WEEF PROPOSALS

SUMMARY

W2019

Table of Contents on last page

Chemical Dept (CHE)

W19-1438

Upgrade of A Pilot Scale Absorption Process

John Zhang
Senior Laboratory Instructor/Manager, Chemical Dept (CHE)
m78zhang@uwaterloo.ca

Description of Proposal

The proposal is to upgrade a pilot-scale absorption column with online data acquisition and process control. The proposed devices below will be essential for the implementation of the upgrading and making this unit operation process laboratory available for our first-year students to experiment on instrumentation and four-year students to conduct open-ended laboratory. Specifically, the proposed lab upgrade includes:
1. A flexible and modular DAQ device that is suitable for the first-year students to experiment on instrumentation, I/O signals, and data acquisition.
2. A computer that works with the above DAQ device and LABVIEW for data acquisition and process control of the absorption unit operation.
3. A reliable temperature controller for an electrical heater in the system and thermocouples for monitoring process temperatures.

Proposal Benefits

1. Students will use the equipment to trace instrumentation and I/O signals in the pilot scale chemical engineering process, along with the lecture course (Gene 123), and so gain better understanding of the underlying concepts and their applications.

2. The upgraded laboratory equipment will align the pilot scale unit operation process with modern industrial operations, and so very suitable for open-ended laboratory in our senior lab course.
3. The upgrade of the laboratory unit will also open the possibility of lab course integration with process control and will allow students to design, assembly, and test their own design experiments.

Estimated Equipment Lifetime

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

Implementation Schedule

The equipment can be assembled and tested as soon as they are available and will be ready for the laboratory course in the Winter term of 2020.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
NI DAQ device and modules, temperature controller.	$ 7233	$ 6063	$ 5318	$ 0
Total	**$ 7,233**	**$ 6,063**	**$ 5,318**	**$ 0**

Civil and Environmental Dept (CEE)

W19-1448

22 Computers for 4th Year CEE Labs

Syed Shah
IT Technician, Civil and Environmental Dept (CEE)
syed.shah@uwaterloo.ca

Description of Proposal

The current computers and monitors in the CEE 4th Year Labs are ~5 years old, thus aged and obsolete.

The computers are suffering from dust build up, poor thermal dissipation, aged capacitors, and failing power supplies/mechanical drives.

The monitors are suffering from prolonged usage, such as dim backlights, dead pixels, flaky connectors, scratched screens, aged capacitors, and poor thermal dissipation from dust build up.

Furthermore, the failing systems are using old standards and hardware and to improve the quality of the labs, newer hardware and standards would allow for improved usability. In other words, the computers and monitors have run their course and are due for a refresh.

We have already replaced 51 systems with this new hardware in E2-2340, thus the hardware proposed is tried and tested. There are a total of 22 systems that need to be replaced in E2-1713 and DWE-1402.

Proposal Benefits

In essence: Drastically improve the student experience, in terms of user experience, reliability and efficiency.

The newer systems are workstation grade computers, which allow for significantly heavier workloads. Not only are common tasks, like browsing or word processing, faster, but so are computationally heavy tasks. This allows students to get more done in less time.
These systems provide a superior image quality, increase workflow, productivity, and provide all around better ergonomics for students.

Estimated Equipment Lifetime

~4 Years.

Implementation Schedule

Winter 2019.
The systems will be implemented a week from approval.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Lenovo P330 Workstations + Monitors	$ 39006	$ 19503	$ 0	$ 0
Total	**$ 39,006**	**$ 19,503**	**$ 0**	**$ 0**

Civil and Environmental Dept (CEE)

W19-1491

HACH DR1900 Spectrophotometers

Mark Merlau
Lab Technologist, Civil and Environmental Dept (CEE)
mmerlau@uwaterloo.ca

Description of Proposal

The HACH DR1900 spectrophotometer is an extremely valuable instrument for colorimetric analysis of water samples. It has a wide range of adaptability that allows selection of monochromatic light of any wavelength in the visible spectrum (340 to 800 nm). The unit is lightweight, compact, and built for the most demanding field conditions. In addition to the rugged exterior, the unit comes with over 220 preprogrammed methods already built in. This helps prevent measurement errors and ensures consistently accurate results regardless of the user's knowledge.
This proposal is for two HACH DR1900 spectrophotometers and twelve pairs of 1" square glass sample cells with caps.

Proposal Benefits

The HACH DR1900 spectrophotometer is used in virtually all of the CEE water quality labs. The proposal will benefit approximately 430 students per year and will enable continued testing of water and wastewater samples.

Estimated Equipment Lifetime

Approximately 15 years, with 1-year warranty.

Implementation Schedule

Immediately upon receipt.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
DR1900 Spectrophotometer (Qty. 2)	$ 9770	$ 0	$ 0	$ 0
Sample Cells with Caps (Qty. 12)	$ 3432	$ 0	$ 0	$ 0
Total	**$ 13,202**	**$ 0**	**$ 0**	**$ 0**

Electrical and Computer Dept. (ECE)

W19-1441

ECE Lab Soldering Stations

Kim Pope
Lab Instructor, Electrical and Computer Dept. (ECE)
kim.pope@uwaterloo.ca

Description of Proposal

Purchase Benchtop Equipment for the ECE Lab (E2-3353 Lab). All approximate costs below are in CDN funds and are obtained as of Jan 28, 2019. Each soldering station purchase from TEquipment will also include a spool of free solder ($40 value).

VENDOR Offering Options TEquipment Amazon Mouser, Arbell

Weller WE1010NA 70 watt station (1 per station): $170.72 TEquipment
Weller WSA350 Benchtop Smoke Absorber (1 per station) 92.77 Amazon
SAI ESD Mat 11-00-3-A-2436 (22x36 inch - 1 per station) 51.36 Arbell
Adafruit PCB Holder (# 291) 8.78 Mouser

TOTAL PER STATION COST: $323.63 plus HST + shipping

Proposal Benefits

For the upcoming launch of the ECE-298 course (S2019) there will be approximately 130 and a further 187 students in the F2019 term. Students are wanting to get experience in in scehmatic design, PCB design and in acquiring skills for soldering components to PCB's for their projects.

Skills acquired during this lab course will also be very useful for their 4th year projects course (ECE-498) and for future lab work in industry.

Estimated Equipment Lifetime

Typically ten years for the soldering station and smoke absorbers.

Implementation Schedule

This is required for the S2019 term. For the ECE-298 course we will require sets for 24 stations.

Additional Information

Purchase Options
Option 1: Purchase cost for the above equipment for all 24 stations
Option 2: Cover HALF of the Purchase cost for the above equipment for all 24 stations. The other half will be covered by the ECE department.

HST and shipping costs are NOT included in the costing.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Benchtop Equipment Financing Proposal	$ 7768	$ 3884	$ 0	$ 0

Total	**$ 7,768**	**$ 3,884**	**$ 0**	**$ 0**

Electrical and Computer Dept. (ECE)

W19-1453

ECE GPU Upgrade for ECE 459

Eric Praetzel
Lab. Instructor, Electrical and Computer Dept. (ECE)
praetzel@uwaterloo.ca

Description of Proposal

I propose to upgrade an old graphics card and possibly deploy more on the ECE Ubuntu servers for ECE 459 and other courses.

Proposal Benefits

ECE 459 is a very popular high performance computing course with ~180 students registered every Winter. New courses like ECE 493T21 (autonomous vehicles) also require GPUs but their exact needs are in flux. The ECE 493 prof. was looking for 20+ GPUs to use this term.

ECE has four diverse GPUs - a newer Tesla P4, a very old M2090, a newer GTX 1060 and a GTX 1070 which I donated. These vary widely in performance and the M2090 in particular is 2x slower than the GTX 1070. Ideally all machines would have the same GPU so that students could use any machine and get similar runtimes. The Tesla P4 is not upgradeable. Runtimes for the various GPUs for ECE 459 assignment 2 are:

M2090: 195 seconds
GTX 1060: 140 seconds
Tesla P4: 110 seconds
GTX 1070: 95 seconds
GTX 1080: 70 seconds

There are several upgrade options:
1) replace the old M2090 so that all are somewhat similar in performance
2) replace the M2090 & GTX 1060 with the GTX 1060 being an emergency spare
3) #2 above and buy a GTX 1080 or 1080ti for high perf. computing

Estimated Equipment Lifetime

5 years

Implementation Schedule

S2019

Additional Information

The option for buying a GTX 1080 (or better) is so that a compute server could be setup where students submit jobs and each job is run one at a time. Currently a server will have upto 50 students submitting jobs overlapping with each other, and the GPU can run two at a time at half speed, and three at a time at 1/3 speed. So it's very hard to get repeatable runtimes with the current setup but the students are primarily concerned about being able to effectively use the GPU and it's not so much a competition to see who can have the fastest runtime (but what's wrong with that!).

Cost Breakdown

Item	Option1	Option2	Option3	Option4
One GTX 1070	$ 350	$ 0	$ 0	$ 0
Two GTX 1070	$ 0	$ 700	$ 0	$ 0
Two GTX 1070 + GTX 1080	$ 0	$ 0	$ 1200	$ 0
Total	**$ 350**	**$ 700**	**$ 1,200**	**$ 0**

Electrical and Computer Dept. (ECE)

W19-1454

ECE 222 - RISC-V Programming Boards

Eric Praetzel
Lab. Instructor, Electrical and Computer Dept. (ECE)
praetzel@uwaterloo.ca

Description of Proposal

I propose to purchase upto thirty HiFive1 RISC-V microcontroller boards for ECE 222.

Proposal Benefits

The HiFive1 is an Arduino-compatible RISC-V development board. The programming language is similar to the MIPs processor that CS uses and it is much easier to learn than the ARM processors we currently use.
RISC-V is a fully open microprocessor unlike the ARM, Intel or AMD designs. The student ASIC group has been working on developing RISC-V processors.
ECE 222 uses simpler microcontrollers like this to learn assembly language programming - the simplest programming language that is just above the hardware.

We have been using ARM processors for years (thanks to WEEF purchasing 100 Tiva boards three years ago!) but their programming language is quite complex, with many traps for beginning programmers and our goal is to have the students learn programming, not idiosyncrasies of ARM assembly language.

RISC-V is gaining momentum for both it's academic teachability, and research freedom for making ASICs and FPGA versions, and it's open-source philosophy. Companies such as nVidia and AMD are supporting RISC-V and we believe it will be a technology that will empower UW Engineering students as never before to be able to have both a processor and a board that are open source and part of the ECE undergrad cirriculum.

Please support our proposal to purchase HiFive boards for the ECE labs as soon as they are back in stock. RISC-V is the future of computing.

Estimated Equipment Lifetime

5 years

Implementation Schedule

S 2019

Additional Information

In W2019 we offered the RISC-V processor as an option and it was adopted by 95% of the class. However, the hardware we used (ECE 124 FPGA board) was not optimal. If we use a standard cheap development board then the students can buy their own and perhaps it can be made available via Rigidware.

My expectation is that the WEEF funded Arduino like shield I made for the Tiva boards will work on this board and provide LEDS, 7-segment displays and a speaker.

Recent analysis shows that RISC-V is able to put a 64-bit processor in half the
die-area and uses half the power of a comparable ARM processor.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
10 HiFive1 boards	$ 850	$ 0	$ 0	$ 0
20 HiFive1 boards	$ 0	$ 1700	$ 0	$ 0
30 HiFive1 boards	$ 0	$ 0	$ 2550	$ 0
Total	**$ 850**	**$ 1,700**	**$ 2,550**	**$ 0**

Electrical and Computer Dept. (ECE)

W19-1455

Digital Control Laboratory Equipment

Carmen Caradima
Lab Instructor/ Coordinator, Electrical and Computer Dept. (ECE)
carmen.caradima@uwaterloo.ca

Description of Proposal

The MME and ECE departments have been using equipment from Quanser and National Instruments to support the lab component of ECE.484 (core course for MTE students) and ECE.481 (elective course for ECE students) in the Digital Control Laboratory. A few SYDE, BME, and ME students typically also join this class.
In a project format, students conduct a self-paced exploration of a ball and beam system, which they model and then design controllers for it. Due to the diverse schedules of fourth year students, the lab is run in a 24/7 open format: students reserve a station and drop in to work on the lab, with or without lab staff assistance.
In Fall 2018, the first double-class of MTE completed ECE.484. Feedback from students indicated that the number of stations available was suboptimal, leaving some groups to do lab work at very late hours or unable to benefit from consulting assistance.
We are proposing to expand the lab capacity by an additional 3 stations.

Proposal Benefits

1. Will lower the groups/station ratio to a manageable load; this is currently an issue for the double MTE class.
2. This lab teaches advanced control techniques, while coping with nonlinearities inherent to mechanical systems. Such hands-on and loosely structured labs require our students to do more independent experimentation and creative thinking, which results in deeper learning, while exercising their project and time management skills. These gains make our students more employable and competitive in the job market after graduation.
3. Will benefit approximately 230 students per year.

Estimated Equipment Lifetime

At least 10 - 15 years.

Implementation Schedule

Spring 2019

Additional Information

Option 1: full cost for 3 complete systems
Option 2: 3 x ball & beam systems
Option 3: 2 x ball & beam systems + 1 x NI system
Option 4: 2 x ball & beam systems

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Quanser ball and beam systems	$ 20697	$ 20697	$ 13798	$ 13798
National Instruments cRIO + AI card + servo drive	$ 14187	$ 0	$ 4729	$ 0
PCs, monitors, custom parts (Eng Mach Shop)	$ 5100	$ 0	$ 0	$ 0
Total	**$ 39,984**	**$ 20,697**	**$ 18,527**	**$ 13,798**

Electrical and Computer Dept. (ECE)

W19-1469

ECE Maker and VR Equipment

Derek Wright
Graduate Attributes Lecturer, Electrical and Computer Dept. (ECE)
derek.wright@uwaterloo.ca

Description of Proposal

The ECE curriculum is increasingly adding open-ended design to its EE and CE curricula. However, there is a dearth of supporting equipment available to students. Most notably, there are no VR platforms for students to sign out, and there is no dedicated ECE 3D printer. These issues have been raised numerous times, especially in capstone design projects where the budget is insufficient to cover the capital expenditure. This funding request is to acquire four VR headsets (Oculus Rift x 2 and Go x 2) that students can sign out for extended periods, and one 3D printer that is exclusively for ECE student use (Cubicon Single+). If there is significant uptake of these resources, I will submit a future proposal that includes supportive departmental funding.

Proposal Benefits

ECE students will gain access to increasingly commoditized VR platforms, gaining valuable resume-ready experience without incurring the cost. Further, they will be able to 3D print enclosures, mechanisms, fasteners, and physical articulations for their personal and curricular projects. This will add to the project polish and the students design skill set.

Estimated Equipment Lifetime

The VR headsets ought to last for years, though the hardware may become comparatively sluggish in four years time. The 3D printer ought to last 10 years without requiring a significant rebuild.

Implementation Schedule

The VR equipment will be made immediately avalbe to students for sign-out. The 3D printer can be housed in E2 3155 (the PCB prototyping area) or in the E7 IEEE Student Society space and can be used immediately following bring-up.

Additional Information

ECE will initially fund the 3D printer consumables, and may in time change to passing the cost directly onto student teams or as course operational expense as appropriate. Option 1 and 3 are for one each of the VR headsets, Options 2 and 4 are for two each. Options 3 and 4 include the 3D printer.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Oculus Rift	$ 508	$ 1015	$ 508	$ 1015
Oculus Go	$ 372	$ 744	$ 372	$ 744
Cubicon Single+ 3D Printer	$ 0	$ 0	$ 4746	$ 4746
Total	**$ 880**	**$ 1,759**	**$ 5,626**	**$ 6,505**

Mechanical and Mechatronics Engineering (MME)

W19-1440

Collaborative Robotic Manipulators

William Melek
Director of Mechatronics, Mechanical and Mechatronics Engineering (MME)
william.melek@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 currently makes use of two robots designed and built by the company CRS. However, CRS was bought by another company in 2004 and no longer exists. This means that the robots are increasingly difficult to repair and the technology is increasingly dated. To ensure that our engineering students are taught relevant technology, a new collaborative robotic manipulator is being pursued. Collaborative robots work alongside humans and represent the next major wave of robotic manipulators.

Proposal Benefits

By purchasing a new collaborative 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 the same equipment as the ECE version of the course, allowing added support if required. The robot will also allow us to develop a new course for human robot interaction and artificial intelligence

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

Immediate

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Kinova Gen3 Ultra Lightweight Robot	$ 150000	$ 75000	$ 0	$ 0
Total	**$ 150,000**	**$ 75,000**	**$ 0**	**$ 0**

Mechanical and Mechatronics Engineering (MME)

W19-1458

MME Digital Logic Lab Hardware Upgrades

Allyson Giannikouris
Lecturer, Mechanical and Mechatronics Engineering (MME)
allyson.giannikouris@uwaterloo.ca

Description of Proposal

The Mechanical and Mechatronics students only take one digital logic course as part of their core programming. This is a fantastic opportunity for students to work with tools they may see in the co-op jobs while experimenting with course concepts. Or it would be if we weren't stuck at the turn of the century, somewhere around 2005 to be more exact.

The age of our current equipment is a problem. It's not reliable, so we are limited to 8 groups per session despite having 10 stations. Replacing broken equipment is problematic as all of the systems we use are now deprecated. New labs are currently in development that will use updated FPGA hardware and software. Currently we are using a 13 year old version of an FPGA tool that has been deprecated for several years. The lab equipment is desperately in need of an update, which will also allow the lab studies to be updated so that they are more relevant to today's students and better prepare them to use these tools in the workplace.

Adding stations to the lab would also allow students to work in smaller groups.

Proposal Benefits

These labs are the only core program exposure to FPGAs and PLCs. Upgrading the labs will not only ensure they are using the current industry standard tools that they may encounter on a co-op term, but also allow more challenging exercises as less time is spent learning tools.
Increasing the number of stations will have a positive impact on student learning by allowing for smaller groups. In the Fall 2018 term, the Tron students had roughly 30 students per lab section so most students were part of a group of 4. The lab was originally designed with groups of 2 in mind. With 12 working stations, students will be in groups of 2-3, with every additional station getting us closer to the goal of students completing the exercises in pairs.

Estimated Equipment Lifetime

We expect the equipment to last for 8 – 10 years. The equipment will be maintained by MME lab staff.

Implementation Schedule

The department has committed to a lab update in August 2019. They have committed funds to replace all current FPGA boards and install updated FPGA software and PLC software on all systems. They have also committed to adding two additional lab stations at a cost of roughly $6,700 per station.

Additional Information

While the department has agreed to replace the FPGA boards and add two additional stations. There is space in the room to add up to 2 more, for a total of 14 stations. There are also other upgrades the lab would greatly benefit from. Note that these upgrades are independent of each other and more than one option could be funded. Taxes and shipping have been excluded from estimates.

Option 1: Additional Stations
Add up to 2 additional stations at a cost of roughly $6,700 each

estimated costs
Computer and monitor - $1125.00
FPGA board - $75.00
PLC and interface card - $1500.00
Parts for robot - $4000.00

Option 2: Monitor Upgrades
Upgrade the existing monitors to 21” or 22” widescreen (have you ever tried to program on a 17” that wasn’t widescreen with a group of 3-4? Not fun) at a cost of approx. $125 per monitor for 9 stations (one has already been replaced) for a total of $1125.00.

Option 3: RAM Upgrades
The current computers have only 4 GB of RAM. Compilation for FPGA code will be slow on these machines with the current tools and Windows 10. Only the existing computers need upgrades as computers for new stations will be purchased with 8 GB. 2 x 4 GB sticks of DDR3 are needed for each machine, with costs of ~$80 per computer based on Canada Computers and NewEgg for a total cost of $800.00.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
New lab station	$ 6700	$ 0	$ 0	$ 0
Monitor Upgrades	$ 0	$ 1125	$ 0	$ 0
RAM upgrades	$ 0	$ 0	$ 800	$ 0
Total	**$ 6,700**	**$ 1,125**	**$ 800**	**$ 0**

W19-1501

Ankle-Foot Orthoses Lab for ME 597

James Tung
Assistant Professor, Mechanical and Mechatronics Engineering (MME)
james.tung@uwaterloo.ca

Description of Proposal

This proposal is to develop a lab module for the ME 597 Neural and Rehabilitation Engineering technical elective. Beginning in 2016 with 5 students, ME 597 has expanded annually to a current W19 enrolment of 25 students from MME and SYDE/BME. With roots as a reading course, the content relies heavily on scientific literature and guests (e.g., cochlear implant users) but lacks pragmatic lab content. The aim of this proposal is to support the development of an orthotics lab module to introduce and exercise biomechanical and gait analysis methods. The proposed module encompasses 2 parts: 1) creation of lower limb models and ankle-foot orthoses designs using CAD (e.g., SolidWorks) and AnyBody biomechanics modeling software, and 2) fabrication of 3D printed components to permit biomechanical gait analysis using existing teaching lab equipment (i.e., forceplates, EMG, motion capture). This proposal seeks funding to acquire AnyBody software licenses, materials, and components to fabricate a set of ankle-foot orthoses to develop and refine the proposed lab module. The module will be developed with the assistance of undergraduate students already engaged in designing Advanced Lower-Limb Orthoses (who will take the course in Winter 2020).

Proposal Benefits

The primary benefit of the proposed funding are future ME 597 students. By providing access to tools (i.e., AnyBody biomechanics modeling software), orthoses designs, and equipment to evaluate their effects on gait parameters, the course will enrich student experience. Considering the aging population, demand for both rehabilitation products (e.g., orthoses) and skilled personnel to address disabilities and promote recovery (e.g., following stroke) are growing proportionally. Furthermore, students will have access to state-of-the-art tools to design and fabricate projects eligible for student design competitions in the rehabilitation engineering field (e.g., IDeA, RESNA, Cybathlon). This proposal will also allow more people to expand their design activities in the field of neurorehabilitation.

Estimated Equipment Lifetime

Requested software will have perpetual licenses, supported by updates to 5 years. Materials and components to fabricate orthoses is expected to last for 3 years (i.e., 3 course offerings). It is expected that early designs will be studied to understand basic ankle-foot orthoses, with materials repurposed from old models for new/refined designs. Plans to sustain the proposed lab module will be considered after the initial offerings are conducted and annual operational costs are analyzed.

Implementation Schedule

Software licenses and materials will be ordered immediately to facilitate development of models and fabrication of initial designs (Winter 2019). Laboratory protocols using motion capture systems (i.e., Vicon) will be generated following orthoses fabrication (Spring 2019). Trial runs of the lab module will be conducted Fall 2019, with initial offering anticipated Winter 2020.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
AnyBOdy software, 3D print material, components	$ 2250	$ 2000	$ 1750	$ 0
Total	**$ 2,250**	**$ 2,000**	**$ 1,750**	**$ 0**

Nanotechnology Engineering Dept (NANO)

W19-1436

MA-8005 Manipulators (DC Probes) for Nano Undergra

John Saad
Laboratory Instructor, Nanotechnology Engineering Dept (NANO)
john.saad@uwaterloo.ca

Description of Proposal

This proposal is for purchasing MA-8005 Manipulators (DC Probes) for Nano undergraduate laboratories.

Proposal Benefits

We are planning to purchase new MA-8005 Manipulators that will upgrade the lab from very old worn out probes to new professorial look and very precisely controlled manipulator. It will allow students to measure the sheet resistance for different semiconductor devices. Currently, all NE students are borrowing 5 of these setups from the ECE labs, and as the NE program already doubled the throughput of the circuit's laboratory since spring 2016, there is a need to purchase another 20 new sets. Those setups will be used to expand our equipment to fit in devices testing lab for NE 242 course (Electronic devices).

The expected benefits of the proposal are:
1. To provide new units needed for doubling our labs.
2. To provide spare units to enable quick replacement of faulty units during the lab thus reducing inconvenience to the student group at the problem station.
3. These manipulators will be used in engineering undergraduate course : NE 242 (Electronic devices)
4. It will serve about 120 undergrad students.
5. Could be used for capstone design projects

Estimated Equipment Lifetime

10+ years

Implementation Schedule

Spring 2019

Additional Information

It is our expectation that NE will match WEEF Funding.
Option#1 for 20 units while option#2 for 10 units

Cost Breakdown

Item	Option1	Option2	Option3	Option4
MA-8005 Manipulator from Semiprobe	$ 30000	$ 15000	$ 0	$ 0
Total	**$ 30,000**	**$ 15,000**	**$ 0**	**$ 0**

Engineering Student Machine Shop

W19-1449

Waterjet Cutter for Engineering Student Shop

Peter Teertstra
Director, Sedra Student Design Centre, Engineering Student Machine Shop
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. There are two machine shop facilities that are currently available to students. The E7 Project Shop is a beginner's shop, offering training sessions for students on the use of the milling machine or metal lathe. The E5 Machine Shop is intended for students who are familiar with operating machining tools, and the level and nature of the supervision and the types of tools and equipment provided are reflective of this. In addition to existing conventional milling machines and lathes, the E5 Machine Shop also offers CNC milling machines, welding and sheet metal fabrication.

One of the significant challenges for students working on projects is to accurately and safely cut and drill complicated sheet metal shapes. Most of the time this work is done on a bandsaw and a drill press, resulting in poor part quality and a high risk of injury if the workpiece breaks free.

To address this concern, the Engineering Student Shop is proposing the purchase of an Abrasive Waterjet system, to be installed in the E5 Machine Shop. The waterjet would be used by the Shop Instructors and students to fabricate detailed accurate parts for student team, course based and personal projects.
The operating cost of the equipment, approximately 20 cents per minute for the garnet abrasive material, would be paid for by students when they purchase material from the RigidWare store, or in some other manner.

Proposal Benefits

There are currently no waterjet cutting systems available on campus for access by undergraduate students, leaving only research-based machines (which are inaccessible to students) or outside companies. There is a significant need to access professional quality waterjet cutting equipment for students from all Engineering programs in an open facility, such as the E5 Machine Shop. The specifications for this equipment include a reasonable sized working area (12 x 12 inches) and the ability to cut through up to 1-inch-thick metal, glass, plastic, word and more. Having this equipment available will improve the quality of the end-products and reduce fabrication time significantly, compared to conventional method.

Another benefit is student safety, which is greatly improved using waterjet cutting versus using conventional machines. Cutting complex shapes and drilling holes in a single operation using a waterjet is a safe alternative to performing many operations using sharp, poorly guarded, difficult to use and often dangerous equipment such as a bandsaw or drill press.

Estimated Equipment Lifetime

The waterjet will be administered by the instructor responsible for the E5 Machine Shop. 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. Maintenance of the equipment will be performed on a regular basis as recommended by the manufacturer, and all replacement parts will be purchased by the Engineering Student Shops.

Implementation Schedule

The goal is to purchase and install the equipment during the Spring 2019 term. Once the equipment has been installed and training resources have been put in place, full access should be possible by the start of the Fall 2019 term.

Additional Information

Part of expense would be paid for by reallocating funding provided for Tools and Equipment for the E7 Project Shop, WEEF Proposal #S18-1313. There is currently approximately $8000 of unspent money in this project.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Protomax Personal Abrasive Waterjet	$ 40283	$ 0	$ 0	$ 0
Total	**$ 40,283**	**$ 0**	**$ 0**	**$ 0**

ENGINEERING

W19-1467

E2 Foyer Furnishings & Student Space Upgrades

Mary Robinson
Assoc Director First Year, ENGINEERING
mary.robinson@uwaterloo.ca

Description of Proposal

The furnishings in the E2 foyer don't meet the needs of the students using it and are in dire need of updating. Students are looking for a comfy place to sit, work on their laptops, or charge their phones - currently, this space does not meet those needs. This proposal helps support the upgrades to this space, make this space more inviting to students, and leverage opportunities within the University community.

Proposal Benefits

The improvement of student spaces is a current focus of the University. We can leverage the funding of the big grey study tables, similar to those found across Engineering, with this work. The Dean's Office is helping to co-ordinate the work with Plant Ops and sourcing the furniture.

Estimated Equipment Lifetime

10+ years for the tables, chairs, and couch... depending on level of use/abuse.

Implementation Schedule

Co-ordinating the wall repair and electrical work with Plant Operations has been challenging, especially since this is a low priority project for them. My hope is to have this work complete by Sept 2019.

Additional Information

This proposal continues the work started under S18-1330.

Recent consultation with EngSoc B council is being used to guide this work and from that consultation, we now know we need more money for more chairs & couches.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Armchairs (3 @ $1800 each)	$ 4200	$ 0	$ 0	$ 0
Side tables (3 @ $500 each)	$ 1500	$ 0	$ 0	$ 0
Total	**$ 5,700**	**$ 0**	**$ 0**	**$ 0**

Engineering IDEAs Clinic

W19-1468

Ideas Clinic Autonomous Vehicles

Chris Rennick
Engineering Instructional Developer, Engineering IDEAs Clinic
chris.rennick@uwaterloo.ca

Description of Proposal

The Engineering Ideas Clinic is working to bring real-world problems and equipment to undergraduate students. We firmly believe that "bringing the real-world into the classroom" will reinforce the theory you are learning in lecture, show you the context of that material, and will provide an opportunity for you to integrate all the knowledge you are learning.
To continue bringing meaningful, hands-on activities to students, the Ideas Clinic needs to continue purchasing equipment. As we move forwards, the Ideas Clinic is pushing into domains that until very recently only existed in research labs. The popularity of courses and student teams centered around autonomous vehicles says to us that there is demand for students to get hands-on with equipment from that domain. As a university, if we want you to succeed in this domain, we need to provide the opportunity to experience it where there are proper supports in place.
This proposal is seeking WEEF's support of what we are calling the "Digital Ideas Clinic", and is housed on the second floor of Engineering 7. We are seeking $9,000 (half of the total cost) from WEEF for bench-scale autonomous vehicle platforms. The Ideas Clinic is currently employing two graduate students who are developing a platform that can be used in technical electives across the Faculty of Engineering.

Proposal Benefits

The unique equipment in this facility will allow the Engineering Ideas Clinic to hold high-impact Engineering Days events for Electrical and Computer Engineering students, upper year Mechatronics Engineering students, and others. In addition, this equipment can be used to directly support existing (and new) technical electives from across Engineering.
An estimated 1500 students per year will directly benefit from the activities which this equipment will allow.

Estimated Equipment Lifetime

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

Implementation Schedule

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

Additional Information

The Engineering Ideas Clinic will match the contribution from WEEF dollar for dollar.
WEEF previously supported other equipment for this initiative in the Spring '18 and Fall '18 terms (S18-1299, F18-1365).

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Raspberry Pi 3, $100 or NVIDIA Jetson, $500 each	$ 600	$ 3000	$ 0	$ 0
Traxxas barebones chassis and charger ($400)	$ 2400	$ 2400	$ 0	$ 0
Batteries ($50)	$ 300	$ 300	$ 0	$ 0
Sensors (range, LIDAR, encoders), $600	$ 3600	$ 3600	$ 0	$ 0
Various Electronics (motor controllers,etc): $250	$ 1500	$ 1500	$ 0	$ 0
Wiring, connectors, fasteners: $100	$ 600	$ 600	$ 0	$ 0
Total	**$ 9,000**	**$ 11,400**	**$ 0**	**$ 0**

IEEE University of Waterloo Student Branch

W19-1473

MME Fourth-year Lounge Upgrades

Zack Eskandar
Fourth-Year Lounge Committee Member, IEEE University of Waterloo Student Branch
zeskandar@uwaterloo.ca

Description of Proposal

Currently, there are approximately 350 fourth-year MME students who share a 200 sq. ft. room as lounge space. Primary concern lies in the organization, features, and utility of the spaces. Many of the current fourth-year MME students have expressed displeasure with the current lounge conditions. Thus, the objective of this proposal is to create enjoyable on-campus lounge space that current and future fourth-year MME students can use to relax and complete class work.

This proposal requests funding to renovate the space, including replacing/adding new furniture in the context modifying study spaces/layout to better suit student needs and to update the current furniture (which are in a state of disrepair). Such furniture includes:

- 6 new study tables
- 8 new chairs to be used with said study tables
- 1 adjustable-height work/collaboration tables

Proposal Benefits

The proposal benefits are that MME students in their 4th year, both current and future, will better be able to enjoy their lounge space. The current configuration and condition of study furniture in the lounge is outdated and subsequently, under-utilized. The contents of the proposal, if granted, students will have provide students with better study spaces that are clean and comfortable to work in. It will also give students a renewed sense of respect for the space.

Estimated Equipment Lifetime

The equipment is well-built and estimated to last 25-30 years.

Implementation Schedule

The furniture will be purchased soon as (potential) funding is received. Following order and receiving of the furniture, the furniture will be installed in the lounge space over the course of two weeks.

Additional Information

All items listed are from KI.com (save for one of the options for the chairs). KI is a preferred vendor of the University of Waterloo due to its products being well-built and fire-proof (as per the appropriate specifications).

Cost Breakdown

Item	Option1	Option2	Option3	Option4
2 Collaboration/Standing Deks (Total Price Shown)	$ 3824	$ 3687	$ 0	$ 0
6 new study tables (Total Price Shown)	$ 5865	$ 5614	$ 0	$ 0
8 X new chairs (Total price shown)	$ 4719	$ 911	$ 0	$ 0
Total	**$ 14,408**	**$ 10,212**	**$ 0**	**$ 0**

The Iron Warrior (IW)

W19-1439

Whiteboard and Corkboard for The Iron Warrior

Samridhi Sharma
Editor-in-Chief, The Iron Warrior (IW)
s273sharma@uwaterloo.ca

Description of Proposal

The Iron Warrior has recently moved to another room and we do not have the methods to brainstorm ideas, the way we used to. It would be awesome to have a whiteboard in the office so that everyone has a chance to observe and contribute, unlike now, where the EIC takes notes in a notebook and no one else really knows what is happening.

We would also like to have a corkboard in the office so that we can proudly display the work and contribution of all the members involved, thereby encouraging more people to join the club.

Proposal Benefits

Higher morale in the members, more people joining the club, increased participation from existing members, more awareness and higher quality of article ideas.

More engaging content in the paper is another benefit, such as comics, etc, because artists would have an added incentive of having their drawings displayed on the board for years to come.

Estimated Equipment Lifetime

10 years.

Implementation Schedule

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Whiteboard	$ 33	$ 30	$ 30	$ 0
Cork Board	$ 46	$ 23	$ 30	$ 0
Total	**$ 79**	**$ 53**	**$ 60**	**$ 0**

Engineering Society (EngSoc)

W19-1492

EngSoc Chairs

Michael Beauchemin
VP Finance, Engineering Society (EngSoc)
vpfinance.b@engsoc.uwaterloo.ca

Description of Proposal

The Engineering Society has started to update its furniture in POETS per the POETS furniture plan, available on our website under internal documents (2017). The furniture company that EngSoc is using to source these chairs has studied students seating habits and designed its furniture for maximum durability and comfort. All furniture purchased is approved by current fire code standards. It is important that the Society puts its best foot forwards, especially as POETS is a hot-spot of tours for incoming students.

Proposal Benefits

Replacing the furniture increases the amount of enjoyment and engagement in POETS. It also makes the space more attractive and welcoming to passers-by, which would encourage more students to use the space. New furniture also reduces the risk of potential hygiene issues as a result of ripped upholstery. Over 100 people per day enjoy the atmosphere and ambiance of POETS by using the furniture.

Estimated Equipment Lifetime

The last time new furniture was ordered for POETS, Mary Robinson was still the VP Education. This was more than 15 years ago, and these new chairs are expected to last longer (20 years or more)

Implementation Schedule

The plan is to purchase chairs after funding is released, and goal is to have them implemented into POETS early in the Spring 2019 term.

Additional Information

FedS' Student Life Endowment Fund has funded 6 couches to date (3 in each 2018 and 2017). There remain 1 couch, 2 love seats, and 12 chairs to finish refurbishing the POETS Space. Now that the E7 C&D is open, Engineering Capital Improvement Fund money from the Engineering Society may be allocated to purchasing couches, chairs, and loveseats.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Sela Lounge Chair	$ 24000	$ 16000	$ 8000	$ 2000
Total	**$ 24,000**	**$ 16,000**	**$ 8,000**	**$ 2,000**

Waterloo Architecture Student Association (WASA)

W19-1475

Industrial Sewing Machine for Architecture Campus

Maria Smirnova
3A Student WEEF Representative, Waterloo Architecture Student Association (WASA)
msmirnova@uwaterloo.ca

Description of Proposal

A sewing machine and additional accessories for the school of architecture would prove majorly beneficial and a resource for any and all undergraduates at the school (that being about 300 students in the engineering faculty), as well as graduate architecture students, and faculty.

A sewing machine, which is pretty self-explanatory for in function, will be used for projects of all scales, from small projects in textile studies and industrial design, to the larger possibilities of pavilions and constructions using tensile structures. This machine would grow our arsenal of tools with which architecture students can use to create and design with.

Proposal Benefits

- A tool to expand and push our design capabilities and as a result help with all sorts of projects
- No alternative tools can be used to replace a sewing machine, aside from hand sewing (very time consuming)
- Base machine will not need upgrading due to newer technologies over time. Because it's a sewing machine.
- The suggested accessories upgrade the machine to higher standards allowing a much greater range of use and are necessary.
- A resource students do not have available at the moment, either on campus or off, unless privately owned.
- Useful to over 300 undergraduate students in the engineering faculty

Estimated Equipment Lifetime

As there is very little that needs upgrading, the only lifetime shortening will be of parts that can over time and excessive use wear out and need replacing. However, the machine itself has a very long estimated lifetime.

Implementation Schedule

Can be installed immediately after delivery into any free space in any architecture fabrication lab.

Additional Information

As the machine will not need an entire replacement to it due to technology updates over time, it makes sense to go directly to the higher model, as it is able to do more, and will be around for as long as needed.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Accessory - Machine Bobbins	$ 9	$ 9	$ 0	$ 0
Accessory - Swing Down Roller Edge Guide	$ 107	$ 107	$ 0	$ 0
Industrial Sewing Machine	$ 2154	$ 1499	$ 0	$ 0
Total	**$ 2,270**	**$ 1,615**	**$ 0**	**$ 0**

Baja SAE

W19-1474

UW Baja SAE W19 Proposal

Stan Lu
Team Lead, Baja SAE
stan.lu@uwaterloo.ca

Description of Proposal

The UW Baja SAE team is currently building an entirely new vehicle for Baja SAE Rochester. We have already secured funding for several important components and began construction of the chassis. This proposal is focused on some of the remaining components required by the team to construct an operational vehicle:

Shock Absorbers – The team needs a set (pair) of shock absorbers for the rear suspensions of the vehicle. This component is crucial to the vehicle's load transfer, ride comfort, and kinematic performance (handling).

Front Suspension Bearings – Swivel bearings on the front suspensions will allow the front wheel assembly to be stronger and allow for more range of motion for traversing through obstacles.

Aluminum Billet – These billets are for machining the front wheel hubs. Hubs are what connects the wheels and the brakes to the rest of the vehicle.

Wheels – Off-road tires wear out faster due to the terrain we drive on. We will be testing on older worn (bald) tires, however a new set of wheels would be ideal at competition to provide the vehicle with more traction and better handling.

Proposal Benefits

All items will assist the team in building the new 2019 vehicle, allowing undergrads to develop hands-on technical engineering skills. All proposed items have been carefully selected and designed for the past 8 months by teams of dedicated undergrads. By funding these items WEEF will help turn our designs into reality and allow members of the team to learn from and improve upon their design decisions.

Additionally, funding UW Baja SAE allows the team to operate normally. This means participation in many on-campus engineering events such as open houses, political and business visits to E5, and engineering outreach events. The team also provides (and funds) projects for fourth-year design teams.

Estimated Equipment Lifetime

All proposed items will last the lifetime of the new vehicle, which will most likely exceed 3 years based on past vehicle lifetimes.

Implementation Schedule

All items will be purchased literally within the hour the proposal is approved.

Additional Information

Feel free to mix and match any options.

UWaterloobaja@gmail.com or my personal email for any questions. I would be happy to clarify any questions or concerns.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Shock Absorbers	$ 2000	$ 1800	$ 1500	$ 0
Front Suspension Bearings	$ 480	$ 320	$ 160	$ 0
Aluminum Billet	$ 400	$ 300	$ 200	$ 0
New Wheels	$ 1000	$ 750	$ 500	$ 0
Total	**$ 3,880**	**$ 3,170**	**$ 2,360**	**$ 0**

Midnight Sun Solar Rayce Car Team

W19-1472

Midnight Sun Solar Car Team Array

Clarke Vandenhoven
Lead, Midnight Sun Solar Rayce Car Team
crvandenhoven@edu.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 early stages of designing our next car MSXIV and request an additional $20,000.00 to purchase a new solar array. The purpose of the solar array is to use photovoltaic cells (PV cells) to convert energy from the sun into electricity which powers the vehicle. We intend to represent the University of Waterloo internationally at the American Solar Challenges in 2020 where this solar array will be a required part of our car.

We will likely be approaching SunCat Solar and SunPower Corporation to purchase and encapsulate our array with a total cost of approximately $30,000.00. We are currently defining the dimensions of our car necessary to develop specifications for our custom-made array with an expected order-date in Spring or Fall of 2019.

Proposal Benefits

Solar arrays are an essential but very expensive part of building solar-powered electric vehicles and as such, by supporting the purchase of our array 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 and encapsulation of our solar array, 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 solar arrays will be two years.

Implementation Schedule

The following is our implementation schedule for assembling the solar array:

1) Order the solar array in Spring/Fall 2019

2) Solar array encapsulation in Spring/Fall 2019

3) Integration into our next car in Winter 2020

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Solar Array	$ 20000	$ 15000	$ 10000	$ 0
Total	**$ 20,000**	**$ 15,000**	**$ 10,000**	**$ 0**

Nanorobotics Group (UW_NRG)

W19-1487

UWNRG Equipment Funding Proposal

Skye Torrance
Business and Marketing Team Member, Nanorobotics Group (UW_NRG)
sktorran@edu.uwaterloo.ca

Description of Proposal

The University of Waterloo NanoRobotics Group is an undergraduate research and design group made up of members from a variety of engineering programs. Our goal is to research, design, and construct robots at small scales using cutting edge micro-design concepts to manipulate matter. Our team competes at the International Conference on Robotics and Automation (ICRA), which is hosted by The Institute of Electrical and Electronics Engineers (IEEE). In our past competitive years, we have participated in the Mobile Micro-Robotics Competition as well as the Micro-Assembly Challenge. We perform well at these events; just last year at ICRA 2018 we placed second for micro-assembly and this year we plan to take home first at ICRA 2019 in Montreal.
We are developing new and unique robots to compete at the competition. Some of our exciting robots in development that are expected to compete are Solenoid Actuated Movement (SAM), Micro-Assembly YBCO Apparatus (MAYA), and Surface Acoustic Wave (SAW). Each robot has a unique approach to micro mobility and assembly. We are taking an entirely new competitive approach and are very eager to test our latest designs against the best the world has to offer. UW_NRG will push the boundaries of possibility in mobile micro-technology.

This term we are asking for $1938.49 to reimburse the purchase of a 25 MHz function generator, silicon wafers, neodymium magnet cubes, a dual power supply, microliter pipettes, the parts for a PCB, and the printing costs for posters. These items are essential to finally getting our new robots MAYA and SAW to a competitive standpoint, as well as fine-tuning SAM to ensure maximum potential.

Proposal Benefits

(1) Providing Value to the Engineering Undergraduate Community
We are a dynamic team made up from multiple different faculties. UW_NRG has grown considerably since its inception in 2007. We currently have about 35 active members dispersed among multiple faculties.
These programs include:
- Nanotechnology Engineering
- Software Engineering
- Electrical and Computer Engineering
- Biomedical Engineering
- Chemistry
- Physics
- Computer Science
- Mechatronics Engineering

We give undergraduate students the opportunity to gain unique and valuable skills as part of a student research team. We have opportunities in the lab, in business, marketing, programming, experiment design and analysis, literature review, etc. As a result, students are well-prepared to be competitive for co-op and gain experience in subjects complementary to their studies.
(2) Community and International Exposure for WEEF
WEEF will gain exposure on our team apparel, which is worn in community events and at international competitions, and have their logo posted on our website, on our posters, and on our banners.

Estimated Equipment Lifetime

The 25 MHz function generator, undoped silicon wafers, neodymium magnet cubes, dual power supply, microliter pipettes, PCB parts, and poster will last indefinitely unless damaged.

Implementation Schedule

All of the items we are pitching for will be purchased following the approval of the proposal.

Additional Information

The support WEEF has given UWNRG in the past is highly appreciated. By supporting UWNRG, WEEF will be enabling us to continue developing our research in this cutting-edge field. We look forward to maintaining our mutually beneficial relationship.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
25 MHz Function Generator	$ 589	$ 589	$ 589	$ 589
Undoped Silicon Wafers	$ 549	$ 549	$ 549	$ 549
Neodynium Magnet Cubes	$ 164	$ 164	$ 164	$ 164
Dual Power Supply	$ 332	$ 332	$ 332	$ 0
Microliter Pipettes	$ 155	$ 155	$ 0	$ 0
PCB Parts	$ 92	$ 92	$ 0	$ 0
Poster	$ 60	$ 0	$ 0	$ 0
Total	**$ 1,941**	**$ 1,881**	**$ 1,634**	**$ 1,302**

Alternative Fuels Team (UWAFT)

W19-1442

UWAFT

Vaibhav Patel
Mechanical Co-Lead, Alternative Fuels Team (UWAFT)
vaibhav.n.patel@uwaterloo.ca

Description of Proposal

CAV Computer:
- Necessary to handle CAV simulations and development
- Currently all development is done on personal laptops and it not sufficient for new competition
- Will be used for the entirety of EcoCar 4

Oscilloscope:
- Will help the team with debugging electrical issues with the vehicle
- Helps us measure accurate power draws for our HV system and motors
- We need this to do detailed baselines on the component operations especially for targeted tests
- Will be used for the entirety of EcoCar 4

Proposal Benefits

Bronze Sponsor ($500):
- signed team photo
Silver Sponsor ($1000):
- + UWAFT gear and logo on website
Gold Sponsor ($5000):
- + featured in blog post, facility tour, and standard vehicle logo
Platinum Sponsor ($10000):
- + vehicle company visit, invitation to UWAFT workshops, and access to team resumes

Estimated Equipment Lifetime

4-8 years

Implementation Schedule

ASAP

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
CAV Computer	$ 3370	$ 3040	$ 2560	$ 0
Oscilloscope	$ 4850	$ 4120	$ 3670	$ 0

Total	**$ 8,220**	**$ 7,160**	**$ 6,230**	**$ 0**

Robotics Team (UWRT)

W19-1471

UW Robotics W19

Fraser Robinson
Team Lead, Robotics Team (UWRT)
f3robins@edu.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 two years out of an application pool of over 90 universities, placing 22nd globally in 2018 and 15th globally in 2017. Along with URC the UWRT is also committed to community outreach; making a name for University of Waterloo robotics and encouraging a creative and inventive Waterloo. In Fall term, the team put on courses for first year students in September, ran a workshop for WiSTEM's step into STEM day in October, and represented University of Waterloo robotics at the grand opening of Balzac's Coffee Roasters in Waterloo in November.

The past two seasons have been significant in UWRT team history since what has been a ground up revamp undertaken three years ago. After five years of not competing the team has attended URC for two years in a row and is looking to invest in technology that will increase the rover's competitive edge that much more. For all three previous years the team has used communications routers and antennas that are now over five years old. These parts are bulky, difficult to interface with new systems, and unreliable. UWRT is looking to purchase industry leading Ubiquiti Rocket routers and a Bluebeam Ultra MadmMushroom antenna, allowing rover commands to be reliable for years to come. These routers and antennas are a top priority for the team this term to solidify the backbone of the rover control system.

A recent funding search has seen the team secure a partnership with the industry leading PCB design software company Altium, allowing students the opportunity to design and build their own custom boards for projects like arm control and science sensor sampling. These boards have already been sponsored by Advanced Circuits, with funding now being sought for build up. With all the connectors sponsored from a partnership with JST, purchased parts would include everything from encoders to resistors to solder paste. High quality components will ensure adequate system quality and reliability for these boards to support all of their mechanical systems.

To house many of the new electronics and increase the overall rover aesthetic the team recently began an electrical box project. This system will manage, protect, and cool the majority of electronic components on the rover and prove a great clean surface for sponsorship stickers. Proper monitoring of all housed components is critical, necessitating high end materials for this project. Components will include plastics for outer walls, standoffs for structure, fans for cooling, buck converters for voltage stepping, and distribution blocks for power distribution.

Last term, WEEF generously funded the purchase of two Blackfly S cameras, and after initial testing it has been determined camera lenses would be hugely beneficial. Allowing for a wider field of view will allow for more rover visibility and fine tuning potential when attempting image stitching. To complete the team's autonomy setup, a 10 port USB hub, LED strips, and a higher bandwidth USB expansion card all also being requested. All of these components will last through multiple robots and have been selected for their long lifespan and robust nature.

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.

Communications is critical to team performance at competition, with the team losing camera feeds at the past two competitions. Using the 2.4GHz and 900MHz frequency devices students on the team will be given the opportunity to learn industry level networking skills, configuring the technology to communicate over distances of several kilometers reliably and effectively. The entire team depends on a well functioning communication system and this new technology will enable everyone to be unbounded by any previous communication issues. Ubiquiti and Bluebeam are industry leaders in communications with their fast, light, easy to use products. All solutions have been heavily researched by the communications team to ensure they are the best solution for the rover with unmatched performance and longevity.

Properly funding board components will ensure that all of the hard work the electrical team put into board design will come to flourish. It will also make full use of the Altium sponsorship that the team has secured, providing often difficult to get experience with an industry leading circuit design tool. Board bring up will also give students a great opportunity to learn hands on skills such as SMT soldering and debugging.

The electrical box project fills the need that the team has had for a long time of a presentable surface for sponsor stickers both new and old. It will be professional in both appearance and design, giving the opportunity for all subteams to collaborate in building one of the most visible parts of our rover. With new sponsors like KHK Gears, JST Connectors, and Altium along with long term sponsors such as WEEF and EngSoc the electrical box will not only increase sponsor exposure but additionally increase appeal for new potential sponsors.

USBs are the main interface used between the Jetson TX2 supercomputer and the rest of the rover electronics. A USB hub will ensure that all of these connections are made in a compact, efficient, and safe way. LED strips will go a long way in complementing the electrical box and overall rover appearance, while the USB expansion card will increase Jetson communication quality with the cameras and motor controllers, both of which WEEF has helped purchase. The camera lenses will allow for more diverse software applications that are easier to tune, helping the team to get the most of the new Blackflys. A superior camera experience affects all aspects of the rover, with the biggest impact on the autonomy team. This team continues to be a thriving section of UWRT with roles varying from basic object detection to path planning. It is because of industry like equipment that this project is made possible, ultimately allowing students to transition to professional careers involving technologies like machine vision and autonomous driving.

Estimated Equipment Lifetime

Ubiquiti Rocket 900s and Bluebeam Ultra will last 5+ years at competition and be useful for 10+ years of testing.

Custom boards and the electrical box will last 3-4 years as it serves the new rover and components such as fans and encoders can be repurposed for extended use of 5+ years.

LED Strips, USB hub, and USB expansion card will last 5+ years and can be used for any number of projects.

CS Lenses will last 5+ years with the potential to increase Blackfly lifetime.

Implementation Schedule

Ubiquiti Rocket 900s, Bluebeam Ultra, LED Strips, USB hub, USB expansion, and CS Lenses will be purchased

immediately so that testing can be done as soon as possible.

Custom board components and electrical box parts will be purchased as designs are finalized and second revisions of boards are made. This will be done before the end of the S19 term.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Bluebeam Ultra MadMushroom Antenna	$ 100	$ 100	$ 100	$ 0
2 x Ubiquiti Rocket M900 Router	$ 500	$ 500	$ 500	$ 0
Electrical Box Project	$ 750	$ 500	$ 250	$ 0
Custom Board Components	$ 1000	$ 500	$ 250	$ 0
USB Hub	$ 40	$ 40	$ 40	$ 0
LED Strips	$ 31	$ 31	$ 0	$ 0
USB Expansion Card	$ 110	$ 0	$ 0	$ 0
Computar CS Mount Lenses	$ 250	$ 250	$ 125	$ 0
Total	**$ 2,781**	**$ 1,921**	**$ 1,265**	**$ 0**

Rocketry Team

W19-1499

Waterloo Rocketry- W19 Proposal

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

Description of Proposal

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

We recently flew our new rocket Unexploded Ordnance (UXO) at our annual competition and finished first in our category (10,000 ft Student Researched and Developed Hybrid/Liquid) for the second consecutive year. We attained an altitude of 13,412 ft, which is the highest altitude the team has ever reached and and the highest out of any hybrid or liquid rocket at last year's competition. Building on this success, our team is targeting a 30,000 ft apogee this year. In order to attain this goal, we will need to optimize the weight of our vehicle systems and increase our engine's efficiency and power.

We are requesting funding for five main categories:

1.Run Tank Stand Development

This system will need to be modified in order to correspond with the dimensions of the new rocket, as well as undergo a general upgrade to allow better integration with other updated systems. As well, our current blast shield would be updated for increased safety during tests. Funding for this category would mainly be used for fabrication material.

2. DAQ Development

Funding for this category would be used to upgrade the current data acquisition system, allowing us to more reliably evaluate the performance of our engine. DAQ funding will be used primarily to purchase electrical components such as shielded cable and instrumentation.

3. Fill Disconnect System Upgrades

Our engine requires dedicated plumbing systems to fill with oxidizer prior to firing. This system uses manual and motorized valves to load the engine with propellant, and it is crucial that the fill line can be disconnected remotely, in an efficient way. Upgrades to this system will make it more robust and functional. Funding for this category would mainly be used for fabrication material and plumbing components, such as quick connect fittings.

4. Composite Fabrication Equipment

This equipment will be used during the manufacturing of key parts of our rocket such as our nose cone and fins to create parts that are strong and light. By having this equipment, our team will be able to create a rocket with better performance due to the reduced weight of composites, giving us an advantage against other teams at our competition.

5. Shelving

New shelving would greatly improve the organization in our workbay, allowing us to work more efficiently.

Proposal Benefits

1. Run Tank Stand Development

An improved run tank stand offers multiple operational and safety advantages during testing. As we are unable to perform full-scale launches in Canada, ground testing remains the only reliable source for collecting data necessary for the development of our systems. Upgrades would improve the efficiency and reliability of this system. Furthermore, modifications to safety features, such as the blast shield, would decrease any risk to spectators or personnel.

2. DAQ Development

Data acquisition is crucial in verifying and improving the reliability of our systems, and an upgrade to the system will allow us to further optimize our rocket's design. We have experienced reliability issues with our current system, which compromises our ability to evaluate our engine's performance, and can also create dangerous situations if the state of our system is not fully known. Performing upgrades to DAQ will allow us to operate more safely and push our designs further.

3. Fill Disconnect System Upgrades

Our automated fill disconnect system is one of our most important systems, as it allows the rocket to be filled and prepped remotely, greatly improving the safety and efficiency of our launch operations. Ensuring that this system is as robust and functional as possible is crucial for the safety of personnel.

4. Composite Fabrication Equipment

New tools and equipment for composite fabrication would be used to improve the precision of the construction of the rocket's systems. It will make the process safer, quicker and more reliable.

5. Shelving

The reorganization of the workbay improves both efficiency and safety, as well as giving us more space to work.

Estimated Equipment Lifetime

1. Run Tank Stand Development

The project would be dedicated to modernizing our existing test stand, increasing its life by a minimum of 5 years.

2. DAQ Development

Funding would be allocated to update our existing DAQ systems, extending its viability for a minimum of 3 years.

3. Fill Disconnect System Upgrades

Although our fill disconnect system may change from year to year, the plumbing components purchased for this project will be reusable for other systems and should last at least 5 years.

4. Composite Fabrication Equipment

All tools and equipment purchased will be commercial and of high quality, and we do not anticipate replacing them within the next 5 years.

5. Shelving

The lifetime of good-quality shelving is expected to exceed 10 years.

Implementation Schedule

1, 2, and 3.

As these projects are related to the enhancement of systems currently in development, work would begin immediately and take place over the W19 and S19 terms.

4 and 5.

All requested items can be purchased as soon as funding is secured.

Additional Information

N/A

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Shelving	$ 600	$ 500	$ 400	$ 300
Composite Fabrication Equipment	$ 800	$ 700	$ 600	$ 500
Fill Disconnect System Upgrades	$ 400	$ 350	$ 300	$ 250
DAQ Development	$ 200	$ 160	$ 120	$ 80
Run Tank Stand Development	$ 500	$ 425	$ 350	$ 275
Total	**$ 2,500**	**$ 2,135**	**$ 1,770**	**$ 1,405**

Waterloo Aerial Robotics Group (WARG)

W19-1463

WARG W19 Proposal

Mark Dunk
Team Lead, Waterloo Aerial Robotics Group (WARG)
uw.warg@gmail.com

Description of Proposal

The Waterloo Aerial Robotics Group (WARG) is a team of passionate students developing autonomous aerial vehicles capable of performing various tasks. WARG intends to compete in the annual AUVSI Student UAS competition, in June 2020.
This term WARG will be hosting a series of educational workshops with the aim of introducing new students to the world of aerial robotics. The team will also be hosting a small student competition for participants of this workshop, that all engineering students are welcome to attend.
To this end, WARG is requesting sponsorship for components for additional aerial parts for these workshops and the competition. The team is looking to purchase 3 additional quadcopters that are to be used by the new recruits. These same quadcopters are then expected to be used for the main AUVSI competition that the team will participate in next year. Additionally, the team intends to purchase new batteries and chargers for the quadcopters.

Proposal Benefits

WARG's first priority is student learning, and prides itself in designing and building every aspect of the system from scratch. From the custom designed board that runs the autopilot, the autopilot itself, our image processing suite, our network infrastructure systems including the ground station and tracking antenna and now soon the custom composite airframe, it is sufficient to say that our members get the utmost raw exposure to everything it takes to build an unmanned aircraft. As such we give all our members the opportunity to work on any of the above aforementioned projects, providing them with invaluable, applicable experience.
This term the team is allocating efforts in a series of workshops for new students who are unfamiliar with the world of aerial robotics. The workshops are aimed at absolute beginners, and will cover everything to flight dynamics of a quadcopter to the intricate parts of an autopilot. A competition will be hosted between these members to test their newly taught skills.
The competition will use smaller quadcopters, with the main premise of getting students to learn to tune these vehicles for autonomous flight through a set of trajectories. The competition will be hosted indoors, and students will be judged based on tracking accuracy and power usage, which their tuning will affect directly.
WARG is hoping for support from WEEF for our workshops to fund the purchase three quadcopters, to be used directly for student learning. In addition to the quadcopters, we are looking to replace our aging supply of lithium batteries. Replacing these batteries ensures the safety and reliability of our aircraft. The team is also hoping to obtain funding for battery chargers as the current ones requires a DC supply and are only capable of charging one battery at a time. Being able to rapidly charge multiple batteries is particularly useful at events, such as student engagement and competitions.
WEEF is currently in our highest sponsorship bracket. This proposal will allow WEEF to continue to be a "High Flyer" sponsor. Being a High Flyer means that a large WEEF logo will be added to our aircraft, website and on team apparel.

Estimated Equipment Lifetime

The estimated lifetime for the quadcopters is approximately 3 years, the batteries will last from 2-3 years depending on use conditions, and the battery chargers should last at least 5 years.

Implementation Schedule

WARG will be purchasing all items in late Winter to early Spring 2019.

Additional Information

Team Website: www.uwarg.com
Photos: www.flickr.com/photos/uwarg
Competition Rule: https://tinyurl.com/y7bxq45c

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Lithium Batteries	$ 400	$ 200	$ 200	$ 0
Battery Charger	$ 500	$ 200	$ 200	$ 0
Quadcopter	$ 1500	$ 1500	$ 1000	$ 1000
Total	**$ 2,400**	**$ 1,900**	**$ 1,400**	**$ 1,000**

UW Formula Motorsports

W19-1482

Formula Motorsports Proposal

Ryan Aldous
Business Team Member, UW Formula Motorsports
uwfsae@gmail.com

Description of Proposal

The UW Formula Motorsports Team designs, builds, tests and competes with an open-wheel competition car, competing in the Formula SAE series. Our proposal is intended to support long-term team goals to make us go faster than ever before.

Proposal Benefits

Potentiometers are the foundation of any suspension validation. Not much can be proven through simulations without concrete readings that come from potentiometers. They are an essential tool for learning and innovating, allowing our team to interpolate and extrapolate data to make proper and educated adjustments to the car so it can reach its maximum potential.

In order to get an even epoxy spray onto our molds we need a functioning epoxy gun. This purchase will allow us to achieve a cleaner finish of our carbon parts and a more even bond between layers of our molds.

Estimated Equipment Lifetime

Current potentiometers were purchased in the summer of 2013. We expect this batch to last at least 5 years.

Implementation Schedule

Items will be purchased and installed immediately on the 2019 vehicle and will be racing for the first time in May 2019.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Linear Shock Potentiometer	$ 2000	$ 1500	$ 1000	$ 500
Epoxy Gun	$ 173	$ 173	$ 0	$ 0
Total	**$ 2,173**	**$ 1,673**	**$ 1,000**	**$ 500**

Waterloo Architecture Students Association (WASA)

W19-1495

WASA -- Lathe Tools for Fabrication Lab

Alexa Holder
1B WEEF Representative, Waterloo Architecture Students Association (WASA)
amholder@edu.uwaterloo.ca

Description of Proposal

The University of Waterloo School of Architecture fabrication lab is a space for students to participate in the process of making, allowing them to represent their design via physical models and providing another avenue for project development. The equipment in the shop allows students to experiment with the process of constructing installations, models, sculpture, furniture and other projects through hand tools, workshop machinery and digital fabrication tools.

Currently, there is a growing interest among the student body in woodturning on the electric lathe. At the moment, there is only a very limited set of tools for working on the lathe. The basic tools in the workshop don’t allow students to explore the full capacity of this piece of equipment: For instance, they don’t allow for hollowed projects (i.e. bowl-like forms).They are poorly made, making them more difficult to use and potentially dangerous for beginner woodturners.

The items in this proposal will be for woodturning tools to make hollowed projects and replace existing woodturning tools with higher quality, safer tools.

Proposal Benefits

Overall, the proposal will benefit the entire student body at the school of architecture by providing tools for students to learn woodworking. Ammar Ghazal and Joanne Yau, students with experience in woodturning, have expressed interest in running workshops for students who wish to learn to use the lathe, an event that could occur if we had a more comprehensive set of tools. This would ensure these new tools are well-used and accessible to all students.

Estimated Equipment Lifetime

Students will need to sharpen the tools occasionally for optimal performance. However, these items are quality tools that are expected to last 10 years.

Implementation Schedule

Immediate.

Additional Information

At the first-choice price point, students will be provided with the tools that are essential for making hollowed projects, expanding the diversity of what can be turned on our lathe with a scroll chuck and better, more diverse turning tools. It will additionally replace all the low quality woodturning tools with new ones. Subsequent price points expand the set of available tools, but don't replace the existing poor quality ones.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Oneway Basic Scroll Chuck (1â€• thread)	$ 225	$ 225	$ 225	$ 0
Economy Turning Tools Set	$ 402	$ 283	$ 136	$ 0

Total	**$ 627**	**$ 508**	**$ 361**	**$ 0**

Waterloo iGEM

W19-1459

iGEM Automated Lab Proposal

Kingsley Wong
Team Lead, Waterloo iGEM
k222wong@edu.uwaterloo.ca

Description of Proposal

Thanks to your support in the past, our genetic engineering team has been able to design, execute, and present great synthetic biology projects. Waterloo iGEM recruits UW students from all faculties, and we have a strong representation of students from the Engineering Faculty. We offer students an opportunity to apply engineering principles to solve a real world problem. From designing gene circuits, developing math models and software, to analyzing social implications of our project, our team has something for everyone. Moreover, we are not only a benefit for our team members: we also offer interesting, hands-on workshops for UW students! We host discussions on ethical dilemmas as well as provide opportunities for students to perform lab experiments. We are also always happy to provide lab tours or have students shadow one of our team members for a day! In 2019, we're hoping to expand our team to do more hardware. To do this, we need more lab automation.

Proposal Benefits

Lab automation has several benefits. It would speed up our progress, allowing us to complete more work throughout the year and perform better in the competition. It would also be a great opportunity for students to learn more about using automation. For instance, they would have the opportunity to develop code for robotic automation. Moreover, the less time our members spend carrying out repetitive tasks like pipetting, the more time and effort can be put towards designing, troubleshooting, and redesigning experiments.

Estimated Equipment Lifetime

If granted, equipment would be very well take care of. After speaking to company representatives, we estimate this new equipment would last around 12 years.

Implementation Schedule

We hope to purchase new equipment in early 2019 and train our team on it as soon as possible.

Additional Information

N/A

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Opentron Pipetting Robot	$ 4000	$ 0	$ 0	$ 0
Pipette Set	$ 700	$ 1000	$ 1250	$ 0
Motorized Serological Pipette	$ 250	$ 600	$ 0	$ 0
Total	**$ 4,950**	**$ 1,600**	**$ 1,250**	**$ 0**

Software Eng.

W19-1496

Revitalizing SE shared space with new cables

Roxane Fruytier
Software Engineering Society VP of Events, Software Eng.
roxane.fruytier@uwaterloo.ca

Description of Proposal

SE students have access to two labs and a lounge with table space and monitors. These monitors have older cables (VGA) which most laptops don't support, so they go unused. As an SE Soc exec, several students have come forward to me asking for the possibility to acquire HDMI cables and adapters so they could take advantage of the monitors when doing assignments and/or collaborating with others on projects.

This proposal also includes USB-C dongles as well as USB-C and MagSafe 2 power adapters. The MagSafe 2 laptop chargers currently available in the SE shared space have worn out after extensive use by students in the past 3 years, and require replacement. As well, most laptop owned by SE students do not support MagSafe 2 chargers anymore. In the past, it would be difficult to purchase a power adapter which could be used for more than a small subset of laptops, but with USB-C becoming the de facto interface for charging, we are able to accommodate more students with these purchases. A MagSafe 2 charger is also requested for students with older MacBook models and to replace the existing ones that have worn out.

Proposal Benefits

The items requested in this proposal would benefit a significant portion of the SE cohort. As software students, most of our assignments require the use of a laptop and the use of monitors allows us to be more productive on campus. Thus, these HDMI cables can help revitalize the labs with more up-to-date equipment so students can make better use of the lab space. In addition, the results of a recent survey sent to the SE student body, and which received over 67 responses from off and on stream students, showed that 48 respondents would use the monitors if HDMI cables were provided, of which 21 respondents already use the provided monitors today.

Software students rely on their laptops for the majority of the work they do, and the availability of these laptop chargers are a lifesaver. Many students already use the laptop chargers provided in the SE shared space, but some of them are broken due to their extensive use. Replacing them and providing new ones will allow more students to charge their laptops without having to commute back home to get their own laptop chargers. Furthermore, the results of a recent survey showed that 29 respondents have used the provided laptop chargers located in the SE shared space. Additionally, 50 respondents said they would use the laptop chargers if a more wide variety of them were made available, which is as many people who use the whiteboards available in those spaces based on the survey’s answers.

Estimated Equipment Lifetime

5+ years. The equipment would not undergo very much wear and tear. We would put WEEF stickers on the equipment, label them SE property and potentially secure them to the tables. We already provide dongles and power adapter and thus theft should be of minimum risks.

Implementation Schedule

Once funding is received, we will immediately go forward with purchasing the equipment and installing it in the labs.

Additional Information

The equipment will be purchased primarily from Monoprice and Amazon (the prices tend to be much cheaper than big box

electronics stores).

Cost Breakdown

Item	Option1	Option2	Option3	Option4
85W MagSafe 2 Power Adapter	$ 99	$ 0	$ 0	$ 0
5-Port 60W USB Wall Charger (1 USB-C, 4 USB-3.0 A)	$ 60	$ 60	$ 0	$ 0
USB-C (male) to USB-C (male) cable	$ 15	$ 15	$ 0	$ 0
USB-C (male) to USB-A (female) adapter (2)	$ 16	$ 16	$ 16	$ 0
USB-C (male) to HDMI (female) adapter (2)	$ 30	$ 30	$ 30	$ 30
HDMI cable (5)	$ 17	$ 17	$ 17	$ 17
Total	**$ 237**	**$ 138**	**$ 63**	**$ 47**

Engineers wihout Borders (University of Waterloo)

W19-1451

Engineers Without Borders - Podcast Microphones

Sennett Kennaley
Fundraising Lead, Engineers wihout Borders (University of Waterloo)
saskennaley@uwaterloo.ca

Description of Proposal

Engineers Without Borders (EWB) Waterloo Chapter has its own podcast titled "Ideas WIthout Borders". EWB has currently uploaded 11 episodes with one more currently in progress. Topics of these podcasts range from world issues, such as the Dakota Access Pipeline, to topics relating more to students, such as mental health. The podcasts can feature anywhere from 2-10 speakers and last approximately 30 minutes. The goal of these podcasts is to spread awareness of the chosen topic throughout the Waterloo campus as well as to open a dialogue with the EWB general members.

The podcasts are currently being recorded on a smartphone, which is not ideal. EWB would like to increase the production value of our podcasts by using industry standard microphones. EWB would like to purchase 3 Blue Yeti USB microphones, however options have been provided for 1 and 2 microphones.

Proposal Benefits

The current production value of the EWB podcasts inhibits our listeners from understanding everything being said. EWB is also interested in presenting our podcasts as a more professional form of media. Using a phone for podcast recordings appears amateur and is not the image EWB would like to our listeners. In order for our podcast messages to be clearly heard as well as respected as professional microphones are necessary.

Estimated Equipment Lifetime

The microphone(s) should last approximately 10 years. Considering EWB releases on average six podcasts per year, this would mean an increased production value on roughly 60 more podcasts if production schedule remains constant.

Implementation Schedule

Once funding is confirmed, the microphone(s) will be ordered through Amazon and can be implemented into our next podcast recording.

Additional Information

The following link is for the Ideas Without Borders Spotify page:
https://open.spotify.com/show/0bmA7i51FTe1b5l3ud92rA?si=DenvYpJZQ6m_1JC_t7J1-g

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Blue Yeti USB Microphone	$ 369	$ 255	$ 141	$ 0
Total	**$ 369**	**$ 255**	**$ 141**	**$ 0**

Concrete Toboggan & Canoe

W19-1447

UW Concrete Team - WEEF PROPOSAL W19

Sinthujan Kalainathan
Finance Lead, Concrete Toboggan & Canoe
skalainathan@uwaterloo.ca

Description of Proposal

The UW concrete team would like to receive funds for various equipment to be able to build concrete canoes and toboggans for years to come. With WEEF's help, we would like to procure a new weighing scale and adapter, as well as a license for the desktop version of Rhino for the computer in the Design bay.

Proposal Benefits

The rules for the competition are strict on weight requirements. The scale would help us ensure that all parts of our toboggan and canoe are within the guidelines as well as helping us be more accurate in the measurements of our concrete mixes. Additionally, with the purchase of Rhino 6 we will be able to better construct our concrete canoe, as right now we are working on free trials and would prefer the comfort of having one license for the team.

Estimated Equipment Lifetime

The weighing scale and adapter should last between 15-20 years. The Rhino 6 software should be adequate for 5 years.

Implementation Schedule

We would like to purchase all these items by the middle of February to be able to start production of our canoe for the Spring 2019 competition.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Rhino 6 - Software	$ 292	$ 0	$ 0	$ 0
Weighing Scale and Adapter	$ 228	$ 0	$ 0	$ 0
Total	**$ 520**	**$ 0**	**$ 0**	**$ 0**

UW Steel Bridge Team

W19-1470

Winter UW Steel Bridge Team Sponsorship

Stephan Marlés Werner
Finance Captain, UW Steel Bridge Team
scmarles@edu.uwaterloo.ca

Description of Proposal

As the Finance Captain of the UW Steel Bridge Team, we are requesting a sponsorship from the WEEF committee for a new plasma cutting table to improve our methods of construction and design of connections to represent the university in a higher regard at competitions. This will allow the team to make more advanced cuts for our members.

Proposal Benefits

Benefits will be towards the Civil/Eviro/Geo Engineering Students who have a strong drive to participate in the steel/infrastructure industry. Team members will be able to participate in the industrial construction of members and joints. The team is currently requires a better plasma cutting table for the newly purchased plasma cutter, which WEEF assisted in purchasing. With more experienced welders, through practice sessions, the team will be able to create more meticulous joints and members that will greatly increase the University of Waterloo's presence in competitions.

Benefits:
1.Exposure to a new welding technique
2.Rate at which members can become more proficient in the trade increases
3.More complex joints and members can be assembled
4.Faster construction time than usual
5.Will serve 50 members that keep increasing per year

Estimated Equipment Lifetime

CROSSFIRE CNC Plasma Table with Water Table - 5 years

However, with proper care and maintenance, +10 years.

Implementation Schedule

Winter 2019 Term

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
CROSSFIRE CNC Plasma Table with/out Water Table	$ 2500	$ 2260	$ 0	$ 0
Total	**$ 2,500**	**$ 2,260**	**$ 0**	**$ 0**

Waterloo Submarine Racing Team

Sasha Hall
Team Lead, Waterloo Submarine Racing Team
s24hall@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 third submarine, named Claire. Its two predecessors, AMY and BOLT, competed in the 2016 European International Submarine Races (eISR) and 2017 International Submarine Races (ISR), respectively. A description of the items and associated cost follows:
1. Angle Grinder - $95 – removing excess material from cut pieces
2. Electrical Test Leads - $200 – use with SDC electrical equipment
3. Digital Multimeter - $100 – for team electrical work
4. Hand Tools - $120 – such as wire strippers, calipers, jig saw blades, sand paper jigs, mill gauge
5. Soldering Iron Kit - $200 – for team electrical work

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 weigh scale will provide students with hands on experience on composites and resin mixture measurements. The chairs will improve the ergonomics of the work environment and promote team work in the bay leading to a better atmosphere and create more learning opportunities. For sponsorships over $500, WatSub will include the WEEF logo on our website, t-shirts, and submarine.

Estimated Equipment Lifetime

1. Angle Grinder – 5 years
2. Electrical Test Leads – 5 years
3. Digital Multimeter – 5 years
4. Hand Tools – 5 years
5. Soldering iron kit – 5 years

Implementation Schedule

All items would be purchased as soon as possible or have already been purchased, as they are necessities. We endeavor to have these purchases made by April 2019.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Angle Grinder	$ 95	$ 150	$ 0	$ 0
Digital Multimeter	$ 100	$ 200	$ 0	$ 0
Hand Tools	$ 120	$ 250	$ 0	$ 0
Soldering Iron Kit	$ 200	$ 300	$ 0	$ 0
Electrical Test Leads	$ 200	$ 200	$ 0	$ 0
Total	**$ 715**	**$ 1,100**	**$ 0**	**$ 0**

Autonomous Sailboat (UWAST)

W19-1493

UW Sailbot - Winter 2019 WEEF Proposal

Jessen Liang
Mechanical Production Lead, Autonomous Sailboat (UWAST)
rjliang@uwaterloo.ca

Description of Proposal

UW Sailbot designs, builds, and programs autonomous wind-powered vessels to compete in the International Robotics Sailing Regatta (IRSR). The team grew from just five core members in 2016 to 15 core members and 50 general members from more than 7 programs.
In June 2018, the team competed at the IRSR in Worcester, MA and placed 4th overall, with 2nd in collision avoidance, 2nd in presentation, and 3rd in endurance. This is admirable performance for a 2nd year team, and this year UW Sailbot has its eyes set even higher.
Tackling IRSR 2019, the team aims to focus on refining the 2018 boat to increase its autonomy and speed. In addition, the team will focus on knowledge integration and help new members get more involved.

To prepare for the 2019 Build Season, UW Sailbot would like to request an assortment of hardware and mechanical periphery. This is to prepare for several control surface overhauls; namely, the rudder, keel, and Sailwinch. A custom made Sailwinch motor and gearbox will be constructed this term. In addition, the rudder controls, actuators, and linkages are being reconstructed. The keel is also being re-laid.

The usages and purposes of the parts required are discussed below.

Male Waterproof Connector - $79.52 - CAN-enabled connector for external periphery
Female Waterproof Connector - $125.52 - CAN-enabled connector for external periphery
Sensor Breakout Board - $100.00 - Central Sensor Board – process all external data
Rudder Controller Board - $50.00 - CAN to Rudder Control Board
Winch Controller Board - $50.00 - CAN to Sailwinch Control Board
Power Distribution Board - $100.00 - Ensures even power distribution to all systems
Hot Air Rework Station - $1086.72 - Allows soldering extremely small components
HiTec Actobotics Servo Arm - $27.96 - To prevent stripping as with plastic servo arms
HiTec HS5086WP Waterproof Servo - $66.00 - Rudder Servo
VexPro 60t Spur Gear - $21.00 - Part of Sailwinch Gearbox
VexPro 48t Timing Belt Pulley - $24.00 - Part of Sailwinch Gearbox
VexPro 60t Belt - $22.00 - Part of Sailwinch Gearbox
VexPro 12t Pinion - $38.00 - Part of Sailwinch Gearbox
Pinion Puller - $60.00 - For Sailwinch Gearbox Assembly
VexPro 20t Spur Gear - $15.00 - Part of Sailwinch Gearbox
Andymark RS – 775 125 Motor - $60.00 - Part of Sailwinch Gearbox
2-56 x ¼” Servo Screw, 25pk - $4.67 - Proprietary Servo Horn Screw

Proposal Benefits

We are the University of Waterloo’s sole and premier autonomous maritime team. As wind-powered, passively driven water vessels, sailboat dynamics present a unique engineering challenge requiring skills not found on any other student design team. Over 50 team members split over 3 teams combine their skills to create a competitive boat. A Mechanical team learns

about hull design, hydrodynamics, and aerodynamics, using 3D Modelling and Simulation Software. Hardware-inclined students gain experience with power electronics, electric motors, and sensor integration. For Software students, path planning, location recognition, embedded programming, machine learning, and computer vision are fields central to our team mission. The team has also been internationally recognized, having been featured on CTV for our 2018 Boat Launch and winning distinctions in competitions internatioanlly. In addition, the team helps the university promote the engineering program by presenting at Open House, SDC events, Alumni Reunion, and more.

Estimated Equipment Lifetime

Male Waterproof Connector - $79.52 - 3 Years – Projected time until system redesign
Female Waterproof Connector - $125.52 - 3 Years – Projected time until system redesign
Sensor Breakout Board - $100.00 - 3 Years – Projected time until system redesign
Rudder Controller Board - $50.00 - 3 Years – Projected time until system redesign
Winch Controller Board - $50.00 - 3 Years – Projected time until system redesign
Power Distribution Board - $100.00 - 3 Years – Projected time until system redesign
Hot Air Rework Station - $1086.72 - 5+ Years – Low Stress Tool
HiTec Actobotics Servo Arm - $27.96 - 2+ Years – Can be reused with new rudders
HiTec HS5086WP Waterproof Servo - $66.00 - 2 Years – Projected Rudder Assembly
VexPro 60t Spur Gear - $21.00 - 2 Years – Projected Sailwinch Life
VexPro 48t Timing Belt Pulley - $24.00 - 2 Years – Projected Sailwinch Life
VexPro 60t Belt - $22.00 - 2 Years – Projected Sailwinch Life
VexPro 12t Pinion - $38.00 - 2 Years – Projected Sailwinch Life
Pinion Puller - $60.00 - 5+ Years – Low Stress Tool
VexPro 20t Spur Gear - $15.00 - 2 Years – Projected Sailwinch Life
Andymark RS – 775 125 Motor - $60.00 - 2 Years – Projected Sailwinch Life
2-56 x ¼” Servo Screw, 25pk - $4.67 - 2+ Years – Scarce use

Implementation Schedule

Electrical components will be used immediately. Mechanical components will enable small-scale testing in W19 and will begin full-scale production in S19.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Sensor Breakout Board	$ 100	$ 100	$ 100	$ 100
Power Distribution Board	$ 100	$ 100	$ 100	$ 100
Rudder Controller Board	$ 50	$ 50	$ 0	$ 0
Winch Controller Board	$ 50	$ 50	$ 0	$ 0
Hot Air Rework Station	$ 1090	$ 0	$ 0	$ 0
HiTec Actobotics Servo Arm	$ 30	$ 30	$ 30	$ 0
HiTec HS5086WP Waterproof Servo	$ 66	$ 66	$ 0	$ 0
VexPro 60t Spur Gear	$ 21	$ 21	$ 21	$ 21
VexPro 48t Timing Belt Pulley	$ 24	$ 24	$ 24	$ 24
VexPro 60t Belt	$ 22	$ 22	$ 22	$ 22
VexPro 12t Pinion	$ 38	$ 38	$ 38	$ 38
Pinion Puller	$ 60	$ 60	$ 60	$ 0
VexPro 20t Spur Gear	$ 15	$ 15	$ 15	$ 15
Andymark RS â€“ 775 125 Motor	$ 60	$ 60	$ 60	$ 60
2-56 x Â¼â€• Servo Screw, 25pk	$ 5	$ 5	$ 5	$ 0
Male Waterproof Connector	$ 80	$ 80	$ 80	$ 40
Female Waterproof Connector	$ 125	$ 125	$ 125	$ 63
Total	**$ 1,936**	**$ 846**	**$ 680**	**$ 483**

WATonomous Winter 2019 WEEF Proposal

Narayan Subramoniam
Sponsorship Sub-team Lead, WATonomous
nsubramoniam@uwaterloo.ca

Description of Proposal

In April 2017, WATonomous was chosen to represent the University of Waterloo alongside seven other schools in North America, to compete in the Society of Automotive Engineers' (SAE) AutoDrive Challenge™. The competition spans over three years, during which the teams aim to modify a stock Chevrolet Bolt EV into a fully autonomous vehicle. This competition is the newest form of collegiate design series that SAE has to offer, having followed from Formula SAE and Baja SAE. The second annual competition will take place in Ann Arbor, Michigan in April 2018, where our team will compete in urban environment driving scenarios with static and dynamic objects. This will be located at an urban test facility that simulates the myriad complexities that vehicles will encounter in urban and suburban driving environments.

From competition sponsors, WATonomous has received a Chevrolet Bolt EV, a set of LiDAR and RADAR sensors, high-powered computing platforms, as well as initial funding for other start up costs. However, In our first year, we successfully raised funds to purchase necessary components, such as sensor mounts, development computers, cameras, retro-reflective testing mannequins, and networking materials. Tools that the team continue to use to enhance their ongoing learning experience and meet competition demands. This proposal is to request funding to help support WATonomous in its second and even more demanding year. The resources will go directly towards the following required materials for the Winter 2019 term, and will last throughout the remainder of the challenge, and possible successor competitions.

Vehicle plating costs: With the recent exciting announcement from the Ministry of Transportation that autonomous vehicles equipped with SAE Level 3 technology can be driven on Ontario roads, we are moving ahead with insuring and registering the vehicle for road use.

Novatel mount: Our novatel unit which provides all our odometry and inertial information currently sits velcroed to our armrest. As the car moves, tiny wobbles make many of our measurements inaccurate. The point of these funds is to build a better mount to reduce the measurement errors.

Power over Ethernet (PoE) injector: We have 4 cameras not yet mounted onto the car because the driver provided is faulty. Currently, they are powered by our car, so only one person, physically present, would be able to work on it at the same time. Having 2 POE injector would allow 2 team members to bring these cameras with them and setup the development environments on their laptop to work more efficiently on fixing the drivers.

New car cameras: Last term, as we purchased the requested cameras, we got caught off guard by driver compatibility issues. None of this was featured in the cameras' official documentation, and we still do not know the fix. This term, we dedicated a team to tackle the driver issue, as we have 4 cameras of the new model. In the meantime, we plan to order 2 more cameras of the old model to unblock many of our other teams, relying on data from non-front facing cameras. Our final sensor suite will incorporate these 2 sensors on the sides of our front bumper to improve lane detection.

Camera cases: Last term, we've requested funds for cameras and lenses. However, these new equipments did not come with a some case to shelter them from bad weather. We are building cheap cases to protect them from mainly wind, rain, snow.

Side roof rack mounts: One of the challenge of our year 2 competition is parking. To achieve so, we need cameras pointed on the side of the car. The cameras have been purchased, but the mounts have not been built.

Power Supply Unit: One of our PSUs needs an upgrade from 500W to 600W.

Wire straps: In year 1, we focused mainly on the vehicle's autonomous aspects. By the end of year 3, SAE wants us to make this a consumer grade autonomous vehicle. As we move towards the year 2 check-in, we need to make the vehicle more presentable, and one of the key things will be wire management before we place back all the parts we've removed.

New compute rack: Our current compute rack sits in our trunk and can't be easily extended. We plan to build a new rack to address these pain points. The new rack will be screwed into our trunk, stabilizing our compute suite and our sensor electrical system. It will also be retractable to allow for easy extensivity.

Power extension bars: WATonomous has a prod culture of encouraging collaboration both within and across disciplinary fields. As a result, interdisciplinary meetings tend to get crowded and the availability of power outlets is vastly reduced. The availability of power extension bars would help support the collaborative culture and improve productivity.

DSLR: As the University's sole autonomous vehicle student design team, our marketing team has the exciting responsibility of spreading awareness and inspiration to community members and future leaders. Having a DSLR camera to accurately and creatively record and disseminate information would be an invaluable resource for marketing and future sponsorship requests.

Proposal Benefits

Contributions to our team allow members to continue developing knowledge in the field of robotics, especially autonomous vehicles. This term alon approximately 130 high achieving individuals were chosen to join the team in pursuit of this demanding endeavour, making WATonomous one of the largest student design teams in the University of Waterloo's Sedra Student Design Centre. Furthermore, approximately 70% of our technical team members are from the Faculty of Engineering; all gaining experience in software, electrical and mechanical design, along with gaining project management experience as part of the business team. Approximately 36 technical members are fourth-year students working on WATonomous as their Capstone Design projects. The technical experience gained through competing in the SAE AutoDrive Challenge™ will further enhance engineering students' knowledge on software, electrical, mechanical, systems design, technical report writing, communication, and competition skill sets. Funding from WEEF will be able to help fulfill the high level of needs for the large volume of students that are engaged in the team.

Estimated Equipment Lifetime

All of the requested items will be used throughout the remainder of the three-year project; longer if there is a successor project. Some of these materials would also be highly desirable to other student design teams, and thus, could be donated to them if there is no successor competition.

Implementation Schedule

Equipment is to be purchased in the Winter 2019 term to use for Year 2 challenge requirements.

Additional Information

The price breakdown for each item can be found in the following document.
https://drive.google.com/open?id=1b6BFYWg5OOjbsBZ7DKeKOKOTG-ty-zT6

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Vehicle Insurance	$ 2500	$ 0	$ 0	$ 0
Inspection costs	$ 100	$ 0	$ 0	$ 0
Vehicle Registration	$ 32	$ 0	$ 0	$ 0
Green plates	$ 59	$ 0	$ 0	$ 0
Plate sticker	$ 120	$ 0	$ 0	$ 0
RIV certificate	$ 350	$ 0	$ 0	$ 0
Wire Straps	$ 30	$ 0	$ 0	$ 0
Power Supply Unit	$ 60	$ 0	$ 0	$ 0
Power over Ethernet Injector	$ 140	$ 0	$ 0	$ 0
Power extension bars	$ 13	$ 0	$ 0	$ 0
Camera cases	$ 100	$ 0	$ 0	$ 0
New car cameras	$ 2600	$ 0	$ 0	$ 0
Side roof rack mounts	$ 200	$ 0	$ 0	$ 0
Novatel mount	$ 100	$ 0	$ 0	$ 0
New compute rack	$ 100	$ 0	$ 0	$ 0
Total	**$ 6,504**	**$ 0**	**$ 0**	**$ 0**

Industry 4.0 Design Team

W19-1462

Industry 4.0 WEEF Proposal

Jillian Dawn Exconde
General Member, Industry 4.0 Design Team
jdexconde@uwaterloo.ca

Description of Proposal

We would like to build our own Industry 4.0 model factory to incorporate into the competition. Each year the model factory would change so the competition would be different each year.

Proposal Benefits

- The competition could change every year for a more interesting competition, which would attract the attention of prospective students.
- It would bring attention to Management Engineering, which is a growing but little-known part of the engineering faculty. - The model factory would be a great learning tool for the members of the Industry 4.0 team.
- It could help attract the attention of other engineering disciplines who could learn MSCI concepts that would be applicable to their future co-ops and careers.
- Companies or individuals considering sponsoring Industry 4.0 would have an impressive tangible model to look at.

Estimated Equipment Lifetime

The parts are fairly permanent parts and shouldn't have to be replaced unless they break by external means for at least 6 years.

Implementation Schedule

If funding is granted, purchase will be done by the end of Winter 2019. Build up of the simulated manufacturing line will be done in Spring 2019 and first test is scheduled on Fall 2019.

Additional Information

Industry 4.0's primary goal is to create an industry-related competition for high school students to get a real grasp as to what management engineering has to offer. This vision will also promote the program and its unique aspects in a hands-on, engaging manner. Through the high school students' first-hand taste of management engineering, they may be more inclined to pursue a future in this sort of engineering, as they will know more about the program beyond its unfamiliar name. Industry 4.0 also provides current management engineering students the opportunity to apply what they have learned from their courses in a situational fashion. The chance to design and execute their own competition from scratch will provide the occasion to deal with all of the various components that go into a factory or manufacturing plant. This will further advance the students' knowledge of management engineering, as well as the encouragement of passion for their program.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Fischertechnik Indexed Line 2 machining stations	$ 1895	$ 0	$ 1895	$ 0
Fischertechnik 9V electronic switching power suply	$ 0	$ 31	$ 31	$ 0
Total	**$ 1,895**	**$ 31**	**$ 1,926**	**$ 0**

Esperto Labs

W19-1443

Esperto Labs Funding

Anh Le
Sponsorship Manager, Esperto Labs
taleha@edu.uwaterloo.ca

Description of Proposal

Esperto Labs is a student design team at the University of Waterloo building projects related to open-source wearables and robotics.
Our first project is the Esperto Watch, an open-source wearable platform simple enough for beginners to learn with yet powerful enough for professionals to use in their work. Everything from the watch hardware, firmware, mobile application, and web application can be modified by the user to meet the requirements of their application.
Our platform can be used by young engineering students to learn about wearable and embedded development but also be used by professional developers in their work to develop and test algorithms and sensors.
Our team is asking WEEF for funding in order to proceed onto the 3rd revision of the Esperto Watch hardware and software.

Proposal Benefits

Our small team consists of more than 20 core members consisting of mostly University of Waterloo engineering students. Each of our members have large roles related to hardware design, mechanical design, mobile development .etc
Our team gives students plenty of opportunities to learn new skills while perfecting skills that they already have. Our team is closely-knit, providing an environment where students can openly speak about the future of the team, new features, and any concerns.
The team is asking WEEF for sponsorship to be able to continue their hard work on the next iterations of the watch. Furthermore, funding from WEEF will result in more prototypes being readily available for students to work on. Funding would allow our team leads to pursue and recruit more Engineering students and continue to design new revisions of the watch, including features such as wireless charging and Wi-Fi.

Estimated Equipment Lifetime

Our hardware will last at least a year and will be used by our developers. Prototype boards will last at least 2 years as they are more generic and can be used by various applications.
The hardware will continue to be used for prototyping and showcasing after this time period.

Implementation Schedule

All components will be purchased immediately to allow team members to begin using them right away!

Additional Information

NA

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Prototype boards	$ 70	$ 0	$ 0	$ 0
PCB	$ 1100	$ 1100	$ 550	$ 0
Mechanical	$ 200	$ 100	$ 0	$ 0

Total	**$ 1,370**	**$ 1,200**	**$ 550**	**$ 0**

WatLock

W19-1498

Watlock: Airlock Components Proposal

Zaky Abrar Shaikh
Project Lead: Finance, WatLock
za2shaikh@uwaterloo.ca

Description of Proposal

Watlock is a relatively new student design team aiming to win the UBC Mars Colony Project Airlock Challenge. Our rapidly growing team is tasked with designing and prototyping a fully functional and sustainable airlock. Our engineering students are required to implement various skills and principles from multiple fields such as materials science, robotics, and sensors, in order to design the critical components of the airlock. Once construction is complete, our airlock will compete against the airlocks of many other top schools in Ontario. We'd like to request that you assist us in collecting the parts necessary to begin prototyping our airlock as soon as possible. The total cost of all the equipment comes to $3398.90 including shipping and handling. Our team has just been verified by Sedra as an official design team, and we have been granted a lab in E5. As of March, our team will begin prototyping, and the team requires the parts outlined below for the construction of the airlock.

Proposal Benefits

Watlock is filled with undergraduate engineering students developing many skills in order to further their careers. As such, our team is proud to facilitate a healthy learning environment in which our engineering students get hands on lab experience, as well as develop strong leadership and communication skills. We encourage all members to develop creative and unique solutions to difficult engineering problems. Our team has students from many programs such as:
- Nanotechnology Engineering
- Electrical and Computer Engineering
- Chemical Engineering
- Mechatronics Engineering
- Mechanical Engineering
- Management Engineering
- Biomedical Engineering
- Environmental Engineering

By sponsoring us, WEEF will gain exposure through our apparel - worn at all conferences and competitions - our website, our social media pages, any posters and banners, and potentially on the airlock itself.

Estimated Equipment Lifetime

First Aid Emergency Kit: 5-7 years
Lighting: 4-7 years
Acrylic: 8-10 years

All other items should not break and will last as long as necessary.

Implementation Schedule

All parts will be immediately used to being prototyping.

Additional Information

WEEF has been extremely generous in its support of our team. The generous donations have funded our fabrics project, as

well as allowed us to purchase many of the critical parts for the electrical systems of the airlock. All of WEEF's support has been greatly appreciated, and we hope to continue our mutually-beneficial relationship.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Toolbox	$ 676	$ 676	$ 0	$ 676
Wrench Set	$ 46	$ 46	$ 46	$ 46
Drill Bits	$ 25	$ 25	$ 25	$ 25
Ratchet and Socket Set	$ 38	$ 38	$ 38	$ 38
First Aid Emergency Kit	$ 29	$ 29	$ 29	$ 29
Lighting	$ 2588	$ 1294	$ 2588	$ 1294
Acrylic	$ 755	$ 755	$ 0	$ 0
Total	**$ 4,157**	**$ 2,863**	**$ 2,726**	**$ 2,108**

WatFly

W19-1503

Boeing GoFly Competition proposal

Abinesh Chandrasekhar
Technical Lead, WatFly
watfly.waterloo@gmail.com

Description of Proposal

WatFly is University of Waterloo's student design team whose goal is to win Boeing's GoFly Competition while providing invaluable technical and life experiences to our diverse team members.

Batteries management system:
Justification: Battery module health monitoring and logging. Helps us keep the battery pack in good health to maximize cell life and ensure safety.
Temperature and voltage logging during flight. Ensuring/preventing thermal runaways critical.
$500 - In house development of BMS. Ti BMS chips (10X) + Development board.
$1000 - Partly funded nuvation module.
$3500 - fully funded nuvation module + partial funding for batteries (21700)

A description of the items, associated cost, and justification, listed by priority follows:

Motors :
Justification: Fydp relying on motors for propeller and wing testing. Scheduled at fire safety lab. FYDP responsible for half wing + batteries + motor + propeller. Fully funded for all components except for motors.
$1000 - brushed DC motor.
$2000 - Brushed motor and motor controller including installation and software.
$5000 - brushless DC motors. Emrax 208, motor to be used in actual craft.

Windtunnel Testing Hardware:
Justification: On-campus infrastructure does not exist to support full-scale aerodynamic validation of aircraft, we are at the point where validating is a priority. Therefore we need to acquire our own hardware (PIV, Transducer, Anemometer, etc.) and test off-campus, or build a mobile wind tunnel.
$500 will buy hardware
$1000 will buy hardware and partial mobile wind tunnel
$1500 will buy hardware and mobile wind tunnel
Flight-computer Prototype Hardware:
Justification: We are bigger than a hobby RC drone, yet smaller than a commercial aircraft, thus there exist no flight controllers (we checked!) that satisfy our needs and we'll be developing our own.
$100: Hobby grade board with minimum IMU sensors.
$250: Made-to-spec board with redundant sensors.
$500: Made-to-spec board plus off-the-shelf PixHawk controller

Proposal Benefits

We are the only team in UW working in manned-aerospace vehicles, providing unique opportunities to students who are interested in this trendy and growing field, including: avionics design, controls of a transient aircraft, developing one of the world's lightest powertrains and energy systems, composites structures, and designing to aerospace standards.

Being the only Canadian student team participating in the competition, WatFly also extends UW's reach as an innovation hub as we participate in this new international competition (GoFly).
The funds would also allow us to purchase required hardware for set up and calibration of the wind tunnel, and force sensors for measuring model forces.

Estimated Equipment Lifetime

Motors - 5+ years
Battery Management System - 5 years
Wind Tunnel Test Hardware - 5 years
Flight-computer Prototype Hardware - 1 years

Implementation Schedule

All items would be purchased as soon as possible (Fall 2018 term) or have already been purchased, as they are crucial for the team's success. The competition is Oct 2019, however the design, prototyping and validation needs to be completed for Jan 2018.

Additional Information

Sponsorship levels:
Diamond - $20,000 - All of Platinum's plus Personalized advertisement in UW Facebook groups, Opportunity to fly the aircraft.
Platinum - $10,000 - All of Gold's plus Logo on the side of aircraft (Medium), Business logo on the vehicle, Invitation to speak at all hosted events.
Gold - $5,000 - All of Silver's plus Advertisement in university newspapers, Access to team resume book, Logo on the side of aircraft (small).
Silver - $1,000 - Logo on website & t-shirt. Social media post, detailing your contribution.

WEEF could qualify as a Platinum sponsor due to your cumulative yearly contributions! Follow us on social media to see how the team promotes its supporters.
Website: https://www.watfly.ca/
Facebook: https://www.facebook.com/WatFly/
Twitter: https://twitter.com/Wat_Fly
Instagram: https://www.instagram.com/wat_fly/

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Motors	$ 5000	$ 2000	$ 1000	$ 0
Battery Management System	$ 3500	$ 1000	$ 500	$ 0
Flight-computer Prototype Hardware	$ 500	$ 250	$ 100	$ 0
Windtunnel Test Hardware	$ 1500	$ 1000	$ 500	$ 0
Total	**$ 10,500**	**$ 4,250**	**$ 2,100**	**$ 0**

UW REACT

W19-1502

UW REACT WEEF Proposal W19

Michael Midura
Director, UW REACT
michael.midura@uwreact.ca

Description of Proposal

The University of Waterloo Robotics Engineering and Autonomous Controls Team (hereinafter UW REACT) builds fully autonomous FIRST robots and hosts the world's largest Robot in 3 Days event. UW REACT is a team with roots in the FIRST Robotics Competition (hereinafter FRC). FRC is one of the largest high school robotics competitions in the world, and an especially popular competition in Ontario and the KW region. FRC challenges students to design, build, and program industrial-size robots and compete in a unique field game. Each year's challenge is revealed in January and teams have 6 weeks to complete their robot before they bag it and send it off to competition. FRC remains one of the most rigorous engineering challenges a high school student can participate in, and many engineers at the University are alumni of the program. However, upon entering post-secondary education, FIRST alumni are unable to continue competing in this challenge in the same way they did in high school, having to switch to a mentorship role and losing hands-on access to the robot.

UW REACT brings new life to FRC after high school by allowing FIRST alumni to continue participating in the FIRST Robotics Competition while increasing the difficulty of the challenge to include knowledge gained throughout university. UW REACT solves the FIRST alumni problem in two ways: the UW REACT student design team, and the University of Waterloo Robot in 3 Days (hereinafter UW Ri3D) event. For students looking for a challenge in similar difficulty and scope to other student design teams, while maintaining the core principles of FRC, they look towards UW REACT. We bring the competition to a university-level by fielding a fully autonomous robot without a human driver, as opposed to the traditional tele-operated robots. Students compete at multiple off-season events from July until September each year. On the other hand, if students don't want to take too much time away from their studies but still want an intense, fast-paced challenge, they attend UW Ri3D. For the past 2 years, over 40 students each year have built a 120-pound FRC robot in just 72 hours during a hackathon-style event. All resources from the event are open-sourced allowing high school FRC teams to use our work as a basis for inspiration and prototyping, since many teams lack the funding required to properly prototype. Yearly footage of UW Ri3D is available online at https://goo.gl/ns5r5g

Our team is currently seeking financial support for the purchase of materials surrounding the implementation of a fully autonomous perception system, and structural materials for building our 120 pound robot. The funding would cover much of the sensing equipment required, including on-robot GPUs for vision processing, cameras, IMUs, radar, actuators, metal, and more to build on supplies using during Ri3D. Thanks to running Ri3D, we have escaped the large startup cost associated with an FRC team, but due to increasing the difficulty of the challenge, we require a whole new array of equipment used in the development of fully autonomous robots.

Proposal Benefits

Our team has its roots in the original UW Ri3D competition ran at the University in Winter 2018, and as such, we remain fully committed towards giving back to both the University and FIRST communities. The team would allow FIRST alumni who enter the University in engineering programs to apply the knowledge they learn in class towards an engineering challenge that is still the site of much research and development today. The competition is fast, fun, and welcoming to new students; anyone can get involved if they are excited about robots. The team would provide any engineering student with valuable hands-on experience for co-op placements and a way to connect what they learn in class to real-world engineering.

The team would also serve as a fantastic way to attract more students to engineering programs at the University, as no other post-secondary institution in the world currently has a such a team and FIRST alumni would jump at the opportunity to continue building FIRST robots. With the introduction of our team, the University is now the leading post-secondary institution in terms of engagement for FIRST alumni.

Our team also gives back to the FIRST community by releasing all of our resources as open source material; this allows other FRC teams to use our work to help further their own creations if they do not have the technical capabilities or financial means to prototype themselves. We aim to inspire other FRC teams to develop an interest in both mechanical and software design and to foster an inclusive learning community.

Estimated Equipment Lifetime

Due to rapid innovation in the field of robotics, the required sensors and deep learning materials should have a lifetime use of about 3 years. We will be reusing all the equipment we can by moving them between our various robot designs year after year. We will replace certain parts as emerging technologies continue to develop and provide us with the resources to build better robots. Furthermore, due to the competition changing year after year, structural material such as aluminum and steel, and wiring material such as cable and crimps will need to be purchased each year to suit the needs of the competition. However, thanks to running Ri3D each year, we have escaped the large startup cost associated with an FRC team, and most of these parts have a lifetime of 5 or more years. Most of these parts are a part of the traditional FRC control system, including the roboRIO microcontroller, Power Distribution Panel, Pneumatic Control Module, and others. These parts will not have to be replaced until the FRC control system is completely revamped, which is not set for a revision until 2022, and even then, it may remain the same.

Implementation Schedule

With the FRC challenge having been released this January, we have begun designing our robots and using our sensing equipment purchased from previous years contributions from WEEF. We are full steam ahead and well on our way to creating a successful robot in our pilot year. Our first competition is being held from August 16 to 18, giving us about 7 more months to build. If we are granted funding, we will be purchasing immediately.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Assorted Electrical Wires/Connectors	$ 200	$ 150	$ 100	$ 80
Jetson TX2 (x1)	$ 395	$ 395	$ 395	$ 395
Nav-X MXP (x1)	$ 130	$ 130	$ 0	$ 0
Pigeon IMU (x1)	$ 80	$ 80	$ 0	$ 0
Assorted Aluminum Stock	$ 1600	$ 800	$ 400	$ 200
ZED Depth Camera (x2)	$ 700	$ 700	$ 350	$ 350
Blackfly S Color 1.6 MP USB3 Vision (x2)	$ 840	$ 840	$ 420	$ 420
Lenses for RGB Cameras (x4)	$ 600	$ 600	$ 450	$ 450
Pneumatic Cylinders (x4)	$ 200	$ 200	$ 100	$ 100
VersaPlanetary Gearbox Stages	$ 250	$ 150	$ 80	$ 50
775pro Motor (x4)	$ 104	$ 104	$ 52	$ 52
#25 Roller Chain	$ 100	$ 100	$ 50	$ 50
Total	**$ 5,199**	**$ 4,249**	**$ 2,397**	**$ 2,147**

Waterloop

W19-1504

Waterloop Linear Induction Motor

Clive Chan
Technical Director, Waterloop
clive.chan@uwaterloo.ca

Description of Proposal

The proposal for Winter 2018 from the Waterloop team will be funding for the Linear Induction Motor (LIM) system, including lithium ion batteries, electrical steel, copper windings, inverter, battery management system, embedded control boards, and machining costs. The LIM works by supplying high current AC to coils of wire to create a moving magnetic field, inducing currents in the track that create propulsive force. This will allow the pod to propel itself contactlessly.

This is the first such propulsion system of its kind in the competition, and is superior to alternatives such as wheeled propulsion, as there are no moving parts to wear down at extremely high speed. This will eventually make possible a true transcontinental Hyperloop system.

The total estimated cost for the LIM is $12,000, which breaks down as follows into the following rough categories:
~ $2000: batteries (18650 cells) & BMS
~ $500: fire-retardant, vacuum-compatible battery enclosure
~ $2500: variable-frequency inverter
~ $500: other electronics & control systems
~ $1500: LIM material cost (electrical steel, magnet wire, epoxy, mounts to frame, etc.)
~ $1500: waterjet cutting of electrical steel laminations, machining for structural parts
~ $1000: LIM cooling system
~ $2500: small scale LIM model-validation prototype & VFD & test rig

Much of sourcing & procurement has been done, and will be mostly completed by this Saturday (2/9).

Proposal Benefits

The linear induction motor is the central component to the Waterloop design, as it is the only contactless propulsion system in the competition. The technology is complex, but we are one of only a few groups worldwide exploring high speed applications of linear induction motors. With this design, we believe that we can showcase Waterloo's and Canada's innovative spirit on the world stage.

Our team this term is, as always, majority Engineering, with the rest distributed among all the other faculties. We have here a unique electromagnetic and structural engineering problem that will give a wide diversity of experience to our members. Waterloop also hosts one to two co-ops every term (one this term), allowing them an even greater opportunity to learn as a full time member.

Waterloop has a strong presence in the Ontario transportation space, and we're building partnerships with organisations from Ministry of Transportation Ontario (MTO), to our sponsors like Balluff, Altium, Boko, Babylon VR, PayPal, to many organisations within our own school such as HeForShe and others. We’ve even been tweeted by Trudeau!

Estimated Equipment Lifetime

The estimated equipment lifetime of the LIM is about one year, since the Competition operates on a one year cycle, and we

plan to do a full redesign of the LIM next year based on what we learn from this one. It's possible and in the past quite common that various parts will be reused for the next competition, though we do not yet have firm designs for the next Competition.

Implementation Schedule

Waterloop follows a 3 stage process of design, build, and test, each lasting for one term. We are currently in the build stage from January 2019 to April 2019. We are already procuring parts, and we intend to begin building immediately, completing the subsystem build by the beginning of April and integrating the full pod by May.

The actual competition will be in July 2019 (exact date to be announced), which is when we will be bringing our design to California to compete at the SpaceX Hyperloop Competition.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
batteries (18650 cells) & BMS	$ (2000)	$ (0)	$ (0)	$ (0)
fire-retardant, vacuum-compatible battery enclosur	$ (500)	$ (0)	$ (0)	$ (0)
variable-frequency inverter	$ (2500)	$ (0)	$ (0)	$ (0)
other electronics & control systems	$ (500)	$ (0)	$ (0)	$ (0)
LIM material cost (electrical steel, magnet wire,	$ (1500)	$ (0)	$ (0)	$ (0)
waterjet cutting of electrical steel laminations,.	$ (1500)	$ (0)	$ (0)	$ (0)
LIM cooling system	$ (1000)	$ (0)	$ (0)	$ (0)
small scale LIM model-validation prototype & VFD &	$ (2500)	$ (0)	$ (0)	$ (0)
Total	**$ -12,000**	**$ 0**	**$ 0**	**$ 0**

UW Additive

W19-1505

Accessories for UW Additive

Gurshan Deol
Founder, UW Additive
gurshan.deol@uwaterloo.ca

Description of Proposal

UW Additive is a new student design team focused on additive manufacturing. This term goals for the team is to set up a manufacturing space in the E5 Print Center and teaching lower year students how to design with additive. We currently have 2 printers that are being setup along with a Stratasys Dimensions 1200ES that is in ned of repair.

We would like to purchase replacement parts for the Dimension 1200ES as well as some accessories (pliers, allen keys, crescent wrench, small toolbox).

We're hoping to find a way to interface with the different student design teams so they have easier access to 3D printing, which can be an issue for smaller teams especially. The current 3D printing services available on campus are very spread out, unreliable and expensive.

Parts list

4 x B1232H24B (blower fan)
Set of allen keys
Crescent wrench
Plier set
Toolbox

Proposal Benefits

The proposal would allow us to maintain and improve the printers easily. Improving the printing environment is beneficial to all users and minimizes downtime of the system.

The blower fans are necessary for the Dimension 1200ES printer to work, it would be very beneficial to have this printer available to all students ($30,000 machine).

Estimated Equipment Lifetime

10 years

Implementation Schedule

Tools & parts will be bought immediately, Dimension 1200ES will be fixed before end of term.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
B1232H24B-BSR-I832	$ 21	$ 21	$ 21	$ 21
B1232H24B-BSR-I832	$ 21	$ 21	$ 21	$ 21
B1232H24B-BSR-I832	$ 21	$ 21	$ 21	$ 21
B1232H24B-BSR-I832	$ 21	$ 21	$ 21	$ 21
Allen key set	$ 14	$ 14	$ 14	$ 0
Adjustable Wrench	$ 18	$ 18	$ 18	$ 0
Plier set	$ 30	$ 30	$ 0	$ 0
Toolbox	$ 14	$ 0	$ 0	$ 0
Digital Infrared Thermometer Laser Temperature Gun	$ 35	$ 0	$ 0	$ 0
Wire Stripper	$ 40	$ 0	$ 0	$ 0
Utility Knife	$ 14	$ 14	$ 14	$ 0
Total	**$ 249**	**$ 160**	**$ 130**	**$ 84**

UWRobotics - Autonomous Robot Racing Team

W19-1437

Hummingbot - Autonomous Robot Racing - UWRobotics

Jack (Jianxiang) Xu
Team Lead, UWRobotics - Autonomous Robot Racing Team
j337xu@uwaterloo.ca

Description of Proposal

Our passion is to build a state-of-the-art autonomous high-speed racing vehicle that outperforms human-controlled racing cars.

Our team consists of 25 Undergraduate and Graduate Students currently attending the University of Waterloo, as well as a network of Alumni, Professors, Advisors, and a Research Lab (CogDrive). Our team is a multi-award-winning team that competes annually in the International Autonomous Robot Racing Competition (IARRC) for over 10 years.

Every year, the team designs and builds a mini-vehicle that races in a fully autonomous mode, against other robots from all over the world. The robot has to navigate through obstacle-filled courses without any human guidance or control.

This year, we are building a new robot from scratch, since the old robot has been used for 4-5 years, and has been worn out. We only made 4th place due to the mechanical and electrical components worn out during the competition. This year, we are building a more compact and powerful robot. Hence, we need financial support from WEEF. And this robot will be ur future developing platforms for the next few years (3-5 years).

The main proposal request is for fundings on hardware related including Custom PCBs and Electronics.

Proposal Benefits

Direct Benefits:
We will put WEEF logo on our promotion packages (including future sponsorship package, logos on website, merchandise and robots). Logo sizes and other benefits will depend on the amount of sponsorship.

Indirect Benefits:
(This is an international competition hosted by CogDrive Lab from the University of Waterloo to promote the University reputations and impacts on autonomous ground vehicles area and encourage undergrads from all over the world on the autonomous vehicle. And we are the team representing the University of Waterloo, and it will highly promote the support from WEEF on autonomous mobile robotics.)

Estimated Equipment Lifetime

Since the entire robot will last at least 3 years.

The custom PCB has expandable GPIO, and it enables more potentials on low-level interface.

The PCB has a powerful Cortex M4 processor, which will enable more power for much more advanced control algorithms.

The entire custom hardware will be 50% cheaper than purchasing off-the-shelf modules and enable students exploring more advanced topics on low-level barebone C firmware, RTOS, and electrical skills.

Implementation Schedule

The board design is almost done, and will be fully tested in the simulation by the end of January.

The manufacturing will start in early February, and hardware is expected to be fully assembled and tested by the end of February.

We are expecting to work on the control firmware and interfaces around mid-March.

We would finish all low-level code before the Spring term.

The competition is on July 14th.

Additional Information

To be clarified:

Although we are sharing the same account as MarsRover Team under UWRobotics, we are two separate identities, and two entirely different projects with two entirely separate teams and team lead.

We are also entirely separate from the hosting team, IARRC 2019 Org.. The new organization is running by a lab, with a separate design team account from the UWRobotics Team.

Feel free to reach out for any further questions.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Absolute Encoder & Misc. Sensors	$ 200	$ 100	$ 100	$ 100
Custom Power Distribution board PCB & Electronics	$ 300	$ 200	$ 200	$ 200
Custom Hummingbot Main MCU PCB & Electronics	$ 500	$ 400	$ 300	$ 300
Total	**$ 1,000**	**$ 700**	**$ 600**	**$ 600**

Waterloo IARRC Committee

W19-1450

Waterloo IARRC proposal (W2019)

Keqi Shu
Marketing Lead, Waterloo IARRC Committee
k3shu@uwaterloo.ca

Description of Proposal

The International Autonomous Robot Racing Challenge (IARRC) (https://iarrc.org) is an international competition which provides students with real-world, hands-on engineering design challenges, including components of mechanical, computer, control software, and system integration. Students work together to design and build robotic vehicles that can navigate twisting, obstacle-filled courses without any human guidance or control.

This event have a long tradition. Starting from 2005, the competition was first held in University of Waterloo and are expanding its influence throughout the years with the effort of previous years of students. The competition had been receiving more and more participants each year and in 2018, we had received as much as 20 team application to participate from all over the world and we are expecting more teams joining the event this year.

To welcome the growing influence among the undergraduate robotics teams, this year the event will be increased the variety of competition forms. Besides keeping the Drag Race and Circuit Race, Obstacle Avoidance Challenge and Urban Road Challenge are added. We call for funds to purchase long-lasting equipment for the new competition forms to improve our credibility and professionality for greater scale of the competition.

Proposal Benefits

To the competition: The racing timer will give the precise time that the vehicle take to finish the laps, since the teams are performing much better than before and it would be hard to decided the time and sequence of different teams with the current stopwatch. We are also planning to use more equipment such as cones, bumpers and road signs to create more complex road conditions to make the competition more challenging.

To undergraduate participants: Unlike other long-term competitions such as Watonomous's SAE challenge, this competition is an annual challenge. It is a better fit for undergraduate students, since they can explore their interest in a large scale within a short period of time.

To WEEF: We would advertise the WEEF during the competition time by putting WEEF's logo in future sponsor list on website, posters, and the flyers. Logo sizes and other benefits will depend on the amount of sponsorship.

To UWaterloo: Having the 15 years of history, the annual competition is a chance to extend the tradition and expand the reputation of UW community. The new forms of competition will attract more talented students throughout the world, which will potentially promote source of intelligence to our community.

Estimated Equipment Lifetime

Racing Timer (2*1000) - 5 years
White Duct Tapes (30*10) - 1 year
Cone (2*30) - 5 years
Bumper (3*10) - 5 years
Road sign (15*10) - 5 years

start/finish banner (5*50) - 5 years
Racing Signal (2*200) - 5 years
Volunteer Badges (3*20) - 5 years

Implementation Schedule

All items will be purchased immediately after funding is granted.

Additional Information

none

Cost Breakdown

Item	Option1	Option2	Option3	Option4
Racing Timer	$ 2000	$ 1500	$ 1000	$ 0
White Duct Tapes	$ 300	$ 300	$ 300	$ 0
Cone	$ 60	$ 60	$ 60	$ 0
Bumper	$ 30	$ 30	$ 30	$ 0
Road sign	$ 150	$ 150	$ 150	$ 0
Start/finish banner	$ 250	$ 250	$ 250	$ 0
Racing Signal	$ 400	$ 400	$ 400	$ 0
Volunteer Badges	$ 60	$ 60	$ 60	$ 0
Total	**$ 3,250**	**$ 2,750**	**$ 2,250**	**$ 0**

F_rmLab

W19-1480

F_rmLab Equipment

Alex Gontarz
Vice President, F_rmLab
agontarz@uwaterloo.ca

Description of Proposal

F_rmlab is in need of 3-4 CNC milling bits, and an infrared tracking camera (such as the Microsoft Kinect).

Proposal Benefits

The CNC milling bits will benefit every student in the faculty of architecture, as the F_rmlab-run CNC machine is available for all to use. This will result in better quality models by the students, and more freedom for F_rmlab to pursue new projects.

The IR depth camera is a versatile tool that most notably can be used for interactive installations that F_rmlab is planning. These installations aim to involve the community and create more local exposure for the School of Architecture.

Estimated Equipment Lifetime

It is difficult to estimate the lifespan of CNC endmill bits, because it depends on the quality, frequency of use and how well they are used. With proper care, high quality bit can cut for thousands of hours.

The IR camera will not need to be replaced in the future.

Implementation Schedule

Both the CNC bits and camera are planned to be implemented right away.

Additional Information

None.

Cost Breakdown

Item	Option1	Option2	Option3	Option4
CNC Endmills	$ 210	$ 135	$ 0	$ 0
IR Depth Camera	$ 190	$ 190	$ 0	$ 0
Total	**$ 400**	**$ 325**	**$ 0**	**$ 0**

Table of Contents

50	WP-1451	Engineers Without Borders - Podcast Microphones	$ 369
51	WP-1447	UW Concrete Team - WEEF PROPOSAL W19	$ 520
52	WP-1470	Winter UW Steel Bridge Team Sponsorship	$ 2,500
53	WP-1481	Waterloo Submarine Racing Team	$ 1,100
55	WP-1493	UW Sailbot - Winter 2019 WEEF Proposal	$ 1,936
58	WP-1500	WATonomous Winter 2019 WEEF Proposal	$ 6,504
61	WP-1462	Industry 4.0 WEEF Proposal	$ 1,926
62	WP-1443	Esperto Labs Funding	$ 1,370
64	WP-1498	Watlock: Airlock Components Proposal	$ 4,157
66	WP-1503	Boeing GoFly Competition proposal	$ 10,500
68	WP-1502	UW REACT WEEF Proposal W19	$ 5,199
71	WP-1504	Waterloop Linear Induction Motor	$ 0
73	WP-1505	Accessories for UW Additive	$ 249
75	WP-1437	Hummingbot - Autonomous Robot Racing - UWRobotics	$ 1,000
77	WP-1450	Waterloo IARRC proposal (W2019)	$ 3,250
79	WP-1480	F_rmLab Equipment	$ 400
		Total	**$ 90,689**