipment in the bay cost less than expected, we would like to reallocate the remaining roughly 120 dollars to purchase emergency stop buttons for equipment. This is the remainder of the item "chemical storage cabinet" from the F19 funding cycle.

Proposal Benefits

Some of the old buttons broke, we need new ones anyways.

Estimated Equipment Lifetime

Buttons are pretty resilient. This is not a consumable.

Implementation Schedule

Given that we can't do anything until the E-stops are replaced, pretty much immediately.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Estop button	120	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	120	0	0	0

UW VEX U - Winter 2020

UW VEX U
Alex Su
alex.su@uwaterloo.ca

Description of Proposal

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

We are requesting funding to allow us to grow the universities' first VEX U team. We have made great progress in the past year, however there are still many items that we would like to purchase to make our team well equipped to compete at future competitions. Funding would cover equipment, tools, sensors and robot parts. In addition to this, funding would help overcome any competition fees we encounter. Many resources, such as electronics, parts, tools, and the playing field are reusable past their time of purchase. We believe that a VEX U team would fill the University's void of not having a large scale competitive robotics team. At the same time, the team is such that it is not intimidating to new students who only have had a high school background since there is only a small learning curve involved. It will be a fun and competitive way for students to get an introduction to the various aspects of robotics, programming and engineering.

Proposal Benefits

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

additional robots is lessened. This team would also act as a good opportunity for students to get their first hands-on experience, a valuable characteristic that co-op employers look for. Not only would this benefit students in their search for co-op placements, but it would increase the University's reputation of producing students that have applied experience. Another way this team would benefit the University's reputation is through the competitions. Good performances at competitions can bring international recognition to the University. At the very least, just having a presence at competitions builds the reputation of the University.

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

Platinum ($2000+)

- Recognition in official team name announced at competition

- Company name in social media, press releases, brochures

- Large logo on robots

- Premium logo on website, team banner and jersey

Gold ($1000+)

- Company name in social media, press releases, brochures

- Medium logo on robots

- Large logo on website, team banner and jersey

Silver ($500+)

- Company name in social media, press releases, brochures

- Medium logo on website, team banner and jersey

Bronze ($300+)

- Company name in social media, press releases, brochures

- Small logo on website, team banner and jersey

Blue ($100)

- Small logo on website, team banner and jersey

Estimated Equipment Lifetime

At first glance, the initial start-up cost for a VEX U team is high. However, it soon becomes clear that the majority of this cost exists because it is our first year. Past the first year, there is minimal recurring cost, with only a few hundred dollars required for replacement parts and game elements. The majority of the components that our team requires to compete can be used for multiple years. For instance, the electronics such as the controller, microcontroller, motors, and sensors have long lifespans lasting multiple years assuming normal wear and tear. Batteries will need to be replaced every 2-3 years as their performance diminishes over time. The main recurring purchase will be structural parts such as aluminum c-channels and steel hardware. These components undergo heavy stresses during competition and thus begin to bend/weaken after repeated use. With proper care, the majority of the components from the initial purchase can be used for multiple seasons. As a result, the recurring cost of running a VEX U team is substantially less than the upfront investment required to start one.

Implementation Schedule

In order to be ready for competition, our team must have two competition-ready robots (the university competition requires a 15” and 24” robot). This term we are programming and tuning our robots so that they are ready for the world championship in April. The requested funding will be used very soon after it is allocated.

Additional Information

More information about the items we are requesting funding for:

Various Sensors are needed for autonomous functionality. This includes the purchase of 4 Intel RealSense Cameras(Depth+Tracking), each is required for both of the 2 robots. Jetson Nano, Nvid

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Various Sensors(Vision, IMU, Switches etc.)	1000	700	500	300
Pneumatics System	400	250	200	100
Competition Perimeter	697.76	650.00	600.00	500.00
Power/Hand Tools for Competition use	500.00	400.00	300.00	200.00
0	0	0	0	0
Total	2797.76	2200	1750	1175

UW IEOM WEEF Proposal

UW IEOM
Samer Khalil - President
s39khali@edu.uwaterloo.ca

Description of Proposal

IEOM Society's core purpose is to globally foster critical thinking and its effective utilization in the field of Industrial Engineering (IE) and Operations Management (OM) by providing means to communicate and network among diversified people, especially in emerging countries, motivated by similar interests.

The purpose of the club is to gather University of Waterloo students, staff, faculty, and members of the UWaterloo community at large to connect with professionals in the industry, participate in case research competitions, and, compete and present their research at international conferences

MISSION:

We want to be an innovation centre of global leadership development by integrating the principles of IE and OM and preparing future leaders of industry (you) with the skills, knowledge and professional industry ethics through talks/networking/workshops etc.

Club events, activities, and/or initiatives will include:

-Exposure to principles of operations management prevalent in industry today

-The chance to attend events/talks/workshops based on industrial engineering, supply chain management and continuous improvement

-Show your talent by competing in research paper/poster contests and case competitions

-Go on facility tours to get first hand experience of industry practices

We greatly appreciate your generosity as it will allow us to host those research and paper competitions for the students! We are passionate towards our mission of educating and spreading IE/OM knowledge to not only UW but all Canada.

Proposal Benefits

As a team we have 3 major goals:

1) We see that IE and OM are somehow neglected at UW and we want to provide the space, the people, the resources AND "THE COMPETITION & NETWORKING SPACE" for the fields at a much bigger scale.

We want to host the recurring Annual International IEOM Conference at UW and have UW IEOM as the main Industrial Engineering and Operations Management port in all of Canada.

We are part of a prestigious organization led by professionals in over 120+ different student chapters around the world.

2) We would like to attract and educate people from all around UWaterloo on operations management and industrial engineering. Uniting Chemical Engineering-Management Engineering-Systems Engineering to be the leaders of the Chapter as they all have common grounds.

3) We want to be able to host our first Case/Research Competition in UW this semester for the students. Just like Hackathons encourage University Students to work and problem solve technologies, we want to grow Industrial problem solving at UW.

Estimated Equipment Lifetime

Item-->

Banner: 5 years

Table Cloth: 3 year

Paper Binders: 3 years

Pens (stationary): 3 years

Paper (stationary): 3 years

Laser Pointer: 4 years

Microphone: 3 years

Laptop Stickers: 1 term

Implementation Schedule

-Banner and TableCloth will be purchased Immediately

-Stationary and Electronics will be purchased depending on estimated attendance and requirements during events

Student Team
Proposal F-61

Additional Information

{Price

Estimated Useful Life

Link}

1)Banner

Average: $101

Quantity (2): $202

5 years

Link 1: (70)

Link 2:(134)

Link 3: (86.24 starting - 100)

2)Table Cloth

Average: $16.6

Quantity (6): $99.6

3 year

Link 1: 12.99

Link 2: 24.99

Link 3: 11.89

3) Paper Bin

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Table Cloth	100	100	0	0
Banner	101	101	101	101
Stationary	145	0	145	145
Lazer Pointer	0	0	38	38
0	0	0	0	0
Total	346	201	284	345

Student Team
Proposal F-70

Midnight Sun Hardware Component 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 races for over 30 years. Currently, we are in the final stages of designing our next car MSXIV and request an additional $2,500.00 to purchase new hardware components. The components will be used to connect the batteries to the motors and for various other connections within the car.

We will likely be purchasing the components through JLCPCB, TE, Digikey, and Mouser. We intend to represent the University of Waterloo internationally at the American Solar Challenges in 2020 where these boards (with components), connectors, and contactors/ relays will be a required part of our car.

Proposal Benefits

Hardware components are an essential but very expensive part of building solar-powered electric vehicles and as such, by supporting the purchase, WEEF is supporting our entire team.

By joining our team (in either the firmware, hardware, mechanical 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 firmware development, PCB manufacturing, mechanical design and financial management as well as soft skills including problem solving, teamwork and communication. Our team includes students from a wide range of departments including Electrical, Computer, Management, Software, Mechanical, Mechatronics and Systems Design Engineering. Thus, by supporting our team financially, you are supporting the success of students around the Engineering Faculty.

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 2020.

Lastly, by providing further support to fund the purchase of the hardware components, WEEF will qualify as a Gold Tier sponsor of our car and will earn a logo on both our car and team jerseys.

Estimated Equipment Lifetime

The estimated life cycle for our hardware components will be two years for this vehicle.

Implementation Schedule

Integration of boards – February - March 2020

Integration of array – March 2020

Finished car – July 2020

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Relays/ Contactors – Used to connect batteries to motors. Needed to control them to react to fault conditions.	1200	1000	800	600
Boards and components - Used for measurement and controls the power throughout the car	2000	1500	1000	0
High Voltage Connectors - Used for high voltage connections in cars, low contact resistance, required for the battery box	600	500	0	0
0	0	0	0	0
0	0	0	0	0
Total	3800	3000	1800	600

Waterloo International Genetically Engineered Machine Sponsorship Application

Waterloo iGEM 2020
Paige Aldridge, Finance Manager
uwigem.business@gmail.com

Description of Proposal

iGEM (international genetically engineered machine) is an interdisciplinary student team focused on solving relevant problems using synthetic biology and genetic engineering. Just under a third of the students on our team come from the faculty of engineering.

Our main focus as a team is the yearly iGEM competition which gives students the opportunity to push the boundaries of synthetic biology using genetically engineered systems. Our multidisciplinary team consists of students working in the lab, on policy and practices, and mathematical modelling. We work together to build, test, and measure an engineered biological system of our own design. With funding from WEEF, we will have the ability to purchase the equipment and materials necessary to complete our research in the lab, which is central to our project. This includes providing micropipettes to accurately dispense and measure the solutions required to conduct wet-lab chemistry and synthetic biology. Gel visualization systems and a power pack for gel electrophoresis which are used as the main tools for visualizing protein and DNA samples which are the building blocks in the engineered systems. As well as lab coats for use in our new lab space as PPE for students.

Proposal Benefits

Each year, we provide a one-of-a-kind opportunity for undergraduate students of all years and experience levels to delve into problem-oriented research, development, and engineering. Currently participating on our team are 14 faculty of engineering students from a diverse range of programs, and together they make up just over a third each of the lab & design and mathematical modelling subteams (and just under a third of the whole team).

Furthermore, our team is entirely student driven providing the only on-campus opportunity for undergraduates to engineer, build, and test biological systems of their own design. This unique opportunity provides a robust practical learning experience for undergraduate engineering students to complement their academic and co-op experiences. Thus by providing funding to support our lab operations, we are better able to compete at a high level and provide opportunities for the engineering students on the team.

It also provides engineering students the chance to interact, learn from, and collaborate with international experts in the related fields of biological engineering. Thus, Waterloo iGEM supports the academic and professional needs of engineering students interested in biobased engineering or in general problem-driven project development.

In summary, by gaining sponsorship, we would be able to purchase the necessary equipment to conduct our research in order to produce a system designed to conquer an everyday problem using genetically engineered biological systems and achieve the team's primary goal.

Estimated Equipment Lifetime

For funding of pipette sets, the lifetime of this equipment is estimated at 7 years with some yearly maintenance (pipette calibration).

The estimated lifetime for the set of lab coats is 3-6 years.

The estimated equipment lifetime for the proposed gel imaging and documentation system + analysis software is 5-8 years.

Implementation Schedule

Purchases for lab equipment and materials will be done prior to the upcoming spring term (May 2020) in preparation for our lab research period (May-August 2020).

Additional Information

The faculty of science recognizes our contributions to innovation on campus as evidenced by our integration into the Science Innovation Hub (SIH, imagined by Concept) as well as supporting us financially by helping to cover some of our expenses, including

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Pipette Set: Single-channel adjustable volume micropipettes (6,4,2, or 1 full/partial sets)	2504	1652	728	364
Lab coats: set of lab coats for protective wear in our new lab space (10 or 6)	270	162	0	0
Gel imaging system for protein + DNA gels, and visualization of fluorescent molecules from other analytical modalities (ex: TLC)	9254	0	0	0
Power supply for gel electrophoresis (the main analytical technique for DNA and protein in the lab)	537	0	0	0
0	0	0	0	0
Total	12565	1814	728	364

University of Waterloo Nanorobotics Group (UWNRG) Winter 2020 WEEF Proposal

University of Waterloo Nanorobotics Group (UWNRG)
Sofia Rizzo - Business and Marketing Team Lead
business@uwnrg.org

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 sensors that will be able to identify bacteria present in the growing solution. 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. 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 liquid nitrogen dewar will last more than a year even though liquid nitrogen freezes up, its designated purpose is to store liquid nitrogen and can be constantly reused. It has a foam rubber insulation to prevent breakage, and comes with a heat insulated cap. Precision pump tube should last more than a year since it is made out of high performance materials, reusable and will be sturdy enough to not break or crack. Products formed by acds gene fragments and plasmids will be used over the next couple of years. The hydroponics system lighting will be reused until damaged or broken.

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

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Liquid Nitrogen Dewar - Used to store liquid nitrogen, which MAYA requires to keep its superconductors at a low temperature.	2412.00	1809.00	1206.00	603.00
Precision Pump Tube - Steadily pump liquid nitrogen to the MAYA assembly so the risk of inaccurate quantum flux pin is reduced.	730.00	547.50	365.00	182.50
acds Gene Fragments - Plasmids and gene fragments to design and engineer a custom bacteria for use in hydroponic agriculture.	650.00	487.50	325.00	162.50
Hydroponics System Lighting -used by Vision in their hydroponic systems to simulate natural sunlight and grow plants for testing	300.00	225.00	150.00	75.00
0	0	0	0	0
Total	4092	3069	2046	1023

UWFM W20 Proposal

UW Formula Motorsports
Aidan McCarthy, Business Team
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 SAE 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

We are requesting funding for E3 Engineering Machine Shop time in order to use this time to machine our suspension uprights, and have our chassis welding done as well as other CNC work. The uprights are one of the most critical parts of our suspension and can be reused for multiple seasons. As the team begins to move more towards composite materials we would like to purchase a Rotary Vane Vacuum pump in order to ease our process of manufacturing for composite parts. This pump is a very durable piece of equipment and will not only bring great value to the team now but also positions us well moving forward to work with structural composites and eventually move to a carbon fibre monocoque chassis. The vacuum pressure gauge is to be used with the vacuum pump in order to measure the pressure within the vacuum bag. The steering wheel quick disconnect will allow us to more easily integrate our data acquisition units as well as other controls onto our steering wheel as it allows us to directly link the steering wheel to the ECU through the quick disconnect. The MoTeC M150 ECU and development package will allow our team to modify the ECU on the fly and write our own code in order to tune the car, collect data, and better our performance. This development package is available to us at a heavy discount of over $2000USD and will help to students to further their learning by writing and testing their own code for our car's ECU. We are asking for the Gel Coat Spray Gun as both of our spray guns are heavily worn from use and in need of replacing. Respirator masks are being supplied through a sponsor at a discount and are crucial safety equipment for many jobs on the team.

Estimated Equipment Lifetime

The engineering machine shop time should last us approximately 2 years. The vacuum pump should last us a minimum of 10 years. The digital vacuum gauge should last us a minimum of 5 years. The steering wheel quick disconnect should last us a minimum of 3 years. The development package for the MoTeC M150 ECU should last us a minimum of 10 years. The Gel Coat Spray Gun should last us a minimum of 5 years. The Respirator masks should last us a minimum of 5 years.

Implementation Schedule

All items will be purchased as soon as funding is confirmed aside from E3 engineering machine shop time which will be purchased as it is used. All of these items if funded will start to be utilized this term.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
E3 Engineering Machine Shop	2000	1000	500	0
Rotary Vane Vacuum Pump ($1400) + CPS VG200 Digital Vacuum Gauge ($202)	1602	1400	1120	785
Steering Wheel Quick Disconnect	900	900	720	500
Development Package for MoTeC M150 ECU	800	800	800	200
0	0	0	0	0
Total	5832	4630	3140	1485

Hummingbot W20 WEEF Funding Proposal

UWRobotics - Robot Racing
Nicholas Pfeifle
nspfeifl@uwaterloo.ca

Description of Proposal

After the ambitious rebuild during the 2018-2019 season, the team is looking to update designs and replace components that were damaged during competition.

Repairing the gear train and motor control system will improve power efficiency and lengthen runtime, transitioning to higher torque motors will allow for a lower gear ratio and reduce long term wear and tear. This endeavour is already partially funded.

Upgrading to a larger tire diameter drastically raised speeds, and along with suspension reinforcement keeps the robot stable during tight corners, a project that WEEF funding recently helped complete.

The Autonomous Racing team is looking to replace components that were damaged during a major electrical short the previous year. To prevent this issue from arising in the future replacing the emergency stop circuit has become a priority.

It has come to our attention that our existing safeguards were inadequate and we are hoping to rectify the shortcomings in our power management.

Motor torque has been lackluster in the past, and the team is hoping to be able to replace the now five year old motor with a set that can more easily accelerate from a full stop.

Proposal Benefits

The Autonomous Racing team serves to put into practice concepts from academia and push them to their limits. Working with WatCAR, CogDrive, and RoboHub labs our members help to further involvement of undergraduate students in the emergent field of autonomous driving.

Additionally the team serves to bridge a disconnect in modern thought surrounding autonomous driving, optimizing for speed. Working with multi-disciplinary engineering students as well as mathematics and physics students the issue is tackled from diverse perspectives, pushing code and motors to the max.

Estimated Equipment Lifetime

Given that the last usage period lasted roughly five years, it is not unreasonable to expect the current purchases will last that long as well.

Implementation Schedule

Given that the competition will occur in the Spring term, purchasing will occur between now and the end of Spring term in order for it to be effective.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Gear Train, A number of gearing ratios to improve options in optimizing for speed and torque varying by terrain	40	40	20	0
High Torque Motor, Allows for easier acceleration after a stop and enables more processing equipment to be on board	80	80	40	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	120	120	60	0

Waterloo Formula Electric (updated)

Waterloo Formula Electric
William Meyer - Team Operations Lead
wmmeyer@uwaterloo.ca

Description of Proposal

Waterloo Formula Electric is requesting $760 to purchase tools required to build and test our car safely, including high-voltage insulated gloves, mats. These items are required for our competition and to work safely with our high voltage battery.

We are also requesting funds for an organizational box system with small item inserts to organize projects. The sortimo T-boxxes and containers will help organize the bay as this was a large issue at competition with the amount of time it took to move things around. This will help us with our upcoming competition and additionally will also improve team efficiency and allow us to get more things done spending less time looking for things. Due to crossing the USA border, organizational and accountability of parts being brought over is imperative.

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

Blankets have a long service life, up to 5 years.

The HV insulating gloves require re-testing at regular intervals, as per our rules, but will last for at least 2 years.

The boxes will last indefinitely and can be reused for each project

Implementation Schedule

After receiving confirmation of the funding, WFE will purchase the items and put them into service by March 2020.

The organization boxes will be used very valuable in project work and at competition at the end of April.

Additional Information

The HV insulating blanket is required due to our work with HV in the accumulator of the car. Being as the accumulator produces over 300V, working on the accumulator, especially during assembly and disassembly is a very dangerous prospect. The level of ris

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
1 m^2 HV Insulating Blanket	524.67	0	0	0
Two pairs of 2 HV Insulating Gloves	235	0	0	0
16 or 8 Various types of Sortimo T-Boxx	1565	785	0	0
0	0	0	0	0
0	0	0	0	0
Total	2324.67	785	0	0

UWSA Maker Lab 3D Printer Repairs

School of Architecture (ARCH) Maker Lab
Cian Hrabi, Senior WEEF Representative, School of Architecture (ARCH)
cmhrabi@edu.uwaterloo.ca

Description of Proposal

The UWSA Maker Lab is a student-run space inside the school of architecture, used for academic work and student teams/initiatives. The M.Lab supplies tools needed to create rough architectural models, test ideas, and mock up prototypes. The M.Lab currently operates three small 3D printers and a small CNC router, all of which are maintained by students. One of the 3D printers has broken and requires a new part to operate. This proposal is for the purchase of one “V4 Hot End” replacement part for a MakerGear 3D printer.

Proposal Benefits

By purchasing replacement parts instead of entirely new machines, the M.Lab saves money and materials, as we do not waste all the parts of the printer that still function properly. We also take advantage of students' familiarity with these machines by servicing them ourselves, saving further cost. By repairing this 3D printer, we allow students to experiment with the technology more freely, expanding the possibilities of their design coursework and workflow. The M.Lab also provides necessary resources, including this 3D Printer, to the school’s annual submission for Toronto Nuit Blanche, through the student group FORMLab. Access to all available resources is important to the efficiency of this student team, especially during submission deadlines when many people are working in the space at once.

Estimated Equipment Lifetime

The estimated lifetime of this existing printer is 3 additional years.

Implementation Schedule

Immediate.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
MakerGear V4 Hot End Replacement Part – tax and shipping incl.	119.69	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	119.69	0	0	0

Waterloop: WEEF Winter 2020 Proposal

Waterloop
Parul Sahdev - Business (Sponsorship Lead)
Parul.s@waterloop.ca

Description of Proposal

Waterloop is the University of Waterloo's Hyperloop student design team, dedicated to establishing Canada as the leader in Hyperloop Technology. Long-term, we are developing the technology for the fifth mode of transportation: a mode that allows an individual to travel 1,300 km/h in a safe, reliable, and fully sustainable environment. Short-term, we are designing a pod to compete on the world stage in SpaceX's Hyperloop Design Competition.

Over the past few terms, we have refined our design and completed some testing and prototyping. This term, Waterloop's goal is simple: to build the pod. The plan is to complete manufacturing of the pod, and to host an initial unveiling event by the end of the term. In order to achieve this, we are asking for WEEF's support in the manufacturing of a few critical, but costly systems. The funding breakdown is explained in the attached document, along with more details regarding the description of the proposal.

Proposal Benefits

1. Benefits to WEEF

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

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

- Exclusive tickets to our pod unveil event

- WEEF logo on the Waterloop website

- Dedicated social media exposure acknowledging WEEF's support

- Logo on presentation materials

- Logo on pod shell

2. Benefits to the Engineering Community

A. Representation of UWaterloo's Faculty of Engineering

For the past four years, Team Waterloop has competed against some of the top universities around the world in SpaceX's Hyperloop Competition. The team has competed in the final stage twice before, traveling to SpaceX's test facility in Hawthorne, California.

The financial support provided by WEEF allows the team to represent the University of Waterloo on the global stage in one of the most modern and innovative design competitions in the world. Funding provided from WEEF will not only support Waterloop's mission to become the leading competitor in Canada for the Hyperloop competition, but it will also encourage future team growth, and allow for better hands-on practice for the concepts that the students touch on in classes.

B. Student learning

At over 100 members strong, Waterloop is one of the larger student design teams around. While most of the team are junior undergraduates, many students have gone above and beyond the curriculum to learn graduate-level topics in motor control, electromagnetic simulations, and battery design. Developing a LIM from the ground-up is a serious technical feat.

The team helps by providing educational experiences to students, along with other faculty volunteers, via a fun yet challenging team experience. Our team demands a large time commitment, and helps teach the necessary leadership skills required to excel in the workforce.

Waterloop is also one of the only student teams working with pneumatics, and provides students with an opportunity to get hands-on experience with pressurized systems.

Estimated Equipment Lifetime

- Linear induction motors are known to have an enduring life span, since they suffer no wear and tear from friction. The LIMs that the team builds, hope to last for many years to come.

- The braking system will be reused in future iterations of the pod. Therefore, it is important to purchase high-quality pneumatic equipment.

- The battery system will be mounted to the pod for testing, and used until the next competition. The electrical team takes utmost care to maintain optimal battery health throughout testing.

Implementation Schedule

In order to build the pod this term, all funding will be used immediately to purchase the aforementioned components. Once all components have been purchased, the team will manufacture and assemble the systems, mount them to the pod, and conduct testing.

The components will be used for the next several terms for testing and ultimately competing in the Hyperloop competition.

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**
Batteries	1000	700	500	300
Power Electronics	1000	700	500	300
LIM Manufacturing	5000	3700	3000	2500
Braking (pneumatics) components	1000	700	500	400
0	0	0	0	0
Total	8000	5800	4500	3500

WEEF Proposal Winter 2020

UW Robotics Team
Daniel Dudziak - Finance/Business Lead
dddudzia@uwaterloo.ca

Description of Proposal

The University of Waterloo Robotics Team (UWRT) consists of over 55 students who aspire to design, build, and program the robots of tomorrow. The team competes at the University Rover Challenge held by the Mars Society with the challenge to design and build the next generation of Mars rovers that will one day work alongside human explorers in the field. The team has been accepted to the competition for the past three years out of an application pool of over 90 universities, placing 33rd globally in 2019, 22nd in 2018, and 15th in 2017. Along with URC, the UWRT is also committed to community outreach. In the summer term, the team shared our season success and functioning rover with everyone from elementary school students to sponsor company employees.

Battery Components

1. Variable Power Supply for Battery Charger

2. Battery for Rover

The battery and associated components are pretty much the heart of the rover. We do not have our own power supply for the battery charger which means that we rely on other teams to charge our rover. This has been really inconvenient as it has affected our testing greatly. Additionally, we need a backup battery that we can use during the competition if the first fails or runs out of charge unexpectedly. The second battery would also be used during testing while the other is charging.

Electrical Components/Tools

1. PCB Components

2. Motor Drivers

3. Desoldering Tweezers

4. Connector Kit

Every year we require multiple revisions of our PCBs, so a second revision is required to ensure that everything works like clockwork. Next, we need six backup motor drivers for the six motor drivers we use on the rover. In the past, we have had issues with motor drivers being blown during testing and at the competition, so we must be prepared. Additionally, desoldering tweezers would be extremely beneficial since they would increase our efficiency while working on our PCBs. They are truly imperative for not ruining the boards while desoldering. Also, a connector kit is needed to essentially hold everything together and complete the wiring of our rover.

Mechanical Components/Tools

1. Portable Shop Vacuum

2. AMT Encoders

3. Torque Wrench + Sockets

The portable shop vacuum will easily clean metal dust and chips which may prevent the frying of electronics when hand drilling the rover. The AMT encoders would be used as backups in the event that the ones we have now break. Finally, accurate bolt preloading is very useful and offers many benefits. A torque wrench along with sockets would be able to provide these benefits.

3D Printer

Throughout the past few years, 3D printing has become more common and accessible. The ingenuity and flexibility offered by 3D printing for customizable parts mean that our team does a lot of 3D printing. We have options on campus for printing, however, our own 3D printer would decrease costs, add convenience, and create numerous benefits as the amount we 3D print increases yearly.

Proposal Benefits

The UWRT has proven to be a great educational ground for undergraduate students interested in robotics for 15 years as one of the most iconic student teams in Waterloo. With WEEF's funding, UWRT can continue to participate in university events put on by organizations such as the SDC, WiSTEM, and Engineering Outreach. A truly multidisciplinary group, UWRT builds robots that could not be imagined by a single type of engineering emphasizing teamwork, collaboration, and system integration.

Battery Components

We are currently charging our LiPo batteries using a different design team's power supply which is very troublesome as sometimes they are using their power supply so we can't use it and other times they aren't around so we can't charge our battery. Furthermore, we need to have a power supply that we can take to competition in Utah to be able to charge our battery throughout the competition. Additionally, we currently have one LiPo battery, however, especially for competition, we need another one so that we can test and compete while the other battery is charging. It is also really important to have a second battery in case the first one fails.

Electrical Components/Tools

First, regarding PCBs, we have sponsors who sponsor the manufacturing of our PCBs, but we need WEEF to support our components for the second revision of our boards which is essential to the completion of our rover. Next, we need six motor drivers as backups for our current motor drivers (we use three of the drivers on the robot). In the past due to human fault, motor drivers have been blown during testing and at competition. So it would be really detrimental to have that happen, without having backup motor drivers. Furthermore, we need the desoldering tweezers while assembling PCBs and while reworking PCBs. They are vital to be able to work more efficiently and prevent ruining our boards while desoldering components. Lastly, the connector kit will be used for further necessary wiring of the rover.

Mechanical Components/Tools

The portable shop vacuum will be useful to help clean up the bay more easily and to prevent metal dust and chips from frying electronics if hand drilling the rover. The AMT encoders are necessary in case our AMT encoders (which have no backup) break during competition. Lastly, a torque wrench allows accurate bolt preloading, so it will be very useful to improve fastener design choices. Improved fastener design choices can lead to weight reduction and more design confidence, resulting in better designs.

3D Printer

This would be extremely useful in all aspects of building our rover. The team already does a lot of 3D printing, and every year the amount of 3D printing done continues to rise. With our own 3D printer, the cost at RPC and Watimake can be drastically reduced. Additionally, the cost of buying a printer is anticipated to break even within a couple of years.

Estimated Equipment Lifetime

1. Battery Components

a) Variable Power Supply for Battery Charger will last 5+ years

b) Battery for Rover will last 2+ years

2. Electrical Components/Tools

a) PCB Components will last for 1 year

b) Motor Drivers will last for 2+ years

c) Desoldering Tweezers will last for 5+ years

d) Connector Kit will last for 1 year

3. Mechanical Components/Tools

a) Portable Shop Vacuum will last for 2+ years

b) AMT Encoders will last for 1 year

c) Torque Wrench + Sockets will last for 5+ years

4. 3D Printer

a) 3D Printer will last for 6+ years

Implementation Schedule

Battery Components

Variable Power Supply for Battery Charger: Will be used immediately to be able to charge our LiPo batteries.

Battery for Rover: We will be using it on the rover before and during competition.

Electrical Components/Tools

PCB Components: This will be used during mid-march to be able to assemble our second revision of boards.

Motor Drivers: These motors will be used immediately before and during competition and will also serve as back up motors.

Desoldering Tweezers: This will be used this competition season and during subsequent seasons, while assembling PCBs and while reworking PCBs.

Connector Kit: This will be used for further wiring the rover. Therefore, it will be used immediately once we get funding for it.

Mechanical Components/Tools

Portable Shop Vacuum: This will be used regularly to prevent metal dust and chips from frying electronics if hand drilling the rover.

AMT Encoders: This will be used at the competition this year in case current encoders (with no replacements) break.

Torque Wrench + Sockets: This will be used regularly to improve fastener design choices.

3D Printer

3D Printer: This will be used regularly upon purchase since the team uses 3-D printing extensively.

Additional Information

Longer Description of Items Being Requested

Description:

1. Battery Components: This includes the variable power supply for the battery charger which is a power supply to be able to charge our LiPo battery. It also includes The battery that powers up ou

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Battery Components: Variable power supply for the battery charger, LiPo battery for the rover	1235	1015	560	0
Electrical Components/Tools: PCB Components, six motor drivers, desoldering tweezers, connector kit	1250	765	483	0
Mechanical Components/Tools: Portable shop vacuum; AMT encoders, a digital torque wrench and socket adapters	315	315	135	0
3D Printer: This includes an FDM single extruder 3-D printer	1000	600	0	0
0	0	0	0	0
Total	3800	2695	1178	0

Waterloo Rocketry W20 WEEF Proposal

Waterloo Rocketry
Jacob Deery, Team Lead
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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.

We recently flew our new rocket Shark of the Sky (SotS) at our annual competition and finished second in our category (30,000 ft Student Researched and Developed Hybrid/Liquid). 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. New developments this year include a new liquid engine and a complete overhaul of our recovery system.

We are requesting funding for the following categories:

1. Plumbing

Our propulsion and ground systems feature networks of hoses, valves, and fittings necessary for managing propellant loading and venting. In order to support the more sophisticated plumbing configurations and capabilities required for our new liquid engine, we will need additional basic components as well as specialized fittings for attaching to tubes, gas cylinders, and sensors.

2. Airframe

In order to achieve our goal of a 30,000 ft apogee, it is critical that we optimize our airframe in order to reduce weight without losing structural integrity. We have already made changes this year and plan to continue with further development in the next cycle. Funding for this category would mainly be used for fabrication material.

3. Recovery

To fully recover the rocket after launch it is crucial to have a performant recovery system. The system is in the last phases of design and the necessary elements for it have been determined. Funding for this category would be used for recovery electronics and fabrication material.

4. Launch Systems

To comply with future competition regulations and the team's future needs, the system requires an increase in reliability and robustness. Intended upgrades this year include system upgrades for better data display and adding more switches for future proofing and liquid engine compatibility.

Proposal Benefits

1. Plumbing

Many of our current plumbing components are old and are difficult to clean and assemble. Replacing these components makes our plumbing system more reliable and longer lasting, which in turn allows us to perform our tests more safely. Upgrading our system will allow us to increase the sophistication and performance of our propulsion system, which is necessary for achieving higher altitudes and launching more powerful rockets.

2. Airframe

Airframe development provides valuable learning opportunities and unique challenges for team members to take on. As well, the continued progression of this system is essential to ensure our team remains competitive and attains the best flight performance possible for our rocket, as well as maintaining a high level of safety during launch.

3. Recovery

Recovery is important in the Rocketry team because it is a grading point when it comes to competition. Additionally, the recovery sector invites any takers on participating making for a learning environment within all team members. Finally, with recovering the entire system after launch there will be a lot of cost saving for the next cycle in terms of technology and materials.

4. Launch Systems

It is crucial to have this in order to be able to launch the rocket and perform all necessary testing. The data logging allows post launch analysis to improve loading and launching operations. Live video allows for a real time view to analyze system failures.

Estimated Equipment Lifetime

1. Plumbing

Funding for this category will be used to purchase fittings that will be robust and long-lasting. We hope to avoid replacing these fittings for the next five years.

2. Airframe

Improvements to our airframe are estimated to remain for at least the remaining lifespan of our current project (2-3 years).

3. Recovery

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

4. Launch Systems

Yearly minor upgrades are expected to match each rocket's needs, although the core system is estimated to remain for five years.

Implementation Schedule

All purchases will begin soon after funding is secured and designs are finalized, likely near the end of W20, and continue into S20.

Additional Information

N/A

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Plumbing	2500	2200	1700	1100
Airframe	2800	2400	2000	1600
Recovery	1500	1200	1000	500
Launch Systems	800	600	400	200
0	0	0	0	0
Total	7600	6400	5100	3400

WEEF Funding Proposal W2020

University of Waterloo Aquadrone
Carter Ward, Team Captain; Amaar Quadri, Mechanical Lead
cjward@edu.uwaterloo.ca

Description of Proposal

University of Waterloo Aquadrone is a student design team focused on developing a fully autonomous submarine to compete in the 2020 International RoboSub Competition.

Currently we are assembling and testing the mechanical and electrical systems of the autonomous underwater vehicle. Our goal is to finish our mechanical and electrical systems by the end of March 2020, to give our vision and competition logic teams time to test the programs they have written. The systems that we have built and tested include our frame, robotic claw and pneumatic systems, and we are still developing and testing some of our more complex mechanical and electrical systems.

Our team is requesting WEEF for funding to buy the final few components that will allow us to complete the construction of the submarine.

Proposal Benefits

The funding will be immensely useful to our team as it will allow us to finish purchasing, machining, assembling and testing the designs our members have created. This will allow nearly forty engineers to gain experience with electrical and mechanical design, manufacturing and assembly.

Our members will have opportunities such as learning machining skills in the machine shop, which will be useful for their engineering careers as they will be able to rapid prototype more effectively.

Estimated Equipment Lifetime

The vast majority of the equipment that will be purchased will be useful throughout the life of our team. Every component being purchased will be used throughout until the competition in 2020, and likely beyond that as well for future competitions. This equipment will give many engineers across several different terms the chance to design, work with, and learn about an exciting area of engineering.

Implementation Schedule

All the components will be purchased immediately. This will allow our engineering students

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Batteries and Waterproofing Equipment (etc)	690	480	470	465
Upgraded PCB Components (etc)	400	340	340	340
Mechanical Mounting Components (etc)	430	430	430	430
Manipulator and Torpedos (etc)	360	345	300	300
0	0	0	0	0
Total	2440	2095	2010	2005

UW Concrete WEEF W2020 Proposal

UW Concrete Team
Rudi Rendel, Finance Captain
uwconcreteteam@uwaterloo.ca

Description of Proposal

The UW Concrete Team would like to request WEEF's assistance in purchasing items that will help in the design and construction of our concrete canoe and toboggan, and items that will assist in the safety of our competing team. We are planning to use the funding to purchase a Rhinoceros permanent software license, crampons for better traction in the snow for our competing members, and helmets for our racing team in the concrete toboggan.

Proposal Benefits

The design of a concrete canoe can be very difficult due to the curved nature of the canoe hull and body. Rhinoceros is a software that assists with modelling complex 3D shapes and mathematical formulas. Our team has experience using this software in the past to help create the detailed shape of our canoe. This software can also export files that our team can use with the CNC machine when cutting the formwork. This drastically reduces the time required for design and construction phases of the canoe.

The crampons and helmets are both key safety items for the concrete toboggan competition. Our team was unfortunate enough to have an accident at this year's competition and our high quality helmets allowed our members to escape with minimum injuries. The crampons are also important for the pushing of the toboggan in slippery conditions.

Estimated Equipment Lifetime

The equipment that we purchase will last for at least 5 to 10 years. The software license is permanent, and the crampons and helmets should last multiple years and competitions before needing replacements.

Implementation Schedule

The software would be used as soon as possible to design this years and next years concrete canoe. The helmets and crampons would be purchased as soon as possible to have them ready for next winters (2021) competition.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Helmets (x4)	1100	1100	1100	1100
Rhinoceros Software License (x2)	565	565	282.50	0
Crampons (x2)	80	40	80	40
0	0	0	0	0
0	0	0	0	0
Total	1745	1705	1462.5	1140

Student Team
Proposal F-74

Waterloo Submarine Racing Team

Waterloo Submarine Racing Team
Aurelie Sinclair, Team Lead
aasincla@uwaterloo.ca

Description of Proposal

The Waterloo Submarine Racing Team (WatSub) is Ontario's first human-powered submarine racing team, and one of very few active Canadian teams. We design, manufacture, test, and race the submarine internationally. The team is formed by students who share a passion to push their technical boundaries and seek inventive ideas - in line with the true spirit of the Faculty of Engineering at the University of Waterloo. WatSub is an opportunity to showcase unique talents in the quest to become an international competitor in submarine racing. The team looks to integrate individuals from different engineering disciplines into an exciting new challenge that requires original and comprehensive solutions. We are currently seeking equipment for our team. This equipment would allow us to continue the design, testing, and racing of our fourth submarine, named Darwin. Its three predecessors, AMY and BOLT and Claire, competed in the 2016 European International Submarine Races (eISR), 2017 International Submarine Races (ISR) and 2019 International Submarine Races (ISR), respectively. A description of the items and associated cost follows: Submersible strobe light, which is a safety requirement for the submarine at competition - $50. 2. Material for the seal of electronics enclosures - $20. 3. Small sized spare air scuba tank for the submarine pilot - $525 4. Marine sealant, for sealing around inputs and outputs of our electrical enclosures - $40

Proposal Benefits

We design, fund, manufacture, test, and race a human-powered submarine, with every step of this process done by UW students. This means exclusive learning opportunities for students, such as composites monocoque manufacturing, propeller design and optimization, advanced hydrodynamics, and many others. Our team consists of engineering students from a variety of engineering disciplines and skill levels with varying levels of time commitment, making the team inclusive and open to all students - independent of their background, experience, or schedule. The lamp ensures that the submarine is visible in the race basin. The spare air tank will simplify the process for the pilot to get into the submarine. For sponsorships over $500, WatSub will include the WEEF logo on our website, t-shirts, and submarine.

Estimated Equipment Lifetime

Light - 5 years

Scuba tank - 20 years

Seal material - 2 years

Marine sealant - 2 years

Implementation Schedule

The material for the electronics box seal and the marine sealant would be purchased as soon as possible, within the current school term. The lamp would be purchased in time for building the submarine in spring term and the spare air tank would be purchased before testing the full submarine during fall term.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Submersible Strobe Light	70	40	0	0
Material for pilot interface seal	20	0	0	0
Small SCUBA tank	525	440	0	0
Marine Sealant	40	20	0	0
0	0	0	0	0
Total	655	500	0	0

UWaterloo IISE WEEF Sponsorship Proposal

Uwaterloo IISE
Dana Mohammed, Finance Director
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Description of Proposal

The Institute of Industrial and Systems Engineers, IISE, the world's largest professional society dedicated solely to the support of the profession, is an international, nonprofit association that provides leadership for the application, education, training, research, and development of industrial and systems engineering. The purpose of this organization is to provide knowledge, training, and networking opportunities that inspire students to become technically and socially competent Management and Systems Engineers. Specifically, our chapter strives to provide avenues for growth academically, professionally, and socially through unique events and services.

Currently the team provides services such as resume critiques, mock interviews, speaker panels and run various events and workshops to allow students to develop their skills in professional, social and academical aspects. The chapter has also recently launched IISE Spotlights, which are blog posts on interviewing Management Engineering students and shining light on their amazing academic and professional experiences. Most importantly, the UWaterloo IISE team puts a great amount of effort each year in organizing and providing funding for the various events that the chapter hosts, attends and participates in. One of the main highlight events in IISE is the IISE Annual Regional Conference which targets mainly undergraduate students in different universities across Canada, and gives them exposure to networking events, speaker panels, academic and professional competitions and many other events that add to their industry experience and exposure in a professional environment.

The team also participates in various events which include open houses, Management 101, Student Design Showcase, in which the team partially represents Management Engineering and is the front face of IISE in the University of Waterloo as well. Participating in such events requires some supplies and equipment in order to help the executive team manage and execute the various events. These include a calendar (organizer) for the team to effectively plan and manage the different events it will host and participate in, upcoming milestones to meet as well as make plans for upcoming terms. Also, a Polycom conference call device will greatly help the team manage its different meetings and make it easier for members both on and off campus to easily attend the meetings. As part of IISE's mission to promote student growth in various aspects, the UWaterloo IISE Chapter will plan to arrange several competitions between students of the Management and Systems Engineering disciplines to help expose students to applicable and practical scenarios and experiences that will further help them in their transition to the working world and also prepare them for their upcoming co-op terms, in addition to preparing them for the competitions of the coming Annual IISE Regional Conference.

The chapter team also hosts various other academic, social and professional events targeted towards the students which require financial contribution. The team sincerely appreciates the Waterloo Engineering Endowment Fund in providing the chapter with any sort of funding for the items specified below in this proposal.

Proposal Benefits

The IISE Waterloo Chapter provides the opportunity for all engineering students across the university to participate in the various events that it hosts. Considering the Industrial Engineering focus in the Institution, the majority of participants are Management, Systems, and Mechanical Engineering students. One of our main goals for the upcoming events is to encourage and involve more first year students and new members into the IISE family, in a way of promoting these events as a helpful tool that will contribute to the development of the students' skills in academic, professional and social aspects. These events are also a great way for students to get a head-start in the industry prior to graduation, by hosting events that invite industry professionals, alumni and other key guest speakers that discuss career options, professional tips and insight, which will make them at an advantage upon graduation in terms of employment.

Throughout the years we have been able to successfully branch out to other engineering programs in promoting what the chapter has to offer. With Management Engineering students having the strongest presence at 45% due to the nature of the team, the team also constitutes of a wide range of students from other programs: 19% Systems Design, 12% Mechanical, 6% Software, 4% Electrical & Computer, 3% Civil, and 3% Chemical. As the chapter grows and progresses, we hope to encourage more students from different disciplines to participate in and take part of the different events being hosted.

The past year has been an extremely successful one for the UWaterloo IISE student chapter. The delegation representing UWaterloo at the University of Toronto IISE Annual Conference in January 2020 was able to earn several prizes in the competitions hosted at the conference. Furthermore, the team was previously selected to present at the 2017 IISE Annual Conference & Expo in Pittsburgh, Pennsylvania, with all other student teams and chapters attending. The team spoke about the best practices they utilize and how other chapters can implement them into their teams. Participating in these events is a great opportunity for students to represent Waterloo on an international scale and the UWaterloo chapter takes pride in this accomplishment and aims to be invited to several more in the coming few years.

Over the years, the events hosted by UWaterloo IISE have been a great way to help students develop and progress throughout their years at university, whether it be helping first year students in critiquing their resumes or hosting mock interviews prior to interview season, or inviting guest industry professionals as a way for upper year students to network and explore different career options for after graduation; in which these events have proven successful in such development over the years.

With the help of our partners and sponsors we hope to reach more students each year, and make UWaterloo IISE a student team that stands out from the rest with its appearance in representing the Institution to the best extent possible.

Estimated Equipment Lifetime

All the items mentioned above will be used by the executive team members to further develop the workflow and implementation strategy of the UWaterloo IISE agenda, which will have its effect on all future and upcoming events it participates in, attends or hosts as a symbol and representation of IISE internationally and the UWaterloo Chapter.

Implementation Schedule

All expenses contributed towards the calendar, conference call device and local competition funds will be purchased preferably upon the receipt of the funds, in order to be fully prepared for any upcoming events.

Additional Information

Calendar (Organizer):

Quantity: 1

Price per item: $50

Polycom Conference Call Device:

Quantity: 1

Price per item: $350

Local Competition Funds:

Quantity: 1

Price Per Item: $400

Cost Breakdown

Item	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Calendar (Organizer)	50	30	30	30
Polycom Conference Call Device	350	300	350	250
Local Competition Funds	400	250	450	500
0	0	0	0	0
0	0	0	0	0
Total	800	580	830	780

Student Team
Proposal F-77

Cold Saw for UW Steel Bridge Design Team

UW Steel Bridge Design Team
Erik Nurse, Finance Lead
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Description of Proposal

The UW Steel Bridge Design Team is looking to acquire a cold saw for our team.

Proposal Benefits

The cold saw will provide the team with two benefits:

1. The cold saw will allow us to make more accurate cuts on larger sized pieces of steel to be used in our modular bridge.

2. Having the cold saw in the possession of the team will allow us to have access to the saw at our discretion. Currently we do not have enough time and access to the saws and tools needed to cut steel in the Student Design Center .

Estimated Equipment Lifetime

The saw comes with a 5-year warrant included in the price . Cold saw blades can be used between 800-1000 times before being needed to be sharpened, while a blade can last 40 sharpens.

Implementation Schedule

A plan to add the saw to the team's current tool set has not yet been officially put into place.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Bailegh Manual Coldsaw (CS-275EU) $2994.54	2994.54	2500	1500	500
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	2994.54	2500	1500	500

WEEF W20 UWAFT Proposal

UWAFT
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Description of Proposal

UWAFT(University of Waterloo Alternatives Fuel Team), is a student team focused around the development and acceleration of hybrid vehicle research. Our team is compromised of about 50 undergraduate students, and 3 masters students. We have 7 sub teams that range across many disciplines (mechanical, electrical, controls, autonomous vehicles, app development, business, and systems safety), each offering training for our new members to become experts in each field. The goal of this team is to convert a 2019 Chevrolet Blazer from a naturally aspirated gasoline vehicle, to a hybrid vehicle.

To be able to integrate an electrical system effectively, our team needs reliable half shafts. Half shafts are used to transmit power from the motor to the wheels. These half shafts are common failure components for teams and often leads to teams being unable to compete at comp. Our team is requesting funding so that we are able to design and build a secondary set of half shafts, so that if the current set is to fail, we are able to continue in the competition. This is the method that many previous successful teams have employed, but our team is unable to pursue this due to budget issues. The request is to have WEEF help us achieve this.

We are also growing very rapidly as a team, with two new sub teams and many new engineering students across various stub teams. With this growing team we are looking to create more work stations, which will require new keyboards, mice, and screens. The current items we have are also outdated and many of it has started to malfunction. With resources running low and the team outgrowing our equipment, we are requesting funding to be able to catch up to where our team currently stands.

Proposal Benefits

The funding provided for half shafts will allow our team to be competitive at year 2 of the EcoCAR Mobility challenge. With half shafts being common failure components historically, the funding will allow our team the opportunity to ensure a competitive edge. This means that our team will be able continue on winning awards for Waterloo engineering and allow our students efforts to be well rewarded.

The funding for the extra computer equipment allows our team to accommodate our constant growth. With a new app development and business team, we need the equipment to allow these teams to perform efficiently. This equipment will be used for new workstations so that new members can take on more tasks and continue to get the training they need to become leaders in their respective fields.

Estimated Equipment Lifetime

The half shafts will be used in the vehicle and at competition for the next 3 years, plus an extra 3 years of vehicle functionality. The extra computer equipment often has a 5 year lifetime.

Implementation Schedule

Since these components are essential to this term's success, the funding will be used right when it becomes available. The half shafts will be ordered and manufactured for competition in May, and the computer equipment will be ordered to allow for development this term.

Additional Information

Cost Breakdown

Item	Option 1	Option 2	Option 3	Option 4
Halfshafts	6000	4500	2500	2000
Computer Accessories	1000	800	500	400
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
Total	7000	5300	3000	2400